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                Job Submission Protocol Mapping Recommendations
                        for the Job Monitoring MIB

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Abstract

   This document defines the recommended mapping for many currently
   popular Job submission protocols to objects and attributes in the Job
   Monitoring MIB.

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1.0 INTRODUCTION

    The Job Monitoring MIB [JobMIB] is intended to be implemented in a
    device or server that supports any job submission protocol. However,
    the information available and the method of presentation varies
    significantly by job submission protocol. A common method of mapping
    job submission information to the Job Monitoring MIB is essential for
    interoperability of Job MIB agents and monitoring applications. This
    document defines recommended mappings for most popular job submission
    protocols to ensure this compatibility.

All mappings are unidirectional from the job submission protocol to
the MIB. It is assumed that support of the job submission protocol
in the printer implies that the reverse information flow is presently
defined and does not require interaction from the MIB. This mapping
is not defined in this document as it should be obvious.

This document refers to system configurations that are defined in the
Job Monitoring MIB [JobMIB]. For those readers that are familiar
with the configuration descriptions, a short summary appears here.
Please see the Job MIB document for further details.

Configuration 1: This is a simple peer-to-peer system which contains
                  only a client and a printer. The Job MIB agent is
                  resident in the printer.

Configuration 2: This system contains a client, server, and a
                  printer. The Jib MIB agent is resident in the
                  server.

Configuration 3: This system, as in configuration 2, contains a
                  client, server, and a printer. In this case the
                  Job MIB agent is implemented within the printer.

The most important object to be mapped is jmJobSubmissionID, since
this is a method for the user or client to determine the jmJobIndex
for a submitted job. Therefore, jmJobSubmissionID is specified for
all job submission protocols defined in this document. The remaining
objects mapped include only those items that have the equivalent
information presented to the printer by the job submission protocol.

While this document places a strong emphasis on jmJobSubmissionID
mapping to obtain jmJobIndex, the preferred method is through the use
of a bi-directional job submission protocol that returns the
equivalent value of jmJobIndex to the client, such as IPP. When a
bi-directional protocol that returns jmJobIndex is in use, the
jmJobSubmissionID object has no value to the client. When the
jmJobIndex cannot be returned, the use of a client defined
jmJobSubmissionID is preferred over an agent derived value. The
client defined version allows for retrieval of jmJobIndex using a
single SNMP Get operation, since jmJobSubmissionID is the index into
the jmJobIDTable. An agent derived value will require a search
through multiple entries in the jmJobIDTable.

The majority of the protocols mapped in this document are oriented
towards network job submission. However, the Job Monitoring MIB is
also intended to monitor print jobs received from other than network
ports, such as parallel and serial ports. Some of the job submission
protocols included that are used with non-networked ports are PJL,

PostScript, and TIP/SI. In addition, the Job Monitoring MIB can be
used with print jobs that are internally generated, such as self test
pages. In this latter case, no mapping is required since all job
submission protocols are bypassed.

2.0 LINE PRINTER DAEMON (LPR/LPD) PROTOCOL

The LPR/LPD printing protocol [LPD] is used with BSD UNIX systems in
the client-server-printer configuration. Usage of the Job Monitoring
MIB with LPR/LPD will most likely conform to Configuration 3, where
the monitor application or the server uses SNMP to obtain job
information from the printer. The client communicates with the UNIX
server using the existing LPD protocol to obtain job information.

The LPR/LPD protocol is also used in the Windows environment to
implement peer-to-peer printing, as shown in configuration 1. In
this case, SNMP is used by the client and/or the monitor application
to obtain the job information.

One of the major problems of LPR/LPD is the large number of vendor
unique extensions currently used with the protocol and the resulting
compatibility issues between available implementations. To avoid
these issues, this mapping of LPR/LPD is restricted to the protocol
as defined by RFC 1179.

The LPR/LPD protocol transfers print job data and control information
in separate files, known as the Data File and Control File,
respectively. Most of the information concerning the print job is
contained in the Control File. In many LPD implementations, the
Control File is transferred following the Data File. Thus much of
the information concerning the job may not be available until the
completion of the data transmission.

2.1 jmJobSubmissionID Mapped to LPR/LPD

The LPR/LPD Receive Data File command contains a parameter which
defines the name of the data file. This name field is structured as
follows:

    dfaXXX<host-name> or daXXXX<host-name>

Where XXX or XXXX is the numeric job number assigned by the network
entity submitting the print job to the printer. The recommended
mapping of this name field to jmJobSubmissionID is:

     octet 1:   '9'

     octets 2-40: Contains the <host-name> portion of the name field. If
                   the <host-name> portion is less than 40 octets, the
                   left-most character in the string shall appear in octet
                   position 2. Any unused portion of this field shall be
                   filled with spaces. Otherwise, only the last 39 bytes
                   shall be included.

     octets 41-48: '00000XXX' or '0000XXXX', where XXX or XXXX is the
                decimal (ASCII coded) representation of the LPR/LPD job
                number.

2.2 jmJobIndex Mapped to LPR/LPD

   The job index (jmJobIndex) is assigned by the SNMP job monitoring
   agent and is independent of the XXX (or XXXX) index assigned by the
   LPR/LPD client. This will allow the SNMP agent to track jobs
   received from multiple sources.

2.3 Other MIB Objects Mapped to LPR/LPD

MIB Object	LPR/LPD Parameter
jmJobKOctetsPerCopyRequested	Number of bytes as defined in the Data File
jmJobOwner	Control file command code = P (User Id)

2.4 The Attribute Group Mapped to LPD

   Other attributes that are applicable, but not defined in this section
   such as attributes that map to a vendor unique extension, may also be
   included.

MIB attribute	LPR/LPD information	Data type
jobName	Job Name (notes 1, 2)	Octet String
queueNameRequested	Queue name from the Data File	Octet String
fileName	Source File Name (notes 1, 3)	Octet String

Notes:
------
   1. The information is optional in the Control File. The attribute
      should be included if present in the Control File.
   2. Control file command code = J. If this optional field is omitted
      from the control file, then the agent returns the file name
      (command code = N), if present.
   3. Control file command code = N.

3.0 APPLETALK PROTOCOL

   AppleTalk was originally developed as a peer-to-peer network
   protocol, as described in configuration 1, for use with Apple
   Macintosh computers. Today, print spoolers are also available for
   use with Macintosh computer networks that conform to configurations
   2/3. In addition, printing with the AppleTalk protocol is supported
   from both Windows NT servers and Novell servers also per
   configurations 2/3.

   The AppleTalk protocol provides very little information that can be
   used with the Job Monitoring MIB. The Macintosh print drivers are
   able to provide information concerning the user and document name but
   imbed this information in the PDL, which is typically PostScript.
   The preferred jmJobSubmissionID is constructed from the information
   in the PostScript file, as defined in section 9.0.

3.1 jmJobSubmissionID Mapped to AppleTalk

   An alternative jmJobSubmissionID may be constructed from the
   Connection Identifier contained in the AppleTalk Printer Access
   Protocol (PAP) header. Since the Connection Id is not readily
   available in any of the defined AppleTalk implementations, this
   approach may be of little utility.

   octet 1:   'A'

   octets 2-40: Contains the AppleTalk printer name, with the first
                 character of the name in octet 2. AppleTalk printer
                 names are a maximum of 31 characters. Any unused
                 portion of this field shall be filled with spaces.

   octets 41-48: '00000XXX', where 'XXX' is the decimal (ASCII coded)
                  representation of the Connection Id.

3.2 Other AppleTalk Mappings

   No other Job MIB objects or parameters can be derived from
   information available in the AppleTalk headers

4.0 INTERNET PRINTING PROTOCOL (IPP)

   The Internet Printing Protocol [IPP] supports printing using any one
   of the three possible configurations. For configuration 2, the
   mapping defined herein is performed on an agent within the server.
   Otherwise, the mapping is performed on an agent within the printer.

4.1 jmJobSubmissionID Mapped to IPP

   IPP contains a rich set of parameters which allow several methods of
   creating the jmJobSubmissionID object. To prevent interoperability
   problems, the preferred method is to use the IPP job-uri attribute as
   follows:

   octet 1:   '4'

   octets 2-40: Contains the IPP job-uri job description attribute
                 generated by the printer. (The job-uri is returned to
                 the client by IPP.) If the job-uri is less than 40
                 octets, the left-most character in the string shall
                 appear in octet position 2. Any unused portion of this
                 field shall be filled with spaces. Otherwise, only the
                 last 39 bytes shall be included.

   octets 41-48: Contains the decimal (ASCII coded) representation of
                  the job-id job description attribute. Leading zeros
                  shall be inserted to fill the entire 8 octet field.

   NOTE - Since IPP returns the "job-identifier" attribute with the
   jmJobIndex value for a job when the job is submitted, the use of the
   jmJobSubmissionID table should not be needed by a management
   application. See Section 1.0.

4.2 jmJobIndex Mapped to IPP

   The job index (jmJobIndex) assigned by the SNMP job monitoring agent
   is returned to the client by IPP as the job-id job description
   attribute. (Since IPP does not require consecutively generated job-
   ids, the agent may receive jobs from multiple clients and can assign
   jmJobIndex in an ascending sequence independent of the submitting job
   client.) The IPP job-id must be restricted to the range of 1 to
   99,999,999 (decimal) to allow the value to be properly represented in
   jmJobSubmissionID.

4.3 Other MIB Objects Mapped to IPP

```
   MIB Object                        | IPP Job attribute
   -------------------------------+-------------------------------
   jmJobState                        | job-state
   jmJobStateReasons1                | job-state-reasons (note 1)
   jmNumberOfInterveningJobs         | number-of-intervening-jobs
   jmJobKOctetsPerCopyRequested      | job-k-octets
   jmJobKOctetsProcessed             | job-k-octets-processed
   jmJobImpressionsPerCopyRequested  | job-impressions
   jmJobImpressionsCompleted         | job-impressions-completed
   jmJobOwner                        | job-originating-user-name
```

   Notes:
   ------
   1. jmJobStateReasons1 is a bit map which can describe up to 31 job
      state reasons. Also the IPP "job-state-reasons" attribute is a
      multi-valued attribute with each value being a keyword. The IPP
      condition may change multiple bits in this object. The IPP "job-
      state-reasons" attribute may also change one or more of the
      jobStateReasonsN attributes (see section 4.4).

4.4 The Attribute Group Mapped to IPP

   The following mappings are required if the listed IPP job template
   attribute is provided.

```
MIB attribute              | IPP job attribute           | Data type
---------------------------+-----------------------------+------------
jobStateReasonsN(N=2, 3, 4)| job-state-reasons (note 3)  | Integer
jobCodedCharSet            | attributes-charset (note 1) | Octet String
jobNaturalLanguageTag      | attributes-natural-language | Octet String
jobURI                     | job-uri                     | Octet String
jobName                    | job-name                    | Octet String
physicalDevice             | output-device-assigned      | Octet String
numberOfDocuments          | number-of-documents         | Integer
jobPriority                | job-priority                | Integer
jobHoldUntil               | job-hold-until              | Octet String
sides                      | sides (note 2)              | Integer
finishing                  | finishings                  | Integer
printQualityRequested      | print-quality               | Integer
printerResolutionRequested | printer-resolution          | Integer
jobCopiesRequested         | copies (note 4)             | Integer
documentCopiesRequested    | copies (note 4)             | Integer
jobCollationType           | multiple-document-handling  | Integer
sheetsRequested            | job-media-sheets            | Integer
sheetsCompleted            | job-media-sheets-completed  | Integer
mediumRequested            | media                       | Octet String
jobSubmissionTime          | time-at-submission          | Integer
jobStartedProcessingTime   | time-at-processing          | Integer
jobCompletionTime          | time-at-completed           | Integer
```

   Notes:
   ------
   1. jobCodedCharSet is an enum from the IANA registry which is also
      used in the Printer MIB. The IPP attributes-charset is the name
      (MIME preferred name) of the character set.
   2. The Job MIB sides attribute uses the integer values "1" and "2".
      The IPP sides attribute uses three keywords.
   3. jobStateReasonsN are three attributes (N=2, 3, 4). Also the IPP
      "job-state-reasons" attribute is a multi-valued attribute with
      each value being a keyword. The IPP condition may change multiple
      bits in one or more of these Job MIB attributes. See also
      jmJobStateReasons1 in section 4.3.
   4. The IPP "copies" attribute maps to the Job MIB:
      (1) jobCopiesRequested when the job has only one document OR IPP
          "multiple-document-handling" is 'single-valued'
      (2) documentCopiesRequested, in which case the MIB value is the
          total number of document copies that the job will produce as a
          whole.

5.0 INTELLIGENT PRINTER DATA STREAM (IPDS)

   The IPDS datastream facilitates a close relationship between the
   print supervisor (Print Services Facility - PSF) and the printer.
   There are PSF applications for UNIX, Windows, OS/2, OS/400 and host
   operating systems such as VM, MVS and VSE. Together, PSF and IPDS
   represent a complete, mature and robust job management framework
   which includes font and resource management, page progress tracking,
   job cancellation, complete error recovery and end-user notification.
   Because PSF and the printer correspond via the use of locally
   assigned IDÆs, there is a limited amount of clear text information
   provided during submission for use by the Job MIB.

5.1 jmJobSubmissionId Mapped to IPDS

   For IPDS on the MVS or VSE platform:

   octet 1:   'E'

   octets 2-40: Contains bytes 2-27 of the XOH Define Group Boundary
                 Group ID triplet. Octet position 2 must carry the
                 value x'01'. Bytes 28-40 must be filled with spaces.

   octets 41-48: Contains a decimal (ASCII coded) representation of the
                  jmJobIndex assigned by the agent. Leading zeros shall
                  be inserted to fill the entire 8 octet field.

   For IPDS on the VM platform:

   octet 1:   'F'

   octets 2-40: Contains bytes 2-31 of the XOH Define Group Boundary
                 Group ID triplet. Octet position 2 must carry the
                 value x'02'. Bytes 32-40 must be filled with spaces.

   octets 41-48: Contains a decimal (ASCII coded) representation of the
                  jmJobIndex assigned by the agent. Leading zeros shall
                  be inserted to fill the entire 8 octet field.

   For IPDS on the OS/400 platform:

   octet 1:   'G'

   octets 2-40: Contains bytes 2-36 of the XOH Define Group Boundary
                 Group ID triplet. Octet position 2 must carry the
                 value x'03'. Bytes 37-40 must be filled with spaces.

     octets 41-48: Contains a decimal (ASCII coded) representation of the
                    jmJobIndex assigned by the agent. Leading zeros shall
                    be inserted to fill the entire 8 octet field.

5.2 The Attribute Group Mapped to IPDS

For MVS/VSE:

MIB attribute	IPDS XOH DGB Group ID	Data type
jobSourcePlatformType sptMVS(7)	Byte 2 = x'01'	Integer
jobName	Bytes 4-11	Octet String

For VM:

MIB attribute	IPDS XOH DGB Group ID	Data type
jobSourcePlatformType sptVM(8)	Byte 2 = x'02'	Integer
fileName	Bytes 4-11	Octet String

For OS/400:

MIB attribute	IPDS XOH DGB Group ID	Data type
jobSourcePlatformType sptOS400(9)	byte 2 = x'03'	Integer
fileName	Bytes 23-32	Octet String
jobName	Bytes 37-46	Octet String

6.0 DOCUMENT PRINTING APPLICATION (DPA)

   The ISO 10175 Document Printing Application (DPA) [DPA] supports
   printing using any one of the three possible configurations. For
   configuration 2, the mapping defined herein is performed on a server.
   Otherwise, the mapping is performed on an agent within the printer.

6.1 jmJobSubmissionID Mapped to DPA

   DPA contains a rich set of parameters which allow several methods of
   creating the jmJobSubmissionID object. To prevent interoperability
   problems, the preferred method is to use the DPA job-owner attribute
   as follows:

       octet 1:   '0'

    octets 2-40:   Contains the DPA job-owner attribute supplied by the
                   submitter. If the job-owner is less than 40 octets,
                   the left-most character in the string shall appear in
                   octet position 2. Any unused portion of this field
                   shall be filled with spaces. Otherwise, only the last
                   39 bytes shall be included.

    octets 41-48: Contains an 8-digit sequential decimal number.

6.2 jmJobIndex Mapped to DPA

    The job index (jmJobIndex) assigned by the SNMP job monitoring agent
    is returned to the client by DPA as a decimal digit string as the
    value of the DPA job-identifier attribute. (Since DPA does not
    require consecutively generated job-identifiers, the agent may
    receive jobs from multiple clients and can assign the jmJobIndex in
    an ascending sequence independent of the submitting job client.) The
    DPA job-identifier must be restricted to the range of 1 to 99,999,999
    (decimal) to allow the value to be properly represented in
    jmJobSubmissionID.

    NOTE - Since DPA returns the "job-identifier" attribute with the
    jmJobIndex value for a job when the job is submitted, the use of the
    jmJobSubmissionID table should not be needed by a management
    application. See Section 1.0.

6.3 Other MIB Objects Mapped to DPA

    MIB Object | DPA Job attribute
    ---------------------------------+----------------------------------
    jmJobState | job-state
    jmJobStateReasons1 | job-state-reasons (note 2)
    jmNumberOfInterveningJobs | intervening-jobs
    jmJobKOctetsPerCopyRequested | total-job-octets (notes 1, 3)
    jmJobKOctetsProcessed | job-octets-completed (note 1)
    jmJobImpressionsPerCopyRequested | job-impression-count (note 3)
    jmJobImpressionsCompleted | impressions-completed
    jmJobOwner | job-owner

    Notes:
    ------
    1. jmJobKOctetsPerCopyRequested and jmJobKOctetsProcessed is in K
       octets while the DPA job-total-octets and job-octets-completed is
       in octets and is 63-bits of significance.

   2. jmJobStateReasons1 is a bit map which can describe up to 31 job
      state reasons. Also the DPA "job-state-reasons" attribute is a
      multi-valued attribute with each value being an object identifier
      (OID). The DPA condition may change multiple bits in this object.
      The DPA condition may also change one or more of the
      jobStateReasonsN attributes (see section 4.4)
   3. DPA octets include the multiplication factor due to job and
      document copies, while the MIB values do not.

6.4 The Attribute Group Mapped to DPA

   The following mappings are required if the listed DPA job attribute
   is provided.

```
MIB attribute              | DPA job attribute            |IPP Data type
---------------------------+------------------------------+-------------
jobStateReasonsN(N=2, 3, 4)| job-state-reasons (note 2)   | Integer
jobCodedCharSet            | (note 1)                     | Octet String
jobAccountName             | accounting-information       | Octet String
jobName                    | job-name                     | Octet String
deviceNameRequested        | printer-name-requested       | Octet String
physicalDevice             | printers-assigned            | Octet String
numberOfDocuments          | number-of-documents          | Integer
fileName                   | file-name                    | Octet String
documentName               | document-name                | Octet String
jobComment                 | job-comment                  | Octet String
documentFormat             | document-format              | Octet String
jobPriority                | job-priority                 | Integer
jobProcessAfterDateAndTime | job-print-after              | Octet String
outputBin                  | results-profile.output-bin   | Octet String
sides                      | sides (note 3)               | Integer
finishing                  | job-finishing, finishing     | Integer
printQualityRequested      | print-quality                | Integer
printerResolutionRequested | default-printer-resolution   | Integer
                           |  (note 4)                    |
jobCopiesRequested         | results-profile.job-copies   | Integer
jobCopiesCompleted         | job-copies-completed         | Integer
documentCopiesRequested    | copy-count (note 5)          | Integer
documentCopiesCompleted    | copies-completed (note 6)    | Integer
sheetsRequested            | job-media-sheet-count        | Integer
sheetsCompleted            | job-media-sheets-completed   | Integer
pagesRequested             | job-page-count               | Integer
pagesCompleted             | pages-completed              | Integer
mediumRequested            | page-media-select,           | Octet String
                           |  default-medium              |
jobSubmissionTime          | submission-time (note 7)     | Octet String
jobStartedProcessingTime   | started-printing-time (note 7) Octet String
jobCompletionTime          | completion-time (note 7)     | Octet String
```

   Notes:
   ------
     1. Every DPA attribute is tagged indicating the coded character set
        to be used for that attribute.
     2. jobStateReasonsN are three attributes (N=2, 3, 4). The DPA
        condition may change one or more of the bits in one or more of
        these Job MIB items. Also the DPA job-state-reasons is a multi-
        valued attribute with each value being an OBJECT IDENTIFIER (OID).
     3. The Job MIB sides attribute is an integer '1' or '2' while the DPA
        sides attribute has one of six OID values that includes plex.
     4. printerResolutionRequested has x and y resolution and is intended
        to override the resolution instruction in the document, if any,
        while the DPA default-printer-resolution is the same in x and y
        and only takes effect if the document does not contain a
        resolution instruction
     5. The DPA "copy-count" attribute is a per-document attribute, so the
        MIB value is the sum of the documents' "copy-count" values times
        the job's "results-profile.job-copies" value.
     6. The DPA "copies-completed" attribute is a per-document attribute,
        so the MIB value is the sum of the documents' "copies-completed"
        values times the job's "results-profile.job-copies" value.
     7. The DPA GeneratlizedTime data type is defined by ISO 8824 (ISO-
        8824) while the MIB DateAndTime is defined by SNMPv2-TC (SNMPv2-
        TC).

7.0 NOVELL DISTRIBUTED PRINT SERVICE (NDPS)

   Novell Distributed Print Services is a DPA based job submission
   protocol that conforms to configuration 3.

7.1 jmJobSubmissionID Mapped to NDPS

   NDPS supports the generation of a properly formatted
   jmJobSubmissionID for use in the Job MIB, via the attribute ndps-
   att-job-identifier.

7.2 jmJobIndex Mapped to NDPS

   NDPS defines the attribute ndps-att-job-identifier-on-printer that
   can be used to return the value of jmJobIndex to the NDPS client. See
   Section 1.0.

7.3 Other MIB Objects Mapped to NDPS

```
MIB Object                       | NDPS Parameter
---------------------------------+------------------------------------
jmJobState                       | ndps-att-current-job-state (note 1)
jmJobStateReasons1               | ndps-att-job-state-reasons (note 2)
jmNumberOfInterveningJobs        | ndps-att-intervening-jobs
jmJobKOctetsPerCopyRequested     | ndps-att-total-job-octets (notes 3,4)
jmJobKOctetsProcessed            | ndps-att-octets-completed (note 3)
jmJobImpressionsPerCopyRequested | ndps-att-job-impressions-count
jmJobImpressionsCompleted        | ndps-att-impressions-completed
jmJobOwner                       | ndps-att-job-owner (note 5)
```

   Notes:
   ------
   1. Some of the NDPS job states must be represented by both a
      jmJobState and a jmJobStateReasons1 object or a jobStateReasonsN
      attribute (N=2, 3, 4).
   2. The NDPS job state reasons may be mapped to either the object
      jmJobStateReasons1 or the attribute jobStateReasonsN (N=2, 3, 4).
   3. jmJobKOctetsPerCopyRequested and jmJobKOctetsProcessed is in K
      octets while the NDPS ndps-att-job-total-octets and ndps-att-job-
      octets-completed is in octets and is 63-bits of significance.
   4. NDPS octets include the multiplication factor due to job and
      document copies, while the MIB values do not.
   5. The Job MIB object must be multiplied by the attribute
      jobCopiesRequested to obtain the NDPS attribute value, if multiple
      copies have been requested.

7.4 The Attribute Group Mapped to NDPS

   The following mappings are required if the listed PJL attribute or
   command option is provided.

```
   MIB attribute            | NDPS parameter               | Data type
   -------------------------+------------------------------+------------
   jobStateReasonsN(N=2, 3, 4)| ndps-job-state-reasons     | Integer
   jobAccountName           | ndps-att-job-owner           | Octet String
   jobName                  | ndps-att-job-name            | Octet String
   jobOriginatingHost       | ndps-att-job-originator      | Octet String
   deviceNameRequested      | ndps-att-printer-name--      | Octet String
                            |   requested                  |
   numberOfDocuments        | ndps-att-number-of-documents | Integer
   fileName                 | ndps-att-document-file-name  | Octet String
   documentName             | ndps-att-document-name       | Octet String
   jobComment               | ndps-att-job-comment         | Octet String
   documentFormatIndex      | ndps-att-prtInterpreterIndex | Integer
   documentFormat           | ndps-att-document-format     | Integer
   jobPriority              | ndps-att-job-priority        | Integer
   jobProcessAfterDateAndTime | ndps-att-job-print-after   | Octet String
   outputBin                | ndps-att-results-profile     | Integer
                            |   (note 1)                   |
   sides                    | ndps-att-sides (note 2)      | Integer
   finishing                | ndps-att-job-finishing       | Integer
   printQualityRequested    | ndps-att-print-quality       | Integer
   printerResolutionRequested | ndps-att-default-printer--  |
                            |   resolution (note 3)        | Integer
   printerResolutionUsed    | ndps-att-default-resolutions--
                            |   used                       | Integer
   jobCopiesRequested       | ndps-att-results-profile     | Integer
                            |   (note 4)                   |
   jobCopiesCompleted       | ndps-att-job-copies-completed| Integer
   documentCopiesRequested  | ndps-att-copy-count (note 5) | Integer
   documentCopiesCompleted  | ndps-att-copies-completed    | Integer
                            |   (note 6)                   |
   sheetsRequested          | ndps-att-job-media--         |
                            |   sheet-count                | Integer
   sheetsCompleted          | ndps-att-media-sheets--      |
                            |   completed                  | Integer
   mediumConsumed           | ndps-att-media-used          | Integer
   jobSubmissionToServerTime | ndps-att-submission-time    | Octet String
                            |   (note 7)                   |
   jobSubmissionTime        | ndps-att-started-printing-time Octet String
                            |   (note 7)                   |
   jobCompletionTime        | ndps-att-completion-time     | Octet String
                            |   (note 7)                   |
```

   Notes:
   ------
   1. The output-bin field in ndps-att-results-profile is to be used.
   2. The Job MIB sides attribute is an integer '1' or '2' while the
      NDPS sides attribute has one of six OID values that includes plex.

3. printerResolutionRequested has x and y resolution and is intended
   to override the resolution instruction in the document, if any,
   while the ndps-att-default-printer-resolution is the same in x and
   y and only takes effect if the document does not contain a
   resolution instruction
4. The job-copies field in ndps-att-results-profile is to be used.
5. The NDPS "copy-count" attribute is a per-document attribute, so
   the MIB value is the sum of the documents' "copy-count" values
   times the job's "results-profile.job-copies" value.
6. The NDPS "copies-completed" attribute is a per-document attribute,
   so the MIB value is the sum of the documents' "copies-completed"
   values times the job's "results-profile.job-copies" value.
7. The NDPS GeneratlizedTime data type is defined by ISO 8824 (ISO-
   8824) while the MIB DateAndTime is defined by SNMPv2-TC (SNMPv2-
   TC).

8.0 PRINTER JOB LANGUAGE (PJL)

   PJL [PJL] has been developed by Hewlett-Packard to provide job
   control information to the printer and status information to
   applications, independent of the PDL.

8.1 jmJobSubmissionID Mapped to PJL

   PJL has defined the SUBMISSIONID option for the JOB command which
   indicates a properly formatted jmJobSubmissionID for use in the Job
   MIB. The PJL JOB command is presented at the start of a print job
   with options that apply only the attached job. The syntax for this
   command option is:

      @PJL JOB SUBMISSIONID = "id string"

   Driver software that implements this PJL command option must provide
   the "id string" in one of the client version formats specified in the
   Job MIB for jmJobSubmissionID.

   For drivers that are not able to create the SUBMISSIONID option, it
   is recommended that jmJobSubmissionID format 0 be created by the
   agent using the PJL attribute DocOwner or DocOwnerId.

   octet 1:   '0'

   octets 2-40: Contains the string associated with DocOwner or
                 DocOwnerId. If the string is less than 40 octets, the
                 left-most character in the string shall appear in octet

                  position 2. Otherwise, only the last 39 bytes shall be
                  included. Any unused portion of this field shall be
                  filled with spaces. If DocOwner or DocOwnerId cannot
                  be obtained, this field shall be blank.

     octets 41-48: Contains the value of jmJobIndex associated with the
                    job. Leading zeros shall be inserted to fill the
                    entire 8 octet field.

8.2 jmJobIndex Mapped to PJL

   PJL does not provide a value that can be mapped to jmJobIndex.

8.3 Other MIB Objects Mapped to PJL

   MIB Object | PJL Job attribute
   ----------------------+------------------------------------
   jobOwner | DocOwner or DocOwnerId attribute

8.4 The Attribute Group Mapped to PJL

   The following mappings are required if the listed PJL attribute or
   command option is provided.

MIB attribute	PJL attribute or command option	Data type
serverAssignedJobName	DocName attribute or the command	Octet String
	@PJL JOB Name = "string"	Octet String
submittingServerName	SrcServerName attribute	Octet String
jobOriginatingHost	SrcPort attribute	Octet String
queueNameRequested	SrcQ attribute	Octet String
fileName	JobFName attribute	Octet String
jobComment	JobDesc attribute	Octet String
jobSubmissionTime	TimeSubmit attribute	Octet String

9.0 POSTSCRIPT

   The PostScript PDL permits comment fields which can be used by
   application drivers to include job information. Although there are
   no restrictions or requirements as to what information may be
   included, many drivers include job owner and/or document name.

9.1 jmJobSubmissionID Mapped to PostScript

   The use of a standard format job submission id comment string will
   allow interoperability of printers and drivers from multiple vendors.
   The following comment string format is recommended for use with
   PostScript level 1 and level 2 data streams.

      %%JMPJobSubmissionId:(id-string)

   where "id string" can be any jmJobSubmissionID format reserved for
   clients.

9.2 Other MIB Objects and Attributes Mapped to PostScript

   No Other mappings from PostScript comment strings are recommended,
   but many Job MIB objects and attributes can be defined using vendor
   unique comment strings.

10.0 NETWARE PSERVER

   The NetWare PServer job submission protocol is implemented in a
   client- server-printer system on the server to printer link as
   defined in configuration 3.

10.1 jmJobSubmissionID Mapped to PServer

   octet 1:   'B'

   octets 2-40: Contains the Directory Path Name of the agent as
                 recorded by the Novell File Server in the queue
                 directory. If the string is less than 40 octets, the
                 left-most character in the string shall appear in octet
                 position 2. Otherwise, only the last 39 bytes shall be
                 included. Any unused portion of this field shall be
                 filled with spaces.

   octets 41-48: '000XXXXX' The decimal (ASCII coded) representation
                   of the Job Number as per the NetWare File Server Queue
                   Management Services.

10.2 jmJobIndex Mapped to PServer

   The job index (jmJobIndex) is assigned by the SNMP job monitoring
   agent and is independent of the Job Number assigned by the NetWare
   File Server Queue Management Services. This will allow the SNMP
   agent to track jobs received from multiple sources.

10.3 Other MIB Objects Mapped to PJL

```
   MIB Object            | PServer Job attribute
   ----------------------+------------------------------------------
   jobOwner              | Client Id Number
```

10.4 The Attribute Group Mapped to PServer

   The following mappings are required if the listed PServer parameter
   is provided in the Novell File Server queue directory.

```
   MIB attribute               | PServer parameter           | Data type
   ----------------------------+-----------------------------+--------------
   serverAssignedJobName       | Job File Name               | Octet String
   queueNameRequested          | Queue Id                    | Integer
   physicalDevice              | Server Id Number            | Integer
   jobComment                  | Job Description             | Octet String
   jobPriority                 | (note 1)                    | Integer
   jobProcessAfterDateAndTime  | Target Execution Time       | Octet String
   jobCopiesRequested          | Number of Copies            | Integer
   mediumRequested             | Form Name                   | Octet String
   jobSubmissionToServerTime   | Job Entry Time              | Octet String
```

   Notes:
   ------
   1. The job priority is determined by the priority assigned to the
      queue that contains the job. Each queue can be assigned a unique
      priority and the priority of the job is inherited from the queue.

11.0 NETWARE NPRINTER or RPRINTER

   The NetWare NPrinter/RPrinter protocol was designed to transfer print
   data from a Novell File Server to a printer attached directly to a
   local port (e.g. parallel or serial) on a PC. NPrinter/RPrinter is
   an extremely lightweight printing protocol. Consequently, no
   information required by the Job Monitoring MIB is provided and a
   meaningful jmJobSubmissionID cannot be generated.

   It is recommended that an additional job submission layer, such as
   PJL or another vendor private protocol, be included on top of
   NPrinter/RPrinter to provide the required information. The mapping
   should then be performed according to the recommendations of the
   higher layer submission protocol.

12.0   SERVER MESSAGE BLOCK (SMB) PROTOCOL

   The Server Message Block protocol is used with several PC Network
   operating systems, such as Microsoft Windows for Workgroups, IBM LAN
   Server, and Artisoft Lantastic. SMB systems supporting the Job
   Monitoring MIB will conform to either configuration 1 or 3.

12.1   jmJobSubmissionID Mapped to SMB

   octet 1:   'C'

   octets 2-40: Contains a decimal (ASCII coded) representation of the
                 16 bit SMB Tree Id field, which uniquely identifies the
                 connection that submitted the job to the printer. The
                 most significant digit of the numeric string shall be
                 placed in octet position 2. All unused portions of
                 this field shall be filled with spaces. The SMB Tree
                 Id has a maximum value of 65,535.

   octets 41-48: Contains a decimal (ASCII coded) representation of the
                  File Handle returned from the printer agent to the
                  client in response to a Create Print File command.
                  Leading zeros shall be inserted to fill the entire 8
                  octet field.

12.2   jmJobIndex Mapped to SMB

   It is strongly recommended that the File Handle returned from the
   printer agent be identical to jmJobIndex. If these items are
   identical, there is no need for the client application to perform a
   search on jmJobSubmissionID. To be compatible with the 16 bit field
   allocated to this value by SMB, the maximum jmJobIndex is 65,535.

12.3 Other MIB objects Mapped to SMB

   MIB Object | SMB Parameter
   ----------------+---
   jmJobOwner | SMB User Id field (note 1)

   Notes:
   ------
   1. A decimal (ASCII coded) representation of the SMB User Id numeric
      shall be presented as jmJobOwner.

13.0   TRANSPORT INDEPENDENT PRINTER/SYSTEM INTERFACE (TIP/SI)

   The TIP/SI protocol, although currently specified as a part of the
   IEEE 1284 parallel port standards [TIP/SI], was originally developed
   as a network protocol. TIP/SI thus has the potential of being
   integrated into any network or non-network configuration.

13.1   jmJobSubmissionID Mapped to TIP/SI

   octet 1:   'D'

   octets 2-40: Contains the Job Name from the Job Control-Start Job
                 (JC-SJ) command. If the Job Name portion is less than
                 40 octets, the left-most character in the string shall
                 appear in octet position 2. Any unused portion of this
                 field shall be filled with spaces. Otherwise, only the
                 last 39 bytes shall be included.

   octets 41-48: Contains a decimal (ASCII coded) representation of the
                  jmJobIndex assigned by the agent. Leading zeros shall
                  be inserted to fill the entire 8 octet field.

13.2   jmJobIndex Mapped to TIP/SI

   jmJobIndex is returned to the client as the Printer Assigned Job Id
   in a Job Control-Start Job (JC-SJ) response packet. To be compatible
   with the 16 bit field allocated to this value by TIP/SI, the maximum
   jmJobIndex is 65,535.

13.3   Other MIB Objects Mapped to TIP/SI

   MIB Object | TIP/SI Parameter
   ----------------------+---
   jmJobOwner | User string

13.4   The Attribute Group Mapped to TIP/SI

   MIB attribute | TIP/SI information | Data type
   ----------------------+--------------------------------+------------
   jobName | Job Name string | Octet String
   jobComment | Additional Information string | Octet String

14.0 Security Considerations

   This document provides mapping recommendations of job submission
   protocols for use with the Job Monitoring MIB. The mapping procedures
   defined do not enhance or compromise any security provisions
   available within the job submission protocols contained within this
   document.

   The security considerations specified for the Job Monitoring MIB
   [JobMIB] are also unaffected by any of the recommendations in this
   document.

   The security provisions available in the job submission protocols are
   documented in the appropriate specifications that define the
   protocols. The degree of security available varies from very good,
   for protocols such as the Internet Printing Protocol [IPP], to non-
   existent, for example the Line Printer Daemon Protocol [LPD].

   Since the defined mapping operation occurs as a secondary operation
   after the user has been authenticated and there is no storage of any
   authorization credentials other than the user name, no security
   breaches are anticipated. Also, the Job MIB does not provide any
   back-door mechanism for access to any other security parameters.
   However, implementers must always consider the impact of the defined
   mapping procedures upon the security model desired from the protocol.

15.0 REFERENCES

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