



# The Printer Working Group

IPP Workgroup Session

February 7, 2023



# Before We Begin...

- PWG Antitrust Policy:
  - [https://www.pwg.org/chair/membership\\_docs/pwg-antitrust-policy.pdf](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.
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- **This meeting is being recorded**

# Agenda (1/3)



## February 7, 2023 (US Eastern Standard Time)

When	What
10:00 - 10:45	PWG Plenary
10:45 - 11:00	IPP WG: Status
11:00 - 12:00	IPP WG: PWG Call for Objections and Formal Vote
12:00 - 12:45	Lunch Break
12:45 - 14:00	IPP WG: Evolution of IPP/2.x and IPP Everywhere

# Agenda (2/3)



## February 8, 2023 (US Eastern Standard Time)

When	What
10:00 - 11:00	IPP WG: Prototype-Ready Specifications
11:00 - 12:00	IPP WG: Evolution of IPP and OAuth, Part 1
12:00 - 12:45	Lunch Break
12:45 - 14:30	IPP WG: Evolution of IPP and OAuth, Part 2

# Agenda (3/3)



## February 9, 2023 (US Eastern Standard Time)

When	What
10:00 - 12:00	IDS WG: Status and Discussion
12:00 - 12:45	Lunch Break
12:45 - 13:45	IPP WG: 3D Printing Liaisons
13:45 - 14:00	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, the PWG Semantic Model schema, and handle synchronization with changes in IPP
- **Due for an update**



- **Pending:**

- PWG 5100.5-2019 (Document Object v1.1): 4 issues
- PWG 5100.6-2003 (Page Overrides v1.0): 2 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): 8 issues
- PWG 5100.19-2015 (Implementor's Guide v2.0): 8 issues
- PWG 5100.22-2019 (System Service v1.0): 3 issues
- PWG 5107.3-2019 (MFD Alerts v1.1): 1 issue

- **In-Progress:**

- PWG 5100.7-2019 (Job Extensions v2.0): 8 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 - Driver Replacement): 15 issues
- PWG 5100.14-2020 (IPP Everywhere v1.1): 4 issues
- PWG 5100.20-2020 (IPP Everywhere v1.1 Self-Cert): 1 issue



# IPP Job Extensions v2.1

- Stable draft:
  - <https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippjobext21-20221212-rev.pdf>
- Updates PWG 5100.7-2019: IPP Job Extensions v2.0
- Primary focus is clarifications for "media-col", "media-col-database", "media-col-ready", "media-size", and "media-size-supported"
- Also adds:
  - Missing attributes: "job-hold-until-time-supported", "job-processing-time", "max-page-ranges-supported"
  - New values for "media-source" and "print-content-optimize"
- PWG Call for Objections ends February 10, 2023 at 10pm PST



# IPP Driver Replacement Extensions v2.0 (NODRIVER)



- Stable Draft:
  - <https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippnodriver20-20230121.pdf>
- Updates PWG 5100.13-2013: IPP Job and Printer Extensions - Set 3 (JPS3)
  - Old title "Driverless Printing Extensions"
- Prototyping completed in the PAPPL project
- PWG Last Call completed
- PWG Formal Vote until March 1, 2023 at 10pm PST



# The Printer Working Group

Lunch Break

*Resuming at 12:45pm ET*



# IPP/2.x Fourth Edition

- Current interim draft:
  - <https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippbase23-20220809-rev.pdf>
- Errata update of PWG 5100.12-2015:
  - Clarification about Get-Printer-Attributes operation
  - Definition of classes or categories of printers
  - 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 and JOBEXT 2.1

# IPP Everywhere v2.0



- Current prototype draft:
  - <https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippeve20-20221107-rev.pdf>
- Major update of PWG 5100.14-2020: IPP Everywhere v1.1
  - Most RECOMMENDED items become REQUIRED
  - New CONDITIONALLY REQUIRED items
  - REQUIRE "printer-firmware-xxx" Printer Status attributes
  - REQUIRE Get-Printers from PWG 5100.22 for print servers
  - RECOMMEND IPP-USB support
- Proposed schedule:
  - Stable draft Q2/Q3 2023

# IPP Everywhere Printer Self-Certification Manual v2.0



- Initial draft:
  - <https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippeveselfcert20-20220510.pdf>
- Major update to PWG 5100.20-2020
  - Synchronize with changes in IPP Everywhere v2.0
  - Add IPP-USB support (particularly for USB-only printers)
  - Add feature tests for duplex, finishings, roll, tray
  - Add Get-Printers test for servers
- Proposed schedule:
  - Prototype draft and beta tools Q2/Q3 2023

# IPP Everywhere™ v2.0 Printer Self-Certification Tests



- Existing tests:
  - mDNS/DNS-SD - required service types, TXT keys, and values
  - IPP - required operations, attributes, and values, 'media-needed'
  - Document - basic printing tests for PWG Raster, JPEG, and PDF
- New tests:
  - Color printing - verify print-color mode works to switch between color and grayscale for PWG Raster, JPEG, and PDF
  - Duplex printing - verify odd number of pages works, PWG Raster, JPEG (fail/ignore), PDF
  - Stapling, Folding, Punching - verify all supported staple values work for PWG Raster, JPEG, and PDF with different numbers of pages, duplex modes (as supported)
  - Trimming/cutting - verify cutter works for roll media (as supported)
  - Server - verify Get-Printers operation works, do IPP tests against each reported printer
- JPEG and PDF tests only performed if the Printer supports them



# Self-Certification Tools

- **Platforms:**
  - Linux: Distribute as free app via snapcraft for Intel and ARM
  - macOS: 10.14+, distribute as free app via Mac AppStore for Intel and Apple Silicon
  - Windows: 10+, distribute as free app via Windows Store for Intel
- Command-line and GUI front-end (rather than running individual scripts)
- Potential issues with using ISTO as publishing vendor
  - Maybe have one PWG member publish the official apps instead?



# Self-Certification Tools (con't)

- "ippevetool"
  - GUI and command-line
  - Run self-certification tests
  - Inspect TXT records, Printer attributes, resources (icon/profile/string), and X.509 certificates
  - Do ad-hoc print tests using canned and/or user-supplied files
  - Do ad-hoc ipptool tests using canned and/or user-supplied files
  - Look-up specs for attributes and values via IPP registry
- Github repository:
  - <https://github.com/istopwg/ippeveselfcert>
  - "master" branch has current work-in-progress





# Self-Certification Tools (con't)

- Implementing front-end using Flutter (GUI) and Dart (language)
  - One code base for all platforms
  - Compiles to native code
  - Potential for supporting Android, \*BSD, and iOS/iPadOS
  - Existing "nsd" mDNS/DNS-SD library can be used for Android, iOS/iPadOS, macOS, and Windows
    - Need to write Avahi nsd plugin ("nsd\_avahi") for Linux/\*BSD
  - Need to implement proper IPP library for Dart
- Back-end uses ipptool from libcups project:
  - <https://github.com/OpenPrinting/libcups>



# Self-Certification Tools (con't)

IPP Everywhere™ Tool

- Canon TS5100 series
- DYMO LabelWriter 450 Twin Turbo
- EPSON SC-P800 Series
- EPSON WF-7520 Series
- HP OfficeJet Pro 8030 series [692825]
- HP Officejet Pro X576dw MFP [3483FE]
- Lexmark MC3426adw
- Rollo X1040
- Zebra GX420d
- Zebra GX430t

IPP Everywhere™ Tool

← HP Officejet Pro X576dw MFP [3483FE]

Overview IPP Attributes Print File Self-Certification



State: idle, accepting jobs, cover-open  
Location: Mike's Office  
Make and Model: HP Officejet Pro X576dw MFP  
Firmware: LZPICN2022AR

**DNS-SD TXT Record:**

Name	Value
txtvers	1
qttotal	1
pdl	application/vnd.hp-PCL,application/vnd.hp-PCLXL,application/postscript,application/pdf,image/jpeg,application/PCLm,image/urf
rp	ipp/print
PaperMax	legal-A4
kind	document, envelope, photo, postcard
URF	CPJ,MTI-2-8-9-10-11,PQ3-4-5,RS300-600,SRGB24,OBIO,w8,DEVW8,DEVRGB24,ADOBERGB24,DM3,JSI9-1-2,V1.4
ty	HP Officejet Pro X576dw MFP
product	(HP Officejet Pro X576dw MFP)
usb_MFG	HP
usb_MDL	HP Officejet Pro X576dw MFP
adminurl	http://HPFC15B43483FE.local/#hld-pgAirPrint

IPP Everywhere™ Tool

← HP Officejet Pro X576dw MFP [3483FE]

Overview IPP Attributes Print File Self-Certification

Checklist:  Production-ready firmware  
 Firmware update required  
 Print server  
 Output was correct

Model Names: Model 1  
Model 2  
Model 3  
...  
Model N

Product Family:

Product Webpage:

Self-certification results appear here



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# Prototype-Ready Specifications

- IPP Encrypted Jobs and Documents v1.0 (TRUSTNOONE)
  - <https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ipptrustnoone10-20210519.pdf>
  - Still looking for prototype(s)
  - Has application to both Cloud and "high integrity/security" printing
- IPP Enterprise Printing Extensions v2.0 (EPX)
  - <https://ftp.pwg.org/pub/pwg/ipp/wd/wd-ippepx20-20230208.pdf>
  - Prototyping is underway in PAPP



# Evolution of IPP and OAuth

- Wiki:
  - <https://github.com/istopwg/ippsample/wiki/IPP-and-OAuth>
- Goals:
  - Define/reference best practices for using OAuth/OpenID with IPP
  - Prototype/deploy OAuth/OpenID support for printing
- Update existing IPP specifications:
  - PWG 5100.11-2010: IPP Job and Printer Extensions - Set 2 (JPS2) (*Now titled "IPP Enterprise Printing Extensions v2.0 (EPX)"*)
  - 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)
- Publish new IPP best-practice:
  - PWG 5199.x: Cloud Printing with IPP Everywhere v1.0



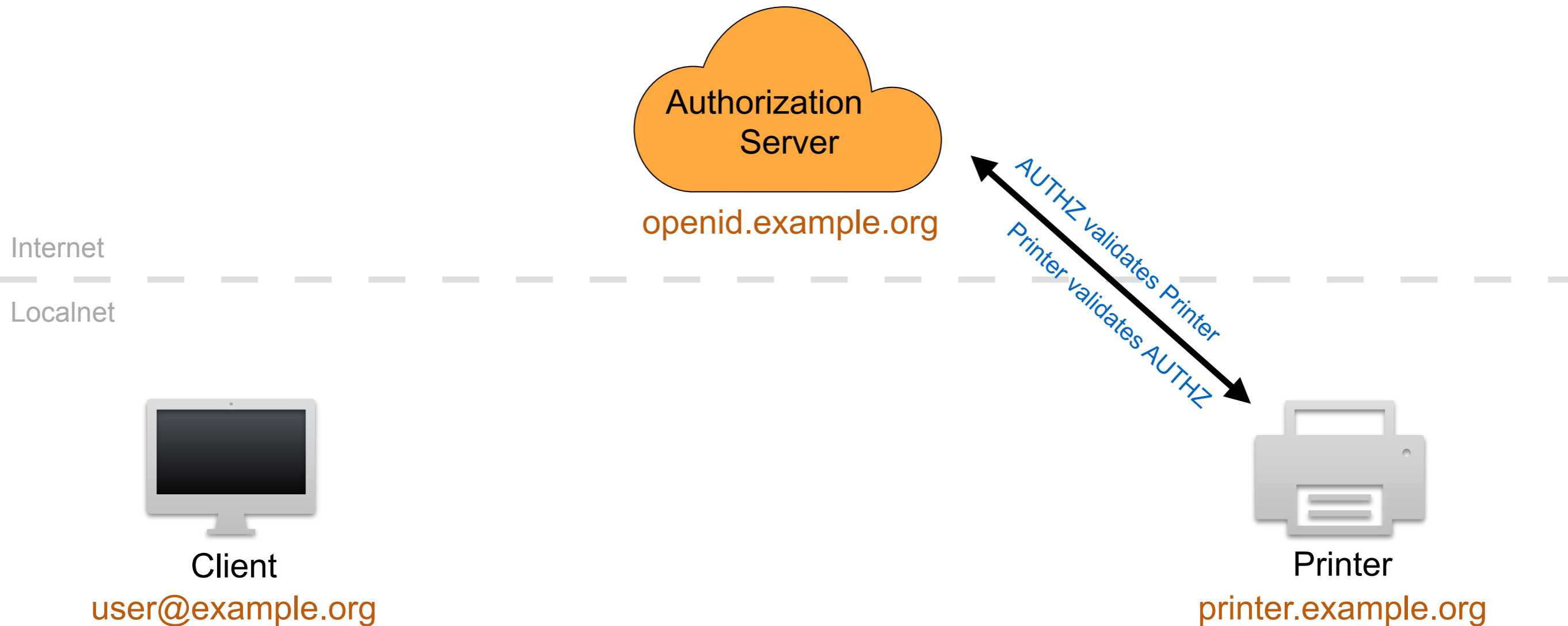
# OAuth Trust Model

- Clients, Proxies, and Printers trust Authorization Servers and Printers using X.509 certificate validation during TLS handshake
  - CA-signed certificates only (self-signed too hard to manage trust)
  - Public CA for Internet services, private/local CA usually for local services
- Challenges:
  - "printer-uri" and "system-uri" values can have different hostname/IP address values based on configuration - which one(s) to use/prefer?
    - For OAuth, could specify to use the first URI with a "uri-authentication-supported" and/or "xri-authentication" value of 'oauth'
  - Currently there is no standard way to obtain CA-signed X.509 certificates for mDNS (.local) hostnames
    - Mike has been working on ACME-Based Provisioning of IoT Devices
    - <https://datatracker.ietf.org/doc/draft-sweet-iot-acme/>



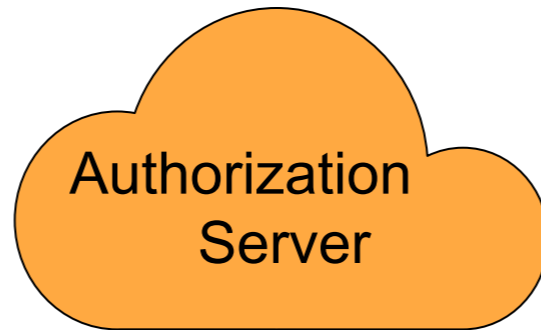
# OAuth Trust Model (Local Printer)

## Provisioning



# OAuth Trust Model (Local Printer)

## Discovery



openid.example.org

Internet

Localnet



Client

user@example.org

Client validates Printer X.509

Client queries and validates Printer AUTHZ

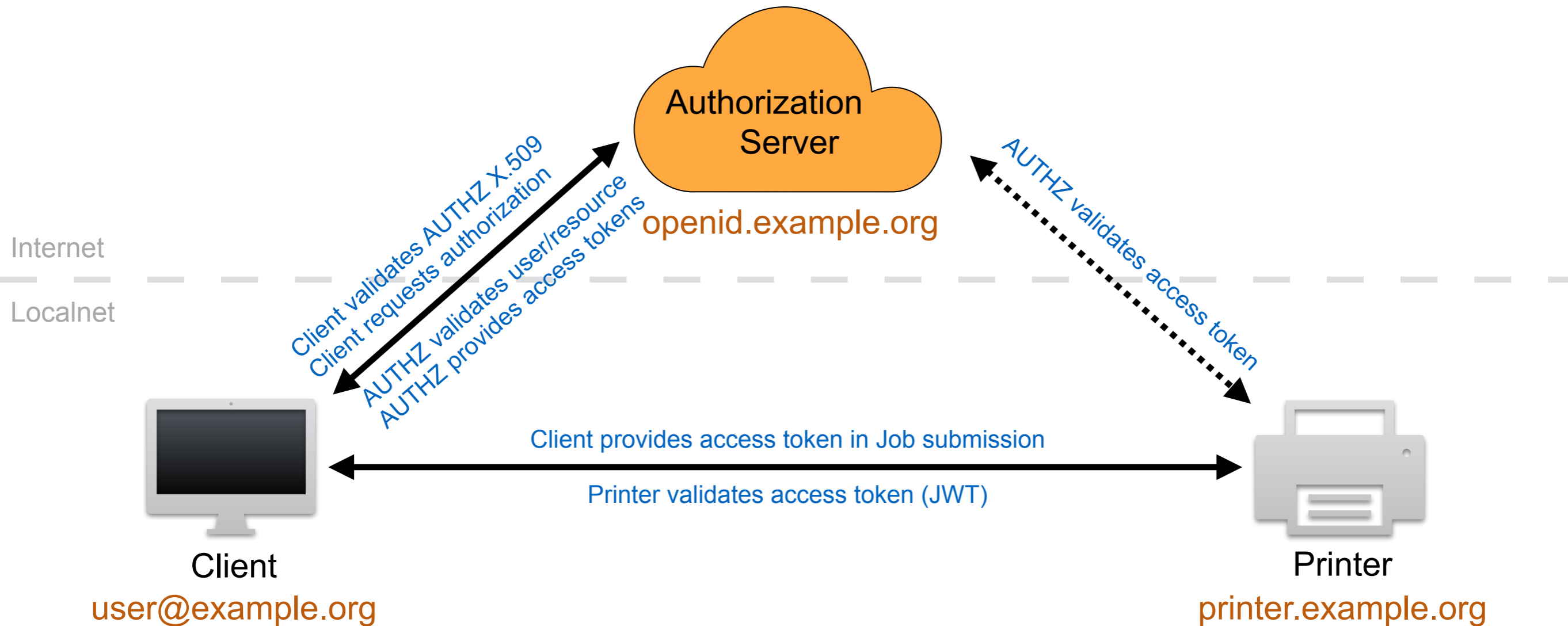


Printer

printer.example.org

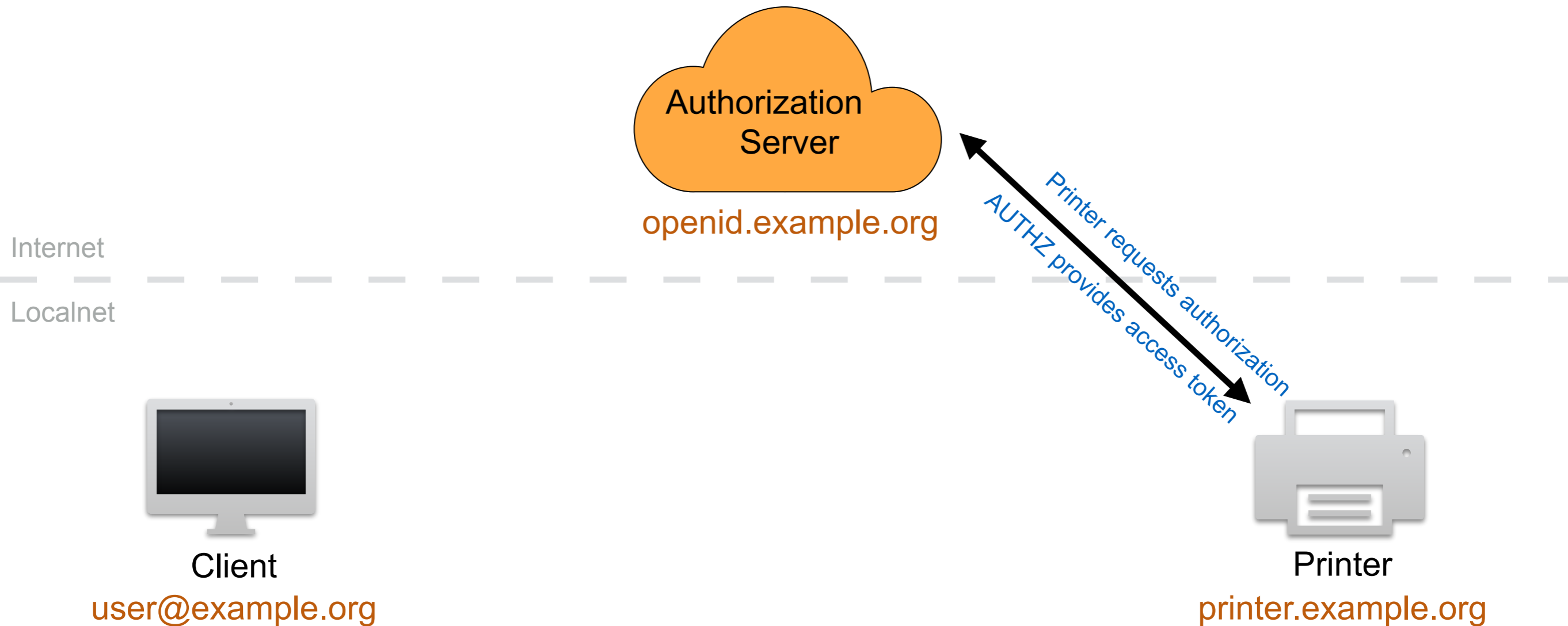
# OAuth Trust Model (Local Printer)

## Submission



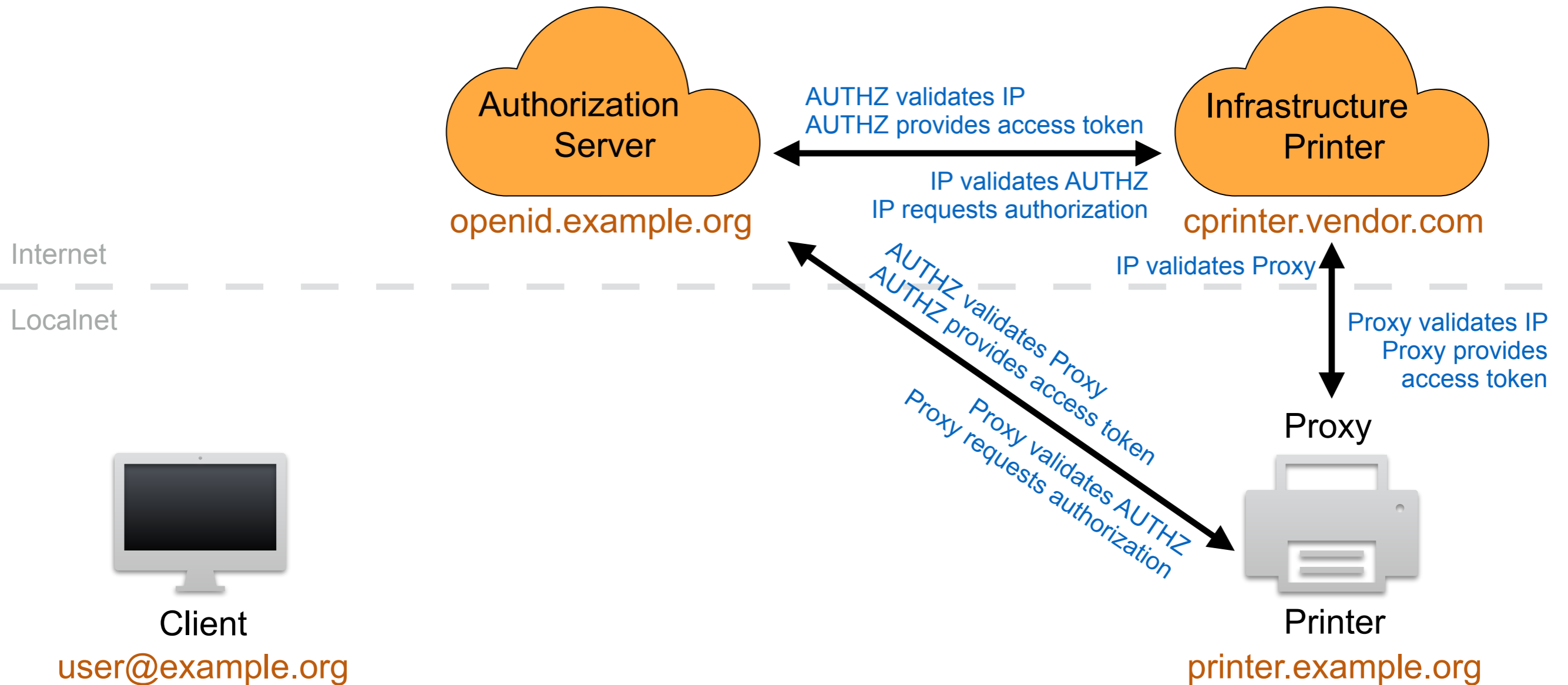
# OAuth Trust Model (Local Printer)

## Release Printing



# OAuth Trust Model (Cloud Printer)

## Provisioning





# Establishing Trust Relationship

- Google white paper:
  - <https://ftp.pwg.org/pub/pwg/ipp/whitepaper/google-pwg-trust.pdf>



# The Printer Working Group

Lunch Break

*Resuming at 12:45pm ET*



# OAuth Identity/OpenID

- OAuth doesn't define a standard mechanism for user identity
- OpenID Connect defines one method:
  - <https://openid.net/developers/specs/>
- Google white paper:
  - [https://ftp.pwg.org/pub/pwg/ipp/whitepaper/google-pwg\\_user\\_identity.pdf](https://ftp.pwg.org/pub/pwg/ipp/whitepaper/google-pwg_user_identity.pdf)





# OAuth Authorization

- RFC 8693: OAuth 2.0 Token Exchange
  - <https://www.rfc-editor.org/rfc/rfc8693.html>
    - This specification defines a protocol for an HTTP- and JSON-based Security Token Service (STS) by defining how to request and obtain security tokens from OAuth 2.0 authorization servers, including security tokens employing impersonation and delegation.
- IETF Rich Authorization Requests draft:
  - <https://datatracker.ietf.org/doc/draft-ietf-oauth-rar/>
    - This document specifies a new parameter `authorization_details` that is used to carry fine-grained authorization data in OAuth messages.
  - Expands on OAuth scopes to provide fine-grained authorization
  - Possible application in IPP:
    - [https://ftp.pwg.org/pub/pwg/ipp/whitepaper/google-pwg\\_user\\_identity.pdf#page=3](https://ftp.pwg.org/pub/pwg/ipp/whitepaper/google-pwg_user_identity.pdf#page=3)
- Proposed JWE/JWS strategy:
  - <https://github.com/istopwg/ippsample/wiki/IPP-and-OAuth>



# The Printer Working Group

IDS Workgroup Session

February 9, 2023



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12:45 - 13:45	IPP WG: 3D Printing Liaisons
13:45 - 14:00	IPP WG: Next Steps



# 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
- Proposed future work (2023-2024):
  - IPP 3D Scan Service v1.0 specification to address 3D scanning
  - IPP 3D Production Printing Extensions v1.0 specification to address VDMA - OPC UA "Joint Working Group (JWG) for Additive Manufacturing" efforts
  - Updated PWG 3D Print Job Ticket and Associated Capabilities v2.0 (PJT3D) best practice to incorporate production extensions and IPP 3D v1.1
  - Create sample 3MF print files with embedded job tickets, do more IPP 3D prototyping

# 3D Printing Liaisons



- **Have a new liaison agreement with the 3MF Consortium**
  - Want to create some sample 3MF print files with embedded job tickets and do more IPP 3D prototyping
  - Collaborate with 3MF and AMSC to use IPP 3D to satisfy need to query device capabilities and securely submit content for printing
- **INCITS Expert Group of Digital Manufacturing**
  - INCITS Executive Board decided to disband the group at its January 2023 monthly meeting
  - An INCITS email with further information on the disbanding of the EG was shared with the PWG SC.
  - Opportunity to consider establishing a direct Category C liaison with ISO/IEC JTC 1 WG 12 3D Printing and scanning as a replacement for the access PWG was obtaining previously via INCITS EG
- **VDMA OPC UA for Additive Manufacturing - Joint Working Group 40 540**
  - <https://www.vdma.org/events-trade-fairs/-/event/view/70649>
  - Paul Tykodi is representing the PWG in the activities of the Joint Working Group. The JWG has a potential interest in referencing IPP 3D standard for secure remote job submission





# 3D Meetings (1/2)

- TIPE 3D Printing 2023 Virtual F2F: January 24-26, 2023
  - Paul attended 2 sessions
- America Makes Technical Review and eXchange (TRX): March 7-8, 2023 at the University of Texas in El Paso (UTEP):
  - I am unable to attend in person and I have reached out to America Makes to see whether there will be recordings available for any of the following sessions:
    - Joint Metal Additive Database Definition (JMADD)
    - AMNOW
    - Data-Driven Qualification for Additive Manufacturing
    - Acceleration of Large-Scale Additive Manufacturing (ALSAM)



# 3D Meetings (2/2)

- The ASTM International Conference on Additive Manufacturing (ICAM 2023): October 30 - November 3, 2023 in Washington, DC:
  - <https://amcoe.org/event/icam2023/>
  - Plan to attend in person
- Formnext: November 6-10, 2023 in Frankfurt, Germany
  - Additive Manufacturing Standards Forum: November 6
  - Frankfurt Am Main Germany: November 7-10
  - If IPP 3D OPC UA efforts proceed to Proof of Concept in conjunction with umati (<https://umati.org/>), plan to attend in person



# The Printer Working Group

## Next Steps



# Next Steps

- IPP/2.x Fourth Edition (Mike)
  - Prototype draft in Q2/Q3 2023
- IPP Driver Replacement Extensions v2.0 (Smith)
  - PWG Formal Approval ends March 1, 2023
- IPP Encrypted Jobs and Documents v1.0 (Mike/Smith)
  - Stable draft in Q2 2023
- IPP Enterprise Printing Extensions v2.0 (Smith)
  - Stable draft in Q1 2023
- IPP Everywhere v2.0 (Mike)
  - Stable draft in Q2/Q3 2023
- IPP Everywhere Printer Self-Certification Manual v2.0 (Mike)
  - Prototype draft in Q2/Q3 2023
- IPP Job Extensions v2.1 (Mike)
  - PWG Call for Objections ends February 10, 2023



# 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 16 and March 2, 2023 at 3pm ET