



Delivering on the Promise of Triple Play Digital Media

Consumers have a lot to look forward to in the next few years: Video on demand (VoD), intelligent roaming between GSM and WiFi networks with voice over IP (VoIP), online gaming, interactive TV and access to High-Definition TV (HDTV), and the digital home.

These are just some of the advances in digital media now being driven by the convergence of consumer electronics, computing and communications technologies. The digital home is rapidly moving from vision to every day reality, and by 2005 it is likely that consumers will be capable of accessing the full spectrum of “triple-play” digital media services, including video, voice and data throughout their homes over networked consumer electronics devices, PCs and mobile clients. This article examines the technologies needed to make vision a reality, and some important implications for developers.

Delivering Triple-Play

The triple-play promise for the digital home is compelling: consumers will soon be able to access, store and distribute digital video, photos, music and data anytime and anywhere around the home. Delivering on the promise requires ongoing development in four areas—the communications infrastructure needed to deliver content into the home, the network infrastructure within the home itself, the home’s controller or digital “hub” and digital content, including content protection.

Infrastructure

The infrastructure of the communications network outside the home has already been thoroughly addressed by the industry as the architecture continues to evolve from traditional circuit-switched to Internet Protocol (IP) packet-based networks. DSL, satellite and cable networks are all capable of transmitting triple-play services including high-speed data, voice and video. In this environment, the fact that all media and communications services will run over IP enables a new dimension of integration and interoperability.

Telecommunications equipment manufacturers (TEMs) are currently responding to the requirements of service providers and carriers with a new generation of modular, open-architecture platforms based on telecom industry standards including AdvancedTCA* (ATCA) and carrier-grade operating systems. An infrastructure based on these modular, standards-based hardware and software building blocks has significant benefits, including the ability to minimize operating expenses (OpEx) by reducing inventory requirements and the cost of network management. Even beyond these cost reductions, one of the greatest advantages of the modular approach to network infrastructure is the ability to help TEMs work more closely with service providers to meet consumer demand for the latest and greatest digital media services and applications.

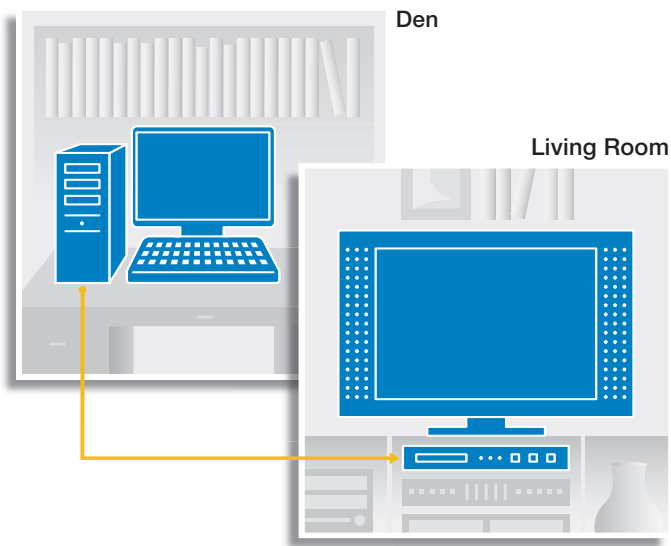


Figure 1. Streaming Video

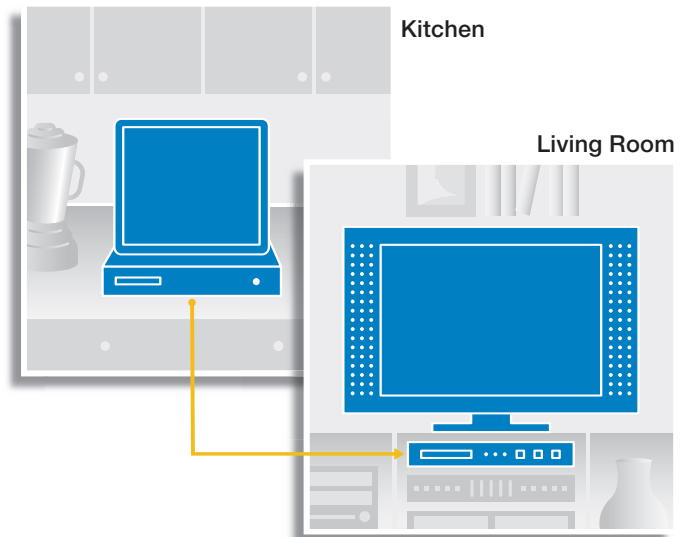


Figure 2. Sharing Digital Photos

TEMs, carriers, service providers and suppliers are also actively engaged through standards organizations and industry forums to resolve technical issues around Quality of Service (QoS), high availability and interoperability, all of which promise to enhance end-user satisfaction with new digital media services. A remaining challenge is the need for a standards-based services model that will make it possible for service providers to flexibly offer incremental media services from third-party providers with the convenience and efficiency of centralized billing.

Inside the Home

It is a different world inside the home, where an essentially unregulated networking environment can include a mixed bag of technologies, ranging from conventional wired Ethernet and WiFi wireless home networks to high-speed Internet services delivered over DSL or cable. Here, networking standards are still in a state of ongoing definition and development. The industry's current challenge is to make the in-home network as stable as the external telecommunications infrastructure. Such stability will enable consumers to seamlessly create, share and enjoy digital content using all of their digital devices and ultimately give users the ability to enjoy a personalized digital media experience anytime and anywhere, in or around their homes.

Today's consumers have multiple wired and wireless options available for their home networks, and each of them has advantages and disadvantages. End-users and service providers will ultimately select technologies based on ease of deployment, simplicity of operation, lowest operating cost and best overall reliability. The ultimate test of the in-home

network will be its ability to complete the 'end-to-end' media experience needed to deliver premium and technically demanding triple-play services including VoD.

To make this happen, the industry needs to address some remaining technical issues that can impact the functionality of home networks, including interference from appliances and other non-digital radio-frequency (RF) sources in the home. Service providers who depend on WiFi must also concern themselves with potential interference from neighboring networks, signal attenuation from building materials and physical obstructions that can block signals.

The "Digital Hub"

Another essential for triple-play service delivery is the device that functions as the controller or "digital hub" within the home—the device that lets users control how digital content is acquired, stored and distributed to other consumer electronics (CE) devices over the home network. This role can be performed by PCs, IP-digital set top box (IP-DSTB) or a number of "intelligent" CE products. All of these devices are likely to include hard disk drives or provide the ability to connect to other networked devices that can be used to provide cache storage to ease bandwidth constraints. Examples of such cache storage devices include recording products and services that enable consumers to time-shift TV programming.

It is probable that given the current range of choices, consumers will not limit their selection to any one type of device, but instead base their decision on the specific requirements of individual services and usage models. As the following examples

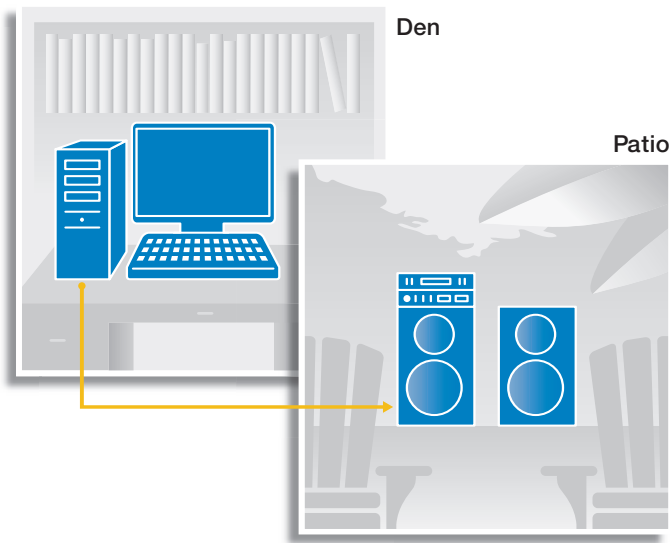


Figure 3. Listening to Music

illustrate, a PC could be used to link with the service provider and flexibly control and distribute digital content to different devices throughout the home over the home network connection.

Streaming Video

(Figure 1) You are working to finish a project using your home PC in the den, but you do not want to miss a favorite TV program. A software application on the PC lets you choose your family's entertainment center from an on-screen menu, select the TV channel you want and view the program in a window on your PC screen. You can use this functionality to simultaneously record a second TV program for later viewing.

Sharing Digital Photos

(Figure 2) You have downloaded digital photos from your cell phone/digital camera to your PC and then enhanced them with a software application. Now you want to share the results with other members of your family. You use another software application on your PC to select the living room TV from an on-screen menu and display your photos on the TV's big screen for easier viewing by the entire family.

Listening to Music

(Figure 3) You select MP3* music tracks stored on the PC in the den and then use a PC application to bring up an on-screen menu and send your selections to an audio system on the patio.

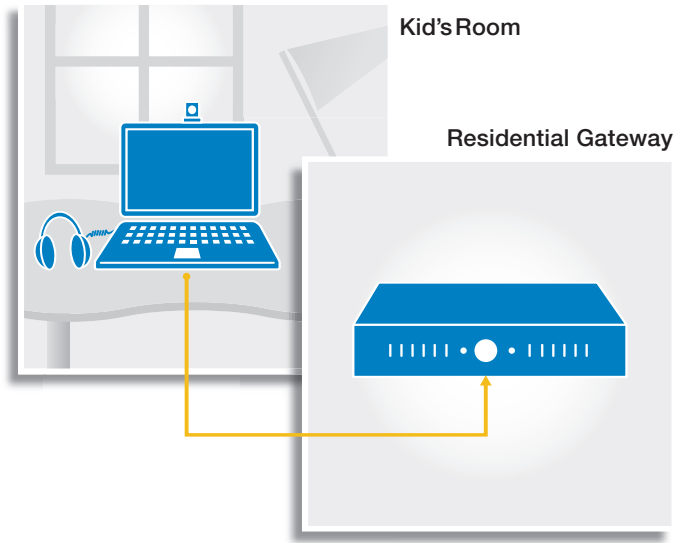


Figure 4. Voice over IP on the Home Network

Voice over IP on the Home Network

(Figure 4) Your kids are using a PC in their upstairs bedroom to play an online game, while at the same time conducting an online conversation over the Internet using a VoIP application with a headset plugged into the PC.

IP-Digital Set Top Boxes

In the near future, home users will also be able to use a IP-digital set top box to deliver content to any CE device from anywhere in the house. To make this possible, the IP-DSTB will need to support a range of advanced capabilities:

- Processing performance and headroom needed to run demanding software applications, software-based residential gateway networking and software decoding of Microsoft's Windows* Media* 9 and Advanced Video Compression (MPEG-4) codecs that are not currently supported in hardware.
- Advanced graphics, including the ability to overlay graphics at up to 1080i native resolution, with per-pixel alpha blending.
- Video processing capable of decoding multiple high-definition video streams in high-definition personal video recorders (PVRs), with the ability to stream video to remote displays, providing "whole-home" PVR video.
- Remote management, including the ability to remotely update the device configuration.

Security

Security in the digital home is also a significant issue, because digital content needs to be protected at every stage as it is accessed, stored and distributed. This requirement means that digital home devices will need to support multiple types of conditional access and Digital Rights Management (DRM) technologies. Options here include AES encryption on the hard drive and encryption with Digital Transmission Content Protection (DTCP) for network distribution. High-bandwidth Digital Content Protection (HDCP) can also be used to protect the distribution of premium high-definition content to a local display.

Technologies are now available that provide CE device and set top box manufacturers with the flexibility they need to rapidly and cost effectively develop new hardware and software solutions:

- A wide choice of memory card formats, networking interfaces and digital and analog input/outputs for audio and video.
- A modular interface for tuners and a PCI/mini-PCI interface to facilitate development and the testing of new configurations.
- The ability to develop software stacks in-house or select stacks from third-party providers.
- Interoperability standards and development tools to ensure that devices work together on the home network.

Content Protection

Consumers can also use their PCs to subscribe to music and video services on-line and enjoy access to their favorite digital content at any time throughout the home. An important question here is whether the industry can adequately protect this premium content while striking a balance between low-cost, easy access and relatively expensive closed boxes capable of providing content protection. Addressing this issue requires a video distribution system that provides security, content protection and digital rights management, and these additional levels of content protection that are currently under development.

Conclusion

Moving today's digital home vision to reality and enabling the delivery of compelling triple-play digital media will require the industry to focus on the following technical challenges:

- Unifying the network infrastructures both inside and outside the home.
- Focusing on the controller or digital hub.
- Understanding the benefits of both PC-centric and set-top box usage models.
- Protecting premium content.

When these challenges are met, consumers will be able to enjoy triple-play products and services for the digital home that will enable them to explore the real possibilities inherent to the digital world.

About Intel's Digital Home Initiative and Consumer Electronics Products

To learn more about Intel's efforts in the digital home please visit <http://www.intel.com/technology/digitalhome/>

For more information, visit the Intel Consumer Electronics home page at: www.intel.com/go/consumerelectronics



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