Scalable Vector Graphics (SVG) 1.0 Specification

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Abstract

This specification defines the features and syntax for Scalable Vector Graphics (SVG), a language for describing two-dimensional vector and mixed vector/raster graphics in XML.

Status of this document

This document is a public review draft version of the SVG specification. This working draft attempts to address most of the review comments that were received during the second Last Call period, which started 3 March 2000, and also incorporates other modifications resulting from continuing collaboration with other working groups and continuing work within the SVG working group. Among the areas of the specification that are known to require further work are the text, font, animation chapters and any sections relating to events. Most of

the further work is expected to be primarily editorial in nature with few further changes to the language itself. Depending on feedback to this draft, the goal is to publish a Candidate Recommendation soon once outstanding issues are addressed.

A complete list of all changes since the previous public draft specification is available in [Appendix M: Change History](#).

This is a draft document and might be updated, replaced or obsoleted by other documents at any time. While we do not anticipate substantial changes, we still caution that further changes are possible. It is inappropriate to use this document as reference material or to cite it as other than "work in progress".

We explicitly invite comments on this specification. Please send them to svg-comments@w3.org.

The SVG working group has been using a staged approach. Initially, the working group developed a detailed set of SVG Requirements, which are listed in [SVG Requirements](#). These requirements were posted for public review initially in October 1998. For the most part, the specification has been developed to provide the feature set listed in the requirements document. At some point, an updated version of [SVG Requirements](#) might be posted which contains detailed editorial comments about which requirements have been addressed in this draft (along with hyperlinks to the relevant sections of the specification) and notes about which requirements have not been addressed yet and why.

Public discussion of SVG features takes place on [www-svg@w3.org](#), which is an automatically [archived](#) email list. Information on how to subscribe to public W3C email lists can be found at [http://www.w3.org/Mail/Request](#).

The home page for the W3C graphics activity is [http://www.w3.org/Graphics/Activity](#). Further information about SVG may be found at the W3C [SVG Overview](#) page.

A list of current W3C Recommendations and other technical documents can be found at [http://www.w3.org/TR/](#).

Available languages

The English version of this specification is the only normative version. However, for translations in other languages see [http://www.w3.org/Graphics/SVG/svg-updates/translations.html](#).

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Full Table of Contents

The following sections have not been written yet, but are expected to be be present in later versions of this specification:

- ● Appendix N: Element and attribute index
- ● Appendix O: Index

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1 Introduction

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1.1 About SVG

This specification defines the features and syntax for [Scalable Vector Graphics (SVG)](#).

SVG is a language for describing two-dimensional graphics in XML [[XML10](#)]. SVG allows for three types of graphic objects: vector graphic shapes (e.g., paths consisting of straight lines and curves), images and text. Graphical objects can be grouped, styled, transformed and composited into previously rendered objects. The feature set includes nested transformations, clipping paths, alpha masks, filter effects and template objects.

SVG drawings can be interactive and dynamic. Animations can be defined and triggered either declaratively (i.e., by embedding SVG animation elements in SVG content) or via scripting.

Sophisticated applications of SVG are possible by use of supplemental scripting language with access to SVG's Document Object Model (DOM), which provides complete access to all elements, attributes and properties. A rich set of event handlers such as onmouseover and onclick can be assigned to any SVG graphical object. Because of its compatibility and leveraging of other Web standards, features like scripting can be done on XHTML and SVG elements simultaneously within the same Web page.

SVG is a language for rich graphical content. For accessibility reasons, if there is an original source document containing higher-level structure and semantics, it is recommended that the higher-level information be made available somehow, either by making the original source document available, or making an alternative version available in an alternative format which conveys the higher-level information, or by using SVG's facilities to include the higher-level information within the SVG content. For suggested techniques in achieving greater accessibility, see [Accessibility](#).

1.2 SVG MIME type, file name extension and Macintosh filetype

The MIME type for SVG is `"image/svg-xml"`. The W3C will register this MIME type around the time when SVG is approved as a W3C Recommendation.

It is recommended that SVG files have the extension `".svg"` (all lower case) on all platforms.

It is recommended that SVG files stored on Macintosh HFS file systems be given a filetype of `"svg "` (all lower case, with a space character as the fourth letter).

1.3 Compatibility with Other Standards Efforts

SVG leverages and integrates with other W3C specifications and standards efforts. By leveraging and conforming to other standards, SVG becomes more powerful and makes it easier for users to learn how to incorporate SVG into their Web sites.

The following describes some of the ways in which SVG maintains compatibility with, leverages and integrates with other W3C efforts:

- SVG is an application of XML and is compatible with the "Extensible Markup Language (XML) 1.0" Recommendation [XML10]

- SVG is compatible with the "Namespaces in XML" Recommendation [XML-NS]

- SVG utilizes "XML Linking Language (XLink)" [XLINK] for URI referencing.

- SVG's syntax for referencing element IDs is a compatible subset of the ID referencing syntax in "XML Pointer Language (XPointer)" [XPTR].

- SVG content can be styled by either CSS (see "Cascading Style Sheets (CSS) level 2" specification [CSS2]) or XSL (see "XSL Transformations (XSLT) Version 1.0" [XSLT]). (See Styling with CSS and Styling with XSL)

- SVG supports relevant properties and approaches common to CSS and XSL, plus selected semantics and features of CSS (see SVG's styling properties and SVG's Use of Cascading Style Sheets).

- External style sheets are referenced using the mechanism documented in "Associating Style Sheets with XML documents Version 1.0" [XML-SS].

- SVG includes a complete Document Object Model (DOM) and conforms to the "Document Object Model (DOM) level 1" Recommendation [DOM1]. The SVG DOM has a high level of compatibility and consistency with the HTML DOM that is defined in the DOM level 1 specification. Additionally, the SVG DOM supports and incorporates many of the facilities described in "Document Object Model (DOM) level 2" [DOM2], including the CSS object model and event handling.

- SVG incorporates some features and approaches that are part of the "Synchronized Multimedia Integration Language (SMIL) 1.0 Specification" [SMIL1], including the 'switch' element and the systemLanguage attribute.

- SVG's animation features (see Animation) were developed in collaboration with the W3C Synchronized Multimedia (SYMM) Working Group, developers of the Synchronized Multimedia Integration

Language (SMIL) 1.0 Specification [SMIL1]. SVG's animation features incorporate and extend the general-purpose XML animation capabilities described in the "SMIL Animation" specification [SMILANIM].

- SVG has been designed to allow future versions of SMIL to use animated or static SVG content as media components.
- SVG attempts to achieve maximum compatibility with both HTML 4.0 [HTML4] and XHTML(tm) 1.0 [XHTML]. Many of SVG's facilities are modeled directly after HTML, including its use of CSS [CSS2], its approach to event handling, its approach to its Document Object Model [DOM2].
- SVG is compatibility with W3C work on internationalization. References (W3C and otherwise) include: [UNICODE] and [CHARMOD]. Also, see Internationalization Support.
- SVG is compatible with W3C work on Web Accessibility [WAI]. Also, see Accessibility Support.

In environments which support [DOM2] for other XML grammars (e.g., XHTML [XHTML]) and which also support SVG and the SVG DOM, a single scripting approach can be used simultaneously for both XML documents and SVG graphics, in which case interactive and dynamic effects will be possible on multiple XML namespaces using the same set of scripts.

1.4 Terminology

Within this specification, the key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" are to be interpreted as described in RFC 2119 (see [RFC2119]). However, for readability, these words do not appear in all uppercase letters in this specification.

At times, this specification recommends good practice for authors and user agents. These recommendations are not normative and conformance with this specification does not depend on their realization. These recommendations contain the expression "We recommend ...", "This specification recommends ...", or some similar wording.

1.5 Definitions

basic shape

Standard shapes which are predefined in SVG as a convenience for common graphical operations. Specifically: 'rect', 'circle', 'ellipse', 'line', 'polyline', 'polygon'.

canvas

a surface onto which graphics elements are drawn, which can be real physical media such as a display or paper or an abstract surface such as a allocated region of computer memory. See the discussion of the SVG canvas in the chapter on Coordinate Systems, Transformations and Units.

clipping path

a combination of 'path', 'text' and basic shapes which serve as the outline of a (in the absense of antialiasing) 1-bit mask, where everything on the "inside" of the outline is allowed to show through but everything on the outside is masked out. See Clipping paths.

container element

> An element which can have graphics elements and other container elements as child elements. Specifically: 'svg', 'g', 'defs' 'symbol', 'clipPath', 'mask', 'pattern', 'marker', 'a' and 'switch'.

current innermost SVG document fragment

> The XML document sub-tree which starts with the most immediate ancestor 'svg' element of a given SVG element

current SVG document fragment

> The XML document sub-tree which starts with the outermost ancestor 'svg' element of a given SVG element, with the requirement that all container elements between the outermost 'svg' and this element are all elements in the SVG language

current transformation matrix (CTM)

> Transformation matrices define the mathematical mapping from one coordinate system into another using a 3x3 matrix using the equation [x' y' 1] = [x y 1] * matrix. The *current transformation matrix* (CTM) defines the mapping from the user coordinate system into the viewport coordinate system. See Coordinate system transformations

fill

> The operation of painting the interior of a shape or the interior of the character glyphs in a text string.

font

> A font represents an organized collection of glyphs in which the various glyph representations will share a common look or styling such that, when a string of characters is rendered together, the result is highly legible, conveys a particular artistic style and provides consistent inter-character alignment and spacing.

glyph

> A glyph represents a unit of rendered content within a font. Often, there is a one-to-one correspondence between characters to be drawn and corresponding glyphs (e.g., often, the character "A" is rendered using a single glyph), but other times multiple glyphs are used to render a single character (e.g., use of accents) or a single glyph can be used to render multiple characters (e.g., ligatures). Typically, a glyph is defined by one or more shapes such as a path, possibly with additional information such as rendering hints that help a font engine to produce legible text in small sizes.

graphics element

> One of the element types that can cause graphics to be drawn onto the target canvas. Specifically: 'path', 'text', 'rect', 'circle', 'ellipse', 'line', 'polyline', 'polygon', 'image' and 'use'.

graphics referencing element

> A graphics element which uses a reference to a different document or element as the source of its graphical content. Specifically: 'use' and 'image'.

local URI reference

> A Uniform Resource Identifier [URI] that does not include an <absoluteURI> or <relativeURI> and thus represents a reference to an element/fragment within the current document. See References and the 'defs' element.

mask

> a container element which can contain graphics elements or other container elements which define a set of graphics that is to be used as a semi-transparent mask for compositing foreground objects into the

current background. See Masks.

non-local URI reference

A Uniform Resource Identifier [URI] that includes an <absoluteURI> or <relativeURI> and thus (usually) represents a reference to a different document or an element/fragment within a different document. See References and the 'defs' element.

paint

A paint represents a way of putting color values onto the canvas. A paint might consists of both color values and associated alpha values which control the blending of colors against already existing color values on the canvas. SVG supports three types of built-in paint: color, gradients and patterns.

presentation attribute

An XML attribute on an SVG element which specifies a value for a given property for that element. See Styling.

property

A parameter that helps specify how a document should be rendered. A complete list of SVG's properties can be found in Property Index. Properties are assigned to elements in the SVG language either by presentation attributes on elements in the SVG language or by using a styling language such as CSS [CSS2]. See Styling.

shape

A graphics element that is defined by some combination of straight lines and curves. Specifically: 'path', 'rect', 'circle', 'ellipse', 'line', 'polyline', 'polygon'.

stroke

The operation of painting the outline of a shape or the outline of character glyphs in a text string.

SVG canvas

the canvas onto which the SVG content is rendered. See the discussion of the SVG canvas in the chapter on Coordinate Systems, Transformations and Units.

SVG document fragment

The XML document sub-tree which starts with an 'svg' element. An SVG document fragment can consist of a stand-alone SVG document, or a fragment of a parent XML document enclosed by an 'svg' element. When an 'svg' element is an descendant of another 'svg' element, there are two SVG document fragments, one for each 'svg' element. (One SVG document fragment is contained within another SVG document fragment.)

SVG viewport

the viewport within the SVG canvas which defines the rectangular region into which SVG content is rendered. See the discussion of the SVG viewport in the chapter on Coordinate Systems, Transformations and Units.

text content element

One of SVG's elements that can define a text string that is to be rendered onto the canvas. SVG's text content elements are the following: 'text', 'tspan', 'tref', 'glyphRun' and 'textPath'.

transformation

A modification of the current transformation matrix (CTM) by providing a supplemental transformation

in the form of a set of simple transformations specifications (such as scaling, rotation or translation) and/or one or more transformation matrices. See Coordinate system transformations

transformation matrix

Transformation matrices define the mathematical mapping from one coordinate system into another using a 3x3 matrix using the equation [x' y' 1] = [x y 1] * matrix. See current transformation matrix (CTM) and Coordinate system transformations

URI Reference

A Uniform Resource Identifier [URI] which serves as a reference to a file or to an element/fragment within a file. See References and the 'defs' element.

user coordinate system

In general, a coordinate system defines locations and distances on the current canvas. The current user coordinate system is the coordinate system that is currently active and which is used to define how coordinates and lengths are located and computed, respectively, on the current canvas. See initial user coordinate system and Coordinate system transformations.

user space

A synonym for user coordinate system.

user units

A coordinate value or length expressed in user units represents a coordinate value or length in the current user coordinate system. Thus, 10 user units represents a length of 10 units in the current user coordinate system.

viewport

a rectangular region within the current canvas onto which graphics elements are to be rendered. See the discussion of the SVG viewport in the chapter on Coordinate Systems, Transformations and Units.

viewport coordinate system

In general, a coordinate system defines locations and distances on the current canvas. The viewport coordinate system is the coordinate system that is active at the start of processing of an 'svg' element, before processing the optional viewBox attribute. In the case of an SVG document fragment that is embedded within a parent document which uses CSS to manage its layout, then the viewport coordinate system will have the same orientation and lengths as in CSS, with the origin at the top-left on the viewport. See The initial viewport and Establishing a new viewport.

viewport space

A synonym for viewport coordinate system.

viewport units

A coordinate value or length expressed in viewport units represents a coordinate value or length in the viewport coordinate system. Thus, 10 viewport units represents a length of 10 units in the viewport coordinate system.

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2 Concepts

Explaining the name: SVG

SVG stands for Scalable Vector Graphics, an XML grammar for stylable graphics, usable as an XML Namespace.

Scalable

To be scalable means to increase or decrease uniformly. In terms of graphics, scalable means not being limited to a single, fixed, pixel size. On the Web, scalable means that that a particular technology can grow to a large number of files, a large number of users, a wide variety of applications. SVG, being a graphics technology for the Web, is scalable in both senses of the word.

SVG graphics are scalable to different display resolutions, so that for example printed output uses the full resolution of the printer and can be displayed at the same size on screens of different resolutions. The same SVG graphic can be placed at different sizes on the same Web page, and re-used at different sizes on different pages. SVG graphics can be magnified to see fine detail, or to aid those with low vision.

SVG graphics are scalable because they can be referenced or included inside other SVG graphics, allowing a complex illustration to be built up in parts, perhaps by several people. The symbol, marker and font capabilities promote re-use of graphical components, maximise the advantages of HTTP cacheing and avoid the need for a centralised registry of approved symbols.

Vector

Vector graphics contain geometric objects such as lines and curves. This gives greater flexibility compared to raster-only formats (such as PNG and JPEG) which have to store information for every pixel of the graphic. Typically, vector formats can also integrate raster images and can combine them with vector information such as clipping paths to produce a complete illustration; SVG is no exception.

Since all modern displays are raster-oriented, the difference between raster-only and vector graphics comes down to where they are rasterised; client side in the case of vector graphics, as opposed to already rasterised on the server. SVG gives control over the rasterisation process, for example to allow anti-aliased artwork without the ugly aliasing typical of low quality vector implementations. SVG also provided client-side raster filter effects, so that moving to a vector format does not mean the loss of popular effects such as soft drop shadows.

Graphics

Most existing XML grammars represent either textual information, or represent raw data such as financial information. They typically provide only rudimentary graphical capabilities, often less capable than the HTML 'img' element. SVG fills a gap in the market by providing a rich, structured description of vector and mixed vector/raster graphics; it can be used standalone, or as an XML namespace with other grammars.

XML

XML, a [W3C Recommendation](#) for structured information exchange, has become extremely popular and is both widely and reliably implemented. By being written in XML, SVG builds on this strong foundation and gains many advantages such as a sound basis for internationalisation, powerful structuring capability, an object model, and so on. By building on existing, cleanly-implemented specifications, XML-based grammars are open to implementation without a huge reverse engineering effort.

Namespace

It is certainly useful to have a standalone, SVG-only viewer. But SVG is also intended to be used as one component in a multi-namespace XML application. This multiplies the power of each of the namespaces used, to allow innovative new content to be created. For example, SVG graphics may be included in a document which uses any text-oriented XML namespace - including XHTML. A scientific document, for example, might also use MathML [MATHML] for mathematics in the document. The combination of SVG and SMIL leads to interesting, time based, graphically rich presentations.

SVG is a good, general-purpose component for any multi-namespace grammar that needs to use graphics.

Stylable

The advantages of style sheets in terms of presentational control, flexibility, faster download and improved maintenance are now generally accepted, certainly for use with text. SVG extends this control to the realm of graphics.

The combination of scripting, DOM and CSS is often termed "Dynamic HTML" and is widely used for animation, interactivity and presentational effects. SVG allows the same script-based manipulation of the document tree and the style sheet.

Important SVG Concepts

Graphical Objects

With any XML grammar, consideration has to be given to what exactly is being modelled. For textual formats, modelling is typically at the level of paragraphs and phrases, rather than individual nouns, adverbs, or phonemes. Similarly, SVG models graphics at the level of graphical objects rather than individual points.

SVG provides a general path element, which can be used to create a huge variety of graphical objects, and also provides common geometric objects such as rectangles and ellipses. These are convenient for hand coding and may be used in the same ways as the more general path element. SVG provides fine control over the coordinate system in which graphical objects are defined and the transformations that will be applied during rendering.

Symbols

It would have been possible to define some standard symbols that SVG would provide. But which ones? There would always be additional symbols for electronics, cartography, flowcharts, that people would need that were not provided until the "next version". SVG allows users to create, re-use and share their own symbols without requiring a centralised registry. Communities of users can create and refine the symbols that they need, without having to ask a committee. Designers can be sure exactly of the graphical appearance of the symbols they use

and not have to worry about unsupported symbols.

Symbols may be used at different sizes and orientations, and can be restyled to fit in with the rest of the graphical composition.

Raster Effects

Many existing Web graphics use the filtering operations found in paint packages to create blurs, shadows, lighting effects and so on. With the client-side rasterisation used with vector formats, such effects might be thought impossible. SVG allows the declarative specification of filters, either singly or in combination, which can be applied on the client side when the SVG is rendered. These are specified in such a way that the graphics are still scalable and displayable at different resolutions.

Fonts

Graphically rich material is often highly dependent on the particular font used and the exact spacing of the glyphs. In many cases, designers convert text to outlines to avoid any font substitution problems. This means that the original text is not present and thus seachability and accessibility suffer. In response to feedback from designers, SVG includes font elements so that both text and graphical appearance are preserved.

Animation

Animation can be produced via script-based manipulation of the document, but scripts are difficult to edit and interchange between authoring tools is harder. Again in response to feedback from the design community, SVG includes declarative animation elements which were designed collaboratively by the SVG and SYMM working groups. This allows the animated effects common in existing Web graphics to be expressed in SVG.

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3 Rendering Model

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3.1 Introduction

Implementations of SVG are expected to behave as though they implement a rendering (or imaging) model corresponding to the one described in this chapter. A real implementation is not required to implement the model in this way, but the result on any device supported by the implementation shall match that described by this model.

The appendix on conformance requirements describes the extent to which an actual implementation may deviate from this description. In practice an actual implementation will deviate slightly because of limitations of the output device (e.g. only a limited range of colors might be supported) and because of practical limitations in implementing a precise mathematical model (e.g. for realistic performance curves are approximated by straight lines, the approximation need only be sufficiently precise to match the conformance requirements.)

3.2 The painters model

SVG uses a "painters model" of rendering. Paint is applied in successive operations to the output device such that each operation paints over some area of the output device. When the area overlaps a previously painted area the new paint partially or completely obscures the old. When the paint is not completely opaque the result on the output device is defined by the (mathematical) rules for compositing described under Simple Alpha

Blending.

3.3 Rendering Order

Elements in an SVG document fragment have an implicit drawing order, with the first elements in the SVG document fragment getting "painted" first. Subsequent elements are painted on top of previously painted elements.

3.4 Grouping

Grouping elements such as the 'g' have the effect of producing a temporary separate canvas onto which child elements are painted. Upon the completion of the group, the effect is as if the group's canvas is painted onto the ancestors canvas using the standard rendering rules for individual graphic objects.

3.5 Types of graphics elements

SVG supports three fundamental types of graphics elements that can be rendered onto the canvas:

- Shapes, which represent some combination of straight line and curves
- Text, which represents some combination of character glyphs
- Raster images, which represent an array of values that specify the paint color and opacity (often termed alpha) at a series of points on a rectangular grid. (SVG requires support for specified raster image formats under conformance requirements.)

3.5.1 Painting shapes and text

Shapes and text can be filled (i.e., apply paint to the interior of the shape) and stroked (i.e., apply paint along the outline of the shape). A stroke operation is centered on the outline of the object; thus, in effect, half of the paint falls on the interior of the shape and half of the paint falls outside of the shape.

For certain types of shapes, marker symbols (which themselves can consist of any combination of shapes, text and images) can be drawn at selected vertices. Each marker symbol is painted as if its graphical content were expanded into the SVG document tree just after the shape object which is using the given marker symbol. The graphical contents of a marker symbol are rendered using the same methods are graphics elements. Marker symbols are not applicable to text.

The fill is painted first, then the stroke, and then the marker symbols. The marker symbols are rendered in order along the outline of the shape, from the start of the shape to the end of the shape.

Each fill and stroke operation has its own opacity settings; thus, you can fill and/or stroke a shape with a semi-transparently drawn solid color, with different opacity values for the fill and stroke operations.

The fill and stroke operations are entirely independent painting operations; thus, if you both fill and stroke a shape, half of the stroke will be painted on top of part of the fill.

SVG supports the following built-in types of paint which can be used in fill and stroke operations:

- Solid color

- [Gradients](#) (linear and radial)
- [Patterns](#)

3.5.2 Painting raster images

When a raster image is rendered, the original samples are "resampled" using standard algorithms to produce samples at the positions required on the output device. Resampling requirements are discussed under [conformance requirements](#).

3.6 Filtering painted regions

SVG allows any painting operation to be filtered. (See [Filter Effects](#))

In this case the result must be as though the paint operations had been applied to an intermediate canvas, of a size determined by the rules given in [Filter Effects](#) then filtered by the processes defined in [Filter Effects](#).

3.7 Clipping, masking and object opacity

SVG allows any painting operation to be limited to a sub-region of the output device by clipping and masking. This is described in [Clipping, Masking and Compositing](#)

Clipping uses a path to define a region of the output device to which paint can be applied. Any painting operation executed within the scope of the clipping must be rendered such that only those parts of the device that fall within the clipping region are affected by the painting operation. A clipping path can be thought of as a mask wherein those pixels outside the clipping path are black with an alpha value of zero and those pixels inside the clipping path are white with an alpha value of 1. "Within" is defined by the same rules used to determine the interior of a path for painting. The clipping path is typically anti-aliased on low-resolution devices (see ['shape-rendering'](#)). Clipping is described in [Clipping paths](#).

Masking uses the luminance of the color channels and alpha channel in a referenced SVG element to define a supplemental set of alpha values which are multiplied to the alpha values already present in the graphics to which the mask is applied. Masking is described in [Masking](#).

A supplemental masking operation may also be specified by applying a "global" opacity to a set of rendering operations. In this case the mask is infinite, with a color of white and an alpha channel of the given opacity value. (See ['opacity' property](#).)

In all cases the SVG implementation must behave as though all painting and filtering is first performed to an intermediate (imaginary) canvas. Then, alpha values on the intermediate canvas are multiplied by the implicit alpha values from the clipping path, the alpha values from the mask, and the alpha values from the ['opacity' property](#). The resulting canvas is composited into the background using [simple alpha blending](#). Thus if an area of the output device is painted with a group opacity of 50% using opaque red paint followed by opaque green paint the result is as though it had been painted with just 50% opaque green paint. This is because the opaque green paint completely obscures the red paint on the intermediate canvas before the intermediate as a whole is rendered onto the output device.

3.8 Parent Compositing

SVG document fragments can be semi-opaque. In many environments (e.g., web browsers), the SVG document fragment has a final compositing step where the document as a whole is blended translucently into the background canvas.

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4 Basic Data Types and Interfaces

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- 4.3 Basic DOM interfaces

4.1 Basic data types

The common data types for SVG's properties and attributes fall into the following categories:

- <angle>: An angle value is a <number> optionally followed immediately with an angle unit identifier. Angle unit identifiers are:
  - deg: degrees
  - grad: grads
  - rad: radians

  For properties defined in [CSS2], an angle unit identifier must be provided. For SVG-specific attributes and properties, the angle unit identifier is optional. If not provided, the angle value is assumed to be in degrees.
  The corresponding SVG DOM interface definition for <angle> is SVGAngle.

- <color>: The basic type <color> is a CSS2-compatible specification for a color in the sRGB color space [SRGB]. <color> applies to SVG's use of the 'color' property and is a component of the definitions of properties 'fill', 'stroke' 'stop-color', 'flood-color' and 'lighting-color', which also offer optional ICC-based color specifications.
  A <color> is either a keyword (see Recognized color keyword names) or a numerical RGB specification.
  In addition to these color keywords, users may specify keywords that correspond to the colors used by objects in the user's environment. The normative definition of these keywords is [CSS2 system colors].
  The format of an RGB value in hexadecimal notation is a '#' immediately followed by either three or six hexadecimal characters. The three-digit RGB notation (#rgb) is converted into six-digit form (#rrggbb) by replicating digits, not by adding zeros. For example, #fb0 expands to #ffbb00. This ensures that white (#ffffff) can be specified with the short notation (#fff) and removes any dependencies on the color depth of the display. The format of an RGB value in the functional notation is 'rgb(' followed by a comma-separated list of three numerical values (either three integer values or three percentage values) followed by ')'. The integer value 255 corresponds to 100%, and to F or FF in the hexadecimal notation: rgb(255,255,255) = rgb(100%,100%,100%) = #FFF. White space characters are allowed around the numerical values. All RGB colors are specified in the sRGB color space (see [SRGB]). Using sRGB provides an unambiguous and objectively measurable definition of of the color, which can be related to international standards (see [COLORIMETRY]).
  The corresponding SVG DOM interface definitions for <color> are defined in [DOM2-CSS]; in particular, see the [DOM2-CSS-RGBCOLOR]. SVG's extension to color, including the ability to specify ICC-based colors, are represented in DOM interface SVGColor.

- <coordinate>: The format of a <coordinate> is a <number> optionally followed immediately by a unit identifier.
  If the <coordinate> is expressed as a simple number without a unit identifier (e.g., 48), then the value represents a coordinate value in the current user coordinate system (see Coordinate Systems, Transformations and Units).
  If one of the unit identifiers is provided (e.g., 12mm), the <coordinate> represents the coordinate in the user coordinate system that is the given distance (measured in the viewport coordinate system) from the origin of the user coordinate system along the relevant axis (the X axis for X coordinates, the Y axis for Y coordinates). (See Processing rules when using absolute unit identifiers and percentages.)
  If a percentage is provided (e.g., 10%), the <coordinate> represents the coordinate in the user coordinate system that is the given distance (measured as a percentage of the width or height of a contextually-defined reference object such as the current viewport) from the origin of the user coordinate system along the relevant axis (the X axis for X coordinates, the Y axis for Y coordinates). (See Processing rules when using absolute unit identifiers and percentages.)
  Within the SVG DOM, a <coordinate> is represented as an SVGLength since both values have the same syntax (although the semantics are not identical).

- <frequency>: Frequency values are used with aural properties. The normative definition of frequency values can be found in [CSS2-AURAL]. A frequency value is a <number> immediately followed by a frequency unit identifier. Frequency unit identifiers are:
  - Hz: Hertz

- ❍ kHz: kilo Hertz

Frequency values may not be negative.
The corresponding SVG DOM interface definitions for <frequency> are defined in [DOM2-CSS].

- <integer>: An <integer> is specified as an optional sign character ('+' or '-', with '+' being the default) followed by one or more digits "0" to "9".
  Unless stated otherwise for a particular attribute or property, the range for a <integer> encompasses (at a minimum) -2147483648 to -2147483647.
  Within the SVG DOM, an <integer> is represented as an SVGInteger.

- <length>: A length is a distance measurement. The format of a <length> is a <number> optionally followed immediately by a unit identifier. (Note that a <number> has different formulations depending on whether it is applied to a property or an XML attribute.)
  If the <length> is expressed as a value without a unit identifier (e.g., 48), then the <length> represents a distance in the current user coordinate system.
  If one of the unit identifiers is provided (e.g., 12mm), then the <length> represents a width, height or length value in the viewport coordinate system, depending on the value which is being represented. (See Processing rules when using absolute unit identifiers and percentages.)
  If a percentage is provided (e.g., 10%), then the given percentage represents a percentage of the width, height or weighted average of the width and height of the viewport, depending on the value which is being represented. (See Processing rules when using absolute unit identifiers and percentages.)
  Within the SVG DOM, a <length> is represented as an SVGLength.

- <list of xxx> (where xxx represents a value of some type): A list consists of a separated sequence of values. The specification of lists is different for property values than for XML attribute values.

  - ❍ Lists in property values are comma-separated, with optional white space before or after the comma.

  - ❍ Unless explicitly described differently, lists within SVG's XML attributes are either comma-separated, with optional white space before or after the comma, or white space-separated.

  White space in lists is defined as one or more of the following consecutive characters: "space" (Unicode code 32), "tab" (9), "line feed" (10), "carriage return" (13) and "form-feed" (12).
  Within the SVG DOM, a <list of xxx> is represented by various custom interfaces, such as SVGTransformList.

- <number> (real number value): The specification of real number values is different for property values than for XML attribute values.

  - ❍ CSS2 [CSS2] states that a property value which is a <number> is specified in decimal notation (i.e., a <decimal-number>), which consists of either an <integer>, or an optional sign character followed by zero or more digits followed by a dot (.) followed by zero or more digits with at least one digit required either before or after the dot. Thus, for conformance with CSS2, any property in SVG which accepts <number> values is specified in decimal notation only.

  - ❍ For SVG's XML attributes, to provide as much scalability in numeric values as possible, real number values can be provided either in decimal notation or in scientific notation (i.e., a <scientific-number>), which consists of a <decimal-number> immediately followed by the letter "e" or "E" immediately followed by an <integer>.

  Unless stated otherwise for a particular attribute or property, a <number> has the capacity for at least a single-precision floating point number (see [ICC32]) and has a range (at a minimum) of -3.4e+38F to +3.4e+38F.
  It is recommended that higher precision floating point storage and computation be performed on operations such as coordinate system transformations to provide the best possible precision and to prevent round-off errors.
  Conforming High-Quality SVG Viewers are required to use at least double-precision floating point (see [ICC32]) intermediate calculations on certain numerical operations.
  Within the SVG DOM, a <number> is represented as an SVGNumber.

- <paint> : The values for properties 'fill' and 'stroke' are specifications of the type of paint to use when filling or stroking a given graphics element. The available options and syntax for <paint> is described in Specifying paint.
  Within the SVG DOM, <paint> is represented as an SVGPaint.

- <percentage>: The format of a percentage value is a <number> immediately followed by a '%'. Percentage values are always relative to another value, for example a length. Each attribute or property that allows percentages also defines the reference distance measurement to which the percentage refers.
  Within the SVG DOM, a <percentage> is represented as an SVGLength.

- <time>: A time value is a <number> immediately followed by a time unit identifier. Time unit identifiers are:

  - ❍ ms: milliseconds

  - ❍ s: seconds

  Time values are used in CSS properties and may not be negative.
  The corresponding SVG DOM interface definitions for <time> are defined in [DOM2-CSS].

- <transform-list> : The detailed description of the possible values for a <transform-list> are detailed in Modifying the User Coordinate System: the transform attribute.
  Within the SVG DOM, <transform-list> is represented as an SVGTransformList.

- <uri> (Uniform Resource Identifiers [URI] references): A URI is the address of a resource on the Web. For the specification of URI references in SVG, see URI references.
  Within the SVG DOM, <uri> is represented as a DOMString.

4.2 Recognized color keyword names

The following is the list of recognized color keywords that can be used as a keyword value for data type <color>:

aliceblue	rgb(240, 248, 255)	lightpink	rgb(255, 182, 193)
antiquewhite	rgb(250, 235, 215)	lightsalmon	rgb(255, 160, 122)
aqua	rgb(0, 255, 255)	lightseagreen	rgb(32, 178, 170)
aquamarine	rgb(127, 255, 212)	lightskyblue	rgb(135, 206, 250)
azure	rgb(240, 255, 255)	lightslategray	rgb(119, 136, 153)
beige	rgb(245, 245, 220)	lightslategrey	rgb(119, 136, 153)
bisque	rgb(255, 228, 196)	lightsteelblue	rgb(176, 196, 222)
black	rgb(0, 0, 0)	lightyellow	rgb(255, 255, 224)
blanchedalmond	rgb(255, 235, 205)	lime	rgb(0, 255, 0)
blue	rgb(0, 0, 255)	limegreen	rgb(50, 205, 50)
blueviolet	rgb(138, 43, 226)	linen	rgb(250, 240, 230)
brown	rgb(165, 42, 42)	magenta	rgb(255, 0, 255)
burlywood	rgb(222, 184, 135)	maroon	rgb(128, 0, 0)
cadetblue	rgb(95, 158, 160)	mediumaquamarine	rgb(102, 205, 170)
chartreuse	rgb(127, 255, 0)	mediumblue	rgb(0, 0, 205)
chocolate	rgb(210, 105, 30)	mediumorchid	rgb(186, 85, 211)
coral	rgb(255, 127, 80)	mediumpurple	rgb(147, 112, 219)
cornflowerblue	rgb(100, 149, 237)	mediumseagreen	rgb(60, 179, 113)
cornsilk	rgb(255, 248, 220)	mediumslateblue	rgb(123, 104, 238)
crimson	rgb(220, 20, 60)	mediumspringgreen	rgb(0, 250, 154)
cyan	rgb(0, 255, 255)	mediumturquoise	rgb(72, 209, 204)
darkblue	rgb(0, 0, 139)	mediumvioletred	rgb(199, 21, 133)
darkcyan	rgb(0, 139, 139)	midnightblue	rgb(25, 25, 112)
darkgoldenrod	rgb(184, 134, 11)	mintcream	rgb(245, 255, 250)
darkgray	rgb(169, 169, 169)	mistyrose	rgb(255, 228, 225)
darkgreen	rgb(0, 100, 0)	moccasin	rgb(255, 228, 181)
darkgrey	rgb(169, 169, 169)	navajowhite	rgb(255, 222, 173)
darkkhaki	rgb(189, 183, 107)	navy	rgb(0, 0, 128)
darkmagenta	rgb(139, 0, 139)	oldlace	rgb(253, 245, 230)
darkolivegreen	rgb(85, 107, 47)	olive	rgb(128, 128, 0)
darkorange	rgb(255, 140, 0)	olivedrab	rgb(107, 142, 35)
darkorchid	rgb(153, 50, 204)	orange	rgb(255, 165, 0)
darkred	rgb(139, 0, 0)	orangered	rgb(255, 69, 0)
darksalmon	rgb(233, 150, 122)	orchid	rgb(218, 112, 214)
darkseagreen	rgb(143, 188, 143)	palegoldenrod	rgb(238, 232, 170)
darkslateblue	rgb(72, 61, 139)	palegreen	rgb(152, 251, 152)
darkslategray	rgb(47, 79, 79)	paleturquoise	rgb(175, 238, 238)
darkslategrey	rgb(47, 79, 79)	palevioletred	rgb(219, 112, 147)
darkturquoise	rgb(0, 206, 209)	papayawhip	rgb(255, 239, 213)
darkviolet	rgb(148, 0, 211)	peachpuff	rgb(255, 218, 185)
deeppink	rgb(255, 20, 147)	peru	rgb(205, 133, 63)
deepskyblue	rgb(0, 191, 255)	pink	rgb(255, 192, 203)
dimgray	rgb(105, 105, 105)	plum	rgb(221, 160, 221)
dimgrey	rgb(105, 105, 105)	powderblue	rgb(176, 224, 230)
dodgerblue	rgb(30, 144, 255)	purple	rgb(128, 0, 128)
firebrick	rgb(178, 34, 34)	red	rgb(255, 0, 0)
floralwhite	rgb(255, 250, 240)	rosybrown	rgb(188, 143, 143)
forestgreen	rgb(34, 139, 34)	royalblue	rgb(65, 105, 225)
fuchsia	rgb(255, 0, 255)	saddlebrown	rgb(139, 69, 19)
gainsboro	rgb(220, 220, 220)	salmon	rgb(250, 128, 114)

ghostwhite	rgb(248, 248, 255)	sandybrown	rgb(244, 164, 96)
gold	rgb(255, 215, 0)	seagreen	rgb(46, 139, 87)
goldenrod	rgb(218, 165, 32)	seashell	rgb(255, 245, 238)
gray	rgb(128, 128, 128)	sienna	rgb(160, 82, 45)
grey	rgb(128, 128, 128)	silver	rgb(192, 192, 192)
green	rgb(0, 128, 0)	skyblue	rgb(135, 206, 235)
greenyellow	rgb(173, 255, 47)	slateblue	rgb(106, 90, 205)
honeydew	rgb(240, 255, 240)	slategray	rgb(112, 128, 144)
hotpink	rgb(255, 105, 180)	slategrey	rgb(112, 128, 144)
indianred	rgb(205, 92, 92)	snow	rgb(255, 250, 250)
indigo	rgb(75, 0, 130)	springgreen	rgb(0, 255, 127)
ivory	rgb(255, 255, 240)	steelblue	rgb(70, 130, 180)
khaki	rgb(240, 230, 140)	tan	rgb(210, 180, 140)
lavender	rgb(230, 230, 250)	teal	rgb(0, 128, 128)
lavenderblush	rgb(255, 240, 245)	thistle	rgb(216, 191, 216)
lawngreen	rgb(124, 252, 0)	tomato	rgb(255, 99, 71)
lemonchiffon	rgb(255, 250, 205)	turquoise	rgb(64, 224, 208)
lightblue	rgb(173, 216, 230)	violet	rgb(238, 130, 238)
lightcoral	rgb(240, 128, 128)	wheat	rgb(245, 222, 179)
lightcyan	rgb(224, 255, 255)	white	rgb(255, 255, 255)
lightgoldenrodyellow	rgb(250, 250, 210)	whitesmoke	rgb(245, 245, 245)
lightgray	rgb(211, 211, 211)	yellow	rgb(255, 255, 0)
lightgreen	rgb(144, 238, 144)	yellowgreen	rgb(154, 205, 50)
lightgrey	rgb(211, 211, 211)		

4.3 Basic DOM interfaces

The following interfaces are defined below: SVGElement, SVGList, SVGLengthList, SVGAnimatedLengthList, SVGAnimatedString, SVGAnimatedBoolean, SVGAnimatedEnumeration, SVGAngle, SVGAnimatedAngle, SVGColor, SVGICCColor, SVGAnimatedInteger, SVGLength, SVGAnimatedLength, SVGAnimatedNumber, SVGNumberList, SVGAnimatedNumberList, SVGRect, SVGAnimatedRect, SVGUnitTypes, SVGStylable, SVGTransformable, SVGTests, SVGLangSpace, SVGExternalResourcesRequired, SVGFitToViewBox, SVGZoomAndPan, SVGViewSpec, SVGURIReference, SVGCSSRule, SVGRenderingIntent.

Interface SVGElement

All of the SVG DOM interfaces that correspond directly to elements in the SVG language (e.g., the SVGPathElement interface corresponds directly to the 'path' element in the language) are derivative from base class SVGElement.

IDL Definition

```
interface SVGElement : Element {
          attribute DOMString id;
                       // raises DOMException on setting
  readonly attribute SVGSVGElement ownerSVGElement;
  readonly attribute SVGElement viewportElement;
};
```

Attributes

DOMString id

The value of the id attribute on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

readonly SVGSVGElement ownerSVGElement

The nearest ancestor 'svg' element. Null if this is the given element is the outermost 'svg' element.

readonly SVGElement viewportElement

> The element which established the current viewport. Often, the nearest ancestor 'svg' element. Null if this is the given element is the outermost 'svg' element.

Interface SVGList

This interface defines a set of generic list handling attributes and methods.

IDL Definition

```
interface SVGList {

  readonly attribute unsigned long numberOfItems;

  void    clear (  )
                  raises( DOMException );
  Object initialize ( in Object newItem )
                  raises( DOMException, SVGException );
  Object createItem (   );
  Object getItem ( in unsigned long index )
                  raises( DOMException );
  Object insertItemBefore ( in Object newItem, in unsigned long index )
                  raises( DOMException, SVGException );
  Object replaceItem ( in Object newItem, in unsigned long index )
                  raises( DOMException, SVGException );
  Object removeItem ( in unsigned long index )
                  raises( DOMException );
  Object appendItem ( in Object newItem )
                  raises( DOMException, SVGException );
};
```

Attributes

readonly unsigned long numberOfItems

> The number of items in the list.

Methods

clear

> Clears all existing current items from the list, with the result being an empty list.
>
> No Parameters
>
> No Return Value
>
> Exceptions
>
> > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the list cannot be modified.

initialize

> Clears all existing current items from the list and re-initializes the list to hold the single item specified by the parameter.
>
> Parameters
>
> > in Object newItem The item which should become the only member of the list.
>
> Return value
>
> > Object The item being inserted into the list.
>
> Exceptions
>
> > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the list cannot be modified.
> > SVGException   SVG_WRONG_TYPE_ERR: Raised if parameter newItem is the wrong type of object for the given list.

createItem

> Creates an initialized item of the appropriate type for this list.
>
> No Parameters
>
> Return value
>
> > Object The created item.

No Exceptions

getItem

Returns the specified item from the list.

Parameters

in unsigned long index The index of the item from the list which is to be returned. The first item is number 0.

Return value

Object The selected item.

Exceptions

DOMException INDEX_SIZE_ERR: Raised if the index number is negative or greater than or equal to numberOfItems.

insertItemBefore

Inserts a new item into the list at the specified position. The first item is number 0.

Parameters

in Object newItem   The item which is to be inserted into the list.
in unsigned long index The index of the item before which the new item is to be inserted. The first item is number 0.
                         If the index is less than or equal to 0, then the new item is inserted at the front of the list. If the
                         index is greater than or equal to numberOfItems, then the new item is appended to the end of the
                         list.

Return value

Object The inserted item.

Exceptions

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the list cannot be modified.
SVGException   SVG_WRONG_TYPE_ERR: Raised if parameter newItem is the wrong type of object for the given list.

replaceItem

Replaces an existing item in the list with a new item.

Parameters

in Object newItem   The item which is to be inserted into the list.
in unsigned long index The index of the item which is to be replaced. The first item is number 0.

Return value

Object The inserted item.

Exceptions

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the list cannot be modified.
                INDEX_SIZE_ERR: Raised if the index number is negative or greater than or equal to numberOfItems.
SVGException   SVG_WRONG_TYPE_ERR: Raised if parameter newItem is the wrong type of object for the given list.

removeItem

Removes an existing item from the list.

Parameters

in unsigned long index The index of the item which is to be removed. The first item is number 0.

Return value

Object The removed item.

Exceptions

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the list cannot be modified.
                INDEX_SIZE_ERR: Raised if the index number is negative or greater than or equal to numberOfItems.

appendItem

Inserts a new item at the end of the list.

Parameters

in Object newItem The item which is to be inserted into the list. The first item is number 0.

Return value

Object The inserted item.

Exceptions

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the list cannot be modified.
SVGException   SVG_WRONG_TYPE_ERR: Raised if parameter newItem is the wrong type of object for the given list.

Interface SVGLengthList

Used for values that can be expressed as an array of SVGLengths.

The various methods inherited from SVGList, which are defined in SVGList to accept parameters and return values of type Object, must receive parameters of type SVGLength and return values of type SVGLength.

IDL Definition

```
interface SVGLengthList : SVGList {};
```


Interface SVGAnimatedLengthList

Used for attributes of type SVGLengthList which can be animated.

IDL Definition

```
interface SVGAnimatedLengthList {

         attribute SVGLengthList baseVal;
                      // raises DOMException on setting
  readonly attribute SVGLengthList animVal;
};
```

Attributes

SVGLengthList baseVal

The base value of the given attribute before applying any animations.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

readonly SVGLengthList animVal

If the given attribute or property is being animated, contains the current animated value of the attribute or property. If the given attribute or property is not currently being animated, contains the same value as 'baseVal'.

Interface SVGAnimatedString

Used for attributes of type DOMString which can be animated.

IDL Definition

```
interface SVGAnimatedString {

         attribute DOMString baseVal;
                      // raises DOMException on setting
  readonly attribute DOMString animVal;
};
```

Attributes

DOMString baseVal

The base value of the given attribute before applying any animations.

Exceptions on setting

>DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

readonly DOMString animVal

>If the given attribute or property is being animated, contains the current animated value of the attribute or property. If the given attribute or property is not currently being animated, contains the same value as 'baseVal'.

Interface SVGAnimatedBoolean

Used for attributes of type boolean which can be animated.

IDL Definition

```
interface SVGAnimatedBoolean {

         attribute boolean baseVal;
                    // raises DOMException on setting
  readonly attribute boolean animVal;
};
```

Attributes

boolean baseVal

>The base value of the given attribute before applying any animations.

>Exceptions on setting

>>DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

readonly boolean animVal

>If the given attribute or property is being animated, contains the current animated value of the attribute or property. If the given attribute or property is not currently being animated, contains the same value as 'baseVal'.

Interface SVGAnimatedEnumeration

Used for attributes whose value must be a constant from a particular enumeration and which can be animated.

IDL Definition

```
interface SVGAnimatedEnumeration {

         attribute unsigned short baseVal;
                    // raises DOMException on setting
  readonly attribute unsigned short animVal;
};
```

Attributes

unsigned short baseVal

>The base value of the given attribute before applying any animations.

>Exceptions on setting

>>DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

readonly unsigned short animVal

>If the given attribute or property is being animated, contains the current animated value of the attribute or property. If the given attribute or property is not currently being animated, contains the same value as 'baseVal'.

Interface SVGAngle

The SVGAngle interface corresponds to the <angle> basic data type.

IDL Definition

```
interface SVGAngle {

  // Angle Unit Types
  const unsigned short SVG_ANGLETYPE_UNKNOWN     = 0;
  const unsigned short SVG_ANGLETYPE_UNSPECIFIED = 1;
  const unsigned short SVG_ANGLETYPE_DEG         = 2;
  const unsigned short SVG_ANGLETYPE_RAD         = 3;
  const unsigned short SVG_ANGLETYPE_GRAD        = 4;

  readonly attribute unsigned short unitType;
          attribute float           value;
                    // raises DOMException on setting
          attribute float           valueInSpecifiedUnits;
                    // raises DOMException on setting
          attribute DOMString       valueAsString;
                    // raises DOMException on setting

  void newValueSpecifiedUnits ( in unsigned short unitType, in float valueInSpecifiedUnits );
  void convertToSpecifiedUnits ( in unsigned short unitType );
};
```

Definition group Angle Unit Types

   Defined constants

SVG_ANGLETYPE_UNKNOWN	The unit type is not one of predefined unit types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.
SVG_ANGLETYPE_UNSPECIFIED	No unit type was provided (i.e., a unitless value was specified). For angles, a unitless value is treated the same as if degrees were specified.
SVG_ANGLETYPE_DEG	The unit type was explicitly set to degrees.
SVG_ANGLETYPE_RAD	The unit type is radians.
SVG_ANGLETYPE_GRAD	The unit type is grads.

Attributes

   readonly unsigned short unitType

   The type of the value as specified by one of the constants specified above.

   float value

   The angle value as a floating point value, in degrees. Setting this attribute will cause valueInSpecifiedUnits and valueAsString to be updated automatically to reflect this setting.

   Exceptions on setting

   DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

   float valueInSpecifiedUnits

   The angle value as a floating point value, in the units expressed by unitType. Setting this attribute will cause value and valueAsString to be updated automatically to reflect this setting.

   Exceptions on setting

   DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

   DOMString valueAsString

   The angle value as a string value, in the units expressed by unitType. Setting this attribute will cause value and valueInSpecifiedUnits to be updated automatically to reflect this setting.

   Exceptions on setting

   DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Methods

   newValueSpecifiedUnits

   Reset the value as a number with an associated unitType, thereby replacing the values for all of the attributes on the object.

Parameters

> in unsigned short unitType   The unitType for the angle value (e.g., SVG_ANGLETYPE_DEG).
>
> in float valueInSpecifiedUnits   The angle value.

No Return Value

No Exceptions

convertToSpecifiedUnits

> Preserve the same value, but convert to the specified unitType. Object attributes unitType, valueAsSpecified and valueAsString might be modified as a result of this method,
>
> Parameters
>
>> in unsigned short unitType   The unitType to switch to (e.g., SVG_ANGLETYPE_DEG).
>
> No Return Value
>
> No Exceptions

Interface SVGAnimatedAngle

Corresponds to all properties and attributes whose values can be basic type 'angle' and which are animatable.

IDL Definition

```
interface SVGAnimatedAngle {

          attribute SVGAngle baseVal;
                      // raises DOMException on setting
  readonly attribute SVGAngle animVal;
};
```

Attributes

SVGAngle baseVal

> The base value of the given attribute before applying any animations.
>
> Exceptions on setting
>
>> DOMException   NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

readonly SVGAngle animVal

> If the given attribute or property is being animated, contains the current animated value of the attribute or property. If the given attribute or property is not currently being animated, contains the same value as 'baseVal'.

Interface SVGColor

The SVGColor corresponds to color value definition for properties 'stop-color', 'flood-color' and 'lighting-color' and is a base class for interface SVGPaint. It incorporates SVG's extended notion of color, which incorporates ICC-based color specifications.

Interface SVGColor does *not* correspond to the <color> basic data type. For the <color> basic data type, the applicable DOM interfaces are defined in [DOM2-CSS]; in particular, see the [DOM2-CSS-RGBCOLOR].

IDL Definition

```
interface SVGColor {

  // Color Types
  const unsigned short SVG_COLORTYPE_UNKNOWN          = 0;
  const unsigned short SVG_COLORTYPE_RGBCOLOR         = 1;
  const unsigned short SVG_COLORTYPE_RGBCOLOR_ICCCOLOR = 2;

  readonly attribute unsigned short colorType;
  readonly attribute css::RGBColor       rgbColor;
  readonly attribute SVGICCColor    iccColor;
```

```
  void         setRGBColor ( in css::RGBColor rgbColor );
  void         setRGBColorICCColor ( in css::RGBColor rgbColor, in SVGICCColor iccColor );
  css::RGBColor    createRGBColor (  );
  SVGICCColor createSVGICCColor (  );
};
```

Definition group Color Types

Defined constants

SVG_COLORTYPE_UNKNOWN	The color type is not one of predefined types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.
SVG_COLORTYPE_RGBCOLOR	An sRGB color has been specified without an alternative ICC color specification.
SVG_COLORTYPE_RGBCOLOR_ICCCOLOR	An sRGB color has been specified along with an alternative ICC color specification.

Attributes

readonly unsigned short colorType

The type of the value as specified by one of the constants specified above.

readonly css::RGBColor rgbColor

The color specified in the sRGB color space.

readonly SVGICCColor iccColor

The alternate ICC color specification.

Methods

setRGBColor

Modifies the color value to be the specified sRGB color without an alternate ICC color specification.

Parameters

in css::RGBColor rgbColor The new sRGB color specification.

No Return Value

No Exceptions

setRGBColorICCColor

Modifies the color value to be the specified sRGB color with an alternate ICC color specification.

Parameters

in css::RGBColor rgbColor The new sRGB color specification.
in SVGICCColor iccColor   The alternate ICC color specification.

No Return Value

No Exceptions

createRGBColor

Returns an RGBColor object which is initialized to red=green=blue=0.

No Parameters

Return value

css::RGBColor The returned RGBColor object.

No Exceptions

createSVGICCColor

Returns an SVGICCColor object which is initialized to an empty list of colors and a null for the colorProfile string.

No Parameters

Return value

SVGICCColor The returned SVGICCColor object.

No Exceptions

Interface SVGICCColor

The SVGICCColor expresses an ICC-based color specification and is a base class for interface SVGColor

IDL Definition

```
interface SVGICCColor {

         attribute DOMString colorProfile;
                      // raises DOMException on setting
  readonly attribute SVGList   colors;
};
```

Attributes

DOMString colorProfile

The name of the color profile, which is the first parameter of an ICC color specification.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

readonly SVGList colors

The list of color values that define this ICC color. Each color value is an arbitrary floating point number.

The various methods from SVGList, which are defined to accept parameters and return values of type Object, must receive parameters of type float and return values of type float.

Interface SVGAnimatedInteger

Used for attributes of basic type 'integer' which can be animated.

IDL Definition

```
interface SVGAnimatedInteger {

         attribute long baseVal;
                      // raises DOMException on setting
  readonly attribute long animVal;
};
```

Attributes

long baseVal

The base value of the given attribute before applying any animations.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

readonly long animVal

If the given attribute or property is being animated, contains the current animated value of the attribute or property. If the given attribute or property is not currently being animated, contains the same value as 'baseVal'.

Interface SVGLength

The SVGLength interface corresponds to the <length> basic data type.

IDL Definition

```
interface SVGLength {

  // Length Unit Types
```

```
      const unsigned short SVG_LENGTHTYPE_UNKNOWN    = 0;
      const unsigned short SVG_LENGTHTYPE_NUMBER     = 1;
      const unsigned short SVG_LENGTHTYPE_PERCENTAGE = 2;
      const unsigned short SVG_LENGTHTYPE_EMS        = 3;
      const unsigned short SVG_LENGTHTYPE_EXS        = 4;
      const unsigned short SVG_LENGTHTYPE_PX         = 5;
      const unsigned short SVG_LENGTHTYPE_CM         = 6;
      const unsigned short SVG_LENGTHTYPE_MM         = 7;
      const unsigned short SVG_LENGTHTYPE_IN         = 8;
      const unsigned short SVG_LENGTHTYPE_PT         = 9;
      const unsigned short SVG_LENGTHTYPE_PC         = 10;

  readonly attribute unsigned short unitType;
          attribute float           value;
                    // raises DOMException on setting
          attribute float           valueInSpecifiedUnits;
                    // raises DOMException on setting
          attribute DOMString        valueAsString;
                    // raises DOMException on setting

  void newValueSpecifiedUnits ( in unsigned short unitType, in float valueInSpecifiedUnits );
  void convertToSpecifiedUnits ( in unsigned short unitType );
};
```

Definition group Length Unit Types

Defined constants

SVG_LENGTHTYPE_UNKNOWN	The unit type is not one of predefined unit types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.
SVG_LENGTHTYPE_NUMBER	No unit type was provided (i.e., a unitless value was specified), which indicates a value in user units.
SVG_LENGTHTYPE_PERCENTAGE	A percentage value was specified.
SVG_LENGTHTYPE_EMS	A value was specified using the "em" units defined in CSS2.
SVG_LENGTHTYPE_EXS	A value was specified using the "ex" units defined in CSS2.
SVG_LENGTHTYPE_PX	A value was specified using the "px" units defined in CSS2.
SVG_LENGTHTYPE_CM	A value was specified using the "cm" units defined in CSS2.
SVG_LENGTHTYPE_MM	A value was specified using the "mm" units defined in CSS2.
SVG_LENGTHTYPE_IN	A value was specified using the "in" units defined in CSS2.
SVG_LENGTHTYPE_PT	A value was specified using the "pt" units defined in CSS2.
SVG_LENGTHTYPE_PC	A value was specified using the "pc" units defined in CSS2.

Attributes

readonly unsigned short unitType

The type of the value as specified by one of the constants specified above.

float value

The value as an floating point value, in user units. Setting this attribute will cause valueInSpecifiedUnits and valueAsString to be updated automatically to reflect this setting.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float valueInSpecifiedUnits

The value as an floating point value, in the units expressed by unitType. Setting this attribute will cause value and valueAsString to be updated automatically to reflect this setting.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

DOMString valueAsString

The value as a string value, in the units expressed by unitType. Setting this attribute will cause value and valueInSpecifiedUnits to be updated automatically to reflect this setting.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Methods

newValueSpecifiedUnits

> Reset the value as a number with an associated unitType, thereby replacing the values for all of the attributes on the object.
>
> Parameters
>
> > in unsigned short unitType The unitType for the value (e.g., SVG_LENGTHTYPE_MM).
> > in float valueInSpecifiedUnits The new value.
>
> No Return Value
>
> No Exceptions

convertToSpecifiedUnits

> Preserve the same value, but convert to the specified unitType. Object attributes unitType, valueAsSpecified and valueAsString might be modified as a result of this method,
>
> Parameters
>
> > in unsigned short unitType The unitType to switch to (e.g., SVG_LENGTHTYPE_MM).
>
> No Return Value
>
> No Exceptions

Interface SVGAnimatedLength

Used for attributes of basic type 'length' which can be animated.

IDL Definition

```
interface SVGAnimatedLength {

         attribute SVGLength baseVal;
                      // raises DOMException on setting
  readonly attribute SVGLength animVal;
};
```

Attributes

SVGLength baseVal

> The base value of the given attribute before applying any animations.
>
> Exceptions on setting
>
> > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

readonly SVGLength animVal

> If the given attribute or property is being animated, contains the current animated value of the attribute or property. If the given attribute or property is not currently being animated, contains the same value as 'baseVal'.

Interface SVGAnimatedNumber

Used for attributes of basic type 'number' which can be animated.

IDL Definition

```
interface SVGAnimatedNumber {

         attribute float baseVal;
                      // raises DOMException on setting
  readonly attribute float animVal;
};
```

Attributes

float baseVal

> The base value of the given attribute before applying any animations.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

readonly float animVal

If the given attribute or property is being animated, contains the current animated value of the attribute or property. If the given attribute or property is not currently being animated, contains the same value as 'baseVal'.

Interface SVGNumberList

Used for values that can be expressed as an array of numbers (i.e., each entry is a 'float').

The various methods inherited from SVGList, which are defined in SVGList to accept parameters and return values of type Object, must receive parameters of type float and return values of type float.

IDL Definition

```
interface SVGNumberList : SVGList {};
```

Interface SVGAnimatedNumberList

Used for attributes which take a list of numbers and which can be animated.

IDL Definition

```
interface SVGAnimatedNumberList {

            attribute SVGNumberList baseVal;
                      // raises DOMException on setting
  readonly attribute SVGNumberList animVal;
};
```

Attributes

SVGNumberList baseVal

The base value of the given attribute before applying any animations.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

readonly SVGNumberList animVal

If the given attribute or property is being animated, contains the current animated value of the attribute or property. If the given attribute or property is not currently being animated, contains the same value as 'baseVal'.

Interface SVGRect

Rectangles are defined as consisting of a (x,y) coordinate pair identifying a minimum X value, a minimum Y value, and a width and height, which are usually constrained to be non-negative.

IDL Definition

```
interface SVGRect {

            attribute float x;
                      // raises DOMException on setting
            attribute float y;
                      // raises DOMException on setting
            attribute float width;
                      // raises DOMException on setting
            attribute float height;
```

```
                                    // raises DOMException on setting
        };
```

Attributes

    float x

        Corresponds to attribute x on the given element.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

    float y

        Corresponds to attribute y on the given element.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

    float width

        Corresponds to attribute width on the given element.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

    float height

        Corresponds to attribute height on the given element.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGAnimatedRect

Used for attributes of type SVGRect which can be animated.

IDL Definition

```
interface SVGAnimatedRect {

         attribute SVGRect baseVal;
                      // raises DOMException on setting
  readonly attribute SVGRect animVal;
};
```

Attributes

    SVGRect baseVal

        The base value of the given attribute before applying any animations.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

    readonly SVGRect animVal

        If the given attribute or property is being animated, contains the current animated value of the attribute or property. If the given attribute or property is not currently being animated, contains the same value as 'baseVal'.

Interface SVGUnitTypes

The SVGUnitTypes interface defines a commonly used set of constants and is a base interface used by SVGGradientElement, SVGPatternElement, SVGClipPathElement, SVGMaskElement, and SVGFilterElement.

IDL Definition

```
interface SVGUnitTypes {
```

```
  // Unit Types
  const unsigned short SVG_UNIT_TYPE_UNKNOWN         = 0;
  const unsigned short SVG_UNIT_TYPE_USERSPACEONUSE  = 1;
  const unsigned short SVG_UNIT_TYPE_USERSPACE       = 2;
  const unsigned short SVG_UNIT_TYPE_OBJECTBOUNDINGBOX = 3;
};
```

Definition group Unit Types

Defined constants

SVG_UNIT_TYPE_UNKNOWN	The type is not one of predefined types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.
SVG_UNIT_TYPE_USERSPACEONUSE	Corresponds to value userSpaceOnUse.
SVG_UNIT_TYPE_USERSPACE	Corresponds to value userSpace.
SVG_UNIT_TYPE_OBJECTBOUNDINGBOX	Corresponds to value objectBoundingBox.

Interface SVGStylable

IDL Definition

```
interface SVGStylable {

          attribute SVGAnimatedString className;
                    // raises DOMException on setting
  readonly attribute css::CSSStyleDeclaration style;

  css::CSSValue getPresentationAttribute ( in DOMString name );
  css::CSSValue getAnimatedPresentationAttribute ( in DOMString name );
};
```

Attributes

SVGAnimatedString className

Corresponds to attribute class on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

readonly css::CSSStyleDeclaration style

Corresponds to attribute style on the given element. If the user agent does not support styling with CSS, then this attribute must always have the value of null.

Methods

getPresentationAttribute

Returns the base/static value of a given *presentation attribute* as an object of type CSSValue. The returned object is live; changes to the objects represent immediate changes to the objects to which the CSSValue is attached.

Parameters

in DOMString name Retrieves a "presentation attribute" by name.

Return value

css::CSSValue The static/base value of the given *presentation attribute* as a CSSValue, or NULL if the given attribute does not have a specified value.

If the given attribute or property is being animated, contains the current animated value of the attribute or property. If the given attribute or property is not currently being animated, contains the same value as 'baseVal'.

No Exceptions

getAnimatedPresentationAttribute

Returns the current animated value of a given *presentation attribute* as an object of type CSSValue. The returned object is readonly. An attempt to modify the return value will generate an exception.

Parameters

    in DOMString name Retrieves the current animated value of a "presentation attribute" by name.

Return value

    css::CSSValue The current animated value of the given *presentation attribute* as a CSSValue, or NULL if the given attribute does not have a specified value.

No Exceptions

Interface SVGTransformable

Interface SVGTransformable contains properties and methods that apply to all elements which have attribute transform.

IDL Definition

```
interface SVGTransformable {

  readonly attribute SVGElement                 nearestViewportElement;
  readonly attribute SVGElement                 farthestViewportElement;
           attribute SVGAnimatedTransformList transform;
                       // raises DOMException on setting

  SVGRect   getBBox ( );
  SVGMatrix getCTM (  );
  SVGMatrix getScreenCTM (  );
  SVGMatrix getTransformToElement ( in SVGElement element )
                raises( SVGException );
};
```

Attributes

readonly SVGElement nearestViewportElement

The element which established the current viewport. Often, the nearest ancestor 'svg' element. Null if the current element is the outermost 'svg' element.

readonly SVGElement farthestViewportElement

The farthest ancestor 'svg' element. Null if the current element is the outermost 'svg' element.

SVGAnimatedTransformList transform

Corresponds to attribute transform on the given element.

Exceptions on setting

    DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Methods

getBBox

Returns the tight bounding box in current user space (i.e., after application of the transform attribute) on the geometry of all contained graphics elements, exclusive of stroke-width and filter effects).

No Parameters

Return value

    SVGRect An SVGRect object that defines the bounding box.

No Exceptions

getCTM

Returns the transformation matrix from current user units (i.e., after application of the transform attribute) to the viewport coordinate system for the nearestViewportElement.

No Parameters

Return value

    SVGMatrix An SVGMatrix object that defines the CTM.

No Exceptions

getScreenCTM

Returns the transformation matrix from current user units (i.e., after application of the transform attribute) to the parent user agent's notice of a "pixel". For display devices, ideally this represents a physical screen pixel. For other devices or environments where physical pixel sizes are not know, then an algorithm similar to the CSS2 definition of a "pixel" can be used instead.

No Parameters

Return value

SVGMatrix An SVGMatrix object that defines the given transformation matrix.

No Exceptions

getTransformToElement

Returns the transformation matrix from the user coordinate system on the current element (after application of the transform attribute) to the user coordinate system on **element** (after application of its transform attribute).

Parameters

in SVGElement element The target element.

Return value

SVGMatrix An SVGMatrix object that defines the transformation.

Exceptions

SVGException SVG_MATRIX_NOT_INVERTABLE: Raised if the currently defined transformation matrices make it impossible to compute the given matrix (e.g., because one of the transformations is singular).

Interface SVGTests

Interface SVGTests defines an interface which applies to all elements which have attributes <u>requiredFeatures</u>, <u>requiredExtensions</u> and <u>systemLanguage</u>.

IDL Definition

```
interface SVGTests {

          attribute SVGList requiredFeatures;
                    // raises DOMException on setting
          attribute SVGList requiredExtensions;
                    // raises DOMException on setting
          attribute SVGList systemLanguage;
                    // raises DOMException on setting

  boolean hasExtension ( in DOMString extension );
};
```

Attributes

SVGList requiredFeatures

Corresponds to attribute requiredFeatures on the given element. The various methods from SVGList, which are defined to accept parameters and return values of type Object, must receive parameters of type DOMString and return values of type DOMString.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGList requiredExtensions

Corresponds to attribute requiredExtensions on the given element. The various methods from SVGList, which are defined to accept parameters and return values of type Object, must receive parameters of type DOMString and return values of type DOMString.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGList systemLanguage

Corresponds to attribute systemLanguage on the given element. The various methods from SVGList, which are defined to accept parameters and return values of type Object, must receive parameters of type DOMString and return values of type DOMString.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Methods

    hasExtension

        Returns true if the user agent supports the given extension, specified by a URI.

        Parameters

            in DOMString extension The name of the extension, expressed as a URI.

        Return value

            boolean True or false, depending on whether the given extension is supported.

        No Exceptions

Interface SVGLangSpace

Interface SVGLangSpace defines an interface which applies to all elements which have attributes [xml:lang] and [xml:space].

IDL Definition

```
interface SVGLangSpace {

         attribute DOMString xmllang;
                   // raises DOMException on setting
         attribute DOMString xmlspace;
                   // raises DOMException on setting
};
```

Attributes

    DOMString xmllang

        Corresponds to attribute xml:lang on the given element.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

    DOMString xmlspace

        Corresponds to attribute xml:space on the given element.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGExternalResourcesRequired

Interface SVGExternalResourcesRequired defines an interface which applies to all elements where this element or one of its descendants can reference an external resource.

IDL Definition

```
interface SVGExternalResourcesRequired {

         attribute SVGAnimatedBoolean externalResourcesRequired;
                   // raises DOMException on setting
};
```

Attributes

    SVGAnimatedBoolean externalResourcesRequired

        Corresponds to attribute externalResourcesRequired on the given element.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGFitToViewBox

Interface SVGFitToViewBox defines DOM attributes that apply to elements which have XML attributes viewBox and preserveAspectRatio.

IDL Definition

```
interface SVGFitToViewBox {

          attribute SVGAnimatedRect              viewBox;
                    // raises DOMException on setting
          attribute SVGAnimatedPreserveAspectRatio preserveAspectRatio;
                    // raises DOMException on setting
};
```

Attributes

SVGAnimatedRect viewBox

    Corresponds to attribute viewBox on the given element.

    Exceptions on setting

        DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedPreserveAspectRatio preserveAspectRatio

    Corresponds to attribute preserveAspectRatio on the given element.

    Exceptions on setting

        DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGZoomAndPan

The SVGZoomAndPan interface defines attribute "zoomAndPan" and associated constants.

IDL Definition

```
interface SVGZoomAndPan {

  // Zoom and Pan Types
  const unsigned short SVG_ZOOMANDPAN_UNKNOWN  = 0;
  const unsigned short SVG_ZOOMANDPAN_DISABLE = 1;
  const unsigned short SVG_ZOOMANDPAN_MAGNIFY = 2;
  const unsigned short SVG_ZOOMANDPAN_ZOOM     = 3;

          attribute unsigned short zoomAndPan;
                    // raises DOMException on setting
};
```

Definition group Zoom and Pan Types

    Defined constants

SVG_ZOOMANDPAN_UNKNOWN	The enumeration was set to a value that is not one of predefined types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.
SVG_ZOOMANDPAN_DISABLE	Corresponds to value disable.
SVG_ZOOMANDPAN_MAGNIFY	Corresponds to value magnify.
SVG_ZOOMANDPAN_ZOOM	Corresponds to value zoom.

Attributes

unsigned short zoomAndPan

    Corresponds to attribute zoomAndPan on the given element. The value must be one of the zoom and pan constants specified above.

    Exceptions on setting

        DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGViewSpec

The interface corresponds to an SVG View Specification.

IDL Definition

```
interface SVGViewSpec :
              SVGZoomAndPan,
              SVGFitToViewBox {

          attribute SVGTransformList transform;
                    // raises DOMException on setting
          attribute SVGElement       viewTarget;
                    // raises DOMException on setting
  readonly attribute DOMString        viewBoxString;
  readonly attribute DOMString        preserveAspectRatioString;
  readonly attribute DOMString        transformString;
  readonly attribute DOMString        viewTargetString;
};
```

Attributes

SVGTransformList transform

Corresponds to the transform setting on the SVG View Specification.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGElement viewTarget

Corresponds to the viewTarget setting on the SVG View Specification.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

readonly DOMString viewBoxString

Corresponds to the viewBox setting on the SVG View Specification.

readonly DOMString preserveAspectRatioString

Corresponds to the preserveAspectRatio setting on the SVG View Specification.

readonly DOMString transformString

Corresponds to the transform setting on the SVG View Specification.

readonly DOMString viewTargetString

Corresponds to the viewTarget setting on the SVG View Specification.

Interface SVGURIReference

Interface SVGURIReference defines an interface which applies to all elements which have the collection of XLink attributes, such as xlink:href, which define a URI reference.

IDL Definition

```
interface SVGURIReference {

          attribute DOMString xlinkType;
                    // raises DOMException on setting
          attribute DOMString xlinkRole;
                    // raises DOMException on setting
          attribute DOMString xlinkTitle;
                    // raises DOMException on setting
          attribute DOMString xlinkShow;
                    // raises DOMException on setting
```

```
            attribute DOMString xlinkActuate;
                        // raises DOMException on setting
            attribute SVGAnimatedString href;
                        // raises DOMException on setting
    };
```

Attributes

DOMString xlinkType

Corresponds to attribute xlink:type on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

DOMString xlinkRole

Corresponds to attribute xlink:role on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

DOMString xlinkTitle

Corresponds to attribute xlink:title on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

DOMString xlinkShow

Corresponds to attribute xlink:show on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

DOMString xlinkActuate

Corresponds to attribute xlink:actuate on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedString href

Corresponds to attribute xlink:href on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGCSSRule

SVG extends interface CSSRule with interface SVGCSSRule by adding an SVGColorProfileRule rule to allow for specification of ICC-based color.

It is likely that this extension will become part of a future version of CSS and DOM.

IDL Definition

```
interface SVGCSSRule : css::CSSRule {
  // Additional CSS RuleType to support ICC color specifications
  const unsigned short COLOR_PROFILE_RULE = 7;
};
```

Definition group Additional CSS RuleType to support ICC color specifications

Defined constants

COLOR_PROFILE_RULE The rule is an @color-profile.

Interface SVGRenderingIntent

The SVGRenderingIntent defines the enumerated list of possible values for 'rendering-intent' attributes or descriptors.

IDL Definition

```
interface SVGRenderingIntent {

  // Rendering Intent Types
  const unsigned short RENDERING_INTENT_UNKNOWN              = 0;
  const unsigned short RENDERING_INTENT_AUTO                 = 1;
  const unsigned short RENDERING_INTENT_PERCEPTUAL           = 2;
  const unsigned short RENDERING_INTENT_RELATIVE_COLORIMETRIC = 3;
  const unsigned short RENDERING_INTENT_SATURATION           = 4;
  const unsigned short RENDERING_INTENT_ABSOLUTE_COLORIMETRIC = 5;
};
```

Definition group Rendering Intent Types

Defined constants

RENDERING_INTENT_UNKNOWN	The type is not one of predefined types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.
RENDERING_INTENT_AUTO	Corresponds to a value of auto.
RENDERING_INTENT_PERCEPTUAL	Corresponds to a value of perceptual.
RENDERING_INTENT_RELATIVE_COLORIMETRIC	Corresponds to a value of relative-colorimetric.
RENDERING_INTENT_SATURATION	Corresponds to a value of saturation.
RENDERING_INTENT_ABSOLUTE_COLORIMETRIC	Corresponds to a value of absolute-colorimetric.

5 Document Structure

Contents

5.1 Defining an SVG document fragment: the 'svg' element

5.1.1 Overview

An SVG document fragment consists of any number of SVG elements contained within an 'svg' element.

An SVG document fragment can range from an empty fragment (i.e., no content inside of the 'svg' element), to a very simple SVG document fragment containing a single SVG graphics element such as a 'rect', to a complex, deeply nested collection of container elements and graphics elements.

An SVG document fragment can stand by itself as a self-contained file or resource, in which case the SVG document fragment is an SVG document, or it can be embedded inline as a fragment within a parent XML document.

The following example shows simple SVG content embedded as a fragment within a parent XML document. Note the use of XML namespaces to indicate that the 'svg' and 'ellipse' elements belong to the SVG namespace:

```
<?xml version="1.0" standalone="yes"?>
<parent xmlns="http://someplace.org"
        xmlns:svg="http://www.w3.org/2000/svg-20000629">
   <!-- parent contents here -->
   <svg:svg width="4cm" height="8cm">
      <svg:ellipse cx="2cm" cy="4cm" rx="2cm" ry="1cm" />
   </svg:svg>
   <!-- ... -->
</parent>
```

This example shows a slightly more complex (i.e., it contains multiple rectangles) stand-alone, self-contained SVG document:

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="5cm" height="4cm">
  <desc>Four separate rectangles
  </desc>
    <rect x="0.5cm" y="0.5cm" width="2cm" height="1cm"/>
    <rect x="0.5cm" y="2cm" width="1cm" height="1.5cm"/>
    <rect x="3cm" y="0.5cm" width="1.5cm" height="2cm"/>
    <rect x="3.5cm" y="3cm" width="1cm" height="0.5cm"/>
</svg>
```

View this example as SVG (SVG-enabled browsers only)

'svg' elements can appear in the middle of SVG content. This is the mechanism by which SVG document fragments can be embedded within other SVG document fragments.

Another use for 'svg' elements within the middle of SVG content is to establish a new viewport and alter the meaning of unit identifiers. See Establishing a new viewport and Redefining the meaning of unit identifiers.

5.1.2 The 'svg' element

```
<!ENTITY % svgExt "" >
<!ELEMENT svg (desc|title|metadata|defs|
                    path|text|rect|circle|ellipse|line|polyline|polygon|
                    use|image|svg|g|view|switch|a|altGlyphDef|
                    script|style|symbol|marker|clipPath|mask|
                    linearGradient|radialGradient|pattern|filter|cursor|font|
                    animate|set|animateMotion|animateColor|animateTransform|
                    color-profile|font-face
                    %ceExt;%svgExt;)* >
<!ATTLIST svg
  xmlns CDATA #FIXED "http://www.w3.org/2000/svg-20000629"
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  viewBox %ViewBoxSpec; #IMPLIED
  preserveAspectRatio %PreserveAspectRatioSpec; 'xMidYMid meet'
  zoomAndPan (disable | magnify | zoom) 'magnify'
  %graphicsElementEvents;
```

```
%documentEvents;
x %Coordinate; #IMPLIED
y %Coordinate; #IMPLIED
width %Length; #REQUIRED
height %Length; #REQUIRED
contentScriptType %ContentType; "text/ecmascript"
contentStyleType %ContentType; "text/css" >
```

Attribute definitions:

xmlns [:*prefix*] = "resource-name"

> Standard XML attribute for identifying an XML namespace. Refer to the "Namespaces in XML" Recommendation [XML-NS].
> Animatable: no.

x = "<coordinate>"

> (Has no meaning or effect on outermost 'svg' elements.)
> The X-axis coordinate of one corner of the rectangular region into which an embedded 'svg' element is placed.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> Animatable: yes.

y = "<coordinate>"

> (Has no meaning or effect on outermost 'svg' elements.)
> The Y-axis coordinate of one corner of the rectangular region into which an embedded 'svg' element is placed.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> Animatable: yes.

width = "<length>"

> For outermost 'svg' elements, the intrinsic width of the SVG document fragment. For embedded 'svg' elements, the width of the rectangular region into which the 'svg' element is placed.
> A negative value is an error (see Error processing). A value of zero disables rendering of the element.
> Animatable: yes.

height = "<length>"

> For outermost 'svg' elements, the intrinsic height of the SVG document fragment. For embedded 'svg' elements, the height of the rectangular region into which the 'svg' element is placed.
> A negative value is an error (see Error processing). A value of zero disables rendering of the element.
> Animatable: yes.

Attributes defined elsewhere:

> %langSpaceAttrs;, class, %graphicsElementEvents;, %documentEvents;, %testAttrs;, externalResourcesRequired, viewBox, preserveAspectRatio, zoomAndPan, contentScriptType, contentStyleType, style, %PresentationAttributes-All;.

5.2 Grouping and Naming Collections of Drawing Elements: the 'g' element

5.2.1 Overview

The 'g' element is the element for grouping and naming collections of drawing elements. If several drawing elements share similar attributes, they can be collected together using a 'g' element.

Grouping constructs, when used in conjunction with the 'desc' and 'title' elements, provide information about document structure and semantics. Documents that are rich in structure may be rendered graphically, as speech, or as braille. and thus promote accessibility.

A group of drawing elements, as well as individual objects, can be given a name using the id attribute. Named groups are needed for several purposes such as animation and re-usable objects.

An example:

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="5cm" height="5cm">
  <desc>Two groups, each of two rectangles
  </desc>
  <g id="group1" style="fill:red">
    <rect x="1cm" y="1cm" width="1cm" height="1cm" />
    <rect x="3cm" y="1cm" width="1cm" height="1cm" />
  </g>
  <g id="group2" style="fill:blue">
    <rect x="1cm" y="3cm" width="1cm" height="1cm" />
    <rect x="3cm" y="3cm" width="1cm" height="1cm" />
  </g>
</svg>
```

[View this example as SVG (SVG-enabled browsers only)](#)

A 'g' element can contain other 'g' elements nested within it, to an arbitrary depth. Thus, the following is possible:

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="4in" height="3in">
  <desc>Groups can nest
  </desc>
  <g>
     <g>
       <g>
       </g>
     </g>
   </g>
</svg>
```

Any drawing element that is not contained within a 'g' is treated (at least conceptually) as if it were in its own group.

5.2.2 The 'g' element

```
<!ENTITY % gExt "" >
<!ELEMENT g (desc|title|metadata|defs|
                  path|text|rect|circle|ellipse|line|polyline|polygon|
                  use|image|svg|g|view|switch|a|altGlyphDef|
                  script|style|symbol|marker|clipPath|mask|
                  linearGradient|radialGradient|pattern|filter|cursor|font|
                  animate|set|animateMotion|animateColor|animateTransform|
                  color-profile|font-face
                  %ceExt;%gExt;)* >
<!ATTLIST g
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;  >
```

Attributes defined elsewhere:
  %stdAttrs;, %langSpaceAttrs;, class, transform, %graphicsElementEvents;, %testAttrs;, externalResourcesRequired, style,

[%PresentationAttributes-All;](#).

5.3 References and the 'defs' element

5.3.1 Overview

SVG makes extensive use of URI references [[URI](#)] to other objects. For example, to fill a rectangle with a linear gradient, you first define a 'linearGradient' element and give it an ID, as in:

```
<linearGradient id="MyGradient">...</linearGradient>
```

You then reference the linear gradient as the value of the 'fill' property for the rectangle, as in:

```
<rect style="fill:url(#MyGradient)"/>
```

In SVG, the following facilities allow URI references:

- the ['a'](#) element
- the ['altGlyph'](#) element
- the ['animate'](#) element
- the ['animateColor'](#) element
- the ['animateMotion'](#) element
- the ['animateTransform'](#) element
- the ['clip-path'](#) property
- the ['cursor'](#) element and ['cursor'](#) property
- the ['feImage'](#) element
- the ['fill'](#) property
- the ['filter'](#) element and ['filter'](#) property
- the ['image'](#) element
- the ['linearGradient'](#) element
- the ['marker','marker-start','marker-mid' and 'marker-end](#) properties
- the ['mask'](#) property
- the ['pattern'](#) element
- the ['radialGradient'](#) element
- the ['script'](#) element
- the ['src'](#) descriptor on an @color-profile definition
- the ['stroke'](#) property
- the ['textpath'](#) element
- the ['tref'](#) element
- the ['set'](#) element
- the ['use'](#) element

URI references are defined in either of the following forms:

```
<URI-reference> = [ <absoluteURI> | <relativeURI> ] [ "#" <elementID> ]    -or-
<URI-reference> = [ <absoluteURI> | <relativeURI> ] [ "#xpointer(id(" <elementID> "))" ]
```

where <elementID> is the ID of the referenced element.

(Note that the two forms above (i.e., #<elementID> and #xpointer(id(<elementID>))) are formulated in syntaxes compatible with "XML Pointer Language (XPointer)" [[XPTR](#)]. These two formulations of URI references are the only XPointer formulations that are required in

SVG 1.0 user agents.)

SVG supports two types of URI references:

- local URI references, where the URI references does not contain an <absoluteURI> or <relativeURI> and thus only contains a fragment identifier (i.e., #<elementID> or #xpointer(id<elementID>))
- non-local URI references, where the URI references does contain an <absoluteURI> or <relativeURI>

The following rules apply to the processing of URI references:

- URI references to elements that do not exist shall be treated as invalid references.
- URI references to elements which are inappropriate targets for the given reference shall be treated as invalid references. For example, the 'clip-path' property can only refer to <clipPath> elements. The property setting clip-path:url(#MyElement) is an invalid reference if the referenced element is not a <clipPath>.

It is recommended that, wherever possible, referenced elements be defined inside of a 'defs' element. Among the elements that are always referenced: 'altGlyphDef', 'clipPath', 'cursor', 'filter', 'linearGradient', 'marker', 'mask', 'pattern', 'radialGradient' and 'symbol'. Defining these elements inside of a 'defs' element promotes understandability of the SVG content and thus promotes accessibility.

5.3.2 URI reference attributes

A URI reference is specified within an href attribute in the XLink [XLINK] namespace. If the default prefix of 'xlink:' is used for attributes in the XLink namespace, then the attribute will be specified as xlink:href. The value of this attribute is the URI of the desired resource.

Addtional XLink attributes can be specified that provide supplemental information regarding the referenced resource. These additional attributes are included in the DTD in the following entity:

```
<!ENTITY % xlinkRefAttrs
 "xmlns:xlink CDATA #FIXED 'http://www.w3.org/2000/xlink/namespace/'
  xlink:type (simple|extended|locator|arc) 'simple'
  xlink:role CDATA #IMPLIED
  xlink:title CDATA #IMPLIED
  xlink:show (new|embed|replace) 'embed'
  xlink:actuate (onRequest|onLoad) 'onLoad'" >
```

xmlns [:*prefix*] = "resource-name"

> Standard XML attribute for identifying an XML namespace. This attribute makes the XLink [XLink] namespace available to the current element. Refer to the "Namespaces in XML" Recommendation [XML-NS].
> Animatable: no.

xlink:type = 'simple'

> Identifies the type of XLink being used. For hyperlinks in SVG, only simple links are available. Refer to the "XML Linking Language (XLink)" [XLink].
> Animatable: no.

xlink:role = '<string>'

> A generic string used to describe the function of the link's content. Refer to the "XML Linking Language (XLink)" [XLink].
> Animatable: no.

xlink:title = '<string>'

> Human-readable text describing the link. Refer to the "XML Linking Language (XLink)" [XLink].
> Animatable: no.

xlink:show = 'new | replace | embed'

> Indicates whether, upon activation of the link, a new view is created for the target of the link, whether the contents of the view are replaced by the target of the link, or whether the referenced resource is incorporated into the current document. Refer to the "XML Linking Language (XLink)" [XLink].
> Animatable: no.

xlink:actuate = 'onRequest | onLoad'

> Indicates whether the contents of the referenced object are incorporated upon user action or automatically (i.e., without user action). Refer to the "XML Linking Language (XLink)" [XLink].

5.3.3 The 'defs' element

The 'defs' element is a container element for referenced elements. For understandability and accessibility reasons, it is recommended that, whenever possible, referenced elements be defined inside of a 'defs'.

The content model for 'defs' is the same as for the 'g' element; thus, any element that can be a child of a 'g' can also be a child of a 'defs', and vice versa.

When the current SVG document fragment is rendered as SVG on visual media, graphics elements that are descendants of a 'defs' are not drawn; thus, in this case, the 'display' property does not apply to 'defs' (i.e., there is an implicit 'display:none').

```
<!ENTITY % defsExt "" >
<!ELEMENT defs (desc|title|metadata|defs|
                path|text|rect|circle|ellipse|line|polyline|polygon|
                use|image|svg|g|view|switch|a|altGlyphDef|
                script|style|symbol|marker|clipPath|mask|
                linearGradient|radialGradient|pattern|filter|cursor|font|
                animate|set|animateMotion|animateColor|animateTransform|
                color-profile|font-face
                %ceExt;%defsExt;)* >
<!ATTLIST defs
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;  >
```

Attributes defined elsewhere:

> %stdAttrs;, %langSpaceAttrs;, class, transform, %testAttrs;, externalResourcesRequired, style, %PresentationAttributes-All;, %graphicsElementEvents;.

To provide some SVG user agents with an opportunity to implement efficient implementations in streaming environments, creators of SVG content are encouraged to place all elements which are targets of local URI references within a 'defs' element which is a direct child of one of the ancestors of the referencing element. For example:

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
"http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="8cm" height="3cm">
  <desc>Local URI references within ancestor's 'defs' element.</desc>
  <defs>
    <linearGradient id="Gradient01">
      <stop offset="20%" style="stop-color:#39F"/>
      <stop offset="90%" style="stop-color:#F3F"/>
    </linearGradient>
  </defs>
  <rect x="1cm" y="1cm" width="6cm" height="1cm"
        style="fill:url(#Gradient01)" />
</svg>
```

View this example as SVG (SVG-enabled browsers only)

In the document above, the linear gradient is defined within a 'defs' element which is the direct child of the 'svg' element, which in turn is an ancestor of the 'rect' element which references the linear gradient. Thus, the above document conforms to the guideline.

5.4 The 'desc' and 'title' elements

Each container element or graphics element in an SVG drawing can supply a 'desc' and/or a 'title' description string where the description is text-only. When the current SVG document fragment is rendered as SVG on visual media, 'desc' and 'title' elements are not rendered as part of the graphics. User agents may, however, for example, display the 'title' element as a tooltip, as the pointing device moves over particular elements. Alternate presentations are possible, both visual and aural, which display the 'desc' and 'title' elements but do not display 'path' elements or other graphics elements. This is readily achieved by using a different (perhaps user) stylesheet. For deep hierarchies, and for following 'use' element references, it is sometimes desirable to allow the user to control how deep they drill down into descriptive text.

```
<!ELEMENT desc (#PCDATA) >
<!ATTLIST desc
  %stdAttrs;
  %langSpaceAttrs;
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %StructuredText; >
```

Attributes defined elsewhere:

       %stdAttrs;, %langSpaceAttrs;, class, style.

```
<!ELEMENT title (#PCDATA) >
<!ATTLIST title
  %stdAttrs;
  %langSpaceAttrs;
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %StructuredText; >
```

Attributes defined elsewhere:

       %stdAttrs;, %langSpaceAttrs;, class, style.

The following is an example. In typical operation, the SVG user agent would not render the 'desc' and 'title' elements but would render the remaining contents of the 'g' element.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg SYSTEM "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="4in" height="3in">
<g>
  <title>
    Company sales by region
  </title>
  <desc>
    This is a bar chart which shows
    company sales by region.
  </desc>
  <!-- Bar chart defined as vector data -->
</g>
</svg>
```

Description and title elements can contain marked-up text from other namespaces. Here is an example:

```
<?xml version="1.0" standalone="yes"?>
<svg width="4in" height="3in"
 xmlns="http://www.w3.org/2000/svg-20000629">
   <desc xmlns:mydoc="http://foo.org/mydoc">
      <mydoc:title>This is an example SVG file</mydoc:title>
      <mydoc:para>The global description uses markup from the
        <mydoc:emph>mydoc</mydoc:emph> namespace.</mydoc:para>
   </desc>
   <g>
```

```
    <!-- the picture goes here -->
    </g>
</svg>
```

Authors should always provide a 'title' child element to the outermost 'svg' element within a stand-alone SVG document. The 'title' child element to an 'svg' element serves the purposes of identifying the content of the given SVG document fragment. Since users often consult documents out of context, authors should provide context-rich titles. Thus, instead of a title such as "Introduction", which doesn't provide much contextual background, authors should supply a title such as "Introduction to Medieval Bee-Keeping" instead. For reasons of accessibility, user agents should always make the content of the 'title' child element to the outermost 'svg' element available to users. The mechanism for doing so depends on the user agent (e.g., as a caption, spoken).

The DTD definitions of many of SVG's elements (particularly, container and text elements) place no restriction on the placement or number of the 'desc' and 'title' sub-elements. This flexibility is only present so that there will be a consistent content model for container elements, because some container elements in SVG allow fox mixed content, and because the mixed content rules for XML [XML-MIXED] do not permit the desired restrictions. Representations of future versions of the SVG language might use more expressive representations than DTDs which allow for more restrictive mixed content rules. It is strongly recommended that at most one 'desc' and at most one 'title' element appear as a child of any particular element, and that these elements appear before any other child elements (except possibly 'metadata' elements) or character data content. If user agents need to choose among multiple 'desc' or 'title' elements for processing (e.g., to decide which string to use for a tooltip), the user agent shall choose the first one.

5.5 The 'symbol' element

The 'symbol' element is used to define graphical template objects which can be instantiated by a 'use' element.

The use of 'symbol' elements for graphics that are used multiple times in the same document adds structure and semantics. Documents that are rich in structure may be rendered graphically, as speech, or as braille. and thus promote accessibility.

The key distinctions between a 'symbol' and a 'g' are:

- A 'symbol' element itself is not rendered. Only instances of a 'symbol' element (i.e., a reference to a 'symbol' by a 'use' element) are rendered.
- A 'symbol' element has attributes viewBox and preserveAspectRatio which allow a 'symbol' to scale-to-fit within a rectangular viewport defined by the referencing 'use' element.

Closely related to the 'symbol' element are the 'marker' and 'pattern' elements.

```
<!ENTITY % symbolExt "" >
<!ELEMENT symbol (desc|title|metadata|defs|
                  path|text|rect|circle|ellipse|line|polyline|polygon|
                  use|image|svg|g|view|switch|a|altGlyphDef|
                  script|style|symbol|marker|clipPath|mask|
                  linearGradient|radialGradient|pattern|filter|cursor|font|
                  animate|set|animateMotion|animateColor|animateTransform|
                  color-profile|font-face
                  %ceExt;%symbolExt;)* >
<!ATTLIST symbol
  %stdAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  viewBox %ViewBoxSpec; #IMPLIED
  preserveAspectRatio %PreserveAspectRatioSpec; 'xMidYMid meet'
  %graphicsElementEvents; >
```

Attributes defined elsewhere:

%stdAttrs;, %langSpaceAttrs;, class, externalResourcesRequired, viewBox, preserveAspectRatio, style, %PresentationAttributes-All;, %graphicsElementEvents;.

5.6 The 'use' element

Any 'svg', 'symbol', 'g', graphics element or other 'use' is potentially a template object that can be re-used (i.e., "instanced") in the SVG document via a 'use' element. The 'use' element references another element and indicates that the graphical contents of that element is included/drawn at that given point in the document.

Unlike 'image', the 'use' element cannot reference entire files.

The 'use' element has optional attributes x, y, width and height which are used to map the graphical contents of the referenced element onto a rectangular region within the current coordinate system.

The effect of a 'use' element is as if the contents of the referenced element were deeply cloned into a separate non-exposed DOM tree which had the 'use' element as its parent and all of the 'use' element's ancestors as its higher-level ancestors. Because the cloned DOM tree is non-exposed, the SVG Document Object Model (DOM) only contains the 'use' element and its attributes. The SVG DOM does not show the referenced element's contents as children of 'use' element.

For user agents that support Styling with CSS, the conceptual deep cloning of the referenced element into a non-exposed DOM tree also copies any property values resulting from the CSS cascade [CSS2-CASCADE] on the referenced element and its contents. CSS2 selectors can be applied to the original (i.e., referenced) elements because they are part of the formal document structure. CSS2 selectors cannot be applied to the (conceptually) cloned DOM tree because its contents are not part of the formal document structure.

Property inheritance, however, works as if the referenced element had been textually included as a deeply cloned child of the 'use' element. The referenced element inherits properties from the 'use' element and the 'use' element's ancestors. An instance of a referenced element does not inherit properties from the referenced element's original parents.

If event attributes are assigned to referenced elements, then the actual target for the event will be the SVGElementInstance object within the "instance tree" corresponding to the given referenced element.

The behavior of the 'visibility' property conforms to this model of property inheritance. Thus, specifying 'visibility:hidden' on a 'use' element does not guarantee that the referenced content will not be rendered. If the 'use' element specifies 'visibility:hidden' and the element it references specifies 'visibility:hidden' or 'visibility:inherit', then that one element will be hidden. However, if the referenced element instead specifies 'visibility:visible', then that element will be visible even if the 'use' element specifies 'visibility:hidden'.

A 'use' element has the same visual effect as if the 'use' element were replaced by the following generated content:

- **If the 'use' element references a 'symbol' element**:

  In the generated content, the 'use' will be replaced by 'g', where all attributes from the 'use' element except for x, y, width, height and xlink:href are transferred to the generated 'g' element. An additional transformation translate(x,y) is appended to the end (i.e., right-side) of the transform attribute on the generated 'g', where x and y represent the values of the x and y attributes on the 'use' element. The referenced 'symbol' and its contents are deep-cloned into the generated tree, with the exception that the 'symbol' is replaced by an 'svg'. This generated 'svg' will always have explicit values for attributes width and height. If attributes width and/or height are provided on the 'use' element, then these attributes will be transferred to the generated 'svg'. If attributes width and/or height are not specified, the generated 'svg' element will use values of 100% for these attributes.

- **If the 'use' element references an 'svg' element:**

  In the generated content, the 'use' will be replaced by 'g', where all attributes from the 'use' element except for x, y, width, height and xlink:href are transferred to the generated 'g' element. An additional transformation translate(x,y) is appended to the end (i.e., right-side) of the transform attribute on the generated 'g', where x and y represent the values of the x and y attributes on the 'use' element. The referenced 'svg' and its contents are deep-cloned into the generated tree. If attributes width and/or height are provided on the 'use' element, then these values will override the corresponding attributes on the 'svg' in the generated tree.

- **Otherwise:**

  In the generated content, the 'use' will be replaced by 'g', where all attributes from the 'use' element except for x, y, width, height and xlink:href are transferred to the generated 'g' element. An additional transformation translate(x,y) is appended to the end (i.e., right-side) of the transform attribute on the generated 'g', where x and y represent the values of the x and y attributes on the 'use'

element. The referenced object and its contents are deep-cloned into the generated tree.

For user agents that support [Styling with CSS](#), the generated ['g'](#) element carries along with it the "cascaded" property values on the 'use' element which result from the CSS cascade [[CSS2-CASCADE](#)]. Additionally, the copy (deep clone) of the referenced resource carries along with it the "cascaded" property values resulting from the CSS cascade on the original/referenced elements. Thus, the result of various CSS selectors in combination with the [class](#) and [style](#) attributes are, in effect, replaced by the functional equivalent of a [style](#) attribute in the generated content which conveys the "cascaded" property values.

Example Use01 below has a simple 'use' on a ['rect'](#).

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="10cm" height="3cm">
  <desc>Example Use01 - Simple case of 'use' on a 'rect'</desc>
  <defs>
    <rect id="MyRect" width="6cm" height="1cm"/>
  </defs>
  <use x="2cm" y="1cm" xlink:href="#MyRect" />
</svg>
```
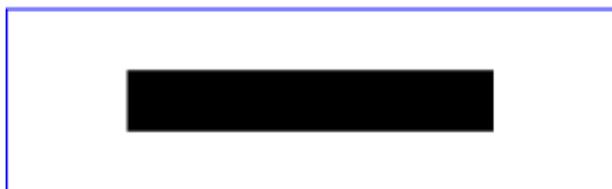

Example Use01

[View this example as SVG (SVG-enabled browsers only)](#)

The visual effect would be equivalent to the following document:

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="10cm" height="3cm">
  <desc>Example Use01-GeneratedContent - Simple case of 'use' on a 'rect'</desc>

  <!-- 'defs' section left out -->


  <!-- Start of generated content. Replaces 'use' -->
  <g transform="translate(2cm,1cm)">
    <rect width="6cm" height="1cm"/>
  </g>
  <!-- End of generated content -->

</svg>
```

[View this example as SVG (SVG-enabled browsers only)](#)

Example Use02 below has a 'use' on a ['symbol'](#).

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="10cm" height="3cm">
  <desc>Example Use02 - 'use' on a 'symbol'</desc>
  <defs>
    <symbol id="MySymbol" viewBox="0 0 20 20">
      <desc>MySymbol - four rectangles in a grid</desc>
```

```
      <rect x="1" y="1" width="8" height="8"/>
      <rect x="11" y="1" width="8" height="8"/>
      <rect x="1" y="11" width="8" height="8"/>
      <rect x="11" y="11" width="8" height="8"/>
    </symbol>
  </defs>
  <use x="4.5cm" y="1cm" width="1cm" height="1cm"
       xlink:href="#MySymbol" />
</svg>
```


Example Use02

The visual effect would be equivalent to the following document:

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="10cm" height="3cm">
  <desc>Example Use02-GeneratedContent - 'use' on a 'symbol'</desc>

  <!-- 'defs' section left out -->

  <!-- Start of generated content. Replaces 'use' -->
  <g transform="translate(4.5cm, 1cm)" >
    <!-- Start of referenced 'symbol'. 'symbol' replaced by 'svg',
         with x,y,width,height=0%,0%,100%,100% -->
    <svg width="1cm" height="1cm"
         viewBox="0 0 20 20">
      <rect x="1" y="1" width="8" height="8"/>
      <rect x="11" y="1" width="8" height="8"/>
      <rect x="1" y="11" width="8" height="8"/>
      <rect x="11" y="11" width="8" height="8"/>
    </svg>
    <!-- End of referenced symbol -->
  </g>
  <!-- End of generated content -->

</svg>
```

Example Use03 illustrates what happens when a 'use' has a transform attribute.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="10cm" height="3cm">
  <desc>Example Use03 - 'use' with a 'transform' attribute</desc>
  <defs>
    <rect id="MyRect" x="0" y="0" width="6cm" height="1cm"/>
  </defs>
  <use xlink:href="#MyRect"
       transform="translate(2cm,.25cm) rotate(10)" />
</svg>
```

Example Use03

The visual effect would be equivalent to the following document:

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="10cm" height="3cm">
  <desc>Example Use03-GeneratedContent - 'use' with a 'transform' attribute</desc>

  <!-- 'defs' section left out -->

  <!-- Start of generated content. Replaces 'use' -->
  <g transform="translate(2cm,.25cm) rotate(10)">
    <rect x="0" y="0" width="6cm" height="1cm"/>
  </g>
  <!-- End of generated content -->

</svg>
```

Example Use04 illustrates a 'use' element with various methods of applying CSS styling.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="12cm" height="3cm" viewBox="0 0 1200 300">
  <desc>Example Use04 - 'use' with CSS styling</desc>
  <defs style="/* rule 9 */ stroke-miterlimit: 10" >
    <path id="MyPath" d="M300 50 L900 50 L900 250 L300 250"
                    class="MyPathClass"
                    style="/* rule 10 */ stroke-dasharray:300 100" />
  </defs>
  <style type="text/css">
    <![CDATA[
      /* rule 1 */ #MyUse { fill: blue }
      /* rule 2 */ #MyPath { stroke: red }
      /* rule 3 */ use { fill-opacity: .5 }
      /* rule 4 */ path{ stroke-opacity: .5 }
      /* rule 5 */ .MyUseClass { stroke-linecap: round }
      /* rule 6 */ .MyPathClass { stroke-linejoin: bevel }
      /* rule 7 */ use > path{ shape-rendering: optimizeQuality }
      /* rule 8 */ svg > path{ visibility: hidden }
    ]]>
  </style>

  <g style="/* rule 11 */ stroke-width: 40">
    <use id="MyUse" xlink:href="#MyPath"
         class="MyUseClass"
         style="/* rule 12 */ stroke-dashoffset:50" />
  </g>
</svg>
```
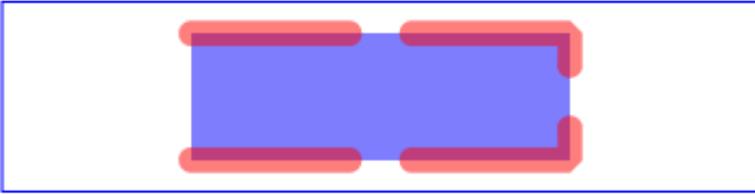
Example Use04

The visual effect would be equivalent to the following document. Observe that some of the style rules above apply to the generated content (i.e., rules 1-6, 10-12), whereas others do not (i.e., rules 7-9). The rules which do not affect the generated content are:

- Rules 7 and 8: CSS selectors only apply to the formal document tree, not on the generated tree; thus, these selectors will not yield a match.
- Rule 9: The generated tree only inherits from the ancestors of the 'use' element and does not inherit from the ancestors of the referenced element; thus, this rule does not affect the generated content.

In the generated content below, the selectors that yield a match have been transferred into inline 'style' attributes for illustrative purposes.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="12cm" height="3cm" viewBox="0 0 1200 300">
  <desc>Example Use04-GeneratedContent - 'use' with a 'transform' attribute</desc>

  <!-- 'style' and 'defs' sections left out -->

  <g style="/* rule 11 */ stroke-width:40">

    <!-- Start of generated content. Replaces 'use' -->
    <g style="/* rule 1 */ fill:blue;
              /* rule 3 */ fill-opacity:.5;
              /* rule 5 */ stroke-linecap:round;
              /* rule 12 */ stroke-dashoffset:50" >
      <path d="M300 50 L900 50 L900 250 L300 250"
            style="/* rule 2 */ stroke:red;
                   /* rule 4 */ stroke-opacity:.5;
                   /* rule 6 */ stroke-linejoin: bevel;
                   /* rule 10 */ stroke-dasharray:300 100" />
    </g>
    <!-- End of generated content -->

  </g>
</svg>
```

When a 'use' references another element which is another 'use' or whose content contains a 'use' element, then the deep cloning approach described above is recursive.

```
<!ENTITY % useExt "" >
<!ELEMENT use (%descTitleMetadata;,(animate|set|animateMotion|animateColor|animateTransform
                %geExt;%useExt;)*) >
<!ATTLIST use
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #REQUIRED
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;
  x %Coordinate; #IMPLIED
  y %Coordinate; #IMPLIED
  width %Length; #IMPLIED
  height %Length; #IMPLIED >
```

Attribute definitions:

x = "<u><coordinate></u>"

> The X-axis coordinate of one corner of the rectangular region into which the referenced element is placed.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> <u>Animatable</u>: yes.

y = "<u><coordinate></u>"

> The Y-axis coordinate of one corner of the rectangular region into which the referenced element is placed.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> <u>Animatable</u>: yes.

width = "<u><length></u>"

> The width of the rectangular region into which the referenced element is placed.
> <u>Animatable</u>: yes.

height = "<u><length></u>"

> The height of the rectangular region into which the referenced element is placed.
> <u>Animatable</u>: yes.

xlink:href = "<u><uri></u>"

> A <u>URI reference</u> to an element/fragment within an SVG document.
> <u>Animatable</u>: yes.

Attributes defined elsewhere:

> <u>%stdAttrs;</u>, <u>%langSpaceAttrs;</u>, <u>class</u>, <u>transform</u>, <u>%graphicsElementEvents;</u>, <u>%testAttrs;</u>, <u>externalResourcesRequired</u>, <u>%xlinkRefAttrs;</u>, <u>style</u>, <u>%PresentationAttributes-All;</u>.

5.7 The 'image' element

The 'image' element indicates that the contents of a complete file are to be rendered into a given rectangle within the current user coordinate system. The 'image' element can refer to raster image files such as PNG or JPEG or to files with MIME type of "image/svg". <u>Conforming SVG viewers</u> need to support at least PNG, JPEG and SVG format files.

When an 'image' element references a raster image file such as PNG or JPEG files, then the raster image is fitted into the region specified by the <u>x</u>, <u>y</u>, <u>width</u> and <u>height</u> attribute such that the top/left corner of the raster image exactly aligns with coordinate (<u>x</u>,<u>y</u>), and the bottom/right corner of the raster image exactly aligns with coordinate (<u>x</u>+<u>width</u>,<u>y</u>+<u>height</u>). When an 'image' element references an SVG file, then the 'image' element establishes a new viewport for the SVG file as described in <u>Establishing a new viewport</u>. The bounds for the new viewport

are defined by attributes <u>x</u>, <u>y</u>, <u>width</u> and <u>height</u>.

The resource referenced by the 'image' element represents a separate document which generates its own parse tree and document object model (if the resource is XML). Thus, there is no inheritance of properties into the image.

Unlike <u>'use'</u>, the 'image' element cannot reference elements within an SVG file.

```
<!ENTITY % imageExt "" >
<!ELEMENT image (%descTitleMetadata;,(animate|set|animateMotion|animateColor|animateTransform
                  %geExt;%imageExt;)*) >
<!ATTLIST image
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #REQUIRED
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-Graphics;
  %PresentationAttributes-Viewports;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;
  x %Coordinate; #IMPLIED
  y %Coordinate; #IMPLIED
  width %Length; #REQUIRED
  height %Length; #REQUIRED >
```

Attribute definitions:

x = "<u><coordinate></u>"

> The X-axis coordinate of one corner of the rectangular region into which the referenced document is placed.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> <u>Animatable</u>: yes.

y = "<u><coordinate></u>"

> The Y-axis coordinate of one corner of the rectangular region into which the referenced document is placed.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> <u>Animatable</u>: yes.

width = "<u><length></u>"

> The width of the rectangular region into which the referenced document is placed.
> A negative value is an error (see <u>Error processing</u>). A value of zero disables rendering of the element.
> <u>Animatable</u>: yes.

height = "<u><length></u>"

> The height of the rectangular region into which the referenced document is placed.
> A negative value is an error (see <u>Error processing</u>). A value of zero disables rendering of the element.
> <u>Animatable</u>: yes.

xlink:href = "<u><uri></u>"

> A <u>URI reference</u>.
> <u>Animatable</u>: yes.

Attributes defined elsewhere:

> <u>%stdAttrs;</u>, <u>%langSpaceAttrs;</u>, <u>class</u>, <u>transform</u>, <u>%graphicsElementEvents;</u>, <u>%testAttrs;</u>, <u>externalResourcesRequired</u>, <u>%xlinkRefAttrs;</u>, <u>style</u>, <u>%PresentationAttributes-Graphics;</u>, <u>%PresentationAttributes-Viewports;</u>.

An example:

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="4in" height="3in">
  <desc>This graphic links to an external image
  </desc>
  <image x="200" y="200" width="100px" height="100px"
         xlink:href="myimage.png">
    <title>My image</title>
  </image>
</svg>
```

5.8 Conditional processing

5.8.1 Conditional processing overview

SVG contains a 'switch' element along with attributes requiredFeatures, requiredExtensions and systemLanguage to provide an ability to specify alternate viewing depending on the capabilities of a given user agent or the user's language.

```
<!ENTITY % testAttrs
  "requiredFeatures %FeatureList; #IMPLIED
   requiredExtensions %ExtensionList; #IMPLIED
   systemLanguage %LanguageCodes; #IMPLIED" >
```

Attributes requiredFeatures, requiredExtensions and systemLanguage act as tests and return either true or false results. The 'switch' renders the first of its children for which all of these attributes test true. If the given attribute is not specified, then a true value is assumed.

5.8.2 The 'switch' element

The 'switch' element evaluates the requiredFeatures, requiredExtensions and systemLanguage attributes on its direct child elements in order, and then processes and renders the first child for which these attributes evaluate to true. All others will be bypassed and therefore not rendered. If the child element is a container element such as a 'g', then the entire subtree is either processed/rendered or bypassed/not rendered.

```
<!ENTITY % switchExt "" >
<!ELEMENT switch (%descTitleMetadata;,
                  (path|text|rect|circle|ellipse|line|polyline|polygon|
                   use|image|svg|g|switch|a|foreignObject|
                   animate|set|animateMotion|animateColor|animateTransform
                   %ceExt;%switchExt;)*) >
<!ATTLIST switch
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents; >
```

Attributes defined elsewhere:

%stdAttrs;, %langSpaceAttrs;, class, transform, %graphicsElementEvents;, %testAttrs;, externalResourcesRequired, style, %PresentationAttributes-All;.

For more information and an example, see Embedding foreign object types.

5.8.3 The requiredFeatures attribute

Definition of requiredFeatures:

requiredFeatures = *list-of-features*

> The value is a list of feature strings, with the individual values separated by white space. Determines whether all of the named *features* are supported by the user agent. Only feature strings defined in this section (see below) are allowed. If all of the given features are supported, then the attribute evaluates to true; otherwise, the current element and its children are skipped and thus will not be rendered and cannot be referenced by another element.
> Animatable: no.

All feature strings referring to language capabilities begin with **"org.w3c.svg"**. All feature strings referring to SVG DOM capabilities begin with **"org.w3c.dom.svg"**.

The following are the feature strings for the requiredFeatures attribute. These same feature strings apply to the hasFeature method call that is part of the SVG DOM's support for the DOMImplementation interface defined in [DOM2-CORE] (see Feature strings for the **hasFeature** method call).

- The feature string **"org.w3c.svg"** indicates that the user agent supports at least one of the following (all of which are described subsequently): **"org.w3c.svg.lang"**, **"org.w3c.svg.dynamic"**, **"org.w3c.svg.static"** or **"org.w3c.dom.svg"**. (Because the feature string **"org.w3c.svg"** can be ambiguous in some circumstances, it is recommended that more specific feature strings be used.)
- The feature string **"org.w3c.svg.lang"** indicates that the user agent can parse and process all of the language features defined in this specification. This value indicates that there is no language feature defined in this specification which will cause the user agent to fail in its processing.
- The feature string **"org.w3c.svg.static"** indicates the availability of all of the language capabililities defined in:
  - Basic Data Types and Interfaces
  - Document Structure
  - Styling
  - Coordinate Systems, Transformations and Units
  - Paths
  - Basic Shapes
  - Text
  - Painting: Filling, Stroking and Marker Symbols
  - Color
  - Gradients and Patterns
  - Clipping, Masking and Compositing
  - Filter Effects
  - Fonts
  - The 'switch' element
  - The requiredFeatures attribute
  - The systemLanguage attribute

  For SVG viewers, **"org.w3c.svg.static"** indicates that the viewer can process and render successfully all of the language features listed above.
- The feature string **"org.w3c.dom.svg.static"** indicates the availability of all of the DOM interfaces and methods that correspond to the language features for **"org.w3c.svg.static"**.
- The feature string **"org.w3c.svg.animation"** includes all of the language capabilities defined for **"org.w3c.svg.static"** plus the availability of all of the language capabililities defined in Animation. For SVG viewers running on media capable of rendering time-based material, such as displays, **"org.w3c.svg.animation"** indicates that the viewer can process and render successfully all of the corresponding language features.
- The feature string **"org.w3c.dom.svg.animation"** corresponds to the availability of DOM interfaces and methods that correspond to

the language features for **"org.w3c.svg.animation"**.

- The feature string **"org.w3c.svg.dynamic"** includes all of the language capabilities defined for **"org.w3c.svg.animation"** plus the availability of all of the language capabilities and DOM interfaces defined in [Relationship with DOM2 events](#), [Linking](#) and [Interactivity](#) and [Scripting](#). For SVG viewers running on media capable of rendering time-based material, such as displays, **"org.w3c.svg.dynamic"** indicates that the viewer can process and render successfully all of the corresponding language features.
- The feature string **"org.w3c.dom.svg.dynamic"** corresponds to the availability of DOM interfaces and methods that correspond to the language features for **"org.w3c.svg.dynamic"**.
- The feature string **"org.w3c.svg.all"** corresponds to the availability of all of the language capabilities defined in this specification.
- The feature string **"org.w3c.dom.svg.all"** corresponds to the availability of all of the DOM interfaces defined in this specification.

If the attribute is not present, then its implicit return value is "true". If a null string or empty string value is given to attribute requiredFeatures, the attribute returns "false".

requiredFeatures is often used in conjunction with the ['switch'](#) element. If the requiredFeatures is used in other situations, then it represents a simple switch on the given element whether to render the element or not.

5.8.4 The requiredExtensions attribute

The requiredExtensions attribute defines a list of required language extensions. Language extensions are capabilities within a user agent that go beyond the feature set defined in this specification. Each extension is identified by a [URI reference](#).

Definition of requiredExtensions:

requiredFeatures = *list-of-extensions*

> The value is a list of [URI reference](#)s which identify the required extensions, with the individual values separated by white space. Determines whether all of the named *extensions* are supported by the user agent. If all of the given extensions are supported, then the attribute evaluates to true; otherwise, the current element and its children are skipped and thus will not be rendered and cannot be referenced by another element.
> [Animatable](#): no.

If a given [URI reference](#) contains white space within itself, that white space must be escaped.

If the attribute is not present, then its implicit return value is "true". If a null string or empty string value is given to attribute requiredExtensions, the attribute returns "false".

requiredExtensions is often used in conjunction with the ['switch'](#) element. If the requiredExtensions is used in other situations, then it represents a simple switch on the given element whether to render the element or not.

The URI names for the extension should include versioning information, such as "http://www.foo.org/SVGExtensionXYZ/1.0", so that script writers can distinguish between different versions of a given extension.

5.8.5 The systemLanguage attribute

The attribute value is a comma-separated list of language names as defined in [[RFC1766](#)].

Evaluates to "true" if one of the languages indicated by user preferences exactly equals one of the languages given in the value of this parameter, or if one of the languages indicated by user preferences exactly equals a prefix of one of the languages given in the value of this parameter such that the first tag character following the prefix is "-".

Evaluates to "false" otherwise.

Note: This use of a prefix matching rule does not imply that language tags are assigned to languages in such a way that it is always true that if a user understands a language with a certain tag, then this user will also understand all languages with tags for which this tag is a prefix.

The prefix rule simply allows the use of prefix tags if this is the case.

Implementation note: When making the choice of linguistic preference available to the user, implementers should take into account the fact that users are not familiar with the details of language matching as described above, and should provide appropriate guidance. As an example, users may assume that on selecting "en-gb", they will be served any kind of English document if British English is not available. The user interface for setting user preferences should guide the user to add "en" to get the best matching behavior.

Multiple languages MAY be listed for content that is intended for multiple audiences. For example, content that is presented simultaneously in the original Maori and English versions, would call for:

```
<text systemLanguage="mi, en"><!-- content goes here --></text>
```

However, just because multiple languages are present within the object on which the **systemLanguage** test attribute is placed, this does not mean that it is intended for multiple linguistic audiences. An example would be a beginner's language primer, such as "A First Lesson in Latin," which is clearly intended to be used by an English-literate audience. In this case, the **systemLanguage** test attribute should only include "en".

Authoring note: Authors should realize that if several alternative language objects are enclosed in a ['switch'](#), and none of them matches, this may lead to situations where no content is displayed. It is thus recommended to include a "catch-all" choice at the end of such a ['switch'](#) which is acceptable in all cases.

For the systemLanguage attribute: [Animatable](#): no.

5.9 Common attributes

5.9.1 The id attribute

The id attribute is available on all SVG elements:

```
<!ENTITY % stdAttrs
  "id ID #IMPLIED" >
```

Attribute definitions:

id = "name"

> Standard XML attribute for assigning a unique *name* to an element. Refer to the the "Extensible Markup Language (XML) 1.0" Recommendation [[XML10](#)].
> [Animatable](#): no.

5.9.2 The xml:lang and xml:space attributes

Elements that might contain character data content have attributes xml:lang and xml:space:

```
<!ENTITY % langSpaceAttrs
  "xml:lang NMTOKEN #IMPLIED
   xml:space (default|preserve) #IMPLIED" >
```

Attribute definitions:

xml:lang = "languageID"

> Standard XML attribute to specify the language (e.g., English) used in the contents and attribute values of particular elements. Refer to the "Extensible Markup Language (XML) 1.0" Recommendation [[XML10](#)].
> [Animatable](#): no.

xml:space = "{default | preserve}"

> Standard XML attribute to specify whether white space is preserved in character data. The only possible values are *default* and *preserve*. Refer to the "Extensible Markup Language (XML) 1.0" Recommendation [[XML10](#)] and to the discussion [white space handling](#) in SVG.
> [Animatable](#): no.

5.9.3 The externalResourcesRequired attribute

Documents often reference and use the contents of other files (and other web resources) as part of their rendering. In some cases, authors want to specify that particular resources are required for a document to be considered correct.

Attribute externalResourcesRequired is available on all elements which potentially can reference external resources. It specifies whether referenced resources that are not part of the current document are required.

Attribute definition:

externalResourcesRequired = "false | true"

> false
>
>> (The default value if no ancestor element has a value for this attribute.) Indicates that resources external to the current document are optional. Document rendering can proceed even if external resources are unavailable to the current element and its descendants.
>
> true
>
>> Indicates that resources external to the current document are required. If an external resource is not available, progressive rendering is suspended until that resource and all other required resources become available, have been parsed and are ready to be rendered. If a timeout event occurs on a required resource, then the document goes into an error state (see Error processing). The document remains in an error state until all required resources become available.

This attribute applies to all types of resource references, including style sheets, color prorfiles (see Color profile descriptions) and fonts specified by a URI Reference using a 'font-face' element or a CSS @font-face specification. In particular, if an element sets externalResourcesRequired="true", then all style sheets must be available since any style sheet might affect the rendering of that element.

Attribute externalResourcesRequired is inheritable; thus,if set on a container element, its value will apply to the elements within the container which don't specify a value for this attribute.

Because setting externalResourcesRequired="true" on a container element can have the effect of disabling progressive display of the contents of that container, tools that generate SVG content are cautioned against using simply setting externalResourcesRequired="true" on the outermost 'svg' element on a universal basis. Instead, it is better to specify externalResourcesRequired="true" on those particular graphics elements or container elements which specify need the availability of external resources in order to render properly.

For externalResourcesRequired: Animatable: yes.

5.10 DOM interfaces

The following interfaces are defined below: SVGDocument, SVGSVGElement, SVGGElement, SVGDefsElement, SVGDescElement, SVGTitleElement, SVGSymbolElement, SVGUseElement, SVGElementInstance, SVGElementInstanceList, SVGImageElement, SVGSwitchElement, GetSVGDocument.

Interface SVGDocument

When an 'svg' element is embedded inline as a component of a document from another namespace, such as when an 'svg' element is embedded inline within an XHTML document [XHTML], then an SVGDocument object will not exist; instead, the root object in the document object hierarchy will be a Document object of a different type, such as an HTMLDocument object.

However, an SVGDocument object will indeed exist when the root element of the XML document hierarchy is an 'svg' element, such as when viewing a standalone SVG file (i.e., a file with MIME type "image/svg"). In this case, the SVGDocument object will be the the root object of the document object model hierarchy.

In the case where an SVG document is embedded by reference, such as when an XHTML document has an 'object' element whose href attribute references an SVG document (i.e., a document whose MIME type is "image/svg" and whose root element is thus an 'svg' element), there will exist two distinct DOM hierarchies. The first DOM hierarchy will be for the referencing document (e.g., an XHTML document). The second DOM hierarchy will be for the referenced SVG document. In this second DOM hierarchy, the root object of the document object model hierarchy is an SVGDocument object.

The SVGDocument interface contains a similar list of attributes and methods to the HTMLDocument interface described in Document Object Model (HTML) Level 1 chapter of the [DOM1] specification.

IDL Definition

```
interface SVGDocument :
                Document,
                events::DocumentEvent {

        attribute DOMString     title;
```

```
                                // raises DOMException on setting
  readonly attribute DOMString      referrer;
  readonly attribute DOMString       domain;
  readonly attribute DOMString        URL;
  readonly attribute SVGSVGElement rootElement;
};
```

Attributes

DOMString title

> The title of a document as specified by the title sub-element of the 'svg' root element (i.e., <svg><title>Here is the title</title>...</svg>)

> Exceptions on setting

> > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

readonly DOMString referrer

> Returns the URI of the page that linked to this page. The value is an empty string if the user navigated to the page directly (not through a link, but, for example, via a bookmark).

readonly DOMString domain

> The domain name of the server that served the document, or a null string if the server cannot be identified by a domain name.

readonly DOMString URL

> The complete URI of the document.

readonly SVGSVGElement rootElement

> The closest ancestor 'svg' element. If this element is an outermost 'svg' element (i.e., either it is the root element of the document or if its parent is in a different namespace), then this attribute will be null.

Interface SVGSVGElement

A key interface definition is the SVGSVGElement interface, which is the interface that corresponds to the 'svg' element. This interface contains various miscellaneous commonly-used utility methods, such as matrix operations and the ability to control the time of redraw on visual rendering devices.

IDL Definition

```
interface SVGSVGElement :
              SVGElement,
              SVGTests,
              SVGLangSpace,
              SVGExternalResourcesRequired,
              SVGStylable,
              SVGFitToViewBox,
              SVGZoomAndPan,
              events::EventTarget,
              events::DocumentEvent {

        attribute SVGAnimatedLength x;
                    // raises DOMException on setting
        attribute SVGAnimatedLength y;
                    // raises DOMException on setting
        attribute SVGAnimatedLength width;
                    // raises DOMException on setting
        attribute SVGAnimatedLength height;
                    // raises DOMException on setting
        attribute DOMString          contentScriptType;
                    // raises DOMException on setting
        attribute DOMString          contentStyleType;
                    // raises DOMException on setting
  readonly attribute SVGRect              viewport;
  readonly attribute float pixelUnitToMillimeterX;
  readonly attribute float pixelUnitToMillimeterY;
```

```
    readonly attribute float screenPixelToMillimeterX;
    readonly attribute float screenPixelToMillimeterY;
             attribute boolean useCurrentView;
                        // raises DOMException on setting
    readonly attribute SVGViewSpec currentView;
             attribute float currentScale;
                        // raises DOMException on setting
             attribute SVGPoint currentTranslate;
                        // raises DOMException on setting

    unsigned long suspendRedraw ( in unsigned long max_wait_milliseconds );
    void          unsuspendRedraw ( in unsigned long suspend_handle_id )
                    raises( DOMException );
    void          unsuspendRedrawAll (   );
    void          forceRedraw (   );
    void          pauseAnimations (   );
    void          unpauseAnimations (   );
    boolean       animationsPaused (   );
    float         getCurrentTime (   );
    void          setCurrentTime ( in float seconds );
    NodeList      getIntersectionList ( in SVGRect rect, in SVGElement referenceElement );
    NodeList      getEnclosureList ( in SVGRect rect, in SVGElement referenceElement );
    boolean       checkIntersection ( in SVGElement element, in SVGRect rect );
    boolean       checkEnclosure ( in SVGElement element, in SVGRect rect );
    void          deSelectAll (   );
    SVGLength            createSVGLength (   );
    SVGAngle             createSVGAngle (   );
    SVGPoint             createSVGPoint (   );
    SVGMatrix            createSVGMatrix (   );
    SVGRect              createSVGRect (   );
    SVGTransform         createSVGTransform (   );
    SVGTransform    createSVGTransformFromMatrix ( in SVGMatrix matrix );
    SVGICCColor             createSVGICCColor (   );
    SVGColor             createSVGColor (   );
    SVGPaint             createSVGPaint (   );
    Element        getElementById ( in DOMString elementId );
};
```

Attributes

SVGAnimatedLength x

   Corresponds to attribute x on the given 'svg' element.

   Exceptions on setting

       DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength y

   Corresponds to attribute y on the given 'svg' element.

   Exceptions on setting

       DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength width

   Corresponds to attribute width on the given 'svg' element.

   Exceptions on setting

       DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength height

   Corresponds to attribute height on the given 'svg' element.

   Exceptions on setting

       DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

DOMString contentScriptType

   Corresponds to attribute contentScriptType on the given 'svg' element.

Exceptions on setting

    DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

DOMString contentStyleType

Corresponds to attribute contentStyleType on the given 'svg' element.

Exceptions on setting

    DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

readonly SVGRect viewport

The position and size of the viewport (implicit or explicit) that corresponds to this 'svg' element. When the user agent is actually rendering the content, then the position and size values represent the actual values when rendering. The position and size values are unit-less values in the coordinate system of the parent element. If no parent element exists (i.e., 'svg' element represents the root of the document tree), if this SVG document is embedded as part of another document (e.g., via the HTML 'object' element), then the position and size are unitless values in the coordinate system of the parent document. (If the parent uses CSS or XSL layout, then unitless values represent pixel units for the current CSS or XSL viewport, as described in the CSS2 specification.) If the parent element does not have a coordinate system, then the user agent should provide reasonable default values for this attribute.

readonly float pixelUnitToMillimeterX

Size of a pixel units (as defined by CSS2) along the X axis of the viewport, which represents a unit somewhere in the range of 70dpi to 120dpi, and, on systems that support this, might actually match the characteristics of the target medium. On systems where it is impossible to know the size of a pixel, a suitable default pixel size is provided.

readonly float pixelUnitToMillimeterY

Corresponding size of a pixel unit along the Y axis of the viewport.

readonly float screenPixelToMillimeterX

UI events in DOM level 2 indicate the screen positions at which the given UI event occurred. When the user agent actually knows the physical size of a "screen unit", this attribute will express that information; otherwise, user agents will provide a suitable default value such as .28mm.

readonly float screenPixelToMillimeterY

Corresponding size of a screen pixel along the Y axis of the viewport.

boolean useCurrentView

The initial view (i.e., before zooming and panning) of the current innermost SVG document fragment can be either the "standard" view (i.e., based on attributes on the 'svg' element such as fitBoxToViewport) or to a "custom" view (i.e., a hyperlink into a particular 'view' or other element - see Linking into SVG content: URI fragments and SVG views). If the initial view is the "standard" view, then this attribute is false. If the initial view is a "custom" view, then this attribute is true.

Exceptions on setting

    DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

readonly SVGViewSpec currentView

The definition of the initial view (i.e., before zooming and panning) of the current innermost SVG document fragment. The meaning depends on the situation:

- If the initial view was a "standard" view, then:
  - the values for viewBox, preserveAspectRatio and zoomAndPan within currentView will match the values for the corresponding DOM attributes that are on SVGSVGElement directly
  - the values for transform and viewTarget within currentView will be null
- If the initial view was a link into a 'view' element, then:
  - the values for viewBox, preserveAspectRatio and zoomAndPan within currentView will correspond to the corresponding attributes for the given 'view' element
  - the values for transform and viewTarget within currentView will be null
- If the initial view was a link into another element (i.e., other than a 'view'), then:
  - the values for viewBox, preserveAspectRatio and zoomAndPan within currentView will match the values for the corresponding DOM attributes that are on SVGSVGElement directly for the closest ancestor 'svg' element
  - the values for transform within currentView will be null
  - the viewTarget within currentView will represent the target of the link
- If the initial view was a link into the SVG document fragment using an SVG view specification fragment identifier (i.e., #svgView(...)), then:

- the values for viewBox, preserveAspectRatio, zoomAndPan, transform and viewTarget within currentView will correspond to the values from the SVG view specification fragment identifier

float currentScale

This attribute indicates the current scale factor relative to the initial view to take into account user "magnification" or "zooming" and associated "panning" operations, as described under Magnification, zooming and panning. DOM attributes currentScale and currentTranslate are equivalent to the 2x3 matrix [a b c d e f] = [currentScale 0 0 currentScale currentTranslate.x currentTranslate.y]. If "magnification" is enabled (i.e., zoomAndPan="magnify"), then the effect is as if an extra transformation were placed at the outermost level on the SVG document fragment (i.e., outside the outermost 'svg' element). If "zooming" is enabled (i.e., zoomAndPan="zoom"), then the effect is as if an extra 'g' element enclosed all of the children and that 'g' element specified a transformation to achieve the desired zooming effect.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGPoint currentTranslate

The corresponding translation factor that takes into account user "magnification".

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Methods

suspendRedraw

Takes a time-out value which indicates that redraw shall not occur until: (a) the corresponding unsuspendRedraw(suspend_handle_id) call has been made, (b) an unsuspendRedrawAll() call has been made, or (c) its timer has timed out. In environments that do not support interactivity (e.g., print media), then redraw shall not be suspended. suspend_handle_id = suspendRedraw(max_wait_milliseconds) and unsuspendRedraw(suspend_handle_id) must be packaged as balanced pairs. When you want to suspend redraw actions as a collection of SVG DOM changes occur, then precede the changes to the SVG DOM with a method call similar to suspend_handle_id = suspendRedraw(max_wait_milliseconds) and follow the changes with a method call similar to unsuspendRedraw(suspend_handle_id). Note that multiple suspendRedraw calls can be used at once and that each such method call is treated independently of the other suspendRedraw method calls.

Parameters

in unsigned long max_wait_milliseconds The amount of time in milliseconds to hold off before redrawing the device. Values greater than 60 seconds will be truncated down to 60 seconds.

Return value

unsigned long A number which acts as a unique identifier for the given suspendRedraw() call. This value must be passed as the parameter to the corresponding unsuspendRedraw() method call.

No Exceptions

unsuspendRedraw

Cancels a specified suspendRedraw() by providing a unique suspend_handle_id.

Parameters

in unsigned long suspend_handle_id A number which acts as a unique identifier for the desired suspendRedraw() call. The number supplied must be a value returned from a previous call to suspendRedraw()

No Return Value

Exceptions

DOMException This method will raise a DOMException with value **NOT_FOUND_ERR** if an invalid value (i.e., no such suspend_handle_id is active) for suspend_handle_id is provided.

unsuspendRedrawAll

Cancels all currently active suspendRedraw() method calls. This method is most useful at the very end of a set of SVG DOM calls to ensure that all pending suspendRedraw() method calls have been cancelled.

No Parameters

No Return Value

No Exceptions

forceRedraw

In rendering environments supporting interactivity, forces the user agent to immediately redraw all regions of the viewport that require updating.

No Parameters

No Return Value

No Exceptions

pauseAnimations

Suspends/pauses all currently running animations that are defined within the SVG document fragment corresponding to this 'svg' element, causing the animation clock corresponding to this document fragment to stand still until it is unpaused.

No Parameters

No Return Value

No Exceptions

unpauseAnimations

Unsuspends/unpauses currently running animations that are defined within the SVG document fragment, causing the animation clock to continue from the time at which it was suspended.

No Parameters

No Return Value

No Exceptions

animationsPaused

Returns true if this SVG document fragment is in a paused state.

No Parameters

Return value

      boolean Boolean indicating whether this SVG document fragment is in a paused state.

No Exceptions

getCurrentTime

Returns the current time in seconds relative to the start time for the current SVG document fragment.

No Parameters

Return value

      float The current time in seconds.

No Exceptions

setCurrentTime

Adjusts the clock for this SVG document fragment, establishing a new current time.

Parameters

      in float seconds The new current time in seconds relative to the start time for the current SVG document fragment.

No Return Value

No Exceptions

getIntersectionList

Returns the list of graphics elements whose rendered content intersects the supplied rectangle, honoring the 'pointer-events' property value on each candidate graphics element.

Parameters

in SVGRect rect	The test rectangle. The values are in the initial coordinate system for the current 'svg' element.
in SVGElement referenceElement	If not null, then only return elements whose drawing order has them below the given reference element.

No Return Value

No Exceptions

getEnclosureList

Returns the list of graphics elements whose rendered content is entirely contained within the supplied rectangle, honoring the 'pointer-events' property value on each candidate graphics element.

Parameters

in SVGRect rect	The test rectangle. The values are in the initial coordinate system for the current 'svg' element.

> in SVGElement referenceElement If not null, then only return elements whose drawing order has them below the given reference element.

No Return Value

No Exceptions

checkIntersection

Returns true if the rendered content of the given element intersects the supplied rectangle, honoring the 'pointer-events' property value on each candidate graphics element.

Parameters

> in SVGElement element The element on which to perform the given test.
>
> in SVGRect rect The test rectangle. The values are in the initial coordinate system for the current 'svg' element.

No Return Value

No Exceptions

checkEnclosure

Returns true if the rendered content of the given element is entirely contained within the supplied rectangle, honoring the 'pointer-events' property value on each candidate graphics element.

Parameters

> in SVGElement element The element on which to perform the given test.
>
> in SVGRect rect The test rectangle. The values are in the initial coordinate system for the current 'svg' element.

No Return Value

No Exceptions

deSelectAll

Unselects any selected objects, including any selections of text strings and type-in bars.

No Parameters

No Return Value

No Exceptions

createSVGLength

Creates an SVGLength object outside of any document trees. The object is initialized to the value of 0 user units.

No Parameters

Return value

> SVGLength An SVGLength object.

No Exceptions

createSVGAngle

Creates an SVGAngle object outside of any document trees. The object is initialized to the value 0 degrees (unitless).

No Parameters

Return value

> SVGAngle An SVGAngle object.

No Exceptions

createSVGPoint

Creates an SVGPoint object outside of any document trees. The object is initialized to the point (0,0) in the user coordinate system.

No Parameters

Return value

> SVGPoint An SVGPoint object.

No Exceptions

createSVGMatrix

Creates an SVGMatrix object outside of any document trees. The object is initialized to the identity matrix.

No Parameters

Return value

   SVGMatrix   An SVGMatrix object.

No Exceptions

createSVGRect

Creates an SVGRect object outside of any document trees. The object is initialized such that all values are set to 0 user units.

No Parameters

Return value

   SVGRect   An SVGRect object.

No Exceptions

createSVGTransform

Creates an SVGTransform object outside of any document trees. The object is initialized to an identify matrix transform (SVG_TRANSFORM_MATRIX).

No Parameters

Return value

   SVGTransform   An SVGTransform object.

No Exceptions

createSVGTransformFromMatrix

Creates an SVGTransform object outside of any document trees. The object is initialized to the given matrix transform (i.e., SVG_TRANSFORM_MATRIX).

Parameters

   in SVGMatrix matrix   The transform matrix.

Return value

   SVGTransform   An SVGTransform object.

No Exceptions

createSVGICCColor

Creates an SVGICCColor object outside of any document trees. The object is initialized to an empty list of color values.

No Parameters

Return value

   SVGICCColor   An SVGICCColor object.

No Exceptions

createSVGColor

Creates an SVGColor object outside of any document trees. The object is the color (0,0,0) in the sRGB color space, with no alternate ICC color specification.

No Parameters

Return value

   SVGColor   An SVGColor object.

No Exceptions

createSVGPaint

Creates an SVGPaint object outside of any document trees. The object is initialized to SVG_PAINTTYPE_NONE.

No Parameters

Return value

   SVGPaint   An SVGPaint object.

No Exceptions

getElementById

Searches this SVG document fragment (i.e., the search is restricted to a subset of the document tree) for an Element whose id is given by elementId. If an Element is found, that Element is returned. If no such element exists, returns null. Behavior is not defined if more than one element has this id.

Parameters

in DOMString elementId The unique id value for an element.

Return value

Element The matching element.

No Exceptions

Interface SVGGElement

The SVGGElement interface corresponds to the 'g' element.

IDL Definition

```
interface SVGGElement :
                SVGElement,
                SVGTests,
                SVGLangSpace,
                SVGExternalResourcesRequired,
                SVGStylable,
                SVGTransformable,
                events::EventTarget {};
```

Interface SVGDefsElement

The SVGDefsElement interface corresponds to the 'defs' element.

IDL Definition

```
interface SVGDefsElement :
                SVGElement,
                SVGTests,
                SVGLangSpace,
                SVGExternalResourcesRequired,
                SVGStylable,
                SVGTransformable,
                events::EventTarget {};
```

Interface SVGDescElement

The SVGDescElement interface corresponds to the 'desc' element.

IDL Definition

```
interface SVGDescElement :
                SVGElement,
                SVGLangSpace,
                SVGStylable {};
```

Interface SVGTitleElement

The SVGTitleElement interface corresponds to the 'title' element.

IDL Definition

```
interface SVGTitleElement :
              SVGElement,
              SVGLangSpace,
              SVGStylable {};
```

Interface SVGSymbolElement

The SVGSymbolElement interface corresponds to the 'symbol' element.

IDL Definition

```
interface SVGSymbolElement :
              SVGElement,
              SVGLangSpace,
              SVGExternalResourcesRequired,
              SVGStylable,
              SVGFitToViewBox,
              events::EventTarget {};
```

Interface SVGUseElement

The SVGUseElement interface corresponds to the 'use' element.

IDL Definition

```
interface SVGUseElement :
              SVGElement,
              SVGURIReference,
              SVGTests,
              SVGLangSpace,
              SVGExternalResourcesRequired,
              SVGStylable,
              SVGTransformable,
              events::EventTarget {

        attribute SVGAnimatedLength   x;
                  // raises DOMException on setting
        attribute SVGAnimatedLength   y;
                  // raises DOMException on setting
        attribute SVGAnimatedLength   width;
                  // raises DOMException on setting
        attribute SVGAnimatedLength   height;
                  // raises DOMException on setting
  readonly attribute SVGElementInstance instanceRoot;
  readonly attribute SVGElementInstance animatedInstanceRoot;
};
```

Attributes

SVGAnimatedLength x

    Corresponds to attribute x on the given 'use' element.

Exceptions on setting

> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength y

Corresponds to attribute y on the given 'use' element.

Exceptions on setting

> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength width

Corresponds to attribute width on the given 'use' element.

Exceptions on setting

> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength height

Corresponds to attribute height on the given 'use' element.

Exceptions on setting

> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

readonly SVGElementInstance instanceRoot

The root of the "instance tree". See description of SVGElementInstance for a discussion on the instance tree.

readonly SVGElementInstance animatedInstanceRoot

If the 'href' attribute is being animated, contains the current animated root of the "instance tree". If the 'href' attribute is not currently being animated, contains the same value as 'instanceRoot'. The root of the "instance tree". See description of SVGElementInstance for a discussion on the instance tree.

Interface SVGElementInstance

For each 'use' element, the SVG DOM maintains a shadow tree (the "instance tree") of objects of type SVGElementInstance. A SVGElementInstance represents a single node in the instance tree. The root/topmost object in the instance tree is pointed to by the instanceRoot attribute on the SVGUseElement object for the corresponding 'use' element.

If the 'use' element references a simple graphics element such as a 'rect', then there is only a single SVGElementInstance object, and the correspondingElement attribute on this SVGElementInstance object is the SVGRectElement that corresponds to the referenced 'rect' element.

If the 'use' element references a 'g' which contains two 'rect' elements, then the instance tree contains three SVGElementInstance objects, a root SVGElementInstance object whose correspondingElement is the SVGGElement object for the 'g', and then two child SVGElementInstance objects, each of which has its correspondingElement that is an SVGRectElement object.

If the referenced object is itself a 'use', or if there are 'use' subelements within the referenced object, the instance tree will contain recursive expansion of the indirect references to form a complete tree. For example, if a 'use' element references a 'g', and the 'g' itself contains a 'use', and that 'use' references a 'rect', then the instance tree for the original (outermost) 'use' will consist of a hierarchy of SVGElementInstance objects, as follows:

```
SVGElementInstance #1 (parentNode=null, firstChild=#2, correspondingElement is the 'g')
  SVGElementInstance #2 (parentNode=#1, firstChild=#3, correspondingElement is the other 'use')
    SVGElementInstance #3 (parentNode=#2, firstChild=null, corresponding Element is the 'rect')
```

IDL Definition

```
interface SVGElementInstance : events::EventTarget {
  readonly attribute SVGElement correspondingElement;
  readonly attribute SVGUseElement correspondingUseElement;
  readonly attribute SVGElementInstance parentNode;
  readonly attribute SVGElementInstanceList childNodes;
  readonly attribute SVGElementInstance firstChild;
  readonly attribute SVGElementInstance lastChild;
  readonly attribute SVGElementInstance previousSibling;
  readonly attribute SVGElementInstance nextSibling;
```

```
};
```

Attributes

readonly SVGElement correspondingElement

The corresponding element to which this object is an instance. For example, if a 'use' element references a 'rect' element, then an SVGElementInstance is created, with its correspondingElement being the SVGElementInstance object for the 'rect' element.

readonly SVGUseElement correspondingUseElement

The corresponding 'use' element to which this SVGElementInstance object belongs. When 'use' elements are nested (e.g., a 'use' references another 'use' which references a graphics element such as a 'rect'), then the correspondingUseElement is the outermost 'use' (i.e., the one which indirectly references the 'rect', not the one with the direct reference).

readonly SVGElementInstance parentNode

The parent of this SVGElementInstance within the instance tree. All SVGElementInstance objects have a parent except the SVGElementInstance which corresponds to the element which was directly referenced by the 'use' element, in which case parentNode is null.

readonly SVGElementInstanceList childNodes

An SVGElementInstanceList that contains all children of this SVGElementInstance within the instance tree. If there are no children, this is an SVGElementInstanceList containing no entries (i.e., an empty list).

readonly SVGElementInstance firstChild

The first child of this SVGElementInstance within the instance tree. If there is no such SVGElementInstance, this returns null.

readonly SVGElementInstance lastChild

The last child of this SVGElementInstance within the instance tree. If there is no such SVGElementInstance, this returns null.

readonly SVGElementInstance previousSibling

The SVGElementInstance immediately preceding this SVGElementInstance. If there is no such SVGElementInstance, this returns null.

readonly SVGElementInstance nextSibling

The SVGElementInstance immediately following this SVGElementInstance. If there is no such SVGElementInstance, this returns null.

Interface SVGElementInstanceList

The SVGElementInstanceList interface provides the abstraction of an ordered collection of SVGElementInstance objects, without defining or constraining how this collection is implemented.

IDL Definition

```
interface SVGElementInstanceList {

  readonly attribute SVGElementInstance length;

  SVGElementInstance item ( in unsigned long index );
};
```

Attributes

readonly SVGElementInstance length

The number of SVGElementInstance objects in the list. The range of valid child indices is 0 to length-1 inclusive.

Methods

item

Returns the indexth item in the collection. If index is greater than or equal to the number of nodes in the list, this returns null.

Parameters

in unsigned long index Index into the collection.

Return value

<table>
<tr><td>SVGElementInstance</td><td>The SVGElementInstance object at the indexth position in the SVGElementInstanceList, or null if that is not a valid index.</td></tr>
</table>

No Exceptions

Interface SVGImageElement

The SVGImageElement interface corresponds to the 'image' element.

IDL Definition

```
interface SVGImageElement :
            SVGElement,
            SVGURIReference,
            SVGTests,
            SVGLangSpace,
            SVGExternalResourcesRequired,
            SVGStylable,
            SVGTransformable,
            events::EventTarget {

        attribute SVGAnimatedLength x;
                    // raises DOMException on setting
        attribute SVGAnimatedLength y;
                    // raises DOMException on setting
        attribute SVGAnimatedLength width;
                    // raises DOMException on setting
        attribute SVGAnimatedLength height;
                    // raises DOMException on setting
};
```

Attributes

SVGAnimatedLength x

Corresponds to attribute x on the given 'image' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength y

Corresponds to attribute y on the given 'image' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength width

Corresponds to attribute width on the given 'image' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength height

Corresponds to attribute height on the given 'image' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGSwitchElement

The SVGSwitchElement interface corresponds to the 'switch' element.

IDL Definition

```
interface SVGSwitchElement :
                SVGElement,
                SVGTests,
                SVGLangSpace,
                SVGExternalResourcesRequired,
                SVGStylable,
                SVGTransformable,
                events::EventTarget {};
```

Interface GetSVGDocument

In the case where an SVG document is embedded by reference, such as when an XHTML document has an 'object' element whose href (or equivalent) attribute references an SVG document (i.e., a document whose MIME type is "image/svg" and whose root element is thus an 'svg' element), the SVG user agent is required to implement the GetSVGDocument interface for the element which references the SVG document (e.g., the HTML 'object' or comparable referencing elements).

IDL Definition

```
interface GetSVGDocument {

  SVGDocument getSVGDocument (   )
                  raises( DOMException );
};
```

Methods

getSVGDocument

Returns the [SVGDocument](#) object for the referenced SVG document.

No Parameters

Return value

SVGDocument The SVGDocument object for the referenced SVG document.

Exceptions

DOMException NOT_SUPPORTED_ERR: No SVGDocument object is available.

6 Styling

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6.1 SVG's styling properties

SVG uses styling properties to describe many of its document parameters. Styling properties define how the graphics elements in the SVG content are to be rendered. SVG uses styling properties for the following:

- Parameters which are clearly visual in nature and thus lend themselves to styling. Examples include all attributes that define how an object is "painted," such as fill and stroke colors, linewidths and dash styles.
- Parameters having to do with text styling such as 'font-family' and 'font-size'.
- Parameters which impact the way that graphical elements are rendered, such as specifying clipping paths, masks, arrowheads, markers and filter effects.

SVG shares many of its styling properties with CSS [CSS2] and XSL [XSL]. Except for any additional SVG-specific rules explicitly mentioned in this specification, the normative definition of properties that are shared with CSS and XSL is the definition of the property from the CSS2 specification [CSS2].

The following properties are shared between CSS2, XSL and SVG:

- [Font properties](#):
  - ['font'](#)
  - ['font-family'](#)
  - ['font-size'](#)
  - ['font-size-adjust'](#)
  - ['font-stretch'](#)

- ❍ ['font-style'](#)
- ❍ ['font-variant'](#)
- ❍ ['font-weight'](#)
- Text properties:
  - ❍ ['direction'](#)
  - ❍ ['letter-spacing'](#)
  - ❍ ['text-decoration'](#)
  - ❍ ['unicode-bidi'](#)
  - ❍ ['word-spacing'](#)
- Other properties for visual media:
  - ❍ ['clip'](#) (Only applicable to outermost 'svg')
  - ❍ ['color'](#) is used to provide a potential indirect value (currentColor) for the ['fill'](#), ['stroke'](#), ['stop-color'](#), ['flood-color'](#), ['lighting-color'](#) properties. (The SVG properties which support color allow a color specification which is extended from CSS2 to accommodate color definitions in arbitrary color spaces. See [Color profile descriptions](#).
  - ❍ ['cursor'](#)
  - ❍ ['display'](#)
  - ❍ ['overflow'](#) (Only applicable to [elements which establish a new viewport](#))
  - ❍ ['visibility'](#)

The following SVG properties are not defined in [[CSS2](#)]. The complete normative definitions for these properties are found in this specification:

- [Clipping, Masking and Compositing](#) properties:
  - ❍ ['clip-path'](#)
  - ❍ ['clip-rule'](#)
  - ❍ ['mask'](#)
  - ❍ ['opacity'](#)
- [Filter Effects](#) properties:
  - ❍ ['enable-background'](#)
  - ❍ ['filter'](#)
  - ❍ ['flood-color'](#)
  - ❍ ['flood-opacity'](#)
  - ❍ ['lighting-color'](#)
- [Gradient](#) properties:
  - ❍ ['stop-color'](#)
  - ❍ ['stop-opacity'](#)
- [Interactivity](#) properties:
  - ❍ ['pointer-events'](#)
- [Painting](#) properties:
  - ❍ ['color-interpolation'](#)
  - ❍ ['color-rendering'](#)
  - ❍ ['fill'](#)
  - ❍ ['fill-opacity'](#)
  - ❍ ['fill-rule'](#)
  - ❍ ['image-rendering'](#)
  - ❍ ['marker'](#)
  - ❍ ['marker-end'](#)
  - ❍ ['marker-mid'](#)
  - ❍ ['marker-start'](#)

- ❍ 'shape-rendering'
- ❍ 'stroke'
- ❍ 'stroke-dasharray'
- ❍ 'stroke-dashoffset'
- ❍ 'stroke-linecap'
- ❍ 'stroke-linejoin'
- ❍ 'stroke-miterlimit'
- ❍ 'stroke-opacity'
- ❍ 'stroke-width'
- ❍ 'text-rendering'
- Text properties:
  - ❍ 'baseline-identifier'
  - ❍ 'baseline-shift'
  - ❍ 'dominant-baseline'
  - ❍ 'glyph-orientation-horizontal'
  - ❍ 'glyph-orientation-vertical'
  - ❍ 'text-anchor'
  - ❍ 'writing-mode'

A table that lists and summarizes the styling properties can be found in the Property Index.

6.2 Usage scenarios for styling

SVG has many usage scenarios, each with different needs. Here are three common usage scenarios:

1. **SVG content used as an exchange format (style sheet language-independent)**:

   In some usage scenarios, reliable interoperability of SVG content across software tools is the main goal. Since support for a particular style sheet languages is not guaranteed across all implementations, it is a requirement that SVG content can be fully specified without the use of a style sheet language.

2. **SVG content generated as the output from XSLT [XSLT]**:

   XSLT offers the ability to take a stream of arbitrary XML content as input, apply potentially complex transformations, and then generate SVG content as output. XSLT can be used to transform XML data extracted from databases into an SVG graphical representation of that data. It is a requirement that fully specified SVG content can be generated from XSLT.

3. **SVG content styled with CSS [CSS2]**:

   CSS is a widely implemented declarative language for assigning styling properties to XML content, including SVG. It represents a combination of features, simplicity and compactness that makes it very suitable for many applications of SVG. It is a requirement that CSS styling can be applied to SVG content.

6.3 Alternative ways to specify styling properties

Styling properties can be assigned to SVG elements in the following two ways:

- **Presentation attributes**

  Styling properties can be assigned using SVG's presentation attributes. For each styling property defined in this specification, there is a corresponding XML presentation attribute available on all relevant SVG elements. Detailed information on the presentation attributes can be found in Specifying properties using the presentation attributes.

  The presentation attributes are style sheet language independent and thus are applicable to usage scenario 1 above (i.e., tool interoperability). Because it is straightforward to assign values to XML attributes from XSLT, the presentation attributes are well-suited to

usage scenario 2 above (i.e., SVG generation from XSLT). (See Styling with XSL below.)

Conforming SVG Interpreters and Conforming SVG Viewers are required to support SVG's presentation attributes.

- **CSS**

  To support usage scenario 3 above, SVG content can be styled with CSS. For more information, see Styling with CSS.

  Conforming SVG Interpreters and Conforming SVG Viewers that support CSS styling of generic (i.e., text-based) XML content are required to support CSS styling of SVG content.

6.4 Specifying properties using the presentation attributes

For each styling property defined in this specification (see Property Index), there is a corresponding XML attribute (the presentation attribute) with the same name that is available on all relevant SVG elements. For example, SVG has a 'fill' property that defines how to paint the interior of a shape. There is a corresponding presentation attribute with the same name (i.e., fill) that can be used to specify a value for the 'fill' property on a given element.

The following example shows how the 'fill' and 'stroke' properties can be assigned to a rectangle using the fill and stroke presentation attributes. The rectangle will be filled with red and outlined with blue:

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="10cm" height="5cm">
  <rect x="2cm" y="1cm" width="6cm" height="3cm" fill="red" stroke="blue"/>
</svg>
```

View this example as SVG (SVG-enabled browsers only)

The presentation attributes offer the following advantages:

- **Broad support**. All versions of Conforming SVG Interpreters and Conforming SVG Viewers are required to support the presentation attributes.
- **Simplicity**. Styling properties can be attached to elements by simply providing a value for the presentation attribute on the proper elements.
- **Restyling**. SVG content that uses the presentation attributes is highly compatible with downstream processing using XSLT [XSLT] or supplemental styling by adding CSS style rules to override some of the presentation attributes.
- **Convenient generation using XSLT [XSLT]**. In some cases, XSLT can be used to generate fully styled SVG content. The presentation attributes are compatible with convenient generation of SVG from XSLT.

In some situations, SVG content that uses the presentation attributes has potential limitations versus SVG content that is styled with a style sheet language such as CSS (see Styling with CSS). In other situations, such as when an XSLT style sheet generates SVG content from semantically rich XML source files, the limitations below may not apply. Depending on the situation, some of the following potential limitations may or may not apply to the presentation attributes:

- **Styling attached to content**. The presentation attributes are attached directly to particular elements, thereby diminishing potential advantages that comes from abstracting styling from content, such as the ability to restyle documents for different uses and environments.
- **Flattened data model**. In and of themselves, the presentation attributes do not offer the higher level abstractions that you get with a styling system, such as the ability to define named collections of properties which are applied to particular categories of elements. The result is that, in many cases, important higher level semantic information can be lost, potentially making document reuse and restyling more difficult.
- **Potential increase in file size**. Many types of graphics use similar styling properties across multiple elements. For example, a company organization chart might assign one collection of styling properties to the boxes around temporary workers (e.g., dashed outlines, red fill), and a different collection of styling properties to permanent workers (e.g., solid outlines, blue fill). Styling systems such as CSS allow collections of properties to be defined once in a file. With the styling attributes, it might be necessary to specify presentation attributes on each different element.
- **Potential difficulty when embedded into a CSS-styled parent document**. When SVG content is embedded in other XML, and the desire is to style all aspects of the compound document with CSS, use of the presentation attributes might introduce complexity and difficulty. In this case, it is sometimes easier if the SVG content does not use the presentation attributes and instead is styled using CSS facilities.

For user agents that support CSS, the presentation attributes must be translated to corresponding CSS style rules according to rules described in section 6.4.4 of the CSS2 specification, Precedence of non-CSS presentational hints; thus, the presentation attributes will participate in the CSS2 cascade as if they were replaced by corresponding CSS style rules placed at the start of the author style sheet with a specificity of zero. In general, this means that the presentation attributes have lower priority than other CSS style rules specified in author style sheets or style attributes.

User agents that do not support CSS must ignore any CSS style rules defined in CSS style sheets and style attributes. In this case, the CSS cascade does not apply. (Inheritance of properties, however, does apply. See Property inheritance.)

6.5 Entity definitions for the presentation attributes

The following entities are defined in the DTD for all of the presentation attributes in SVG:

```
<!-- The following presentation attributes apply to container elements. -->
<!ENTITY % PresentationAttributes-Containers
   "enable-background %EnableBackgroundValue; #IMPLIED " >

<!-- The following presentation attributes apply to 'feFlood' elements. -->
<!ENTITY % PresentationAttributes-feFlood
   "flood-color %SVGColor; #IMPLIED
    flood-opacity %OpacityValue; #IMPLIED " >

<!-- The following presentation attributes apply to filling and stroking operations. -->
<!ENTITY % PresentationAttributes-FillStroke
   "fill %Paint; #IMPLIED
    fill-opacity %OpacityValue; #IMPLIED
    fill-rule %ClipFillRule; #IMPLIED
    stroke %Paint; #IMPLIED
    stroke-dasharray %StrokeDashArrayValue; #IMPLIED
    stroke-dashoffset %StrokeDashOffsetValue; #IMPLIED
    stroke-linecap (butt | round | square | inherit) #IMPLIED
    stroke-linejoin (miter | round | bevel | inherit) #IMPLIED
    stroke-miterlimit %StrokeMiterLimitValue; #IMPLIED
    stroke-opacity %OpacityValue; #IMPLIED
    stroke-width %StrokeWidthValue; #IMPLIED " >

<!-- The following presentation attributes have to do with selecting a font to use. -->
<!ENTITY % PresentationAttributes-FontSelection
   "font-family %FontFamilyValue; #IMPLIED
    font-size %FontSizeValue; #IMPLIED
    font-size-adjust %FontSizeAdjustValue; #IMPLIED
    font-stretch (normal | wider | narrower | ultra-condensed | extra-condensed |
                  condensed | semi-condensed | semi-expanded | expanded |
                  extra-expanded | ultra-expanded | inherit) #IMPLIED
    font-style (normal | italic | oblique | inherit) #IMPLIED
    font-variant (normal | small-caps | inherit) #IMPLIED
    font-weight (normal | bold | bolder | lighter | 100 | 200 | 300 |
                 400 | 500 | 600 | 700 | 800 | 900 | inherit) #IMPLIED " >

<!-- The following presentation attributes apply to gradient 'stop' elements. -->
<!ENTITY % PresentationAttributes-Gradients
   "stop-color %SVGColor; #IMPLIED
    stop-opacity %OpacityValue; #IMPLIED " >

<!-- The following presentation attributes apply to graphics elements. -->
<!ENTITY % PresentationAttributes-Graphics
   "clip-path %ClipPathValue; #IMPLIED
    clip-rule %ClipFillRule; #IMPLIED
    color %Color; #IMPLIED
    color-interpolation (auto | sRGB | linearRGB | inherit) #IMPLIED
    color-rendering (auto | optimizeSpeed | optimizeQuality | inherit) #IMPLIED
    cursor %CursorValue; #IMPLIED
    display (inline | block | list-item | run-in | compact | marker |
             table | inline-table | table-row-group | table-header-group |
             table-footer-group | table-row | table-column-group | table-column |
             table-cell | table-caption | none | inherit) #IMPLIED
    filter %FilterValue; #IMPLIED
    image-rendering (auto | optimizeSpeed | optimizeQuality | inherit) #IMPLIED
    mask %MaskValue; #IMPLIED
    opacity %OpacityValue; #IMPLIED
```

```
    pointer-events (visiblePainted | visibleFill | visibleStroke | visibleFillStroke | visible |
                    painted | fill | stroke | fillstroke | all | none | inherit) #IMPLIED
    shape-rendering (auto | optimizeSpeed | crispEdges | geometricPrecision | inherit) #IMPLIED
    text-rendering (auto | optimizeSpeed | optimizeLegibility | geometricPrecision | inherit)
#IMPLIED
    visibility (visible | hidden | inherit) #IMPLIED " >

<!--The following presentation attributes apply to 'feDiffuseLighting' and 'feSpecularLighting'
elements. -->
<!ENTITY % PresentationAttributes-LightingEffects
   "lighting-color %SVGColor; #IMPLIED " >

<!-- The following presentation attributes apply to marker operations. -->
<!ENTITY % PresentationAttributes-Markers
   "marker-start %MarkerValue; #IMPLIED
    marker-mid %MarkerValue; #IMPLIED
    marker-end %MarkerValue; #IMPLIED " >

<!-- The following presentation attributes apply to text content elements. -->
<!ENTITY % PresentationAttributes-TextContentElements
   "baseline-identifier (baseline | top | before-edge | text-top | text-before-edge |
                         middle | bottom | after-edge | text-bottom | text-after-edge |
                         ideographic | lower | hanging | mathematical | inherit) #IMPLIED
    baseline-shift %BaselineShiftValue; #IMPLIED
    direction (ltr | rtl | inherit) #IMPLIED
    glyph-orientation-horizontal %GlyphOrientationHorizontalValue; #IMPLIED
    glyph-orientation-vertical %GlyphOrientationVerticalValue; #IMPLIED
    letter-spacing %SpacingValue; #IMPLIED
    text-decoration %TextDecorationValue; #IMPLIED
    unicode-bidi (normal | embed | bidi-override | inherit) #IMPLIED
    word-spacing %SpacingValue; #IMPLIED " >

<!-- The following presentation attributes apply to 'text' elements. -->
<!ENTITY % PresentationAttributes-TextElements
   "dominant-baseline (auto | autosense-script | no-change | reset|
                       ideographic | lower | hanging | mathematical | inherit ) #IMPLIED
    text-anchor (start | middle | end | inherit) #IMPLIED
    writing-mode (lr-tb | rl-tb | tb-rl | lr | rl | tb | inherit) #IMPLIED " >

<!-- The following presentation attributes apply to elements that establish viewports. -->
<!ENTITY % PresentationAttributes-Viewports
   "clip %ClipValue; #IMPLIED
    overflow (visible | hidden | scroll | auto | inherit) #IMPLIED " >

<!--The following represents the complete list of presentation attributes. -->
<!ENTITY % PresentationAttributes-All
  "%PresentationAttributes-Containers;
   %PresentationAttributes-feFlood;
   %PresentationAttributes-FillStroke;
   %PresentationAttributes-FontSelection;
   %PresentationAttributes-Gradients;
   %PresentationAttributes-Graphics;
   %PresentationAttributes-LightingEffects;
   %PresentationAttributes-Markers;
   %PresentationAttributes-TextContentElements;
   %PresentationAttributes-TextElements;" >
```

6.6 Styling with XSL

XSL style sheets (see [XSLT]) define how to transform XML content into something else, usually other XML. When XSLT is used in conjunction with SVG, sometimes SVG content will serve as both input and output for XSL style sheets. Other times, XSL style sheets will take non-SVG content as input and generate SVG content as output.

The following example uses an external XSL style sheet to transform SVG content into modified SVG content (see Referencing external style sheets). The style sheet sets the 'fill' and 'stroke' properties on all rectangles to red and blue, respectively:

mystyle.xsl

```
<?xml version="1.0" standalone="no"?>
<xsl:stylesheet xmlns:xsl="http://www.w3.org/1999/XSL/Transform" version="1.0">

  <!-- Add DOCTYPE -->
  <xsl:template match="/">
    <xsl:text disable-output-escaping="yes">&lt;!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
      "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd"&gt;
</xsl:text>
    <xsl:apply-templates/>
  </xsl:template>

  <!-- Add styling to all 'rect' elements -->
  <xsl:template match="rect">
    <xsl:copy>
      <xsl:copy-of select="@*"/>
      <xsl:attribute name="fill">red</xsl:attribute>
      <xsl:attribute name="stroke">blue</xsl:attribute>
    </xsl:copy>
  </xsl:template>

  <!-- default is to copy input element -->
  <xsl:template match="*|@*|text()">
    <xsl:copy>
      <xsl:apply-templates select="*|@*|text()"/>
    </xsl:copy>
  </xsl:template>
</xsl:stylesheet>
```

SVG file to be transformed by mystyle.xsl

```
<?xml version="1.0" standalone="no"?>
<svg width="10cm" height="5cm">
  <rect x="2cm" y="1cm" width="6cm" height="3cm"/>
</svg>
```

SVG content after applying mystyle.xsl

```
<?xml version="1.0" encoding="utf-8"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
      "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="10cm" height="5cm">
  <rect x="2cm" y="1cm" width="6cm" height="3cm" fill="red" stroke="blue"/>
</svg>
```

6.7 Styling with CSS

SVG implementations that support CSS are required to support the following:

- External CSS style sheets referenced from the current document (see Referencing external style sheets)
- Internal CSS style sheets (i.e., style sheets embedded within the current document, such as within an SVG 'style' element)
- Inline style (i.e., CSS property declarations within a style attribute on a particular SVG element)

The following example shows the use of an external CSS style sheet to set the 'fill' and 'stroke' properties on all rectangles to red and blue, respectively:

mystyle.css

```
rect {
  fill: red;
  stroke; blue
}
```

SVG file referencing mystyle.css

```
<?xml version="1.0" standalone="no"?>
<?xml-stylesheet href="mystyle.css" type="text/css"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="10cm" height="5cm">
  <rect x="2cm" y="1cm" width="6cm" height="3cm"/>
</svg>
```

View this example as SVG (SVG-enabled browsers only)

CSS style sheets can be embedded within SVG content inside of a 'style' element. The following example uses an internal CSS style sheet to achieve the same result as the previous example:

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="10cm" height="5cm">
  <defs>
    <style type="text/css"><![CDATA[
      rect {
        fill: red;
        stroke: blue
      }
    ]]></style>
  </defs>
  <rect x="2cm" y="1cm" width="6cm" height="3cm"/>
</svg>
```

View this example as SVG (SVG-enabled browsers only)

Note how the CSS style sheet is placed within a CDATA construct (i.e., `<![CDATA[ ... ]]>`), which is necessary since CSS style sheets are not expressed in XML.

Implementations that support CSS are also required to support CSS inline style. Similar to the style attribute in HTML, CSS inline style can be declared within a style attribute in SVG by specifying a semicolon-separated list of property declarations, where each property declaration has the form "name: value".

The following example shows how the 'fill' and 'stroke' properties can be assigned to a rectangle using the style attribute. Just like the previous example, the rectangle will be filled with red and outlined with blue:

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="10cm" height="5cm">
  <rect x="2cm" y="1cm" width="6cm" height="3cm"
        style="fill:red; stroke:blue"/>
</svg>
```

View this example as SVG (SVG-enabled browsers only)

In an SVG user agent that supports CSS style sheets, the following facilities from [CSS2] must be supported:

- CSS2 selectors within style sheets (reference: [Selectors]).
- External CSS style sheets [XML-SS], CSS style sheets within 'style' elements and CSS declaration blocks within style attributes attached to specific SVG elements.
- CSS2 rules for assigning property values, cascading and inheritance.
- @font-face, @media, @import and @charset rules within style sheets.
- CSS2's dynamic pseudo-classes :hover, :active and :focus and pseudo-classes :first-child, :visited, :link and :lang. The remaining CSS2 pseudo-classes, including those having to do with generated content, are not part of the SVG language definition. (Note: an SVG element gains focus when it is selected. See Text selection.)
- For the purposes of aural media, SVG represents a CSS-stylable XML grammar. In user agents that support aural style sheets, CSS aural

style properties can be applied as defined in [CSS2]. (See Aural style sheets.)

SVG defines an @color-profile at-rule [CSS2-ATRULES] for defining color profiles so that ICC color profiles can be applied to CSS-styled SVG content.

6.8 Facilities from CSS and XSL used by SVG

SVG shares various relevant properties and approaches common to CSS and XSL, plus the semantics of many of the processing rules.

SVG shares the following facilities with CSS and XSL:

- Shared properties. Many of SVG's properties are shared between CSS2, XSL and SVG. (See list of shared properties).
- Syntax rules. (The normative references are [CSS2 syntax and basic data types] and [The grammar of CSS2].)
- Allowable data types. (The normative reference is [CSS2 syntax and basic data types]), with the exception that SVG allows <length> and <angle> values without a unit identifier. See Units.)
- Inheritance rules.
- The color keywords from CSS2 that correspond to the colors used by objects in the user's environment. (The normative reference is [CSS2 system colors].)
- For implementations that support CSS styling of SVG content, then that styling must be compatible with various other rules in CSS. (See Styling with CSS.)

6.9 Referencing external style sheets

External style sheets are referenced using the mechanism documented in "Associating Style Sheets with XML documents Version 1.0" [XML-SS].

6.10 The 'style' element

The 'style' element allows style sheets to be embedded directly within SVG content. SVG's 'style' element has the same attributes as the corresponding element in HTML (see HTML's 'style' element).

```
<!ELEMENT style (#PCDATA) >
<!ATTLIST style
  %stdAttrs;
  xml:space (preserve) #FIXED "preserve"
  type %ContentType; #REQUIRED
  media %MediaDesc; #IMPLIED
  title %Text; #IMPLIED >
```

Attribute definitions:

type = *content-type*

> This attribute specifies the style sheet language of the element's contents. The style sheet language is specified as a content type (e.g., "text/css"), as per [RFC2045]. Authors must supply a value for this attribute; there is no default value.
> Animatable: no.

media = *media-descriptors*

> This attribute specifies the intended destination medium for style information. It may be a single media descriptor or a comma-separated list. The default value for this attribute is "screen". The set of recognized *media-descriptors* are the list of media types recognized by CSS2 [CSS2 Recognized media types].
> Animatable: no.

title = *advisory-title*

> (For compatibility with [HTML4]) This attribute specifies an advisory title for the 'style' element.
> Animatable: no.

Attributes defined elsewhere:

The syntax of style data depends on the style sheet language.

Some style sheet languages might allow a wider variety of rules in the 'style' element than in the style attribute. For example, with CSS, rules can be declared within a 'style' element that cannot be declared within a style attribute.

An example showing the 'style' element is provided above (see example).

6.11 The class attribute

Attribute definitions:

class = *list*

> This attribute assigns a class name or set of class names to an element. Any number of elements may be assigned the same class name or names. Multiple class names must be separated by white space characters.
> Animatable: yes.

The class attribute assigns one or more class names to an element. The element may be said to belong to these classes. A class name may be shared by several element instances. The class attribute has several roles:

- As a style sheet selector (when an author wishes to assign style information to a set of elements).
- For general purpose processing by user agents.

In the following example, the 'text' element is used in conjunction with the class attributes to markup document messages. Messages appear in both English and French versions.

```
<!-- English messages -->
<text class="info" lang="en">Variable declared twice</text>
<text class="warning" lang="en">Undeclared variable</text>
<text class="error" lang="en">Bad syntax for variable name</text>

<!-- French messages -->
<text class="info" lang="fr">Variable déclarée deux fois</text>
<text class="warning" lang="fr">Variable indéfinie</text>
<text class="error" lang="fr">Erreur de syntaxe pour variable</text>
```

In an SVG user agent that supports CSS styling, the following CSS style rules would tell visual user agents to display informational messages in green, warning messages in yellow, and error messages in red:

```
text.info    { color: green }
text.warning { color: yellow }
text.error   { color: red }
```

6.12 The style attribute

The style attribute allows per-element style rules to be specified directly on a given element. When CSS styling is used, CSS inline style is specified by including semicolon-separated property declarations of the form "name : value" within the style attribute

Attribute definitions:

style = *style*

> This attribute specifies style information for the current element. The style attribute specifies style information for a single element. The style sheet language of inline style rules is given by the value of attribute contentStyleType on the 'svg' element. The syntax of style data depends on the style sheet language.
> Animatable: no.

The style attribute may be used to apply a particular style to an individual SVG element. If the style will be reused for several elements, authors should use the 'style' element to regroup that information. For optimal flexibility, authors should define styles in external style sheets.

An example showing the style attribute is provided above (see example).

6.13 Specifying the default style sheet language

The contentStyleType attribute on the 'svg' element specifies the default style sheet language for the given document fragment.

contentStyleType = "%ContentType;"

Identifies the default style sheet language for the given document. This attribute sets the style sheet language for the style attributes that are available on many elements. The value %ContentType; specifies a media type, per [RFC2045]. The default value is "text/css".
Animatable: no.

6.14 Property inheritance

Whether or not the user agent supports CSS, property inheritance in SVG follows the property inheritance rules defined in the CSS2 specification. The normative definition for property inheritance is section 6.2 of the CSS2 specification (see Inheritance).

The definition of each property indicates whether the property can inherit the value of its parent.

In SVG, as in CSS2, most elements inherit computed values [CSS2-COMPUTED]. For cases where something other than computed values are inherited, the property definition will describe the inheritance rules. For specified values [CSS2-SPECIFIED] which are expressed in user units, in pixels (e.g., "20px") or in absolute values [CSS2-COMPUTED], the computed value equals the specified value. For specified values which use certain relative units (i.e., *em*, *ex* and percentages), the computed value will have the same units as the value to which it is relative. Thus, if the parent element has a 'font-size' of "10pt" and the current element has a 'font-size' of "120%", then the computed value for 'font-size' on the current element will be "12pt". In cases where the referenced value for relative units is not expressed in any of the standard SVG units (i.e., CSS units or user units), such as when a percentage is used relative to the current viewport or an object bounding box, then the computed value will be in user units.

Note that SVG has some facilities wherein a property which is specified on an ancestor element might effect its descendant element, even if the descendant element has a different assigned value for that property. For example, if a 'clip-path' property is specified on an ancestor element, and the current element has a 'clip-path' of 'none', the ancestor's clipping path still applies to the current element because the semantics of SVG state that the clipping path used on a given element is the intersection of all clipping paths specified on itself and all ancestor elements. The key concept is that property assignment (with possible property inheritance) happens first. After properties values have been assigned to the various elements, then the user agent applies the semantics of each assigned property, which might result in the property assignment of an ancestor element affecting the rendering of its descendants.

6.15 The scope/range of styles

The following define the scope/range of style sheets:

Stand-alone SVG document

There is one parse tree. Style sheets defined anywhere within the SVG document (in style elements or style attributes, or in external style sheets linked with the stylesheet processing instruction) apply across the entire SVG document.

Stand-alone SVG document embedded in an HTML or XML document with the 'img', 'object' (HTML) or 'image' (SVG) elements

There are two completely separate parse trees; one for the referencing document (perhaps HTML/XHTML), and one for the SVG document. Style sheets defined anywhere within the referencing document (in style elements or style attributes, or in external style sheets linked with the stylesheet processing instruction) apply across the entire referencing document but have no effect on the referenced SVG document. Style sheets defined anywhere within the referenced SVG document (in style elements or style attributes, or in external style sheets linked with the stylesheet processing instruction) apply across the entire SVG document, but do not affect the referencing document (perhaps HTML/XHTML). To get the same styling across both HTML/XHTML document and SVG document, link them both to the same stylesheet.

Stand-alone SVG content textually included in an XML document

There is a single parse tree, using multiple namespaces; one or more subtrees are in the SVG namespace. Style sheets defined anywhere within the XML document (in style elements or style attributes, or in external style sheets linked with the stylesheet processing instruction) apply across the entire document, including those parts of it in the SVG namespace. To get different styling for the SVG part, use the style attribute, or put an ID on the 'svg' element and use contextual CSS selectors, or use XSL selectors.

6.16 User agent style sheet

The user agent shall maintain a *user agent style sheet* [CSS2-CASCADE-RULES] for elements in the SVG namespace for visual media [CSS2-VISUAL]. The user agent style sheet below is expressed using CSS syntax; however, user agents are required to support the behavior that corresponds to this default style sheet even if CSS style sheets are not supported in the user agent:

```
svg, symbol, marker, pattern, view, use, image, mask { overflow: hidden }
svg { width:attr(width); height:attr(height) }
```

The first line of the above user agent style sheet will cause the initial clipping path to be established at the bounds of the initial viewport. Furthermose, it will cause new clipping paths to be established at the bounds of the listed elements, all of which are elements that establish a new viewport. (Refer the description of SVG's use of the 'overflow' property for more information.)

The second line of the above user agent style sheet will cause the width and height attributes on the 'svg' element to be used as the default values for the 'width' and 'height' properties during [CSS2-LAYOUT].

6.17 Aural style sheets

For the purposes of aural media, SVG represents a stylable XML grammar. In user agents that support CSS aural style sheets, aural style properties [CSS2-AURAL] can be applied as defined in [CSS2].

Aural style properties can be applied to any SVG element that can contain character data content, including 'desc', 'title', 'tspan'. 'tref'. 'glyphRun' and 'textPath'. On user agents that support aural style sheets, the following [CSS2] properties can be applied:

'azimuth'	[CSS2-azimuth]
'cue'	[CSS2-cue]
'cue-after'	[CSS2-cue-after]
'cue-before'	[CSS2-cue-before]
'elevation'	[CSS2-elevation]
'pause'	[CSS2-pause]
'pause-after'	[CSS2-pause-after]
'pause-before'	[CSS2-pause-before]
'pitch'	[CSS2-pitch]
'pitch-range'	[CSS2-pitch-range]
'play-during'	[CSS2-play-during]
'richness'	[CSS2-richness]
'speak'	[CSS2-speak]
'speak-header'	[CSS2-speak-header]
'speak-numeral'	[CSS2-speak-numeral]
'speak-punctuation'	[CSS2-speak-punctuation]
'speech-rate'	[CSS2-speech-rate]
'stress'	[CSS2-stress]
'voice-family'	[CSS2-voice-family]
'volume'	[CSS2-volume]

For user agents that support aural style sheets and also support [DOM2], the user agent is required to support the DOM interfaces defined in [DOM2-CSS] that correspond to aural properties [CSS2-AURAL]. (See Relationship with DOM2 CSS object model.)

6.18 DOM interfaces

The following interfaces are defined below: SVGStyleElement.

Interface SVGStyleElement

The SVGStyleElement interface corresponds to the 'style' element.

IDL Definition

```
interface SVGStyleElement : SVGElement {
            attribute DOMString xmlspace;
                        // raises DOMException on setting
            attribute DOMString type;
```

```
                         // raises DOMException on setting
           attribute DOMString media;
                         // raises DOMException on setting
           attribute DOMString title;
                         // raises DOMException on setting
};
```

Attributes

DOMString xmlspace

Corresponds to attribute xml:space on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

DOMString type

Corresponds to attribute type on the given 'style' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

DOMString media

Corresponds to attribute media on the given 'style' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

DOMString title

Corresponds to attribute title on the given 'style' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

---

7 Coordinate Systems, Transformations and Units

Contents

7.1 Introduction

For all media, the SVG canvas describes "the space where the SVG content is rendered." The canvas is infinite for each dimension of the space, but rendering occurs relative to a finite rectangular region of the canvas. This finite rectangular region is called the SVG viewport. For visual media [CSS2-VISUAL], the SVG viewport is the viewing area where the user sees the SVG content.

The size of the SVG viewport (i.e., its width and height) is determined by a negotiation process (see Establishing the size of the initial viewport) between the SVG document fragment and its parent (real or implicit). Once that negotiation process is completed, the SVG user agent is provided the following information:

- an integer value that represents the width in "pixels" of the viewport
- an integer value that represents the height in "pixels" of the viewport
- (highly desirable but not required) a real number value that indicates how many millimeters a "pixel" represents

Using the above information, the SVG user agent determines the viewport, an initial viewport coordinate system and an initial user coordinate system such that the two coordinates systems are identical. Both coordinates systems are established such that the origin matches the origin of the viewport, and one unit in the initial coordinate system equals one "pixel" in the viewport. (See Initial coordinate system.) The viewport coordinate system is also called viewport space and and the user coordinate system is also called user space.

Lengths in SVG can be specified as:

- (if no unit identifier is provided) values in user space -- for example, "15"
- (if a unit identifier is provided) a length expressed as an absolute or relative unit measure -- for example, "15mm" or "5em"

The supported length unit identifiers are: em, ex, px, pt, pc, cm, mm, in, and percentages.

A new user space (i.e., a new current coordinate system) can be established at any place within an SVG document fragment by specifying

transformations in the form of transformation matrices or simple transformation operations such as rotation, skewing, scaling and translation. Establishing new user spaces via coordinate system transformations are fundamental operations to 2D graphics and represent the usual method of controlling the size, position, rotation and skew of graphic objects.

New viewports also can be established. By establishing a new viewport, you can redefine the meaning of some of the various unit identifiers (px, pt, pc, cm, mm, in, and percentages) and provide a new reference rectangle for "fitting" a graphic into a particular rectangular area. ("Fit" means that a given graphic is transformed in such a way that its bounding box in user space aligns exactly with the edges of a given viewport.)

7.2 The initial viewport

The SVG user agent negotiates with its parent user agent to determine the viewport into which the SVG user agent can render the document. In some circumstances, SVG content will be embedded in or referenced by a containing document. This containing document might include attributes, properties and/or other parameters (explicit or implicit) which specify or provide hints about the dimensions of the viewport for the SVG content. SVG content itself is required to specify information about the appropriate viewport region for the content via the width and height XML attributes that are required on every 'svg' element. The negotiation process uses any information provided by the containing document and the SVG content itself to choose the viewport location and size.

When the SVG content is embedded inline within a containing document, and that document is styled using CSS, then if there are CSS [CSS2] positioning properties [CSS2-POSN] specified on the outermost 'svg' element that are sufficient to establish the width of the viewport, then these positioning properties establish the viewport's width; otherwise, the width attribute on the outermost 'svg' element establishes the viewport's width. Similarly, if there are CSS [CSS2] positioning properties [CSS2-POSN] specified on the outermost 'svg' element that are sufficient to establish the height of the viewport, then these positioning properties establish the viewport's height; otherwise, the height attribute on the outermost 'svg' element establishes the viewport's height.

If the width or height attributes on the outermost 'svg' element are in user units (i.e., no unit identifier has been provided), then the value is assumed to be equivalent to the same number of "px" units (see Units).

In the following example, an SVG graphic is embedded within a parent XML document which is formatted using CSS layout rules. Since CSS positioning properties are not provided on the outermost 'svg' element, the width="100px" and height="200px" attributes determine the size of the initial viewport:

```
<?xml version="1.0" standalone="yes"?>
<parent xmlns="http://some.url">

   <!-- SVG graphic -->
   <svg xmlns='http://www.w3.org/2000/svg-20000629'
      width="100px" height="200px">
      <path d="M100,100 Q200,400,300,100"/>
      <!-- rest of SVG graphic would go here -->
   </svg>

</parent>
```

The initial clipping path for the SVG document fragment is established according to the rules described in The initial clipping path.

7.3 The initial coordinate system

For the outermost 'svg' element, the SVG user agent determines an initial viewport coordinate system and an initial user coordinate system such that the two coordinates systems are identical. The origin of both coordinate systems is at the origin of the viewport, and one unit in the initial coordinate system equals one "pixel" in the viewport. In most cases, such as stand-alone SVG documents or SVG document fragments embedded within XML parent documents where the parent's layout is determined by CSS [CSS2] or XSL [XSL], the initial viewport coordinate system (and therefore the initial user coordinate system) has its origin at the top/left of the viewport, with the positive X axis pointing towards the right, the positive Y axis pointing down, and text rendered with an "upright" orientation, which means glyphs are oriented such that Roman characters and full-size ideographic characters for Asian scripts have the top edge of the corresponding glyphs oriented upwards and the right edge of the corresponding glyphs oriented to the right.

Example InitialCoords below shows that the initial coordinate system has the origin at the top/left with the X axis pointing to the right and the Y axis pointing down. The initial user coordinate system has one user unit equal to the parent (implicit or explicit) user agent's "pixel".

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="300px" height="100px">
  <desc>Example InitialCoords - SVG's initial coordinate system</desc>

  <g style="fill:none; stroke:black; stroke-width:3">
    <line x1="0" y1="1.5" x2="300" y2="1.5" />
    <line x1="1.5" y1="0" x2="1.5" y2="100" />
  </g>
  <g style="fill:red; stroke:none">
    <rect x="0" y="0" width="3" height="3" />
    <rect x="297" y="0" width="3" height="3" />
    <rect x="0" y="97" width="3" height="3" />
  </g>
  <g style="font-size:14 font-family:Verdana">
    <text x="10" y="20">(0,0)</text>
    <text x="240" y="20">(300,0)</text>
    <text x="10" y="90">(0,100)</text>
  </g>
</svg>
```


Example InitialCoords

View this example as SVG (SVG-enabled browsers only)

7.4 Coordinate system transformations

A new user space (i.e., a new current coordinate system) can be established by specifying transformations in the form of a transform attribute on a container element or graphics element. The transform attribute transforms all user space coordinates and lengths on the given element and all of its ancestors. Transformations can be nested, in which case the effect of the transformations are cumulative.

The following demonstrates simple transformations:

Example OrigCoordSys below shows a document without transformations. The text string is specified in the initial coordinate system.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="400px" height="150px">
  <desc>Example OrigCoordSys - Simple transformations: original picture</desc>
  <g style="fill:none; stroke:black; stroke-width:3">
    <!-- Draw the axes of the original coordinate system -->
    <line x1="0" y1="1.5" x2="400" y2="1.5" />
    <line x1="1.5" y1="0" x2="1.5" y2="150" />
  </g>
  <g>
    <text x="30" y="30" style="font-size:20 font-family:Verdana">
      ABC (orig coord system)
    </text>
```
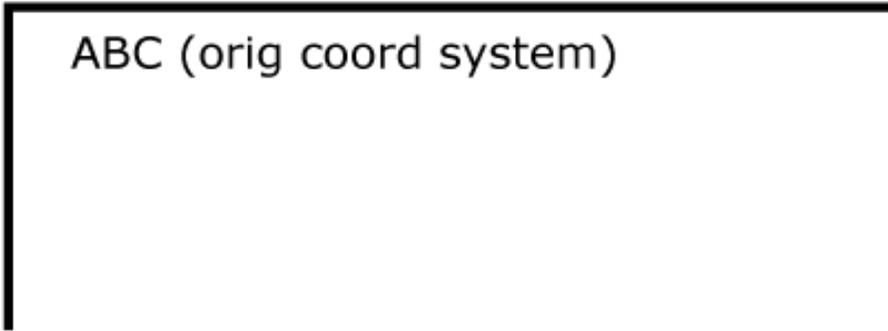
```
    </g>
</svg>
```

ABC (orig coord system)

Example OrigCoordSys

Example NewCoordSys establishes a new user coordinate system by specifying transform="translate(50,50)" on the third 'g' element below. The new user coordinate system has its origin at location (50,50) in the original coordinate system. The result of this transformation is that the coordinate (30,30) in the new user coordinate system gets mapped to coordinate (80,80) in the original coordinate system (i.e., the coordinates have been translated by 50 units in X and 50 units in Y).

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="400px" height="150px">
  <desc>Example NewCoordSys - New user coordinate system</desc>
  <g style="fill:none; stroke:black; stroke-width:3">
    <!-- Draw the axes of the original coordinate system -->
    <line x1="0" y1="1.5" x2="400" y2="1.5" />
    <line x1="1.5" y1="0" x2="1.5" y2="150" />
  </g>
  <g>
    <text x="30" y="30" style="font-size:20 font-family:Verdana">
      ABC (orig coord system)
    </text>
  </g>
  <!-- Establish a new coordinate system, which is
       shifted (i.e., translated) from the initial coordinate
       system by 50 user units along each axis. -->
  <g transform="translate(50,50)">
    <g style="fill:none; stroke:red; stroke-width:3">
      <!-- Draw lines of length 50 user units along
           the axes of the new coordinate system -->
      <line x1="0" y1="0" x2="50" y2="0" style="stroke:red"/>
      <line x1="0" y1="0" x2="0" y2="50" />
    </g>
    <text x="30" y="30" style="font-size:20 font-family:Verdana">
      ABC (translated coord system)
    </text>
  </g>
</svg>
```

ABC (orig coord system)

ABC (translated coord system)

Example NewCoordSys

Example RotateScale illustrates simple **rotate** and **scale** transformations. The example defines two new coordinate systems:

- one which is the result of a translation by 50 units in X and 30 units in Y, followed by a rotation of 30 degrees
- another which is the result of a translation by 200 units in X and 40 units in Y, followed by a scale transformation of 1.5.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="400px" height="120px">
  <desc>Example RotateScale - Rotate and scale transforms</desc>
  <g style="fill:none; stroke:black; stroke-width:3">
    <!-- Draw the axes of the original coordinate system -->
    <line x1="0" y1="1.5" x2="400" y2="1.5" />
    <line x1="1.5" y1="0" x2="1.5" y2="120" />
  </g>
  <!-- Establish a new coordinate system whose origin is at (50,30)
       in the initial coord. system and which is rotated by 30 degrees. -->
  <g transform="translate(50,30)">
    <g transform="rotate(30)">
      <g style="fill:none; stroke:red; stroke-width:3">
        <line x1="0" y1="0" x2="50" y2="0" />
        <line x1="0" y1="0" x2="0" y2="50" />
      </g>
      <text x="0" y="0" style="font-size:20; font-family:Verdana; fill:blue">
        ABC (rotate)
      </text>
    </g>
  </g>
  <!-- Establish a new coordinate system whose origin is at (200,40)
       in the initial coord. system and which is scaled by 1.5. -->
  <g transform="translate(200,40)">
    <g transform="scale(1.5)">
      <g style="fill:none; stroke:red; stroke-width:3">
        <line x1="0" y1="0" x2="50" y2="0" />
        <line x1="0" y1="0" x2="0" y2="50" />
      </g>
      <text x="0" y="0" style="font-size:20; font-family:Verdana; fill:blue">
        ABC (scale)
      </text>
    </g>
  </g>
</svg>
```
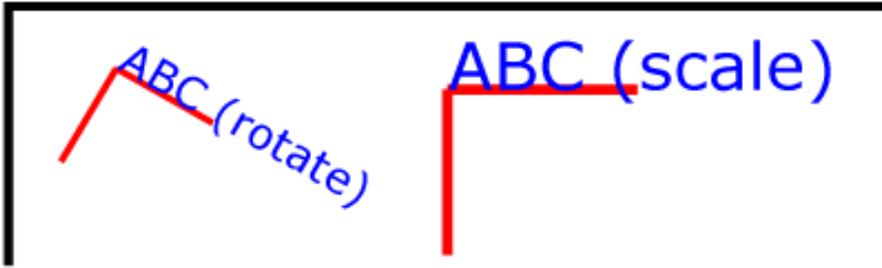
Example RotateScale

Example Skew defines two coordinate systems which are **skewed** relative to the origin coordinate system.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="400px" height="120px">
  <desc>Example Skew - Show effects of skewX and skewY</desc>
  <g style="fill:none; stroke:black; stroke-width:3">
    <!-- Draw the axes of the original coordinate system -->
    <line x1="0" y1="1.5" x2="400" y2="1.5" />
    <line x1="1.5" y1="0" x2="1.5" y2="120" />
  </g>
  <!-- Establish a new coordinate system whose origin is at (30,30)
       in the initial coord. system and which is skewed in X by 30 degrees. -->
  <g transform="translate(30,30)">
    <g transform="skewX(30)">
      <g style="fill:none; stroke:red; stroke-width:3">
        <line x1="0" y1="0" x2="50" y2="0" />
        <line x1="0" y1="0" x2="0" y2="50" />
      </g>
      <text x="0" y="0" style="font-size:20; font-family:Verdana; fill:blue">
        ABC (skewX)
      </text>
    </g>
  </g>
  <!-- Establish a new coordinate system whose origin is at (200,30)
       in the initial coord. system and which is skewed in Y by 30 degrees. -->
  <g transform="translate(200,30)">
    <g transform="skewY(30)">
      <g style="fill:none; stroke:red; stroke-width:3">
        <line x1="0" y1="0" x2="50" y2="0" />
        <line x1="0" y1="0" x2="0" y2="50" />
      </g>
      <text x="0" y="0" style="font-size:20; font-family:Verdana; fill:blue">
        ABC (skewY)
      </text>
    </g>
  </g>
</svg>
```
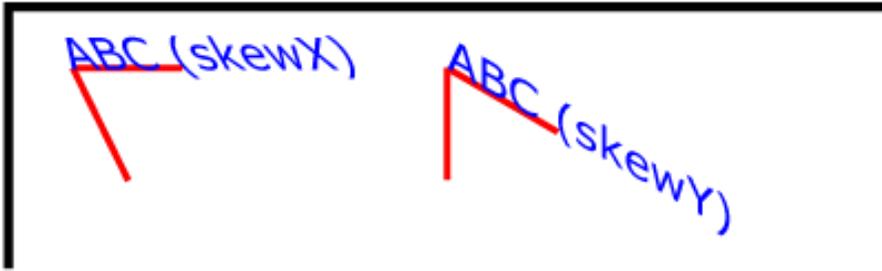
Example Skew

Mathematically, all transformations can be represented as 3x3 transformation matrices of the following form:

$$\begin{bmatrix} a & c & e \\ b & d & f \\ 0 & 0 & 1 \end{bmatrix}$$

Since only six values are used in the above 3x3 matrix, a transformation matrix is also expressed as a vector: **[a b c d e f]**.

Transformations map coordinates and lengths from a new coordinate system into a previous coordinate system:

$$\begin{bmatrix} x_{prevCoordSys} \\ y_{prevCoordSys} \\ 1 \end{bmatrix} = \begin{bmatrix} a & c & e \\ b & d & f \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} x_{newCoordSys} \\ y_{newCoordSys} \\ 1 \end{bmatrix}$$

Simple transformations are represented in matrix form as follows:

- Translation is equivalent to the matrix

$$\begin{bmatrix} 1 & 0 & tx \\ 0 & 1 & ty \\ 0 & 0 & 1 \end{bmatrix}$$

  or **[1 0 0 1 tx ty]**, where *tx* and *ty* are the distances to translate coordinates in *X* and *Y*, respectively.

- Scaling is equivalent to the matrix

$$\begin{bmatrix} sx & 0 & 0 \\ 0 & sy & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

  or **[sx 0 0 sy 0 0]**. One unit in the *X* and *Y* directions in the new coordinate system equals *sx* and *sy* units in the previous coordinate system, respectively.

- Rotation about the origin is equivalent to the matrix

$$\begin{bmatrix} \cos(a) & -\sin(a) & 0 \\ \sin(a) & \cos(a) & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

or **[cos(a) sin(a) -sin(a) cos(a) 0 0]**, which has the effect of rotating the coordinate system axes by angle *a*.

- A skew transformation along the X axis is equivalent to the matrix

$$\begin{bmatrix} 1 & \tan(a) & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

  or **[1 0 tan(a) 1 0 0]**, which has the effect of skewing X coordinates by angle *a*.

- A skew transformation along the Y axis is equivalent to the matrix

$$\begin{bmatrix} 1 & 0 & 0 \\ \tan(a) & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

  or **[1 tan(a) 0 1 0 0]**, which has the effect of skewing Y coordinates by angle *a*.

7.5 Nested transformations

Transformations can be nested to any level. The effect of nested transformations is to post-multiply (i.e., concatenate) the subsequent transformation matrices onto previously defined transformations:

$$\begin{bmatrix} x_{prev} \\ y_{prev} \\ 1 \end{bmatrix} = \begin{bmatrix} a_1 & c_1 & e_1 \\ b_1 & d_1 & f_1 \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} a_2 & c_2 & e_2 \\ b_2 & d_2 & f_2 \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} x_{curr} \\ y_{curr} \\ 1 \end{bmatrix}$$

For each given element, the accumulation of all transformations that have been defined on the given element and all of its ancestors up to and including the element which established the current viewport (usually, the 'svg' element which is the most immediate ancestor to the given element) is called the current transformation matrix or CTM. The CTM thus represents the mapping of current user coordinates to viewport coordinates:

$$CTM = \begin{bmatrix} a_1 & c_1 & e_1 \\ b_1 & d_1 & f_1 \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} a_2 & c_2 & e_2 \\ b_2 & d_2 & f_2 \\ 0 & 0 & 1 \end{bmatrix} \cdot \ldots \cdot \begin{bmatrix} a_n & c_n & e_n \\ b_n & d_n & f_n \\ 0 & 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} x_{viewport} \\ y_{viewport} \\ 1 \end{bmatrix} = CTM \cdot \begin{bmatrix} x_{userspace} \\ y_{userspace} \\ 1 \end{bmatrix}$$

Example Nested illustrates nested transformations.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="400px" height="150px">
  <desc>Example Nested - Nested transformations</desc>
  <g style="fill:none; stroke:black; stroke-width:3">
```

```
      <!-- Draw the axes of the original coordinate system -->
      <line x1="0" y1="1.5" x2="400" y2="1.5" />
      <line x1="1.5" y1="0" x2="1.5" y2="150" />
  </g>
  <!-- First, a translate -->
  <g transform="translate(50.90)">
    <g style="fill:none; stroke:red; stroke-width:3">
      <line x1="0" y1="0" x2="50" y2="0" />
      <line x1="0" y1="0" x2="0" y2="50" />
    </g>
    <text x="0" y="0" style="font-size:16; font-family:Verdana">
      ....Translate(1)
    </text>
    <!-- Second, a rotate -->
    <g transform="rotate(-45)">
      <g style="fill:none; stroke:green; stroke-width:3">
        <line x1="0" y1="0" x2="50" y2="0" />
        <line x1="0" y1="0" x2="0" y2="50" />
      </g>
      <text x="0" y="0" style="font-size:16; font-family:Verdana">
        ....Rotate(2)
      </text>
      <!-- Third, another translate -->
      <g transform="translate(130,160)">
        <g style="fill:none; stroke:blue; stroke-width:3">
          <line x1="0" y1="0" x2="50" y2="0" />
          <line x1="0" y1="0" x2="0" y2="50" />
        </g>
        <text x="0" y="0" style="font-size:16; font-family:Verdana">
          ....Translate(3)
        </text>
      </g>
    </g>
  </g>
</g>
</svg>
```


Example Nested

In the example above, the CTM within the the third nested transformation (i.e,, the transform="translate(130,160)") consists of the concatenation of the three transformations, as follows:

$$\text{CTM} = \text{translate(50,90), rotate(-45), translate(130,160)}$$

$$= \begin{bmatrix} 1 & 0 & 50 \\ 0 & 1 & 90 \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} .707 & .707 & 0 \\ -.707 & .707 & 0 \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 & 130 \\ 0 & 1 & 160 \\ 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} .707 & .707 & 255.03 \\ -.707 & .707 & 111.21 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} x_{initial} \\ y_{initial} \\ 1 \end{bmatrix} = \text{CTM} \cdot \begin{bmatrix} x_{userspace} \\ y_{userspace} \\ 1 \end{bmatrix}$$

7.6 The transform attribute

The value of the transform attribute is a <transform-list>, which is defined as a list of transform definitions, which are applied in the order provided. The individual transform definitions are separated by whitespace and/or a comma. The available types of transform definitions include:

- matrix(<a> <b> <c> <d> <e> <f>), which specifies a transformation in the form of transformation matrix of six values. matrix(a,b,c,d,e,f) is equivalent to applying the transformation matrix **[a b c d e f]**.

- translate(<tx> [<ty>]), which specifies a translation by *tx* and *ty*.

- scale(<sx> [<sy>]), which specifies a scale operation by *sx* and *sy*. If *<sy>* is not provided, it is assumed to be equal to *<sx>*.

- rotate(<rotate-angle> [<cx> <cy>]), which specifies a rotation by <rotate-angle> degrees about a given point.
  If optional parameters <cx> and <cy> are not supplied, the rotate is about the origin of the current user coordinate system. The operation corresponds to the matrix **[cos(a) sin(a) -sin(a) cos(a) 0 0]**.
  If optional parameters <cx> and <cy> are supplied, the rotate is about the point (<cx>, <cy>). The operation represents the equivalent of the following specification: translate(<cx>, <cy>) rotate(<rotate-angle>) translate(-<cx>, -<cy>).

- skewX(<skew-angle>), which specifies a skew transformation along the X axis.

- skewY(<skew-angle>), which specifies a skew transformation along the Y axis.

All numeric values are real <number>s.

If a list of transforms is provided, then the net effect is as if each transform had been specified separately in the order provided. For example,

```
<g transform="translate(-10,-20) scale(2) rotate(45) translate(5,10)">
  <!-- graphics elements go here -->
</g>
```

is functionally equivalent to:

```
<g transform="translate(-10,-20)">
  <g transform="scale(2)">
    <g transform="rotate(45)">
      <g transform="translate(5,10)">
        <!-- graphics elements go here -->
      </g>
    </g>
  </g>
</g>
```

The transform attribute is applied to an element before processing any other coordinate or length values supplied for that element. In the element

```
<rect x="10" y="10" width="20" height="20" transform="scale(2)"/>
```

the x, y, width and height values are processed after the current coordinate system has been scaled uniformly by a factor of 2 by the transform attribute. Attributes x, y, width and height (and any other attributes or properties) are treated as values in the new user coordinate system, not the previous user coordinate system. Thus, the above 'rect' element is functionally equivalent to:

```
<g transform="scale(2)">
  <rect x="10" y="10" width="20" height="20"/>
</g>
```

The following is the BNF for values for the transform attribute. The following notation is used:

- *: 0 or more
- +: 1 or more
- ?: 0 or 1
- (): grouping
- |: separates alternatives
- double quotes surround literals

```
transform-list:
    wsp* transforms? wsp*

transforms:
    transform
    | transform comma-wsp+ transforms

transform:
    matrix
    | translate
    | scale
    | rotate
    | skewX
    | skewY

matrix:
    "matrix" wsp* "(" wsp*
       number comma-wsp
       number comma-wsp
       number comma-wsp
       number comma-wsp
       number comma-wsp
       number wsp* ")"

translate:
    "translate" wsp* "(" wsp* number ( comma-wsp number )? wsp* ")"

scale:
    "scale" wsp* "(" wsp* number ( comma-wsp number )? wsp* ")"
```

```
rotate:
    "rotate" wsp* "(" wsp* number wsp* ")"

skewX:
    "skewX" wsp* "(" wsp* number wsp* ")"

skewY:
    "skewY" wsp* "(" wsp* number wsp* ")"

number:
    sign? integer-constant
    | sign? floating-point-constant

comma-wsp:
    (wsp+ comma? wsp*) | (comma wsp*)

comma:
    ","

integer-constant:
    digit-sequence

floating-point-constant:
    fractional-constant exponent?
    | digit-sequence exponent

fractional-constant:
    digit-sequence? "." digit-sequence
    | digit-sequence "."

exponent:
    ( "e" | "E" ) sign? digit-sequence

sign:
    "+" | "-"

digit-sequence:
    digit
    | digit digit-sequence

digit:
    "0" | "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9"

wsp:
    (#x20 | #x9 | #xD | #xA)
```

For the transform attribute:

Animatable: yes.

See the 'animateTransform' element for information on animating transformations.

7.7 The viewBox attribute

It is often desirable to specify that a given set of graphics stretch to fit a particular container element. The viewBox attribute provides this capability.

All elements that establish a new viewport (see elements that establish viewports) have attribute viewBox. The value of the viewBox attribute is a list of four numbers <min-x>, <min-y>, <width> and <height>, separated by whitespace and/or a comma, which specify a rectangle in user space which should be mapped to the bounds of the viewport established by the given element, taking into account attribute preserveAspectRatio. If specified, an additional transformation is applied to all descendants of the given element to achieve the specified effect.

A negative value for <width> or <height> is an error (see Error processing). A value of zero disables rendering of the element.

Example ViewBox illustrates the use of the viewBox attribute on the outermost 'svg' element to specify that the SVG content should stretch to fit bounds of the viewport.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="300px" height="200px"
     viewBox="0 0 1500 1000" preserveAspectRatio="none" >
  <desc>Example ViewBox - uses the viewBox
   attribute to automatically create an initial user coordinate
   system which causes the graphic to scale to fit into the
   viewport no matter what size the viewport is.</desc>

  <!-- This rectangle goes from (0,0) to (1500,1000) in user space.
       Because of the viewBox attribute above,
       the rectangle will end up filling the entire area
       reserved for the SVG content. -->
  <rect x="0" y="0" width="1500" height="1000" style="fill:yellow" />

  <!-- A large, red triangle -->
  <path style="fill:red" d="M 750,100 L 250,900 L 1250,900 z"/>

  <!-- A text string that spans most of the viewport -->
  <text x="100" y="600" style="font-size:150; font-family:Verdana">
    Stretch to fit
  </text>
</svg>
```

Rendered into viewport with width=300px, height=200px　　　　**Rendered into viewport with width=150px, height=200px**

Example ViewBox

View this example as SVG (SVG-enabled browsers only)

The effect of the viewBox attribute is that the user agent automatically supplies the appropriate transformation matrix to map the specified rectangle in user space to the bounds of the viewport. To achieve the effect of the example on the left, with viewport dimensions of 300 by 200 pixels, the user agent needs to automatically insert a transformation which scales both X and Y by 0.2. The effect is equivalent to having a viewport of size 300px by 200px and the following supplemental transformation in the document, as follows:

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
```

```
   "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="300px" height="200px">

   <g transform="scale(0.2)">

     <!-- Rest of document goes here -->

   </g>
</svg>
```

To achieve the effect of the example on the right, with viewport dimensions of 150 by 200 pixels, the user agent needs to automatically insert a transformation which scales X by 0.1 and Y by 0.2. The effect is equivalent to having a viewport of size 150px by 200px and the following supplemental transformation in the document, as follows:
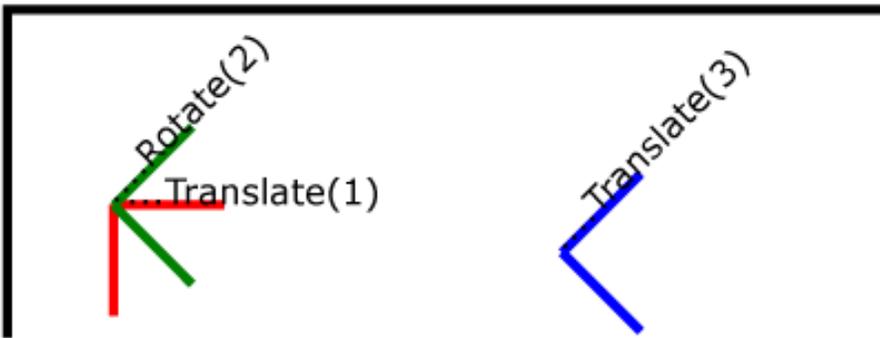
```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
   "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="150px" height="200px">

   <g transform="scale(0.1 0.2)">

     <!-- Rest of document goes here -->

   </g>
</svg>
```

(Note: in some cases the user agent will need to supply a **translate** transformation in addition to a **scale** transformation. For example, on an outermost <u>'svg'</u>, a **translate** transformation will be needed if the viewBox attributes specifies values other than zero for <min-x> or <min-y>.)

For the viewBox attribute:

<u>Animatable</u>: yes.

7.8 The preserveAspectRatio attribute

In some cases when using the <u>viewBox</u> attribute, it is desirable that the graphics stretch to fit non-uniformly to take up the entire viewport. In other cases when using the <u>viewBox</u> attribute, it is desirable that uniform scaling be used for the purposes of preserving the aspect ratio of the graphics.

Attribute preserveAspectRatio="<align> [<meetOrSlice>]", which is available for all elements that establish a new viewport (see <u>elements that establish viewports</u>), indicates whether or not to force uniform scaling. preserveAspectRatio only applies when a value has been provided for <u>viewBox</u> on the same element. If attribute <u>viewBox</u> is not provided, then preserveAspectRatio is ignored.

The <align> parameter indicates whether to force uniform scaling and, if so, the alignment method to use in case the aspect ratio of the <u>viewBox</u> doesn't match the aspect ratio of the viewport. The <align> parameter must be one of the following strings:

- none - Do not force uniform scaling. Scale the graphic content of the given element non-uniformly if necessary such that the element's bounding box exactly matches the viewport rectangle.
  (Note: if <align> is none, then the optional <meetOrSlice> value is ignored.)
- xMinYMin - Force uniform scaling.
  Align the <min-x> of the element's <u>viewBox</u> with the smallest X value of the viewport.
  Align the <min-y> of the element's <u>viewBox</u> with the smallest Y value of the viewport.
- xMidYMin - Force uniform scaling.
  Align the midpoint X value of the element's <u>viewBox</u> with the midpoint X value of the viewport.
  Align the <min-y> of the element's <u>viewBox</u> with the smallest Y value of the viewport.
- xMaxYMin - Force uniform scaling.
  Align the <min-x>+<width> of the element's <u>viewBox</u> with the maximum X value of the viewport.
  Align the <min-y> of the element's <u>viewBox</u> with the smallest Y value of the viewport.
- xMinYMid - Force uniform scaling.
  Align the <min-x> of the element's <u>viewBox</u> with the smallest X value of the viewport.

Align the midpoint Y value of the element's [viewBox](#) with the midpoint Y value of the viewport.

- xMidYMid (the default) - Force uniform scaling.
  Align the midpoint X value of the element's [viewBox](#) with the midpoint X value of the viewport.
  Align the midpoint Y value of the element's [viewBox](#) with the midpoint Y value of the viewport.

- xMaxYMid - Force uniform scaling.
  Align the <min-x>+<width> of the element's [viewBox](#) with the maximum X value of the viewport.
  Align the midpoint Y value of the element's [viewBox](#) with the midpoint Y value of the viewport.

- xMinYMax - Force uniform scaling.
  Align the <min-x> of the element's [viewBox](#) with the smallest X value of the viewport.
  Align the <min-y>+<height> of the element's [viewBox](#) with the maximum Y value of the viewport.

- xMidYMax - Force uniform scaling.
  Align the midpoint X value of the element's [viewBox](#) with the midpoint X value of the viewport.
  Align the <min-y>+<height> of the element's [viewBox](#) with the maximum Y value of the viewport.

- xMaxYMax - Force uniform scaling.
  Align the <min-x>+<width> of the element's [viewBox](#) with the maximum X value of the viewport.
  Align the <min-y>+<height> of the element's [viewBox](#) with the maximum Y value of the viewport.

The <meetOrSlice> parameter is optional and, if provided, is separated from the <align> value by one or more spaces and then must be one of the following strings:

- meet (the default) - Scale the graphic such that:
  - aspect ratio is preserved
  - the entire [viewBox](#) is visible within the viewport
  - the [viewBox](#) is scaled up as much as possible, while still meeting the other criteria

  In this case, if the aspect ratio of the graphic does not match the viewport, some of the viewport will extend beyond the bounds of the [viewBox](#) (i.e., the area into which the [viewBox](#) will draw will be smaller than the viewport).

- slice - Scale the graphic such that:
  - aspect ratio is preserved
  - the entire viewport is covered by the [viewBox](#)
  - the [viewBox](#) is scaled down as much as possible, while still meeting the other criteria

  In this case, if the aspect ratio of the [viewBox](#) does not match the viewport, some of the [viewBox](#) will extend beyond the bounds of the viewport (i.e., the area into which the [viewBox](#) will draw is larger than the viewport).

Example PreserveAspectRatio illustrates the various options on preserveAspectRatio. To save space, XML entities have been defined for the three repeated graphic objects, the rectangle with the smile inside and the outlines of the two rectangles which have the same dimensions as the target viewports. The example creates several new viewports by including ['svg'](#) sub-elements embedded inside the outermost ['svg'](#) element (see [Establishing a new viewport](#)). The smile is drawing the text string ":)" rotated 90 degrees.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd" [
<!ENTITY Smile "
  <rect x='.5' y='.5' width='29' height='39' style='fill:yellow; stroke:red'/>
  <g transform='rotate(90)'>
    <text x='10' y='10' style='font-family:Verdana;
         font-weight:bold; font-size:14'>:)</text>
  </g>">
<!ENTITY Viewport1 "<rect x='.5' y='.5' width='49' height='29'
                          style='fill:none; stroke:blue'/>">
<!ENTITY Viewport2 "<rect x='.5' y='.5' width='29' height='59'
                          style='fill:none; stroke:blue'/>">
]>
<svg width="480px" height="270px" style="font-family:Verdana; font-size:8">
  <desc>Example PreserveAspectRatio - demonstrate available options</desc>
  <text x="10" y="30">SVG to fit</text>
  <g transform="translate(20,40)">&Smile;</g>
```

```
<text x="10" y="110">Viewport 1</text>
<g transform="translate(10,120)">&Viewport1;</g>
<text x="10" y="180">Viewport 2</text>
<g transform="translate(20,190)">&Viewport2;</g>
<text x="100" y="30">-------------- meet --------------</text>
<g transform="translate(100,60)"><text y="-10">xMin*</text>&Viewport1;
   <svg preserveAspectRatio="xMinYMin meet" viewBox="0 0 30 40"
      width="50" height="30">&Smile;</svg></g>
<g transform="translate(170,60)"><text y="-10">xMid*</text>&Viewport1;
   <svg preserveAspectRatio="xMidYMid meet" viewBox="0 0 30 40"
      width="50" height="30">&Smile;</svg></g>
<g transform="translate(240,60)"><text y="-10">xMax*</text>&Viewport1;
   <svg preserveAspectRatio="xMaxYMax meet" viewBox="0 0 30 40"
      width="50" height="30">&Smile;</svg></g>
<text x="330" y="30">---------- meet ----------</text>
<g transform="translate(330,60)"><text y="-10">*YMin</text>&Viewport2;
   <svg preserveAspectRatio="xMinYMin meet" viewBox="0 0 30 40"
      width="30" height="60">&Smile;</svg></g>
<g transform="translate(380,60)"><text y="-10">*YMid</text>&Viewport2;
   <svg preserveAspectRatio="xMidYMid meet" viewBox="0 0 30 40"
      width="30" height="60">&Smile;</svg></g>
<g transform="translate(430,60)"><text y="-10">*YMax</text>&Viewport2;
   <svg preserveAspectRatio="xMaxYMax meet" viewBox="0 0 30 40"
      width="30" height="60">&Smile;</svg></g>
<text x="100" y="160">---------- slice ----------</text>
<g transform="translate(100,190)"><text y="-10">xMin*</text>&Viewport2;
   <svg preserveAspectRatio="xMinYMin slice" viewBox="0 0 30 40"
      width="30" height="60">&Smile;</svg></g>
<g transform="translate(150,190)"><text y="-10">xMid*</text>&Viewport2;
   <svg preserveAspectRatio="xMidYMid slice" viewBox="0 0 30 40"
      width="30" height="60">&Smile;</svg></g>
<g transform="translate(200,190)"><text y="-10">xMax*</text>&Viewport2;
   <svg preserveAspectRatio="xMaxYMax slice" viewBox="0 0 30 40"
      width="30" height="60">&Smile;</svg></g>
<text x="270" y="160">-------------- slice --------------</text>
<g transform="translate(270,190)"><text y="-10">*YMin</text>&Viewport1;
   <svg preserveAspectRatio="xMinYMin slice" viewBox="0 0 30 40"
      width="50" height="30">&Smile;</svg></g>
<g transform="translate(340,190)"><text y="-10">*YMid</text>&Viewport1;
   <svg preserveAspectRatio="xMidYMid slice" viewBox="0 0 30 40"
      width="50" height="30">&Smile;</svg></g>
<g transform="translate(410,190)"><text y="-10">*YMax</text>&Viewport1;
   <svg preserveAspectRatio="xMaxYMax slice" viewBox="0 0 30 40"
      width="50" height="30">&Smile;</svg></g>
</svg>
```

SVG to fit:

--------------- meet ---------------
xMin*   xMid*   xMax*

---------- meet ----------
*Ymin   *Ymid   *Ymax

Viewport 1

---------- slice ----------
xMin*   xMid*   xMax*

-------------- slice --------------
*YMin   *YMid   *YMax

Viewport 2
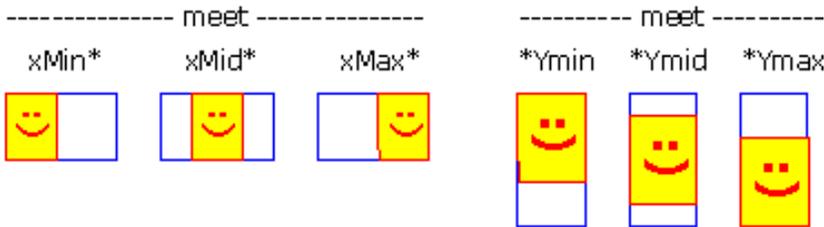
Example PreserveAspectRatio

View this example as SVG (SVG-enabled browsers only)

For the preserveAspectRatio attribute:

Animatable: yes.

7.9 Establishing a new viewport

At any point in an SVG drawing, you can establish a new viewport into which all contained graphics is drawn by including an 'svg' element inside SVG content. By establishing a new viewport, you also implicitly establish a new viewport coordinate system, a new user coordinate system, new meanings for many of the unit identifiers and, potentially, a new clipping path.

The bounds of the new viewport are defined by the x, y, width and height attributes on the element establishing the new viewport, such as an 'svg' element. Both the new viewport coordinate system and the new user coordinate system have their origins at (x, y), where x and y represent the value of the corresponding attributes on the element establishing the viewport. The orientation of the new viewport coordinate system and the new user coordinate system correspond to the orientation of the current user coordinate system for the element establishing the viewport. A single unit in the new viewport coordinate system and the new user coordinate system are the same size as a single unit in the current user coordinate system for the element establishing the viewport.

Here is an example:

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="4in" height="3in">
  <desc>This SVG drawing embeds another one,
    thus establishing a new viewport
  </desc>
  <!-- The following statement establishing a new viewport
       and renders SVG drawing B into that viewport -->
  <svg x="25%" y="25%" width="50%" height="50%">
     <!-- drawing B goes here -->
  </svg>
</svg>
```
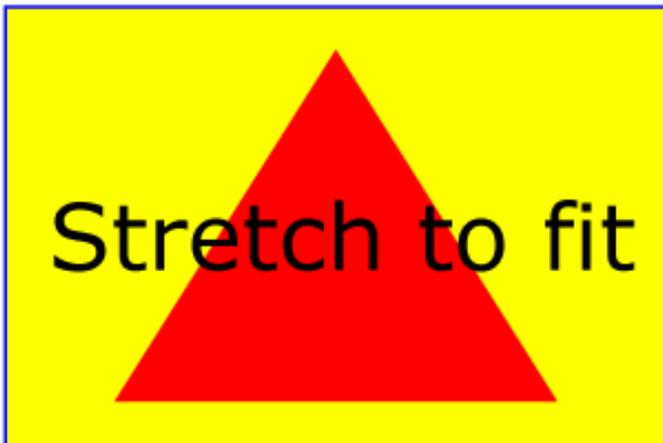
For an extensive example of creating new viewports, see Example PreserveAspectRatio.

In addition to the 'svg' element, the following other elements also establish a new viewport:

- A 'use' or 'image' element establishes a temporary new viewport for drawing instances of referenced elements or files
- A 'marker' element establishes a temporary new viewport for drawing arrowheads and polymarkers
- When a pattern is used to fill or stroke an object by reference to a 'pattern' element, a temporary new viewport is established for each drawn instance of the pattern.
- When a 'mask' element is used to establish a mask for an object and maskUnits="objectBoundingBox", a temporary new viewport is established to draw the elements within the 'mask' element.
- A 'foreignObject' element creates a new viewport for rendering the content that is within the element.

Whenever 'use', 'image', 'pattern', 'mask' or 'foreignObject' establish a new viewport, the bounds of the new viewport correspond to the x, y, width and height attributes on the given elements. The rules for how viewports are created for 'marker' elements can be found in the section of this specification that describes the 'marker' element.

Whether a new viewport also establishes a new additional clipping path is determined by the value of the 'overflow' property on the element which establishes the new viewport. If a clipping path is created to correspond to the new viewport, the clipping path's geometry is determined by the value of the 'clip' property. Also, see Clip to viewport vs. clip to viewBox.

7.10 Units

All coordinates and lengths in SVG can be specified with or without a unit identifier.

If a coordinate or length value is a number without a unit identifier (e.g., "25"), then the given coordinate or length is assumed to be in user units (i.e., a value in user space). For example:

```
<text style="font-size: 50">Text size is 50 user units</text>
```

If coordinate or length value is a number following by a unit identifier (e.g., "25cm" or "15em"), then the given coordinate represents either an absolute length in viewport units or a relative length (i.e., a value relative to some other distance measurement). The list of unit identifiers in SVG matches the list of unit identifiers in CSS: em, ex, px, pt, pc, cm, mm, in and percentages.

As in CSS, the *em* and *ex* unit identifiers are relative to the current font's *font-size* and *x-height*, respectively.

When the various absolute unit identifiers (i.e., px, pt, pc, cm, mm, in) are used, the coordinate and length values represent values within the viewport coordinate system and do not change their meaning as transformations alter the current coordinate system. Thus, "12pt" can be made to represent exactly 12 points on the actual visual medium even if the user coordinate system has been scaled.

Example AbsoluteUnits illustrates how absolute units do not scale even when transformations are applied.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="450px" height="150px" style="font-family:Verdana">
  <desc>Example AbsoluteUnits - Absolute units and coordinate transformations
  </desc>
  <!-- Draw an outline of the drawing in blue -->
  <rect x="1" y="1" width="448" height="148" style="fill:none; stroke:blue"/>

  <!-- The following two text elements will both draw with a
       font height of 12 pixels -->
  <text x="20" y="25" style="font-size: 12; fill: black">
    This draws 12 pixels high.
  </text>
  <text x="20" y="50" style="font-size: 12px; fill: red">
    This draws 12 pixels high.
  </text>

  <!-- Now scale the coordinate system by 2. -->
  <g transform="scale(2)">

     <!-- The following text will actually draw 24 pixels high
          because each unit in the new coordinate system equals
          2 units in the previous coordinate system. -->
     <text x="20" y="50" style="font-size: 12; fill:green">
       This draws 24 pixels high.
     </text>

     <!-- The following text will actually still draw 12 pixels high
          because the unit identifier has been provided. -->
     <text x="20" y="62.5" style="font-size: 12px; fill:blue">
       This draws 12 pixels high.
     </text>
  </g>
</svg>
```

Example AbsoluteUnits

When the current SVG document fragment has not yet been subject to transformations (e.g., when you have a standalone SVG document or an SVG document fragment embedded directly within a XML document styled with CSS2 or XSL), then the initial value for a *px* unit must be set in conformance with the rules for *px* units as described in [CSS2 lengths]. If the SVG implementation is part of a user agent which provides for styling XML documents using CSS2-compatible *px* units, then the SVG user agent should get its initial value for a *px* unit to match the value used for other XML styling operations.

Note that use of *px* units can cause inconsistent visual results on different systems; thus, *px* units are only recommended for situations where positioning must be aligned relative to the device pixel grid, such as when SVG content needs to align visually with other pixel-aligned XML content.

7.11 Redefining the meaning of unit identifiers

The process of establishing a new viewport, such as when there is 'svg' element inside of another SVG 'svg', changes the meaning of the following unit identifiers: px, pt, pc, cm, mm, in, and % (percentages). A "pixel" (the px unit) becomes equivalent to a single unit in the user coordinate system for the given 'svg' element. The meaning of the other absolute unit identifiers (pt, pc, cm, mm, in) are determined as an appropriate multiple of a *px* unit using the actual size of *px* unit (as passed from the parent user agent to the SVG user agent). Any percentage values that are relative to the current viewport will also represent new values.

Example AbsoluteUnitsRedefined illustrates how absolute units identifiers have their meaning changed when a new viewport is established.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="480px" height="225px" style="font-family:Verdana">
  <desc>Example AbsoluteUnitsRedefined - Transformation with establishment of a new viewport
  </desc>
  <!-- Draw an outline of the drawing in blue -->
  <rect x="1" y="1" width="478" height="223" style="fill:none; stroke:blue"/>

  <!-- The following two text elements will both draw with a
       font height of 12 pixels -->
  <text x="20" y="25" style="font-size: 12; fill: black">
    This draws 12 pixels high.
  </text>
  <text x="20" y="50" style="font-size: 12px; fill: red">
    This draws 12 pixels high.
  </text>

  <!-- This time, scale the coordinate system by 3. -->
  <g transform="scale(3)">

    <!-- Establish a new viewport and thus change the meaning of
         some unit identifiers. -->
    <svg x="0" y="25" width="160" height="50">
      <!-- Draw an interior outline of the viewport in brown -->
```

```
        <rect x="1" y="1" width="158" height="48"
              style="fill:none; stroke:brown; stroke-width:.33333"/>

        <!-- The following two text elements will both draw with a
             font height of 36 screen pixels. The first text element
             defines its height in user coordinates, which have been
             scaled by 3. The second text element defines its height
             in px units, which have been redefined to be three times
             as big as screen pixels due the <svg> element establishing
             a new viewport. -->
        <text x="2" y="20" style="font-size: 12; fill:magenta">
          This draws 36 pixels high.
        </text>
        <text x="2" y="40" style="font-size: 12px; fill:cyan">
          This draws 36 pixels high.
        </text>
      </svg>
    </g>
</svg>
```

This draws 12 pixels high.

This draws 12 pixels high.

This draws 36 pixels high.

This draws 36 pixels high.
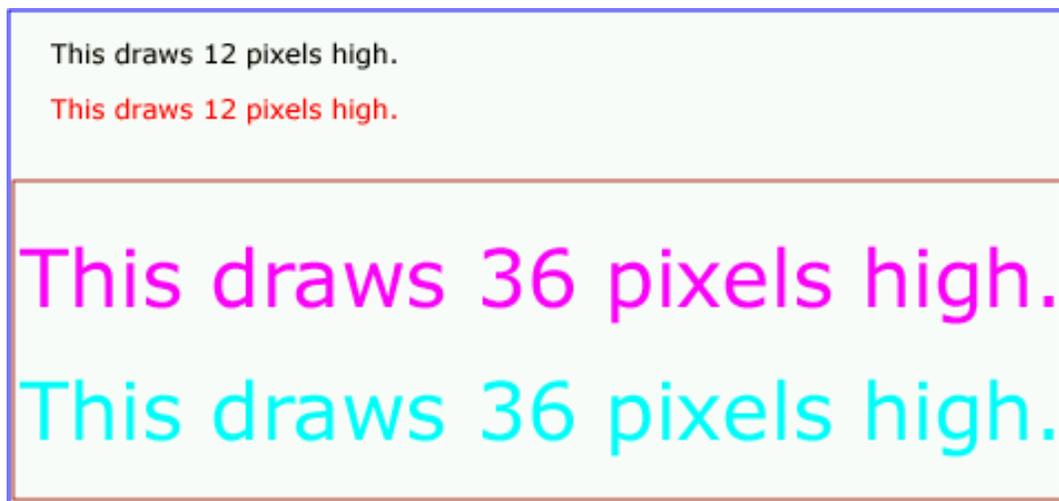
Example AbsoluteUnitsRedefined

View this example as SVG (SVG-enabled browsers only)

7.12 Object bounding box units

The following elements offer the option of expressing coordinate values and lengths as fractions (and, in some cases, percentages) of the bounding box (via keyword objectBoundingBox) on a given element:

Element	Attribute	Effect
'linearGradient'	gradientUnits="objectBoundingBox"	Indicates that the attributes which specify the gradient vector (x1, y1, x2, y2) represent fractions or percentages of the bounding box of the element to which the gradient is applied.
'radialGradient'	gradientUnits="objectBoundingBox"	Indicates that the attributes which specify the center (cx, cy), the radius (r) and focus (fx, fy) represent fractions or percentages of the bounding box of the element to which the gradient is applied.
'pattern'	patternUnits="objectBoundingBox"	Indicates that the attributes which define how to tile the pattern (x, y, width, height) and that the user coordinate system for the contents of the pattern is established using the bounding box of the element to which the pattern is applied.

'clipPath'	clipPathUnits="objectBoundingBox"	Indicates that the user coordinate system for the contents of the 'clipPath' element is established using the bounding box of the element to which the clipping path is applied.
'mask'	maskUnits="objectBoundingBox"	Indicates that the user coordinate system for the contents of the 'mask' element is established using the bounding box of the element to which the mask is applied.
'filter'	filterUnits="objectBoundingBox"	Indicates that the attributes which define the filter effects region (x, y, width, height) represent fractions or percentages of the bounding box of the element to which the filter is applied.
'filter'	primitiveUnits="objectBoundingBox"	Indicates that the various length values within the filter primitives represent fractions or percentages of the bounding box of the element to which the filter is applied.

When keyword objectBoundingBox is used, then the effect is as if a supplemental transformation matrix were inserted into the list of nested transformation matrices to create a new user coordinate system.

First, the (**minx**,**miny**) and (**maxx**,**maxy**) coordinates are determined for the referencing element and all of its descendants. The values **minx**, **miny**, **maxx** and **maxy** are determined by computing the maximum extent of the shape of the element in X and Y with respect to the user coordinate system for the referencing element. The bounding box is the tightest fitting rectangle aligned with the axes of the referencing element's user coordinate system that entirely encloses the referencing element and its descendants. The bounding box is computed exclusive of any values for clipping, masking, filter effects, opacity and stroke-width. For curved shapes, the bounding box encloses all portions of the shape, not just end points. For 'text' elements, for the purposes of the bounding box calculation, each glyph is treated as a separate graphics element. The calculations assume that all glyphs occupy the full glyph cell. For example, for horizontal text, the calculations assume that each glyph extends vertically to the full ascent and descent values for the font.

Then, coordinate (0,0) in the new user coordinate system is mapped to the (minx,miny) corner of the tight bounding box within the user coordinate system of the referencing element and coordinate (1,1) in the new user coordinate system is mapped to the (maxx,maxy) corner of the tight bounding box of the referencing element. In most situations, the following transformation matrix produces the correct effect:

```
[ (maxx-minx) 0 0 (maxy-miny) minx miny ]
```

When percentages are used with keyword objectBoundingBox, a percentage represents the same value as the corresponding decimal value (e.g., 50% means the same as 0.5).

Keyword objectBoundingBox should not be used when the geometry of the referencing element has no width or no height, such as the case of a horizontal or vertical line, even when the line has actual thickness when viewed due to having a non-zero stroke width since stroke width is ignored for bounding box calculations. When the geometry of the referencing element has no width or height and objectBoundingBox is specified, then the given effect (e.g., a gradient or a filter) will be ignored.

7.13 Processing rules when using absolute unit identifiers and percentages

Even when coordinates and lengths in SVG have an absolute unit identifier or represent a percentage (see Units), these values are first mapped into user space, and then processing occurs as if the values had been specified as the corresponding value in user space.

For coordinates and lengths in SVG which have an absolute unit identifier or represent a percentage of the viewport, the values are converted into user space values as follows:

- For any x-coordinate value or width value (xValueInVPSpace) expressed using an absolute unit identifier, first convert xValueInVPSpace into viewport pixel units using the SVG user agent's standard conversion factor from pixels to real world units (e.g., millimeters) to yield xValueInVPPixels. Then transform the points (0,0) and (xValueInVPPixels,0), from viewport space to current user space using the inverse of the current transformation matrix, yielding two points in userspace Q1 and Q2. Do a distance calculation between Q1 and Q2 (sqrt((Q2x-Q1x)**2 + (Q2y-Q1y)**2)) and use that as the value for the given operation.
- For any y-coordinate value or height value (yValueInVPSpace) expressed using an absolute unit identifier, then use the same method as above, except use points (0,0) and (0,yValueInVPPixels) instead.
- For any x-coordinate value or width value (xValueInVPSpace) expressed as a percentage of the viewport, transform the points (0,0) and (percentageValue*vpWidthInPixels,0), from viewport space to current user space using the inverse of the current transformation matrix, yielding two points in userspace Q1 and Q2. Do a distance calculation between Q1 and Q2 (sqrt((Q2x-Q1x)**2 + (Q2y-Q1y)**2)) and use that as the value for the given operation.
- For any y-coordinate value or height value (yValueInVPSpace) expressed as a percentage of the viewport, then use the same

method as above, except use points (0,0) and (0,percentageValue*vpHeightInPixels) instead.

- For any other length value in viewport space (lengthVPSpace), the following approach is used to give appropriate weighting to the contribution of the two dimensions of the viewport. First, convert lengthVPSpace into viewport pixel units using the SVG user agent's standard conversion factor from pixels to to real world units (e.g., millimeters) to yield lengthVPPixels. Calculate the distance from (0,0) and (vpWidthInPixels,vpHeightInPixels) in viewport space using the formula: vpDiagLengthVPPixels=sqrt(vpWidthInPixels**2 + vpHeightInPixels**2). Using the inverse of the current transformation matrix, determine the points in user space (P1x,P1y) and (P2x,P2y) which correspond to the points (0,0) and (vpWidthInPixels,vpHeightInPixels) in viewport space. Calculate the distance from (P1x,P1y) and (P2x,P2y) in user space using the formula: vpDiagLengthUserSpace=sqrt((P2x-P1x)**2 + (P2y-P1y)**2)). Then, convert the original viewport-relative length into a length in user space using the formula: lengthUserSpace = lengthVPPixels * (vpDiagLengthUserSpace/vpDiagLengthVPPixels).
- If a viewport-relative percentage value is given, then use the same method as above, except calculate lengthVPPixels as lengthVPPixels=percentageValue*sqrt(vpWidthPixels**2 + vpHeightPixels**2)/sqrt(2).

Any values expressed as fractions or percentages of the current object bounding box are mapped to corresponding values in user space as follows:

- For any x-coordinate value or width value, determine the minimum and maximum x-coordinates in user space for the object bounding box (bboxXMinUserSpace and bboxXMaxUserSpace, respectively). An x-coordinate value is converted into a coordinate in user space using the formula bboxXMinUserSpace+percentageValue*(bboxXMaxUserSpace-bboxXMinUserSpace) and a width value is converted into a length in user space using the formula percentageValue*(bboxXMaxUserSpace-bboxXMinUserSpace).
- For any y-coordinate value or width value, determine the minimum and maximum y-coordinates in user space for the object bounding box (bboxYMinUserSpace and bboxYMaxUserSpace, respectively). A y-coordinate value is converted into a coordinate in user space using the formula bboxYMinUserSpace+percentageValue*(bboxYMaxUserSpace-bboxYMinUserSpace) and a height value is converted into a length in user space using the formula percentageValue*(bboxYMaxUserSpace-bboxYMinUserSpace).
- For any other length value expressed as a fraction or percentage of the current object bounding box, determine the minimum and maximum x and y coordinates in user space for the object bounding box (bboxXMinUserSpace, bboxXMaxUserSpace, bboxYMinUserSpace and bboxYMaxUserSpace), calculate bboxWidth=bboxXMaxUserSpace-bboxXMinUserSpace and bboxHeight=bboxYMaxUserSpace-bboxYMinUserSpace, and then map the fraction or percentage of the current object bounding box to a length in user space using the formula percentageValue*sqrt(bboxWidth**2 + bboxHeight**2)/sqrt(2).

7.14 DOM interfaces

The following interfaces are defined below: SVGPoint, SVGMatrix, SVGTransformList, SVGAnimatedTransformList, SVGTransform, SVGPreserveAspectRatio, SVGAnimatedPreserveAspectRatio.

Interface SVGPoint

Many of the SVG DOM interfaces refer to objects of class SVGPoint. An SVGPoint is an (x,y) coordinate pair. When used in matrix operations, an SVGPoint is treated as a vector of the form:

```
[x]
[y]
[1]
```

IDL Definition

```
interface SVGPoint {

        attribute float x;
                // raises DOMException on setting
        attribute float y;
                // raises DOMException on setting

  SVGPoint matrixTransform ( in SVGMatrix matrix );
};
```

Attributes

> float x

>> The x coordinate.

>> Exceptions on setting

>>> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

> float y

>> The y coordinate.

>> Exceptions on setting

>>> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Methods

> matrixTransform

>> Applies a 2x3 matrix transformation on this SVGPoint object and returns a new, transformed SVGPoint object:

>> `newpoint = matrix * thispoint`

>> Parameters

>>> in SVGMatrix matrix The matrix which is to be applied to this SVGPoint object.

>> Return value

>>> SVGPoint A new SVGPoint object.

>> No Exceptions

Interface SVGMatrix

Many of SVG's graphics operations utilize 2x3 matrices of the form:

```
[a c e]
[b d f]
```

which, when expanded into a 3x3 matrix for the purposes of matrix arithmetic, become:

```
[a c e]
[b d f]
[0 0 1]
```

IDL Definition

```
interface SVGMatrix {

          attribute float a;
                    // raises DOMException on setting
          attribute float b;
                    // raises DOMException on setting
          attribute float c;
                    // raises DOMException on setting
          attribute float d;
                    // raises DOMException on setting
          attribute float e;
                    // raises DOMException on setting
          attribute float f;
                    // raises DOMException on setting

     SVGMatrix multiply ( in SVGMatrix secondMatrix );
     SVGMatrix inverse (   )
                  raises( SVGException );
     SVGMatrix translate ( in float x, in float y );
```

```
    SVGMatrix scale ( in float scaleFactor );
    SVGMatrix scaleNonUniform ( in float scaleFactorX, in float scaleFactorY );
    SVGMatrix rotate ( in float angle );
    SVGMatrix rotateFromVector ( in float x, in float y )
                  raises( SVGException );
    SVGMatrix flipX (  );
    SVGMatrix flipY (  );
    SVGMatrix skewX ( in float angle );
    SVGMatrix skewY ( in float angle );
};
```

Attributes

float a

The a component of the matrix.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float b

The b component of the matrix.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float c

The c component of the matrix.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float d

The d component of the matrix.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float e

The e component of the matrix.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float f

The f component of the matrix.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Methods

multiply

Performs matrix multiplication. This matrix is post-multiplied by another matrix, returning the resulting new matrix.

Parameters

in SVGMatrix secondMatrix The matrix which is post-multiplied to this matrix.

Return value

SVGMatrix The resulting matrix.

No Exceptions

inverse

Returns the inverse matrix.

No Parameters

Return value

SVGMatrix The inverse matrix.

Exceptions

SVGException SVG_MATRIX_NOT_INVERTABLE: Raised if this matrix is not invertable.

translate

Post-multiplies a translation transformation on the current matrix and returns the resulting matrix.

Parameters

in float x The distance to translate along the X axis.
in float y The distance to translate along the Y axis.

Return value

SVGMatrix The resulting matrix.

No Exceptions

scale

Post-multiplies a uniform scale transformation on the current matrix and returns the resulting matrix.

Parameters

in float scaleFactor Scale factor in both X and Y.

Return value

SVGMatrix The resulting matrix.

No Exceptions

scaleNonUniform

Post-multiplies a non-uniform scale transformation on the current matrix and returns the resulting matrix.

Parameters

in float scaleFactorX Scale factor in X.
in float scaleFactorY Scale factor in Y.

Return value

SVGMatrix The resulting matrix.

No Exceptions

rotate

Post-multiplies a rotation transformation on the current matrix and returns the resulting matrix.

Parameters

in float angle Rotation angle.

Return value

SVGMatrix The resulting matrix.

No Exceptions

rotateFromVector

Post-multiplies a rotation transformation on the current matrix and returns the resulting matrix. The rotation angle is determined by taking (+/-) atan(y/x). The direction of the vector (x,y) determines whether the positive or negative angle value is used.

Parameters

in float x The X coordinate of the vector (x,y). Must not be zero.
in float y The Y coordinate of the vector (x,y). Must not be zero.

Return value

SVGMatrix The resulting matrix.

Exceptions

SVGException SVG_INVALID_VALUE_ERR: Raised if one of the parameters has an invalid value.

flipX

> Post-multiplies the transformation [-1 0 0 1 0 0] and returns the resulting matrix.
>
> No Parameters
>
> Return value
>
>> SVGMatrix The resulting matrix.
>
> No Exceptions

flipY

> Post-multiplies the transformation [1 0 0 -1 0 0] and returns the resulting matrix.
>
> No Parameters
>
> Return value
>
>> SVGMatrix The resulting matrix.
>
> No Exceptions

skewX

> Post-multiplies a skewX transformation on the current matrix and returns the resulting matrix.
>
> Parameters
>
>> in float angle Skew angle.
>
> Return value
>
>> SVGMatrix The resulting matrix.
>
> No Exceptions

skewY

> Post-multiplies a skewY transformation on the current matrix and returns the resulting matrix.
>
> Parameters
>
>> in float angle Skew angle.
>
> Return value
>
>> SVGMatrix The resulting matrix.
>
> No Exceptions

Interface SVGTransformList

SVGTransformList maintains an ordered list of SVGTransform objects. The SVGTransformList and SVGTransform interfaces correspond to the various attributes which specify a set of transformations, such as the transform attribute which is available for many of SVG's elements.

The various methods inherited from SVGList, which are defined in SVGList to accept parameters and return values of type Object, must receive parameters of type SVGTransform and return values of type SVGTransform.

IDL Definition

```
interface SVGTransformList : SVGList {
  SVGTransform createSVGTransformFromMatrix ( in SVGMatrix matrix );
  SVGTransform consolidate (  );
};
```

Methods

createSVGTransformFromMatrix

> Creates an SVGTransform object which is initialized to transform of type SVG_TRANSFORM_MATRIX and whose values are the given matrix.
>
> Parameters

in SVGMatrix matrix The matrix which defines the transformation.

Return value

SVGTransform The returned SVGTransform object.

No Exceptions

consolidate

Consolidates the list of separate SVGTransform objects by multiplying the equivalent transformation matrices together to result in a list consisting of a single SVGTransform object of type SVG_TRANSFORM_MATRIX.

No Parameters

Return value

SVGTransform The resulting SVGTransform object which becomes single item in the list. If the list was empty, then a value of null is returned.

No Exceptions

Interface SVGAnimatedTransformList

Used for the various attributes which specify a set of transformations, such as the transform attribute which is available for many of SVG's elements, and which can be animated.

IDL Definition

```
interface SVGAnimatedTransformList {

        attribute SVGTransformList baseVal;
                    // raises DOMException on setting
  readonly attribute SVGTransformList animVal;
};
```

Attributes

SVGTransformList baseVal

The base value of the given attribute before applying any animations.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

readonly SVGTransformList animVal

If the given attribute or property is being animated, contains the current animated value of the attribute or property. If the given attribute or property is not currently being animated, contains the same value as 'baseVal'.

Interface SVGTransform

SVGTransform is the interface for one of the component transformations within a SVGTransformList; thus, a SVGTransform object corresponds to single component (e.g., "scale(..)" or "matrix(...)") within a transform attribute specification.

IDL Definition

```
interface SVGTransform {

  // Transform Types
  const unsigned short SVG_TRANSFORM_UNKNOWN   = 0;
  const unsigned short SVG_TRANSFORM_MATRIX    = 1;
  const unsigned short SVG_TRANSFORM_TRANSLATE = 2;
  const unsigned short SVG_TRANSFORM_SCALE     = 3;
  const unsigned short SVG_TRANSFORM_ROTATE    = 4;
```

```
      const unsigned short SVG_TRANSFORM_SKEWX     = 5;
      const unsigned short SVG_TRANSFORM_SKEWY     = 6;

      readonly attribute unsigned short type;
      readonly attribute SVGMatrix matrix;
      readonly attribute float angle;

      void setMatrix ( in SVGMatrix matrix );
      void setTranslate ( in float tx, in float ty );
      void setScale ( in float sx, in float sy );
      void setRotate ( in float angle );
      void setSkewX ( in float angle );
      void setSkewY ( in float angle );
};
```

Definition group Transform Types

Defined constants

SVG_TRANSFORM_UNKNOWN	The unit type is not one of predefined types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.
SVG_TRANSFORM_MATRIX	A "matrix(...)" transformation.
SVG_TRANSFORM_TRANSLATE	A "translate(...)" transformation.
SVG_TRANSFORM_SCALE	A "scale(...)" transformation.
SVG_TRANSFORM_ROTATE	A "rotate(...)" transformation.
SVG_TRANSFORM_SKEWX	A "skewX(...)" transformation.
SVG_TRANSFORM_SKEWY	A "skewY(...)" transformation.

Attributes

readonly unsigned short type

The type of the value as specified by one of the constants specified above.

readonly SVGMatrix matrix

The matrix that represents this transformation.
For SVG_TRANSFORM_MATRIX, the matrix contains the a, b, c, d, e, f values supplied by the user.
For SVG_TRANSFORM_TRANSLATE, e and f represents the translation amounts (a=1,b=0,c=0,d=1).
For SVG_TRANSFORM_SCALE, a and d represents the scale amounts (b=0,c=0,e=0,f=0).
For SVG_TRANSFORM_ROTATE, SVG_TRANSFORM_SKEWX and SVG_TRANSFORM_SKEWY, a, b, c and d represent the matrix which will result in the given transformation (e=0,f=0).

readonly float angle

A convenience attribute for SVG_TRANSFORM_ROTATE, SVG_TRANSFORM_SKEWX and SVG_TRANSFORM_SKEWY. It holds the angle that was specified.
For SVG_TRANSFORM_MATRIX, SVG_TRANSFORM_TRANSLATE and SVG_TRANSFORM_SCALE, angle will be zero.

Methods

setMatrix

Sets the transform type to SVG_TRANSFORM_MATRIX, with parameter matrix defining the new transformation.

Parameters

in SVGMatrix matrix The new matrix for the transformation.

No Return Value

No Exceptions

setTranslate

Sets the transform type to SVG_TRANSFORM_TRANSLATE, with parameters tx and ty defining the translation amounts.

Parameters

in float tx The translation amount in X.
in float ty The translation amount in Y.

No Return Value

No Exceptions

setScale

Sets the transform type to SVG_TRANSFORM_SCALE, with parameters sx and sy defining the scale amounts.

Parameters

in float sx The scale factor in X.
in float sy The scale factor in Y.

No Return Value

No Exceptions

setRotate

Sets the transform type to SVG_TRANSFORM_ROTATE, with parameter angle defining the rotation angle.

Parameters

in float angle The rotation angle.

No Return Value

No Exceptions

setSkewX

Sets the transform type to SVG_TRANSFORM_SKEWX, with parameter angle defining the amount of skew.

Parameters

in float angle The skew angle.

No Return Value

No Exceptions

setSkewY

Sets the transform type to SVG_TRANSFORM_SKEWY, with parameter angle defining the amount of skew.

Parameters

in float angle The skew angle.

No Return Value

No Exceptions

Interface SVGPreserveAspectRatio

The SVGPreserveAspectRatio interface corresponds to the preserveAspectRatio attribute, which is available for some of SVG's elements.

IDL Definition

```
interface SVGPreserveAspectRatio {

  // Alignment Types
  const unsigned short SVG_PRESERVEASPECTRATIO_UNKNOWN  = 0;
  const unsigned short SVG_PRESERVEASPECTRATIO_NONE     = 1;
  const unsigned short SVG_PRESERVEASPECTRATIO_XMINYMIN = 2;
  const unsigned short SVG_PRESERVEASPECTRATIO_XMIDYMIN = 3;
  const unsigned short SVG_PRESERVEASPECTRATIO_XMAXYMIN = 4;
  const unsigned short SVG_PRESERVEASPECTRATIO_XMINYMID = 5;
  const unsigned short SVG_PRESERVEASPECTRATIO_XMIDYMID = 6;
  const unsigned short SVG_PRESERVEASPECTRATIO_XMAXYMID = 7;
  const unsigned short SVG_PRESERVEASPECTRATIO_XMINYMAX = 8;
  const unsigned short SVG_PRESERVEASPECTRATIO_XMIDYMAX = 9;
  const unsigned short SVG_PRESERVEASPECTRATIO_XMAXYMAX = 10;
  // Meet-or-slice Types
  const unsigned short SVG_MEETORSLICE_UNKNOWN  = 0;
  const unsigned short SVG_MEETORSLICE_MEET  = 1;
  const unsigned short SVG_MEETORSLICE_SLICE = 2;
```

```
                attribute unsigned short align;
                        // raises DOMException on setting
                attribute unsigned short meetOrSlice;
                        // raises DOMException on setting
        };
```

Definition group Alignment Types

Defined constants

SVG_PRESERVEASPECTRATIO_UNKNOWN	The enumeration was set to a value that is not one of predefined types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.
SVG_PRESERVEASPECTRATIO_NONE	Corresponds to value 'none' for attribute preserveAspectRatio.
SVG_PRESERVEASPECTRATIO_XMINYMIN	Corresponds to value 'xMinYMin' for attribute preserveAspectRatio.
SVG_PRESERVEASPECTRATIO_XMIDYMIN	Corresponds to value 'xMidYMin' for attribute preserveAspectRatio.
SVG_PRESERVEASPECTRATIO_XMAXYMIN	Corresponds to value 'xMaxYMin' for attribute preserveAspectRatio.
SVG_PRESERVEASPECTRATIO_XMINYMID	Corresponds to value 'xMinYMid' for attribute preserveAspectRatio.
SVG_PRESERVEASPECTRATIO_XMIDYMID	Corresponds to value 'xMidYMid' for attribute preserveAspectRatio.
SVG_PRESERVEASPECTRATIO_XMAXYMID	Corresponds to value 'xMaxYMid' for attribute preserveAspectRatio.
SVG_PRESERVEASPECTRATIO_XMINYMAX	Corresponds to value 'xMinYMax' for attribute preserveAspectRatio.
SVG_PRESERVEASPECTRATIO_XMIDYMAX	Corresponds to value 'xMidYMax' for attribute preserveAspectRatio.
SVG_PRESERVEASPECTRATIO_XMAXYMAX	Corresponds to value 'xMaxYMax' for attribute preserveAspectRatio.

Definition group Meet-or-slice Types

Defined constants

SVG_MEETORSLICE_UNKNOWN	The enumeration was set to a value that is not one of predefined types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.
SVG_MEETORSLICE_MEET	Corresponds to value 'meet' for attribute preserveAspectRatio.
SVG_MEETORSLICE_SLICE	Corresponds to value 'slice' for attribute preserveAspectRatio.

Attributes

unsigned short align

> The type of the alignment value as specified by one of the constants specified above.

> Exceptions on setting

>> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

unsigned short meetOrSlice

> The type of the meet-or-slice value as specified by one of the constants specified above.

> Exceptions on setting

>> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGAnimatedPreserveAspectRatio

Used for attributes of type SVGPreserveAspectRatio which can be animated.

IDL Definition

```
interface SVGAnimatedPreserveAspectRatio {

           attribute SVGPreserveAspectRatio baseVal;
                     // raises DOMException on setting
  readonly attribute SVGPreserveAspectRatio animVal;
};
```

Attributes

SVGPreserveAspectRatio baseVal

> The base value of the given attribute before applying any animations.

> Exceptions on setting

>> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

readonly SVGPreserveAspectRatio animVal

> If the given attribute or property is being animated, contains the current animated value of the attribute or property. If the given attribute or property is not currently being animated, contains the same value as 'baseVal'.

8 Paths

Contents

8.1 Introduction

Paths represent the outline of a shape which can be filled, stroked, used as a clipping path, or any combination of the three. (See Filling, Stroking and Paint Servers and Clipping, Masking and Compositing.)

A path is described using the concept of a current point. In an analogy with drawing on paper, the current point can be thought of as the location of the pen. The position of the pen can be changed, and the outline of a shape (open or closed) can be traced by dragging the pen in either straight lines or curves.

Paths represent the geometry of the outline of an object, defined in terms of *moveto* (set a new current point), *lineto* (draw a straight line), *curveto* (draw a curve using a cubic bezier), *arc* (elliptical or circular arc) and *closepath* (close the current shape by drawing a line to the last *moveto*) elements. Compound paths (i.e., a path with subpaths, each consisting of a single *moveto* followed by one or more line or curve operations) are possible to allow effects such as "donut holes" in objects.

This chapter describes the syntax, behavior and DOM interfaces for SVG paths. Various implementation notes for SVG paths can be found in 'path' element implementation notes and Elliptical arc implementation notes.

A path is defined in SVG using the 'path' element.

8.2 The 'path' element

```
<!ENTITY % pathExt "" >
<!ELEMENT path (%descTitleMetadata;,(animate|set|animateMotion|animateColor|animateTransform
                %geExt;%pathExt;)*) >
<!ATTLIST path
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-Graphics;
  %PresentationAttributes-Markers;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;
  d %PathData; #REQUIRED
  pathLength %Number; #IMPLIED >
```

Attribute definitions:

d = "*path data*"

> The definition of the outline of a shape. See Path data.
> Animatable: yes. Path data animation is only possible when each path data specification within an animation specification has exactly the same list of path data commands as the d attribute. If an animation is specified and the list of path data commands is not the same, then the animation specification is in error (see Error Processing). The animation engine interpolates each parameter to each path data command separately based on the attributes to the given animation element. Any flags/booleans are interpolated as fractions between zero and one, with any non-zero value considered to be a value of one/true.

pathLength = "<number>"

> The author's computation of the total length of the path, in user units. This value is used to calibrate the user agent's own distance-along-a-path calculations with that of the author. The user agent will scale all distance-along-a-path computations by the ratio of pathLength to the user agent's own computed value for total path length. pathLength potentially affects calculations for text on a path, motion animation and various stroke operations.
> A negative value is an error (see Error processing).
> Animatable: yes.

Attributes defined elsewhere:

> %stdAttrs;, %langSpaceAttrs;, class, transform, %graphicsElementEvents;, %testAttrs;, externalResourcesRequired, style, %PresentationAttributes-FillStroke; %PresentationAttributes-Graphics; %PresentationAttributes-Markers;.

8.3 Path data

8.3.1 General information about path data

A path is defined by including a **'path'** element which contains a **d="(path data)"** attribute, where the **d** attribute contains the *moveto*, *line*, *curve* (both cubic and quadratic beziers), *arc* and *closepath* instructions.

The following example specifies a path in the shape of a triangle. (The **M** indicates a *moveto*, the **L**'s indicate *lineto*'s, and the **z** indicates a *closepath*:

Example triangle01 specifies a path in the shape of a triangle. (The **M** indicates a *moveto*, the **L**'s indicate *lineto*'s, and the **z** indicates a *closepath*).

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="4cm" height="4cm" viewBox="0 0 400 400">
  <title>Example triangle01- simple example of a 'path'</title>
  <desc>A path that draws a rectangle</desc>
  <rect x="1" y="1" width="398" height="398"
      style="fill:none; stroke:blue"/>
  <path d="M 100 100 L 300 100 L 200 300 z"
      style="fill:red; stroke:blue; stroke-width:3"/>
</svg>
```
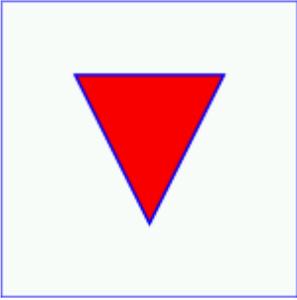
Example triangle01

[View this example as SVG (SVG-enabled browsers only)](#)

Path data values can contain newline characters and thus can be broken up into multiple lines to improve readability. Because of line length limitations with certain related tools, it is recommended that SVG generators split long path data strings across multiple lines, with each line not exceeding 255 characters. Also note that newline characters are only allowed at certain places within a path data value.

The syntax of path data is very abbreviated in order to allow for minimal file size and efficient downloads, since many SVG files will be dominated by their path data. Some of the ways that SVG attempts to minimize the size of path data are as follows:

- All instructions are expressed as one character (e.g., a *moveto* is expressed as an **M**)
- Superfluous white space and separators such as commas can be eliminated (e.g., "M 100 100 L 200 200" contains unnecessary spaces and could be expressed more compactly as "M100 100L200 200")
- The command letter can be eliminated on subsequent commands if the same command is used multiple times in a row (e.g., you can drop the second "L" in "M 100 200 L 200 100 L -100 -200" and use "M 100 200 L 200 100 -100 -200" instead)
- Relative versions of all commands are available (upper case means absolute coordinates, lower case means relative coordinates)
- Alternate forms of *lineto* are available to optimize the special cases of horizontal and vertical lines (absolute and relative)
- Alternate forms of *curve* are available to optimize the special cases where some of the control points on the current segment can be determined automatically from the control points on the previous segment

The path data syntax is a prefix notation (i.e., commands followed by parameters). The only allowable decimal point is a period (".") and no other delimiter characters are allowed. (For example, the following is an invalid numeric value in a path data stream: "13,000.56". Instead, say: "13000.56".)

In the tables below, the following notation is used:

- (): grouping of parameters
- +: 1 or more of the given parameter(s) is required

The following sections list the commands.

8.3.2 The "moveto" commands

The "moveto" commands (**M** or **m**) establish a new current point. The effect is as if the "pen" were lifted and moved to a new location. A path data segment must begin with either one of the "moveto" commands or one of the "arc" commands. Subsequent "moveto" commands (i.e., when the "moveto" is not the first command) represent the start of a new *subpath*:

Command	Name	Parameters	Description
M (absolute) **m** (relative)	moveto	(x y)+	Start a new sub-path at the given (x,y) coordinate. **M** (uppercase) indicates that absolute coordinates will follow; **m** (lowercase) indicates that relative coordinates will follow. If a relative moveto (**m**) appears as the first element of the path, then it is treated as a pair of absolute coordinates. If a moveto is followed by multiple pairs of coordinates, the subsequent pairs are treated as implicit lineto commands.

8.3.3 The "closepath" command

The "closepath" (**Z** or **z**) causes an automatic straight line to be drawn from the current point to the initial point of the current subpath. "Closepath" differs in behavior from what happens when "manually" closing a subpath via a "lineto" command in how ['stroke-linejoin'](#) and ['stroke-linecap'](#) are implemented. With "closepath", the end of the final segment of the subpath is "joined" with the start of the initial segment of the subpath using the current value of ['stroke-linejoin'](#) . If you instead "manually" close the subpath via a "lineto" command, the start of the first segment and the end of the last segment are not joined but instead are each capped using the current value of ['stroke-linecap'](#):

Command	Name	Parameters	Description
Z or **z**	closepath	(none)	Close the current subpath by drawing a straight line from the current point to current subpath's most recent starting point (usually, the most recent moveto point).

8.3.4 The "lineto" commands

The various "lineto" commands draw straight lines from the current point to a new point:

Command	Name	Parameters	Description
L (absolute) **l** (relative)	lineto	(x y)+	Draw a line from the current point to the given (x,y) coordinate which becomes the new current point. **L** (uppercase) indicates that absolute coordinates will follow; **l** (lowercase) indicates that relative coordinates will follow. A number of coordinates pairs may be specified to draw a polyline. At the end of the command, the new current point is set to the final set of coordinates provided.
H (absolute) **h** (relative)	horizontal lineto	x+	Draws a horizontal line from the current point (cpx, cpy) to (x, cpy). **H** (uppercase) indicates that absolute coordinates will follow; **h** (lowercase) indicates that relative coordinates will follow. Multiple x values can be provided (although usually this doesn't make sense). At the end of the command, the new current point becomes (x, cpy) for the final value of x.
V (absolute) **v** (relative)	vertical lineto	y+	Draws a vertical line from the current point (cpx, cpy) to (cpx, y). **V** (uppercase) indicates that absolute coordinates will follow; **v** (lowercase) indicates that relative coordinates will follow. Multiple y values can be provided (although usually this doesn't make sense). At the end of the command, the new current point becomes (cpx, y) for the final value of y.

8.3.5 The curve commands

These three groups of commands draw curves:

- Cubic bezier commands (**C**, **c**, **S** and **s**). A cubic bezier segment is defined by a start point, an end point, and two control points.
- Quadratic bezier commands (**Q**, **q**, **T** and **T**). A quadratic bezier segment is defined by a start point, an end point, and one control point.
- Elliptical arc commands (**A** and **a**). An elliptical arc segment draws a segment of an ellipse.

8.3.6 The cubic bezier curve commands

The cubic bezier commands are as follows:

Command	Name	Parameters	Description
C (absolute) **c** (relative)	curveto	(x1 y1 x2 y2 x y)+	Draws a cubic bezier curve from the current point to (x,y) using (x1,y1) as the control point at the beginning of the curve and (x2,y2) as the control point at the end of the curve. **C** (uppercase) indicates that absolute coordinates will follow; **c** (lowercase) indicates that relative coordinates will follow. Multiple sets of coordinates may be specified to draw a polybezier. At the end of the command, the new current point becomes the final (x,y) coordinate pair used in the polybezier.
S (absolute) **s** (relative)	shorthand/smooth curveto	(x2 y2 x y)+	Draws a cubic bezier curve from the current point to (x,y). The first control point is assumed to be the reflection of the second control point on the previous command relative to the current point. (If there is no previous command or if the previous command was not an C, c, S or s, assume the first control point is coincident with the current point.) (x2,y2) is the second control point (i.e., the control point at the end of the curve). **S** (uppercase) indicates that absolute coordinates will follow; **s** (lowercase) indicates that relative coordinates will follow. Multiple sets of coordinates may be specified to draw a polybezier. At the end of the command, the new current point becomes the final (x,y) coordinate pair used in the polybezier.

Example cubic01 shows some simple uses of cubic bezier commands within a path. Note that the control point for the "S" command is computed automatically as the reflection of the control point for the previous "C" command relative to the start point of the "S" command.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="5cm" height="4cm" viewBox="0 0 500 400">
  <title>Example cubic01- cubic bezier commands in path data</title>
  <desc>Picture showing a simple example of path data
        using both a "C" and an "S" command,
        along with annotations showing the control points
        and end points</desc>
  <style type="text/css"><![CDATA[
    .Border { fill:none; stroke:blue; stroke-width:1 }
    .Connect { fill:none; stroke:#888888; stroke-width:2 }
```

```
    .SamplePath { fill:none; stroke:red; stroke-width:5 }
    .EndPoint { fill:none; stroke:#888888; stroke-width:2 }
    .CtlPoint { fill:#888888; stroke:none }
    .AutoCtlPoint { fill:none; stroke:blue; stroke-width:4 }
    .Label { font-size:22; font-family:Verdana }
  ]]></style>

  <rect class="Border" x="1" y="1" width="498" height="398" />

  <polyline class="Connect" points="100,200 100,100" />
  <polyline class="Connect" points="250,100 250,200" />
  <polyline class="Connect" points="250,200 250,300" />
  <polyline class="Connect" points="400,300 400,200" />
  <path class="SamplePath" d="M100,200 C100,100 250,100 250,200
                                        S400,300 400,200" />
  <circle class="EndPoint" cx="100" cy="200" r="10" />
  <circle class="EndPoint" cx="250" cy="200" r="10" />
  <circle class="EndPoint" cx="400" cy="200" r="10" />
  <circle class="CtlPoint" cx="100" cy="100" r="10" />
  <circle class="CtlPoint" cx="250" cy="100" r="10" />
  <circle class="CtlPoint" cx="400" cy="300" r="10" />
  <circle class="AutoCtlPoint" cx="250" cy="300" r="9" />
  <text class="Label" x="25" y="70">M100,200 C100,100 250,100 250,200</text>
  <text class="Label" x="325" y="350"
        style="text-anchor:middle">S400,300 400,200</text>
</svg>
```
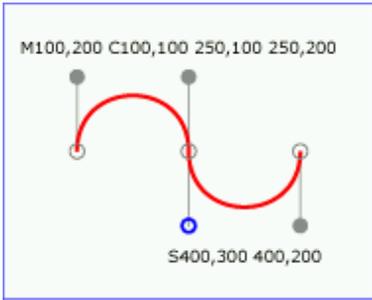

Example cubic01

[View this example as SVG (SVG-enabled browsers only)](#)

The following picture shows some how cubic bezier curves change their change depending on the position of the control points. The first five examples illustrate a single cubic bezier path segment. The example at the lower right shows a "C" command followed by an "S" command.
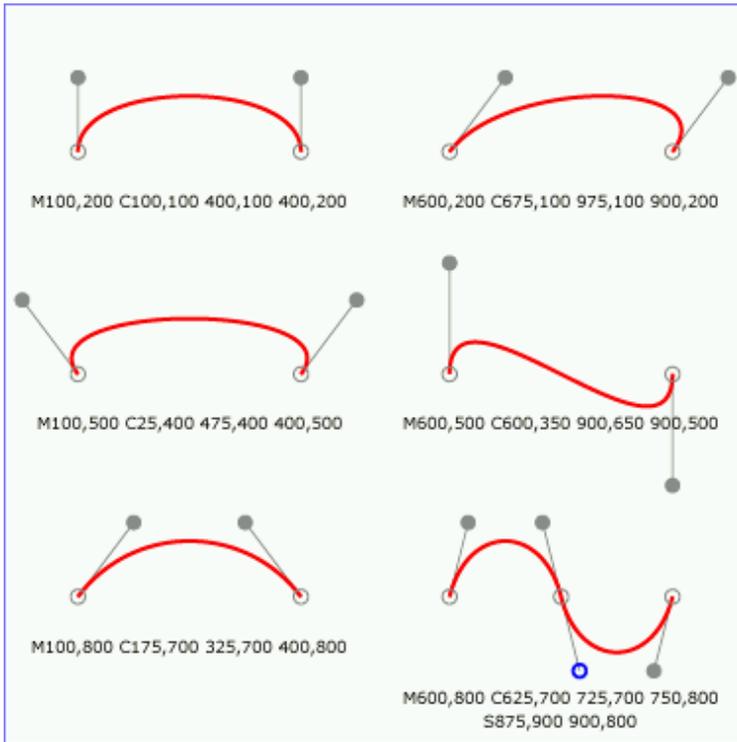
8.3.7 The quadratic bezier curve commands

The quadratic bezier commands are as follows:

Command	Name	Parameters	Description
Q (absolute) **q** (relative)	quadratic bezier curveto	(x1 y1 x y)+	Draws a quadratic bezier curve from the current point to (x,y) using (x1,y1) as the control point. **Q** (uppercase) indicates that absolute coordinates will follow; **q** (lowercase) indicates that relative coordinates will follow. Multiple sets of coordinates may be specified to draw a polybezier. At the end of the command, the new current point becomes the final (x,y) coordinate pair used in the polybezier.
T (absolute) **t** (relative)	Shorthand/smooth quadratic bezier curveto	(x y)+	Draws a quadratic bezier curve from the current point to (x,y). The control point is assumed to be the reflection of the control point on the previous command relative to the current point. (If there is no previous command or if the previous command was not a Q, q, T or t, assume the control point is coincident with the current point.) **T** (uppercase) indicates that absolute coordinates will follow; **t** (lowercase) indicates that relative coordinates will follow. At the end of the command, the new current point becomes the final (x,y) coordinate pair used in the polybezier.

Example quad01 shows some simple uses of quadratic bezier commands within a path. Note that the control point for the "T" command is computed automatically as the reflection of the control point for the previous "Q" command relative to the start point of the "T" command.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="12cm" height="6cm" viewBox="0 0 1200 600">
  <title>Example quad01 - quadratic bezier commands in path data</title>
  <desc>Picture showing a "Q" a "T" command,
        along with annotations showing the control points
        and end points</desc>
  <rect x="1" y="1" width="1198" height="598"
        style="fill:none; stroke:blue; stroke-width:1"/>

  <path d="M200,300 Q400,50 600,300 T1000,300"
        style="fill:none; stroke:red; stroke-width:5" />
```

```
    <!-- End points -->
    <g style="fill:black">
      <circle cx="200" cy="300" r="10"/>
      <circle cx="600" cy="300" r="10"/>
      <circle cx="1000" cy="300" r="10"/>
    </g>
    <!-- Control points and lines from end points to control points -->
    <g style="fill:#888888">
      <circle cx="400" cy="50" r="10"/>
      <circle cx="800" cy="550" r="10"/>
    </g>
    <path d="M200,300 L400,50 L600,300
             L800,550 L1000,300"
          style="fill:none; stroke:#888888; stroke-width:2"/>
</svg>
```
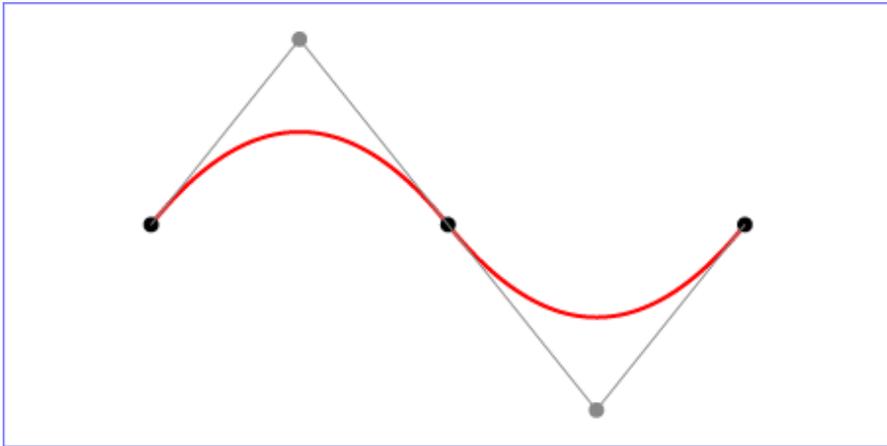

Example quad01

8.3.8 The elliptical arc curve commands

The elliptical arc commands are as follows:

Command	Name	Parameters	Description
A (absolute) **a** (relative)	elliptical arc	(rx ry x-axis-rotation large-arc-flag sweep-flag x y)+	Draws an elliptical arc from the current point to (**x**, **y**). The size and orientation of the ellipse are defined by two radii (**rx**, **ry**) and an **x-axis-rotation**, which indicates how the ellipse as a whole is rotated relative to the current coordinate system. The center (**cx**, **cy**) of the ellipse is calculated automatically to satisfy the constraints imposed by the other parameters. **large-arc-flag** and **sweep-flag** contribute to the automatic calculations and help determine how the arc is drawn.

Example arcs01 shows some simple uses of arc commands within a path.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="12cm" height="4cm" viewBox="0 0 1200 400">
  <title>Example arcs01 - arc commands in path data</title>
  <desc>Picture of a pie chart with two pie wedges and
        a picture of a line with arc blips</desc>
  <rect x="1" y="1" width="1198" height="398"
        style="fill:none; stroke:blue; stroke-width:1"/>

  <path d="M300,200 h-150 a150,150 0 1,0 150,-150 z"
        style="fill:red; stroke:blue; stroke-width:5"/>
  <path d="M275,175 v-150 a150,150 0 0,0 -150,150 z"
        style="fill:yellow; stroke:blue; stroke-width:5"/>
```

```
    <path d="M600,350 l 50,-25
              a25,25 -30 0,1 50,-25 l 50,-25
              a25,50 -30 0,1 50,-25 l 50,-25
              a25,75 -30 0,1 50,-25 l 50,-25
              a25,100 -30 0,1 50,-25 l 50,-25"
          style="fill:none; stroke:red; stroke-width:5" />
</svg>
```
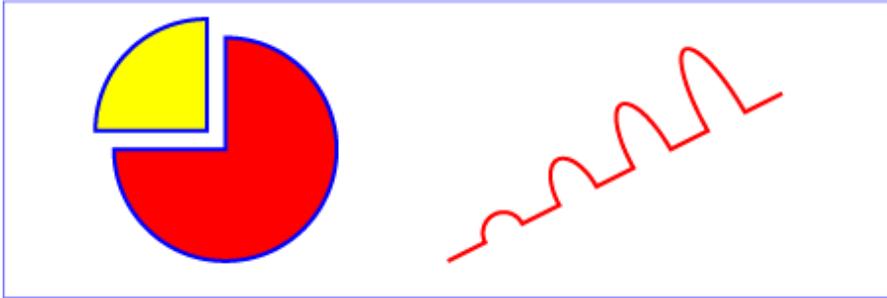

Example arcs01

The elliptical arc command draws a section of an ellipse which meets the following constraints:

- the arc starts at the current point
- the arc ends at point (**x**, **y**)
- the ellipse has the two radii (**rx**, **ry**)
- the X-axis of the ellipse is rotated by **x-axis-rotation** relative to the X-axis of the current coordinate system.

For most situations, there are actually four different arcs (two different ellipses, each with two different arc sweeps) that satisfy these constraints. **large-arc-flag** and **sweep-flag** indicate which one of the four arcs are drawn, as follows:

- Of the four candidate arc sweeps, two will represent an arc sweep of greater than or equal to 180 degrees (the "large-arc"), and two will represent an arc sweep of less than or equal to 180 degrees (the "small-arc"). If **large-arc-flag** is '1', then one of the two larger arc sweeps will be chosen; otherwise, if **large-arc-flag** is '0', one of the smaller arc sweeps will be chosen,
- If **sweep-flag** is '1', then the arc will be drawn in a "positive-angle" direction (i.e., the ellipse formula x=**cx**+**rx***cos(theta) and y=**cy**+**ry***sin(theta) is evaluated such that theta starts at an angle corresponding to the current point and increases positively until the arc reaches (x,y)). A value of 0 causes the arc to be drawn in a "negative-angle" direction (i.e., theta starts at an angle value corresponding to the current point and decreases until the arc reaches (x,y)).

The following illustrates the four combinations of **large-arc-flag** and **sweep-flag** and the four different arcs that will be drawn based on the values of these flags. For each case, the following path data command was used:

```
<path d="M 125,75 a100,50 0 ?,? 100,50"
      style="fill:none; stroke:red; stroke-width:6"/>
```

where "?,?" is replaced by "0,0" "0,1" "1,0" and "1,1" to generate the four possible cases.
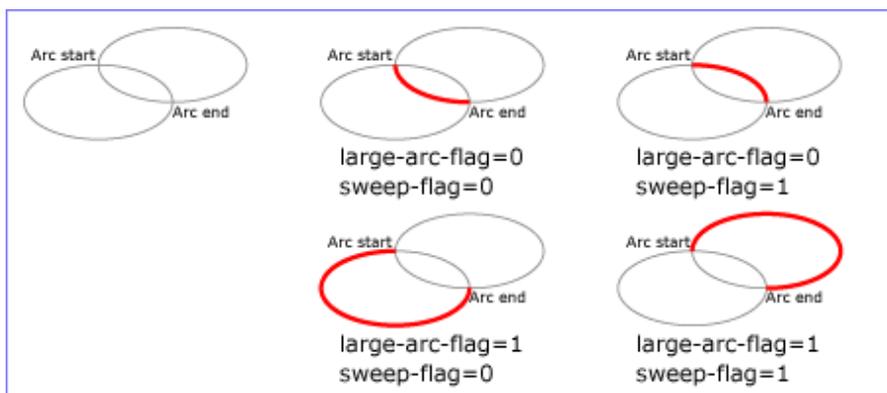
Refer to Elliptical arc implementation notes for detailed implementation notes for the path data elliptical arc commands.

8.3.9 The grammar for path data

The following notation is used in the BNF description of the grammar for path data:

- *: 0 or more
- +: 1 or more
- ?: 0 or 1
- (): grouping
- |: separates alternatives
- double quotes surround literals

The following is the BNF for SVG paths.

```
svg-path:
    wsp* subpaths? wsp*

subpaths:
    subpath
    | subpath wsp* subpaths

subpath:
    moveto wsp* subpath-elements?

subpath-elements:
    subpath-element
    | subpath-element wsp* subpath-elements

subpath-element:
    closepath
    | lineto
    | horizontal-lineto
    | vertical-lineto
    | curveto
    | smooth-curveto
    | quadratic-bezier-curveto
    | smooth-quadratic-bezier-curveto
    | elliptical-arc

moveto:
    ( "M" | "m" ) wsp* moveto-argument-sequence

moveto-argument-sequence:
    coordinate-pair
    | coordinate-pair comma-wsp? lineto-argument-sequence

closepath:
    ("Z" | "z")

lineto:
    ( "L" | "l" ) wsp* lineto-argument-sequence

lineto-argument-sequence:
    coordinate-pair
    | coordinate-pair comma-wsp? lineto-argument-sequence

horizontal-lineto:
    ( "H" | "h" ) wsp* horizontal-lineto-argument-sequence

horizontal-lineto-argument-sequence:
    coordinate
    | coordinate comma-wsp? horizontal-lineto-argument-sequence

vertical-lineto:
    ( "V" | "v" ) wsp* vertical-lineto-argument-sequence

vertical-lineto-argument-sequence:
    coordinate
    | coordinate comma-wsp? vertical-lineto-argument-sequence

curveto:
    ( "C" | "c" ) wsp* curveto-argument-sequence
```

```
curveto-argument-sequence:
    curveto-argument
    | curveto-argument comma-wsp? curveto-argument-sequence

curveto-argument:
    coordinate-pair comma-wsp? coordinate-pair comma-wsp? coordinate-pair

smooth-curveto:
    ( "S" | "s" ) wsp* smooth-curveto-argument-sequence

smooth-curveto-argument-sequence:
    smooth-curveto-argument
    | smooth-curveto-argument comma-wsp? smooth-curveto-argument-sequence

smooth-curveto-argument:
    coordinate-pair comma-wsp? coordinate-pair

quadratic-bezier-curveto:
    ( "Q" | "q" ) wsp* quadratic-bezier-curveto-argument-sequence

quadratic-bezier-curveto-argument-sequence:
    quadratic-bezier-curveto-argument
    | quadratic-bezier-curveto-argument comma-wsp?
        quadratic-bezier-curveto-argument-sequence

quadratic-bezier-curveto-argument:
    coordinate-pair comma-wsp? coordinate-pair

smooth-quadratic-bezier-curveto:
    ( "T" | "t" ) wsp* smooth-quadratic-bezier-curveto-argument-sequence

smooth-quadratic-bezier-curveto-argument-sequence:
    coordinate-pair
    | coordinate-pair comma-wsp? smooth-quadratic-bezier-curveto-argument-sequence

elliptical-arc:
    ( "A" | "a" ) wsp* elliptical-arc-argument-sequence

elliptical-arc-argument-sequence:
    elliptical-arc-argument
    | elliptical-arc-argument comma-wsp? elliptical-arc-argument-sequence

elliptical-arc-argument:
    nonnegative-number comma-wsp? nonnegative-number comma-wsp?
        number comma-wsp flag comma-wsp flag comma-wsp coordinate-pair

coordinate-pair:
    coordinate comma-wsp? coordinate

coordinate:
    number

nonnegative-number:
    integer-constant
    | floating-point-constant

number:
    sign? integer-constant
    | sign? floating-point-constant

flag:
    "0" | "1"

comma-wsp:
    (wsp+ comma? wsp*) | (comma wsp*)

comma:
    ","

integer-constant:
    digit-sequence

floating-point-constant:
    fractional-constant exponent?
```

```
    | digit-sequence exponent

fractional-constant:
    digit-sequence? "." digit-sequence
    | digit-sequence "."

exponent:
    ( "e" | "E" ) sign? digit-sequence

sign:
    "+" | "-"

digit-sequence:
    digit
    | digit digit-sequence

digit:
    "0" | "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9"

wsp:
    (#x20 | #x9 | #xD | #xA)
```

The processing of the BNF must consume as much of a given BNF production as possible, stopping at the point when a character is encountered which no longer satisfies the production. Thus, in the string "M 100-200", the first coordinate for the "moveto" consumes the characters "100" and stops upon encountering the minus sign because the minus sign cannot follow a digit in the production of a "coordinate". The result is that the first coordinate will be "100" and the second coordinate will be "-200".

Similarly, for the string "M 0.6.5", the first coordinate of the "moveto" consumes the characters "0.6" and stops upon encountering the second decimal point because the production of a "coordinate" only allows one decimal point. The result is that the first coordinate will be "0.6" and the second coordinate will be ".5".

8.4 Distance along a path

Various operations, including [text on a path](#) and [motion animation](#) and various [stroke operations](#), require that the user agent compute the distance along the geometry of a graphics element, such as a 'path'.

Exact mathematics exist for computing distance along a path, but the formulas are highly complex and require substantial computation. It is recommended that authoring products and user agents employ algorithms that produce as precise results as possible; however, to accommodate implementation differences and to help distance calculations produce results that approximate author intent, the [pathLength](#) attribute can be used to provide the author's computation of the total length of the path so that the user agent can scale distance-along-a-path computations by the ratio of pathLength to the user agent's own computed value for total path length.

A "moveto" operation within a 'path' element is defined to have zero length. Only the various "lineto", "curveto" and "arcto" commands contribute to path length calculations.

8.5 DOM interfaces

The following interfaces are defined below: [SVGPathSeg](#), [SVGPathSegClosePath](#), [SVGPathSegMovetoAbs](#), [SVGPathSegMovetoRel](#), [SVGPathSegLinetoAbs](#), [SVGPathSegLinetoRel](#), [SVGPathSegCurvetoCubicAbs](#), [SVGPathSegCurvetoCubicRel](#), [SVGPathSegCurvetoQuadraticAbs](#), [SVGPathSegCurvetoQuadraticRel](#), [SVGPathSegArcAbs](#), [SVGPathSegArcRel](#), [SVGPathSegLinetoHorizontalAbs](#), [SVGPathSegLinetoHorizontalRel](#), [SVGPathSegLinetoVerticalAbs](#), [SVGPathSegLinetoVerticalRel](#), [SVGPathSegCurvetoCubicSmoothAbs](#), [SVGPathSegCurvetoCubicSmoothRel](#), [SVGPathSegCurvetoQuadraticSmoothAbs](#), [SVGPathSegCurvetoQuadraticSmoothRel](#), [SVGAnimatedPathData](#), [SVGPathElement](#).

Interface SVGPathSeg

The SVGPathSeg interface is a base interface that corresponds to a single command within a path data specification.

IDL Definition

```
interface SVGPathSeg {

  // Path Segment Types
  const unsigned short PATHSEG_UNKNOWN                    = 0;
  const unsigned short PATHSEG_CLOSEPATH                  = 1;
  const unsigned short PATHSEG_MOVETO_ABS                 = 2;
  const unsigned short PATHSEG_MOVETO_REL                 = 3;
  const unsigned short PATHSEG_LINETO_ABS                 = 4;
  const unsigned short PATHSEG_LINETO_REL                 = 5;
```

```
const unsigned short PATHSEG_CURVETO_CUBIC_ABS            = 6;
const unsigned short PATHSEG_CURVETO_CUBIC_REL            = 7;
const unsigned short PATHSEG_CURVETO_QUADRATIC_ABS        = 8;
const unsigned short PATHSEG_CURVETO_QUADRATIC_REL        = 9;
const unsigned short PATHSEG_ARC_ABS                      = 10;
const unsigned short PATHSEG_ARC_REL                      = 11;
const unsigned short PATHSEG_LINETO_HORIZONTAL_ABS        = 12;
const unsigned short PATHSEG_LINETO_HORIZONTAL_REL        = 13;
const unsigned short PATHSEG_LINETO_VERTICAL_ABS          = 14;
const unsigned short PATHSEG_LINETO_VERTICAL_REL          = 15;
const unsigned short PATHSEG_CURVETO_CUBIC_SMOOTH_ABS     = 16;
const unsigned short PATHSEG_CURVETO_CUBIC_SMOOTH_REL     = 17;
const unsigned short PATHSEG_CURVETO_QUADRATIC_SMOOTH_ABS = 18;
const unsigned short PATHSEG_CURVETO_QUADRATIC_SMOOTH_REL = 19;

readonly attribute unsigned short pathSegType;
readonly attribute DOMString      pathSegTypeAsLetter;
};
```

Definition group Path Segment Types

Defined constants

PATHSEG_UNKNOWN	The unit type is not one of predefined types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.
PATHSEG_CLOSEPATH	Corresponds to a "closepath" (z) path data command.
PATHSEG_MOVETO_ABS	Corresponds to an "absolute moveto" (M) path data command.
PATHSEG_MOVETO_REL	Corresponds to a "relative moveto" (m) path data command.
PATHSEG_LINETO_ABS	Corresponds to an "absolute lineto" (L) path data command.
PATHSEG_LINETO_REL	Corresponds to a "relative lineto" (l) path data command.
PATHSEG_CURVETO_CUBIC_ABS	Corresponds to an "absolute cubic bezier curveto" (C) path data command.
PATHSEG_CURVETO_CUBIC_REL	Corresponds to a "relative cubic bezier curveto" (c) path data command.
PATHSEG_CURVETO_QUADRATIC_ABS	Corresponds to an "absolute quadratic bezier curveto" (Q) path data command.
PATHSEG_CURVETO_QUADRATIC_REL	Corresponds to a "relative quadratic bezier curveto" (q) path data command.
PATHSEG_ARC_ABS	Corresponds to an "absolute arcto" (A) path data command.
PATHSEG_ARC_REL	Corresponds to a "relative arcto" (a) path data command.
PATHSEG_LINETO_HORIZONTAL_ABS	Corresponds to an "absolute horizontal lineto" (H) path data command.
PATHSEG_LINETO_HORIZONTAL_REL	Corresponds to a "relative horizontal lineto" (h) path data command.
PATHSEG_LINETO_VERTICAL_ABS	Corresponds to an "absolute vertical lineto" (V) path data command.
PATHSEG_LINETO_VERTICAL_REL	Corresponds to a "relative vertical lineto" (v) path data command.
PATHSEG_CURVETO_CUBIC_SMOOTH_ABS	Corresponds to an "absolute smooth cubic curveto" (S) path data command.
PATHSEG_CURVETO_CUBIC_SMOOTH_REL	Corresponds to a "relative smooth cubic curveto" (s) path data command.
PATHSEG_CURVETO_QUADRATIC_SMOOTH_ABS	Corresponds to an "absolute smooth quadratic curveto" (T) path data command.
PATHSEG_CURVETO_QUADRATIC_SMOOTH_REL	Corresponds to a "relative smooth quadratic curveto" (t) path data command.

Attributes

readonly unsigned short pathSegType

The type of the path segment as specified by one of the constants specified above.

readonly DOMString pathSegTypeAsLetter

The type of the path segment, specified by the corresponding one character command name.

Interface SVGPathSegClosePath

The SVGPathSegClosePath interface corresponds to a "closepath" (z) path data command.

IDL Definition

```
interface SVGPathSegClosePath : SVGPathSeg {};
```

Interface SVGPathSegMovetoAbs

The SVGPathSegMovetoAbs interface corresponds to an "absolute moveto" (M) path data command.

IDL Definition

```
interface SVGPathSegMovetoAbs : SVGPathSeg {
          attribute float   x;
                       // raises DOMException on setting
          attribute float   y;
                       // raises DOMException on setting
};
```

Attributes

    float x

        The absolute X coordinate for the end point of this path segment.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

    float y

        The absolute Y coordinate for the end point of this path segment.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGPathSegMovetoRel

The SVGPathSegMovetoRel interface corresponds to an "relative moveto" (m) path data command.

IDL Definition

```
interface SVGPathSegMovetoRel : SVGPathSeg {
          attribute float   x;
                       // raises DOMException on setting
          attribute float   y;
                       // raises DOMException on setting
};
```

Attributes

    float x

        The relative X coordinate for the end point of this path segment.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

    float y

        The relative Y coordinate for the end point of this path segment.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGPathSegLinetoAbs

The SVGPathSegLinetoAbs interface corresponds to an "absolute lineto" (L) path data command.

IDL Definition

```
interface SVGPathSegLinetoAbs : SVGPathSeg {
          attribute float   x;
                       // raises DOMException on setting
          attribute float   y;
                       // raises DOMException on setting
};
```

Attributes

    float x

        The absolute X coordinate for the end point of this path segment.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float y

The absolute Y coordinate for the end point of this path segment.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGPathSegLinetoRel

The SVGPathSegLinetoRel interface corresponds to an "relative lineto" (l) path data command.

IDL Definition

```
interface SVGPathSegLinetoRel : SVGPathSeg {
          attribute float   x;
                    // raises DOMException on setting
          attribute float   y;
                    // raises DOMException on setting
};
```

Attributes

float x

The relative X coordinate for the end point of this path segment.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float y

The relative Y coordinate for the end point of this path segment.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGPathSegCurvetoCubicAbs

The SVGPathSegCurvetoCubicAbs interface corresponds to an "absolute cubic bezier curveto" (C) path data command.

IDL Definition

```
interface SVGPathSegCurvetoCubicAbs : SVGPathSeg {
          attribute float   x;
                    // raises DOMException on setting
          attribute float   y;
                    // raises DOMException on setting
          attribute float   x1;
                    // raises DOMException on setting
          attribute float   y1;
                    // raises DOMException on setting
          attribute float   x2;
                    // raises DOMException on setting
          attribute float   y2;
                    // raises DOMException on setting
};
```

Attributes

float x

The absolute X coordinate for the end point of this path segment.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float y

The absolute Y coordinate for the end point of this path segment.

Exceptions on setting

> > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float x1

> The absolute X coordinate for the first control point.
>
> Exceptions on setting
>
> > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float y1

> The absolute Y coordinate for the first control point.
>
> Exceptions on setting
>
> > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float x2

> The absolute X coordinate for the second control point.
>
> Exceptions on setting
>
> > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float y2

> The absolute Y coordinate for the second control point.
>
> Exceptions on setting
>
> > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGPathSegCurvetoCubicRel

The SVGPathSegCurvetoCubicRel interface corresponds to a "relative cubic bezier curveto" (c) path data command.

IDL Definition

```
interface SVGPathSegCurvetoCubicRel : SVGPathSeg {
        attribute float   x;
                    // raises DOMException on setting
        attribute float   y;
                    // raises DOMException on setting
        attribute float   x1;
                    // raises DOMException on setting
        attribute float   y1;
                    // raises DOMException on setting
        attribute float   x2;
                    // raises DOMException on setting
        attribute float   y2;
                    // raises DOMException on setting
};
```

Attributes

float x

> The relative X coordinate for the end point of this path segment.
>
> Exceptions on setting
>
> > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float y

> The relative Y coordinate for the end point of this path segment.
>
> Exceptions on setting
>
> > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float x1

> The relative X coordinate for the first control point.
>
> Exceptions on setting
>
> > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float y1

> The relative Y coordinate for the first control point.

Exceptions on setting

> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float x2

The relative X coordinate for the second control point.

Exceptions on setting

> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float y2

The relative Y coordinate for the second control point.

Exceptions on setting

> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGPathSegCurvetoQuadraticAbs

The SVGPathSegCurvetoQuadraticAbs interface corresponds to an "absolute quadratic bezier curveto" (Q) path data command.

IDL Definition

```
interface SVGPathSegCurvetoQuadraticAbs : SVGPathSeg {
          attribute float   x;
                      // raises DOMException on setting
          attribute float   y;
                      // raises DOMException on setting
          attribute float   x1;
                      // raises DOMException on setting
          attribute float   y1;
                      // raises DOMException on setting
};
```

Attributes

float x

The absolute X coordinate for the end point of this path segment.

Exceptions on setting

> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float y

The absolute Y coordinate for the end point of this path segment.

Exceptions on setting

> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float x1

The absolute X coordinate for the control point.

Exceptions on setting

> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float y1

The absolute Y coordinate for the control point.

Exceptions on setting

> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGPathSegCurvetoQuadraticRel

The SVGPathSegCurvetoQuadraticRel interface corresponds to a "relative quadratic bezier curveto" (q) path data command.

IDL Definition

```
interface SVGPathSegCurvetoQuadraticRel : SVGPathSeg {
          attribute float   x;
                      // raises DOMException on setting
          attribute float   y;
```

```
                            // raises DOMException on setting
                 attribute float   x1;
                            // raises DOMException on setting
                 attribute float   y1;
                            // raises DOMException on setting
        };
```

Attributes

    float x

        The relative X coordinate for the end point of this path segment.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

    float y

        The relative Y coordinate for the end point of this path segment.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

    float x1

        The relative X coordinate for the control point.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

    float y1

        The relative Y coordinate for the control point.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGPathSegArcAbs

The SVGPathSegArcAbs interface corresponds to an "absolute arcto" (A) path data command.

IDL Definition

```
interface SVGPathSegArcAbs : SVGPathSeg {
         attribute float    x;
                    // raises DOMException on setting
         attribute float    y;
                    // raises DOMException on setting
         attribute float    r1;
                    // raises DOMException on setting
         attribute float    r2;
                    // raises DOMException on setting
         attribute float    angle;
                    // raises DOMException on setting
         attribute boolean largeArcFlag;
                    // raises DOMException on setting
         attribute boolean sweepFlag;
                    // raises DOMException on setting
};
```

Attributes

    float x

        The absolute X coordinate for the end point of this path segment.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

    float y

        The absolute Y coordinate for the end point of this path segment.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

    float r1

The X axis radius for the ellipse (i.e., r1).

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float r2

The Y axis radius for the ellipse (i.e., r2).

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float angle

The rotation angle in degrees for the ellipse's X-axis relative to the X-axis of the user coordinate system.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

boolean largeArcFlag

The value of the large-arc-flag parameter.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

boolean sweepFlag

The value of the sweep-flag parameter.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGPathSegArcRel

The SVGPathSegArcRel interface corresponds to a "relative arcto" (a) path data command.

IDL Definition

```
interface SVGPathSegArcRel : SVGPathSeg {
          attribute float   x;
                      // raises DOMException on setting
          attribute float   y;
                      // raises DOMException on setting
          attribute float   r1;
                      // raises DOMException on setting
          attribute float   r2;
                      // raises DOMException on setting
          attribute float   angle;
                      // raises DOMException on setting
          attribute boolean largeArcFlag;
                      // raises DOMException on setting
          attribute boolean sweepFlag;
                      // raises DOMException on setting
};
```

Attributes

float x

The relative X coordinate for the end point of this path segment.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float y

The relative Y coordinate for the end point of this path segment.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float r1

The X axis radius for the ellipse (i.e., r1).

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float r2

The Y axis radius for the ellipse (i.e., r2).

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float angle

The rotation angle in degrees for the ellipse's X-axis relative to the X-axis of the user coordinate system.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

boolean largeArcFlag

The value of the large-arc-flag parameter.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

boolean sweepFlag

The value of the sweep-flag parameter.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGPathSegLinetoHorizontalAbs

The SVGPathSegLinetoHorizontalAbs interface corresponds to an "absolute horizontal lineto" (H) path data command.

IDL Definition

```
interface SVGPathSegLinetoHorizontalAbs : SVGPathSeg {
        attribute float   x;
                        // raises DOMException on setting
};
```

Attributes

float x

The absolute X coordinate for the end point of this path segment.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGPathSegLinetoHorizontalRel

The SVGPathSegLinetoHorizontalRel interface corresponds to a "relative horizontal lineto" (h) path data command.

IDL Definition

```
interface SVGPathSegLinetoHorizontalRel : SVGPathSeg {
        attribute float   x;
                        // raises DOMException on setting
};
```

Attributes

float x

The relative X coordinate for the end point of this path segment.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGPathSegLinetoVerticalAbs

The SVGPathSegLinetoVerticalAbs interface corresponds to an "absolute vertical lineto" (V) path data command.

IDL Definition

```
interface SVGPathSegLinetoVerticalAbs : SVGPathSeg {
          attribute float   y;
                    // raises DOMException on setting
};
```

Attributes

    float y

        The absolute Y coordinate for the end point of this path segment.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGPathSegLinetoVerticalRel

The SVGPathSegLinetoVerticalRel interface corresponds to a "relative vertical lineto" (v) path data command.

IDL Definition

```
interface SVGPathSegLinetoVerticalRel : SVGPathSeg {
          attribute float   y;
                    // raises DOMException on setting
};
```

Attributes

    float y

        The relative Y coordinate for the end point of this path segment.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGPathSegCurvetoCubicSmoothAbs

The SVGPathSegCurvetoCubicSmoothAbs interface corresponds to an "absolute smooth cubic curveto" (S) path data command.

IDL Definition

```
interface SVGPathSegCurvetoCubicSmoothAbs : SVGPathSeg {
          attribute float   x;
                    // raises DOMException on setting
          attribute float   y;
                    // raises DOMException on setting
          attribute float   x2;
                    // raises DOMException on setting
          attribute float   y2;
                    // raises DOMException on setting
};
```

Attributes

    float x

        The absolute X coordinate for the end point of this path segment.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

    float y

        The absolute Y coordinate for the end point of this path segment.

Exceptions on setting

>   DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float x2

>   The absolute X coordinate for the second control point.

>   Exceptions on setting

>>   DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float y2

>   The absolute Y coordinate for the second control point.

>   Exceptions on setting

>>   DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGPathSegCurvetoCubicSmoothRel

The SVGPathSegCurvetoCubicSmoothRel interface corresponds to a "relative smooth cubic curveto" (s) path data command.

IDL Definition

```
interface SVGPathSegCurvetoCubicSmoothRel : SVGPathSeg {
            attribute float   x;
                        // raises DOMException on setting
            attribute float   y;
                        // raises DOMException on setting
            attribute float   x2;
                        // raises DOMException on setting
            attribute float   y2;
                        // raises DOMException on setting
};
```

Attributes

float x

>   The relative X coordinate for the end point of this path segment.

>   Exceptions on setting

>>   DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float y

>   The relative Y coordinate for the end point of this path segment.

>   Exceptions on setting

>>   DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float x2

>   The relative X coordinate for the second control point.

>   Exceptions on setting

>>   DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float y2

>   The relative Y coordinate for the second control point.

>   Exceptions on setting

>>   DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGPathSegCurvetoQuadraticSmoothAbs

The SVGPathSegCurvetoQuadraticSmoothAbs interface corresponds to an "absolute smooth quadratic curveto" (T) path data command.

IDL Definition

```
interface SVGPathSegCurvetoQuadraticSmoothAbs : SVGPathSeg {
            attribute float   x;
                        // raises DOMException on setting
            attribute float   y;
```

```
                                            // raises DOMException on setting
          };
```

Attributes

>   float x
>
>>   The absolute X coordinate for the end point of this path segment.
>>
>>   Exceptions on setting
>>
>>>   DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.
>
>   float y
>
>>   The absolute Y coordinate for the end point of this path segment.
>>
>>   Exceptions on setting
>>
>>>   DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGPathSegCurvetoQuadraticSmoothRel

The SVGPathSegCurvetoQuadraticSmoothRel interface corresponds to a "relative smooth quadratic curveto" (t) path data command.

IDL Definition

```
          interface SVGPathSegCurvetoQuadraticSmoothRel {

                    attribute float   x;
                              // raises DOMException on setting
                    attribute float   y;
                              // raises DOMException on setting
          };
```

Attributes

>   float x
>
>>   The relative X coordinate for the end point of this path segment.
>>
>>   Exceptions on setting
>>
>>>   DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.
>
>   float y
>
>>   The relative Y coordinate for the end point of this path segment.
>>
>>   Exceptions on setting
>>
>>>   DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGAnimatedPathData

The SVGAnimatedPathData interface supports elements which have a 'd' attribute which holds SVG path data, and supports the ability to animate that attribute.

The SVGAnimatedPathData interface provides two lists to access and modify the base/static contents of the d attribute:

- DOM attribute pathSegList provides access to the static/base contents of the d attribute in a form which matches one-for-one with SVG's syntax.
- DOM attribute normalizedPathSegList provides normalized access to the static/base contents of the d attribute where all path data commands are expressed in terms of the following subset of SVGPathSeg types: SVG_PATHSEG_MOVETO_ABS (M), SVG_PATHSEG_LINETO_ABS (L), SVG_PATHSEG_CURVETO_CUBIC_ABS (C) and SVG_PATHSEG_CLOSEPATH (z).

and two lists to access the current animated values of the d attribute:

- DOM attribute animatedPathSegList provides access to the current animated contents of the d attribute in a form which matches one-for-one with SVG's syntax.
- DOM attribute animatedNormalizedPathSegList provides normalized access to the current animated contents of the d attribute where all path data commands are expressed in terms of the following subset of SVGPathSeg types: SVG_PATHSEG_MOVETO_ABS (M), SVG_PATHSEG_LINETO_ABS (L), SVG_PATHSEG_CURVETO_CUBIC_ABS (C) and SVG_PATHSEG_CLOSEPATH (z).

Each of the two lists are always kept synchronized. Modifications to one list will immediately cause the corresponding list to be modified. Modifications to normalizedPathSegList might cause entries in pathSegList to be broken into a set of normalized path segments.

Additionally, the 'd' attribute on the 'path' element accessed via the XML DOM (e.g., using the getAttribute() method call) will reflect any changes made to

pathSegList or normalizedPathSegList.

```
interface SVGAnimatedPathData : SVGPathSeg {
  readonly attribute SVGList    pathSegList;
  readonly attribute SVGList    normalizedPathSegList;
  readonly attribute SVGList    animatedPathSegList;
  readonly attribute SVGList    animatedNormalizedPathSegList;
};
```

Attributes

readonly SVGList pathSegList

Provides access to the base/static contents of the d attribute in a form which matches one-for-one with SVG's syntax. Thus, if the d attribute has an "absolute moveto (M)" and an "absolute arcto (A)" command, then pathSegList will have two entries: a SVG_PATHSEG_MOVETO_ABS and a SVG_PATHSEG_ARC_ABS.

The various methods from SVGList, which are defined to accept parameters and return values of type Object, must receive parameters of type SVGPathSeg and return values of type SVGPathSeg.

readonly SVGList normalizedPathSegList

Provides access to the base/static contents of the d attribute in a form where all path data commands are expressed in terms of the following subset of SVGPathSeg types: SVG_PATHSEG_MOVETO_ABS (M), SVG_PATHSEG_LINETO_ABS (L), SVG_PATHSEG_CURVETO_CUBIC_ABS (C) and SVG_PATHSEG_CLOSEPATH (z). Thus, if the d attribute has an "absolute moveto (M)" and an "absolute arcto (A)" command, then pathSegList will have one SVG_PATHSEG_MOVETO_ABS entry followed by a series of SVG_PATHSEG_ARC_ABS entries which approximate the arc. This alternate representation is available to provide a simpler interface to developers who would benefit from a more limited set of commands.

The various methods from SVGList, which are defined to accept parameters and return values of type Object, must receive parameters of type SVGPathSeg and return values of type SVGPathSeg, and the only valid SVGPathSeg types are SVG_PATHSEG_MOVETO_ABS (M), SVG_PATHSEG_LINETO_ABS (L), SVG_PATHSEG_CURVETO_CUBIC_ABS (C) and SVG_PATHSEG_CLOSEPATH (z).

readonly SVGList animatedPathSegList

Provides access to the current animated contents of the d attribute in a form which matches one-for-one with SVG's syntax. If the given attribute or property is being animated, contains the current animated value of the attribute or property. If the given attribute or property is not currently being animated, contains the same value as 'pathSegList'.

The various methods from SVGList, which are defined to accept parameters and return values of type Object, must receive parameters of type SVGPathSeg and return values of type SVGPathSeg.

readonly SVGList animatedNormalizedPathSegList

Provides access to the current animated contents of the d attribute in a form where all path data commands are expressed in terms of the following subset of SVGPathSeg types: SVG_PATHSEG_MOVETO_ABS (M), SVG_PATHSEG_LINETO_ABS (L), SVG_PATHSEG_CURVETO_CUBIC_ABS (C) and SVG_PATHSEG_CLOSEPATH (z). If the given attribute or property is being animated, contains the current animated value of the attribute or property. If the given attribute or property is not currently being animated, contains the same value as 'normalizedPathSegList'.

The various methods from SVGList, which are defined to accept parameters and return values of type Object, must receive parameters of type SVGPathSeg and return values of type SVGPathSeg.

Interface SVGPathElement

The SVGPathElement interface corresponds to the 'path' element.

IDL Definition

```
interface SVGPathElement :
                SVGElement,
                SVGTests,
                SVGLangSpace,
                SVGExternalResourcesRequired,
                SVGStylable,
                SVGTransformable,
                events::EventTarget,
                SVGAnimatedPathData {

        attribute SVGAnimatedNumber pathLength;
                    // raises DOMException on setting
```

```
    float          getTotalLength (  );
    SVGPoint       getPointAtLength ( in float distance );
    unsigned long getPathSegAtLength ( in float distance );
    SVGPathSegClosePath    createSVGPathSegClosePath (  );
    SVGPathSegMovetoAbs    createSVGPathSegMovetoAbs ( in float x, in float y );
    SVGPathSegMovetoRel    createSVGPathSegMovetoRel ( in float x, in float y );
    SVGPathSegLinetoAbs    createSVGPathSegLinetoAbs ( in float x, in float y );
    SVGPathSegLinetoRel    createSVGPathSegLinetoRel ( in float x, in float y );
    SVGPathSegCurvetoCubicAbs    createSVGPathSegCurvetoCubicAbs ( in float x, in float y, in float
x1, in float y1, in float x2, in float y2 );
    SVGPathSegCurvetoCubicRel    createSVGPathSegCurvetoCubicRel ( in float x, in float y, in float
x1, in float y1, in float x2, in float y2 );
    SVGPathSegCurvetoQuadraticAbs    createSVGPathSegCurvetoQuadraticAbs ( in float x, in float y, in
float x1, in float y1 );
    SVGPathSegCurvetoQuadraticRel    createSVGPathSegCurvetoQuadraticRel ( in float x, in float y, in
float x1, in float y1 );
    SVGPathSegArcAbs    createSVGPathSegArcAbs ( in float x, in float y, in float r1, in float r2, in
float angle, in boolean largeArcFlag, in boolean sweepFlag );
    SVGPathSegArcRel    createSVGPathSegArcRel ( in float x, in float y, in float r1, in float r2, in
float angle, in boolean largeArcFlag, in boolean sweepFlag );
    SVGPathSegLinetoHorizontalAbs    createSVGPathSegLinetoHorizontalAbs ( in float x );
    SVGPathSegLinetoHorizontalRel    createSVGPathSegLinetoHorizontalRel ( in float x );
    SVGPathSegLinetoVerticalAbs    createSVGPathSegLinetoVerticalAbs ( in float y );
    SVGPathSegLinetoVerticalRel    createSVGPathSegLinetoVerticalRel ( in float y );
    SVGPathSegCurvetoCubicSmoothAbs    createSVGPathSegCurvetoCubicSmoothAbs ( in float x, in float y,
in float x2, in float y2 );
    SVGPathSegCurvetoCubicSmoothRel    createSVGPathSegCurvetoCubicSmoothRel ( in float x, in float y,
in float x2, in float y2 );
    SVGPathSegCurvetoQuadraticSmoothAbs    createSVGPathSegCurvetoQuadraticSmoothAbs ( in float x, in
float y );
    SVGPathSegCurvetoQuadraticSmoothRel    createSVGPathSegCurvetoQuadraticSmoothRel ( in float x, in
float y );
};
```

Attributes

SVGAnimatedNumber pathLength

    Corresponds to attribute pathLength on the given 'path' element.

    Exceptions on setting

        DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Methods

getTotalLength

    Returns the user agent's computed value for the total length of the path using the user agent's distance-along-a-path algorithm, as a distance in
the current user coordinate system.

    No Parameters

    Return value

        float The total length of the path.

    No Exceptions

getPointAtLength

    Returns the (x,y) coordinate in user space which is `distance` units along the path, utilizing the user agent's distance-along-a-path algorithm.

    Parameters

        in float distance The distance along the path, relative to the start of the path, as a distance in the current user coordinate system.

    Return value

        SVGPoint The returned point in user space.

    No Exceptions

getPathSegAtLength

    Returns the index into pathSegList which is `distance` units along the path, utilizing the user agent's distance-along-a-path algorithm.

    Parameters

        in float distance The distance along the path, relative to the start of the path, as a distance in the current user coordinate system.

    Return value

        unsigned long The index of the path segment, where the first path segment is number 0.

No Exceptions

createSVGPathSegClosePath

Returns a stand-alone, parentless SVGPathSegClosePath object.

No Parameters

Return value

SVGPathSegClosePath A stand-alone, parentless SVGPathSegClosePath object.

No Exceptions

createSVGPathSegMovetoAbs

Returns a stand-alone, parentless SVGPathSegMovetoAbs object.

Parameters

in float x The absolute X coordinate for the end point of this path segment.
in float y The absolute Y coordinate for the end point of this path segment.

Return value

SVGPathSegMovetoAbs A stand-alone, parentless SVGPathSegMovetoAbs object.

No Exceptions

createSVGPathSegMovetoRel

Returns a stand-alone, parentless SVGPathSegMovetoRel object.

Parameters

in float x The relative X coordinate for the end point of this path segment.
in float y The relative Y coordinate for the end point of this path segment.

Return value

SVGPathSegMovetoRel A stand-alone, parentless SVGPathSegMovetoRel object.

No Exceptions

createSVGPathSegLinetoAbs

Returns a stand-alone, parentless SVGPathSegLinetoAbs object.

Parameters

in float x The absolute X coordinate for the end point of this path segment.
in float y The absolute Y coordinate for the end point of this path segment.

Return value

SVGPathSegLinetoAbs A stand-alone, parentless SVGPathSegLinetoAbs object.

No Exceptions

createSVGPathSegLinetoRel

Returns a stand-alone, parentless SVGPathSegLinetoRel object.

Parameters

in float x The relative X coordinate for the end point of this path segment.
in float y The relative Y coordinate for the end point of this path segment.

Return value

SVGPathSegLinetoRel A stand-alone, parentless SVGPathSegLinetoRel object.

No Exceptions

createSVGPathSegCurvetoCubicAbs

Returns a stand-alone, parentless SVGPathSegCurvetoCubicAbs object.

Parameters

in float x   The absolute X coordinate for the end point of this path segment.
in float y   The absolute Y coordinate for the end point of this path segment.
in float x1 The absolute X coordinate for the first control point.
in float y1 The absolute Y coordinate for the first control point.
in float x2 The absolute X coordinate for the second control point.
in float y2 The absolute Y coordinate for the second control point.

Return value

SVGPathSegCurvetoCubicAbs A stand-alone, parentless SVGPathSegCurvetoCubicAbs object.

No Exceptions

createSVGPathSegCurvetoCubicRel

Returns a stand-alone, parentless SVGPathSegCurvetoCubicRel object.

Parameters

    in float x   The relative X coordinate for the end point of this path segment.
    in float y   The relative Y coordinate for the end point of this path segment.
    in float x1 The relative X coordinate for the first control point.
    in float y1 The relative Y coordinate for the first control point.
    in float x2 The relative X coordinate for the second control point.
    in float y2 The relative Y coordinate for the second control point.

Return value

    SVGPathSegCurvetoCubicRel A stand-alone, parentless SVGPathSegCurvetoCubicRel object.

No Exceptions

createSVGPathSegCurvetoQuadraticAbs

Returns a stand-alone, parentless SVGPathSegCurvetoQuadraticAbs object.

Parameters

    in float x   The absolute X coordinate for the end point of this path segment.
    in float y   The absolute Y coordinate for the end point of this path segment.
    in float x1 The absolute X coordinate for the control point.
    in float y1 The absolute Y coordinate for the control point.

Return value

    SVGPathSegCurvetoQuadraticAbs A stand-alone, parentless SVGPathSegCurvetoQuadraticAbs object.

No Exceptions

createSVGPathSegCurvetoQuadraticRel

Returns a stand-alone, parentless SVGPathSegCurvetoQuadraticRel object.

Parameters

    in float x   The relative X coordinate for the end point of this path segment.
    in float y   The relative Y coordinate for the end point of this path segment.
    in float x1 The relative X coordinate for the control point.
    in float y1 The relative Y coordinate for the control point.

Return value

    SVGPathSegCurvetoQuadraticRel A stand-alone, parentless SVGPathSegCurvetoQuadraticRel object.

No Exceptions

createSVGPathSegArcAbs

Returns a stand-alone, parentless SVGPathSegArcAbs object.

Parameters

    in float x   The absolute X coordinate for the end point of this path segment.
    in float y   The absolute Y coordinate for the end point of this path segment.
    in float r1   The X axis radius for the ellipse (i.e., r1).
    in float r2   The Y axis radius for the ellipse (i.e., r2).
    in float angle   The rotation angle in degrees for the ellipse's X-axis relative to the X-axis of the user coordinate system.
    in boolean largeArcFlag The value for the large-arc-flag parameter.
    in boolean sweepFlag   The value for the sweep-flag parameter.

Return value

    SVGPathSegArcAbs A stand-alone, parentless SVGPathSegArcAbs object.

No Exceptions

createSVGPathSegArcRel

Returns a stand-alone, parentless SVGPathSegArcRel object.

Parameters

    in float x   The relative X coordinate for the end point of this path segment.
    in float y   The relative Y coordinate for the end point of this path segment.
    in float r1   The X axis radius for the ellipse (i.e., r1).
    in float r2   The Y axis radius for the ellipse (i.e., r2).
    in float angle   The rotation angle in degrees for the ellipse's X-axis relative to the X-axis of the user coordinate system.
    in boolean largeArcFlag The value for the large-arc-flag parameter.
    in boolean sweepFlag   The value for the sweep-flag parameter.

Return value

SVGPathSegArcRel A stand-alone, parentless SVGPathSegArcRel object.

No Exceptions

createSVGPathSegLinetoHorizontalAbs

Returns a stand-alone, parentless SVGPathSegLinetoHorizontalAbs object.

Parameters

in float x The absolute X coordinate for the end point of this path segment.

Return value

SVGPathSegLinetoHorizontalAbs A stand-alone, parentless SVGPathSegLinetoHorizontalAbs object.

No Exceptions

createSVGPathSegLinetoHorizontalRel

Returns a stand-alone, parentless SVGPathSegLinetoHorizontalRel object.

Parameters

in float x The relative X coordinate for the end point of this path segment.

Return value

SVGPathSegLinetoHorizontalRel A stand-alone, parentless SVGPathSegLinetoHorizontalRel object.

No Exceptions

createSVGPathSegLinetoVerticalAbs

Returns a stand-alone, parentless SVGPathSegLinetoVerticalAbs object.

Parameters

in float y The absolute Y coordinate for the end point of this path segment.

Return value

SVGPathSegLinetoVerticalAbs A stand-alone, parentless SVGPathSegLinetoVerticalAbs object.

No Exceptions

createSVGPathSegLinetoVerticalRel

Returns a stand-alone, parentless SVGPathSegLinetoVerticalRel object.

Parameters

in float y The relative Y coordinate for the end point of this path segment.

Return value

SVGPathSegLinetoVerticalRel A stand-alone, parentless SVGPathSegLinetoVerticalRel object.

No Exceptions

createSVGPathSegCurvetoCubicSmoothAbs

Returns a stand-alone, parentless SVGPathSegCurvetoCubicSmoothAbs object.

Parameters

in float x   The absolute X coordinate for the end point of this path segment.
in float y   The absolute Y coordinate for the end point of this path segment.
in float x2 The absolute X coordinate for the second control point.
in float y2 The absolute Y coordinate for the second control point.

Return value

SVGPathSegCurvetoCubicSmoothAbs A stand-alone, parentless SVGPathSegCurvetoCubicSmoothAbs object.

No Exceptions

createSVGPathSegCurvetoCubicSmoothRel

Returns a stand-alone, parentless SVGPathSegCurvetoCubicSmoothRel object.

Parameters

in float x   The relative X coordinate for the end point of this path segment.
in float y   The relative Y coordinate for the end point of this path segment.
in float x2 The relative X coordinate for the second control point.
in float y2 The relative Y coordinate for the second control point.

Return value

SVGPathSegCurvetoCubicSmoothRel A stand-alone, parentless SVGPathSegCurvetoCubicSmoothRel object.

No Exceptions

createSVGPathSegCurvetoQuadraticSmoothAbs

Returns a stand-alone, parentless SVGPathSegCurvetoQuadraticSmoothAbs object.

Parameters

in float x The absolute X coordinate for the end point of this path segment.
in float y The absolute Y coordinate for the end point of this path segment.

Return value

SVGPathSegCurvetoQuadraticSmoothAbs A stand-alone, parentless SVGPathSegCurvetoQuadraticSmoothAbs object.

No Exceptions

createSVGPathSegCurvetoQuadraticSmoothRel

Returns a stand-alone, parentless SVGPathSegCurvetoQuadraticSmoothRel object.

Parameters

in float x The relative X coordinate for the end point of this path segment.
in float y The relative Y coordinate for the end point of this path segment.

Return value

SVGPathSegCurvetoQuadraticSmoothRel A stand-alone, parentless SVGPathSegCurvetoQuadraticSmoothRel object.

No Exceptions

9 Basic Shapes

Contents

9.1 Introduction

SVG contains the following set of basic shape elements:
- rectangles (rectangle, including optional rounded corners)
- circles
- ellipses
- lines
- polylines
- polygons

Mathematically, these shape elements are equivalent to a 'path' element that would construct the same shape. The basic shapes may be stroked, filled and used as clip paths. All of the properties available for 'path' elements also apply to the basic shapes.

9.2 The 'rect' element

The 'rect' element defines a rectangle which is axis-aligned with the current user coordinate system. Rounded rectangles can be achieved by setting appropriate values for attributes rx and ry.

```
<!ENTITY % rectExt "" >
<!ELEMENT rect (%descTitleMetadata;,(animate|set|animateMotion|animateColor|animateTransform
                %geExt;%rectExt;)*) >
<!ATTLIST rect
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-Graphics;
```

```
    transform %TransformList; #IMPLIED
    %graphicsElementEvents;
    x %Coordinate; #IMPLIED
    y %Coordinate; #IMPLIED
    width %Length; #REQUIRED
    height %Length; #REQUIRED
    rx %Length; #IMPLIED
    ry %Length; #IMPLIED >
```

Attribute definitions:

x = "<u><coordinate></u>"

> The X-axis coordinate of the side of the rectangle which has the smaller X-axis coordinate value in the current user coordinate system.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> <u>Animatable</u>: yes.

y = "<u><coordinate></u>"

> The Y-axis coordinate of the side of the rectangle which has the smaller Y-axis coordinate value in the current user coordinate system.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> <u>Animatable</u>: yes.

width = "<u><length></u>"

> The width of the rectangle.
> A negative value is an error (see <u>Error processing</u>). A value of zero disables rendering of the element.
> <u>Animatable</u>: yes.

height = "<u><length></u>"

> The height of the rectangle.
> A negative value is an error (see <u>Error processing</u>). A value of zero disables rendering of the element.
> <u>Animatable</u>: yes.

rx = "<u><length></u>"

> For rounded rectangles, the X-axis radius of the ellipse used to round off the corners of the rectangle.
> A negative value is an error (see <u>Error processing</u>).
> See the notes below about what happens if the attribute is not specified.
> <u>Animatable</u>: yes.

ry = "<u><length></u>"

> For rounded rectangles, the Y-axis radius of the ellipse used to round off the corners of the rectangle.
> A negative value is an error (see <u>Error processing</u>).
> See the notes below about what happens if the attribute is not specified.
> <u>Animatable</u>: yes.

Attributes defined elsewhere:

> <u>%stdAttrs;</u>, <u>%langSpaceAttrs;</u>, <u>class</u>, <u>transform</u>, <u>%graphicsElementEvents;</u>, <u>%testAttrs;</u>, <u>externalResourcesRequired</u>, <u>style</u>, <u>%PresentationAttributes-FillStroke;</u>, <u>%PresentationAttributes-Graphics;</u>.

If a properly specified value is provided for <u>rx</u> but not for <u>ry</u>, then the user agent processes the <u>'rect'</u> element with the effective value for <u>ry</u> as equal to <u>rx</u>. If a properly specified value is provided for <u>ry</u> but not for <u>rx</u>, then the user agent processes the <u>'rect'</u> element with the effective value for <u>rx</u> as equal to <u>ry</u>. If neither <u>rx</u> nor <u>ry</u> has a properly specified value, then the user agent processes the <u>'rect'</u> element as if no rounding had been specified, resulting in square corners. If <u>rx</u> is greater than half of the width of the rectangle, then the user agent processes the <u>'rect'</u> element with the effective value for <u>rx</u> as half of the width of the rectangle. If <u>ry</u> is greater than half of the height of the rectangle, then the user agent processes the <u>'rect'</u> element with the effective value for <u>ry</u> as half of the height of the rectangle.

Mathematically, a <u>'rect'</u> element can be mapped to an equivalent <u>'path'</u> element as follows: (Note: all coordinate and length values are first converted into user space coordinates according to <u>Processing rules when using absolute unit identifiers and percentages</u>.)

- perform an absolute <u>moveto</u> operation to location ($x+rx,y$), where x is the value of the <u>'rect'</u> element's <u>x</u> attribute converted to user space, rx is the effective value of the <u>rx</u> attribute converted to user space and y is the value of the <u>y</u> attribute converted to user space

- perform an absolute horizontal <u>lineto</u> operation to location ($x+width-rx,y$), where $width$ is the <u>'rect'</u> element's <u>width</u> attribute converted to user space

- perform an absolute <u>elliptical arc</u> operation to coordinate ($x+width,y+ry$), where the effective values for the <u>rx</u> and <u>ry</u> attributes on the <u>'rect'</u> element converted to user space are used as the rx and ry attributes on the <u>elliptical arc</u> command, respectively, the *x-axis-rotation*

is set to zero, the *large-arc-flag* is set to zero, and the *sweep-flag* is set to one

- perform a absolute vertical *lineto* to location (*x+width,y+height-ry*), where *height* is the 'rect' element's height attribute converted to user space
- perform an absolute elliptical arc operation to coordinate (*x+width-rx,y+height*)
- perform an absolute horizontal *lineto* to location (*x+rx,y+height*)
- perform an absolute elliptical arc operation to coordinate (*x,y+height-ry*)
- perform an absolute absolute vertical *lineto* to location (*x,y+ry*)
- perform an absolute elliptical arc operation to coordinate (*x+rx,y*)

Example rect01 below expresses all values in physical units (centimeters, in this case). The 'rect' element is filled with yellow and stroked with navy.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="12cm" height="4cm">
  <desc>Example rect01 - rectangle expressed in physical units</desc>

  <rect x="4cm" y="1cm" width="4cm" height="2cm"
        style="fill:yellow; stroke:navy; stroke-width:0.1cm" />
</svg>
```
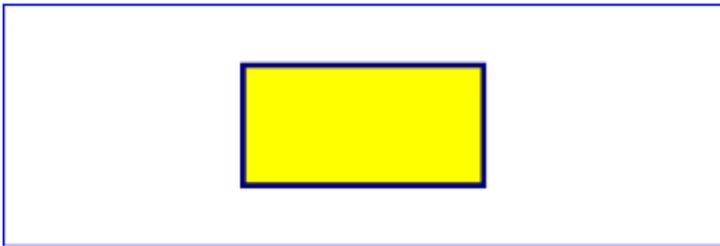

Example rect01

View this example as SVG (SVG-enabled browsers only)

Example rect02 below specifies the coordinates of the two rounded rectangles in the user coordinate system established by the viewBox attribute on the 'svg' element and the transform attribute on the 'g' element. The rx specifies how to round the corners of the rectangles. Note that since no value has been specified for the ry attribute, it will be assigned the same value as the rx attribute.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="12cm" height="4cm" viewBox="0 0 1200 400">
  <desc>Example rect02 - rounded rectangles expressed in user coordinates</desc>

  <rect x="1" y="1" width="1198" height="398"
        style="fill:none; stroke:blue"/>

  <rect x="100" y="100" width="400" height="200" rx="50"
        style="fill:green;" />

  <g transform="translate(700 210) rotate(-30)">
    <rect x="0" y="0" width="400" height="200" rx="50"
          style="fill:none; stroke:purple; stroke-width:30" />
  </g>
</svg>
```
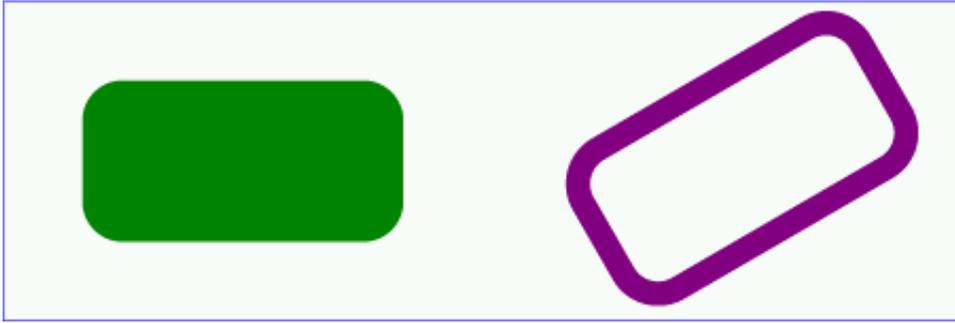
Example rect02

View this example as SVG (SVG-enabled browsers only)

9.3 The 'circle' element

The 'circle' element defines a circle based on a center point and a radius.

```
<!ENTITY % circleExt "" >
<!ELEMENT circle (%descTitleMetadata;,(animate|set|animateMotion|animateColor|animateTransform
                %geExt;%circleExt;)*) >
<!ATTLIST circle
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-Graphics;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;
  cx %Coordinate; #IMPLIED
  cy %Coordinate; #IMPLIED
  r %Length; #REQUIRED >
```

Attribute definitions:

cx = "<coordinate>"

> The X-axis coordinate of the center of the circle.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> Animatable: yes.

cy = "<coordinate>"

> The Y-axis coordinate of the center of the circle.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> Animatable: yes.

r = "<length>"

> The radius of the circle.
> A negative value is an error (see Error processing). A value of zero disables rendering of the element.
> Animatable: yes.

Attributes defined elsewhere:

> %stdAttrs;, %langSpaceAttrs;, class, transform, %graphicsElementEvents;, %testAttrs;, externalResourcesRequired, style,
> %PresentationAttributes-FillStroke;, %PresentationAttributes-Graphics;.

Example circle01 below expresses all values in physical units (centimeters, in this case). The 'circle' element is filled with red and stroked with

blue.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="12cm" height="4cm">
  <desc>Example circle01 - circle expressed in physical units</desc>

  <circle cx="6cm" cy="2cm" r="1cm"
        style="fill:red; stroke:blue; stroke-width:0.1cm" />
</svg>
```
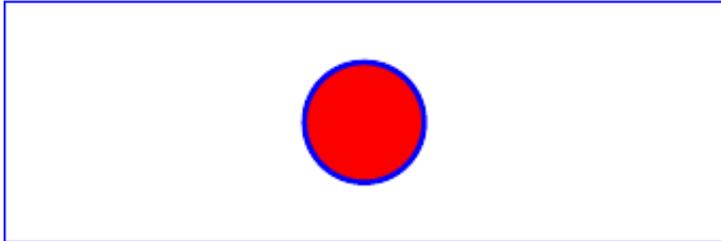

Example circle01

View this example as SVG (SVG-enabled browsers only)

9.4 The 'ellipse' element

The 'ellipse' element defines an ellipse which is axis-aligned with the current user coordinate system based on a center point and two radii.

```
<!ENTITY % ellipseExt "" >
<!ELEMENT ellipse (%descTitleMetadata;,(animate|set|animateMotion|animateColor|animateTransform
                %geExt;%ellipseExt;)*) >
<!ATTLIST ellipse
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-Graphics;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;
  cx %Coordinate; #IMPLIED
  cy %Coordinate; #IMPLIED
  rx %Length; #REQUIRED
  ry %Length; #REQUIRED >
```

Attribute definitions:

cx = "<coordinate>"

> The X-axis coordinate of the center of the ellipse.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> Animatable: yes.

cy = "<coordinate>"

> The Y-axis coordinate of the center of the ellipse.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> Animatable: yes.

rx = "<length>"

The X-axis radius of the ellipse.
A negative value is an error (see Error processing). A value of zero disables rendering of the element.
Animatable: yes.

ry = "<length>"

The Y-axis radius of the ellipse.
A negative value is an error (see Error processing). A value of zero disables rendering of the element.
Animatable: yes.

Attributes defined elsewhere:

%stdAttrs;, %langSpaceAttrs;, class, transform, %graphicsElementEvents;, %testAttrs;, externalResourcesRequired, style, %PresentationAttributes-FillStroke;, %PresentationAttributes-Graphics;.

Example ellipse01 below specifies the coordinates of the two ellipses in the user coordinate system established by the viewBox attribute on the 'svg' element and the transform attribute on the 'g' 'ellipse' elements. Both ellipses uses the default values of zero for the cx and cy attributes (the center of the ellipse). The second ellipse is rotated.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="12cm" height="4cm" viewBox="0 0 1200 400">
  <desc>Example ellipse01 - ellipses expressed in user coordinates</desc>

  <g transform="translate(300 200)">
    <ellipse rx="250" ry="100"
          style="fill:red" />
  </g>

  <ellipse transform="translate(900 200) rotate(-30)"
        rx="250" ry="100"
        style="fill:none; stroke:blue; stroke-width: 20" />

</svg>
```
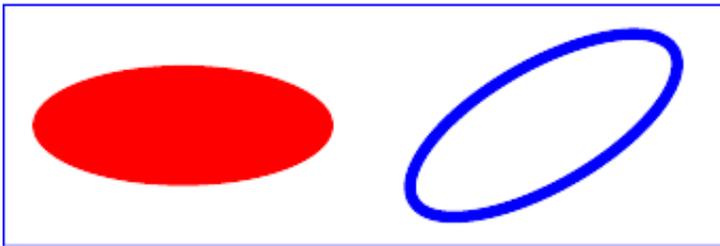

Example ellipse01

View this example as SVG (SVG-enabled browsers only)

9.5 The 'line' element

The 'line' element defines a line segment that starts at one point and ends at another.

```
<!ENTITY % lineExt "" >
<!ELEMENT line (%descTitleMetadata;,(animate|set|animateMotion|animateColor|animateTransform
                %geExt;%lineExt;)*) >
<!ATTLIST line
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-Graphics;
  %PresentationAttributes-Markers;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;
  x1 %Coordinate; #IMPLIED
  y1 %Coordinate; #IMPLIED
  x2 %Coordinate; #IMPLIED
  y2 %Coordinate; #IMPLIED >
```

Attribute definitions:

x1 = "<coordinate>"

> The X-axis coordinate of the start of the line.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> Animatable: yes.

y1 = "<coordinate>"

> The Y-axis coordinate of the start of the line.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> Animatable: yes.

x2 = "<coordinate>"

> The X-axis coordinate of the end of the line.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> Animatable: yes.

y2 = "<coordinate>"

> The Y-axis coordinate of the end of the line.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> Animatable: yes.

Attributes defined elsewhere:

> %stdAttrs;, %langSpaceAttrs;, class, transform, %graphicsElementEvents;, %testAttrs;, externalResourcesRequired, style, %PresentationAttributes-FillStroke;, %PresentationAttributes-Graphics;.

Mathematically, an 'line' element can be mapped to an equivalent 'path' element as follows: (Note: all coordinate and length values are first converted into user space coordinates according to Processing rules when using absolute unit identifiers and percentages.)

- perform an absolute moveto operation to absolute location ($x1,y1$), where $x1$ and $y1$ are the values of the 'line' element's x1 and y1 attributes converted to user space, respectively
- perform an absolute lineto operation to absolute location ($x2,y2$), where $x2$ and $y2$ are the values of the 'line' element's x2 and y2 attributes converted to user space, respectively

Example line01 below specifies the coordinates of the five lines in the user coordinate system established by the viewBox attribute on the 'svg' element. The lines have different thicknesses.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="12cm" height="4cm" viewBox="0 0 1200 400">
  <desc>Example line01 - lines expressed in user coordinates</desc>
```

```
  <g style="fill:none; stroke:green">
    <line x1="100" y1="300" x2="300" y2="100"
          style="stroke-width:5" />
    <line x1="300" y1="300" x2="500" y2="100"
          style="stroke-width:10" />
    <line x1="500" y1="300" x2="700" y2="100"
          style="stroke-width:15" />
    <line x1="700" y1="300" x2="900" y2="100"
          style="stroke-width:20" />
    <line x1="900" y1="300" x2="1100" y2="100"
          style="stroke-width:25" />
  </g>
</svg>
```
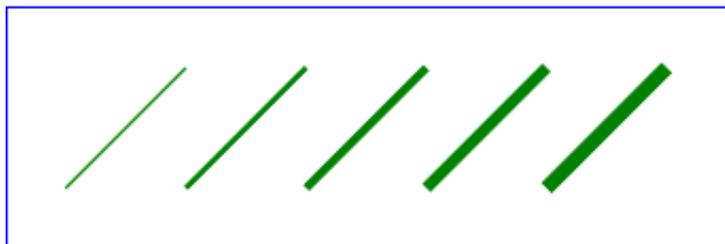

Example line01

View this example as SVG (SVG-enabled browsers only)

9.6 The 'polyline' element

The 'polyline' element defines a set of connected straight line segments. Typically, 'polyline' elements define open shapes.

```
<!ENTITY % polylineExt "" >
<!ELEMENT polyline (%descTitleMetadata;,(animate|set|animateMotion|animateColor|animateTransform
                %geExt;%polylineExt;)*) >
<!ATTLIST polyline
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-Graphics;
  %PresentationAttributes-Markers;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;
  points %Points; #REQUIRED >
```

Attribute definitions:

points = "<list-of-points>"

> The points that make up the polyline. All coordinate values are in the user coordinate system.
> Animatable: yes.

Attributes defined elsewhere:

> %stdAttrs;, %langSpaceAttrs;, class, transform, %graphicsElementEvents;, %testAttrs;, externalResourcesRequired, style,
> %PresentationAttributes-FillStroke;, %PresentationAttributes-Graphics;.

If an odd number of coordinates is provided, then the element is in error, with the same user agent behavior as occurs with an incorrectly specified 'path' element.

Mathematically, a 'polyline' element can be mapped to an equivalent 'path' element as follows: (Note: all coordinate and length values are first converted into user space coordinates according to Processing rules when using absolute unit identifiers and percentages.)

- perform an absolute moveto operation to the first coordinate pair in the list of points
- for each subsequent coordinate pair, perform an absolute lineto operation to that coordinate pair.

Example polyline01 below specifies a polyline in the user coordinate system established by the viewBox attribute on the 'svg' element.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="12cm" height="4cm" viewBox="0 0 1200 400">
  <desc>Example polyline01 - increasingly larger bars</desc>

  <rect x="1" y="1" width="1198" height="398"
        style="fill:none; stroke:blue"/>
  <polyline style="fill:none; stroke:blue; stroke-width:10"
            points="50,375
                    150,375 150,325 250,325 250,375
                    350,375 350,250 450,250 450,375
                    550,375 550,175 650,175 650,375
                    750,375 750,100 850,100 850,375
                    950,375 950,25 1050,25 1050,375
                    1150,375" />
</svg>
```
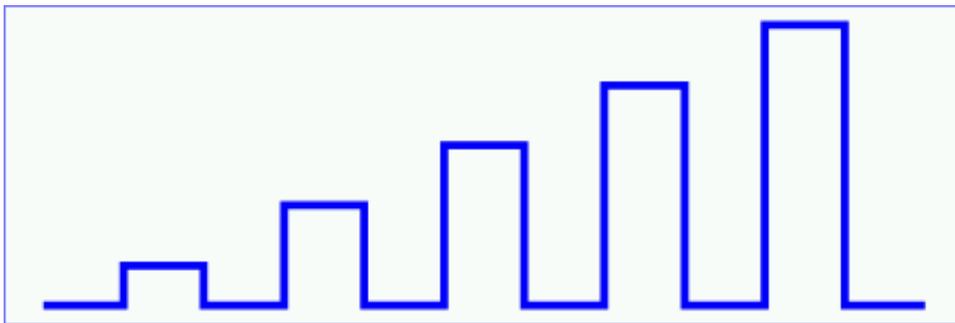

Example polyline01

View this example as SVG (SVG-enabled browsers only)

9.7 The 'polygon' element

The 'polygon' element defines a closed shape consisting of a set of connected straight line segments.

```
<!ENTITY % polygonExt "" >
<!ELEMENT polygon (%descTitleMetadata;,(animate|set|animateMotion|animateColor|animateTransform
              %geExt;%polygonExt;)*) >
<!ATTLIST polygon
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-Graphics;
  %PresentationAttributes-Markers;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;
```

```
          points %Points; #REQUIRED >
```

Attribute definitions:

points = "<list-of-points>"

> The points that make up the polygon. All coordinate values are in the user coordinate system.
> Animatable: yes.

Attributes defined elsewhere:

> %stdAttrs;, %langSpaceAttrs;, class, transform, %graphicsElementEvents;, %testAttrs;, externalResourcesRequired, style, %PresentationAttributes-FillStroke;, %PresentationAttributes-Graphics;.

If an odd number of coordinates is provided, then the element is in error, with the same user agent behavior as occurs with an incorrectly specified 'path' element.

Mathematically, a 'polygon' element can be mapped to an equivalent 'path' element as follows: (Note: all coordinate and length values are first converted into user space coordinates according to Processing rules when using absolute unit identifiers and percentages.)

- perform an absolute moveto operation to the first coordinate pair in the list of points
- for each subsequent coordinate pair, perform an absolute lineto operation to that coordinate pair
- perform a closepath command

Example polygon01 below specifies two polygons (a star and a hexagon) in the user coordinate system established by the viewBox attribute on the 'svg' element.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="12cm" height="4cm" viewBox="0 0 1200 400">
  <desc>Example polygon01 - star and hexagon</desc>

  <polygon style="fill:red; stroke:blue; stroke-width:10"
           points="350,75  379,161 469,161 397,215
                   423,301 350,250 277,301 303,215
                   231,161 321,161" />
  <polygon style="fill:lime; stroke:blue; stroke-width:10"
           points="850,75  958,137.5 958,262.5
                   850,325 742,262.6 742,137.5" />
</svg>
```
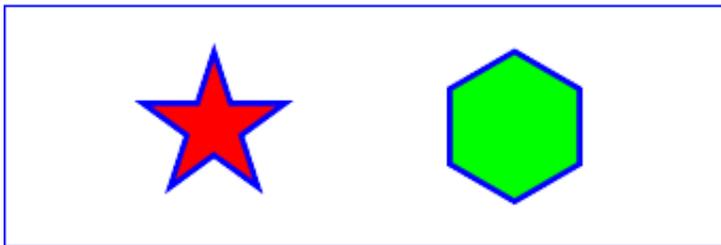

Example polygon01

View this example as SVG (SVG-enabled browsers only)

9.8 The grammar for points specifications in 'polyline' and 'polygon' elements

The following is the BNF for points specifications in 'polyline' and 'polygon' elements. The following notation is used:

- *: 0 or more
- +: 1 or more
- ?: 0 or 1
- (): grouping
- |: separates alternatives

- double quotes surround literals

```
list-of-points:
    wsp* coordinate-pairs? wsp*

coordinate-pairs:
    coordinate-pair
    | coordinate-pair comma-wsp coordinate-pairs

coordinate-pair:
    coordinate comma-wsp coordinate

coordinate:
    number

number:
    sign? integer-constant
    | sign? floating-point-constant

comma-wsp:
    (wsp+ comma? wsp*) | (comma wsp*)

comma:
    ","

integer-constant:
    digit-sequence

floating-point-constant:
    fractional-constant exponent?
    | digit-sequence exponent

fractional-constant:
    digit-sequence? "." digit-sequence
    | digit-sequence "."

exponent:
    ( "e" | "E" ) sign? digit-sequence

sign:
    "+" | "-"

digit-sequence:
    digit
    | digit digit-sequence

digit:
    "0" | "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9"

wsp:
    (#x20 | #x9 | #xD | #xA)+
```

9.9 DOM interfaces

The following interfaces are defined below: SVGRectElement, SVGCircleElement, SVGEllipseElement, SVGLineElement, SVGAnimatedPoints, SVGPolylineElement, SVGPolygonElement.

Interface SVGRectElement

The SVGRectElement interface corresponds to the 'rect' element.

IDL Definition

```
interface SVGRectElement :
            SVGElement,
            SVGTests,
            SVGLangSpace,
            SVGExternalResourcesRequired,
            SVGStylable,
            SVGTransformable,
            events::EventTarget {

    attribute SVGAnimatedLength x;
                // raises DOMException on setting
    attribute SVGAnimatedLength y;
                // raises DOMException on setting
    attribute SVGAnimatedLength width;
                // raises DOMException on setting
    attribute SVGAnimatedLength height;
                // raises DOMException on setting
    attribute SVGAnimatedLength rx;
                // raises DOMException on setting
    attribute SVGAnimatedLength ry;
                // raises DOMException on setting
};
```

Attributes

SVGAnimatedLength x

Corresponds to attribute x on the given 'rect' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength y

Corresponds to attribute y on the given 'rect' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength width

Corresponds to attribute width on the given 'rect' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength height

Corresponds to attribute height on the given 'rect' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength rx

Corresponds to attribute rx on the given 'rect' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength ry

Corresponds to attribute ry on the given 'rect' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGCircleElement

The SVGCircleElement interface corresponds to the 'rect' element.

IDL Definition

```
interface SVGCircleElement :
            SVGElement,
            SVGTests,
            SVGLangSpace,
            SVGExternalResourcesRequired,
            SVGStylable,
            SVGTransformable,
            events::EventTarget {

      attribute SVGAnimatedLength cx;
                  // raises DOMException on setting
      attribute SVGAnimatedLength cy;
                  // raises DOMException on setting
      attribute SVGAnimatedLength r;
                  // raises DOMException on setting
};
```

Attributes

SVGAnimatedLength cx

Corresponds to attribute cx on the given 'circle' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength cy

Corresponds to attribute cy on the given 'circle' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength r

Corresponds to attribute r on the given 'circle' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGEllipseElement

The SVGEllipseElement interface corresponds to the 'ellipse' element.

IDL Definition

```
interface SVGEllipseElement :
            SVGElement,
            SVGTests,
            SVGLangSpace,
            SVGExternalResourcesRequired,
            SVGStylable,
            SVGTransformable,
            events::EventTarget {

      attribute SVGAnimatedLength cx;
                  // raises DOMException on setting
      attribute SVGAnimatedLength cy;
```

```
                            // raises DOMException on setting
            attribute SVGAnimatedLength rx;
                            // raises DOMException on setting
            attribute SVGAnimatedLength ry;
                            // raises DOMException on setting
    };
```

Attributes

    SVGAnimatedLength cx

        Corresponds to attribute cx on the given 'ellipse' element.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

    SVGAnimatedLength cy

        Corresponds to attribute cy on the given 'ellipse' element.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

    SVGAnimatedLength rx

        Corresponds to attribute rx on the given 'ellipse' element.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

    SVGAnimatedLength ry

        Corresponds to attribute ry on the given 'ellipse' element.

        Exceptions on setting

            DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGLineElement

The SVGLineElement interface corresponds to the 'line' element.

IDL Definition

```
    interface SVGLineElement :
                SVGElement,
                SVGTests,
                SVGLangSpace,
                SVGExternalResourcesRequired,
                SVGStylable,
                SVGTransformable,
                events::EventTarget {

            attribute SVGAnimatedLength x1;
                            // raises DOMException on setting
            attribute SVGAnimatedLength y1;
                            // raises DOMException on setting
            attribute SVGAnimatedLength x2;
                            // raises DOMException on setting
            attribute SVGAnimatedLength y2;
                            // raises DOMException on setting
    };
```

Attributes

    SVGAnimatedLength x1

        Corresponds to attribute x1 on the given 'line' element.

        Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength y1

Corresponds to attribute y1 on the given 'line' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength x2

Corresponds to attribute x2 on the given 'line' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength y2

Corresponds to attribute y2 on the given 'line' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGAnimatedPoints

The SVGAnimatedPoints interface supports elements which have a 'points' attribute which holds a list of coordinate values and which support the ability to animate that attribute.

Additionally, the 'points' attribute on the original element accessed via the XML DOM (e.g., using the getAttribute() method call) will reflect any changes made to points.

IDL Definition

```
interface SVGAnimatedPoints {

  readonly attribute SVGList    points;
  readonly attribute SVGList    animatedPoints;
};
```

Attributes

readonly SVGList points

Provides access to the base/static contents of the points attribute.

The various methods from SVGList, which are defined to accept parameters and return values of type Object, must receive parameters of type SVGPoint and return values of type SVGPoint.

readonly SVGList animatedPoints

Provides access to the current animated contents of the points attribute. If the given attribute or property is being animated, contains the current animated value of the attribute or property. If the given attribute or property is not currently being animated, contains the same value as 'points'.

The various methods from SVGList, which are defined to accept parameters and return values of type Object, must receive parameters of type SVGPoint and return values of type SVGPoint.

Interface SVGPolylineElement

The SVGPolylineElement interface corresponds to the 'polyline' element.

IDL Definition

```
interface SVGPolylineElement :
                SVGElement,
                SVGTests,
                SVGLangSpace,
```

```
                SVGExternalResourcesRequired,
                SVGStylable,
                SVGTransformable,
                events::EventTarget,
                SVGAnimatedPoints {};
```

Interface SVGPolygonElement

The SVGPolygonElement interface corresponds to the 'polygon' element.

IDL Definition

```
interface SVGPolygonElement :
                SVGElement,
                SVGTests,
                SVGLangSpace,
                SVGExternalResourcesRequired,
                SVGStylable,
                SVGTransformable,
                events::EventTarget,
                SVGAnimatedPoints {};
```

10 Text

Contents

10.1 Introduction

Text that is to be rendered as part of an SVG document fragment is specified using the 'text' element. The characters to be drawn are expressed as XML character data [XML10] inside the 'text' element.

SVG's 'text' elements are rendered like other graphics elements. Thus, coordinate system transformations, painting, clipping and masking features apply to 'text' elements in the same way as they apply to shapes such as paths and rectangles.

Each 'text' element causes a single string of text to be rendered. SVG performs no automatic line breaking or word wrapping. To achieve the effect of multiple lines of text:

- The author or authoring package needs to pre-compute the line breaks and use multiple 'text' elements (one for each line of text).

- The author or authoring package needs to pre-compute the line breaks and use a single 'text' element with one or more 'tspan' child elements with appropriate values for attributes x, y, dx and dy to set new start positions for those characters which start new lines. (This approach allows user text selection across multiple lines of text -- see Text selection and clipboard operations.)

- Express the text to be rendered in another XML namespace such as XHTML [XHTML] embedded inline within a 'foreignObject' element. (Note: the exact semantics of this approach are not completely defined at this time.)

The text strings within 'text' elements can be rendered in a straight line or rendered along the outline of a 'path' element. SVG supports the following international text processing features for both straight line text and text on a path:

- horizontal and vertical orientation of text
- left-to-right, right-to-left and bi-directional text (e.g., for mixing Roman scripts with Arabic or Hebrew scripts)
- when SVG fonts are used, automatic selection of the correct glyph corresponding to the current form for Arabic and Han text

(The layout rules for straight line text are described in Text layout. The layout rules for text on a path are described in Text on a path layout rules.)

Because SVG text is packaged as XML character data [XML10]:

- Text data in SVG content is readily accessible to the visually impaired (see Accessibility Support)

- In many viewing scenarios, the user will be able to search for and select text strings and copy selected text strings to the system clipboard (see Text selection)

- XML-compatible web search engines will find text strings in SVG content with no additional effort over what they need to do to find text strings in other XML documents

Multi-language SVG content is possible by substituting different text strings based on the user's preferred language.

For accessibility reasons, it is recommended that text which is included in a document have appropriate semantic markup to indicate its function. See SVG accessibility guidelines for more information.

10.2 Characters and their corresponding glyphs

In XML [XML10], textual content is defined in terms of XML characters, where each character is defined by a particular character (i.e., code point) in Unicode [UNICODE]. Fonts, on the other hand, consists of a collection of glyphs, where each glyph consists of some sort of identifier (in some cases a string, in other cases a number) along with drawing instructions for rendering that particular glyph.

In many cases, there is a one-to-one mapping of Unicode characters (i.e., Unicode code points) to glyphs in a font. For example, it is common for a Roman font to contain a single glyph for each of the standard ASCII characters (i.e., A-to-Z, a-to-z, 0-to-9, plus the various punctuation characters found in ASCII). Thus, in most situations, the string "XML", which consists of three Unicode characters, would be rendered by the three glyphs corresponding to "X", "M" and "L", respectively.

In various other cases, however, there is not a strict one-to-one mapping of Unicode characters to glyphs. Some of the circumstances when the mapping is not one-to-one:

- Ligatures - For best looking typesetting, it is often desirable that particular sequences of characters are rendered as a single glyph. An example is the word "office". Many fonts will define an "ffi" ligature. When the word "office" is rendered, sometimes the user agent will render the glyph for the "ffi" ligature instead of rendering distinct glyphs (i.e., "f", "f" and "i") for each of the three characters. Thus, for ligatures, multiple Unicode characters map to a single glyph.

- Composite characters - In various situations, commonly used adornments such as diacritical marks will be stored once in a font as a particular glyph and then composed with one or more other glyphs to result in the desired character. For example, it is possible that a font engine might render the é character by first rendering the glyph for e and then rendering the glyph for ´ (the accent mark) such that the accent mark will appear over the e. In this situation, a single Unicode character map to multiple glyphs.

- Glyph substitution - Some typography systems examine the nature of the textual content and utilize different glyphs in different circumstances. For example, in Arabic, the same Unicode character might render as any of four different glyphs, depending on such factors as whether the character appears at the start, the end or the middle of a text string. In these situations, a single Unicode character might map to one of several alternative glyphs.

- Alternative glyph specification - SVG contains a facility for the author to explicitly specify that a particular sequence of Unicode characters is to be rendered using a particular glyph. (See Alternate glyphs.) When this facility is used, multiple Unicode characters map to a single glyph.

In many situations, the algorithms for mapping from characters to glyphs are system-dependent, resulting in the possibility that the rendering

of text might be (usually slightly) different when viewed in different user environments. If the author of SVG content requires precise selection of fonts and glyphs, then the recommendation is that the necessary fonts (potentially subsetted to only include only the glyphs needed for the given document) be available either as SVG fonts embedded within the SVG content or as web fonts posted at the same web location as the SVG content.

10.3 The 'text' element

The 'text' element defines a graphics element consisting of text. The XML [XML10] character data within the 'text' element, along with relevant attributes and properties and character-to-glyph mapping tables within the font itself, define the glyphs to be rendered. (See Characters and their corresponding glyphs.) The attributes and properties on the 'text' element indicate such things as the writing direction, font specification and painting attributes which describe how exactly to render the characters. Subsequent sections of this chapter describe the relevant text-specific attributes and properties.

Since 'text' elements are rendered using the same rendering methods as other graphics element, all of the same coordinate system transformations, painting, clipping and masking features that apply to shapes such as paths and rectangles also apply to 'text' elements.

It is possible to apply a gradient, pattern, clipping path, mask or filter to text. When one of these facilities is applied to text and keyword objectBoundingBox is used (see Object bounding box units) to specify a graphical effect relative to the "object bounding box", then the object bounding box units are computed relative to the entire 'text' element in all cases, even when different effects are applied to different 'tspan' elements within the same 'text' element.

The 'text' renders its first character at the initial current text position, which is established by the x and y attributes. After the glyph(s) corresponding to the given character is(are) rendered, the current text position is updated for the next character. In the simplest case, the new current text position is the previous current text position plus the glyphs' text advance value (horizontal or vertical). See text layout for a description of glyph placement and glyph advance.

```
<!ENTITY % textExt "" >
<!ELEMENT text (#PCDATA|desc|title|metadata|
                tspan|tref|textPath|altGlyph|a|animate|set|
                animateMotion|animateColor|animateTransform
                %geExt;%textExt;)* >
<!ATTLIST text
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-FontSelection;
  %PresentationAttributes-Graphics;
  %PresentationAttributes-TextContentElements;
  %PresentationAttributes-TextElements;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;
  x %Coordinate; #IMPLIED
  y %Coordinate; #IMPLIED
  textLength %Length; #IMPLIED
  lengthAdjust (spacing|spacingAndGlyphs) #IMPLIED >
```

Attribute definitions:

x = "<coordinate>"

> The X-axis coordinate for the initial current text position for the text to be drawn. If the value is expressed as a simple <number> without a unit identifier (e.g., 48), then the value represents a coordinate in the current user coordinate system.
> If one of the unit identifiers is provided (e.g., 12pt or 10%), then the value represents a distance in viewport units relative to the origin of the user coordinate system. (See Processing rules when using absolute unit identifiers and percentages.)
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> Animatable: yes.

y = "<coordinate>"

> The corresponding Y-axis coordinate for the initial current text position.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> Animatable: yes.

textLength = "<length>"

> The author's computation of the total sum of all of the text advance values that correspond to character data within this element, including the effect of properties 'letter-spacing' and 'word-spacing' and adjustments due to attributes dx and dy on 'tspan' elements.
> This value is used to calibrate the user agent's own calculations with that of the author. The user agent will scale all advance values by the ratio of textLength to the user agent's own computed value for the sum of the advance values.
> A negative value is an error (see Error processing).
> If the attribute is not specified, the effect is as if the author's computation exactly matched the value calculated by the user agent; thus, no advance adjustments are made.
> Animatable: yes.

lengthAdjust = "spacing|spacingAndGlyphs"

> Indicates the type of adjustments which the user agent shall make to make the rendered length of the text match the value specified on the textLength attribute.
> spacing indicates that only the text advance values are adjusted. The glyphs themselves are not stretched or compressed.
> spacingAndGlyphs indicates that the text advance values are adjusted and the glyphs themselves stretched or compressed in one axis (i.e., a direction parallel to the primary text advance direction).
> If the attribute is not specified, the effect is as a value of spacing were specified.
> Animatable: yes.

Attributes defined elsewhere:

> %stdAttrs;, %langSpaceAttrs;, class, transform, %graphicsElementEvents;, %testAttrs;, externalResourcesRequired, style, %PresentationAttributes-FillStroke;, %PresentationAttributes-FontSelection;, %PresentationAttributes-Graphics;, %PresentationAttributes-TextContentElements;, %PresentationAttributes-TextElements;.

Example text01 below expresses all values in physical units such as centimeters and points. The 'text' element contains the text string "Hello, out there" which will be rendered onto the canvas using the Verdana font family with font size of 12 points with the glyphs filled with the color blue.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="10cm" height="3cm">
  <desc>Example text01 - 'Hello, out there' in blue</desc>

  <text x="2.5cm" y="1.5cm"
        style="font-family:Verdana; font-size:16pt; fill:blue">
    Hello, out there
  </text>
</svg>
```
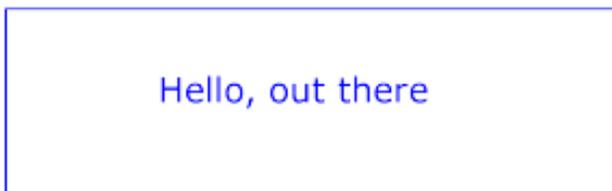

Example text01

View this example as SVG (SVG-enabled browsers only)

Example text02 below expresses the x and y attributes and the 'font-size' property in the user coordinate system set up by the viewBox attribute on the 'svg' element. The 'text' element contains the text string "Text in user space."

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="10cm" height="3cm" viewBox="0 0 1000 300">
```

```
  <desc>Example text02 - Text in user space</desc>

  <text x="250" y="150"
        style="font-family:Verdana; font-size:42.333; fill:blue">
    Text in user space
  </text>
</svg>
```

Text in user space

Example text02

View this example as SVG (SVG-enabled browsers only)

10.4 The 'tspan' element

Within a 'text' element, text and font properties and the current text position can be adjusted with absolute or relative coordinate values by including a 'tspan' element.

```
<!ENTITY % tspanExt "" >
<!ELEMENT tspan (#PCDATA|desc|title|metadata|tspan|tref|altGlyph|a|animate|set|animateColor
                %tspanExt;)* >
<!ATTLIST tspan
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-FontSelection;
  %PresentationAttributes-Graphics;
  %PresentationAttributes-TextContentElements;
  %graphicsElementEvents;
  x %Coordinates; #IMPLIED
  y %Coordinates; #IMPLIED
  dx %Lengths; #IMPLIED
  dy %Lengths; #IMPLIED
  rotate CDATA #IMPLIED
  textLength %Length; #IMPLIED
  lengthAdjust (spacing|spacingAndGlyphs) #IMPLIED >
```

Attribute definitions:

x = "<coordinate>+"

> If a single <coordinate> is provided, this value represents the new absolute X coordinate for the current text position for the first character within the 'tspan' element. If a comma- or space-separated list of <n> <coordinate>s is provided, then the values represent new absolute X coordinates for the current text position for the first <n> characters within the 'tspan' element. If more <coordinate>s are provided than characters, then the extra <coordinate>s will have no effect on glyph positioning. If more characters exist than <coordinate>s, then the starting X coordinate of each extra character is positioned at the X coordinate of the resulting current text position from rendering the previous character within the 'text' element.
>
> unit identifiers, such as cm, pt or %, can be provided for any <coordinate>. If a <coordinate> is provided without a unit identifier (e.g., 48), then the value represents a coordinate in the current user coordinate system. If a unit identifier is provided (e.g., 12pt or 10%), then the value represents a distance in viewport units relative to the origin of the user coordinate system. (Processing rules when using absolute unit identifiers and percentages.)

If the attribute is not specified, the effect is as if the attribute were set to the X coordinate of the current text position.
[Animatable](): yes.

y = "[<coordinate>]()+"

The corresponding list of absolute Y coordinates for the characters within the 'tspan' element.
If the attribute is not specified, the effect is as if the attribute were set to the Y coordinate of the current text position.
[Animatable](): yes.

dx = "[<length>]()+"

If a single <length> is provided, this value represents the new relative X coordinate for the current text position for the first character within the 'tspan' element. Thus, the current text position is shifted along the X axis of the current user coordinate system by <length>. If a comma- or space-separated list of <n> <length>s is provided, then the values represent new relative X coordinates for the current text position for the first <n> characters within the 'tspan' element. Thus, before each character is rendered, the current text position resulting from drawing the previous character (or, for the first character in a ['text']() element, the initial current text position) is shifted along the X axis of the current user coordinate system by <length>. If more <length>s are provided than characters, then any extra <length>s will have no effect on glyph positioning. If more characters exist than <length>s, then the starting X coordinate of each extra character is positioned at the X coordinate of the resulting current text position from rendering the previous character within the ['text']() element.
[unit identifiers](), such as cm, pt or %, can be provided for any <length>. If a <length> is provided without a unit identifier (e.g., 48), then the value represents a length along the X axis in the current user coordinate system. If one of the unit identifiers is provided (e.g., 12pt or 10%), then the value represents a distance in the viewport coordinate system. ([Processing rules when using absolute unit identifiers and percentages]().)
If the attribute is not specified, the effect is as if a value of "0" were specified.
[Animatable](): yes.

dy = "[<length>]()+"

The corresponding list of relative Y coordinates for the characters within the 'tspan' element.
If the attribute is not specified, the effect is as if a value of "0" were specified.
[Animatable](): yes.

rotate = "auto | [<number>]()+"

A value of auto causes all characters to be oriented as specified by other text attributes without any supplemental rotation.
If a single <number> is provided, then this value represents a supplemental rotation about the [current text position]() that will be applied to each glyph corresponding to each character within the 'tspan' element.
If a comma- or space-separated list of <number>s is provided, then the first <number> represents the supplemental rotation of the first character, the second <number> represents the supplemental rotation of the second character, and so on. If more <number>s are provided than there are characters, then the extra <number>s will be ignored. If more characters are provided than <number>s, then the extra characters will be rotated by the last <number> in the list.
This supplemental rotation has no impact on the rules by which [current text position]() is modified as glyphs get rendered.
If the attribute is not specified, the effect is as if a value of "auto" were specified.
[Animatable](): yes (non-additive, 'set' and 'animate' elements only).

textLength = "[<length>]()"

The author's computation of the total sum of all of the text advance values that correspond to character data within this element, including the effect of properties ['letter-spacing']() and ['word-spacing']() and adjustments due to attributes [dx]() and [dy]() on this ['tspan']() element or any descendants. This value is used to calibrate the user agent's own calculations with that of the author. The user agent will scale all advance values by the ratio of textLength to the user agent's own computed value for the sum of the advance values. If attribute length is specified on a given element and also specified on an ancestor, the adjustments on all character data within this element are controlled by the value of textLength on this element exclusively, with the possible side-effect that the adjustment ratio for the contents of this element might be different than the adjustment ratio used for other content that shares the same ancestor. The user agent must assume that the total advance values for the other content within that ancestor is the difference between the advance value on that ancestor and the advance value for this element.
A negative value is an error (see [Error processing]()).
If the attribute is not specified anywhere within a ['text']() element, the effect is as if the author's computation exactly matched the value calculated by the user agent; thus, no advance adjustments are made.
[Animatable](): yes.

Attributes defined elsewhere:

[%stdAttrs;](), [%langSpaceAttrs;](), [class](), [%graphicsElementEvents;](), [%testAttrs;](), [externalResourcesRequired](), [style](), [%PresentationAttributes-FillStroke;](), [%PresentationAttributes-FontSelection;](), [%PresentationAttributes-Graphics;](), [%PresentationAttributes-TextContentElements;](), [lengthAdjust]().

The [x](), [y](), [dx](), [dy]() and [rotate]() on the 'tspan' element are useful in high-end typography scenarios where individual glyphs requires exact placement. These attributes are useful for minor positioning adjustments between characters or for major positioning adjustments, such as

moving the current text position to a new location to achieve the visual effect of a new line of text. Multi-line 'text' elements are possible by defining different 'tspan' elements for each line of text, with attributes x, y, dx and/or dy defining the position of each 'tspan'. (An advantage of such an approach is that users will be able to perform multi-line text selection.)

In situations where advanced typographic control is required and micro-level positioning adjustment are necessary, the SVG content designer needs to ensure that the necessary font will be available for all viewers of the document (e.g., package up the necessary font data in the form of an SVG font or an alternative web font format which is stored at the same web site as the SVG content) and that the viewing software will process the font in the expected way (the capabilities, characteristics and font layout mechanisms vary greatly from system to system). If the SVG content contains x, y, dx or dy attribute values which are meant to correspond to a particular font processed by a particular set of viewing software and either of these requirements is not met, then the text might display with poor quality.

The following additional rules apply to attributes x, y, dx, dy, rotate when they contain a list of numbers:

- Required behavior when multiple XML characters map to a single glyph (e.g., when a ligature is used) - Assume that the i-th and (i+1)-th XML characters map to a single glyph. In this case, the i-th value for the x, y, dx, dy and rotate attributes all apply when rendering the glyph. For the (i+1)-th values, however, the x, y and rotate value are not applied (although the final rotate value would still apply to subsequent characters), whereas the dx and dy are applied to the subsequent XML character (i.e., the (i+2)-th character), if one exists.
- Relationship to right-to-left text and bi-directionality - Text is laid out in a two-step process, where any right-to-left and bi-directional text is first re-ordered into a left-to-right string, and then text layout occurs with the re-ordered text string. Whenever the character data within a 'tspan' element is re-ordered, the corresponding elements within the x, y, dx, dy and rotate are also re-ordered to maintain the correspondence. For example, suppose that you have the following 'tspan' element:

  `<tspan dx="11 12 13 14 15 0 21 22 23 0 31 32 33 34 35 36">Roman and Arabic</span>`

  and that the word "Arabic" will be drawn right-to-left. First, the character data and the corresponding values in the dx list will be reordered, such that the text string will be "Roman and cibarA" and the list of values for the dx attribute will be "11 12 13 14 15 0 21 22 23 0 36 35 34 33 32 31". After this re-ordering, the characters will be positioned using standard left-to-right layout rules.
- Nested 'tspan' elements - The x, y, dx, dy and rotate attributes on a given 'tspan' element apply only to the character data that is directly within that 'tspan' element and do not apply to the character data within child (i.e., nested) 'tspan' elements. If the child/nested 'tspan' elements require positioning adjustments or rotation values, the child/nested 'tspan' elements need to specify x, y, dx, dy and rotate values for their own character data.

The following examples show basic use of the 'tspan' element.

Example tspan01 uses a 'tspan' element to indicate that the word "not" is to use a bold font and have red fill.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="10cm" height="3cm">
  <desc>Example tspan01 - using tspan to change visual attributes</desc>

  <g style="font-family:Verdana; font-size:12pt">
    <text x="2cm" y="1.5cm" style="fill:blue">
      You are
        <tspan style="font-weight:bold; fill:red">not</tspan>
      a banana.
    </text>
  </g>
</svg>
```


Example tspan01

View this example as SVG (SVG-enabled browsers only)

Example tspan02 uses the <u>dx</u> and <u>dy</u> attributes on the 'tspan' to adjust the current text position horizontally and vertically for particular text strings within a <u>'text'</u> element.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="10cm" height="3cm">
  <desc>Example tspan02 - using tspan's dx and dy attributes
        for incremental positioning adjustments</desc>

  <g style="font-family:Verdana; font-size:12pt">
    <text x="2cm" y="1.5cm" style="fill:blue">
      But you
        <tspan dx="2em" dy="-.5cm" style="font-weight:bold; fill:red">
          are
        </tspan>
        <tspan dy="1cm">
          a peach!
        </tspan>
    </text>
  </g>
</svg>
```
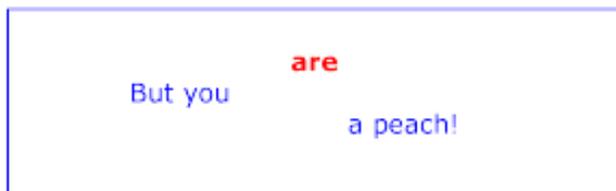

Example tspan02

<u>View this example as SVG (SVG-enabled browsers only)</u>

Example tspan03 uses the <u>x</u> and <u>y</u> attributes on the 'tspan' to establish a new absolute current text position for each glyph to be rendered. The example shows two lines of text within a single <u>'text'</u> element. Because both lines of text are within the same <u>'text'</u> element, the user will be able to select through both lines of text and copy the text to the system clipboard in user agents that support <u>text selection and clipboard operations</u>,

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="10cm" height="3cm">
  <desc>Example tspan03 - using tspan's x and y attributes
        for multiline text and precise glyph positioning</desc>

  <g style="font-family:Verdana; font-size:12pt">
    <text style="fill:rgb(255,164,0)">
      <tspan x="3.0cm 3.5cm 4.0cm 4.5cm 5.0cm 5.5cm 6.0cm 6.5cm" y="1cm">
        Cute and
      </tspan>
      <tspan x="3.75cm 4.25cm 4.75cm 5.25cm 5.75cm" y="2cm">
        fuzzy
      </tspan>
    </text>
  </g>
</svg>
```

Example tspan03

View this example as SVG (SVG-enabled browsers only)

10.5 The 'tref' element

The textual content for a 'text' can be either character data directly embedded within the 'text' element or the character data content of a referenced element, where the referencing is specified with a 'tref' element.

```
<!ENTITY % trefExt "" >
<!ELEMENT tref (desc|title|metadata|animate|set|animateColor
                %trefExt;)* >
<!ATTLIST tref
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #REQUIRED
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-FontSelection;
  %PresentationAttributes-Graphics;
  %PresentationAttributes-TextContentElements;
  %graphicsElementEvents;
  x %Coordinates; #IMPLIED
  y %Coordinates; #IMPLIED
  dx %Lengths; #IMPLIED
  dy %Lengths; #IMPLIED
  rotate CDATA #IMPLIED
  textLength %Length; #IMPLIED
  lengthAdjust (spacing|spacingAndGlyphs) #IMPLIED >
```

Attribute definitions:

xlink:href = "<uri>"

> A URI reference to an element/fragment within an SVG document fragment whose character data content shall be used as character data for this 'tref' element.
> Animatable: yes.

Attributes defined elsewhere:

> %stdAttrs;, %langSpaceAttrs;, class, %graphicsElementEvents;, %testAttrs;, externalResourcesRequired, x, y, dx, dy, rotate, textLength, %xlinkRefAttrs;, style, %PresentationAttributes-FillStroke;, %PresentationAttributes-FontSelection;, %PresentationAttributes-Graphics;, %PresentationAttributes-TextContentElements;, lengthAdjust.

All character data within the referenced element, including character data enclosed within additional markup, will be rendered.

The x, y, dx, dy and rotate attributes have the same meanings as for the 'tspan' element. The attributes are applied as if the 'tref' element was replaced by a 'tspan' with the referenced character data (stripped of all supplemental markup) embedded within the hypothetical 'tspan' element.

Example tref01 shows how to use character data from a different element as the character data for a given 'tspan' element. The first <u>'text'</u> element (with id="ReferencedText") will not draw because it is part of a <u>'defs'</u> element. The second <u>'text'</u> element draws the string "Inline character data". The third <u>'text'</u> element draws the string "Reference character data" because it includes a 'tspan' element which is a reference to element "ReferencedText", and that element's character data is "Referenced character data".

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="10cm" height="3cm">
  <defs>
    <text id="ReferencedText">
      Referenced character data
    </text>
  </defs>
  <desc>Example tref01 - inline vs reference text content</desc>

  <text x="1cm" y="1cm" style="font-size:12pt; fill:blue">
    Inline character data
  </text>
  <text x="1cm" y="2cm" style="font-size:12pt; fill:red">
    <tref xlink:href="#ReferencedText"/>
  </text>
</svg>
```


Example tref01

<u>View this example as SVG (SVG-enabled browsers only)</u>

10.6 The 'glyphRun' element

The 'glyphRun' element provides a way for presenting text as a sequence of particular glyphs from a particular font, which can be used by authoring tools to guarantee correct glyph selection and ordering for the text strings in languages with complex Unicode-to-glyph mapping rules. With 'glyphRun', the glyphs are rendered in exactly the order which has been specified by attribute <u>glyphOrder</u>.

The contents of a 'glyphRun' element are a sequence of <u>'altGlyph'</u> child elements. The Unicode character data contents of the <u>'altGlyph'</u> represent the text data in selection and searching order, and the referenced <u>'altGlyphDef'</u> elements indicate the specific font/glyph combinations to use for rendering that character data. The <u>glyphOrder</u> attribute allows the glyphs to be rendered in a different order.

Properties <u>'direction'</u> and <u>'unicode-bidi'</u> are ignored during processing of a 'glyphRun' element. No character re-ordering (see <u>Relationship with bi-directionality</u>) occurs for the content of a 'glyphRun' element.

```
<!ENTITY % glyphRunExt "" >
<!ELEMENT glyphRun (#PCDATA|desc|title|metadata|altGlyph|a|animate|set|animateColor
                    %glyphRunExt;)* >
<!ATTLIST glyphRun
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-FontSelection;
  %PresentationAttributes-Graphics;
  %PresentationAttributes-TextContentElements;
  %graphicsElementEvents;
  x %Coordinates; #IMPLIED
  y %Coordinates; #IMPLIED
  dx %Lengths; #IMPLIED
  dy %Lengths; #IMPLIED
  rotate CDATA #IMPLIED
  glyphOrder CDATA #IMPLIED
  textLength %Length; #IMPLIED
  lengthAdjust (spacing|spacingAndGlyphs) #IMPLIED >
```

Attribute definitions:

x = "<coordinate>+"

> If a single <coordinate> is provided, this value represents the new absolute X coordinate for the current text position for the first 'altGlyph' (according to the rendering order specified by attribute glyphOrder) within the 'glyphRun' element. If a comma- or space-separated list of <n> <coordinate>s is provided, then the values represent new absolute X coordinates for the current text position for the first <n> first 'altGlyph' within the 'glyphRun' element. If more <coordinate>s are provided than 'altGlyph' elements, then the extra <coordinate>s will have no effect on glyph positioning. If more 'altGlyph' elements exist than <coordinate>s, then the starting X coordinate of each extra 'altGlyph' is positioned at the X coordinate of the resulting current text position from rendering the previous character within the 'text' element.
>
> unit identifiers, such as cm, pt or %, can be provided for any <coordinate>. If a <coordinate> is provided without a unit identifier (e.g., 48), then the value represents a coordinate in the current user coordinate system. If a unit identifier is provided (e.g., 12pt or 10%), then the value represents a distance in viewport units relative to the origin of the user coordinate system. (Processing rules when using absolute unit identifiers and percentages.)
>
> If the attribute is not specified, the effect is as if the attribute were set to the X coordinate of the current text position.
> Animatable: yes.

y = "<coordinate>+"

> The corresponding list of absolute Y coordinates for the 'altGlyph' elements within the 'glyphRun' element.
> If the attribute is not specified, the effect is as if the attribute were set to the Y coordinate of the current text position.
> Animatable: yes.

dx = "<length>+"

> If a single <length> is provided, this value represents the new relative X coordinate for the current text position for the first 'altGlyph' (according to the rendering order specified by attribute glyphOrder) within the 'glyphRun' element. Thus, the current text position is shifted along the X axis of the current user coordinate system by <length>. If a comma- or space-separated list of <n> <length>s is provided, then the values represent new relative X coordinates for the current text position for the first <n> 'altGlyph' elements within the 'glyphRun' element. Thus, before each 'altGlyph' is rendered, the current text position resulting from drawing the previous 'altGlyph' (or, for the first glyph rendered in a 'text' element, the initial current text position) is shifted along the X axis of the current user coordinate system by <length>. If more <length>s are provided than 'altGlyph' elements, then any extra <length>s will have no effect on glyph positioning. If more 'altGlyph' elements exist than <length>s, then the starting X coordinate of each extra character is positioned at the X coordinate of the resulting current text position from rendering the previous 'altGlyph' within the 'text' element.
> unit identifiers, such as cm, pt or %, can be provided for any <length>. If a <length> is provided without a unit identifier (e.g., 48), then the value represents a length along the X axis in the current user coordinate system. If one of the unit identifiers is provided (e.g., 12pt or 10%), then the value represents a distance in the viewport coordinate system. (Processing rules when using absolute unit

identifiers and percentages.)

> If the attribute is not specified, the effect is as if a value of "0" were specified.
> Animatable: yes.

dy = "<length>+"

> The corresponding list of relative Y coordinates for the 'altGlyph' sub-elements within the 'glyphRun' element.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> Animatable: yes.

rotate = "auto | <number>+"

> A value of auto causes all glyphs to be oriented as specified by other text attributes without any supplemental rotation.
> If a single <number> is provided, then this value represents a supplemental rotation about the current text position that will be applied to each 'altGlyph' sub-element rendered within the 'glyphRun' element.
> If a comma- or space-separated list of <number>s is provided, then the first <number> represents the supplemental rotation of the first 'altGlyph' sub-element, the second <number> represents the supplemental rotation of the second 'altGlyph' sub-element, and so on. If more <number>s are provided than there are 'altGlyph' sub-elements, then the extra <number>s will be ignored. If more 'altGlyph' sub-elements are provided than <number>s, then the extra 'altGlyph' sub-element will be rotated by the last <number> in the list.
> This supplemental rotation has no impact on the rules by which current text position is modified as glyphs get rendered.
> If the attribute is not specified, the effect is as if a value of "auto" were specified.
> Animatable: yes (non-additive, 'set' and 'animate' elements only).

glyphOrder = "<integer>+"

> A list of indices which specifies the order in which the 'altGlyph' elements should be rendered. The first 'altGlyph' element is numbered 1.
> The list of <integer>s must contain one value for each positive integer from 1 to <n>, where <n> is the number of indices in the list. (For example, it is illegal to say glyphOrder="1 3 4" because the number "2" is missing.) Failure to meet this constraint makes the document in error.
> If more <integer>s are provided than 'altGlyph' elements, then the extra <integer>s which do not have corresponding 'altGlyph' elements will be skipped.
> If more 'altGlyph' elements exist than <integer>s, then any extra 'altGlyph' elements will be rendered in order after all of the 'altGlyph' elements which have corresponding <integer>s.
> If the attribute is not specified, the effect is as if the attribute contained a list of <integer>s "1 2 3 ..." increasing by 1 up to the number of 'altGlyph' sub-elements in the 'glyphRun' element.
> Animatable: yes.

textLength = "<length>"

> The author's computation of the total sum of all of the text advance values that correspond to character data within this element, including the effect of properties 'letter-spacing' and 'word-spacing' and adjustments due to attributes dx and dy on this 'glyphRun' element or any descendants. This value is used to calibrate the user agent's own calculations with that of the author. The user agent will scale all advance values by the ratio of textLength to the user agent's own computed value for the sum of the advance values. If attribute length is specified on a given element and also specified on an ancestor, the adjustments on all character data within this element are controlled by the value of textLength on this element exclusively, with the possible side-effect that the adjustment ratio for the contents of this element might be different than the adjustment ratio used for other content that shares the same ancestor. The user agent must assume that the total advance values for the other content within that ancestor is the difference between the advance value on that ancestor and the advance value for this element.
> A negative value is an error (see Error processing).
> If the attribute is not specified anywhere within a 'text' element, the effect is as if the author's computation exactly matched the value calculated by the user agent; thus, no advance adjustments are made.
> Animatable: yes.

Attributes defined elsewhere:

> %stdAttrs;, %langSpaceAttrs;, class, %graphicsElementEvents;, %testAttrs;, externalResourcesRequired, style, %PresentationAttributes-FillStroke;, %PresentationAttributes-FontSelection;, %PresentationAttributes-Graphics;, %PresentationAttributes-TextContentElements;, lengthAdjust.

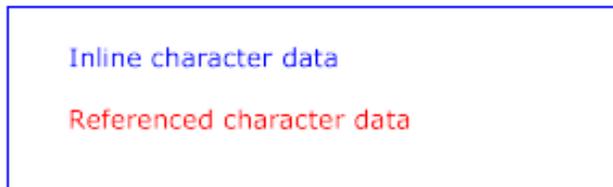To illustrate with an example:

```
<altGlyphDef id="Glyph1">....</altGlyphDef>
<altGlyphDef id="Glyph2">....</altGlyphDef>
<text>
  <glyphRun x="20 30" y="10 10" glyphIndices="2 1">
    <altGlyph xlink:href="Glyph1">A</altGlyph>
```

```
        <altGlyph xlink:href="Glyph2">b</altGlyph>
    </glyphRun>
</text>
```

The result will be that Glyph2 will be rendered at (20,10), and then Glyph1 will be rendered at (30,10).

All white space within a 'glyphRun' that is not part of an <u>'altGlyph'</u> will be ignored.

The value of <u>'writing-mode'</u> determines whether glyph advance is left-to-right, right-to-left or top-to-bottom.

For text selection, when you copy selection to the clipboard, you get the Unicode code points specified inside of the <u>'altGlyph'</u> elements.

If any of the <u>'altGlyph'</u> elements has no character data content within it, then it is assumed to correspond to the previous sibling <u>'altGlyph'</u> which has character data content (i.e., multiple glyphs for a single character). (In this case, it is recommended that user agents do not allow text selection operations to select between glyphs that map to the same character data content.) If there is no previous sibling with character data content, then that <u>'altGlyph'</u> has no corresponding character data content.

10.7 Text layout

10.7.1 Text layout introduction

This section describes the text layout features supported by SVG, which includes support for various international writing directions, such as left-to-right (e.g., Roman scripts), right-to-left (e.g., Hebrew or Arabic), bi-directional (e.g., mixing Roman with Arabic) and vertical (e.g., Asian scripts). The descriptions in this section assume straight line text (i.e., text that is either strictly horizontal or vertical with respect to the current user coordinate system). Subsequent sections describe the supplemental layout rules for <u>text on a path</u>.

Because SVG does not provide for automatic line breaks or word wrapping, internationalized text layout is simpler in SVG than in languages such as XHTML [<u>XHTML</u>].

In processing a given <u>'text'</u> element, the SVG user agent keeps track of the current text position. The initial current text position is established by the <u>x</u> and <u>y</u> attributes on the <u>'text'</u> element. The current text position is adjusted after each glyph to establish a new current text position at which the next glyph shall be rendered. The adjustment to the current text position is based on the current <u>text advance direction</u>, the <u>glyph orientation</u> relative to the text advance direction, the metrics of the glyph just rendered, kerning tables in the font and the current values of various attributes and properties, such as the <u>spacing properties</u> and any <u>x</u>, <u>y</u>, <u>dx</u> and <u>dy</u> attributes on <u>'tspan'</u> elements.

For each glyph to be rendered, the SVG user agent determines an appropriate reference point on the glyph which will be placed exactly at the current text position. The reference point is determined based on character cell metrics in the glyph itself, the current <u>text advance direction</u> and the <u>glyph orientation</u> relative to the text advance direction For the most common uses of Roman text (i.e., <u>'writing-mode:lr'</u>, <u>'text-anchor:start'</u>, and <u>'baseline-identifier:baseline'</u>) the reference point in the glyph will be the intersection of left edge of the glyph character cell (or some other glyph-specific X-axis coordinate indicating a left-side origin point) with the baseline of the glyph. For most cases with top-to-bottom vertical text layout, the reference point will be either a glyph-specific origin point for top-to-bottom vertical text or the intersection of the center of the glyph with its *top line* (see [<u>CSS2</u>] for a definition of *top line*).

The various text layout diagrams in this section use the following symbols:

 - wide-cell glyph (e.g. Han) which is the *n*-th character in the text run

 - narrow-cell glyph (e.g. Roman) which is the *n*-th glyph in the text run

 - connected glyph (e.g. Hebrew or Arabic) which is the *n*-th glyph in the text run

The orientation which the above symbols assume in the diagrams corresponds to the orientation that the glyphs they represent are intended to assume when rendered in the user agent. Spacing between these characters in the diagrams is usually symbolic, unless intentionally changed to make a point.

10.7.2 Setting the primary text advance direction

The 'writing-mode' property specifies whether the primary text advance direction for a 'text' element shall be left-to-right, right-to-left, or top-to-bottom. The 'writing-mode' property applies only to 'text' elements; the property is ignored for 'tspan', 'tref', 'glyphRun' and 'textPath' sub-elements. (Note that even when the primary text advance direction if left-to-right or right-to-left, some or all of the content within a given 'text' element might advance in the opposite direction because of the Unicode [UNICODE] bi-directional algorithm or because of explicit text advance overrides due to properties 'direction' and 'unicode-bidi'. For more on bi-directional text, see Relationship with bi-directionality.)

'writing-mode'

Value:	lr-tb | rl-tb | tb-rl | lr | rl | tb | inherit
Initial:	lr-tb
Applies to:	'text' elements
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	no

lr-tb | lr

> Sets the primary text advance direction to left-to-right, as is common in most Roman-based documents. For most characters, the *current text position* is advanced from left to right after each glyph is rendered. (When the character data includes characters which are subject to the Unicode bi-directional algorithm, the text advance rules are more complex. See Relationship with bi-directionality).

rl-tb | rl

> Sets the primary text advance direction to right-to-left, as is common in Arabic or Hebrew scripts.

tb-rl | tb

> Sets the primary text advance direction to top-to-bottom, as is common in Asian scripts. Though hardly as frequent as horizontal, this type of vertical layout also occurs in Latin based documents, particularly in table column or row labels. In most cases, the vertical baselines running through the middle of each glyph are aligned.

10.7.3 Glyph orientation within a text run

In some cases, it is required to alter the orientation of a sequence of characters relative to the primary text advance direction. The requirement is particularly applicable to vertical layouts of East Asian documents, where sometimes half-width Roman text is to be displayed horizontally and other times vertically.

Two properties control the glyph orientation relative to the primary text advance direction. 'glyph-orientation-vertical' controls glyph orientation when the primary text advance direction is vertical. 'glyph-orientation-horizontal' controls glyph orientation when the primary text advance direction is horizontal.

'glyph-orientation-vertical'

Value:	<angle> | auto | inherit
Initial:	auto
Applies to:	'text', 'tspan', 'tref', 'glyphRun', 'textPath' elements
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	no

<angle>

> The value of the angle is a <integer> restricted to the range of -360 to +360 in 90-degree increments.
> A value of 0 indicates that all glyphs are oriented with the bottom of the glyphs toward the primary text advance direction, resulting in glyphs which are stacked vertically on top of each other. A value of 90 indicates a rotation of 90 degrees clockwise from the "0" orientation. Negative angle values are computed modulo 360; thus, a value of -90 is equivalent to a value of 270.

auto

> The glyph orientation relative to the primary text advance direction is determined automatically based on the Unicode character number of the rendered glyph.
>
> Full-width ideographic and full-width Roman glyphs (excluding ideographic punctuation) are oriented as if an <angle> of "0" had been specified (i.e., glyphs are oriented with the bottom of the glyphs toward the primary text advance direction, resulting in glyphs which are stacked vertically on top of each other).
>
> Ideographic punctuation and other ideographic characters having alternate horizontal and vertical forms shall use the vertical form of the glyph.

Text which is not full-width will be set as if an <angle> of "90" had been specified; thus, half-width Roman text will be rotated 90 degree clockwise versus full-width ideographic and full-width Roman text.

Note that a value of auto will generally produce the expected results in common uses of mixing Japanese with European characters; however, the exact algorithms are based on complex interactions between many factors, including font design, and thus different algorithms might be employed in different processing environments. For precise control, specify explicit <angle> values.

The glyph orientation affects the amount that the current text position advances as each glyph is rendered. When the primary text advance direction is vertical and the 'glyph-orientation-vertical' results in an orientation angle that is a multiple of 180 degrees, then the current text position is incremented according to the vertical metrics of the glyph. Otherwise, if the 'glyph-orientation-vertical' results in an orientation angle that is not a multiple of 180 degrees, then the current text position is incremented according to the horizontal metrics of the glyph.

The diagrams below illustrate different uses of 'glyph-orientation-vertical'. The diagram on the left shows the result of the mixing of full-width ideographic characters with half-width Roman characters when 'glyph-orientation-vertical' for the Roman characters is either auto or 90. The diagram on the right show the result of mixing full-width ideographic characters with half-width Roman characters when Roman characters are specified to have a 'glyph-orientation-vertical' of 0.
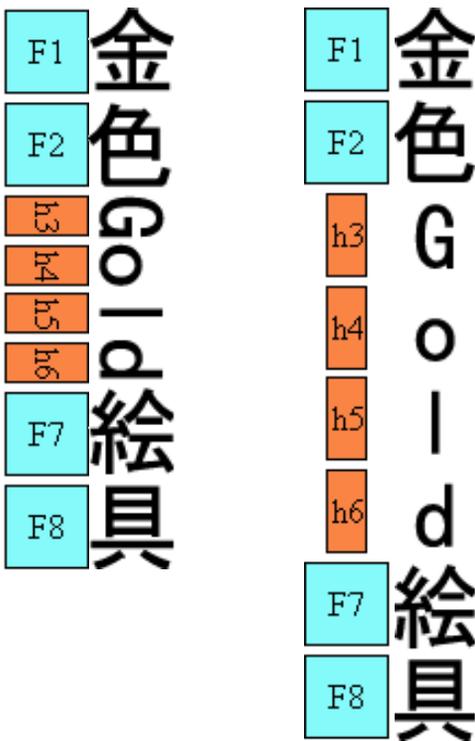
'glyph-orientation-horizontal'

Value:	<angle> | inherit
Initial:	0
Applies to:	'text', 'tspan', 'tref', 'glyphRun', 'textPath' elements
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	no

<angle>

The value of the angle is a <integer> restricted to the range of -360 to +360 in 90-degree increments.

A value of 0 indicates that all glyphs are oriented with the right edge of the glyphs toward the primary text advance direction, resulting in glyphs which are positioned side by side. A value of 90 indicates an orientation of 90 degrees clockwise from the "0" orientation. Negative angle values are computed modulo 360; thus, a value of -90 is equivalent to a value of 270.

The glyph orientation affects the amount that the current text position advances as each glyph is rendered. When the primary text advance direction is horizontal and the 'glyph-orientation-horizontal' results in an orientation angle that is a multiple of 180 degrees, then the current text position is incremented according to the horizontal metrics of the glyph. Otherwise, if the 'glyph-orientation-vertical' results in an orientation angle that is not a multiple of 180 degrees, then the current text position is incremented according to the vertical metrics of the glyph.

10.7.4 Relationship with bi-directionality

The characters in certain scripts are written from right to left. In some documents, in particular those written with the Arabic or Hebrew script, and in some mixed-language contexts, text in a single line may appear with mixed directionality. This phenomenon is called bidirectionality, or "bidi" for short.

The Unicode standard ([UNICODE], section 3.11) defines a complex algorithm for determining the proper directionality of text. The algorithm consists of an implicit part based on character properties, as well as explicit controls for embeddings and overrides. The SVG user agent applies this bidirectional algorithm when determining the layout of characters within a 'text' element. The 'direction' and 'unicode-bidi' properties allow authors to override the inherent directionality of the content characters and thus explicitly control how the elements and attributes of a document language map to this algorithm. These two properties are only applicable when the primary text advance direction is horizontal.

Because the directionality of a text depends on the structure and semantics of the document language, in most cases these properties will be used only by designers of document type descriptions (DTDs) or authors of special documents.

A more complete discussion of bi-directionality can be found in the "Cascading Style Sheets (CSS) level 2" specification [CSS2].

The processing model for right-to-left or bi-directional horizontal text is as follows. The user agent processes the characters which are provided in lexical order and re-orders the characters after processing the Unicode bi-directional algorithm and properties 'direction' and 'unicode-bidi', resulting in a potentially re-ordered list of characters which are now in left-to-right rendering order. Simultaneous with re-ordering of the characters, the x, y, dx, dy and rotate attributes on the 'tspan' and 'tref' elements are also re-ordered to maintain the original correspondence between characters and attribute values. While kerning or ligature processing might be font-specific, the preferred model is that kerning and ligature processing occurs between combinations of characters or glyphs after the characters have been re-ordered. Similarly, text selection occurs on the re-ordered text (i.e., based on visual layout rather than lexical layout).

When included in a 'text' element whose primary text advance direction is vertical, Arabic text has a default orientation where the glyphs are rotated 90 degrees counter-clockwise from standard vertically-oriented glyphs, making the default orientation of the Arabic glyphs the same as for half-width Roman glyphs.

'direction'

Value:	ltr | rtl | inherit
Initial:	ltr
Applies to:	all elements, but see prose
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	no

This property specifies the base writing direction of text and the direction of embeddings and overrides (see 'unicode=bidi') for the Unicode bidirectional algorithm. For the 'direction' property to have any effect, the 'unicode=bidi' property's value must be 'embed' or 'override'.

Except for any additional information provided in this specification, the normative definition of the property is in [CSS2].

The 'direction' property applies only to text whose glyph orientation has the right edge of the glyphs oriented in the same direction as the primary text advance direction, which includes the usual case of horizontally-oriented Roman or Arabic text and the case of half-width Roman or Arabic characters rotated 90 degrees clockwise relative to a top-to-bottom primary text advance direction.

'unicode-bidi'

Value:	normal | embed | bidi-override | inherit
Initial:	normal
Applies to:	all elements, but see prose
Inherited:	no
Percentages:	N/A
Media:	visual
Animatable:	no

Except for any additional information provided in this specification, the normative definition of the property is in [CSS2].

10.8 Alignment properties

10.8.1 Text alignment properties

Each text element establishes an initial current text position. The following property is used to align the contents of a 'text' element relative to the current text position.

'text-anchor'

Value:	start | middle | end | inherit
Initial:	start
Applies to:	'text' elements
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	yes

This property, which applies only to 'text' elements and is ignored for elements 'tspan', 'tref', 'glyphRun' and 'textPath', describes how the characters within a 'text' element are aligned relative to the initial current text position for the 'text' element. Values have the following meanings:

start

 The rendered characters are aligned such that the start of the text string is at the initial current text position. For standard Roman text, this is comparable to left alignment. For Asian text with a vertical primary text direction, this is comparable to top alignment.

middle

 The rendered characters are aligned such that the middle of the text string is at the current text position. (For text on a path, conceptually the text string is first laid out in a straight line. The midpoint between the start of the text string and the end of the text string is determined. Then, the text string is mapped onto the path with this midpoint placed at the current text position.)

end

 The rendered characters are aligned such that the end of the text string is at the initial current text position. For standard Roman text, this is comparable to right alignment.

10.8.2 Baseline alignment properties

One of the characteristics of international text is that there are different baselines (different alignment points) for glyphs in different scripts. For example, in horizontal writing, ideographic scripts, such as Chinese, Japanese and Korean, align the bottoms of the glyphs; alphabetic based scripts, such as Latin, Cyrillic, Hebrew, Arabic, align a point that is the bottom of most glyphs, but some glyphs descend below the baseline; and Indic based scripts are aligned at a point that is near the top of the glyphs.

When different scripts are mixed on a line of text, an adjustment must be made to ensure that the glyphs in the different scripts are aligned relatively correctly with one another. Open Type [OPENTYPE] fonts have a Baseline table (BASE) [OPENTYPE-BASETABLE] that specifies the offsets of the alternative baselines from the current baseline.

SVG uses a similar baseline-table model that assumes one script (at one font-size) is the "dominant run" during processing of a 'text' element; that is, all other baselines are defined in relation to this dominant run. The baseline of the script with the dominant run is called the dominant baseline. So, for example, if the dominant baseline is the alphabetic/Latin baseline, there will be offsets in the baseline-table for the alternate baselines, such as the ideographic baseline and the Indic baseline. There will also be an offset for the math baseline which is used for some math fonts. Note that there are separate baseline tables for horizontal and vertical writing-modes. The offsets in these tables may be different for horizontal and vertical writing.

The dominant baseline is fixed for an entire 'text' element.

The baseline-table establishes at the start of processing of a 'text' element is called the dominant baseline-table.

Because the value of the 'font-family' property is a list of fonts, to insure a consistent choice of baseline-table we define the *nominal font* in a font list as the first font in the list for which a glyph data is available. This is the first that could contain a glyph for each character encountered. (For this definition, glyph data is assumed to be present if a font substitution is made or if the font is synthesized.) This definition insures a content independent determination of the font and baseline table that is to be used.

The value of the 'font-size' property on the 'text' element establishes the dominant baseline-table font size.

The model assumes that each glyph has a 'baseline-identifier' value which specifies the baseline with which the glyph is to be aligned. (The 'baseline-identifier' is called the "Baseline Tag" in the OpenType baseline-table description.) The initial value of the 'baseline-identifier' property uses the baseline identifier associated with the given glyph. Alternate values for 'baseline-identifier' can be useful for glyphs such as a "*" which are ambiguous with respect to script membership.

The model assumes that the font from which the glyph is drawn also has a baseline table, the font baseline-table. This baseline table has

offsets in units-per-em from the (0,0) point to each of the baselines the font knows about. In particular, it has the offset from the glyph's (0,0) point to the baseline identified by the 'baseline-identifier'.

The offset values in the baseline-table are in "design units" which means fractional units of the EM. CSS calls these "units-per-em" [CSS2-UNITSPEREM]. Thus, the current 'font-size' is used to determine the actual offset from the dominant baseline to the alternate baselines.

The glyph is aligned so that its baseline identified by its 'baseline-identifier' is aligned with the baseline with the same name from the dominant baseline-table.

The offset from the dominant baseline of the parent to the baseline identified by the 'baseline-identifier' is computed using the dominant baseline-table and dominant baseline-table font-size. The font baseline-table and font-size applicable to the glyph are used to compute the offset from the identified baseline to the (0,0) point of the glyph. This second offset is subtracted from the first offset to get the position of the (0,0) point in the shift direction. Both offsets are computed by multiplying the baseline value from the baseline-table times the appropriate font-size value.

If the 'baseline-identifier' identifies the dominant baseline, then the first offset is zero and the glyph is aligned with the dominant baseline; otherwise, the glyph is aligned with the chosen alternate baseline.

The baseline-alignment properties follow.

'dominant-baseline'

Value:	auto | autosense-script | no-change | reset| ideographic | lower | hanging | mathematical | inherit
Initial:	auto
Applies to:	'text' elements
Inherited:	no
Percentages:	N/A
Media:	visual
Animatable:	yes

The 'dominant-baseline' property is used to re-determine the dominant baseline and re-establish the font-size used with the baseline-table is added. This property can also be used to explicitly set the dominant baseline when the 'auto' value would give an incorrect result. Values for the property have the following meaning:

auto

If this property occurs on a 'text' element, the dominant-baseline is set using the rules for 'autosense-script' below. Otherwise, the dominant baseline and the baseline-table remain the same as that of the parent. If the 'baseline-shift' value actually shifts the baseline, then the baseline-table font-size is set to the current 'font-size', otherwise the baseline-table font-size remains the same as that of the parent. If there is no parent, the dominant-baseline is set to be the 'lower' baseline, the baseline-table is set for that baseline and the baseline-table font-size is set to the current 'font-size'.

autosense-script

The dominant baseline and the baseline-table are set as follows. Use the first character descendant[, after any re-ordering due to character direction and bi-directionality,] which has an unambiguous script identifier to determine the dominant script of the element's content. Using the nominal font for the element, set the 'dominant-baseline' (and, correspondingly, the dominant baseline-table) to the default baseline, in the current writing-mode, for the dominant script. If there is no such character, then set the 'alphabetic' baseline as the dominant-baseline.

no-change

The dominant baseline, the baseline-table and the baseline-table font-size remain the same as that of the parent.

reset-size

The dominant baseline and the baseline table remain the same, but the baseline-table font-size is changed to the value of the 'font-size' property on this element. This re-scales the baseline table for the current 'font-size'.

ideographic

The dominant baseline is set to the 'ideographic' baseline using the baseline-table and baseline-table font-size of the parent, the baseline table is changed to correspond to the 'ideographic' baseline, and the baseline-table font-size is changed to the value of the 'font-size' property on this element.

hanging

The dominant baseline is set to the 'hanging' baseline using the baseline-table and baseline-table font-size of the parent, the baseline table is changed to correspond to the 'hanging' baseline, and the baseline-table font-size is changed to the value of the 'font-size' property on this element.

lower

The dominant baseline is set to the 'lower' baseline using the baseline-table and baseline-table font-size of the parent, the baseline table is changed to correspond to the 'lower' baseline, and the baseline-table font-size is changed to the value of the 'font-size' property on this element. (The 'lower' baseline is the standard baseline for Roman scripts.)

mathematical

The dominant baseline is set to the 'mathematical' baseline using the baseline-table and baseline-table font-size of the parent, the baseline table is changed to correspond to the 'mathematical' baseline, and the baseline-table font-size is changed to the value of the 'font-size' property on this element.

If there is no baseline-table in the nominal font or if the baseline-table lacks an entry for the desired baseline, then the User Agent may use heuristics to determine the position of the desired baseline.

'baseline-identifier'

Value:	baseline | top | before-edge | text-top | text-before-edge | middle | bottom | after-edge | text-bottom | text-after-edge | ideographic | lower | hanging | mathematical | inherit
Initial:	see text below
Applies to:	'text', 'tspan', 'tref', 'glyphRun', 'textPath' elements
Inherited:	no
Percentages:	N/A
Media:	visual
Animatable:	yes

For SVG, the initial value is the dominant baseline of the *nominal font* for the first character in the 'text' element [after any re-ordering due to character direction and bi-directionality].

For the values below, the alignment-point defaults to the baseline with the same name as the value. That is, for the value 'ideographic' the alignment-point is the 'ideographic' baseline of the object being aligned. Values have the following meanings:

baseline

The alignment-point of the object being aligned is aligned with the dominant baseline of the parent.

top

The alignment point of the box is aligned with the 'top' baseline of the parent.

before-edge

The alignment point of the box is aligned with the 'before-edge' baseline of the parent. [The 'before-edge' is the relative equivalent of 'top'. 'before-edge' works for both horizontal and vertical writing-modes. Thus, for common horizontal writing-modes, 'before-edge' is the same as 'top' and, for vertical writing modes, 'before-edge' is equivalent to 'right' for 'TB-RL' writing-mode and to 'left' for TB-LR' writing-mode.]

text-top

The alignment-point of the object being aligned is aligned with the 'text-top' baseline of the parent.

text-before-edge

The alignment-point of the object being aligned is aligned with the 'text-before-edge' baseline of the parent. [The 'text-before-edge' is the relative equivalent of 'text-top'. 'text-before-edge' works for both horizontal and vertical writing-modes.]

bottom

The alignment point of the box is aligned with the 'bottom' baseline of the parent.

after-edge

The alignment point of the box is aligned with the 'after-edge' baseline of the parent. [The 'after-edge' is the relative equivalent of 'bottom'. 'after-edge' works for both horizontal and vertical writing-modes.]

text-bottom

The alignment-point of the object being aligned is aligned with the 'text-bottom' baseline of the parent.

text-after-edge

The alignment-point of the object being aligned is aligned with the 'text-after-edge' baseline of the parent. [The 'text-after-edge' is the relative equivalent of 'text-bottom'. 'text-after-edge' works for both horizontal and vertical writing-modes.]

middle

The alignment point of the box is aligned with the midpoint of the EM box of the nominal font when that EM box is positioned on the dominant baseline.

ideographic

The alignment-point of the object being aligned is aligned with the ideographic baseline of the parent.

alphabetic

> The alignment-point of the object being aligned is aligned with the alphabetic baseline of the parent.

hanging

> The alignment-point of the object being aligned is aligned with the hanging baseline of the parent.

mathematical

> The alignment-point of the object being aligned is aligned with the mathematical baseline of the parent.

The offset of the 'text-top' baseline is determined by the ascent of the nominal font relative to the dominant baseline multiplied by the computed value of the 'font-size' property. The ascent is measured in units-per-em The determination of the 'text-before-edge', 'text-bottom' and 'text-after-edge' baseline offsets is analogous; the descent of the nominal font is used for 'text-bottom' and 'text-after-edge'.

'baseline-shift'

Value:	baseline | sub | super | <u><percentage></u> | <u><length></u> | inherit
Initial:	baseline
Applies to:	<u>'text'</u>, <u>'tspan'</u>, <u>'tref'</u>, <u>'glyphRun'</u> and <u>'textPath'</u> elements
Inherited:	no
Percentages:	refers to the 'line-height' of the <u>'text'</u> element, which in the case of SVG is defined to be equal to the 'font-size'
Media:	visual
<u>*Animatable*</u>:	yes (non-additive, 'set' and 'animate' elements only)

The 'baseline-shift' property allows repositioning of the dominant-baseline relative to the dominant-baseline of the <u>'text'</u> element. The shifted object might be a sub- or superscript. Within the shifted object, the whole baseline table is offset; not just a single baseline. The amount of the shift is determined from information from the parent, the sub- or superscript offset from the nominal font of the parent, percent of the 'line-height' of the parent or an absolute value.

Values for the property have the following meaning:

baseline

> There is no baseline shift; the dominant baseline remains where it is.

sub

> The dominant baseline is shifted to the default position for subscripts. The offset to this position is determined by the font data for the nominal font as adjusted by the dominant baseline-table font-size.

super

> The dominant baseline is shifted to the default position for superscripts. The offset to this position is determined by the font data for the nominal font as adjusted by the dominant baseline-table font-size.

<percentage>

> The computed value of the property is this percentage multiplied by the computed 'line-height' of the <u>'text'</u> element. A value of '0%' is equivalent to 'baseline'.

<length>

> The dominant baseline is shifted by the <length> value. A value of '0cm' is equivalent to 'baseline'.

10.9 Font selection properties

SVG uses the following font specification properties. Except for any additional information provided in this specification, the normative definition of the property is in [CSS2]. Any SVG-specific notes about these properties are contained in the descriptions below.

'font-family'

Value:	[[<family-name> | <generic-family>],]* [<family-name> | <generic-family>] | inherit
Initial:	depends on user agent
Applies to:	all elements
Inherited:	yes
Percentages:	N/A
Media:	visual
<u>*Animatable*</u>:	yes

This property indicates which font family is to be used to render the text, specified as a prioritized list of font family names and/or generic family names. Except for any additional information provided in this specification, the normative definition of the property is in [CSS2].

'font-style'

Value:	normal | italic | oblique | inherit
Initial:	normal
Applies to:	all elements
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	yes

This property specifies whether the text is to be rendered using a normal, italic or oblique face. Except for any additional information provided in this specification, the normative definition of the property is in [CSS2].

'font-variant'

Value:	normal | small-caps | inherit
Initial:	normal
Applies to:	all elements
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	yes

This property indicates whether the text is to be rendered using the normal glyphs for lowercase characters or using small-caps glyphs for lowercase characters. Except for any additional information provided in this specification, the normative definition of the property is in [CSS2].

'font-weight'

Value:	normal | bold | bolder | lighter | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | inherit
Initial:	normal
Applies to:	all elements
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	yes

This property refers to the boldness or lightness of the glyphs used to render the text, relative to other fonts in the same font family. Except for any additional information provided in this specification, the normative definition of the property is in [CSS2].

'font-stretch'

Value:	normal | wider | narrower | ultra-condensed | extra-condensed | condensed | semi-condensed | semi-expanded | expanded | extra-expanded | ultra-expanded | inherit
Initial:	normal
Applies to:	all elements
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	yes

This property indicates the desired amount of condensing or expansion in the glyphs used to render the text. Except for any additional information provided in this specification, the normative definition of the property is in [CSS2].

'font-size'

Value:	<absolute-size> | <relative-size> | <length> | <percentage> | inherit
Initial:	medium
Applies to:	all elements
Inherited:	yes, the computed value is inherited
Percentages:	refer to parent element's font size
Media:	visual
Animatable:	yes

This property refers to the size of the font from baseline to baseline when multiple lines of text are set solid in a multiline layout environment. For SVG, if a <length> is provided without a unit identifier (e.g., an unqualified number such as 128), the SVG user agent processes the <length> as a height value in the current user coordinate system.

If a <length> is provided with one of the unit identifiers (e.g., 12pt or 10%), then the SVG user agent converts the <length> into a corresponding value in the current user coordinate system by applying the Processing rules when using absolute unit identifiers and percentages.

Except for any additional information provided in this specification, the normative definition of the property is in [CSS2].

'font-size-adjust'

Value:	<number>	none	inherit
Initial:	none
Applies to:	all elements
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	yes (non-additive, 'set' and 'animate' elements only)

This property allows authors to specify an aspect value for an element that will preserve the x-height of the first choice font in a substitute font. Except for any additional information provided in this specification, the normative definition of the property is in [CSS2].

'font'

Value:	[[<'font-style'> || <'font-variant'> || <'font-weight'>]?
	<'font-size'> [/ <'line-height'>]? <'font-family'>]	
	caption	icon	menu	message-box|
	small-caption	status-bar	inherit
Initial:	see individual properties
Applies to:	all elements
Inherited:	yes
Percentages:	allowed on 'font-size' and 'line-height' ('line-height' same as 'font-size' in SVG)
Media:	visual
Animatable:	yes (non-additive, 'set' and 'animate' elements only)

Shorthand property for setting 'font-style', 'font-variant', 'font-weight', 'font-size', 'line-height' and 'font-family'. The 'line-height' property has no visual effect in SVG. Conforming SVG Viewers are not required to support the various system font options (caption, icon, menu, message-box, small-caption and status-bar) and can use a system font or one of the generic fonts instead.

Except for any additional information provided in this specification, the normative definition of the property is in [CSS2].

10.10 Spacing properties

'letter-spacing'

Value:	normal	<length>	inherit
Initial:	normal
Applies to:	all elements
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	yes

This property specifies spacing behavior between text characters. For SVG, if a <length> is provided without a unit identifier (e.g., an unqualified number such as 128), the SVG user agent processes the <length> as a width value in the current user coordinate system.

If a <length> is provided with one of the unit identifiers (e.g., .25em or 1%), then the SVG user agent converts the <length> into a corresponding value in the current user coordinate system by applying the Processing rules when using absolute unit identifiers and percentages.

Except for any additional information provided in this specification, the normative definition of the property is in [CSS2].

'word-spacing'

Value:	normal	<length>	inherit
Initial:	normal
Applies to:	all elements
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	yes

This property specifies spacing behavior between words. For SVG, if a <length> is provided without a unit identifier (e.g., an unqualified

number such as 128), the SVG user agent processes the <length> as a width value in the current user coordinate system.

If a <length> is provided with one of the [unit identifiers](#) (e.g., .25em or 1%), then the SVG user agent converts the <length> into a corresponding value in the current user coordinate system by applying the [Processing rules when using absolute unit identifiers and percentages](#).

Except for any additional information provided in this specification, the normative definition of the property is in [[CSS2](#)].

10.11 Text decoration

'text-decoration'

Value:	none | [underline || overline || line-through || blink] | inherit
Initial:	none
Applies to:	all elements
Inherited:	no (see prose)
Percentages:	N/A
Media:	visual
[*Animatable*](#):	yes

This property describes decorations that are added to the text of an element. [Conforming SVG Viewers](#) are not required to support the **blink** value.

Except for any additional information provided in this specification, the normative definition of the property is in [[CSS2](#)].

The CSS2 specification [[CSS2](#)] defines the behavior of the 'text-decoration' property using the terminology "block-level elements" and "inline elements". For the purposes of the 'text-decoration' property and SVG, a ['text'](#) element represents a block-level element and any of the potential children of a ['text'](#) element (e.g., a ['tspan'](#)) represent inline elements.

Also, the CSS2 definition of 'text-decoration' specifies that the "color of the decorations" remain the same on descendant elements. Since SVG offers a painting model consisting of the ability to apply various types of paint (see [Painting: Filling, Stroking and Marker Symbols](#)) to both the interior (i.e., the "fill") and the outline (i.e., the "stroke") of text, for SVG the 'text-decoration' property is defined such that, for an element which has a specified value for the 'text-decoration' property, all decorations on its content and that of its descendants are rendered using the same fill/stroke properties as are present on the given element. If the 'text-decoration' property is specified on a descendant, then that overrides the ancestor.

Example textdecoration01, which uses an internal CSS style sheet, provides examples for 'text-decoration'. The first line of text has no value for 'text-decoration', so the initial value of 'text-decoration:none' is used. The second line shows 'text-decoration:line-through'. The third line shows 'text-decoration:underline'. The fourth line illustrates the rule whereby decorations are rendered using the same fill/stroke properties as are present on the element for which the 'text-decoration' is specified. Since 'text-decoration' is specified on the ['text'](#) element, all text within the ['text'](#) element has its underline rendered with the same fill/stroke properties as exist on the ['text'](#) element (i.e., blue fill, red stroke), even though the various words have different fill/stroke property values. However, the word "different" explicitly specifies a value for 'text-decoration'; thus, its underline is rendered using the fill/stroke properties as the ['tspan'](#) element that surrounds the word "different" (i.e., yellow fill, darkgreen stroke):

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="12cm" height="4cm" viewBox="0 0 1200 400">
  <desc>Example textdecoration01 - behavior of 'text-decoration' property</desc>
  <defs>
    <style type="text/css"><![CDATA[
      text { font-size:60; fill:blue; stroke:red; stroke-width: 1 }
    ]]></style>
  </defs>
  <rect x="1" y="1" width="1198" height="398" style="fill:none; stroke:blue"/>
  <text x="100" y="75">Normal text</text>
  <text x="100" y="165" style="text-decoration:line-through">Text with line-through</text>
  <text x="100" y="255" style="text-decoration:underline">Underlined text</text>
  <text x="100" y="345" style="text-decoration:underline">
    <tspan>One </tspan>
    <tspan style="fill:yellow; stroke:purple">word </tspan>
    <tspan style="fill:yellow; stroke:black">has </tspan>
    <tspan style="fill:yellow; stroke:darkgreen; text-decoration:underline">different</tspan>
    <tspan style="fill:yellow; stroke:blue"> underlining</tspan>
```

```
    </text>
</svg>
```
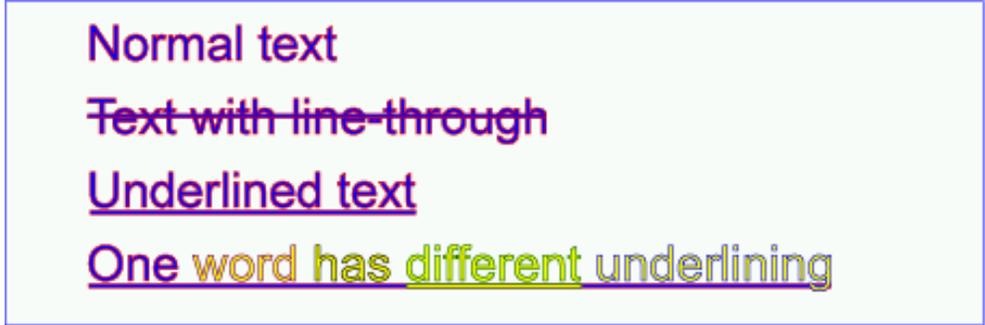

Example textdecoration01

View this example as SVG (SVG-enabled and CSS-enabled browsers only)

10.12 Text on a path

10.12.1 Introduction to text on a path

In addition to text drawn in a straight line, SVG also includes the ability to place text along the shape of a 'path' element. To specify that a block of text is to be rendered along the shape of a 'path', include the given text within a 'textPath' element which includes an xlink:href attribute with a URI reference to a 'path' element.

10.12.2 The 'textPath' element

```
<!ENTITY % textPathExt "" >
<!ELEMENT textPath (#PCDATA|desc|title|metadata|tspan|tref|altGlyph|a|animate|set|animateColor
                 %textPathExt;)* >
<!ATTLIST textPath
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #REQUIRED
  %langSpaceAttrs;
  %testAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-FontSelection;
  %PresentationAttributes-Graphics;
  %PresentationAttributes-TextContentElements;
  %graphicsElementEvents;
  startOffset CDATA #IMPLIED
  textLength %Length; #IMPLIED
  lengthAdjust (spacing|spacingAndGlyphs) #IMPLIED
  method (align|stretch) #IMPLIED
  spacing (auto|exact) #IMPLIED >
```

Attribute definitions:

startOffset = "<length> | <percentage>"

> An offset from the start of the 'path' for the initial current text position, calculated using the user agent's distance along the path algorithm. If a <length> without a percentage is given, then the startOffset represents a distance along the path measured in the current user coordinate system.

If a <u><percentage></u> is given, then the startOffset represents a percentage distance along the entire path. Thus, startOffset="0%" indicates the start point of the <u>'path'</u> and startOffset="100%" indicates the end point of the <u>'path'</u>.

A negative value is an error (see <u>Error processing</u>).

If the attribute is not specified, the effect is as if a value of "0" were specified.

<u>Animatable</u>: yes.

method = "align | stretch"

Indicates the method by which text should be rendered along the path.

A value of align indicates that the glyphs should be rendered using simple 2x3 transformations such that there is no stretching/warping of the glyphs. Typically, supplemental rotation, scaling and translation transformations are done for each glyph to be rendered. As a result, with align, fonts where the glyphs are designed to be connected (e.g., cursive fonts), the connections may not align properly when text is rendered along a path.

A value of stretch indicates that the glyph outlines will be converted into paths, and then all end points and control points will be adjusted to be along the perpendicular vectors from the path, thereby stretching/warping the glyphs. This approach will result in connected/cursive glyphs maintaining their connections.

If the attribute is not specified, the effect is as if a value of align were specified.

<u>Animatable</u>: yes.

spacing = "auto | exact"

Indicates how the user agent should determine the spacing between glyphs that are to be rendered along a path.

A value of exact indicates that the glyphs should be rendered exactly according to the spacing rules as specified in <u>Text on a path layout rules</u>.

A value of auto indicates that the user agent should use text-on-a-path layout algorithms to adjust the spacing between glyphs in order to achieve visually appealing results.

If the attribute is not specified, the effect is as if a value of exact were specified.

<u>Animatable</u>: yes.

xlink:href = "<u><uri></u>"

A <u>URI reference</u> to the <u>'path'</u> element onto which the glyphs will be rendered. If <uri> is an invalid reference (e.g., no such element exists, or the referenced element is not a <u>'path'</u>), then the 'textPath' element is in error and its entire contents shall not be rendered by the user agent.

<u>Animatable</u>: yes.

Attributes defined elsewhere:

<u>%stdAttrs;</u>, <u>%langSpaceAttrs;</u>, <u>class</u>, <u>%graphicsElementEvents;</u>, <u>%testAttrs;</u>, <u>externalResourcesRequired</u>, <u>textLength</u>, <u>%xlinkRefAttrs;</u>, <u>style</u>, <u>%PresentationAttributes-FillStroke;</u>, <u>%PresentationAttributes-FontSelection;</u>, <u>%PresentationAttributes-Graphics;</u>, <u>%PresentationAttributes-TextContentElements;</u>, <u>lengthAdjust</u>.

Example toap01 provides a simple example of text on a path:

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="10cm" height="3cm" viewBox="0 0 1000 300">
  <defs>
    <path id="MyPath"
          d="M 100 200
             C 200 100 300   0 400 100
             C 500 200 600 300 700 200
             C 800 100 900 100 900 100" />
  </defs>
  <desc>Example toap01 - simple text on a path</desc>

  <use xlink:href="#MyPath" style="fill:none; stroke:red" />
  <text style="font-family:Verdana; font-size:42.3333; fill:blue">
    <textPath xlink:href="#MyPath">
      We go up, then we go down, then up again
    </textPath>
  </text>
</svg>
```
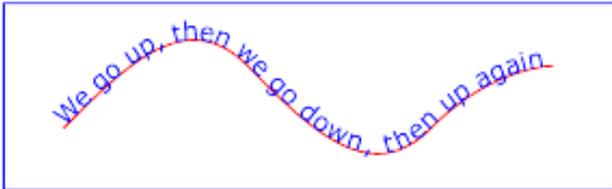
Example toap01

Example toap02 shows how 'tspan' elements can be included within 'textPath' elements to adjust styling attributes and adjust the current text position before rendering a particular glyph. The first occurrence of the word "up" is filled with the color red. Attribute dy is used to lift the word "up" from the baseline.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="10cm" height="3cm" viewBox="0 0 1000 300">
  <defs>
    <path id="MyPath"
          d="M 100 200
             C 200 100 300    0 400 100
             C 500 200 600 300 700 200
             C 800 100 900 100 900 100" />
  </defs>
  <desc>Example toap02 - tspan within textPath</desc>

  <use xlink:href="#MyPath" style="fill:none; stroke:red" />
  <text style="font-family:Verdana; font-size:42.3333; fill:blue">
    <textPath xlink:href="#MyPath">
      We go
      <tspan dy="-30" style="fill:red">
        up
      </tspan>
      <tspan dy="30">
        ,
      </tspan>
      then we go down, then up again
    </textPath>
  </text>
</svg>
```
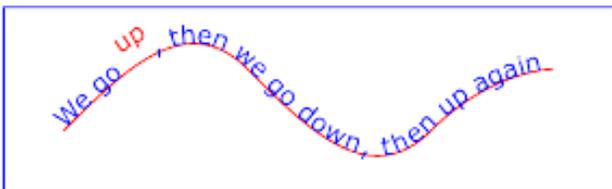

Example toap02

Example toap03 demonstrates the use of the startOffset attribute on the 'textPath' element to specify the start position of the text string as a particular position along the path. Notice that glyphs that fall off the end of the path are not rendered (see text on a path layout rules).

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="10cm" height="3cm" viewBox="0 0 1000 300">
  <defs>
    <path id="MyPath"
```

```
          d="M 100 200
             C 200 100 300    0 400 100
             C 500 200 600 300 700 200
             C 800 100 900 100 900 100" />
  </defs>
  <desc>Example toap03 - text on a path with startOffset attribute</desc>

  <use xlink:href="#MyPath" style="fill:none; stroke:red" />
  <text style="font-family:Verdana; font-size:42.3333; fill:blue">
    <textPath xlink:href="#MyPath" startOffset="80%">
      We go up, then we go down, then up again
    </textPath>
  </text>
</svg>
```
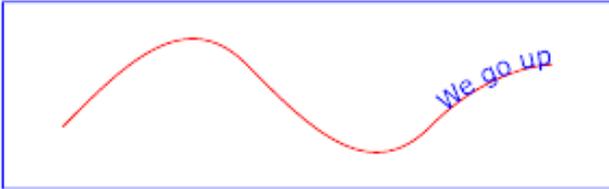
Example toap03

10.12.3 Text on a path layout rules

Example toap04 will be used to illustrate the particular layout rules for text on a path that supplement the basic text layout rules for straight line horizontal or vertical text.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="10cm" height="3cm" viewBox="0 0 1000 300">
  <defs>
    <path id="MyPath"
          d="M 100 100
             C 150 100 250 200 300 200
             C 350 200 450 100 500 100
             C 550 100 650 200 700 200
             C 750 200 850 100 900 100" />
  </defs>
  <desc>Example toap04 = text on a path layout rules</desc>

  <use xlink:href="#MyPath" style="fill:none; stroke:red" />
  <text style="font-family:Verdana; font-size:63.5; fill:blue">
    <textPath xlink:href="#MyPath">
      Choose shame or get war
    </textPath>
  </text>
</svg>
```
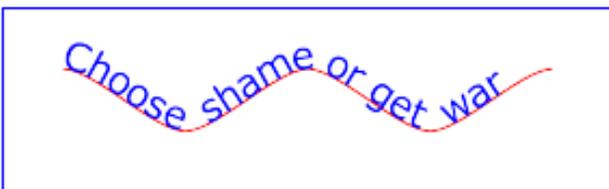
Example toap04

The following picture does an initial zoom in on the first glyph in the 'text' element.
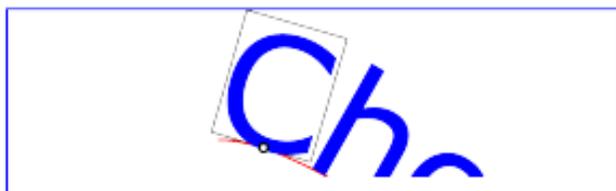
The small dot above shows the point at which the glyph is attached to the path. The box around the glyph shows the glyph is rotated such that its horizontal axis is parallel to the tangent of the curve at the point at which the glyph is attached to the path. The box also shows the glyph's charwidth (i.e., the amount which the current text position advances horizontally when the glyph is drawn using horizontal text layout).

The next picture zooms in further to demonstrate the detailed layout rules.
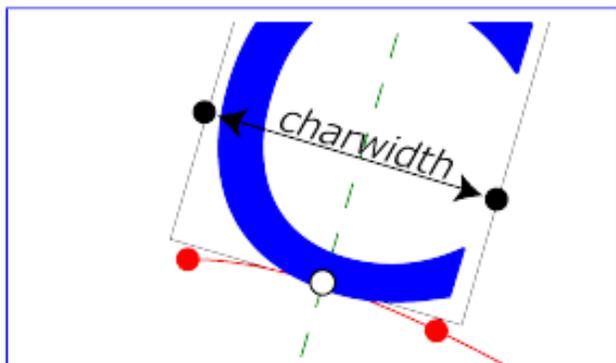
For horizontal text layout along a path, the layout rules are as follows:

- Determine the startpoint-on-the-path for the first glyph using attribute startOffset and, if present, the dx attribute on a 'tspan' element. (In the picture above, the startpoint-on-the-path is the leftmost dot on the path.)
- Determine the glyph's charwidth (i.e., the amount which the current text position advances horizontally when the glyph is drawn using horizontal text layout). (In the picture above, the charwidth is the distance between the two dots at the side of the box.)
- Determine the point on the curve which is charwidth distance along the path from the startpoint-on-the-path for this glyph, calculated using the user agent's distance along the path algorithm. This point is the endpoint-on-the-path for the glyph. (In the picture above, the endpoint-on-the-path for the glyph is the rightmost dot on the path.)
- Determine the midpoint-on-the-path, which is the point on the path which is "halfway" (user agents can choose either a distance calculation or a parametric calculation) between the startpoint-on-the-path and the endpoint-on-the-path. (In the picture above, the midpoint-on-the-path is shown as a white dot.)
- Determine the glyph-midline, which is the vertical line in the glyph's coordinate system that goes through the glyph's X-axis midpoint. (In the picture above, the glyph-midline is shown as a dashed line.)
- Position the glyph such that the glyph-midline passes through the midpoint-on-the-path and is perpendicular to the line through the startpoint-on-the-path and the endpoint-on-the-path.
- Align the glyph vertically relative to the midpoint-on-the-path based on property 'baseline-identifier' and any specified values for attribute dy on a 'tspan' element. In the example above, the 'baseline-identifier' property is unspecified, so the initial value of 'baseline-identifier:baseline' will be used. There are no 'tspan' elements; thus, the baseline of the glyph is aligned to the midpoint-on-the-path.
- For each subsequent glyph, set a new startpoint-on-the-path as the previous endpoint-on-the-path, but with appropriate adjustments taking into account kerning tables in the font and current values of various attributes and properties, including spacing properties and 'tspan' elements with values provided for attributes dx and dy. All adjustments are calculated as distance adjustments along the path, calculated using the user agent's distance along the path algorithm.
- Glyphs whose midpoint-on-the-path are off the end of the path are not rendered.
- Continue rendering glyphs until there are no more glyphs.

In the calculations above, if either the startpoint-on-the-path or the endpoint-on-the-path is off the end of the path, then extend the path beyond its end points with a straight line that is parallel to the tangent at the path at its end point so that the midpoint-on-the-path can still be calculated.

For 'tspan' elements that are children of 'textPath' elements, x and y attributes on 'tspan' elements have no effect on text layout.

Vertical, right-to-left and bi-directional text layout rules also apply to text on a path. Conceptually, the target path is stretched out into either a horizontal or vertical straight line segment. For horizontal text layout flows, the path is stretched out into a hypothetical horizontal line segment such that the start of the path is mapped to the left of the line segment. For vertical text layout flows, the path is stretched out into a hypothetical vertical line segment such that the start of the path is mapped to the top of the line segment. The standard text layout rules are applied to the hypothetical straight line segment and the result is mapped back onto the target path.

10.13 Alternate glyphs

There are situations such as ligatures, special-purpose fonts (e.g., a font for music symbols) or alternate glyphs for Asian text strings where it is required that a different glyph is used than the glyph which normally corresponds to the given character data. Also, The W3C Character Model [CHARMOD] encourages creators of XML to normalize character data to facilitate meaningful exchange of character data and to promote correct comparisons between character strings. This normalization potentially loses some information about which specific glyph is required to achieve a particular visual result.

The 'altGlyph' element provides control over the glyphs used to render particular character data.

```
<!ENTITY % altGlyphExt "" >
<!ELEMENT altGlyph (#PCDATA %altGlyphExt;)* >
<!ATTLIST altGlyph
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #REQUIRED
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED >
```

Attribute definitions:

xlink:href = "<uri>"

> A URI reference either to a 'glyph' element in an SVG document fragment or to a 'altGlyphDef' element. If the reference is to a 'glyph' element, then that glyph is rendered instead of the character(s) that are inside of the 'altGlyph' element. If the reference is to a 'altGlyphDef' element, then if an appropriate set alternate glyphs are located from processing the 'altGlyphDef' element, then those alternate glyphs are rendered instead of the character(s) that are inside of the 'altGlyph' element. If the reference does not result in successful identification of an alternate glyph to use, then the character(s) that are inside of the 'altGlyph' element are rendered. Animatable: no.

Attributes defined elsewhere:

> %stdAttrs;, %xlinkRefAttrs;, %testAttrs;, %langSpaceAttrs;, externalResourcesRequired.

The 'altGlyphDef' element defines a list of possible glyph substitutions which can be referenced from an 'altGlyph' element.

An 'altGlyphDef' can specify either a single glyph or a sequence of glyphs. When only a single glyph is desired, then the 'altGlyphDef' has one or more 'glyphRef' elements as its children. When a sequence of glyphs is desired, then the 'altGlyphDef' has one or more 'altGlyphItem' elements as its children, where each 'altGlyphItem' has 'glyphRef' elements as its children.

Each 'glyphRef' element represents a potential glyph to use as an alternate glyph. The first 'glyphRef' element which results in a successful identification of an actual glyph will be applied. If a list of 'altGlyphItem' elements if provided, then the first successful 'glyphRef' within each 'altGlyphItem' will be applied. If any of the 'altGlyphItem' elements does not successfully find one of its 'glyphRef' glyphs, then the entire attempt to define an alternate glyph fails, and the user agent then renders the character data within the referencing 'altGlyph' element.

```
<!ENTITY % altGlyphDefExt "" >
<!ELEMENT altGlyphDef ((atlGlyphItem+|glyphRef+) %altGlyphDefExt;) >
<!ATTLIST altGlyphDef
  %stdAttrs; >
```

Attributes defined elsewhere:

> %stdAttrs;.

'altGlyphItem' elements are used when an 'altGlyphDef' element specifies that multiple glyphs should be used as the substitute glyphs.

```
<!ENTITY % altGlyphItemExt "" >
<!ELEMENT altGlyphItem (glyphRef+ %altGlyphItemExt;) >
<!ATTLIST altGlyphItem
  %stdAttrs; >
```

Attributes defined elsewhere:

> %stdAttrs;.

The 'glyphRef' element defines a possible glyph substitution, consisting of a font selectors, a glyph identifier and a font format.

```
<!ELEMENT glyphRef EMPTY >
<!ATTLIST glyphRef
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #REQUIRED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FontSelection;
  glyphRef CDATA #REQUIRED
  format CDATA #REQUIRED >
```

Attribute definitions:

xlink:href = "<uri>"

> A URI reference to a 'glyph' element in an SVG document fragment. The referenced 'glyph' is rendered as an alternate glyph.
> Animatable: no.

glyphRef = "<string>"

> The glyph identifier, the format of which is dependent on the format of the given font.
> Animatable: no.

format = "<string>"

> The format of the given font. If the font is in one of the formats listed in the [CSS2] specification (e.g., *TrueDoc™ Portable Font Resource* or *Embedded OpenType*), then the <string> must contain the corresponding font format string defined in the [CSS2] specification (e.g., *truedoc-pfr* or *embedded-opentype*).
> Animatable: no.

Attributes defined elsewhere:

> %stdAttrs;, %xlinkRefAttrs;, class, style, %PresentationAttributes-FontSelection;.

10.14 White space handling

SVG supports the standard XML attribute **xml:space** to specify the handling of white space characters within a given **'text'** element's character data. **xml:space** is an inheritable attribute which can have one of two values:

- **default** (the initial/default value for xml:space) - When `xml:space="default"`, the SVG user agent will do the following. First, it will remove all carriage return and linefeed characters. Then it will convert all tab characters into space characters. Then, it will strip off all leading and trailing space characters. Then, all contiguous space characters will be consolidated.

- **preserve** - When `xml:space="preserve"`, the SVG user agent will do the following. It will convert all carriage returns, linefeeds and tab characters into space characters. Then, it will draw all space characters, including leading, trailing and multiple contiguous space characters. Thus, when drawn with `xml:space="preserve"`, the string "a   b" (three spaces between "a" and "b") will produce a larger separation between "a" and "b" than "a b" (one space between "a" and "b").

The following examples illustrate that line indentation can be important when using `xml:space="default"`. The fragments below show two pairs of equivalent 'text' elements. Each pair consists of two equivalent 'text' elements, with the first 'text' element using xml:space='default' and the second using xml:space='preserve'. For these examples, there is no extra white space at the end of any of the lines (i.e., the line break occurs immediately after the last visible character).

```
[01]  <text xml:space='default'>
[02]    WS example
[03]    indented lines
```

```
[04]   </text>
[05]   <text xml:space='preserve'>WS example indented lines</text>
[06]
[07]   <text xml:space='default'>
[08]WS example
[09]non-indented lines
[10]   </text>
[11]   <text xml:space='preserve'>WS examplenon-indented lines</text>
```

The first pair of 'text' elements above show the effect of indented character data. The attribute xml:space='default' in the first 'text' element instructs the user agent to:

- convert all tabs (if any) to space characters,
- strip out all line breaks (i.e., strip out the line breaks at the end of lines [01], [02] and [03]),
- strip out all leading space characters (i.e., strip out space characters before "WS example" on line [02]),
- strip out all trailing space characters (i.e., strip out space characters before "</text>" on line [04]),
- consolidate all intermediate space characters (i.e., the space characters before "indented lines" on line [03]) into a single space character.

The second pair of 'text' elements above show the effect of indented character data. The attribute xml:space='default' in the third 'text' element instructs the user agent to:

- convert all tabs (if any) to space characters,
- strip out all line breaks (i.e., strip out the line breaks at the end of lines [07], [08] and [09]),
- strip out all leading space characters (there are no leading space characters in this example),
- strip out all trailing space characters (i.e., strip out space characters before "</text>" on line [10]),
- consolidate all intermediate space characters into a single space character (in this example, there are not intermediate space characters).

The xml:space attribute is:

  Animatable: no.

10.15 Text selection and clipboard operations

Conforming SVG viewers on systems which have the capacity for text selection (e.g., systems which are equipped with a pointer device such as a mouse) and which have system clipboards for copy/paste operations are required to support:

- user selection of text strings in SVG content
- the ability to copy selected text strings to the system clipboard

A text selection operation starts when all of the following occur:

- the user positions the pointing device over a glyph that has been rendered as part of a 'text' element, initiates a *select* operation (e.g., pressing the standard system mouse button for select operations) and then moves the pointing device while continuing the *select* operation (e.g., continuing to press the standard system mouse button for select operations)
- no other visible graphics element has been painted above the glyph at the point at which the pointing device was clicked
- no links or events have been assigned to the 'text' , 'tspan' or 'textPath' , element(s) (or their ancestors) associated with the given glyph.

As the text selection operation proceeds (e.g., the user continues to press the given mouse button), all associated events with other graphics elements are ignored (i.e., the text selection operation is modal) and the SVG user agent shall dynamically indicate which characters are selected by an appropriate highlighting technique, such as redrawing the selected glyphs with inverse colors. As the pointer is moved during the text selection process, the end glyph for the text selection operation is the glyph within the same 'text' element whose character cell is closest to the pointer. All characters within the 'text' element whose position within the 'text' element is between the start of selection and end of selection shall be highlighted, regardless of position on the canvas and regardless of any graphics elements that might be above the end of selection point.

Once the text selection operation ends (e.g., the user releases the given mouse button), the selected text will stay highlighted until an event occurs which cancels text selection, such as a pointer device activation event (e.g., pressing a mouse button).

Detailed rules for determining which characters to highlight during a text selection operation are provided in Text selection implementation notes.

For systems which have system clipboards, the SVG user agent is required to provide a user interface for initiating a copy of the currently selected text to the system clipboard. It is sufficient for the SVG user agent to post the selected text string in the system's appropriate clipboard format for plain text, but preferable if the SVG user agent also posts a rich text alternative which captures the various font properties associated with the given text string.

For bi-directional text, the user agent must support text selection in lexical order, which will result in discontinuous highlighting of glyphs due to the bi-directional reordering of characters. User agents can provide an alternative ability to select bi-directional text in visual rendering order (i.e., after bi-directional text layout algorithms have been applied), with the result that selected character data might be discontinous lexically. In this case, if the user requests that bi-directional text be copied to the clipboard, then the user agent is required to make appropriate adjustments to copy only the visually selected characters to the clipboard.

When feasible, it is recommended that generators of SVG attempt to order their text strings to facilitate properly ordered text selection within SVG viewing applications such as Web browsers.

10.16 DOM interfaces

The following interfaces are defined below: SVGTextContentElement, SVGTextElement, SVGTextRotate, SVGAnimatedTextRotate, SVGTextPositioningElement, SVGTSpanElement, SVGTRefElement, SVGGlyphRunElement, SVGTextPathElement, SVGAltGlyphElement, SVGAltGlyphDefElement, SVGAltGlyphItemElement, SVGGlyphRefElement.

Interface SVGTextContentElement

The SVGTextContentElement interface is inherited by various text-related interfaces, such as SVGTextElement, SVGTSpanElement, SVGTRefElement, SVGGlyphRunElement and SVGTextPathElement.

IDL Definition

```
interface SVGTextContentElement :
              SVGElement,
              SVGTests,
              SVGLangSpace,
              SVGExternalResourcesRequired,
              SVGStylable,
              events::EventTarget {

  // lengthAdjust Types
  const unsigned short LENGTHADJUST_UNKNOWN   = 0;
  const unsigned short LENGTHADJUST_SPACING      = 1;
  const unsigned short LENGTHADJUST_SPACINGANDGLYPHS    = 2;

          attribute SVGAnimatedLength      textLength;
                    // raises DOMException on setting
          attribute SVGAnimatedEnumeration lengthAdjust;
                    // raises DOMException on setting

  long     getNumberOfChars (   );
  float    getComputedTextLength (   );
  float    getSubStringLength ( in unsigned long charnum, in unsigned long nchars )
                    raises( DOMException );
  SVGPoint getStartPositionOfChar ( in unsigned long charnum )
                    raises( DOMException );
  SVGPoint getEndPositionOfChar ( in unsigned long charnum )
                    raises( DOMException );
  SVGRect  getExtentOfChar ( in unsigned long charnum )
                    raises( DOMException );
  float    getRotationOfChar ( in unsigned long charnum )
                    raises( DOMException );
  long     getCharNumAtPosition ( in SVGPoint point );
  void     selectSubString ( in unsigned long charnum, in unsigned long nchars )
                    raises( DOMException );
};
```

Definition group lengthAdjust Types

Defined constants

LENGTHADJUST_UNKNOWN	The enumeration was set to a value that is not one of predefined types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.
LENGTHADJUST_SPACING	Corresponds to value spacing.
LENGTHADJUST_SPACINGANDGLYPHS	Corresponds to value spacingAndGlyphs.

Attributes

SVGAnimatedLength textLength

Corresponds to attribute textLength on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedEnumeration lengthAdjust

Corresponds to attribute lengthAdjust on the given element. The value must be one of the length adjust constants specified above.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Methods

getNumberOfChars

Returns the total number of characters to be rendered within the current element. Includes characters which are included via a 'tref' reference.

No Parameters

Return value

long Total number of characters.

No Exceptions

getComputedTextLength

The total distance in the primary text advance direction (or along the text path, if using text-on-a-path) necessary to render all of the characters within the current element. For non-rendering environments, the user agent shall make reasonable assumptions about glyph metrics.

No Parameters

Return value

float The text advance distance.

No Exceptions

getSubStringLength

The total distance in the primary text advance direction (or along the text path, if using text-on-a-path) necessary to render the specified substring of the characters within the current element. For non-rendering environments, the user agent shall make reasonable assumptions about glyph metrics.

Parameters

in unsigned long charnum The index of the first character in the substring, where the first character has an index of 0.
in unsigned long nchars The number of characters in the substring.

Return value

float The text advance distance.

Exceptions

DOMException INDEX_SIZE_ERR: Raised if the charnum is negative or if charnum+nchars is greater than or equal to the number of characters at this node.

getStartPositionOfChar

Returns the start position (i.e., the current text position at the start of rendering the character) in the user coordinate system for rendering the glyph(s) that correspond to the specified character.

Parameters

in unsigned long charnum The index of the character, where the first character has an index of 0.

Return value

SVGPoint The character's start position.

Exceptions

DOMException INDEX_SIZE_ERR: Raised if the charnum is negative or if charnum is greater than or equal to the number of characters at this node.

getEndPositionOfChar

Returns the end position (i.e., the current text position at the end of rendering the character) in the user coordinate system for rendering the glyph(s) that correspond to the specified character.

Parameters

in unsigned long charnum The index of the character, where the first character has an index of 0.

Return value

SVGPoint The character's end position.

Exceptions

DOMException INDEX_SIZE_ERR: Raised if the charnum is negative or if charnum is greater than or equal to the number of characters at this node.

getExtentOfChar

Returns a tightest rectangle which defines the minimum and maximum X and Y values in the user coordinate system for rendering the glyph(s) that correspond to the specified character. The calculations assume that all glyphs occupy the full standard character cell for the font.

Parameters

in unsigned long charnum The index of the character, where the first character has an index of 0.

Return value

SVGRect The rectangle which encloses all of the rendered glyph(s).

Exceptions

DOMException INDEX_SIZE_ERR: Raised if the charnum is negative or if charnum is greater than or equal to the number of characters at this node.

getRotationOfChar

Returns the rotation value relative to the current user coordinate system used to render the glyph(s) corresponding to the specified character. If multiple glyph(s) are used to render the given character and the glyphs each have different rotations (e.g., due to text-on-a-path), the user agent shall an average value (e.g., the rotation angle at the midpoint along the path for all glyphs used to render this character).

Parameters

in unsigned long charnum The index of the character, where the first character has an index of 0.

Return value

float The rotation angle.

Exceptions

DOMException INDEX_SIZE_ERR: Raised if the charnum is negative or if charnum is greater than or equal to the number of characters at this node.

getCharNumAtPosition

Returns the index of the character whose character cell bounding box contains the specified point. The calculations assume that all glyphs occupy the full standard character cell for the font. If no such character exists, a value of -1 is returned. If multiple such characters exist, the character within the element whose glyphs were rendered last (i.e., take into account any reordering such as for bi-directional text) is used.

Parameters

in SVGPoint point A point in user space.

Return value

long The index of the character which is at the given point, where the first character has an index of 0.

No Exceptions

selectSubString

Causes the specified substring to be selected just as if the user selected the substring interactively.

Parameters

in unsigned long charnum The index of the start character which is at the given point, where the first character has an index of 0.

in unsigned long nchars The number of characters in the substring. If nchars specifies more characters than are available, then the substring will consist of all characters starting with charnum until the end of the list of characters.

No Return Value

Exceptions

DOMException INDEX_SIZE_ERR: Raised if the charnum is negative or if charnum is greater than or equal to the number of characters at this node.

Interface SVGTextElement

The SVGTextElement interface corresponds to the 'text' element.

IDL Definition

```
interface SVGTextElement :
            SVGTextContentElement,
            SVGTransformable {

    attribute SVGAnimatedLength x;
                // raises DOMException on setting
    attribute SVGAnimatedLength y;
                // raises DOMException on setting
};
```

Attributes

SVGAnimatedLength x

Corresponds to attribute x on the given 'text' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength y

Corresponds to attribute y on the given 'text' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGTextRotate

This interface corresponds to the 'rotate' attribute that exists on interfaces [SVGTSpanElement](), [SVGTRefElement](), [SVGGlyphRunElement]() and [SVGTextPathElement]().

IDL Definition

```
interface SVGTextRotate {

  // rotate types
  const unsigned short ROTATE_UNKNOWN = 0;
  const unsigned short ROTATE_AUTO    = 1;
```

```
        const unsigned short ROTATE_ANGLES   = 2;

             attribute unsigned short rotateValueType;
                      // raises DOMException on setting
             attribute SVGList angles;
                      // raises DOMException on setting
};
```

Definition group rotate types

Defined constants

ROTATE_UNKNOWN	Unknown value.
ROTATE_AUTO	Corresponds to value auto.
ROTATE_ANGLES	A list of angle values has been provided.

Attributes

unsigned short rotateValueType

Corresponds to attribute rotate on the given element. The value must be one of the rotate type constants specified above.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGList angles

Corresponds to attribute rotate on the given element.

When rotateValueType=ROTATE_ANGLES, the list of angles.

The various methods from SVGList, which are defined to accept parameters and return values of type Object, must receive parameters of type SVGAngle and return values of type SVGAngle.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGAnimatedTextRotate

Corresponds to all properties and attributes whose values are of type SVGTextRotate and which are animatable.

IDL Definition

```
interface SVGAnimatedTextRotate {

        attribute SVGTextRotate baseVal;
                  // raises DOMException on setting
  readonly attribute SVGTextRotate animVal;
};
```

Attributes

SVGTextRotate baseVal

The base value of the given attribute before applying any animations.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

readonly SVGTextRotate animVal

If the given attribute or property is being animated, contains the current animated value of the attribute or property. If the given attribute or property is not currently being animated, contains the same value as 'baseVal'.

Interface SVGTextPositioningElement

The SVGTextPositioningElement interface is inherited by text-related interfaces: SVGTSpanElement, SVGTRefElement, SVGGlyphRunElement and SVGTextPathElement.

IDL Definition

```
interface SVGTextPositioningElement : SVGTextContentElement {
        attribute SVGAnimatedLengthList x;
                        // raises DOMException on setting
        attribute SVGAnimatedLengthList y;
                        // raises DOMException on setting
        attribute SVGAnimatedLengthList dx;
                        // raises DOMException on setting
        attribute SVGAnimatedLengthList dy;
                        // raises DOMException on setting
        attribute SVGAnimatedTextRotate rotate;
                        // raises DOMException on setting
};
```

Attributes

SVGAnimatedLengthList x

Corresponds to attribute x on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLengthList y

Corresponds to attribute y on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLengthList dx

Corresponds to attribute dx on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLengthList dy

Corresponds to attribute dy on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedTextRotate rotate

Corresponds to attribute rotate on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGTSpanElement

The SVGTSpanElement interface corresponds to the 'tspan' element.

IDL Definition

```
interface SVGTSpanElement : SVGTextPositioningElement {};
```

Interface SVGTRefElement

The SVGTRefElement interface corresponds to the 'tref' element.

IDL Definition

```
interface SVGTRefElement :
                SVGTextPositioningElement,
                SVGURIReference {};
```

Interface SVGGlyphRunElement

The SVGGlyphRunElement interface corresponds to the 'glyphRun' element.

IDL Definition

```
interface SVGGlyphRunElement : SVGTextPositioningElement {
  readonly attribute SVGAnimatedNumberList glyphOrder;
};
```

Attributes

readonly SVGAnimatedNumberList glyphOrder

Corresponds to attribute glyphOrder on the given element.

Interface SVGTextPathElement

The SVGTextPathElement interface corresponds to the 'textPath' element.

IDL Definition

```
interface SVGTextPathElement :
                SVGTextPositioningElement,
                SVGURIReference {

  // textPath Method Types
  const unsigned short TEXTPATH_METHODTYPE_UNKNOWN   = 0;
  const unsigned short TEXTPATH_METHODTYPE_ALIGN     = 1;
  const unsigned short TEXTPATH_METHODTYPE_STRETCH    = 2;
  // textPath Spacing Types
  const unsigned short TEXTPATH_SPACINGTYPE_UNKNOWN   = 0;
  const unsigned short TEXTPATH_SPACINGTYPE_AUTO     = 1;
  const unsigned short TEXTPATH_SPACINGTYPE_EXACT     = 2;

          attribute SVGAnimatedLength              startOffset;
                    // raises DOMException on setting
          attribute SVGAnimatedEnumeration method;
                    // raises DOMException on setting
          attribute SVGAnimatedEnumeration spacing;
                    // raises DOMException on setting
};
```

Definition group textPath Method Types

Defined constants

TEXTPATH_METHODTYPE_UNKNOWN	The enumeration was set to a value that is not one of predefined types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.
TEXTPATH_METHODTYPE_ALIGN	Corresponds to value align.
TEXTPATH_METHODTYPE_STRETCH	Corresponds to value stretch.

Definition group textPath Spacing Types

Defined constants

TEXTPATH_SPACINGTYPE_UNKNOWN	The enumeration was set to a value that is not one of predefined types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.
TEXTPATH_SPACINGTYPE_AUTO	Corresponds to value auto.
TEXTPATH_SPACINGTYPE_EXACT	Corresponds to value exact.

Attributes

SVGAnimatedLength startOffset

Corresponds to attribute startOffset on the given 'textPath' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedEnumeration method

Corresponds to attribute method on the given 'textPath' element. The value must be one of the method type constants specified above.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedEnumeration spacing

Corresponds to attribute spacing on the given 'textPath' element. The value must be one of the spacing type constants specified above.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGAltGlyphElement

The SVGAltGlyphElement interface corresponds to the 'altGlyph' element.

IDL Definition

```
interface SVGAltGlyphElement :
             SVGTextContentElement,
             SVGURIReference {};
```


Interface SVGAltGlyphDefElement

The SVGAltGlyphDefElement interface corresponds to the 'altGlyphDef' element.

IDL Definition

```
interface SVGAltGlyphDefElement : SVGElement {};
```

Interface SVGAltGlyphItemElement

The SVGAltGlyphItemElement interface corresponds to the 'altGlyphItem' element.

IDL Definition

```
interface SVGAltGlyphItemElement : SVGElement {};
```

Interface SVGGlyphRefElement

The SVGGlyphRefElement interface corresponds to the 'glyphSub' element.

IDL Definition

```
interface SVGGlyphRefElement :
                SVGElement,
                SVGURIReference,
                SVGStylable {

        attribute DOMString glyphRef;
                    // raises DOMException on setting
        attribute DOMString format;
                    // raises DOMException on setting
};
```

Attributes

DOMString glyphRef

Corresponds to attribute glyphRef on the given 'glyphSub' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

DOMString format

Corresponds to attribute format on the given 'glyphSub' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

11 Painting: Filling, Stroking and Marker Symbols

Contents

11.1 Introduction

'path' elements, 'text' elements and basic shapes can be **filled** (which means painting the interior of the object) and **stroked** (which means painting along the outline of the object). Filling and stroking both can be thought of in more general terms as **painting** operations.

Certain elements (i.e., 'path', 'polyline', 'polygon' and 'line' elements) can also have marker symbols drawn at their vertices.

With SVG, you can paint (i.e., fill or stroke) with:
- a single color
- a gradient (linear or radial)
- a pattern (vector or image, possibly tiled)
- custom paints available via extensibility

SVG uses the general notion of a **paint server**. Paint servers are specified using a URI reference on a 'fill' or 'stroke' property. Gradients and patterns are just specific types of paint servers.

11.2 Specifying paint

Properties 'fill' and 'stroke' take on a value of type <paint>, which is specified as follows:

<paint>:   none |
            currentColor |
            <color> [icc-color(<name>,<icccolorvalue>+)] |
            <uri> [none | currentColor | <color> [icc-color(<name>,<icccolorvalue>+)]] |
            inherit

none

      Indicates that the object has no fill (i.e., the interior is transparent).

currentColor

Indicates that the object is. filled with the color specified by the 'color' property. This mechanism is provided to facilitate sharing of color attributes between parent grammars such as other (non-SVG) XML. This mechanism allows you to define a style in your HTML which sets the 'color' property and then pass that style to the SVG user agent so that your SVG text will draw in the same color.

<color>
  [icc-color(<name>,<icccolorvalue>[,<icccolorvalue>]*)]

  <color> is the explicit color (in the sRGB [SRGB] color space) to be used to fill the current object. SVG supports all of the syntax alternatives for <color> defined in [CSS2]. If an optional ICC color specification is provided, then the user agent searches the color profile description database for an color profile description entry whose name descriptor matches <name> and uses the last matching entry that is found. (If no match is found, then the ICC color specification is ignored.) The comma-separated list (with optional white space) of **<icccolorvalue>**'s is a set of ICC-profile-specific color values, expressed as <number>s. On platforms which support ICC-based color management, the **icc-color** gets precedence over the <color> (which is in the sRGB color space). Note that color interpolation occurs in an RGB color space even if an ICC-based color specification is provided (see 'color-interpolation'). Percentages are not allowed on **<icccolorvalue>**'s. For more on ICC-based colors, refer to Color profile descriptions.

<uri>
  [none |
  currentColor |
  <color> [icc-color(<name>,<icccolorvalue>[,<icccolorvalue>]*)]]

  The <uri> is how you identify a fancy paint style such as a gradient, a pattern or a custom paint from extensibility. The <uri> provides. the ID of the paint server (e.g., a gradient or a pattern) to be used to paint the current object. If the URI reference is not valid (e.g., it points to an object that doesn't exist or the object is not a valid paint server), then the paint method following the <uri> (i.e., **none | currentColor |**
  <color>
  [icc-color(<name>,<icccolorvalue>[,<icccolorvalue>]*)]|
  inherit) is used if provided; otherwise, the document is in error (see Error processing).

11.3 Fill Properties

'fill'

Value:	<paint> (See Specifying paint)
Initial:	black
Applies to:	all elements
Inherited:	see Inheritance of Painting Properties below
Percentages:	N/A
Media:	visual
Animatable:	yes

The 'fill' property paints the interior of the given graphical element. The area to be painted consists of any areas inside the outline of the shape. To determine the inside of the shape, all subpaths are considered, and the interior is determined according to the rules associated with the current value of the 'fill-rule' property. The zero-width geometric outline of a shape is included in the area to be painted.

The fill operation automatically closes all open subpaths by connecting the last point of the subpath with the first point of the subpath before painting the fill. Thus, fill operations apply to both open subpaths within 'path' elements (i.e., subpaths without a closepath command) and 'polyline' elements.
.

'fill-rule'

Value:	evenodd	nonzero	inherit
Initial:	evenodd
Applies to:	all elements
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	yes

The 'fill-rule' property indicates the algorithm which is to be used to determine what parts of the canvas are included inside the shape. For a simple, non-intersecting path, it is intuitively clear what region lies "inside"; however, for a more complex path, such as a path that intersects itself or where one subpath encloses another, the interpretation of "inside" is not so obvious.

The 'fill-rule' property provides two options for how the inside of a shape is determined:

evenodd

  This rule determines the "insideness" of a point on the canvas by drawing a ray from that point to infinity in any direction and counting the number of path segments from the given shape that the ray crosses. If this number is odd, the point is inside; if even, the point is outside. The following drawing illustrates the **evenodd** rule:
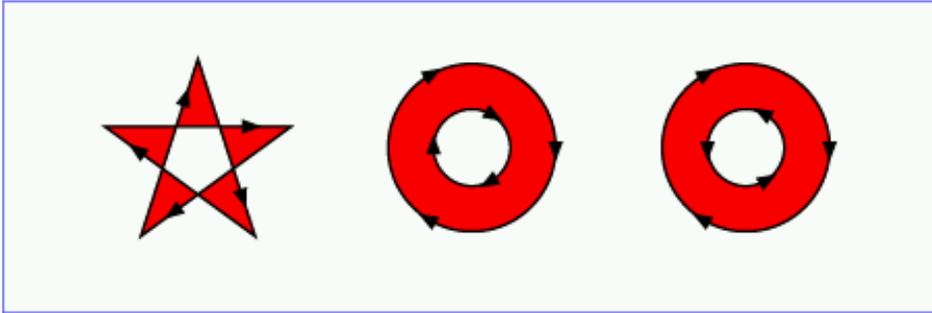
nonzero

> This rule determines the "insideness" of a point on the canvas by drawing a ray from that point to infinity in any direction and then examining the places where a segment of the shape crosses the ray. Starting with a count of zero, add one each time a path segment crosses the ray from left to right and subtract one each time a path segment crosses the ray from right to left. After counting the crossings, if the result is zero then the point is *outside* the path. Otherwise, it is *inside*. The following drawing illustrates the **nonzero** rule:
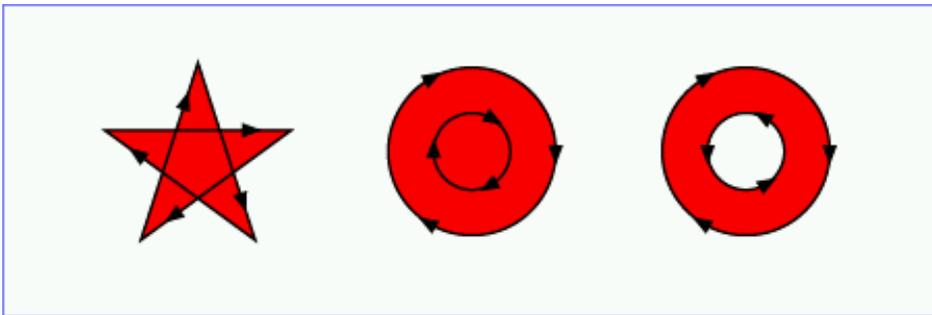
(Note: the above explanations do not specify what to do if a path segment coincides with or is tangent to the ray. Since any ray will do, one may simply choose a different array that does not have such problem intersections.)

Here are examples which illustrate the two rules:

'fill-opacity'

Value:	<opacity-value> | inherit
Initial:	1
Applies to:	all elements
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	yes

'fill-opacity' specifies the opacity of the painting operation used to paint the interior the current object. (See Painting shapes and text.)

<opacity-value>

> The opacity of the painting operation used to fill the current object. Any values outside the range 0.0 (fully transparent) to 1.0 (fully opaque) will be clamped to this range. (See Clamping values which are restricted to a particular range.)

Related properties: 'stroke-opacity' and 'opacity'.

11.4 Stroke Properties

The following are the properties which affect how an element is stroked.

In all cases, all stroking properties which are affected by directionality, such as those having to do with dash patterns, must be rendered such that the stroke operation starts at the same point at which the graphics element starts. In particular, for 'path' elements, the start of the path is the first point of the initial "moveto" command.

For stroking properties such as dash patterns whose computations are dependent on progress along the outline of the graphics element, distance calculations are required to utilize the SVG user agent's standard Distance along a path algorithms.

When stroking is performed using a complex paint server, such as a gradient or a pattern, the stroke operation must be identical to the result that would have occurred if the geometric shape defined by the geometry of the current graphics element and its associated stroking properties were converted to an equivalent 'path' element and then filled using the given paint server.

'stroke'

Value:	<paint> (See Specifying paint)
Initial:	none
Applies to:	all elements
Inherited:	see Inheritance of Painting Properties below
Percentages:	N/A
Media:	visual
Animatable:	yes

The 'stroke' property paints along the outline of the given graphical element.

A subpath (see Paths) consisting of a single moveto is not stroked. A subpath consisting of a moveto and lineto to the same exact location or a subpath consisting of a moveto and a closepath will be stroked only if the 'stroke-linecap' property is set to "round", producing a circle centered at the given point.

'stroke-width'

Value:	<width>	inherit
Initial:	1
Applies to:	all elements
Inherited:	yes
Percentages:	Yes
Media:	visual
Animatable:	yes

<width>

The width of the stroke on the current object, expressed as a <length>. If a percentage is used, the <width> is expressed as a percentage of the current viewport. (See Processing rules when using absolute unit identifiers and percentages.)
A zero value causes no stroke to be painted. A negative value is an error (see Error processing).

'stroke-linecap'

Value:	butt	round	square	inherit
Initial:	butt
Applies to:	all elements
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	yes

'stroke-linecap' specifies the shape to be used at the end of open subpaths when they are stroked.

butt

See drawing below.

round

See drawing below.

square

See drawing below.

'stroke-linejoin'

Value:	miter	round	bevel	inherit
Initial:	miter
Applies to:	all elements
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	yes

'stroke-linejoin' specifies the shape to be used at the corners of paths (or other vector shapes) that are stroked. when they are stroked.

miter

See drawing below.

round

      See drawing below.

bevel

      See drawing below.

'stroke-miterlimit'

Value:	<miterlimit> | inherit
Initial:	4
Applies to:	all elements
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	yes

When two line segments meet at a sharp angle and **miter** joins have been specified for 'stroke-linejoin', it is possible for the miter to extend far beyond the thickness of the line stroking the path. The 'stroke-miterlimit' imposes a limit on the ratio of the miter length to the 'stroke-linewidth'.

<miterlimit>

      The limit on the ratio of the miter length to the 'stroke-linewidth'. The value of **<miterlimit>** must be a number greater than or equal to 1. Any other value is an error (see Error processing).

'stroke-dasharray'

Value:	none | <dasharray> | inherit
Initial:	none
Applies to:	all elements
Inherited:	yes
Percentages:	yes (see below)
Media:	visual
Animatable:	yes (non-additive)

'stroke-dasharray' controls the pattern of dashes and gaps used to stroke paths. **<dasharray>** contains a list of comma-separated (with optional white space) <number>s that specify the lengths of alternating dashes and gaps in user units. If an odd number of values is provided, then the list of values is repeated to yield an even number of values. Thus, stroke-dasharray: 5 3 2 is equivalent to stroke-dasharray: 5 3 2 5 3 2.

none

      Indicates that no dashing is used. If stroked, the line is drawn solid.

<dasharray>

      A list of comma-separated <length>'s (with optional white space), each of which can have a unit identifier , including specification of a percentage. A percentage represents a distance as a percentage of the current viewport. (See Processing rules when using absolute unit identifiers and percentages.) A negative <length> value is an error (see Error processing). If the sum of the <length>'s is zero, then the stroke is rendered as if a value of **none** were specified.

'stroke-dashoffset'

Value:	<dashoffset> | inherit
Initial:	0
Applies to:	all elements
Inherited:	yes
Percentages:	see prose
Media:	visual
Animatable:	yes

'stroke-dashoffset' specifies the distance into the dash pattern to start the dash.

<dashoffset>

      A <length>. If a percentage is used, the <width> is expressed as a percentage of the current viewport (See Processing rules when using absolute unit identifiers and percentages.)
      Values can be negative.

'stroke-opacity'

Value:	<opacity-value> | inherit
Initial:	1
Applies to:	all elements

'stroke-opacity' specifies the opacity of the painting operation used to stroke the current object. (See Painting shapes and text.)

<opacity-value>

The opacity of the painting operation used to stroke the current object. Any values outside the range 0.0 (fully transparent) to 1.0 (fully opaque) will be clamped to this range. (See Clamping values which are restricted to a particular range.)

Related properties: 'fill-opacity' and 'opacity'.

11.5 Controlling visibility

SVG uses two properties, 'display' and 'visibility', to control the visibility of graphical content. Either property can make an element invisible.

The differences between the two properties are as follows:

- When applied to a container element, setting 'display' to none causes the container and all of its children to be invisible; thus, it acts on groups of elements as a group. 'visibility', however, only applies to individual graphics elements. Setting 'visibility' to hidden on a 'g' will only make its children invisible if the children set their own 'visibility' properties to inherit (or, of course, hidden). Note that 'visibility' is *not* an inheritable property.
- When the 'display' property is set to none, then rendering occurs as if the given element and its children were not in the document. With 'visibility' set to hidden, however, processing occurs as if the element were still in the document and still taking up space, but just not rendered onto the canvas. This distinction has implications for the 'tspan', 'tref' and 'glyphRun' elements and event processing. If 'display' is set to none on a 'tspan', 'tref' or 'glyphRun' element, then the text string is ignored for the purposes of text layout; however, if 'visibility' is set to hidden, the text string is used for text layout (i.e., it takes up space) even though it is not rendered on the canvas. Regarding events, if 'display' is set to none, the element receives no events; however,if 'visibility' is set to hidden, the element might still receive events, depending on the value of property 'pointer-events'.

'display'

Value:	inline | block | list-item |
	run-in | compact | marker |
	table | inline-table | table-row-group | table-header-group |
	table-footer-group | table-row | table-column-group | table-column |
	table-cell | table-caption | none | inherit
Initial:	inline
Applies to:	all elements
Inherited:	no
Percentages:	N/A
Media:	all
Animatable:	yes

A value of display: none indicates that the given element and its children shall not be rendered (i.e., document rendering occurs as if the given element and its children were not part of the document). Any value other than none or inherit indicates that the given element shall be rendered by the SVG user agent.

Except for any additional information provided in this specification, the normative definition of the property is in [CSS2].

'visibility'

Value:	visible | hidden | collapse | inherit
Initial:	inherit
Applies to:	all elements
Inherited:	no
Percentages:	N/A
Media:	visual
Animatable:	yes

visible

The current graphics element is visible.

hidden or **collapse**

The current graphics element is invisible (i.e., nothing is painted on the canvas).

Note that if the 'visibility' property is set to hidden on a 'tspan', 'tref' or 'glyphRun' element, then the text is invisible but still takes up space in calculations of text layout.

Depending on the value of property 'pointer-events', graphics elements which have their 'visibility' property set to hidden still might receive events.

Except for any additional information provided in this specification, the normative definition of the property is in [CSS2].

11.6 Markers

11.6.1 Introduction

To use a marker symbol for arrowheads or polymarkers, you need to define a **'marker'** element which defines the marker symbol and then refer to that 'marker' element using the various marker properties (i.e., 'marker-start', 'marker-end', 'marker-mid' or 'marker') on the given 'path' element or vector graphic shape. Here is an example which draws a triangular marker symbol that is drawn as an arrowhead at the end of a path:

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="4in" height="3in"
     viewBox="0 0 4000 3000" >
  <defs>
    <marker id="Triangle"
      viewBox="0 0 10 10" refX="0" refY="5"
      markerUnits="strokeWidth"
      markerWidth="2" markerHeight="3"
      orient="auto">
      <path d="M 0 0 L 10 5 L 0 10 z" />
    </marker>
  </defs>
  <desc>Placing an arrowhead at the end of a path.
  </desc>
  <path d="M 1000 1000 L 2000 1000 L 2500 1500"
        style="fill:none; stroke:black; stroke-width:100;
        marker-end:url(#Triangle)" />
</svg>
```

View this example as SVG (SVG-enabled browsers only)

11.6.2 The 'marker' element

The **'marker'** element defines the graphics that is to be used for drawing arrowheads or polymarkers on a given 'path' element or vector graphic shape.

```
<!ENTITY % markerExt "" >
<!ELEMENT marker (desc|title|metadata|defs|
                  path|text|rect|circle|ellipse|line|polyline|polygon|
                  use|image|svg|g|view|switch|a|altGlyphDef|
                  script|style|symbol|marker|clipPath|mask|
                  linearGradient|radialGradient|pattern|filter|cursor|font|
                  animate|set|animateMotion|animateColor|animateTransform|
                  color-profile|font-face
                  %ceExt;%markerExt;)* >
<!ATTLIST marker
  %stdAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  viewBox %ViewBoxSpec; #IMPLIED
  preserveAspectRatio %PreserveAspectRatioSpec; 'xMidYMid meet'
  refX %Coordinate; #IMPLIED
  refY %Coordinate; #IMPLIED
  markerUnits (strokeWidth | userSpaceOnUse | userSpace) #IMPLIED
  markerWidth  %Length; #IMPLIED
```

```
        markerHeight %Length; #IMPLIED
        orient CDATA #IMPLIED >
```

Attribute definitions:

markerUnits = "strokeWidth | userSpaceOnUse | userSpace"

>**markerUnits** indicates how to interpret the values of **markerWidth** and **markerHeight** (described as follows).
>If **markerUnits="strokeWidth"** (the default), then **markerWidth** and **markerHeight** represent scale factors relative to the stroke width in place for graphic object referencing the marker.
>If **markerUnits="userSpaceOnUse"**, then **markerWidth** and **markerHeight** represent values in the current user coordinate system in place at the time when the 'marker' element is referenced (i.e., the user coordinate system for the element referencing the 'marker' element via the 'marker', 'marker-start', 'marker-mid' or 'marker-end' property). If **markerUnits="userSpace"**, then **markerWidth** and **markerHeight** represent values in the user coordinate system in place for the graphic object referencing the marker.
>
>If attribute markerUnits is not specified, then the effect is as if a value of strokeWidth were specified.
>Animatable: yes.

refX = "<coordinate>"

>The X-axis coordinate of the reference point which is to be aligned exactly at the marker position. The coordinate is defined in the coordinate system after application of the viewBox and preserveAspectRatio attributes.
>If the attribute is not specified, the effect is as if a value of "0" were specified.
>Animatable: yes.

refY = "<coordinate>"

>The Y-axis coordinate of the reference point which is to be aligned exactly at the marker position. The coordinate is defined in the coordinate system after application of the viewBox and preserveAspectRatio attributes.
>If the attribute is not specified, the effect is as if a value of "0" were specified.
>Animatable: yes.

markerWidth = "<length>"

>Represents the width of the temporary viewport that is to be created when drawing the marker.
>A negative value is an error (see Error processing). A value of zero disables rendering of the element.
>If the attribute is not specified, the effect is as if a value of "3" were specified.
>Animatable: yes.

markerHeight = "<length>"

>Represents the height of the temporary viewport that is to be created when drawing the marker.
>A negative value is an error (see Error processing). A value of zero disables rendering of the element.
>If the attribute is not specified, the effect is as if a value of "3" were specified.
>Animatable: yes.

orient = "auto | <angle>"

>Indicates how the marker is rotated. A value of *auto* indicates that the marker is oriented such that its positive X-axis is pointing in a direction that is the average of the ending direction of path segment going into the vertex and the starting direction of the path segment going out of the vertex. (Refer to 'path' element implementation notes for a more thorough discussion directionality of path segments.) A value of *<angle>* represents a particular orient in the user space of the graphic object referencing the marker. For example, if a value of "0" is given, then the marker will be drawn such that its X-axis will align with the X-axis of the user space of the graphic object referencing the marker. If the attribute is not specified, the effect is as if a value of "0" were specified.
>Animatable: yes (non-additive, 'set' and 'animate' elements only).

Attributes defined elsewhere:

>%stdAttrs;, %langSpaceAttrs;, class, externalResourcesRequired, viewBox, preserveAspectRatio, style, %PresentationAttributes-All;.

Markers are drawn such that their reference point (i.e., attributes refX and refY) is positioned at the given vertex.

11.6.3 Marker properties

'marker-start' defines the arrowhead or polymarker that shall be drawn at the first vertex of the given **'path'** element or vector graphic shape.
'marker-end' defines the arrowhead or polymarker that shall be drawn at the final vertex. **'marker-mid'** defines the arrowhead or polymarker that shall be drawn at every other vertex (i.e., every vertex except the first and last).

'marker-start', 'marker-end', marker-mid'

Value:	none |
	inherit |
	<uri>
Initial:	none

Applies to:	'path', 'line', 'polyline' and 'polygon' elements
Inherited:	see Inheritance of Painting Properties below
Percentages:	N/A
Media:	visual
Animatable:	yes

none

Indicates that no marker symbol shall be drawn at the given vertex (vertices).

<uri>

The <uri> is a URI reference to the ID of a 'marker' element which shall be used as the arrowhead symbol or polymarker at the given vertex (vertices). If the URI reference is not valid (e.g., it points to an object that is undefined or the object is not a 'marker' element), then the marker(s) shall not be drawn.

The **'marker'** property specifies the marker symbol that shall be used for all points on the sets the value for all vertices on the given **'path'** element or vector graphic shape. It is a short-hand for the three individual marker properties:

'marker'

Value:	see individual properties
Initial:	see individual properties
Applies to:	'path', 'line', 'polyline' and 'polygon' elements
Inherited:	see Inheritance of Painting Properties below
Percentages:	N/A
Media:	visual
Animatable:	yes

11.6.4 Details on how markers are rendered

Markers are drawn after the given object is filled and stroked.

Each marker is drawn into a temporary viewport. The temporary viewport and its associated temporary viewport coordinate system are such that:

- The axes of the temporary viewport coordinate system are aligned according to the orient attribute on the 'marker' element and the slope of the curve at the given vertex. (Note: if there is a discontinuity at a vertex, the slope is the average of the slopes of the two segments of the curve that join at the given vertex. If a slope cannot be determined, the slope is assumed to be zero.)

- The size of a single unit in X and Y in the temporary viewport coordinate system (and correspondingly in the user coordinate system associated with that viewport) is determined by the value of attribute markerUnits.
  If markerUnits equals strokeWidth, the temporary viewport coordinate system is scaled by the current value of property 'stroke-width'.
  If markerUnits equals userSpaceOnUse, then no extra scale transformation is applied.
  If markerUnits equals userSpace, then a scale transformation is applied to map X-axis and Y-axis length measurements in the current user coordinate system to the corresponding X-axis and Y-axis length measurements in the user coordinate system of the 'marker' element such that the length measurements represent the same distances within the initial viewport coordinate system.

- Attributes markerWidth and markerHeight on the 'marker' element determine the width and height of the temporary viewport expressed in the temporary viewer coordinate system.

- The origin of the temporary viewport coordinate system is at a point translated from the given vertex by (-markerWidth * refX / viewBoxWidth, -markerHeight * refY / viewBoxHeight) in the temporary viewport coordinate system, where:

  - markerWidth and markerHeight are the values of attributes markerWidth and markerHeight on the 'marker' element

  - refX and refY are the values of attributes refX and refY on the 'marker' element

  - viewBoxWidth and viewBoxHeight are the width and height values on on the viewBox attribute on the 'marker' element, respectively.
    If the viewBox attribute is not specified, then viewBoxWidth and viewBoxHeight are assumed to have the same values as markerWidth and markerHeight.

For illustrative purposes, we'll repeat the marker example shown earlier:

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="4in" height="3in"
    viewBox="0 0 4000 3000" >
  <defs>
    <marker id="Triangle"
      viewBox="0 0 10 10" refX="0" refY="5"
      markerUnits="strokeWidth"
      markerWidth="2" markerHeight="3"
```

```
        orient="auto">
      <path d="M 0 0 L 10 5 L 0 10 z" />
    </marker>
  </defs>
  <desc>Placing an arrowhead at the end of a path.
  </desc>
  <path d="M 1000 1000 L 2000 1000 L 2500 1500"
        style="fill:none; stroke:black; stroke-width:100;
        marker-end:url(#Triangle)" />
</svg>
```

View this example as SVG (SVG-enabled browsers only)

The rendering effect of the above file will be visually identical to the following:

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="4in" height="3in"
     viewBox="0 0 4000 3000" >

  <desc>File which produces the same effect
      as the marker example file, but without
      using markers.
  </desc>
  <!-- The path draws as before, but without the marker properties -->
  <path d="M 1000 1000 L 2000 1000 L 2500 1500"
        style="fill:none; stroke:black; stroke-width:100" />

  <!-- The following logic simulates drawing a marker
       at final vertex of the path. -->

  <!-- First off, move the origin of the user coordinate system
       so that the origin is now aligned with the end point of the path. -->
  <g transform="translate(2500,1500)" >

    <!-- Now, rotate the coordinate system 45 degrees because
         the marker specified orient="auto" and the final segment
         of the path is going in the direction of 45 degrees. -->
    <g transform="rotate(45)" >

      <!-- Now, scale the coordinate system by the current value of
           the 'stroke-width' property, which is 100. -->
      <g transform="scale(100)" >

        <!-- Now, translate the coordinate system by
             (-markerWidth * refX / viewBoxWidth, -markerHeight * refY / viewBoxHeight)
             so that (refX,refY) within the marker will align with the vertex.
             Since refX is zero, there is no horizontal translation.
             Since markerWidth is 3, refY is 5 and height of the viewBox is 10,
             translate in Y by -3*5/10 = -1.5 -->
        <g transform="translate(0,-1.5)" >

          <!-- Establish a new viewport with an 'svg' element.
               The width/height of the viewport are 2 and 3 times
               the current stroke-width. -->
          <svg width="2" height="3" viewBox="0 0 10 10"" >

            <!-- Expand out the contents of the 'marker' element. -->
            <path d="M 0 0 L 10 5 L 0 10 z" />
          </svg>
        </g>
      </g>
    </g>
  </g>
</svg>
```

View this example as SVG (SVG-enabled browsers only)

11.7 Rendering properties

The SVG user agent performs color interpolations and compositing in the following cases:

- when rendering gradients
- when performing color animations (see 'animateColor')
- when performing alpha blending/compositing of graphics elements into the current background
- when performing various filter effects

The 'color-interpolation' property specifies whether color interpolations and compositing shall be performed in the sRGB [SRGB] color space or in a (light energy linear) linearized RGB color space.

The conversion formulas between sRGB color space and linearized RGB color space is can be found in [SRGB]. The following formula shows the conversion from sRGB to linearized RGB:

```
  R'[sRGB] = R[sRGB] / 255
  G'[sRGB] = G[sRGB] / 255
  B'[sRGB] = B[sRGB] / 255

If R'[sRGB], G'[sRGB], B'[sRGB] <= 0.04045

  R[linearRGB] = R'[sRGB] / 12.92
  G[linearRGB] = G'[sRGB] / 12.92
  B[linearRGB] = B'[sRGB] / 12.92

else if R'[sRGB], G'[sRGB], B'[sRGB] > 0.04045

  R[linearRGB] = ((R'[sRGB] + 0.055) / 1.055) ^ 2.4
  G[linearRGB] = ((G'[sRGB] + 0.055) / 1.055) ^ 2.4
  B[linearRGB] = ((B'[sRGB] + 0.055) / 1.055) ^ 2.4
```

Out-of-range color values, if supported by the user agent, also are converted using the above formulas. (See Clamping values which are restricted to a particular range.)

'color-interpolation'

Value:	auto | sRGB | linearRGB | inherit
Initial:	sRGB
Applies to:	color interpolation and compositing operations
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	yes

auto

Indicates that the user agent can choose either the **sRGB** or **linearRGB**spaces for color interpolation. This option indicates that the author doesn't require that color interpolation occur in a particular color space.

sRGB

Indicates that color interpolation should occur in the sRGB color space.

linearRGB

Indicates that color interpolation should occur in the linearized RGB color space as described above.

The creator of SVG content might want to provide a hint to the implementation about how to make speed vs. quality tradeoffs as it performs color interpolation and compositing. The 'color-rendering' property provides a hint to the SVG user agent about how to optimize its color interpolation and compositing operations:

'color-rendering'

Value:	auto | optimizeSpeed | optimizeQuality | inherit
Initial:	auto
Applies to:	color interpolation and compositing operations
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	yes

auto

Indicates that the user agent shall make appropriate tradeoffs to balance speed and quality, but quality shall be given more importance than speed.

optimizeSpeed

Indicates that the user agent shall emphasize rendering speed over quality. For RGB display devices, this option will sometimes cause the user agent to perform color interpolation and compositing in the device RGB color space.

optimizeQuality

Indicates that the user agent shall emphasize quality over rendering speed.

The creator of SVG content might want to provide a hint to the implementation about what tradeoffs to make as it renders vector graphics elements such as 'path' elements and basic shapes such as circles and rectangles. The 'shape-rendering' property provides these hints.

'shape-rendering'

Value:	auto | optimizeSpeed | crispEdges | geometricPrecision | inherit
Initial:	auto
Applies to:	all elements
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	yes

auto

Indicates that the user agent shall make appropriate tradeoffs to balance speed, crisp edges and geometric precision, but with geometric precision given more importance than speed and crisp edges.

optimizeSpeed

Indicates that the user agent shall emphasize rendering speed over geometric precision and crisp edges. This option will sometimes cause the user agent to turn off shape anti-aliasing.

crispEdges

Indicates that the user agent shall attempt to emphasize the contrast between clean edges of artwork over rendering speed and geometric precision. To achieve crisp edges, the user agent might turn off anti-aliasing for all lines and curves or possibly just for straight lines which are close to vertical or horizontal. Also, the user agent might adjust line positions and line widths to align edges with device pixels.

geometricPrecision

Indicates that the user agent shall emphasize geometric precision over speed and crisp edges.

The creator of SVG content might want to provide a hint to the implementation about what tradeoffs to make as it renders text. The 'text-rendering' property provides these hints.

'text-rendering'

Value:	auto | optimizeSpeed | optimizeLegibility | geometricPrecision | inherit
Initial:	auto
Applies to:	'text' elements
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	yes

auto

Indicates that the user agent shall make appropriate tradeoffs to balance speed, legibility and geometric precision, but with legibility given more importance than speed and geometric precision.

optimizeSpeed

Indicates that the user agent shall emphasize rendering speed over legibility and geometric precision. This option will sometimes cause the user agent to turn off text anti-aliasing.

optimizeLegibility

Indicates that the user agent shall emphasize legibility over rendering speed and geometric precision. The user agent will often choose whether to apply anti-aliasing techniques, built-in font hinting or both to produce the most legible text.

geometricPrecision

Indicates that the user agent shall emphasize geometric precision over legibility and rendering speed. This option will usually cause the user agent to suspend the use of hinting so that glyph outlines are drawn with comparable geometric precision to the rendering of path data.

The creator of SVG content might want to provide a hint to the implementation about how to make speed vs. quality tradeoffs as it performs image processing. The 'image-rendering' property provides a hint to the SVG user agent about how to optimize its image rendering.:

'image-rendering'

Value:	auto | optimizeSpeed | optimizeQuality | inherit

Initial:	auto
Applies to:	images
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	yes

auto

> Indicates that the user agent shall make appropriate tradeoffs to balance speed and quality, but quality shall be given more importance than speed.

optimizeSpeed

> Indicates that the user agent shall emphasize rendering speed over quality. This option will sometimes cause the user agent to use a bilinear image resampling algorithm.

optimizeQuality

> Indicates that the user agent shall emphasize quality over rendering speed. This option will sometimes cause the user agent to use a bicubic image resampling algorithm.

11.8 Inheritance of painting properties

The values of any of the painting properties described in this chapter can be inherited from a given object's parent. Painting, however, is always done on each leaf-node individually, never at the 'g' level. Thus, for the following SVG, even though the gradient fill is specified on the 'g', the gradient is simply inherited through the 'g' element down into each rectangle, each of which is rendered such that its interior is painted with the gradient.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="7cm" height="2cm">
  <desc>Gradients apply to leaf nodes
  </desc>
  <g>
    <defs>
      <linearGradient id="MyGradient" gradientUnits="objectBoundingBox">
        <stop offset="0%" style="stop-color:#F60"/>
        <stop offset="100%" style="stop-color:#FF6"/>
      </linearGradient>
    </defs>
    <g style="fill:url(#MyGradient)">
      <rect x="1cm" y="1cm" width="2cm" height="1cm"/>
      <rect x="4cm" y="1cm" width="2cm" height="1cm"/>
    </g>
  </g>
</svg>
```

View this example as SVG (SVG-enabled browsers only)

11.9 DOM interfaces

The following interfaces are defined below: SVGPaint, SVGMarkerElement.

Interface SVGPaint

The SVGPaint interface corresponds to basic type <paint> and represents the values of properties 'fill' and 'stroke'.

IDL Definition

```
interface SVGPaint : SVGColor {
  // Paint Types
  const unsigned short SVG_PAINTTYPE_UNKNOWN              = 0;
  const unsigned short SVG_PAINTTYPE_RGBCOLOR            = 1;
```

```
   const unsigned short SVG_PAINTTYPE_RGBCOLOR_ICCCOLOR     = 2;
   const unsigned short SVG_PAINTTYPE_NONE                  = 101;
   const unsigned short SVG_PAINTTYPE_CURRENTCOLOR          = 102;
   const unsigned short SVG_PAINTTYPE_URI_NONE              = 103;
   const unsigned short SVG_PAINTTYPE_URI_CURRENTCOLOR      = 104;
   const unsigned short SVG_PAINTTYPE_URI_RGBCOLOR          = 105;
   const unsigned short SVG_PAINTTYPE_URI_RGBCOLOR_ICCCOLOR = 106;

   readonly attribute unsigned short paintType;
   readonly attribute DOMString      uri;

   void setUri ( in DOMString uri );
   void setPaint ( in unsigned short paintType, in DOMString uri, in css::RGBColor rgbColor, in
SVGICCColor iccColor );
};
```

Definition group Paint Types

Defined constants

SVG_PAINTTYPE_UNKNOWN	The paint type is not one of predefined types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.
SVG_PAINTTYPE_RGBCOLOR	An sRGB color has been specified without an alternative ICC color specification.
SVG_PAINTTYPE_RGBCOLOR_ICCCOLOR	An sRGB color has been specified along with an alternative ICC color specification.
SVG_PAINTTYPE_NONE	Corresponds to a 'none' value on a <paint> specification.
SVG_PAINTTYPE_CURRENTCOLOR	Corresponds to a 'currentColor' value on a <paint> specification.
SVG_PAINTTYPE_URI_NONE	A URI has been specified, along with either an explicit or an implicit 'none' as the backup paint method in case the URI is unavailable or invalid.
SVG_PAINTTYPE_URI_CURRENTCOLOR	A URI has been specified, along with 'currentColor' as the backup paint method in case the URI is unavailable or invalid.
SVG_PAINTTYPE_URI_RGBCOLOR	A URI has been specified, along with an sRGB color as the backup paint method in case the URI is unavailable or invalid.
SVG_PAINTTYPE_URI_RGBCOLOR_ICCCOLOR	A URI has been specified, along with both an sRGB color and alternate ICC color as the backup paint method in case the URI is unavailable or invalid.

Attributes

readonly unsigned short paintType

The type of paint, identified by one of the constants above.

readonly DOMString uri

When the paintType specifies a URI, this attribute holds the URI string. When the paintType does not specify a URI, this attribute is null.

Methods

setUri

Sets the paintType to SVG_PAINTTYPE_URI_NONE and sets uri to the specified value.

Parameters

in DOMString uri The URI for the desired paint server.

No Return Value

No Exceptions

setPaint

Sets the paintType as specified by the parameters. If paintType requires a URI, then uri must be non-null and a valid string; otherwise, uri must be null. If paintType requires an RGBColor, then rgbColor must be a valid RGBColor object; otherwise, rgbColor must be null. If paintType requires an SVGICCColor, then iccColor must be a valid SVGICCColor object; otherwise, iccColor must be null.

Parameters

in unsigned short paintType One of the defined constants for paintType.
in DOMString uri   The URI for the desired paint server, or null.
in css::RGBColor rgbColor   The specification of an sRGB color, or null.
in SVGICCColor iccColor   The specification of an ICC color, or null.

No Return Value

No Exceptions

Interface SVGMarkerElement

The SVGMarkerElement interface corresponds to the 'marker' element.

IDL Definition

```
interface SVGMarkerElement :
              SVGElement,
              SVGLangSpace,
              SVGExternalResourcesRequired,
              SVGStylable,
              SVGFitToViewBox {

  // Marker Unit Types
  const unsigned short SVG_MARKERUNITS_UNKNOWN       = 0;
  const unsigned short SVG_MARKERUNITS_USERSPACEONUSE = 1;
  const unsigned short SVG_MARKERUNITS_USERSPACE     = 2;
  const unsigned short SVG_MARKERUNITS_STROKEWIDTH   = 3;
  // Marker Orientation Types
  const unsigned short SVG_MARKER_ORIENT_UNKNOWN     = 0;
  const unsigned short SVG_MARKER_ORIENT_AUTO        = 1;
  const unsigned short SVG_MARKER_ORIENT_ANGLE       = 2;

          attribute SVGAnimatedLength      refX;
                    // raises DOMException on setting
          attribute SVGAnimatedLength      refY;
                    // raises DOMException on setting
          attribute SVGAnimatedEnumeration markerUnits;
                    // raises DOMException on setting
          attribute SVGAnimatedLength      markerWidth;
                    // raises DOMException on setting
          attribute SVGAnimatedLength      markerHeight;
                    // raises DOMException on setting
  readonly attribute SVGAnimatedEnumeration orientType;
  readonly attribute SVGAnimatedAngle      orientAngle;

  void setOrientToAuto (  );
  void setOrientToAngle ( in SVGAngle angle );
};
```

Definition group Marker Unit Types

Defined constants

SVG_MARKERUNITS_UNKNOWN	The marker unit type is not one of predefined types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.
SVG_MARKERUNITS_USERSPACEONUSE	The value of attribute markerUnits is 'userSpaceOnUse'.
SVG_MARKERUNITS_USERSPACE	The value of attribute markerUnits is 'userSpace'.
SVG_MARKERUNITS_STROKEWIDTH	The value of attribute markerUnits is 'strokeWidth'.

Definition group Marker Orientation Types

Defined constants

SVG_MARKER_ORIENT_UNKNOWN	The marker orientation is not one of predefined types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.
SVG_MARKER_ORIENT_AUTO	Attribute orient has value 'auto'.
SVG_MARKER_ORIENT_ANGLE	Attribute orient has an angle value.

Attributes

SVGAnimatedLength refX

Corresponds to attribute refX on the given 'marker' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength refY

Corresponds to attribute refY on the given 'marker' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedEnumeration markerUnits

Corresponds to attribute markerUnits on the given 'marker' element. One of the Marker Units Types defined above.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength markerWidth

Corresponds to attribute markerWidth on the given 'marker' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength markerHeight

Corresponds to attribute markerHeight on the given 'marker' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

readonly SVGAnimatedEnumeration orientType

Corresponds to attribute orient on the given 'marker' element. One of the Marker Orientation Types defined above.

readonly SVGAnimatedAngle orientAngle

Corresponds to attribute orient on the given 'marker' element. If markerUnits is SVG_MARKER_ORIENT_ANGLE, the angle value for attribute orient; otherwise, it will be set to zero.

Methods

setOrientToAuto

Sets the value of attribute orient to 'auto'.

No Parameters

No Return Value

No Exceptions

setOrientToAngle

Sets the value of attribute orient to the given angle.

Parameters

in SVGAngle angle The angle value to use for attribute orient.

No Return Value

No Exceptions

---

12 Color

Contents

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12.1 Introduction

All SVG colors are specified in the sRGB color space (see [SRGB]). At a minimum, SVG user agents shall conform to the color behavior requirements specified in the Colors chapter of the CSS2 specification (see [CSS2]).

Additionally, SVG content can specify an alternate color specification using an ICC profiles (see [ICC32]). If ICC-based colors are provided and the SVG user agent support ICC color, then the ICC-based color takes precedence over the sRGB color specification. Note that color interpolation occurs in an RGB color space even if an ICC-based color specification is provided (see 'color-interpolation').

12.2 The 'color' property

The 'color' property is used to provide a potential indirect value (currentColor) for the 'fill', 'stroke', 'stop-color', 'flood-color', 'lighting-color' properties.

'color'

Value:	<color>	inherit
Initial:	depends on user agent
Applies to:	'fill' and 'stroke' properties
Inherited:	see Inheritance of Painting Properties
Percentages:	N/A
Media:	visual
Animatable:	yes

Except for any additional information provided in this specification, the normative definition of the property is in [CSS2].

12.3 Color profile descriptions

12.3.1 Overview of color profile descriptions

The International Color Consortium has established a standard, the ICC Profile [ICC32], for documenting the color characteristics of input and output devices. Using these profiles, it is possible to build a transform and correct visual data for viewing on different devices.

A color profile description provides the bridge between an ICC profile and references to that ICC profile within SVG content. The color profile description is added to the user agent's list of known color profiles and then used to select the relevant profile. The color profile description contains descriptors for the location of the color profile on the Web, a name to reference the profile and information about rendering intent.

12.2.2 Alternative ways for defining a color profile description

Color profile descriptions can be specified in either of the following ways:

- a 'color-profile' element
- an @*color-profile* rule within a CSS style sheet (only applicable for user agents which support using CSS [CSS2] to style the SVG content)

12.3.3 The 'color-profile' element

```
<!ELEMENT color-profile (%descTitleMetadata;,color-profile-src) >
<!ATTLIST color-profile
  %stdAttrs;
  name CDATA #REQUIRED
  rendering-intent (auto | perceptual | relative-colorimetric | saturation | absolute-colorimetric)
"auto" >
```

Attribute definitions:

name = "<name>"

> The name which is used as the first parameter for icc-color specifications within 'fill', 'stroke', 'stop-color', 'flood-color' and 'lighting-color' property values to identify the color profile to use for the ICC color specification. Note that if <name> is not provided, it will be impossible to reference the given color profile description.
> Animatable: no.

rendering-intent = "auto | perceptual | relative-colorimetric | saturation | absolute-colorimetric"

> 'rendering-intent' permits the specification of a color profile rendering intent other than the default. 'rendering-intent' is applicable primarily to color profiles corresponding to CMYK color spaces. The different options cause different methods to be used for translating colors to the color gamut of the target rendering device:
>
> **auto**
>
> > This is the default behavior. The user-agent determines the best intent based on the content type. For image content containing an embedded profile, it shall be assumed that the intent specified within the profile is the desired intent. Otherwise, the user agent shall use the current profile and force the intent, overriding any intent that might be stored in the profile itself.
>
> **perceptual**
>
> > This method, often the preferred choice for images, preserves the relationship between colors. It attempts to maintain relative color values among the pixels as they are mapped to the target device gamut. Sometimes pixel values that were originally within the target device gamut are changed in order to avoid hue shifts and discontinuities and to preserve as much as possible the overall appearance of the scene.
>
> **saturation**
>
> > Preserves the relative saturation (chroma) values of the original pixels. Out of gamut colors are converted to colors that have the same saturation but fall just inside the gamut.
>
> **relative colorimetric**
>
> > Leaves colors that fall inside the gamut unchanged. This method usually converts out of gamut colors to colors that have the same lightness but fall just inside the gamut.
>
> **absolute colorimetric**
>
> > Disables white point matching when converting colors. This option is generally not recommended.
>
> Animatable: no.

Attributes defined elsewhere:

> %stdAttrs;.

```
<!ELEMENT color-profile-src EMPTY >
<!ATTLIST color-profile-src
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #REQUIRED >
```

Attribute definitions:

xlink:href = "<uri>"

The name or location of a standard ICC profile resource. Due to the size of profiles, the <uri> may specify a special name representing a standard profile. The name sRGB, being the standard WWW color space, is defined separately because of its significance, although the rules regarding application of any special profile shall be identical.

[Animatable](): no.

Attributes defined elsewhere:

[%stdAttrs;](), [%xlinkRefAttrs;]().

12.3.4 @color-profile' when using CSS styling

When the document is styled using CSS, the **@color-profile** rule can be used to specify a color profile description. The general form is:

```
@color-profile { <color-profile-description> }
```

where the <color-profile-description> has the form:

```
descriptor: value;
[...]
descriptor: value;
```

Each @color-profile rule specifies a value for every color profile descriptor, either implicitly or explicitly. Those not given explicit values in the rule take the initial value listed with each descriptor in this specification. These descriptors apply solely within the context of the @color-profile rule in which they are defined, and do not apply to document language elements. Thus, there is no notion of which elements the descriptors apply to, or whether the values are inherited by child elements.

The following are the descriptors for a <color-profile-description>:

'src' (Descriptor)

> *Values:* sRGB | <uri> | inherit
> *Initial:* auto
> *Media:* visual

sRGB

> The source profile is assumed to be sRGB [SRGB]. This differs from **auto** in that it overrides an embedded profile inside an image.

<uri>

> The name or location of a standard ICC profile resource. Due to the size of profiles, the <uri> may specify a special name representing a standard profile. The name sRGB, being the standard WWW color space, is defined separately because of its significance, although the rules regarding application of any special profile shall be identical.

'name' (Descriptor)

> *Values:* <name>
> *Initial:* undefined
> *Media:* visual

<name>

> See the description for the [name]() attribute on the ['color-profile']() element. Note that if <name> is not provided, it will be impossible to reference the given @color-profile definition.

'rendering-intent' (Descriptor)

> *Values:* auto | perceptual | relative-colorimetric | saturation | absolute-colorimetric
> *Initial:* auto
> *Media:* visual
> [Animatable](): no

See the description for the [rendering-intent]() attribute on the ['color-profile']() element.

12.4 DOM interfaces

The following interfaces are defined below: [SVGColorProfileElement](), [SVGColorProfileSrcElement](), [SVGColorProfileRule]().

Interface SVGColorProfileElement

The SVGColorProfileElement interface corresponds to the 'color-profile' element.

IDL Definition

```
interface SVGColorProfileElement :
            SVGElement,
            SVGRenderingIntent {

        attribute DOMString      name;
                    // raises DOMException on setting
        attribute unsigned short renderingIntent;
                    // raises DOMException on setting
};
```

Attributes

DOMString name

Corresponds to property name within an @color-profile rule.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

unsigned short renderingIntent

The type of rendering intent, identified by one of the SVGRenderingIntent constants.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGColorProfileSrcElement

The SVGColorProfileSrcElement interface corresponds to the 'color-profile-src' element.

IDL Definition

```
interface SVGColorProfileSrcElement :
            SVGElement,
            SVGURIReference {};
```


Interface SVGColorProfileRule

The SVGColorProfileRule interface represents an @color-profile rule in a CSS style sheet. An @color-profile rule identifies a ICC profile which can be referenced within a given document.

Support for the SVGColorProfileRule interface is only required in user agents that support styling with CSS.

IDL Definition

```
interface SVGColorProfileRule :
            SVGCSSRule,
            SVGRenderingIntent {

        attribute DOMString      src;
                    // raises DOMException on setting
        attribute DOMString      name;
                    // raises DOMException on setting
        attribute unsigned short renderingIntent;
                    // raises DOMException on setting
};
```

Attributes

DOMString src

Corresponds to property src within an @color-profile rule.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

DOMString name

Corresponds to property name within an @color-profile rule.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

unsigned short renderingIntent

The type of rendering intent, identified by one of the SVGRenderingIntent constants.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

---

13 Gradients and Patterns

Contents

13.1 Introduction

With SVG, you can fill (i.e., paint the interior) or stroke (i.e., paint the outline) of shapes and text using one of the following:

- color
- gradients (linear or radial)
- patterns (vector or image, possibly tiled)

SVG uses the general notion of a **paint server**. Gradients and patterns are just specific types of built-in paint servers.

Paint servers are referenced using a URI reference on a 'fill' or 'stroke' property.

13.2 Gradients

13.2.1 Introduction

Gradients consist of continuously smooth color transitions along a vector from one color to another, possibly followed by additional transitions along the same vector to other colors. SVG provides for two types of gradients, **linear gradients** and **radial gradients**.

Once defined, gradients are then referenced using 'fill' or 'stroke' or properties on a given graphics element to indicate that the given element shall be filled or stroked with the referenced gradient.

13.2.2 Linear gradients

Linear gradients are defined by a **'linearGradient'** element.


```
<!ENTITY % linearGradientExt "" >
<!ELEMENT linearGradient (%descTitleMetadata;,(stop|animate|set|animateTransform
                  %linearGradientExt;)*) >
<!ATTLIST linearGradient
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #IMPLIED
  externalResourcesRequired %Boolean; #IMPLIED
  gradientUnits (userSpaceOnUse | userSpace | objectBoundingBox) #IMPLIED
  gradientTransform %TransformList; #IMPLIED
  x1 %Coordinate; #IMPLIED
  y1 %Coordinate; #IMPLIED
  x2 %Coordinate; #IMPLIED
  y2 %Coordinate; #IMPLIED
  spreadMethod (pad | reflect | repeat) "pad" >
```

Attribute definitions:

gradientUnits = "*userSpaceOnUse | userSpace | objectBoundingBox*"

> Defines the coordinate system for attributes x1, y1, x2, y2.
> If gradientUnits="userSpaceOnUse", x1, y1, x2, y2 represent values in the current user coordinate system in place at the time when the 'linearGradient' element is referenced (i.e., the user coordinate system for the element referencing the 'linearGradient' element via a 'fill' or 'stroke' property).
> If gradientUnits="userSpace", x1, y1, x2, y2 represent values in the current user coordinate system in place at the time when the 'linearGradient' element is defined.
> If gradientUnits="objectBoundingBox", then x1, y1, x2, y2 represent fractions or percentages of the bounding box of the element to which the gradient is applied (see Object bounding box units). In this case, the stripes of the linear gradient are perpendicular to the gradient vector in object bounding box space (i.e., the abstract coordinate system where (0,0) is at the top/left of the object bounding box and (1,1) is at the bottom/right of the object bounding box). When the object's bounding box is not square, the stripes that are conceptually perpendicular to the gradient vector within object bounding box space will render non-perpendicular relative to the gradient vector in user space due to application of the non-uniform scaling transformation from bounding box space to user space.
> If attribute gradientUnits is not specified, then the effect is as if a value of userSpaceOnUse were specified.
> Animatable: yes.

gradientTransform = "<transform-list>"

> Contains the definitions of an optional additional transformation from the gradient coordinate system onto the target coordinate system (i.e., userSpaceOnUse, userSpace or objectBoundingBox). This allows for things such as skewing the gradient. This additional transformation matrix is post-multiplied to (i.e., inserted to the right of) any previously defined transformations, including the implicit transformation necessary to convert from object bounding box units to user space.
> Animatable: yes.

x1 = "<coordinate>"

> **x1, y1, x2, y2** define a *gradient vector* for the linear gradient. This *gradient vector* provides starting and ending points onto which the gradient stops are mapped. The values of **x1, y1, x2, y2** can be either numbers or

percentages.
If the attribute is not specified, the effect is as if a value of "0%" were specified.
Animatable: yes.

y1 = "<u><coordinate></u>"

See <u>x1</u>.
If the attribute is not specified, the effect is as if a value of "0%" were specified.
Animatable: yes.

x2 = "<u><coordinate></u>"

See <u>x1</u>.
If the attribute is not specified, the effect is as if a value of "100%" were specified.
Animatable: yes.

y2 = "<u><coordinate></u>"

See <u>x1</u>.
If the attribute is not specified, the effect is as if a value of "0%" were specified.
Animatable: yes.

spreadMethod = "pad | reflect | repeat"

Indicates what happens if the the gradient starts or ends inside the bounds of the *target rectangle*. Possible values are: *pad*, which says to use the terminal colors of the gradient to fill the remainder of the target region, *reflect*, which says to reflect the gradient pattern start-to-end, end-to-start, start-to-end, etc. continuously until the *target rectangle* is filled, and *repeat*, which says to repeat the gradient pattern start-to-end, start-to-end, start-to-end, etc. continuously until the target region is filled.
Animatable: yes.

xlink:href = "<u><uri></u>"

A <u>URI reference</u> to a different 'linearGradient' or 'radialGradient' element within the current SVG document fragment. Any 'linearGradient' attributes which are defined on the referenced element which are not defined on this element are inherited by this element. If this element has no defined gradient stops, and the referenced element does (possibly due to its own href attribute), then this element inherits the gradient stop from the referenced element. Inheritance can be indirect to an arbitrary level; thus, if the referenced element inherits attribute or gradient stops due to its own href attribute, then the current element can inherit those attributes or gradient stops.
Animatable: yes.

Attributes defined elsewhere:

<u>%stdAttrs;</u>, <u>%xlinkRefAttrs;</u>, <u>externalResourcesRequired</u>.

Percentages are allowed for **x1, y1, x2, y2**. For gradientUnits="userSpaceOnUse" or gradientUnits="userSpace", percentages represent values relative to the current viewport. For gradientUnits="objectBoundingBox", percentages represent values relative to the bounding box for the object.

If **x1** = **x2** and **y1** = **y2**, then the area to be painted will be painted as a single color using the color and opacity of the last <u>gradient stop</u>.

Example lingrad01 shows how to fill a rectangle by referencing a linear gradient paint server.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="8cm" height="4cm">
  <desc>Example lingrad01 - fill a rectangle by referencing a
```

```
            linear gradient paint server</desc>
  <g>
    <defs>
      <linearGradient id="MyGradient">
        <stop offset="5%" style="stop-color:#F60"/>
        <stop offset="95%" style="stop-color:#FF6"/>
      </linearGradient>
    </defs>

    <!-- Outline the drawing area in blue -->
    <rect style="fill:none; stroke:blue"
          x=".01cm" y=".01cm" width="7.98cm" height="3.98cm"/>

    <!-- The rectangle is filled using a linear gradient paint server -->
    <rect style="fill:url(#MyGradient); stroke:black"
          x="1cm" y="1cm" width="6cm" height="2cm"/>
  </g>
</svg>
```
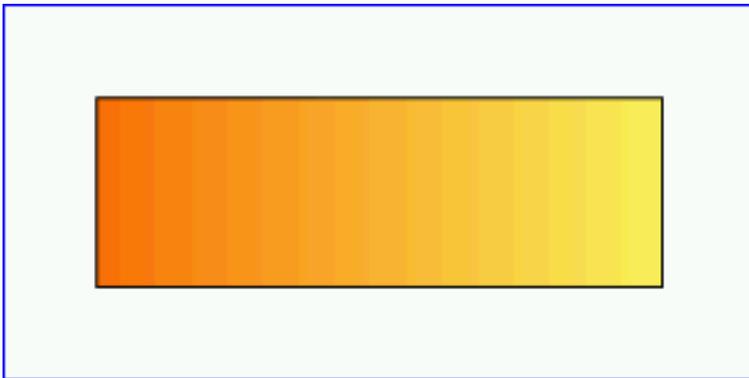

Example lingrad01

View this example as SVG (SVG-enabled browsers only)

13.2.3 Radial gradients

Radial gradients are defined by a **'radialGradient'** element.


```
<!ENTITY % radialGradientExt "" >
<!ELEMENT radialGradient (%descTitleMetadata;,(stop|animate|set|animateTransform
                    %radialGradientExt;)*) >
<!ATTLIST radialGradient
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #IMPLIED
  externalResourcesRequired %Boolean; #IMPLIED
  gradientUnits (userSpaceOnUse | userSpace | objectBoundingBox) #IMPLIED
  gradientTransform %TransformList; #IMPLIED
  cx %Coordinate; #IMPLIED
  cy %Coordinate; #IMPLIED
  r %Length; #IMPLIED
```

```
  fx %Coordinate; #IMPLIED
  fy %Coordinate; #IMPLIED
  spreadMethod (pad | reflect | repeat) "pad" >
```

Attribute definitions:

gradientUnits = "*userSpaceOnUse | userSpace | objectBoundingBox*"

> Defines the coordinate system for attributes cx, cy, r, fx, fy.
> If gradientUnits="userSpaceOnUse", cx, cy, r, fx, fy represent values in the current user coordinate system in place at the time when the 'radialGradient' element is referenced (i.e., the user coordinate system for the element referencing the 'radialGradient' element via a 'fill' or 'stroke' property).
> If **gradientUnits="userSpace"**, cx, cy, r, fx, fy represent values in the current user coordinate system in place at the time when the 'linearGradient' element is defined.
> If **gradientUnits="objectBoundingBox"**, then cx, cy, r, fx, fy represent fractions or percentages of the bounding box of the element to which the gradient is applied (see Object bounding box units). In this case, the rings of the radial gradient are circular with respect to the object bounding box space (i.e., the abstract coordinate system where (0,0) is at the top/left of the object bounding box and (1,1) is at the bottom/right of the object bounding box). When the object's bounding box is not square, the rings that are conceptually circular within object bounding box space will render as elliptical due to application of the non-uniform scaling transformation from bounding box space to user space.
> If attribute gradientUnits is not specified, then the effect is as if a value of userSpaceOnUse were specified.
> Animatable: yes.

gradientTransform = "<transform-list>"

> Contains the definitions of an optional additional transformation from the gradient coordinate system onto the target coordinate system (i.e., userSpaceOnUse, userSpace or objectBoundingBox). This allows for things such as skewing the gradient. This additional transformation matrix is post-multiplied to (i.e., inserted to the right of) any previously defined transformations, including the implicit transformation necessary to convert from object bounding box units to user space.
> Animatable: yes.

cx = "<coordinate>"

> **cx, cy, r** define the largest/outermost circle for the radial gradient. The gradient will be drawn such that the 100% gradient stop is mapped to the perimeter of this largest/outermost circle.
> If the attribute is not specified, the effect is as if a value of "50%" were specified.
> Animatable: yes.

cy = "<coordinate>"

> See cx.
> If the attribute is not specified, the effect is as if a value of "50%" were specified.
> Animatable: yes.

r = "<length>"

> See cx.
> A negative value is an error (see Error processing). A value of zero will cause the area to be painted as a single color using the color and opacity of the last gradient stop.
> If the attribute is not specified, the effect is as if a value of "50%" were specified.
> Animatable: yes.

fx = "<coordinate>"

> **fx, fy** define the focal point for the radial gradient. The gradient will be drawn such that the 0% gradient stop is mapped to (fx, fy).
> If attribute fx is not specified, fx will coincide with cx.
> Animatable: yes.

fy = "<ins><coordinate></ins>"

> See <ins>fx</ins>.
> If attribute fy is not specified, fy will coincide with <ins>cy</ins>.
> <ins>Animatable</ins>: yes.

spreadMethod = "pad | reflect | repeat"

> Indicates what happens if the the gradient starts or ends inside the bounds of the object(s) being painted by the gradient. Has the same values and meanings as the <ins>spreadMethod</ins> attribute on <ins>'linearGradient'</ins> element.
> <ins>Animatable</ins>: yes.

xlink:href = "<ins><uri></ins>"

> A <ins>URI reference</ins> to a different 'linearGradient' or 'radialGradient' element within the current SVG document fragment. Any 'radialGradient' attributes which are defined on the referenced element which are not defined on this element are inherited by this element. If this element has no defined gradient stops, and the referenced element does (possibly due to its own href attribute), then this element inherits the gradient stop from the referenced element. Inheritance can be indirect to an arbitrary level; thus, if the referenced element inherits attribute or gradient stops due to its own href attribute, then the current element can inherit those attributes or gradient stops.
> <ins>Animatable</ins>: yes.

Attributes defined elsewhere:

> <ins>%stdAttrs;</ins>, <ins>%xlinkRefAttrs;</ins>, <ins>externalResourcesRequired</ins>.

Percentages are allowed for **cx, cy, r, fx, fy**. For gradientUnits="userSpaceOnUse" or gradientUnits="userSpace", percentages represent values relative to the current viewport. For gradientUnits="objectBoundingBox", percentages represent values relative to the bounding box for the object.

Example radgrad01 shows how to fill a rectangle by referencing a linear gradient paint server.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="8cm" height="4cm">
  <desc>Example radgrad01 - fill a rectangle by referencing a
        radial gradient paint server</desc>
  <g>
    <defs>
      <radialGradient id="MyGradient"
                      cx="4cm" cy="2cm" r="3cm" fx="4cm" fy="2cm">
        <stop offset="0%" style="stop-color:red"/>
        <stop offset="50%" style="stop-color:blue"/>
        <stop offset="100%" style="stop-color:red"/>
      </radialGradient>
    </defs>

    <!-- Outline the drawing area in blue -->
    <rect style="fill:none; stroke:blue"
          x=".01cm" y=".01cm" width="7.98cm" height="3.98cm"/>

    <!-- The rectangle is filled using a radial gradient paint server -->
    <rect style="fill:url(#MyGradient); stroke:black"
          x="1cm" y="1cm" width="6cm" height="2cm"/>
  </g>
```

```
</svg>
```
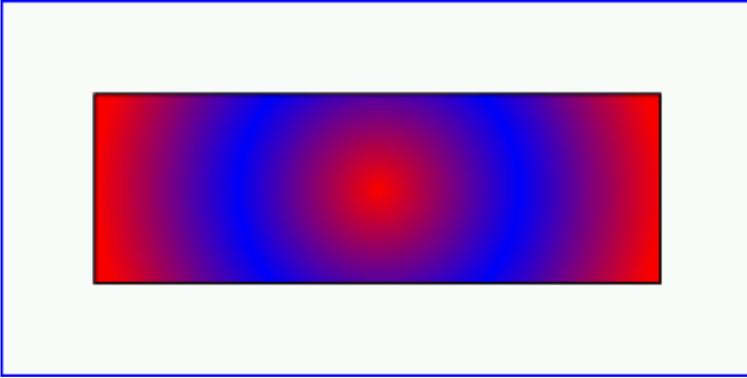

Example radgrad01

View this example as SVG (SVG-enabled browsers only)

13.2.4 Gradient stops

The ramp of colors to use on a gradient is defined by the **'stop'** elements that are child elements to either the 'linearGradient' element or the 'radialGradient' element.

```
<!ENTITY % stopExt "" >
<!ELEMENT stop (animate|set|animateColor
                    %stopExt;)* >
<!ATTLIST stop
  %stdAttrs;
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-Gradients;
  offset %Length; #REQUIRED >
```

Attribute definitions:

offset = "*length*"

The **offset** attribute is either a <number> (usually ranging from 0 to 1) or a percentage (correspondingly usually ranging from 0% to 100%) which indicates where the gradient stop is placed. For linear gradients, the offset attribute represents a location along the *gradient vector*. For radial gradients, it represents a percentage distance from (fx,fy) to the edge of the outermost/largest circle.
Animatable: yes.

Attributes defined elsewhere:

%stdAttrs;, class, style, %PresentationAttributes-Gradients;.

The 'stop-color' property indicates what color to use at that gradient stop. The keyword currentColor and ICC colors can be specified in the same manner as within a <paint> specification for the 'fill' and 'stroke' properties.

'stop-color'

Value: currentColor |
           <color> [icc-color(<name>,<icccolorvalue>+)] |
           inherit

Initial:	black
Applies to:	'stop' elements
Inherited:	no
Percentages:	N/A
Media:	visual
Animatable:	yes

The 'stop-opacity' property defines the opacity of a given gradient stop.

'stop-opacity'

Value:	<alphavalue>	inherit
Initial:	1
Applies to:	'stop' elements
Inherited:	no
Percentages:	N/A
Media:	visual
Animatable:	yes

Some notes on gradients:

- Gradient offset values less than 0 (or less than 0%) are rounded up to 0%. Gradient offset values greater than 1 (or greater than 100%) are rounded down to 100%.

- There needs to be at least two stops defined to have a gradient effect. If no stops are defined, then painting shall occur as if 'none' were specified as the paint style. If one stop is defined, then paint with the solid color fill using the color defined for that gradient stop.

- Each gradient offset value is required to be equal to or greater than the previous gradient stop's offset value. If a given gradient stop's offset value is not equal to or greater than all previous offset values, then the offset value is adjusted to be equal to the largest of all previous offset values.

- If two gradient stops have the same offset value, then the latter gradient stop controls the color value at the overlap point.

13.3 Patterns

A pattern is used to fill or stroke an object using a pre-defined graphic object which can be replicated ("tiled") at fixed intervals in *x* and *y* to cover the areas to be painted.

Patterns are defined using a **'pattern'** element and then referenced by properties **fill:** and **stroke:**.

```
<!ENTITY % patternExt "" >
<!ELEMENT pattern (desc|title|metadata|defs|
                   path|text|rect|circle|ellipse|line|polyline|polygon|
                   use|image|svg|g|view|switch|a|altGlyphDef|
                   script|style|symbol|marker|clipPath|mask|
                   linearGradient|radialGradient|pattern|filter|cursor|font|
                   animate|set|animateMotion|animateColor|animateTransform|
                   color-profile|font-face
                   %ceExt;%patternExt;)* >
<!ATTLIST pattern
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #IMPLIED
  %testAttrs;
```

```
%langSpaceAttrs;
externalResourcesRequired %Boolean; #IMPLIED
class %ClassList; #IMPLIED
style %StyleSheet; #IMPLIED
%PresentationAttributes-All;
viewBox %ViewBoxSpec; #IMPLIED
preserveAspectRatio %PreserveAspectRatioSpec; 'xMidYMid meet'
patternUnits (userSpaceOnUse | userSpace | objectBoundingBox) #IMPLIED
patternTransform %TransformList; #IMPLIED
x %Coordinate; #IMPLIED
y %Coordinate; #IMPLIED
width %Length; #REQUIRED
height %Length; #REQUIRED >
```

Attribute definitions:

patternUnits = "*userSpaceOnUse | userSpace | objectBoundingBox*"

> Defines the coordinate system for attributes x, y, width, height and the contents of the 'pattern'.
> If patternUnits="userSpaceOnUse", x, y, width, height and the contents of the 'pattern' represent values in the current user coordinate system in place at the time when the 'pattern' element is referenced (i.e., the user coordinate system for the element referencing the 'pattern' element via a 'fill' or 'stroke' property).
> If patternUnits="userSpace", x, y, width, height and the contents of the 'pattern' represent values in the current user coordinate system in place at the time when the 'mask' element is defined.
> If patternUnits="objectBoundingBox", x, y, width, height represent fractions or percentages of the bounding box of the element to which the pattern is applied. Additionally, the user coordinate system for the contents of the pattern is established using the bounding box of the element to which the pattern is applied. (See Object bounding box units.)
> If attribute patternUnits is not specified, then the effect is as if a value of userSpaceOnUse were specified.
> Animatable: yes.

patternTransform = "<transform-list>"

> Contains the definitions of an optional additional transformation from the pattern coordinate system onto the target coordinate system (i.e., userSpaceOnUse, userSpace or objectBoundingBox). This allows for things such as skewing the pattern tiles. This additional transformation matrix is post-multiplied to (i.e., inserted to the right of) any previously defined transformations, including the implicit transformation necessary to convert from object bounding box units to user space.
> Animatable: yes.

x = "<coordinate>"

> **x, y, width, height** indicate how the pattern tiles are placed and spaced and represent coordinates and values in the coordinate space specified by **patternUnits**.
> If the attribute is not specified, the effect is as if a value of "0%" were specified.
> Animatable: yes.

y = "<coordinate>"

> See x.
> If the attribute is not specified, the effect is as if a value of "0%" were specified.
> Animatable: yes.

width = "<length>"

> See x.
> A negative value is an error (see Error processing). A value of zero disables rendering of the element (i.e., no paint is applied).

height = "<length>"

> See x.
> A negative value is an error (see Error processing). A value of zero disables rendering of the element (i.e., no paint is applied).
> Animatable: yes.

xlink:href = "<uri>"

> A URI reference to a different 'pattern' element within the current SVG document fragment. Any attributes which are defined on the referenced element which are not defined on this element are inherited by this element. If this element has children, and the referenced element does (possibly due to its own href attribute), then this element inherits the children from the referenced element. Inheritance can be indirect to an arbitrary level; thus, if the referenced element inherits attributes or children due to its own href attribute, then the current element can inherit those attributes or gradient stops.
> Animatable: yes.

Attributes defined elsewhere:

> %stdAttrs;, %langSpaceAttrs;, class, %testAttrs;, externalResourcesRequired, viewBox, preserveAspectRatio, %xlinkRefAttrs;, style, %PresentationAttributes-All;.

Example pattern01 shows how to fill a rectangle by referencing a linear gradient paint server.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="8cm" height="4cm" >
  <defs>
    <pattern id="TrianglePattern"
             x="0" y="0" width="1cm" height="1cm"
             viewBox="0 0 10 10" >
      <path d="M 0 0 L 7 0 L 3.5 7 z" style="fill:red; stroke:blue"/>
    </pattern>
  </defs>

  <!-- Outline the drawing area in blue -->
  <rect style="fill:none; stroke:blue"
        x=".01cm" y=".01cm" width="7.98cm" height="3.98cm"/>

  <!-- The ellipse is filled using a triangle pattern paint server
       and stroked with black -->
  <ellipse style="fill:url(#TrianglePattern); stroke:black"
           cx="4cm" cy="2cm" rx="3.5cm" ry="1.5cm" />
</svg>
```
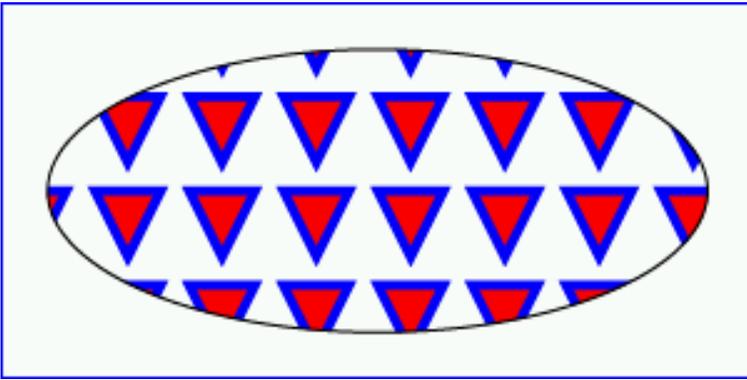
Example pattern01

View this example as SVG (SVG-enabled browsers only)

13.4 DOM interfaces

The following interfaces are defined below: SVGGradientElement, SVGLinearGradientElement, SVGRadialGradientElement, SVGStopElement, SVGPatternElement.

Interface SVGGradientElement

The SVGGradientElement interface is a base interface used by SVGLinearGradientElement and SVGRadialGradientElement.

IDL Definition

```
interface SVGGradientElement :
                SVGElement,
                SVGURIReference,
                SVGExternalResourcesRequired,
                SVGUnitTypes {

  // Spread Method Types
  const unsigned short SVG_SPREADMETHOD_UNKNOWN = 0;
  const unsigned short SVG_SPREADMETHOD_PAD     = 1;
  const unsigned short SVG_SPREADMETHOD_REFLECT = 2;
  const unsigned short SVG_SPREADMETHOD_REPEAT  = 3;

          attribute SVGAnimatedEnumeration   gradientUnits;
                    // raises DOMException on setting
          attribute SVGAnimatedTransformList gradientTransform;
                    // raises DOMException on setting
          attribute SVGAnimatedEnumeration   spreadMethod;
                    // raises DOMException on setting
};
```

Definition group Spread Method Types

Defined constants

SVG_SPREADMETHOD_UNKNOWN	The type is not one of predefined types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.
SVG_SPREADMETHOD_PAD	Corresponds to value pad.
SVG_SPREADMETHOD_REFLECT	Corresponds to value reflect.
SVG_SPREADMETHOD_REPEAT	Corresponds to value repeat.

Attributes

SVGAnimatedEnumeration gradientUnits

Corresponds to attribute gradientUnits on the given element. Takes on one of the constants defined in SVGUnitTypes.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedTransformList gradientTransform

Corresponds to attribute gradientTransform on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedEnumeration spreadMethod

Corresponds to attribute spreadMethod on the given element. One of the Spread Method Types.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGLinearGradientElement

The SVGLinearGradientElement interface corresponds to the 'linearGradient' element.

IDL Definition

```
interface SVGLinearGradientElement : SVGGradientElement {
        attribute SVGAnimatedLength x1;
                    // raises DOMException on setting
        attribute SVGAnimatedLength y1;
                    // raises DOMException on setting
        attribute SVGAnimatedLength x2;
                    // raises DOMException on setting
        attribute SVGAnimatedLength y2;
                    // raises DOMException on setting
};
```

Attributes

SVGAnimatedLength x1

Corresponds to attribute x1 on the given 'linearGradient' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength y1

Corresponds to attribute y1 on the given 'linearGradient' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength x2

Corresponds to attribute x2 on the given 'linearGradient' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength y2

Corresponds to attribute y2 on the given 'linearGradient' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGRadialGradientElement

The SVGRadialGradientElement interface corresponds to the 'radialGradient' element.

IDL Definition

```
interface SVGRadialGradientElement : SVGGradientElement {
            attribute SVGAnimatedLength cx;
                        // raises DOMException on setting
            attribute SVGAnimatedLength cy;
                        // raises DOMException on setting
            attribute SVGAnimatedLength r;
                        // raises DOMException on setting
            attribute SVGAnimatedLength fx;
                        // raises DOMException on setting
            attribute SVGAnimatedLength fy;
                        // raises DOMException on setting
};
```

Attributes

SVGAnimatedLength cx

Corresponds to attribute cx on the given 'radialGradient' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength cy

Corresponds to attribute cy on the given 'radialGradient' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength r

Corresponds to attribute r on the given 'radialGradient' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength fx

Corresponds to attribute fx on the given 'radialGradient' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength fy

Corresponds to attribute fy on the given 'radialGradient' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGStopElement

The SVGStopElement interface corresponds to the 'stop' element.

IDL Definition

```
interface SVGStopElement :
            SVGElement,
            SVGStylable {

        attribute SVGAnimatedNumber offset;
                    // raises DOMException on setting
};
```

Attributes

SVGAnimatedNumber offset

Corresponds to attribute offset on the given 'stop' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGPatternElement

The SVGPatternElement interface corresponds to the 'pattern' element.

IDL Definition

```
interface SVGPatternElement :
            SVGElement,
            SVGURIReference,
            SVGTests,
            SVGLangSpace,
            SVGExternalResourcesRequired,
            SVGStylable,
```

```
              SVGFitToViewBox,
              SVGUnitTypes {

      attribute SVGAnimatedEnumeration   patternUnits;
                  // raises DOMException on setting
      attribute SVGAnimatedTransformList patternTransform;
                  // raises DOMException on setting
      attribute SVGAnimatedLength         x;
                  // raises DOMException on setting
      attribute SVGAnimatedLength         y;
                  // raises DOMException on setting
      attribute SVGAnimatedLength         width;
                  // raises DOMException on setting
      attribute SVGAnimatedLength         height;
                  // raises DOMException on setting
};
```

Attributes

SVGAnimatedEnumeration patternUnits

Corresponds to attribute patternUnits on the given 'pattern' element. Takes on one of the constants defined in SVGUnitTypes.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedTransformList patternTransform

Corresponds to attribute patternTransform on the given 'pattern' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength x

Corresponds to attribute x on the given 'pattern' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength y

Corresponds to attribute y on the given 'pattern' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength width

Corresponds to attribute width on the given 'pattern' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength height

Corresponds to attribute height on the given 'pattern' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

14 Clipping, Masking and Compositing

Contents

14.1 Introduction

SVG supports the following clipping/masking features:

- clipping paths, which uses any combination of 'path', 'text' and basic shapes to serve as the outline of a (in the absense of antialiasing) 1-bit mask, where everything on the "inside" of the outline is allowed to show through but everything on the outside is masked out
- masks, which are container elements which can contain graphics elements or other container elements which define a set of graphics that is to be used as a semi-transparent mask for compositing foreground objects into the current background.

One key distinction between a clipping path and a mask is that clipping paths are hard masks (i.e., the silhouette consists of either fully opaque pixels or fully transparent pixels, with the possible exception of antialiasing along the edge of the silhouette) whereas masks consist of an image where each pixel value indicates the degree of transparency vs. opacity. In a mask, each pixel value can range from fully transparent to fully opaque.

SVG supports only simple alpha blending compositing (see Simple Alpha Blending/Compositing).

(Insert drawings showing a clipping path, a grayscale imagemask, simple alpha blending and more complex blending.)

14.2 Simple alpha blending/compositing

Graphics elements are blended into the elements already rendered on the canvas using simple alpha blending/compositing, in which the resulting color and opacity at any given pixel on the canvas is the result of the following formulas (all color values use premultiplied alpha):

```
Er, Eg, Eb     - Element color value
Ea             - Element opacity/alpha value
Cr, Cg, Cb     - Canvas color value (before blending)
Ca             - Canvas opacity/alpha value (before blending)
Cr', Cg', Cb'  - Canvas color value (after blending)
Ca'            - Canvas opacity/alpha value (after blending)

Ca' = 1 - (1 - Ea) * (1 - Ca)
Cr' = (1 - Ea) * Cr + Er
Cg' = (1 - Ea) * Cg + Eg
Cb' = (1 - Ea) * Cb + Eb
```

The following rendering properties, which provide information about the color space in which to perform the compositing operations, apply to compositing operations:

- 'color-interpolation'
- 'color-rendering'

14.3 Clipping paths

14.3.1 Introduction

The clipping path restricts the region to which paint can be applied. Conceptually, any parts of the drawing that lie outside of the region bounded by the currently active clipping path are not drawn. A clipping path can be thought of as a 1-bit mask.

14.3.2 The initial clipping path

When an 'svg' element is either the root element in the document or is embedded within a document whose layout is determined according to the layout rules of CSS or XSL, then the user agent must establish an initial clipping path for the SVG document fragment. The 'overflow' and 'clip' properties along with additional SVG user agent processing rules determine the initial clipping path which the user agent establishes for the SVG document fragment:

14.3.3 The 'overflow' and 'clip' properties

'overflow'

Value:	visible | hidden | scroll | auto | inherit
Initial:	see prose
Applies to:	elements which establish a new viewport
Inherited:	no
Percentages:	N/A

Media:	visual
Animatable:	yes

The 'overflow' property has the same parameter values and has the same meaning as defined in [CSS2-overflow]; however, the following additional points apply:

- The 'overflow' property only applies to elements that establish new viewports, such as 'svg' elements. (See the discussion of the elements which establish a new viewport.)

- When an outermost SVG 'svg' element is embedded inline within a parent XML grammar which uses CSS layout [CSS2-LAYOUT] or XSL formatting [XSL], if the 'overflow' property has the value hidden, then the user agent will establish an initial clipping path equal to the bounds of the initial viewport; otherwise, the initial clipping path is set according to the clipping rules as defined in [CSS2-overflow].

- When an outermost SVG 'svg' element is standalone or embedded inline within a parent XML grammar which does not use CSS layout [CSS2-LAYOUT] or XSL formatting [XSL], the 'overflow' property on the outermost 'svg' element is ignored for the purposes of visual rendering and the initial clipping path is set to the bounds of the initial viewport.

- For 'svg' elements that are embedded inside of an ancestor SVG document fragment (i.e., without a 'foreignObject' element between the inner 'svg' and the nearest ancestor 'svg') or for any other elements which establish a new viewport, the 'overflow' property determines whether an additional new clipping path is established around the bounds of the viewport established by the given element. If the value of the the 'overflow' property is hidden, then a new clipping path is established; otherwise, no new clipping path is established.

- The initial value for 'overflow' as defined in [CSS2-overflow] is 'visible'; however, the User agent style sheet specifies that the 'overflow' property on all elements within an SVG document fragment has the value 'hidden'.

As a result of the above, the default behavior of SVG user agents is to establish a clipping path to the bounds of the initial viewport and to establish a new clipping path for each element which establishes a new viewport.

For stand-alone SVG viewers or in situations where an SVG document fragment is embedded inline within a parent XML grammar which does not use CSS layout or XSL formatting, then the initial clipping path must be set to the bounds of the viewing region in which the SVG document fragment is rendered, even if the 'overflow' property is set to a value other than hidden.

For related information, see Clip to viewport vs. clip to viewBox.

'clip'

Value:	<shape> | auto | inherit
Initial:	auto
Applies to:	elements which establish a new viewport
Inherited:	no
Percentages:	N/A
Media:	visual
Animatable:	yes

The 'clip' property only applies to elements which establish a new viewport. The 'clip' property has the same parameter values as defined in [CSS2-clip]. Unitless values, which indicates current user coordinates, are permitted on the coordinate values on the <shape>. The value of "auto" defines a clipping path along the bounds of the viewport created by the given element.

14.3.4 Clip to viewport vs. clip to viewBox

It is important to note that initial values for the 'overflow' and 'clip' properties and the User agent style sheet will result in an initial clipping path that is set to the bounds of the initial viewport. When attributes viewBox and preserveAspectRatio attributes are specified on a viewport-creating element, it is sometime desirable that the initial viewport be set to the bounds

of the viewBox instead of the viewport, particularly when preserveAspectRatio specifies uniform scaling and the aspect ratio of the viewBox does not match the aspect ratio of the viewport.

To set the initial clipping path to the bounds of the viewBox instead of the viewport, set the bounds of 'clip' property to the same rectangle as specified on the viewBox attribute. (Note that the parameters don't match. 'clip' takes values <top>, <right>,<bottom> and <left>, whereas viewBox takes values <min-x>, <min-y>, <width> and <height>.)

14.3.5 Establishing a new clipping path

A clipping path is defined with a 'clipPath' element. A clipping path is used/referenced using the 'clip-path' property.

A 'clipPath' element can contain 'path' elements, 'text' elements, other vector graphic shapes (such as 'circle') or a 'use' element. If a 'use' element is a child of a 'clipPath' element, it must directly reference path, text or vector graphic shape elements. Indirect references are an error (see Error processing). The silhouettes of the child elements are logically OR'd together to create a single silhouette which is then used to restrict the region onto which paint can be applied.

It is an error if the 'clip-path' property references a non-existent object or if the referenced object is not a 'clipPath' element (see Error processing).

For a given graphics element, the actual clipping path used will be the intersection of the clipping path specified by its 'clip-path' property (if any) with any clipping paths on its ancestors, as specified by the 'clip-path' property on the ancestor elements, or by the 'overflow' property on ancestor elements which establish a new viewport. Also, see the discussion of the initial clipping path.)

A couple of notes:

* The 'clipPath' element itself and its child elements do *not* inherit clipping paths from the ancesotors of the 'clipPath' element.
* The 'clipPath' element or any of its children can specify property 'clip-path'.
  If a valid 'clip-path' reference is placed on a 'clipPath' element, the resulting clipping path is the intersection of the contents of the 'clipPath' element with the referenced clipping path.
  If a valid 'clip-path' reference is placed on one of the children of a 'clipPath' element, then the given child element is clipped by the referenced clipping path before OR'ing the silhouette of the child element with the silhouettes of the other child elements.

```
<!ENTITY % clipPathExt "" >
<!ELEMENT clipPath (%descTitleMetadata;,
                    (path|text|rect|circle|ellipse|line|polyline|polygon|
                     use|animate|set|animateMotion|animateColor|animateTransform
                     %ceExt;%clipPathExt;)*) >
<!ATTLIST clipPath
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-FontSelection;
  %PresentationAttributes-Graphics;
  %PresentationAttributes-TextContentElements;
```

```
      %PresentationAttributes-TextElements;
      transform %TransformList; #IMPLIED
      clipPathUnits (userSpaceOnUse | userSpace | objectBoundingBox) #IMPLIED >
```

Attribute definitions:

clipPathUnits = "*userSpaceOnUse | userSpace | objectBoundingBox*"

> Defines the coordinate system for the contents of the 'clipPath'.
> If clipPathUnits="userSpaceOnUse", the contents of the 'clipPath' represent values in the current user coordinate system in place at the time when the 'clipPath' element is referenced (i.e., the user coordinate system for the element referencing the 'clipPath' element via the 'clip-path' property).
> If clipPathUnits="userSpace", the contents of the 'clipPath' represent values in the current user coordinate system in place at the time when the 'clipPath' element is defined.
> If clipPathUnits="objectBoundingBox", then the user coordinate system for the contents of the 'clipPath' element is established using the bounding box of the element to which the clipping path is applied (see Object bounding box units).
> If attribute clipPathUnits is not specified, then the effect is as if a value of userSpaceOnUse were specified.
> Animatable: yes.

Attributes defined elsewhere:

> %stdAttrs;, %langSpaceAttrs;, class, transform, %testAttrs;, externalResourcesRequired, style, %PresentationAttributes-FillStroke;, %PresentationAttributes-FontSelection;, %PresentationAttributes-Graphics;, %PresentationAttributes-TextContentElements;, %PresentationAttributes-TextElements;.

'clip-path'

Value:	<uri> | none | inherit
Initial:	none
Applies to:	all elements
Inherited:	no
Percentages:	N/A
Media:	visual
Animatable:	yes

<uri>

> A URI reference to another graphical object within the same SVG document fragment which will be used as the clipping path.

'clip-rule'

Value:	evenodd | nonzero | inherit
Initial:	evenodd
Applies to:	graphics elements within a 'clipPath' element
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	yes

evenodd

> See description of 'fill-rule' property.

nonzero

> See description of 'fill-rule' property.

The 'clip-rule' property only applies to graphics elements that are contained within a 'clipPath' element. The following fragment of code will cause a nonzero clipping rule to be applied to the clipping path because 'clip-rule' is specified on the

['path'](#) element that defines the clipping shape:

```
<g style="clip-rule:evenodd">
  <clipPath id="MyClip">
    <path d="..." style="clip-rule:nonzero" />
  </clipPath>
  <rect style="clip-path:url(#MyClip)" ... />
</g>
```

whereas the following fragment of code will *not* cause a nonzero clipping rule to be applied because the 'clip-rule' is specified on the referencing element, not on the object defining the clipping shape:

```
<g style="clip-rule:evenodd">
  <clipPath id="MyClip">
    <path d="..." />
  </clipPath>
  <rect style="clip-path:url(#MyClip); clip-rule:nonzero" ... />
</g>
```

14.4 Masking

In SVG, you can specify that any other graphics object or 'g' element can be used as an alpha mask for compositing the current object into the background.

A mask is defined with a 'mask' element. A mask is used/referenced using the 'mask' property.

A 'mask' can contain any graphical elements or grouping elements such as a 'g'.

It is an error if the 'mask' property references a non-existent object or if the referenced object is not a 'mask' element (see [Error Processing](#)).

The effect is as if the child elements of the 'mask' are rendered into an offscreen image. Any graphical object which uses/references the given 'mask' element will be painted onto the background through the mask, thus completely or partially masking out parts of the graphical object.

For a four-channel RGBA graphics object that is used as a mask, both the color channels and the alpha channel of the mask contribute to the masking operation. The alpha mask that is used to composite the current object into the background represents the product of the luminance of the color channels (determined using the luminance-to-alpha formulas as defined in the ['feColorMatrix'](#) filter primitive) and the alpha channel from the mask.

For a three-channel RGB graphics object that is used as a mask (e.g., when referencing a 3-channel image file), the effect is as if the object were converted into a 4-channel RGBA image with the alpha channel uniformly set to 1.

For a single-channel image that is used as a mask (e.g., when referencing a 1-channel grayscale image file), the effect is as if the object were converted into a 4-channel RGBA image, where the single channel from the referenced object is used as the alpha channel and the color channels are set to 100% white.

The effect of a mask is identical to what would have happened if there were no mask but instead the alpha channel of the given object were multiplied with the mask's resulting alpha values (i.e., the product of the mask's luminance from its color channels multiplied by the mask's alpha channel).

Note that SVG 'path"s, shapes (e.g., 'circle') and 'text' are all treated as four-channel RGBA images for the purposes of masking operations.

Example mask01 uses an image to mask a rectangle.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
```

```
<svg width="8cm" height="3cm">
  <desc>Example mask01 - blue text masked with gradient against red background
  </desc>
  <defs>
    <linearGradient id="Gradient" x1="0cm" y1="0cm" x2="8cm" y2="0cm">
      <stop offset="0" style="stop-color:black; stop-opacity:0"/>
      <stop offset="1" style="stop-color:black; stop-opacity:1"/>
    </linearGradient>
    <mask id="Mask">
      <rect x="0cm" y="0cm" width="8cm" height="3cm" style="fill:url(#Gradient)" />
    </mask>
    <text id="Text" x="4cm" y="2cm"
          style="font-family:Verdana; font-size:1cm; text-anchor:middle">
      Masked text
    </text>
  </defs>

  <!-- Draw a pale red rectangle in the background -->
  <rect x="0cm" y="0cm" width="8cm" height="3cm" style="fill:#FF8080"/>

  <!-- Draw the text string twice. First, filled blue, with the mask applied.
       Second, outlined in black without the mask. -->
  <use xlink:href="#Text" style="fill:blue; mask:url(#Mask)"/>
  <use xlink:href="#Text" style="fill:none; stroke:black; stroke-width:.02cm"/>
</svg>
```


Example mask01

[View this example as SVG (SVG-enabled browsers only)](#)

```
<!ENTITY % maskExt "" >
<!ELEMENT mask (desc|title|metadata|defs|
                path|text|rect|circle|ellipse|line|polyline|polygon|
                use|image|svg|g|view|switch|a|altGlyphDef|
                script|style|symbol|marker|clipPath|mask|
                linearGradient|radialGradient|pattern|filter|cursor|font|
                animate|set|animateMotion|animateColor|animateTransform|
                color-profile|font-face
                %ceExt;%maskExt;)*  >
<!ATTLIST mask
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
```

```
    style %StyleSheet; #IMPLIED
    %PresentationAttributes-All;
    transform %TransformList; #IMPLIED
    maskUnits (userSpaceOnUse | userSpace | objectBoundingBox) #IMPLIED
    x %Coordinate; #IMPLIED
    y %Coordinate; #IMPLIED
    width %Length; #IMPLIED
    height %Length; #IMPLIED >
```

Attribute definitions:

maskUnits = "*userSpaceOnUse | userSpace | objectBoundingBox*"

> Defines the coordinate system for attributes x, y, width, height and the contents of the 'mask'.
> If maskUnits="userSpaceOnUse", x, y, width, height and the contents of the 'mask' represent values in the current user coordinate system in place at the time when the 'mask' element is referenced (i.e., the user coordinate system for the element referencing the 'mask' element via the 'mask' property).
> If maskUnits="userSpace", x, y, width, height and the contents of the 'mask' represent values in the current user coordinate system in place at the time when the 'mask' element is defined.
> If maskUnits="objectBoundingBox", then the user coordinate system for the contents of the 'mask' element is established using the bounding box of the element to which the clipping path is applied (see Object bounding box units).
> If attribute maskUnits is not specified, then the effect is as if a value of userSpaceOnUse were specified.
> Animatable: yes.

x = "<coordinate>"

> The X-axis coordinate of one corner of the rectangle for the largest possible offscreen buffer. Note that the clipping path used to render any graphics within the mask will consist of the intersection of the current clipping path associated with the given object and the rectangle defined by x, y, width, height.
> If the attribute is not specified, the effect is as if a value of "0%" were specified.
> Animatable: yes.

y = "<coordinate>"

> The Y-axis coordinate of one corner of the rectangle for the largest possible offscreen buffer.
> If the attribute is not specified, the effect is as if a value of "0%" were specified.
> Animatable: yes.

width = "<length>"

> The width of the largest possible offscreen buffer. Note that the clipping path used to render any graphics within the mask will consist of the intersection of the current clipping path associated with the given object and the rectangle defined by x, y, width, height.
> A negative value is an error (see Error processing). A value of zero disables rendering of the element.
> If the attribute is not specified, the effect is as if a value of "100%" were specified.
> Animatable: yes.

height = "<length>"

> The height of the largest possible offscreen buffer.
> A negative value is an error (see Error processing). A value of zero disables rendering of the element.
> If the attribute is not specified, the effect is as if a value of "100%" were specified.
> Animatable: yes.

Attributes defined elsewhere:

> %stdAttrs;, %langSpaceAttrs;, class, transform, %testAttrs;, externalResourcesRequired, style, %PresentationAttributes-All;.

The following is a description of the 'mask' property.

'mask'

<uri>

       A URI reference to another graphical object which will be used as the mask.

14.5 Object and group opacity: the 'opacity' property

There are several opacity properties within SVG:

- Fill opacity

- Stroke opacity

- Gradient stop opacity

- Object/group opacity (described here)

Except for object/group opacity (described just below), all other opacity properties are involved in intermediate rendering operations. Object/group opacity can be thought of conceptually as a postprocessing operation. Conceptually, after the object/group is rendered into an RGBA offscreen image, the object/group opacity setting specifies how to blend the offscreen image into the current background.

'opacity'

<alphavalue>

       The uniform opacity setting to be applied across an entire object. Any values outside the range 0.0 (fully transparent) to 1.0 (fully opaque) will be clamped to this range. (See Clamping values which are restricted to a particular range.) If the object is a container element such as a 'g', then the effect is as if the contents of the 'g' were blended against the current background using a mask where the value of each pixel of the mask is <alphavalue>. (See Simple alpha blending/compositing.)

Example opacity01, illustrates various usage of the 'opacity' property on elements and groups.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="12cm" height="3.5cm">
  <desc>Example opacity01 - opacity property</desc>

  <!-- Background blue rectangle -->
  <rect x="1cm" y="1cm" width="10cm" height="1.5cm" style="fill:#0000ff" />

  <!-- Red circles going from opaque to nearly transparent -->
  <circle cx="2cm" cy="1cm" r=".5cm" style="fill:red; opacity:1" />
```

```
<circle cx="4cm" cy="1cm" r=".5cm" style="fill:red; opacity:.8" />
<circle cx="6cm" cy="1cm" r=".5cm" style="fill:red; opacity:.6" />
<circle cx="8cm" cy="1cm" r=".5cm" style="fill:red; opacity:.4" />
<circle cx="10cm" cy="1cm" r=".5cm" style="fill:red; opacity:.2" />

<!-- Opaque group, opaque circles -->
<g style="opacity:1">
  <circle cx="1.825cm" cy="2.5cm" r=".5cm" style="fill:red; opacity:1" />
  <circle cx="2.175cm" cy="2.5cm" r=".5cm" style="fill:green; opacity:1" />
</g>
<!-- Group opacity: .5, opacity circles -->
<g style="opacity:.5">
  <circle cx="3.825cm" cy="2.5cm" r=".5cm" style="fill:red; opacity:1" />
  <circle cx="4.175cm" cy="2.5cm" r=".5cm" style="fill:green; opacity:1" />
</g>
<!-- Opaque group, semi-transparent green over red -->
<g style="opacity:1">
  <circle cx="5.825cm" cy="2.5cm" r=".5cm" style="fill:red; opacity:.5" />
  <circle cx="6.175cm" cy="2.5cm" r=".5cm" style="fill:green; opacity:.5" />
</g>
<!-- Opaque group, semi-transparent red over green -->
<g style="opacity:1">
  <circle cx="8.175cm" cy="2.5cm" r=".5cm" style="fill:green; opacity:.5" />
  <circle cx="7.825cm" cy="2.5cm" r=".5cm" style="fill:red; opacity:.5" />
</g>
<!-- Group opacity .5, semi-transparent green over red -->
<g style="opacity:.5">
  <circle cx="10.175cm" cy="2.5cm" r=".5cm" style="fill:red; opacity:.5" />
  <circle cx="9.825cm" cy="2.5cm" r=".5cm" style="fill:green; opacity:.5" />
</g>
</svg>
```
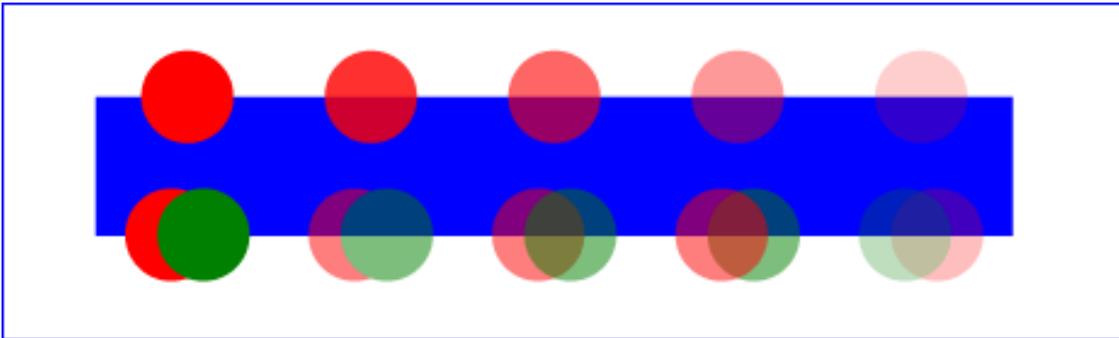

Example opacity01

View this example as SVG (SVG-enabled browsers only)

In the example above, the top row of circles have differing opacities, ranging from 1.0 to 0.2. The bottom row illustrates five 'g' elements, each of which contains overlapping red and green circles, as follows:

- The first group shows the opaque case for reference. The group has opacity of 1, as do the circles.
- The second group shows group opacity when the elements in the group are opaque.
- The third and fourth group show that opacity is not commutative. In the third group (which has opacity of 1), a semi-transparent green circle is drawn on top of a semi-transparent red circle, whereas in the fourth group a semi-transparent red circle is drawn on top of a semi-transparent green circle. Note that area where the two circles intersect display different colors. The third group shows more green color in the intersection area, whereas the fourth group shows more red color.

- The fifth group shows the multiplicative effect of opacity settings. Both the circles and the group itself have opacity settings of .5. The result is that the portion of the red circle which does not overlap with the green circle (i.e., the top/right of the red circle) will blend into the blue rectangle with accumulative opacity of .25 (i.e., .5*.5), which, after blending into the blue rectangle, results in a blended color which is 25% red and 75% blue.

14.6 DOM interfaces

The following interfaces are defined below: SVGClipPathElement, SVGMaskElement.

Interface SVGClipPathElement

The SVGClipPathElement interface corresponds to the 'clipPath' element.

IDL Definition

```
interface SVGClipPathElement :
                SVGElement,
                SVGTests,
                SVGLangSpace,
                SVGExternalResourcesRequired,
                SVGStylable,
                SVGTransformable,
                SVGUnitTypes {

        attribute SVGAnimatedEnumeration clipPathUnits;
                    // raises DOMException on setting
};
```

Attributes

> SVGAnimatedEnumeration clipPathUnits
>
>> Corresponds to attribute clipPathUnits on the given 'clipPath' element. Takes on one of the constants defined in SVGUnitTypes.
>>
>> Exceptions on setting
>>
>>> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGMaskElement

The SVGMaskElement interface corresponds to the 'mask' element.

IDL Definition

```
interface SVGMaskElement :
                SVGElement,
                SVGTests,
                SVGLangSpace,
                SVGExternalResourcesRequired,
                SVGStylable,
```

```
            SVGTransformable,
            SVGUnitTypes {

    attribute SVGAnimatedEnumeration maskUnits;
                // raises DOMException on setting
    attribute SVGAnimatedLength      x;
                // raises DOMException on setting
    attribute SVGAnimatedLength      y;
                // raises DOMException on setting
    attribute SVGAnimatedLength      width;
                // raises DOMException on setting
    attribute SVGAnimatedLength      height;
                // raises DOMException on setting
};
```

Attributes

SVGAnimatedEnumeration maskUnits

Corresponds to attribute maskUnits on the given 'mask' element. Takes on one of the constants defined in SVGUnitTypes.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength x

Corresponds to attribute x on the given 'mask' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength y

Corresponds to attribute y on the given 'mask' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength width

Corresponds to attribute width on the given 'mask' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength height

Corresponds to attribute height on the given 'mask' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

---

15 Filter Effects

Contents

15.1 Introduction

This chapter describes SVG's declarative filter effects feature set, which when combined with the 2D power of SVG can describe much of the common artwork on the web in such a way that client-side generation and alteration can be performed easily.

A filter effect consists of a series of graphics operations that are applied to a given source graphic to produce a modified graphical result. The result of the filter effect is rendered to the target device instead of the original source graphic. The following illustrates the process:
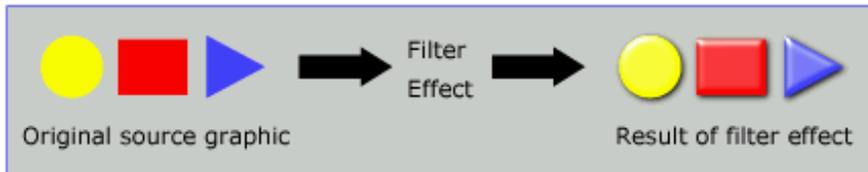
View this example as SVG (SVG-enabled browsers only)

Filter effects are defined by 'filter' elements. To apply a filter effect to a graphics element or a container element, you set the value of the 'filter' property on the given element such that it references the filter effect.

Each 'filter' element contains a set of filter primitives as its children. Each filter primitive performs a single fundamental graphical operation (e.g., a blur or a lighting effect) on one or more inputs, producing a graphical result. Because most of the filter primitives represent some form of image processing, in most cases the output from a filter primitive is a single RGBA image.

The original source graphic or the result/output from a filter primitive can be used as input into one or more other filter primitives. A common application is to use the source graphic multiple times. For example, a simple filter could replace one graphic by two by adding a black copy of original source graphic offset to create a drop shadow. In effect, there are now two layers of graphics, both with the same original source graphics.

When applied to grouping elements such as 'g', the 'filter' property applies to the contents of the group as a whole. The group's children do not render to the screen directly; instead, the graphics commands necessary to render the children are stored temporarily. Typically, the graphics commands are executed as part of the processing of the referenced 'filter' element via use of the keywords SourceGraphic or SourceAlpha.

15.2 An example

The following shows an example of a filter effect.

Example filters01 - introducing filter effects.

```
<?xml version="1.0"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 03December 1999//EN"
            "http://www.w3.org/Graphics/SVG/SVG-19991203.dtd">
<svg width="7.5cm" height="5cm" viewBox="0 0 200 120">
  <title>Example filters01.svg - introducing filter effects</title>
  <desc>An example which combines multiple filter primitives
        to produce a 3D lighting effect on a graphic consisting
        of the string "SVG" sitting on top of oval filled in red
        and surrounded by an oval outlined in red.</desc>
  <defs>
    <filter id="MyFilter">
      <desc>Produces a 3D lighting effect.</desc>
      <feGaussianBlur in="SourceAlpha" stdDeviation="4" result="blur"/>
      <feOffset in="blur" dx="4" dy="4" result="offsetBlur"/>
      <feSpecularLighting in="blur" surfaceScale="5" specularConstant="1"
                          specularExponent="10" style="lighting-color:white"
                          result="specOut">
        <fePointLight x="-5000" y="-10000" z="20000"/>
      </feSpecularLighting>
      <feComposite in="specOut" in2="SourceAlpha" operator="in" result="specOut"/>
      <feComposite in="SourceGraphic" in2="specOut" operator="arithmetic"
                k1="0" k2="1" k3="1" k4="0" result="litPaint"/>
      <feMerge>
        <feMergeNode in="offsetBlur"/>
        <feMergeNode in="litPaint"/>
      </feMerge>
    </filter>
  </defs>
  <rect x="1" y="1" width="198" height="118" style="fill:#888888; stroke:blue"/>
  <g style="filter:url(#MyFilter)">
        <g>
      <path style="fill:none; stroke:#D90000; stroke-width:10"
            d="M50,90 C0,90 0,30 50,30 L150,30 C200,30 200,90 150,90 z" />
```

```
        <path style="fill:#D90000"
              d="M60,80 C30,80 30,40 60,40 L140,40 C170,40 170,80 140,80 z" />
        <g style="fill:#FFFFFF; stroke:black; font-size:45; font-family:Verdana">
          <text x="52" y="76">SVG</text>
        </g>
      </g>
    </g>
</svg>
```


Example filters01

The filter effect used in the example above is repeated here with reference numbers in the left column before each of the six filter primitives:

```
     <filter id="MyFilter">
       <desc>Produces a 3D lighting effect.</desc>
1      <feGaussianBlur in="SourceAlpha" stdDeviation="4" result="blur"/>
2      <feOffset in="blur" dx="4" dy="4" result="offsetBlur"/>
3      <feSpecularLighting in="blur" surfaceScale="5" specularConstant="1"
                           specularExponent="10" style="lighting-color:white"
                           result="specOut">
         <fePointLight x="-5000" y="-10000" z="20000"/>
       </feSpecularLighting>
4      <feComposite in="specOut" in2="SourceAlpha" operator="in" result="specOut"/>
5      <feComposite in="SourceGraphic" in2="specOut" operator="arithmetic"
                    k1="0" k2="1" k3="1" k4="0" result="litPaint"/>
6      <feMerge>
         <feMergeNode in="offsetBlur"/>
         <feMergeNode in="litPaint"/>
       </feMerge>
     </filter>
```

The following pictures show the intermediate image results from each of the six filter elements:

Source graphic   After filter primitive 1   After filter primitive 2   After filter primitive 3

After filter primitive 4   After filter primitive 5   After filter primitive 6
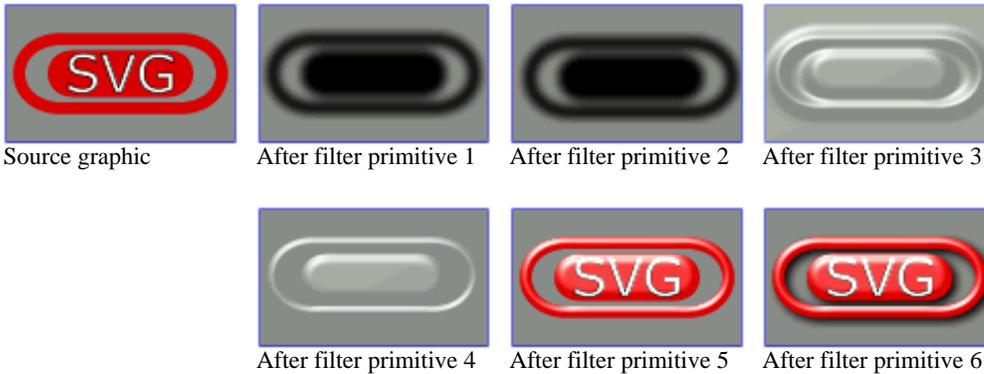
1. Filter primitive 'feGaussianBlur' takes input SourceAlpha, which is the alpha channel of the source graphic. The result is stored in a temporary buffer named "blur". Note that "blur" is used as input to both filter primitives 2 and 3.

2. Filter primitive 'feOffset' takes buffer "blur", shifts the result in a positive direction in both x and y, and creates a new buffer named "offsetBlur". The effect is that of a drop shadow.

3. Filter primitive 'feSpecularLighting', uses buffer "blur" as a model of a surface elevation and generates a lighting effect from a single point source. The result is stored in buffer "specOut".

4. Filter primitive 'feComposite' masks out the result of filter primitive 3 by the original source graphics alpha channel so that the intermediate result is no bigger than the original source graphic.

5. Filter primitive 'feComposite' composites the result of the specular lighting with the original source graphic.

6. Filter primitive 'feMerge' composites two layers together. The lower layer consists of the drop shadow result from filter primitive 2. The upper layer consists of the specular lighting result from filter primitive 5.

15.3 The 'filter' element

The description of the 'filter' elements is as follows:

```
<!ENTITY % filterExt "" >
<!ELEMENT filter (%descTitleMetadata;,(feBlend|feFlood|
   feColorMatrix|feComponentTransfer|
   feComposite|feConvolveMatrix|feDiffuseLighting|feDisplacementMap|
   feGaussianBlur|feImage|feMerge|
   feMorphology|feOffset|feSpecularLighting|
   feTile|feTurbulence|
   animate|set
   %filterExt;)*) >
<!ATTLIST filter
   %stdAttrs;
   %xlinkRefAttrs;
   xlink:href %URI; #IMPLIED
   %langSpaceAttrs;
   externalResourcesRequired %Boolean; #IMPLIED
   class %ClassList; #IMPLIED
   style %StyleSheet; #IMPLIED
   %PresentationAttributes-All;
   filterUnits (userSpaceOnUse | userSpace | objectBoundingBox) #IMPLIED
   primitiveUnits (userSpaceOnUse | userSpace | objectBoundingBox) #IMPLIED
   x %Coordinate; #IMPLIED
   y %Coordinate; #IMPLIED
   width %Length; #IMPLIED
   height %Length; #IMPLIED
   filterRes CDATA #IMPLIED >
```

Attribute definitions:

filterUnits = "*userSpaceOnUse | userSpace | objectBoundingBox*"

> See Filter effects region.

primitiveUnits = "*userSpaceOnUse | userSpace | objectBoundingBox*"

> Specifies the coordinate system for the various length values within the filter primitives.
> If **primitiveUnits="userSpaceOnUse"**, any length values within the filter definitions represent values in the current user coordinate system in place at the time when the 'filter' element is referenced (i.e., the user coordinate system for the element referencing the 'filter' element via a 'filter' property).
> If **primitiveUnits="userSpace"**, any length values within the filter definitions represent values in the current user coordinate system in place at the time when the 'filter' element is defined.
> If **primitiveUnits="objectBoundingBox"**, then any length values within the filter definitions represent fractions or percentages of the bounding box on the referencing element (see Object bounding box units).
> If attribute primitiveUnits is not specified, then the effect is as if a value of userSpaceOnUse were specified.
> Animatable: yes.

x = "*x-coordinate*"

> See Filter effects region.

y = "*y-coordinate*"

> See Filter effects region.

width = "*length*"

> See Filter effects region.

height = "*length*"

> See [Filter effects region](#).

filterRes = "*<number> [<number>]*"

> See [Filter effects region](#).

xlink:href = "[<uri>](#)"

> A [URI reference](#) to another 'filter' element within the current SVG document fragment. Any attributes which are defined on the referenced 'filter' element which are not defined on this element are inherited by this element. If this element has no defined filter nodes, and the referenced element has defined filter nodes (possibly due to its own href attribute), then this element inherits the filter nodes defined from the referenced 'filter' element. Inheritance can be indirect to an arbitrary level; thus, if the referenced 'filter' element inherits attribute or its filter node specification due to its own href attribute, then the current element can inherit those attributes or filter node specifications.
> [Animatable](#): yes.

Attributes defined elsewhere:

> [%stdAttrs;](#), [%langSpaceAttrs;](#), [%xlinkRefAttrs;](#) [externalResourcesRequired](#), [%PresentationAttributes-All;](#).

15.4 The 'filter' property

The description of the 'filter' property is as follows:

'filter'

Value:	<uri> | none | inherit
Initial:	none
Applies to:	graphics and container elements
Inherited:	no
Percentages:	N/A
Media:	visual
[Animatable](#):	yes

<uri>

> A [URI reference](#) to a ['filter'](#) element which defines the filter effects that shall be applied to this element.

> Do not apply any filter effects to this element.

15.5 Filter effects region

A ['filter'](#) element can define a region on the canvas on which a given filter effect applies and can provide a resolution for any intermediate continuous tone images used to process any raster-based filter primitives. The ['filter'](#) element has the following attributes which work together to define the filter effects region:

- **filterUnits={ userSpaceOnUse | userSpace | objectBoundingBox }**.
  Defines the coordinate system for attributes [x, y, width, height](#).
  If **filterUnits="userSpaceOnUse"**, [x, y, width, height](#) and any length values within the filter definitions represent values in the current user coordinate system in place at the time when the ['filter'](#) element is referenced (i.e., the user coordinate system for the element referencing the ['filter'](#) element via a ['filter'](#) property).
  If **filterUnits="userSpace"** (the default), [x, y, width, height](#) and any length values within the filter definitions represent values in the current user coordinate system in place at the time when the ['filter'](#) element is defined.
  If **filterUnits="objectBoundingBox"**, then [x, y, width, height](#) represent fractions or percentages of the bounding box on the referencing element (see [Object bounding box units](#)).
  If attribute filterUnits is not specified, then the effect is as if a value of userSpaceOnUse were specified.
  [Animatable](#): yes.

- **x, y, width, height**, which indicate the rectangle for the largest possible offscreen buffer. The coordinate system for these attributes depends on the value for attribute [filterUnits](#).
  Negative values for **width** or **height** are an error (see [Error processing](#)). Zero values disable rendering of the element which referenced the filter.
  [Animatable](#): yes.

- **filterRes** (which has the form `x-pixels [y-pixels]`) indicates the width/height of the intermediate images in pixels. If not provided, then a reasonable default resolution appropriate for the target device will be used. (For displays, an appropriate display resolution, preferably the current display's pixel resolution, is the default. For printing, an appropriate common printer resolution, such as 400dpi, is the default.) Negative values are an error (see [Error processing](#)). Zero values disable rendering of the element which referenced the filter.
  [Animatable](#): yes.

For performance reasons on display devices, it is recommended that the filter effect region is designed to match pixel-for-pixel with the background.

It is often necessary to provide padding space because the filter effect might impact bits slightly outside the tight-fitting bounding box on a given object. For these purposes, it is possible to provide negative percentage values for **x, y** and percentages values greater than 100% for **width, height**. For example, x="-10%" y="-10%" width="120%" height="120%".

15.6 Accessing the background image

Two possible pseudo input images for filter effects are BackgroundImage and BackgroundAlpha, which each represent an image snapshot of the canvas under the filter region at the time that the <filter> element is invoked. BackgroundImage represents both the color values and alpha channel of the canvas (i.e., RGBA pixel values), whereas BackgroundAlpha represents only the alpha channel.

Implementations of SVG user agents often will need to maintain supplemental background image buffers in order to support the BackgroundImage and BackgroundAlpha pseudo input images. Sometimes, the background image buffers will contain an in-memory copy of the accumulated painting operations on the current canvas.

Because in-memory image buffers can take up significant system resources, SVG content must explicitly indicate to the SVG user agent that the document needs access to the background image before BackgroundImage and BackgroundAlpha pseudo input images can be used. The property which enables access to the background image is **'enable-background'**:

'enable-background'

Value:	accumulate | new [(<x> <y> <width> <height>)] | inherit
Initial:	accumulate
Applies to:	container elements
Inherited:	no
Percentages:	N/A
Media:	visual
Animatable:	no

'enable-background' is only applicable to container elements and specifies how the SVG user agents manages the accumulation of the background image.

A value of **new** indicates two things:

- It enables the ability of children of the current container element to access the background image.

- It indicates that a new (i.e., initially fully transparent) background image canvas is established and that (in effect) all children of the current container element shall be rendered into the new background image canvas in addition to being rendered onto the target device.

A meaning of **enable-background: accumulate** (the initial/default value) depends on context:

- If an ancestor container element has a property value of 'enable-background:new', then all graphics elements within the current container element are rendered both onto the parent container element's background image canvas and onto the target device.

- Otherwise, there is no current background image canvas, so it is only necessary to render graphics elements onto the target device. (No need to render to the background image canvas.)

If a filter effect specifies either the BackgroundImage or the BackgroundAlpha pseudo input images and no ancestor container element has a property value of 'enable-background:new', then the background image request is technically in error. Processing will proceed without interruption (i.e., no error message) and a fully transparent image shall be provided in response to the request.

The optional **(<x>,<y>,<width>,<height>)** parameters on the **new** value indicate the sub-region of user space where access to the background image is allowed to happen. These parameters enable the SVG user agent potentially to allocate smaller temporary image buffers than the default values, which might require the SVG user agent to allocate buffers as large as the current viewport. Thus, the values <x>,<y>,<width>,<height> act as a clipping rectangle on the background image canvas. Negative values for <width> or <height> are an error (see Error processing). Zero values for <width> or <height> have the effect of making the background image empty (i.e., fully transparent).

15.7 Filter primitives overview

15.7.1 Overview

This section describes the various filter primtives that can be assembed to achieve a particular filter effect.

Unless otherwise stated, all image filters operate on linear premultiplied RGBA samples. Filters which work more naturally on non premultiplied data (feColorMatrix and feComponentTransfer) will temporarily undo and redo premultiplication as specified. All raster effect filtering operations take 1 to N input RGBA images, additional attributes as parameters, and produce a single output RGBA image.

The RGBA result from each filter primitive will be clamped into the allowable ranges for colors and opacity values. Thus, for example, the result from a given filter primitives will have any negative color values or opacity values adjusted up to color/opacity of zero.

15.7.2 Common attributes

The following attributes are available for most of the filter primitives:

```
<!ENTITY % filter_primitive_attributes
  "x %Coordinate; #IMPLIED
   y %Coordinate; #IMPLIED
   width %Length; #IMPLIED
   height %Length; #IMPLIED
   result CDATA #IMPLIED" >

<!ENTITY % filter_primitive_attributes_with_in
  "%filter_primitive_attributes;
   in CDATA #IMPLIED">
```

Attribute definitions:

x = "*<coordinate>*"

>   The minimum x coordinate for the sub-region which restricts calculation and rendering of the given filter primitive. See filter region
>   sub-region.
>   Animatable: yes.

y = "*<coordinate>*"

>   The minimum y coordinate for the sub-region which restricts calculation and rendering of the given filter primitive. See filter region
>   sub-region. Animatable: yes.

width = "*<length>*"

>   The width of the sub-region which restricts calculation and rendering of the given filter primitive. See filter region sub-region.
>   A negative value is an error (see Error processing). A value of zero disables the effect of the given filter primitive (i.e., the result is a fully
>   transparent image).
>   Animatable: yes.

height = "*<length>*"

>   The height of the sub-region which restricts calculation and rendering of the given filter primitive. See filter region sub-region.
>   A negative value is an error (see Error processing). A value of zero disables the effect of the given filter primitive (i.e., the result is a fully
>   transparent image).
>   Animatable: yes.

result = "*<filter-primitive-reference>*"

>   Assigned name for this filter primitive. If supplied, then graphics that results from processing this filter primitive can be referenced by an in
>   attribute on a subsequent filter primitive within the same 'filter' element. If no value is provided, the output will only be available for re-use as
>   the implicit input into the next filter primitive if that filter primitive provides no value for its in attribute.
>   Note that a *<filter-primitive-reference>* is not an XML ID; instead, a *<filter-primitive-reference>* is only are meaningful within a given 'filter'
>   element and thus have only local scope. It is legal for the same *<filter-primitive-reference>* to appear multiple times within the same 'filter'
>   element. When referenced, the *<filter-primitive-reference>* will use the closest preceding filter primitive with the given result.
>   Animatable: yes.

in = "*SourceGraphic* | *SourceAlpha* | *BackgroundImage* | *BackgroundAlpha* | *FillPaint* | *StrokePaint* | *<filter-primitive-reference>*"

>   Identifies input for the given filter primitive. The value can be either one of six keywords or can be a string which matches a previous result
>   attribute value within the same 'filter' element. If no value is provided and this is the first filter primitive, then this filter primitive will use
>   SourceGraphic as its input. If no value is provided and this is a subsequent filter primitive, then this filter primitive will use the result from the
>   previous filter primitive as its input.
>
>   If the value for result appears multiple times within a given 'filter' element, then a reference to that result will use the closest preceding filter
>   primitive with the given value for attribute result. Forward references to results are an error.
>
>   Definitions for the six keywords:
>
>   SourceGraphic
>
> >   This keyword represents the graphics elements that were the original input into the 'filter' element. For raster effects filter primitives,
> >   the graphics elements will be rasterized into an initially clear RGBA raster in image space. Pixels left untouched by the original graphic
> >   will be left clear. The image is specified to be rendered in linear RGBA pixels. The alpha channel of this image captures any
> >   anti-aliasing specified by SVG. (Since the raster is linear, the alpha channel of this image will represent the exact percent coverage of
> >   each pixel.)
>
>   SourceAlpha

This keyword represents the graphics elements that were the original input into the ['filter'](#) element. SourceAlpha has all of the same rules as [SourceGraphic](#) except that only the alpha channel is used. The input image is an RGBA image consisting of implicitly black color values for the RGB channels, but whose alpha channel is the same as [SourceGraphic](#). If this option is used, then some implementations might need to rasterize the graphics elements in order to extract the alpha channel.

BackgroundImage

This keyword represents an image snapshot of the canvas under the filter region at the time that the ['filter'](#) element was invoked. See [Accessing the background image](#).

BackgroundAlpha

Same as [BackgroundImage](#) except only the alpha channel is used. See [SourceAlpha](#) and [Accessing the background image](#).

FillPaint

This keyword represents the value of the ['fill'](#) property on the target element for the filter effect. The FillPaint image has conceptually infinite extent. Frequently this image is opaque everywhere, but it might not be if the "paint" itself has alpha, as in the case of an alpha gradient or transparent pattern.

StrokePaint

This keyword represents the value of the ['stroke'](#) property on the target element for the filter effect. Same as The StrokePaint image has conceptually infinite extent. Frequently this image is opaque everywhere, but it might not be if the "paint" itself has alpha, as in the case of an alpha gradient or transparent pattern.

[Animatable](#): yes.

15.7.3 Filter primitive sub-region

All filter primitives have attributes **x**, **y**, **width** and **height** which identify a sub-region which restricts calculation and rendering of the given filter primitive. These attributes are defined according to the same rules as other filter primitives coordinate and length attributes.

x, **y**, **width** and **height** default to the union (i.e., tightest fitting bounding box) of the sub-regions defined for all referenced nodes. If there are no referenced nodes (e.g., for ['feImage'](#) or ['feTurbulence'](#), which have no specified value for [in](#), or if [in](#)="[SourceGraphic](#)") or for ['feTile'](#) (which is special), the default subregion is 0%,0%,100%,100%, where percentages are relative to the dimensions of the filter region.

x, **y**, **width** and **height** act as a hard clip clipping rectangle.

All intermediate offscreens are defined to not exceed the intersection of **x**, **y**, **width** and **height** with the [filter region](#). The filter region and any of the **x**, **y**, **width** and **height** sub-regions are to be set up such that all offscreens are made big enough to accommodate any pixels which even partly intersect with either the filter region or the x,y,width,height subregions.

['feImage'](#) scales the referenced image to fit exactly into the sub-region specified by **x**, **y**, **width** and **height**.

['feTile'](#) references a previous filter primitive and then stitches the tiles together based on the **x**, **y**, **width** and **height** values of the referenced filter primitive.

15.8 Light source elements and properties

15.8.1 Introduction

The following sections define the elements that define a light source, ['feDistantLight'](#), ['fePointLight'](#) and ['feSpotLight'](#), and property ['lighting-color'](#), which defines the color of the light.

15.8.2 Light source 'feDistantLight'

```
<!ELEMENT feDistantLight (animate|set)* >
<!ATTLIST feDistantLight
  %stdAttrs;
  azimuth %Number; #IMPLIED
  elevation %Number; #IMPLIED >
```

Attribute definitions:

azimuth = "*<number>*"

Direction angle for the light source on the XY plane, in degrees.
[Animatable](#): yes.

elevation = "*<number>*"

Direction angle for the light source on the YZ plane, in degrees.
Animatable: yes.

Attributes defined elsewhere:

%stdAttrs;.

15.8.3 Light source 'fePointLight'

```
<!ELEMENT fePointLight (animate|set)* >
<!ATTLIST fePointLight
  %stdAttrs;
  x %Number; #IMPLIED
  y %Number; #IMPLIED
  z %Number; #IMPLIED >
```

Attribute definitions:

x = "*<number>*"

X location for the light source.
Animatable: yes.

y = "*<number>*"

Y location for the light source.
Animatable: yes.

z = "*<number>*"

Z location for the light source.
Animatable: yes.

Attributes defined elsewhere:

%stdAttrs;.

15.8.4 Light source 'feSpotLight'

```
<!ELEMENT feSpotLight (animate|set)* >
<!ATTLIST feSpotLight
  %stdAttrs;
  x %Number; #IMPLIED
  y %Number; #IMPLIED
  z %Number; #IMPLIED
  pointsAtX %Number; #IMPLIED
  pointsAtY %Number; #IMPLIED
  pointsAtZ %Number; #IMPLIED
  specularExponent %Number; #IMPLIED
  limitingConeAngle %Number; #IMPLIED >
```

Attribute definitions:

x = "*<number>*"

X location for the light source.
Animatable: yes.

y = "*<number>*"

Y location for the light source.
Animatable: yes.

z = "*<number>*"

Z location for the light source.
Animatable: yes.

pointsAtX = "*<number>*"

X location of the point at which the light source is pointing.
Animatable: yes.

pointsAtY = "*[<number>](#)*"

> Y location of the point at which the light source is pointing.
> [Animatable](#): yes.

pointsAtZ = "*[<number>](#)*"

> Z location of the point at which the light source is pointing.
> [Animatable](#): yes.

specularExponent = "*[<number>](#)*"

> Exponent value controlling the focus for the light source.
> [Animatable](#): yes.

limitingConeAngle = "*[<number>](#)*"

> A limiting cone which restricts the region where the light is projected. No light is projected outside the cone. limitingConeAngle represents the angle between the spot light axis (i.e. the axis between the light source and the point to which it is pointing at) and the spot light cone. User agents should apply a smoothing technique such as anti-aliasing at the boundary of the cone.
> If no value is specified, then no limiting cone will be applied.
> [Animatable](#): yes.

Attributes defined elsewhere:

> [%stdAttrs;](#).

15.8.5 The 'lighting-color' property

The 'lighting-color' property defines the color of the light source for filter primitives ['feDiffuseLighting'](#) and ['feSpecularLighting'](#).

'lighting-color'

Value:	currentColor |
	[<color>](#) [icc-color(<name>,<icccolorvalue>+)] |
	inherit
Initial:	white
Applies to:	['feDiffuseLighting'](#) and ['feSpecularLighting'](#) elements
Inherited:	no
Percentages:	N/A
Media:	visual
[Animatable](#):	yes

15.9 Filter primitive 'feBlend'

This filter composites two objects together using commonly used imaging software blending modes. It performs a pixel-wise combination of two input images.

```
<!ELEMENT feBlend (animate|set)* >
<!ATTLIST feBlend
  %stdAttrs;
  %filter_primitive_attributes_with_in;
  in2 CDATA #REQUIRED
  mode (normal | multiply | screen | darken | lighten) "normal" >
```

Attribute definitions:

mode = "*normal | multiply | screen | darken | lighten*"

> One of the image blending modes (see [table](#) below). Default is: normal.
> [Animatable](#): yes.

in2 = "*(see [in](#) attribute)*"

> The second input image to the blending operation. This attribute can take on the same values as the [in](#) attribute.
> [Animatable](#): yes.

Attributes defined elsewhere:

> [%stdAttrs;](#), [%filter_primitive_attributes_with_in;](#).

For all feBlend modes, the result opacity is computed as follows:

```
qr = 1 - (1-qa)*(1-qb)
```

For the compositing formulas below, the following definitions apply:

```
cr = Result color (RGB) - premultiplied
qa = Opacity value at a given pixel for image A
qb = Opacity value at a given pixel for image B
ca = Color (RGB) at a given pixel for image A - premultiplied
cb = Color (RGB) at a given pixel for image B - premultiplied
```

The following table provides the list of available image blending modes:

Image Blending Mode	Formula for computing result color
normal	cr = (1 - qa) * cb + ca
multiply	cr = (1-qa)*cb + (1-qb)*ca + ca*cb
screen	cr = cb + ca - ca * cb
darken	cr = Min ((1 - qa) * cb + ca, (1 - qb) * ca + cb)
lighten	cr = Max ((1 - qa) * cb + ca, (1 - qb) * ca + cb)

Example feBlend shows examples of the five blend modes.

```
<?xml version="1.0"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
          "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="5cm" height="5cm" viewBox="0 0 500 500">
  <title>Example feBlend - Examples of feBlend modes</title>
  <desc>Five text strings blended into a gradient,
        with one text string for each of the five feBlend modes.</desc>
  <defs>
    <linearGradient id="MyGradient" gradientUnits="userSpaceOnUse"
            x1="100" y1="0" x2="300" y2="0">
      <stop offset="0" style="stop-color:#000000"/>
      <stop offset=".33" style="stop-color:#ffffff"/>
      <stop offset=".67" style="stop-color:#ff0000"/>
      <stop offset="1" style="stop-color:#808080"/>
    </linearGradient>
    <filter id="Normal">
      <feBlend mode="normal" in2="BackgroundImage" in="SourceGraphic"/>
    </filter>
    <filter id="Multiply">
      <feBlend mode="multiply" in2="BackgroundImage" in="SourceGraphic"/>
    </filter>
    <filter id="Screen">
      <feBlend mode="screen" in2="BackgroundImage" in="SourceGraphic"/>
    </filter>
    <filter id="Darken">
      <feBlend mode="darken" in2="BackgroundImage" in="SourceGraphic"/>
    </filter>
    <filter id="Lighten">
      <feBlend mode="lighten" in2="BackgroundImage" in="SourceGraphic"/>
    </filter>
  </defs>
  <rect style="fill:none; stroke:blue"
        x="1" y="1" width="498" height="498"/>
  <g style="enable-background: new">
    <rect x="100" y="20" width="300" height="460" style="fill:url(#MyGradient)"/>
    <g style="font-family:Verdana; font-size:75; fill:#888888; fill-opacity:.6">
      <text x="50" y="90" style="filter:url(#Normal)">Normal</text>
      <text x="50" y="180" style="filter:url(#Multiply)">Multiply</text>
      <text x="50" y="270" style="filter:url(#Screen)">Screen</text>
      <text x="50" y="360" style="filter:url(#Darken)">Darken</text>
      <text x="50" y="450" style="filter:url(#Lighten)">Lighten</text>
    </g>
  </g>
</svg>
```
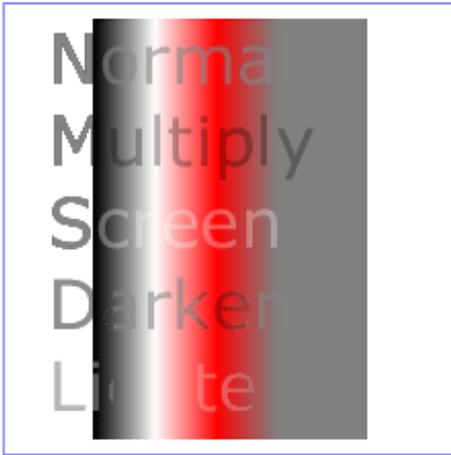
Example feBlend

View this example as SVG (SVG-enabled browsers only)

15.10 Filter primitive 'feColorMatrix'

This filter applies a matrix transformation:

```
| R' |     | a00 a01 a02 a03 a04 |   | R |

| G' |     | a10 a11 a12 a13 a14 |   | G |

| B' |  =  | a20 a21 a22 a23 a24 | * | B |

| A' |     | a30 a31 a32 a33 a34 |   | A |

| 1  |     | 0   0   0   0   1   |   | 1 |
```

on the RGBA color and alpha values of every pixel on the input graphics to produce a result with a new set of RGBA color and alpha values.

The calculations are performed on non-premultiplied color values. If the input graphics consists of premultiplied color values, those values are automatically converted into non-premultiplied color values for this operation.

These matrices often perform an identity mapping in the alpha channel. If that is the case, an implementation can avoid the costly undoing & redoing of the premultiplication for all pixels with A = 1.

```
<!ELEMENT feColorMatrix (animate|set)* >
<!ATTLIST feColorMatrix
  %stdAttrs;
  %filter_primitive_attributes_with_in;
  type (matrix | saturate | hueRotate | luminanceToAlpha) "matrix"
  values CDATA #IMPLIED >
```

Attribute definitions:

type = "*matrix | saturate | hueRotate | luminanceToAlpha*"

> Indicates the type of matrix operation. The keyword matrix indicates that a full 5x4 matrix of values will be provided. The other keywords represent convenience shortcuts to allow commonly used color operations to be performed without specifying a complete matrix.
> Animatable: yes.

values = "*list of <number>s*"

> The contents of values depends on the value of attribute type:
>
> ❍ For type="matrix", values is a list of 20 matrix values (a00 a01 a02 a03 a04 a10 a11 ... a34), separated by whitespace and/or a comma. For example, the identity matrix could be expressed as:
>
> ```
> type="matrix"
> values="1 0 0 0 0  0 1 0 0 0  0 0 1 0 0  0 0 0 1 0"
> ```
>
> ❍ For type="saturate", values is single real number value (0 to 1) or one percentage value (e.g., 50%). A saturate operation is equivalent

to the following matrix operation:

```
| R' |         |0.213+0.787s  0.715-0.715s  0.072-0.072s 0  0 |     | R |

| G' |         |0.213-0.213s  0.715+0.285s  0.072-0.072s 0  0 |     | G |

| B' |   =     |0.213-0.213s  0.715-0.715s  0.072+0.928s 0  0 | * | B |

| A' |         |          0            0              0  1  0 |     | A |

| 1  |         |          0            0              0  0  1 |     | 1 |
```

❍ For type="hueRotate", values is single one real number value (degrees). A hueRotate operation is equivalent to the following matrix operation:

```
| R' |         | a00  a01  a02  0  0 |     | R |

| G' |         | a10  a11  a12  0  0 |     | G |

| B' |   =     | a20  a21  a22  0  0 | * | B |

| A' |         | 0    0    0    1  0 |     | A |

| 1  |         | 0    0    0    0  1 |     | 1 |
```

where the terms a00, a01, etc. are calculated as follows:

```
| a01 a01 a02 |     [+0.213 +0.715 +0.072]
| a10 a11 a12 |  =  [+0.213 +0.715 +0.072] +
| a20 a21 a22 |     [+0.213 +0.715 +0.072]

                          [+0.787 -0.715 -0.072]
   cos(hueRotate value) * [-0.212 +0.285 -0.072] +
                          [-0.213 -0.715 +0.928]

                          [-0.213 -0.715+0.928]
   sin(hueRotate value) * [+0.143 +0.140-0.283]
                          [-0.787 +0.715+0.072]
```

Thus, the upper left term of the hue matrix turns out to be:

```
.213 + cos(hueRotate value)*.787 - sin(hueRotate value)*.213
```

❍ For type="luminanceToAlpha", values is not applicable. A luminanceToAlpha operation is equivalent to the following matrix operation:

```
| R' |         |       0        0        0  0  0 |     | R |

| G' |         |       0        0        0  0  0 |     | G |

| B' |   =     |       0        0        0  0  0 | * | B |

| A' |         | 0.2125   0.7154   0.0721  0  0 |     | A |

| 1  |         |       0        0        0  0  1 |     | 1 |
```

[Animatable]: yes.

Attributes defined elsewhere:

%stdAttrs;, %filter_primitive_attributes_with_in;.

Example feColorMatrix shows examples of the four types of feColorMatrix operations.

```
<?xml version="1.0"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
          "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="8cm" height="5cm" viewBox="0 0 800 500">
  <title>Example feColorMatrix - Examples of feColorMatrix operations</title>
  <desc>Five text strings showing the effects of feColorMatrix:
      an unfiltered text string acting as a reference,
      use of the feColorMatrix matrix option to convert to grayscale,
```

```
          use of the feColorMatrix saturate option,
          use of the feColorMatrix hueRotate option,
          and use of the feColorMatrix luminanceToAlpha option.</desc>
  <defs>
    <linearGradient id="MyGradient" gradientUnits="userSpaceOnUse"
            x1="100" y1="0" x2="500" y2="0">
      <stop offset="0" style="stop-color:#ff00ff"/>
      <stop offset=".33" style="stop-color:#88ff88"/>
      <stop offset=".67" style="stop-color:#2020ff"/>
      <stop offset="1" style="stop-color:#d00000"/>
    </linearGradient>
    <filter id="Matrix" filterUnits="objectBoundingBox"
            x="0%" y="0%" width="100%" height="100%">
      <feColorMatrix type="matrix" in="SourceGraphic"
          values=".33 .33 .33 0 0
                  .33 .33 .33 0 0
                  .33 .33 .33 0 0
                  .33 .33 .33 0 0"/>
    </filter>
    <filter id="Saturate40" filterUnits="objectBoundingBox"
            x="0%" y="0%" width="100%" height="100%">
      <feColorMatrix type="saturate" in="SourceGraphic" values="40%"/>
    </filter>
    <filter id="HueRotate90" filterUnits="objectBoundingBox"
            x="0%" y="0%" width="100%" height="100%">
      <feColorMatrix type="hueRotate" in="SourceGraphic" values="90"/>
    </filter>
    <filter id="LuminanceToAlpha" filterUnits="objectBoundingBox"
            x="0%" y="0%" width="100%" height="100%">
      <feColorMatrix type="luminanceToAlpha" in="SourceGraphic" result="a"/>
      <feComposite in="SourceGraphic" in2="a" operator="in" />
    </filter>
  </defs>
  <rect style="fill:none; stroke:blue"
        x="1" y="1" width="798" height="498"/>
  <g style="font-family:Verdana; font-size:75;
            font-weight:bold; fill:url(#MyGradient)">
    <rect x="100" y="0" width="500" height="20" />
    <text x="100" y="90">Unfiltered</text>
    <text x="100" y="190" style="filter:url(#Matrix)">Matrix</text>
    <text x="100" y="290" style="filter:url(#Saturate20)">Saturate</text>
    <text x="100" y="390" style="filter:url(#HueRotate90)">HueRotate</text>
    <text x="100" y="490" style="filter:url(#LuminanceToAlpha)">Luminance</text>
  </g>
</svg>
```


Example feColorMatrix

15.11 Filter primitive 'feComponentTransfer'

This filter primitive performs component-wise remapping of data as follows:

```
R' = feFuncR( R )
G' = feFuncG( G )
B' = feFuncB( B )
A' = feFuncA( A )
```

for every pixel. It allows operations like brightness adjustment, contrast adjustment, color balance or thresholding.

The calculations are performed on non-premultiplied color values. If the input graphics consists of premultiplied color values, those values are automatically converted into non-premultiplied color values for this operation. (Note that the undoing and redoing of the premultiplication can be avoided if feFuncA is the identity transform and all alpha values on the source graphic are set to 1.)

```
<!ELEMENT feComponentTransfer (feFuncR?,feFuncG?,feFuncB?,feFuncA?) >
<!ATTLIST feComponentTransfer
  %stdAttrs;
  %filter_primitive_attributes_with_in; >

<!ENTITY % component_transfer_function_attributes
  "type (identity | table | discrete | linear | gamma) #REQUIRED
   tableValues CDATA #IMPLIED
   slope %Number; #IMPLIED
   intercept %Number; #IMPLIED
   amplitude %Number; #IMPLIED
   exponent %Number; #IMPLIED
   offset %Number; #IMPLIED" >

<!ELEMENT feFuncR (animate|set)* >
<!ATTLIST feFuncR
  %stdAttrs;
  %component_transfer_function_attributes; >

<!ELEMENT feFuncG (animate|set)* >
<!ATTLIST feFuncG
  %stdAttrs;
  %component_transfer_function_attributes; >

<!ELEMENT feFuncB (animate|set)* >
<!ATTLIST feFuncB
  %stdAttrs;
  %component_transfer_function_attributes; >

<!ELEMENT feFuncA (animate|set)* >
<!ATTLIST feFuncA
  %stdAttrs;
  %component_transfer_function_attributes; >
```

The specification of the transfer functions is defined by the sub-elements to 'feComponentTransfer':

'feFuncR', transfer function for red component of the input graphic

'feFuncG', transfer function for green component of the input graphic

'feFuncB', transfer function for blue component of the input graphic

'feFuncA', transfer function for alpha component of the input graphic

The attributes below apply to sub-elements 'feFuncR', 'feFuncG', 'feFuncB' and 'feFuncA' define the transfer functions.

Attribute definitions:

type = "*identity | table | discrete | linear | gamma*"

Indicates the type of component transfer function. The type of function determines the applicability of the other attributes.

❍ For identity:

```
            C' = C
```

❍ For table, the function is defined by linear interpolation into a lookup table defined by attribute tableValues. Interpolations use the following formula:

k/N <= C < (k+1)/N => C' = v_k + (C - k/N)*N * (v_{k+1} - v_k)

❍ For discrete, the function is defined by the step function defined by attribute tableValues. Interpolations use the following formula:

k/N <= C < (k+1)/N => C' = v_k

❍ For linear, the function is defined by the following linear equation:

C' = slope * C + intercept

❍ For gamma, the function is defined by the following exponential function:

C' = amplitude * pow(C, exponent) + offset

Animatable: yes.

tableValues = "*(list of <number>s)*"

When type="table", the list of <number>s *v0,v1,...vn*, separated by white space and/or a comma, which define the lookup table.
Animatable: yes.

slope = "*<number>*"

When type="linear", the slope of the linear function.
Animatable: yes.

intercept = "*<number>*"

When type="linear", the intercept of the linear function.
Animatable: yes.

amplitude = "*<number>*"

When type="gamma", the amplitude of the gamma function.
Animatable: yes.

exponent = "*<number>*"

When type="gamma", the exponent of the gamma function.
Animatable: yes.

offset = "*<number>*"

When type="gamma", the offset of the gamma function.
Animatable: yes.

Attributes defined elsewhere:

%stdAttrs;, %filter_primitive_attributes_with_in;.

Example feComponentTransfer shows examples of the four types of feComponentTransfer operations.

```
<?xml version="1.0"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
          "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="8cm" height="4cm" viewBox="0 0 800 400">
  <title>Example feComponentTransfer - Examples of feComponentTransfer operations</title>
  <desc>Four text strings showing the effects of feComponentTransfer:
        an identity function acting as a reference,
        use of the feComponentTransfer table option,
        use of the feComponentTransfer linear option,
        and use of the feComponentTransfer gamma option.</desc>
  <defs>
    <linearGradient id="MyGradient" gradientUnits="userSpaceOnUse"
          x1="100" y1="0" x2="600" y2="0">
      <stop offset="0" style="stop-color:#ff0000"/>
      <stop offset=".33" style="stop-color:#00ff00"/>
      <stop offset=".67" style="stop-color:#0000ff"/>
      <stop offset="1" style="stop-color:#000000"/>
    </linearGradient>
    <filter id="Identity" filterUnits="objectBoundingBox"
          x="0%" y="0%" width="100%" height="100%">
      <feComponentTransfer>
        <feFuncR type="identity"/>
```

```
        <feFuncG type="identity"/>
        <feFuncB type="identity"/>
        <feFuncA type="identity"/>
      </feComponentTransfer>
    </filter>
    <filter id="Table" filterUnits="objectBoundingBox"
            x="0%" y="0%" width="100%" height="100%">
      <feComponentTransfer>
        <feFuncR type="table" tableValues="0 0 1 1"/>
        <feFuncG type="table" tableValues="1 1 0 0"/>
        <feFuncB type="table" tableValues="0 1 1 0"/>
      </feComponentTransfer>
    </filter>
    <filter id="Linear" filterUnits="objectBoundingBox"
            x="0%" y="0%" width="100%" height="100%">
      <feComponentTransfer>
        <feFuncR type="linear" slope=".5" intercept=".25"/>
        <feFuncG type="linear" slope=".5" intercept="0"/>
        <feFuncB type="linear" slope=".5" intercept=".5"/>
      </feComponentTransfer>
    </filter>
    <filter id="Gamma" filterUnits="objectBoundingBox"
            x="0%" y="0%" width="100%" height="100%">
      <feComponentTransfer>
        <feFuncR type="gamma" amplitude="2" exponent="5" offset="0"/>
        <feFuncG type="gamma" amplitude="2" exponent="3" offset="0"/>
        <feFuncB type="gamma" amplitude="2" exponent="1" offset="0"/>
      </feComponentTransfer>
    </filter>
  </defs>
  <rect style="fill:none; stroke:blue"
        x="1" y="1" width="798" height="398"/>
  <g style="font-family:Verdana; font-size:75;
            font-weight:bold; fill:url(#MyGradient)">
    <rect x="100" y="0" width="600" height="20" />
    <text x="100" y="90">Identity</text>
    <text x="100" y="190" style="filter:url(#Table)">TableLookup</text>
    <text x="100" y="290" style="filter:url(#Linear)">LinearFunc</text>
    <text x="100" y="390" style="filter:url(#Gamma)">GammaFunc</text>
  </g>
</svg>
```


Example feComponentTransfer

[View this example as SVG (SVG-enabled browsers only)](#)

15.12 Filter primitive 'feComposite'

This filter performs the combination of the two input images pixel-wise in image space using one of the Porter-Duff [PORTERDUFF] compositing operations: *over, in, atop, out, xor*. Additionally, a component-wise *arithmetic* operation (with the result clamped between [0..1]) can be applied.

The *arithmetic* operation is useful for combining the output from the 'feDiffuseLighting' and 'feSpecularLighting' filters with texture data. It is also useful for implementing *dissolve*. If the *arithmetic* operation is chosen, each result pixel is computed using the following formula:

```
result = k1*i1*i2 + k2*i1 + k3*i2 + k4
```

For these operations, the extent of the resulting image can be affected. In other words, even if two images do not overlap in image space, the extent for *over* will essentially include the union of the extents of the two input images.

```
<!ELEMENT feComposite (animate|set)* >
<!ATTLIST feComposite
  %stdAttrs;
  %filter_primitive_attributes_with_in;
  in2 CDATA #REQUIRED
  operator (over | in | out | atop | xor | arithmetic) "over"
  k1 %Number; #IMPLIED
  k2 %Number; #IMPLIED
  k3 %Number; #IMPLIED
  k4 %Number; #IMPLIED >
```

Attribute definitions:

operator = "*over | in | out | atop | xor | arithmetic*"

> The compositing operation that is to be performed. All of the operator types except arithmetic match the correspond operation as described in [PORTERDUFF]. The arithmetic operator is described above.
> Animatable: yes.

k1 = "*<number>*"

> Only applicable if operator="arithmetic".
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> Animatable: yes.

k2 = "*<number>*"

> Only applicable if operator="arithmetic".
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> Animatable: yes.

k3 = "*<number>*"

> Only applicable if operator="arithmetic".
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> Animatable: yes.

k4 = "*<number>*"

> Only applicable if operator="arithmetic".
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> Animatable: yes.

in2 = "*(see in attribute)*"

> The second input image to the compositing operation. This attribute can take on the same values as the in attribute.
> Animatable: yes.

Attributes defined elsewhere:

> %stdAttrs;, %filter_primitive_attributes_with_in;.

Example feComposite shows examples of the six types of feComposite operations. It also shows two different techniques to using the BackgroundImage as part of the compositing operation.

The first two rows render bluish triangles into the background. A filter is applied which composites reddish triangles into the bluish triangles using one of the compositing operations. The result from compositing is drawn onto an opaque white temporary surface, and then that result is written to the canvas. (The opaque white temporary surface obliterates the original bluish triangle.)

The last two rows apply the same compositing operations of reddish triangles into bluish triangles. However, the compositing result is directly blended into the canvas (the opaque white temporary surface technique is not used). In some cases, the results are different than when a temporary opaque white surface is used. The original bluish triangle from the background shines through wherever the compositing operation results in completed transparent pixel. In other cases, the result from compositing is blended into the bluish triangle, resulting in a different final color value.

```
<?xml version="1.0"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
          "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="11cm" height="6.5cm" viewBox="0 0 1100 650">
  <title>Example feComposite - Examples of feComposite operations</title>
  <desc>Four rows of six pairs of overlapping triangles depicting
```

```
          the six different feComposite operators under different
          opacity values and different clearing of the background.</desc>
          <defs>
      <desc>Define two sets of six filters for each of the six compositing operators.
          The first set wipes out the background image by flooding with opaque white.
          The second set does not wipe out the background, with the result
          that the background sometimes shines through and is other cases
          is blended into itself (i.e., "double-counting").</desc>
      <filter id="overFlood" filterUnits="objectBoundingBox" x="-5%" y="-5%" width="110%"
height="110%">
        <feFlood style="flood-color:#ffffff; flood-opacity:1" result="flood"/>
        <feComposite in="SourceGraphic" in2="BackgroundImage" operator="over" result="comp"/>
        <feMerge> <feMergeNode in="flood"/> <feMergeNode in="comp"/> </feMerge>
      </filter>
      <filter id="inFlood" filterUnits="objectBoundingBox" x="-5%" y="-5%" width="110%" height="110%">
        <feFlood style="flood-color:#ffffff; flood-opacity:1" result="flood"/>
        <feComposite in="SourceGraphic" in2="BackgroundImage" operator="in" result="comp"/>
        <feMerge> <feMergeNode in="flood"/> <feMergeNode in="comp"/> </feMerge>
      </filter>
      <filter id="outFlood" filterUnits="objectBoundingBox" x="-5%" y="-5%" width="110%"
height="110%">
        <feFlood style="flood-color:#ffffff; flood-opacity:1" result="flood"/>
        <feComposite in="SourceGraphic" in2="BackgroundImage" operator="out" result="comp"/>
        <feMerge> <feMergeNode in="flood"/> <feMergeNode in="comp"/> </feMerge>
      </filter>
      <filter id="atopFlood" filterUnits="objectBoundingBox" x="-5%" y="-5%" width="110%"
height="110%">
        <feFlood style="flood-color:#ffffff; flood-opacity:1" result="flood"/>
        <feComposite in="SourceGraphic" in2="BackgroundImage" operator="atop" result="comp"/>
        <feMerge> <feMergeNode in="flood"/> <feMergeNode in="comp"/> </feMerge>
      </filter>
      <filter id="xorFlood" filterUnits="objectBoundingBox" x="-5%" y="-5%" width="110%"
height="110%">
        <feFlood style="flood-color:#ffffff; flood-opacity:1" result="flood"/>
        <feComposite in="SourceGraphic" in2="BackgroundImage" operator="xor" result="comp"/>
        <feMerge> <feMergeNode in="flood"/> <feMergeNode in="comp"/> </feMerge>
      </filter>
      <filter id="arithmeticFlood" filterUnits="objectBoundingBox"
              x="-5%" y="-5%" width="110%" height="110%">
        <feFlood style="flood-color:#ffffff; flood-opacity:1" result="flood"/>
        <feComposite in="SourceGraphic" in2="BackgroundImage" result="comp"
                     operator="arithmetic" k1=".5" k2=".5" k3=".5" k4=".5"/>
        <feMerge> <feMergeNode in="flood"/> <feMergeNode in="comp"/> </feMerge>
      </filter>
      <filter id="overNoFlood" filterUnits="objectBoundingBox" x="-5%" y="-5%" width="110%"
height="110%">
        <feComposite in="SourceGraphic" in2="BackgroundImage" operator="over" result="comp"/>
      </filter>
      <filter id="inNoFlood" filterUnits="objectBoundingBox" x="-5%" y="-5%" width="110%"
height="110%">
        <feComposite in="SourceGraphic" in2="BackgroundImage" operator="in" result="comp"/>
      </filter>
      <filter id="outNoFlood" filterUnits="objectBoundingBox" x="-5%" y="-5%" width="110%"
height="110%">
        <feComposite in="SourceGraphic" in2="BackgroundImage" operator="out" result="comp"/>
      </filter>
      <filter id="atopNoFlood" filterUnits="objectBoundingBox" x="-5%" y="-5%" width="110%"
height="110%">
        <feComposite in="SourceGraphic" in2="BackgroundImage" operator="atop" result="comp"/>
      </filter>
      <filter id="xorNoFlood" filterUnits="objectBoundingBox" x="-5%" y="-5%" width="110%"
height="110%">
        <feComposite in="SourceGraphic" in2="BackgroundImage" operator="xor" result="comp"/>
      </filter>
      <filter id="arithmeticNoFlood" filterUnits="objectBoundingBox"
              x="-5%" y="-5%" width="110%" height="110%">
        <feComposite in="SourceGraphic" in2="BackgroundImage" result="comp"
                     operator="arithmetic" k1=".5" k2=".5" k3=".5" k4=".5"/>
      </filter>
      <path id="Blue100" d="M 0 0 L 100 0 L 100 100 z" style="fill:#00ffff"/>
      <path id="Red100" d="M 0 0 L 0 100 L 100 0 z" style="fill:#ff00ff"/>
```

```
  <path id="Blue50" d="M 0 125 L 100 125 L 100 225 z" style="fill:#00ffff; fill-opacity:.5"/>
  <path id="Red50" d="M 0 125 L 0 225 L 100 125 z" style="fill:#ff00ff; fill-opacity:.5"/>
  <g id="TwoBlueTriangles">
    <use xlink:href="#Blue100"/>
    <use xlink:href="#Blue50"/>
  </g>
  <g id="BlueTriangles">
    <use transform="translate(275,25)" xlink:href="#TwoBlueTriangles"/>
    <use transform="translate(400,25)" xlink:href="#TwoBlueTriangles"/>
    <use transform="translate(525,25)" xlink:href="#TwoBlueTriangles"/>
    <use transform="translate(650,25)" xlink:href="#TwoBlueTriangles"/>
    <use transform="translate(775,25)" xlink:href="#TwoBlueTriangles"/>
    <use transform="translate(900,25)" xlink:href="#TwoBlueTriangles"/>
  </g>
</defs>

<rect style="fill:none; stroke:blue" x="1" y="1" width="1098" height="648"/>
<g style="font-family:Verdana; font-size:40; shape-rendering:crispEdges">
  <desc>Render the examples using the filters that draw on top of
        an opaque white surface, thus obliterating the background.</desc>
  <g style="enable-background:new">
    <text x="15" y="75">opacity 1.0</text>
    <text x="15" y="115" style="font-size:27">(with feFlood)</text>
    <text x="15" y="200">opacity 0.5</text>
    <text x="15" y="240" style="font-size:27">(with feFlood)</text>
    <use xlink:href="#BlueTriangles"/>
    <g transform="translate(275,25)">
      <use  xlink:href="#Red100" style="filter:url(#overFlood)"/>
      <use  xlink:href="#Red50" style="filter:url(#overFlood)"/>
      <text x="5" y="275">over</text>
    </g>
    <g transform="translate(400,25)">
      <use  xlink:href="#Red100" style="filter:url(#inFlood)"/>
      <use  xlink:href="#Red50" style="filter:url(#inFlood)"/>
      <text x="35" y="275">in</text>
    </g>
    <g transform="translate(525,25)">
      <use  xlink:href="#Red100" style="filter:url(#outFlood)"/>
      <use  xlink:href="#Red50" style="filter:url(#outFlood)"/>
      <text x="15" y="275">out</text>
    </g>
    <g transform="translate(650,25)">
      <use  xlink:href="#Red100" style="filter:url(#atopFlood)"/>
      <use  xlink:href="#Red50" style="filter:url(#atopFlood)"/>
      <text x="10" y="275">atop</text>
    </g>
    <g transform="translate(775,25)">
      <use  xlink:href="#Red100" style="filter:url(#xorFlood)"/>
      <use  xlink:href="#Red50" style="filter:url(#xorFlood)"/>
      <text x="15" y="275">xor</text>
    </g>
    <g transform="translate(900,25)">
      <use  xlink:href="#Red100" style="filter:url(#arithmeticFlood)"/>
      <use  xlink:href="#Red50" style="filter:url(#arithmeticFlood)"/>
      <text x="-25" y="275">arithmetic</text>
    </g>
  </g>
  <g transform="translate(0,325)" style="enable-background:new">
  <desc>Render the examples using the filters that do not obliterate
        the background, thus sometimes causing the background to continue
        to appear in some cases, and in other cases the background
        image blends into itself ("double-counting").</desc>
    <text x="15" y="75">opacity 1.0</text>
    <text x="15" y="115" style="font-size:27">(without feFlood)</text>
    <text x="15" y="200">opacity 0.5</text>
    <text x="15" y="240" style="font-size:27">(without feFlood)</text>
    <use xlink:href="#BlueTriangles"/>
    <g transform="translate(275,25)">
      <use  xlink:href="#Red100" style="filter:url(#overNoFlood)"/>
      <use  xlink:href="#Red50" style="filter:url(#overNoFlood)"/>
```

```
      <text x="5" y="275">over</text>
    </g>
    <g transform="translate(400,25)">
      <use  xlink:href="#Red100" style="filter:url(#inNoFlood)"/>
      <use  xlink:href="#Red50" style="filter:url(#inNoFlood)"/>
      <text x="35" y="275">in</text>
    </g>
    <g transform="translate(525,25)">
      <use  xlink:href="#Red100" style="filter:url(#outNoFlood)"/>
      <use  xlink:href="#Red50" style="filter:url(#outNoFlood)"/>
      <text x="15" y="275">out</text>
    </g>
    <g transform="translate(650,25)">
      <use  xlink:href="#Red100" style="filter:url(#atopNoFlood)"/>
      <use  xlink:href="#Red50" style="filter:url(#atopNoFlood)"/>
      <text x="10" y="275">atop</text>
    </g>
    <g transform="translate(775,25)">
      <use  xlink:href="#Red100" style="filter:url(#xorNoFlood)"/>
      <use  xlink:href="#Red50" style="filter:url(#xorNoFlood)"/>
      <text x="15" y="275">xor</text>
    </g>
    <g transform="translate(900,25)">
      <use  xlink:href="#Red100" style="filter:url(#arithmeticNoFlood)"/>
      <use  xlink:href="#Red50" style="filter:url(#arithmeticNoFlood)"/>
      <text x="-25" y="275">arithmetic</text>
    </g>
   </g>
  </g>
</svg>
```
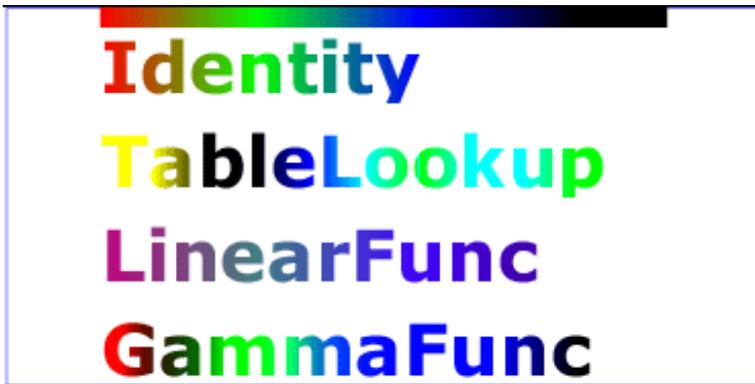

Example feComposite

[View this example as SVG (SVG-enabled browsers only)](#)

15.13 Filter primitive 'feConvolveMatrix'

feConvolveMatrix applies a matrix convolution filter effect. A convolution combines pixels in the input image with neighboring pixels to produce a resulting image. A wide variety of imaging operations can be achieved through convolutions, including blurring, edge detection, sharpening, embossing and beveling.

A matrix convolution is based on an n-by-m matrix (the convolution kernel) which describes how a given pixel value in the input image is combined with its neighboring pixel values to produce a resulting pixel value. Each result pixel is determined by applying the kernel matrix to the corresponding source pixel and its neighboring pixels.

To illustrate, suppose you have a input image which is 5 pixels by 5 pixels, whose color values are as follows:

```
    0  20  40 235 235
  100 120 140 235 235
```

```
200 220 240 235 235
225 225 255 255 255
225 225 255 255 255
```

and you define a 3-by-3 convolution kernel as follows:

```
1 2 3
4 5 6
7 8 9
```

Let's focus on the pixel at the second row and second column of the image (source pixel value is 120). Assuming the simplest case (where the input image's pixel grid aligns perfectly with the kernel's pixel grid) and assuming default values for attributes divisor, targetX and targetY, then resulting pixel value will be:

```
(1*  0 + 2* 20 + 3* 40 +
4*100 + 5*120 + 6*140 +
7*200 + 8*220 + 9*240) / (1+2+3+4+5+6+7+8+9)
```

Because they operate on pixels, matrix convolutions are inherently resolution-dependent. To make 'feConvolveMatrix produce resolution-independent results, an explicit value should be provided for either the filterRes attribute on the 'filter' element and/or attribute kernelUnitLength.

kernelUnitLength, in combination with the other attributes, defines an implicit pixel grid in the filter effects coordinate system (i.e., the coordinate system established by the filterUnits attribute). If the pixel grid established by kernelUnitLength does not align perfectly with the pixel grid established by attribute filterRes, then the input image will be temporarily resampled to align its pixels with kernelUnitLength. The convolution happens on the resampled image. After applying the convolution, the image is resampled back to its original resolution.

```
<!ELEMENT feConvolveMatrix (animate|set)* >
<!ATTLIST feConvolveMatrix
  %filter_primitive_attributes_with_in;
  order CDATA #REQUIRED
  kernelMatrix CDATA #REQUIRED
  divisor %Number; #IMPLIED
  bias %Number; #IMPLIED
  targetX %Integer; #IMPLIED
  targetY %Integer; #IMPLIED
  edgeMode (duplicate|wrap|none) "duplicate"
  kernelUnitLength CDATA #IMPLIED
  preserveAlpha %Boolean; #IMPLIED >
```

Attribute definitions:

order = "<orderX> [<orderY>]"

> Indicates the number of cells in each dimension for kernelMatrix. The values provided must be <integer>s greater than zero. If two values are provided, the values are separated by space characters and/or a comma. <orderX> indicates the number of columns in the matrix. <orderY> indicates the number of rows in the matrix. If <orderY> is not provided, it defaults to <orderX>.
> A typical value is order="3". It is recommended that only small values (e.g., 3) be used; higher values may result in very high CPU overhead and usually do not produce results that justify the impact on performance.
> If the attribute is not specified, the effect is as if a value of "3" were specified.
> Animatable: yes.

kernelMatrix = "<list of numbers>"

> The list of <number>s that make up the kernel matrix for the convolution. Values are separated by space characters and/or a comma. The number of entries in the list must equal <orderX> times <orderY>.
> Animatable: yes.

divisor = "<number>"

> After applying the kernelMatrix to the input image to yield a number, that number is divided by divisor to yield the final destination color value. A divisor that is the sum of all the matrix values tends to have an evening effect on the overall color intensity of the result. It is an error to specify a divisor of zero. The default value is the sum of all values in kernelMatrix, with the exception that if the sum is zero, then the divisor is set to 1.
> Animatable: yes.

bias = "<number>"

> After applying the kernelMatrix to the input image to yield a number and applying the divisor, the bias attribute is added to each component. One application of bias is when it is desirable to have .5 gray value be the zero response of the filter. If bias is not specified, then the effect is as if a value of zero were specified.
> Animatable: yes.

targetX = "[<integer>](#)"

Determines the positioning in X of the convolution matrix relative to a given target pixel in the input image. The leftmost column of the matrix is column number zero. The value must be such that: 0 <= targetX < orderX. By default, the convolution matrix is centered in X over each pixel of the input image (i.e., targetX = floor (orderX / 2)).
[Animatable](#): yes.

targetY = "[<integer>](#)"

Determines the positioning in Y of the convolution matrix relative to a given target pixel in the input image. The topmost row of the matrix is row number zero. The value must be such that: 0 <= targetY < orderY. By default, the convolution matrix is centered in Y over each pixel of the input image (i.e., targetY = floor (orderY / 2)).
[Animatable](#): yes.

edgeMode = "duplicate | wrap | none"

Determines how to extend the input image as necessary with color values so that the matrix operations can be applied when the kernel is positioned at or near the edge of the input image.

"duplicate" indicates that the input image is extended along each of its borders as necessary by duplicating the color values at the given edge of the input image.

```
Original N-by-M image, where m=M-1 and n=N-1:
          11 12 ... 1m 1M
          21 22 ... 2m 2M
          .. .. ... .. ..
          n1 n2 ... nm nM
          N1 N2 ... Nm NM

Extended by two pixels using "duplicate":
   11 11    11 12 ... 1m 1M    1M 1M
   11 11    11 12 ... 1m 1M    1M 1M

   11 11    11 12 ... 1m 1M    1M 1M
   21 21    21 22 ... 2m 2M    2M 2M
   .. ..    .. .. ... .. ..    .. ..
   n1 n1    n1 n2 ... nm nM    nM nM
   N1 N1    N1 N2 ... Nm NM    NM NM

   N1 N1    N1 N2 ... Nm NM    NM NM
   N1 N1    N1 N2 ... Nm NM    NM NM
```

"wrap" indicates that the input image is extended by taking the color values from the opposite edge of the image.

```
Extended by two pixels using "wrap":
   nm nM    n1 n2 ... nm Nm    n1 n2
   Nm NM    N1 N2 ... Nm NM    N1 N2

   1M 1m    11 12 ... 1m 1M    11 12
   2M 2m    21 22 ... 2m 2M    21 22
   .. ..    .. .. ... .. ..    .. ..
   nm nM    n1 n2 ... nm nM    n1 n2
   Nm NM    N1 N2 ... Nm NM    N1 N2

   1m 1M    11 12 ... 1m 1M    11 12
   2m 2M    21 22 ... 2m 2M    21 22
```

"none" indicates that the input image is extended with pixel values of zero for R, G, B and A.

[Animatable](#): yes.

kernelUnitLength = "<xLength> [<yLength>]"

Indicates the intended distance in current filter units (i.e., units as determined by the value of attribute filterUnits) between successive columns and rows, respectively, in the kernelMatrix. By specifying value(s) for kernelUnitLength, the kernel becomes defined in a scalable, abstract coordinate system. If kernelUnitLength is not specified, the default value is one pixel in the offscreen bitmap, which is a pixel-based coordinate system, and thus potentially not scalable. For some level of consistency across display media and user agents, it is necessary that a value be provided for at least one of filterRes and kernelUnitLength. In some implementations, the most consistent results and the fastest performance will be achieved if the pixel grid of the temporary offscreen images aligns with the pixel grid of the kernel.
A negative or zero value is an error (see [Error processing](#)).
[Animatable](#): yes.

preserveAlpha = "false | true"

A value of false indicates that the convolution will apply to all channels, including the alpha channel.

A value of true indicates that the convolution will only apply to the color channels. In this case, the filter will temporarily unpremultiply the color component values, apply the kernel, and then re-premultiply at the end.

If preserveAlpha is not specified, then the effect is as if a value of false were specified.

[Animatable]: yes.

Attributes defined elsewhere:

> [%stdAttrs;](), [%filter_primitive_attributes_with_in;]().

15.14 Filter primitive 'feDiffuseLighting'

This filter primitive lights an image using the alpha channel as a bump map. The resulting image is an RGBA opaque image based on the light color with alpha = 1.0 everywhere. The lighting calculation follows the standard diffuse component of the Phong lighting model. The resulting image depends on the light color, light position and surface geometry of the input bump map.

The light map produced by this filter primitive can be combined with a texture image using the multiply term of the *arithmetic* ['feComposite']() compositing method. Multiple light sources can be simulated by adding several of these light maps together before applying it to the texture image.

The resulting RGBA image is computed as follows:

$D_r = k_d * N.L * L_r$
$D_g = k_d * N.L * L_g$
$D_b = k_d * N.L * L_b$
$D_a = 1.0$

where

> k_d = diffuse lighting constant
> N = surface normal unit vector, a function of x and y
> L = unit vector pointing from surface to light, a function of x and y in the point and spot light cases
> L_r, L_g, L_b = RGB components of light, a function of x and y in the spot light case

N is a function of x and y and depends on the surface gradient as follows:

The surface described by the input alpha image A_{in} (x,y) is:

$Z (x,y) = surfaceScale * A_{in} (x,y)$

Surface normal is calculated using the Sobel gradient 3x3 filter:

$N_x (x,y)= - surfaceScale * 1/4*((I(x+1,y-1) + 2*I(x+1,y) + I(x+1,y+1))$
$\qquad\qquad\qquad - (I(x-1,y-1) + 2*I(x-1,y) + I(x-1,y+1)))$
$N_y (x,y)= - surfaceScale * 1/4*((I(x-1,y+1) + 2*I(x,y+1) + I(x+1,y+1))$
$\qquad\qquad\qquad - (I(x-1,y-1) + 2*I(x,y-1) + I(x+1,y-1)))$
$N_z (x,y) = 1.0$

$N = (N_x, N_y, N_z) / Norm((N_x,N_y,N_z))$

L, the unit vector from the image sample to the light is calculated as follows:

For Infinite light sources it is constant:

$L_x = cos(azimuth)*cos(elevation)$
$L_y = -sin(azimuth)*cos(elevation)$
$L_z = sin(elevation)$

For Point and spot lights it is a function of position:

$L_x = Light_x - x$
$L_y = Light_y - y$
$L_z = Light_z - Z(x,y)$

$L = (L_x, L_y, L_z) / Norm(L_x, L_y, L_z)$

where $Light_x$, $Light_y$, and $Light_z$ are the input light position.

L_r, L_g, L_b, the light color vector is a function of position in the spot light case only:

$L_r = Light_r*pow((-L.S),specularExponent)$

$L_g = Light_g*pow((-L.S),specularExponent)$

$L_b = Light_b*pow((-L.S),specularExponent)$

where S is the unit vector pointing from the light to the point (pointsAtX, pointsAtY, pointsAtZ) in the x-y plane:

$S_x = pointsAtX - Light_x$

$S_y = pointsAtY - Light_y$

$S_z = pointsAtZ - Light_z$

$S = (S_x, S_y, S_z) / Norm(S_x, S_y, S_z)$

If L.S is positive, no light is present. $(L_r = L_g = L_b = 0)$

```
<!ELEMENT feDiffuseLighting ((feDistantLight|fePointLight|feSpotLight),(animate|set|animateColor)*)
>
<!ATTLIST feDiffuseLighting
  %stdAttrs;
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-LightingEffects;
  %filter_primitive_attributes_with_in;
  surfaceScale %Number; #IMPLIED
  diffuseConstant %Number; #IMPLIED >
```

Attribute definitions:

surfaceScale = "*<number>*"

> height of surface when $A_{in} = 1$.
> Animatable: yes.

diffuseConstant = "*<number>*"

> kd in Phong lighting model. In SVG, this can be any non-negative number.
> Animatable: yes.

Attributes defined elsewhere:

> %stdAttrs;, %filter_primitive_attributes_with_in;.

The light source is defined by one of the child elements 'feDistantLight', 'fePointLight' or 'feSpotLight'. The light color is specified by property 'lighting-color'.

15.15 Filter primitive 'feDisplacementMap'

This filter primitive uses the pixels values from the image from in2 to spatially displace the image from in. This is the transformation to be performed:

```
P'(x,y) <- P( x + scale * ((XC(x,y) - .5), y + scale * (YC(x,y) - .5))
```

where P(x,y) is the input image, in, and P'(x,y) is the destination. XC(x,y) and YC(x,y) are the component values of the designated by the *xChannelSelector* and *yChannelSelector*. For example, to use the R component of in2 to control displacement in x and the G component of Image2 to control displacement in y, set *xChannelSelector* to "R" and *yChannelSelector* to "G".

The displacement map defines the inverse of the mapping performed.

This filter can have arbitrary non-localized effect on the input which might require substantial buffering in the processing pipeline. However with this formulation, any intermediate buffering needs can be determined by *scale* which represents the maximum displacement in either x or y.

```
<!ELEMENT feDisplacementMap (animate|set)* >
<!ATTLIST feDisplacementMap
  %stdAttrs;
  %filter_primitive_attributes_with_in;
  in2 CDATA #REQUIRED
  scale %Number; #IMPLIED
  xChannelSelector (R | G | B | A) "A"
  yChannelSelector (R | G | B | A) "A" >
```

Attribute definitions:

scale = "*<number>*"

> Displacement scale factor.
> <u>Animatable</u>: yes.

xChannelSelector = "*R | G | B | A*"

> Indicates which channel from <u>in2</u> to use to displace the pixels in <u>in</u> along the X axis.
> <u>Animatable</u>: yes.

yChannelSelector = "*R | G | B | A*"

> Indicates which channel from <u>in2</u> to use to displace the pixels in <u>in</u> along the Y axis.
> <u>Animatable</u>: yes.

in2 = "*(see <u>in</u> attribute)*"

> The second input image, which is used to displace the pixels in the image from attribute <u>in</u>. This attribute can take on the same values as the <u>in</u> attribute.
> <u>Animatable</u>: yes.

Attributes defined elsewhere:

> <u>%stdAttrs;</u>, <u>%filter_primitive_attributes_with_in;</u>.

15.16 Filter primitive 'feFlood'

This filter primitive creates an image with infinite extent filled with the color and opacity values from properties 'flood-color' and 'flood-opacity'.

```
<!ELEMENT feFlood (animate|set|animateColor)* >
<!ATTLIST feFlood
  %stdAttrs;
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-feFlood;
  %filter_primitive_attributes_with_in; >
```

Attributes defined elsewhere:

> <u>%stdAttrs;</u>, <u>%filter_primitive_attributes_with_in;</u>, <u>class</u>, <u>style</u>, <u>%PresentationAttributes-feFlood;</u>.

The 'flood-color' property indicates what color to use to flood the current filter primitive sub-region. The keyword currentColor and ICC colors can be specified in the same manner as within a <u><paint></u> specification for the <u>'fill'</u> and <u>'stroke'</u> properties.

'flood-color'

Value:	currentColor |
	<u><color></u> [icc-color(<name>,<icccolorvalue>+)] |
	inherit
Initial:	black
Applies to:	<u>'feFlood'</u> elements
Inherited:	no
Percentages:	N/A
Media:	visual
<u>*Animatable*</u>:	yes

The 'flood-opacity' property defines the opacity value to use across the entire filter primitive sub-region.

'flood-opacity'

Value:	<alphavalue> | inherit
Initial:	1
Applies to:	<u>'feFlood'</u> elements
Inherited:	no
Percentages:	N/A
Media:	visual
<u>*Animatable*</u>:	yes

15.17 Filter primitive 'feGaussianBlur'

This filter primitive performs a Gaussian blur on the input image.

The Gaussian blur kernel is an approximation of the normalized convolution:

$H(x) = \exp(-x^2/(2s^2)) / \sqrt{2 \cdot pi \cdot s^2}$

where 's' is the standard deviation specified by stdDeviation.

The value of stdDeviation can be either one or two numbers. If two numbers are provided, the first number represents a standard deviation value along the X axis of the current coordinate system and the second value represents a standard deviation in Y. If one number is provided, then that value is used for both X and Y.

Even if only one value is provided for stdDeviation, this can be implemented as a separable convolution.

For larger values of 's' (s >= 2.0), an approximation can be used: Three successive box-blurs build a piece-wise quadratic convolution kernel, which approximates the Gaussian kernel to within roughly 3%.

let d = floor(s * 3*sqrt(2*pi)/4 + 0.5)

... if d is odd, use three box-blurs of size 'd', centered on the output pixel.

... if d is even, two box-blurs of size 'd' (the first one centered one pixel to the left, the second one centered one pixel to the right of the output pixel one box blur of size 'd+1' centered on the output pixel.

Frequently this operation will take place on alpha-only images, such as that produced by the built-in input, SourceAlpha. The implementation may notice this and optimize the single channel case. If the input has infinite extent and is constant, this operation has no effect. If the input has infinite extent and is a tile, the filter is evaluated with periodic boundary conditions.

```
<!ELEMENT feGaussianBlur (animate|set)* >
<!ATTLIST feGaussianBlur
  %stdAttrs;
  %filter_primitive_attributes_with_in;
  stdDeviation CDATA #IMPLIED >
```

Attribute definitions:

stdDeviation = "*<number> [<number>]*"

> The standard deviation for the blur operation. If two <number>s are provided, the first number represents a standard deviation value along the X axis of the current coordinate system and the second value represents a standard deviation in Y. If one number is provided, then that value is used for both X and Y.
> A negative value is an error (see Error processing). A value of zero disables the effect of the given filter primitive (i.e., the result is a fully transparent image).
> Animatable: yes.

Attributes defined elsewhere:

> %stdAttrs;, %filter_primitive_attributes_with_in;.

The example at the start of this chapter makes use of the feGaussianBlur filter primitive to create a drop shadow effect.

15.18 Filter primitive 'feImage'

This filter primitive refers to a graphic external to this filter element, which is loaded or rendered into an RGBA raster and becomes the result of the filter primitive.

This filter primitive can refer to an external image or can be a reference to another piece of SVG. It produces an image similar to the builtin image source SourceGraphic except that the graphic comes from an external source.

If the xlink:href references a stand-alone image resource such as a JPEG or PNG file, then the image resource is rendered according to the behavior of the 'image' element; otherwise, the referenced resource is rendered according to the behavior of the 'use' element. In either case, the current user coordinate system depends on the value of attribute primitiveUnits on the 'filter' element.

```
<!ELEMENT feImage (animate|set|animateTransform)* >
<!ATTLIST feImage
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #REQUIRED
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  transform %TransformList; #IMPLIED
  %filter_primitive_attributes; >
```

Attributes defined elsewhere:

> %stdAttrs;, %langSpaceAttrs;, class, transform, externalResourcesRequired, %xlinkRefAttrs;, xlink:href, style, %PresentationAttributes-All;,
> %filter_primitive_attributes;.

15.19 Filter primitive 'feMerge'

This filter primitive composites input image layers on top of each other using the *over* operator with *Input1* on the bottom and the last specified input, *InputN*, on top.

Many effects produce a number of intermediate layers in order to create the final output image. This filter allows us to collapse those into a single image. Although this could be done by using n-1 Composite-filters, it is more convenient to have this common operation available in this form, and offers the implementation some additional flexibility.

Each 'feMerge' element can have any number of 'feMergeNode' subelements, each of which has an in attribute.

The canonical implementation of feMerge is to render the entire effect into one RGBA layer, and then render the resulting layer on the output device. In certain cases (in particular if the output device itself is a continuous tone device), and since merging is associative, it might be a sufficient approximation to evaluate the effect one layer at a time and render each layer individually onto the output device bottom to top.

If the topmost image input is SourceGraphic, the implementation is encouraged to render the layers up to that point, and then render the SourceGraphic directly from its vector description on top.

```
<!ELEMENT feMerge (feMergeNode)* >
<!ATTLIST feMerge
  %stdAttrs;
  %filter_primitive_attributes; >

<!ELEMENT feMergeNode (animate|set)* >
<!ATTLIST feMergeNode
  %stdAttrs;
  in CDATA #IMPLIED >
```

Attributes defined elsewhere:

> %stdAttrs;, %filter_primitive_attributes;, in.

The example at the start of this chapter makes use of the feMerge filter primitive to composite two intermediate filter results together.

15.20 Filter primitive 'feMorphology'

This filter primitive performs "fattening" or "thinning" of artwork. It is particularly useful for fattening or thinning an alpha channel,

The dilation (or erosion) kernel is a rectangle with a width of 2*x-radius+1 and a height of *y-radius*+1.

Frequently this operation will take place on alpha-only images, such as that produced by the built-in input, SourceAlpha. In that case, the implementation might want to optimize the single channel case.

If the input has infinite extent and is constant, this operation has no effect. If the input has infinite extent and is a tile, the filter is evaluated with periodic boundary conditions.

```
<!ELEMENT feMorphology (animate|set)* >
<!ATTLIST feMorphology
  %stdAttrs;
  %filter_primitive_attributes_with_in;
  operator (erode | dilate) "erode"
  radius %Length; #IMPLIED >
```

Attribute definitions:

operator = "*erode | dilate*"

> A keyword indicating whether to erode (i.e., thin) or dilate (fatten) the source graphic.
> Animatable: yes.

radius = "*<number> [<number>]*"

> The radius (or radii) for the operation. If two <number>s are provided, the first number represents a x-radius in the current coordinate system and the second value represents a y-radius. If one number is provided, then that value is used for both X and Y.
> A negative value is an error (see Error processing). A value of zero disables the effect of the given filter primitive (i.e., the result is a fully transparent image).
> Animatable: yes.

Attributes defined elsewhere:

> %stdAttrs;, %filter_primitive_attributes_with_in;.

Example feMorphology shows examples of the four types of feMorphology operations.

```
<?xml version="1.0"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
          "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="5cm" height="7cm" viewBox="0 0 700 500">
  <title>Example feMorphology - Examples of erode and dilate</title>
  <desc>Five text strings drawn as outlines.
        The first is unfiltered. The second and third use 'erode'.
        The fourth and fifth use 'dilate'.</desc>
  <defs>
    <filter id="Erode3">
      <feMorphology operator="erode" in="SourceGraphic" radius="3" />
    </filter>
    <filter id="Erode6">
      <feMorphology operator="erode" in="SourceGraphic" radius="6" />
    </filter>
    <filter id="Dilate3">
      <feMorphology operator="dilate" in="SourceGraphic" radius="3" />
    </filter>
    <filter id="Dilate6">
      <feMorphology operator="dilate" in="SourceGraphic" radius="6" />
    </filter>
  </defs>
  <rect style="fill:none; stroke:blue; stroke-width:2"
        x="1" y="1" width="698" height="498"/>
  <g style="enable-background: new">
    <g style="font-family:Verdana; font-size:75;
              fill:none; stroke:black; stroke-width:6">
      <text x="50" y="90">Unfiltered</text>
      <text x="50" y="180" style="filter:url(#Erode3)">Erode radius 3</text>
      <text x="50" y="270" style="filter:url(#Erode6)">Erode radius 6</text>
      <text x="50" y="360" style="filter:url(#Dilate3)">Dilate radius 3</text>
      <text x="50" y="450" style="filter:url(#Dilate6)">Dilate radius 6</text>
    </g>
  </g>
</svg>
```

Example feMorphology

View this example as SVG (SVG-enabled browsers only)

15.21 Filter primitive 'feOffset'

This filter primitive offsets the input image relative to its current position in the image space by the specified vector.

This is important for effects like drop shadows.

```
<!ELEMENT feOffset (animate|set)* >
<!ATTLIST feOffset
  %stdAttrs;
  %filter_primitive_attributes_with_in;
  dx %Length; #IMPLIED
  dy %Length; #IMPLIED >
```

Attribute definitions:

dx = "*<length>*"

> The amount to offset the input graphic along the x axis.
> Animatable: yes.

dy = "*<length>*"

> The amount to offset the input graphic along the y axis.
> Animatable: yes.

Attributes defined elsewhere:

> %stdAttrs;, %filter_primitive_attributes_with_in;.

The example at the start of this chapter makes use of the feOffset filter primitive to offset the drop shadow from the original source graphic.

15.22 Filter primitive 'feSpecularLighting'

This filter primitive lights a source graphic using the alpha channel as a bump map. The resulting image is an RGBA image based on the light color. The lighting calculation follows the standard specular component of the Phong lighting model. The resulting image depends on the light color, light position and surface geometry of the input bump map. The result of the lighting calculation is added. The filter primitive assumes that the viewer is at infinity the z direction (i.e the unit vector in the eye direction is (0,0,1) everywhere).

This filter primitive produces an image which contains the specular reflection part of the lighting calculation. Such a map is intended to be combined with a texture using the *add* term of the *arithmetic* 'feComposite' method. Multiple light sources can be simulated by adding several of these light maps before applying it to the texture image.

The resulting RGBA image is computed as follows:

$S_r = k_s * pow(N.H, specularExponent) * L_r$
$S_g = k_s * pow(N.H, specularExponent) * L_g$
$S_b = k_s * pow(N.H, specularExponent) * L_b$
$S_a = max(S_r, S_g, S_b)$

where

k_s = specular lighting constant

N = surface normal unit vector, a function of x and y

H = "halfway" unit vectorbetween eye unit vector and light unit vector

L_r, L_g, L_b = RGB components of light

See 'feDiffuseLighting' for definition of N and (L_r, L_g, L_b).

The definition of H reflects our assumption of the constant eye vector E = (0,0,1):

H = (L + E) / Norm(L+E)

where L is the light unit vector.

Unlike the 'feDiffuseLighting', the 'feSpecularLighting' filter produces a non-opaque image. This is due to the fact that specular result (S_r, S_g, S_b, S_a) is meant to be added to the textured image. The alpha channel of the result is the max of the color components, so that where the specular light is zero, no additional coverage is added to the image and a fully white highlight will add opacity.

The 'feDiffuseLighting' and 'feSpecularLighting' filters will often be applied together. An implementation may detect this and calculate both maps in one pass, instead of two.

```
<!ELEMENT feSpecularLighting ((feDistantLight|fePointLight|feSpotLight),(animate|set|animateColor)*)
>
<!ATTLIST feSpecularLighting
  %stdAttrs;
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-LightingEffects;
  %filter_primitive_attributes_with_in;
  surfaceScale %Number; #IMPLIED
  specularConstant %Number; #IMPLIED
  specularExponent %Number; #IMPLIED >
```

Attribute definitions:

surfaceScale = "*<number>*"

> height of surface when A_{in} = 1.
> Animatable: yes.

specularConstant = "*<number>*"

> ks in Phong lighting model. In SVG, this can be any non-negative number.
> Animatable: yes.

specularExponent = "*<number>*"

> Exponent for specular term, larger is more "shiny". Range 1.0 to 128.0.
> Animatable: yes.

Attributes defined elsewhere:

> %stdAttrs;, %filter_primitive_attributes_with_in;.

The light source is defined by one of the child elements 'feDistantLight', 'fePointLight' or 'feDistantLight'. The light color is specified by property 'lighting-color'.

The example at the start of this chapter makes use of the feSpecularLighting filter primitive to achieve a highly reflective, 3D glowing effect.

15.23 Filter primitive 'feTile'

This filter primitive creates an image with infinite extent by replicating the input image in image space.

Typically, the input image has been defined with a filter primitive sub-region in order to define the tiling rectangle.

```
<!ELEMENT feTile (animate|set)* >
<!ATTLIST feTile
  %stdAttrs;
  %filter_primitive_attributes_with_in; >
```

Attributes defined elsewhere:

%stdAttrs;, %filter_primitive_attributes_with_in;.

15.24 Filter primitive 'feTurbulence'

This filter primitive creates an image using the Perlin turbulence function. It allows the synthesis of artificial textures like clouds or marble. For a detailed description the of the Perlin turbulence function, see "Texturing and Modeling", Ebert et al, AP Professional, 1994. The resulting image will have maximal size in image space.

It is possible to create bandwidth-limited noise by synthesizing only one octave.

The following C code shows the exact algorithm used for this filter effect.
For fractalSum, you get a turbFunctionResult that is aimed at a range of -1 to 1 (the actual result might exceed this range in some cases). To convert to a color value, use the formula colorValue = ((turbFunctionResult * 255) + 255) / 2, then clamp to the range 0 to 255.
For turbulence, you get a turbFunctionResult that is aimed at a range of 0 to 1 (the actual result might exceed this range in some cases). To convert to a color value, use the formula colorValue = (turbFunctionResult * 255), then clamp to the range 0 to 255.
The following order is used for applying the pseudo random numbers. An initial seed value is computed based on attribute seed. Then the implementation computes the lattice points for R, then continue getting additional pseudo random numbers relative to the last generated pseudo random number and compute the lattice points for G, and so on for B and A.

```
/* Produces results in the range [1, 2**31 - 2].
Algorithm is: r = (a * r) mod m
where a = 16807 and m = 2**31 - 1 = 2147483647
See [Park & Miller], CACM vol. 31 no. 10 p. 1195, Oct. 1988
To test: the algorithm should produce the result 1043618065
as the 10,000th generated number if the original seed is 1.
*/
#define RAND_m 2147483647 /* 2**31 - 1 */
#define RAND_a 16807 /* 7**5; primitive root of m */
#define RAND_q 127773 /* m / a */
#define RAND_r 2836 /* m % a */

long setup_seed(long lSeed)
{
    if (lSeed <= 0) lSeed = -(lSeed % (RAND_m - 1)) + 1;
    if (lSeed > RAND_m - 1) lSeed = RAND_m - 1;
    return lSeed;
}

long random(long lSeed)
{
    long result;
    result = RAND_a * (lSeed % RAND_q) - RAND_r * (lSeed / RAND_q);
    if (result <= 0) result += RAND_m;
    return result;
}

#define BSize 0x100
#define BM 0xff
#define PerlinN 0x1000
#define NP 12 /* 2^PerlinN */
#define NM 0xfff
static uLatticeSelector[BSize + BSize + 2];
static float fGradient[4][BSize + BSize + 2][2];
static void init(long lSeed)
{
    float s;
    int i, j, k;
    lSeed = setup_seed(lSeed);
    for(k = 0; k < 4; k++)
    {
        for(i = 0; i < BSize; i++)
```

```
            {
                uLatticeSelector[i] = i;
                for (j = 0; j < 2; j++)
                    fGradient[k][i][j] = (float)(((lSeed = random(lSeed)) % (BSize + BSize)) - BSize) /
BSize;
                s = float(sqrt(fGradient[k][i][0] * fGradient[k][i][0] + fGradient[k][i][1] *
fGradient[k][i][1]));
                fGradient[k][i][0] /= s;
                fGradient[k][i][1] /= s;
            }
    }
    while(--i)
    {
        k = uLatticeSelector[i];
        uLatticeSelector[i] = uLatticeSelector[j = (lSeed = random(lSeed)) % BSize];
        uLatticeSelector[j] = k;
    }
    for(i = 0; i < BSize + 2; i++)
    {
        uLatticeSelector[BSize + i] = uLatticeSelector[i];
        for(k = 0; k < 4; k++)
            for(j = 0; j < 2; j++)
                fGradient[k][BSize + i][j] = fGradient[k][i][j];
    }
}

#define s_curve(t) ( t * t * (3. - 2. * t) )
#define lerp(t, a, b) ( a + t * (b - a) )
float noise2(int nColorChannel, float vec[2])
{
    int bx0, bx1, by0, by1, b00, b10, b01, b11;
    float rx0, rx1, ry0, ry1, *q, sx, sy, a, b, t, u, v;
    register i, j;
    t = vec[0] + PerlinN;
    bx0 = ((int)t) & BM;
    bx1 = (bx0+1) & BM;
    rx0 = t - (int)t;
    rx1 = rx0 - 1.0f;
    t = vec[1] + PerlinN;
    by0 = ((int)t) & BM;
    by1 = (by0+1) & BM;
    ry0 = t - (int)t;
    ry1 = ry0 - 1.0f;
    i = uLatticeSelector[bx0];
    j = uLatticeSelector[bx1];
    b00 = uLatticeSelector[i + by0];
    b10 = uLatticeSelector[j + by0];
    b01 = uLatticeSelector[i + by1];
    b11 = uLatticeSelector[j + by1];
    sx = float(s_curve(rx0));
    sy = float(s_curve(ry0));
    q = fGradient[nColorChannel][b00]; u = rx0 * q[0] + ry0 * q[1];
    q = fGradient[nColorChannel][b10]; v = rx1 * q[0] + ry0 * q[1];
    a = lerp(sx, u, v);
    q = fGradient[nColorChannel][b01]; u = rx0 * q[0] + ry1 * q[1];
    q = fGradient[nColorChannel][b11]; v = rx1 * q[0] + ry1 * q[1];
    b = lerp(sx, u, v);
    return lerp(sy, a, b);
}

// Returns 'turbFunctionResult'
float turbulence(int nColorChannel, float *point, float fBaseFreq, int nNumOctaves, bool
bFractalSum)
{
    float fSum = 0.0f;
    float vec[2];
    float fFrequency = fBaseFreq;
    for(int nOctave = 0; nOctave < nNumOctaves; nOctave++)
    {
        vec[0] = fFrequency * point[0];
        vec[1] = fFrequency * point[1];
```

```
        if(bFractalSum)
            fSum += float(noise2(nColorChannel, vec) / (fFrequency / fBaseFreq));
        else
            fSum += float(fabs(noise2(nColorChannel, vec)) / (fFrequency / fBaseFreq));
        fFrequency *= 2;
    }
    return fSum;
}


<!ELEMENT feTurbulence (animate|set)* >
<!ATTLIST feTurbulence
    %stdAttrs;
    %filter_primitive_attributes;
    baseFrequency CDATA #IMPLIED
    numOctaves %Integer; #IMPLIED
    seed %Number; #IMPLIED
    stitchTiles (stitch | noStitch) "noStitch"
    type (fractalNoise | turbulence) "turbulence" >
```

Attribute definitions:

baseFrequency = "*<number> [<number>]*"

> The base frequency (frequencies) parameter(s) for the noise function. If two <number>s are provided, the first number represents a base frequency in the X direction and the second value represents a base frequency in the Y direction. If one number is provided, then that value is used for both X and Y.
> Animatable: yes.

numOctaves = "*<integer>*"

> The numOctaves parameter for the noise function.
> Animatable: yes.

seed = "*<number>*"

> The starting number for the pseudo random number generator.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> Animatable: yes.

stitchTiles = "*stitch | noStitch*"

> If stitchTiles="noStitch", no attempt it made to achieve smooth transitions at the border of tiles which contain a turbulence function. Sometimes the result will show clear discontinuities at the tile borders.
> If stitchTiles="stitch", then the user agent will automatically adjust baseFrequency-x and baseFrequency-y values such that the feTurbulence node's width/height (i.e., the width/height of the current subregion) contains an integral number of the Perlin tile width/height for the first octave. The baseFrequency will be adjusted up or down depending on which way has the smallest relative (not absolute) change as follows: Given the frequency, calculate lowFreq=floor(width*frequency)/width and hiFreq=ceil(width*frequency)/width. If frequency/lowFreq < hiFreq/frequency then use lowFreq, else use hiFreq. While generating turbulence values, generate lattice vectors as normal for Perlin Noise, except for those lattice points that lie on the right or bottom edges of the active area (the size of the resulting tile). In those cases, copy the lattice vector from the opposite edge of the active area.
> Animatable: yes.

type = "*fractalNoise | turbulence*"

> Indicates whether the filter primitive should perform a noise or turbulence function.
> Animatable: yes.

Attributes defined elsewhere:

> %stdAttrs;, %filter_primitive_attributes;.

Example feTurbulence shows the effects of various parameter settings for feTurbulence.

```
<?xml version="1.0"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
          "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="450px" height="325px" viewBox="0 0 450 325">
  <title>Example feTurbulence - Examples of feTurbulence operations</title>
  <desc>Six rectangular areas showing the effects of
        various parameter settings for feTurbulence.</desc>
  <g  style="font-family:Verdana; text-anchor:middle; font-size:10">
    <defs>
      <filter id="Turb1" filterUnits="objectBoundingBox"
              x="0%" y="0%" width="100%" height="100%">
```

```
          <feTurbulence type="turbulence" baseFrequency="0.05" numOctaves="2"/>
        </filter>
        <filter id="Turb2" filterUnits="objectBoundingBox"
                x="0%" y="0%" width="100%" height="100%">
          <feTurbulence type="turbulence" baseFrequency="0.1" numOctaves="2"/>
        </filter>
        <filter id="Turb3" filterUnits="objectBoundingBox"
                x="0%" y="0%" width="100%" height="100%">
          <feTurbulence type="turbulence" baseFrequency="0.05" numOctaves="8"/>
        </filter>
        <filter id="Turb4" filterUnits="objectBoundingBox"
                x="0%" y="0%" width="100%" height="100%">
          <feTurbulence type="fractalNoise" baseFrequency="0.1" numOctaves="4"/>
        </filter>
        <filter id="Turb5" filterUnits="objectBoundingBox"
                x="0%" y="0%" width="100%" height="100%">
          <feTurbulence type="fractalNoise" baseFrequency="0.4" numOctaves="4"/>
        </filter>
        <filter id="Turb6" filterUnits="objectBoundingBox"
                x="0%" y="0%" width="100%" height="100%">
          <feTurbulence type="fractalNoise" baseFrequency="0.1" numOctaves="1"/>
        </filter>
      </defs>

      <rect x="1" y="1" width="448" height="323"
            style="fill:none; stroke:blue; stroke-width:1" />

      <rect x="25" y="25" width="100" height="75" style="filter:url(#Turb1)" />
      <text x="75" y="117">type=turbulence</text>
      <text x="75" y="129">baseFrequency=0.05</text>
      <text x="75" y="141">numOctaves=2</text>

      <rect x="175" y="25" width="100" height="75" style="filter:url(#Turb2)" />
      <text x="225" y="117">type=turbulence</text>
      <text x="225" y="129">baseFrequency=0.1</text>
      <text x="225" y="141">numOctaves=2</text>

      <rect x="325" y="25" width="100" height="75" style="filter:url(#Turb3)" />
      <text x="375" y="117">type=turbulence</text>
      <text x="375" y="129">baseFrequency=0.05</text>
      <text x="375" y="141">numOctaves=8</text>

      <rect x="25" y="180" width="100" height="75" style="filter:url(#Turb4)" />
      <text x="75" y="272">type=fractalNoise</text>
      <text x="75" y="284">baseFrequency=0.1</text>
      <text x="75" y="296">numOctaves=4</text>

      <rect x="175" y="180" width="100" height="75" style="filter:url(#Turb5)" />
      <text x="225" y="272">type=fractalNoise</text>
      <text x="225" y="284">baseFrequency=0.4</text>
      <text x="225" y="296">numOctaves=4</text>

      <rect x="325" y="180" width="100" height="75" style="filter:url(#Turb6)" />
      <text x="375" y="272">type=fractalNoise</text>
      <text x="375" y="284">baseFrequency=0.1</text>
      <text x="375" y="296">numOctaves=1</text>
    </g>
</svg>
```
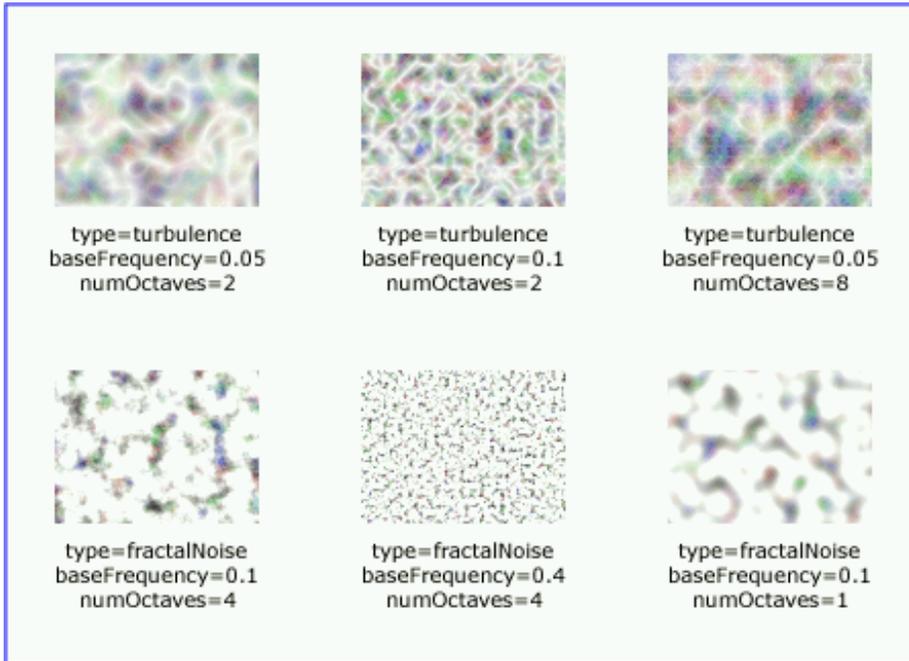
Example feTurbulence

[View this example as SVG (SVG-enabled browsers only)](#)

15.25 DOM interfaces

The following interfaces are defined below: SVGFilterElement, SVGFilterPrimitiveStandardAttributes, SVGFEBlendElement, SVGFEColorMatrixElement, SVGFEComponentTransferElement, SVGComponentTransferFunctionElement, SVGFEFuncRElement, SVGFEFuncGElement, SVGFEFuncBElement, SVGFEFuncAElement, SVGFECompositeElement, SVGFEConvolveMatrixElement, SVGFEDiffuseLightingElement, SVGFEDistantLightElement, SVGFEPointLightElement, SVGFESpotLightElement, SVGFEDisplacementMapElement, SVGFEFloodElement, SVGFEGaussianBlurElement, SVGFEImageElement, SVGFEMergeElement, SVGFEMergeNodeElement, SVGFEMorphologyElement, SVGFEOffsetElement, SVGFESpecularLightingElement, SVGFETileElement, SVGFETurbulenceElement.

Interface SVGFilterElement

The SVGFilterElement interface corresponds to the 'filter' element.

IDL Definition

```
interface SVGFilterElement :
            SVGElement,
            SVGURIReference,
            SVGLangSpace,
            SVGExternalResourcesRequired,
            SVGStylable,
            SVGUnitTypes {

        attribute SVGAnimatedEnumeration filterUnits;
                // raises DOMException on setting
        attribute SVGAnimatedEnumeration primitiveUnits;
                // raises DOMException on setting
        attribute SVGAnimatedLength      x;
                // raises DOMException on setting
        attribute SVGAnimatedLength      y;
                // raises DOMException on setting
        attribute SVGAnimatedLength      width;
```

```
                                    // raises DOMException on setting
              attribute SVGAnimatedLength       height;
                                    // raises DOMException on setting
              attribute SVGAnimatedInteger    filterResX;
                                    // raises DOMException on setting
              attribute SVGAnimatedInteger    filterResY;
                                    // raises DOMException on setting

    void setFilterRes ( in unsigned long filterResX, in unsigned long filterResY );
  };
```

Attributes

SVGAnimatedEnumeration filterUnits

Corresponds to attribute filterUnits on the given 'filter' element. Takes on one of the constants defined in SVGUnitTypes.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedEnumeration primitiveUnits

Corresponds to attribute primitiveUnits on the given 'filter' element. Takes on one of the constants defined in SVGUnitTypes.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength x

Corresponds to attribute x on the given 'filter' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength y

Corresponds to attribute y on the given 'filter' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength width

Corresponds to attribute width on the given 'filter' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength height

Corresponds to attribute height on the given 'filter' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedInteger filterResX

Corresponds to attribute filterRes on the given 'filter' element. Contains the X component of attribute filterRes.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedInteger filterResY

Corresponds to attribute filterRes on the given 'filter' element. Contains the Y component (possibly computed automatically) of attribute filterRes.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Methods

setFilterRes

Sets the values for attribute filterRes.

Parameters

in unsigned long filterResX The X component of attribute filterRes.
in unsigned long filterResY The Y component of attribute filterRes.

No Return Value

Interface SVGFilterPrimitiveStandardAttributes

This interface defines the set of DOM attributes that are common across the filter interfaces.

IDL Definition

```
interface SVGFilterPrimitiveStandardAttributes {

          attribute SVGAnimatedLength x;
                    // raises DOMException on setting
          attribute SVGAnimatedLength y;
                    // raises DOMException on setting
          attribute SVGAnimatedLength width;
                    // raises DOMException on setting
          attribute SVGAnimatedLength height;
                    // raises DOMException on setting
          attribute SVGAnimatedString result;
                    // raises DOMException on setting
};
```

Attributes

SVGAnimatedLength x

Corresponds to attribute x on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength y

Corresponds to attribute y on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength width

Corresponds to attribute width on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength height

Corresponds to attribute height on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedString result

Corresponds to attribute result on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGFEBlendElement

The SVGFEBlendElement interface corresponds to the 'feBlend' element.

IDL Definition

```
interface SVGFEBlendElement :
              SVGElement,
              SVGFilterPrimitiveStandardAttributes {

   // Blend Mode Types
```

```
      const unsigned short SVG_FEBLEND_MODE_UNKNOWN  = 0;
      const unsigned short SVG_FEBLEND_MODE_NORMAL    = 1;
      const unsigned short SVG_FEBLEND_MODE_MULTIPLY = 2;
      const unsigned short SVG_FEBLEND_MODE_SCREEN    = 3;
      const unsigned short SVG_FEBLEND_MODE_DARKEN    = 4;
      const unsigned short SVG_FEBLEND_MODE_LIGHTEN  = 5;

              attribute SVGAnimatedString       in1;
                        // raises DOMException on setting
              attribute SVGAnimatedString       in2;
                        // raises DOMException on setting
              attribute SVGAnimatedEnumeration mode;
                        // raises DOMException on setting
    };
```

Definition group Blend Mode Types

Defined constants

SVG_FEBLEND_MODE_UNKNOWN	The type is not one of predefined types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.
SVG_FEBLEND_MODE_NORMAL	Corresponds to value normal.
SVG_FEBLEND_MODE_MULTIPLY	Corresponds to value multiply.
SVG_FEBLEND_MODE_SCREEN	Corresponds to value screen.
SVG_FEBLEND_MODE_DARKEN	Corresponds to value darken.
SVG_FEBLEND_MODE_LIGHTEN	Corresponds to value lighten.

Attributes

SVGAnimatedString in1

Corresponds to attribute in on the given 'feBlend' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedString in2

Corresponds to attribute in2 on the given 'feBlend' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedEnumeration mode

Corresponds to attribute mode on the given 'feBlend' element. Takes on one of the Blend Mode Types.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface **SVGFEColorMatrixElement**

The SVGFEColorMatrixElement interface corresponds to the 'feColorMatrix' element.

IDL Definition

```
interface SVGFEColorMatrixElement :
              SVGElement,
              SVGFilterPrimitiveStandardAttributes {

  // Color Matrix Types
  const unsigned short SVG_FECOLORMATRIX_TYPE_UNKNOWN         = 0;
  const unsigned short SVG_FECOLORMATRIX_TYPE_MATRIX          = 1;
  const unsigned short SVG_FECOLORMATRIX_TYPE_SATURATE        = 2;
  const unsigned short SVG_FECOLORMATRIX_TYPE_HUEROTATE       = 3;
  const unsigned short SVG_FECOLORMATRIX_TYPE_LUMINANCETOALPHA = 4;

            attribute SVGAnimatedString       in1;
                      // raises DOMException on setting
            attribute SVGAnimatedEnumeration type;
                      // raises DOMException on setting
```

```
        readonly attribute SVGAnimatedNumberList  values;
};
```

Definition group Color Matrix Types

 Defined constants

  SVG_FECOLORMATRIX_TYPE_UNKNOWN   The type is not one of predefined types. It is invalid to attempt to
                           define a new value of this type or to attempt to switch an existing
                           value to this type.
  SVG_FECOLORMATRIX_TYPE_MATRIX   Corresponds to value matrix.
  SVG_FECOLORMATRIX_TYPE_SATURATE   Corresponds to value saturate.
  SVG_FECOLORMATRIX_TYPE_HUEROTATE   Corresponds to value hueRotate.
  SVG_FECOLORMATRIX_TYPE_LUMINANCETOALPHA   Corresponds to value luminanceToAlpha.

Attributes

 SVGAnimatedString in1

  Corresponds to attribute in on the given 'feColorMatrix' element.

  Exceptions on setting

   DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

 SVGAnimatedEnumeration type

  Corresponds to attribute type on the given 'feColorMatrix' element. Takes on one of the Color Matrix Types.

  Exceptions on setting

   DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

 readonly SVGAnimatedNumberList values

  Corresponds to attribute values on the given 'feColorMatrix' element.

  Provides access to the contents of the values attribute.

Interface SVGFEComponentTransferElement

The SVGFEComponentTransferElement interface corresponds to the 'feComponentTransfer' element.

IDL Definition

```
interface SVGFEComponentTransferElement :
            SVGElement,
            SVGFilterPrimitiveStandardAttributes {

        attribute SVGAnimatedString in1;
                    // raises DOMException on setting
};
```

Attributes

 SVGAnimatedString in1

  Corresponds to attribute in on the given 'feBlend' element.

  Exceptions on setting

   DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGComponentTransferFunctionElement

This interface defines a base interface used by the component transfer function interfaces.

IDL Definition

```
interface SVGComponentTransferFunctionElement : SVGElement {
  // Component Transfer Types
  const unsigned short SVG_FECOMPONENTTRANFER_TYPE_UNKNOWN  = 0;
```

```
        const unsigned short SVG_FECOMPONENTTRANFER_TYPE_IDENTITY = 1;
        const unsigned short SVG_FECOMPONENTTRANFER_TYPE_TABLE    = 2;
        const unsigned short SVG_FECOMPONENTTRANFER_TYPE_DISCRETE   = 3;
        const unsigned short SVG_FECOMPONENTTRANFER_TYPE_LINEAR   = 4;
        const unsigned short SVG_FECOMPONENTTRANFER_TYPE_GAMMA    = 5;

                attribute SVGAnimatedEnumeration type;
                            // raises DOMException on setting
    readonly attribute SVGAnimatedNumberList  tableValues;
                attribute SVGAnimatedNumber       slope;
                            // raises DOMException on setting
                attribute SVGAnimatedNumber       intercept;
                            // raises DOMException on setting
                attribute SVGAnimatedNumber       amplitude;
                            // raises DOMException on setting
                attribute SVGAnimatedNumber       exponent;
                            // raises DOMException on setting
                attribute SVGAnimatedNumber       offset;
                            // raises DOMException on setting
    };
```

Definition group Component Transfer Types

Defined constants

SVG_FECOMPONENTTRANFER_TYPE_UNKNOWN	The type is not one of predefined types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.
SVG_FECOMPONENTTRANFER_TYPE_IDENTITY	Corresponds to value identity.
SVG_FECOMPONENTTRANFER_TYPE_TABLE	Corresponds to value table.
SVG_FECOMPONENTTRANFER_TYPE_DISCRETE	Corresponds to value discrete.
SVG_FECOMPONENTTRANFER_TYPE_LINEAR	Corresponds to value linear.
SVG_FECOMPONENTTRANFER_TYPE_GAMMA	Corresponds to value gamma.

Attributes

SVGAnimatedEnumeration type

Corresponds to attribute type on the given element. Takes on one of the Component Transfer Types.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

readonly SVGAnimatedNumberList tableValues

Corresponds to attribute tableValues on the given element.

SVGAnimatedNumber slope

Corresponds to attribute slope on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber intercept

Corresponds to attribute intercept on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber amplitude

Corresponds to attribute amplitude on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber exponent

Corresponds to attribute exponent on the given element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber offset

Corresponds to attribute offset on the given element.

Exceptions on setting

Interface SVGFEFuncRElement

The SVGFEFuncRElement interface corresponds to the 'feFuncR' element.

IDL Definition

```
interface SVGFEFuncRElement : SVGComponentTransferFunctionElement {};
```

Interface SVGFEFuncGElement

The SVGFEFuncGElement interface corresponds to the 'feFuncG' element.

IDL Definition

```
interface SVGFEFuncGElement : SVGComponentTransferFunctionElement {};
```

Interface SVGFEFuncBElement

The SVGFEFuncBElement interface corresponds to the 'feFuncB' element.

IDL Definition

```
interface SVGFEFuncBElement : SVGComponentTransferFunctionElement {};
```

Interface SVGFEFuncAElement

The SVGFEFuncAElement interface corresponds to the 'feFuncA' element.

IDL Definition

```
interface SVGFEFuncAElement : SVGComponentTransferFunctionElement {};
```

Interface SVGFECompositeElement

The SVGFECompositeElement interface corresponds to the 'feComposite' element.

IDL Definition

```
interface SVGFECompositeElement :
                SVGElement,
                SVGFilterPrimitiveStandardAttributes {

  // Composite Operators
  const unsigned short SVG_FECOMPOSITE_OPERATOR_UNKNOWN    = 0;
  const unsigned short SVG_FECOMPOSITE_OPERATOR_OVER       = 1;
  const unsigned short SVG_FECOMPOSITE_OPERATOR_IN         = 2;
  const unsigned short SVG_FECOMPOSITE_OPERATOR_OUT        = 3;
  const unsigned short SVG_FECOMPOSITE_OPERATOR_ATOP       = 4;
  const unsigned short SVG_FECOMPOSITE_OPERATOR_XOR        = 5;
```

```
    const unsigned short SVG_FECOMPOSITE_OPERATOR_ARITHMETIC = 6;

          attribute SVGAnimatedString      in1;
                    // raises DOMException on setting
          attribute SVGAnimatedString      in2;
                    // raises DOMException on setting
          attribute SVGAnimatedEnumeration operator;
                    // raises DOMException on setting
          attribute SVGAnimatedNumber       k1;
                    // raises DOMException on setting
          attribute SVGAnimatedNumber       k2;
                    // raises DOMException on setting
          attribute SVGAnimatedNumber       k3;
                    // raises DOMException on setting
          attribute SVGAnimatedNumber       k4;
                    // raises DOMException on setting
};
```

Definition group Composite Operators

Defined constants

SVG_FECOMPOSITE_OPERATOR_UNKNOWN   The type is not one of predefined types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.

SVG_FECOMPOSITE_OPERATOR_OVER   Corresponds to value over.

SVG_FECOMPOSITE_OPERATOR_IN   Corresponds to value in.

SVG_FECOMPOSITE_OPERATOR_OUT   Corresponds to value out.

SVG_FECOMPOSITE_OPERATOR_ATOP   Corresponds to value atop.

SVG_FECOMPOSITE_OPERATOR_XOR   Corresponds to value xor.

SVG_FECOMPOSITE_OPERATOR_ARITHMETIC Corresponds to value arithmetic.

Attributes

SVGAnimatedString in1

Corresponds to attribute in on the given 'feComposite' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedString in2

Corresponds to attribute in2 on the given 'feComposite' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedEnumeration operator

Corresponds to attribute operator on the given 'feComposite' element. Takes on one of the Composite Operators.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber k1

Corresponds to attribute k1 on the given 'feComposite' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber k2

Corresponds to attribute k2 on the given 'feComposite' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber k3

Corresponds to attribute k3 on the given 'feComposite' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber k4

Corresponds to attribute k4 on the given 'feComposite' element.

Exceptions on setting

        DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGFEConvolveMatrixElement

The SVGFEConvolveMatrixElement interface corresponds to the 'feConvolveMatrix' element.

IDL Definition

```
interface SVGFEConvolveMatrixElement :
              SVGElement,
              SVGFilterPrimitiveStandardAttributes {

  // Edge Mode Values
  const unsigned short SVG_EDGEMODE_UNKNOWN   = 0;
  const unsigned short SVG_EDGEMODE_DUPLICATE = 1;
  const unsigned short SVG_EDGEMODE_WRAP      = 2;
  const unsigned short SVG_EDGEMODE_NONE      = 3;

          attribute SVGAnimatedInteger     orderX;
                    // raises DOMException on setting
          attribute SVGAnimatedInteger     orderY;
                    // raises DOMException on setting
  readonly attribute SVGAnimatedNumberList  kernelMatrix;
          attribute SVGAnimatedNumber      divisor;
                    // raises DOMException on setting
          attribute SVGAnimatedNumber      bias;
                    // raises DOMException on setting
          attribute SVGAnimatedInteger     targetX;
                    // raises DOMException on setting
          attribute SVGAnimatedInteger     targetY;
                    // raises DOMException on setting
          attribute SVGAnimatedEnumeration edgeMode;
                    // raises DOMException on setting
          attribute SVGAnimatedLength      kernelUnitLengthX;
                    // raises DOMException on setting
          attribute SVGAnimatedLength      kernelUnitLengthY;
                    // raises DOMException on setting
          attribute SVGAnimatedBoolean     preserveAlpha;
                    // raises DOMException on setting
};
```

Definition group Edge Mode Values
> **Defined constants**

> > SVG_EDGEMODE_UNKNOWN The type is not one of predefined types. It is invalid to attempt to define a new value of this type
> >   or to attempt to switch an existing value to this type.
> > SVG_EDGEMODE_DUPLICATE Corresponds to value duplicate.
> > SVG_EDGEMODE_WRAP Corresponds to value wrap.
> > SVG_EDGEMODE_NONE Corresponds to value none.

Attributes
> SVGAnimatedInteger orderX

> > Corresponds to attribute order on the given 'feConvolveMatrix' element.

> > Exceptions on setting

> > > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

> SVGAnimatedInteger orderY

> > Corresponds to attribute order on the given 'feConvolveMatrix' element.

> > Exceptions on setting

> > > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

> readonly SVGAnimatedNumberList kernelMatrix

> > Corresponds to attribute kernelMatrix on the given element.

SVGAnimatedNumber divisor

> Corresponds to attribute divisor on the given 'feConvolveMatrix' element.
>
> Exceptions on setting
>
> > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber bias

> Corresponds to attribute bias on the given 'feConvolveMatrix' element.
>
> Exceptions on setting
>
> > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedInteger targetX

> Corresponds to attribute targetX on the given 'feConvolveMatrix' element.
>
> Exceptions on setting
>
> > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedInteger targetY

> Corresponds to attribute targetY on the given 'feConvolveMatrix' element.
>
> Exceptions on setting
>
> > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedEnumeration edgeMode

> Corresponds to attribute edgeMode on the given 'feConvolveMatrix' element. Takes on one of the Edge Mode Types.
>
> Exceptions on setting
>
> > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength kernelUnitLengthX

> Corresponds to attribute kernelUnitLength on the given 'feConvolveMatrix' element.
>
> Exceptions on setting
>
> > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength kernelUnitLengthY

> Corresponds to attribute kernelUnitLength on the given 'feConvolveMatrix' element.
>
> Exceptions on setting
>
> > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedBoolean preserveAlpha

> Corresponds to attribute preserveAlpha on the given 'feConvolveMatrix' element.
>
> Exceptions on setting
>
> > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGFEDiffuseLightingElement

The SVGFEDiffuseLightingElement interface corresponds to the 'feDiffuseLighting' element.

IDL Definition

```
interface SVGFEDiffuseLightingElement :
            SVGElement,
            SVGFilterPrimitiveStandardAttributes {

        attribute SVGAnimatedString in1;
                  // raises DOMException on setting
        attribute SVGAnimatedNumber surfaceScale;
                  // raises DOMException on setting
        attribute SVGAnimatedNumber diffuseConstant;
                  // raises DOMException on setting
};
```

Attributes

SVGAnimatedString in1

    Corresponds to attribute in on the given 'feDiffuseLighting' element.

    Exceptions on setting

        DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber surfaceScale

    Corresponds to attribute surfaceScale on the given 'feDiffuseLighting' element.

    Exceptions on setting

        DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber diffuseConstant

    Corresponds to attribute diffuseConstant on the given 'feDiffuseLighting' element.

    Exceptions on setting

        DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGFEDistantLightElement

The SVGFEDistantLightElement interface corresponds to the 'feDistantLight' element.

IDL Definition

```
interface SVGFEDistantLightElement : SVGElement {
          attribute SVGAnimatedNumber azimuth;
                        // raises DOMException on setting
          attribute SVGAnimatedNumber elevation;
                        // raises DOMException on setting
};
```

Attributes

SVGAnimatedNumber azimuth

    Corresponds to attribute azimuth on the given 'feDistantLight' element.

    Exceptions on setting

        DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber elevation

    Corresponds to attribute elevation on the given 'feDistantLight' element.

    Exceptions on setting

        DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGFEPointLightElement

The SVGFEPointLightElement interface corresponds to the 'fePointLight' element.

IDL Definition

```
interface SVGFEPointLightElement : SVGElement {
          attribute SVGAnimatedNumber x;
                        // raises DOMException on setting
          attribute SVGAnimatedNumber y;
                        // raises DOMException on setting
          attribute SVGAnimatedNumber z;
                        // raises DOMException on setting
};
```

Attributes

SVGAnimatedNumber x

    Corresponds to attribute x on the given 'fePointLight' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber y

Corresponds to attribute y on the given 'fePointLight' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber z

Corresponds to attribute z on the given 'fePointLight' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGFESpotLightElement

The SVGFESpotLightElement interface corresponds to the 'feSpotLight' element.

IDL Definition

```
interface SVGFESpotLightElement : SVGElement {
        attribute SVGAnimatedNumber x;
                    // raises DOMException on setting
        attribute SVGAnimatedNumber y;
                    // raises DOMException on setting
        attribute SVGAnimatedNumber z;
                    // raises DOMException on setting
        attribute SVGAnimatedNumber pointsAtX;
                    // raises DOMException on setting
        attribute SVGAnimatedNumber pointsAtY;
                    // raises DOMException on setting
        attribute SVGAnimatedNumber pointsAtZ;
                    // raises DOMException on setting
        attribute SVGAnimatedNumber specularExponent;
                    // raises DOMException on setting
        attribute SVGAnimatedNumber limitingConeAngle;
                    // raises DOMException on setting
};
```

Attributes

SVGAnimatedNumber x

Corresponds to attribute x on the given 'feSpotLight' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber y

Corresponds to attribute y on the given 'feSpotLight' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber z

Corresponds to attribute z on the given 'feSpotLight' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber pointsAtX

Corresponds to attribute pointsAtX on the given 'feSpotLight' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber pointsAtY

Corresponds to attribute pointsAtY on the given 'feSpotLight' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber pointsAtZ

Corresponds to attribute pointsAtZ on the given 'feSpotLight' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber specularExponent

Corresponds to attribute specularExponent on the given 'feSpotLight' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber limitingConeAngle

Corresponds to attribute limitingConeAngle on the given 'feSpotLight' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGFEDisplacementMapElement

The SVGFEDisplacementMapElement interface corresponds to the 'feDisplacementMap' element.

IDL Definition

```
interface SVGFEDisplacementMapElement :
                SVGElement,
                SVGFilterPrimitiveStandardAttributes {

  // Channel Selectors
  const unsigned short SVG_CHANNEL_UNKNOWN = 0;
  const unsigned short SVG_CHANNEL_R       = 1;
  const unsigned short SVG_CHANNEL_G       = 2;
  const unsigned short SVG_CHANNEL_B       = 3;
  const unsigned short SVG_CHANNEL_A       = 4;

          attribute SVGAnimatedString      in1;
                    // raises DOMException on setting
          attribute SVGAnimatedString      in2;
                    // raises DOMException on setting
          attribute SVGAnimatedNumber      scale;
                    // raises DOMException on setting
          attribute SVGAnimatedEnumeration xChannelSelector;
                    // raises DOMException on setting
          attribute SVGAnimatedEnumeration yChannelSelector;
                    // raises DOMException on setting
};
```

Definition group Channel Selectors

Defined constants

SVG_CHANNEL_UNKNOWN	The type is not one of predefined types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.
SVG_CHANNEL_R	Corresponds to value R.
SVG_CHANNEL_G	Corresponds to value G.
SVG_CHANNEL_B	Corresponds to value B.
SVG_CHANNEL_A	Corresponds to value A.

Attributes

SVGAnimatedString in1

Corresponds to attribute in on the given 'feDisplacementMap' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedString in2

> Corresponds to attribute in2 on the given 'feDisplacementMap' element.

> Exceptions on setting

>> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber scale

> Corresponds to attribute scale on the given 'feDisplacementMap' element.

> Exceptions on setting

>> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedEnumeration xChannelSelector

> Corresponds to attribute xChannelSelector on the given 'feDisplacementMap' element. Takes on one of the Channel Selectors.

> Exceptions on setting

>> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedEnumeration yChannelSelector

> Corresponds to attribute yChannelSelector on the given 'feDisplacementMap' element. Takes on one of the Channel Selectors.

> Exceptions on setting

>> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGFEFloodElement

The SVGFEFloodElement interface corresponds to the 'feFlood' element.

IDL Definition

```
interface SVGFEFloodElement :
                SVGElement,
                SVGStylable,
                SVGFilterPrimitiveStandardAttributes {

            attribute SVGAnimatedString      in1;
                        // raises DOMException on setting
};
```

Attributes

SVGAnimatedString in1

> Corresponds to attribute in on the given 'feBlend' element.

> Exceptions on setting

>> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGFEGaussianBlurElement

The SVGFEGaussianBlurElement interface corresponds to the 'feGaussianBlur' element.

IDL Definition

```
interface SVGFEGaussianBlurElement :
                SVGElement,
                SVGFilterPrimitiveStandardAttributes {

            attribute SVGAnimatedString in1;
                        // raises DOMException on setting
            attribute SVGAnimatedNumber stdDeviationX;
                        // raises DOMException on setting
            attribute SVGAnimatedNumber stdDeviationY;
                        // raises DOMException on setting
```

```
  void setStdDeviation ( in SVGLength stdDeviationX, in SVGLength stdDeviationY );
};
```

Attributes

SVGAnimatedString in1

Corresponds to attribute in on the given 'feGaussianBlur' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber stdDeviationX

Corresponds to attribute stdDeviation on the given 'feGaussianBlur' element. Contains the X component of attribute stdDeviation.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber stdDeviationY

Corresponds to attribute stdDeviation on the given 'feGaussianBlur' element. Contains the Y component (possibly computed automatically) of attribute stdDeviation.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Methods

setStdDeviation

Sets the values for attribute stdDeviation.

Parameters

in SVGLength stdDeviationX The X component of attribute stdDeviation.
in SVGLength stdDeviationY The Y component of attribute stdDeviation.

No Return Value

No Exceptions

Interface SVGFEImageElement

The SVGFEImageElement interface corresponds to the 'feImage' element.

IDL Definition

```
interface SVGFEImageElement :
                SVGElement,
                SVGURIReference,
                SVGLangSpace,
                SVGExternalResourcesRequired,
                SVGStylable,
                SVGTransformable,
                SVGFilterPrimitiveStandardAttributes {};
```


Interface SVGFEMergeElement

The SVGFEMergeElement interface corresponds to the 'feMerge' element.

IDL Definition

```
interface SVGFEMergeElement :
                SVGElement,
                SVGFilterPrimitiveStandardAttributes {};
```

Interface SVGFEMergeNodeElement

The SVGFEMergeNodeElement interface corresponds to the 'feMergeNode' element.

IDL Definition

```
interface SVGFEMergeNodeElement : SVGElement {
          attribute SVGAnimatedString in1;
                      // raises DOMException on setting
};
```

Attributes

SVGAnimatedString in1

Corresponds to attribute in on the given 'SVGFEMergeNodeElement' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGFEMorphologyElement

The SVGFEMorphologyElement interface corresponds to the 'feMorphology' element.

IDL Definition

```
interface SVGFEMorphologyElement :
                SVGElement,
                SVGFilterPrimitiveStandardAttributes {

  // Morphology Operators
  const unsigned short SVG_MORPHOLOGY_OPERATOR_UNKNOWN = 0;
  const unsigned short SVG_MORPHOLOGY_OPERATOR_ERODE   = 1;
  const unsigned short SVG_MORPHOLOGY_OPERATOR_DILATE  = 2;

          attribute SVGAnimatedString      in1;
                      // raises DOMException on setting
          attribute SVGAnimatedEnumeration operator;
                      // raises DOMException on setting
          attribute SVGAnimatedLength      radiusX;
                      // raises DOMException on setting
          attribute SVGAnimatedLength      radiusY;
                      // raises DOMException on setting
};
```

Definition group Morphology Operators

   Defined constants

SVG_MORPHOLOGY_OPERATOR_UNKNOWN	The type is not one of predefined types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.
SVG_MORPHOLOGY_OPERATOR_ERODE	Corresponds to value erode.
SVG_MORPHOLOGY_OPERATOR_DILATE	Corresponds to value dilate.

Attributes

SVGAnimatedString in1

Corresponds to attribute in on the given 'feMorphology' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedEnumeration operator

Corresponds to attribute operator on the given 'feMorphology' element. Takes on one of the Morphology Operators.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength radiusX

> Corresponds to attribute radius on the given 'feMorphology' element.

> Exceptions on setting

>> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength radiusY

> Corresponds to attribute radius on the given 'feMorphology' element.

> Exceptions on setting

>> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGFEOffsetElement

The SVGFEOffsetElement interface corresponds to the 'feOffset' element.

IDL Definition

```
interface SVGFEOffsetElement :
                SVGElement,
                SVGFilterPrimitiveStandardAttributes {

         attribute SVGAnimatedString in1;
                        // raises DOMException on setting
         attribute SVGAnimatedLength dx;
                        // raises DOMException on setting
         attribute SVGAnimatedLength dy;
                        // raises DOMException on setting
};
```

Attributes

SVGAnimatedString in1

> Corresponds to attribute in on the given 'feOffset' element.

> Exceptions on setting

>> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength dx

> Corresponds to attribute dx on the given 'feOffset' element.

> Exceptions on setting

>> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength dy

> Corresponds to attribute dy on the given 'feOffset' element.

> Exceptions on setting

>> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGFESpecularLightingElement

The SVGFESpecularLightingElement interface corresponds to the 'feSpecularLighting' element.

IDL Definition

```
interface SVGFESpecularLightingElement :
                SVGElement,
                SVGFilterPrimitiveStandardAttributes {

         attribute SVGAnimatedString in1;
                        // raises DOMException on setting
         attribute SVGAnimatedNumber surfaceScale;
                        // raises DOMException on setting
         attribute SVGAnimatedNumber specularConstant;
```

```
                            // raises DOMException on setting
              attribute SVGAnimatedNumber specularExponent;
                            // raises DOMException on setting
    };
```

Attributes

SVGAnimatedString in1

Corresponds to attribute in on the given 'feSpecularLighting' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber surfaceScale

Corresponds to attribute surfaceScale on the given 'feSpecularLighting' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber specularConstant

Corresponds to attribute specularConstant on the given 'feSpecularLighting' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber specularExponent

Corresponds to attribute specularExponent on the given 'feSpecularLighting' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGFETileElement

The SVGFETileElement interface corresponds to the 'feTile' element.

IDL Definition

```
interface SVGFETileElement :
                SVGElement,
                SVGFilterPrimitiveStandardAttributes {

        attribute SVGAnimatedString in1;
                        // raises DOMException on setting
    };
```

Attributes

SVGAnimatedString in1

Corresponds to attribute in on the given 'feTile' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGFETurbulenceElement

The SVGFETurbulenceElement interface corresponds to the 'feTurbulence' element.

IDL Definition

```
interface SVGFETurbulenceElement :
                SVGElement,
                SVGFilterPrimitiveStandardAttributes {

    // Turbulence Types
```

```
      const unsigned short SVG_TURBULENCE_TYPE_UNKNOWN      = 0;
      const unsigned short SVG_TURBULENCE_TYPE_FRACTALNOISE = 1;
      const unsigned short SVG_TURBULENCE_TYPE_TURBULENCE   = 2;
      // Stitch Options
      const unsigned short SVG_STITCHTYPE_UNKNOWN  = 0;
      const unsigned short SVG_STITCHTYPE_STITCH   = 1;
      const unsigned short SVG_STITCHTYPE_NOSTITCH = 2;

              attribute SVGAnimatedNumber      baseFrequencyX;
                        // raises DOMException on setting
              attribute SVGAnimatedNumber      baseFrequencyY;
                        // raises DOMException on setting
              attribute SVGAnimatedInteger     numOctaves;
                        // raises DOMException on setting
              attribute SVGAnimatedNumber      seed;
                        // raises DOMException on setting
              attribute SVGAnimatedEnumeration stitchTiles;
                        // raises DOMException on setting
              attribute SVGAnimatedEnumeration type;
                        // raises DOMException on setting
    };
```

Definition group Turbulence Types

Defined constants

SVG_TURBULENCE_TYPE_UNKNOWN	The type is not one of predefined types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.
SVG_TURBULENCE_TYPE_FRACTALNOISE	Corresponds to value fractalNoise.
SVG_TURBULENCE_TYPE_TURBULENCE	Corresponds to value turbulence.

Definition group Stitch Options

Defined constants

SVG_STITCHTYPE_UNKNOWN	The type is not one of predefined types. It is invalid to attempt to define a new value of this type or to attempt to switch an existing value to this type.
SVG_STITCHTYPE_STITCH	Corresponds to value stitch.
SVG_STITCHTYPE_NOSTITCH	Corresponds to value noStitch.

Attributes

SVGAnimatedNumber baseFrequencyX

Corresponds to attribute baseFrequencyX on the given 'feTurbulence' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber baseFrequencyY

Corresponds to attribute baseFrequencyY on the given 'feTurbulence' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedInteger numOctaves

Corresponds to attribute numOctaves on the given 'feTurbulence' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedNumber seed

Corresponds to attribute seed on the given 'feTurbulence' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedEnumeration stitchTiles

Corresponds to attribute stitchTiles on the given 'feTurbulence' element. Takes on one of the Stitching Options.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedEnumeration type

Corresponds to attribute type on the given 'feTurbulence' element. Takes on one of the Turbulence Types.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

---

16 Interactivity

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16.1 Introduction

SVG content can be interactive (i.e., responsive to user-initiated events) by utilizing the following features in the SVG language:

- User-initiated actions such as button presses on the pointing device (e.g., a mouse) or keyboard events can cause [animations](#) or [scripts](#) to execute.
- The user can initiate hyperlinks to new web pages (see [Links out of SVG content: the 'a' element](#)) by actions such as mouse clicks when the pointing device is positioned over particular graphics elements.
- In many cases, depending on the value of the [zoomAndPan](#) attribute on the ['svg'](#) element and on the characteristics of the user agent, users are able to zoom into and pan around SVG content.
- User movements of the pointing device can cause changes to the [cursor](#) that shows the current position of the pointing device.

This chapter describes:

- information about [user interface events](#), including under which circumstances user interface events are triggered

- how to indicate whether a given document can be [zoomed and panned](#)

- how to specify which [cursors](#) to use

Related information can be found in other chapters:

- hyperlinks are discussed in [Links](#)

- scripting and event attributes are discussed in [Scripting](#)

- SVG's relationship to DOM2 events is discussed in [Relationship with DOM2 event model](#)

- animation is discussed in [Animation](#)

16.2 User interface events

On user agents which support interactivity, it is common for authors to define SVG document such that they are responsive to user interface events. Among the set of possible user events are [pointer events](#), keyboard events, and document events.

In response to user interface (UI) events, the author might start an animation, perform a hyperlink to another web page, highlight part of the document (e.g., change the color of the graphics elements which are under the pointer), initiate a "roll-over" (e,g., cause some previously hidden graphics elements to appear near the pointer) or launch a script which communicates with a remote database.

For all UI event-related features defined as part of the SVG language via [event attributes](#) or [animation](#), the event model corresponds to the *event bubbling* model described in DOM2 [[DOM2-EVBUBBLE](#)]. The *event capture* model from DOM2 [[DOM2-EVCAPTURE](#)] can only be established from DOM method calls.

16.3 Pointer events

User interface events that occur because of user actions performed on a pointer device are called pointer events.

Many systems support pointer devices such as a mouse or trackball. On systems which use a mouse, pointer events consist of actions such as mouse movements and mouse clicks. On systems with a different pointer device, the pointing device often emulates the behavior of the mouse by providing a mechanism for equivalent user actions, such as a button to press which is equivalent to a mouse click.

For each pointer event, the SVG user agent determines the *target element* of a given pointer event. The target element is the topmost graphics element whose relevant graphical content is under the pointer at the time of the event. (See property ['pointer-events'](#) for a description of how to determine whether an element's relevant graphical content is under the pointer, and thus in which circumstances that graphic element can be the target element for a pointer event.) When an element is not displayed (i.e., when the ['display'](#) property on that element or one of its ancestors has a value of none), that element cannot be the target of pointer events.

The event is either initially dispatched to the *target element*, to one of the target element's ancestors, or not dispatched, depending on the following:

- If there are no graphics elements whose relevant graphics content is under the pointer (i.e., there is no target element), the event is not dispatched.

- Otherwise, there is a target element. If there is an ancestor of the target element which has specified an event handler with event capturing [[DOM2-EVCAPTURE](#)] for the given event, then the event is

dispatched to that ancestor element.

- Otherwise, if the target element has an appropriate event handler for the given event, the event is dispatched to the target element.
- Otherwise, each ancestor of the target element (starting with its immediate parent) is checked to see if it has an appropriate event handler. If an ancestor is found with an appropriate event handler, the event is dispatched to that ancestor element.
- Otherwise, the event is discarded.

When event bubbling [DOM2-EVBUBBLE] is active, bubbling occurs up to all direct ancestors of the target element. Descendant elements receive events before their ancestors. Thus, if a 'path' element is a child of a 'g' element and they both have event listeners for **click** events, then the event will be dispatched to the 'path' element before the 'g' element.

When event capturing [DOM2-EVCAPTURE] is active, ancestor elements receive events before their descendants.

After an event is initially dispatched to a particular element, unless an appropriate action has been taken to prevent further processing (e.g., by invoking the preventCapture() or preventBubble() DOM method call), the event will be passed to the appropriate event handlers (if any) for that element's ancestors (in the case of event bubbling) or that element's descendants (in the case of event capture) for further processing.

16.4 Processing order for user interface events

The processing order for user interface events is as follows:

- Event handlers assigned to the topmost graphics element under the pointer (and the various ancestors of that graphics element via potential event bubbling [DOM2-EVBUBBLE]) receive the event first. If none of the activation event handlers take an explicit action to prevent further processing of the given event (e.g., by invoking the preventDefault() DOM method), then the event is passed on for:
- Processing of any relevant dynamic pseudo-classes (i.e., :hover, :active and :focus) [CSS2-DYNPSEUDO], after which the event is passed on for:
- (For those user interface events which invoke hyperlinks, such as mouse clicks in some user agents) Link processing. If a hyperlink is invoked in response to a user interface event, the hyperlink typically will disable further activation event processing (e.g., often, the link will define a hyperlink to another web page). If link processing does not disable further processing of the given event, then the event is passed on for:
- (For those user interface events which can select text, such as mouse clicks and drags on 'text' elements) Text selection processing. When a text selection operation occurs, typically it will disable further processing of the given event; otherwise, the event is passed on for:
- Document-wide event processing, such as user agent facilities to allow zooming and panning of an SVG document fragment.

16.5 The 'pointer-events' property

In different circumstances, authors may want to control under what circumstances particular graphic elements can become the target of pointer events. For example, the author might want a given element to receive pointer events only when the pointer is over the stroked perimeter of a given shape. In other cases, the author might want a given element to ignore pointer events under all circumstances so that graphical elements underneath the given element will become the target of pointer events.

For example, suppose a circle with a 'stroke' of red (i.e., the outline is solid red) and a 'fill' of none (i.e., the interior is not painted) is rendered directly on top of a rectangle with a 'fill' of blue. The author might want the circle to to be the target of pointer events only when the pointer is over the perimeter of the circle. When the pointer is over the interior of the circle, the author might want the underlying rectangle to be the target element of pointer events.

The 'pointer-events' property specifies under what circumstances a given graphics element can be the target element for a pointer event. It affects the circumstances under which the following are processed:

- user interface events such as mouse clicks
- dynamic pseudo-classes (i.e., :hover, :active and :focus) [CSS2-DYNPSEUDO]
- hyperlinks (see Links out of SVG content: the 'a' element)

'pointer-events'

Value:	visiblePainted | visibleFill | visibleStroke | visibleFillStroke | visible | painted | fill | stroke | fillstroke | all | none | inherit
Initial:	visiblePainted
Applies to:	container elements and graphics elements
Inherited:	yes
Percentages:	N/A
Media:	visual
Animatable:	yes

visiblePainted

> The given element can be the target element for pointer events when the 'visibility' property is set to visible and when the pointer is over a "painted" area. The pointer is over a painted area if it is over the interior (i.e., fill) of the element and the 'fill' property is set to a value other than 'none' or it is over the perimeter (i.e., stroke) of the element and the 'stroke' property is set to a value other than 'none'.

visibleFill

> The given element can be the target element for pointer events when the 'visibility' property is set to visible and when the pointer is over the interior (i.e., fill) of the element. The value of the 'fill' property does not effect event processing.

visibleStroke

> The given element can be the target element for pointer events when the 'visibility' property is set to visible and when the pointer is over the perimeter (i.e., stroke) of the element. The value of the 'stroke' property does not effect event processing.

visible

> The given element can be the target element for pointer events when the 'visibility' property is set to visible . and the pointer is over either the interior (i.e., fill) or the perimeter (i.e., stroke) of the element. The values of the 'fill' and 'stroke' do not effect event processing.

painted

The given element can be the target element for pointer events when the pointer is over a "painted" area. The pointer is over a painted area if it is over the interior (i.e., fill) of the element and the 'fill' property is set to a value other than 'none' or it is over the perimeter (i.e., stroke) of the element and the 'stroke' property is set to a value other than 'none'. The value of the 'visibility' property does not effect event processing.

fill

The given element can be the target element for pointer events when the pointer is over the interior (i.e., fill) of the element. The values of the 'fill' and 'visibility' properties do not effect event processing.

stroke

The given element can be the target element for pointer events when the pointer is over the perimeter (i.e., stroke) of the element. The values of the 'stroke' and 'visibility' properties do not effect event processing.

all

The given element can be the target element for pointer events whenever the pointer is over either the interior (i.e., fill) or the perimeter (i.e., stroke) of the element. The values of the 'fill', 'stroke' and 'visibility' properties do not effect event processing.

The given element does not receive pointer events.

For text elements, hit detection is performed on a character cell basis. The values visiblePainted, visibleFill, visibleStroke and visibleFillStroke are all defined to be equivalent to the value visible, and the values painted, fill, stroke and fillStroke are all defined to be equivalent to the value all.

For raster elements, hit detection can be defined to be dependent on whether the pixel under the pointer is fully transparent. For any of the values visiblePainted, visibleFill, visibleStroke and visibleFillStroke, the raster element receives the event if the 'visibility' property is set to visible and the pixel under the pointer is not fully transparent. For a value of visible, the raster element receives the event if the 'visibility' property is set to visible even if the pixel under the pointer is fully transparent. For any of the values painted, fill, stroke and fillStroke, the raster element receives the event if the the pixel under the pointer is not fully transparent, no matter what the value is for the 'visibility' property. For a value of all, the raster element receives the event even if the pixel under the pointer is fully transparent, no matter what the value is for the 'visibility' property.

16.6 Magnification, zooming and panning

Magnification represents a complete, uniform transformation on an an SVG document fragment, where the magnify operation scales all graphical elements by the same amount. A magnify operation has the effect of a supplemental scale and translate transformation placed at the outermost level on the SVG document fragment (i.e., outside the outermost 'svg' element).

Zooming represents a (potentially non-uniform) scale transformation on an SVG document fragment in response to a user interface action. All elements which are specified in user coordinates will scale uniformly, but elements which use unit identifiers to define coordinates or lengths may be transformed differently. A zoom operation has the effect of a supplemental scale and translate transformation inserted into the transformation hierarchy between the outermost 'svg' element and its children, as if an extra 'g' element enclosed all of the

children and that 'g' element specified a transformation to achieve the desired zooming effect.

Panning represents a translation (i.e., a shift) transformation on an SVG document fragment in response to a user interface action.

SVG user agents that operate in interaction-capable user environments are required to support the ability to magnify, zoom and pan.

The outermost 'svg' element in an SVG document fragment has attribute zoomAndPan, which takes the possible values of *disable*, *magnify* and *zoom*, with the default being *magnify*.

If *disable*, the user agent shall disable any zooming, magnification and panning controls and not allow the user to magnify, zoom or pan on the given document fragment.

If *magnify*, in environments that support user interactivity, the user agent shall provide controls to allow the user to perform a "magnify" operation on the document fragment.

If *zoom*, in environments that support user interactivity, the user agent shall provide controls to allow the user to perform a "zoom" operation on the document fragment.

If a zoomAndPan attribute is assigned to an inner 'svg' element, the zoomAndPan setting on the inner 'svg' element will have no effect on the SVG user agent.

Animatable: no.

16.7 Cursors

16.7.1 Introduction to cursors

Some interactive display environments provide the ability to modify the appearance of the pointer, which is also known as the *cursor*. Three types of cursors are available:

- Standard built-in cursors
- Platform-specific custom cursors
- Platform-independent custom cursors

The 'cursor' property is used to specify which cursor to use. The 'cursor' property can be used to reference standard built-in cursors by specifying a keyword such as *crosshair* or a custom cursor. Custom cursors are references via a <uri> and can point to either an external resource such as a platform-specific cursor file or to a 'cursor' element, which can be used to define a platform-independent cursor.

16.7.2 The 'cursor' property

'cursor'

Value:	[[<uri> ,]* [auto | crosshair | default | pointer | move | e-resize | ne-resize | nw-resize | n-resize | se-resize | sw-resize | s-resize | w-resize| text | wait | help]] | inherit
Initial:	auto
Applies to:	container elements and graphics elements
Inherited:	yes
Percentages:	N/A

| *Media:* | visual, interactive |
| *Animatable:* | yes |

This property specifies the type of cursor to be displayed for the pointing device. Values have the following meanings:

auto

> The UA determines the cursor to display based on the current context.

crosshair

> A simple crosshair (e.g., short line segments resembling a "+" sign).

default

> The platform-dependent default cursor. Often rendered as an arrow.

pointer

> The cursor is a pointer that indicates a link.

move

> Indicates something is to be moved.

e-resize, ne-resize, nw-resize, n-resize, se-resize, sw-resize, s-resize, w-resize

> Indicate that some edge is to be moved. For example, the 'se-resize' cursor is used when the movement starts from the south-east corner of the box.

text

> Indicates text that can be selected. Often rendered as an I-bar.

wait

> Indicates that the program is busy. Often rendered as a watch or hourglass.

help

> Help is available for the object under the cursor. Often rendered as a question mark or a balloon.

<uri>

> The user agent retrieves the cursor from the resource designated by the URI. If the user agent cannot handle the first cursor of a list of cursors, it shall attempt to handle the second, etc. If the user agent cannot handle any user-defined cursor, it must use the generic cursor at the end of the list.

```
P { cursor : url("mything.cur"), url("second.csr"), text; }
```

The 'cursor' property for SVG is identical to the 'cursor' property defined in the "Cascading Style Sheets (CSS) level 2" specification [CSS2], with the exception that SVG user agents must support cursors defined by the 'cursor' element.

16.7.3 The 'cursor' element

The 'cursor' element can be used to define a platform-independent custom cursor. A recommended approach for defining a platform-independent custom cursor is to create a PNG [PNG01] image and define a 'cursor' element that references the PNG image and identifies the exact position within the image which is the pointer position (i.e., the hot spot).

```
<!ELEMENT cursor (%descTitleMetadata;) >
<!ATTLIST cursor
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #REQUIRED
  %testAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  x %Coordinate; #IMPLIED
  y %Coordinate; #IMPLIED >
```

Attribute definitions:

x = "<u><coordinate></u>"

> The *x-coordinate* of the position in the cursor's coordinate system which represents the precise position
> that is being pointed to.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> <u>Animatable</u>: yes.

y = "<u><coordinate></u>"

> The *y-coordinate* of the position in the cursor's coordinate system which represents the precise position
> that is being pointed to.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> <u>Animatable</u>: yes.

xlink:href = "<u><uri></u>"

> A <u>URI reference</u> to the file or element which provides the image of the cursor.
> <u>Animatable</u>: yes.

Attributes defined elsewhere:

> <u>%stdAttrs;</u>, <u>%testAttrs;</u>, <u>%xlinkRefAttrs;</u>, <u>externalResourcesRequired</u>.

SVG user agents are required to support PNG format images as targets of the xlink:href property.

16.8 DOM interfaces

The following interfaces are defined below: <u>SVGCursorElement</u>.

Interface SVGCursorElement

The SVGCursorElement interface corresponds to the 'cursor' element.

IDL Definition

```
interface SVGCursorElement :
```

```
                SVGElement,
                SVGURIReference,
                SVGTests,
                SVGExternalResourcesRequired {

          attribute SVGAnimatedLength x;
                        // raises DOMException on setting
          attribute SVGAnimatedLength y;
                        // raises DOMException on setting
  };
```

Attributes

SVGAnimatedLength x

> Corresponds to attribute x on the given 'cursor' element.
>
> Exceptions on setting
>
>> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is
>> readonly.

SVGAnimatedLength y

> Corresponds to attribute y on the given 'cursor' element.
>
> Exceptions on setting
>
>> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is
>> readonly.

---

17 Linking

Contents

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17.1 Links out of SVG content: the 'a' element

SVG provides an **'a'** element, analogous to like HTML's 'a' element, to indicate hyperlinks; those parts of the drawing which when clicked on will cause the current browser frame to be replaced by the contents of the URL specified in the *href* attribute.

Example link01 assigns a hyperlink to an ellipse.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="5cm" height="3cm">
  <desc>Example link01 - a hyperlink on an ellipse
  </desc>
  <rect x=".01cm" y=".01cm" width="4.98cm" height="2.98cm"
        style="fill:none; stroke:blue"/>
  <a xlink:href="http://www.w3.org">
    <ellipse cx="2.5cm" cy="1.5cm" rx="2cm" ry="1cm"
             style="fill:red"/>
  </a>
</svg>
```
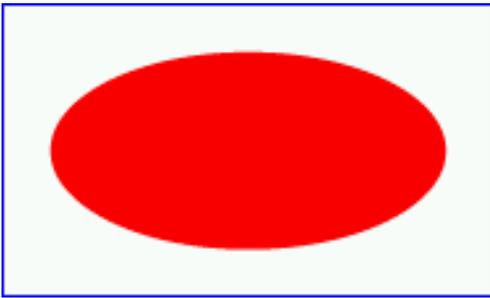
Example link01

View this example as SVG (SVG-enabled browsers only)

If the above SVG file is viewed by a user agent that supports both SVG and HTML, then clicking on the ellipse will cause the current window or frame to be replaced by the W3C home page.

```
<!ENTITY % aExt "" >
<!ELEMENT a       (#PCDATA|desc|title|metadata|defs|
                   path|text|rect|circle|ellipse|line|polyline|polygon|
                   use|image|svg|g|view|switch|a|altGlyphDef|
                   script|style|symbol|marker|clipPath|mask|
                   linearGradient|radialGradient|pattern|filter|cursor|font|
                   animate|set|animateMotion|animateColor|animateTransform|
                   color-profile|font-face
                   %ceExt;%aExt;)* >
<!ATTLIST a
  %stdAttrs;
  xmlns:xlink CDATA #FIXED "http://www.w3.org/2000/xlink/namespace/"
  xlink:type (simple|extended|locator|arc) #FIXED "simple"
  xlink:role CDATA #IMPLIED
  xlink:title CDATA #IMPLIED
  xlink:show (new|embed|replace) 'replace'
  xlink:actuate (onRequest|onLoad) #FIXED 'onRequest'
  xlink:href %URI; #REQUIRED
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;
  target %LinkTarget; #IMPLIED >
```

Attribute definitions:

xmlns [:*prefix*] = "*resource-name*"

Standard XML attribute for identifying an XML namespace. This attribute makes the XLink [XLink] namespace available to the current element. Refer to the "Namespaces in XML" Recommendation [XML-NS].

Animatable: no.

xlink:type = 'simple'

Identifies the type of XLink being used. For hyperlinks in SVG, only simple links are available. Refer to the "XML Linking Language (XLink)" [XLink].

Animatable: no.

xlink:role = '<string>'

A generic string used to describe the function of the link's content. Refer to the "XML Linking Language (XLink)" [XLink].

Animatable: no.

xlink:title = '<string>'

Human-readable text describing the link. Refer to the "XML Linking Language (XLink)" [XLink].

Animatable: no.

xlink:show = 'replace'

Indicates that upon activation of the link the referenced document will. replace the entire contents of the current document. Refer to the "XML Linking Language (XLink)" [XLink].

Animatable: no.

xlink:actuate = 'onRequest'

Indicates that the contents of the referenced object are incorporated into the current document upon user action. Refer to the "XML Linking Language (XLink)" [XLink].

Animatable: no.

xlink:href = "<uri>"

The location of the referenced object, expressed as a URI reference. Refer to the "XML Linking Language (XLink)" [XLink].

Animatable: yes.

target = "*<frame-target>*"

This attribute has applicability when the current SVG document is used as part of an HTML [HTML4] or XHTML [XHTML] parent document which defines multiple frames. This attribute specifies the name of an HTML or XHTML frame into which a document is to be opened when the hyperlink is activated. For more information, refer to the appropriate HTML or XHTML specifications.

Animatable: yes.

Attributes defined elsewhere:

%stdAttrs; %langSpaceAttrs;, class, transform, %graphicsElementEvents;, %testAttrs;, externalResourcesRequired style, %PresentationAttributes-All;.

17.2 Linking into SVG content: URI fragments and SVG views

17.2.1 Introduction: URI fragments and SVG views

On the Internet, resources are identified using URIs (Uniform Resource Identifiers) [URI]. For example, an SVG file called MyDrawing.svg located at http://www.MyCompany.com might have the following URI:

```
http://www.MyCompany.com/MyDrawing.svg
```

A URI can also address a particular element within an XML document by including a URI fragment identifier as part of the URI. A URI which includes a URI fragment identifier consists of an optional base URI, followed by a "#" character, followed by the URI fragment identifier. For example, the following URI can be used to specify the element whose ID is "Lamppost" within file MyDrawing.svg:

```
http://www.MyCompany.com/MyDrawing.svg#Lamppost
```

Because SVG content often represent a picture or drawing of something, a common need is to link into a particular view of the document, where a view indicates the initial transformations so as to present a closeup of a particular section of the document.

17.2.2 SVG fragment identifiers

To link into a particular view of an SVG document, the URI fragment identifier needs to be a correctly formed SVG fragment identifier. An SVG fragment identifier, which defines the meaning of the "selector" or "fragment identifier" portion of URIs that locate resources of MIME media type "image/svg".

An SVG fragment identifier can come in three forms:
- Shorthand *bare name* form of addressing (e.g., MyDrawing.svg#MyView). This form of addressing, which allows addressing an SVG element by its ID, is compatible with the fragment addressing mechanism for older versions of HTML and the shorthand bare name formulation in "XML Pointer Language (XPointer)" [XPTR]. (The bare name form of addressing #MyElement is equivalent to the XPointer formulation #xpointer(id('MyView')).)
- XPointer-compatible ID reference (e.g., MyDrawing.svg#xpointer(id('MyView'))). This form of addressing, which also allows addressing an SVG element by its ID, is compatible with the syntax for referencing IDs in "XML Pointer Language (XPointer)" [XPTR].
- SVG view specification (e.g., MyDrawing.svg#svgView(viewBox(0,200,1000,1000))). This form of addressing specifies the desired view of the document (e.g., the region of the document to view, the initial zoom level) completely within the SVG fragment specification. The contents of the SVG view specification are the five parameter specifications, viewBox(...), preserveAspectRatio(...), transform(...), zoomAndPan(...) and viewTarget(...), whose parameters have the same meaning as the corresponding attributes on a 'view' element.

An SVG fragment identifier is defined as follows:

```
SVGFragmentIdentifier ::= BareName |
                          XPointerIDRef |
                          SVGViewSpec
```

```
BareName ::= XML_Name

XPointerIDRef ::= 'xpointer(id(' XML_Name ')))'

SVGViewSpec ::= 'svgView(' SVGViewAttributes ')'

SVGViewAttributes ::= SVGViewAttribute |
                      SVGViewAttribute ';' SVGViewAttributes

SVGViewAttribute ::= viewBoxSpec |
                     preserveAspectRatioSpec |
                     transformSpec |
                     enableZoomAndPanControlsSpec |
                     viewTargetSpec

viewBoxSpec ::= 'viewBox(' X ',' Y ',' Width ',' Height ')'

X ::= Number

Y ::= Number

Width ::= Number

Height ::= Number

preserveAspectRatioSpec = 'preserveAspectRatio(' AspectParams ')'

AspectParams ::= AspectValue |
                 AspectValue ',' MeetOrSlice

AspectValue ::= 'none' | 'xMinYMin' | 'xMinYMid' | 'xMinYMax' |
                'xMidYMin' | 'xMidYMid' | 'xMidYMax' |
                'xMaxYMin' | 'xMaxYMid' | 'xMaxYMax'

MeetOrSlice ::= 'meet' | 'slice'


Height ::= Number

transformSpec ::= 'transform(' TransformParams ')'

transformSpec ::= 'zoomAndPan(' TrueOrFalse ')'

TrueOrFalse ::= 'true' | 'false'

viewTargetSpec ::= 'viewTarget(' XML_Name ')'
```

where:

- XML_Name is an XML name (i.e., matches the name formulation rules in XML 1.0).
- Number is a real number.
- The parameter values for viewBoxSpec corresponds to to the parameter values for the viewBox attribute

on the ['svg'](#) element. For example, viewBox(0,0,200,200).

- The parameter values for preserveAspectRatioSpec corresponds to to the parameter values for the [preserveAspectRatio](#) attribute on the ['svg'](#) element. For example, preserveAspectRatio(xMidYMid).

- The parameter values for transformSpec corresponds to to the parameter values for the [transform](#) attribute that is available on many SVG elements. For example, transform(matrix(2 0 0 2 10 15)).

- The parameter values for transformSpec corresponds to to the parameter values for the [transform](#) attribute that is available on many SVG elements. For example, transform(matrix(2 0 0 2 10 15)).

- The parameter values for enableZoomAndPanControlsSpec corresponds to to the parameter values for the [zoomAndPan](#) attribute on the ['svg'](#) element. For example, zoomAndPan(false).

- The parameter values for viewTargetSpec corresponds to to the parameter values for the [viewTarget](#) attribute on the ['view'](#) element. For example, viewTarget(MyElementID).

Spaces are not allowed in fragment specifications; thus, commas are. used to separate numeric values within an SVG view specification (e.g., #svgView(viewBox(0,0,200,200))) and semicolons are. used to separate attributes (e.g., #svgView(viewBox(0,0,200,200);preserveAspectRatio(none))).

When a source document performs a hyperlink into an SVG document via an HTML [[HTML4](#)] linking element (i.e., <a href=...> element in HTML) or an XLink specification [[XLINK](#)], then the SVG fragment identifier specifies the initial view into the SVG document, as follows:

- If no SVG fragment identifier is provided (e.g, the specified URI did not contain a "#" character, such as MyDrawing.svg), then the initial view into the SVG document is established using the view specification attributes (i.e., viewBox, etc.) on the outermost ['svg'](#) element.

- If the SVG fragment identifier addresses a ['view'](#) element within an SVG document (e.g., MyDrawing.svg#MyView or MyDrawing.svg#xpointer(id('MyView'))) then the closest ancestor ['svg'](#) element is displayed in the viewport. Any view specification attributes included on the given ['view'](#) element override the corresponding view specification attributes on the closest ancestor ['svg'](#) element.

- If the SVG fragment identifier addresses any element other than a ['view'](#) element, then the document defined by the closest ancestor ['svg'](#) element is displayed in the viewport using the view specification attributes on that ['svg'](#) element.

17.2.3 Predefined views: the 'view' element

The 'view' element is defined as follows:

```
<!ENTITY % viewExt "" >
<!ELEMENT view (%descTitleMetadata;%viewExt;) >
<!ATTLIST view
  %stdAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  viewBox %ViewBoxSpec; #IMPLIED
  preserveAspectRatio %PreserveAspectRatioSpec; 'xMidYMid meet'
  zoomAndPan (disable | magnify | zoom) 'magnify'
  viewTarget CDATA #IMPLIED >
```

Attribute definitions:

viewTarget = "*XML_Name [XML_NAME]*"

> Indicates the target object associated with the view. If provided, then the target element(s) will. be highlighted.
> [Animatable](): no.

Attributes defined elsewhere:

> [%stdAttrs;](), [viewBox](), [preserveAspectRatio](), [zoomAndPan]() [externalResourcesRequired]().

17.3 DOM interfaces

The following interfaces are defined below: [SVGAElement](), [SVGViewElement]().

Interface SVGAElement

The SVGAElement interface corresponds to the 'a' element.

IDL Definition

```
interface SVGAElement :
            SVGElement,
            SVGURIReference,
            SVGTests,
            SVGLangSpace,
            SVGExternalResourcesRequired,
            SVGStylable,
            SVGTransformable,
            events::EventTarget {

        attribute SVGAnimatedString target;
                    // raises DOMException on setting
};
```

Attributes

> SVGAnimatedString target

>> Corresponds to attribute target on the given 'a' element.

>> Exceptions on setting

>>> DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGViewElement

The SVGViewElement interface corresponds to the 'view' element.

IDL Definition

```
interface SVGViewElement :
            SVGElement,
            SVGExternalResourcesRequired,
            SVGFitToViewBox,
            SVGZoomAndPan {

    attribute SVGElement viewTarget;
                    // raises DOMException on setting
};
```

Attributes

SVGElement viewTarget

Corresponds to attribute viewTarget on the given 'view' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

---

18 Scripting

Contents

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18.1 Specifying the scripting language

18.1.1 Specifying the default scripting language

The contentScriptType attribute on the 'svg' element specifies the default scripting language for the given document fragment.

. contentScriptType = "%ContentType;"

> Identifies the default scripting language for the given document. This attribute sets the scripting language used to process the value strings in event attributes. The value %ContentType; specifies a media type, per [RFC2045]. The default value is "text/ecmascript".
> Animatable: no.

18.1.2 Local declaration of a scripting language

It is also possible to specify the scripting language for each individual 'script' element by specifying a type attribute on the 'script' element.

18.2 The 'script' element

A 'script' element is equivalent to the 'script' element in HTML and thus is the place for scripts (e.g., ECMAScript). Any functions defined within any 'script' element have a "global" scope across the entire current document.

Example script01 defines a function `circle_click` which is called by the onclick event attribute on the 'circle' element. The drawing below on the left is the initial image. The drawing below on the right shows the result after

clicking on the circle.

Note that this example demonstrates the use of the onclick event attribute for explanatory purposes. The example presupposes the presence of an input device with the same behavioral characteristics as a mouse, which will not always be the case. To support the widest range of users, the onactivate event attribute should be used instead of the onclick event attribute.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="6cm" height="5cm" viewBox="0 0 600 500">
  <desc>Example script01 - invoke an ECMAScript function from an onclick event
  </desc>
  <!-- ECMAScript to change the radius with each click -->
  <script type="text/ecmascript"> <![CDATA[
    function circle_click(evt) {
      var circle = evt.target;
      var currentRadius = circle.getAttribute("r");
      if (currentRadius == 100)
        circle.setAttribute("r", currentRadius*2);
      else
        circle.setAttribute("r", currentRadius*0.5);
    }
  ]]> </script>

  <!-- Outline the drawing area with a blue line -->
  <rect x="1" y="1" width="598" height="498" style="fill:none; stroke:blue"/>

  <!-- Act on each click event -->
  <circle onclick="circle_click(evt)" cx="300" cy="225" r="100"
          style="fill:red"/>

  <text x="300" y="480"
        style="font-family:Verdana; font-size:35; text-anchor:middle">
    Click on circle to change its size
  </text>
</svg>
```
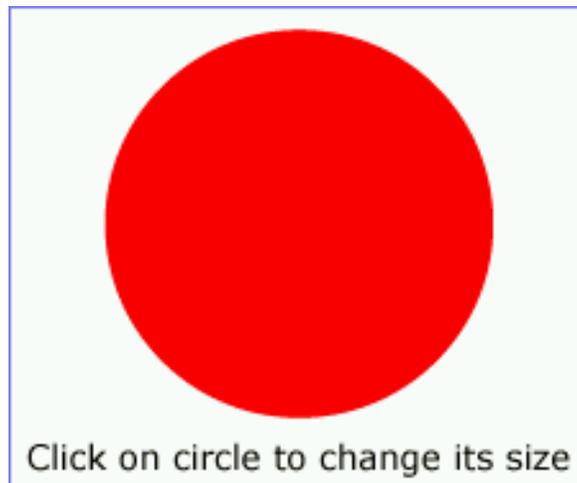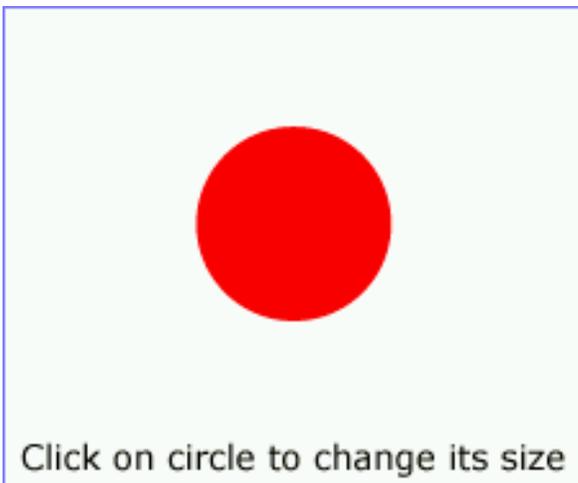

Example script01

View this example as SVG (SVG-enabled browsers only)


```
<!ELEMENT script (#PCDATA) >
<!ATTLIST script
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #IMPLIED
  externalResourcesRequired %Boolean; #IMPLIED
  type %ContentType; #REQUIRED >
```

Attribute definitions:

type = "%ContentType;"

> Identifies the scripting language for the given 'script' element. The value %ContentType; specifies a media type, per [RFC2045]. Animatable: no.

Attributes defined elsewhere:

> %stdAttrs;, %xlinkRefAttrs;, href, externalResourcesRequired.

18.3 Event handling

Events can cause scripts to execute when either of the following has occurred:
- Event attributes such as "onclick" or "onload" are assigned to particular elements, where the value of the event attributes contains script which is executed when the given event occurs.
- Event listeners as described in [DOM2-EVENTS] are defined which are invoked when a given event happens on a given object

Related sections of the spec:
- User interface events describes how an SVG user agent handles events such as pointer movements events (e.g., mouse movement) and activation events (e.g., mouse click).
- Relationship with DOM2 events describes what parts of DOM are supported by SVG and how to register event listeners

18.4 Event attributes

The following event attributes are available on many SVG elements, including its graphics elements and its container elements.

Mouse Events

- **onfocusin**
- **onfocusout**
- **onactivate**
- **onmousedown**

- **onmouseup**
- **onclick**
- **ondblclick**
- **onmouseover**
- **onmousemove**
- **onmouseout**

[Animatable](): no.

Keyboard Events

- **onkeydown**
- **onkeypress**
- **onkeyup**

[Animatable](): no.

State Change Events

- **onload** (The event is triggered at the point at which the user agent has fully parsed the element and its descendants and is ready to act appropriately upon that element, such as being ready to render the element to the target device. [Referenced external resources that are required]() must be loaded, parsed and ready to render before the event is triggered. Optional external resources are not required to be ready for the event to be triggered.)
- **onresize** (only applicable to outermost 'svg' elements which are to be mapped into a rectangular region/viewport. Similar semantics to DOM level 2 resize event for HTML.)
- **onscroll** (only applicable to outermost 'svg' elements which are to be mapped into a rectangular region/viewport. Similar semantics to DOM level 2 scroll event for HTML.)
- **onunload** (only applicable to outermost 'svg' elements which are to be mapped into a rectangular region/viewport)
- **onzoom** (only applicable to outermost 'svg' elements which are to be mapped into a rectangular region/viewport)
- **onerror** (similar semantics to DOM level 2 error event for HTML)
- **onabort** (similar semantics to DOM level 2 abort event for HTML)

[Animatable](): no.

A **load** event is dispatched only to the element to which the event applies; it is not dispatched to its ancestors. For example, if an ['image']() element and its parent ['g']() element both have event listeners for **load** events, when the ['image']() element has been loaded, only its event listener will be invoked. (The ['g']() element's event listener will indeed get invoked, but the invocation will happen when the ['g']() itself has been loaded.)

Additionally, SVG's scripting engine needs to have the *altKey*, *ctrlKey* and *shiftKey* properties available.

18.5 DOM interfaces

The following interfaces are defined below: SVGScriptElement, SVGZoomEvent.

Interface SVGScriptElement

The SVGScriptElement interface corresponds to the 'script' element.

IDL Definition

```
interface SVGScriptElement :
            SVGElement,
            SVGURIReference,
            SVGExternalResourcesRequired {

        attribute DOMString type;
                    // raises DOMException on setting
};
```

Attributes

DOMString type

Corresponds to attribute type on the given 'script' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Interface SVGZoomEvent

The zoom event handler occurs before the zoom event is processed. The remainder of the DOM represents the previous state of the document. The document will be updated upon normal return from the event handler.

The UI event type for a zoom event is:

zoom

The zoom event occurs when the user initiates an action which causes the current view of the SVG document fragment to be rescaled. Event handlers are only recognized on 'svg' elements.

❍ Bubbles: Yes

❍ Cancelable: No

❍ Context Info: zoomRectScreen, previousScale, previousTranslate, newScale, newTranslate, screenX, screenY, clientX, clientY, altKey, ctrlKey, shiftKey, metaKey, relatedNode.
(screenX, screenY, clientX, clientY indicate the center of the zoom area, with clientX, clientY in viewport coordinates for the corresponding 'svg' element. relatedNode is the corresponding 'svg' element.)

IDL Definition

```
interface SVGZoomEvent : events::UIEvent {
          attribute SVGRect zoomRectScreen;
                          // raises DOMException on setting
          attribute float previousScale;
                          // raises DOMException on setting
          attribute SVGPoint previousTranslate;
                          // raises DOMException on setting
          attribute float newScale;
                          // raises DOMException on setting
          attribute SVGPoint newTranslate;
                          // raises DOMException on setting
};
```

Attributes

SVGRect zoomRectScreen

>   The specified zoom rectangle in screen units.

>   Exceptions on setting

>   > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float previousScale

>   The scale factor from previous zoom operations that was in place before the zoom operation occurred.

>   Exceptions on setting

>   > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGPoint previousTranslate

>   The translation values from previous zoom operations that were in place before the zoom operation occurred.

>   Exceptions on setting

>   > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

float newScale

>   The scale factor that will be in place after the zoom operation has been processed.

>   Exceptions on setting

>   > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGPoint newTranslate

>   The translation values that will be in place after the zoom operation has been processed.

>   Exceptions on setting

>   > DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

19 Animation

Contents

19.1 Introduction

Because the Web is a dynamic medium, SVG supports the ability to change vector graphics over time. SVG content can be animated in the following ways:

- Using SVG's Animation Elements. SVG document fragments can describe time-based modifications to the document's elements. Using the various animation elements, you can do motion paths, fade-in/fade-out effects and objects that grow, shrink, spin or change color.
- Using the SVG DOM. The SVG DOM conforms to key aspects of the "Document Object Model (DOM) level 1" [DOM1] and "Document Object Model (DOM) level 2" [DOM2] specifications. Every attribute and style sheet setting is accessible to scripting, and SVG offers a set of additional DOM interfaces to support efficient animation via scripting. As a result, virtually any kind of animation can be achieved. The timer facilities in scripting languages such as ECMAScript can be used to start up and control the animations. (See example below.)
- SVG has been designed to allow future versions of SMIL [SMIL1] to use animated or static SVG content as media components.
- In the future, it is expected that future versions of SMIL will be modularized and that components of it could be used in conjunction with SVG and other XML grammars to achieve animation effects.

19.2 Animation elements

19.2.1 Relationship to SMIL Animation

SVG's animation elements were developed in collaboration with the W3C Synchronized Multimedia (SYMM) Working Group, developers of the Synchronized Multimedia Integration Language (SMIL) 1.0 Specification [SMIL1].

The SYMM working group, in collaboration with the SVG working group, has authored the SMIL Animation specification [SMILANIM], which represents a general-purpose XML animation feature set. SVG incorporates the animation features defined in the SMIL Animation specification and provides some SVG-specific extensions.

SVG supports the following four animation elements which are defined in the SMIL Animation specification:

'animate'   allows scalar attributes and properties to be assigned different values over time
'set'   a convenient shorthand for 'animate', which is useful for assigning animation values to non-numeric attributes and properties, such as the 'visibility' property
'animateMotion'   moves an element along a motion path
'animateColor'   modifies the color value of particular attributes or properties over time

Additionally, SVG includes the following compatible extensions to SMIL Animation:

'animateTransform'   modifies one of SVG's transformation attributes over time, such as the transform attribute
path attribute   SVG allows the any feature from SVG's path data syntax to be specified in a path attribute to the 'animateMotion' element. (SMIL Animation only allows a subset of SVG's path data syntax within a path attribute.)
keyPoints attribute   SVG adds a keyPoints attribute to the 'animateMotion' to provide precise control of the velocity of motion path animations
rotate attribute   SVG adds a rotate attribute to the 'animateMotion' to control whether an object is automatically rotated so that its X-axis points in the same direction (or opposite direction) as the directional tangent vector of the motion path

SMIL Animation requires that the host language define how identify the elements which are to be animated. For compatibility with other aspects of the language, SVG uses URI references via an xlink:href attribute to identify the elements which are to be targets of the animations.

SMIL Animation requires that the host language define the meaning for document begin and the document end. Since an 'svg' is sometimes the root of the XML document tree and other times can be a component of a parent XML grammar, SVG defines an effective begin and effective end for an SVG document fragment. The effective begin of an SVG document fragment is the exact time at which the 'svg' element's onload event is triggered. The effective end of an SVG document fragment is the point at which the document fragment has been released and is no longer being processed by the user agent.

The term presentation time indicates the effective position in time relative to the effective begin of a document fragment. Presentation time behaves like the timecode shown on a counter of a tape-deck that advances at the speed of the presentation. It reflects that the presentation can be stopped, and that its speed can be decreased or increased either by user actions, or by the animation engine itself.

SVG defines more constrained error processing that is defined in the SMIL Animation [SMILANIM] specification. SMIL Animation defines error processing behavior where the document continues to run in certain error situations, whereas all animations within an SVG document fragment will stop in the event of any error within the document (see Error processing).

The SMIL Animation specification was jointly developed by the SYMM and SVG working groups. SVG is a host language in terms of SMIL Animation and therefore introduces additional constraints and features as permitted by that specification. Except as specifically noted, all animation elements and attributes described for SVG conform to the SMIL Animation [SMILANIM] specification.

19.2.2 Animation elements example

Example anim01 below demonstrates each of SVG's five animation elements.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="8cm" height="3cm"  viewBox="0 0 800 300">
  <desc>Example anim01 - demonstrate animation elements</desc>

  <!-- The following illustrates the use of the 'animate' element
       to animate a rectangles x, y, and width attributes so that
       the rectangle grows to ultimately fill the viewport. -->
  <rect id="RectElement" x="300" y="100" width="300" height="100"
        style="fill:rgb(255,255,0)" >
    <animate attributeName="x" attributeType="XML"
             begin="0s" dur="9s" fill="freeze" from="300" to="0" />
    <animate attributeName="y" attributeType="XML"
             begin="0s" dur="9s" fill="freeze" from="100" to="0" />
    <animate attributeName="width" attributeType="XML"
             begin="0s" dur="9s" fill="freeze" from="300" to="800" />
    <animate attributeName="height" attributeType="XML"
             begin="0s" dur="9s" fill="freeze" from="100" to="300" />
  </rect>

  <!-- Set up a new user coordinate system so that
       the text string's origin is at (0,0), allowing
       rotation and scale relative to the new origin -->
```

```
  <g transform="translate(100,100)" >
    <!-- The following illustrates the use of the 'set', 'animateMotion',
         'animateColor' and 'animateTransform' elements. The 'text' element
         below starts off hidden (i.e., invisible). At 3 seconds, it:
            * becomes visible
            * continuously moves diagonally across the viewport
            * changes color from blue to dark red
            * rotates from -30 to zero degrees
            * scales by a factor of three. -->
    <text id="TextElement" x="0" y="0"
          style="font-family:Verdana; font-size:35.27; visibility:hidden" >
      It's alive!
      <set attributeName="visibility" attributeType="CSS" to="visible"
           begin="3s" dur="6s" fill="freeze" />
      <animateMotion path="M 0 0 L 100 100"
           begin="3s" dur="6s" fill="freeze" />
      <animateColor attributeName="fill" attributeType="CSS"
           from="rgb(0,0,255)" to="rgb(128,0,0)"
           begin="3s" dur="6s" fill="freeze" />
      <animateTransform attributeName="transform" attributeType="XML"
           type="rotate" from="-30" to="0"
           begin="3s" dur="6s" fill="freeze" />
      <animateTransform attributeName="transform" attributeType="XML"
           type="scale" from="1" to="3" additive="sum"
           begin="3s" dur="6s" fill="freeze" />
    </text>
  </g>
</svg>
```


At zero seconds
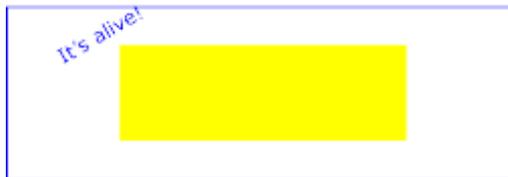
At three seconds
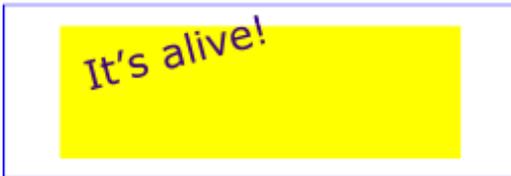
At six seconds

At nine seconds

Example anim01

The sections below describe the various animation attributes and elements.

19.2.3 Attributes to identify the target of an animation

The following attributes are common to all animation elements and identify the target element and the attribute or property whose value changes over time.

```
<!ENTITY % animTargetAttrs
 "%xlinkRefAttrs;
  xlink:href  %URI;  #IMPLIED
  attributeName  CDATA  #REQUIRED
  attributeType  CDATA  #IMPLIED" >
```

Attribute definitions:

xlink:href = "<uri>"

> A URI reference to the element which is the target of this animation and which therefore will be modified over time.
> The target element must be part of the current SVG document fragment.

<uri> must point to exactly one target element which is capable of being the target of the given animation. If <uri> points to multiple target elements or the given target element is not capable of being a target of the given animation or the given target element is not part of the current SVG document fragment, then the document is in error (see Error processing).

If the xlink:href attribute is not provided, then the target element will be the immediate parent element of the current animation element. Refer to the descriptions of the individual animation elements for any restrictions on what types of elements can be targets of particular types of animations.

For more information, see [SMILANIM-TARGET].

attributeName = **<attributeName>**

Specifies the name of the target attribute. An XMLNS prefix may be used to indicate the XML namespace for the attribute. The prefix will be interpreted in the scope of the target element.

For more information, see [SMILANIM-TARGET].

attributeType = "**CSS | XML | auto**"

Specifies the namespace in which the target attribute and its associated values are defined. The attribute value is one of the following:

"XML"

This specifies that the value of "attributeName" is the name of an XML attribute on the target element. The attribute must be defined as animatable in this specification.

"CSS"

This specifies that the value of "attributeName" is the name of a CSS property defined as animatable in this specification.

"auto"

This specifies that the user agent will automatically check to determine if there is an animatable SVG property whose name matches the value of attributeName; if not, the user agent will check to determine if there is an animatable XML attribute on the target element whose name matches the value of attributeName.

The default value is "auto".

For more information, see [SMILANIM-TARGET].

Attributes defined elsewhere:

%xlinkRefAttrs;.

19.2.4 Attributes to control the timing of the animation

The following attributes are common to all animation elements and control the timing of the animation, including what causes the animation to start and end, whether the animation runs repeatedly, and whether to retain the end state the animation once the animation ends.

```
<!ENTITY % animTimingAttrs
  "begin CDATA #IMPLIED
   dur CDATA #IMPLIED
   restart (always | never | whenNotActive) 'always'
   repeatCount CDATA #IMPLIED
   repeatDur CDATA #IMPLIED
   end CDATA #IMPLIED
   fill (remove | freeze) 'remove'" >
```

Attribute definitions:

begin

Defines when the element begins (i.e. become active).
The attribute value can be one of the following types of values:

clock-value

Specifies the presentation time at which the animation begins. The begin is thus defined relative to the document begin.

syncbase-value : (id-ref ".") ("begin" | "end") ("+"clock-value)?

Describes a syncbase and an offset from that syncbase. The element begin is defined relative to the begin **B** or active end **AE** of another animation.

event-value : (id-ref ".")? (event-ref) ("+"clock-value)?

Describes an event and an optional offset that determine the element begin. The animation begin is defined relative to the time that the event is raised. The list of event-symbols available for a given event-base element is the list of event attributes available for the given element as defined by the SVG DTD, with the one difference that the leading 'on' is removed from the event name (i.e., the animation event name is 'click', not 'onclick'). (See Event handling for a discussion of the various event attributes that can be used as Event-symbols.) Details of event-based timing are described in [SMILANIM-UNIFY].

"indefinite"

> The begin of the animation will be determined by a "beginElement()" method call or a hyperlink targeted to the animation element. The SMIL Animation DOM methods are described in DOM interfaces.
> Hyperlink-based timing is described in [SMILANIM-LINKS].

For more information, see [SMILANIM-ATTR-BEGIN].

dur

Specifies the simple duration.
The attribute value can be one of the following types of values:

clock-value

> Specifies the length of the simple duration in presentation time.

"indefinite"

> Specifies the simple duration **d** as indefinite.

For more information, see [SMILANIM-ATTR-DUR].

end

Defines the active end **AE** of the animation (i.e. the end of the active duration).
The attribute value can be one of the following types of values:

clock-value

> Specifies the presentation time of the active end. The active end is thus defined relative to the document begin.

syncbase-value : (id-ref) (".begin" | ".end")? ("+"clock-value)?

> Describes a syncbase and an offset from that syncbase. The active end is defined relative to the begin **B** or active end **AE** of another animation.

event-value : (id-ref ".")? (event-ref) ("+"clock-value)?

> Describes an event and an optional offset that determine the active end. The active end is defined relative to the time that the event is raised. The event must be raised after the animation begins, and before the active duration otherwise ends (e.g. as defined by repeatDur). The list of event-symbols available for a given event-base element is the list of event attributes available for the given element as defined by the SVG DTD. (See Event handling for a discussion of the various event attributes that can be used as Event-symbols.) Details of event-based timing are described in [SMILANIM-UNIFY].

"indefinite"

> The active end of the animation will be determined by an "endElement()" method call. The SMIL Animation DOM methods are described in the specification of DOM Interface ElementTimeControl section.

For more information, see [SMILANIM-ATTR-END].

restart

always

> The animation can be restarted at any time.
> This is the default value.

never

> The animation cannot be restarted for the remainder of the document duration.

whenNotActive

> The animation can only be restarted when it is not active (i.e. after the active end). Attempts to restart the animation during its active duration are ignored.

For more information, see [SMILANIM-ATTR-RESTART].

repeatCount

Specifies the number of iterations of the animation function. It can have the following attribute values:

numeric value

> This is a (base 10) "floating point" numeric value that specifies the number of iterations. It can include partial iterations expressed as fraction values. A fractional value describes a portion of the simple duration **d**. Values must be greater than 0.

"indefinite"

> The animation is defined to repeat indefinitely (i.e. until the document ends).

For more information, see [SMILANIM-ATTR-REPEATCOUNT].

repeatDur

Specifies the total duration for repeat. It can have the following attribute values:

clock-value

> Specifies the duration in presentation time to repeat the animation function **f(t)**.

"indefinite"

> The animation is defined to repeat indefinitely (i.e. until the document ends).

For more information, see [SMILANIM-ATTR-REPEATDUR].

fill

This attribute can have the following values:

freeze

> The animation effect F(t) is defined to freeze the effect value at the last value of the active duration. The animation effect is "frozen" for the remainder of the document duration (or until the animation is restarted - see [SMILANIM-RESTART]).

remove

> The animation effect is removed (no longer applied) when the active duration of the animation is over. After the active end **AE** of the animation, the animation no longer affects the target (unless the animation is restarted - see [SMILANIM-RESTART]).
>
> This is the default value.

For more information, see [SMILANIM-ATTR-FILL].

If both `repeatCount` or `repeatDur` are specified (and the simple duration is not indefinite), the active duration is defined as the minimum of the specified repeatDur, and the simple duration multiplied by repeatCount. For the purposes of this comparison, a defined value is considered to be "less than" a value of "indefinite". If the simple duration is indefinite, and both `repeatCount` or `repeatDur` are specified, the `repeatCount` will be ignored, and the `repeatDur` will be used (refer to the examples below describing `repeatDur` and an indefinite simple duration). These rules are included in [SMILANIM-D].

Timing Attribute Values

In the syntax specifications that follow, allowed white space is indicated as "S", defined as follows (taken from the [XML] definition for "S"):

```
S ::= (#x20 | #x9 | #xD | #xA)+
```

Clock values

Clock values have the following syntax:

```
Clock-val          ::= Full-clock-val | Partial-clock-val
                       | Timecount-val
Full-clock-val     ::= Hours ":" Minutes ":" Seconds ("." Fraction)?
Partial-clock-val ::= Minutes ":" Seconds ("." Fraction)?
Timecount-val      ::= Timecount ("." Fraction)? (Metric)?
Metric             ::= "h" | "min" | "s" | "ms"
Hours              ::= DIGIT+; any positive number
Minutes            ::= 2DIGIT; range from 00 to 59
Seconds            ::= 2DIGIT; range from 00 to 59
Fraction      ::= DIGIT+
Timecount     ::= DIGIT+
2DIGIT        ::= DIGIT DIGIT
DIGIT         ::= [0-9]
```

For Timecount values, the default metric suffix is "s" (for seconds). No embedded white space is allowed in clock values, although leading and trailing white space characters will be ignored.

Clock values describe presentation time.

The following are examples of legal clock values:

- Full clock values:
  - 02:30:03   = 2 hours, 30 minutes and 3 seconds
  - 50:00:10.25 = 50 hours, 10 seconds and 250 milliseconds
- Partial clock value:
  - 02:33   = 2 minutes and 33 seconds
  - 00:10.5 = 10.5 seconds = 10 seconds and 500 milliseconds
- Timecount values:
  - 3.2h   = 3.2 hours = 3 hours and 12 minutes
  - 45min   = 45 minutes
  - 30s   = 30 seconds
  - 5ms   = 5 milliseconds
  - 12.467 = 12 seconds and 467 milliseconds

Fractional values are just (base 10) floating point definitions of seconds. Thus:

```
00.5s = 500 milliseconds
00:00.005 = 5 milliseconds
```

A syncbase value has the following syntax:

```
Syncbase-value    ::= ( Syncbase-element "." Time-symbol )
                      ( S "+" S Clock-value )?
Syncbase-element ::= Id-value
Time-symbol       ::= "begin" | "end"
```

A syncbase value starts with a Syncbase-element term defining the value of an "id" attribute of an animation element referred to as the *syncbase element*. This element must be another animation element contained in the host document.

The syncbase element is qualified with one of the following *time symbols:*

begin

> Specifies the begin time of the syncbase element.

end

> Specifies the Active End **AE** of the syncbase element.

The time symbol can be followed by a clock value. The clock value specifies a [presentation time](#) offset from the time (i.e. the begin or end) specified by the syncbase and time symbol. If the clock value is omitted, it defaults to "0".

No embedded white space is allowed between a syncbase element and a time-symbol. White space will be ignored before and after a "+" for a clock value. Leading and trailing white space characters (i.e. before and after the entire syncbase value) will be ignored.

Examples:

```
begin="x.end+45s"  : Begin 45 seconds after "x" ends
begin=" x.begin "  : Begin when "x" begins
end="x.begin + 1m" : End 1 minute after "x" begins
```

An event value has the following syntax:

```
Event-value        ::= ( Eventbase-element "." )? Event-symbol
                       ( S "+" S Clock-value )?
Eventbase-element ::= Id-value
```

An Event value starts with an Eventbase-element term that specifies the *event-base element*. The event-base element is the element on which the event is observed. Given DOM event bubbling, the event-base element may be either the element that raised the event, or it may be an ancestor element on which the bubbled event can be observed. Refer to DOM-Level2-Events [[DOM2-EVENTS](#)] for details.

The "Id-value" is the value of an attribute declared to be an "id" in the host language, for the event-base element. This element must be another animation element contained in the host document.

If the Eventbase-element term is missing, the event-base element defaults to the target element of the animation.

If the id value term is missing, the event-base element is defined to be the target element of the animation.

The event value must specify an Event-symbol. This term specifies the name of the event that is raised on the Event-base element. . The list of event-symbols available for a given event-base element is the list of event attributes available for the given element as defined by the [SVG DTD](#). (See [Event handling](#) for a discussion of the various event attributes that can be used as Event-symbols.)

The last term specifies an optional clock-value that is a [presentation time](#) offset from the event. If this term is omitted, the offset is 0.

No embedded white space is allowed between an eventbase element and an event-symbol. White space will be ignored before and after a "+" for a clock value. Leading and trailing white space (i.e. before and after the entire eventbase value) is not allowed.

Note that it is not considered an error to specify an event that cannot be raised on the Event-base element (such as click for audio or other non-visual elements). Similarly, if the host language allows dynamically created events (as supported by DOM-Level2-Events [[DOM2-EVENTS](#)]), and it is not possible to specify all Event-symbol names, unrecognized names may not be considered errors. Host language specifications must include a description of legal event names, and/or allow any name to be used.

Examples:

```
begin=" x.onload "    : Begin when "onload" is observed on "x"
begin="x.onfocus+3s" : Begin 3 seconds after an "onfocus" event on "x"
```

The defaults for the event and target element syntax make it easy to define simple interactive behavior. The following example sets the `rect` element color to be red for 5 seconds, when the user clicks on the element.

```
  <rect ...>
    <set begin="onclick" dur="5s" to="red"
         attributeName="fill" attributeType="CSS" />
    ...
  </rect>
```

19.2.5 Attributes that define animation values over time

The following attributes are common to elements 'animate', 'animateMotion', 'animateColor' and 'animateTransform'. These attributes define the values that are assigned to the target attribute or property over time. The attributes below provide control over the relative timing of keyframes and the interpolation method between discrete values.

```
<!ENTITY % animValueAttrs
  "calcMode (discrete | linear | evenPace | spline) 'linear'
  values CDATA #IMPLIED
  from CDATA #IMPLIED
  to CDATA #IMPLIED
  by CDATA #IMPLIED
  keyTimes CDATA #IMPLIED
  keySplines CDATA #IMPLIED" >
```

Attribute definitions:

The animation is described either as a list of *values*, or in a simplified form that describes the *from*, *to* and *by* values.

from = "**<value>**"

> Specifies the starting value of the animation.

to = "**<value>**"

> Specifies the ending value of the animation.

by = "**<value>**"

> Specifies a relative offset value for the animation.

values = "**<list>**"

> A semicolon-separated list of one or more values. Vector-valued attributes are supported using the vector syntax of the `attributeType` domain.

The animation values specified in the animation element must be legal values for the specified attribute. Leading and trailing white space, and white space before and after semi-colon separators, will be ignored.

All values specified must be legal values for the specified attribute (as defined in the associated namespace). If any values are not legal, the animation will have no effect.

If a list of values is used, the animation will apply the values in order over the course of the animation. If a list of *values* is specified, any *from*, *to* and *by* attribute values are ignored.

The simpler syntax provides for several variants. Note that `from` is optional, but that one of `by` or `to` must be used (unless of course a list of `values` is provided). It is not legal to specify both `by` and `to` attributes - if both are specified, only the `to` attribute will be used (the `by` will be ignored). The combinations of attributes yield the following classes of animation:

from-to animation

> Specifying a `from` value and a `to` value defines a simple animation, equivalent to a `values` list with 2 values. The animation function is defined to start with the `from` value, and to finish with the `to` value.

from-by animation

> Specifying a `from` value and a `by` value defines a simple animation in which the animation function is defined to start with the `from` value, and to change this over the course of the simple duration **d** by a *delta* specified with the `by` attribute. This can only be used with attributes that support addition (e.g. most numeric attributes).

by animation

> Specifying only a by value defines a simple animation in which the animation function is defined to offset the underlying value for the attribute, using a delta that varies over the course of the simple duration **d**, starting from a delta of 0 and ending with the delta specified with the `by` attribute. This can only be used with attributes that support addition.

to animation

> This describes an animation in which the animation function is defined to start with the underlying value for the attribute, and finish with the value specified with the `to` attribute. Using this form, an author can describe an animation that will start with whatever value the attribute has

originally, and will end up at the desired `to` value.

For more information on these attributes, see [SMILANIM-ATTR-VALUES].

The last two forms "*by animation*" and "*to animation*" have additional semantic constraints when combined with other animations. The details of this are described in [SMILANIM-FROMTOBY-ADD].

Examples

The following example using the `values` syntax animates the width of a <u>'rect'</u> over the course of 10 seconds from a width of 40 to a width of 100 and back to 40.

```
<rect ...>
   <animate attributeName="width" values="40;100;40" dur="10s"/>
</rect>
```

The following "*from-to animation*" example animates the width of a <u>'rect'</u> over the course of 10 seconds from a width of 50 to a width of 100.

```
<rect ...>
   <animate attributeName="width" from="50" to="100" dur="10s"/>
</rect>
```

The following "*from-by animation*" example animates the width of a <u>'rect'</u> over the course of 10 seconds from a width of 50 to a width of 75.

```
<rect ...>
   <animate attributeName="width" from="50" by="25" dur="10s"/>
</rect>
```

The following "*by animation*" example animates the width of a <u>'rect'</u> over the course of 10 seconds from the original width of 40 to a width of 70.

```
<rect width="40"...>
   <animate attributeName="width" by="30" dur="10s"/>
</rect>
```

The following "*to animation*" example animates the width of a <u>'rect'</u> over the course of 10 seconds from the original width of 40 to a width of 100.

```
<rect width="40"...>
   <animate attributeName="width" to="100" dur="10s"/>
</rect>
```

By default, a simple linear interpolation is performed over the values, evenly spaced over the duration of the animation. Additional attributes can be used for finer control over the interpolation and timing of the values. The `calcMode` attribute defines the basic method of applying values to the attribute. The `keyTimes` attribute provides additional control over the timing of the animation function, associating a time with each value in the `values` list. Finally, the `keySplines` attribute provides a means of controlling the pacing of interpolation *between* the values in the `values` list.

`calcMode` = "**discrete | linear | paced | spline**"

> Specifies the interpolation mode for the animation. This can take any of the following values. The default mode is "linear", however if the attribute does not support linear interpolation (e.g. for strings), this attribute is ignored and discrete interpolation is always used.

> `"discrete"`

>> This specifies that the animation function will jump from one value to the next without any interpolation.

> `"linear"`

>> Simple linear interpolation between values is used to calculate the animation function. This is the default `calcMode`.

> `"paced"`

>> Defines interpolation to produce an even pace of change across the animation. This is only supported for values that define a linear numeric range, and for which some notion of "distance" between points can be calculated (e.g. position, width, height, etc.). If "paced" is specified, any `keyTimes` or `keySplines` will be ignored.

> `"spline"`

>> Interpolates from one value in the `values` list to the next according to a time function defined by a cubic Bezier spline. The points of the spline are defined in the `keyTimes` attribute, and the control points for each interval are defined in the `keySplines` attribute.

`keyTimes` = "**<list>**"

> A semicolon-separated list of time values used to control the pacing of the animation. Each time in the list corresponds to a value in the `values` attribute list, and defines when the value is used in the animation function. Each time value in the `keyTimes` list is specified as a floating point value between 0 and 1 (inclusive), representing a proportional offset into the simple duration of the animation element.
> Each successive time value must be greater than or equal to the preceding time value.
> The first time value in the list must be 0, and the last time value in the list must be 1.
> If a list of `keyTimes` is specified, there must be exactly as many values in the `keyTimes` list as in the `values` list.

If there are any errors in the keyTimes specification (bad values, too many or too few values), the animation will have no effect.
If the simple duration is indefinite, any keyTimes specification will be ignored.

keySplines = "**\<list\>**"

A set of Bezier control points associated with the keyTimes list, defining a cubic Bezier function that controls interval pacing. The attribute value is a semi-colon separated list of control point descriptions. Each control point description is a set of four values: x1 y1 x2 y2, describing the Bezier control points for one time segment. The keyTimes values that define the associated segment are the Bezier "anchor points", and the keySplines values are the control points.
Thus, there must be one fewer sets of control points than there are keyTimes.
The values must all be in the range 0 to 1.
This attribute is ignored unless the calcMode is set to "spline".
If there are any errors in the keySplines specification (bad values, too many or too few values), the animation will have no effect.

If the keyTimes attribute is not specified, the values in the values attribute are assumed to be equally spaced through the animation duration, according to the calcMode:

- For discrete animation, the duration is divided into equal time periods, one per value. The animation function takes on the values in order, one value for each time period.

- For linear and spline animation, the duration is divided into n-1 even periods, and the animation function is a linear interpolation between the values at the associated times. Note that a linear animation will be a nicely closed loop if the first value is repeated as the last.

Note that for the shorthand forms *to animation* and *from-to animation*, there are only 1 and 2 values respectively. Thus a discrete *to animation* will simply set the "to" value for the simple duration. A discrete *from-to animation* will set the "from" value for the first half of the simple duration and the "to" value for the second half of the simple duration.

Note that if the calcMode is set to "paced", the keyTimes attribute is ignored, and the values in the values attribute are spaced to produce a constant rate of change as the target attribute value is interpolated.

If the argument values for keyTimes or interSpline are not legal (including too few or too many values for either attribute), the animation will have no effect.

In the calcMode, keyTimes and keySplines attribute values, leading and trailing white space and white space before and after semi-colon separators will be ignored.

Examples

This example describes a somewhat unusual usage: "*from-to animation*" with discrete animation. The 'text' element supports the font-style property, which takes a string, and so implies a calcMode of discrete. The animation will set the font-style to "normal" for 5 seconds (half the simple duration) and then set the font-style to "italic" for 5 seconds.

```
<text style="font-style:normal"...>
  <animate attributeName="font-style"
      from="normal" to="italic" dur="10s"/>
</text>
```

This example illustrates the use of keyTimes:

```
<animate attributeName="x" dur="10s" values="0; 50; 100"
    keyTimes="0; .8; 1" calcMode="linear"/>
```

The keyTimes values causes the "x" attribute to have a value of "0" at the start of the animation, "50" after 8 seconds (at 80% into the simple duration) and "100" at the end of the animation. The value will change more slowly in the first half of the animation, and more quickly in the second half.

Extending this example to use keySplines:

```
<animate attributeName="x" dur="10s" values="0; 50; 100"
    keyTimes="0; .8; 1" calcMode="spline"
    keySplines=".5 0 .5 1; 0 0 1 1" />
```

The keyTimes still causes the "x" attribute to have a value of "0" at the start of the animation, "50" after 8 seconds and "100" at the end of the animation. However, the keySplines values define a curve for pacing the interpolation between values. In the example above, the spline causes an ease-in and ease-out effect between time 0 and 8 seconds (i.e. between keyTimes 0 and .8, and values "0" and "50"), but a strict linear interpolation between 8 seconds and the end (i.e. between keyTimes .8 and 1, and values "50" and "100"). See the figure below for an illustration of the curves that these keySplines values define.

For some attributes, the *pace* of change might not be easily discernable by viewers. However for animations like motion, the ability to make the *speed* of the motion change gradually, and not in abrupt steps can be important. The keySplines attribute provides this control.

The following figure illustrates the interpretation of the keySplines attribute. Each diagram illustrates the effect of keySplines settings for a single interval (i.e. between the associated pairs of values in the keyTimes and values lists.). The horizontal axis can be thought of as the input value for the *unit progress* of interpolation within the interval - i.e. the pace with which interpolation proceeds along the given interval. The vertical axis is the resulting value for the *unit progress*, yielded by the keySplines function.
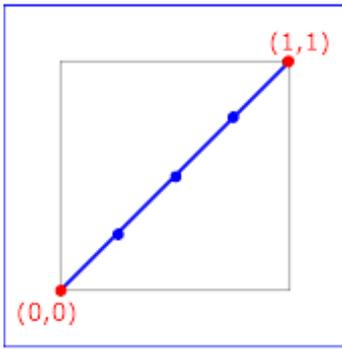
keySplines="0 0 1 1" (the default)
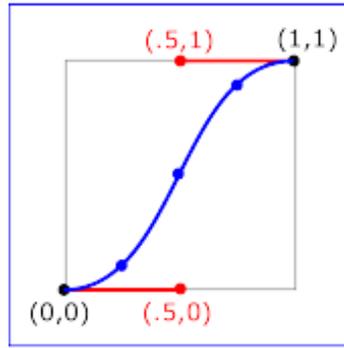
keySplines=".5 0 .5 1"
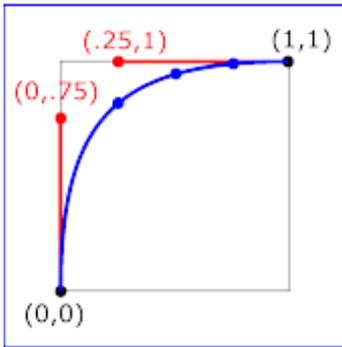
keySplines="0 .75 .25 1"
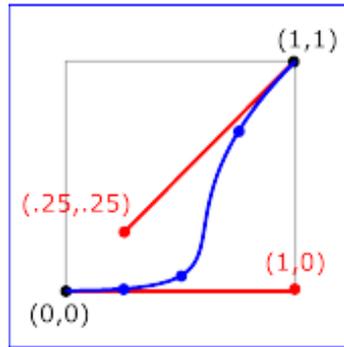
keySplines="1 0 .25 .25"

Examples of keySplines

To illustrate the calculations, consider the simple example:

```
<animate dur="4s" values="10; 20" keyTimes="0; 1"
     calcMode="spline" keySplines={as in table} />
```

Using the keySplines values for each of the four cases above, the approximate interpolated values as the animation proceeds are:

keySplines values	Initial value	After 1s	After 2s	After 3s	Final value
0 0 1 1	10.0	12.5	15.0	17.5	20.0
.5 0 .5 1	10.0	11.0	15.0	19.0	20.0
0 .75 .25 1	10.0	18.0	19.3	19.8	20.0
1 0 .25 .25	10.0	10.1	10.6	16.9	20.0

For a formal definition of Bezier spline calculation, see [FOLEY-VANDAM].

19.2.6 Combining animations

At a particular moment in time, an attribute can be animated by several animations, i.e. animations can overlap in time. The effect of this depends on whether the animations combined are additive or non-additive. An additive animation function will take the initial value of the attribute as defined by the animations that are already running, and use it as its begin value. A non-additive animation will replace the initial value with a new begin value

When there are multiple animations defined for a given attribute with complete durations that overlap at any moment, the two either add together or one overrides the other. The active animations are prioritized according to their begin. The animation first activated (i.e. begun by scheduled timing or by an event) has lowest priority and the most recently begun animation has highest priority. Higher priority animations that are not additive will override all earlier animations, and simply set the attribute value. Animations that are additive apply (i.e. add to) to the result of the earlier-activated animations. When two animations have the same begin, the first in lexical order has lower priority.

For more information, see [SMILANIM-ADD] and [SMILANIM-ACCUM].

19.2.7 Attributes that control whether animations are additive

The following attributes are common to elements ['animate'](#), ['animateMotion'](#), ['animateColor'](#) and ['animateTransform'](#).

It is frequently useful to define animation as an offset or delta to an attribute's value, rather than as absolute values. A simple "grow" animation can increase the width of an object by 10 pixels:

```
<rect width="20px" ...>
   <animate attributeName="width" from="0px" to="10px" dur="10s"
            additive="sum"/>
</rect>
```

The width begins at 20 pixels, and increases to 30 pixels over the course of 10 seconds. If the animation were declared to be not additive, the same from and to values would make the width go from 0 to 10 pixels over 10 seconds.

When there are multiple animations defined for a given attribute that are active at a given moment, the two either add together or one overrules the other. The active animations are prioritized according to the *activation* time of each. The animation first activated (i.e. begun by scheduled timing or by an event) has lowest priority and the most recently begun animation has highest priority. Higher priority animations that are not additive will overrule all earlier animations, and set the attribute value. Animations that are additive apply (i.e. add to) to the result of the earlier-activated animations. When two animations start at the same point in time, the first in lexical order is applied first.

It is frequently useful for repeated animations to build upon the previous results, accumulating with each interation. The following example causes the rectangle to continue to grow with each repeat of the animation:

```
<rect width="20px" ...>
   <animate attributeName="width" from="0px" to="10px" dur="10s"
            additive="sum" accumulate="sum" repeatCount="5"/>
</rect>
```

At the end of the first repetition, the rectangle has a width of 30 pixels. At the end of the second repetition, the rectangle has a width of 40 pixels. At the end of the fifth repetition, the rectangle has a width of 70 pixels.

```
<!ENTITY % animAdditionAttrs
 "additive       (replace | sum) 'replace'
  accumulate     (none | sum) 'none'" >
```

Attribute definitions:

additive = "**replace | sum**"

> Controls whether or not the animation is additive.
> If "sum", the animation will add to the underlying value of the attribute and other lower priority animations.
> If "replace", the animation will override the underlying value of the attribute and other lower priority animations. This is the default, however the behavior is also affected by the animation value attributes **by** and **to**, as described in [[SMILANIM-FROMTOBY-ADD](#)].

accumulate = "**none | sum**"

> Controls whether or not the animation is cumulative.
> If "sum", each repeat iteration after the first builds upon the last value of the previous iteration.
> If "none", repeat iterations are not cumulative. This is the default.
> This attribute is ignored if the target attribute value does not support addition, or if the animation element does not repeat.
> Cumulative animation is not defined for "*to animation*". This attribute will be ignored if the animation function is specified with only the to attribute.

19.2.8 Inheritance

SVG allows both attributes and properties to be animated. If a given attribute or property is inheritable by descendants, then animations on a parent element such as a ['g'](#) element has the effect of propagating the attribute or property animation values to descendant elements as the animation proceeds; thus, descendant elements can inherit animated attributes and properties from their ancestors.

19.2.9 The 'animate' element

The 'animate' element is used to animate a single attribute or property over time. For example, to make a rectangle repeatedly fade away over 5 seconds, you can specify:

```
<rect>
  <animate attributeType="CSS" attributeName="opacity"
         from="1" to="0" dur="5s" repeatCount="indefinite" />
</rect>


<!ENTITY % animateExt "" >
<!ELEMENT animate (%descTitleMetadata;%animateExt;) >
<!ATTLIST animate
  %stdAttrs;
  %testAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  %animTargetAttrs;
  %animTimingAttrs;
  %animValueAttrs;
  %animAdditionAttrs; >
```

Attributes defined elsewhere:

> %stdAttrs;, %testAttrs;, externalResourcesRequired, %animTargetAttrs;, %animTimingAttrs;, %animValueAttrs;, %animAdditionAttrs;.

For a list of attributes and properties that can be animated using the 'animate' element, see Elements, attributes and properties that can be animated.

19.2.10 The 'set' element

The 'set' element provides a simple means of just setting the value of an attribute for a specified duration. It supports all attribute types, including those that cannot reasonably be interpolated, such as string and boolean values. The 'set' element is non-additive. The effect of repeatCount and repeatDur attributes are just to extend the defined duration. In addition, using fill="freeze" will have the same effect as an indefinite duration.


```
<!ENTITY % setExt "" >
<!ELEMENT set (%descTitleMetadata;%setExt;) >
<!ATTLIST set
  %stdAttrs;
  %testAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  %animTargetAttrs;
  %animTimingAttrs;
  to CDATA #IMPLIED >
```

Attribute definitions:

to = "<value>"

> Specifies the value for the attribute during the duration of the 'set' element. The <value> must be appropriate to the target attribute or property.

Attributes defined elsewhere:

> %stdAttrs;, %testAttrs;, externalResourcesRequired, %animTargetAttrs;, %animTimingAttrs;.

For a list of attributes and properties that can be animated using the 'set' element, see Elements, attributes and properties that can be animated.

19.2.11 The 'animateMotion' element

The 'animateMotion' element causes a referenced element to move along a motion path.

```
<!ENTITY % animateMotionExt "" >
<!ELEMENT animateMotion (%descTitleMetadata;,mpath? %animateMotionExt;) >
<!ATTLIST animateMotion
  %stdAttrs;
  %testAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  %xlinkRefAttrs;
  xlink:href %URI; #IMPLIED
  %animTimingAttrs;
  %animValueAttrs;
  %animAdditionAttrs;
  path CDATA #IMPLIED
  rotate CDATA #IMPLIED
  origin CDATA #IMPLIED >
```

Attribute definitions:

path = "<path-data>"

> The motion path, expressed in the same format and interpreted the same way as the <u>d=</u> attribute on the <u>'path'</u> element. The effect of a motion path animation is to add a supplemental transformation matrix onto the CTM for the referenced object which causes a translation along the X and Y axis of the current user coordinate system by the computed X and Y values computed over time.

keyPoints = "<list-of-numbers>"

> keyPoints takes a semicolon-separated list of floating point values between 0 and 1 and indicates how far along the motion path the object shall move at the moment in time specified by corresponding keyTimes value. Distance calculations use the user agent's <u>distance along the path</u> algorithm. Each progress value in the list corresponds to a value in the `keyTimes` attribute list.
> If a list of `keyPoints` is specified, there must be exactly as many values in the `keyPoints` list as in the `keyTimes` list.
> If there are any errors in the `keyPoints` specification (bad values, too many or too few values), the animation will have no effect.

rotate = "<angle> | auto | auto-reverse"

> auto indicates that the object is rotated over time by the angle of the direction (i.e., directional tangent vector) of the motion path. auto-reverse indicates that the object is rotated over time by the angle of the direction (i.e., directional tangent vector) of the motion path plus 180 degrees. An actual angle value can also be given, which represents an angle relative to X-axis of current user coordinate system. The rotate attribute adds a supplemental transformation matrix onto the CTM to apply a rotation transformation about the origin of the current user coordinate system. The rotation transformation is applied after the supplemental translation transformation that is computed due to the <u>path</u> attribute. The default value is 0.

origin = "default"

> The origin attribute is defined in the SMIL Animation specification [<u>SMILANIM-ATTR-ORIGIN</u>]. It has no effect in SVG.

Attributes defined elsewhere:

> <u>%stdAttrs;</u>, <u>%xlinkRefAttrs;</u>, <u>xlink:href</u>, <u>%testAttrs;</u>, <u>externalResourcesRequired</u>, <u>%animTimingAttrs;</u>, <u>%animValueAttrs;</u>, <u>%animAdditionAttrs;</u>.

```
<!ENTITY % mpathExt "" >
<!ELEMENT mpath (%descTitleMetadata;%mpathExt;) >
<!ATTLIST mpath
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #REQUIRED
  externalResourcesRequired %Boolean; #IMPLIED >
```

Attribute definitions:

xlink:href = "<u><uri></u>"

> A <u>URI reference</u> to the <u>'path'</u> element which defines the motion path.
> <u>Animatable</u>: no.

Attributes defined elsewhere:

> <u>%stdAttrs;</u>,, <u>%xlinkRefAttrs;</u> <u>externalResourcesRequired</u>.

For 'animateMotion', the specified values for <u>from</u>, <u>by</u>, <u>to</u> and <u>values</u> consists of x, y coordinate pairs, with a comma separating the x coordinate from the y coordinate. For example, from="33,15" specifies an x coordinate value of 33 and a y coordinate value of 15.

If provided, the values attribute must consists of a list of x, y coordinate pairs, where commas separate the x coordinate from the y coordinate and semicolons separate the various coordinate pairs, such as values="10,20;30,20;30,40" or values="10mm,20mm;30mm,20mm;30mm,40mm". Each coordinate represents a length. Attributes from, by, to and values specify a shape on the current canvas which represents the motion path.

Two options are available which allow definition of a motion path using any of SVG's path data commands:

- the path attribute defines a motion path directly on 'animateMotion' element using any of SVG's path data commands.
- the 'mpath' sub-element provides the ability to reference an external 'path' element as the definition of the motion path.

Note that SVG's path data commands can only contain values in user space, whereas from, by, to and values can specify coordinates in user space or using unit identifiers. See Processing rules when using absolute unit identifiers and percentages.

The various (x,y) points of the shape provide a supplemental transformation matrix onto the CTM for the referenced object which causes a translation along the X and Y axis of the current user coordinate system by the (x,y) values of the shape computed over time. Thus, the referenced object is translated over time by the offset of the motion path relative to the origin of the current user coordinate system. The supplemental transformation is applied on top of any transformations due to the target element's transform attribute or any animations on that attribute due to 'animateTransform' elements on the target element.

The additive and accumulate attributes apply to 'animateMotion' elements. Multiple 'animateMotion' elements all simultaneously referencing the same target element can be additive with respect to each other; however, the transformations which result from the 'animateMotion' elements are always supplemental to any transformations due to the target element's transform attribute or any 'animateTransform' elements.

The default calculation mode (calcMode) for animateMotion is "paced". This will produce constant velocity motion along the specified path. Note that while animateMotion elements can be additive, it is important to observe that the addition of two or more "paced" (constant velocity) animations might not result in a combined motion animation with constant velocity.

When a path is combined with "linear" or "spline" calcMode settings, and if attribute keyPoints is not provided, the number of values is defined to be the number of points defined by the path, unless there are "move to" commands within the path. A "move to" command within the path (i.e. other than at the beginning of the path description) does not count as an additional point for the purpose of keyTimes and keySplines, and does not define an additional "segment" for the purposes of timing or interpolation. When a path is combined with a "paced" calcMode setting, all "move to" commands are considered to have 0 length (i.e. they always happen instantaneously), and is not considered in computing the pacing.

For more flexibility in controlling the velocity along the motion path, the keyPoints attribute provides the ability to specify the progress along the motion path for each of the keyTimes specified values. If specified, keyPoints causes keyTimes to apply to the values in keyPoints rather than the points specified in the values attribute array or the points on the path attribute.

The override rules for 'animateMotion are as follows. Regarding the definition of the motion path, the 'mpath' element overrides the the path attribute, which overrides values, which overrides from/by/to. Regarding determining the points which correspond to the keyTimes attributes, the keyPoints attribute overrides path, which overrides values, which overrides from/by/to.

At any time *t* within a motion path animation of effective duration *dur*, the computed coordinate (x,y) along the motion path is determined by finding the point (x,y) which is *t/dur* distance along the motion path using the user agent's distance along the path algorithm.

The following example demonstrates the supplemental transformation matrices that are computed during a motion path animation.

Example animMotion01 shows a triangle moving along a motion path.

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="5cm" height="3cm"  viewBox="0 0 500 300">
  <desc>Example animMotion01 - demonstrate motion animation computations</desc>

  <!-- Draw the outline of the motion path in blue, along
       with three small circles at the start, middle and end. -->
  <path d="M100,250 C 100,50 400,50 400,250"
        style="fill:none; stroke:blue; stroke-width:7.06" />
  <circle cx="100" cy="250" r="17.64" style="fill:blue" />
  <circle cx="250" cy="100" r="17.64" style="fill:blue" />
  <circle cx="400" cy="250" r="17.64" style="fill:blue" />

  <!-- Here is a triangle which will be moved about the motion path.
       It is defined with an upright orientation with the base of
       the triangle centered horizontally just above the origin. -->
  <path d="M-25,12.5 L25,12.5 L 0,87.5 z"
        style="fill:yellow; stroke:red; stroke-width:7.06" >

    <!-- Define the motion path animation -->
    <animateMotion dur="6s" repeatCount="indefinite"
                path="M100,250 C 100,50 400,50 400,250" rotate="auto" />
  </path>
```

```
</svg>
```
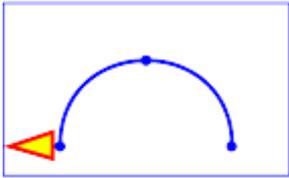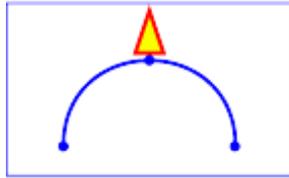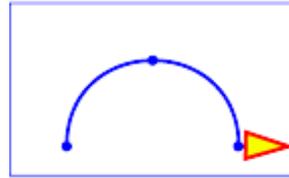

At zero seconds   At three seconds   At six seconds

Example animMotion01

[View this example as SVG (SVG-enabled browsers only)](#)

The following table shows the supplemental transformation matrices that are applied to achieve the effect of the motion path animation.

	After 0s	After 3s	After 6s
Supplemental transform due to movement along motion path	translate(100,250)	translate(250,100)	translate(400,250)
Supplemental transform due to rotate="auto"	rotate(-90)	rotate(0)	rotate(90)

For a list of elements that can be animated using the 'animateMotion' element, see [Elements, attributes and properties that can be animated](#).

19.2.12 The 'animateColor' element

The 'animateColor' element specifies a color transformation over time.

```
<!ENTITY % animateColorExt "" >
<!ELEMENT animateColor (%descTitleMetadata;%animateColorExt;) >
<!ATTLIST animateColor
  %stdAttrs;
  %testAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  %animTargetAttrs;
  %animTimingAttrs;
  %animValueAttrs;
  %animAdditionAttrs; >
```

Attributes defined elsewhere:

> [%stdAttrs;](#), [%testAttrs;](#), [externalResourcesRequired](#), [%animTargetAttrs;](#), [%animTimingAttrs;](#), [%animValueAttrs;](#), [%animAdditionAttrs;](#).

The [from](#), [by](#) and [to](#) attributes take color values, where each color value is expressed using the same syntax that is available for the target attribute or property.

The [values](#) attribute for the 'animateColor' element consists of a semicolon-separated list of color values, where each individual color value is expressed using the same syntax that is available for the target attribute or property.

Out of range color values can be provided, but user agent processing will be implementation dependent. User agents should clamp color values to allow color range values as late as possible, but note that system differences might preclude consistent behavior across different systems.

The ['color-interpolation'](#) property applies to color interpolations that result from 'animateColor' animations.

For a list of attributes and properties that can be animated using the 'animateColor' element, see [Elements, attributes and properties that can be animated](#).

19.2.13 The 'animateTransform' element

The 'animateTransform' element animates a transformation attribute on a target element, thereby allowing animations to control translation, scaling, rotation and/or skewing.

```
<!ENTITY % animateTransformExt "" >
<!ELEMENT animateTransform (%descTitleMetadata;%animateTransformExt;) >
<!ATTLIST animateTransform
  %stdAttrs;
  %testAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  %animTargetAttrs;
  %animTimingAttrs;
  %animValueAttrs;
  %animAdditionAttrs;
  type (translate | scale | rotate | skewX | skewY) "translate" >
```

Attribute definitions:

type = "translate | scale | rotate | skewX | skewY"

> Indicates the type of transformation which is to have its values change over time.

Attributes defined elsewhere:

> %stdAttrs;, %testAttrs;, externalResourcesRequired, %animTargetAttrs;, %animTimingAttrs;, %animValueAttrs;, %animAdditionAttrs;.

The from, by and to attributes take a value expressed using the same syntax that is available for the given transformation type:

- For a type="translate", each individual value is expressed as <tx> [,<ty>].
- For a type="scale", each individual value is expressed as <sx> [,<sy>].
- For a type="rotate", each individual value is expressed as <rotate-angle>.
- For a type="skewX" and type="skewY", each individual value is expressed as <skew-angle>.

(See The transform attribute.)

The values attribute for the 'animateTransform' element consists of a semicolon-separated list of values, where each individual value is expressed as described above for from, by and to.

If calcMode has the value paced, then a total "distance" for each component of the transformation is calculated (e.g., for a translate operation, a total distance is calculated for both *tx* and *ty*) consisting of the sum of the absolute values of the differences between each pair of values, and the animation runs to produce a constant distance movement for each individual component.

When an animation is active, the effect of non-additive 'animateTransform' (i.e., additive="replace") is to replace the given attribute's value with the transformation defined by the 'animateTransform'. The effect of additive (i.e., additive="sum") is to post-multiply the transformation matrix corresponding to the transformation defined by this 'animateTransform'. To illustrate:

```
<circle ...>
  <animateTransform type="rotate" from="0" to="90" dur="5s"/>
  <animateTransform type="scale" from="1" to="2" dur="5s"/>
</circle>
```

In the code snippet above, at time 5 seconds, the visual result of above animation would be equivalent to the following static circle:

```
<circle transform="rotate(90); scale(2)" ... />
```

For a list of attributes and properties that can be animated using the 'animateTransform' element, see Elements, attributes and properties that can be animated.

19.2.14 Elements, attributes and properties that can be animated

The following lists all of the elements which can be animated by an 'animateMotion' element:

- 'svg' ('animateMotion' has no effect on outermost 'svg' elements)
- 'g'
- 'path'
- 'rect'
- 'circle'
- 'ellipse'

- ['line'](#)
- ['polyline'](#)
- ['polygon'](#)
- ['text'](#)
- ['use'](#)
- ['image'](#)
- ['clipPath'](#)
- ['mask'](#)
- ['switch'](#)

Each attribute or property within this specification indicates whether or not it can be animated by SVG's animation elements. Animatable attributes and properties are designated as follows:

Animatable: yes.

whereas attributes and properties that cannot be animated are designated:

Animatable: no.

SVG has a defined set of basic data types for its various supported attributes and properties. For those attributes and properties that can be animated, the following table indicates which animation elements can be used to animate each of the basic data types.

Basic data type	Additive?	'animate'	'set'	'animate Color'	'animate Transform'	Notes
<angle>	yes	yes	yes	no	no	
<color>	yes	yes	yes	yes	no	Only RGB color values are additive.
<coordinate>	yes	yes	yes	no	no	
<frequency>	no	no	no	no	no	
<integer>	yes	yes	yes	no	no	
<length>	yes	yes	yes	no	no	
<list of xxx>	no	yes	yes	no	no	
<number>	yes	yes	yes	no	no	
<paint>	yes	yes	yes	yes	no	Only RGB color values are additive.
<percentage>	yes	yes	yes	no	no	
<time>	no	no	no	no	no	
<transform-list>	yes	no	no	no	yes	
<uri>	yes	yes	yes	no	no	
All other animatable attributes and properties	no	yes	yes	no	no	

Any deviation from the above table or other special note about the animation capabilities of a particular attribute or property is included in section of the specification where the given attribute or property is defined.

19.3 Animation using the SVG DOM

The following example shows a simple animation:

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 20000629//EN"
  "http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd">
<svg width="12cm" height="2cm" viewBox="0 0 1200 200"
     onload="StartAnimation(evt)" >

  <script type="text/ecmascript"><![CDATA[
    var timevalue = 0;
    var timer_increment = 50;
    var max_time = 5000;
    var text_element;
    function StartAnimation(evt) {
```

```
      text_element = evt.target.ownerDocument.getElementById("TextElement");
      ShowAndGrowElement();
    }
    function ShowAndGrowElement() {
      timevalue = timevalue + timer_increment;
      if (timevalue > max_time)
        return;

      // Scale the text string gradually until it is 20 times larger
      scalefactor = (timevalue * 20.) / max_time;
      text_element.setAttribute("transform", "scale(" + scalefactor + ")");
      // Make the string more opaque
      opacityfactor = timevalue / max_time;
      text_element.setAttribute("style", "opacity:" + opacityfactor);

      // Call ShowAndGrowElement again <timer_increment> milliseconds later.
      setTimeout("ShowAndGrowElement()", timer_increment)
    }
    window.ShowAndGrowElement = ShowAndGrowElement
  ]]></script>

  <g transform="translate(50,150)" style="fill:red; font-size:7">
    <text id="TextElement">SVG</text>
  </g>
</svg>
```

View this example as SVG (SVG-enabled browsers only)

The above SVG file contains a single graphics element, a text string that says "SVG". The animation loops for 5 seconds. The text string starts out small and transparent and grows to be large and opaque. Here is an explanation of how this example works:

- The onload="StartAnimation(evt)" attribute indicates that, once the document has been fully loaded and processed, invoke ECMAScript function StartAnimation.
- The 'script' element defines the ECMAScript which makes the animation happen. The StartAnimation() function is only called once to give a value to global variable text_element and to make the initial call to ShowAndGrowElement(). ShowAndGrowElement() is called every 50 milliseconds and resets the transform and style attributes on the text element to new values each time it is called. At the end of ShowAndGrowElement, the function tells the ECMAScript engine to call itself again after 50 more milliseconds.
- The 'g' element shifts the coordinate system so that the origin is shifted toward the lower-left of the viewing area. It also defines the fill color and font-size to use when drawing the text string.
- The 'text' element contains the text string and is the element whose attributes get changed during the animation.

If scripts are modifying the same attributes or properties that are being animated by SVG's animation elements, the scripts modify the base value for the animation. If a base value is modified while an animation element is animating the corresponding attribute or property, the animations are required to adjust dynamically to the new base value.

If a script is modifying a property on the override style sheet at the same time that an animation element is animating that property, the result is implementation-dependent; thus, it is recommended that this be avoided.

19.4 DOM interfaces

The following interfaces are defined below: ElementTimeControl, SVGAnimationElement, SVGAnimateElement, SVGSetElement, SVGAnimateMotionElement, SVGAnimateTransformElement, TimeEvent.

Interface ElementTimeControl

The ElementTimeControl interface, defined in the SMIL Animation specification [SMILANIM-DOM-METHODS], defines common methods for elements which define animation behaviors compatible with SMIL Animation.

Calling beginElement() causes the animation to begin in the same way that an animation with event-based begin timing begins. The effective begin time is the current presentation time at the time of the DOM method call. Note that beginElement() is subject to the restart attribute in the same manner that event-based begin timing is. If an animation is specified to disallow restarting at a given point, beginElement() methods calls must fail.

Calling beginElementAt(seconds) has the same behavior as beginElement(), except that the animation starts midway into the animation (i.e., a given number of seconds offset from the normal start of the animation.) If the offset value goes beyond the simple duration or the simple duration is undefined, (e.g., the end time is indefinite), then the animation does not start.

Calling endElement() causes an animation to end the active duration. Depending upon the value of the fill attribute, the animation effect may no longer be applied, or it may be frozen at the current effect. If an animation is not currently active (i.e. if it has not yet begun or if it is frozen), the endElement() method will fail.

IDL Definition

```
interface ElementTimeControl {

  boolean beginElement (  )
                    raises( DOMException );
  boolean beginElementAt ( in float offset )
                    raises( DOMException );
  boolean endElement (  )
                    raises( DOMException );
  boolean endElementAt ( in float offset )
                    raises( DOMException );
};
```

Methods

beginElement

Causes this element to begin the local timeline (subject to sync constraints).

No Parameters

Return value

boolean true if the method call was successful and the element was begun. false if the method call failed. Possible reasons for failure include:

- The element is already active and can't be restart when it is active. (the restart attribute is set to "whenNotActive")
- The element is active or has been active and can't be restart. (the restart attribute is set to "never").

Exceptions

DOMException SYNTAX_ERR: The element was not defined with the appropriate syntax to allow beginElement calls.

beginElementAt

Causes this element to begin the local timeline (subject to sync constraints), at the passed offset from the current time when the method is called. If the offset is >= 0, the semantics are equivalent to an event-base begin with the specified offset. If the offset is < 0, the semantics are equivalent to beginElement(), but the element active duration is evaluated as though the element had begun at the passed (negative) offset from the current time when the method is called.

Parameters

in float offset The offset in seconds at which to begin the element.

Return value

boolean true if the method call was successful and the element was begun. false if the method call failed. Possible reasons for failure include:

- The element is already active and can't be restart when it is active. (the restart attribute is set to "whenNotActive")
- The element is active or has been active and can't be restart. (the restart attribute is set to "never").

Exceptions

DOMException SYNTAX_ERR: The element was not defined with the appropriate syntax to allow beginElementAt calls.

endElement

Causes this element to end the local timeline (subject to sync constraints).

No Parameters

Return value

boolean true if the method call was successful and the element was ended. false if method call failed. Possible reasons for failure include:

- The element doesn't support the endElement method. (the end attribute is not set to "indefinite")
- The element is not active.

Exceptions

DOMException SYNTAX_ERR: The element was not defined with the appropriate syntax to allow endElement calls.

endElementAt

Causes this element to end the local timeline (subject to sync constraints) at the specified offset from the current time when the method is called.

Parameters

    in float offset The offset in seconds at which to end the element. Must be >= 0.

Return value

    boolean `true` if the method call was successful and the element was begun. `false` if the method call failed. Possible reasons for failure include:

        ■ The element is not active.

Exceptions

    DOMException SYNTAX_ERR: The element was not defined with the appropriate syntax to allow `endElementAt` calls.

Interface SVGAnimationElement

The SVGAnimationElement interface is the base interface for all of the animation element interfaces: SVGAnimateElement, SVGSetElement, SVGAnimateMotionElement and SVGAnimateTransformElement.

Unlike other SVG DOM interfaces, the SVG DOM does not specify convenience DOM properties corresponding to the various language attributes on SVG's animation elements. Specification of these convenience properties in a way that will be compatible with future versions of SMIL Animation is expected in a future version of SVG. The current method for accessing and modifying the attributes on the animation elements is to use the standard `getAttribute`, `setAttribute`, `getAttributeNS` and `setAttributeNS` defined in DOM2.

IDL Definition

```
interface SVGAnimationElement :
                SVGElement,
                SVGTests,
                SVGExternalResourcesRequired,
                ElementTimeControl {

  readonly attribute SVGElement targetElement;

  float getStartTime (  );
  float getCurrentTime (  );
  float getSimpleDuration (  )
                raises( DOMException );
};
```

Attributes

    readonly SVGElement targetElement

        The element which is being animated.

Methods

    getStartTime

        Returns the start time in seconds for this animation.

        No Parameters

        Return value

            float The start time in seconds for this animation relative to the start time of the time container.

        No Exceptions

    getCurrentTime

        Returns the current time in seconds relative to time zero for the given time container.

        No Parameters

        Return value

            float The current time in seconds relative to time zero for the given time container.

        No Exceptions

    getSimpleDuration

        Returns the number of seconds for the simple duration for this animation. If the simple duration is undefined (e.g., the end time is

indefinite), then an exception is raised.

No Parameters

Return value

> float The number of seconds for the simple duration for this animation.

Exceptions

> DOMException NOT_SUPPORTED_ERR: The simple duration is not determined on the given element.

Interface SVGAnimateElement

The SVGAnimateElement interface corresponds to the 'animate' element.

Object-oriented access to the attributes of the 'animate' element via the SVG DOM is not available.

IDL Definition

```
interface SVGAnimateElement : SVGAnimationElement {};
```

Interface SVGSetElement

The SVGSetElement interface corresponds to the 'set' element.

Object-oriented access to the attributes of the 'set' element via the SVG DOM is not available.

IDL Definition

```
interface SVGSetElement : SVGAnimationElement {};
```

Interface SVGAnimateMotionElement

The SVGAnimateMotionElement interface corresponds to the 'animateMotion' element.

Object-oriented access to the attributes of the 'animateMotion' element via the SVG DOM is not available.

IDL Definition

```
interface SVGAnimateMotionElement : SVGAnimationElement {};
```

Interface SVGAnimateTransformElement

The SVGAnimateTransformElement interface corresponds to the 'animateTransform' element.

Object-oriented access to the attributes of the 'animateTransform' element via the SVG DOM is not available.

IDL Definition

```
interface SVGAnimateTransformElement : SVGAnimationElement {};
```

Interface TimeEvent

The TimeEvent interface, defined in the SMIL Animation specification [SMILANIM-DOM-METHODS], defines events that occur due to animation state changes.

The available event types for animation events are:

begin

This event is raised when the element local timeline begins to play. It will be raised each time the element begins the active duration (i.e. when it restarts, but not when it repeats). It may be raised both in the course of normal (i.e. scheduled or interactive) timeline play, as well as in the case that the element was begun with the beginElement() or beginElementAt() methods. Note that if an element is restarted while it is currently playing, the element will raise an end event and another begin event, as the element restarts.

- ❍ Bubbles: No
- ❍ Cancelable: No
- ❍ Context Info: None

end

This event is raised at the active end of the element. Note that this event is not raised at the simple end of each repeat. This event may be raised both in the course of normal (i.e. scheduled or interactive) timeline play, as well as in the case that the element was ended with the endElement() or endElementAt() methods. Note that if an element is restarted while it is currently playing, the element will raise an end event and another begin event, as the element restarts.

- ❍ Bubbles: No
- ❍ Cancelable: No
- ❍ Context Info: None

repeat

This event is raised when an element local timeline repeats. It will be raised each time the element repeats, after the first iteration.
The event provides a numerical indication of which repeat iteration is beginning. The value is a 0-based integer, but the repeat event is not raised for the first iteration and so the observed values of the detail attribute will be >= 1.

- ❍ Bubbles: No
- ❍ Cancelable: No
- ❍ Context Info: detail (current iteration)

IDL Definition

```
interface TimeEvent : events::Event {
  readonly attribute views::AbstractView view;
  readonly attribute long               detail;

  void initTimeEvent ( in DOMString typeArg, in views::AbstractView viewArg, in long detailArg );
};
```

Attributes

readonly views::AbstractView view

Identifies the *AbstractView* [DOM2-VIEWS] from which the event was generated.

readonly long detail

Specifies some detail information about the Event, depending on the type of the event. For this event type, indicates the repeat number for the animation.

Methods

initTimeEvent

Initiatizes the value of a *TimeEvent* created through the *DocumentEvent* interface. This method may only be called before the *TimeEvent* has been dispatched via the *dispatchEvent* method, though it may be called multiple times during that phase if necessary. If called multiple times, the final invocation takes precedence.

Parameters

in DOMString typeArg	Specifies the event type.
in views::AbstractView viewArg	Specifies the Event's *AbstractView*.
in long detailArg	Specifies the *Event*'s detail.

No Return Value

No Exceptions

20 Fonts

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20.1 Introduction

Reliable delivery of fonts is considered a critical requirement for SVG. Designers require the ability to create SVG graphics with whatever fonts they care to use and then have the same fonts appear in the end user's browser when viewing an SVG drawing, even if the given end user hasn't purchased the fonts in question. This parallels the print world, where the designer uses a given font when authoring a drawing for print, but when the end user views the same drawing within a magazine the text appears with the correct font.

SVG utilizes the web font facility defined in the "Cascading Style Sheets (CSS) level 2" specification [CSS2] as a key mechanism for reliable delivery of font data to end users. A common scenario is that SVG authoring applications will generate compressed, subsetted web fonts for all text elements used by a given SVG document fragment. Typically, the web fonts will be saved in a location relative to the referencing document.

One disadvantage to the Webfont facility to date is that no particular font formats that were required to be supported. The result was that different implementations supported different web font formats, thereby making it difficult for web site creators to post a single web site that is supported by a large percentage of installed browsers.

To provide a common font format that will exist in all conforming SVG user agents, SVG includes elements which allow for fonts to be defined in SVG.

SVG fonts can improve the semantic richness of graphics that represent text. For example, many company logos consist of the company name drawn artistically. In some cases, accessibility might be enhanced by expressing the logo as a series of glyphs in an SVG font and then rendering the logo as a 'text' element which references this font.

20.2 SVG fonts

20.2.1 Overview of SVG fonts

An SVG font is a font defined using SVG's 'font' element.

The purpose of SVG fonts is to allow for delivery of glyph outlines in display-only environments. SVG fonts that accompany web pages must be supported only in browsing and viewing situations. Graphics editing applications or file translation tools must not attempt convert SVG fonts into system fonts. The intent is that SVG files be interchangeable between two content creators, but not the SVG fonts that might accompany these SVG files. Instead, each content creator will need to license the given font before being able to successfully edit the SVG file. The font-face-name attribute indicates the name of licensed font to use for editing,

SVG fonts contain unhinted font outlines. Because of this, on many implementations there will be limitations regarding the quality and legibility of text in small font sizes. For increased quality and legibility in small font sizes, content creators may want to use an alternate font technology, such as fonts that ship with operating systems or an alternate web font format.

Because SVG fonts are expressed using SVG elements and attributes, in some cases the SVG font will take up more space than if the font were expressed in a different web font format which was especially designed for compact expression of font data. For the fastest delivery of web pages, content creators may want to use an alternate font technology.

A key value of SVG fonts is guaranteed availability in SVG user agents. In some situations, it might be appropriate for an SVG font to be the first choice for rendering some text. In other situations, the SVG font might be an alternate, back-up font in case the first choice font (perhaps a hinted system font) is not available to a given user.

The characteristics and attributes of SVG fonts correspond closely to the font characteristics and parameters described in the "Cascading Style Sheets (CSS) level 2" specification [CSS2]. In this model, various font metrics, such as advance values and baseline locations, and the glyph outlines themselves, are expressed in units that are relative to an abstract square whose height is the intended distance between lines of type in the same type size. This square is called the em square and it is the design grid on which the glyph outlines are defined. The value of the units-per-em attribute on the 'font' element specifies how many units the em square is divided into. Common values for other font types are, for example, 250 (Intellifont), 1000 (Type 1) and 2048 (TrueType, TrueType GX and Open-Type). Unlike standard graphics in SVG, where the initial coordinate system has the Y axis pointing downward (see The initial coordinate system), the design grid for SVG fonts, along with the initial coordinate system for the glyphs, has the Y axis pointing upward for consistency with accepted industry practice for many popular font formats.

SVG fonts and their associated glyphs do not specify bounding box information. Because the glyph outlines are expressed as SVG graphics elements, the implementation has the option to render the glyphs either using standard graphics calls or by using special-purpose font rendering technology, in which case any necessary maximum bounding box and overhang calculations can be performed from analysis of the graphics elements contained within the glyph outlines.

An SVG font can be either embedded within the SVG document fragment that uses the font or saved as an external file and referenced via a URI reference.

Here is an example of how you might embed an SVG font inside of an SVG document.

```
<?xml version="1.0" standalone="yes"?>
<svg width="400px" height="300px"
  xmlns = 'http://www.w3.org/2000/svg-20000629'>
  <defs>
    <font id="Font1">
      <font-face font-family="Super Sans" font-weight="bold" font-style="normal"
          units-per-em="1000" cap-height="600" x-height="400"
          ascent="700" descent="300" horiz-adv-x="1000"
          baseline="0" centerline="350"
          mathline="350" ideographic="400" hanging="500"
          topline="700">
        <font-face-src>
          <font-face-name name="Super Sans Bold"/>
        </font-face-src>
      </font-face>
      <missing-glyph><path d="M0,0h200v200h-200z"/></missing-glyph>
```

```
      <glyph unicode="!" horiz-adv-x="300"><!-- Outline of exclam. pt. glyph --></glyph>
      <glyph unicode="@"><!-- Outline of @ glyph --></glyph>
      <!-- more glyphs -->
    </font>
  <text style="font-family: 'Super Sans', Helvetica, sans-serif;
                  font-weight: bold; font-style: normal">Text
    using embedded font</text>
</svg>
```

Here is an example of how you might use the CSS @font-face facility to reference an SVG font which is saved in an external file.
First referenced SVG font file:

```
<?xml version="1.0" standalone="yes"?>
<svg width="100%" height="100%"
 xmlns = 'http://www.w3.org/2000/svg-20000629'>
  <defs>
    <font id="Font2">
      <font-face font-family="Super Sans" font-weight="normal" font-style="italic"
          units-per-em="1000" cap-height="600" x-height="400"
          ascent="700" descent="300" horiz-adv-x="1000"
          baseline="0" centerline="350"
          mathline="350" ideographic="400" hanging="500"
          topline="700">
        <font-face-src>
          <font-face-name name="Super Sans Italic"/>
        </font-face-src>
      </font-face>
      <missing-glyph><path d="M0,0h200v200h-200z"/></missing-glyph>
      <glyph unicode="!" horiz-adv-x="300"><!-- Outline of exclam. pt. glyph --></glyph>
      <glyph unicode="@"><!-- Outline of @ glyph --></glyph>
      <!-- more glyphs -->
    </font>
  </defs>
</svg>
```

The SVG file which uses/references the above SVG font

```
<?xml version="1.0" standalone="yes"?>
<svg width="400px" height="300px"
 xmlns = 'http://www.w3.org/2000/svg-20000629'>  <defs>
    <style type="text/css">
      <![CDATA[
        @font-face {
          font-family: 'Super Sans';
          font-weight: normal;
          font-style: italic;
          src: url("myfont.svg#Font2") format(svg)
        }
      ]]>
    </style>
  </defs>
  <text style="font-family: 'Super Sans'; font-weight:normal;
                  font-style: italic">Text using embedded font</text>
</svg>
```

20.2.2 The 'font' element

The 'font' element defines an SVG font.

```
<!ENTITY % fontExt "" >
<!ELEMENT font (%descTitleMetadata;,font-face,
                missing-glyph,(glyph|hkern|vkern %fontExt;)*) >
<!ATTLIST font
  %stdAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  horiz-origin-x %Number; #IMPLIED
  horiz-origin-y %Number; #IMPLIED
  horiz-adv-x %Number; #REQUIRED
  vert-origin-x %Number; #IMPLIED
  vert-origin-y %Number; #IMPLIED
  vert-adv-y %Number; #IMPLIED >
```

Attribute definitions:

horiz-origin-x = "<number>"

> The X-coordinate in the font coordinate system of the origin of a glyph to be used when drawing horizontally oriented text.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> Animatable: no.

horiz-origin-y = "<number>"

> The Y-coordinate in the font coordinate system of the origin of a glyph to be used when drawing horizontally oriented text.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> Animatable: no.

horiz-adv-x = "<number>"

> The default horizontal advance after rendering a glyph in horizontal orientation. Glyph widths are required to be positive,
> even if the glyph is typically rendered right-to-left, as in Hebrew and Arabic scripts.
> Animatable: no.

vert-origin-x = "<number>"

> The X-coordinate in the font coordinate system of the origin of a glyph to be used when drawing vertically oriented text.
> If the attribute is not specified, the effect is as if the attribute were set to half of the value of attribute horiz-adv-x.
> Animatable: no.

vert-origin-y = "<number>"

> The Y-coordinate in the font coordinate system of the origin of a glyph to be used when drawing vertically oriented text.
> If the attribute is not specified, the effect is as if the attribute were set to position specified by the font's ascent attribute.
> Animatable: no.

vert-adv-y = "<number>"

> The default vertical advance after rendering a glyph in vertical orientation.
> If the attribute is not specified, the effect is as if the attribute were set to the sum of the values of attributes ascent and.
> descent.
> Animatable: no.

Attributes defined elsewhere:

> %stdAttrs;, externalResourcesRequired, class, style, %PresentationAttributes-All;.

Each 'font' element must have a 'font-face' child element which describes various characteristics of the font.

20.2.3 The 'glyph' element

The 'glyph' element defines the graphics for a given glyph. The coordinate system for the glyph is defined by the various attributes in the 'font' element.

The contents of a 'glyph' can be any SVG graphics elements. However, in some implementations, faster font rendering (and possibly improved quality) might occur when glyph definitions consist of a single 'path' element.

```
<!ENTITY % glyphExt "" >
<!ELEMENT glyph (desc|title|metadata|defs|
                 path|text|rect|circle|ellipse|line|polyline|polygon|
                 use|image|svg|g|view|switch|a|altGlyphDef|
                 script|style|symbol|marker|clipPath|mask|
                 linearGradient|radialGradient|pattern|filter|cursor|font|
                 animate|set|animateMotion|animateColor|animateTransform|
                 color-profile|font-face
                 %glyphExt;)* >
<!ATTLIST glyph
  %stdAttrs;
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  unicode CDATA #IMPLIED
  glyph-name CDATA #IMPLIED
  vert-text-orient CDATA #IMPLIED
  arabic CDATA #IMPLIED
  han CDATA #IMPLIED
  horiz-adv-x %Number; #IMPLIED
  vert-adv-y %Number; #IMPLIED >
```

Attribute definitions:

unicode = "<string>"

> One or more Unicode characters indicating the sequence of Unicode characters which corresponds to this glyph. If a character is provided, then this glyph corresponds to the given Unicode character. If multiple characters are provided, then this glyph corresponds to the given sequence of Unicode characters. One use of sequence of characters is for ligatures. For example, if unicode="ffl", then the given glyph will be used to render the sequence of characters "f", "f", and "l". (This could alternatively have been expressed using character entities, using XML character references expressed in hexadecimal notation: unicode="ffl", or XML character references expressed in decimal notation: unicode="ffl".) When determining the glyph(s) to draw a given character sequence, the 'font' element is searched from its first 'glyph' element to its last in lexical order to see if the upcoming sequence of Unicode characters to be rendered match the sequence of Unicode characters specified in the unicode attribute for the given 'glyph' element. The first successful match is used.
>
> Note that any occurrences of 'altGlyph' take precedence over the glyph selection rules within an SVG font.
> If the unicode attribute is not provided, then the only way to use this glyph is via an 'altGlyph' reference.
> Animatable: no.

glyph-name = "<name> [, <name>]* "

> A name for the glyph. It is recommended that glyph names be unique across a font. The glyph names can be used in situations where Unicode character numbers do not provide sufficient information to access the correct glyph, such as when there are multiple glyphs per Unicode character. The glyph names can be referenced in kerning definitions.
> Animatable: no.

vert-text-orient = "default | h | v"

> When drawing vertical text, indicates whether the given glyph is meant to be drawn with a vertical or horizontal orientation. The default value is vertOrient="default", which indicates that the Unicode character number determines the orientation of

this glyph.
[Animatable](#): no.

arabic = "initial | medial | terminal | isolated"

For Arabic glyphs, indicates which of the four possible forms this glyph represents.
[Animatable](#): no.

han = "ja | zht | zhs | kor"

For glyphs in the Han range, indicates which of the four possible forms this glyph represents.
[Animatable](#): no.

horiz-adv-x = "<number>"

The horizontal advance after rendering a glyph in horizontal orientation. The default value is the value of the font's [horizAdvX](#) attribute. Glyph widths are required to be positive, even if the glyph is typically rendered right-to-left, as in Hebrew and Arabic scripts.
[Animatable](#): no.

vert-adv-y = "<number>"

The vertical advance after rendering a glyph in vertical orientation.
If the attribute is not specified, the effect is as if the attribute were set to the value of the font's [vertAdvY](#) attribute.
[Animatable](#): no.

Attributes defined elsewhere:

[%stdAttrs;](#), [style](#), [class](#), [%PresentationAttributes-All;](#).

20.2.4 The 'missing-glyph' element

The 'missing-glyph' element defines the graphics to use if there is an attempt to draw a glyph from a given font and the given glyph has been defined. The attributes on the 'missing-glyph' element have the same meaning as the corresponding attributes on the ['glyph'](#) element.

```
<!ENTITY % missing-glyphExt "" >
<!ELEMENT missing-glyph (desc|title|metadata|defs|
                    path|text|rect|circle|ellipse|line|polyline|polygon|
                    use|image|svg|g|view|switch|a|altGlyphDef|
                    script|style|symbol|marker|clipPath|mask|
                    linearGradient|radialGradient|pattern|filter|cursor|font|
                    animate|set|animateMotion|animateColor|animateTransform|
                    color-profile|font-face
                    %missing-glyphExt;)* >
<!ATTLIST missing-glyph
  %stdAttrs;
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  horiz-adv-x %Number; #IMPLIED
  vert-adv-y %Number; #IMPLIED >
```

Attributes defined elsewhere:

[%stdAttrs;](#), [horiz-adv-x](#), [vert-adv-y](#), [class](#), [style](#), [%PresentationAttributes-All;](#).

20.2.5 The 'hkern' and 'vkern' elements

The 'hkern' and 'vkern' elements define kerning pairs for horizontally-oriented and vertically-oriented pairs of glyphs, respectively.

Kern pairs identify pairs of glyphs within a single font whose inter-glyph spacing is adjusted when the pair of glyphs are rendered

next to each other. In addition to the requirement that the pair of glyphs are from the same font, SVG font kerning happens only when the two glyphs correspond to characters which have the same values for properties 'font-family', 'font-size', 'font-style', 'font-weight', 'font-variant', 'font-stretch', 'font-size-adjust' and 'font'.

An example of a kerning pair are the letters "Va", where the typographic result might look better if the letters "V" and the "a" were rendered slightly closer together.

Right-to-left and bi-directional text in SVG is laid out in a two-step process, which is described in Relationship with bi-directionality. If SVG fonts are used, before kerning is aplied, characters are re-ordered into left-to-right (or top-to-bottom, for vertical text) visual rendering order. Kerning from SVG fonts is then applied on pairs of glyphs which are rendered contiguously. The first glyph in the kerning pair is the left (or top) glyph in visual rendering order. The second glyph in the kerning pair is the right (or bottom) glyph in the pair.

For convenience to font designers and to minimize file sizes, a single 'hkern' and 'vkern' can define a single kerning adjustment value between one set of glyphs (e.g., a range of Unicode characters) and another set of glyphs (e.g., another range of Unicode characters).

The 'hkern' element defines kerning pairs and adjustment values in the horizontal advance value when drawing pairs of glyphs which the two glyphs are contiguous and are both rendered horizontally (i.e., side-by-side). The spacing between characters is reduced by the kerning adjustment. (Negative kerning adjustments increase the spacing between characters.)

```
<!ELEMENT hkern EMPTY >
<!ATTLIST hkern
  %stdAttrs;
  u1 CDATA #IMPLIED
  g1 CDATA #IMPLIED
  u2 CDATA #IMPLIED
  g2 CDATA #IMPLIED
  k %Number; #REQUIRED >
```

Attribute definitions:

u1 = "[<character> | <urange>] [, [<character> | <urange>]]* "

> A sequence (comma-separated) of Unicode characters (refer to the description of the unicode attribute to the 'glyph' element for a description of how to express individual Unicode characters) and/or unicode ranges (see description of unicode ranges in [CSS2]) which identify a set of possible first glyphs in the kerning pair. If a given Unicode character within the set has multiple corresponding 'glyph' elements (i.e., there are multiple 'glyph' elements with the same unicode attribute value, but different glyphName values), then all such glyphs are included in the set. Comma is the separator character; thus, to kern a comma, specify the comma as part of a Unicode range or as a glyph name using the g1 attribute. The total set of possible first glyphs in the kerning pair is the union of glyphs specified by the u1 and g1 attributes.
> Animatable: no.

g1 = "<name> [, <name>]* "

> A sequence (comma-separated) of glyph names (i.e., values that match glyphName attributes on 'glyph' elements) which identify a set of possible first glyphs in the kerning pair. All glyphs with the given glyph name are included in the set. The total set of possible first glyphs in the kerning pair is the union of glyphs specified by the u1 and g1 attributes.
> Animatable: no.

u2 = "[<number> | <urange>] [, [<number> | <urange>]]* "

> Same as the u1 attribute, except that u2 specifies possible second glyphs in the kerning pair.
> Animatable: no.

g2 = "<name> [, <name>]* "

> Same as the g1 attribute, except that g2 specifies possible second glyphs in the kerning pair.
> Animatable: no.

k = "<number>"

> The amount to decrease the spacing between the two glyphs in the kerning pair. The value is in the font coordinate system.
> Animatable: no.

Attributes defined elsewhere:

%stdAttrs;.

At least one each of u1 or g1 and at least one of u2 or g2 must be provided.

The 'vkern' element defines kerning pairs and adjustment values in the vertical advance value when drawing pairs of glyphs together when stacked vertically. The spacing between characters is reduced by the kerning adjustment.

```
<!ELEMENT vkern EMPTY >
<!ATTLIST vkern
  %stdAttrs;
  u1 CDATA #IMPLIED
  g1 CDATA #IMPLIED
  u2 CDATA #IMPLIED
  g2 CDATA #IMPLIED
  k %Number; #REQUIRED >
```

Attributes defined elsewhere:

%stdAttrs;, u1, g1, u2, g2, k.

20.3 Describing a font

20.3.1 Overview of font descriptions

A font description provides the bridge between an author's font specification and the font data, which is the data needed to format text and to render the abstract glyphs to which the characters map - the actual scalable outlines or bitmaps. Fonts are referenced by properties, such as the 'font-family' property.

Each specified font description is added to the font database and so that it can be used to select the relevant font data. The font description contains descriptors such as the location of the font data on the Web, and characterizations of that font data. The font descriptors are also needed to match the font properties to particular font data. The level of detail of a font description can vary from just the name of the font up to a list of glyph widths.

For more about font descriptions, refer to the font chapter in the CSS2 specification [CSS2 Fonts].

20.3.2 Alternative ways for providing a font description

Font descriptions can be specified in either of the following ways:
- a 'font-face' element
- an @font-face rule within a CSS style sheet (only applicable for user agents which support using CSS to style the SVG content)

20.3.3 The 'font-face' element

The 'font-face' element corresponds directly to the @font-face facility in CSS2. It can be used to describe the characteristics of any font, SVG font or otherwise.

When used to describe the characteristics of an SVG font contained within the same document, it is recommended that the

'font-face' element be a child of the 'font' element it is describing so that the 'font' element can be self-contained and fully-described. In this case, any 'font-face-src' elements within the 'font-face' element are ignored as it is assumed that the 'font-face' element is describing the characteristics of its parent 'font' element.

```
<!ELEMENT font-face (%descTitleMetadata;,font-face-src?,definition-src?) >
<!ATTLIST font-face
  %stdAttrs;
  font-family CDATA #IMPLIED
  font-style CDATA #IMPLIED
  font-variant CDATA #IMPLIED
  font-weight CDATA #IMPLIED
  font-stretch CDATA #IMPLIED
  font-size CDATA #IMPLIED
  unicode-range CDATA #IMPLIED
  units-per-em %Number; #IMPLIED
  panose-1 CDATA #IMPLIED
  stemv %Number; #IMPLIED
  stemh %Number; #IMPLIED
  slope %Number; #IMPLIED
  cap-height %Number; #IMPLIED
  x-height %Number; #IMPLIED
  accent-height %Number; #IMPLIED
  ascent %Number; #IMPLIED
  descent %Number; #IMPLIED
  widths CDATA #IMPLIED
  bbox CDATA #IMPLIED
  ideographic %Number; #IMPLIED
  baseline %Number; #IMPLIED
  centerline %Number; #IMPLIED
  mathline %Number; #IMPLIED
  hanging %Number; #IMPLIED
  topline %Number; #IMPLIED
  underline-position %Number; #IMPLIED
  underline-thickness %Number; #IMPLIED
  strikethrough-position %Number; #IMPLIED
  strikethrough-thickness %Number; #IMPLIED
  overline-position %Number; #IMPLIED
  overline-thickness %Number; #IMPLIED >
```

Attribute definitions:

font-family = "<string>"

> Same syntax and semantics as the 'font-family' descriptor within an @font-face rule.
> Animatable: no.

font-style = "all | [normal | italic | oblique] [, [normal | italic | oblique]]*"

> Same syntax and semantics as the 'font-style' descriptor within an @font-face rule. The style of a font. Takes on the same values as the 'font-style' property, except that a comma-separated list is permitted.
> If the attribute is not specified, the effect is as if a value of "all" were specified.
> Animatable: no.

font-variant = "[normal | small-caps] [,[normal | small-caps]]*"

> Same syntax and semantics as the 'font-variant' descriptor within an @font-face rule. Indication of whether this face is the small-caps variant of a font. Takes on the same values as the 'font-variant' property, except that a comma-separated list is permitted.

If the attribute is not specified, the effect is as if a value of "normal" were specified.

Animatable: no.

font-weight = "all | [normal | bold |100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900] [, [normal | bold |100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900]]*"

Same syntax and semantics as the 'font-weight' descriptor within an @font-face rule.

The weight of a face relative to others in the same font family. Takes on the same values as the 'font-weight' property with three exceptions:

1. relative keywords (bolder, lighter) are not permitted
2. a comma-separated list of values is permitted, for fonts that contain multiple weights
3. an additional keyword, 'all', is permitted, which means that the font will match for all possible weights; either because it contains multiple weights, or because that face only has a single weight.

If the attribute is not specified, the effect is as if a value of "all" were specified.

Animatable: no.

font-stretch = "all | [normal | ultra-condensed | extra-condensed | condensed | semi-condensed | semi-expanded | expanded | extra-expanded | ultra-expanded] [, [normal | ultra-condensed | extra-condensed | condensed | semi-condensed | semi-expanded | expanded | extra-expanded | ultra-expanded]]*"

Same syntax and semantics as the 'font-stretch' descriptor within an @font-face rule. Indication of the condensed or expanded nature of the face relative to others in the same font family. Takes on the same values as the 'font-stretch' property except that:

❍ relative keywords (wider,narrower) are not permitted
❍ a comma-separated list is permitted
❍ the keyword 'all' is permitted

If the attribute is not specified, the effect is as if a value of "normal" were specified.

Animatable: no.

font-size = "<string>"

Same syntax and semantics as the 'font-size' descriptor within an @font-face rule.

Animatable: no.

unicode-range = "<urange> [, <urage>]*"

Same syntax and semantics as the 'unicode-range' descriptor within an @font-face rule. The range of ISO 10646 characters [UNICODE] covered by the font. Except for any additional information provided in this specification, the normative definition of the attribute is in [CSS2].

If the attribute is not specified, the effect is as if a value of "U+0-10FFFF" were specified.

Animatable: no.

units-per-em = "<number>"

Same syntax and semantics as the 'units-per-em' descriptor within an @font-face rule. The number of coordinate units on the em square, the size of the design grid on which glyphs are laid out.

This value is almost always necessary as nearly every other attribute requires the definition of a design grid.

If the attribute is not specified, the effect is as if a value of "1000" were specified.

Animatable: no.

panose-1 = "[<integer>]{10}"

Same syntax and semantics as the 'panose-1' descriptor within an @font-face rule. The Panose-1 number, consisting of ten decimal integers, separated by whitespace. Except for any additional information provided in this specification, the normative definition of the attribute is in [CSS2].

If the attribute is not specified, the effect is as if a value of "0 0 0 0 0 0 0 0 0 0" were specified.

Animatable: no.

stemv = "<number>"

Same syntax and semantics as the 'stemv' descriptor within an @font-face rule.

Animatable: no.

stemh = "<number>"

Same syntax and semantics as the 'stemh' descriptor within an @font-face rule.
Animatable: no.

slope = "<number>"

Same syntax and semantics as the 'slope' descriptor within an @font-face rule. The vertical stroke angle of the font. Except for any additional information provided in this specification, the normative definition of the attribute is in [CSS2].
If the attribute is not specified, the effect is as if a value of "0" were specified.
Animatable: no.

cap-height = "<number>"

Same syntax and semantics as the 'cap-height' descriptor within an @font-face rule. The height of uppercase glyphs in the font within the font coordinate system.
Animatable: no.

x-height = "<number>"

Same syntax and semantics as the 'x-height' descriptor within an @font-face rule. The height of lowercase glyphs in the font within the font coordinate system.
Animatable: no.

accent-height = "<number>"

The distance from the baseline to the top of accent characters, measure by a distance within the font coordinate system.
If the attribute is not specified, the effect is as if the attribute were set to the value of the ascent attribute. If this descriptor is used, the units-per-em attribute must also be specified.
Animatable: no.

ascent = "<number>"

Same syntax and semantics as the 'ascent' descriptor within an @font-face rule. The maximum unaccented height of the font within the font coordinate system.
Animatable: no.

descent = "<number>"

Same syntax and semantics as the 'descent' descriptor within an @font-face rule. The maximum unaccented depth of the font within the font coordinate system.
Animatable: no.

widths = "<string>"

Same syntax and semantics as the 'widths' descriptor within an @font-face rule.
Animatable: no.

bbox = "<string>"

Same syntax and semantics as the 'bbox' descriptor within an @font-face rule.
Animatable: no.

ideographic = "<number>"

Comparable syntax and semantics as the 'baseline' descriptor within an @font-face rule. Indicates the alignment coordinate for glyphs which represent ideographic characters. If this descriptor is provided, the units-per-em attribute must also be specified.
Animatable: no.

baseline = "<number>"

Same syntax and semantics as the 'baseline' descriptor within an @font-face rule. The lower baseline of a font within the font coordinate system.
Animatable: no.

centerline = "<number>"

Same syntax and semantics as the 'centerline' descriptor within an @font-face rule. The central baseline of a font within the font coordinate system.
Animatable: no.

mathline = "<number>"

> Same syntax and semantics as the 'mathline' descriptor within an @font-face rule. The mathematical baseline of a font within the font coordinate system.
> Animatable: no.

hanging = "<number>"

> Comparable syntax and semantics as the 'baseline' descriptor within an @font-face rule. Indicates the alignment coordinate for glyphs which represent ideographic characters. If this descriptor is provided, the units-per-em attribute must also be specified.
> Animatable: no.

topline = "<number>"

> Same syntax and semantics as the 'topline' descriptor within an @font-face rule. The top baseline of a font within the font coordinate system.
> Animatable: no.

underline-position = "<number>"

> The ideal position of an underline within the font coordinate system. If this descriptor is provided, the units-per-em attribute must also be specified. If this descriptor is provided, the units-per-em attribute must also be specified.
> Animatable: no.

underline-thickness = "<number>"

> The ideal thickness of an underline, expressed as a length within the font coordinate system. If this descriptor is provided, the units-per-em attribute must also be specified.
> Animatable: no.

strikethrough-position = "<number>"

> The ideal position of a strike-through within the font coordinate system. If this descriptor is provided, the units-per-em attribute must also be specified.
> Animatable: no.

strikethrough-thickness = "<number>"

> The ideal thickness of a strike-through, expressed as a length within the font coordinate system. If this descriptor is provided, the units-per-em attribute must also be specified.
> Animatable: no.

overline-position = "<number>"

> The ideal position of an overline within the font coordinate system. If this descriptor is provided, the units-per-em attribute must also be specified.
> Animatable: no.

overline-thickness = "<number>"

> The ideal thickness of an overline, expressed as a length within the font coordinate system. If this descriptor is provided, the units-per-em attribute must also be specified.
> Animatable: no.

Attributes defined elsewhere:

> %stdAttrs;.

The following elements and attributes correspond to the 'src' descriptor within an @font-face rule.

```
<!ELEMENT font-face-src (font-face-uri|font-face-name)+ >
<!ATTLIST font-face-src
  %stdAttrs; >


<!ELEMENT font-face-uri (font-face-format*) >
<!ATTLIST font-face-uri
```

```
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #REQUIRED >

<!ELEMENT font-face-format EMPTY >
<!ATTLIST font-face-format
  %stdAttrs;
  string CDATA #IMPLIED >

<!ELEMENT font-face-name EMPTY >
<!ATTLIST font-face-name
  %stdAttrs;
  name CDATA #IMPLIED >

<!ELEMENT definition-src EMPTY >
<!ATTLIST definition-src
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #REQUIRED >
```

Attributes defined elsewhere:

> %stdAttrs;, %xlinkRefAttrs;, xlink:href.

20.4 DOM interfaces

The following interfaces are defined below: SVGFontElement, SVGGlyphElement, SVGMissingGlyphElement, SVGHKernElement, SVGVKernElement, SVGFontFaceElement, SVGFontFaceSrcElement, SVGFontFaceUriElement, SVGFontFaceFormatElement, SVGFontFaceNameElement, SVGDefinitionSrcElement.

Interface SVGFontElement

The SVGFontElement interface corresponds to the 'font' element.

Object-oriented access to the attributes of the 'font' element via the SVG DOM is not available.

IDL Definition

```
    interface SVGFontElement :
                  SVGElement,
                  SVGExternalResourcesRequired,
                  SVGStylable {};
```


Interface SVGGlyphElement

The SVGGlyphElement interface corresponds to the 'glyph' element.

Object-oriented access to the attributes of the 'glyph' element via the SVG DOM is not available.

IDL Definition

```
interface SVGGlyphElement :
             SVGElement,
             SVGStylable {};
```

Interface SVGMissingGlyphElement

The SVGMissingGlyphElement interface corresponds to the 'missing-glyph' element.

Object-oriented access to the attributes of the 'missing-glyph' element via the SVG DOM is not available.

IDL Definition

```
interface SVGMissingGlyphElement :
             SVGElement,
             SVGStylable {};
```

Interface SVGHKernElement

The SVGHKernElement interface corresponds to the 'hkern' element.

Object-oriented access to the attributes of the 'hkern' element via the SVG DOM is not available.

IDL Definition

```
interface SVGHKernElement : SVGElement {};
```

Interface SVGVKernElement

The SVGVKernElement interface corresponds to the 'vkern' element.

Object-oriented access to the attributes of the 'vkern' element via the SVG DOM is not available.

IDL Definition

```
interface SVGVKernElement : SVGElement {};
```

Interface SVGFontFaceElement

The SVGFontFaceElement interface corresponds to the 'font-face' element.

Object-oriented access to the attributes of the 'font-face' element via the SVG DOM is not available.

IDL Definition

```
interface SVGFontFaceElement : SVGElement {};
```

Interface SVGFontFaceSrcElement

The SVGFontFaceSrcElement interface corresponds to the 'font-face-src' element.

IDL Definition

```
interface SVGFontFaceSrcElement : SVGElement {};
```

Interface SVGFontFaceUriElement

The SVGFontFaceUriElement interface corresponds to the 'font-face-uri' element.

Object-oriented access to the attributes of the 'font-face-uri' element via the SVG DOM is not available.

IDL Definition

```
interface SVGFontFaceUriElement : SVGElement {};
```

Interface SVGFontFaceFormatElement

The SVGFontFaceFormatElement interface corresponds to the 'font-face-format' element.

Object-oriented access to the attributes of the 'font-face-format' element via the SVG DOM is not available.

IDL Definition

```
interface SVGFontFaceFormatElement : SVGElement {};
```

Interface SVGFontFaceNameElement

The SVGFontFaceNameElement interface corresponds to the 'font-face-name' element.

Object-oriented access to the attributes of the 'font-face-name' element via the SVG DOM is not available.

IDL Definition

```
interface SVGFontFaceNameElement : SVGElement {};
```

Interface SVGDefinitionSrcElement

The SVGDefinitionSrcElement interface corresponds to the 'definition-src' element.

Object-oriented access to the attributes of the 'definition-src' element via the SVG DOM is not available.

IDL Definition

```
interface SVGDefinitionSrcElement : SVGElement {};
```

---

21 Metadata

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21.1 Introduction

Metadata is information about a document.

In the computing industry, there are ongoing standardization efforts towards metadata with the goal of promoting industry interoperability and efficiency. Content creators should track these developments and include appropriate metadata in their SVG content which conforms to these various metadata standards as they emerge.

The W3C Note "Metadata and SVG" [not yet published] discusses in detail various issues concerning metadata and SVG. The document provides a current set of recommendations about appropriate uses of metadata in conjunction with SVG.

The W3C has ongoing metadata activities which provide general metadata guidelines. One of the W3C's metadata activities is the definition of Resource Definition Framework (RDF), a W3C Recommendation for specifying metadata. The specifications for RDF can be found at:

- Resource Description Framework Model and Syntax Specification
- Resource Description Framework (RDF) Schema Specification

Another activity relevant to most applications of metadata is the Dublin Core, which is a set of generally applicable core metadata properties (e.g., Title, Creator/Author, Subject, Description, etc.).

Individual industries or individual content creators are free to define their own metadata schema but are encouraged to follow existing metadata standards and use standard metadata schema wherever possible to promote interchange and interoperability. If a particular standard metadata schema does not meet your needs, then it is usually better to define an additional metadata schema in an existing framework such as RDF and to use custom metadata schema in combination with standard metadata schema, rather than totally ignore the standard schema.

21.2 The 'metadata' element

Metadata which is included with SVG content should be specified within 'metadata' elements. The contents of the 'metadata' should be elements from other XML namespaces, with these elements from these namespaces expressed in a manner conforming with the "Namespaces in XML" Recommendation [XML-NS].

Authors should provide a 'metadata' child element to the outermost 'svg' element within a stand-alone SVG document. The 'metadata' child element to an 'svg' element serves the purposes of identifying document-level metadata.

The DTD definitions of many of SVG's elements (particularly, container and text elements) place no restriction on the placement or number of the 'metadata' sub-elements. This flexibility is only present so that there will be a consistent content model for container elements, because some container elements in SVG allow fox mixed content, and because the mixed content rules for XML [XML-MIXED] do not permit the desired restrictions. Representations of future versions of the SVG language might use more expressive representations than DTDs which allow for more restrictive mixed content rules. It is strongly recommended that at most one 'metadata' element appear as a child of any particular element, and that this element appear before any other child elements (except possibly 'desc' or 'title' elements) or character data content. If metadata-processing user agents need to choose among multiple 'metadata' elements for processing (e.g., to decide which string to use for a tooltip), the user agent shall choose the first one.

```
<!ENTITY % metadataExt "" >
<!ELEMENT metadata (#PCDATA %metadataExt;)* >
<!ATTLIST metadata
  %stdAttrs; >
```

Attribute definitions:

Attributes defined elsewhere:

> %stdAttrs;.

21.3 An example

Here is an example of how metadata can be included in an SVG document. The example uses the Dublin Core version 1.1 schema:

```
<?xml version="1.0" standalone="yes"?>
<svg width="4in" height="3in"
    xmlns = 'http://www.w3.org/2000/svg-20000629'>
    <desc xmlns:myfoo="http://openinterchange.org/myfoo">
      <myfoo:title>This is a financial report</myfoo:title>
      <myfoo:descr>The global description uses markup from the
        <myfoo:emph>myfoo</myfoo:emph> namespace.</myfoo:descr>
      <myfoo:scene><myfoo:what>widget $growth</myfoo:what>
      <myfoo:contains>$three $graph-bar</myfoo:contains>
        <myfoo:when>1998 $through 2000</myfoo:when> </myfoo:scene>
    </desc>
```

```
    <metadata>
      <rdf:RDF
                xmlns:rdf = "http://www.w3.org/...-rdf-syntax-ns"
                xmlns:rdfs = "http://www.w3.org/TR/...-schema"
                xmlns:dc = "http://purl.org/dc/elements/1.1/" >
          <rdf:Description about="http://openinterchange.org/myfoo"
                  dc:title="MyFoo Financial Report"
                  dc:description="$three $bar $thousands $dollars $from 1998
$through 2000"
                  dc:publisher="Openinterchange Organization"
                  dc:date="2000-04-11"
                  dc:format="image/svg"
                  dc:language="en" >
          <dc:creator>
            <rdf:Bag>
                <rdf:li>Irving Bird</rdf:li>
                <rdf:li>Mary Lambert</rdf:li>
            </rdf:Bag>
          </dc:creator>
        </rdf:Description>
      </rdf:RDF>
    </metadata>
</svg>
```

21.4 DOM interfaces

The following interfaces are defined below: [SVGMetadataElement](#).

Interface SVGMetadataElement

The SVGMetadataElement interface corresponds to the 'metadata' element.

IDL Definition

```
    interface SVGMetadataElement : SVGElement {};
```

_____

22 Backwards Compatibility

A user agent (UA) might not have the ability to process and view SVG content. The following list outlines two of the backwards compatibility scenarios associated with SVG content:

- For XML grammars with the ability to embed SVG content, it is assumed that some sort of alternate representation capability such as the 'switch' element and some sort of feature-availability test facility (such as what is described in the SMIL 1.0 specification [SMIL1]) will be available.

  This 'switch' element and feature-availability test facility (or their equivalents) are the recommended way for XML authors to provide an alternate representation to SVG content, such as an image or a text string. The following example shows how to embed an SVG drawing within a SMIL 1.0 document such that an alternate image will display in the event the UA doesn't support SVG. (In this example, the SVG content is included via a URL reference. With some parent XML grammars it will also be possible to include an SVG document fragment inline within the same file as its parent grammar.)

```
<?xml version="1.0" standalone="yes"?>
<smil>
  <body>
    <!-- With SMIL 1.0, the first child element of 'switch'
         which the SMIL 1.0 user agent is able to process
         and which tests true will get processed and all other
         child elements will have no visual effect. In this case,
         if the SMIL 1.0 user agent can process "image/svg",
         then the SVG will appear; otherwise, the alternate image
         (the second child element) will appear. -->
    <switch>
      <!-- Render the SVG if possible. -->
      <ref type="image/svg" src="drawing.svg" />

      <!-- Else, render the alternate image. -->
      <img src="alternate_image.jpg" />
    </switch>
  </body>
</smil>
```

- For HTML 4.0, SVG drawings can be embedded using the 'object' element. An alternate representation such as an image can be included as the content of the 'object' element. In this case, the SVG content usually will be included via a URL reference. The following example shows how to use the 'object' element to include an SVG drawing via a URL reference with an image serving as the alternate representation in the absence of an SVG user agent:

```
<html>
  <body>
    <object type="image/svg" data="drawing.svg">
      <!-- The contents of the <object> element (i.e., an alternate
           image) are drawn in the event the user agent cannot process
```

```
        the SVG drawing. -->
      <img src="alternate_image.jpg" alt="short description" />
    </object>
  </body>
</html>
```

---

23 Extensibility

Contents

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- [23.3 The 'foreignObject' element](#)
- [23.4 An example](#)
- [23.5 DOM interfaces](#)

23.1 Foreign namespaces and private data

SVG allows inclusion of elements from foreign namespaces anywhere with the SVG content. In general, the SVG user agent will include the unknown elements in the DOM but will otherwise ignore unknown elements. (The notable exception is described under Embedding Foreign Object Types.)

Additionally, SVG allows inclusion of attributes from foreign namespaces on any SVG element. The SVG user agent will include unknown attributes in the DOM but with otherwise ignore unknown attributes.

SVG's ability to include foreign namespaces can be used for the following purposes:

- Application-specific information so that authoring applications can include model-level data in the SVG content to serve their "roundtripping" purposes (i.e., the ability to write, then read a file without loss of higher-level information).

- Supplemental data for extensibility. For example, suppose you have an extrusion extension which takes any 2D graphics and extrudes it in three dimensions. When applying the extrusion extension, you probably will need to set some parameters. The parameters can be included in the SVG content by inserting elements from an extrusion extension namespace.

To illustrate, a business graphics authoring application might want to include some private data within an SVG document so that it could properly reassemble the chart (a pie chart in this case) upon reading it back in:

```
<?xml version="1.0" standalone="yes"?>
<svg width="4in" height="3in"
     xmlns = 'http://www.w3.org/2000/svg-20000629'>
  <defs>
    <myapp:piechart xmlns:myapp="http://mycompany/mapapp"
                    title="Sales by Region">
      <myapp:pieslice label="Northern Region" value="1.23"/>
      <myapp:pieslice label="Eastern Region" value="2.53"/>
      <myapp:pieslice label="Southern Region" value="3.89"/>
      <myapp:pieslice label="Western Region" value="2.04"/>
      <!-- Other private data goes here -->
    </myapp:piechart>
  </defs>
  <desc>This chart includes private data in another namespace
  </desc>
  <!-- In here would be the actual SVG graphics elements which
       draw the pie chart -->
</svg>
```

23.2 Embedding foreign object types

One goal for SVG is to provide a mechanism by which other XML language processors can render into an area within an SVG drawing, with those renderings subject to the various transformations and compositing parameters that are currently active at a given point within the SVG content tree. One particular example of this is to provide a frame for XML content styled with CSS or XSL so that dynamically reflowing text (subject to SVG transformations and compositing) could be inserted into the middle of some SVG content. Another example is inserting a MathML [MATHML] expression into an SVG drawing.

The 'foreignObject' element allows for inclusion of a foreign namespace which has its graphical content drawn by a different user agent. The included foreign graphical content is subject to SVG transformations and compositing.

The contents of 'foreignObject' are assumed to be from a different namespace. Any SVG elements within a 'foreignObject' will not be drawn, except in the situation where a properly defined SVG subdocument with a proper xmlns (see "Namespaces in XML" [XML-NS]) attribute specification is embedded recursively. One situation where this can occur is when an SVG document fragment is embedded within another non-SVG document fragment, which in turn is embedded within an SVG document fragment (e.g., an SVG document fragment contains an XHTML document fragment which in turn contains yet another SVG document fragment).

Usually, a 'foreignObject' will be used in conjunction with the 'switch' element and the requiredExtensions attribute to provide proper checking for user agent support and provide an alternate rendering in case user agent support isn't available.

23.3 The 'foreignObject' element

```
<!ENTITY % foreignObjectExt "" >
<!ELEMENT foreignObject (#PCDATA %ceExt;%foreignObjectExt;)* >
<!ATTLIST foreignObject
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;
  x %Coordinate; #IMPLIED
  y %Coordinate; #IMPLIED
  width %Length; #REQUIRED
  height %Length; #REQUIRED
  %StructuredText; >
```

Attribute definitions:

x = "<coordinate>"

> The X-axis coordinate of one corner of the rectangular region into which the graphics associated with the contents of the 'foreignObject' will be rendered.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> Animatable: yes.

y = "<coordinate>"

> The Y-axis coordinate of one corner of the rectangular region into which the referenced document is placed.
> If the attribute is not specified, the effect is as if a value of "0" were specified.
> Animatable: yes.

width = "<length>"

> The width of the rectangular region into which the referenced document is placed.

A negative value is an error (see Error processing). A value of zero disables rendering of the element.

Animatable: yes.

height = "<length>"

The height of the rectangular region into which the referenced document is placed.
A negative value is an error (see Error processing). A value of zero disables rendering of the element.
Animatable: yes.

Attributes defined elsewhere:

%stdAttrs;, %langSpaceAttrs;, class, transform, %graphicsElementEvents;, %testAttrs;, externalResourcesRequired, style, %PresentationAttributes-All;.

23.4 An example

Here is an example:

```
<?xml version="1.0" standalone="yes"?>
<svg width="4in" height="3in"
 xmlns = 'http://www.w3.org/2000/svg-20000629'>
  <desc>This example uses the switch element to provide a
  fallback graphical representation of an equation, if
  XMHTML is not supported.
  </desc>
  <!-- The <switch> element will process the first child element
       whose testing attributes evaluate to true.-->
  <switch>

    <!-- Process the embedded HTML if the requiredExtensions attribute
         evaluates to true (i.e., the user agent supports XHTML
         embedded within SVG). -->
    <foreignObject width="100" height="50"
                     requiredExtensions="http://www.foo.com/SVGExtensions/EmbeddedXHTML">
      <!-- XHTML content goes here -->
    </foreignObject>

    <!-- Else, process the following alternate SVG.
         Note that there are no testing attributes on the <g> element.
         If no testing attributes are provided, it is as if there
         were testing attributes and they evaluated to true.-->
    <g>
      <!-- Draw a red rectangle with a text string on top. -->
      <rect width="20" height="20" style="fill: red"/>
      <text>Formula goes here</text>
    </g>

  </switch>
</svg>
```

It is not required that SVG user agent support the ability to invoke other arbitrary user agents to handle embedded foreign object types; however, all conforming SVG user agents would need to support the **'switch'** element and must be able to render valid SVG elements when they appear as one of the alternatives within a **'switch'** element.

Ultimately, it is expected that commercial Web browsers will support the ability for SVG to embed content from other XML grammars which use CSS or XSL to format their content, with the resulting CSS- or XSL-formatted content subject to SVG transformations and compositing. At this time, such a capability is not a requirement.

23.5 DOM interfaces

The following interfaces are defined below: SVGForeignObjectElement.

Interface SVGForeignObjectElement

The SVGForeignObjectElement interface corresponds to the 'foreignObject' element.

IDL Definition

```
interface SVGForeignObjectElement :
                SVGElement,
                SVGTests,
                SVGLangSpace,
                SVGExternalResourcesRequired,
                SVGStylable,
                SVGTransformable,
                events::EventTarget {

        attribute SVGAnimatedLength x;
                    // raises DOMException on setting
        attribute SVGAnimatedLength y;
                    // raises DOMException on setting
        attribute SVGAnimatedLength width;
                    // raises DOMException on setting
        attribute SVGAnimatedLength height;
                    // raises DOMException on setting
};
```

Attributes

SVGAnimatedLength x

Corresponds to attribute x on the given 'foreignObject' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength y

Corresponds to attribute y on the given 'foreignObject' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength width

Corresponds to attribute width on the given 'foreignObject' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

SVGAnimatedLength height

Corresponds to attribute height on the given 'foreignObject' element.

Exceptions on setting

DOMException NO_MODIFICATION_ALLOWED_ERR: Raised when the node is readonly.

Appendix A: DTD

Contents

This appendix is normative.

```
<!-- ====================================================================
  This is the DTD for SVG 1.0 (draft 20000629).

  The specification for SVG that corresponds to this DTD is available at:

    http://www.w3.org/TR/2000/WD-SVG-20000629/

  Copyright (c) 2000 W3C (MIT, INRIA, Keio), All Rights Reserved.

  For this working draft:

    Namespace:
      http://www.w3.org/2000/svg-20000629

    Public identifier:
      PUBLIC "-//W3C//DTD SVG 20000629//EN"

    URI for the DTD:
      http://www.w3.org/TR/2000/WD-SVG-20000629/DTD/svg-20000629.dtd
======================================================================= -->


<!-- ============================================================
     ENTITY DEFINITIONS: Data types
     ============================================================ -->
```

```
<!ENTITY % BaselineShiftValue "CDATA">
    <!-- 'baseline-shift' property/attribute value (e.g., 'baseline', 'sub', etc.) -->

<!ENTITY % Boolean "(false | true)">
    <!-- feature specification -->

<!ENTITY % ClassList "CDATA">
    <!-- list of classes -->

<!ENTITY % ClipValue "CDATA">
    <!-- 'clip' property/attribute value (e.g., 'auto', rect(...)) -->

<!ENTITY % ClipPathValue "CDATA">
    <!-- 'clip-path' property/attribute value (e.g., 'none', %URI;) -->

<!ENTITY % ClipFillRule "(evenodd | nonzero | inherit)">
    <!-- 'clip-rule' or fill-rule property/attribute value -->

<!ENTITY % ContentType "CDATA">
    <!-- media type, as per [RFC2045] -->

<!ENTITY % Coordinate "CDATA">
    <!-- a <coordinate> -->

<!ENTITY % Coordinates "CDATA">
    <!-- a list of <coordinate>s -->

<!ENTITY % Color "CDATA">
    <!-- a <color> value, as per [CSS2-color] -->

<!ENTITY % CursorValue "CDATA">
    <!-- 'cursor' property/attribute value (e.g., 'crosshair', %URI;) -->

<!ENTITY % EnableBackgroundValue "CDATA">
    <!-- 'enable-background' property/attribute value (e.g., 'new', 'accumulate') -->

<!ENTITY % ExtensionList "CDATA">
    <!-- extension list specification -->

<!ENTITY % FeatureList "CDATA">
    <!-- feature list specification -->

<!ENTITY % FilterValue "CDATA">
    <!-- 'filter' property/attribute value (e.g., 'none', %URI;) -->

<!ENTITY % FontFamilyValue "CDATA">
    <!-- 'font-family' property/attribute value (i.e., list of fonts) -->

<!ENTITY % FontSizeValue "CDATA">
    <!-- 'font-size' property/attribute value -->

<!ENTITY % FontSizeAdjustValue "CDATA">
    <!-- 'font-size-adjust' property/attribute value -->

<!ENTITY % GlyphOrientationHorizontalValue "CDATA">
    <!-- 'glyph-orientation-horizontal' property/attribute value (e.g., <angle>) -->

<!ENTITY % GlyphOrientationVerticalValue "CDATA">
    <!-- 'glyph-orientation-vertical' property/attribute value (e.g., 'auto', <angle>) -->

<!ENTITY % Integer "CDATA">
    <!-- a <integer> -->

<!ENTITY % LanguageCode "NMTOKEN">
    <!-- a language code, as per [RFC1766] -->

<!ENTITY % LanguageCodes "CDATA">
    <!-- comma-separated list of language codes, as per [RFC1766] -->
```

```
<!ENTITY % Length "CDATA">
    <!-- a <length> -->

<!ENTITY % Lengths "CDATA">
    <!-- a list of <length>s -->

<!ENTITY % LinkTarget "NMTOKEN">
    <!-- link to this target -->

<!ENTITY % MarkerValue "CDATA">
    <!-- 'marker' property/attribute value (e.g., 'none', %URI;) -->

<!ENTITY % MaskValue "CDATA">
    <!-- 'mask' property/attribute value (e.g., 'none', %URI;) -->

<!ENTITY % MediaDesc "CDATA">
    <!-- comma-separated list of media descriptors. -->

<!ENTITY % Number "CDATA">
    <!-- a <number> -->

<!ENTITY % OpacityValue "CDATA">
    <!-- opacity value (e.g., <number>) -->

<!ENTITY % Paint "CDATA">
    <!-- a 'fill' or 'stroke' property/attribute value: <paint> -->

<!ENTITY % PathData "CDATA">
    <!-- a path data specification -->

<!ENTITY % Points "CDATA">
    <!-- a list of points -->

<!ENTITY % PreserveAspectRatioSpec "CDATA">
    <!-- 'preserveAspectRatio' attribute specification -->

<!ENTITY % Script "CDATA">
    <!-- script expression -->

<!ENTITY % SpacingValue "CDATA">
    <!-- 'letter-spacing' or 'word-spacing' property/attribute value (e.g., normal | <length>) -->

<!ENTITY % StrokeDashArrayValue "CDATA">
    <!-- 'stroke-dasharray' property/attribute value (e.g., 'none', list of <number>s) -->

<!ENTITY % StrokeDashOffsetValue "CDATA">
    <!-- 'stroke-dashoffset' property/attribute value (e.g., 'none', <legnth>) -->

<!ENTITY % StrokeMiterLimitValue "CDATA">
    <!-- 'stroke-miterlimit' property/attribute value (e.g., <number>) -->

<!ENTITY % StrokeWidthValue "CDATA">
    <!-- 'stroke-width' property/attribute value (e.g., <length>) -->

<!ENTITY % StructuredText
  "content CDATA #FIXED 'structured text'" >

<!ENTITY % StyleSheet "CDATA">
    <!-- style sheet data -->

<!ENTITY % SVGColor "CDATA">
    <!-- An SVG color value (RGB plus optional ICC) -->

<!ENTITY % Text "CDATA">
    <!-- arbitrary text string -->

<!ENTITY % TextDecorationValue "CDATA">
```

```
        <!-- 'text-decoration' property/attribute value (e.g., 'none', 'underline') -->

<!ENTITY % TransformList "CDATA">
        <!-- list of transforms -->

<!ENTITY % URI "CDATA">
        <!-- a Uniform Resource Identifier, see [URI] -->

<!ENTITY % ViewBoxSpec "CDATA">
        <!-- 'viewBox' attribute specification -->


<!-- ==============================================================
        ENTITY DEFINITIONS: Collections of common attributes
        ============================================================== -->

<!-- All elements have an ID. -->
<!ENTITY % stdAttrs
 "id ID #IMPLIED" >

<!-- Common attributes for elements that might contain character data content. -->
<!ENTITY % langSpaceAttrs
 "xml:lang %LanguageCode; #IMPLIED
   xml:space (default|preserve) #IMPLIED" >

<!-- Common attributes to check for system capabilities. -->
<!ENTITY % testAttrs
 "requiredFeatures %FeatureList; #IMPLIED
   requiredExtensions %ExtensionList; #IMPLIED
   systemLanguage %LanguageCodes; #IMPLIED" >

<!-- For most uses of URI referencing:
        standard XLink attributes other than xlink:href. -->
<!ENTITY % xlinkRefAttrs
 "xmlns:xlink CDATA #FIXED 'http://www.w3.org/2000/xlink/namespace/'
   xlink:type (simple|extended|locator|arc) 'simple'
   xlink:role CDATA #IMPLIED
   xlink:title CDATA #IMPLIED
   xlink:show (new|embed|replace) 'embed'
   xlink:actuate (onRequest|onLoad) 'onLoad'" >

<!ENTITY % graphicsElementEvents
  "onfocusin %Script; #IMPLIED
   onfocusout %Script; #IMPLIED
   onactivate %Script; #IMPLIED
   onmousedown %Script; #IMPLIED
   onmouseup %Script; #IMPLIED
   onclick %Script; #IMPLIED
   ondblclick %Script; #IMPLIED
   onmouseover %Script; #IMPLIED
   onmousemove %Script; #IMPLIED
   onmouseout %Script; #IMPLIED
   onkeydown %Script; #IMPLIED
   onkeypress %Script; #IMPLIED
   onkeyup %Script; #IMPLIED
   onload %Script; #IMPLIED
   onselect %Script; #IMPLIED" >

<!ENTITY % documentEvents
  "onresize %Script; #IMPLIED
   onscroll %Script; #IMPLIED
   onunload %Script; #IMPLIED
   onzoom %Script; #IMPLIED
   onerror %Script; #IMPLIED
   onabort %Script; #IMPLIED " >

<!-- This entity allows for at most one of desc, title and metadata,
```

```
      supplied in any order -->
<!ENTITY % descTitleMetadata
          "(((desc,((title,metadata?)|(metadata,title?))?)|
          (title,((desc,metadata?)|(metadata,desc?))?)|
          (metadata,((desc,title?)|(title,desc?))?))?)" >


<!-- ================================================================
     ENTITY DEFINITIONS: Collections of presentation attributes
     ================================================================ -->

<!-- The following presentation attributes apply to container elements. -->
<!ENTITY % PresentationAttributes-Containers
   "enable-background %EnableBackgroundValue; #IMPLIED " >

<!-- The following presentation attributes apply to 'feFlood' elements. -->
<!ENTITY % PresentationAttributes-feFlood
   "flood-color %SVGColor; #IMPLIED
    flood-opacity %OpacityValue; #IMPLIED " >

<!-- The following presentation attributes apply to filling and stroking operations. -->
<!ENTITY % PresentationAttributes-FillStroke
   "fill %Paint; #IMPLIED
    fill-opacity %OpacityValue; #IMPLIED
    fill-rule %ClipFillRule; #IMPLIED
    stroke %Paint; #IMPLIED
    stroke-dasharray %StrokeDashArrayValue; #IMPLIED
    stroke-dashoffset %StrokeDashOffsetValue; #IMPLIED
    stroke-linecap (butt | round | square | inherit) #IMPLIED
    stroke-linejoin (miter | round | bevel | inherit) #IMPLIED
    stroke-miterlimit %StrokeMiterLimitValue; #IMPLIED
    stroke-opacity %OpacityValue; #IMPLIED
    stroke-width %StrokeWidthValue; #IMPLIED " >

<!-- The following presentation attributes have to do with selecting a font to use. -->
<!ENTITY % PresentationAttributes-FontSelection
   "font-family %FontFamilyValue; #IMPLIED
    font-size %FontSizeValue; #IMPLIED
    font-size-adjust %FontSizeAdjustValue; #IMPLIED
    font-stretch (normal | wider | narrower | ultra-condensed | extra-condensed |
                  condensed | semi-condensed | semi-expanded | expanded |
                  extra-expanded | ultra-expanded | inherit) #IMPLIED
    font-style (normal | italic | oblique | inherit) #IMPLIED
    font-variant (normal | small-caps | inherit) #IMPLIED
    font-weight (normal | bold | bolder | lighter | 100 | 200 | 300 |
                 400 | 500 | 600 | 700 | 800 | 900 | inherit) #IMPLIED " >

<!-- The following presentation attributes apply to gradient 'stop' elements. -->
<!ENTITY % PresentationAttributes-Gradients
   "stop-color %SVGColor; #IMPLIED
    stop-opacity %OpacityValue; #IMPLIED " >

<!-- The following presentation attributes apply to graphics elements. -->
<!ENTITY % PresentationAttributes-Graphics
   "clip-path %ClipPathValue; #IMPLIED
    clip-rule %ClipFillRule; #IMPLIED
    color %Color; #IMPLIED
    color-interpolation (auto | sRGB | linearRGB | inherit) #IMPLIED
    color-rendering (auto | optimizeSpeed | optimizeQuality | inherit) #IMPLIED
    cursor %CursorValue; #IMPLIED
    display (inline | block | list-item | run-in | compact | marker |
             table | inline-table | table-row-group | table-header-group |
             table-footer-group | table-row | table-column-group | table-column |
             table-cell | table-caption | none | inherit) #IMPLIED
    filter %FilterValue; #IMPLIED
    image-rendering (auto | optimizeSpeed | optimizeQuality | inherit) #IMPLIED
    mask %MaskValue; #IMPLIED
    opacity %OpacityValue; #IMPLIED
    pointer-events (visiblePainted | visibleFill | visibleStroke | visibleFillStroke | visible |
```

```
                        painted | fill | stroke | fillstroke | all | none | inherit) #IMPLIED
    shape-rendering (auto | optimizeSpeed | crispEdges | geometricPrecision | inherit) #IMPLIED
    text-rendering (auto | optimizeSpeed | optimizeLegibility | geometricPrecision | inherit)
#IMPLIED
    visibility (visible | hidden | inherit) #IMPLIED " >

<!--The following presentation attributes apply to 'feDiffuseLighting' and 'feSpecularLighting'
elements. -->
<!ENTITY % PresentationAttributes-LightingEffects
  "lighting-color %SVGColor; #IMPLIED " >

<!-- The following presentation attributes apply to marker operations. -->
<!ENTITY % PresentationAttributes-Markers
  "marker-start %MarkerValue; #IMPLIED
   marker-mid %MarkerValue; #IMPLIED
   marker-end %MarkerValue; #IMPLIED " >

<!-- The following presentation attributes apply to text content elements. -->
<!ENTITY % PresentationAttributes-TextContentElements
  "baseline-identifier (baseline | top | before-edge | text-top | text-before-edge |
                       middle | bottom | after-edge | text-bottom | text-after-edge |
                       ideographic | lower | hanging | mathematical | inherit) #IMPLIED
    baseline-shift %BaselineShiftValue; #IMPLIED
    direction (ltr | rtl | inherit) #IMPLIED
    glyph-orientation-horizontal %GlyphOrientationHorizontalValue; #IMPLIED
    glyph-orientation-vertical %GlyphOrientationVerticalValue; #IMPLIED
    letter-spacing %SpacingValue; #IMPLIED
    text-decoration %TextDecorationValue; #IMPLIED
    unicode-bidi (normal | embed | bidi-override | inherit) #IMPLIED
    word-spacing %SpacingValue; #IMPLIED " >

<!-- The following presentation attributes apply to 'text' elements. -->
<!ENTITY % PresentationAttributes-TextElements
  "dominant-baseline (auto | autosense-script | no-change | reset|
                     ideographic | lower | hanging | mathematical | inherit ) #IMPLIED
    text-anchor (start | middle | end | inherit) #IMPLIED
    writing-mode (lr-tb | rl-tb | tb-rl | lr | rl | tb | inherit) #IMPLIED " >

<!-- The following presentation attributes apply to elements that establish viewports. -->
<!ENTITY % PresentationAttributes-Viewports
  "clip %ClipValue; #IMPLIED
    overflow (visible | hidden | scroll | auto | inherit) #IMPLIED " >

<!--The following represents the complete list of presentation attributes. -->
<!ENTITY % PresentationAttributes-All
  "%PresentationAttributes-Containers;
   %PresentationAttributes-feFlood;
   %PresentationAttributes-FillStroke;
   %PresentationAttributes-FontSelection;
   %PresentationAttributes-Gradients;
   %PresentationAttributes-Graphics;
   %PresentationAttributes-LightingEffects;
   %PresentationAttributes-Markers;
   %PresentationAttributes-TextContentElements;
   %PresentationAttributes-TextElements;" >



<!-- ================================================================
     ENTITY DEFINITIONS: DTD extensions
     ================================================================ -->

<!-- Allow for extending the DTD with internal subset for
     container and graphics elements -->
<!ENTITY % ceExt "" >
<!ENTITY % geExt "" >


<!-- ================================================================
```

```
      DEFINITIONS CORRESPONDING TO: Document Structure
      =============================================================== -->

<!ENTITY % svgExt "" >
<!ELEMENT svg (desc|title|metadata|defs|
                    path|text|rect|circle|ellipse|line|polyline|polygon|
                    use|image|svg|g|view|switch|a|altGlyphDef|
                    script|style|symbol|marker|clipPath|mask|
                    linearGradient|radialGradient|pattern|filter|cursor|font|
                    animate|set|animateMotion|animateColor|animateTransform|
                    color-profile|font-face
                    %ceExt;%svgExt;)* >
<!ATTLIST svg
  xmlns CDATA #FIXED "http://www.w3.org/2000/svg-20000629"
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  viewBox %ViewBoxSpec; #IMPLIED
  preserveAspectRatio %PreserveAspectRatioSpec; 'xMidYMid meet'
  zoomAndPan (disable | magnify | zoom) 'magnify'
  %graphicsElementEvents;
  %documentEvents;
  x %Coordinate; #IMPLIED
  y %Coordinate; #IMPLIED
  width %Length; #REQUIRED
  height %Length; #REQUIRED
  contentScriptType %ContentType; "text/ecmascript"
  contentStyleType %ContentType; "text/css" >

<!ENTITY % gExt "" >
<!ELEMENT g (desc|title|metadata|defs|
                    path|text|rect|circle|ellipse|line|polyline|polygon|
                    use|image|svg|g|view|switch|a|altGlyphDef|
                    script|style|symbol|marker|clipPath|mask|
                    linearGradient|radialGradient|pattern|filter|cursor|font|
                    animate|set|animateMotion|animateColor|animateTransform|
                    color-profile|font-face
                    %ceExt;%gExt;)* >
<!ATTLIST g
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;  >

<!ENTITY % defsExt "" >
<!ELEMENT defs (desc|title|metadata|defs|
                    path|text|rect|circle|ellipse|line|polyline|polygon|
                    use|image|svg|g|view|switch|a|altGlyphDef|
                    script|style|symbol|marker|clipPath|mask|
                    linearGradient|radialGradient|pattern|filter|cursor|font|
                    animate|set|animateMotion|animateColor|animateTransform|
                    color-profile|font-face
                    %ceExt;%defsExt;)* >
```

```
<!ATTLIST defs
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;  >

<!ELEMENT desc (#PCDATA) >
<!ATTLIST desc
  %stdAttrs;
  %langSpaceAttrs;
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %StructuredText; >

<!ELEMENT title (#PCDATA) >
<!ATTLIST title
  %stdAttrs;
  %langSpaceAttrs;
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %StructuredText; >

<!ENTITY % symbolExt "" >
<!ELEMENT symbol (desc|title|metadata|defs|
                  path|text|rect|circle|ellipse|line|polyline|polygon|
                  use|image|svg|g|view|switch|a|altGlyphDef|
                  script|style|symbol|marker|clipPath|mask|
                  linearGradient|radialGradient|pattern|filter|cursor|font|
                  animate|set|animateMotion|animateColor|animateTransform|
                  color-profile|font-face
                  %ceExt;%symbolExt;)* >
<!ATTLIST symbol
  %stdAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  viewBox %ViewBoxSpec; #IMPLIED
  preserveAspectRatio %PreserveAspectRatioSpec; 'xMidYMid meet'
  %graphicsElementEvents; >

<!ENTITY % useExt "" >
<!ELEMENT use (%descTitleMetadata;,(animate|set|animateMotion|animateColor|animateTransform
                %geExt;%useExt;)*) >
<!ATTLIST use
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #REQUIRED
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;
```

```
    x %Coordinate; #IMPLIED
    y %Coordinate; #IMPLIED
    width %Length; #IMPLIED
    height %Length; #IMPLIED >

<!ENTITY % imageExt "" >
<!ELEMENT image (%descTitleMetadata;,(animate|set|animateMotion|animateColor|animateTransform
                   %geExt;%imageExt;)*) >
<!ATTLIST image
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #REQUIRED
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-Graphics;
  %PresentationAttributes-Viewports;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;
  x %Coordinate; #IMPLIED
  y %Coordinate; #IMPLIED
  width %Length; #REQUIRED
  height %Length; #REQUIRED >

<!ENTITY % switchExt "" >
<!ELEMENT switch (%descTitleMetadata;,
                   (path|text|rect|circle|ellipse|line|polyline|polygon|
                    use|image|svg|g|switch|a|foreignObject|
                    animate|set|animateMotion|animateColor|animateTransform
                    %ceExt;%switchExt;)*) >
<!ATTLIST switch
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents; >


<!-- =============================================================
     DEFINITIONS CORRESPONDING TO: Styling
     ============================================================= -->

<!ELEMENT style (#PCDATA) >
<!ATTLIST style
  %stdAttrs;
  xml:space (preserve) #FIXED "preserve"
  type %ContentType; #REQUIRED
  media %MediaDesc; #IMPLIED
  title %Text; #IMPLIED >


<!-- =============================================================
     DEFINITIONS CORRESPONDING TO: Paths
     ============================================================= -->

<!ENTITY % pathExt "" >
<!ELEMENT path (%descTitleMetadata;,(animate|set|animateMotion|animateColor|animateTransform
```

```
                  %geExt;%pathExt;)*) >
<!ATTLIST path
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-Graphics;
  %PresentationAttributes-Markers;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;
  d %PathData; #REQUIRED
  pathLength %Number; #IMPLIED >


<!-- ============================================================
     DEFINITIONS CORRESPONDING TO: Basic Shapes
     ============================================================ -->

<!ENTITY % rectExt "" >
<!ELEMENT rect (%descTitleMetadata;,(animate|set|animateMotion|animateColor|animateTransform
                %geExt;%rectExt;)*) >
<!ATTLIST rect
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-Graphics;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;
  x %Coordinate; #IMPLIED
  y %Coordinate; #IMPLIED
  width %Length; #REQUIRED
  height %Length; #REQUIRED
  rx %Length; #IMPLIED
  ry %Length; #IMPLIED >

<!ENTITY % circleExt "" >
<!ELEMENT circle (%descTitleMetadata;,(animate|set|animateMotion|animateColor|animateTransform
                %geExt;%circleExt;)*) >
<!ATTLIST circle
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-Graphics;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;
  cx %Coordinate; #IMPLIED
  cy %Coordinate; #IMPLIED
  r %Length; #REQUIRED >

<!ENTITY % ellipseExt "" >
<!ELEMENT ellipse (%descTitleMetadata;,(animate|set|animateMotion|animateColor|animateTransform
                %geExt;%ellipseExt;)*) >
```

```
<!ATTLIST ellipse
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-Graphics;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;
  cx %Coordinate; #IMPLIED
  cy %Coordinate; #IMPLIED
  rx %Length; #REQUIRED
  ry %Length; #REQUIRED >

<!ENTITY % lineExt "" >
<!ELEMENT line (%descTitleMetadata;,(animate|set|animateMotion|animateColor|animateTransform
                %geExt;%lineExt;)*) >
<!ATTLIST line
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-Graphics;
  %PresentationAttributes-Markers;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;
  x1 %Coordinate; #IMPLIED
  y1 %Coordinate; #IMPLIED
  x2 %Coordinate; #IMPLIED
  y2 %Coordinate; #IMPLIED >

<!ENTITY % polylineExt "" >
<!ELEMENT polyline (%descTitleMetadata;,(animate|set|animateMotion|animateColor|animateTransform
                %geExt;%polylineExt;)*) >
<!ATTLIST polyline
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-Graphics;
  %PresentationAttributes-Markers;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;
  points %Points; #REQUIRED >

<!ENTITY % polygonExt "" >
<!ELEMENT polygon (%descTitleMetadata;,(animate|set|animateMotion|animateColor|animateTransform
                %geExt;%polygonExt;)*) >
<!ATTLIST polygon
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
```

```
   style %StyleSheet; #IMPLIED
   %PresentationAttributes-FillStroke;
   %PresentationAttributes-Graphics;
   %PresentationAttributes-Markers;
   transform %TransformList; #IMPLIED
   %graphicsElementEvents;
   points %Points; #REQUIRED >


<!-- ================================================================
     DEFINITIONS CORRESPONDING TO: Text
     ================================================================ -->

<!ENTITY % textExt "" >
<!ELEMENT text (#PCDATA|desc|title|metadata|
                tspan|tref|textPath|altGlyph|a|animate|set|
                animateMotion|animateColor|animateTransform
                %geExt;%textExt;)* >
<!ATTLIST text
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-FontSelection;
  %PresentationAttributes-Graphics;
  %PresentationAttributes-TextContentElements;
  %PresentationAttributes-TextElements;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;
  x %Coordinate; #IMPLIED
  y %Coordinate; #IMPLIED
  textLength %Length; #IMPLIED
  lengthAdjust (spacing|spacingAndGlyphs) #IMPLIED >

<!ENTITY % tspanExt "" >
<!ELEMENT tspan (#PCDATA|desc|title|metadata|tspan|tref|altGlyph|a|animate|set|animateColor
                %tspanExt;)* >
<!ATTLIST tspan
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-FontSelection;
  %PresentationAttributes-Graphics;
  %PresentationAttributes-TextContentElements;
  %graphicsElementEvents;
  x %Coordinates; #IMPLIED
  y %Coordinates; #IMPLIED
  dx %Lengths; #IMPLIED
  dy %Lengths; #IMPLIED
  rotate CDATA #IMPLIED
  textLength %Length; #IMPLIED
  lengthAdjust (spacing|spacingAndGlyphs) #IMPLIED >

<!ENTITY % trefExt "" >
<!ELEMENT tref (desc|title|metadata|animate|set|animateColor
```

```
                    %trefExt;)* >
<!ATTLIST tref
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #REQUIRED
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-FontSelection;
  %PresentationAttributes-Graphics;
  %PresentationAttributes-TextContentElements;
  %graphicsElementEvents;
  x %Coordinates; #IMPLIED
  y %Coordinates; #IMPLIED
  dx %Lengths; #IMPLIED
  dy %Lengths; #IMPLIED
  rotate CDATA #IMPLIED
  textLength %Length; #IMPLIED
  lengthAdjust (spacing|spacingAndGlyphs) #IMPLIED >

<!ENTITY % glyphRunExt "" >
<!ELEMENT glyphRun (#PCDATA|desc|title|metadata|altGlyph|a|animate|set|animateColor
                    %glyphRunExt;)* >
<!ATTLIST glyphRun
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-FontSelection;
  %PresentationAttributes-Graphics;
  %PresentationAttributes-TextContentElements;
  %graphicsElementEvents;
  x %Coordinates; #IMPLIED
  y %Coordinates; #IMPLIED
  dx %Lengths; #IMPLIED
  dy %Lengths; #IMPLIED
  rotate CDATA #IMPLIED
  glyphOrder CDATA #IMPLIED
  textLength %Length; #IMPLIED
  lengthAdjust (spacing|spacingAndGlyphs) #IMPLIED >

<!ENTITY % textPathExt "" >
<!ELEMENT textPath (#PCDATA|desc|title|metadata|tspan|tref|altGlyph|a|animate|set|animateColor
                    %textPathExt;)* >
<!ATTLIST textPath
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #REQUIRED
  %langSpaceAttrs;
  %testAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-FontSelection;
  %PresentationAttributes-Graphics;
```

```
    %PresentationAttributes-TextContentElements;
    %graphicsElementEvents;
    startOffset CDATA #IMPLIED
    textLength %Length; #IMPLIED
    lengthAdjust (spacing|spacingAndGlyphs) #IMPLIED
    method (align|stretch) #IMPLIED
    spacing (auto|exact) #IMPLIED >

<!ENTITY % altGlyphExt "" >
<!ELEMENT altGlyph (#PCDATA %altGlyphExt;)* >
<!ATTLIST altGlyph
    %stdAttrs;
    %xlinkRefAttrs;
    xlink:href %URI; #REQUIRED
    %testAttrs;
    %langSpaceAttrs;
    externalResourcesRequired %Boolean; #IMPLIED >

<!ENTITY % altGlyphDefExt "" >
<!ELEMENT altGlyphDef ((atlGlyphItem+|glyphRef+) %altGlyphDefExt;) >
<!ATTLIST altGlyphDef
    %stdAttrs; >

<!ENTITY % altGlyphItemExt "" >
<!ELEMENT altGlyphItem (glyphRef+ %altGlyphItemExt;) >
<!ATTLIST altGlyphItem
    %stdAttrs; >

<!ELEMENT glyphRef EMPTY >
<!ATTLIST glyphRef
    %stdAttrs;
    %xlinkRefAttrs;
    xlink:href %URI; #REQUIRED
    class %ClassList; #IMPLIED
    style %StyleSheet; #IMPLIED
    %PresentationAttributes-FontSelection;
    glyphRef CDATA #REQUIRED
    format CDATA #REQUIRED >


<!-- =============================================================
     DEFINITIONS CORRESPONDING TO: Painting: Filling, Stroking and Marker Symbols
     ============================================================= -->

<!ENTITY % markerExt "" >
<!ELEMENT marker (desc|title|metadata|defs|
                  path|text|rect|circle|ellipse|line|polyline|polygon|
                  use|image|svg|g|view|switch|a|altGlyphDef|
                  script|style|symbol|marker|clipPath|mask|
                  linearGradient|radialGradient|pattern|filter|cursor|font|
                  animate|set|animateMotion|animateColor|animateTransform|
                  color-profile|font-face
                  %ceExt;%markerExt;)* >
<!ATTLIST marker
    %stdAttrs;
    %langSpaceAttrs;
    externalResourcesRequired %Boolean; #IMPLIED
    class %ClassList; #IMPLIED
    style %StyleSheet; #IMPLIED
    %PresentationAttributes-All;
    viewBox %ViewBoxSpec; #IMPLIED
    preserveAspectRatio %PreserveAspectRatioSpec; 'xMidYMid meet'
    refX %Coordinate; #IMPLIED
```

```
  refY %Coordinate; #IMPLIED
  markerUnits (strokeWidth | userSpaceOnUse | userSpace) #IMPLIED
  markerWidth  %Length; #IMPLIED
  markerHeight %Length; #IMPLIED
  orient CDATA #IMPLIED >


<!-- ==============================================================
     DEFINITIONS CORRESPONDING TO: Color
     ============================================================== -->

<!ELEMENT color-profile (%descTitleMetadata;,color-profile-src) >
<!ATTLIST color-profile
  %stdAttrs;
  name CDATA #REQUIRED
  rendering-intent (auto | perceptual | relative-colorimetric | saturation | absolute-colorimetric)
"auto" >

<!ELEMENT color-profile-src EMPTY >
<!ATTLIST color-profile-src
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #REQUIRED >


<!-- ==============================================================
     DEFINITIONS CORRESPONDING TO: Gradients and Patterns
     ============================================================== -->
<!ENTITY % linearGradientExt "" >
<!ELEMENT linearGradient (%descTitleMetadata;,(stop|animate|set|animateTransform
                %linearGradientExt;)*) >
<!ATTLIST linearGradient
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #IMPLIED
  externalResourcesRequired %Boolean; #IMPLIED
  gradientUnits (userSpaceOnUse | userSpace | objectBoundingBox) #IMPLIED
  gradientTransform %TransformList; #IMPLIED
  x1 %Coordinate; #IMPLIED
  y1 %Coordinate; #IMPLIED
  x2 %Coordinate; #IMPLIED
  y2 %Coordinate; #IMPLIED
  spreadMethod (pad | reflect | repeat) "pad" >


<!ENTITY % radialGradientExt "" >
<!ELEMENT radialGradient (%descTitleMetadata;,(stop|animate|set|animateTransform
                %radialGradientExt;)*) >
<!ATTLIST radialGradient
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #IMPLIED
  externalResourcesRequired %Boolean; #IMPLIED
  gradientUnits (userSpaceOnUse | userSpace | objectBoundingBox) #IMPLIED
  gradientTransform %TransformList; #IMPLIED
  cx %Coordinate; #IMPLIED
  cy %Coordinate; #IMPLIED
  r %Length; #IMPLIED
  fx %Coordinate; #IMPLIED
  fy %Coordinate; #IMPLIED
  spreadMethod (pad | reflect | repeat) "pad" >
```

```
<!ENTITY % stopExt "" >
<!ELEMENT stop (animate|set|animateColor
                  %stopExt;)* >
<!ATTLIST stop
  %stdAttrs;
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-Gradients;
  offset %Length; #REQUIRED >

<!ENTITY % patternExt "" >
<!ELEMENT pattern (desc|title|metadata|defs|
                   path|text|rect|circle|ellipse|line|polyline|polygon|
                   use|image|svg|g|view|switch|a|altGlyphDef|
                   script|style|symbol|marker|clipPath|mask|
                   linearGradient|radialGradient|pattern|filter|cursor|font|
                   animate|set|animateMotion|animateColor|animateTransform|
                   color-profile|font-face
                   %ceExt;%patternExt;)* >
<!ATTLIST pattern
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #IMPLIED
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  viewBox %ViewBoxSpec; #IMPLIED
  preserveAspectRatio %PreserveAspectRatioSpec; 'xMidYMid meet'
  patternUnits (userSpaceOnUse | userSpace | objectBoundingBox) #IMPLIED
  patternTransform %TransformList; #IMPLIED
  x %Coordinate; #IMPLIED
  y %Coordinate; #IMPLIED
  width %Length; #REQUIRED
  height %Length; #REQUIRED >


<!-- ==============================================================
     DEFINITIONS CORRESPONDING TO: Clipping, Masking and Compositing
     ============================================================== -->

<!ENTITY % clipPathExt "" >
<!ELEMENT clipPath (%descTitleMetadata;,
                    (path|text|rect|circle|ellipse|line|polyline|polygon|
                     use|animate|set|animateMotion|animateColor|animateTransform
                    %ceExt;%clipPathExt;)*) >
<!ATTLIST clipPath
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-FillStroke;
  %PresentationAttributes-FontSelection;
  %PresentationAttributes-Graphics;
  %PresentationAttributes-TextContentElements;
  %PresentationAttributes-TextElements;
  transform %TransformList; #IMPLIED
```

```
            clipPathUnits (userSpaceOnUse | userSpace | objectBoundingBox) #IMPLIED >

<!ENTITY % maskExt "" >
<!ELEMENT mask (desc|title|metadata|defs|
                   path|text|rect|circle|ellipse|line|polyline|polygon|
                   use|image|svg|g|view|switch|a|altGlyphDef|
                   script|style|symbol|marker|clipPath|mask|
                   linearGradient|radialGradient|pattern|filter|cursor|font|
                   animate|set|animateMotion|animateColor|animateTransform|
                   color-profile|font-face
                   %ceExt;%maskExt;)*  >
<!ATTLIST mask
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  transform %TransformList; #IMPLIED
  maskUnits (userSpaceOnUse | userSpace | objectBoundingBox) #IMPLIED
  x %Coordinate; #IMPLIED
  y %Coordinate; #IMPLIED
  width %Length; #IMPLIED
  height %Length; #IMPLIED >


<!-- ================================================================
     DEFINITIONS CORRESPONDING TO: Filter Effects
     ================================================================ -->

<!ENTITY % filterExt "" >
<!ELEMENT filter (%descTitleMetadata;,(feBlend|feFlood|
  feColorMatrix|feComponentTransfer|
  feComposite|feConvolveMatrix|feDiffuseLighting|feDisplacementMap|
  feGaussianBlur|feImage|feMerge|
  feMorphology|feOffset|feSpecularLighting|
  feTile|feTurbulence|
  animate|set|
  %filterExt;)*) >
<!ATTLIST filter
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #IMPLIED
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  filterUnits (userSpaceOnUse | userSpace | objectBoundingBox) #IMPLIED
  primitiveUnits (userSpaceOnUse | userSpace | objectBoundingBox) #IMPLIED
  x %Coordinate; #IMPLIED
  y %Coordinate; #IMPLIED
  width %Length; #IMPLIED
  height %Length; #IMPLIED
  filterRes CDATA #IMPLIED >

<!ENTITY % filter_primitive_attributes
  "x %Coordinate; #IMPLIED
   y %Coordinate; #IMPLIED
   width %Length; #IMPLIED
   height %Length; #IMPLIED
```

```
    result CDATA #IMPLIED" >

<!ENTITY % filter_primitive_attributes_with_in
   "%filter_primitive_attributes;
    in CDATA #IMPLIED">

<!ELEMENT feDistantLight (animate|set)* >
<!ATTLIST feDistantLight
  %stdAttrs;
  azimuth %Number; #IMPLIED
  elevation %Number; #IMPLIED >

<!ELEMENT fePointLight (animate|set)* >
<!ATTLIST fePointLight
  %stdAttrs;
  x %Number; #IMPLIED
  y %Number; #IMPLIED
  z %Number; #IMPLIED >

<!ELEMENT feSpotLight (animate|set)* >
<!ATTLIST feSpotLight
  %stdAttrs;
  x %Number; #IMPLIED
  y %Number; #IMPLIED
  z %Number; #IMPLIED
  pointsAtX %Number; #IMPLIED
  pointsAtY %Number; #IMPLIED
  pointsAtZ %Number; #IMPLIED
  specularExponent %Number; #IMPLIED
  limitingConeAngle %Number; #IMPLIED >

<!ELEMENT feBlend (animate|set)* >
<!ATTLIST feBlend
  %stdAttrs;
  %filter_primitive_attributes_with_in;
  in2 CDATA #REQUIRED
  mode (normal | multiply | screen | darken | lighten) "normal" >

<!ELEMENT feColorMatrix (animate|set)* >
<!ATTLIST feColorMatrix
  %stdAttrs;
  %filter_primitive_attributes_with_in;
  type (matrix | saturate | hueRotate | luminanceToAlpha) "matrix"
  values CDATA #IMPLIED >

<!ELEMENT feComponentTransfer (feFuncR?,feFuncG?,feFuncB?,feFuncA?) >
<!ATTLIST feComponentTransfer
  %stdAttrs;
  %filter_primitive_attributes_with_in; >

<!ENTITY % component_transfer_function_attributes
   "type (identity | table | discrete | linear | gamma) #REQUIRED
    tableValues CDATA #IMPLIED
    slope %Number; #IMPLIED
    intercept %Number; #IMPLIED
    amplitude %Number; #IMPLIED
    exponent %Number; #IMPLIED
    offset %Number; #IMPLIED" >

<!ELEMENT feFuncR (animate|set)* >
<!ATTLIST feFuncR
  %stdAttrs;
```

```
  %component_transfer_function_attributes; >

<!ELEMENT feFuncG (animate|set)* >
<!ATTLIST feFuncG
  %stdAttrs;
  %component_transfer_function_attributes; >

<!ELEMENT feFuncB (animate|set)* >
<!ATTLIST feFuncB
  %stdAttrs;
  %component_transfer_function_attributes; >

<!ELEMENT feFuncA (animate|set)* >
<!ATTLIST feFuncA
  %stdAttrs;
  %component_transfer_function_attributes; >

<!ELEMENT feComposite (animate|set)* >
<!ATTLIST feComposite
  %stdAttrs;
  %filter_primitive_attributes_with_in;
  in2 CDATA #REQUIRED
  operator (over | in | out | atop | xor | arithmetic) "over"
  k1 %Number; #IMPLIED
  k2 %Number; #IMPLIED
  k3 %Number; #IMPLIED
  k4 %Number; #IMPLIED >

<!ELEMENT feConvolveMatrix (animate|set)* >
<!ATTLIST feConvolveMatrix
  %filter_primitive_attributes_with_in;
  order CDATA #REQUIRED
  kernelMatrix CDATA #REQUIRED
  divisor %Number; #IMPLIED
  bias %Number; #IMPLIED
  targetX %Integer; #IMPLIED
  targetY %Integer; #IMPLIED
  edgeMode (duplicate|wrap|none) "duplicate"
  kernelUnitLength CDATA #IMPLIED
  preserveAlpha %Boolean; #IMPLIED >

<!ELEMENT feDiffuseLighting ((feDistantLight|fePointLight|feSpotLight),(animate|set|animateColor)*)
>
<!ATTLIST feDiffuseLighting
  %stdAttrs;
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-LightingEffects;
  %filter_primitive_attributes_with_in;
  surfaceScale %Number; #IMPLIED
  diffuseConstant %Number; #IMPLIED >

<!ELEMENT feDisplacementMap (animate|set)* >
<!ATTLIST feDisplacementMap
  %stdAttrs;
  %filter_primitive_attributes_with_in;
  in2 CDATA #REQUIRED
  scale %Number; #IMPLIED
  xChannelSelector (R | G | B | A) "A"
  yChannelSelector (R | G | B | A) "A" >

<!ELEMENT feFlood (animate|set|animateColor)* >
```

```
<!ATTLIST feFlood
  %stdAttrs;
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-feFlood;
  %filter_primitive_attributes_with_in; >

<!ELEMENT feGaussianBlur (animate|set)* >
<!ATTLIST feGaussianBlur
  %stdAttrs;
  %filter_primitive_attributes_with_in;
  stdDeviation CDATA #IMPLIED >

<!ELEMENT feImage (animate|set|animateTransform)* >
<!ATTLIST feImage
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #REQUIRED
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  transform %TransformList; #IMPLIED
  %filter_primitive_attributes; >

<!ELEMENT feMerge (feMergeNode)* >
<!ATTLIST feMerge
  %stdAttrs;
  %filter_primitive_attributes; >

<!ELEMENT feMergeNode (animate|set)* >
<!ATTLIST feMergeNode
  %stdAttrs;
  in CDATA #IMPLIED >

<!ELEMENT feMorphology (animate|set)* >
<!ATTLIST feMorphology
  %stdAttrs;
  %filter_primitive_attributes_with_in;
  operator (erode | dilate) "erode"
  radius %Length; #IMPLIED >

<!ELEMENT feOffset (animate|set)* >
<!ATTLIST feOffset
  %stdAttrs;
  %filter_primitive_attributes_with_in;
  dx %Length; #IMPLIED
  dy %Length; #IMPLIED >

<!ELEMENT feSpecularLighting ((feDistantLight|fePointLight|feSpotLight),(animate|set|animateColor)*)
>
<!ATTLIST feSpecularLighting
  %stdAttrs;
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-LightingEffects;
  %filter_primitive_attributes_with_in;
  surfaceScale %Number; #IMPLIED
  specularConstant %Number; #IMPLIED
  specularExponent %Number; #IMPLIED >
```

```
<!ELEMENT feTile (animate|set)* >
<!ATTLIST feTile
  %stdAttrs;
  %filter_primitive_attributes_with_in; >

<!ELEMENT feTurbulence (animate|set)* >
<!ATTLIST feTurbulence
  %stdAttrs;
  %filter_primitive_attributes;
  baseFrequency CDATA #IMPLIED
  numOctaves %Integer; #IMPLIED
  seed %Number; #IMPLIED
  stitchTiles (stitch | noStitch) "noStitch"
  type (fractalNoise | turbulence) "turbulence" >


<!-- =============================================================
     DEFINITIONS CORRESPONDING TO: Interactivity
     ============================================================= -->

<!ELEMENT cursor (%descTitleMetadata;) >
<!ATTLIST cursor
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #REQUIRED
  %testAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  x %Coordinate; #IMPLIED
  y %Coordinate; #IMPLIED >


<!-- =============================================================
     DEFINITIONS CORRESPONDING TO: Linking
     ============================================================= -->

<!ENTITY % aExt "" >
<!ELEMENT a        (#PCDATA|desc|title|metadata|defs|
                   path|text|rect|circle|ellipse|line|polyline|polygon|
                   use|image|svg|g|view|switch|a|altGlyphDef|
                   script|style|symbol|marker|clipPath|mask|
                   linearGradient|radialGradient|pattern|filter|cursor|font|
                   animate|set|animateMotion|animateColor|animateTransform|
                   color-profile|font-face
                   %ceExt;%aExt;)* >
<!ATTLIST a
  %stdAttrs;
  xmlns:xlink CDATA #FIXED "http://www.w3.org/2000/xlink/namespace/"
  xlink:type (simple|extended|locator|arc) #FIXED "simple"
  xlink:role CDATA #IMPLIED
  xlink:title CDATA #IMPLIED
  xlink:show (new|embed|replace) 'replace'
  xlink:actuate (onRequest|onLoad) #FIXED 'onRequest'
  xlink:href %URI; #REQUIRED
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;
  target %LinkTarget; #IMPLIED >
```

```
<!ENTITY % viewExt "" >
<!ELEMENT view (%descTitleMetadata;%viewExt;) >
<!ATTLIST view
  %stdAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  viewBox %ViewBoxSpec; #IMPLIED
  preserveAspectRatio %PreserveAspectRatioSpec; 'xMidYMid meet'
  zoomAndPan (disable | magnify | zoom) 'magnify'
  viewTarget CDATA #IMPLIED >


<!-- ================================================================
     DEFINITIONS CORRESPONDING TO: Scripting
     ================================================================ -->

<!ELEMENT script (#PCDATA) >
<!ATTLIST script
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #IMPLIED
  externalResourcesRequired %Boolean; #IMPLIED
  type %ContentType; #REQUIRED >


<!-- ================================================================
     DEFINITIONS CORRESPONDING TO: Animation
     ================================================================ -->

<!ENTITY % animTargetAttrs
 "%xlinkRefAttrs;
  xlink:href %URI; #IMPLIED
  attributeName  CDATA  #REQUIRED
  attributeType  CDATA  #IMPLIED" >

<!ENTITY % animTimingAttrs
 "begin CDATA #IMPLIED
  dur CDATA #IMPLIED
  restart (always | never | whenNotActive) 'always'
  repeatCount CDATA #IMPLIED
  repeatDur CDATA #IMPLIED
  end CDATA #IMPLIED
  fill (remove | freeze) 'remove'" >

<!ENTITY % animValueAttrs
 "calcMode (discrete | linear | evenPace | spline) 'linear'
  values CDATA #IMPLIED
  from CDATA #IMPLIED
  to CDATA #IMPLIED
  by CDATA #IMPLIED
  keyTimes CDATA #IMPLIED
  keySplines CDATA #IMPLIED" >

<!ENTITY % animAdditionAttrs
 "additive       (replace | sum) 'replace'
  accumulate     (none | sum) 'none'" >

<!ENTITY % animateExt "" >
<!ELEMENT animate (%descTitleMetadata;%animateExt;) >
<!ATTLIST animate
  %stdAttrs;
  %testAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  %animTargetAttrs;
```

```
  %animTimingAttrs;
  %animValueAttrs;
  %animAdditionAttrs; >

<!ENTITY % setExt "" >
<!ELEMENT set (%descTitleMetadata;%setExt;) >
<!ATTLIST set
  %stdAttrs;
  %testAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  %animTargetAttrs;
  %animTimingAttrs;
  to CDATA #IMPLIED >

<!ENTITY % animateMotionExt "" >
<!ELEMENT animateMotion (%descTitleMetadata;,mpath? %animateMotionExt;) >
<!ATTLIST animateMotion
  %stdAttrs;
  %testAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  %xlinkRefAttrs;
  xlink:href %URI; #IMPLIED
  %animTimingAttrs;
  %animValueAttrs;
  %animAdditionAttrs;
  path CDATA #IMPLIED
  rotate CDATA #IMPLIED
  origin CDATA #IMPLIED >

<!ENTITY % mpathExt "" >
<!ELEMENT mpath (%descTitleMetadata;%mpathExt;) >
<!ATTLIST mpath
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #REQUIRED
  externalResourcesRequired %Boolean; #IMPLIED >

<!ENTITY % animateColorExt "" >
<!ELEMENT animateColor (%descTitleMetadata;%animateColorExt;) >
<!ATTLIST animateColor
  %stdAttrs;
  %testAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  %animTargetAttrs;
  %animTimingAttrs;
  %animValueAttrs;
  %animAdditionAttrs; >

<!ENTITY % animateTransformExt "" >
<!ELEMENT animateTransform (%descTitleMetadata;%animateTransformExt;) >
<!ATTLIST animateTransform
  %stdAttrs;
  %testAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  %animTargetAttrs;
  %animTimingAttrs;
  %animValueAttrs;
  %animAdditionAttrs;
  type (translate | scale | rotate | skewX | skewY) "translate" >


<!-- ============================================================ -->
```

```
      DEFINITIONS CORRESPONDING TO: Fonts
      ============================================================= -->

<!ENTITY % fontExt "" >
<!ELEMENT font (%descTitleMetadata;,font-face,
                 missing-glyph,(glyph|hkern|vkern %fontExt;)*) >
<!ATTLIST font
  %stdAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  horiz-origin-x %Number; #IMPLIED
  horiz-origin-y %Number; #IMPLIED
  horiz-adv-x %Number; #REQUIRED
  vert-origin-x %Number; #IMPLIED
  vert-origin-y %Number; #IMPLIED
  vert-adv-y %Number; #IMPLIED >


<!ENTITY % glyphExt "" >
<!ELEMENT glyph (desc|title|metadata|defs|
                 path|text|rect|circle|ellipse|line|polyline|polygon|
                 use|image|svg|g|view|switch|a|altGlyphDef|
                 script|style|symbol|marker|clipPath|mask|
                 linearGradient|radialGradient|pattern|filter|cursor|font|
                 animate|set|animateMotion|animateColor|animateTransform|
                 color-profile|font-face
                 %glyphExt;)* >
<!ATTLIST glyph
  %stdAttrs;
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  unicode CDATA #IMPLIED
  glyph-name CDATA #IMPLIED
  vert-text-orient CDATA #IMPLIED
  arabic CDATA #IMPLIED
  han CDATA #IMPLIED
  horiz-adv-x %Number; #IMPLIED
  vert-adv-y %Number; #IMPLIED >

<!ENTITY % missing-glyphExt "" >
<!ELEMENT missing-glyph (desc|title|metadata|defs|
                 path|text|rect|circle|ellipse|line|polyline|polygon|
                 use|image|svg|g|view|switch|a|altGlyphDef|
                 script|style|symbol|marker|clipPath|mask|
                 linearGradient|radialGradient|pattern|filter|cursor|font|
                 animate|set|animateMotion|animateColor|animateTransform|
                 color-profile|font-face
                 %missing-glyphExt;)* >
<!ATTLIST missing-glyph
  %stdAttrs;
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  horiz-adv-x %Number; #IMPLIED
  vert-adv-y %Number; #IMPLIED >

<!ELEMENT hkern EMPTY >
<!ATTLIST hkern
  %stdAttrs;
```

```
    u1 CDATA #IMPLIED
    g1 CDATA #IMPLIED
    u2 CDATA #IMPLIED
    g2 CDATA #IMPLIED
    k %Number; #REQUIRED >

<!ELEMENT vkern EMPTY >
<!ATTLIST vkern
    %stdAttrs;
    u1 CDATA #IMPLIED
    g1 CDATA #IMPLIED
    u2 CDATA #IMPLIED
    g2 CDATA #IMPLIED
    k %Number; #REQUIRED >

<!ELEMENT font-face (%descTitleMetadata;,font-face-src?,definition-src?) >
<!ATTLIST font-face
    %stdAttrs;
    font-family CDATA #IMPLIED
    font-style CDATA #IMPLIED
    font-variant CDATA #IMPLIED
    font-weight CDATA #IMPLIED
    font-stretch CDATA #IMPLIED
    font-size CDATA #IMPLIED
    unicode-range CDATA #IMPLIED
    units-per-em %Number; #IMPLIED
    panose-1 CDATA #IMPLIED
    stemv %Number; #IMPLIED
    stemh %Number; #IMPLIED
    slope %Number; #IMPLIED
    cap-height %Number; #IMPLIED
    x-height %Number; #IMPLIED
    accent-height %Number; #IMPLIED
    ascent %Number; #IMPLIED
    descent %Number; #IMPLIED
    widths CDATA #IMPLIED
    bbox CDATA #IMPLIED
    ideographic %Number; #IMPLIED
    baseline %Number; #IMPLIED
    centerline %Number; #IMPLIED
    mathline %Number; #IMPLIED
    hanging %Number; #IMPLIED
    topline %Number; #IMPLIED
    underline-position %Number; #IMPLIED
    underline-thickness %Number; #IMPLIED
    strikethrough-position %Number; #IMPLIED
    strikethrough-thickness %Number; #IMPLIED
    overline-position %Number; #IMPLIED
    overline-thickness %Number; #IMPLIED >

<!ELEMENT font-face-src (font-face-uri|font-face-name)+ >
<!ATTLIST font-face-src
    %stdAttrs; >

<!ELEMENT font-face-uri (font-face-format*) >
<!ATTLIST font-face-uri
    %stdAttrs;
    %xlinkRefAttrs;
    xlink:href %URI; #REQUIRED >

<!ELEMENT font-face-format EMPTY >
```

```
<!ATTLIST font-face-format
  %stdAttrs;
  string CDATA #IMPLIED >

<!ELEMENT font-face-name EMPTY >
<!ATTLIST font-face-name
  %stdAttrs;
  name CDATA #IMPLIED >

<!ELEMENT definition-src EMPTY >
<!ATTLIST definition-src
  %stdAttrs;
  %xlinkRefAttrs;
  xlink:href %URI; #REQUIRED >


<!-- ================================================================
     DEFINITIONS CORRESPONDING TO: Metadata
     ================================================================ -->

<!ENTITY % metadataExt "" >
<!ELEMENT metadata (#PCDATA %metadataExt;)* >
<!ATTLIST metadata
  %stdAttrs; >


<!-- ================================================================
     DEFINITIONS CORRESPONDING TO: Extensibility
     ================================================================ -->

<!ENTITY % foreignObjectExt "" >
<!ELEMENT foreignObject (#PCDATA %ceExt;%foreignObjectExt;)* >
<!ATTLIST foreignObject
  %stdAttrs;
  %testAttrs;
  %langSpaceAttrs;
  externalResourcesRequired %Boolean; #IMPLIED
  class %ClassList; #IMPLIED
  style %StyleSheet; #IMPLIED
  %PresentationAttributes-All;
  transform %TransformList; #IMPLIED
  %graphicsElementEvents;
  x %Coordinate; #IMPLIED
  y %Coordinate; #IMPLIED
  width %Length; #REQUIRED
  height %Length; #REQUIRED
  %StructuredText; >
```

Appendix B: SVG's Document Object Model (DOM)

Contents

This appendix is normative.

B.1 SVG DOM Overview

This appendix provides an introduction to the SVG DOM and discusses the relationship of the SVG DOM with the Document Object Model (DOM) Level 2 Specification [DOM2]. The specific SVG DOM interfaces that correspond to particular sections of the SVG specification are defined at the end of corresponding chapter in this specification, as follows:

- [Basic DOM interfaces](#)
- [Styling interfaces](#)
- [Document Structure interfaces](#)
- [Coordinate Systems, Transformations and Units interfaces](#)
- [Paths interfaces](#)
- [Basic Shapes interfaces](#)
- [Text interfaces](#)

- [Painting: Filling, Stroking and Marker Symbols interfaces](#)

- [Color interfaces](#)

- [Gradients and Patterns interfaces](#)

- [Clipping, Masking and Compositing interfaces](#)

- [Filter Effects interfaces](#)

- [Interactivity interfaces](#)

- [Linking interfaces](#)

- [Scripting interfaces](#)

- [Animation interfaces](#)

- [Fonts interfaces](#)

- [Metadata interfaces](#)

- [Extensibility interfaces](#)

The SVG DOM is compatible with the Document Object Model (DOM) Level 2 Specification [[DOM2](#)]. In particular:

- The SVG DOM includes complete support for the DOM2 core [[DOM2-CORE](#)]

- Wherever appropriate, the SVG DOM is modeled after and maintains consistency with the DOM for HTML as described in [[DOM2-HTML](#)].

- The SVG DOM includes complete support for the DOM2 views [[DOM2-VIEWS](#)]

- The SVG DOM incorporates relevant aspects of the DOM2 event model [[DOM2-EVENTS](#)]. (For the specific [[DOM2-EVENTS](#)] features that are supported, see [Relationship with DOM2 event model](#).)

- The optional traversal features described in [[DOM2-TRAV](#)] are also optional features within the SVG DOM.

- The range features described in [[DOM2-RANGE](#)] are supported by the SVG DOM.

- For implementations that support CSS, the SVG DOM includes complete support for the DOM2 stylesheets [[DOM2-SHEETS](#)] and it incorporates relevant aspects of the DOM2 CSS object model [[DOM2-CSS](#)]. (For the specific [[DOM2-CSS](#)] features that are supported, see [Relationship with DOM2 CSS object model](#).)

A DOM application can use the hasFeature method of the DOMImplementation interface to verify that the interfaces listed in this section are supported. The list of available interfaces is provided in section [Feature strings for the **hasFeature** method call](#).

B.2 Naming Conventions

The SVG DOM follows similar naming conventions to the Document Object Model HTML [[DOM2-HTML](#)].

All names are defined as one or more English words concatenated together to form a single string. Property or method names start with the initial keyword in lowercase, and each subsequent word starts with a capital letter. For example, a property that returns document meta information such as the date the file was created might be

named "fileDateCreated". In the ECMAScript binding, properties are exposed as properties of a given object. In Java, properties are exposed with get and set methods.

For attributes with the CDATA data type, the case of the return value is that given in the source document.

B.3 Interface SVGException

Exception *SVGException*

This exception is raised when a specific SVG operation is impossible to perform.

IDL Definition

```
exception SVGException {
  unsigned short   code;
};

// SVGExceptionCode
const unsigned short SVG_WRONG_TYPE_ERR          = 0;
const unsigned short SVG_INVALID_VALUE_ERR       = 1;
const unsigned short SVG_MATRIX_NOT_INVERTABLE   = 2;
```

B.4 Feature strings for the hasFeature method call

The feature strings that are available for the **hasFeature** method call that is part of the SVG DOM's support for the DOMImplementation interface defined in [DOM2-CORE] are the same features strings available for the requiredFeatures attribute that is available for many SVG elements.

The **version** number for the **hasFeature** method call is "1".

B.5 Relationship with DOM2 events

The SVG DOM supports the following interfaces and event types from [DOM2-EVENTS]:
- The SVG DOM supports all of the interfaces defined in [DOM2-EVENTS].
- The SVG DOM supports the following UI event types [DOM2-UIEVENTS]:
  - ❍ resize
  - ❍ scroll (triggered by either scroll or pan user actions)
  - ❍ focusin
  - ❍ focusout

- ❍ activate
- The SVG DOM supports the following mouse event types [DOM2-MOUSEEVENTS]:
  - ❍ click
  - ❍ mousedown
  - ❍ mouseup
  - ❍ mouseover
  - ❍ mousemove
  - ❍ mouseout

  clientX and *clientY* parameters for mouse events represent viewport coordinates for the corresponding 'svg' element. *relatedNode* is the corresponding outermost 'svg' element.
- The SVG DOM supports the following keyboard event types [DOM2-KEYEVENTS]:
  - ❍ keypress
  - ❍ keydown
  - ❍ keyup
- The SVG DOM supports the following mutation event types [DOM2-MUTEVENTS]:
  - ❍ DOMSubtreeModified
  - ❍ DOMNodeInserted
  - ❍ DOMNodeRemoved
  - ❍ DOMNodeRemovedFromDocument
  - ❍ DOMNodeInsertedIntoDocument
  - ❍ DOMAttrModified
  - ❍ DOMCharacterDataModified
- The SVG DOM defines the following SVG-specific custom event interfaces, which are compatible with the HTML event types [DOM2-HTMLEVENTS] defined in [DOM2-EVENTS]. These event interfaces are mandatory for SVG user agents:
  - ❍ load
  - ❍ unload
  - ❍ abort
  - ❍ error

  Additionally, the SVG DOM defines an additional custom event interface that is not available in the HTML DOM:
  - ❍ SVGZoomEvent
- Events can be triggered whenever there is a state change in an animation, such as animation start, animation end or animation repeat. See Interface TimeEvent.

Each SVG element which has at least one event attribute assigned to it in the SVG DTD supports the DOM2 event registration interfaces [DOM2-EVREG] and be registered as an event listener for the corresponding DOM2 event using the event registration interfaces. Thus, for example, if the SVG DTD indicates that a given element supports the "onclick" event attribute, then an event listener for the "click" event can be registered with the given element as the event target.

SVG's [animation elements](#) also support the DOM2 event registration interfaces [[DOM2-EVREG](#)]. Event listeners for an animation [Interface time event](#) such as animation start, animation end or animation repeat can be registered on any of the [animation elements](#).

Event listeners which are established by DOM2 Event registration interfaces [[DOM2-EVREG](#)] receive events before any event listeners that correspond to event attributes (see [Event attributes](#)) or [animations](#).

In Java, one way that event listeners can be established is to define a class which implements the EventListener interface, such as:

```
class MyAction1 implements EventListener {
  public void handleEvent(Event evt) {
    // process the event
  }
}
// ... later ...
MyAction1 mc1 = new MyAction1();
myElement.addEventListener("DOMActivate", mc1, false);
```

In ECMA Script, one way to establish an event listener is to define a function and pass the name of that function to the addEventListener method:

```
function myAction1(evt) {
  // process the event
}
// ... later ...
myElement.addEventListener("DOMActivate", myAction1, false)
```

In ECMA Script, the character data content of an [Event attribute](#) become the definition of the ECMA Script function which gets invoked in response to the event. As with all registered ECMA Script event listener functions, this function receives an Event object as a parameter, and the name of the Event object is **evt**. For example, it is possible to say:

```
<rect onactivate="MyActivateHandler(evt)" .../>
```

which will pass the Event object **evt** into function `MyActivateHandler`.

B.6 Relationship with DOM2 CSS object model (CSS OM)

B.6.1 Introduction

The section describes the facilities from the Document Object Model CSS [[DOM2-CSS](#)], the CSS OM, that are part of the SVG DOM.

B.6.2 User agents that do not support styling with CSS

User agents that do not support styling with CSS are only required to support the following interfaces from [DOM2-CSS]. These interfaces are used in conjunction with the getPresentationAttribute method call on interface SVGStylable. This method must be supported on all implementations of the SVG DOM:

- Interface RGBColor
- Interface CSSValue

B.6.3 User agents that support styling with CSS

User agents that support Styling with CSS, the SVG DOM, and aural styling [CSS2-AURAL] must support all of the interfaces defined in [DOM2-CSS] which apply to aural properties.

For visual media [CSS2-VISUAL], the SVG DOM supports all of the required interfaces defined in [DOM2-CSS]. All of the interfaces that are optional for [DOM2-CSS] are also optional for the SVG DOM.

B.6.4 Extended interfaces

Whether or not a user agent supports styling with CSS, a user agent still must support interface CSSValue, as this is the type that is returned from the getPresentationAttribute method call on interface SVGStylable.

[DOM2-CSS] defines a set of extended interfaces [DOM2-CSS-EI] for use in conjunction with interface CSSValue. The table below specifies the type of CSSValue [DOM2-CSSVALUE] used to represent each SVG property that applies to visual media [CSS2-VISUAL]. The expectation is that the CSSValue returned from the getPropertyCSSValue method on the CSSStyleDeclaration interface or the getPresentationAttribute method on the SVGStylable interface can be cast down, using binding-specific casting methods, to the specific derived interface.

For properties that are represented by a custom interface (the valueType of the CSSValue is CSS_CUSTOM), the name of the derived interface is specified in the table. For these properties, the table below indicates which extended interfaces are mandatory and which are not.

For properties that consist of lists of values (the valueType of the CSSValue is CSS_VALUE_LIST), the derived interface is CSSValueList. For all other properties (the valueType of the CSSValue is CSS_PRIMITIVE_VALUE), the derived interface is CSSPrimitiveValue.

For shorthand properties, a CSSValue always will have a value of null. Shorthand property values can only be accessed and modified as strings.

The SVG DOM defines the following SVG-specific custom property interfaces, all of which are mandatory for SVG user agents:

- SVGColor
- SVGICCColor
- SVGPaint

Property Name	Representation	(Extended interfaces only) Mandatory?
'baseline-identifier'	ident	
'baseline-shift'	`ident, length, percentage`	
'clip'	rect, ident	
'clip-path'	uri, ident	
'clip-rule'	ident	
'color'	rgbcolor, ident	
'color-interpolation'	ident	
'color-rendering'	ident	
'cursor'	[DOM2-CSS2Cursor]	no
'direction'	ident	
'display'	ident	
'dominant-baseline'	ident	
'enable-background'	ident	
'fill'	SVGPaint	yes
'fill-opacity'	number	
'fill-rule'	ident	
'filter'	uri, ident	
'flood-color'	SVGColor	yes
'flood-opacity'	number	
'font'	`null`	
'font-family'	list of strings and idents	
'font-size'	ident, length, percentage	
'font-size-adjust'	number, ident	
'font-stretch'	ident	
'font-style'	ident	
'font-variant'	ident	
'font-weight'	ident	
'glyph-orientation-horizontal'	ident	
'glyph-orientation-vertical'	ident	
'image-rendering'	ident	
'letter-spacing'	ident, length	
'lighting-color'	SVGColor	yes
'marker'	`null`	

['marker-end'](#)	uri, ident	
['marker-mid'](#)	uri, ident	
['marker-start'](#)	uri, ident	
['mask'](#)	uri, ident	
['opacity'](#)	number	
['overflow'](#)	ident	
['pointer-events'](#)	ident	
['shape-rendering'](#)	ident	
['stop-color'](#)	[SVGColor](#)	yes
['stop-opacity'](#)	number	
['stroke'](#)	[SVGPaint](#)	yes
['stroke-dasharray'](#)	ident or list of lengths	
['stroke-dashoffset'](#)	length	
['stroke-linecap'](#)	ident	
['stroke-linejoin'](#)	ident	
['stroke-miterlimit'](#)	length	
['stroke-opacity'](#)	number	
['stroke-width'](#)	length	
['text-anchor'](#)	ident	
['text-decoration'](#)	list of ident	
['text-rendering'](#)	ident	
['unicode-bidi'](#)	ident	
['visibility'](#)	ident	
['word-spacing'](#)	length, ident	
['writing-mode'](#)	ident	

B.7 Invalid values

If a script sets a DOM attribute to an invalid value (e.g., a negative number for an attribute that requires a non-negative number or an out-of-range value for an enumeration), unless this specification indicates otherwise, no exception shall be raised on setting, but the given document fragment shall become technically in error as described in [Error processing](#).

Appendix C. IDL Definitions

This appendix contains the complete OMG IDL for the SVG Document Object Model definitions.

The IDL files are also available as: http://www.w3.org/TR/2000/???/idl.zip

```
// File: svg.idl
#ifndef _SVG_IDL_
#define _SVG_IDL_


// For access to DOM2 core
#include "dom.idl"

// For access to DOM2 events
#include "events.idl"

// For access to those parts from DOM2 CSS OM used by SVG DOM.
#include "css.idl"


#pragma prefix "dom.w3c.org"
#pragma javaPackage "org.w3c.dom"
module svg
{
  typedef dom::DOMString DOMString;
  typedef dom::DOMException DOMException;
  typedef dom::Element Element;
  typedef dom::Document Document;
  typedef dom::NodeList NodeList;

  // Predeclarations
  interface SVGElement;
  interface SVGList;
  interface SVGLangSpace;
  interface SVGExternalResourcesRequired;
  interface SVGTests;
  interface SVGFitToViewBox;
  interface SVGZoomAndPan;
  interface SVGViewSpec;
  interface SVGURIReference;
  interface SVGPoint;
  interface SVGMatrix;
  interface SVGPreserveAspectRatio;
  interface SVGAnimatedPreserveAspectRatio;
  interface SVGTransformList;
  interface SVGAnimatedTransformList;
  interface SVGTransform;
  interface SVGICCColor;
  interface SVGColor;
  interface SVGPaint;
  interface SVGTransformable;
  interface SVGDocument;
  interface SVGSVGElement;
  interface SVGElementInstance;
  interface SVGElementInstanceList;


  exception SVGException {
    unsigned short   code;
  };

  // SVGExceptionCode
  const unsigned short SVG_WRONG_TYPE_ERR          = 0;
```

```
const unsigned short SVG_INVALID_VALUE_ERR        = 1;
const unsigned short SVG_MATRIX_NOT_INVERTABLE    = 2;

interface SVGElement : Element {
          attribute DOMString id;
                      // raises DOMException on setting
  readonly attribute SVGSVGElement ownerSVGElement;
  readonly attribute SVGElement viewportElement;
};

interface SVGList {

  readonly attribute unsigned long numberOfItems;

  void    clear (  )
                  raises( DOMException );
  Object initialize ( in Object newItem )
                  raises( DOMException, SVGException );
  Object createItem (  );
  Object getItem ( in unsigned long index )
                  raises( DOMException );
  Object insertItemBefore ( in Object newItem, in unsigned long index )
                  raises( DOMException, SVGException );
  Object replaceItem ( in Object newItem, in unsigned long index )
                  raises( DOMException, SVGException );
  Object removeItem ( in unsigned long index )
                  raises( DOMException );
  Object appendItem ( in Object newItem )
                  raises( DOMException, SVGException );
};

interface SVGLengthList : SVGList {};

interface SVGAnimatedLengthList {

          attribute SVGLengthList baseVal;
                      // raises DOMException on setting
  readonly attribute SVGLengthList animVal;
};

interface SVGAnimatedString {

          attribute DOMString baseVal;
                      // raises DOMException on setting
  readonly attribute DOMString animVal;
};

interface SVGAnimatedBoolean {

          attribute boolean baseVal;
                      // raises DOMException on setting
  readonly attribute boolean animVal;
};

interface SVGAnimatedEnumeration {

          attribute unsigned short baseVal;
                      // raises DOMException on setting
  readonly attribute unsigned short animVal;
};

interface SVGAngle {

  // Angle Unit Types
  const unsigned short SVG_ANGLETYPE_UNKNOWN     = 0;
  const unsigned short SVG_ANGLETYPE_UNSPECIFIED = 1;
  const unsigned short SVG_ANGLETYPE_DEG         = 2;
  const unsigned short SVG_ANGLETYPE_RAD         = 3;
  const unsigned short SVG_ANGLETYPE_GRAD        = 4;
```

```
  readonly attribute unsigned short unitType;
          attribute float           value;
                    // raises DOMException on setting
          attribute float           valueInSpecifiedUnits;
                    // raises DOMException on setting
          attribute DOMString       valueAsString;
                    // raises DOMException on setting

  void newValueSpecifiedUnits ( in unsigned short unitType, in float valueInSpecifiedUnits );
  void convertToSpecifiedUnits ( in unsigned short unitType );
};

interface SVGAnimatedAngle {

          attribute SVGAngle baseVal;
                    // raises DOMException on setting
  readonly attribute SVGAngle animVal;
};

interface SVGColor {

  // Color Types
  const unsigned short SVG_COLORTYPE_UNKNOWN          = 0;
  const unsigned short SVG_COLORTYPE_RGBCOLOR         = 1;
  const unsigned short SVG_COLORTYPE_RGBCOLOR_ICCCOLOR = 2;

  readonly attribute unsigned short colorType;
  readonly attribute css::RGBColor        rgbColor;
  readonly attribute SVGICCColor    iccColor;

  void        setRGBColor ( in css::RGBColor rgbColor );
  void        setRGBColorICCColor ( in css::RGBColor rgbColor, in SVGICCColor iccColor );
  css::RGBColor    createRGBColor (  );
  SVGICCColor createSVGICCColor (  );
};

interface SVGICCColor {

          attribute DOMString colorProfile;
                    // raises DOMException on setting
  readonly attribute SVGList   colors;
};

interface SVGAnimatedInteger {

          attribute long baseVal;
                    // raises DOMException on setting
  readonly attribute long animVal;
};

interface SVGLength {

  // Length Unit Types
  const unsigned short SVG_LENGTHTYPE_UNKNOWN    = 0;
  const unsigned short SVG_LENGTHTYPE_NUMBER     = 1;
  const unsigned short SVG_LENGTHTYPE_PERCENTAGE = 2;
  const unsigned short SVG_LENGTHTYPE_EMS        = 3;
  const unsigned short SVG_LENGTHTYPE_EXS        = 4;
  const unsigned short SVG_LENGTHTYPE_PX         = 5;
  const unsigned short SVG_LENGTHTYPE_CM         = 6;
  const unsigned short SVG_LENGTHTYPE_MM         = 7;
  const unsigned short SVG_LENGTHTYPE_IN         = 8;
  const unsigned short SVG_LENGTHTYPE_PT         = 9;
  const unsigned short SVG_LENGTHTYPE_PC         = 10;

  readonly attribute unsigned short unitType;
          attribute float           value;
                    // raises DOMException on setting
```

```
        attribute float          valueInSpecifiedUnits;
                // raises DOMException on setting
        attribute DOMString      valueAsString;
                // raises DOMException on setting

  void newValueSpecifiedUnits ( in unsigned short unitType, in float valueInSpecifiedUnits );
  void convertToSpecifiedUnits ( in unsigned short unitType );
};

interface SVGAnimatedLength {

        attribute SVGLength baseVal;
                // raises DOMException on setting
  readonly attribute SVGLength animVal;
};

interface SVGAnimatedNumber {

        attribute float baseVal;
                // raises DOMException on setting
  readonly attribute float animVal;
};

interface SVGNumberList : SVGList {};

interface SVGAnimatedNumberList {

        attribute SVGNumberList baseVal;
                // raises DOMException on setting
  readonly attribute SVGNumberList animVal;
};

interface SVGRect {

        attribute float x;
                // raises DOMException on setting
        attribute float y;
                // raises DOMException on setting
        attribute float width;
                // raises DOMException on setting
        attribute float height;
                // raises DOMException on setting
};

interface SVGAnimatedRect {

        attribute SVGRect baseVal;
                // raises DOMException on setting
  readonly attribute SVGRect animVal;
};

interface SVGUnitTypes {

  // Unit Types
  const unsigned short SVG_UNIT_TYPE_UNKNOWN          = 0;
  const unsigned short SVG_UNIT_TYPE_USERSPACEONUSE   = 1;
  const unsigned short SVG_UNIT_TYPE_USERSPACE        = 2;
  const unsigned short SVG_UNIT_TYPE_OBJECTBOUNDINGBOX = 3;
};

interface SVGStylable {

        attribute SVGAnimatedString className;
                // raises DOMException on setting
  readonly attribute css::CSSStyleDeclaration style;

  css::CSSValue getPresentationAttribute ( in DOMString name );
  css::CSSValue getAnimatedPresentationAttribute ( in DOMString name );
};
```

```
interface SVGTransformable {

  readonly attribute SVGElement                    nearestViewportElement;
  readonly attribute SVGElement                    farthestViewportElement;
          attribute SVGAnimatedTransformList transform;
                      // raises DOMException on setting

  SVGRect   getBBox (  );
  SVGMatrix getCTM (  );
  SVGMatrix getScreenCTM (  );
  SVGMatrix getTransformToElement ( in SVGElement element )
                  raises( SVGException );
};

interface SVGTests {

          attribute SVGList requiredFeatures;
                      // raises DOMException on setting
          attribute SVGList requiredExtensions;
                      // raises DOMException on setting
          attribute SVGList systemLanguage;
                      // raises DOMException on setting

  boolean hasExtension ( in DOMString extension );
};

interface SVGLangSpace {

          attribute DOMString xmllang;
                      // raises DOMException on setting
          attribute DOMString xmlspace;
                      // raises DOMException on setting
};

interface SVGExternalResourcesRequired {

          attribute SVGAnimatedBoolean externalResourcesRequired;
                      // raises DOMException on setting
};

interface SVGFitToViewBox {

          attribute SVGAnimatedRect               viewBox;
                      // raises DOMException on setting
          attribute SVGAnimatedPreserveAspectRatio preserveAspectRatio;
                      // raises DOMException on setting
};

interface SVGZoomAndPan {

  // Zoom and Pan Types
  const unsigned short SVG_ZOOMANDPAN_UNKNOWN   = 0;
  const unsigned short SVG_ZOOMANDPAN_DISABLE = 1;
  const unsigned short SVG_ZOOMANDPAN_MAGNIFY = 2;
  const unsigned short SVG_ZOOMANDPAN_ZOOM    = 3;

          attribute unsigned short zoomAndPan;
                      // raises DOMException on setting
};

interface SVGViewSpec :
              SVGZoomAndPan,
              SVGFitToViewBox {

          attribute SVGTransformList transform;
                      // raises DOMException on setting
          attribute SVGElement       viewTarget;
                      // raises DOMException on setting
```

```
  readonly attribute DOMString          viewBoxString;
  readonly attribute DOMString          preserveAspectRatioString;
  readonly attribute DOMString          transformString;
  readonly attribute DOMString          viewTargetString;
};

interface SVGURIReference {

          attribute DOMString xlinkType;
                    // raises DOMException on setting
          attribute DOMString xlinkRole;
                    // raises DOMException on setting
          attribute DOMString xlinkTitle;
                    // raises DOMException on setting
          attribute DOMString xlinkShow;
                    // raises DOMException on setting
          attribute DOMString xlinkActuate;
                    // raises DOMException on setting
          attribute SVGAnimatedString href;
                    // raises DOMException on setting
};

interface SVGCSSRule : css::CSSRule {
  // Additional CSS RuleType to support ICC color specifications
  const unsigned short COLOR_PROFILE_RULE = 7;
};

interface SVGRenderingIntent {

  // Rendering Intent Types
  const unsigned short RENDERING_INTENT_UNKNOWN               = 0;
  const unsigned short RENDERING_INTENT_AUTO                  = 1;
  const unsigned short RENDERING_INTENT_PERCEPTUAL            = 2;
  const unsigned short RENDERING_INTENT_RELATIVE_COLORIMETRIC = 3;
  const unsigned short RENDERING_INTENT_SATURATION            = 4;
  const unsigned short RENDERING_INTENT_ABSOLUTE_COLORIMETRIC = 5;
};

interface SVGDocument :
            Document,
            events::DocumentEvent {

          attribute DOMString    title;
                    // raises DOMException on setting
  readonly attribute DOMString     referrer;
  readonly attribute DOMString      domain;
  readonly attribute DOMString       URL;
  readonly attribute SVGSVGElement rootElement;
};

interface SVGSVGElement :
            SVGElement,
            SVGTests,
            SVGLangSpace,
            SVGExternalResourcesRequired,
            SVGStylable,
            SVGFitToViewBox,
            SVGZoomAndPan,
            events::EventTarget,
            events::DocumentEvent {

          attribute SVGAnimatedLength x;
                    // raises DOMException on setting
          attribute SVGAnimatedLength y;
                    // raises DOMException on setting
          attribute SVGAnimatedLength width;
                    // raises DOMException on setting
          attribute SVGAnimatedLength height;
                    // raises DOMException on setting
```

```
            attribute DOMString         contentScriptType;
                        // raises DOMException on setting
            attribute DOMString         contentStyleType;
                        // raises DOMException on setting
  readonly attribute SVGRect           viewport;
  readonly attribute float pixelUnitToMillimeterX;
  readonly attribute float pixelUnitToMillimeterY;
  readonly attribute float screenPixelToMillimeterX;
  readonly attribute float screenPixelToMillimeterY;
            attribute boolean useCurrentView;
                        // raises DOMException on setting
  readonly attribute SVGViewSpec currentView;
            attribute float currentScale;
                        // raises DOMException on setting
            attribute SVGPoint currentTranslate;
                        // raises DOMException on setting

  unsigned long suspendRedraw ( in unsigned long max_wait_milliseconds );
  void          unsuspendRedraw ( in unsigned long suspend_handle_id )
                  raises( DOMException );
  void          unsuspendRedrawAll (   );
  void          forceRedraw (   );
  void          pauseAnimations (   );
  void          unpauseAnimations (   );
  boolean       animationsPaused (   );
  float         getCurrentTime (   );
  void          setCurrentTime ( in float seconds );
  NodeList      getIntersectionList ( in SVGRect rect, in SVGElement referenceElement );
  NodeList      getEnclosureList ( in SVGRect rect, in SVGElement referenceElement );
  boolean       checkIntersection ( in SVGElement element, in SVGRect rect );
  boolean       checkEnclosure ( in SVGElement element, in SVGRect rect );
  void          deSelectAll (   );
  SVGLength           createSVGLength (   );
  SVGAngle            createSVGAngle (   );
  SVGPoint            createSVGPoint (   );
  SVGMatrix           createSVGMatrix (   );
  SVGRect             createSVGRect (   );
  SVGTransform        createSVGTransform (   );
  SVGTransform     createSVGTransformFromMatrix ( in SVGMatrix matrix );
  SVGICCColor            createSVGICCColor (   );
  SVGColor            createSVGColor (   );
  SVGPaint            createSVGPaint (   );
  Element        getElementById ( in DOMString elementId );
};

interface SVGGElement :
            SVGElement,
            SVGTests,
            SVGLangSpace,
            SVGExternalResourcesRequired,
            SVGStylable,
            SVGTransformable,
            events::EventTarget {};

interface SVGDefsElement :
            SVGElement,
            SVGTests,
            SVGLangSpace,
            SVGExternalResourcesRequired,
            SVGStylable,
            SVGTransformable,
            events::EventTarget {};

interface SVGDescElement :
            SVGElement,
            SVGLangSpace,
            SVGStylable {};

interface SVGTitleElement :
```

```
            SVGElement,
            SVGLangSpace,
            SVGStylable {};

interface SVGSymbolElement :
            SVGElement,
            SVGLangSpace,
            SVGExternalResourcesRequired,
            SVGStylable,
            SVGFitToViewBox,
            events::EventTarget {};

interface SVGUseElement :
            SVGElement,
            SVGURIReference,
            SVGTests,
            SVGLangSpace,
            SVGExternalResourcesRequired,
            SVGStylable,
            SVGTransformable,
            events::EventTarget {

        attribute SVGAnimatedLength   x;
                    // raises DOMException on setting
        attribute SVGAnimatedLength   y;
                    // raises DOMException on setting
        attribute SVGAnimatedLength   width;
                    // raises DOMException on setting
        attribute SVGAnimatedLength    height;
                    // raises DOMException on setting
  readonly attribute SVGElementInstance instanceRoot;
  readonly attribute SVGElementInstance animatedInstanceRoot;
};

interface SVGElementInstance : events::EventTarget {
  readonly attribute SVGElement correspondingElement;
  readonly attribute SVGUseElement correspondingUseElement;
  readonly attribute SVGElementInstance parentNode;
  readonly attribute SVGElementInstanceList childNodes;
  readonly attribute SVGElementInstance firstChild;
  readonly attribute SVGElementInstance lastChild;
  readonly attribute SVGElementInstance previousSibling;
  readonly attribute SVGElementInstance nextSibling;
};

interface SVGElementInstanceList {

  readonly attribute SVGElementInstance length;

  SVGElementInstance item ( in unsigned long index );
};

interface SVGImageElement :
            SVGElement,
            SVGURIReference,
            SVGTests,
            SVGLangSpace,
            SVGExternalResourcesRequired,
            SVGStylable,
            SVGTransformable,
            events::EventTarget {

        attribute SVGAnimatedLength x;
                    // raises DOMException on setting
        attribute SVGAnimatedLength y;
                    // raises DOMException on setting
        attribute SVGAnimatedLength width;
                    // raises DOMException on setting
        attribute SVGAnimatedLength height;
```

```
                                 // raises DOMException on setting
};

interface SVGSwitchElement :
              SVGElement,
              SVGTests,
              SVGLangSpace,
              SVGExternalResourcesRequired,
              SVGStylable,
              SVGTransformable,
              events::EventTarget {};

interface GetSVGDocument {

  SVGDocument getSVGDocument (  )
                  raises( DOMException );
};

interface SVGStyleElement : SVGElement {
            attribute DOMString xmlspace;
                        // raises DOMException on setting
            attribute DOMString type;
                        // raises DOMException on setting
            attribute DOMString media;
                        // raises DOMException on setting
            attribute DOMString title;
                        // raises DOMException on setting
};

interface SVGPoint {

            attribute float x;
                        // raises DOMException on setting
            attribute float y;
                        // raises DOMException on setting

  SVGPoint matrixTransform ( in SVGMatrix matrix );
};

interface SVGMatrix {

            attribute float a;
                        // raises DOMException on setting
            attribute float b;
                        // raises DOMException on setting
            attribute float c;
                        // raises DOMException on setting
            attribute float d;
                        // raises DOMException on setting
            attribute float e;
                        // raises DOMException on setting
            attribute float f;
                        // raises DOMException on setting

  SVGMatrix multiply ( in SVGMatrix secondMatrix );
  SVGMatrix inverse (  )
                  raises( SVGException );
  SVGMatrix translate ( in float x, in float y );
  SVGMatrix scale ( in float scaleFactor );
  SVGMatrix scaleNonUniform ( in float scaleFactorX, in float scaleFactorY );
  SVGMatrix rotate ( in float angle );
  SVGMatrix rotateFromVector ( in float x, in float y )
                  raises( SVGException );
  SVGMatrix flipX (  );
  SVGMatrix flipY (  );
  SVGMatrix skewX ( in float angle );
  SVGMatrix skewY ( in float angle );
};
```

```
interface SVGTransformList : SVGList {
  SVGTransform createSVGTransformFromMatrix ( in SVGMatrix matrix );
  SVGTransform consolidate (  );
};

interface SVGAnimatedTransformList {

          attribute SVGTransformList baseVal;
                    // raises DOMException on setting
  readonly attribute SVGTransformList animVal;
};

interface SVGTransform {

  // Transform Types
  const unsigned short SVG_TRANSFORM_UNKNOWN   = 0;
  const unsigned short SVG_TRANSFORM_MATRIX    = 1;
  const unsigned short SVG_TRANSFORM_TRANSLATE = 2;
  const unsigned short SVG_TRANSFORM_SCALE     = 3;
  const unsigned short SVG_TRANSFORM_ROTATE    = 4;
  const unsigned short SVG_TRANSFORM_SKEWX     = 5;
  const unsigned short SVG_TRANSFORM_SKEWY     = 6;

  readonly attribute unsigned short type;
  readonly attribute SVGMatrix matrix;
  readonly attribute float angle;

  void setMatrix ( in SVGMatrix matrix );
  void setTranslate ( in float tx, in float ty );
  void setScale ( in float sx, in float sy );
  void setRotate ( in float angle );
  void setSkewX ( in float angle );
  void setSkewY ( in float angle );
};

interface SVGPreserveAspectRatio {

  // Alignment Types
  const unsigned short SVG_PRESERVEASPECTRATIO_UNKNOWN   = 0;
  const unsigned short SVG_PRESERVEASPECTRATIO_NONE      = 1;
  const unsigned short SVG_PRESERVEASPECTRATIO_XMINYMIN = 2;
  const unsigned short SVG_PRESERVEASPECTRATIO_XMIDYMIN = 3;
  const unsigned short SVG_PRESERVEASPECTRATIO_XMAXYMIN = 4;
  const unsigned short SVG_PRESERVEASPECTRATIO_XMINYMID = 5;
  const unsigned short SVG_PRESERVEASPECTRATIO_XMIDYMID = 6;
  const unsigned short SVG_PRESERVEASPECTRATIO_XMAXYMID = 7;
  const unsigned short SVG_PRESERVEASPECTRATIO_XMINYMAX = 8;
  const unsigned short SVG_PRESERVEASPECTRATIO_XMIDYMAX = 9;
  const unsigned short SVG_PRESERVEASPECTRATIO_XMAXYMAX = 10;
  // Meet-or-slice Types
  const unsigned short SVG_MEETORSLICE_UNKNOWN   = 0;
  const unsigned short SVG_MEETORSLICE_MEET  = 1;
  const unsigned short SVG_MEETORSLICE_SLICE = 2;

          attribute unsigned short align;
                    // raises DOMException on setting
          attribute unsigned short meetOrSlice;
                    // raises DOMException on setting
};

interface SVGAnimatedPreserveAspectRatio {

          attribute SVGPreserveAspectRatio baseVal;
                    // raises DOMException on setting
  readonly attribute SVGPreserveAspectRatio animVal;
};

interface SVGPathSeg {
```

```
  // Path Segment Types
  const unsigned short PATHSEG_UNKNOWN                        = 0;
  const unsigned short PATHSEG_CLOSEPATH                      = 1;
  const unsigned short PATHSEG_MOVETO_ABS                     = 2;
  const unsigned short PATHSEG_MOVETO_REL                     = 3;
  const unsigned short PATHSEG_LINETO_ABS                     = 4;
  const unsigned short PATHSEG_LINETO_REL                     = 5;
  const unsigned short PATHSEG_CURVETO_CUBIC_ABS              = 6;
  const unsigned short PATHSEG_CURVETO_CUBIC_REL              = 7;
  const unsigned short PATHSEG_CURVETO_QUADRATIC_ABS          = 8;
  const unsigned short PATHSEG_CURVETO_QUADRATIC_REL          = 9;
  const unsigned short PATHSEG_ARC_ABS                        = 10;
  const unsigned short PATHSEG_ARC_REL                        = 11;
  const unsigned short PATHSEG_LINETO_HORIZONTAL_ABS          = 12;
  const unsigned short PATHSEG_LINETO_HORIZONTAL_REL          = 13;
  const unsigned short PATHSEG_LINETO_VERTICAL_ABS            = 14;
  const unsigned short PATHSEG_LINETO_VERTICAL_REL            = 15;
  const unsigned short PATHSEG_CURVETO_CUBIC_SMOOTH_ABS       = 16;
  const unsigned short PATHSEG_CURVETO_CUBIC_SMOOTH_REL       = 17;
  const unsigned short PATHSEG_CURVETO_QUADRATIC_SMOOTH_ABS   = 18;
  const unsigned short PATHSEG_CURVETO_QUADRATIC_SMOOTH_REL   = 19;

  readonly attribute unsigned short pathSegType;
  readonly attribute DOMString      pathSegTypeAsLetter;
};

interface SVGPathSegClosePath : SVGPathSeg {};

interface SVGPathSegMovetoAbs : SVGPathSeg {
        attribute float   x;
                  // raises DOMException on setting
        attribute float   y;
                  // raises DOMException on setting
};

interface SVGPathSegMovetoRel : SVGPathSeg {
        attribute float   x;
                  // raises DOMException on setting
        attribute float   y;
                  // raises DOMException on setting
};

interface SVGPathSegLinetoAbs : SVGPathSeg {
        attribute float   x;
                  // raises DOMException on setting
        attribute float   y;
                  // raises DOMException on setting
};

interface SVGPathSegLinetoRel : SVGPathSeg {
        attribute float   x;
                  // raises DOMException on setting
        attribute float   y;
                  // raises DOMException on setting
};

interface SVGPathSegCurvetoCubicAbs : SVGPathSeg {
        attribute float   x;
                  // raises DOMException on setting
        attribute float   y;
                  // raises DOMException on setting
        attribute float   x1;
                  // raises DOMException on setting
        attribute float   y1;
                  // raises DOMException on setting
        attribute float   x2;
                  // raises DOMException on setting
        attribute float   y2;
                  // raises DOMException on setting
```

```
};

interface SVGPathSegCurvetoCubicRel : SVGPathSeg {
        attribute float   x;
                   // raises DOMException on setting
        attribute float   y;
                   // raises DOMException on setting
        attribute float   x1;
                   // raises DOMException on setting
        attribute float   y1;
                   // raises DOMException on setting
        attribute float   x2;
                   // raises DOMException on setting
        attribute float   y2;
                   // raises DOMException on setting
};

interface SVGPathSegCurvetoQuadraticAbs : SVGPathSeg {
        attribute float   x;
                   // raises DOMException on setting
        attribute float   y;
                   // raises DOMException on setting
        attribute float   x1;
                   // raises DOMException on setting
        attribute float   y1;
                   // raises DOMException on setting
};

interface SVGPathSegCurvetoQuadraticRel : SVGPathSeg {
        attribute float   x;
                   // raises DOMException on setting
        attribute float   y;
                   // raises DOMException on setting
        attribute float   x1;
                   // raises DOMException on setting
        attribute float   y1;
                   // raises DOMException on setting
};

interface SVGPathSegArcAbs : SVGPathSeg {
        attribute float   x;
                   // raises DOMException on setting
        attribute float   y;
                   // raises DOMException on setting
        attribute float   r1;
                   // raises DOMException on setting
        attribute float   r2;
                   // raises DOMException on setting
        attribute float   angle;
                   // raises DOMException on setting
        attribute boolean largeArcFlag;
                   // raises DOMException on setting
        attribute boolean sweepFlag;
                   // raises DOMException on setting
};

interface SVGPathSegArcRel : SVGPathSeg {
        attribute float   x;
                   // raises DOMException on setting
        attribute float   y;
                   // raises DOMException on setting
        attribute float   r1;
                   // raises DOMException on setting
        attribute float   r2;
                   // raises DOMException on setting
        attribute float   angle;
                   // raises DOMException on setting
        attribute boolean largeArcFlag;
                   // raises DOMException on setting
```

```
            attribute boolean sweepFlag;
                        // raises DOMException on setting
};

interface SVGPathSegLinetoHorizontalAbs : SVGPathSeg {
            attribute float   x;
                        // raises DOMException on setting
};

interface SVGPathSegLinetoHorizontalRel : SVGPathSeg {
            attribute float   x;
                        // raises DOMException on setting
};

interface SVGPathSegLinetoVerticalAbs : SVGPathSeg {
            attribute float   y;
                        // raises DOMException on setting
};

interface SVGPathSegLinetoVerticalRel : SVGPathSeg {
            attribute float   y;
                        // raises DOMException on setting
};

interface SVGPathSegCurvetoCubicSmoothAbs : SVGPathSeg {
            attribute float   x;
                        // raises DOMException on setting
            attribute float   y;
                        // raises DOMException on setting
            attribute float   x2;
                        // raises DOMException on setting
            attribute float   y2;
                        // raises DOMException on setting
};

interface SVGPathSegCurvetoCubicSmoothRel : SVGPathSeg {
            attribute float   x;
                        // raises DOMException on setting
            attribute float   y;
                        // raises DOMException on setting
            attribute float   x2;
                        // raises DOMException on setting
            attribute float   y2;
                        // raises DOMException on setting
};

interface SVGPathSegCurvetoQuadraticSmoothAbs : SVGPathSeg {
            attribute float   x;
                        // raises DOMException on setting
            attribute float   y;
                        // raises DOMException on setting
};

interface SVGPathSegCurvetoQuadraticSmoothRel {

            attribute float   x;
                        // raises DOMException on setting
            attribute float   y;
                        // raises DOMException on setting
};

interface SVGAnimatedPathData : SVGPathSeg {
  readonly attribute SVGList   pathSegList;
  readonly attribute SVGList   normalizedPathSegList;
  readonly attribute SVGList   animatedPathSegList;
  readonly attribute SVGList   animatedNormalizedPathSegList;
};

interface SVGPathElement :
```

```
                SVGElement,
                SVGTests,
                SVGLangSpace,
                SVGExternalResourcesRequired,
                SVGStylable,
                SVGTransformable,
                events::EventTarget,
                SVGAnimatedPathData {

            attribute SVGAnimatedNumber pathLength;
                        // raises DOMException on setting

    float           getTotalLength (  );
    SVGPoint        getPointAtLength ( in float distance );
    unsigned long getPathSegAtLength ( in float distance );
    SVGPathSegClosePath    createSVGPathSegClosePath (  );
    SVGPathSegMovetoAbs    createSVGPathSegMovetoAbs ( in float x, in float y );
    SVGPathSegMovetoRel    createSVGPathSegMovetoRel ( in float x, in float y );
    SVGPathSegLinetoAbs    createSVGPathSegLinetoAbs ( in float x, in float y );
    SVGPathSegLinetoRel    createSVGPathSegLinetoRel ( in float x, in float y );
    SVGPathSegCurvetoCubicAbs    createSVGPathSegCurvetoCubicAbs ( in float x, in float y, in float
x1, in float y1, in float x2, in float y2 );
    SVGPathSegCurvetoCubicRel    createSVGPathSegCurvetoCubicRel ( in float x, in float y, in float
x1, in float y1, in float x2, in float y2 );
    SVGPathSegCurvetoQuadraticAbs    createSVGPathSegCurvetoQuadraticAbs ( in float x, in float y,
in float x1, in float y1 );
    SVGPathSegCurvetoQuadraticRel    createSVGPathSegCurvetoQuadraticRel ( in float x, in float y,
in float x1, in float y1 );
    SVGPathSegArcAbs    createSVGPathSegArcAbs ( in float x, in float y, in float r1, in float r2,
in float angle, in boolean largeArcFlag, in boolean sweepFlag );
    SVGPathSegArcRel    createSVGPathSegArcRel ( in float x, in float y, in float r1, in float r2,
in float angle, in boolean largeArcFlag, in boolean sweepFlag );
    SVGPathSegLinetoHorizontalAbs    createSVGPathSegLinetoHorizontalAbs ( in float x );
    SVGPathSegLinetoHorizontalRel    createSVGPathSegLinetoHorizontalRel ( in float x );
    SVGPathSegLinetoVerticalAbs    createSVGPathSegLinetoVerticalAbs ( in float y );
    SVGPathSegLinetoVerticalRel    createSVGPathSegLinetoVerticalRel ( in float y );
    SVGPathSegCurvetoCubicSmoothAbs    createSVGPathSegCurvetoCubicSmoothAbs ( in float x, in float
y, in float x2, in float y2 );
    SVGPathSegCurvetoCubicSmoothRel    createSVGPathSegCurvetoCubicSmoothRel ( in float x, in float
y, in float x2, in float y2 );
    SVGPathSegCurvetoQuadraticSmoothAbs    createSVGPathSegCurvetoQuadraticSmoothAbs ( in float x,
in float y );
    SVGPathSegCurvetoQuadraticSmoothRel    createSVGPathSegCurvetoQuadraticSmoothRel ( in float x,
in float y );
  };

  interface SVGRectElement :
                SVGElement,
                SVGTests,
                SVGLangSpace,
                SVGExternalResourcesRequired,
                SVGStylable,
                SVGTransformable,
                events::EventTarget {

            attribute SVGAnimatedLength x;
                        // raises DOMException on setting
            attribute SVGAnimatedLength y;
                        // raises DOMException on setting
            attribute SVGAnimatedLength width;
                        // raises DOMException on setting
            attribute SVGAnimatedLength height;
                        // raises DOMException on setting
            attribute SVGAnimatedLength rx;
                        // raises DOMException on setting
            attribute SVGAnimatedLength ry;
                        // raises DOMException on setting
  };
```

```
interface SVGCircleElement :
            SVGElement,
            SVGTests,
            SVGLangSpace,
            SVGExternalResourcesRequired,
            SVGStylable,
            SVGTransformable,
            events::EventTarget {

        attribute SVGAnimatedLength cx;
                    // raises DOMException on setting
        attribute SVGAnimatedLength cy;
                    // raises DOMException on setting
        attribute SVGAnimatedLength r;
                    // raises DOMException on setting
};

interface SVGEllipseElement :
            SVGElement,
            SVGTests,
            SVGLangSpace,
            SVGExternalResourcesRequired,
            SVGStylable,
            SVGTransformable,
            events::EventTarget {

        attribute SVGAnimatedLength cx;
                    // raises DOMException on setting
        attribute SVGAnimatedLength cy;
                    // raises DOMException on setting
        attribute SVGAnimatedLength rx;
                    // raises DOMException on setting
        attribute SVGAnimatedLength ry;
                    // raises DOMException on setting
};

interface SVGLineElement :
            SVGElement,
            SVGTests,
            SVGLangSpace,
            SVGExternalResourcesRequired,
            SVGStylable,
            SVGTransformable,
            events::EventTarget {

        attribute SVGAnimatedLength x1;
                    // raises DOMException on setting
        attribute SVGAnimatedLength y1;
                    // raises DOMException on setting
        attribute SVGAnimatedLength x2;
                    // raises DOMException on setting
        attribute SVGAnimatedLength y2;
                    // raises DOMException on setting
};

interface SVGAnimatedPoints {

  readonly attribute SVGList   points;
  readonly attribute SVGList   animatedPoints;
};

interface SVGPolylineElement :
            SVGElement,
            SVGTests,
            SVGLangSpace,
            SVGExternalResourcesRequired,
            SVGStylable,
            SVGTransformable,
            events::EventTarget,
```

```
                SVGAnimatedPoints {};

interface SVGPolygonElement :
                SVGElement,
                SVGTests,
                SVGLangSpace,
                SVGExternalResourcesRequired,
                SVGStylable,
                SVGTransformable,
                events::EventTarget,
                SVGAnimatedPoints {};

interface SVGTextContentElement :
                SVGElement,
                SVGTests,
                SVGLangSpace,
                SVGExternalResourcesRequired,
                SVGStylable,
                events::EventTarget {

  // lengthAdjust Types
  const unsigned short LENGTHADJUST_UNKNOWN   = 0;
  const unsigned short LENGTHADJUST_SPACING     = 1;
  const unsigned short LENGTHADJUST_SPACINGANDGLYPHS     = 2;

            attribute SVGAnimatedLength       textLength;
                      // raises DOMException on setting
            attribute SVGAnimatedEnumeration lengthAdjust;
                      // raises DOMException on setting

  long      getNumberOfChars (   );
  float     getComputedTextLength (   );
  float     getSubStringLength ( in unsigned long charnum, in unsigned long nchars )
                  raises( DOMException );
  SVGPoint getStartPositionOfChar ( in unsigned long charnum )
                  raises( DOMException );
  SVGPoint getEndPositionOfChar ( in unsigned long charnum )
                  raises( DOMException );
  SVGRect   getExtentOfChar ( in unsigned long charnum )
                  raises( DOMException );
  float     getRotationOfChar ( in unsigned long charnum )
                  raises( DOMException );
  long      getCharNumAtPosition ( in SVGPoint point );
  void      selectSubString ( in unsigned long charnum, in unsigned long nchars )
                  raises( DOMException );
};

interface SVGTextElement :
                SVGTextContentElement,
                SVGTransformable {

            attribute SVGAnimatedLength x;
                      // raises DOMException on setting
            attribute SVGAnimatedLength y;
                      // raises DOMException on setting
};

interface SVGTextRotate {

  // rotate types
  const unsigned short ROTATE_UNKNOWN = 0;
  const unsigned short ROTATE_AUTO     = 1;
  const unsigned short ROTATE_ANGLES  = 2;

            attribute unsigned short rotateValueType;
                      // raises DOMException on setting
            attribute SVGList angles;
                      // raises DOMException on setting
};
```

```
interface SVGAnimatedTextRotate {
         attribute SVGTextRotate baseVal;
                      // raises DOMException on setting
  readonly attribute SVGTextRotate animVal;
};

interface SVGTextPositioningElement : SVGTextContentElement {
         attribute SVGAnimatedLengthList x;
                      // raises DOMException on setting
         attribute SVGAnimatedLengthList y;
                      // raises DOMException on setting
         attribute SVGAnimatedLengthList dx;
                      // raises DOMException on setting
         attribute SVGAnimatedLengthList dy;
                      // raises DOMException on setting
         attribute SVGAnimatedTextRotate rotate;
                      // raises DOMException on setting
};

interface SVGTSpanElement : SVGTextPositioningElement {};

interface SVGTRefElement :
             SVGTextPositioningElement,
             SVGURIReference {};

interface SVGGlyphRunElement : SVGTextPositioningElement {
  readonly attribute SVGAnimatedNumberList glyphOrder;
};

interface SVGTextPathElement :
             SVGTextPositioningElement,
             SVGURIReference {

  // textPath Method Types
  const unsigned short TEXTPATH_METHODTYPE_UNKNOWN   = 0;
  const unsigned short TEXTPATH_METHODTYPE_ALIGN     = 1;
  const unsigned short TEXTPATH_METHODTYPE_STRETCH    = 2;
  // textPath Spacing Types
  const unsigned short TEXTPATH_SPACINGTYPE_UNKNOWN   = 0;
  const unsigned short TEXTPATH_SPACINGTYPE_AUTO     = 1;
  const unsigned short TEXTPATH_SPACINGTYPE_EXACT     = 2;

         attribute SVGAnimatedLength            startOffset;
                      // raises DOMException on setting
         attribute SVGAnimatedEnumeration method;
                      // raises DOMException on setting
         attribute SVGAnimatedEnumeration spacing;
                      // raises DOMException on setting
};

interface SVGAltGlyphElement :
             SVGTextContentElement,
             SVGURIReference {};

interface SVGAltGlyphDefElement : SVGElement {};

interface SVGAltGlyphItemElement : SVGElement {};

interface SVGGlyphRefElement :
             SVGElement,
             SVGURIReference,
             SVGStylable {

         attribute DOMString glyphRef;
                      // raises DOMException on setting
         attribute DOMString format;
                      // raises DOMException on setting
```

```
    };

    interface SVGPaint : SVGColor {
      // Paint Types
      const unsigned short SVG_PAINTTYPE_UNKNOWN              = 0;
      const unsigned short SVG_PAINTTYPE_RGBCOLOR             = 1;
      const unsigned short SVG_PAINTTYPE_RGBCOLOR_ICCCOLOR    = 2;
      const unsigned short SVG_PAINTTYPE_NONE                 = 101;
      const unsigned short SVG_PAINTTYPE_CURRENTCOLOR         = 102;
      const unsigned short SVG_PAINTTYPE_URI_NONE             = 103;
      const unsigned short SVG_PAINTTYPE_URI_CURRENTCOLOR     = 104;
      const unsigned short SVG_PAINTTYPE_URI_RGBCOLOR         = 105;
      const unsigned short SVG_PAINTTYPE_URI_RGBCOLOR_ICCCOLOR = 106;

      readonly attribute unsigned short paintType;
      readonly attribute DOMString      uri;

      void setUri ( in DOMString uri );
      void setPaint ( in unsigned short paintType, in DOMString uri, in css::RGBColor rgbColor, in
SVGICCColor iccColor );
    };

    interface SVGMarkerElement :
                  SVGElement,
                  SVGLangSpace,
                  SVGExternalResourcesRequired,
                  SVGStylable,
                  SVGFitToViewBox {

      // Marker Unit Types
      const unsigned short SVG_MARKERUNITS_UNKNOWN        = 0;
      const unsigned short SVG_MARKERUNITS_USERSPACEONUSE = 1;
      const unsigned short SVG_MARKERUNITS_USERSPACE      = 2;
      const unsigned short SVG_MARKERUNITS_STROKEWIDTH    = 3;
      // Marker Orientation Types
      const unsigned short SVG_MARKER_ORIENT_UNKNOWN      = 0;
      const unsigned short SVG_MARKER_ORIENT_AUTO         = 1;
      const unsigned short SVG_MARKER_ORIENT_ANGLE        = 2;

              attribute SVGAnimatedLength       refX;
                        // raises DOMException on setting
              attribute SVGAnimatedLength       refY;
                        // raises DOMException on setting
              attribute SVGAnimatedEnumeration markerUnits;
                        // raises DOMException on setting
              attribute SVGAnimatedLength       markerWidth;
                        // raises DOMException on setting
              attribute SVGAnimatedLength       markerHeight;
                        // raises DOMException on setting
      readonly attribute SVGAnimatedEnumeration orientType;
      readonly attribute SVGAnimatedAngle       orientAngle;

      void setOrientToAuto (  );
      void setOrientToAngle ( in SVGAngle angle );
    };

    interface SVGColorProfileElement :
                  SVGElement,
                  SVGRenderingIntent {

              attribute DOMString       name;
                        // raises DOMException on setting
              attribute unsigned short renderingIntent;
                        // raises DOMException on setting
    };

    interface SVGColorProfileSrcElement :
                  SVGElement,
                  SVGURIReference {};
```

```
interface SVGColorProfileRule :
            SVGCSSRule,
            SVGRenderingIntent {

        attribute DOMString       src;
                    // raises DOMException on setting
        attribute DOMString       name;
                    // raises DOMException on setting
        attribute unsigned short renderingIntent;
                    // raises DOMException on setting
};

interface SVGGradientElement :
            SVGElement,
            SVGURIReference,
            SVGExternalResourcesRequired,
            SVGUnitTypes {

  // Spread Method Types
  const unsigned short SVG_SPREADMETHOD_UNKNOWN = 0;
  const unsigned short SVG_SPREADMETHOD_PAD     = 1;
  const unsigned short SVG_SPREADMETHOD_REFLECT = 2;
  const unsigned short SVG_SPREADMETHOD_REPEAT  = 3;

        attribute SVGAnimatedEnumeration   gradientUnits;
                    // raises DOMException on setting
        attribute SVGAnimatedTransformList gradientTransform;
                    // raises DOMException on setting
        attribute SVGAnimatedEnumeration   spreadMethod;
                    // raises DOMException on setting
};

interface SVGLinearGradientElement : SVGGradientElement {
        attribute SVGAnimatedLength x1;
                    // raises DOMException on setting
        attribute SVGAnimatedLength y1;
                    // raises DOMException on setting
        attribute SVGAnimatedLength x2;
                    // raises DOMException on setting
        attribute SVGAnimatedLength y2;
                    // raises DOMException on setting
};

interface SVGRadialGradientElement : SVGGradientElement {
        attribute SVGAnimatedLength cx;
                    // raises DOMException on setting
        attribute SVGAnimatedLength cy;
                    // raises DOMException on setting
        attribute SVGAnimatedLength r;
                    // raises DOMException on setting
        attribute SVGAnimatedLength fx;
                    // raises DOMException on setting
        attribute SVGAnimatedLength fy;
                    // raises DOMException on setting
};

interface SVGStopElement :
            SVGElement,
            SVGStylable {

        attribute SVGAnimatedNumber offset;
                    // raises DOMException on setting
};

interface SVGPatternElement :
            SVGElement,
            SVGURIReference,
            SVGTests,
```

```
            SVGLangSpace,
            SVGExternalResourcesRequired,
            SVGStylable,
            SVGFitToViewBox,
            SVGUnitTypes {

            attribute SVGAnimatedEnumeration    patternUnits;
                    // raises DOMException on setting
            attribute SVGAnimatedTransformList  patternTransform;
                    // raises DOMException on setting
            attribute SVGAnimatedLength         x;
                    // raises DOMException on setting
            attribute SVGAnimatedLength         y;
                    // raises DOMException on setting
            attribute SVGAnimatedLength         width;
                    // raises DOMException on setting
            attribute SVGAnimatedLength         height;
                    // raises DOMException on setting
};

interface SVGClipPathElement :
            SVGElement,
            SVGTests,
            SVGLangSpace,
            SVGExternalResourcesRequired,
            SVGStylable,
            SVGTransformable,
            SVGUnitTypes {

            attribute SVGAnimatedEnumeration clipPathUnits;
                    // raises DOMException on setting
};

interface SVGMaskElement :
            SVGElement,
            SVGTests,
            SVGLangSpace,
            SVGExternalResourcesRequired,
            SVGStylable,
            SVGTransformable,
            SVGUnitTypes {

            attribute SVGAnimatedEnumeration maskUnits;
                    // raises DOMException on setting
            attribute SVGAnimatedLength      x;
                    // raises DOMException on setting
            attribute SVGAnimatedLength      y;
                    // raises DOMException on setting
            attribute SVGAnimatedLength      width;
                    // raises DOMException on setting
            attribute SVGAnimatedLength      height;
                    // raises DOMException on setting
};

interface SVGFilterElement :
            SVGElement,
            SVGURIReference,
            SVGLangSpace,
            SVGExternalResourcesRequired,
            SVGStylable,
            SVGUnitTypes {

            attribute SVGAnimatedEnumeration filterUnits;
                    // raises DOMException on setting
            attribute SVGAnimatedEnumeration primitiveUnits;
                    // raises DOMException on setting
            attribute SVGAnimatedLength      x;
                    // raises DOMException on setting
            attribute SVGAnimatedLength      y;
```

```
                          // raises DOMException on setting
            attribute SVGAnimatedLength      width;
                          // raises DOMException on setting
            attribute SVGAnimatedLength      height;
                          // raises DOMException on setting
            attribute SVGAnimatedInteger    filterResX;
                          // raises DOMException on setting
            attribute SVGAnimatedInteger    filterResY;
                          // raises DOMException on setting

  void setFilterRes ( in unsigned long filterResX, in unsigned long filterResY );
};

interface SVGFilterPrimitiveStandardAttributes {

            attribute SVGAnimatedLength x;
                          // raises DOMException on setting
            attribute SVGAnimatedLength y;
                          // raises DOMException on setting
            attribute SVGAnimatedLength width;
                          // raises DOMException on setting
            attribute SVGAnimatedLength height;
                          // raises DOMException on setting
            attribute SVGAnimatedString result;
                          // raises DOMException on setting
};

interface SVGFEBlendElement :
              SVGElement,
              SVGFilterPrimitiveStandardAttributes {

  // Blend Mode Types
  const unsigned short SVG_FEBLEND_MODE_UNKNOWN  = 0;
  const unsigned short SVG_FEBLEND_MODE_NORMAL   = 1;
  const unsigned short SVG_FEBLEND_MODE_MULTIPLY = 2;
  const unsigned short SVG_FEBLEND_MODE_SCREEN   = 3;
  const unsigned short SVG_FEBLEND_MODE_DARKEN   = 4;
  const unsigned short SVG_FEBLEND_MODE_LIGHTEN  = 5;

            attribute SVGAnimatedString      in1;
                          // raises DOMException on setting
            attribute SVGAnimatedString      in2;
                          // raises DOMException on setting
            attribute SVGAnimatedEnumeration mode;
                          // raises DOMException on setting
};

interface SVGFEColorMatrixElement :
              SVGElement,
              SVGFilterPrimitiveStandardAttributes {

  // Color Matrix Types
  const unsigned short SVG_FECOLORMATRIX_TYPE_UNKNOWN         = 0;
  const unsigned short SVG_FECOLORMATRIX_TYPE_MATRIX          = 1;
  const unsigned short SVG_FECOLORMATRIX_TYPE_SATURATE        = 2;
  const unsigned short SVG_FECOLORMATRIX_TYPE_HUEROTATE       = 3;
  const unsigned short SVG_FECOLORMATRIX_TYPE_LUMINANCETOALPHA = 4;

            attribute SVGAnimatedString      in1;
                          // raises DOMException on setting
            attribute SVGAnimatedEnumeration type;
                          // raises DOMException on setting
  readonly attribute SVGAnimatedNumberList  values;
};

interface SVGFEComponentTransferElement :
              SVGElement,
              SVGFilterPrimitiveStandardAttributes {
```

```
            attribute SVGAnimatedString in1;
                    // raises DOMException on setting
};

interface SVGComponentTransferFunctionElement : SVGElement {
  // Component Transfer Types
  const unsigned short SVG_FECOMPONENTTRANFER_TYPE_UNKNOWN  = 0;
  const unsigned short SVG_FECOMPONENTTRANFER_TYPE_IDENTITY = 1;
  const unsigned short SVG_FECOMPONENTTRANFER_TYPE_TABLE    = 2;
  const unsigned short SVG_FECOMPONENTTRANFER_TYPE_DISCRETE   = 3;
  const unsigned short SVG_FECOMPONENTTRANFER_TYPE_LINEAR   = 4;
  const unsigned short SVG_FECOMPONENTTRANFER_TYPE_GAMMA    = 5;

            attribute SVGAnimatedEnumeration type;
                    // raises DOMException on setting
  readonly attribute SVGAnimatedNumberList  tableValues;
            attribute SVGAnimatedNumber       slope;
                    // raises DOMException on setting
            attribute SVGAnimatedNumber       intercept;
                    // raises DOMException on setting
            attribute SVGAnimatedNumber       amplitude;
                    // raises DOMException on setting
            attribute SVGAnimatedNumber       exponent;
                    // raises DOMException on setting
            attribute SVGAnimatedNumber       offset;
                    // raises DOMException on setting
};

interface SVGFEFuncRElement : SVGComponentTransferFunctionElement {};

interface SVGFEFuncGElement : SVGComponentTransferFunctionElement {};

interface SVGFEFuncBElement : SVGComponentTransferFunctionElement {};

interface SVGFEFuncAElement : SVGComponentTransferFunctionElement {};

interface SVGFECompositeElement :
            SVGElement,
            SVGFilterPrimitiveStandardAttributes {

  // Composite Operators
  const unsigned short SVG_FECOMPOSITE_OPERATOR_UNKNOWN    = 0;
  const unsigned short SVG_FECOMPOSITE_OPERATOR_OVER       = 1;
  const unsigned short SVG_FECOMPOSITE_OPERATOR_IN         = 2;
  const unsigned short SVG_FECOMPOSITE_OPERATOR_OUT        = 3;
  const unsigned short SVG_FECOMPOSITE_OPERATOR_ATOP       = 4;
  const unsigned short SVG_FECOMPOSITE_OPERATOR_XOR        = 5;
  const unsigned short SVG_FECOMPOSITE_OPERATOR_ARITHMETIC = 6;

            attribute SVGAnimatedString      in1;
                    // raises DOMException on setting
            attribute SVGAnimatedString      in2;
                    // raises DOMException on setting
            attribute SVGAnimatedEnumeration operator;
                    // raises DOMException on setting
            attribute SVGAnimatedNumber      k1;
                    // raises DOMException on setting
            attribute SVGAnimatedNumber      k2;
                    // raises DOMException on setting
            attribute SVGAnimatedNumber      k3;
                    // raises DOMException on setting
            attribute SVGAnimatedNumber      k4;
                    // raises DOMException on setting
};

interface SVGFEConvolveMatrixElement :
            SVGElement,
            SVGFilterPrimitiveStandardAttributes {
```

```
  // Edge Mode Values
  const unsigned short SVG_EDGEMODE_UNKNOWN   = 0;
  const unsigned short SVG_EDGEMODE_DUPLICATE = 1;
  const unsigned short SVG_EDGEMODE_WRAP      = 2;
  const unsigned short SVG_EDGEMODE_NONE      = 3;

          attribute SVGAnimatedInteger      orderX;
                    // raises DOMException on setting
          attribute SVGAnimatedInteger      orderY;
                    // raises DOMException on setting
  readonly attribute SVGAnimatedNumberList  kernelMatrix;
          attribute SVGAnimatedNumber       divisor;
                    // raises DOMException on setting
          attribute SVGAnimatedNumber       bias;
                    // raises DOMException on setting
          attribute SVGAnimatedInteger      targetX;
                    // raises DOMException on setting
          attribute SVGAnimatedInteger      targetY;
                    // raises DOMException on setting
          attribute SVGAnimatedEnumeration edgeMode;
                    // raises DOMException on setting
          attribute SVGAnimatedLength       kernelUnitLengthX;
                    // raises DOMException on setting
          attribute SVGAnimatedLength       kernelUnitLengthY;
                    // raises DOMException on setting
          attribute SVGAnimatedBoolean      preserveAlpha;
                    // raises DOMException on setting
};

interface SVGFEDiffuseLightingElement :
          SVGElement,
          SVGFilterPrimitiveStandardAttributes {

          attribute SVGAnimatedString in1;
                    // raises DOMException on setting
          attribute SVGAnimatedNumber surfaceScale;
                    // raises DOMException on setting
          attribute SVGAnimatedNumber diffuseConstant;
                    // raises DOMException on setting
};

interface SVGFEDistantLightElement : SVGElement {
          attribute SVGAnimatedNumber azimuth;
                    // raises DOMException on setting
          attribute SVGAnimatedNumber elevation;
                    // raises DOMException on setting
};

interface SVGFEPointLightElement : SVGElement {
          attribute SVGAnimatedNumber x;
                    // raises DOMException on setting
          attribute SVGAnimatedNumber y;
                    // raises DOMException on setting
          attribute SVGAnimatedNumber z;
                    // raises DOMException on setting
};

interface SVGFESpotLightElement : SVGElement {
          attribute SVGAnimatedNumber x;
                    // raises DOMException on setting
          attribute SVGAnimatedNumber y;
                    // raises DOMException on setting
          attribute SVGAnimatedNumber z;
                    // raises DOMException on setting
          attribute SVGAnimatedNumber pointsAtX;
                    // raises DOMException on setting
          attribute SVGAnimatedNumber pointsAtY;
                    // raises DOMException on setting
          attribute SVGAnimatedNumber pointsAtZ;
```

```
                          // raises DOMException on setting
          attribute SVGAnimatedNumber specularExponent;
                          // raises DOMException on setting
          attribute SVGAnimatedNumber limitingConeAngle;
                          // raises DOMException on setting
};

interface SVGFEDisplacementMapElement :
            SVGElement,
            SVGFilterPrimitiveStandardAttributes {

  // Channel Selectors
  const unsigned short SVG_CHANNEL_UNKNOWN = 0;
  const unsigned short SVG_CHANNEL_R       = 1;
  const unsigned short SVG_CHANNEL_G       = 2;
  const unsigned short SVG_CHANNEL_B       = 3;
  const unsigned short SVG_CHANNEL_A       = 4;

          attribute SVGAnimatedString      in1;
                          // raises DOMException on setting
          attribute SVGAnimatedString      in2;
                          // raises DOMException on setting
          attribute SVGAnimatedNumber      scale;
                          // raises DOMException on setting
          attribute SVGAnimatedEnumeration xChannelSelector;
                          // raises DOMException on setting
          attribute SVGAnimatedEnumeration yChannelSelector;
                          // raises DOMException on setting
};

interface SVGFEFloodElement :
            SVGElement,
            SVGStylable,
            SVGFilterPrimitiveStandardAttributes {

          attribute SVGAnimatedString      in1;
                          // raises DOMException on setting
};

interface SVGFEGaussianBlurElement :
            SVGElement,
            SVGFilterPrimitiveStandardAttributes {

          attribute SVGAnimatedString in1;
                          // raises DOMException on setting
          attribute SVGAnimatedNumber stdDeviationX;
                          // raises DOMException on setting
          attribute SVGAnimatedNumber stdDeviationY;
                          // raises DOMException on setting

  void setStdDeviation ( in SVGLength stdDeviationX, in SVGLength stdDeviationY );
};

interface SVGFEImageElement :
            SVGElement,
            SVGURIReference,
            SVGLangSpace,
            SVGExternalResourcesRequired,
            SVGStylable,
            SVGTransformable,
            SVGFilterPrimitiveStandardAttributes {};

interface SVGFEMergeElement :
            SVGElement,
            SVGFilterPrimitiveStandardAttributes {};

interface SVGFEMergeNodeElement : SVGElement {
          attribute SVGAnimatedString in1;
                          // raises DOMException on setting
```

```
};

interface SVGFEMorphologyElement :
                SVGElement,
                SVGFilterPrimitiveStandardAttributes {

  // Morphology Operators
  const unsigned short SVG_MORPHOLOGY_OPERATOR_UNKNOWN = 0;
  const unsigned short SVG_MORPHOLOGY_OPERATOR_ERODE   = 1;
  const unsigned short SVG_MORPHOLOGY_OPERATOR_DILATE  = 2;

            attribute SVGAnimatedString      in1;
                      // raises DOMException on setting
            attribute SVGAnimatedEnumeration operator;
                      // raises DOMException on setting
            attribute SVGAnimatedLength      radiusX;
                      // raises DOMException on setting
            attribute SVGAnimatedLength      radiusY;
                      // raises DOMException on setting
};

interface SVGFEOffsetElement :
                SVGElement,
                SVGFilterPrimitiveStandardAttributes {

            attribute SVGAnimatedString in1;
                      // raises DOMException on setting
            attribute SVGAnimatedLength dx;
                      // raises DOMException on setting
            attribute SVGAnimatedLength dy;
                      // raises DOMException on setting
};

interface SVGFESpecularLightingElement :
                SVGElement,
                SVGFilterPrimitiveStandardAttributes {

            attribute SVGAnimatedString in1;
                      // raises DOMException on setting
            attribute SVGAnimatedNumber surfaceScale;
                      // raises DOMException on setting
            attribute SVGAnimatedNumber specularConstant;
                      // raises DOMException on setting
            attribute SVGAnimatedNumber specularExponent;
                      // raises DOMException on setting
};

interface SVGFETileElement :
                SVGElement,
                SVGFilterPrimitiveStandardAttributes {

            attribute SVGAnimatedString in1;
                      // raises DOMException on setting
};

interface SVGFETurbulenceElement :
                SVGElement,
                SVGFilterPrimitiveStandardAttributes {

  // Turbulence Types
  const unsigned short SVG_TURBULENCE_TYPE_UNKNOWN      = 0;
  const unsigned short SVG_TURBULENCE_TYPE_FRACTALNOISE = 1;
  const unsigned short SVG_TURBULENCE_TYPE_TURBULENCE   = 2;
  // Stitch Options
  const unsigned short SVG_STITCHTYPE_UNKNOWN  = 0;
  const unsigned short SVG_STITCHTYPE_STITCH   = 1;
  const unsigned short SVG_STITCHTYPE_NOSTITCH = 2;

            attribute SVGAnimatedNumber      baseFrequencyX;
```

```
                        // raises DOMException on setting
          attribute SVGAnimatedNumber       baseFrequencyY;
                    // raises DOMException on setting
          attribute SVGAnimatedInteger     numOctaves;
                    // raises DOMException on setting
          attribute SVGAnimatedNumber      seed;
                    // raises DOMException on setting
          attribute SVGAnimatedEnumeration stitchTiles;
                    // raises DOMException on setting
          attribute SVGAnimatedEnumeration type;
                    // raises DOMException on setting
};

interface SVGCursorElement :
          SVGElement,
          SVGURIReference,
          SVGTests,
          SVGExternalResourcesRequired {

          attribute SVGAnimatedLength x;
                    // raises DOMException on setting
          attribute SVGAnimatedLength y;
                    // raises DOMException on setting
};

interface SVGAElement :
          SVGElement,
          SVGURIReference,
          SVGTests,
          SVGLangSpace,
          SVGExternalResourcesRequired,
          SVGStylable,
          SVGTransformable,
          events::EventTarget {

          attribute SVGAnimatedString target;
                    // raises DOMException on setting
};

interface SVGViewElement :
          SVGElement,
          SVGExternalResourcesRequired,
          SVGFitToViewBox,
          SVGZoomAndPan {

          attribute SVGElement viewTarget;
                    // raises DOMException on setting
};

interface SVGScriptElement :
          SVGElement,
          SVGURIReference,
          SVGExternalResourcesRequired {

          attribute DOMString type;
                    // raises DOMException on setting
};

interface SVGZoomEvent : events::UIEvent {
          attribute SVGRect zoomRectScreen;
                    // raises DOMException on setting
          attribute float previousScale;
                    // raises DOMException on setting
          attribute SVGPoint previousTranslate;
                    // raises DOMException on setting
          attribute float newScale;
                    // raises DOMException on setting
          attribute SVGPoint newTranslate;
                    // raises DOMException on setting
```

```
};

interface ElementTimeControl {

  boolean beginElement (  )
                  raises( DOMException );
  boolean beginElementAt ( in float offset )
                  raises( DOMException );
  boolean endElement (  )
                  raises( DOMException );
  boolean endElementAt ( in float offset )
                  raises( DOMException );
};

interface SVGAnimationElement :
              SVGElement,
              SVGTests,
              SVGExternalResourcesRequired,
              ElementTimeControl {

  readonly attribute SVGElement targetElement;

  float getStartTime (  );
  float getCurrentTime (  );
  float getSimpleDuration (  )
                  raises( DOMException );
};

interface SVGAnimateElement : SVGAnimationElement {};

interface SVGSetElement : SVGAnimationElement {};

interface SVGAnimateMotionElement : SVGAnimationElement {};

interface SVGAnimateTransformElement : SVGAnimationElement {};

interface TimeEvent : events::Event {
  readonly attribute views::AbstractView view;
  readonly attribute long                detail;

  void initTimeEvent ( in DOMString typeArg, in views::AbstractView viewArg, in long detailArg );
};

interface SVGFontElement :
              SVGElement,
              SVGExternalResourcesRequired,
              SVGStylable {};

interface SVGGlyphElement :
              SVGElement,
              SVGStylable {};

interface SVGMissingGlyphElement :
              SVGElement,
              SVGStylable {};

interface SVGHKernElement : SVGElement {};

interface SVGVKernElement : SVGElement {};

interface SVGFontFaceElement : SVGElement {};

interface SVGFontFaceSrcElement : SVGElement {};

interface SVGFontFaceUriElement : SVGElement {};

interface SVGFontFaceFormatElement : SVGElement {};

interface SVGFontFaceNameElement : SVGElement {};
```

```
   interface SVGDefinitionSrcElement : SVGElement {};

   interface SVGMetadataElement : SVGElement {};

   interface SVGForeignObjectElement :
               SVGElement,
               SVGTests,
               SVGLangSpace,
               SVGExternalResourcesRequired,
               SVGStylable,
               SVGTransformable,
               events::EventTarget {

           attribute SVGAnimatedLength x;
                       // raises DOMException on setting
           attribute SVGAnimatedLength y;
                       // raises DOMException on setting
           attribute SVGAnimatedLength width;
                       // raises DOMException on setting
           attribute SVGAnimatedLength height;
                       // raises DOMException on setting
   };


};

#endif // _SVG_IDL_
```

Appendix D. Java Language Binding

The Java binding for the SVG Document Object Model definitions is available at:

http://www.w3.org/TR/2000/WD-SVG-20000629/java-binding.zip

Appendix E. ECMA Script Language Binding

The ECMA Script binding for the SVG Document Object Model definitions is available at:

http://www.w3.org/TR/2000/WD-SVG-20000629/ecmascript-binding.html

Appendix F: Implementation Requirements

Contents

This appendix is normative.

F.1 Introduction

The following are notes about implementation requirements corresponding to various features in the SVG language.

F.2 Error processing

There are various scenarios where an SVG document fragment is technically in error:

- When the content does not conform to the XML 1.0 specification [XML10], such as the use of incorrect XML syntax
- When an element or attribute is encountered in the document which is not part of the SVG DTD and

which is not properly identified as being part of another namespace (see "Namespaces in XML" [XML-NS])

- When an element has an attribute or property value which is not permissible according to this specification
- Other situations that are described as being *in error* in this specification

A document can go in and out of error over time. For example, document changes from the SVG DOM or from animation can cause a document to become *in error* and a further change can cause the document to become correct again.

The following error processing shall occur when a document is in error:

- The document shall be rendered up to, but not including, the first element which has an error. (Exception: if a 'path' element is the first element which has an error and the only errors are in the path data specification, then render the 'path' up to the point of the path data error. See 'path' element implementation notes.) This approach will provide a visual clue to the user/developer about where the error might be in the document.
- If the document has animations, the animations shall stop at the point at which an error is encountered and the visual presentation of the document shall reflect the animated status of the document at the point the error was encountered.
- A highly perceptive indication of error shall occur. For visual rendering situations, an example of an indication of error would be to render a translucent colored pattern such as a checkerboard on top of the area where the SVG content is rendered.
- If the user agent has access to an error reporting capability such as status bar, it is recommended that the user agent provide whatever additional detail it can to enable the developer/user to quickly find the source of the error. For example, the user agent might provide an error message along with a line number and character number at which the error was encountered.

Because of situations where a block of scripting changes might cause a given SVG document fragment to go into and out of error, error processing shall occur only at times when document presentation (e.g., rendering to the display device) is updated. In particular, error processing shall be disabled whenever redraw has been suspended via DOM calls to suspendRedraw().

F.3 Version control

The SVG user agent must verify the reference to the PUBLIC identifier in the `<!DOCTYPE>` statement or the namespace reference in the `xmlns` attribute on the 'svg' element to ensure that the given document (or document fragment) identifies a version of the SVG language which the SVG user agent supports. If the version information is missing or the version information indicates a version of the SVG language which the SVG user agent does not support, then the SVG user agent is not required to render that document or fragment. In particular, it is not required that an SVG user agent attempt to render future versions of the SVG language. If the user environment provides such an option, the user agent should alert or otherwise notify the user that the version of the file is not supported and suggest an alternate processing option (e.g., installing an updated version of the user agent) if such an option exists.

An SVG user agent which supports the SVG Recommendation should alert or otherwise notify the user whenever it encounters an SVG document (or document fragment) whose `<!DOCTYPE>` statement or corresponding `xmlns` attribute corresponds to a working draft version of the SVG specification. All content based on working drafts of this specification should be updated to the SVG Recommendation.

F.4 Clamping values which are restricted to a particular range

Some numeric attribute and property values have restricted ranges, such as color component values. When out of range values are provided, but user agent shall defer any error checking until after presentation time, as composited actions might produce intermediate values which are out of range but final values which are within range.

Color values are not in error if they are out of range, even if final computations produce an out of range color value at presentation time. It is recommended that user agents clamp color values to the nearest color value (possibly determined by simple clipping) which the system can process as late as possible (e.g., presentation time), although it is acceptable for user agents to clamp color values as early as parse time. Thus, implementation dependencies might preclude consistent behavior across different systems when out of range color values are used.

Opacity values out of range are not in error and should be clamped to the range 0 to 1 at the time which opacity values have to be processed (e.g., at presentation time or when it is necessary to perform intermediate filter effect calculations).

F.5 'path' element implementation notes

A conforming SVG user agent must implement path rendering as follows:

- Error handling:
  - The general rule for error handling in path data is that the SVG user agent shall render a 'path' element up to (but not including) the path command containing the first error in the path data specification. This will provide a visual clue to the user/developer about where the error might be in the path data specification. This rule will greatly discourage generation of invalid SVG path data.
  - If a path data command contains an incorrect set of parameters, then the given path data command is rendered up to and including the last correctly defined path segment, even if that path segment is a sub-component of a compound path data command, such as a "lineto" with several pairs of coordinates. For example, for the path data string "M 10,10 L 20,20,30", there is an odd number of parameters for the "L" command, which requires an even number of parameters. The user agent is required to draw the line from (10,10) to (20,20) and then perform error reporting since "L 20 20" is the last correctly defined segment of the pat data specification.
  - Wherever possible, all SVG user agents shall report all errors to the user.
- Markers, directionality and zero-length path segments:
  - If markers are specified, then a marker is drawn on every applicable vertex, even if the given vertex is the end point of a zero-length path segment and even if "moveto" commands follow each other.
  - Certain line-capping and line-joining situations and markers require that a path segment have directionality at its start and end points. Zero-length path segments have no directionality. In these cases, the following algorithm is used to establish directionality: to determine the directionality of the start point of a zero-length path segment, go backwards in the path data

specification within the current subpath until you find a segment which has directionality at its end point (e.g., a path segment with non-zero length) and use its ending direction; otherwise, temporarily consider the start point to lack directionality. Similarly, to determine the directionality of the end point of a zero-length path segment, go forwards in the path data specification within the current subpath until you find a segment which has directionality at its start point (e.g., a path segment with non-zero length) and use its starting direction; otherwise, temporarily consider the end point to lack directionality. If the start point has directionality but the end point doesn't, then the end point uses the start point's directionality. If the end point has directionality but the start point doesn't, then the start point uses the end point's directionality. Otherwise, set the directionality for the path segment's start and end points to align with the positive X-axis in user space.

❍ If **'stroke-linecap'** is set to **butt** and the given path segment has zero length, do not draw the linecap for that segment; however, do draw the linecap for zero-length path segments when **'stroke-linecap'** is set to either **round** or **square**. (This allows round and square dots to be drawn on the canvas.)

● The S/s commands indicate that the first control point of the given cubic bezier segment is calculated by reflecting the previous path segments second control point relative to the current point. The exact math is as follows. If the current point is (curx, cury) and the second control point of the previous path segment is (oldx2, oldy2), then the reflected point (i.e., (newx1, newy1), the first control point of the current path segment) is:

```
(newx1, newy1) = (curx - (oldx2 - curx), cury - (oldy2 - cury))
               = (2*curx - oldx2, 2*cury - oldy2)
```

● A non-positive radius value is an error.

● Unrecognized contents within a path data stream (i.e., contents that are not part of the path data grammar) is an error.

F.6 Elliptical arc implementation notes

F.6.1 Elliptical arc syntax

An elliptical arc is a particular path command. As such, it is described by the following parameters in order:

(x_1, y_1) are the absolute coordinates of the current point on the path, obtained from the last two parameters of the previous path command.

r_X and r_Y are the radii of the ellipse (also known as its semi-major and semi-minor axes).

is the angle from the x-axis of the current coordinate system to the x-axis of the ellipse.

f_A is the large arc flag, and is 0 if an arc spanning less than or equal to 180 degrees is chosen, or 1 if an arc spanning greater than 180 degrees is chosen.

f_S is the sweep flag, and is 0 if the line joining center to arc sweeps through decreasing angles, or 1 if it sweeps through increasing angles.

(x_2, y_2) are the absolute coordinates of the final point of the arc.

This parameterization of elliptical arcs will be referred to as *endpoint parameterization*. One of the advantages of endpoint parameterization is that it permits a consistent path syntax in which all path commands end in the coordinates of the new "current point". The following notes give rules and formulae to help implementers deal with endpoint parameterization.

F.6.2 Out-of-range parameters

Arbitrary numerical values are permitted for all elliptical arc parameters, but where these values are invalid or out of range, an implementation must make sense of them as follows:

If the endpoints (x_1, y_1) and (x_2, y_2) are identical, then this is equivalent to omitting the elliptical arc segment entirely.

If $r_X = 0$ or $r_Y = 0$ then this arc is treated as a straight line segment (a "lineto") joining the endpoints.

If r_X or r_Y have negative signs, these are dropped (the absolute value is used instead).

If r_X, r_Y and are such that there is no solution (basically, the ellipse is not big enough to reach from (x_1, y_1) to (x_2, y_2)) then the ellipse is scaled up uniformly until there is exactly one solution (until the ellipse is just big enough).

 is taken mod 360 degrees.

Any nonzero value for either of the flags f_A or f_S is taken to mean the value 1.

This forgiving yet consistent treatment of out-of-range values ensures that

The inevitable approximations arising from computer arithmetic cannot cause a valid set of values written by one SVG implementation to be treated as invalid when read by another SVG implementation. This would otherwise be a problem for common boundary cases such as a semicircular arc.

Continuous animations that cause parameters to pass through invalid values are not a problem. The motion remains continuous.

F.6.3 Parameterization alternatives

An arbitrary point (x, y) on the elliptical arc can be described by the 2-dimensional matrix equation

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} \cos \varphi & -\sin \varphi \\ \sin \varphi & \cos \varphi \end{pmatrix} \cdot \begin{pmatrix} r_X \cos \theta \\ r_Y \sin \theta \end{pmatrix} + \begin{pmatrix} c_X \\ c_Y \end{pmatrix}$$
(F.6.3.1)

(c_X, c_Y) are the coordinates of the center of the ellipse.

r_X and r_Y are the radii of the ellipse (also known as its semi-major and semi-minor axes).

φ is the angle from the x-axis of the current coordinate system to the x-axis of the ellipse.

θ ranges from:

θ_1 which is the start angle of the elliptical arc prior to the stretch and rotate operations.

θ_2 which is the end angle of the elliptical arc prior to the stretch and rotate operations.

$\Delta\theta$ which is the difference between these two angles.

If one thinks of an ellipse as a circle that has been stretched and then rotated, then

θ_1, θ_1 and $\Delta\theta$

are the start angle, end angle and sweep angle, respectively of the arc prior to the stretch and rotate operations. This leads to an alternate parameterization which is common among graphics APIs, which will be referred to as *center parameterization*. In the next sections, formulas are given for mapping in both directions between center parameterization and endpoint parameterization.

F.6.4 Conversion from center to endpoint parameterization

Given:

$$c_X \quad c_X \quad r_X \quad r_Y \quad \varphi \quad \theta_1 \quad \Delta\theta$$

the task is to find:

$$x_1 \quad y_1 \quad x_2 \quad y_2 \quad f_A \quad f_S$$

Here are the formulas:

$$\begin{pmatrix} x_1 \\ y_1 \end{pmatrix} = \begin{pmatrix} \cos\varphi & -\sin\varphi \\ \sin\varphi & \cos\varphi \end{pmatrix} \cdot \begin{pmatrix} r_X \cos\theta_1 \\ r_Y \sin\theta_1 \end{pmatrix} + \begin{pmatrix} c_X \\ c_Y \end{pmatrix} \tag{F.6.4.1}$$

$$\begin{pmatrix} x_2 \\ y_2 \end{pmatrix} = \begin{pmatrix} \cos\varphi & -\sin\varphi \\ \sin\varphi & \cos\varphi \end{pmatrix} \cdot \begin{pmatrix} r_X \cos(\theta_1 + \Delta\theta) \\ r_Y \sin(\theta_1 + \Delta\theta) \end{pmatrix} + \begin{pmatrix} c_X \\ c_Y \end{pmatrix} \tag{F.6.4.2}$$

$$f_A = \begin{cases} 1 & \text{if } |\Delta\theta| > 180° \\ 0 & \text{if } |\Delta\theta| \le 180° \end{cases} \tag{F.6.4.3}$$

$$f_S = \begin{cases} 1 & \text{if } \Delta\theta > 0° \\ 0 & \text{if } \Delta\theta < 0° \end{cases} \tag{F.6.4.4}$$

F.6.5 Conversion from endpoint to center parameterization

Given:

$$x_1 \; y_1 \; x_2 \; y_2 \; f_A \; f_S$$

the task is to find:

$$c_X \; c_X \; r_X \; r_Y \; \varphi \; \theta_1 \; \Delta\theta$$

The equations simplify after a translation which places the origin at the midpoint of the line joining (x_1, y_1) to (x_2, y_2), followed by a rotation to line up the coordinate axes with the axes of the ellipse. All transformed coordinates will be written with primes. They are computed as intermediate values on the way toward finding the required center parameterization variables. This procedure consists of the following steps:

Step 1: Compute (x_1', y_1') according to the formula

$$\begin{pmatrix} x_1' \\ y_1' \end{pmatrix} = \begin{pmatrix} \cos\varphi & \sin\varphi \\ -\sin\varphi & \cos\varphi \end{pmatrix} \cdot \begin{pmatrix} \frac{x_1 - x_2}{2} \\ \frac{y_1 - y_2}{2} \end{pmatrix} \tag{F.6.5.1}$$

Step 2: Compute (c_X', c_Y') according to the formula

$$\begin{pmatrix} c_X' \\ c_Y' \end{pmatrix} = \pm \sqrt{\frac{r_X^2 r_Y^2 - r_X^2 y_1'^2 - r_Y^2 x_1'^2}{r_X^2 y_1'^2 + r_Y^2 x_1'^2}} \begin{pmatrix} \dfrac{r_X y_1'}{r_Y} \\[2mm] -\dfrac{r_Y x_1'}{r_X} \end{pmatrix}$$

(F.6.5.2)

where the + sign is chosen if $f_A \neq f_S$

and the - sign is chosen if $f_A = f_S$

Step 3: Compute (c_X, c_Y) from (c_X', c_Y')

$$\begin{pmatrix} c_X \\ c_Y \end{pmatrix} = \begin{pmatrix} \cos\varphi & -\sin\varphi \\ \sin\varphi & \cos\varphi \end{pmatrix} \cdot \begin{pmatrix} c_X' \\ c_Y' \end{pmatrix} + \begin{pmatrix} \dfrac{x_1 + x_2}{2} \\[2mm] \dfrac{y_1 + y_2}{2} \end{pmatrix}$$

(F.6.5.3)

Step 4: Compute θ_1 and $\Delta\theta$

In general, the angle between two vectors (u_X, u_Y) and (v_X, v_Y) can be computed as

$$\angle(\vec{u}, \vec{v}) = \pm \arccos \frac{\vec{u} \cdot \vec{v}}{\|\vec{u}\| \|\vec{v}\|}$$

(F.6.5.4)

where the $\pm$ sign appearing here is the sign of $u_X v_Y - u_Y v_X$

This angle function can be used to express θ_1 and $\Delta\theta$ as follows:

$$\theta_1 = \angle\left(\begin{pmatrix} 1 \\ 0 \end{pmatrix}, \begin{pmatrix} \dfrac{x_1' - c_X'}{r_X} \\[2mm] \dfrac{y_1' - c_Y'}{r_Y} \end{pmatrix} \right)$$

(F.6.5.5)

$$\Delta\theta \equiv \angle\left(\left(\begin{array}{c}\dfrac{x_1{}'-c_X{}'}{r_X}\\\dfrac{y_1{}'-c_Y{}'}{r_Y}\end{array}\right),\left(\begin{array}{c}\dfrac{-x_1{}'-c_X{}'}{r_X}\\\dfrac{-y_1{}'-c_Y{}'}{r_Y}\end{array}\right)\right) \bmod 360° \qquad \text{(F.6.5.6)}$$

where $\Delta\theta_1$ is fixed in the range $-360° < \Delta\theta < 360°$ such that:

if $f_S = 0$, then $\Delta\theta < 0$,

else if $f_S = 1$, then $\Delta\theta > 0$.

In other words, if $f_S = 0$ and the right side of (F.6.5.6) is > 0, then subtract $360°$, whereas if $f_S = 1$ and the right side of (F.6.5.6) is < 0, then add $360°$. In all other cases leave it as is.

F.6.6 Correction of out-of-range radii

This section formalizes the adjustments to out-of-range r_X and r_Y mentioned in F.6.2. Algorithmically these adjustments consist of the following steps:

Step 1: Ensure radii are non-zero

If $r_X = 0$ or $r_Y = 0$, then treat this as a straight line from (x_1, y_1) to (x_2, y_2) and stop. Otherwise,

Step 2: Ensure radii are positive

Take the absolute value of r_X and r_Y:

$$r_X \longrightarrow |r_X| \qquad\qquad r_Y \longrightarrow |r_Y| \qquad\qquad \text{(F.6.6.1)}$$

Step 3: Ensure radii are large enough

Using the primed coordinate values of equation (F.6.5.1), compute

$$\Lambda = \frac{x_1{}'^2}{r_X{}^2} + \frac{y_1{}'^2}{r_Y{}^2} \qquad\qquad \text{(F.6.6.2)}$$

If the result of the above equation is less than or equal to 1, then no further change need be made to r_X and r_Y. If the result of the above equation is greater than 1, then make the replacements

$$r_X \longrightarrow \sqrt{\Lambda}\, r_X \qquad\qquad r_Y \longrightarrow \sqrt{\Lambda}\, r_Y \qquad\qquad \text{(F.6.6.3)}$$

Step 4: Proceed with computations

Proceed with the remaining elliptical arc computations, such as those in section F.6.5. Note: As a consequence of the radii corrections in this section, equation (F.6.5.2) for the center of the ellipse always has at least one solution (i.e. the radicand is never negative). In the case that the radii are scaled up using equation (F.6.6.3), the radicand of (F.6.5.2) is zero and there is exactly one solution for the center of the ellipse.

F.7 Text selection implementation notes

The following implementation notes describe the algorithm for deciding which characters are selected during a text selection operation.

The text selection operation determines the *start selection character(s)* and *start selection subregion* and the *end selection character(s)* and *end selection subregion*. To determine the *start selection character(s)*, the SVG user agent determines which rendered glyph received the initial select event (e.g., the initial mouse down event) and which *character(s)* corresponds to the given glyph (note that for ligatures, a single glyph represents multiple characters). For all of the glyphs used to render the given *character(s)*, determine *start selection subregion* depending on whether the selection/pointer event occurred in the top/left, top/right, bottom/left or bottom/right subregion of the character cell area that encompasses all of the glyphs used to render the given *character(s)*.

The *end character(s)* and the relevant *end character(s) subregion* are determined using a similar method, except use the pointer location at the end of the select operation (e.g., when the user releases the given mouse button).

For systems which support pointer devices such as a mouse, the user agent is required to provide a mechanism for selecting text even when the given text has associated event handlers or links, which might block text selection due to event processing precedence rules (see Pointer events). One implementation option for platforms which support a pointer device such as a mouse, the user agent may provide for a small additional region around character cells which initiate text selection operations but do not initiate event handlers or links.

For horizontal text (i.e., when the baseline of the glyph is parallel to the primary text advance direction):

- If the *start selection subregion* is either the top/left or bottom/left, then the selection starts between the *start character(s)* and the previous character in visual rendering order for the 'text' element. (If this is the first character in visual rendering order for the 'text' element, then the selection starts with this first character in visual rendering order. Note that the bi-directional algorithm might result in the selection being between two characters that are not contiguous in lexical order.)

- If the *start selection subregion* is either the top/right or bottom/right, then the selection starts between the *start character(s)* and the next character in visual rendering order for the 'text' element. (If this is the last character in visual rendering order for the 'text' element, then the selection starts with this last character in visual rendering order. Note that the bi-directional algorithm might result in the selection being between two characters that are not contiguous in lexical order.)

For vertical text (i.e., when the baseline of the glyph is perpendicular to the primary text advance direction):

- If the *start selection subregion* is either the top/left or top/right, then the selection starts between the *start character(s)* and the previous character in visual rendering order for the 'text' element. (If this is the first character in visual rendering order for the 'text' element, then the selection starts with this first character in visual rendering order. Note that the bi-directional algorithm might result in the selection

being between two characters that are not contiguous in lexical order.)

- If the *start selection subregion* is either the bottom/left or bottom/right, then the selection starts between the *start character(s)* and the next character in visual rendering order for the ['text'](#) element. (If this is the last character in visual rendering order for the ['text'](#) element, then the selection starts with this last character in visual rendering order. Note that the bi-directional algorithm might result in the selection being between two characters that are not contiguous in lexical order.)

When the user agent is implementing selection of bi-directional text in lexical order and the selection starts (or ends) between characters which are not contiguous in lexical order, then there might be multiple potential combinations of characters that can be considered part of the selection. The algorithms to choose among the combinations of potential selection options shall choose the selection option which most closely matches the text string's visual rendering order.

F.8 Printing implementation notes

For user agents which support both zooming on display devices and printing, it is recommended that the default printing option produce printed output that reflects the display device's current view of the current SVG document fragment (assuming there is no media-specific styling), taking into account any zooming and panning done by the user, the current state of animation, and any document changes due to DOM and scripting . Thus, if the user zooms into a particular area of a map on the display device and then requests a hardcopy, the hardcopy should show the same view of the map as appears on the display device. If a user pauses an animation and prints, the hardcopy should show the same graphics as the currently paused picture on the display device. If scripting has added or removed elements from the document, then the hardcopy should reflect the same changes that would be reflected on the display.

When an SVG document is rendered on a static-only device such as a printer which do not support SVG's animation and scripting and facilities, then the user agent shall ignore any animation and scripting elements in the document and render the remaining graphics elements according to the rules in this specification.

Appendix G: Conformance Criteria

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- [G.1 Introduction](#)
- [G.2 Conforming SVG Document Fragments](#)
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This appendix is normative.

G.1 Introduction

Different sets of SVG conformance criteria exist for:

- [Conforming SVG Document Fragments](#)
- [Conforming SVG Stand-Alone Files](#)
- [Conforming SVG Included Documents](#)
- [Conforming SVG Generators](#)
- [Conforming SVG Interpreters](#)
- [Conforming SVG Viewers](#)

G.2 Conforming SVG Document Fragments

An SVG document fragment is a *Conforming SVG Document Fragment* if it adheres to the specification described in this document ([Scalable Vector Graphics (SVG) Specification](#)) including SVG's DTD (see [Document Type Definition](#)) and also:

- (relative to XML) is [well-formed](#).
- if all non-SVG namespace elements and attributes and all xmlns attributes which refer to non-SVG namespace elements are removed from the given document, and if an appropriate `<?xml...?>` statement is included at the top of the document, and if an appropriate `<!DOCTYPE svg ... >` statement which points to the SVG DTD is included immediately thereafter, the result is a [valid XML](#)

document.

- conforms to the following W3C Recommendations:
  - ❍ the XML 1.0 specification (Extensible Markup Language (XML) 1.0).
  - ❍ (if any namespaces other than SVG are used in the document) Namespaces in XML.
  - ❍ any use of CSS shall conform to Cascading Style Sheets, level 2 CSS2 Specification.
  - ❍ any references to external style sheets shall conform to Associating stylesheets with XML documents.

The SVG language or these conformance criteria provide no designated size limits on any aspect of SVG content. There are no maximum values on the number of elements, the amount of character data, or the number of characters in attribute values.

G.3 Conforming SVG Stand-Alone Files

A file is a *Conforming SVG Stand-Alone File* if:

- it is an XML document.
- its root element is an 'svg' element.
- it conforms to the criteria for Conforming SVG Document Fragment.

G.4 Conforming SVG Included Document Fragments

SVG document fragments can be included within parent XML documents using the XML namespace facilities described in Namespaces in XML.

An SVG document fragment that is included within a parent XML document is a *Conforming Included SVG Document Fragment* if the SVG document fragment, when taken out of the parent XML document, conforms to the SVG Document Type Definitions (DTD).

In particular, note that individual elements from the SVG namespace *cannot* be used by themselves. Thus, the SVG part of the following document is *not* conforming:

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE SomeParentXMLGrammar PUBLIC "-//SomeParent"
  "http://SomeParentXMLGrammar.dtd">
<ParentXML>
  <!-- Elements from ParentXML go here -->

  <!-- The following is not conforming -->
  <z:rect xmlns:z="http://www.w3.org/2000/svg-20000629"
          x="0" y="0" width="10" height="10" />

  <!-- More elements from ParentXML go here -->
</ParentXML>
```

Instead, for the SVG part to become a Conforming Included SVG Document Fragment, the file could be

modified as follows (the example below shows the use of Stylable SVG):

```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE SomeParentXMLGrammar PUBLIC "-//SomeParent"
  "http://SomeParentXMLGrammar.dtd">
<ParentXML>
  <!-- Elements from ParentXML go here -->

  <!-- The following is conforming -->
  <z:svg xmlns:z="http://www.w3.org/2000/svg-20000629"
        width="100px" height="100px" >
    <z:rect x="0" y="0" width="10" height="10" />
  </z:svg>

  <!-- More elements from ParentXML go here -->
</ParentXML>
```

G.5 Conforming SVG Generators

A *Conforming SVG Generator* is a program which:

- always creates at least one of Conforming SVG Document Fragments, Conforming SVG Stand-Alone Files or Conforming SVG Included Documents.
- does not create non-conforming SVG document fragments of any of the above types.

Additionally, an authoring tool which is a Conforming SVG Generator conforms to all of the Priority 1 accessibility guidelines from the document "Authoring Tool Accessibility Guidelines 1.0" [ATAG] that are relevant to generators of SVG content. (Priorities 2 and 3 are encouraged but not required for conformance).

SVG generators are encouraged to follow W3C developments in the area of internationalization. Of particular interest is the *W3C Character Model* and the concept of *Webwide Early Uniform Normalization*, which promises to enhance the interchangability of Unicode character data across users and applications. Future versions of the SVG Specification are likely to require support of the *W3C Character Model* in Conforming SVG Generators.

G.6 Conforming SVG Interpreters

An SVG interpreter is a program which can parse and process SVG document fragments. Examples of SVG interpreters are server-side transcoding tools (e.g., a tool which converts SVG content into a raster image) or analysis tools (e.g., a tool which extracts the text content from SVG content). An SVG viewer also satisfies the requirements of an SVG interpreter in that it does indeed parse and process SVG document fragments, where processing consists of rendering the SVG content to the target medium.

A *Conforming SVG Interpreter* is defined as follows:

- The interpreter must be able to successfully parse and process any Conforming SVG Document Fragment. (It is not required, however, that the semantics of every possible SVG feature be understood and supported beyond parsing. Thus, for example, a Conforming SVG Interpreter might only parse the defined syntax but not process the semantics of all features in the language.)

- The XML parser must be able to parse and process and XML constructs defined within [XML10] and [XML-NS].

- If the program allows scripts to run against Document Object Model, then a Conforming SVG Interpreter must support the entire DOM model for SVG defined in this specification.

G.7 Conforming SVG Viewers

An SVG viewer is a program which can parse and process an SVG document fragment and render the contents of the document onto some sort of output medium such as a display or printer; thus, an *SVG Viewer* is also an *SVG Interpreter*.

There are two sub-categories of *Conforming SVG Viewers*:

- *Conforming Static SVG Viewers* support the static features of SVG that correspond to the feature string "org.w3c.svg.static" (see Feature strings). This category often corresponds to platforms and environments which only render static documents, such as printers.

- *Conforming Dynamic SVG Viewers* support the features of SVG that corespond to the feature string "org.w3c.svg.dynamic" (see Feature strings). This category often applies to platforms and environments such as common web browsers which support user interaction and dynamic document content (i.e., documents whose content can change over time). (User interaction includes support for hyperlinking, events [e.g., mouse clicks], text selection and zooming/panning [see Interactivity]. Dynamic document content can be achieved via declarative animation or by scripts modifying the SVG DOM.)

Specific criteria that apply to both *Conforming Static SVG Viewers* and *Conforming Dynamic SVG Viewers*:

- The program must also be a Conforming SVG Interpreter,

- For interactive user environments, facilities must exist for zooming and panning of standalone SVG documents or SVG document fragments embedded within parent XML documents.

- In environments that have appropriate user interaction facilities, the viewer must support the ability to activate hyperlinks.

- If printing devices are supported, SVG content must be printable at printer resolutions with the same graphics features available as required for display (e.g., the specified colors must be rendered on color printers).

- On systems where this information is available, the parent environment must provide the viewer with information about physical device resolution. In situations where this information is impossible to determine, the parent environment shall pass a reasonable value for device resolution which tends to approximate most common target devices.

- The viewer must support JPEG [JPEG] and PNG [PNG10] image formats.

- The viewer must support alpha channel blending of the image of the SVG content onto the target canvas.

- SVG implementations which support the HTTP protocol must correctly support gzip-encoded SVG data streams according to the HTTP 1.1 specification [RFC2616]; thus, the client must specify "Accept-Encoding: gzip" [HTTP-ACCEPT-ENCODING] on its request-header field and then decompress any gzip-encoded data streams that are downloaded from the server. If the implementation supports progressive rendering, the implementation should also support progressive rendering of compressed data streams.

- The viewer must support BASE64 encoded content using the "data:" protocol [RFC2397] wherever URI referencing is permitted within SVG content.

- The viewer must support the following W3C Recommendations with regard to SVG content:
  - complete support for the XML 1.0 specification ([Extensible Markup Language (XML) 1.0)](#).
  - complete support for inclusion of non-SVG namespaces within SVG content [Namespaces in XML](#). (Note that data from non-SVG namespaces are included in the DOM but are otherwise ignored.)
- All visual rendering must be accurate to within one device pixel to the mathematically correct result.
- On systems which support accurate sRGB [SRGB] color, all sRGB color computations and all resulting color values must be accurate to within one sRGB color component value, where sRGB color component values range from 0 to 255.

Although anti-aliasing support isn't a strict requirement for a Conforming SVG Viewer, it is highly recommended for display devices. Lack of anti-aliasing support will generally result in poor results on display devices.

Specific criteria that apply to only *Conforming Dynamic SVG Viewers*:

- In web browser environments, the viewer must have the ability to search and select text strings within SVG content.
- If display devices are supported, the viewer must have the ability to select and copy text from SVG content to the system clipboard.
- The viewer must have complete support for an ECMAScript binding of the [SVG Document Object Model](#).

The Web Accessibility Initiative [WAI] is defining "User Agent Accessibility Guidelines 1.0" [UAAG]. Viewers are encouraged to conform to the Priority 1 accessibility guidelines defined in this document, and preferably also Priorities 2 and 3. Once the guidelines are completed, a future version of this specification is likely to require conformance to the Priority 1 guidelines in Conforming SVG Viewers.

A higher order concept is that of a *Conforming High-Quality SVG Viewer*, with sub-categories *Conforming High-Quality Static SVG Viewer* and *Conforming High-Quality Dynamic SVG Viewer*.

Both a *Conforming High-Quality Static SVG Viewer* and a *Conforming High-Quality Dynamic SVG Viewer* must support the following additional features:

- Professional-quality results with good processing and rendering performance and smooth, flicker-free animations.
- On low-resolution devices such as display devices at 150dpi or less, support for smooth edges on lines, curves and text. (Smoothing is often accomplished using anti-aliasing techniques.)
- Color management via ICC profile support (i.e., the ability to support colors defined using ICC profiles).
- Resampling of image data using algorithms at least as good as bicubic resampling methods.
- At least double-precision floating point computation on coordinate system transformation numerical calculations.

A *Conforming High-Quality Dynamic SVG Viewer* must support the following additional features:

- Progressive rendering and animation effects (i.e., the start of the document will start appearing and animations will start running in parallel with downloading the rest of the document).
- Restricted screen updates (i.e., only required areas of the display are updated in response to redraw events).

- Background downloading of images and fonts retrieved from a web server, with updating of the display once the downloads are complete.

A *Conforming SVG Viewer* must be able to apply styling properties to SVG content using [presentation attributes](#).

If the user agent includes a CSS2 capability, a *Conforming SVG Viewer* must support CSS styling of SVG content and must support all features from CSS2 ([Cascading Style Sheets, level 2 CSS2 Specification](#)) that are described in this specification as applying to SVG (see [properties shared with CSS and XSL](#), [Styling with CSS](#) and [Facilities from CSS and XSL used by SVG](#)). The supported features from CSS2 must be implemented in accordance with the [conformance definitions from the CSS2 specification](#).

Appendix H: Accessibility Support

Contents

- H.1 WAI Accessibility Guidelines
- H.2 SVG Content Accessibility Guidelines

This appendix is informative, not normative.

H.1 WAI Accessibility Guidelines

This appendix explains how accessibility guidelines published by W3C's Web Accessibility Initiative (WAI) apply to SVG.

1. The "Web Content Accessibility Guidelines 1.0" [WCAG] explains how authors can create Web content that is accessible to people with disabilities.

2. The "Authoring Tool Accessibility Guidelines 1.0" [ATAG] explains how developers can design accessible authoring tools such as SVG authoring tools. To conform to the SVG specification, an SVG authoring tool must conform to ATAG (priority 1). SVG support for element grouping and reuse is relevant to designing accessible SVG authoring tools.

3. The "User Agent Accessibility Guidelines 1.0" [UAAG] explains how developers can design accessible user agents such as SVG-enabled browsers. To conform to the SVG specification, an SVG user agent should conform to UAAG. SVG support for scaling, style sheets, the DOM, and metadata are all relevant to designing accessible SVG user agents.

The W3C Note "Accessibility Features of SVG" [not yet published] explains in detail how the requirements of the three guidelines apply to SVG.

H.2 SVG Content Accessibility Guidelines

This section explains briefly how authors can create accessible SVG documents; it summarizes "Accessibility Features of SVG" [not yet published].

Provide text equivalents for graphics.

○ When the text content of a graphic (e.g., in a 'text' element) explains its function, no text equivalent is required. Use the 'title' child element to explain the function 'text' elements whose meaning is not clear from their text content.

○ When a graphic does not include explanatory text content, it requires a text equivalent. If the equivalent is complex, use the 'desc' element, otherwise use the 'title' child element.

- If a graphic is built from meaningful parts, build the description from meaningful parts.

Don't rely on color alone.

- Don't use color alone to convey information.
- Ensure adequate color contrast. Use style sheets so that users who require certain color combinations may apply them through user style sheets.

Use markup and style sheets and do so properly.

- Represent text as character data, not as images or curves. Style text with fonts. Authors may describe their own fonts in SVG.
- Separate structure from presentation.
- Use the 'g' element and rich descriptions to structure SVG documents. Reuse named objects.
- Publish highly-structured documents, not just graphical representations. Documents that are rich in structure may be rendered graphically, as speech, or as braille. For example, express mathematical relationships in MathML [MATHML] and use SVG for explanatory graphics.
- Author documents that validate to the SVG grammar.
- Use style sheets to specify graphical and aural presentation.
- Use relative units in style sheets.

Clarify natural language usage.

- Use xml:lang to identify the natural language of content and changes in natural language.

Ensure that dynamic content is accessible.

- Ensure that text equivalents for dynamic content are updated when the dynamic content changes.
- Ensure that SVG documents are usable when scripts or other programmatic objects are turned off or not supported.

Appendix I: Internationalization Support

Contents

- [I.1 Introduction](#)
- [I.2 Internationalization and SVG](#)
- [I.3 SVG Internationalization Guidelines](#)

This appendix is informative, not normative.

I.1 Introduction

This appendix provides a brief summary of SVG's support for internationalization. The appendix is hyperlinked to the sections of the specification which elaborate on particular topics.

I.2 Internationalization and SVG

SVG is an application of XML [XML10] and thus supports Unicode [UNICODE], which provides universal 16-bit encoding for the scripts of the world's principal languages.

Additionally, SVG provides a mechanism for precise control of the glyphs used to draw text strings, which is described in Alternate glyphs. This facility provides:

- access to glyphs which are not defined in standard Unicode [UNICODE]
- the ability to follow the guidelines for normalizing character data for the purposes of enhanced interoperability (see [CHARMOD]), while still having precise control over the glyphs that are drawn.

SVG supports:

- Horizontal, left-to-right text found in Roman scripts (see the 'writing-mode' property)
- Vertical and vertical-ideographic text (see the 'writing-mode' property)
- Arabic bi-directional text (see the 'direction' and 'unicode-bidi' properties)

SVG fonts support alternate glyphs for Arabic and Han text.

Multi-language SVG documents are possible by utilizing the systemLanguage attribute to have different text strings appear based on the user's language setting.

I.3 SVG Internationalization Guidelines

SVG generators should follow W3C guidelines for normalizing character data [CHARMOD] and should use the facilities for Alternate glyphs to override the standard glyphs used to represent normalized character data with specified glyphs.

Appendix J: Minimizing SVG File Sizes

This appendix is informative, not normative.

Considerable effort has been made to make SVG file sizes as small as possible while still retaining the benefits of XML and achieving compatibility and leverage with other W3C specifications.

Here are some of the features in SVG that promote small file sizes:

- SVG's path data definition was defined to produce a compact data stream for vector graphics data: all commands are one character in length; relative coordinates are available; separator characters don't have to be supplied when tokens can be identified implicitly; smooth curve formulations are available (cubic beziers, quadratic beziers and elliptical arcs) to prevent the need to tesselate into polylines; and shortcut formulations exist for common forms of cubic bezier segments, quadratic bezier segments, and horizontal and vertical straight line segments so that the minimum number of coordinates need to be specified.
- Text can be specified using XML character data -- no need to convert to outlines.
- SVG contains a facility for defining symbols once and referencing them multiple times using different visual attributes and different sizing, positioning, clipping and client-side filter effects
- User agents that support styling with CSS can use CSS selectors and property inheritance to define commonly used sets of attributes once as named styles.
- Filter effects allow for compelling visual results and effects typically found only in image-authoring tools using small amounts of vector and/or raster data

Additionally, HTTP 1.1 allows for compressed data to be passed from server to client, which can result in significant file size reduction. Here are some sample compression results using gzip compression on SVG documents:

Uncompressed SVG	With gzip compression	Compression ratio
12,912	2,463	81%
12,164	2,553	79%
11,613	2,617	77%
18,689	4,077	78%
13,024	2,041	84%

A related issue is progressive rendering. Some SVG viewers will support:

- the ability to display the first parts of an SVG document fragments as the remainder of the document is downloaded from the server; thus, the user will see part of the SVG drawing right away and interact with it, even if the SVG file size is large.
- delayed downloading of images and fonts. Just like some HTML browsers, some SVG viewers will download images and Web fonts last, substituting a temporary image and system fonts, respectively, until the given image and/or font is available.

Here are techniques for minimizing SVG file sizes and minimizing the time before the user is able to start

interacting with the SVG document fragments:

- Construct the SVG file such that any links which the user might want to click on are included at the beginning of the SVG file
- Use default values whenever possible rather than defining all attributes and properties explicitly.
- Take advantage of the path data data compaction facilities: use relative coordinates; use *h* and *v* for horizontal and vertical lines; use *s* or *t* for cubic and quadratic bezier segments whenever possible; eliminate extraneous white space and separators.
- Utilize symbols if the same graphic appears multiple times in the document
- For user agents that support styling with CSS, utilize CSS property inheritance and selectors to consolidate commonly used properties into named styles or to assign the properties to a parent <g> element.
- Utilize filter effects to help construct graphics via client-side graphics operations.

Appendix K. References

Contents

- [H.1 Normative references](#)
- [H.2 Informative references](#)

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  - ❍ **[CSS2-CASCADE]** CSS2 cascading and inheritance

  - ❍ **[CSS2-CASCADE-RULES]** CSS2 cascading rules

  - ❍ **[CSS2-SPECIFIED]** CSS2 specified values

  - ❍ **[CSS2-COMPUTED]** CSS2 computed values

  - ❍ **[CSS2-INHERIT]** CSS2 inheritance

  - ❍ **[CSS2-ATRULES]** CSS2 At-rules

  - ❍ **[CSS2-POSN]** CSS2 positioning properties

  - ❍ **[CSS2-LAYOUT]** CSS2 positioning properties

  - ❍ **[CSS2-DYNPSEUDO]** CSS2 dynamic pseudo-classes

  - ❍ **[CSS2-AURAL]** aural media

  - ❍ **[CSS2-VISUAL]** visual media

  - ❍ **[CSS2-UNITSPEREM]** units per em

- **[CSS2-azimuth]** [CSS2 'azimuth' property definition](#)
- **[CSS2-clip]** [CSS2 'clip' property definition](#)
- **[CSS2-color]** [CSS2 'color' property definition](#)
- **[CSS2-cue]** [CSS2 'cue' property definition](#)
- **[CSS2-cue-after]** [CSS2 'cue-after' property definition](#)
- **[CSS2-cue-before]** [CSS2 'cue-before' property definition](#)
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- **[CSS2-pause-before]** [CSS2 'pause-before' property definition](#)
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- **[CSS2-speak-numeral]** [CSS2 'speak-numeral' property definition](#)
- **[CSS2-speak-punctuation]** [CSS2 'speak-punctuation' property definition](#)
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- **[SMILANIM-ADD]** Additive Animation

- **[SMILANIM-ACCUM]** Controlling behavior of repeating animation - Cumulative Animation

- **[SMILANIM-FROMTOBY-ADD]** How from, to and by attributes affect additive behavior

- **[SMILANIM-LINKS]** Hyperlinks and Timing

- **[SMILANIM-TRANSITIONS]** State Transition Model

- **[SMILANIM-RESTART]** Restarting animations

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- **[SMILANIM-ATTR-DUR]** 'dur' attribute

- **[SMILANIM-ATTR-END]** 'end' attribute

- **[SMILANIM-ATTR-RESTART]** 'restart' attribute

- **[SMILANIM-ATTR-REPEATCOUNT]** 'repeatCount' attribute

- **[SMILANIM-ATTR-REPEATDUR]** 'repeatDur' attribute

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Appendix L: Property Index

Name	Values	Initial value	Applies to (Default: all)	Inherited?	Percentages (Default: N/A)	Media groups	Animatable
'baseline-identifier'	baseline | top | before-edge | text-top | text-before-edge | middle | bottom | after-edge | text-bottom | text-after-edge | ideographic | lower | hanging | mathematical | inherit	see property description	'text', 'tspan', 'tref', 'glyphRun', 'textPath' elements	no		visual	yes
'baseline-shift'	baseline | sub | super | <percentage> | <length> | inherit	baseline	'text', 'tspan', 'tref', 'glyphRun' and 'textPath' elements	no	refers to the 'line-height' of the 'text' element, which in the case of SVG is defined to be equal to the 'font-size'	visual	yes (non-additive, 'set' and 'animate' elements only)
'clip'	<shape> | auto | inherit	auto	elements which establish a new viewport	no		visual	yes
'clip-path'	<uri> | none | inherit	none	all elements	no		visual	yes
'clip-rule'	evenodd | nonzero | inherit	evenodd	graphics elements within a 'clipPath' element	yes		visual	yes
'color'	<color> | inherit	depends on user agent	'fill', 'stroke', 'stop-color', 'flood-color', 'lighting-color' properties	see Inheritance of Painting Properties		visual	yes
'color-interpolation'	auto | sRGB | linearRGB | inherit	sRGB	color interpolation and compositing operations	yes		visual	yes
'color-rendering'	auto | optimizeSpeed | optimizeQuality | inherit	auto	color interpolation and compositing operations	yes		visual	yes
'cursor'	[[<uri> ,]* [auto | crosshair | default | pointer | move | e-resize | ne-resize | nw-resize | n-resize | se-resize | sw-resize | s-resize | w-resize| text | wait | help]] | inherit	auto	container elements and graphics elements	yes		visual, interactive	yes
'direction'	ltr | rtl | inherit	ltr	all elements, but see prose	yes		visual	no
'display'	inline | block | list-item | run-in | compact | marker | table | inline-table | table-row-group | table-header-group | table-footer-group | table-row | table-column-group | table-column | table-cell | table-caption | none | inherit	inline		see Inheritance of Painting Properties below		all	yes
'dominant-baseline'	auto | autosense-script | no-change | reset| ideographic | lower | hanging | mathematical | inherit	auto	'text' elements	no		visual	yes
'enable-background'	accumulate | new [(<x> <y> <width> <height>)] | inherit	accumulate	container elements	no		visual	no
'fill'	<paint> (See Specifying paint)	black		no		visual	yes
'fill-opacity'	<opacity-value> | inherit	1		yes		visual	yes
'fill-rule'	evenodd | nonzero | inherit	evenodd		yes		visual	yes

'filter'	<uri> | none | inherit	none	graphics and container elements	no		visual	yes
'flood-color'	currentColor | <color> [icc-color(<name>,<icccolorvalue>+)] | inherit	black	'feFlood' elements	no		visual	yes
'flood-opacity'	<alphavalue> | inherit	1	'feFlood' elements	no		visual	yes
'font'	[['font-style' || 'font-variant' || 'font-weight']? 'font-size' [/ 'line-height']? 'font-family'] | caption | icon | menu | message-box | small-caption | status-bar | inherit	see individual properties		yes	allowed on 'font-size' and 'line-height' ('line-height' same as 'font-size' in SVG)	visual	yes (non-additive, 'set' and 'animate' elements only)
'font-family'	[[<family-name> | <generic-family>],]* [<family-name> | <generic-family>] | inherit	depends on user agent		yes		visual	yes
'font-size'	<absolute-size> | <relative-size> | <length> | <percentage> | inherit	medium		yes, the computed value is inherited	refer to parent element's font size	visual	yes
'font-size-adjust'	<number> | none | inherit	none		yes		visual	yes
'font-stretch'	normal | wider | narrower | ultra-condensed | extra-condensed | condensed | semi-condensed | semi-expanded | expanded | extra-expanded | ultra-expanded | inherit	normal		yes		visual	yes
'font-style'	normal | italic | oblique | inherit	normal		yes		visual	yes
'font-variant'	normal | small-caps | inherit	normal		yes		visual	yes
'font-weight'	normal | bold | bolder | lighter | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | inherit	normal		yes		visual	yes
'glyph-orientation-horizontal'	<angle> | inherit	0	'text', 'tspan', 'tref', 'glyphRun', 'textPath' elements	yes		visual	no
'glyph-orientation-vertical'	<angle> | auto | inherit	auto	'text', 'tspan', 'tref', 'glyphRun', 'textPath' elements	yes		visual	no
'image-rendering'	auto | optimizeSpeed | optimizeQuality | inherit	auto	images	yes		visual	yes
'letter-spacing'	normal | <length> | inherit	normal		yes		visual	yes
'lighting-color'	currentColor | <color> [icc-color(<name>,<icccolorvalue>+)] | inherit	white	'feDiffuseLighting' and 'feSpecularLighting' elements	no		visual	yes
'marker'	see individual properties	see individual properties	'path', 'line', 'polyline' and 'polygon' elements	see Inheritance of Painting Properties below		visual	yes
'marker-end' 'marker-mid' 'marker-start'	none | inherit | <uri>	none	'path', 'line', 'polyline' and 'polygon' elements	see Inheritance of Painting Properties below		visual	yes
'mask'	<uri> | none | inherit	none		no		visual	yes
'opacity'	<alphavalue> | inherit	1		no		visual	yes
'overflow'	visible | hidden | scroll | auto | inherit	see prose	elements which establish a new viewport	no		visual	yes

Property	Values	Initial	Applies to	Inherited	Percentages	Media	Animatable
['pointer-events'](#)	visiblePainted | visibleFill | visibleStroke | visibleFillStroke | visible | painted | fill | stroke | fillstroke | all | none | inherit	visiblePainted	[container elements](#) and [graphics elements](#)	yes		[visual](#)	yes
['shape-rendering'](#)	auto | optimizeSpeed | crispEdges | geometricPrecision | inherit	auto		yes		[visual](#)	yes
['stop-color'](#)	currentColor | [<color>](#) [icc-color(<name>,<icccolorvalue>+)] | inherit	black	['stop'](#) elements	no		[visual](#)	yes
['stop-opacity'](#)	<alphavalue> | inherit	1	['stop'](#) elements	no		[visual](#)	yes
['stroke'](#)	<paint> (See [Specifying paint](#))	none		see [Inheritance of Painting Properties](#) below		[visual](#)	yes
['stroke-dasharray'](#)	none | <dasharray> | inherit	none		yes		[visual](#)	
['stroke-dashoffset'](#)	<dashoffset> | inherit	0		yes	see prose	[visual](#)	yes
['stroke-linecap'](#)	butt | round | square | inherit	butt		yes		[visual](#)	yes
['stroke-linejoin'](#)	miter | round | bevel | inherit	miter		yes		[visual](#)	yes
['stroke-miterlimit'](#)	<miterlimit> | inherit	4		yes		[visual](#)	yes
['stroke-opacity'](#)	<opacity-value> | inherit	1		yes		[visual](#)	yes
['stroke-width'](#)	<width> | inherit	1		yes		[visual](#)	yes
['text-anchor'](#)	start | middle | end | inherit	start	['text'](#) elements	yes		[visual](#)	yes
['text-decoration'](#)	none | [underline || overline || line-through || blink] | [inherit](#)	none		no (see prose)		[visual](#)	yes
['text-rendering'](#)	auto | optimizeSpeed | optimizeLegibility | geometricPrecision | inherit	auto	'text' elements	yes		[visual](#)	yes
['unicode-bidi'](#)	normal | embed | bidi-override | [inherit](#)	normal	all elements, but see prose	no		[visual](#)	no
['visibility'](#)	visible | hidden | collapse | [inherit](#)	inherit		no		[visual](#)	yes
['word-spacing'](#)	normal | [<length>](#) | [inherit](#)	normal		yes		[visual](#)	yes
['writing-mode'](#)	lr-tb | rl-tb | tb-rl | lr | rl | tb | inherit	lr-tb	['text'](#) elements	yes		[visual](#)	no

Appendix M: Change History

Changes with the 29 June 2000 SVG Draft Specification

- Global/miscellaneous changes
  - ❍ Replaced the two-grammar approach from the March 3 spec (i.e., Stylable SVG and Exchange SVG) with a single grammar approach which allows styling either using CSS or via corresponding XML attributes. The chapter on Exchange SVG has been removed as a result of this. See the remainder of this change history for what other changes occurred.
  - ❍ Various minor error corrections to the sections of the specification describing the language and the SVG DOM, along with various miscellaneous editorial fixes.
  - ❍ DOM: Significant changes due to consolidating Stylable SVG and Exchange SVG into a single grammar. All #ifdef STYLABLESVG and #ifdef EXCHANGESVG logic has been removed. The various DOM attributes corresponding to the XML presentation attributes have been removed in favor of a single method, getPresentationAttribute(attr-name), that is present on interface "Stylable".
  - ❍ DOM: Cleanup of SVG DOM to ensure that script writers have access to every attribute which is animatable and to make the SVG DOM use a consistent approach to presenting the current animated value, with many changes as a result. Defined new DOM interfaces such as SVGAnimatedAngle, SVGAnimatedNumber, SVGAnimatedLength, etc. and modified many attributes from previous types (e.g., SVGAngle, SVGNumber, SVGLength) to the new types (e.g., SVGAnimatedAngle, SVGAnimatedNumber, SVGAnimatedLength). Removed specific access to animated values from SVGPaint and SVGColor as the animated values of these properties are available from the override style sheet. Several bug fixes during this cleanup process where the DOM types did not match the types in the language.
  - ❍ DOM: Changed all indices to range from 0 to nItems-1, rather than 1 to nItems, to conform to the way DOM numbers its indices, including interfaces SVGList, SVGPath and SVGTextContentElement.
  - ❍ DOM: Added DOMException NO_MODIFICATION_ALLOWED_ERR for all attributes which are not readonly in case an attempt is made to change these attributes when the underlying node is readonly.
  - ❍ DOM: Moved DOM attribute "className" (corresponds to XML attribute 'class') into interface SVGStylable as it is available the same places the 'style' attribute is.
- Changes to Basic Data Types and Interfaces
  - ❍ Added a new section, Recognized color keyword names, which lists the expanded list of (147) color keywords, expected to be compatible with CSS3.
  - ❍ Under the definition of <color>, included a note saying that any of the user interface / system

color keywords names from CSS2 can also be used.

- ❍ DOM: Changed attributes on SVGTests to be an SVGList so that it is possible to access the individual entries in the list. Also, added a hasExtension() method to match the core DOM call hasFeature().
- ❍ DOM: Changed the method names for SVGList from 'insertBefore()', 'replace()', 'remove()' and 'append()' to 'insertItemBefore()', 'replaceItem()', 'removeItem()', and 'appendItem()' in order to purposely avoid using the same method names as the Node interface in DOM since the corresponding methods on SVGList take different parameter lists than Node.

- Changes to Document Structure

  - ❍ Changed the description of the 'use' element to say that a 'use' is rendered as if it were replaced by a 'g' rather than an 'svg'. The new description eliminates problems in the areas of undesirable clipping and undesirable redefinition of CSS units which existed in previous versions.
  - ❍ Added a paragraph to the description of the 'image' element to make clear that raster images are fitted into the region (x,y) to (x+width,y+height) and that SVG files are processed using the standard rules for establishing a new viewport.
  - ❍ Changed 'system-required' to 'requiredFeatures' and defined the attribute to indicate whether the specified list of features is supported by the user agent. Added 'requiredExtensions' to indicate whether the given list of extensions is supported by the user agent.
  - ❍ Renamed 'system-language' to 'systemLanguage' to match the upcoming change with SMIL-Boston. Copied the description for this attribute from the latest SMIL-Boston draft.
  - ❍ Added a note indicating what happens if an event attribute is assigned to an element referenced directly or indirectly via a 'use'.
  - ❍ Added a paragraph to the description of the 'use' element to talk explicitly about how the 'visibility' property inherits into the referenced content of the 'use'.
  - ❍ Added an additional paragraph to description of 'externalResourcesRequired' to caution generators of SVG against setting this attribute to 'true' on the outermost SVG element as that might preclude progressive rendering of the content.
  - ❍ DOM: Added 'instanceRoot' and 'animatedInstanceRoot' to SVGUseElement and two new interfaces, SVGElementInstance and SVGElementInstanceList, to allow handling of events assigned to elements references by a 'use' element.

- Changes to Styling

  - ❍ Added a bullet saying that any of the user interface / system color keywords names from CSS2 are supported by SVG.
  - ❍ Major changes to this chapter to reflect the change from the two-grammar approach in the March 3 spec into a single, consolidated grammar which allows styling either using CSS or via corresponding XML attributes. The discussion now talks about properties in general and the two ways of expressing these properties: via XML "presentation attributes" or CSS style declarations.
  - ❍ Included simple examples of styling using an XSL external style sheet and styling using a CSS external style sheet. Revised the example of an internal CSS sheet.
  - ❍ Changed the section titled "Default style sheet" to "User agent style sheet" and clarified that the user agent style sheet shall only have the initial values specified in this specification when rendering on visual media.

- Changes to Coordinate Systems, Transformations and Units

  - ❍ Created a new section, 7.13 Establishing a new user coordinate system via object bounding box, that explains the rules for when coordinates are relative to an object bounding box. Consolidated

various descriptions that used to be scattered about the specification for the exact rules concerning the computation of the bounding box and added a clarification of how bounding box works on 'text' elements.

❍ Due to implementation difficulty and performance implications, removed the ability to use unit identifiers within a 'transform' attribute.

● Changes to Paths

❍ Minor bug fixes to BNF for path data.

❍ Changed the name of attribute 'length' to 'pathLength' to avoid DOM conflict with the 'length' DOM attribute that exists on the Node interface.

❍ DOM: Major changes to the DOM for path segments. Now, SVGPathSeg is a base interface, with a different interface defined for each of the path segment types, such as SVGPathSegMovetoAbs. SVGPathElement now contains factory methods for creating each of the path segment types.

● Changes to Basic Shapes

❍ Minor fixes to the BNF for the 'points' attribute for 'polyline' and 'polygon'.

❍ Changed the rules for negative values for rx/ry on 'rect', r on 'circle' and rx/ry on 'ellipse' elements to be consistent with the treatment of inappropriate negative values in the rest of the spec. Now, negative values are an error.

● Changes to Text

❍ Added new element 'glyphRun' to allow for a list of glyphs with different rendering order versus search/selection order. This feature addresses various internationalized text requirements.

❍ Added attribute 'textLength' on 'text', 'tspan', 'tref' and 'textPath' elements to provide an option for an author to indicate the expected length which a given text string is supposed to take up.

❍ Added new attribute 'lengthAdjust' to allow a choice between two methods for fitting text to a particular textLength: either just adjust the text advance values, or also stretch/compress the glyphs.

❍ Added attribute 'method' to 'textPath' to allow an option to warp/stretch text-on-a-path. This facility will make cursive/script fonts (e.g., Arabic) stay connected when rendered along a path.

❍ Added attribute 'spacing' to 'textPath' to allow an option for user agents to apply algorithms to make the rendered results as visual pleasing as possible.

❍ Added clarification on objectBoundingBox on 'text' elements, documenting that the bounding box covers the entire 'text' element even when the effect is specified on a 'tspan' within the 'text' element.

❍ Expanded the description of 'text-decoration' to describe explicitly how decorations are to be rendered and which properties are used to render the decorations. Added an example to illustrate the rules.

❍ Fixed bug in spec where the default values for 'x' and 'y' on 'tspan' were defined as zero. The intent all along has been that a 'tspan' continues at the current text position from the previous character. As a result, there is new wording for what happens when any of the attributes 'x', 'y', 'dx', 'dy' and 'rotate' are not provided.

● Changes to Painting: Filling, Stroking and Marker Symbols

❍ Changed the initial value for 'fill' from 'currentColor' to 'black' due to feedback from implementers and test developers that 'currentColor' does not have a real initial value, thus causing any SVG file that uses the initial value to have unknown rendering.

- ❍ For various properties defined in this chapter, specified what happens when negative or zero values are supplied for items that represent lengths, distances or percentages. Typically, negative values are an error and positive values cause the item either to not be rendered or to fallback to some default rendering.
- ❍ State explicitly that a zero stroke-width disables painting of the stroke.
- ❍ Changed the description of how to render 'marker' elements to improve clarity and fix errors in the description. The order of the tranformations is described differently, particularly how (refX,refY) are factored in.
- ❍ Changed the initial value for 'stroke-miterlimit' to 4 (instead of 8) as this better matches current industry practice and publishing industry guidelines.
- ❍ Moved the 'display' property from the Styling chapter into this chapter, and then moved both the 'display' and 'visibility' properties into their own section entitled "Controlling visibility". Added a short discussion of the differences between these two properties.
- ❍ Fixed bugs in definition of 'visibility' property. This property, which we share with CSS2, had been defined as inheritable, but the property is not inheritable. Also, the initial value was set incorrectly (should be 'inherit').
- ❍ Added 'collapse' keyword to 'visibility' property to match CSS2. 'collapse' is defined in CSS2 to mean the same as 'hidden' for everything but tables.
- ❍ Added clarification notes on the 'visibility' property about how invisible 'tspan' elements still take up space and how invisible objects still might receive events, depending on the value of property 'pointer-events'.
- ❍ Included a detailed description of the two options for 'fill-rule' and included pictures illustrating the concept.
- Changes to Color
  - ❍ DOM: Changed the name of CSSColorProfileRule to SVGColorProfileRule as it directly inherits from interface SVGCSSRule, not CSSRule. As future version of the CSS OM evolve, this can be renamed to something like CSSColorProfileRule and the current name can be deprecated.
  - ❍ DOM: Added a note that SVGColorProfileRule that support for it is only required for implementations that support CSS.
  - ❍ DOM: Added DOM interfaces corresponding to elements 'color-profile' and 'color-profile-src'. Factored out SVGRenderingIntent into a separate interface that is shared between SVGColorProfileElement and SVGColorProfileRule.
- Changes to Gradients and Patterns
  - ❍ Changed the default for gradientUnits and patternUnits from 'userSpace' to 'userSpaceOnUse' after implementation feedback about difficulty achieving fast performance with 'userSpace'. The decision was that the default needs to be something with good performance characteristics.
  - ❍ Changed the description of 'linearGradient' to say if x1=x2 and y1=y2, then the gradient is rendered as a solid color matching the last gradient stop.
  - ❍ Changed the description of 'radialGradient' to say if r=0, then the gradient is rendered as a solid color matching the last gradient stop.
  - ❍ Clarified the behavior of linear/radial gradients in object bounding box space as being rendered perpendicular/circular relative to object bounding box space, which will result in non-perpendicular/elliptical results if the bounding box is not square in user space.
  - ❍ Clarified that the gradientTransform and patternTransform matrices are inserted immediately to the right (i.e., post-multiplied) to the transformation matrix caused by 'gradientUnits' or

'patternUnits'.

- ❍ Changed the default values for fx/fy on radial gradients from "50%" to "same as cx/cy".
- ❍ Added a 'spreadMethod' attribute to radial gradients for consistency with the specification for linear gradients.
- ❍ Fixed bug introduced in April 13 spec where default value on y2 in 'linearGradient' was erroneously set to "100%" instead of the correct value of "0%".

- ● Changes to Clipping, Masking and Compositing

  - ❍ Changed the default for clipPathUnits and maskUnits from 'userSpace' to 'userSpaceOnUse' after implementation feedback about difficulty achieving fast performance with 'userSpace'. The decision was that the default needs to be something with good performance characteristics.
  - ❍ Masks now use both the luminance of the color channels and the alpha channel. Previously, there was a very arbitrary and confusing set of scenarios when the luminance of the color channels were used in a mask. Now, the luminance is used always. This change makes for a more consistent rendering model and better matches industry practice.
  - ❍ Changed the initial value on 'clip-path' from "see prose" to 'none'. There is no actual behavioral change with this change; the old prose described the same affect as 'none'.
  - ❍ Explicitly stated that if clipPathUnits="objectBoundingBox", the 'transform' attribute on the 'clipPath' element is ignored as the coordinate system has become defined relative to the bounding box on the referencing element.
  - ❍ Added clarification to the description of 'clip-rule' indicating that the property only applies to shapes within a 'clipPath' element.

- ● Changes to Filter Effects

  - ❍ Added attribute primitiveUnits as a separate attribute from filterUnits so that different coordinate systems can be used to specify the filter region versus the length and coordinate values within the filter primitives. For example, the filter region might be specified relative to the object bounding box, but the filter primitives might be specified relative to the current user coordinate system. The separation is particularly useful if applying a common filter effect to multiple text strings, where the filter effect region is defined in terms of object bounding box but the primitives have a common light source position.
  - ❍ Modified the coefficients for 'luminanceToAlpha' in feColorMatrix as the previous coefficients were incorrect. (The old formulas were based on NTSC colors rather than sRGB).
  - ❍ Changed the types of k1,k2,k3,k4 on feComposite to be numbers and removed the erroneous comment about only 0 and 1 being the only valid values.
  - ❍ Removed attribute resultScale from feDiffuseLighting as it did not really address the presumed end user needs, and those needs can be accomplished in other ways.
  - ❍ Added attribute 'bias' to feConvolveMatrix, which allows a constant value to be added to each color channel after application of the kernel.
  - ❍ Added attribute 'preserveAlpha' to feConvolveMatrix, which provides an option to specify whether the kernel should be applied to all channels or just the color channels.
  - ❍ Added attribute 'limitingConeAngle' to feSpotLight, to allow for the effect of a spotlight to be restricted to a particular conic area.
  - ❍ Minor updates to code for feTurbulence after actual compilation and use and verification across different implementations.
  - ❍ Changed the default for filterUnits and primitiveUnits from 'userSpace' to 'userSpaceOnUse' after implementation feedback about difficulty achieving fast performance with 'userSpace'. The

decision was that the default needs to be something with good performance characteristics.

- ❍ Added a 'discrete' option to feComponentTransfer for a step function, which is a common way to achieve a posterizing effect.
- ❍ Changed attribute 'lightColor' in 'feDiffuseLighting' and 'diffuseConstant' into property 'lighting-color' for consistency so that everything that defines a color value is done via a property. This also provides consistency with 'flood-color' in 'feFlood'.
- ❍ Change 'diffuseConstant' and 'specularConstant' to take any non-negative value instead of just values in the range of 0 to 1. This change coincided with dropping the 'resultScale' attribute for 'feDiffuseLighting'.
- ❍ DOM: Changed the name of DOM attribute "in" to "in1" since "in" is a keyword and cannot be used as a DOM attribute name.

- ● Changes to [Interactivity](#)

  - ❍ Replaced attribute 'enableZoomAndPanControls="true|false"' with attribute 'zoomAndPan="disable|magnify|zoom"', with the default being 'magnify'. This new formulation and new default helps alleviate unexpected behavior that was occurring when filters and gradients were specified using CSS units and the user zoomed in on the graphic.

- ● Changes to [Scripting](#)

  - ❍ Fixed bugs in the scripting example.

- ● Changes to [Animation](#)

  - ❍ Added an 'mpath' child element to 'animateMotion' so that the motion path can be defined via a reference to a previously defined 'path' element.
  - ❍ Added a few sentences under 'animateMotion' to clarify that the motion animation provides a transformation that is supplemental to any transformations from the elements 'transform' attribute or any animations on the 'transform' attribute.
  - ❍ Fixed bugs in the DOM animation example.

- ● Changes to [Fonts](#)

  - ❍ Made it possible for 'font-face' to be a child of 'font' so that a single 'font' element can contain all information necessary for other documents and other languages to make use of the font.
  - ❍ Moved many font-descriptor attributes from the 'font' element to the 'font-face' element, such as 'font-size', font-weight', 'cap-height', etc. This change reduces redundancy in the language.
  - ❍ Minor modifications to the list of descriptors in 'font-face' to be the union of the font descriptors from CSS2 and any new font descriptors that are emerging from the work on XSL.
  - ❍ Made the 'unicode' attribute on the 'glyph' element #IMPLIED to allow for definition of glyphs which do not have corresponding code points in Unicode. Such glyphs can only be accessed via the 'altGlyph' facility.
  - ❍ Added class/style/presentation attributes to the 'font' element per decision that all container elements would allow all properties.
  - ❍ Clarified that font metrics and the initial coordinate system for glyphs is based on the CSS2 model of an em square. Also, clarified that the coordinate system for SVG fonts has the Y axis pointing up to match common practice with other font formats.
  - ❍ Changed the default for attribute unicode-range from "U+0-7FFFFFFF" to "U+0-10FFFF", as no XML characters beyond that range.

- ● Changes to [SVG DTD](#)

❍ Substantial changes to the DTD to accommodate the consolidation of Stylable SVG and Exchange SVG (from the March 3 spec) into a single language which has both XML "presentation attributes" and the ability to style with CSS (i.e., a 'style' element and a 'style' attribute). Instead of three DTD files (shared, stylable, exchange), there is now only one DTD file. All of the conditional logic based on the names "SVGStylable" versus "SVGExchange" from the March 3 specification has been removed

❍ Substantial editorial cleanup of the DTD, including reordering the element definitions to match the order in which they appear in the spec, grouping element definitions by chapter, adding a table of contents with links to each section of the DTD, comments over each section of the DTD, new names for various entities, etc.

❍ Substantial cleanup of the list of "presentation attributes" on the various elements. The rule is that if a given attribute collection might apply to a given element or any of its descendants, then that collection of presentation attributes is available on the given element. Defined a new entity PresentationAttributes-All which contains a complete list of the presentation attributes. All container elements and the 'use' element now reference this new entity so that all presentation attributes are available for these elements.

❍ Unified the content models for 'mask', 'pattern', 'symbol', 'marker', 'glyph', 'missing-glyph' and 'a' for greater consistency and to give implementers a greater ability to share code.

❍ Added 'desc' and 'title' to 'tspan', 'tref', 'textPath', 'linearGradient', 'radialGradient' and 'filter' for more DTD consistency.

❍ Allow a 'metadata' sub-element wherever a 'desc' or 'title' can go so that metadata can be specified locally for each distinct container and graphics element.

❍ Made changes to ensure that attribute 'class' existed everywhere where attribute 'style' existed, which means adding 'class' to 'feFlood', 'glyph' and 'missing-glyph'.

● Changes to SVG DOM

❍ Added a section on "Invalid values" to clarify what happens when an invalid value is assigned to an attribute.

● Changes to IDL

❍ The IDL reflects all of the changes to the DOM mentioned in other parts of this change history. Most significantly, the IDL reflect changes to accommodate the consolidation of Stylable SVG and Exchange SVG (from the March 3 spec), such as the removal of all #ifdef STYLABLESVG and #ifdef EXCHANGESVG.

● Changes to Java language DOM binding

❍ To accommodate the consolidation of Stylable SVG and Exchange SVG (from the March 3 spec), there is now only a single Java binding instead of two separate ones.

❍ Various fixes to the Java binding based on reports from implementers have been incorporated into the Java binding that accompanies this draft.

● Changes to ECMAScript language DOM binding

❍ To accommodate the consolidation of Stylable SVG and Exchange SVG (from the March 3 spec), there is now only a single ECMAScript binding instead of two separate ones.

❍ Added constants to the ECMAScript language binding as is now done with other W3C specifications.

● Changes to Conformance Criteria

❍ Modifications associated with replacing the two-grammar approach from the March 3 spec (i.e., Stylable SVG and Exchange SVG) with a single grammar approach which allows styling either

using CSS or via corresponding XML attributes. Now, all Conforming SVG Viewers must support the ability to assign styling properties via the XML "presentation attributes", and any CSS-enabled viewer must support the ability to assign styling properties via CSS syntax in the form of CSS style sheets or style rules within a 'style' attribute.

- Changes to [Minimizing SVG File Sizes](#)

  ○ Updated the gzip compression table using five SVG files from the 20000608 test suite.

- Changes to [References](#)

  ○ Moved Authoring Tools Accessibility Guidelines into the normative section as these guidelines are now a Recommendation and conformance to these guidelines is a requirement for authoring tools that are Conforming SVG Generators.

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This will contain the index