Why You Should Upgrade to UPnP+

February 2015
• What is UPnP+?
• Why is UPnP+ necessary?
• How does UPnP+ deliver these benefits?
• What’s New in UPnP+ for UPnP Device Architecture?
• UPnP Cloud Architecture in UPnP+
• UPnP+ Security and DeviceProtection
• UPnP+ DCP Versions
• UPnP+ and the Internet of Things
• Upgrade to UPnP+
What is UPnP+?

• UPnP+ is a new certification level for UPnP devices and services

• It is fully backwards-compatible with existing UPnP devices and services
Why is UPnP+ necessary?

Audio/Video Devices
- Remote Cloud Access
- Richer content support: Playlist, Multitracks,...
- Updated to IPv6 & HTML5

Gateways
- Tighter security
- Updated to IPv6

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

... and interoperability
How does UPnP+ deliver these benefits?

- 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

**Framework**
- UDA 2.0
  - Dual IPv4/IPv6 Support
  - Cloud-Capable

**Floating Services**
- DeviceProtection
- FriendlyInfoUpdate
- EnergyManagement
- BasicManagement

**Latest Version of DCPs**
- AV:4
  - MediaRenderer:3
  - MediaServer:4
- IGD:2
- Optional or Conditionally Required Services
  - ConfigurationManagement
  - SoftwareManagement
  - QOS
### What’s new in UPnP+ for UPnP Device Architecture?

<table>
<thead>
<tr>
<th>Specification</th>
<th>UPnP Certification</th>
<th>UPnP+ Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>UDA</td>
<td>• UPnP version 1.0 is a minimum requirement,</td>
<td>• UPnP version 2.0 is a minimum requirement</td>
</tr>
<tr>
<td></td>
<td>• UPnP version 1.1 is optional</td>
<td></td>
</tr>
<tr>
<td>IPv6 Annex</td>
<td>• UPnP certification requires IPv4 support</td>
<td>• UPnP+ certification requires dual-stack (IPv4/IPv6) implementation as described in the new UPnP UDA annex</td>
</tr>
<tr>
<td></td>
<td>• IPv6 support is optional and the currently published IPv6 annex is out of date</td>
<td></td>
</tr>
<tr>
<td>UDA Cloud Annex</td>
<td>• UDA V1.0 devices cannot be certified as cloud devices, however legacy UDA V1.0 devices can be bridged to the cloud using a UPnP+ certified CPDev Cloud Proxy device</td>
<td>• UPnP cloud device support (UCCD) is mandatory for UPnP+ device certification</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• UPnP cloud control point support (UCC-CP) is mandatory for UPnP+ control point certification</td>
</tr>
</tbody>
</table>
UPnP+ Brings UDA 2.0

• Clarifications in the UDA specification
  • Support for Control Point identification
  • Subscription support for individual state variables
  • A clarification was made that UDA 2.0 control points shall be backwards compatible with UDA 1.x devices
  • Version mapping clarification
  • Initial bye-bye clarification
  • M-search responses clarification
  • Various language editorial changes for consistency

• An updated IPv6 Annex that brings the IPv6 requirements up to date with the latest IETF specifications
  • Requires support of IPv6 as well as backwards compatibility with IPv4 in a dual-stack implementation
  • Allows for unambiguous identification of devices that have both interfaces
  • Includes a selection strategy that ensures IPv4 devices will continue to operate

• A new UPnP Cloud Architecture Annex that defines a unique, secure, and extremely flexible way to use the XMPP protocol to share UPnP devices with people in virtual “chat rooms”
UPnP Cloud Overview

Devices have 2 interfaces
1. LAN side (traditional UPnP)
2. Cloud side (UDA 2.0 Cloud)
3. Unique device identifiable on both interfaces
- **UPnP Cloud Capable Devices (UCCD)** and **Control Points (UCC-CP)** as XMPP clients, for example “user@upnpcloud.com/urn:upnp-...MediaServer:4...uuid”
UPnP Cloud Architecture uses XMPP as a transport mechanism to connect LANs, mobile devices and web services securely over the Internet.

- XMPP requires SASL for authentication and TLS for link encryption and is considered very secure, even over local and public networks.
- Eventing is done over XMPP PubSub so is also secure.

This means all UCCDs and UCC-CPs need to log in to an XMPP account (JID).

- Device sharing is private until a user decides to share outside of their account such as in a secure room.
- UPnP specifications are silent about how you register the device/control point to your account at this time.
Cloud security

- Enables the following use cases:
- 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 your TV to display their pictures (or display your pictures to Moms TV).
  - The visitor can use a guest WiFi network or the 3/4G 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.
# UPnP+ Add-on Services

<table>
<thead>
<tr>
<th>Service</th>
<th>UPnP Certification</th>
<th>UPnP+ Certification</th>
</tr>
</thead>
</table>
| DeviceProtection             | • DeviceProtection:1 is optional | • DeviceProtection:1 is required for UPnP+ certification  
• http://upnp.org/specs/gw/deviceprotection1/  
• http://sourceforge.net/projects/upnpdm/ - an open source implementation from Orange (includes DeviceProtection, DeviceManagement: BMS & CMS & SMS) |
| FriendlyInfoUpdate           | • FriendlyInfoUpdate:1 support is optional | • FriendlyInfoUpdate:1 support is mandatory for UPnP+ certification |
| EnergyManagement             | • EnergyManagement:1 is optional | • EnergyManagement:1 support is mandatory in UPnP+ certification  
• EnergyManagement proxy is mandatory for mains powered devices  
http://upnp.org/specs/lp/energymanagement1/ |
| BasicManagementService       | • BasicManagementService:1 is optional | • BasicManagementService:2 is mandatory |
| ConfigurationManagementServ  | • ConfigurationManagementService:1 is optional | • ConfigurationManagementService:2 is optional |
| SoftwareManagementService    | • SoftwareManagementService:1 is optional | • SoftwareManagementService:2 is optional |
Device Protection

• 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.
Device Protection (2)

• Uses TLS with self generated certificates
  • no trust authority involved

• Secured control points therefore use HTTPS for
  • device and service description downloads
  • invocation of actions allowed by their user role

• Certificate identification is translated to a “recognized” control point
  • e.g. regular user, guest,...

• Additional login required to identify specific users, such as “Admin”

• DCPs can further define roles and distinguish which actions each role has access to, vendors may define additional roles.

• Any control point, including unsecured ones, can still register for events
  • e.g. see what state the device is in
## UPnP+ Device Control Protocol (DCP) Versions?

<table>
<thead>
<tr>
<th>Specification</th>
<th>UPnP Certification</th>
<th>UPnP+ Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>IGD</td>
<td>• IGD:1</td>
<td>• IGD:2 [<a href="http://upnp.org/specs/gw/igd2/">http://upnp.org/specs/gw/igd2/</a>] *</td>
</tr>
<tr>
<td>AV</td>
<td>• AV:1</td>
<td>• AV:4 [<a href="http://upnp.org/specs/av/av4/">http://upnp.org/specs/av/av4/</a>]</td>
</tr>
<tr>
<td>MediaServer</td>
<td>• MediaServer:1</td>
<td>• MediaServer:4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• MULTI_STREAM feature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• CONTAINER_SHORTCUTS feature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• CDS Search()</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• MULTI_STREAM properties are conditionally required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Relaxed Tracking Changes Option</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• TCO properties are conditionally required</td>
</tr>
<tr>
<td>MediaRenderer</td>
<td>• MediaRenderer:1</td>
<td>• MediaRenderer:3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Trickmode Pause() is required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• SetStaticPlaylist(), SetStreamingPlaylist() and GetPlaylistInfo() are required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• GetRendererItemInfo() is required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• GetAllowedTransforms(), GetTransforms(), SetTransforms() and GetAllAvailableTransforms() are required</td>
</tr>
</tbody>
</table>

* note that IGD:1 is deprecated as of March 30, 2015
For MediaServer Device:

• Search and Change Tracking operations on servers: simplify for control devices, aggregation of content for better and faster presentation (CDS Search)
  • Better aggregation improves customer experience, and avoid the current mix (finding photo object under video cause picture not being displayed)

• Facilitate mapping and hence aggregation of UPnP Trees (Container Shortcuts)
  • Fast index into well known access points such as MUSIC, IMAGES, VIDEOS, ...

• Enable support for multiplex elements in servers (MULTI_STREAM)
  • Describes multitrack audio, text subtitles, etc. contained in an multiplexed stream
For MediaRenderer Device:

• Playlist renderer-side operated (SetStaticPlaylist(), SetStreamingPlaylist() and GetPlaylistInfo())
  • Allow to continue operation on playlist from a third party controller (Playlist sharing between control points)

• Pre-checking for playback capability (including DRM) (GetRendererItemInfo)
  • UPnP controller to check if DRM protected content can be played back

• Allow operations on media content (GetAllowedTransforms(), GetTransforms(), SetTransforms() and GetAllAvailableTransforms())
  • Standardized mechanism to rotate image, enable and select subtitles, audio tracks, etc.
  • Multi_STREAM specific transform
Ready today
UPnP embraces other technologies by Bridging.
• Different transports
• Different DataModels
All 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

Technology is ready:
• Specs are publicly available at [www.upnp.org](http://www.upnp.org)
  • Demo source code available: [https://github.com/upnpforum](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 SensorManagement provides bridging to other networks (Bluetooth, ZigBee, Z-Wave, CoAP, etc) by using a SensorManagement bridge with a north-facing UPnP interface

• Built as a UPnP DCP, so UPnP+ mechanisms apply:
  • Device Protection with ACL
  • Cloud extensions
SensorManagement

- Existing DCP that exposes IOT (bridged) Devices.
  - Can be an single device
  - Can be an set of (bridged) devices

- Uses nodes in an tree to define an IOT device
  - Using Collection construct to define an device

- Each IOT Device its own sub tree and is represented by:
  - Device identifiers (Common Device Identifiers)
  - Supported Sensors/Actuators (Data Items)
Sensor Management (2)

• Manufacturer can define own:
  • Device Identifiers
  • Data Items

• Current 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

• UPnP Forum has an open-source demonstration application that shows bridging to Bluetooth
DataModel Refrigerator Example

Refrigerator is a modelled device – can be generic or specific.

Features are named collection of sensors/actuators.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>/UPnP/SensorMgt</td>
<td></td>
</tr>
<tr>
<td>SensorCollectionsNumberOfEntries</td>
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</tr>
<tr>
<td>SensorCollections/</td>
<td></td>
</tr>
<tr>
<td>1/CollectionsID</td>
<td>Collection0001</td>
</tr>
<tr>
<td>1/CollectionsFriendlyName</td>
<td>&quot;Your Refrigerator&quot;</td>
</tr>
<tr>
<td>1/CollectionsInformation</td>
<td>&quot;Vendor Refrigerator Model RF217ACRS&quot;</td>
</tr>
<tr>
<td>1/CollectionsSpecific</td>
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<td>1/SensorPollingInterval</td>
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<td>1/SensorReportChangeOnly</td>
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<tr>
<td>1/SensorsRelatedNumberOfEntries</td>
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<tr>
<td>1/SensorGroupsNumberOfEntries</td>
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</tbody>
</table>
DataModel Refrigerator (Cont)

Model continued from previous slide

<table>
<thead>
<tr>
<th>DataItem</th>
<th>Number of Entries</th>
<th>Description</th>
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<tbody>
<tr>
<td>AccumulatedPowerUsed</td>
<td>9</td>
<td>See Annex A.1.1.1</td>
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<tr>
<td>FreezerTemp</td>
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</tr>
<tr>
<td>GroceryTemp</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>VegetableTemp</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>DoorOpenAlarm</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>PowerFaultAlarm</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>StatusInterval</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Table continues with more data items:

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Encoding</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AccumulatedPowerUsed</td>
<td>uda:ui4</td>
<td>ascii</td>
<td>See Annex A.1.1.1</td>
</tr>
<tr>
<td>FreezerTemp</td>
<td>uda:ui4</td>
<td>ascii</td>
<td></td>
</tr>
<tr>
<td>GroceryTemp</td>
<td>uda:ui4</td>
<td>ascii</td>
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<tr>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Summary

- UPnP+ provides the confidence of proven security, superior interoperability and the new features that make it the most complete and open solution for the Internet of Things.
- The cloud solution of UPnP+ is the simplest and most complete way to securely share devices.
- UPnP+ certification is inexpensive and open source solutions can validate their implementations for free.
- UPnP+ certification is available today.
- More to come...
UPnP+ Next Steps

New Features to Fit Industry Needs

- Cloud
- IGD
- IoT
- Live Register for Data Model
- Cloud Proxy
- NAT Direct (ICE/STUN/TURN)
- RESTful Interface
- Group & Script SensorMgmt
- Group & Script for Control Point

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Thank you

Questions?
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  • Executive Director
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• Follow us on Twitter @UPnP Forum or join the Forum’s Facebook community at http://www.facebook.com/UPnPForum
• **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: [www.upnp.org](http://www.upnp.org)

• UPnP Forum Invites Orgs to use UPnP+ Certification

• Overview: UPnP+ Initiative
  • [http://upnp.org/latestupdates/upnpplus/](http://upnp.org/latestupdates/upnpplus/)

• Presentation: UPnP Internet of Things Overview

• Presentation: Bringing UPnP to the Cloud and IOT
  • [http://upnp.org/resources/documents/Bringing_UPnP_to_the_Cloud_and_IoT_May2014.pdf](http://upnp.org/resources/documents/Bringing_UPnP_to_the_Cloud_and_IoT_May2014.pdf)

• Whitepaper: UPnP Enabling Standard IoT: Future-proofing device communications
For the interconnected lifestyle