The Printer Working Group

IPP Workgroup Session

February 14, 2024

Before We Begin...

- 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 meeting attendee 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.
- 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 Document
  - (but please do read the IP policy above if you haven't done so)
- **This meeting is being recorded to assist in preparation of minutes but will not be published**

Agenda (1/2)

February 14, 2024 (US Eastern Standard Time)

When	What
10:00 - 11:30	PWG Plenary
11:30 - 12:00	IPP WG: Status / Charter Review
12:00 - 12:45	Lunch Break
12:45 - 14:00	IPP WG: IPP Enterprise Printing Extensions v2.0

Agenda (2/2)

February 15, 2024 (US Eastern Standard Time)

When	What
10:00 - 10:30	IDS WG: Liaison Status
10:30 - 12:00	IPP WG: Strong Device Identity BoF
12:00 - 12:45	Lunch Break
12:45 - 13:45	IPP WG: IPP System Service / IPP Shared Infrastructure Extensions
13:45 - 14:15	IPP WG: 3D Printing Liaisons / Discussions
14:15 - 14:30	IPP WG: Next Steps

Charter

- Current charter:
  - https://ftp.pwg.org/pub/pwg/ipp/charter/ch-ipp-charter-20210409.pdf
- Draft charter for 2024-2025:
  - https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ipp-charter-20240213-rev.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, the PWG Semantic Model schema, and handle synchronization with changes in IPP

Errata

- Pending:
  - PWG 5100.6-2003 (IPP Page Overrides v1.0): 2 issues
  - PWG 5100.8-2003 (IPP "-actuals" v1.0): 1 issue
  - PWG 5100.9-2009 (IPP Printer State Extensions v1.0): 2 issues
  - PWG 5100.15-2014 (IPP FaxOut v1.0): 2 issues
  - PWG 5100.19-2015 (IPP Implementor's Guide v2.0): 8 issues
  - PWG 5107.3-2019 (MFD Alerts v1.1): 1 issue
- In-Progress:
  - PWG 5100.5-2019 (IPP Document Object v1.1): 4 issues
  - PWG 5100.11-2010 (IPP JPS2/Enterprise Printing Extensions v1.0): 7 issues
  - PWG 5100.12-2015 (IPP 2.0, 2.1, and 2.2): 2 issues
  - PWG 5100.14-2020 (IPP Everywhere v1.1): 4 issues
  - PWG 5100.18-2015 (IPP Shared Infrastructure Extensions v1.0): 8 issues
  - PWG 5100.20-2020 (IPP Everywhere v1.1 Self-Cert): 1 issue
  - PWG 5100.22-2019 (IPP System Service v1.0): 3 issues

IPP OAuth Extensions v1.0 (OAUTH)

- Prototype draft:
  - https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippoauth10-20230814-rev.pdf
- Goals:
  - Define/reference best practices for using OAuth/OpenID with IPP
  - Prototype/deploy OAuth/OpenID support for printing
- Prototyping Status:
  - OAuth (JWT) and X.509 support code is available in libcups v3 and CUPS 2.5
  - https://github.com/OpenPrinting/cups/tree/master
  - https://github.com/OpenPrinting/libcups/tree/master
  - https://github.com/OpenPrinting/cups-local/tree/master
  - https://github.com/OpenPrinting/cups-sharing/tree/master
- Proposed Schedule:
  - Stable draft Q1 2024

Other Working Drafts

- IPP Document Object v1.2 (DOCOBJECT):
  - https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippdocobject12-20240103-rev.pdf
- IPP Encrypted Jobs and Documents v1.0 (TRUSTNOONE):
  - https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ipptrustnoone10-20210519.pdf
- IPP Everywhere v2.0 (EVE):
  - https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippeve20-20221107.pdf
- IPP Everywhere Printer Self-Certification Manual v2.0 (SELFCERT):
  - https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippeveselfcert20-20220510.pdf
- IPP Wi-Fi Configuration Extensions v1.0 (WIFI):
  - https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippwifi10-20240102.pdf
- Internet Printing Protocol/2.x Fourth Edition (BASE):
  - https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippbase23-20220809.pdf

The Printer Working Group

Lunch Break

February 14, 2024

IPP workgroup resuming at 12:45pm ET

IPP Enterprise Printing Extensions v2.0

- LCRC draft and comments:
  - https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippepx20-20240131.pdf
  - https://ftp.pwg.org/pub/pwg/ipp/wd/lcrc-epx-20-20240131.txt
- Prototyping status:
  - Smith and Mike have completed prototyping with PAPPL
  - https://github.com/wifiprintguy/pappl-epx/tree/epx-proto-libcups3-2
- PWG Last Call:
  - Completed February 2, 2024 with 9 responses and 54 comments
- Proposed schedule:
  - PWG Formal Vote soon

IPP Enterprise Printing Extensions v2.0 LCRC (1/9)

- CR1: Use case figures mention “Job ticket”. I presume “Job ticket” refers to a initial value/default job object that is used to create all jobs with defaults? Is there a spec where this concept is defined? Should there be a reference to that here? It appears that job ticket is an abstract (or phantom) object (ie – an object that does not really exist until a concrete operation is received) and gets updated based user authentication state?
- CR2: Section 3.2.8 Description paragraph seems to imply Duncan has permission to print in color, yet Figure 3 shows Duncan does not have permission. Is there a different between Duncan’s “office user account” and his “personal account” – is this why Figure 3 shows he cannot print in color – I cannot tell if there are 2 different accounts in play here.
- CR3: Section 4.2.1 Job Proof and Suspend 2nd paragraph line 629-630 – Error! Reference source not found

IPP Enterprise Printing Extensions v2.0 LCRC (2/9)

- MR1: 3.2.8 User Not Listed in Print Policy Denied Ability to Print in Color comment: The first paragraph of this section describes a scenario where Duncan IS ALLOWED to print a document in color while the sequence diagram (Figure 3) shows that Duncan CANNOT select "Color" for printing.
- MS1. The boilerplate on page 3 needs to be updated - the "About" headings need to be boldface, the links all need to be https, and the www.pwg.org link needs to be converted to a hyperlink.
- MS2. Section 1: Update last sentence to be "Section 14.1 lists the changes to the earlier revision of this specification."
- MS3. Section 2.2: Update to new boilerplate from the template.
- MS4. Section 2.2, line 333: Remove extra space after "Input Page:"
- MS5. Section 2.2, line 343: Add comma before "and Send-URI."
- MS6. Section 2.2, line 355: Capitalize "A" for "A hardware implementation of ..."

IPP Enterprise Printing Extensions v2.0 LCRC (3/9)

- MS7. Section 2.3: HTTP/1.1 is now STD 99 (RFC 9112)
- MS8. Section 3.1: No need to mention or reference ISO DPA here - we aren't pulling in anything more than what is in IPP/1.1, so just mention *that*.
- MS9. Section 3.1, line 421: Template uses lowercase "should" in this situation.
- MS10. Section 3.1, line 424: Should be "Also, given the availability ..." (Given is incorrectly capitalized)
- MS11. Section 3.2.3: Recommend wording this as AAA Framework, with the corresponding definition and references from PWG 5100.18 (INFRA).
- MS12. Section 3.2.6: No need to reference PWG 5100.5 as the use case highlights multiple documents but not a particular implementation of it (and STD92 supports multiple document jobs).
- MS13. Figures 1 (page 16), 3 (page 18), and 4 (page 19): Hard to read black text with dark red background.

IPP Enterprise Printing Extensions v2.0 LCRC (4/9)

- MS14. Global: Bulleted lists are missing bullets and indentation - fix style (see sections 3.4, 10.*)
- MS15. Section 3.5, line 582: IPP/1.1 reference should be "Internet Printing Protocol/1.1 [STD92]", not "IETF IPP/1.1"
- MS16. Section 3.5, line 584: "Optimize compatibility" isn't a technical requirement. Maybe "Maintain compatibility with existing IPP operations ..."? Also, don't differentiate IETF and PWG operations, they are all maintained by us.
- MS17. Section 4.1: Fix last three sentences, maybe something like: "... but with the key difference that, unlike Get-Printer-Attributes, the Printer is expected to challenge the Client for authentication when processing a Get-User-Printer-Attributes request. A Printer declares its support for the Job Print Policy by including the Get-User-Printer-Attributes operation in its "operations-supported" Printer Description attribute [STD92]."

IPP Enterprise Printing Extensions v2.0 LCRC (5/9)

- MS18. Figures 5 (page 23), 6 (page 24), 7 (page 25), 8 (page 26), 9 and 10 (page 27), and 11 and 12 (page 28): White text on a yellow background is hard to read.
- MS19. Section 4.2.2: Drop "as of this publication"
- MS20. Section 4.4, line 674: Drop comma after "processing", i.e. "... as part of processing to make the Job available ..."
- MS21. Between Figure 7 and 8, unnecessary page break
- MS22. Section 5.1, lines 763-765: Add "requested-attributes" [STD92]
- MS23. Section 6.1.1, line 823: "operation attribute" not "Job Template attribute"
- MS24. Tables 6 and 7 (page 35): Row height is messed up, header needs to be bottom left aligned
- MS25. Section 6.2.2, line 936-937: Reword, perhaps "Note: There is no "proof-copies-default" Printer Description attribute."

IPP Enterprise Printing Extensions v2.0 LCRC (6/9)

- MS26. Section 6.4.3, line 1034: Drop "option", i.e. "that syntax is now OBSOLETE."
- MS27. Section 6.4.5: Title should not have quotes around unknown syntax
- MS28. Tables 13 (pages 43-44), 17 (pages 52-53), 18 (pages 53-55), 20 (pages 56-58), 21 (page 58), 22 (pages 59-60), 23 (pages 60-61): Repeat heading row
- MS29. Section 6.4.17, 6.4.18: Delete (duplicate) - these should only be Printer Status attributes
- MS30. Section 8.3, line 1462: Reword "MUST support the applicable keywords"
- MS31. Section 8.4, lines 1466-1467: Drop which-jobs-supported reference.
- MS32. Section 12: Security and Privacy Considerations, "In addition to the security and privacy considerations described in Internet Printing Protocol/1.1 [STD92]..."

IPP Enterprise Printing Extensions v2.0 LCRC (7/9)

- MS33. Section 12.1, line 1622: "supplies" (not supplys)
- MS34. Section 13.x: Multiple issues, will work with you offline to correct the registration templates.
- MS35. Section 13.2: "Keyword Registrations"
- MS36. Section 13.3: "Enum Registrations"
- MS37. Section 14.1, lines 1901-1902: Drop "(which were never observed to have been used in practice)"
- MS38. Section 14.1, lines 1907-1908: Add informative reference, make "from [LAKESIDE20201201];"
- MS39. Section 14.1, lines 1909-1910: Reword as "Added the "printer-storage" and "printer-storage-description" attributes to provide a mapping of the Host Resources MIB for storage devices;"
- MS40. Section 15.1, lines 1924-1925: Move to informative section 15.2

IPP Enterprise Printing Extensions v2.0 LCRC (8/9)

- MS41. Section 15.1: Update PWG5100.3, PWG5100.7, PWG5100.13, UNICODE; remove RFC7230; add STD99
- MS42. Section 15.2: Update EPX-ABNF, remove PWG5100.5, PWG5100.18, RFC3380
- MS43. Section 16: "Authors"
- SK1: Section 10: Add conformance requirements for "which-jobs" keywords
- SK2: Section 4.1: Change "most authenticated user" to "Authenticated User" (defined term from section 2.2)
- WW1: Para 3.2.7 - 3.2.8 In the references to Figures 1, 2 , 3 and 4, the spec reads similar to "Ed's experience and the underlying IPP interaction is illustrated in the sequence diagram in Figure 4." One option is to change "is" to "are" for grammer. An alternative wording might be "The IPP interaction underlying Ed's experience is illustrated in the sequence diagram in Figure ..."

IPP Enterprise Printing Extensions v2.0 LCRC (9/9)

- WW2: Para 4.1 . "By convention, the Get-Printer-Attributes is expected to never challenge the Client for authentication." I suggest the Get-Printer-Attributes operation..."
- WW3: Para 6.2.3 I suggest "This attribute MAY be used with the "job-password" attribute (section 6.1.1). However, this could prevent the initial copies or the "job-release-action” attribute (section 6.1.3) to create a Release Job that is also a Proof Job." Or separate with a semicolin. I also find it confusing... how could initial copies prevent creation of a Release Job that is also a Proof Job.?
- WW4: Para 6.4.18 - Unexpected font change.
- WW5: Table 18. In two places "Used in cases of fan-out [STD92], might not cause a Job to be aborted vs. conflicts detected at submission time that prevent Job Creation." Might be confusing. Perhaps "Although certain conflicts detected at submission time prevent Job Creation, those reported in cases of fan-out [STD92] might not cause a Job to be aborted."

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12:00 - 12:45	Lunch Break
12:45 - 13:45	IPP WG: IPP System Service / IPP Shared Infrastructure Extensions
13:45 - 14:15	IPP WG: 3D Printing Liaisons / Discussions
14:15 - 14:30	IPP WG: Next Steps

Strong Device Identity BoF

- Who needs it?
- Trust on First Use (TOFU)
- Strong Device Identity vs. Device Attestation
- Home Networks and Trust
- Use Cases
- Examples:
  - Matter
  - IEEE 802.1AR / TPM

Strong Device Identity – Who needs it?

- Increasing need for robust trust establishment now includes the home and small business environments
  - Zero Trust Networks
  - Hybrid work environments driving this into the home, but still using enterprise (awkward) workflows
  - Growth of IoT is creating a second more trustworthy "realm" within a home network
- Legacy trust establishment (self-signed certificates / TOFU / certificate pinning) nearing threshold of unacceptability
  - Trust on First Use has no system for initial validation
- Printers are either basically untrusted or have trust established using "enterprise" credential provisioning, which is awkward and unwieldy for home / SMB market segment

Trust on First Use

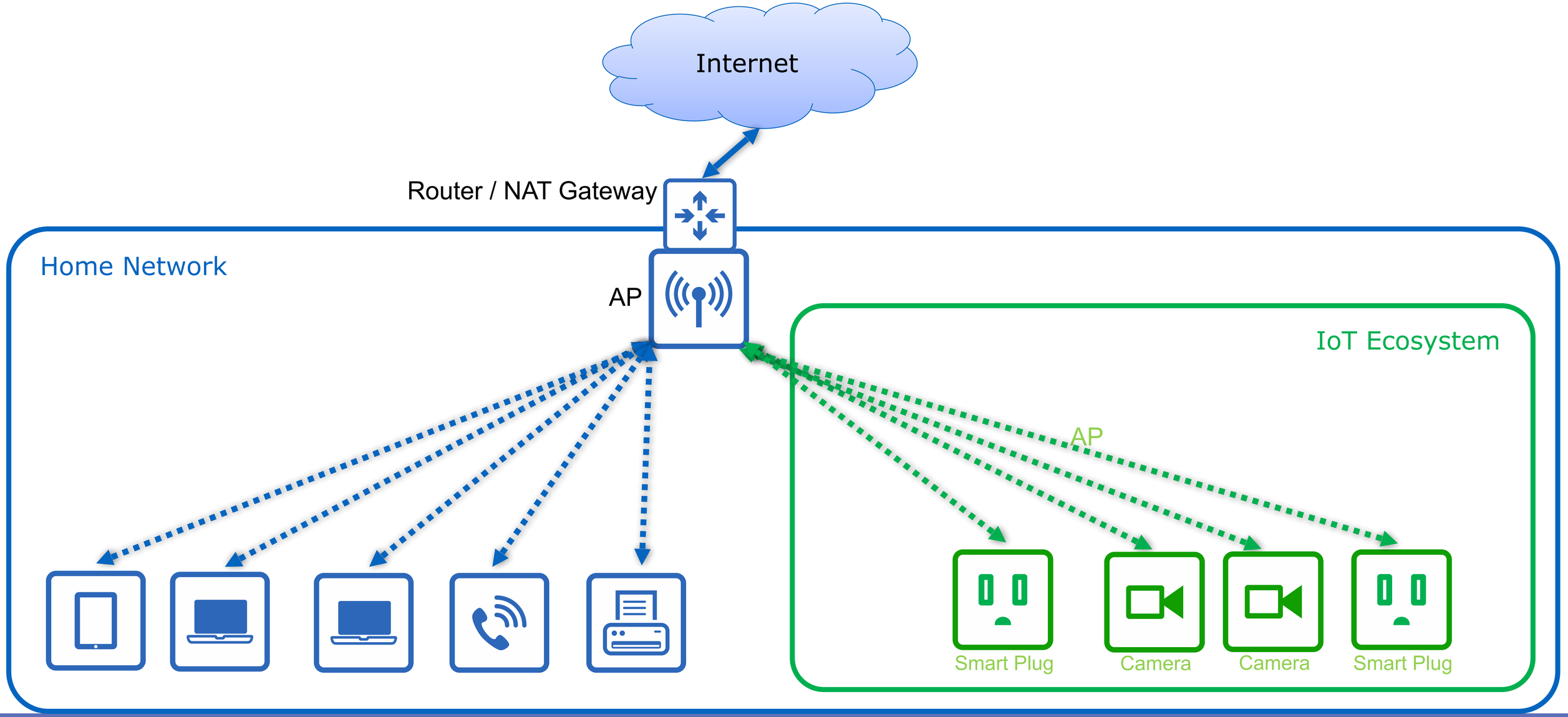
- Device joins network
- Client connects to Device via TLS
  - If the device is unrecognized (no entry in cache for whatever identifying keys are used), cache TLS server cert for that device and trust it***
  - If the device is recognized and the cert hasn't changed, continue to trust it
  - If the device is recognized but the certificate has changed, suspend trust and request user intervention

***** Validation in a web browser is awkward; most print systems trust with no validation**

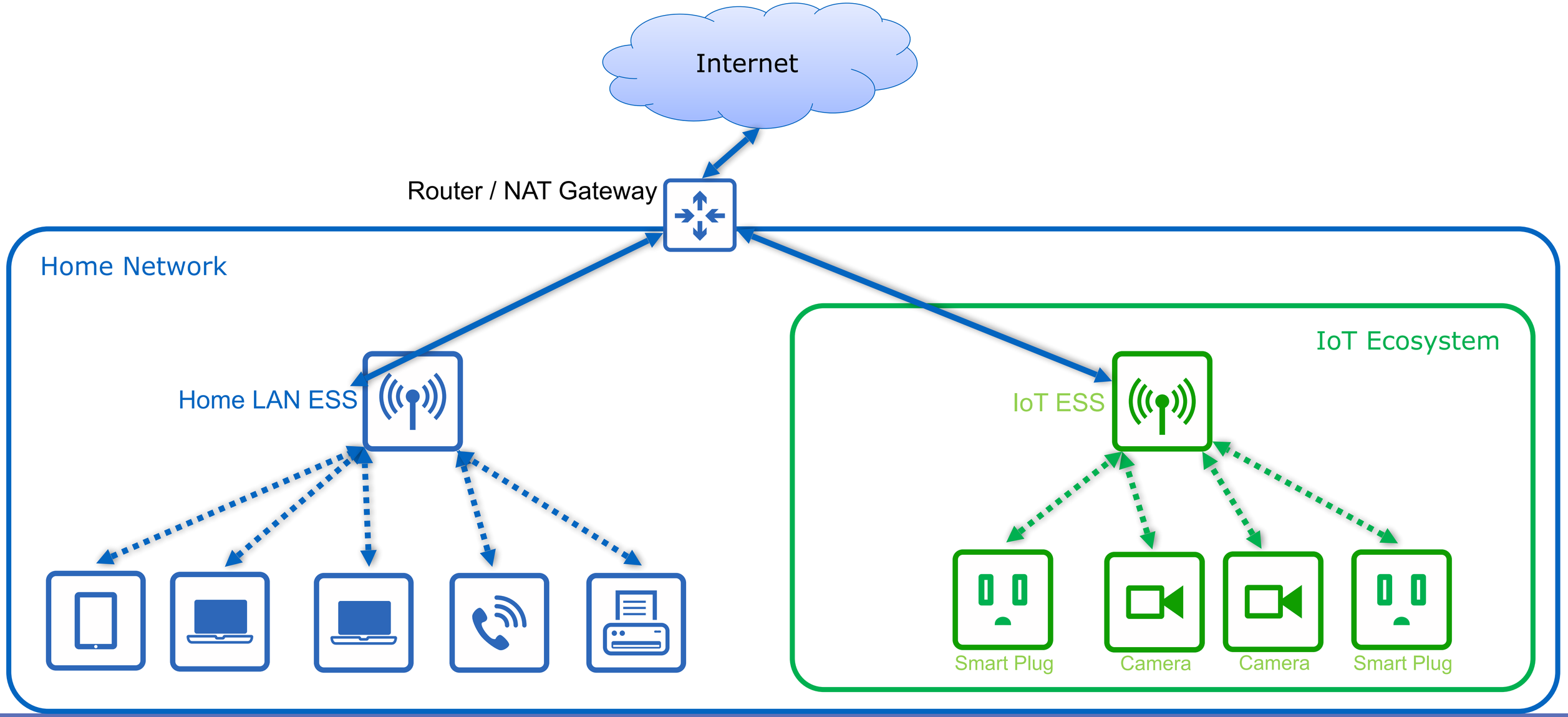
Strong Device Identity vs. Device Attestation

- What is the difference?
- Device Identity: Verifiable individual identity and manufacturer identity
- Device Attestation: Device Identity + verifiable device health assertions (software / firmware is unaltered)

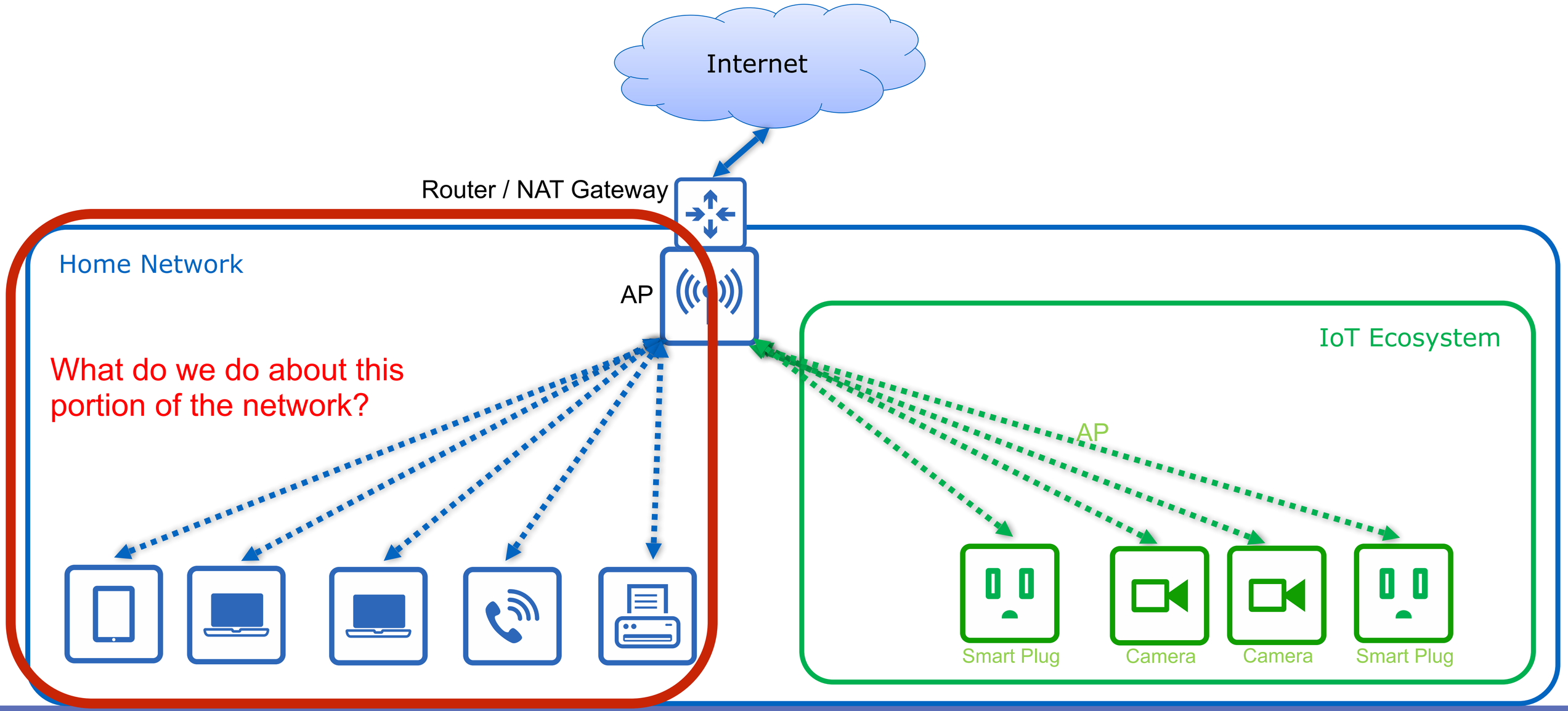
Home Network



Home Network



Home Network



Use Case

- User is a home owner who buys a printer and attaches it to their network via an Ethernet cable. A Network Manager daemon running on the User's home router notifies the agent app on the User's phone that a new device has been added to the network, indicating that it will be isolated until the Printer's identity and assertions of health have been validated, and requests approval to perform the validation. The User approves the offer. The Network Manager performs the validation, which succeeds. The User points their laptop's browser at the Printer to configure some settings, and the browser trusts the Printer because it is now holding a TLS certificate issued by a CA associated with that network.

Matter IoT Device Attestation

- Taken from the new Matter Handbook:
  - https://handbook.buildwithmatter.com/howitworks/attestation/
- During the commissioning process, a device cryptographically proves (attests) to the commissioner that:
  - it is a genuine product
  - it is a product that passed Matter compliance tests and has been thus certified by CSA.
- In order to accomplish those goals, the device carries:
  - A Device Attestation Certificate (DAC) that conveys device's manufacturer ID (VID) and product ID (PID). The DAC chains up to a set of trusted roots, approved by CSA members.
  - A securely-stored, private key associated with the public key stored in the DAC that proves the device owns this unique certificate.
- Certificate declaration is a statement cryptographically signed by CSA that states that a tuple (VID,PID) has passed Matter compliance tests.

IEEE 802.1AR / TPM

- IEEE 802.1AR-2018
  - C.2 DevID uses in consumer devices
  - End users are not expected to directly use the IEEE 802.1AR device identity. Instead the DevID is expected to be used by a home networking access point or router. These devices provide network connectivity to all devices on the home network and also provide security mechanisms such as passwords or Web-based authentication.
  - Often routers and access points also include a mechanism for limiting which devices can join the network through configuration of a list of allowed MAC addresses or other device identifying information. The IEEE 802.1AR device identity can be used as a secure form of identity for these purposes. Vendors that include human readable identity information within the DevID subject field, or use a machine readable serialNumber attribute, or the subjectAltName hardwareModuleName, can provide integrated solutions with interfaces that are both more user-friendly and more secure than current MAC address-based solutions.

The Printer Working Group

Lunch Break

February 15, 2024

IPP workgroup resuming at 12:45pm ET

IPP Shared Infrastructure Extensions v1.1 (INFRA)

- Initial draft:
  - https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippinfra11-20240102-rev.pdf
- Errata update of PWG 5100.18-2015:
  - Fixed typos
  - Updated references
  - Reference OAUTH and SYSTEM specifications
  - Sync up with EPX - Release Printing and Proof Printing
- Proposed schedule:
  - Prototype draft Q1 2024

IPP System Service v1.1 (SYSTEM)

- Initial draft:
  - https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippsystem11-20240214-rev.pdf
- Errata update of PWG 5100.22-2019:
  - Fixed typos
  - Updated references
  - Merged System Service Discovery registration content
  - Added Register-Output-Device extensions for X.509 authentication
- Proposed schedule:
  - Prototype draft Q1 2024

3D Printing and Scanning Discussions

- 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)
  - PWG 5199.7-2019: PWG Safe G-Code Subset for 3D Printing v1.0
- How to explain these specifications to 3D vendors?
  - Update 3D Printing page to reference the How to Use the Internet Printing Protocol book?
  - Add use cases?
  - Other thoughts?

3D Meetings (1/2)

- Drupa - May/June 2024
  - https://www.drupa.com/en/Media_News/Press/Press_Material/Press_releases/drupa_next_age_Platform_for_networking_and_new_business
  - We have been invited to prepare a presentation looking at how standardization may shape future directions in Additive Manufacturing for the Drupa Next Age stage
  - The Drupa representative is interested in hearing whether Microsoft might be willing to participate in a PWG sponsored panel discussion focusing on the potential benefits Microsoft sees in possibly converting its 3D Printer support in Windows OS to an IPP class driver concept.
  - In the last SC meeting, Smith Kennedy suggested he felt this type of presentation would need to be supported by some PWG use cases that would need to be developed.
    - Q: Is this something PWG membership wants to do?

3D Meetings (2/2)

- TCT 3Sixty Conference - June 2024
  - https://tct3sixty.com/
  - We have been invited to submit an abstract on any of the following Additive Manufacturing topics:
    - Construction & Architecture - Safe G-Code for sharing test files
    - Standards & Repeatability - Use aspects of IPP suite of standards to develop cloud to device secure remote job submission option for production class additive manufacturing devices
    - IP & Security - Common Criteria for Additive Manufacturing
  - Q: Is this something we want to do?
    - If so, it is due by December 8th, 2023

The Printer Working Group

Next Steps

Next Steps (1/2)

- Internet Printing Protocol/2.x Fourth Edition (Mike)
  - Prototype draft in Q1 2024
- IPP Document Object v1.2 (Mike)
  - Prototype draft in Q1 2024
- IPP Encrypted Jobs and Documents v1.0 (Mike/Smith)
  - Stable draft in Q2 2024
- IPP Enterprise Printing Extensions v2.0 (Smith)
  - PWG Formal Vote soon
- IPP Everywhere v2.0 (Mike)
  - Stable draft in Q1 2024
- IPP Everywhere Printer Self-Certification Manual v2.0 (Mike)
  - Prototype draft in Q1 2024
- IPP OAuth Extensions v1.0 (Mike/Piotr)
  - Stable draft in Q1 2024

Next Steps (2/2)

- IPP Shared Infrastructure Extensions v1.1 (Mike)
  - Prototype draft in Q1 2024
- IPP System Service v1.1 (Mike)
  - Prototype draft in Q1 2024
- IPP Wi-Fi Configuration Extensions v1.0 (Mike)
  - Stable draft in Q1 2024

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, February 29 and March 14, 2024 at 3pm ET