



The Printer Working Group

IPP Workgroup Session, Day 1

May 5, 2021



PWG Antitrust Policy

- "This meeting is being held in accordance with the PWG Antitrust Policy"
 - https://www.pwg.org/chair/membership_docs/pwg-antitrust-policy.pdf
- The IEEE-ISTO Printer Working Group ("PWG") will not become involved in the business decisions of its Members. The PWG strictly complies with applicable antitrust laws. Every PWG Member shall comply with this policy. The PWG Officers and PWG Workgroup Officers are responsible to ensure that this policy is adhered to in all PWG activities.

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Agenda (1/3)



May 5, 2021 (US Eastern Daylight Time)

When	What
10:00 - 11:00	Open Printing: CUPS Plenary
11:00 - 12:00	Open Printing: Printer Applications
12:00 - 12:45	Lunch
12:45 - 14:15	OpenPrinting: cups-filters and more
14:15 - 14:30	IPP WG: Status
14:30 - 15:00	Break
15:00 - 16:00	IPP WG: IPP/2.0 and IPP Everywhere 2.0

Agenda (2/3)



May 6, 2021 (US Eastern Daylight Time)

When	What
10:00 - 12:00	IDS WG: Status and Discussion
12:00 - 12:45	Lunch
12:45 - 13:15	IPP WG: IPP Encrypted Jobs and Documents v1.0
13:15 - 14:15	IPP WG: Cloud Printing and Scanning BoF
14:15 - 14:45	Break
14:45 - 16:00	IPP WG: IPP Enterprise Printing Extensions v2.0

Agenda (3/3)



May 7, 2021 (US Eastern Daylight Time)

When	What
10:00 - 12:00	IPP WG: 3D Scanning and Production BoF
12:00 - 12:45	Lunch
12:45 - 14:15	IPP WG: IPP Driverless Printing Extensions v2.0
14:15 - 14:45	Break
14:45 - 15:15	IPP WG: IPP Production Printing Extensions v2.0
15:15 - 15:30	IPP WG: Next Steps



- Current charter:
 - <https://ftp.pwg.org/pub/pwg/ipp/charter/ch-ipp-charter-20210409.pdf>
- The Internet Printing Protocol (IPP) workgroup is chartered with the maintenance of IPP and the IETF IPP registry, and support for new clients, network architectures (Cloud, SDN), MFD/Imaging service bindings, and emerging technologies such as 3D Printing
- In addition, we maintain the IETF Finisher MIB, Job MIB, and Printer MIB registries, the PWG MIBs, and handle synchronization with changes in IPP



- **IPP WG Co-Chairs:**
 - Paul Tykodi (TCS)
 - Ira McDonald (High North)
- **IPP WG Secretary:**
 - Michael Sweet (Lakeside Robotics)
- **IPP WG Document Editors:**
 - Ira McDonald (High North) - IPP WG Charter
 - Michael Sweet (Lakeside Robotics) – Internet Printing Protocol/2.0 Fourth Edition, IPP Encrypted Jobs and Documents v1.0, IPP Production Printing Extensions v2.0
 - Smith Kennedy (HP Inc.) – IPP Driverless Printing Extensions v2.0, IPP Encrypted Jobs and Documents v1.0, IPP Enterprise Printing Extensions v2.0, IPP Finishings v2.2

Status (1/3)



- PWG Specifications in development:
 - Internet Printing Protocol/2.0 Fourth Edition - Interim
 - IPP Driverless Printing Extensions v2.0 - Interim
 - IPP Encrypted Jobs and Documents v1.0 - Prototype
 - IPP Enterprise Printing Extensions v2.0 - Interim
 - IPP Finishings v3.0 - Prototype
 - IPP Production Printing Extensions v2.0 - Prototype
- Recently published:
 - PWG 5199.11-2021: Job Accounting with IPP v1.0
 - IPP Label Printing Extensions v1.0 (registration)
 - IPP System Service Discovery v1.0 (registration)
 - PWG 5100.14-2020: IPP Everywhere v1.1
 - PWG 5100.16-2020: IPP Transaction-Based Printing Extensions v1.1
 - PWG 5100.20-2020: IPP Everywhere Printer Self-Certification Manual v1.1



Status (2/3)

- Up-to-date pending IANA registrations online:
 - <https://www.pwg.org/ipp/ipp-registrations.xml>
 - Continue to maintain this in parallel for new specifications
 - Github repository: <https://github.com/istopwg/ippregistry>
- IPP Everywhere Printer Self-Certifications:
 - <https://www.pwg.org/printers>
 - ~~629~~ **692** printers currently listed from HP and Lexmark
 - 1.0 self-certification tools update 5 approved August 2020, can be used until June 30, 2021
 - 1.1 self-certification tools update 2 approved October 2020
- IPP Sample Code:
 - Github repository:
 - <https://github.com/istopwg/ippsample>
 - Fork of CUPS code includes ipp3dprinter, ippeveprinter, ippfind, ippproxy, ippserver, ipptool, ipptransform, and ipptransform3d



- Pending Errata:

- PWG 5100.5-2019 (Document Object v1.1): 4 issues
- PWG 5100.6-2003 (Page Overrides v1.0): 2 issues
- PWG 5100.7-2019 (Job Extensions v2.0): 5 issues
- PWG 5100.8-2003 ("-actuals" v1.0): 1 issue
- PWG 5100.9-2009 (Printer State Extensions v1.0): 2 issues
- PWG 5100.15-2014 (FaxOut v1.0): 2 issues
- PWG 5100.18-2015 (Infrastructure Extensions v1.0): 6 issues
- PWG 5100.19-2015 (Implementor's Guide v2.0): 6 issues
- PWG 5100.22-2019 (System Service v1.0): 2 issues
- PWG 5107.3-2019 (MFD Alerts v1.1): 1 issue

- In-Progress Errata:

- PWG 5100.1-2017 (Finishings v2.1): 3 issues
- PWG 5100.3-2001 (Production Printing): 2 issues
- PWG 5100.11-2010 (JPS2 - Enterprise Printing): 7 issues
- PWG 5100.12-2015 (IPP 2.0, 2.1, and 2.2): 2 issues
- PWG 5100.13-2012 (JPS3 - Driverless Printing): 15 issues



IPP Everywhere Self-Certification

- Resources:
 - <https://www.pwg.org/ipp/everywhere.html> (for info)
 - <https://www.pwg.org/ippeveselfcert> (tools and submission instructions)
 - <https://www.pwg.org/printers> (printer list)
 - <https://github.com/istopwg/ippeveselfcert> (Github repo)
- Released v1.0 Update 5 of self-certification tools on June 17th, 2020 (approved on August 13th, 2020)
 - v1.0 is tracking CUPS 2.2.x (previous stable branch)
 - v1.0 certifications will be accepted until June 30, 2021
- Released v1.1 Update 2 tools on October 7th, 2020 (approved on October 22nd, 2020)
 - v1.1 tracks OpenPrinting CUPS 2.4.x (current development branch)
 - Future update 3 (in testing) will address issues identified by HP and Lexmark



The Printer Working Group

Break

Resuming at 3:00pm EDT



IPP/2.0 Fourth Edition

- Current interim draft:
 - <https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippbase23-20210211-rev.pdf>
- Errata update of PWG 5100.12-2015:
 - Updated document references, including an informative reference to IPP Everywhere
 - Simplified reference tables and conformance requirements
 - New history of the development of the Internet Printing Protocol content to explain how we ended up with different protocol versions with the same encoding
- Proposed schedule:
 - Prototype draft after EPX 2.0, FIN 3.0, and PPX 2.0



IPP Everywhere v2.0

- Mandate support for valuable features that were added as recommendations in IPP Everywhere v1.1:
 - TLS, privacy, job accounting
- Add feature definitions for important "vertical solution" use cases:
 - Cloud printing, finishings, authentication with different methods (e.g. Basic, Digest, OAuth2), Job Release, Job Storage
- Define a complete IPP Everywhere MFD by adding new IPP Everywhere service definitions?
- Define tests to self-certify standard common features:
 - Sides
 - Variations in page orientation (e.g. mixed portrait / landscape pages in source document tested with both short and long edge feed media)
- Proposed schedule:
 - Initial draft when NODRIVER reaches prototype status



The Printer Working Group

IPP Workgroup Session, Day 2
February 10, 2021



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May 6, 2021 (US Eastern Daylight Time)

When	What
10:00 - 12:00	IDS WG: Status and Discussion
12:00 - 12:45	Lunch
12:45 - 13:15	IPP WG: IPP Encrypted Jobs and Documents v1.0
13:15 - 14:15	IPP WG: Cloud Printing and Scanning BoF
14:15 - 14:45	Break
14:45 - 16:00	IPP WG: IPP Enterprise Printing Extensions v2.0

IPP Encrypted Jobs and Documents v1.0 (TRUSTNOONE)



- Current prototype draft:
 - <https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ipptrustnoone10-20200218.pdf>
- Uses PGP to provide confidentiality and integrity checking (signatures)
 - Had to remove S/MIME support due to the cryptographic weaknesses that were exposed by EFAIL
- Waiting on prototyping
- Proposed schedule:
 - Stable draft in Q1 2022



S/MIME 4.0 for TRUSTNOONE

- S/MIME v4.0 (RFC 8551) resolves the critical EFAIL cryptographic weaknesses of S/MIME v3.2
 - <https://tools.ietf.org/html/rfc8551>
 - Uses cipher suites with Galois/Counter Mode (GCM) which are not vulnerable to the EFAIL exploits
- S/MIME was originally chosen early in the development of this document because it uses the same X.509 infrastructure as TLS
- Both PGP and S/MIME provide an equivalent level of protection and largely use the same cipher suites, but:
 - PGP relies on the "web of trust" for certificate validation
 - X.509 relies on CAs and/or "Trust On First Use" (TOFU) policies for certificate validation
- Q: Do we want to bring back S/MIME for TRUSTNOONE?
- Q: Do we want to support two different methods?



Cloud Printing and Scanning BoF

- Published candidate standards and best practice:
 - [PWG 5100.18-2015: IPP Shared Infrastructure Extensions v1.0 \(INFRA\)](#)
 - [PWG 5100.22-2019: IPP System Service v1.0 \(SYSTEM\)](#)
 - [PWG 5199.10-2019: IPP Authentication Methods v1.0 \(AUTH\)](#)
- Gathering a list of potential improvements/extensions to INFRA and SYSTEM
- Additional goals to support/improve interoperability with Microsoft Universal Print Service:
 - Direct Printing
 - Release Printing
 - Scan support
 - More SNMP MIB support



Proposed INFRA Extensions

- Reference SYSTEM for Register-Output-Device
- Provide examples for Proxy registration and authentication:
 - HTTP Basic/Digest
 - OAuth 2.0 with HTTP Bearer tokens
 - TLS with X.509 certificates generated by System from CSRs
 - TLS with X.509 certificates provided by Proxy to System
- Add Release Printing ("follow me") content
- Add Scan service content:
 - Put-Next-Document-Data operation
 - How to handle Push Scan - best probably to only allow URI schemes that handle indirect delivery like mailto:



Proposed SYSTEM Extensions

- Provide examples for Proxy registration and authentication:
 - HTTP Basic/Digest
 - OAuth 2.0 with HTTP Bearer tokens
 - TLS with X.509 certificates generated by System from CSRs
 - TLS with X.509 certificates provided by Proxy to System
- Add attributes to allow Proxy to discovery registration/auth/X.509 requirements
 - Equivalent of "system-mandatory-printer-attributes" for Register-Output-Device
 - "system-x509-xxx" attributes to describe certificate/CSR requirements (cipher suites, hashes, bit depths, etc.)

Interoperability with MS Universal Print



- Microsoft Universal Print Service has some differences from INFRA/SYSTEM/AUTH
 - Registration uses MS-specific RESTful interface, which generates the X.509 certificate to use for authentication
 - X.509 is used for authentication with the OAuth token endpoint
 - OAuth is used for registration and IPP requests
- Goals for interoperability:
 - Make sure X.509 and OAuth usage is consistent
 - Maybe extend current "oauth-xxx" attributes to include and "oauth-authentication-supported" (or similar) attribute to specify the type of authentication to use when refreshing the OAuth bearer token (addresses use of X.509 authentication)
- Also plan on continuing discussions with Universal Print team about using SYSTEM instead of RESTful interface for provisioning

Direct Printing



- Investigating how to support simultaneous Cloud and Direct printing support
 - Use case is to use Cloud printing when the Client is not connected to the enterprise network (e.g. cellular, guest Wi-Fi) but use direct printing when the Client is connected to the enterprise network
- Need a way for a Client to automatically switch between the different types of connections
 - Would be nice to also recognize when a printer is available via Wi-Fi P2P
- Security (impersonation) attacks are a big issue



- IPP Scan:
 - <https://ftp.pwg.org/pub/pwg/candidates/cs-ippscan10-20140918-5100.17.pdf>
- IPP Scan is not supported by shipping MFPs, which use eSCL
 - New public specification: <https://mopria.org/spec-download>
 - How to integrate with INFRA, and would Clients then need to support both protocols?
- "Release Scan" functionality might be needed to support creating a scan Job and then waiting to start scanning until the End User is at the Scanner to feed the document
 - Need to understand the use cases
 - Enterprise MFPs often directly support push scanning to local or Cloud storage - in that scenario we don't need a protocol to initiate it (much like the Copy and FaxIn services)



More SNMP MIB Support

Existing SNMP MIB Support

SNMP Element	IPP Attribute(s)	Defined In
finDevice	printer-finisher/-description	PWG 5100.1
finSupply	printer-finisher-supply/-description	PWG 5100.1
hrStorage	printer-storage/-description	IPP Storage
prtAlert	printer-alert/-description	PWG 5107.3
prtCover	printer-cover/-description	IPP Registry
prtGeneral...	printer-service-contact	PWG 5100.11
prtInput	printer-input-tray	PWG 5100.13
prtMarkerColorant	printer-supply	PWG 5100.13
prtMarkerSupplies	printer-supply/-description	PWG 5100.13
prtOutput	printer-output-tray	PWG 5100.13



More SNMP MIB Support (con't)

- Pending registrations:
 - printer-cover/-description: <https://www.pwg.org/archives/ipp/2021/020865.html>, headed for future PSX errata update
 - printer-service-col: <https://www.pwg.org/archives/ipp/2021/020864.html>, headed for EPX
 - printer-storage/-description: <https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippstorage10-20210129.pdf>
- Other host/printer MIB elements have been reviewed but don't seem to be appropriate for mapping



The Printer Working Group

Break

Resuming at 2:45pm EDT



- Current prototype draft:
 - <https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippepx20-20210418-rev.pdf>
- Update of PWG 5100.11-2010: IPP Job and Printer Extensions - Set 2 (JPS2)
 - Obsoleted "job-save-disposition (collection)", replaced by new Job Storage feature
 - Obsoleted "pages-per-subset (1setOf integer(0:MAX))", replaced by "job-pages-per-subset (integer(1:MAX))" in 5100.1
 - Deprecated "proof-print (collection)", replaced by "proof-copies (integer(1:MAX))"
 - Obsoleted "sheet-collate (type2 keyword)" - base attribute from RFC 3381 is obsolete
 - Added "job-release-action (type2 keyword)" to support Job Release
 - Some non-enterprise-specific attributes were moved to PWG 5100.7
- Proposed schedule:
 - Stable draft in Q4 2021



The Printer Working Group

IPP Workgroup Session, Day 3

May 7, 2021



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14:15 - 14:45	Break
14:45 - 15:15	IPP WG: IPP Production Printing Extensions v2.0
15:15 - 15:30	IPP WG: Next Steps



3D Scanning and Production BoF

- Current documents:
 - PWG 5100.21-2019: IPP 3D Printing Extensions v1.1
 - PWG 5199.5-2017: PWG 3D Print Job Ticket and Associated Capabilities v1.0 (PJT3D)
- Proposed future work (2021-2022):
 - IPP 3D Scan Service v1.0 specification to address 3D scanning
 - IPP 3D Production Printing Extensions v1.0 specification to address AMSC AMNOW efforts
 - Updated PWG 3D Print Job Ticket and Associated Capabilities v2.0 (PJT3D) best practice to incorporate production extensions and IPP 3D v1.1



3D Scanning Service

- Should be straight-forward to adapt the attributes and operations from IPP 3D Printing Extensions v1.1 and IPP Scan Service v1.0 to a new IPP 3D Scan Service v1.0 specification
- Unique sub-units/technologies?
 - Identify capabilities and states/information that need to be exposed
- Job Ticket
 - Identify attributes and values needed when scanning
 - Scan modes - just point cloud/geometry information, color/grayscale imaging, etc.



3D Scanning Service (con't)

- What file format to standardize on?
- ASTM Committee E57 has published ASTM E2807 (Standard Specification for 3D Imaging Data Exchange, Version 1.0):
 - <https://www.astm.org/COMMITTEE/E57.htm>
 - <https://www.astm.org/Standards/E2807.htm>
 - Open Source implementation of ASTM E2807:
 - <http://libe57.org>
 - Conference paper providing an overview of ASTM E2807:
 - <https://www.ri.cmu.edu/publications/the-astm-e57-file-format-for-3d-imaging-data-exchange/>
- **Unfortunately, this specification is not freely available from ASTM**



3D Production Printing

- 3D equivalent of the IPP Production Printing Extensions
- Focus on large-scale printers that print large/long Jobs
 - Attributes/values for manipulating input documents (shifting output, other properties?)
 - Attributes/values for work/error reports
 - Instructions to the operator(s)
 - Contacts/recipients
 - Other values?



3D Printing Organizations/Liaisons

- 3MF Consortium: <https://www.3mf.io>
- AMSC: <https://www.americamakes.us/>
 - AMNOW: <https://www.americamakes.us/ncdmm-and-catalyst-connection-announce-next-phase-of-amnow-program-to-support-additive-manufacturing-technology-insertion-into-the-u-s-army-supply-chain/>
- ASTM Committee F42: <https://www.astm.org/COMMITTEE/F42.htm>
- INCITS: <https://www.incits.org>
 - Potential 3D Printing Protection Profile (with IDS workgroup)
 - Looking at AMSC-identified gaps, particularly 3D scanning
- ISO/IEC JTC 1 WG 12: <https://www.iso.org/committee/45020.html>
 - ISO TR 22100-4: Best Practice document already published
- PDF Association + ISO/IEC TC171: <https://www.iso.org/committee/53674.html>
- SAE ITC Additive Manufacturing Data Consortium: <https://www.sae-itc.com/amdc>
- SME iRAMP: <https://www.sme.org/iramp/>



The Printer Working Group

Lunch Break

Resuming at 12:45pm EDT



IPP Driverless Printing Ext v2.0

- Current interim draft:
 - <https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippnodriver20-20201029-rev.pdf>
- Updates PWG 5100.13-2012: IPP Job and Printer Extensions - Set 3 (JPS3)
- Proposed schedule:
 - Prototype draft in Q3 2021



The Printer Working Group

Break

Resuming at 2:45pm EDT



IPP Production Printing Ext v2.0

- Current prototype draft:
 - <https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippppx20-20201029-rev.pdf>
- Updates PWG 5100.3-2001: IPP Production Printing Attributes
- Proposed schedule:
 - Stable draft in Q3 2021



The Printer Working Group

Next Steps



Next Steps

- IPP/2.0 Fourth Edition (Mike)
 - Prototype draft in Q3 2021
- IPP Driverless Printing Extensions v2.0 (Smith)
 - Prototype draft in Q3 2021
- IPP Encrypted Jobs and Documents v1.0 (Mike/Smith)
 - Stable draft in Q1 2022
- IPP Enterprise Printing Extensions v2.0 (Smith)
 - Stable draft in Q4 2021
- IPP Finishings v3.0 (Smith)
 - Stable draft in Q3 2021
- IPP Production Printing Extensions v2.0 (Mike)
 - Stable draft in Q3 2021



More Information

- We welcome participation from all interested parties
- IPP Working Group web page
 - <https://www.pwg.org/ipp/index.html>
- Subscribe to the IPP mailing list
 - <https://www.pwg.org/mailman/listinfo/ipp>
- IPP WG holds bi-weekly phone conferences announced on the IPP mailing list
 - Next conference calls scheduled for Thursday, May 20, 2021 and June 3, 2021 at 3pm EDT