



# **UPnP™ Technology – The Simple, Seamless Home Network**

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## INTRODUCTION

The average home or small business network usually works like this: The user has a single Internet connection between computers, transfers files with a few mouse clicks, prints files, and maybe has a wireless router to allow him or her to work from a laptop within appropriate range. Market penetration of high-speed connections and their proven utility has prompted a strong desire among consumers to do much more with their networks including store and stream media, integrate TVs as the 'hub' from which to access data and entertainment, use mobile phones to access or transport media and more. The reality for most consumers; however, is that the mere idea of investing in and installing a network able to provide such activities induces a sort of mental anguish, which puts advanced networking in the realm of the impossible.



The perception of home networking as not only difficult to use, but expensive and time consuming to install inhibits adoption. Most users seek an affordable "plug-and-play" solution to ease their pain. Taking a cue from other industries that solved adoption barriers by developing open standards, the networking industry reacted. Over the last 10 years, several standards groups formed to focus on improving the overall networking experience. One such group that emerged as an industry leader is called the UPnP Forum.

The Forum is comprised of more than 810 member companies across many industries promoting the adoption of uniform techni-

cal device interconnectivity standards, and testing and certifying of devices conforming to these standards. Consumer electronics manufacturers within the Forum develop products that incorporate the UPnP technology to deliver a seamless, simple and beneficial home networking experience.

In February 2001, the UPnP Implementers Committee (UIC) was formed as a non-profit organization to promote the adoption of UPnP technology. The UIC administers the UPnP device certification process and UPnP logo licensing. UIC has over 69 members that certify devices that implement standards that are written and approved by the UPnP Forum. UIC also provides information to UIC members and interested parties regarding UPnP device certification.

The UPnP device certification process is open to any vendor who is a member of the UPnP Forum and UIC, has paid the UIC dues (UPnP Forum membership is free), and has devices that support UPnP functionality. In just five years, over 275 devices have been certified. UPnP certified devices range from printers to media servers and from wireless routers to mobile control devices.

A very important technology, UPnP technology transforms the user's networking experience. With UPnP certified devices, users no longer have to hire high-priced network integrators to make the system work and other adapters that may or may not work.

### UPnP Achievements

- 275 UPnP devices certified to date (1 December 2006)
  - 130+ UPnP certified networked audio-video devices
- Millions of UPnP compliant Internet gateways shipped
- Hundreds of millions of UPnP enabled personal computers already deployed
- Bridges demonstrated between UPnP technology and other home automation networks
- Availability of commercial tools for more than a dozen vendors for many OS and embedded platforms
- Multiplatform support: Java, Linux, Mac OS, Windows

Recently, a major milestone to increase adoption of UPnP technology was achieved when the UIC submitted the UPnP Architecture and Device Control Protocol (DCPs) specifications to the International Organization for Standards/ International Electrotechnical Commission Joint Technical Committee 1 (ISO/IEC JTC1). International standards are a strategic tool which, when used correctly, ensure that customers have a competitively priced product, which is locally available throughout the world. Once the committee recognizes the standard and it goes through the requisite process, it becomes a recognized International Standard.

### THE IDEAL NETWORK

Usage of UPnP network devices offers numerous benefits and advantages to the end user. UPnP enabled devices create seamless interoperability and unprece-

dent simplicity, reliability and ease-of use. The UPnP enabled network provides the following capabilities:

- Media and device independence: UPnP technology can run on any medium that supports IP networking, including phone line, power line, Ethernet, RF, wireless and 1394.
- Platform independence: Vendors use any operating system and any programming language to build UPnP products.
- Internet-based technologies: UPnP technology is built upon IP, TCP, UDP, HTTP and XML, among others.
- UI control: UPnP architecture enables vendor control over device user interface and user interaction using a web browser.
- Programmatic control: UPnP architecture also enables conventional application programmatic control.
- Common base protocols: Vendors agree on base protocol sets on a per-device basis.
- Extendable: Each UPnP product can have value-added services layered on top of the basic device architecture by the individual manufacturers.

Recently, UPnP enabled capabilities took another step forward when the UPnP Forum announced the release of enhanced versions of the UPnP AV specifications (UPnP AV v2), which allow the next progression of the AV-oriented home network. UPnP AV v2 specifications use the UPnP Device Architecture specifications – the core interoperability technology for all UPnP enabled devices.

The UPnP AV v2 specifications extend the entertainment experiences that were

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enabled by the UPnP AV v1 specifications by allowing end users to identify and record desired programs and other digital content for later viewing. These specifications also simplify authorized playback of premium digital content without interfering with the underlying digital rights technology that is being used to protect the premium content.

These new experiences are created by adding UPnP AV v2 specifications' capabilities to the UPnP AV MediaServer and MediaRenderer device classes. AV v2 also allows seamless interoperability between MediaServer and MediaRenderer devices from different manufacturers. MediaServer devices include:

- DVD players
- VCRs
- PCs
- Personal video recorders
- CD players
- MP3 players
- Satellite set-top boxes
- Audio and/or video tuners, etc.

MediaRenderer devices include televisions, PCs, digital media adapters, stereo systems and MP3 players.

## **THE SIMPLE, AFFORDABLE HOME NETWORK**

End users can expect new and innovative network features as companies build UPnP technology into their devices. Recent UPnP product advances have already resulted in an integrated home automation experience that would impress even the most seasoned user.

Recent UPnP enabled product developments include many new and innovative products. Among the latest releases:

- Mobile phones that enable remote access and control of the home network
- Media centers that allow computers to simultaneously access video content and backup and add digital photos
- Wireless broadband routers that enable UPnP devices to manage access to the wide area network (WAN) interface
- Wireless photo frames with slideshow capabilities
- Embeddable software to bridge to existing automation networks
- Media servers that use UPnP to enable them to be configured and used over the network, and more.

These technologies are just the beginning of the UPnP enabled automated home of the future. The UPnP enabled home will feature room-to-room seamless automation. Users will be able to walk up to their front doors and use wireless communication devices to do every imaginable digital activity at an affordable cost. Users will remotely deactivate the security system; control lighting and open and close blinds; activate, deactivate or adjust the thermostats; start a DVD or watch premium content; play home entertainment games; surf the Internet on any viewing device, and more.

UPnP technology will also take networking beyond the house and expand it into vertical markets such as automotive, home health care, advanced energy management, and others. For example, the automobile the person drives will alert not only the driver of a mechanical failure or breakdown, but also automatically notify the home network and alert a family member

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about a problem or call an auto service; when a person sleeps, their health monitoring system will watch their vital signs and transmit information to the proper authorities; utility companies will be able to regulate energy conservation or send information to the network to self-regulate it.

All of the current UPnP related development creates this ecosystem of dependent, 360-degree relationships, that in turn, enhance synergy and promote healthy competition. These synergistic relationships also create economies of scale through increased user adoption that drives up competition and drives down prices. One expert compared these new economies of scale to the price of electronic automotive door windows to manual window levers. He noted that while automotive electronic door windows used to come at a premium price, the demand increased, volume went up, and prices came down. Many analysts expect a similar economic effect as UPnP standard specification adoption increases and pushes down prices in the same manner.

### **INTERNATIONAL STANDARDS CREATE THE IDEAL NETWORK**

The UIC has taken formal steps to accelerate the adoption of the UPnP standards and DCPs, ensure the enduring value of UPnP technology, and help protect the investments in UPnP technology made by Forum members and users. As noted earlier, UIC recently announced the submission

of the UPnP Device Architecture and 15 UPnP DCP specifications to ISO/IEC JTC1 for approval as Publicly Available Specifications (PAS). Previously, ISO/IEC JTC1 had approved the UIC as a submitter of PAS. This approval allowed the submission of UPnP specifications directly to ISO/IEC and initiated the standards approval process. UIC anticipates the process to conclude in mid-2007 with UPnP specifications being recognized as International Standards.

In a November 21, 2006 UIC press release, UIC president Tom McGee said, "Becoming an approved PAS submitter and submitting the UPnP specifications represents significant steps forward for UPnP technology. As an internationally recognized standard, more companies will be interested in certifying devices; and therefore, it will result in increased market adoption."

Alan Messer, chair of the UPnP Forum Steering Committee, said, "With submission of the UPnP Device Architecture and all published DCPs to JTC1, a major milestone to increase adoption worldwide of UPnP technology has been achieved. This is great news for users and implementers of UPnP technology."

UPnP technology as an International Standard represents a watershed moment for the technology. The already-flourishing UPnP technology adoption will increase and create global opportunities for further advancements and increased investment. In the end, the big winner becomes the home network user who now has the ideal network that works automatically and harmoniously – no muss no fuss.



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## MARKET OPPORTUNITIES

The significance of worldwide adoption of UPnP technology comes down to one simple idea: an easy-to-use network becomes a ubiquitously used network. UPnP technology accomplishes this goal. It offers network connectivity of PCs, intelligent appliances and wireless devices. UPnP technology enables data communication between any two devices under the command of any control device on the network. UPnP technology is independent of any particular operating system, programming language or physical medium.

UPnP technology leverages the vertical market opportunities in the consumer space as the technology that enables the painless creation of an easy-to-install and easy-to-use network that combines rich data, entertainment and automation. This simplicity shifts the market away from the smaller early adopters segment to the broader mainstream market. As a result, the ubiquitous home network where users control anything in their houses from anywhere anyplace becomes a reality.

The proliferation of UPnP enabled devices has already given rise to overall network adoption, which shows great promise. For example, *This Week in Consumer Electronics* recently quoted a Parks Associates report that said, "The number of home media servers sold in the United States will quintuple from about 11 million in 2006 to almost 50 million in 2010."

The continuing rise in home network adoption will gain traction as the UIC promotes its joint alliance with DLNA. UPnP provides a baseline or common level of interoper-

ability for all devices and includes a minimum required functionality to ensure devices from different manufacturers work together. Thus, users don't get locked into a single brand name to build an effective network. These combined efforts result in ongoing innovations and support for painless home networking, enhance synergies, and promote UPnP Forum members to certify more devices. Increased device certification leverages the capabilities from an ecosystem of contributors, including hardware and software manufacturers and developers.

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Manufacturers that adopt UPnP's open standard can effectively work together to create new product opportunities through interoperability and interchangeability. For example, NAS manufacturers have been actively creating new features and support for digital media standards. New models come with software that has DLNA certification that makes it easier to get everything on the home network playing. Meeting both the DLNA and UPnP specifications make digital media easily accessible over almost any network. Industry experts expect further collaboration between DLNA and UPnP to continue to help improve and expand related product lines.

## What Does UPnP Do in a Device?

UPnP enabled devices seamlessly and transparently locate each other. UPnP technology defines a standard way of controlling devices using extensible markup language (XML) simple object access protocol (SOAP), which is the standard for Web messaging. The UPnP architecture supports zero-configuration networking and automatic discovery whereby a device can dynamically join a network, obtain an IP address, announce its name, convey its capabilities upon request, and learn about the presence and capabilities of other devices. DHCP (Dynamic Host Configuration Protocol) and DNS (Domain Name System) servers are optional and are only used if available on the network. A device can smoothly and automatically leave or be removed from a network without leaving behind any unwanted state information.

## UPnP Technology in a Larger Context: Collaborating for Digital Interoperability

In order to share information and collaborate to enhance the whole home network, UIC recently entered into a joint alliance with a group called the Digital Living Network Alliance (DLNA). This agreement allows the organizations to share information in a collaborative effort to promote expansion of the home network. Over the course of this relationship, DLNA has incorporated UPnP architecture and Audio-Video (AV) DCPs into its certification process. Now, all devices must pass the UPnP AV device certification to be certified by DLNA. This added requirement has already led to an increase in certified AV devices, as more organizations start adopting DLNA as the home networking standard. The UIC expects this trend to continue as DLNA grows.

DLNA aligns industry leaders in the CE, mobile and PC industries through digital interoperability. DLNA encourages companies involved in all these areas to join and participate in their activities to focus on delivery of an interoperability framework of design guidelines based on open industry standards to complete the cross-industry digital convergence.

DLNA creates a framework for how UPnP technology works within the network protocol stack. DLNA's Interoperability Guideline Functional Components and Technology Ingredients include:

- Connectivity using Ethernet, 802.11 and Bluetooth
- Networking using IPv4 Suite
- Device discovery and control using UPnP Device Architecture v1.0
- Media management and control using UPnP AV v1 and UPnP Printer:1
- Media formats applying required and optional format profiles, and
- Media transport using HTTP (Hypertext Transfer Protocol) (mandatory) and real-time transport protocol (RTP) (optional).

The end user can use their network to simultaneously watch high-definition (HD) video, stream digital audio, make Voice-over IP (VoIP) calls, and surf the Internet. For example, the user can purchase a storage link that turns any USB 2.0 flash drive into network attached storage (NAS), while its always-on server functionality allows users to stream digital media to a UPnP enabled adapter. This allows NAS content – such as files, digital music and video or digital pictures – to be shared by everyone on the network.

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## About the UPnP™ Implementers Corporation

The UPnP Implementers Corporation (UIC) is the non-profit corporation that promotes the adoption of UPnP technology by manufacturers of hardware and software products. The UIC administers the UPnP device certification process and UPnP certification mark licensing.

There are now more than 275 UPnP™ certified products. UPnP certification creates the foundation for interoperability and provides an easy way for retailers and consumers to recognize products that have been developed and tested to comply with the UPnP device standards. The UPnP certification program is required by the Digital Living Networking Alliance (DLNA) as a prerequisite to its certification program.

For more information about certifying your product with the UIC, visit:  
<http://www.upnp-ic.org>.

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## About the UPnP™ Forum

The UPnP Forum includes companies and individuals across multiple industries that play a leading role in the development of specifications for UPnP compliant devices and services. Formed in June 1999, the Forum is a non-profit association of leading companies from a variety of industries including consumer electronics, computing, home automation, home security, appliances, printing, photography, computer networking, mobile products, and other technology-driven industries.

For more information about the UPnP Forum, visit: <http://www.upnp.org>. Send questions of an administrative nature to [UPnPadmin@forum.upnp.org](mailto:UPnPadmin@forum.upnp.org) with the text "UPnP Administration Request" in the subject line of your message.

