The Printer Working Group

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Working Draft

PWG MFD Alerts v1.1 (MFD Alerts)

Status: Stable

Abstract: This document defines an update to the IANA-PRINTER-MIB (originally published in RFC 3805) to provide support for SNMP alerts in a multifunction device (MFD) and an equivalent update to IPP “printer-state-reasons” [STD92] and IPP “printer-alert” [PWG5100.9].

This document is a PWG Working Draft. For a definition of a "PWG Working Draft", see:

http://ftp.pwg.org/pub/pwg/general/pwg-process30.pdf

This document is available electronically at:

http://ftp.pwg.org/pub/pwg/ipp/wd/wd-pwgmfdalerts11-20190216.docx

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About the IEEE-ISTO PWG

The Printer Working Group (or PWG) is a Program of the IEEE Industry Standards and Technology Organization (ISTO) with member organizations including printer manufacturers, print server developers, operating system providers, network operating system providers, network connectivity vendors, and print management application developers. The group is chartered to make printers and the applications and operating systems supporting them work together better. All references to the PWG in this document implicitly mean “The Printer Working Group, a Program of the IEEE ISTO.” In order to meet this objective, the PWG will document the results of their work as open standards that define print related protocols, interfaces, procedures and conventions. Printer manufacturers and vendors of printer related software will benefit from the interoperability provided by voluntary conformance to these standards.

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.

For additional information regarding the Printer Working Group visit:

http://www.pwg.org

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Table of Contents

List of Tables

1. Introduction

This document defines simple extensions to the originally printer-specific IETF Printer MIB v2 [RFC3805] (new enumeration values in prtAlertCode) and IETF IPP/1.1 [STD92] (new keyword values in “printer-state-reasons”) to add support for alert information for multifunction devices (MFDs), which are now very popular alternatives to using separate printer, copier, and facsimile equipment. Prior to the introduction of MFDs, printer vendors and application developers had already created tools, management systems, and device drivers based upon the Printer MIB v2 [RFC3805] and the prtAlertTable. MFDs are typically less expensive than an equivalent set of individual devices, and have the additional advantage of occupying much less office space.

The printer portion of an MFD is used by the print, copy, and facsimile (fax) functions. Additional scanner and scan media path components are used by the copy and fax functions. The fax function also uses a fax modem component with a PSTN interface.

The Printer Working Group (PWG) developed the IETF Printer MIB v2 [RFC3805], which is now implemented in most network printers sold today and defines the prtAlertTable that may be used, with or without SNMP traps, to implement an effective warning and error reporting system.

2. Terminology

2.1 Conformance Terminology

Capitalized terms, such as MUST, MUST NOT, RECOMMENDED, REQUIRED, SHOULD, SHOULD NOT, MAY, and OPTIONAL, have special meaning relating to conformance as defined in Key words for use in RFCs to Indicate Requirement Levels [BCP14]. The term CONDITIONALLY REQUIRED is additionally defined for a conformance requirement that applies when a specified condition is true.

2.2 Printing Terminology

Normative definitions and semantics of printing terms are imported from IETF Printer MIB v2 [RFC3805], IETF Finisher MIB [RFC3806], and IETF Internet Printing Protocol/1.1: Model and Semantics [STD92].

Document: An object created and managed by an IPP Printer that contains the description, processing, and status information. A Document object may have attached data and is bound to a single Job.

Job: An object created and managed by an IPP Printer that contains description, processing, and status information. The Job also contains zero or more Document objects.

Logical Device: a print server, software service, or gateway that processes jobs and either forwards or stores the processed job or uses one or more Physical Devices to render output.

Output Device: a single Logical or Physical Device

Physical Device: a hardware implementation of a endpoint device, e.g., a marking engine, a fax modem, etc.

2.3 Protocol Role Terminology

This document also defines the following protocol roles in order to specify unambiguous conformance requirements:

IPP Client: Initiator of outgoing connections and sender of outgoing IPP operation requests (Hypertext Transfer Protocol -- HTTP/1.1 [RFC7230] User Agent).

IPP Printer: Listener for incoming connections and receiver of incoming IPP operation requests (Hypertext Transfer Protocol -- HTTP/1.1 [RFC7230] Server) that represents one or more Physical Devices or a Logical Device.

SNMP Printer: Listener for incoming SNMP Get and Set management requests and sender of optional outgoing SNMP notifications for a Printer or MFD.

SNMP Client: Initiator of outgoing SNMP Get and Set management requests and receiver of optional incoming SNMP notifications for a Printer or MFD (i.e., an SNMP Manager).

2.4 Other Terminology

Capitalized Term In Italics: defininition of the term with any references as appropriate.

2.5 Acronyms and Organizations

IANA: Internet Assigned Numbers Authority, http://www.iana.org/

IETF: Internet Engineering Task Force, http://www.ietf.org/

ISO: International Organization for Standardization, http://www.iso.org/

PWG: Printer Working Group, http://www.pwg.org/

3. Requirements

3.1 Rationale

The IETF, and PWG standards in the printing industry include:

1. An abstract model of a PrintDevice in section 2.2 of the IETF Printer MIB v2 [RFC3805].

2. An SNMP Alert table for a PrintDevice to support the service and maintenance functions in section 2.2.13 of the IETF Printer MIB v2 [RFC3805].

3. A set of design goals for status monitoring in a printing protocol in section 3.1.3 “Viewing the status and capabilities of a printer” (for End User), section 3.2.1 “Alerting” (for Operator), and section 3.3 “Administrator” (the bullet requirement to “administrate billing or other charge-back mechanisms”) of the IETF IPP Design Goals [RFC2567].

4. A set of MFD service types for Imaging Systems in the JmJobServiceTypesTC textual convention in section 4 of the IETF Job Monitoring MIB [RFC2707].

5. An abstract model of an MFD job in section 2 of the IETF Job Monitoring MIB [RFC2707].

6. An abstract model of an MFD in the PWG MFD Model and Common Semantics [PWG5108.1].

7. In the years since the Printer MIB v2 [RFC3805] was published printers have evolved into MFDs. Prior to the introduction of MFDs, printer vendors and application developers had already created tools, management systems, and device drivers based upon the Printer MIB v2 [RFC3805] and the prtAlertTable. Now that these same vendors are building MFDs, there is an urgent need to leverage these existing tools and management applications.

8. This document defines a new set of MFD alert groups and MFD component alerts that will allow the applications currently using the prtAlertTable to support MFDs.

3.2 Use Cases

Provide use cases for the document in subsections using the casual use case format.

3.2.1 MFDs with OEM Components

Company A markets complete systems, including a full range of computers, printers, and other office peripheral devices. Most of the equipment included with these systems are manufactured by Company A. The remaining equipment is Company A branded (i.e., OEM), but manufactured by others. All of these systems include a management application that monitors all systems components and automatically initiates service calls.

For printer maintenance, the management system uses the prtAlertTable. New system configurations now offer MFDs as options for printers. By including the MFD Alerts in the MFDs and in Company A's management system, Company A can now offer full management and maintenance support for these new MFDs.

3.2.2 MFDs with Alert Messages

Company B is now adding a new series of MFDs to its extensive line of printers. The current printer families include a deluxe driver that monitors the prtAlertTable to provide status information to the end user. The monitor function does not interpret the prtAlertCode or the prtAlertLocation values, but instead queries and displays the prtAlertDescription value to indicate the fault condition. This feature allows the end user to initiate any action that may be required to complete the user's jobs. The fault information may be related to a job that precedes the user's current job so, if the owner of the previous job is not able or to does not wish to act, the owner of the new job may take the appropriate action so that normal operation can resume. By including the MFD Alerts in their new MFD family, Company B can now offer the monitor function for these new MFDs.

3.3 Exceptions

There are no significant exceptions to describe for the above use cases

3.4 Out of Scope

The following are considered out of scope for this specification:

1. Defininition of any components that are not already defined in the PWG MFD Model and Common Semantics [PWG5108.1];

2. Defininition of any semantics for workflow applications;

3. Defininition of any semantics for document repositories; and

4. Defininition of any application-specific semantics for MFD monitoring using MFD Alerts.

3.5 Design Requirements

The design requirements for this specification are:

1. Define a set of alert groups to provide alert capability for MFDs equivalent to the capability currently provided for printers for registration in the PrtAlertGroupTC in the IANA Printer MIB [IANAPRT];

2. Define new alert groups for MFD components only where functionally equivalent groups do not already exist for the PrintDevice(for example, a ScanMediaPath is inherently entirely separate from any print MediaPath);

3. Do not define new alert groups for MFD components where functionally equivalent groups already exist for the PrintDevice(for example, ScanDevice covers should be modeled using the existing Cover group);

4. Define a set of component-specific alerts for new ScanDevice and FaxDevice components for registration in the PrtAlertCodeTC in the IANA Printer MIB [IANAPRT]; and

5. Define a set of component-specific extension alerts for existing Input, Output, and MediaPath alert groups that correspond to extensions for the ScanMediaPath alert group.

4. SNMP Printer Model Extensions

This section briefly summarizes extensions to the abstract SNMP Printer Model, originally defined in section 2 of IETF Printer MIB v2 [RFC3805], based on the PWG MFD Model and Common Semantics [PWG5108.1], to include the ScanDevice and FaxDevice, their additional subunits, and the new OutputChannel subunit.

4.1 ScanDevice

The ScanDevice uses the following subunits: Console, Cover, Interface, Interpreter, OutputChannel, Processor, ScanMediaPath, Scanner, Storage, and optionally the VendorSubunit.

4.2 FaxDevice

The FaxDevice uses the following subunits: Console, Cover, FaxModem, Finisher, InputChannel, InputTray, Interface, Interpreter, Marker, MediaPath, OutputChannel, OutputTray, Processor, ScanMediaPath, Scanner, Storage, and optionally the VendorSubunit.

4.3 OutputChannel

An OutputChannel is the opposite of an InputChannel – it sends jobs and user data from an MFD via a configured application protocol (e.g., SMTP) to specified destinations.

5. MFD Alerts

5.1 MFD Subunit Alert Groups

The new MFD subunit alert groups and the associated alert group values are defined in this section for registration in PrtAlertGroupTC in IANA Printer MIB [IANAPRT].

Table 1: MFD Alert Groups

MFD Alert Group	PrtAlertGroupTC Value

MFD Alert Group	PrtAlertGroupTC Value
scanDevice	50
scanner	51
scanMediaPath	52
faxDevice	60
faxModem	61
outputChannel	70

5.2 MFD Subunit Alerts

The new MFD subunit alerts and the associated alert values are defined in this section for registration in PrtAlertCodeTC in IANA Printer MIB [IANAPRT].

Note: The original Printer MIB v1 [RFC1759] and subsequent Printer MIB v2 [RFC3805] did not define any (Input)Channel-specific alerts. Therefore, this MFD Alerts specification does not define any OutputChannel-specific alerts. The generic alerts (subunitXxx) originally defined in [RFC3805] and registered in [IANAPRT] may be used for both (Input)Channel and OutputChannel subunits.

Table 2: MFD Subunit Alerts

MFD Subunit Alert	PrtAlertCodeTC
-- Input Group	
inputMediaTrayFeedError	814
inputMediaTrayJam	815
inputMediaTrayFailure	816
inputPickRollerLifeWarn	817
inputPickRollerLifeOver	818
inputPickRollerFailure	819
inputPickRollerMissing	820
-- Output Group	
outputMediaTrayFeedError	905
outputMediaTrayJam	906
outputMediaTrayFailure	907
-- Marker Supplies Group	
markerCleanerMissing	1116
markerDeveloperMissing	1117
markerFuserMissing	1118
markerInkMissing	1119
markerOpcMissing	1120
markerPrintRibbonMissing	1121
markerSupplyAlmostEmpty	1122
markerSupplyEmpty	1123
markerSupplyMissing	1124
markerWasteAlmostFull	1125
markerWasteFull	1126
markerWasteMissing	1127
markerWasteInkReceptacleMissing	1128
markerWasteTonerReceptacleMissing	1129

MFD Subunit Alert	PrtAlertCodeTC
markerTonerMissing	1130
-- Media Path Group	
mediaPathFailure	1305
mediaPathJam	1306
mediaPathInputRequest	1310
mediaPathInputFeedError	1311
mediaPathInputJam	1312
mediaPathInputEmpty	1313
mediaPathOutputFeedError	1321
mediaPathOutputJam	1322
mediaPathOutputFull	1323
mediaPathPickRollerLifeWarn	1331
mediaPathPickRollerLifeOver	1332
mediaPathPickRollerFailure	1333
mediaPathPickRollerMissing	1334
-- Scanner Group	
scannerLightLifeAlmostOver	5101
scannerLightLifeOver	5102
scannerLightFailure	5103
scannerLightMissing	5104
scannerSensorLifeAlmostOver	5111
scannerSensorLifeOver	5112
scannerSensorFailure	5113
scannerSensorMissing	5114
-- Scan Media Path Group	
scanMediaPathTrayMissing	5201
scanMediaPathTrayAlmostFull	5202
scanMediaPathTrayFull	5203
scanMediaPathFailure	5205
scanMediaPathJam	5206
scanMediaPathInputRequest	5210
scanMediaPathInputFeedError	5211
scanMediaPathInputJam	5212
scanMediaPathInputEmpty	5213
scanMediaPathOutputFeedError	5221
scanMediaPathOutputJam	5222
scanMediaPathOutputFull	5223
scanMediaPathPickRollerLifeWarn	5231
scanMediaPathPickRollerLifeOver	5232
scanMediaPathPickRollerFailure	5233
scanMediaPathPickRollerMissing	5234
-- Fax Modem Group	
faxModemMissing	6101
faxModemLifeAlmostOver	6102
faxModemLifeOver	6103
faxModemTurnedOn	6104
faxModemTurnedOff	6105
faxModemInactivityTimeout	6110
faxModemProtocolAlert	6111
faxModemEquipmentFailure	6112

MFD Subunit Alert	PrtAlertCodeTC
faxModemNoDialTone	6113
faxModemLineBusy	6114
faxModemNoAnswer	6115
faxModemVoiceDetected	6116
faxModemCarrierLost	6117
faxModemTrainingFailure	6118

Note: SNMP Printer subunit alert codes ending in “Error” only occur when the MFD/Printer is stopped.

5.3 IPP printer-state-reasons (1setOf type2 keyword)

The new MFD alert values of "printer-state-reasons" [STD92] are defined in this section for registration in IANA IPP Registry [IANAIPP]. The table below defines new MFD alert values of "printer-state-reasons" [STD92] and their mapping to/from new MFD alert values of 'PrtAlertCodeTC' [IANAPRT] defined above in section 5.2.

Table 3: IPP MFD printer-state-reasons

SNMP MFD PrtAlertCodeTC	IPP MFD printer-state-reasons
-- Input Group	
inputMediaTrayFeedError(814)	input-media-tray-feed-error
inputMediaTrayJam(815)	input-media-tray-jam
inputMediaTrayFailure(816)	input-media-tray-failure
inputPickRollerLifeWarn(817)	input-pick-roller-life-warn
inputPickRollerLifeOver(818)	input-pick-roller-life-over
inputPickRollerFailure(819)	input-pick-roller-failure
inputPickRollerMissing(820)	input-pick-roller-missing
-- Output Group	
outputMediaTrayFeedError(905)	output-media-tray-feed-error
outputMediaTrayJam(906)	output-media-tray-jam
outputMediaTrayFailure(907)	output-media-tray-failure
-- Marker Supplies Group	
markerCleanerMissing(1116)	marker-cleaner-missing
markerDeveloperMissing(1117)	marker-developer-missing
markerFuserMissing(1118)	marker-fuser-missing
markerInkMissing(1119)	marker-ink-missing
markerOpcMissing(1120)	marker-opc-missing
markerPrintRibbonMissing(1121)	marker-print-ribbon-missing
markerSupplyAlmostEmpty(1122)	marker-supply-almost-empty
markerSupplyEmpty(1123)	marker-supply-empty
markerSupplyMissing(1124)	marker-supply-missing
markerWasteAlmostFull(1125)	marker-waste-almost-full
markerWasteFull(1126)	marker-waste-full
markerWasteMissing(1127)	marker-waste-missing
markerWasteInkReceptacleMissing(1128)	marker-waste-ink-receptacle-missing
markerWasteTonerReceptacleMissing(1129)	marker-waste-toner-receptacle-missing
markerTonerMissing (1130)	marker-toner-missing
-- Media Path Group	

SNMP MFD PrtAlertCodeTC	IPP MFD printer-state-reasons
mediaPathFailure(1305)	media-path-failure
mediaPathJam(1306)	media-path-jam
mediaPathInputRequest(1310)	media-path-input-request
mediaPathInputFeedError(1311)	media-path-input-feed-error
mediaPathInputJam(1312)	media-path-input-jam
mediaPathInputEmpty(1313)	media-path-input-empty
mediaPathOutputFeedError(1321)	media-path-output-feed-error
mediaPathOutputJam(1322)	media-path-output-jam
mediaPathOutputFull(1323)	media-path-output-full
mediaPathPickRollerLifeWarn(1331)	media-path-pick-roller-life-warn
mediaPathPickRollerLifeOver(1332)	media-path-pick-roller-life-over
mediaPathPickRollerFailure(1333)	media-path-pick-roller-failure
mediaPathPickRollerMissing(1334)	media-path-pick-roller-missing
-- Scanner Group	
scannerLightLifeAlmostOver(5101)	scanner-light-life-almost-over
scannerLightLifeOver(5102)	scanner-light-life-over
scannerLightFailure(5103)	scanner-light-failure
scannerLightMissing(5104)	scanner-light-missing
scannerSensorLifeAlmostOver(5111)	scanner-sensor-life-almost-over
scannerSensorLifeOver(5112)	scanner-sensor-life-over
scannerSensorFailure(5113)	scanner-sensor-failure
scannerSensorMissing(5114)	scanner-sensor-missing
-- Scan Media Path Group	
scanMediaPathTrayMissing(5201)	scan-media-path-tray-missing
scanMediaPathTrayAlmostFull(5202)	scan-media-path-tray-almost-full
scanMediaPathTrayFull(5203)	scan-media-path-tray-full
scanMediaPathFailure(5205)	scan-media-path-failure
scanMediaPathJam(5206)	scan-media-path-jam
scanMediaPathInputRequest(5210)	scan-media-path-input-request
scanMediaPathInputFeedError(5211)	scan-media-path-input-feed-error
scanMediaPathInputJam(5212)	scan-media-path-input-jam
scanMediaPathInputEmpty(5213)	scan-media-path-input-empty
scanMediaPathOutputFeedError(5221)	scan-media-path-output-feed-error
scanMediaPathOutputJam(5222)	scan-media-path-output-jam
scanMediaPathOutputFull(5223)	scan-media-path-output-full
scanMediaPathPickRollerLifeWarn(5231)	scan-media-path-pick-roller-life-warn
scanMediaPathPickRollerLifeOver(5232)	scan-media-path-pick-roller-life-over
scanMediaPathPickRollerFailure(5233)	scan-media-path-pick-roller-failure
scanMediaPathPickRollerMissing(5234)	scan-media-path-pick-roller-missing
-- Fax Modem Group	
faxModemMissing(6101)	fax-modem-missing
faxModemLifeAlmostOver(6102)	fax-modem-life-almost-over
faxModemLifeOver(6103)	fax-modem-life-over
faxModemTurnedOn(6104)	fax-modem-turned-on
faxModemTurnedOff(6105)	fax-modem-turned-off
faxModemInactivityTimeout(6110)	
faxModemProtocolAlert(6111)	
faxModemEquipmentFailure(6112)	
faxModemNoDialTone(6113)	
faxModemLineBusy(6114)	

SNMP MFD PrtAlertCodeTC	IPP MFD printer-state-reasons
faxModemNoAnswer(6115)	
faxModemVoiceDetected(6116)	
faxModemCarrierLost(6117)	
faxModemTrainingFailure(6118)	

Note 1: IPP “printer-state-reasons” ending in “error” only occur when the MFD/Printer is stopped.

Note 2: FaxModem alerts for transient conditions are NOT mapped to “printer-state-reasons”.

6. Conformance Requirements

6.1 SNMP Agent Conformance Requirements

To claim conformance to this specification, an SNMP Agent implementation for a Multifunction Device:

(a) MUST implement the prtAlertTable defined in IETF Printer MIB v2;
(b) SHOULD implement the prtAlertTable defined in IETF Printer MIB v2 [RFC3805] as persistent across power cycles and hardware reconfigurations, for reliable fleet management.
(c) MUST support the MFD alert groups defined in section 5.1 of this specification which are registered in PrtAlertGroupTC in IANA Printer MIB [IANAPRT], if the corresponding functionality (e.g., scan) is supported on the MFD;
(d) MUST support the MFD alert codes defined in section 5.2 of this specification which are registered in PrtAlertCodeTC in IANA Printer MIB [IANAPRT], if the corresponding functionality (e.g., scan) is supported on the MFD; and
(e) MUST encode and interpret values of the prtAlertGroup and prtAlertCode objects defined in IETF Printer MIB v2 [RFC3805] according to the registry in IANA Printer MIB [IANAPRT].

6.2 SNMP Client Conformance Requirements

To claim conformance to this specification, an SNMP Client implementation that supports Multifunction Devices:

(a) MUST support the prtAlertTable defined in IETF Printer MIB v2;
(b) MUST support the MFD alert groups defined in section 5.1 of this specification which are registered in PrtAlertGroupTC in IANA Printer MIB [IANAPRT], if the corresponding functionality (e.g., scan) is supported on the SNMP Client;
(c) MUST support the MFD alert codes defined in section 5.2 of this specification which are registered in PrtAlertCodeTC in IANA Printer MIB [IANAPRT], if the corresponding functionality (e.g., scan) is supported on the SNMP Client; and

(d) MUST decode and interpret values of the prtAlertGroup and prtAlertCode objects defined in IETF Printer MIB v2 [RFC3805] according to the registry in IANA Printer MIB [IANAPRT].

6.3 IPP Printer Conformance Requirements

To claim conformance to this specification, an IPP Printer implementation for a Multifunction Device:

(a) MUST support the IPP Printer “printer-alert” and “printer-alert-description” attributes defined in PWG IPP Printer State Extensions [PWG5100.9];
(b) MUST support the MFD alert groups defined in section 5.1 of this specification which are registered in PrtAlertGroupTC in IANA Printer MIB [IANAPRT] for keyword values in “printer-alert”, if the corresponding functionality (e.g., scan) is supported on the MFD;
(c) MUST support the MFD alert codes defined in section 5.2 of this specification which are registered in PrtAlertCodeTC in IANA Printer MIB [IANAPRT] and IANA IPP Registry [IANAIPP] for keyword values in “printer-alert” and “printer-state-reasons”, if the corresponding functionality (e.g., scan) is supported on the MFD; and
(d) MUST encode and interpret values of “printer-alert” and “printer-state-reasons” according to the IANA Printer MIB [IANAPRT] and IANA IPP Registry [IANAIPP].

6.4 IPP Client Conformance Requirements

To claim conformance to this specification, an IPP Client implementation that supports Multifunction Devices:

(a) MUST support the IPP Printer “printer-alert” and “printer-alert-description” attributes defined in PWG IPP Printer State Extensions [PWG5100.9];
(b) MUST support the MFD alert groups defined in section 5.1 of this specification which are registered in PrtAlertGroupTC in IANA Printer MIB [IANAPRT] for keyword values in “printer-alert”, if the corresponding functionality (e.g., scan) is supported on the IPP Client;
(c) MUST support the MFD alert codes defined in section 5.2 of this specification which are registered in PrtAlertCodeTC in IANA Printer MIB [IANAPRT] and IANA IPP Registry [IANAIPP] for keyword values in “printer-alert” and “printer-state-reasons”, if the corresponding functionality (e.g., scan) is supported on the IPP Client; and
(d) MUST decode and interpret values of “printer-alert” and “printer-state-reasons” according to the IANA Printer MIB [IANAPRT] and IANA IPP Registry [IANAIPP].

7. Internationalization Considerations

7.1 IPP Internationalization Considerations

For interoperability and basic support for multiple languages, conforming implementations MUST support:

- Universal Character Set (UCS) Transformation Format -- 8 bit (UTF-8) [STD63] encoding of Unicode [UNICODE] [ISO10646]; and

- Unicode Format for Network Interchange [RFC5198] which requires transmission of well-formed UTF-8 strings and recommends transmission of normalized UTF-8 strings in Normalization Form C (NFC) [UAX15].

Unicode NFC is defined as the result of performing Canonical Decomposition (into base characters and combining marks) followed by Canonical Composition (into canonical composed characters wherever Unicode has assigned them).

WARNING – Performing normalization on UTF-8 strings received from Clients and subsequently storing the results (e.g., in Job objects) could cause false negatives in Client searches and failed access (e.g., to Printers with percent-encoded UTF-8 URIs now 'hidden').

Implementations of this specification SHOULD conform to the following standards on processing of human-readable Unicode text strings, see:

- Unicode Bidirectional Algorithm [UAX9] – left-to-right, right-to-left, and vertical

- Unicode Line Breaking Algorithm [UAX14] – character classes and wrapping

- Unicode Normalization Forms [UAX15] – especially NFC for [RFC5198]

- Unicode Text Segmentation [UAX29] – grapheme clusters, words, sentences

- Unicode Identifier and Pattern Syntax [UAX31] – identifier use and normalization

- Unicode Collation Algorithm [UTS10] – sorting

- Unicode Locale Data Markup Language [UTS35] – locale databases

Implementations of this specification are advised to also review the following informational documents on processing of human-readable Unicode text strings:

- Unicode Character Encoding Model [UTR17] – multi-layer character model

- Unicode Character Property Model [UTR23] – character properties
- Unicode Conformance Model [UTR33] – Unicode conformance basis

7.2 SNMP Internationalization Considerations

The SNMP MFD alert groups and alert codes defined in this document do not add any internationalization considerations beyond those covered in section 8 of the IETF Printer MIB v2 [RFC3805]. The MFD extensions to the IPP Printer "printer-alert" and "printer-state-reasons" attributes defined in this document do not add any internationalization considerations beyond covered in section 7 of IPP/1.1 Model and Semantics [STD92].

8. Security Considerations

8.1 IPP Security Considerations

The IPP extensions defined in this document require the same security considerations as defined in the IPP/1.1: Model and Semantics [STD92].

Implementations of this specification SHOULD conform to the following standard on processing of human-readable Unicode text strings, see:

- Unicode Security Mechanisms [UTS39] – detecting and avoiding security attacks

Implementations of this specification are advised to also review the following informational document on processing of human-readable Unicode text strings:

- Unicode Security FAQ [UNISECFAQ] – common Unicode security issues

8.2 SNMP Security Considerations

The SNMP MFD alert groups and alert codes defined in this document do not add any security considerations beyond those covered in section 9 of the IETF Printer MIB v2 [RFC3805].

9. IANA and PWG Considerations

9.1 Alert Groups

This section contains the exact registration information for IANA to update the IANA-PRINTER-MIB PrtAlertGroupTC Registry [IANAPRT], according to the procedures defined in the IETF Printer MIB v2 [RFC3805] section 5, to cover the new alert groups defined in section 5.1 of this document. Add to PrtAlertGroupTC the following:


```
-- Values for the ScanDevice
  scanDevice(50),          -- MFD Extension
  scanner(51),             -- MFD Extension
  scanMediaPath(52),       -- MFD Extension
-- Values (50) to (59) reserved for the ScanDevice
-- Values for the FaxDevice
  faxDevice(60),           -- MFD Extension
  faxModem(61),            -- MFD Extension
-- Values (60) to (69) reserved for the FaxDevice
-- Values for other common subunits
  outputChannel(70),       -- MFD Extension
-- Values (70) to (79) reserved for common subunits
```

9.2 Alert Codes

This section contains the exact registration information for IANA to update the IANA-PRINTER-MIB PrtAlertCodeTC Registry [IANAPRT], according to the procedures defined in the IETF Printer MIB v2 [RFC3805] section 5, to cover the new alert codes defined in sections 5.2 and 5.3 of this document. Add to PrtAlertCodeTC the following:

```
-- Input Group
  inputMediaTrayFeedError(814),
  inputMediaTrayJam(815),
  inputMediaTrayFailure(816),
  inputMediaTrayPickRollerLifeWarn(817),
  inputMediaTrayPickRollerLifeOver(818),
  inputMediaTrayPickRollerFailure(819),
  inputMediaTrayPickRollerMissing(820),

-- Output Group
  outputMediaTrayFeedError(905),
  outputMediaTrayJam(906),
  outputMediaTrayFailure(907),

-- Marker Supplies Group
  markerCleanerMissing(1116),
  markerDeveloperMissing(1117),
  markerFuserMissing(1118),
  markerInkMissing(1119),
  markerOpcMissing(1120),
  markerPrintRibbonMissing(1121),
  markerSupplyAlmostEmpty(1122),
  markerSupplyEmpty(1123),
  markerSupplyMissing(1124),
  markerWasteAlmostFull(1125),
  markerWasteFull(1126),
  markerWasteMissing(1127),
  markerWasteInkReceptacleMissing(1128),
  markerWasteTonerReceptacleMissing(1129).
  markerTonerMissing(1130).

-- Media Path Group
  mediaPathFailure(1305),
  mediaPathJam(1306),
  mediaPathInputRequest(1310),
```



```
    mediaPathInputFeedError(1311),
    mediaPathInputJam(1312),
    mediaPathOutputFeedError(1321),
    mediaPathOutputJam(1322),
    mediaPathOutputFull(1323),
    mediaPathPickRollerLifeWarn(1331),
    mediaPathPickRollerLifeOver(1332),
    mediaPathPickRollerFailure(1333),
    mediaPathPickRollerMissing(1334),

  -- Scanner Group
    scannerLightLifeAlmostOver(5101),
    scannerLightLifeOver(5102),
    scannerLightFailure(5103),
    scannerLightMissing(5104),
    scannerSensorLifeAlmostOver(5111),
    scannerSensorLifeOver(5112),
    scannerSensorFailure(5113),
    scannerSensorMissing(5114),

  -- Scan Media Path Group
    scanMediaPathTrayMissing(5201),
    scanMediaPathTrayAlmostFull(5202),
    scanMediaPathTrayFull(5203),
    scanMediaPathFailure(5205),
    scanMediaPathJam(5206),
    scanMediaPathInputRequest(5210),
    scanMediaPathInputFeedError(5211),
    scanMediaPathInputJam(5212),
    scanMediaPathOutputFeedError(5221),
    scanMediaPathOutputJam(5222),
    scanMediaPathOutputFull(5223),
    scanMediaPathPickRollerLifeWarn(5231),
    scanMediaPathPickRollerLifeOver(5232),
    scanMediaPathPickRollerFailure(5233),
    scanMediaPathPickRollerMissing(5234),

  -- Fax Modem Group
    faxModemMissing(6101),
    faxModemLifeAlmostOver(6102),
    faxModemLifeOver(6103),
    faxModemTurnedOn(6104),
    faxModemTurnedOff(6105),
    faxModemInactivityTimeout(6110), -- DEPRECATED
    faxModemProtocolAlert(6111), -- DEPRECATED
    faxModemEquipmentFailure(6112), -- DEPRECATED
    faxModemNoDialTone(6113), -- DEPRECATED
    faxModemLineBusy(6114), -- DEPRECATED
    faxModemNoAnswer(6115), -- DEPRECATED
    faxModemVoiceDetected(6116), -- DEPRECATED
    faxModemCarrierLost(6117), -- DEPRECATED
    faxModemTrainingFailure(6118), -- DEPRECATED
```


9.3 IPP Attribute Value Registrations

This section contains the exact registration information for IANA to update according to the procedures defined in [STD92].

The registry entry will contain the following information:

```
Section 9 (References)

[PWG5107.3] PWG Multifunction Device Alerts, PWG 5107.3, TBD.
            ftp://ftp.pwg.org/pub/pwg/ipp/wd

                wd-pmpmfdalerts10-20180813.docx

Section 2 (Keyword Attribute Values)
Attribute Name (attribute syntax)                Reference
---------------------------------                ---------
printer-state-reasons (1setOf type2 keyword)     [STD92]
  input-media-tray-feed-error                    [PWG5107.3]
  input-media-tray-jam                           [PWG5107.3]
  input-media-tray-failure                       [PWG5107.3]
  input-pick-roller-life-warn                    [PWG5107.3]
  input-pick-roller-life-over                    [PWG5107.3]
  input-pick-roller-failure                      [PWG5107.3]
  input-pick-roller-missing                      [PWG5107.3]

  output-media-tray-feed-error                   [PWG5107.3]
  output-media-tray-jam                          [PWG5107.3]
  output-media-tray-failure                      [PWG5107.3]

  marker-cleaner-missing                         [PWG5107.3]
  marker-developer-missing                       [PWG5107.3]
  marker-fuser-missing                           [PWG5107.3]
  marker-ink-missing                             [PWG5107.3]
  marker-opc-missing                             [PWG5107.3]
  marker-print-ribbon-missing                    [PWG5107.3]
  marker-supply-almost-empty                     [PWG5107.3]
  marker-supply-empty                            [PWG5107.3]
  marker-supply-missing                          [PWG5107.3]
  marker-waste-almost-full                       [PWG5107.3]
  marker-waste-full                              [PWG5107.3]
  marker-waste-missing                           [PWG5107.3]
  marker-waste-ink-receptacle-missing            [PWG5107.3]
  marker-waste-toner-receptacle-missing          [PWG5107.3]
  marker-toner-missing                           [PWG5107.3]

  media-path-failure                             [PWG5107.3]
  media-path-jam                                 [PWG5107.3]
  media-path-input-request                       [PWG5107.3]
  media-path-input-feed-error                    [PWG5107.3]
  media-path-input-jam                           [PWG5107.3]
  media-path-input-empty                         [PWG5107.3]
  media-path-output-feed-error                   [PWG5107.3]
  media-path-output-jam                          [PWG5107.3]
  media-path-output-full                         [PWG5107.3]
```


media-path-pick-roller-life-warn	[PWG5107.3]
media-path-pick-roller-life-over	[PWG5107.3]
media-path-pick-roller-failure	[PWG5107.3]
media-path-pick-roller-missing	[PWG5107.3]
scanner-light-life-almost-over	[PWG5107.3]
scanner-light-life-over	[PWG5107.3]
scanner-light-failure	[PWG5107.3]
scanner-light-missing	[PWG5107.3]
scanner-sensor-life-almost-over	[PWG5107.3]
scanner-sensor-life-over	[PWG5107.3]
scanner-sensor-failure	[PWG5107.3]
scanner-sensor-missing	[PWG5107.3]
scan-media-path-tray-missing	[PWG5107.3]
scan-media-path-tray-almost-full	[PWG5107.3]
scan-media-path-tray-full	[PWG5107.3]
scan-media-path-failure	[PWG5107.3]
scan-media-path-jam	[PWG5107.3]
scan-media-path-input-request	[PWG5107.3]
scan-media-path-input-feed-error	[PWG5107.3]
scan-media-path-input-jam	[PWG5107.3]
scan-media-path-output-feed-error	[PWG5107.3]
scan-media-path-output-jam	[PWG5107.3]
scan-media-path-output-full	[PWG5107.3]
scan-media-path-pick-roller-life-warn	[PWG5107.3]
scan-media-path-pick-roller-life-over	[PWG5107.3]
scan-media-path-pick-roller-failure	[PWG5107.3]
scan-media-path-pick-roller-missing	[PWG5107.3]
fax-modem-missing	[PWG5107.3]
fax-modem-life-almost-over	[PWG5107.3]
fax-modem-life-over	[PWG5107.3]
fax-modem-turned-on	[PWG5107.3]
fax-modem-turned-off	[PWG5107.3]

10. References

10.1 Normative References

[BCP14] S. Bradner, “Key words for use in RFCs to Indicate Requirement Levels", RFC 2119/RFC8174 / BCP 14, March 1997 and May 2017, http://tools.ietf.org/html/bcp14

[IANAIPP] "IANA IPP Registry", IANA Registry, http://www.iana.org/assignments/ipp-registrations

[IANAPRT] "IANA Printer MIB", IANA Registry, http://www.iana.org/assignments/ianaprinter-mib

[ISO10646] "Information technology -- Universal Coded Character Set (UCS)", ISO/IEC 10646:2011

[RFC3805] R. Bergman, H. Lewis, I. McDonald, “IETF Printer MIB v2”, RFC 3805, June 2004, https://tools.ietf.org/html/rfc3805

[RFC3806] R. Bergman, H. Lewis, I. McDonald, "Printer Finishing MIB", RFC 3806, June 2004, https://tools.ietf.org/html/rfc3806

[RFC5198] J. Klensin, M. Padlipsky, "Unicode Format for Network Interchange", RFC 5198, March 2008, http://tools.ietf.org/html/rfc5198

[RFC7230] R. Fielding, J. Reschke, "Hypertext Transfer Protocol (HTTP/1.1): Message Syntax and Routing", RFC 7230, June 2014, https://tools.ietf.org/html/rfc7230

[STD63] F. Yergeau, "UTF-8, a transformation format of ISO 10646", RFC 3629/STD 63, November 2003, http://tools.ietf.org/html/rfc3629

[STD66] T. Berners-Lee, R. Fielding, L. Masinter, "Uniform Resource Identifier (URI): Generic Syntax", RFC 3986/STD 66, January 2005, http://tools.ietf.org/html/rfc3986

[STD92] M. Sweet, I. McDonald, "Internet Printing Protocol/1.1", RFC 8010/RFC 8011 / STD 92, June 2018, https://tools.ietf.org/html/std92

[UAX9] Unicode Consortium, “Unicode Bidirectional Algorithm”, UAX#9, May 2018, http://www.unicode.org/reports/tr9/

[UAX14] Unicode Consortium, “Unicode Line Breaking Algorithm”, UAX#14, May 2018, http://www.unicode.org/reports/tr14/

[UAX15] Unicode Consortium, “Normalization Forms”, UAX#15, May 2018, http://www.unicode.org/reports/tr15/

[UAX29] Unicode Consortium, “Unicode Text Segmentation”, UAX#29, May 2018, http://www.unicode.org/reports/tr29/

[UAX31] Unicode Consortium, “Unicode Identifier and Pattern Syntax”, UAX#31, June 2018, http://www.unicode.org/reports/tr31/

[UNICODE] Unicode Consortium, "Unicode Standard", Version 11.0.0, June 2018, http://www.unicode.org/versions/Unicode11.0.0/

[UTS10] Unicode Consortium, “Unicode Collation Algorithm”, UTS#10, May 2018, http://www.unicode.org/reports/tr10/

[UTS35] Unicode Consortium, “Unicode Locale Data Markup Language”, UTS#35, October 2018, http://www.unicode.org/reports/tr35/

[UTS39] Unicode Consortium, “Unicode Security Mechanisms”, UTS#39, May 2018, http://www.unicode.org/reports/tr39/

10.2 Informative References

[RFC1759] R. Smith, F. Wright, T. Hastings, S. Zilles, J. Gyllenskog, “IETF Printer MIB”, RFC 1759, March 1995, https://tools.ietf.org/html/rfc1759

[RFC2567] F.D. Wright, "IETF Design Goals for an Internet Printing Protocol", RFC 2567, April 1999, https://tools.ietf.org/html/rfc2567

[RFC2707] R. Bergman, T. Hastings, S. Isaacson, H. Lewis, "IETF Job Monitoring MIB - V1.0", RFC 2707, September 1999, https://tools.ietf.org/html/rfc2707

[UTR17] Unicode Consortium “Unicode Character Encoding Model”, UTR#17, November 2008, http://www.unicode.org/reports/tr17/

[UTR23] Unicode Consortium “Unicode Character Property Model”, UTR#23, May 2015, http://www.unicode.org/reports/tr23/

[UTR33] Unicode Consortium “Unicode Conformance Model”, UTR#33, November 2008, http://www.unicode.org/reports/tr33/

[UNISECFAQ] Unicode Consortium “Unicode Security FAQ”, November 2016, http://www.unicode.org/faq/security.html

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12. Change History

12.1 16 February 2019

- Stable draft revision (Ira McDonald) – changes per PWG F2F review (February 2019).

- Changed status from “Prototype” to “Stable” per IPP WG consensus.

- Revised section 7.1 IPP Internationalization Considerations to delete [UNICODEXML].

- Revised section 10.2 Informative References to delete [UNICODEXML].

12.2 13 February 2019

- Prototype draft revision (Ira McDonald) – changes per IPP WG review (January 2019).

- Global – Revised all tables to make first row (header) repeat on every page.

- Verified section 2.3 Protocol Role Terminology normative references to [RFC7230] – no change.

- Deleted section 3.2.3 MFDs with Web-based Fleet Management use case – out-of-scope.

- Revised section 3.3 Exceptions to say there are no significant exceptions and deleted corresponding Comment IM1.

- Revised section 4 SNMP Printer Model Extensions to delete Comment IM2 about exposing further Printer MIB subunits in IPP since we already decided not to do so.

- Revised section 6.3 IPP Printer Conformance Requirements and section 6.4 IPP Client Conformance Requirements to delete item (3) about implementing prtAlertTable since it’s out-of-scope.

- Revised section 7.1 IPP Internationalization Considerations to add bullets to all lists and change [UTR20] (withdrawn technical report) to [UNICODEXML] (UTR20 transitioned to W3C).

- Revised section 8.1 IPP Security Considerations to add bullets to all lists and correct an indentation issue in one paragraph.

- Global – Revised section 10 References to change “http://www.ietf.org/rfc” to “https://tools.ietf.org/html” and remove “.txt” suffix in order to get HTML RFC versions w/ errata references.

- Global – Revised section 10 References to append trailing "/" to all Unicode references, update dated versions of all Unicode references, delete [UTR20] (withdrawn technical report) and add [UNICODEXML] (UTR20 transitioned to W3C).

- Revised section 10.1 Normative References to delete [RFC2616] but keep [RFC7230].

- Revised section 10.2 Informative References to delete DMTF [WS-MGMT] and OASIS [WSDM] web services management unused references – out-of-scope.

12.3 28 December 2018

- Interim draft revision (Ira McDonald) – changes per PWG F2F review (November 2018).

- TODO – Update section 10 References.

- Global – Replaced "[RFC8010]" and "[RFC8011]" with "[STD92]" and fixed References.

- Global – Replace "RFC2119]" with "[BCP14]" and fixed References.

- Global – Changed SNMP and IPP protocol roles for clarity per section 2.3 (see below).

- Revised document title and URI from "pmp" to "pwg" scope and v1.0 to v1.1.

- Revised copyright in headers and page 2 to show span "2012-2018".

- Revised Abstract to simplify.

- Revised section 2.3 Protocol Role Terminology to change "Client" to "IPP Client", change "Printer" to "IPP Printer", change "Printer MIB Agent" to "SNMP Printer", and change "Printer MIB Client" to "SNMP Client".

- Revised title of section 3.1 Rationale for Printer MIB and IPP MFD Alerts to "Rationale" and add numbering for clarity.

- Revised section 3.3 Exceptions to add Comment to define some (they're missing).

- Revised section 3.4 Out of Scope to align text with current Document Object draft and add numbering.

- Revised section 3.5 Design Requirements to align text with current Document Object draft and add numbering.

- Revised title of section 4 Printer Model Extensions to "SNMP Printer Model Extensions" for clarity (i.e., these are extensions are to the Printer MIB v2 model).

- Revised title of section 5 MFD and Printer Extension Alerts to "MFD Alerts" for clarity.

- Revised title of section 5.1 MFD Alert Groups to "MFD Subunit Alert Groups" for clarity.

- Revised title of section 5.2 MFD and Printer Extension Subunit Alerts to “MFD Subunit Alerts” for clarity.

- Revised title of Table 2 MFD and Printer Subunit Alerts to “MFD Subunit Alerts” for clarity and added note about “Error” ending only when MFD/Printer is stopped.

- Revised title of Table 3 IPP printer-state-reasons to “IPP MFD printer-state-reasons” for clarity and added notes about “error” ending only when MFD/Printer is stopped and non-mapping of transient FaxModem alerts to IPP.

- Revised Table 3 IPP MFD printer-state-reasons to add missing hyphen to “scan-media-path-input-feed-error” to correct a typo.

- Revised title of section 7.1 IPP Standard Internationalization Considerations to “IPP Internationalization Considerations” for clarity and removed numbering in first list.

- Revised title of section 7.2 MFD Alerts Internationalization Considerations to “SNMP Internationalization Considerations” for clarity.

- Revised title of section 8.1 Standard IPP Security Considerations to “IPP Security Considerations” for clarity.

- Revised title of section 8.2 MFD Alerts Security Considerations to “SNMP Security Considerations” for clarity.

- Revised section 9.2 Alert Codes to suffix “—DEPRECATED” to all of the FaxModem transient alerts (NOT mapped to IPP).

- Revised title of section 9.3 IPP Attribute and Keyword Value Registrations to “IPP Attribute Value Registrations” for consistency and concatenated with former section 9.5

- Deleted original section 9.4 through section 9.8 (all redundant).

- Revised section 11 Author’s Address to move Ron Bergman down to Contributors (as original Author), remove Lexmark from Jerry Thrasher, and add Rick Yardumian and Christopher Rizzo.

12.4 13 August 2018

- Interim draft revision (Ira McDonald).

- Revised section 5.2 Table 2 MFD and Printer Subunit Alerts, to add 15 new Marker Supplies alerts, per Lee Hills (Xerox) and Mike Sweet (Apple).

- Revised section 5.3 Table 3 IPP printer-state-reasons, to correct numeric values for several Scanner alerts (per Table 2) and add “scannerSensorMissing(5114)”, per Rick Yardumian (Canon).

- Revised section 5.3 Table 3 IPP printer-state-reasons, to add 15 new Marker Supplies alerts, per Lee Hills (Xerox) and Mike Sweet (Apple).

- Revised section 9.2 Alert Codes, to add new Marker Supplies and Scanner alerts (per Table 2), per Lee Hills (Xerox), Rick Yardumian (Canon), and Mike Sweet (Apple).

- Revised section 9.3 IPP Attribute and Keyword Value Registrations, to add new Marker Supplies and Scanner alerts (per Table 3), per Lee Hills (Xerox), Rick Yardumian (Canon), and Mike Sweet (Apple).

- Revised sections 9.x to correct registration procedure references in RFC 8011.

- Deleted section 9.9 Semantic Model Registrations (no longer relevant).

- Revised section 10.1 Normative References, to add “STD92” for RFC 8010/8011 and delete PWG 5108.07 (no longer relevant).

12.5 9 February 2018

- Initial draft revision (Smith Kennedy).

- Converted original version to current PWG document template.

