

IoT Hands on Workshop

Introduction / Welcome

July 13, 2015

Scott Lofgren Intel President and Chairman DLNA President and Chairman UPnP Definition Group - OIC

© 2015 UPnP Forum





Thank You for attending the IoT Hands on Workshop



UPnP[®] Agenda for the day

- 1:00pm 2:00pm Intro & Welcome: UPnP Forum and ZTE
- 2:00pm 3:00pm VidiPath Presentation
- 3:00pm 3:30pm Coffee Break
- 3:30pm 4:30pm OIC Presentation and Demo
- 4:30pm 5:30pm UPnP Presentation UPnP & HIT University Demo
- 5:30pm 6:15pm Q&A
- 6:30pm 9:00pm Evening Reception drinks, hors d'oeuvres, demos



Thank you our supporters



VIDI PATH



And all of you for attending!



- PCs and home networking were in their early years, proprietary solutions and lack of standards were the way of life
 - 27% of US households still did not own a PC [2]
 - Poor usability & complexity were listed in the top 5 barriers to adoption, Historical problem areas still bad: e.g. Connecting to the Internet
 - At that time, New product areas presented even more complex problems - wireless home networking, mobile phone/PDA integration, consumer electronics integration, etc.

^[1] Intel internal research report. Non-PC Owners Survey. 2000

^[2] Jupiter Consumer Survey Report: Technology in the Home, June 2003



What were the effects in 2001

- Corporate purchase cycles had lengthened to between 3 to 6 years ^[3]
 - Purchase price is not the key purchase barrier—total cost of ownership was
- Returns and post-sales call costs for PC OEMs were staggering
 - Approximately \$1.48 billion or \$95 per PC sold ^[4]
 - Based on the 40.1 million PCs shipped on the year year
- "No Defect Found" return rate runs as high as 90%+ (depending on product category)
- Consumer electronic returns costs are estimated at \$10B annually ^[5]

[3] Desktop Refresh Cycles: Three Years Is the Standard, But Not the Reality, Forrester Research, 2003

- [4] Ease of Use / PC Quality Roundtable Research on Returns and "No-Defect-Found" rates in the PC industry. 2003
- [5] eBrain Research conducted October, 2002 for Consumer Electronics Association (CEA)



What were the effects in 2001

- Retail return rates holding at 8% to 15% for past three years
 - Plateau reached after steady decline during last decade
 - Average of 13% for notebook PCs and 11% for desktop PCs
 - Only 2-5% of returns are found to be defective
 - 85% of people who return PCs within the first 8-9 days take the exact same model as a replacement
- High OEM NDF rates indicates HW/SW configuration issues
 - OEM1: 33% of all returns are perception based
 - OEM2: approximately 30% NDF rate on system returns
 - OEM3: 76% NDF on desktop returns, 67% on laptop returns

Consumers were frustrated – The Industry was frustrated – Cost of Ownership was high –Profits were tight

[7] Ease-of-Use Roundtable: OEM & Retailers data collection, 2003



The Response

- Companies world wide were slow to react but eventually it was understood that vertical solutions would not allow the market to grow at a quick pace
 - Interoperability issues
 - Customer frustration
 - High support costs



The Result

- The industry turned to Standards
 - To allow for interoperability across brands
 - To drive down support costs
- UPnP
 - Started to allow for all devices on the home network to be able to automatically discover and control each other
- DLNA
 - To ensure content could be moved from device to device within the home network
- Many other standards efforts

The Home Networking / Content sharing ecosystem now has billions of connected devices working together!!



Key learning

 It takes time to define and implement standards to assist with market growth – early identification of needs and efficient execution are vital

SIG	Initial Development	First Product	Initial Market Adoption	Years from Initial development to Initial Market adoption	
MPEG2	1988	1993	1998	10	
802.11	1990	2000	2002	12*	
USB	1994	1998	2003	9 – limited complexity	
MPEG4 – (Baseline of MPEG2)	1995	2001	2007	12	
Bluetooth	1998	1999	2002	4	

As you can see – it can take years to go from standardization start to mass market adoption



Now – Let's Fast forward to today and IoT

IoT is in the exact same situation

- Many players everyone wants a piece of the market
- Fast growing market
- Fragmented implementations
- Interoperability is at a minimum
- Consumer confusion on how to implement interoperable solutions
- Multiple Verticals (e.g. healthcare, transportation, smart home, etc.)



Forecasts for the IoT

Global shipment volume of Wi-Fi (Wireless-Fidelity) connected devices reached around 2.27 billion units in 2014, up 18% year-on-year.

Source: Market Intelligence & Consulting Institute, MIC, April 2015

It is projected that by the end of 2025, there will be in excess of 95 billion IoT connected devices and that annual shipments will have reached 14.5 billion devices per annum. Source: CABA, June 2015

As demand grows and prices fall, [Business Insider] anticipates that connected home device shipments will quadruple over the next five years, to hit 1.8 billion units shipped in 2019.

Source: Business Insider, Mar 2015

Between 2014 and 2019, sensor shipments will surge with a CAGR of 11.4 percent, culminating in a total of 19.1 billion sensors by 2019. Revenues will rise 6 percent annually as a result. Source: IC Insights, April 2015 "IoT (Internet of Things) market in China expected to grow at a CAGR of 32.15% over the period 2014-2019"

Source: TechNavio, March 2015



Global Revenue from Shipments of Residential Internet of Things Devices is Expected to Reach Nearly \$70 Billion in 2025 Source: Navigant Research, June 2015

"The expectations for the Internet of Things are impressive. According to Cisco, the Internet of "Everything" is a \$19 trillion opportunity, while companies like GE see markets like healthcare garnering an extra \$63 billion in incremental value over the next 15 years."

Source: UPnP Forum whitepaper, April 2015



The Challenge

- It is 2015 the market in 2020 is forecasted to be 20 billion devices with 1.8 billion being shipped a year
- It takes about 8 years to take standards from start to mass market implementation

We are already late – We need to come together as an Industry to lessen fragmentation and enable standardization to ensure maximum market growth and interoperability



In The Meeting Today

- You will hear from industry (and consortia) experts working together to solve the IoT interoperability issues
 - UPnP
 - Device discovery and control
 - Beyond the home network
 - DLNA
 - Display and content interoperability
 - OIC
 - IoT connectivity interoperability

These groups (and others) all have liaisons to work together for a holistic standards approach to IoT interoperability!!



Enjoy the Sessions and the Demonstrations!!



UPnP+ and the Internet of Things July 2015



UPnP Forum www.upnp.org

© 2015 UPnP Forum



- UPnP is one of the most widely adopted connectivity standards worldwide
- The Internet of Things requires a robust discovery, service & service framework
- The UPnP Forum developed UPnP+ with the Internet of Things in mind
- UPnP+: Builds upon the foundation of UPnP with increased focus on cloud, security, scalability and services



UPnP: A Proven Foundation For Connectivity

- Over 2 billion devices powered by UPnP
- The UPnP Forum has 15 years experience developing connectivity frameworks
- Built on a foundation of flexible and scalable data models
- Existing device control protocols for home automation devices
- Available in open source and commercial environments, across every major operating system and programming language



The Next Frontier: Internet of Things

- The Internet of Things is expected to be a \$19 trillion market opportunity
- Every industry across the industrial, enterprise and consumer market sectors will be impacted by the Internet of Things
- There is no universal standard for discovery and service delivery in the Internet of Things
- UPnP's maturity and market acceptance make it the logical choice for the Internet of Things



The Need for a Smarter Home

- More and more devices are connecting to the home network and the out to the Internet
- The Smart Home is moving from Islands of Things to the Internet of Things (IoT)
- IoT is driving a whole new market segment and ecosystem of devices
- Manufacturers and developers want open connectivity based on industry standards
- **Consumers want**
 - New products to integrate with what they already have
 - Everything to work together
 - Access and control from anywhere and at any time
 - Everything to be easy to use
 - Useful information to help guide them through the buying process



How UPnP Forum Has Met The Challenge

- New Testing Tools
- Enhancements to the UPnP Device Control Protocols (DCPs) and UPnP architecture
- UPnP[®]+ for Cloud and remote access
- Rigid Cloud Security
- Enhanced compatibility and interoperability through UPnP Bridging
- UPnP+ for the Internet of Things (IoT)
- IoT Management and Control (Device Control Protocol)
- Enhanced Device Protection
- Enhanced Device Management
- Enhanced Services for networking and A/V
- Data Modeling for new devices
- Better management for low power devices
- Integration with resource constrained devices
- Better integration and control for home power management and the utilities



New Usage Scenarios

Social Media Integration

- Universal connectivity through UPnP+ Cloud
- Interaction using Extensible Messaging and Presence Protocol (XMPP)
- Sharing using secure Virtual Chat Rooms
- Management using secure Role-based Access Control

Cohesive Device Interaction And Control

- Universal connectivity through UPnP[®] Bridging
- Bidirectional integration and communications to other non-IP networks (Bluetooth, ZigBee, Z-Wave, CoAP, etc.)
- Access, control, and monitoring through a single Control Point interface

Device Modeling

- Standardized support for the creation of new Data Models or SensorTypes
- Extensible interoperability and manageability with the rest of the UPnP ecosystem
- New levels of innovation and connected solutions within a set of standardized Data Models



What is UPnP+?

- **UPnP+** is a new certification level for UPnP devices and services
- UPnP+ uses a simple and complete certification program with new enriched test tools that are available now
- UPnP+ is fully backwards-compatible with existing UPnP devices and services
- UPnP+ supports full integration of IPv6 with seamless backwards compatibility to IPv4
- UPnP+ provides an improved interoperability baseline incorporating the latest specifications including A/V, Device Protection, and Energy Management



Why is UPnP+ necessary?

Audio/Video Devices



Gateways



Internet of Things







- Remote Cloud Access
- Richer content support: Playlist, Multitracks,...
- Updated to IPv6 & HTML5
- Tighter security
- Updated to IPv6

NEW DEVICES!!! -Flexible architecture -Flexible data model -Strict security -Virtual Cloud device

... and interoperability



What is UPnP+ Cloud?

- Adds cloud services extending the utility of UPnP devices over the Internet
- Builds upon mature UPnP core technologies that already provide a base for IoT
- Enables existing UPnP specifications and devices to be UPnP Cloud capable
- Enables device and service discovery through the UPnP Cloud
- Combines UPnP and XMPP ecosystems to enable new IoT possibilities
- Connects UPnP Devices (UCCD) and Control Points (UCC-CP) as XMPP clients via an XMPP server
- Leverages commonly used web technologies to create secure communication between devices
- Uses role-based access control with read-only actions for untrusted devices
- Supports simple, data-based device descriptions for the incorporation of resource-constrained devices
- Provides a path for low-risk and rapid implementations of UPnP Cloud solutions



What is UPnP Bridging?

- Allows different local communication and protocol networks to interact as one, even if they do not use IP-based networking
- Includes seamless bridging to existing device network protocols such as Bluetooth, Z-Wave, or ZigBee
- Provides a development platform for "home automation hub" manufacturers to integrate with the billions of UPnP devices already in the home
- Aggregates the control point and management interfaces to include disparate technologies and connectivity implementations



- Uses role-based access control with read-only action for untrusted devices
- Adds cloud services extending the utility of UPnP devices over the Internet
- Supports IPv6 as well as IPv4 (for legacy devices)

⇒Uses a simple and complete certification program with new enriched test tools



UPnP+ Certification Overview

UPnP+ Certification

Framework	Floating Services	Latest Version of DCPs
UDA 2.0 • Dual IPv4/IPv6 Support • Cloud-Capable	DeviceProtection	AV:4 • MediaRenderer:3 • MediaServer:4
	FriendlyInfoUpdate	IGD:2
	EnergyManagement	Optional or Conditionally Required Services • ConfigurationManagement
	BasicManagement	SoftwareManagement QOS



UPnP Cloud Overview





UPnP UPnP Cloud – Devices as JIDs

 UPnP Cloud Capable Devices (UCCD) and Control Points (UCC-CP) as XMPP clients, for example "user@upnpcloud.com/urn:upnp-...MediaServer:4...uuid"





Why Security?

Do we really need to ask this question? It is considered essential for IoT to be successful.

- need to protect against malware
- unauthorized access
- DoS attacks
- Privacy is also a consideration.
- UPnP+ provides
- Device Management Services
- Secured communication (LAN and Cloud)
- Role based access



Cloud Security

UPnP Cloud Architecture uses XMPP for cloud connection. Since servers have FQDN this works for any device connected to internet.

These connections are considered quite secure:

- XMPP requires SASL for authentication and TLS for link encryption.
- Eventing uses XMPP PubSub with whitelisting.

•Device sharing is private until a user decides to share outside of their account such as in a secure room.



Cloud Use Cases

- Sample use cases enabled:
- Share information by means of the cloud only, by turning off UDA (LAN) interface.
- ROOMS
 - Create a virtual, secure room, where you can share your TV (or Moms TV).
 - Invite a visitor to that room to use yout TV to display their pictures (or display your pictures to Moms TV).
 - The visitor can use a guest WiFi network or the 3G/4G network on his mobile phone (do not have to share your WiFi password!)
 - The room can be destroyed once sharing is complete.
- Send your content to your home storage.

UPPPERUM LAN Security – DeviceProtection

- DeviceProtection provides role-based access control
 - 3 default roles supported "Public", "Basic", "Admin"
 - Can also add user-defined roles
- When using device protection, unsecured control points still can use the device, i.e. default role of "Public"
 - However, the functionality is then restricted to "open" actions depending on the authenticated role of the control point
- Most actions are profiled so data can be read, but not modified
 - Example 1: a "Public" control point can browse AV-CDS content, but cannot delete or add content
 - Example 2: a "Public" control point may observe the status of a software update but only "Admin" can trigger update.



UPnP+ and the Internet of Things

Ready today

Demo



Demo Setup





Demo Setup



Future Connected Devices





UPnP+ Sensor Bridging

- Provide expanded support for low power sensors that need bridging to the rest of the Internet
 - Low Power efficient bridge
 - Pass-thru and/or storage of existing data

UPnP Non-IP Devices UPnP+ Sensor Bridge Ecosystem Any logical device with non-IP PHY and IP Low Power Standard-based Data Push Access Anywhere Bluetooth Bridged Network Access ZiaBee Sensor Data Forwarding Data Store (Optional)



Bridging concepts

UPnP embraces other technologies by Bridging.

- Different transports
- Different DataModels
- Different technologies mapped to same technology:

All data can be accessed in and outside the home in the same way: unifying the different technologies in the system

UPnP Sensor Network Infrastructure





UPnP IoT Architecture Overview



UPPER IOT Management and Control: Data Model

- An IoT Sensor is defined as a set of SensorURNs
- Generic SensorURNs can be used by multiple devices
 - Standard SensorURNs
- Defining a set of sample devices that use those SensorURNs
 - Standard SensorTypes
- Manufacturers can create their **own SensorTypes** and still maintain interoperability
 - Just have to use standard SensorURNs
- SensorTypes and SensorURNs are like "interfaces"



IoTManagementAndControl Bridge via Apps

Apps										
Runtime										
UPnP SensorManagement		UPnP _{CP}	UPnP AppManagement							
UPnP UCA	UPnl	P DA	•		Apps - driver					
IP					BNx		BNx			

Applications UPnP DCPs UPnP infrastructure Bridged network infrastructure



IoTManagementAndControl Overview



SensorManagement is a UPnP Device

- 2 Mandatory Services
 - ConfigurationManagement
 SensorTransportGeneric
- 2 Optional Services
 - DataStore
 - DeviceProtection





DataModel Refrigerator Example



DataModel Refrigerator (Cont)





UPhP Ongoing work

- Extend list of Common Device Identifiers
 - Support more devices!
- Extend list of Data Items
 - Support more types of actuators/sensors
- Extend list of locations
- Incorporate scripting engine



Sources of Models

- Member companies vendor specific models
- Some popular home devices and bridges
 - HUE, StriimLight, WeMo, ..
- Other SDOs
 - ongoing evaluation based on IPR and accessibility
- Short list of Generic Models and Features
 - UPnP IoT Data Model Task Force



Sustainable Data Model Strategy

• UPnP has been connecting things for a dozen years with **seamless service discovery and control**



- Data models can contain atomic elements and other data models
- UPnP selects official models
- All models are owned and authenticated to owner
- User driven
- Self documenting
- Ensures compatibility
- Must be member to submit a model
- Integrate UPnP member registration right in the process



Technology is ready:

- Specs are publicly available at www.upnp.org
- •Demo source code available: https://github.com/upnpforum
- Works in the home and over the Internet
- •Sharing with others is 100% under user control
- Certification program is up and running
- Process in place to incorporate new data models



UPnP^M UPnP+ Next Steps

New Features to Fit Industry Needs







Questions?



Contact Us

- Scott Lofgren, Intel
 - President & Chairman
 - <u>scott.o.lofgren@intel.com</u>
- Clarke Stevens, CableLabs
 - Technical Committee Chair, IoT Task Force Chair
 - <u>c.stevens@cablelabs.com</u>
- Aja Murray, UPnP Forum
 - Executive Director
 - upnpadmin@forum.upnp.org
- Follow us on Twitter <u>@UPnP Forum</u> or join the Forum' s Facebook community at <u>http://www.facebook.com/UPnPForum</u>



JPnP Cloud source code

- https://github.com/upnpforum
- UPnP Cloud Device Applications
 - Sample desktop applications implementing UPnP Cloud Architecture (UCA). The repository contains the implementation of the following UPnP devices: DimmableLight, MediaServer, MediaRenderer and a light bulb modelled as a SensorManagement device.
- UPnP Cloud Controller Application for Android
 - Sample Android application capable of controlling several types of network devices connected using UPnP protocol for both local (UDA) and cloud devices (UCA).



Other Resources

- Website: <u>www.upnp.org</u>
- UPnP Forum Invites Orgs to use UPnP+ Certification
 - http://upnp.org/news/documents/UPnP_UPnPPlusCertificationLaunch_Nov2014.pdf
- Overview: UPnP+ Initiative
 - http://upnp.org/latestupdates/upnpplus/

Presentation: UPnP Internet of Things Overview

http://upnp.org/resources/documents/UPnP_IoT_Overview_Dec2014.pdf

Presentation: UPnP: The Discovery & Service Layer for IoT

http://upnp.org/resources/documents/UPnP_Internet_of_Things_OverviewPresentation_2015.pdf

Presentation: Bringing UPnP to the Cloud and IOT

http://upnp.org/resources/documents/Bringing_UPnP_to_the_Cloud_and_IoT_May2014.pdf

Whitepaper: UPnP Enabling Standard IoT: Future-proofing device communications

http://upnp.org/resources/whitepapers/UPnPEnablingIoT_2014.pdf



For the interconnected lifestyle