The Printer Working Group

13 August 2018
Working Draft

Printer MIB and IPP MFD Alerts (MFD Alerts)

Status: Interim

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” [RFC 8011] and IPP “printer-alert” [PWG5100.9]. An MFD is typically based on a printer with added scan- and fax-specific components in order to support print, copy, scan, and facsimile (fax) services. This document defines an update to the IANA-PRINTER-MIB to provide support for new MFD components and component-specific alerts and analogous Printer extension alerts for the existing Input, Output, and MediaPath components.

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-pmpmfdalerts10-20180813.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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About the Internet Printing Protocol Workgroup

The Internet Printing Protocol (IPP) workgroup has developed a modern, full-featured network printing protocol, which is now the industry standard. IPP allows a print client to query a printer for its supported capabilities, features, and parameters to allow the selection of an appropriate printer for each print job. IPP also provides job information prior to, during, and at the end of job processing.

For additional information regarding IPP visit:

http://www.pwg.org/ipp/

Implementers of this specification are encouraged to join the IPP Workgroup mailing list in order to participate in any discussions of the specification. Suggested additions, changes, or clarification to this specification, should be sent to the IPP Workgroup mailing list for consideration.

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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 [RFC8011] (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 the 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 [RFC2119]. 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 [RFC8011].

Document: An object created and managed by a 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 a 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:

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

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

Printer MIB Agent: Listener for incoming SNMP Get and Set management requests and sender of optional outgoing SNMP notifications for a Printer or MFD (i.e., an SNMP Agent).

Printer MIB 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 for Printer MIB and IPP MFD Alerts

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

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

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].

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].

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

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

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

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.

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.

3.2.3 MFDs with Web-based Fleet Management

Company C provides a fleet management system based upon DMTF WS-Management [WS-MGMT], OASIS WSDM [WSDM], or any other web-based protocol that is appropriate for fleet management. The communication between the local fleet management server and the local printers is accomplished via SNMP and the information available in the prtAlertTable is queried to maintain the logs in the remote fleet management server. When MFDs are added to the local network, the fleet management system can monitor all the MFD functions with only minor modifications to support the MFD Alerts.

3.3 Exceptions

Provide exceptions for the use cases using the casual use case format.

None in original MFD Alerts...

3.4 Out of Scope

This MFD Alerts specification should not:

1. Define any components that are not already defined in the PWG MFD Model and Common Semantics [PWG5108.1].
2. Define any semantics for workflow applications.
3. Define any semantics for document repositories.
4. Define any application-specific semantics for MFD monitoring using MFD Alerts.

3.5 Design Requirements

This MFD Alerts specification should satisfy the following design requirements:

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].

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.

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.

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

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. Printer Model Extensions

This section briefly summarizes extensions to the abstract 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. The following two figures are taken directly from [PWG5108.1].

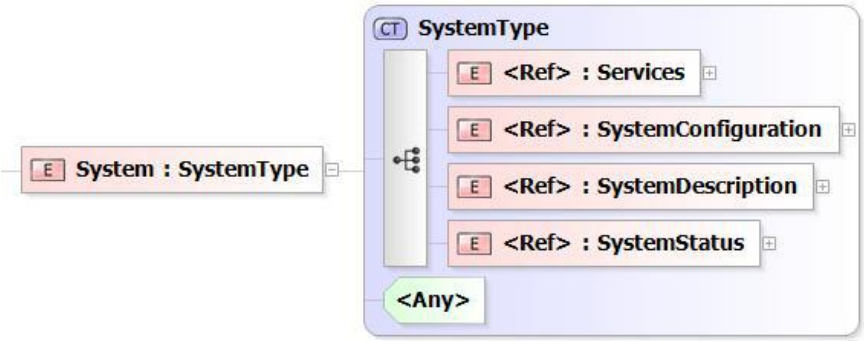

Figure 1: System Object in MFD Model

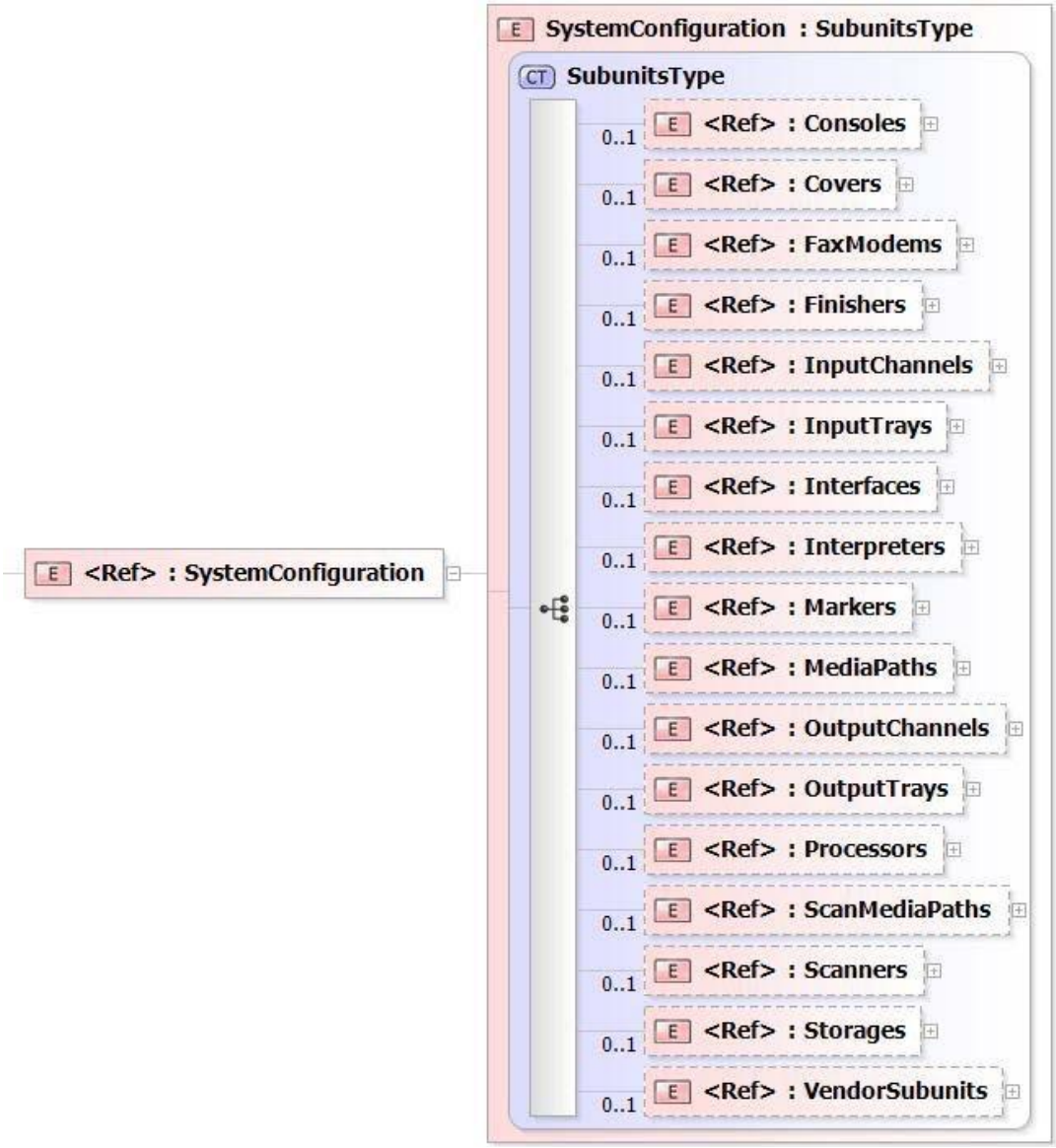

Figure 2: SystemConfiguration Element in MFD Model

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 and Printer Extension Alerts

5.1 MFD Alert Groups

The new MFD 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
scanDevice	50
scanner	51
scanMediaPath	52
faxDevice	60
faxModem	61
outputChannel	70

5.2 MFD and Printer Extension Subunit Alerts

The new MFD and Printer extension 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 and Printer Subunit Alerts

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
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
faxModemProtocolError	6111
faxModemEquipmentFailure	6112
faxModemNoDialTone	6113
faxModemLineBusy	6114
faxModemNoAnswer	6115
faxModemVoiceDetected	6116
faxModemCarrierLost	6117
faxModemTrainingFailure	6118

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

The new MFD alert values of "printer-state-reasons" [RFC8011] are defined in this section for registration in IANA IPP Registry [IANAPRT]. The table below defines new MFD alert values of "printer-state-reasons" [RFC8011] and their mapping to/from new MFD alert values of 'PrtAlertCodeTC' [IANAPRT] defined above in sections 5.2 and 5.3.

Table 3: IPP printer-state-reasons

PrtAlertCodeTC	**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	
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-pathinput-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)	fax-modem-inactivity-timeout
faxModemProtocolError(6111)	fax-modem-protocol-error
faxModemEquipmentFailure(6112)	fax-modem-equipment-failure
faxModemNoDialTone(6113)	fax-modem-no-dial-tone
faxModemLineBusy(6114)	fax-modem-line-busy
faxModemNoAnswer(6115)	fax-modem-no-answer
faxModemVoiceDetected(6116)	fax-modem-voice-detected
faxModemCarrierLost(6117)	fax-modem-carrier-lost
faxModemTrainingFailure(6118)	fax-modem-training-failure

6. Conformance Requirements

6.1 Printer MIB Agent Conformance Requirements

To claim conformance to this specification, a Printer MIB 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 and Printer 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;
(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 Printer MIB Client Conformance Requirements

To claim conformance to this specification, a Printer MIB 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 Printer MIB Client;
(c) MUST support the MFD and Printer 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 Printer MIB Client;
(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 and Printer 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;
(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];
(e) MUST implement the prtAlertTable defined in IETF Printer MIB v2, if a Printer MIB Agent is implemented.

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 and Printer 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;
(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];
(e) MUST support the prtAlertTable defined in IETF Printer MIB v2, if a Printer MIB Client is implemented.

7. Internationalization Considerations

7.1 IPP Standard Internationalization Considerations

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

1. The Universal Character Set (UCS) Transformation Format -- 8 bit (UTF-8) [STD63] encoding of Unicode [UNICODE] [ISO10646]; and
1. The 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 in XML and other Markup Languages [UTR20] – XML usage

Unicode Character Property Model [UTR23] – character properties

Unicode Conformance Model [UTR33] – Unicode conformance basis

7.2 MFD Alerts Internationalization Considerations

The 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 [RFC8011].

8. Security Considerations

8.1 Standard 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 [RFC8011].

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 MFD Alerts Security Considerations

The 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]. The MFD extensions to the IPP Printer "printer-alert" and "printer-state-reasons" attributes defined in this document do not add any security considerations beyond covered in section 8 of IPP/1.1 Model and Semantics [RFC8011].

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),
      faxModemProtocolError(6111),
      faxModemEquipmentFailure(6112),
      faxModemNoDialTone(6113),
      faxModemLineBusy(6114),
      faxModemNoAnswer(6115),
      faxModemVoiceDetected(6116),
      faxModemCarrierLost(6117),
      faxModemTrainingFailure(6118),
```


9.3 IPP Attribute and Keyword Value Registrations

This section contains the exact registration information for IANA to update according to the procedures defined in [RFC8011].

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)     [RFC8011]
  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]
        fax-modem-inactivity-timeout                  [PWG5107.3]
        fax-modem-protocol-error                      [PWG5107.3]
        fax-modem-equipment-failure                   [PWG5107.3]
        fax-modem-no-dial-tone                        [PWG5107.3]
        fax-modem-line-busy                           [PWG5107.3]
        fax-modem-no-answer                           [PWG5107.3]
        fax-modem-voice-detected                      [PWG5107.3]
        fax-modem-carrier-lost                        [PWG5107.3]
        fax-modem-training-failure                    [PWG5107.3]
```

9.4 Attribute Registrations

The attributes defined in this document will be published by IANA according to the procedures in IPP/1.1 Model and Semantics [RFC8011] section 7.2 in the following file:

http://www.iana.org/assignments/ipp-registrations

The registry entries will contain the following information:

```
        Document Description attributes:                    Reference
```



```
--------------------------                                  ---------
name (type)                                                 [REFERENCE]

Document Status attributes:                                 Reference
--------------------------                                  ---------
name (type)                                                 [REFERENCE]

Document Template attributes:                               Reference
--------------------------                                  ---------
name (type)                                                 [REFERENCE]

Job Description attributes:                                 Reference
--------------------------                                  ---------
name (type)                                                 [REFERENCE]

Job Status attributes:                                      Reference
--------------------------                                  ---------
name (type)                                                 [REFERENCE]

Job Template attributes:                                    Reference
--------------------------                                  ---------
name (type)                                                 [REFERENCE]

Operation attributes:                                       Reference
--------------------                                        ---------
name (type)                                                 [REFERENCE]

Printer Description attributes:                             Reference
------------------------------                              ---------
name (type)                                                 [REFERENCE]

Printer Status attributes:                                  Reference
------------------------------                              ---------
name (type)                                                 [REFERENCE]

Subscription Description attributes:                        Reference
------------------------------                              ---------
name (type)                                                 [REFERENCE]

Subscription Status attributes:                             Reference
------------------------------                              ---------
name (type)                                                 [REFERENCE]

Subscription Template attributes:                           Reference
------------------------------                              ---------
name (type)                                                 [REFERENCE]
```

9.5 Attribute Value Registrations

The attributes defined in this document will be published by IANA according to the procedures in IPP/1.1 Model and Semantics [RFC8011] section 7.3 in the following file:

http://www.iana.org/assignments/ipp-registrations

The registry entries will contain the following information:

```
Attributes (attribute syntax)
  Keyword Attribute Value                                   Reference
  -----------------------                                   ---------
name (type2 keyword)                                        [REFERENCE]
  value-1                                                   [REFERENCE]
  value-2                                                   [REFERENCE]
name-supported (1setOf type2 keyword)                       [REFERENCE]
  < all name values >                                       [REFERENCE]
```

9.6 Type2 enum Registrations

The attributes defined in this document will be published by IANA according to the procedures in IPP Model and Semantics [RFC8011] section 7.4 in the following file:

http://www.iana.org/assignments/ipp-registrations

The registry entries will contain the following information:

```
Attributes (attribute syntax)
  Enum Value      Enum Symbolic Name                        Reference
  ----------      ------------------                        ---------
name (type2 enum)                                           [REFERENCE]
  3               value-3                                   [REFERENCE]
  4               value-4                                   [REFERENCE]

operations-supported (1setOf type2 enum)                    [RFC8011]
  0xXXXX          Operation-Name                            [REFERENCE]
```

9.7 Operation Registrations

The attributes defined in this document will be published by IANA according to the procedures in IPP/1.1 Model and Semantics [RFC8011] section 7.8 in the following file:

http://www.iana.org/assignments/ipp-registrations

The registry entries will contain the following information:

```
Operation Name                                              Reference
--------------                                              ---------
Operation-Name                                              [REFERENCE]
Existing-Operation-Name (Extension)                         [REFERENCE]
```

9.8 Status Code Registrations

The attributes defined in this document will be published by IANA according to the procedures in IPP/1.1 Model and Semantics [RFC8011] section 7.9 in the following file:

http://www.iana.org/assignments/ipp-registrations

The registry entries will contain the following information:

```
Value    Status Code Name                                    Reference
------   ------------------------------------------------    ---------
0x0400:0x04FF - Client Error:
  0x04XX client-error-name                                   [REFERENCE]
0x0500:0x05FF - Server Error:
  0x05XX server-error-name                                   [REFERENCE]
```

10. References

10.1 Normative References

[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

[RFC2119] S. Bradner, “Key words for use in RFCs to Indicate Requirement Levels", RFC 2119/BCP 14, March 1997, http://tools.ietf.org/html/rfc2119

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[RFC3805] R. Bergman, H. Lewis, I. McDonald, “IETF Printer MIB v2”, RFC 3805, June 2004, http://www.ietf.org/rfc/rfc3805.txt

[RFC3806] R. Bergman, H. Lewis, I. McDonald, "Printer Finishing MIB", RFC 3806, June 2004, http://www.ietf.org/rfc/rfc3806.txt

[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

[RFC8010] M. Sweet, I. McDonald, "Internet Printing Protocol/1.1: Encoding and Transport", RFC 8010/STD 92, January 2017, https://tools.ietf.org/html/rfc8010

[RFC8011] M. Sweet, I. McDonald, "Internet Printing Protocol/1.1: Model and Semantics", RFC 8011/STD 92, January 2017, https://tools.ietf.org/html/rfc8011

[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

[UAX9] Unicode Consortium, “Unicode Bidirectional Algorithm”, UAX#9, May 2016, http://www.unicode.org/reports/tr9/tr9

[UAX14] Unicode Consortium, “Unicode Line Breaking Algorithm”, UAX#14, June 2016, http://www.unicode.org/reports/tr14/tr14

[UAX15] Unicode Consortium, “Normalization Forms”, UAX#15, February 2016, http://www.unicode.org/reports/tr15/tr15

[UAX29] Unicode Consortium, “Unicode Text Segmentation”, UAX#29, June 2016, http://www.unicode.org/reports/tr29/tr29

[UAX31] Unicode Consortium, “Unicode Identifier and Pattern Syntax”, UAX#31, May 2016, http://www.unicode.org/reports/tr31/tr31

[UNICODE] Unicode Consortium, "Unicode Standard", Version 10.0.0, June 2017, http://www.unicode.org/versions/Unicode10.0.0/

[UTS10] Unicode Consortium, “Unicode Collation Algorithm”, UTS#10, May 2016, http://www.unicode.org/reports/tr10/tr10

[UTS35] Unicode Consortium, “Unicode Locale Data Markup Language”, UTS#35, October 2016, http://www.unicode.org/reports/tr35/tr35

[UTS39] Unicode Consortium, “Unicode Security Mechanisms”, UTS#39, June 2016, 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, http://www.ietf.org/rfc/rfc1759.txt

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[UTR20] Unicode Consortium “Unicode in XML and other Markup Languages”, UTR#20, January 2013, http://www.unicode.org/reports/tr20

[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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[WSDM-MUWS1] V. Bullard, W. Vambenepe, "OASIS Web Services Distributed Management: Management Using Web Services (MUWS 1.1) Part 1",

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[WSDM-MUWS2] V. Bullard, W. Vambenepe, "OASIS Web Services Distributed Management: Management Using Web Services (MUWS 1.1) Part 2", August 2006, http://www.oasis-open.org/committees/download.php/20575/wsdm-muws2-1.1-spec-os-01.pdf

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12. Change History

12.1 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).

12.2 9 February 2018

- Initial draft revision (Smith Kennedy).

- Converted original version to current PWG document template.

