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The UPnP Forum is a Means to an End

Salim AbiEzzi, PhD., Microsoft Corp., Steering Committee Chair

I would like to use this column to clarify a central point about the Forum and its relation to the industry. People often tell me, "We're waiting for the Forum to define standard 'X' and then we will implement it." Or ask, "Why hasn't the Forum defined standard 'Y' yet?"

Forum activities, in order to succeed, need to be driven by business entities. First, companies need to believe in a business opportunity that requires device standards. Then these companies, together with their colleagues and partners, need to provide the resources and drive the development of these standards.

The notion that the Forum defines standards and then offers them up to businesses is not realistic. On the one hand, the Forum has no resources of its own. On the other hand, without the leadership and direct participation of the businesses that will ultimately deploy these standards, the resulting standards will likely not be the correct ones for their products.

The Forum is a means to an end. By providing the following, the Forum facilitates a process driven by businesses:

1. A joint development agreement (the UPnP membership agreement) signed by executives from more than 300 companies. This agreement provides clearly articulated and agreed upon intellectual property terms that allow engineers from different companies to design together.

2. A common device architecture, with foundational protocols for device interoperability, on which device standards are based.

3. A certification and logo program to ensure objective testing of products for standards compliance.

Companies that have a stake in the outcome are responsible for the remainder of the work-defining device standards and building related end-to-end interoperable solutions for customers.

In summary, the Forum (and I as the Chair) are here to help, but members need to reach out, invest, and drive towards each company's respective business objectives. To borrow a famous quote, "Ask not what UPnP can do for you, ask what you can do for UPnP."

Welcome New Forum Members Since October 2000*

Active Planet Software
Analog Devices Inc.
ASUSTek Computer Inc.
ATEN Advance Tech Inc.
ATEN Technology, Inc.
Atinav Inc.
B2C2, Inc.
Barix AG
Boston Acoustics Inc.
Celsius Technology Ltd.
CharBroil Division of W.C. Bradley
Comtech Ltd.
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Digi-Frame Inc.
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GMD Fokus
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Greenfern Corp.
Hager Electro SA
Harman Consumer Group
Heidelberg Digital LLC
Home Director, Inc.
HomeX
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IQ-Home
ISR Inc.
Ivistar AG
Konica Corp.
Lab 7 Networks
LapLink.com
Linkware Technologies, Inc.
Minolta Company, Ltd.
NetEngines Ltd.
Netreon, Inc.
NSTL
P&S DataCom
Panasonic Semiconductor
Phonex Broadband
Plustech Inc.
Qubit Technology Inc.
RF Waves Ltd.
Singingfish.com**
SIT La Precisa SpA
Switchbox Technology Corporation
TAC AB
Tritech Wireless AB
Valence Semiconductor
Zayante Inc.

For a complete list of UPnP Forum members, please visit **www.upnp.org/forum/members.htm.**

*** This list was accurate as of March 29, 2001, bringing total Forum membership to 334 companies.**

Technical Committee: Three Ways to Approximate Dynamic Services

Jeffrey Schlimmer, Microsoft Corp., Technical Committee Chair

One of the recent accomplishments of the Technical Committee is an explanation of three ways to approximate dynamic services instances within UPnP. This topic is described below. For examples, please see the online version of this article at **www.upnp.org**.

Statically enumerate instances of the same service type

One way to approximate dynamic service instances within UPnP version 1.0 is to statically enumerate a large number of instances of the same service type, each with different service identifiers. A control point could invoke an allocate action that would return a service identifier that has been allocated for the control point to use. The allocation action should probably lease the service to the control point, i.e., provide a token that a control point would have to explicitly renew from time to time to continue using the service. This isn't truly dynamic since there is a predetermined maximum number of service instances.

UPnP does require, within a device description, a listing for each service instance that includes a service type, a service identifier, and URLs for control, eventing, and a service description. Typically, for multiple instances of the same service type, the URL for the service description would be identical.

Parameterized access to a single service

A second way to approximate dynamic service instances within UPnP version 1.0 is to pass a service identifier as a parameter to all actions within a single, common service. An allocation action would return a token to be passed to all other actions. The allocation action should probably lease the token to a control point, i.e., provide a token that a control point would have to explicitly renew from time to time.

The device description would list the single allocating service. The service description would include a special parameter to each action for the allocation token.

Dynamic root devices

A third way to approximate dynamic service instances within UPnP Version 1.0 is to dynamically create a new root device each time a dynamic service instance would be needed. A control point could invoke an allocate action that would return a device UDN (Unique Device Name) for a root device that was created for the control point to use. The allocation action should probably lease the root device to the control point, i.e., provide a token that a control point would have to explicitly renew from time to time to continue using the root device. While this isn't truly dynamic services, it is dynamic devices.

When a dynamic root device was created, it would have to be advertised, just as all UPnP devices are.

Comparison

The table below summarizes the relative benefits of these three means for approximating dynamic service instances.

	static enumeration	parameterized access	dynamic devices
Static instances	*n*	1	1
Dynamic instances	*n* [1]	*n*	*n* [2]
Device description	*n* * service declaration [3]	1 service declaration	*n* * device description
Eventing	per instance	all-in-one [4]	per device-instance

[1] A disadvantage of the static enumeration approach is that the maximum number of service instances must be declared in the device description. Other approaches may declare the maximum number via the allowedValueRange of a state variable or via the run-time value of a state variable (see examples).

[2] A disadvantage of the dynamic device approach is that devices that do not correspond to physical containers will be disappearing/reappearing at regular intervals. This may yield a poor user experience on control points that provide direct listings of root devices.

[3] A disadvantage of the static enumeration approach is that the device description is longer. I.e., if there are *n* statically enumerated instances of the same service type, this approach lists *n* service instances, including 2*(*n*-1) redundant XML elements, one for the service type and one for the service description, both of which would be identical for all *n* instances.

[4] A disadvantage of the parameterized access approach is that a control point cannot subscribe to events from a specific "service;" it receives events corresponding to state variable changes in all "services."

UPnP Discovery of Multiple Instances of a Device or Service

Steve Timm, Microsoft Corp., Working Committees Program Manager

UPnP control points use Simple Service Discovery Protocol (SSDP) to discover UPnP devices and services on a network. This article examines UPnP discovery messages, particularly those components used to identify multiple instances of a UPnP device or service type. UPnP discovery explicitly identifies each unique instance of a UPnP device type. Because multiple instances of a service are not exposed by UPnP discovery messages, UPnP discovery does not require every service instance to be advertised, only every service type.

Name space uniquely identifies UPnP device and service types

UPnP discovery takes place in two ways. First, when a device is added to a network, it advertises its presence and a control point caches the information contained in the advertisement. Second, device discovery takes place when a device responds to an M-SEARCH request issued by a control point. In both cases, SSDP protocol is used to exchange discovery messages identifying one or more unique device or service types and their version numbers.

A device or service type is uniquely defined by a prefix consisting of a registered domain name, followed by the name of a UPnP device or service type that is unique in that domain. Since each UPnP standard may define options, each instance of a UPnP device or service type may vary depending on the options that are implemented. It therefore becomes important to distinguish between each instance of a device or service type.

Discovering multiple instances of a device type

UPnP distinguishes between multiple instances of a device type by assigning a universally-unique identifier (UUID) to each device instance. The UUID is specified in the Unique Device Name (UDN) element contained in each device's XML description. The UUID for each device is also included in the Notification Type (NT) and Unique Service Name (USN) headers of each series of SSDP discovery messages issued by a device. This approach allows control points to cache advertisements for each instance of a

UPnP Identified as Solution for Key Windows XP Scenarios

Mark Madigan, Microsoft Corp., Forum Member

UPnP has been identified as the best technology to help overcome a growing barrier to great connected home user experiences: the issue of traversing Network Address Translation (NAT) devices. Great progress has been made to clearly articulate how this UPnP-enabled NAT traversal support can be incorporated into such devices to enable their commercial availability in second half of 2001.

Recognized and promoted as an effective security solution for always-on Internet connections in the home, Internet gateway devices (IGDs) employing NAT assign IP addresses in accordance with RFC 1918 to clients on the private LAN. This provides home computers with an important security mechanism to help prevent attacks from the Internet. In addition, IGDs also provide Internet sharing capability, allowing multiple computers to share one Internet connection. The number of these devices sold into the home is increasing dramatically: Cahners-In-Stat estimates shipments of IGDs will grow from 819,000 units in 2000 to over 13.1 million units shipped in 2004 in North America alone. This tremendous growth puts the total number of IGDs in US homes at more than 33 million by 2004.

As the Microsoft team worked to enable various scenarios made possible by Windows XP®, Microsoft's next-generation Windows operating system, the team needed to account for the

continued on page 5

UPnP Device Certification Process Update

Karen Stash, Microsoft Corp., Program Manager, Device Certification

The UPnP Device Certification Process outlines the steps vendors follow to certify a device as UPnP-compliant and to obtain the UPnP logo. We anticipate certification of a limited number of devices to begin in Spring/Summer 2001. Preparing the certification process has required both legal work and the creation of the process itself.

To date, the Legal Subcommittee, comprised of the Compliance Task Force and appointed legal counsel of several Steering Committee member companies, has met regularly and engaged the law firm Latham and Watkins.

news & events

Second UPnP Plug Fest

Arlene Binuya Murray, Microsoft Corp., Forum Executive Administrator

Metro Link, Inc. hosted the Second UPnP Plug Fest in January with support from ZiLOG, Inc. More than 35 individuals from twelve companies met in Ft. Lauderdale, Florida, for the two-day engineering event. Categories of devices tested ranged from implementations of gateway devices and audio players to security cameras and printers.

Most of the vendors who attended the Plug Fest have implemented the complete UPnP stack. Everyone who attended agreed that the nature of issues being identified and resolved was more complex this time, and test and interoperability events such as the Plug Fests are important to the development of UPnP products.

Microsoft will host the Third UPnP Plug Fest in Redmond, Washington, on May 29-31, 2001. Event details and registration are available at **www.upnp.org/events.htm.**

UPnP Events and Partner Pavilion Opportunities

In an effort to further marketing opportunities for Forum members, following is a list of upcoming UPnP Forum Partner Pavilion events

Connections 2001
www.connectionsconference.com

May 9 - 11, 2001
Washington State Convention Center, Seattle
For: Product/tool/component vendors
Cost: $4000 for 10'x10' space, one conference pass, one exhibit pass
Contact: Steve Harvey at
harvey@parksassociates.com

PC Expo
www.techxny.com/pc_expo/index.html

June 26 - 28, 2001
New York Javits Center, New York City
For: Product/tool/component vendors
Cost: $8100 for booth space, power, Internet, signage, unlimited show floor passes
Logistics contact: Kim Kopp at
kimkop@microsoft.com

Fifth Universal Plug and Play Forum Summit
www.upnp.org

September or October 2001 (tentative)
Microsoft Conference Center, Redmond, WA
For: Product/tool/component vendors
Cost: $3000 for booth space, power, Internet, signage, for conference passes
Contact: **upnpevnt@microsoft.com**

If there are specific events at which a member feels it is important for the UPnP Forum to host a partner pavilion, please let us know by sending email to upnpevnt@microsoft.com.

UPnP at Intel Developer Forum

Preston Hunt and Prakash Iyer, Intel Corp., Forum Members

Intel promoted UPnP through events at the most recent Intel Developer Forum.

First, the Intel UPnP team presented a class on enabling UPnP technology in Internet gateways. The class covered details of the Internet gateway DCP, key usage scenarios enabled by a UPnP Internet gateway, and what it takes to add UPnP support to the three most common gateway platforms (DSL, Cable, and Ethernet). For more information about this class or participation in the UPnP Internet Gateway Working Committee, email **prakash.iyer@intel.com.**

Second, the team presented a class on how UPnP can improve the user experience on a home network. The nearly 200 attendees received an intermediate-level overview of the key features and benefits of UPnP, followed by a live demonstration of a sample UPnP-enabled audio jukebox. A step-by-step demonstration showed how easy it was to add UPnP functionality to the audio jukebox using the Intel UPnP SDK for Linux. For more information about this class, email the instructor, Preston Hunt, at **phunt@intel.com.**

Finally, throughout the conference, Intel Architecture Labs demonstrated the UPnP technology to hundreds of visitors at its booth.

Future UPnP classes are planned for the Fall Intel Developer Forum to be held August 2001 in San Jose, California. For more information about IDF, please visit **www.intel.com/idf.** For information about Intel's UPnP SDK for Linux, please visit **upnp.sourceforge.net.**

Axis Releases Test Design for UPnP Network Camera

Bengt Christensson, Axis Communications, Forum Member

Axis Communications has released UPnP test firmware for the award-winning AXIS 2100 Network Camera. The firmware provides developers with the first reference design for a networked UPnP camera. The AXIS 2100 delivers live video streams using any standard Web browser and is used for applications such as remote monitoring and surveillance.

The UPnP test firmware release for the AXIS 2100 Network Camera gives developers the opportunity to perform actual testing of UPnP user control points to accelerate their own development of UPnP-enabled products. The test firmware is available as a free download from the Axis Web site at **www.axis.com** and can easily be uploaded into a standard AXIS 2100 Network Camera, which is available through major distribution channels.

Axis Communications is a world leader in network peripherals and networking technologies and an active developer and Steering Committee member of the Forum. The company has been involved with the UPnP initiative since its inception in 1999. Axis was first to demonstrate a working UPnP-enabled prototype network camera at the Microsoft Home Living Room demonstration last year at COMDEX.

Digi-Frame to Develop UPnP Picture Frames

Neal Kublan, Digi-Frame Inc., Forum Member

Digi-Frame Inc., a leading provider of digital picture frame technology, announced it is developing a UPnP-enabled digital picture frame to ship in the fourth quarter of 2001. The picture frame will work seamlessly with computers and other peripheral devices on a network without complicated set-up and configuration, making it ideal for homes and small businesses. UPnP technology enables Digi-Frames™ to be automatically recognized by other connected UPnP-enabled devices.

The UPnP-enabled Digi-Frames will allow consumers to display their pictures without needing to subscribe to a proprietary imaging network. Consumers using Windows® Me-based PCs or other UPnP-compatible computers and appliances such as digital cameras and printers will be able to transfer images to and from their Digi-Frames display.

Digi-Frame's engineering team is an active participant in the UPnP Electronic Picture Frame (EPF) Subcommittee. For more information, please visit **www.digi-frame.com**.

Home Director Demonstrates UPnP Applications

Tom King, Home Director, Inc., Forum Member

Home Director, Inc , a home networking technology company, debuted its ControlPoint™ home networking software at the 2001 Consumer Electronics Show in January. The software allows homeowners to easily connect to and control all of a home's networked systems and devices. Home Director's ControlPoint, a UPnP-based control point for networked devices in the home, is accessible from Web-enabled clients, including personal computers, Web pads, handheld computers, Personal Digital Assistants (PDAs) and mobile phones.

ControlPoint automatically discovers and configures devices on the home network, identifies digital content including audio files and digital images, and generates a central resource list. Using the ControlPoint interface, users can then select content from the resource list and stream music from a home computer to any room in the house or create digital photo albums to make available to friends and family via the Internet.

Home Director is also developing UPnP hardware devices, to be available in the third quarter of 2001, that enable and complement the ControlPoint software, including a networked audio player that interfaces with legacy stereo equipment. Another UPnP device enables non-UPnP devices, such as lighting and HVAC systems, to participate in the home network and be managed from the ControlPoint interface.

UPnP Discovery of Multiple instances continued from page 2

device type advertised. It also allows control points to search for a device type and receive responses for each instance of that device type that exists on the network.

Discovering of multiple instances of a service type

If each device contains a single instance of a service type, then each service type may be uniquely identified by its device container. However, some devices may contain multiple instances of the same service type. Multiple instances may be desirable to associate a service instance with different data or device ports. For example, a printer device may instantiate a print service for each print job requested.

To discover multiple instances of a service type in a device, UPnP control points download the XML description for the device containing the service. The URL for this description can be obtained from the Location header defined by SSDP discovery messages. Within a device's XML description, a serviceId is required to identify each instance of a service type. This approach allows control points to identify a unique instance of a service type when multiple instances exist in a device.

Every service type must be advertised

UPnP does not require that every service instance be advertised, only every service type. If a device has d devices and n services but only k distinct service types, then there are $3 + 2d + k$ discovery messages (advertisements, cancellations, and M-SEARCH responses) – not $3 + 2d + s$ messages. This is because the serviceId does not appear in any discovery advertisements; only the serviceType does.

Note that UPnP version 1.0 requires an XML device description for each service instance including a service type, a service identifier, and URLs for control, eventing, and a service description. Typically, for multiple instances of the same service type, the URL for the service description would be identical.

For examples, see the online version of this article at **www.upnp.org**.

Allegro Ships UPnP Toolkit

Bob Van Andel, Allegro Software Development Corp., Forum Member

Allegro Software is now shipping the first of a family of UPnP ANSI-C source code toolkits for embedded devices. Building on the existing RomPager family of embedded Internet toolkits, the RomUPNP toolkits allow device vendors to add UPnP support with a minimum of effort.

The RomUPNP Basic toolkit supports the discovery, description and presentation layers of UPnP when used in conjunction with the RomPager Web Server toolkit. A memory footprint as small as 20Kb for the combined toolkits provides a cost-effective way for a device to appear on Microsoft Windows® Me and Windows XP desktops.

The RomUPNP Advanced toolkit adds support for the control and eventing layers of UPnP and includes the RomPager Advanced Web Server, the RomWebClient (HTTP 1.1 client) toolkit and RomXML parser/framer toolkit. The Advanced toolkit provides complete UPnP control point interoperability in under 80Kb.

The upcoming RomUPNP Control toolkits will provide UPnP control point functions for interoperating with UPnP devices.

As with other products in the RomPager family, the RomUPNP toolkits support all the leading real-time operating system environments.

For further information on the Allegro family of embedded Internet products see **www.allegrosoft.com.**

Intel UPnP SDK for Linux Update

Dan Baumberger, Intel Corp., Forum Member

In February 2001, Intel released version 1.0.2 of the UPnP SDK for Linux. This new version adds support for Linux running on an Intel®StrongARM® processor-based system. It also incorporates fixes for some small issues, many of which were identified by the open source community.

Originally written by the Intel Architecture Labs (**www.intel.com/ial/upnp**), the UPnP SDK 1.0.2 for Linux is an open source effort. The royalty-free source code may be downloaded from **upnp.sourceforge.net**. The web site also hosts discussion mailing lists related to the UPnP SDK. Please contact the project administrator listed on the Web site if you are interested in

Microsoft UPnP Development Kit

Steve Judkins, Microsoft Corp., Forum Member

The final release of the Microsoft UPnP Development Kit is now available at **www.microsoft.com/hwdev/upnp**. The kit is a great resource for creating UPnP devices that interoperate with Microsoft® Windows®. The kit's simplified reference device sample code, documentation and tools help get Windows-compatible UPnP devices to market faster.

While devices can be developed for a variety of operating systems and platforms, the UPnP Development Kit is designed specifically to help build UPnP devices that interoperate with Microsoft Windows Me, Microsoft Windows 2000, Microsoft Windows XP Home Edition, and Microsoft Windows XP control points.

A complete and straightforward sample for the Windows platform is included along with a simplified reference implementation of a UPnP version 1.0 device.

There are no restrictions on the use or modification of the kit's source code when it is used to build UPnP software devices and applications. There is no cost or royalty for use of the kit or the sample code.

Metro Link Releases Java UPnP SDKs for Embedded Systems

Robert Lembree, Metro Link, Inc., Forum Member

Metro Link has released the Metro EnableWorks™ UPnP Software Development Kits (SDKs), which support the Java™ platform. Consisting of a UPnP Device SDK and a UPnP Control Point SDK, Metro EnableWorks provides the developer with a fast, easy path to UPnP compatibility for embedded applications such as set-top boxes, Web pads, wireless devices, audio-video equipment, appliances, and other electronic devices.

The SDKs come with full Javadoc documentation, as well as documentation describing the process of building devices and control points. Working sample code, including sample devices and sample control points, is also included. Metro EnableWorks customers can have UPnP running within minutes of installing the SDK.

The Metro EnableWorks SDKs simplify the development of UPnP-compatible devices by handling all aspects of device discovery, description, control and eventing, through a simple, well documented Java object model and API.

Metro EnableWorks is supported on a wide range of Java versions including Java 1.1, Java 2, and Java 2 Micro Edition (J2ME). In addition to the EnableWorks SDKs, Metro Link offers custom integration services. Metro Link can be reached at **www.metrolink.com**, or **800-821-8315.**

UPnP Identified as Solution for Key Windows XP Scenarios, continued from page 3

proliferation of IGDs that employ NAT. The team wanted to enable the following three Windows XP scenarios:

- Remote assistance, which gives a support professional the ability to directly connect to the user's PC to troubleshoot configuration problems.
- Peer-to-peer connections, which are becoming more and more pervasive.
- Multi-player gaming, which is one of the most popular activities for users with in-home networks and/or Internet connections.

All three of these scenarios are blocked by NAT. Circumventing NAT was of paramount importance. UPnP was identified as the best solution.

The Microsoft team needed to give applications behind the NAT the ability to open ports but still be low cost and simple to implement. Most importantly, the solution needed to be standards-based, allowing for widespread industry adoption to help guarantee the end-user's experience with Windows XP and a multitude of peer-to-peer applications. To solve this problem, the Microsoft team chose UPnP and turned to the Internet Gateway Working Committee.

Currently up for final comment, the specification provides a standard mechanism for applications on client PCs to reserve ports on the IGD and traverse the NAT. By utilizing UPnP, the Home Networking Team was able to quickly identify and implement a standards-based solution.

For more information on the interactions between IGDs and Windows XP, including information on how hardware vendors can help ensure their devices will enable Windows XP experiences,

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