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The Printer Working Group

Printer Port Monitor MIB 1.0

Status: Approved

Abstract: This document defines the PWG Printer Port Monitor (PPM) MIB v1.0 that supports printer status monitoring, automatic installation of device drivers, and other printing applications. The PPM MIB is entirely free-standing, but it also facilitates use of the IETF Host Resources MIB (RFC1514 / RFC2790) and IETF Printer MIB (RFC1759 / RFC3805) for printer status monitoring. The PPM MIB was developed by the PWG's Printer MIB Project (PMP).

This document is a PWG Working Draft. For a definition of a "PWG Working Draft", see: <ftp://ftp.pwg.org/pub/pwg/general/pwg-process20.pdf>

This document is available at:

<ftp://ftp.pwg.org/pub/pwg/candidates/cs-pmpportmib10-20051025-5107.1.pdf>, doc

The ASN.1 source for the PPM MIB is available at:

<ftp://ftp.pwg.org/pub/pwg/candidates/cs-pmpportmib10-20051025-5107.1.mib>

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In general, a PWG standard is a specification that is stable, well understood, and is technically competent, has multiple, independent and interoperable implementations with substantial operational experience, and enjoys significant public support.

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Instructions for subscribing to the PSI mailing list can be found at the following link: <http://www.pwg.org/mailhelp.html>

Members of the PWG and interested parties are encouraged to join the PWG and PSI WG mailing lists in order to participate in discussions, clarifications and review of the WG product. Requests for additional media names for inclusion in this specification should be sent to the PSI mailing list for consideration.

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1 Printer Port Monitor MIB

1.1 Introduction

The PWG Printer Port Monitor (PPM) MIB v1.0 provides information from a printer to a host system to facilitate the automatic installation of device drivers and other printing applications. The information provided for each print service includes connectivity parameters (such as raw TCP printing sockets and LPR/LPD queue names), status monitoring capability, and printer model and manufacturer data. The PPM MIB is not dependent upon the implementation other MIBs, but it does facilitate use of the IETF Host Resources MIB [RFC1514] [RFC2790] and IETF Printer MIB [RFC1759] [RFC3805] for printer status monitoring. The PPM MIB was developed by the PWG's Printer MIB Project (PMP).

1.2 Background

With the release of Microsoft Windows[®] 2000, Microsoft introduced the Standard TCP/IP Port monitor (TCPMon). This port monitor allows Microsoft Windows 2000 to print to many types of network printers in a very consistent manner. This is partially enabled through a file that ships with the operating system called TCPMON.INI, which contains network device parameters and information about exactly how to communicate with many network printers. When Microsoft Windows 2000 was released, TCPMON.INI covered a majority of the existing network print devices, but it became somewhat outdated as time passed and new devices were released. Because these new devices are not supported by TCPMON.INI, print administrators have to enter information for the new ports by hand. This is prone to errors and makes adding a network printer unnecessarily complicated. At times Microsoft has taken updates to TCPMON.INI, but due to a number of factors this solution is still not very robust.

The logical solution to this problem is to get the correct current information directly from the device being installed. However, to enable this there must be a location common across all print vendors for this type of data, and also a standard definition of how to retrieve this data. The logical place to discuss this location and develop the data structure is the Printer Working Group.

At the November 2004 meeting of the PWG, Mike Fenelon (Microsoft) gave a presentation on standardizing a simple MIB for support of printer port monitor applications, particularly for improved automatic device driver installation by operating systems. Mike Fenelon and Ivan Pavicevic (both of Microsoft) also presented an initial ASN.1 draft of such a MIB. The current PPM MIB integrates and harmonizes their initial proposal with existing IETF standard MIBs.

The initial Microsoft Port MIB proposal is archived at [PORT-PROP].

2 Terminology

2.1 Conformance Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as defined in [RFC2119].

2.2 Printer Terminology

The following terms are used in this document:

Printer Device: A device in the IETF Host Resources MIB (that MAY also be represented in the IETF Printer MIB) that supports one or more Printer Ports (see below). A Printer Device is indicated by the value of 'hrDeviceIndex' that specifies an 'hrDeviceType' of 'hrDevicePrinter' in the IETF Host Resources MIB [RFC1514] [RFC2790].

Printer Port: A print data channel that MUST support job submission and MAY also support status monitoring. Printer Ports are defined by the 'prtChannelEntry' in IETF Printer MIB [RFC1759] [RFC3805].

Protocol Type: The protocol type of a given port (print data channel), e.g., LPR [RFC1179]. Protocol Types are specified by the 'prtChannelType' object in IETF Printer MIB [RFC1759] [RFC3805].

Source Port: The transport (TCP, UDP, etc.) source port number for this print protocol (e.g., 721 through 731 for LPR [RFC1179]). Some print protocols define a range of standard transport source ports and may support alternate transport source ports. The 'ppmPortProtocolAltSourceEnabled' object in this MIB provides Source Port information, and the same information may also be present in the 'prtChannelInformation' object in IETF Printer MIB v2 [RFC3805].

Target Port: The transport (TCP, UDP, etc.) target port number for this print protocol (e.g., 515 for LPR [RFC1179]). Most print protocols define a default transport target port and some support alternate transport target ports. The object 'ppmPortProtocolTargetPort' in this MIB can be used to specify the Target Port. The 'prtChannelInformation' in IETF Printer MIB v2 [RFC3805] may also contain this same information.

3 Requirements

3.1 Rationale for PPM MIB

The IETF and IEEE standards for printing define:

- (a) A rationale for an abstract model of printing (to support alternate encodings and protocols) in section 3 of the IETF IPP Rationale [RFC2568], which led to the later development of the PWG Semantic Model/1.0 [PWG5105.1].
- (b) A set of design goals for printer installation and monitoring in section 3.1.1 'Finding or locating a printer' (End User), section 3.1.3 'Viewing the status and capabilities of a printer' (End User), section 3.2.1 'Alerting' (Operator), and section 3.3 'Administrator' (the bullet requirement to 'create an instance of a printer') of the IETF IPP Design Goals [RFC2567].
- (c) A simple abstract model for a Printer Device in the 'hrDeviceTable' and 'hrPrinterTable' in section 4.4 of the IETF Host Resources MIB v2 [RFC2790].

- (d) A detailed abstract model for a Printer Device in section 2.2 and section 6 of the IETF Printer MIB v2 [RFC3805].
- (e) A detailed abstract model for a Printer Port (Print Data Channel) in section 2.2.9 'Interfaces', section 2.2.10 'Print Job Delivery Channels', section 2.2.11 'Interpreters', and the 'prtChannelTable' and 'prtInterpreterTable' in section 6 of the IETF Printer MIB v2 [RFC3805].
- (f) A standard format for machine-readable and human-readable Printer Device capabilities in section 7.6 'Device ID' of [IEEE1284].

Network printers that support SNMP are now common. However, only vendor MIBs currently expose detailed printer capabilities. Therefore, this document defines a simple, free-standing, standard MIB written in IETF SMIv2 [RFC2578] that supports automatic installation of printer device drivers, printer status monitoring, and other basic printing applications, based on a table of Printer and Printer Ports with their capabilities including the machine-readable 'Device ID' defined in [IEEE1284].

3.2 Use Models for PPM MIB

3.2.1 Network Spooler

The PPM MIB MAY be implemented by a network spooler (typically running on a general-purpose network server along with other applications) that supports one or more downstream network printers.

If the network spooler implements the IETF Host Resources MIB [RFC1514] [RFC2790], then it SHOULD implement a row in the 'hrDeviceTable' with 'hrDeviceType' of 'hrDevicePrinter' for each downstream network printer.

If the network spooler implements the IETF Printer MIB [RFC1759] [RFC3805], then it SHOULD implement a row in the 'prtGeneralTable' and a row in 'prtChannelTable' for each configured port for each downstream network printer.

3.2.2 External Network Adapter

The PPM MIB MAY be implemented by an external network adapter that supports one or more locally-attached printers.

If the network adapter implements the IETF Host Resources MIB [RFC1514] [RFC2790], then it SHOULD implement a row in the 'hrDeviceTable' with 'hrDeviceType' of 'hrDevicePrinter' for each locally-attached printer.

The same value of 'hrDeviceIndex' SHOULD be used for the same physical printer (even if several distinct ports are configured).

If the network adapter implements the IETF Printer MIB [RFC1759] [RFC3805], then it SHOULD implement a row in the 'prtGeneralTable' and a row in 'prtChannelTable' for each configured port for each locally-attached printer.

3.2.3 Network Printer

The PPM MIB MAY be implemented by a network printer (typically running an embedded operating system and possibly other imaging applications).

If the network printer implements the IETF Host Resources MIB [RFC1514] [RFC2790], then it SHOULD implement a row in the 'hrDeviceTable' with 'hrDeviceType' of 'hrDevicePrinter'.

If the network printer implements the IETF Printer MIB [RFC1759] [RFC3805], then it SHOULD implement a row in the 'prtGeneralTable' and a row in 'prtChannelTable' for each configured port.

3.3 Design Requirements for PPM MIB

1. The PPM MIB design MUST follow all object naming and MIB structuring requirements defined in IETF SMIv2 [RFC2578] (see section 3.1).
2. The PPM MIB design SHOULD follow all best practices defined in IETF Guidelines for Authors and Reviewers of MIB Documents [RFC4181] (see section 3.1).
3. The PPM MIB design SHOULD include all of the content defined in the Microsoft Port MIB proposal (see sections 1.2 and 3.1).
4. The PPM MIB design MUST NOT require implementation of any version of the IETF Host Resources [RFC1514] [RFC2790] or IETF Printer MIB [RFC1759] [RFC3805] (for low implementation cost - see section 3.1).
5. The PPM MIB design MUST support automatic device driver installation by operating systems (see sections 1.2 and 3.2).
6. The PPM MIB design MUST support status monitoring of Device entries in the IETF Host Resources [RFC1514] [RFC2790] (see sections 3.2 and 4.2.3).
7. The PPM MIB design MUST support status monitoring of General entries in the IETF Printer MIB [RFC1759] [RFC3805] (see sections 3.2 and 4.2.4).
8. The PPM MIB design SHOULD support access to Channel entries in the IETF Printer MIB [RFC1759] [RFC3805] (see sections 3.2 and 4.2.4).

4 Overview of PPM MIB

4.1 Structure of PPM MIB

The PPM MIB is written in SMIv2 [RFC2578] and defines only 'read-only' objects. The PPM MIB does NOT define any 'read-write' or 'read-create' objects (i.e., SNMP Set operations are not supported). The PPM MIB does NOT define any notifications (i.e., SNMP traps are not supported).

The PPM MIB defines three mandatory object groups:

General Group - three scalar objects
(similar to General group in IETF Printer MIB)

- natural language tag for localized text string objects
- number of printers configured
- number of ports configured

Printer Group - one index and seven columnar objects

- printer name (localized in UTF-8 encoded Unicode)
- printer IEEE 1284 device ID (for automatic driver installation)
- printer number of ports
- printer preferred port index
- printer 'hrDeviceIndex' for IETF Host Resources and IETF Printer MIB
- printer SNMP read community name and SNMP status query mode

Port Group - one index and eight columnar objects
(similar to Channel group in IETF Printer MIB)

- port enable mode (for suppressing configured but inactive ports)
- port name (localized in UTF-8 encoded Unicode)
- port service name (i.e., queue) or service URI
- port protocol type, target port, and alternate source port mode
- port 'prtChannelIndex' (for reliable mapping to IETF Printer MIB)
- port LPR byte counting mode (for 'chLPDServer(8)' only)

4.2 Relationship to Other MIBs

4.2.1 Relationship to IANA Printer MIB

The PPM MIB defines the 'ppmPortProtocolType' object, which MAY contain a value from 'PrtChannelTypeTC' in the IANA Printer MIB (originally published in [RFC3805]), to be used for automatic installation of device drivers, etc. The object 'prtChannelType' in [RFC1759] [RFC3805] also uses this textual convention. The IANA Registry can be found at:

<http://www.iana.org/assignments/ianaprinter-mib>

4.2.2 Relationship to IETF Community MIB

The PPM MIB defines the 'ppmPrinterSnmpCommunityName' object, which MAY contain a different SNMP read community name for each configured port to support simple 'MIB views' (common functionality in existing external network adapters). For additional information refer to the 'snmpCommunityName' in IETF Community MIB [RFC3584].

Security Warning: Due to the widespread availability of free 'packet sniffers' (network traffic snooping applications) and SNMP packet decoders, SNMP community names no longer offer even minimal security. This object SHOULD only be used to support 'MIB views'. Implementation SHOULD use SNMPv3 security to protect network resources from unauthorized monitoring.

4.2.3 Relationship to IETF Host Resources MIB

The PPM MIB defines the 'ppmPrinterHrDeviceIndex' object, which MAY contain a value of 'hrDeviceIndex' in the IETF Host Resources MIB [RFC1514] [RFC2790], to be used for status queries in the IETF Host Resources MIB for each port. Status information is provided by 'hrDeviceStatus', 'hrPrinterStatus', and 'hrPrinterDetectedErrorState' objects in the IETF Host Resources MIB [RFC1514] [RFC2790]. For additional information on interpreting printer device status, see section 2.2.13.2 'Overall Printer Status' and Appendix E 'Overall Printer Status Table' in IETF Printer MIB v2 [RFC3805].

The PPM MIB defines the 'ppmPrinterSnmpStatusQueryEnabled' object, to enable or disable SNMP status queries by port monitor applications.

4.2.4 Relationship to IETF Printer MIB

The PPM MIB defines the 'ppmPrinterName' object, which MAY contain a user-friendly printer name in the locale in 'ppmGeneralNaturalLanguage'. This object corresponds to the 'prtGeneralPrinterName' object defined in IETF Printer MIB v2 [RFC3805]

The PPM MIB defines the 'ppmPortName' object, which MAY contain a user-friendly port name in the locale in 'ppmGeneralNaturalLanguage'. This object MAY correspond to the 'prtChannelInformation' object defined in IETF Printer MIB v2 [RFC3805].

The PPM MIB defines the 'ppmPrinterHrDeviceIndex' object, which MAY contain a value of 'hrDeviceIndex' in the IETF Host Resources MIB [RFC1514] [RFC2790], for access to the IETF Printer MIB [RFC1759] [RFC3805] ('hrDeviceIndex' is the high-order index of all tables in the IETF Printer MIB).

The values of 'prtGeneralConfigChanges' and 'prtConsoleDisable' in the 'prtGeneralTable' of IETF Printer MIB may be useful for status queries. The values of 'prtAlertCriticalEvents' and 'prtAlertAllEvents' in the 'prtGeneralTable' of IETF Printer MIB v2 [RFC3805] may also be useful.

The PPM MIB defines the 'ppmPortPrtChannelIndex' object, which MAY contain a value of 'prtChannelIndex' in the IETF Printer MIB [RFC1759] [RFC3805], to be used for status queries in the IETF Printer MIB for each port. Status information is available in 'prtChannelState' and 'prtChannelStatus' in the IETF Printer MIB.

4.2.5 Relationship to IETF Interfaces Group MIB

The PPM MIB defines the 'ppmPortPrtChannelIndex' object, which MAY contain a value of 'prtChannelIndex' in the IETF Printer MIB [RFC1759] [RFC3805] and may be used to find a value of 'prtChannelIfIndex' for physical interface status queries for each port. Status information is available in 'ifAdminStatus', 'ifOperStatus', 'ifLastChange', 'ifInErrors', and 'ifOutErrors' for each physical interface in the IETF Interfaces Group MIB [RFC2863].

4.2.6 Relationship to IETF SNMP Framework MIB

The PPM MIB imports the 'SnmpAdminString' textual convention from the IETF SNMP Framework MIB [RFC3411], for use in all human-readable text string object definitions, in conformance with the IETF Policy on Character Sets and Languages [RFC2279]. 'SnmpAdminString' supports UTF-8 [RFC3629] text string object definitions.

5 Definition of PPM MIB

```
PRINTER-PORT-MONITOR-MIB DEFINITIONS ::= BEGIN
```

```
IMPORTS
```

```
    enterprises, MODULE-IDENTITY, OBJECT-TYPE, Gauge32, Integer32
        FROM SNMPv2-SMI                -- RFC 2578
    TruthValue
        FROM SNMPv2-TC                -- RFC 2579
    MODULE-COMPLIANCE, OBJECT-GROUP
        FROM SNMPv2-CONF              -- RFC 2580
    SnmpAdminString
        FROM SNMP-FRAMEWORK-MIB;      -- RFC 3411
```

```
ppmMIB MODULE-IDENTITY
```

```
    LAST-UPDATED "200510250000Z"
    ORGANIZATION "Printer Working Group, a Program of IEEE/ISTO"
    CONTACT-INFO
        "Editors:
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```

    Send comments using the Printer MIB Project (PMP) Mailing List:
```

```

        ppm@pwg.org
```

```

    To subscribe, see the PWG web page:
```

```

        http://www.pwg.org/"
```

```
DESCRIPTION
```

```
    "The MIB module for printer port monitor support.
```

```

    Copyright (C) IEEE/ISTO PWG (2005).
    REVISION      "200510250000Z"
    DESCRIPTION
        "PWG Approved Version, PWG 5107.1-2005"
    ::= { enterprises pwg(2699) mibs(1) ppmMIB(2) }

```

```

ppmMIBObjects      OBJECT IDENTIFIER ::= { ppmMIB 1 }
ppmMIBConformance OBJECT IDENTIFIER ::= { ppmMIB 2 }
ppmMIBObjectGroups OBJECT IDENTIFIER ::= { ppmMIBConformance 2 }

```

```

--
-- Object Definitions
--

```

```

ppmGeneral          OBJECT IDENTIFIER ::= { ppmMIBObjects 1 }

```

```

ppmGeneralNaturalLanguage OBJECT-TYPE

```

```

    SYNTAX      SnmpAdminString (SIZE (0..63))
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION

```

"The natural language tag (RFC 3066), specified in US-ASCII, for all localized text string objects defined in this MIB (syntax of 'SnmpAdminString'), or the empty string if not specified. For example, 'fr-CH' (French as written in Switzerland).

Compatibility Note: At the time of publication of this MIB, language tags are restricted to US-ASCII. In order to support possible future evolution of languages tags (in a successor to RFC 3066) to allow non-ASCII characters, this object has been defined with a syntax of UTF-8 (RFC 3629).

This natural language tag is necessary for support of correct glyph selection for text display, for support of text-to-speech, for support of correct sorting of text values, etc.

If this object is empty, then the natural language for all localized text string objects in this MIB MUST default to 'en-US' (US English)."

```

REFERENCE

```

"prtGeneralCurrentLocalization in IETF Printer MIB (RFC 1759/3805).

jobNaturalLanguageTag in IETF Job Monitoring MIB (RFC 2707)."

```

DEFVAL      { 'H' }          -- no natural language tag
::= { ppmGeneral 1 }

```

```

ppmGeneralNumberOfPrinters OBJECT-TYPE

```

```

SYNTAX      Gauge32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The number of printers supported on this network system,
    i.e., the number of entries in the 'ppmPrinterTable' below, or
    zero if no printers are currently configured."
DEFVAL      { 0 }          -- no printers configured
 ::= { ppmGeneral 2 }

```

```
ppmGeneralNumberOfPorts OBJECT-TYPE
```

```

SYNTAX      Gauge32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The number of printer ports supported on this network system,
    i.e., the number of entries in the 'ppmPortTable' below, or
    zero if no printer ports are currently configured."
DEFVAL      { 0 }          -- no printer ports configured
 ::= { ppmGeneral 3 }

```

```
ppmPrinter          OBJECT IDENTIFIER ::= { ppmMIBObjects 2 }
```

```
ppmPrinterTable OBJECT-TYPE
```

```

SYNTAX      SEQUENCE OF PpmPrinterEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "A table containing a list of printers configured on this
    network system, especially for use by operating systems to
    facilitate selection and automatic installation of device
    drivers."
 ::= { ppmPrinter 1 }

```

```
ppmPrinterEntry OBJECT-TYPE
```

```

SYNTAX      PpmPrinterEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "An entry containing one printer configured on this
    network system, especially for use by operating systems to
    facilitate selection and automatic installation of device
    drivers."
INDEX { ppmPrinterIndex }
 ::= { ppmPrinterTable 1 }

```

```

PpmPrinterEntry ::= SEQUENCE {
    ppmPrinterIndex          Integer32,
    ppmPrinterName          SnmpAdminString,
    ppmPrinterIEEE1284DeviceId OCTET STRING,
    ppmPrinterNumberOfPorts Gauge32,
    ppmPrinterPreferredPortIndex Integer32,
    ppmPrinterHrDeviceIndex Integer32,
    ppmPrinterSnmpCommunityName OCTET STRING,
    ppmPrinterSnmpQueryEnabled TruthValue
}

```

```

ppmPrinterIndex OBJECT-TYPE
    SYNTAX      Integer32 (1..2147483647)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A locally unique identifier for this network printer.  The
        value of this object SHOULD be preserved (for each printer)
        across reboots and administrative configuration changes.

        If the value of 'ppmPortEnabled' is 'false' for all supported
        ports (i.e., ports with the same value of 'ppmPrinterIndex'),
        then applications MUST NOT attempt installation of this printer.

        Per SMiv2 (RFC 2578), the DEFVAL clause has been omitted on this
        'not-accessible' index object."
    ::= { ppmPrinterEntry 1 }

```

```

ppmPrinterName OBJECT-TYPE
    SYNTAX      SnmpAdminString (SIZE (0..127))
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "A user friendly name for this printer that may be used to
        facilitate user selection of a printer supported by a network
        system, in the locale specified by 'ppmGeneralNaturalLanguage'.
        This printer name may contain non-ASCII characters that are NOT
        allowed in a URI (RFC 3986) without percent-encoding.

        Systems that implement the IETF Printer MIB v1 (RFC 1759) SHOULD
        implement this object as an augmentation to the Printer MIB v1.

        Systems that implement the IETF Printer MIB v2 (RFC 3805) MUST
        ensure that the value of this object is identical to the value
        of 'prtGeneralPrinterName' for each printer.

        The value of this object SHOULD be unique across all printers on

```


this network system and SHOULD be meaningful to end users (e.g., 'PrinterXYZ').

The value of this object SHOULD be set by an out-of-band method (e.g., local console) during installation (by the vendor or site administrator) and SHOULD NOT be subsequently modified, so that the value can be used as a static key for access to the printer.

The charset of this text string object is UTF-8 (RFC 3629), in order to support names that cannot be represented in US-ASCII."

REFERENCE

"prtGeneralPrinterName in IETF Printer MIB v2 (RFC 3805).
printer-name in IPP/1.1 (RFC 2911)."

DEFVAL { 'H } -- printer name not specified
 ::= { ppmPrinterEntry 2 }

ppmPrinterIEEE1284DeviceId OBJECT-TYPE

SYNTAX OCTET STRING (SIZE (0..1023))
MAX-ACCESS read-only
STATUS current

DESCRIPTION

"The IEEE 1284 device ID for this printer, a set of capabilities (keys and values) specified in the US-ASCII charset and the format 'key1: value {, value }; ... keyN: value {,value };', as follows:

- (a) SPACE (0x20), TAB (0x09), VTAB (0x0B), CR (0x0D), NL (0x0A), and FF (0x0C) are allowed, but are ignored when parsing
- (b) other control characters (less than 0x20) MUST NOT be used
- (c) COLON (0x3A), COMMA (0x2C), and SEMICOLON (0x3B) are used as delimiters and MUST NOT be included in any key or value
- (d) each key MUST be separated from value(s) using COLON (0x3A)
- (e) multiple values MUST BE separated using COMMA (0x2C)
- (f) each capability MUST BE terminated using SEMICOLON (0x3B)
- (g) all printers MUST include the following capabilities
 - MANUFACTURER (or abbreviation MFG)
 - MODEL (or abbreviation MDL)
- (h) all printers MAY include the following capabilities
 - COMMAND SET (or abbreviation CMD)
 - COMMENT
 - ACTIVE COMMAND SET

For example (actually all on one line of text):

```
MANUFACTURER:ACME Manufacturing;
COMMAND SET:PCL,PJL,PS,XHTML-Print+xml;
MODEL:LaserBeam 9;
```

```
COMMENT:Anything you like;
ACTIVE COMMAND SET:PCL;
```

The value of this object MUST exactly match the IEEE 1284-2000 Device ID string, except that the length field MUST NOT be specified. The value MUST be assigned by the Printer vendor and MUST NOT be localized by the Print Service.

Compatibility Note: At the time of publication of this MIB, IEEE device IDs are restricted to US-ASCII. In order to support possible future evolution of IEEE device IDs (in a successor to IEEE 1284-2000) to allow non-ASCII characters, this object has been defined with a syntax of OCTET STRING to support the future use of UTF-8 (RFC 3629).

If this object is empty, then the value of 'ppmPortProtocolType' for the selected port SHOULD be used to load a generic driver."

REFERENCE

"Section 7.6 of IEEE 1284-2000.
printer-make-and-model in IPP/1.1 (RFC 2911)."

```
DEFVAL      { 'H' }          -- no IEEE 1284 device ID
 ::= { ppmPrinterEntry 3 }
```

ppmPrinterNumberOfPorts OBJECT-TYPE

```
SYNTAX      Gauge32
MAX-ACCESS  read-only
STATUS      current
```

DESCRIPTION

"The number of printer ports supported on this network printer, i.e., the number of entries in the 'ppmPortTable' below with a first index of 'ppmPrinterIndex', or zero if no printer ports are currently configured."

```
DEFVAL      { 0 }          -- no printer ports configured
 ::= { ppmPrinterEntry 4 }
```

ppmPrinterPreferredPortIndex OBJECT-TYPE

```
SYNTAX      Integer32 (0..2147483647)
MAX-ACCESS  read-only
STATUS      current
```

DESCRIPTION

"The value of 'ppmPortIndex' for the preferred port for this printer (configured by vendor or site administrator), or zero if not specified.

Compatibility Note: The value of zero is NOT valid for 'ppmPortIndex'. It is an out-of-band value.

If this object is non-zero, then installation applications SHOULD default to this port in their user interface dialogue."

REFERENCE

"document-format-default in IPP/1.1 (RFC 2911)."

DEFVAL { 0 } -- no preferred port configured
 ::= { ppmPrinterEntry 5 }

ppmPrinterHrDeviceIndex OBJECT-TYPE

SYNTAX Integer32 (0..2147483647)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of 'hrDeviceIndex' in the IETF Host Resources MIB (RFC 1514/2790), or zero if not specified. This value of 'hrDeviceIndex' MAY be used for status queries for this printer if the value of 'ppmPrinterSnmpQueryEnabled' is 'true'.

Compatibility Note: The value of zero is NOT valid for 'hrDeviceIndex'. It is an out-of-band value.

If this object is zero, then monitoring applications MUST NOT attempt status queries for this printer in the IETF Host Resources MIB (RFC 1514/2790) and/or IETF Printer MIB (RFC 1759/3805)."

REFERENCE

"hrDeviceStatus, hrPrinterStatus, hrPrinterDetectedErrorState in IETF Host Resources MIB (RFC 1514/2790).

Section 2.2.13.2 'Overall Printer Status' and

Appendix E 'Overall Printer Status Table' in IETF Printer MIB v2 (RFC 3805)."

DEFVAL { 0 } -- no host device index
 ::= { ppmPrinterEntry 6 }

ppmPrinterSnmpCommunityName OBJECT-TYPE

SYNTAX OCTET STRING (SIZE (0..255))

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The SNMP read community name, an opaque binary string, for access to status information in IETF Host Resources MIB (RFC 1514/2790) and IETF Printer MIB (RFC 1759/3805) for this printer via the value of 'ppmPrinterHrDeviceIndex' (i.e., a 'MIB view' of these two MIBs).

Security Warning: Due to the widespread availability of free 'packet sniffers' (network traffic snooping applications) and SNMP packet decoders, SNMP community names no longer offer even

weak security. This object SHOULD only be used to support 'MIB views'. Implementations SHOULD use SNMPv3 security to protect network resources from unauthorized monitoring.

If this object is empty, then the SNMP read community name for this printer (if any) SHOULD default to 'public' in US-ASCII."

REFERENCE

"snmpCommunityName in IETF SNMP Community MIB (RFC 3584)."

DEFVAL { 'H } -- no SNMP read community name
 ::= { ppmPrinterEntry 7 }

ppmPrinterSnmpQueryEnabled OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The status query mode for this printer, for queries by monitoring applications in the IETF Host Resources MIB (RFC 1514/2790) and/or IETF Printer MIB (RFC 1759/3805).

If this object is 'true', then monitoring applications MAY attempt status queries for this printer in the IETF Host Resources MIB and/or IETF Printer MIB.

If this object is 'false', then monitoring applications MUST NOT attempt status queries for this printer in the IETF Host Resources MIB and/or IETF Printer MIB."

REFERENCE

"ppmPrinterSnmpCommunityName."

DEFVAL { false } -- SNMP status queries disabled
 ::= { ppmPrinterEntry 8 }

ppmPort OBJECT IDENTIFIER ::= { ppmMIBObjects 3 }

ppmPortTable OBJECT-TYPE

SYNTAX SEQUENCE OF PpmPortEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A table containing a list of input printer ports configured on this network system, especially for use by operating systems to facilitate selection and automatic installation of device drivers."

REFERENCE

"ppmPrinterTable."

::= { ppmPort 1 }

```

ppmPortEntry OBJECT-TYPE
    SYNTAX      PpmPortEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "An entry containing one input printer port configured on
        this network system, especially for use by operating systems to
        facilitate selection and automatic installation of device
        drivers."
    REFERENCE
        "ppmPrinterEntry."
    INDEX       { ppmPrinterIndex, ppmPortIndex }
    ::= { ppmPortTable 1 }

PpmPortEntry ::= SEQUENCE {
    ppmPortIndex                Integer32,
    ppmPortEnabled              TruthValue,
    ppmPortName                 SnmpAdminString,
    ppmPortServiceNameOrURI     SnmpAdminString,
    ppmPortProtocolType         Integer32,
    ppmPortProtocolTargetPort   Integer32,
    ppmPortProtocolAltSourceEnabled TruthValue,
    ppmPortPrtChannelIndex      Integer32,
    ppmPortLprByteCountEnabled  TruthValue
}

ppmPortIndex OBJECT-TYPE
    SYNTAX      Integer32 (1..2147483647)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A locally unique identifier for this printer port when appended
        to the value of 'ppmPrinterIndex' for this printer port.  The
        value of this object SHOULD be preserved (for each port) across
        reboots and administrative configuration changes.

        Per SMIV2 (RFC 2578), the DEFVAL clause has been omitted on this
        'not-accessible' index object."
    ::= { ppmPortEntry 1 }

ppmPortEnabled OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The current administrative configuration mode for this port."

```

If this object is 'false', then applications MUST NOT attempt installation of this port and SHOULD NOT attempt print job submission to this port.

If this object is 'true', then the port is currently enabled.

If this object is 'false', then the port is currently disabled."

REFERENCE

"ppmPortProtocolType and ppmPortHrDeviceIndex."

DEFVAL { false } -- port disabled

::= { ppmPortEntry 2 }

ppmPortName OBJECT-TYPE

SYNTAX SnmpAdminString (SIZE (0..127))

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A user friendly name for this port that may be used to facilitate user selection of a port on a multi-port network system, in the locale specified by 'ppmGeneralNaturalLanguage'. This port name may contain non-ASCII characters that are NOT allowed in a URI (RFC 3986) without percent-encoding.

The value of this object SHOULD be unique across all ports on this network system and SHOULD be meaningful to end users (e.g., 'PrinterXYZ-LPR-Duplex').

The value of this object SHOULD be set by an out-of-band method (e.g., local console) during installation (by the vendor or site administrator) and SHOULD NOT be subsequently modified, so that the value can be used as a static key for access to the port.

The charset of this text string object is UTF-8 (RFC 3629), in order to support names that cannot be represented in US-ASCII."

REFERENCE

"prtChannelInformation in IETF Printer MIB v2 (RFC 3805)."

DEFVAL { 'H' } -- port name not specified

::= { ppmPortEntry 3 }

ppmPortServiceNameOrURI OBJECT-TYPE

SYNTAX SnmpAdminString (SIZE (0..255))

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The service name or URI for this port, specified in UTF-8 (RFC 3629), in the locale specified by 'ppmGeneralNaturalLanguage'. The service name is typically a queue name.

Compatibility Note: At the time of publication of this MIB, the Microsoft tools do not support LPR queue names longer than 32 characters. Network administrators SHOULD NOT assign longer LPR queue names, to prevent interworking problems.

Compatibility Note: At the time of publication of this MIB, IETF URI Generic Syntax (RFC 3986) requires that all non-ASCII characters be percent-encoded, while IETF Internationalized Resource Identifiers (RFC 3987) permits native UTF-8 resource identifiers and supplies mappings to and from standard URI. In order to support current use of IRI and possible future evolution of URI (in a successor to RFC 3986) to allow non-ASCII characters, this object has been defined with a syntax of UTF-8 (RFC 3629).

Examples of well-formed service URI for print protocols include:

- 'lpr://foo.example.com/public-printer' (where 'public-printer' is the LPR queue name portion)

and

- 'ipp://bar.example.com/printer/fox'

If this object is non-empty, then it SHOULD NOT conflict with a the default (e.g., IANA-registered) or explicit transport target port specified in 'ppmPortProtocolTargetPort'. In case of conflict, the URI value in 'ppmPortServiceNameOrURI' is authoritative (e.g., 'ipp://example.com:631/~smith/printer').

If this object is empty and 'ppmPortProtocolType' is 'chLPDServer(8)', the LPR queue name MUST default to 'LPR'."

REFERENCE

"IETF Line Printer Daemon Protocol (RFC 1179).
 'lpr:' URL scheme in IANA-registered SLP Printer Schema at <http://www.iana.org/assignments/svrloc-templates/printer-uri> in LDAP Printer Schema (RFC 3712).
 IPP/1.1: IPP URL Scheme (RFC 3510).
 printer-uri-supported in IPP/1.1 (RFC 2911)."

DEFVAL { 'H } -- no service name or URI
 ::= { ppmPortEntry 4 }

ppmPortProtocolType OBJECT-TYPE

SYNTAX Integer32 (0..2147483647)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The protocol type of this printer port, specified as a value

from 'PrtChannelTypeTC' in the IANA Printer MIB (e.g., 'chLPDServer(8)' for LPR (RFC 1179) or 'chPort9100(11)' for Raw), or zero if not specified.

Compatibility Note: The value of zero is NOT registered in the IANA Printer MIB. It is an out-of-band value. Thus the syntax of this object is NOT specified as 'PrtChannelTypeTC'.

Systems that do NOT implement IETF Printer MIB v2 (RFC 3805) SHOULD use 'chPort9100(11)' for Raw printing (with an alternate port in 'ppmPortProtocolTargetPort', if necessary), because 'chPortTCP(37)' and 'chBidirPortTCP(38)' are NOT defined in IETF Printer MIB v1 (RFC 1759).

Systems that do implement the IETF Printer MIB v2 (RFC 3805) MAY instead use 'chPortTCP(37)' or 'chBidirPortTCP(38)' for Raw printing, because 'chPort9100(11)' is DEPRECATED in IETF Printer MIB v2.

Systems that implement any version of the IETF Printer MIB (RFC 1759/3805) SHOULD use the same value of protocol type for this port in the 'prtChannelTable', so monitoring applications MAY search for more channel information and status."

REFERENCE

"PrtChannelTypeTC in IANA Printer MIB (RFC 3805 and <http://www.iana.org/assignments/ianaprinter-mib>).
prtChannelType in IETF Printer MIB (RFC 1759/3805)."

DEFVAL { 0 } -- protocol type not specified
 ::= { ppmPortEntry 5 }

ppmPortProtocolTargetPort OBJECT-TYPE

SYNTAX Integer32 (0..65535)
MAX-ACCESS read-only
STATUS current

DESCRIPTION

"The transport (TCP, UDP, etc.) target port number for this protocol, i.e., an alternate port from the protocol default, or zero if not specified (use protocol default). This object MAY be used for any print protocol (from the Internet, NetWare, AppleTalk, or other protocol suite).

If this object is zero, then the actual target port number is the default port for the specified 'ppmPortProtocolType' (e.g., 'chPort9100(11)' uses '9100').

If this object is non-zero, then it SHOULD NOT conflict with the default (e.g., IANA-registered) target port implied by the value

of 'ppmPortProtocolType' or the explicit transport target port specified in 'ppmPortServiceNameOrURI'. In case of conflict, the URI value in 'ppmPortServiceNameOrURI' is authoritative (e.g., 'ipp://example.com:631/~smith/printer').

If 'ppmPortProtocolType' is 'chLPDServer(8)', then this object MUST be ignored (because LPR target port is fixed at '515')."

REFERENCE

"IETF Line Printer Daemon Protocol (RFC 1179)."

DEFVAL { 0 } -- target port not specified
 ::= { ppmPortEntry 6 }

ppmPortProtocolAltSourceEnabled OBJECT-TYPE

SYNTAX TruthValue
 MAX-ACCESS read-only
 STATUS current

DESCRIPTION

"The alternate transport source port mode for this protocol.

If this object is 'true', then transport source ports outside the standard range MAY be used (e.g., LPR source port standard range is defined in RFC 1179 to be '721' to '731', inclusive).

If this object is 'false', then transport source ports outside the standard range MUST NOT be used (to avoid protocol errors)."

REFERENCE

"IETF Line Printer Daemon Protocol (RFC 1179)."

DEFVAL { false } -- alt source ports disabled
 ::= { ppmPortEntry 7 }

ppmPortPrtChannelIndex OBJECT-TYPE

SYNTAX Integer32 (0..65535)
 MAX-ACCESS read-only
 STATUS current

DESCRIPTION

"The value of 'prtChannelIndex' in IETF Printer MIB (RFC 1759/3805) that corresponds to this printer port, or zero if not specified.

Compatibility Note: The value of zero is NOT valid for 'prtChannelIndex'. It is an out-of-band value.

Systems that implement any version of the IETF Printer MIB (RFC 1759/3805) SHOULD correctly implement this object, so monitoring applications MAY search for print channel information and status.

If this object is zero, then monitoring applications MUST NOT attempt print channel status queries for this printer port."

REFERENCE

"prtChannelIndex, prtChannelIfIndex, prtChannelState, and prtChannelStatus in IETF Printer MIB (RFC 1759/3805)."

DEFVAL { 0 } -- no print channel index
 ::= { ppmPortEntry 8 }

ppmPortLprByteCountEnabled OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The current LPR byte counting mode for this port if applicable.

If the value of 'ppmPortProtocolType' is NOT 'chLPDServer(8)', then monitoring applications MUST ignore the value of this object.

If this object is 'true', then LPR byte counting is enabled.

If this object is 'false', then LPR byte counting is disabled."

REFERENCE

"IETF Line Printer Daemon Protocol (RFC 1179)."

DEFVAL { false } -- LPR byte counting disabled
 ::= { ppmPortEntry 9 }

--
 -- Conformance
 --

ppmMIBCompliance MODULE-COMPLIANCE

STATUS current

DESCRIPTION

"The compliance statements for SNMP Agents that implement this Printer Port Monitor MIB."

MODULE -- this module

MANDATORY-GROUPS { ppmGeneralGroup, ppmPrinterGroup, ppmPortGroup }

OBJECT ppmPrinterIEEE1284DeviceId

SYNTAX OCTET STRING (SIZE(0..255))

DESCRIPTION

"At least 255 octets maximum string length MUST be supported by all implementations of this object. The 'MANUFACTURER' (or 'MFG') and 'MODEL' (or 'MDL') fields MUST be contained within the first 255 octets of this object (to prevent truncation of

critical information across gateways and mid-level managers).
 Implementations that support less than the 1023 octets maximum
 string length MUST only truncate complete fields (i.e., keyword,
 colon, value(s), and semicolon)."

```
::= { ppmMIBConformance 1 }
```

```
--
```

```
-- Conformance Groups
```

```
--
```

```
ppmGeneralGroup OBJECT-GROUP
```

```
  OBJECTS {
    ppmGeneralNaturalLanguage,
    ppmGeneralNumberOfPrinters,
    ppmGeneralNumberOfPorts
  }
```

```
  STATUS current
```

```
  DESCRIPTION
```

```
    "The General object group in the Printer Port Monitor MIB"
```

```
::= { ppmMIBObjectGroups 1 }
```

```
ppmPrinterGroup OBJECT-GROUP
```

```
  OBJECTS {
    ppmPrinterName,
    ppmPrinterIEEE1284DeviceId,
    ppmPrinterNumberOfPorts,
    ppmPrinterPreferredPortIndex,
    ppmPrinterHrDeviceIndex,
    ppmPrinterSnmpCommunityName,
    ppmPrinterSnmpQueryEnabled
  }
```

```
  STATUS current
```

```
  DESCRIPTION
```

```
    "The Printer object group in the Printer Port Monitor MIB"
```

```
::= { ppmMIBObjectGroups 2 }
```

```
ppmPortGroup OBJECT-GROUP
```

```
  OBJECTS {
    ppmPortEnabled,
    ppmPortName,
    ppmPortServiceNameOrURI,
    ppmPortProtocolType,
    ppmPortProtocolTargetPort,
    ppmPortProtocolAltSourceEnabled,
    ppmPortPrtChannelIndex,
    ppmPortLprByteCountEnabled
  }
```

```
STATUS      current
DESCRIPTION
    "The Port object group in the Printer Port Monitor MIB"
 ::= { ppmMIBObjectGroups 3 }
```

END

6 Conformance Requirements

Conforming implementations of the PPM MIB:

- MUST implement every object defined in the General, Printer and Port groups (although no specific protocol type need be supported)
- MUST initialize every object to the DEFVAL clause (or an actual value) for each OBJECT-TYPE statement in the MIB
- MUST implement every object conformance requirement specified in the SYNTAX, MAX-ACCESS, and DESCRIPTION clauses for each OBJECT-TYPE statement in the MIB
- MUST implement every object conformance requirement specified in the 'ppmMIBCompliance' MODULE-COMPLIANCE statement in the MIB.

7 IANA and PWG Considerations

The PPM MIB defines one enumerated columnar object 'ppmPortProtocolType', used to specify a value from the IANA-maintained registry of print data channel protocol types in the 'PrtChannelTypeTC' textual convention in the IANA Printer MIB (first published in [RFC3805]) at:

<http://www.iana.org/assignments/ianaprinter-mib>

No future PWG registrations will be required for PPM MIB maintenance, because the PPM MIB does not define or use any other enumerations.

8 Internationalization Considerations

The PPM MIB fully conforms to the IETF Policy on Character Sets and Languages [RFC2277], as follows:

- The PPM MIB defines one scalar object 'ppmGeneralNaturalLanguage', used to specify a natural language tag (that conforms to [RFC3066]) for all localized text strings (e.g., 'en-US' for 'English As written in the US').

- The PPM MIB defines three localized text string objects in the UTF-8 charset [RFC3629] with their natural language tag specified in 'ppmGeneralNaturalLanguage'):
 - 'ppmPrinterName' (supports meaningful printer names in any language)
 - 'ppmPortName' (supports meaningful port names in any language)
 - 'ppmPortServiceNameOrURI' (supports future UTF-8, but now ASCII)w ASCII)

9 Security Considerations

The PPM MIB does NOT define any 'read-write' or 'read-create' objects. Nonetheless, security considerations apply to the defined 'read-only' objects.

The PPM MIB exposes a list of SNMPv1/v2 read community name values in the 'ppmPrinterSnmpCommunityName' object, further weakening the dubious security of alternative community names in SNMPv1/v2.

Note: Packet sniffers are freely available on the Web that can read and display the community names in all SNMP packets sent over LANs or other shared media.

It is RECOMMENDED that implementors consider the security features as provided by the SNMPv3 framework (see [RFC3410], section 8), including full support for the SNMPv3 cryptographic mechanisms (for authentication and privacy).

Further, deployment of SNMP versions prior to SNMPv3 is NOT RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to enable cryptographic security. It is then a customer/operator responsibility to ensure that the SNMP entity giving access to an instance of this MIB module is properly configured to give access to the objects only to those principals (users) that have legitimate access rights.

10 Normative References

[IEEE1284]	Standard Signalling Method for a Bidirectional Parallel Peripheral Interface for Personal Computers, IEEE 1284-2000.
[RFC2119]	Key words for use in RFCs to Indicate Requirement Levels, RFC 2119, Bradner. March 1997.
[RFC2578]	Structure of Management Information Version 2, RFC 2578, McCloghrie, Perkins, Schoenwaelder. April 1999.
[RFC2579]	Textual Conventions for SMIv2, RFC 2579, McCloghrie, Perkins, Schoenwaelder. April 1999.
[RFC2580]	Conformance Statements for SMIv2, RFC 2580, McCloghrie, Perkins, Schoenwaelder. April 1999.
[RFC2790]	IETF Host Resources MIB v2, RFC 2790, Grillo, Waldbusser. March 2000.
[RFC2863]	Interfaces Group MIB, RFC 2863, McCloghrie, Kastenholz. June 2000.
[RFC3066]	Tags for the Identification of Languages, RFC 3066, Alvestrand. January 2001.
[RFC3411]	An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks (IETF SNMP Framework MIB), RFC 3411, Harrington, Presuhn, Wijnen. December 2002.

[RFC3629]	UTF-8, a transform of ISO 10646, RFC 3629, Yergeau. November 2003.
[RFC3805]	IETF Printer MIB v2, RFC 3805, Bergman, Lewis, McDonald. June 2004.
[RFC3986]	URI Generic Syntax, RFC 3986, Berners-Lee, Fielding, Masinter. January 2005.

11 Informative References

[PORT-PROP]	Fenelon, Pavecevic. Microsoft Port MIB proposal, November 2004. ftp://ftp.pwg.org/pub/pwg/BOFs/port/TCPMonMIBExtension.pdf (MIB) ftp://ftp.pwg.org/pub/pwg/BOFs/port/TCPMonPWG.ppt (Presentation)
[RFC1179]	Line Printer Daemon Protocol, RFC 1179, McLaughlin. September 1993.
[RFC1514]	IETF Host Resources MIB v1, RFC 1514, Grillo, Waldbusser. August 1990. (obsoleted by [RFC2790])
[RFC1759]	IETF Printer MIB v1, RFC 1759, Smith, Wright, Hastings, Zilles, Gyllenskog. March 1995. (obsoleted by [RFC3805])
[RFC2011]	SNMPv2 MIB for IP using SMIv2, RFC 2011, McCloghrie. November 1996.
[RFC2012]	SNMPv2 MIB for TCP using SMIv2, RFC 2012, McCloghrie. November 1996.
[RFC2013]	SNMPv2 MIB for UDP using SMIv2, RFC 2013, McCloghrie. November 1996.
[RFC2277]	IETF Policy on Character Sets and Languages, RFC 2277, Alvestrand. January 1998.
[RFC2567]	Wright. "Design Goals for an Internet Printing Protocol", RFC 2567, April 1999.
[RFC2568]	Zilles. "Rationale for the Structure of the Model and Protocol for the Internet Printing Protocol", RFC 2568, April 1999.
[RFC2911]	IPP/1.1: Model and Semantics, RFC 2911, Hastings, Herriot, deBry, Isaacson, Powell. September 2000.
[RFC3410]	Introduction and Applicability Statements for Internet-Standard Management Framework, RFC 3410, Case, Mundy, Partain, Stewart. December 2002.
[RFC3510]	IPP/1.1: IPP URL Scheme, RFC 3510, Herriot, McDonald. April 2003.
[RFC3584]	Coexistence between SNMP Versions (IETF Community MIB), RFC 3584, Frye, Levi, Routhier, Wijnen. August 2003.
[RFC3712]	LDAP Schema for Printer Services, RFC 3712, Fleming, McDonald. February 2004.
[RFC3987]	Internationalized Resource Identifiers (IRIs), Duerst, Suignard, RFC 3987. January 2005
[RFC4181]	Heard, C. "Guidelines for Authors and Reviewers of MIB Documents", RFC 4181, September 2005.

Appendix A - Authors Addresses

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