



Intel in
Communications

Case Study

Intel® IXP420 Network Processor

Wireless Network Storage Devices



Wireless Storage for the Digital Home

A single, highly-integrated Intel® NPU powers D-Link's small, portable devices

Summary

The “digital home” is becoming a mainstream phenomenon as consumers adopt new technologies for their multimedia entertainment, including cameras, downloadable music, video editing, and more. This trend requires new multimedia storage solutions, since digital media must be stored in digital format. Most consumers use a combination of DVDs, CDs and PCs for such storage, although these devices are becoming overwhelmed by the volume of content flowing into the digital home.

Recognizing this need, D-Link* developed two new wireless storage devices specifically for home and small business environments. Designed to offload music, video and photo files from the PC, the D-Link* DSM-622 and DSM-624 storage devices allow multiple users on a small network to store, access and playback content from a variety of devices in a variety of formats.

Integral to the D-Link solution is the Intel® IXP420 network processor, an all-in-one chip that helped D-Link keep development costs down while maximizing the performance and features of its unique products. With the full-featured, operating system provided by MontaVista* Linux* Professional Edition, a single D-Link wireless storage device can serve an entire home or small business network.

This case study looks more closely at D-Link's solution for digital storage, and the participation of Intel and MontaVista in helping them deliver the solution quickly and cost-effectively.

Where to Put All That Digital Content?

Digital technology is forever changing the nature of home entertainment and communications. Digital cameras are now mainstream technology. Online service providers are offering downloadable music, and will soon begin serving video content as well. Writable DVDs and powerful video editing software are spawning a large crop of movie production hobbyists. All of which means consumers are building enormous digital libraries.

Consumers are looking for ways to share this digital content among devices in the home and small office environment. Digital home networks now connect more than just PCs and printers, sometimes networking a home's TVs, phones, gaming systems, and stereo equipment.

What's missing from these home networks are the storage solutions that enable multiple users to simultaneously store and access large multimedia files. Servers are unwieldy for the home environment. So most home networks use a router to connect devices in the digital home, which at least allows for the sharing of Internet connections and printers.

Often users store their multimedia files on their home PCs. Although these systems come loaded with ever-increasing hard-disk capacity, users can't easily share the content that's stored on a home PC. DVDs, CDs, and other disk storage solutions are more readily shared, but these devices have limited capacity.

The fact remains: consumers are acquiring huge volumes of digital content and home networks need better access to that material.

In 2003, D-Link observed the rapidly escalating production of digital content and recognized a need for networked storage in the digital home. Company executives envisioned full-featured devices similar to those found in enterprise-quality network-attached storage systems, but scaled down for the home user.

Required Features

The digital home is a unique environment, often culling together an ad hoc collection of devices that aren't engineered on the same platforms. For example, both PCs and Mac* devices can often co-exist in one household. What's more, the users of these machines are often not highly technical and may lack the expertise to develop a sophisticated network.

Therefore, D-Link identified several essential features for its new digital home storage solutions to ensure optimum versatility, as well as a level of reliability and performance analogous to enterprise systems. These features must deliver:

- Seamless compatibility and interoperability among multiple computing and media systems (including devices based on Windows* XP and Me, Mac* OS X, and Linux)
- Universal plug-and-play* (UPnP*) capability for ease of use among a non-technical customer base, and UPnP-AV* capability for compatibility between computing and AV devices

- The option to choose either wired or wireless connectivity for portability and versatility, enabling a single device to serve an entire home or small business network
- Network access so that multiple users could store and share digital files simultaneously, without degrading overall performance
- Wire-speed throughput for efficient transfer of large, digital files
- Compact form factor for maximum versatility in the home or small office
- Scalability via an external USB port so that storage can easily be extended through external storage drives

An All-in-One Challenge

Delivering such a full-featured solution presented D-Link with a dilemma: how to balance the need for a full-featured, high performance system with an acceptable price and ease of use required by the consumer segment.

D-Link clearly understood that solutions designed for the digital home should carry a much lower price tag than their enterprise counterparts. Yet these smaller network systems must still be tightly integrated and offer enterprise-like performance and features. What's more, such solutions should be presented in a package for easy installation and operation by a non-technical user. To a large extent, this

The Intel® IXP420 network processor

The highly integrated Intel® IXP420 network processor provides all of the processing performance and networking capabilities that D-Link* required in their design. It combines a high-performance Intel XScale® core with integrated Network Processor Engines (NPEs) to achieve wire-speed packet processing performance needed for storage and sharing of large multimedia files. The IXP420 network processor also has two 10/100 Base-T Ethernet MACs integrated on the chip, giving users a choice between wired and wireless connectivity.

The Intel IXP420 network processor feature set also includes a high-performance PCI interface and USB controller. This network processor enables cost-effective implementations that extend the processing power, low power consumption and flexibility of the Intel® IXP42X network processors into a broad range of applications. The IXP42X network processors are offered in a range of clock speeds and temperatures to best match developers' requirements.

The high performance and low power advantages of the Intel IXP420 network processor were very important to D-Link. The company needed high performance to build a powerful device that could share and store large multimedia files. But low power was equally important in small form factor devices like the new D-Link* DSM-622 and DSM-624. The IXP420 network processor offered the optimum low power/high performance combination for D-Link's two new designs.

D-Link has worked with Intel support teams for other products and has found the development tools and level of technical support from the Intel-focused developers to be highly valuable. The DSM-622 and DSM-624 are the third design project D-Link has completed with the IXP42X product line—a testament to the quality of Intel components and support.

requires additional engineering, which in turn requires development time and resources, driving up costs.

For D-Link, the development challenge—and the likely solution—lay in the design itself. With the goal of delivering a compact, portable device, D-Link needed to integrate many of the planned features on a single board. At a minimum, D-Link expected to use a high-performance processor for CPU functions and a chipset or network processor to deliver the networking capabilities.

Yet D-Link designers were still faced with significant development work. The variable features planned for the solution—multiple networking options, S independence, UPnP/UPnP-AV compatibility—were likely to require a large number of dedicated engineering resources. D-Link needed tightly integrated processing components that would help minimize this work in order to keep costs low and speed time-to-market.

An All-in-One Solution

The Intel® IXP420 network processor turned out to be exactly what D-Link needed to meet all of their requirements for their new wireless storage devices. Tightly integrated and powerful, the Intel IXP420 network processor allowed D-Link engineers to build their entire solution using a single chip—not two or three chips as the company had expected.

The “all-in-one” chip solution helped D-Link engineers cut development time significantly. It also allowed for a very compact, yet powerful device that fit into a lightweight, small box. These efficiencies helped D-Link keep costs low so that they can achieve an affordable price point for their SOHO/SMB target customers.

D-Link was also thrilled with the performance capabilities of the Intel IXP420 network processor. “One thing that really caught our eye was the fact that the design of the Intel IXP420 network processor matches up with many of the processor-intensive tasks that maximize data performance in wireless solutions,” explains Maggie Chen, Director of Product Management, D-Link. “Plus, the IXP420 network processor enables a networkable application—both wired and wireless—from a single chip design. It’s everything we need all in one chip.” With the Intel IXP420 network processor, D-Link could take advantage of integrated WLAN, USB ports, 10/100 Ethernet ports, and a PCI interface on a single-chip, enabling a single board design of its compact new wireless storage devices.

Multiple engines on the Intel IXP420 network processor give D-Link engineers a lot of processing headroom to maximize performance. “There are a lot of different network tasks that need to be controlled by the storage device—IP header inspection, packet filtering, packet error checking, and so on. All of these processing overhead tasks need to be addressed in some way. We have found that the best way to handle

Why MontaVista*?

MontaVista* Linux* Professional Edition is a comprehensive embedded operating system and cross development environment. It offers real-time functionality using a multi-process and multi-threaded instruction set with extensive bundled software components including rich networking.

As a member of the Intel® Communications Alliance, MontaVista works closely with Intel to optimize and enable the Intel® IXP42X platform by offering tighter integration and performance at lower overall costs. Integration between the MontaVista Linux OS software and the Intel IXP42X network processing hardware maximizes the cost effectiveness of Linux on the software side and the time-to-market acceleration provided by the “off-the-shelf” Intel network processors and Linux software.

“MontaVista Linux offers a powerful operating system and development environment enabling companies to build a wealth of advanced networking and real-time capabilities into their devices, achieving quicker time-to-market and lower total costs,” added Mike Mathews, senior product marketing manager, MontaVista Software. “Communications and Storage equipment designers can benefit from the enhanced communication standards support of Intel’s new development platforms together with the performance, reliability and flexibility of our scalable operating system.”

Off-the-shelf network processors and embedded Linux are helping OEMs like D-Link* deliver an exciting array of network solutions and infrastructure equipment quickly and cost-effectively. What’s more, software and hardware integration, the cost effectiveness of Linux and Open Source, and accelerated development offer time-stressed OEMs a valuable head-start in the race-to-market.

the overhead is to find a network processor that can offload these functions so that the processing core can manage the data transfer. The multiple network processing engines on the Intel® IXP420 network processor take care of those overhead tasks very efficiently,” says Chen.

In another move to save development time and resources, company engineers planned to use the highly integrated MontaVista Linux Professional Edition as the platform’s operating system. The fact that it was already optimized for the Intel XScale® core of the Intel IXP420 network processor was significant, eliminating the need for further development work. (See related grey text box: Why MontaVista?)

“We chose the Intel IXP420 network processor because everything that we needed was already integrated and tested, so we didn’t have to go out and ‘reinvent the wheel,’” explains Chen. Moreover, “Our access to Intel’s engineering team was a tremendous help during development. The support infrastructure that Intel has in place—both in the US and Asia—is very helpful. We also feel very comfortable knowing that there will be lots of strong support from Intel down the road, so we can address technical issues quickly and easily as our product evolves over time.”

About the D-Link* DSM-622 and DSM-624 Wireless Storage Devices

The D-Link DSM-622 and DSM-624 are designed to offload media storage from the home PC, providing a central network location. The integrated, slim hard drive is powerful enough for multiple users to share and store information, play music, and archive digital photography and videos. Maximum performance and large storage capacity means that a single

For More Information:

D-Link* Systems, Inc.
www.dlink.com
MontaVista* Software
www.mvista.com
Intel® IXP420 Network Processor
<http://developer.intel.com/design/network/products/npfamily/ixp420.htm>
The Digital Home—Intel’s Vision
www.intel.com/standards/case/case_dh.htm
Intel® Communications Alliance
www.intel.com/go/ica

network storage device will be able to serve the entire household, business, or office, replacing the need for multiple hard drives and attached storage elsewhere on the network.

Wireless capability and a compact form factor provides flexibility for deployment at any location on the network, easily integrating with most existing wired and wireless networks in homes and small offices. USB 2.0 connectivity gives users the option to easily expand storage capacity. Simple setup is provided through industry standard configuration wizards, including UPnP, UPnP-AV, Samba*, and Rendezvous*, allowing the central home drive to be immediately visible and available to everyone on the network. With the embedded media server stack on the DSM-622 and DSM-624, UPnP-AV capability allows for seamless communication with D-Link Digital Media Adapters (DMAs) as well as playback to other DMAs on the network. Such compatibility gives D-Link customers almost unlimited versatility for storing, accessing and using the wide variety of digital content available in the home network today.

Conclusion

Intel, D-Link, MontaVista and others share a vision for the “digital home” in which interoperable devices can share digital media across a home network. While fulfillment of this vision still requires several new technologies and products, D-Link’s new wireless storage devices complete a part of the picture.

To further that vision, tight integration among components is helping D-Link and others deliver solutions that can cross platforms and facilitate interoperability among previously incompatible devices. Intel network processors are key enablers of that vision.



A community of communications and embedded developers and solution providers



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