



The Printer Working Group

PWG February 2020 Face-to-Face Plenary Session

Smith Kennedy, PWG Chair
February 5, 2020

Plenary Agenda



- Administrivia
- PWG Steering Committee Updates
- PWG Workgroup Status [WG Chairs]
- Liaison Status
- Questions / Next Meeting / Any Other Business

Administrivia



- Welcome and Introductions
- Confirm Minutes Taker
- Review PWG Patent Policy
- Agenda

PWG IP Policy



- "This meeting is being held in accordance with the PWG Intellectual Property Policy"
 - https://www.pwg.org/chair/membership_docs/pwg-ip-policy.pdf
- TL;DR: Anything you say in a PWG meeting or email to a PWG address can be used in a PWG standard
 - (but please do read the IP policy above if you haven't done so)

PWG Patent Statement



PWG standards may include the known use of essential patents and patent applications provided the PWG Chair receives assurance from the patent holder or applicant with respect to patents whose infringement is, or in the case of patent applications, potential future infringement the applicant asserts will be, unavoidable in a compliant implementation of either mandatory or optional portions of the standard. This assurance shall be provided without coercion.

PWG Patent Statement



This assurance shall be either:

- A general disclaimer to the effect that the patentee will not enforce any of its present or future patent(s) whose use would be required to implement either mandatory or optional portions of the proposed PWG standard against any person or entity complying with the standard; or
- A statement that a license for such implementation will be made available without compensation or under reasonable rates, with reasonable terms and conditions that are demonstrably free of any unfair discrimination.



PWG Patent Statement

The PWG is not in a position to give authoritative or comprehensive information about evidence, validity or scope of patents or similar rights, but it is desirable that any available information should be disclosed. Therefore, all PWG members shall, from the outset, draw PWG's attention to any relevant patents either their own or of other organizations including their Affiliates that are known to the PWG members or any of their Affiliates, although PWG is unable to verify the validity of any such information.

Inappropriate Topics for PWG Working Group Meetings



Do Not Discuss:

- The validity/essentiality of patents/patent claims
- The cost of specific patent use
- Licensing terms or conditions
- Product pricing, territorial restrictions, or market share
- Don't discuss ongoing litigation or threatened litigation

DO raise an objection if inappropriate topics are discussed



Agenda Overview – Day 1

(All times Mountain Standard Time)

Wednesday, February 5

- 9:00 – 10:00 PWG Plenary
- 10:00 – 10:30 IPP WG : Status
- 10:30 – 11:00 IPP WG: IPP Everywhere™ v1.1 · IPP Everywhere Self Certification v1.1
- 11:00 – 11:30 Break / Lunch
- 11:30 – 12:00 IPP WG: IPP Production Printing Extensions v2.0
- 12:00 – 1:30 IPP WG: IPP Driverless Printing Extensions v2.0
- 1:30 – 2:00 Break
- 2:00 – 3:00 IPP WG: Job Accounting with IPP v1.0

Agenda Overview – Day 2



(All times Mountain Standard Time)

Thursday, February 6

- 9:00 – 11:00 IDS WG: Status and Discussion · HCD Security Guide
- 11:00 – 11:30 Break / Lunch
- 11:30 – 12:30 IPP WG: IPP Encrypted Jobs and Documents v1.0
- 12:30 – 1:30 IPP WG: IPP Driverless Printing Extensions v2.0
(continued)
- 1:30 – 2:00 Break
- 2:00 – 2:45 IPP WG: 3D Printing – Liaisons and Status
- 2:45 – 3:00 IPP WG: Next Steps



The Printer Working Group

Steering Committee Updates



Officers (2019-2021 Term)

- PWG Chair: Smith Kennedy, HP Inc.
- PWG Vice-Chair: Jeremy Leber, Lexmark
- PWG Secretary: Ira McDonald, High North

2020 Membership



26 Members – Welcome Lakeside Robotics!

 Apple Inc.	 Google	 Lakeside Robotics	 Qualcomm	 Xerox
 Brother Industries, Ltd.	 High North, Inc.	 Lexmark	 Ricoh	 YSoft
 Canon	 HP Inc.	 Meteor Network	 Synaptics	
Danny Brennan	 Intel	 Microsoft	Technical Interface Consulting	
 Epson	 Konica Minolta	 Oki Data	 Toshiba Business Solutions	
 Fuji Xerox	 Kyocera	 PaperCut Software	 Tykodi Consulting Services LLC	



Future Meeting Schedule

- 2020
 - May 5-7: Lexington, Kentucky (Hosted by Lexmark)
 - August 26-27: Virtual?
 - November 11-12: Virtual

Contact chair@pwg.org if you are interested in hosting a PWG F2F event



IPP Everywhere™ Certified Printers

- <https://www.pwg.org/ipp/everywhere.html>
- IPP Everywhere™ Self Certification 1.0 Update 3
 - Current certification toolset available on PWG website
 - Released November 2018
- 412 printers now certified!
 - <https://www.pwg.org/dynamo/eveprinters.php>
 - More on the way!
- More to come
 - IPP Everywhere™ v1.1 v1.0 Update 4 – In Beta
 - IPP Everywhere™ v1.1 – PWG LC Q1 2020
 - IPP Everywhere™ Self Certification 1.1 – PWG LC Q1 2020



Recently Approved Specifications

- IPP Authentication Methods v1.0 – August 16, 2019
 - <https://ftp.pwg.org/pub/pwg/informational/bp-ippauth10-20190816-5199.10.pdf>
- IPP Job Extensions v2.0 – August 16, 2019
 - <https://ftp.pwg.org/pub/pwg/candidates/cs-ippjobext20-20190816-5100.7.pdf>
- IPP System Service v1.0 - Nov 22, 2019
 - <https://ftp.pwg.org/pub/pwg/candidates/cs-ippsystem10-20191122-5100.22.pdf>



Public Relations Efforts

- Recent press releases
 - Oct. 9: Newly approved IPP specifications and Best Practices
 - IPP Authentication Methods v1.0
 - IPP Job Extensions v2.0
 - IPP Document Object v1.1
 - PWG MFD Alerts v1.1
- Pending press releases
 - Status of IPP Everywhere™ Program
 - Recently approved 3D related PWG specifications and recently established 3D-related liaison relationships
 - IPP 3D Printing Extensions v1.1
 - PWG Safe G-Code Subset for 3D Printing v1.0
 - IPP System Service v1.0



Process Updates

- Including Best Practices and Requirements documents in the numbering system
 - Update to "pwg-namespace-policy.txt" in development
 - Update to "ipp-registry-policy.txt" in development
- Process v4.0 in active development
 - Prioritized for completion in 2020



- Original notion: Update existing Process 3.0 to merge in subsequently published PWG process documents
 - [pwg-policy-call-for-obj-last-call-formal-vote-draft-2.txt](#) (draft)
 - [ipp-registry-policy-20191022.docx](#)
 - [pwg-billing-policy-20141001.txt](#)
 - [pwg-white-policy-20140505.txt](#)
 - [pwg-charter-policy-20140407.txt](#)
 - [pwg-prototype-policy-20121029.txt](#)
 - [pwg-namespace-policy-20190823.docx](#) (latest draft)
- Revised notion: Refactor the Process document to describe the processes of the PWG to make them simple and obvious to the uninitiated reader:
 - Job Descriptions for all PWG officers and other officials
 - Proposing new work to the PWG
 - Approving new work and assigning to a PWG work group
 - PWG approval for various document types (whitepaper, standard, etc.)



Website & Infrastructure Updates

- Moving to new web hosting facilities
 - Started in 2018
 - Slow progress because the shift requires a shift in how the various services are managed; not just a simple "lift and drop"
 - Static Website
 - Dynamic Website
 - IPP Everywhere Certification Portal
 - Blog / article / news reporting
 - Document errata issue reporting system
 - FTP Site
 - Mailing lists
- Update to "ipp-registry-policy.txt" will decouple process from reflector archives

Toolchain Updates

- **Current Toolset**
 - Microsoft Word for specifications
 - Microsoft PowerPoint for presentations
 - Plain text for policy documents
- **Why change?**
 - Authoring specifications with Word can be a very manual and error-prone process (e.g. references are awkward)
 - Check with similar groups and see if there are things we can adopt
- **Possible alternatives**
 - LibreOffice 6 for specifications and presentations
 - Smith "experimented" with this 2017-2018
 - Conclusion: painful...
 - Metanorma: AsciiDoc / AsciiDoctor extension for writing specifications
 - In limited use in IETF and other SDOs
 - Ira and Mike have been investigating; some undesirable qualities
 - Smith is experimenting with using AsciiDoc / AsciiDoctor for recent policy document drafts



PWG Design Principles

- Purpose:
 - A document that describes the PWG's core tenets and design principles that guide the design and creation of its IPP, Semantic Model, MIBs, and other technologies
- Scope / Topics to be Covered:
 - IPP
 - Late binding principle
 - Intent vs. process for Job fidelity
 - Value of separating Job attributes from Document content
 - IPP attribute types and design patterns
 - Printer Status vs. Printer Description
 - xxx / xxx-supported / xxx-default vs. xxx / xxx-configured / xxx-supported
 - Collections vs. textual encoding of MIB sequences ("printer-finisher")
 - Semantic Model
 - Creates comprehensible view of the elements in an Imaging System, allowing better communication with other standards organizations dealing with related matters.
 - Presents the basic features necessary in communicating with imaging services, independent of the protocols used in that communication
 - Allows exploitation of the inherent parallelism between different types of imaging services (Print, Scan, Fax, etc.)



Projects on GitHub

- PWG on GitHub:
 - <https://github.com/istopwg>
- IPP Sample
 - <https://github.com/istopwg/ippsample>
- IPP Everywhere Self Certification Tools
 - <https://github.com/istopwg/ippeveselfcert>
- IPP Registry
 - <https://github.com/istopwg/ippregistry>
- PWG Books:
 - <https://github.com/istopwg/pwg-books>



The Printer Working Group

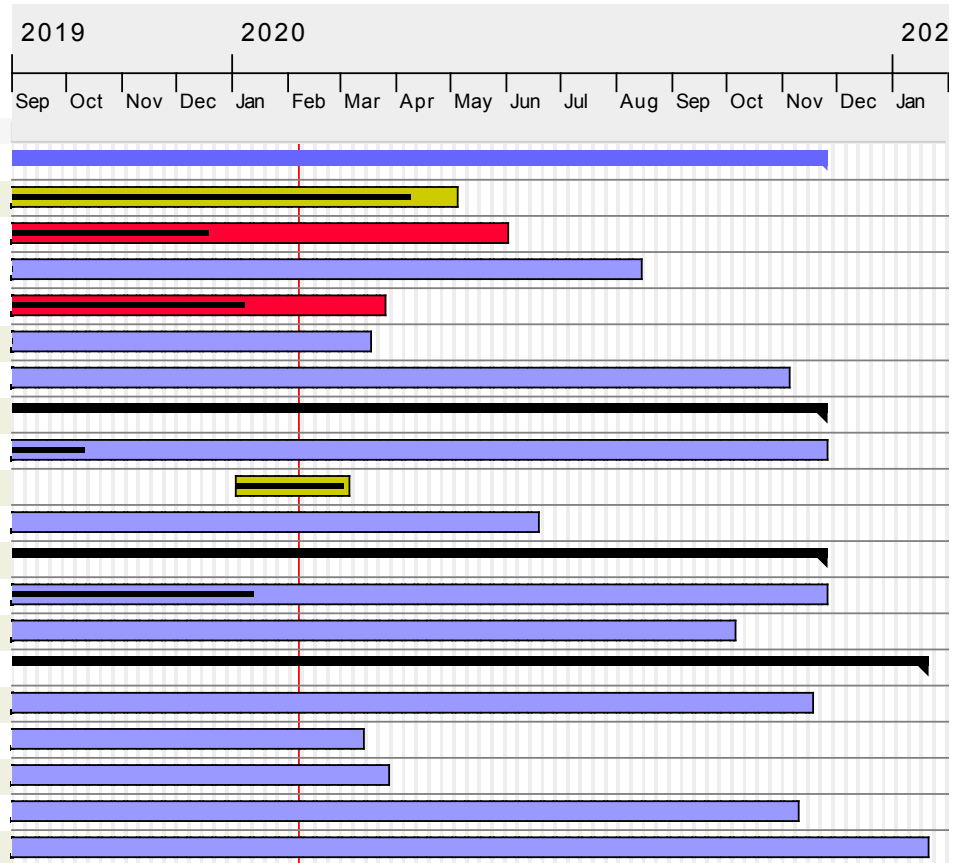
Workgroup Status

Work In Progress



Name

- ▼ • IPP Workgroup
 - IPP Everywhere (EVE) v1.1
 - IPP Everywhere Printer Self Certification v1.1
 - IPP Enterprise Printing Extensions v1.0
 - IPP Production Printing Extensions v2.0
 - IPP Driverless Printing Extensions v2.0
 - IPP Encrypted Jobs and Documents v1.0
 - ▼ • IPP Registrations / White Papers
 - Job Accounting with IPP v1.0
 - IPP Label Printing Extensions v1.0
 - Errata Updates
 - ▼ • IDS Workgroup
 - HCD cPP v1.0
 - PWG HCD Security Guidelines v1.0
 - ▼ • PWG SC
 - Process 4.0
 - IPP Registry Policy
 - PWG Namespace Policy
 - New Website
 - PWG Design Principles



Planned

Interim

Prototype

Prototyped

Stable



The Printer Working Group

IDS Workgroup Status

Alan Sukert (Xerox)



IDS: Original Charter

- Investigate and define standards for addressing general security attributes for imaging devices and services. Our general goals are to:
 - Define standard metrics and protocol bindings to assess the health of Hardcopy Devices to gauge if they should be granted access to a network.
 - Define a set of standard security and policy attributes and values for authorizing Hard Copy Devices, their services and users in a global workspace
 - Provide a general security model for other PWG standards to reference
- Provide a path for vendors to review and contribute to the definition of Common Criteria HCD Protection Profiles



IDS WG: Officers

- IDS WG Chair:
 - Alan Sukert (Xerox)
- IDS WG Vice-Chair
 - TBD
- IDS WG Secretary:
 - Alan Sukert (Xerox)
- IDS WG Document Editors:
 - Ira – HCD Security Guide



IDS: Current Status

- IDS Charter updated to reflect development of HCD Security Guide by Ira
- Focus now is on Common Criteria HCD Protection Profiles and HCD Security Guide
 - IDS Charter updated to focus the IDS WG on outreach with other standards bodies involved in HCD security issues.
 - Looking at initiating interface with TCG Joint Work Group and TBD
 - Conference Calls.
 - Reinitiated Regular IDS Conference Calls
 - Call held on 01/09/2020.
 - Next Conference Call tentatively scheduled for 03/05/2020

IDS: Current Status

- Focus now is on Common Criteria HCD Protection Profiles
 - HCD Technical Committee (TC) Conference Call/Meetings:
 - Regular HCD TC Conference Calls - calls held on 12/10/19 and 01/10/2020
 - The last HCD TC F2F was Thursday, Sep 26th at the 16th CCUF Workshop in Singapore
 - The status of the HCD TC, HCD PP Version 1.1, the effort to form an HCD international TC (iTC) and potential contents of an HCD cPP v1.0 were discussed at the IDS WG Face-to-Face Session on Thursday, November 21, 2019.
 - Will discuss the results of 12/10/19 and 01/10/2020 HCD TC Conference Calls, the 9/26/19 HCD TC F2F Meeting and the current HCD iTC status at the IDS F2F Session on Thursday (Feb 6th)
 - Also looking into establishing possible liaisons and/or more direct involvement with other standards efforts related to the security of imaging devices
- Developing a Security Guide to provide guidance on current security technology and security issues
 - Will review the latest draft at the IDS F2F Session on Thursday (Feb 6th)



The Printer Working Group

IPP Workgroup Status

Paul Tykodi (TCS), Ira McDonald (High North)



- Current charter:
 - <http://ftp.pwg.org/pub/pwg/ipp/charter/ch-ipp-charter-20170615.pdf>
- *Will be doing a charter update in 2020*
- The Internet Printing Protocol (IPP) workgroup is chartered with the maintenance of IPP, the IETF IPP registry, and support for new clients, network architectures (Cloud, SDN), service bindings for MFDs and Imaging Systems, and emerging technologies such as 3D Printing
- In addition, we maintain the IETF Finisher MIB, Job MIB, and Printer MIB registries, 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:
 - Michael Sweet (Lakeside Robotics) – IPP Encrypted Jobs and Documents v1.0, IPP Everywhere v1.1, IPP Everywhere Printer Self-Certification Manual v1.1, IPP Label Printing Extensions v1.0, IPP Production Printing Extensions v2.0, Job Accounting with IPP v1.0
 - Smith Kennedy (HP Inc.) – IPP Driverless Printing Extensions v2.0, IPP Encrypted Jobs and Documents v1.0, IPP Enterprise Printing Extensions v2.0

Status (1/3)



- **PWG Specifications in development:**
 - IPP Encrypted Jobs and Documents v1.0 Interim -
 - IPP Everywhere v1.1 - Stable
 - IPP Everywhere Printer Self-Certification Manual v1.1 - Prototype
 - IPP Enterprise Printing Extensions v2.0 - Interim
 - IPP Driverless Printing Extensions v2.0 - Interim
 - IPP Production Printing Extensions v2.0 - Prototype
 - IPP Transaction-Based Printing Extensions v1.1 - Stable
- **IPP Best Practices in development:**
 - Job Accounting with IPP v1.0 - Interim
- **IPP Registrations in development:**
 - IPP Label Printing Extensions v1.0 - Stable
- **Recently published:**
 - PWG 5100.7-2019: IPP Job Extensions v2.0
 - PWG 5100.22-2019: IPP System Service v1.0
 - PWG 5199.10-2019: IPP Authentication Methods v1.0



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>
 - 412 printers currently listed
 - Third 1.0 self-certification tools update released in November 2018
- IPP Sample Code:
 - Github repository:
 - <https://github.com/istopwg/ippsample>
 - Fork of CUPS code includes ipp3dprinter, ippeveprinter, ippfind, ippproxy, ippserver, ipptool, ipptransform, and ipptransform3d



Status (3/3)

- Pending Errata:

- PWG 5100.1-2017 (Finishings): 2 issues
- PWG 5100.5-2019 (Document Object): 3 issues
- PWG 5100.6-2003 (Page Overrides): 1 issue
- PWG 5100.9-2009 (Printer State Extensions): 1 issue
- PWG 5100.12-2015 (IPP 2.0, 2.1, and 2.2): 2 issues
- PWG 5100.15-2014 (FaxOut): 2 issues
- PWG 5100.18-2015 (Infrastructure Extensions): 5 issues
- PWG 5100.19-2015 (Implementor's Guide 2.0): 6 issues
- PWG 5107.3-2019 (MFD Alerts v1.1): 1 issue

- In-Progress Errata:

- PWG 5100.3-2001 (Production Printing): 2 issues
- PWG 5100.11-2010 (JPS2 - Enterprise Printing): 4 issues
- PWG 5100.13-2012 (JPS3 - Driverless Printing): 12 issues
- PWG 5100.14-2013 (Everywhere v1.0): 11 issues
- PWG 5100.16-2015 (Transactions): 3 issues
- PWG 5100.20-2016 (Everywhere Self-Cert v1.0): 3 issues



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The Printer Working Group

Liaison Status



Trusted Computing Group (TCG)

- **Next TCG Members Meetings**
 - **10-13 February 2020 – Miami, FL, USA – Ira to call in**
 - **15-18 June 2020 – Brussels, Belgium – Ira to call in**
- **Trusted Mobility Solutions (TMS) – Ira is co-chair and co-editor**
 - **Scope: mobile phones, telecom networks, enterprises, NFV/SDN**
 - **Formal – GP (TEE, SE), ETSI (NFV/MEC), ATIS (5G Security)**
 - **Informal – 3GPP, ITU-T, GSMA, SAE, IETF, US NIST**
 - ***TCG TMS Use Cases v2 – published September 2018***
- **Mobile Platform (MPWG) – Ira is co-editor**
 - **Scope: mobile phones, tablets, laptops, etc.**
 - **Formal – GP (TEE, SE), ETSI (NFV/MEC), ATIS (5G Security)**
 - ***TCG Runtime Integrity Preservation for Mobile Devices – Nov 2019***
- **Recent Specifications**
 - **<http://www.trustedcomputinggroup.org/resources>**
 - ***TCG Guide to TPM Changes r1.38 to r1.59 – review January 2020***
 - ***TCG TPM 2.0 Library r1.59 – review January 2020***
 - ***TCG Mobile Runtime Integrity Preservation – November 2019***
 - ***TCG Trusted Attestation Protocol Use Cases – November 2019***
 - ***TCG Trusted Attestation Protocol Info Model – September 2019***



Internet Engineering Task Force (IETF) (1 of 3)

- **Next IETF Members Meetings**
 - IETF 107 – 21-27 March 2020 – Vancouver, Canada – Ira to call in
 - IETF 108 – 25-31 July 2020 – Madrid, Spain – Ira to call in
- **Transport Layer Security (TLS)**
 - TLS/1.3 – RFC 8446 – August 2018
<https://tools.ietf.org/html/rfc8446>
 - DTLS/1.3 – draft-34 – November 2019 – IETF Last Call
<https://datatracker.ietf.org/doc/draft-ietf-tls-dtls14/>
 - Deprecating TLSv1.0 and TLSv1.1 – draft-06 – January 2020 – IETF Last Call
<https://datatracker.ietf.org/doc/draft-ietf-tls-oldversions-deprecate/>
 - Deprecating MD5 and SHA-1 signature hashes in TLS 1.2 – draft-02 – January 2020 – to IETF Last Call
<https://datatracker.ietf.org/doc/draft-ietf-tls-md5-sha1-deprecate/>
 - TLS Certificate Compression – draft-10 – January 2020 – RFC Editor
<https://datatracker.ietf.org/doc/draft-ietf-tls-certificate-compression.txt>
 - Applying GREASE to TLS Extensibility – draft-04 – August 2019 – RFC Editor
<https://datatracker.ietf.org/doc/draft-ietf-tls-grease/>



Internet Engineering Task Force (IETF) (2 of 3)

- **Security Automation and Continuous Monitoring (SACM)**
 - **SACM Endpoint Posture Collection Profile – draft-00 – November 2019 – WG Last Call**
<https://datatracker.ietf.org/doc/draft-ietf-sacm-epcp/>
 - **Concise Software Identifiers – draft-13 – November 2019 – WG Last Call**
<https://datatracker.ietf.org/doc/draft-ietf-sacm-coswid/>
 - **SACM Architecture – draft-04 – October 2019**
<https://datatracker.ietf.org/doc/draft-ietf-sacm-arch/>
- **Concise Binary Object Representation (CBOR)**
 - **Concise Binary Object Representation – draft-12 – December 2019 – to IETF Last Call**
<https://datatracker.ietf.org/doc/draft-ietf-cbor-7049bis/>
 - **CBOR Tags for Typed Arrays – draft-08 – October 2019 – RFC Editor**
<https://datatracker.ietf.org/doc/draft-ietf-cbor-array-tags/>
 - **CBOR Sequences – draft-02 – September 2019 – RFC Editor**
<https://datatracker.ietf.org/doc/draft-ietf-cbor-sequence/>
 - **Concise Data Definition Language (CDDL) – RFC 8610 – June 2019**
<https://tools.ietf.org/html/rfc8610> - JSON/CBOR schema



Internet Engineering Task Force (IETF) (3 of 3)

- **Remote ATtestation ProcedureS (RATS)**
 - **Entity Attestation Token (EAT) – draft-02 – January 2020**
<https://datatracker.ietf.org/doc/draft-ietf-rats-eat/>
 - **Info Model for Claims used in RATS – draft-01 – January 2020**
<https://datatracker.ietf.org/doc/draft-birkholz-rats-information-model/>
 - **YANG Data Model for Challenge-Response Remote Attestation using TPMs – draft-00 – January 2020**
<https://datatracker.ietf.org/doc/draft-ietf-rats-yang-tpm-charra/>
 - **RATS Architecture – draft-00 – December 2019**
<https://datatracker.ietf.org/doc/draft-ietf-rats-architecture/>
- **IRTF Crypto Forum Research Group (CFRG) – future algorithms**
 - **XChaCha: eXtended-nonce ChaCha and AEAD_XChaCha20_Poly1305 – draft-03 – January 2020**
<https://datatracker.ietf.org/doc/draft-irtf-cfrg-xchacha/>
 - **KangarooTwelve – draft-01 – January 2020**
<https://datatracker.ietf.org/doc/draft-irtf-cfrg-kangarootwelve/>
 - **Randomness for Security Protocols – draft-08 – November 2019**
<https://datatracker.ietf.org/doc/draft-irtf-cfrg-randomness-improvements/>
 - **Hybrid Public Key Encryption – draft-02 – November 2019**
<https://datatracker.ietf.org/doc/draft-irtf-cfrg-hpke/>



Linux Foundation OpenPrinting

- **Linux Foundation OP Google Summer of Code 2019**
 - Thanks to OpenPrinting coordinators, mentors, students!
 - Lots of good work & contributions to PWG GitHub projects
 - Close reading of PWG specs revealed additional errata
 - > Test scripts for ipptool for IPP System Service
 - > Test scripts for ipptool for IPP Errata specs
 - > Generic Framework: Legacy Driver to Printer Application
 - > Improve the pdftoraster filter
 - > Turn scp-dbus-service of system-config-printer into C
- **Linux Foundation OP Google Summer of Code 2020**
 - <https://developers.google.com/open-source/gsoc>
 - Planning and student recruitment has already started!
 - Mentor org applications started on 14 January 2020
- **Linux Foundation OP New Website**
 - <https://openprinting.github.io/>
 - Driverless Printing pages w/ PWG IPP Everywhere™ logo
 - <https://openprinting.github.io/driverless/01-standards-and-their-pdls/>
 - <https://github.com/OpenPrinting/openprinting.github.io/issues>

Mopria



- Mopria liaison to PWG : Jeremy Reitz (Xerox)
- No recent updates

3MF Consortium



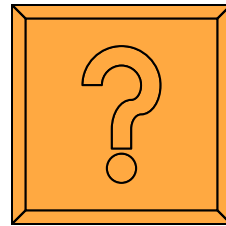
- PWG / 3MF Consortium Liaison signed March 26, 2019
- No recent updates or joint activity



3D / Additive Manufacturing Liaisons

- America Makes & ANSI Additive Manufacturing Standardization Collaborative (AMSC) -
 - www.ansi.org/standards_activities/standards_boards_panels/amsc/Default?menuid=3. The IEEE-ISTO Printer Working Group is participating in the AMSC initiative.
- ISO/IEC JTC 1 WG 12 3D Printing and Scanning eCommittee
 - <https://isotc.iso.org/livelink/livelink?func=ll&objId=19905763&objAction=browse&viewType=1> The IEEE-ISTO Printer Working Group is participating in the ISO initiative via the INCITS Ad Hoc.
- Society of Manufacturing Engineers (iRAMP)
 - Interactive Rapid Additive Manufacturing Portal – www.sme.org/iramp/
- 3D PDF Consortium
 - www.3dpdfconsortium.org

Other Questions / Comments





Next PWG Face-to-Face Meeting

May 5-7: Lexington, Kentucky (Hosted by Lexmark)

Monitor pwg-announce@pwg.org or the [PWG meeting page](#) for more info.

Contact chair@pwg.org if you are interested in and willing to hosting a PWG face-to-face meeting