With the advent of high-speed broadband connections, computer users have been quick to embrace the world of the Internet. From watching breaking news stories via streaming webcasts, to downloading the latest music and films and examining new worlds in multiplayer games, the Internet offers great experiences for everyone.

Unfortunately, with the influx of digital subscriber lines (DSLs) and cable installations, many users realize that traditional PC technologies are not equipped to handle the increased demands for video, audio, and other on-demand information (Figure 1). Ethernet and other internal PC technologies do not support isochronous (time-dependent) data transfers, so problems arise when network traffic becomes congested. Exciting Internet experiences quickly become time consuming and frustrating.

![Figure 1. The Many Demands of Today’s PCs](image-url)
The NVIDIA nForce Media and Communications Processor (MCP) includes the richest set of integrated connectivity solutions in the industry. In its second generation, the nForce2 MCP-T, it simultaneously handles LAN/WAN connections and multiple streams of audio and video from integrated IEEE-1394, USB 2.0, and Ultra ATA/133 ports.

The NVIDIA Audio Processing Unit (APU) is already found in the Microsoft Xbox console, and is an integral part of nForce and nForce2 MCPs that feature NVIDIA’s SoundStorm Audio Project. Now, the APU also delivers full-featured, high-quality, real-time-encoded Dolby Digital 3D (AC-3) audio, and greatly surpasses the audio capabilities of other sound cards and solutions, integrated or otherwise. With the improved audio feature set in Microsoft DirectX® 8.0—realistic 3D, submixed audio streams, and occlusion/obstruction effects—the NVIDIA APU sets the stage for more realistic gaming environments.

The nForce MCP and nForce2 MCP versions also include the advanced isochronous StreamThru Data Transport System, NVIDIA’s networking and broadband architecture. StreamThru noticeably improves time-dependent applications such as media streaming, file downloading, and multiplayer games, to enhance your experience.

IEEE-1394

In the original nForce MCP implementation, IEEE-1394 connectivity (Firewire) was only supported over PCI. Because PCI latency exceeds the IEEE-1394 standard, and because PCI is not isosynchronous, the nForce2 MCP-T Platform Processor integrates hardwired IEEE-1394 support, moving IEEE-1394 to an on-chip native mode. Users can upload video faster from their camcorders and other devices, plus back up their video data more quickly.

Before IEEE-1394, the personal computer world (the computer plus peripherals such as printers, CD-ROM drives, scanners) and the consumer electronics world (televisions, stereos, VHS, DVDs, camcorders) were functionally distinct. IEEE-1394 bridges the two worlds by providing a simple, multimedia-oriented, high-bandwidth isochronous interface between computers, peripherals, and consumer electronics products such as camcorders, VCRs, printers, PCs, TVs, and digital cameras.

NVIDIA continues its role as a leader in platform processing solutions. By implementing IEEE-1394 in the nForce2 MCP-T, it kick-starts the long-heralded convergence of computing, consumer electronics, and networking technologies.

Expandable and Self-Configurable

Up to 63 devices can be easily connected on an IEEE-1394 bus segment. Over 100 bus segments can be connected using bridges. IEEE-1394 does not require device IDs or elaborate setup.
More importantly, IEEE-1394 lets you mix real-time and asynchronous data on a single connection, with the bus still active. IEEE-1394 provides the ability to mix low-speed and high-speed devices on the same network, delivering a truly universal connection for almost any consumer, computer, or peripheral application.

Best of all, consumers can connect their varied IEEE-1394-based digital equipment as easily as they now plug in a lamp, with one wire and connection that senses what is being connected and how to configure it. No mismatched plugs, no tangle of “in” and “out” connections—just an end to multiple products blinking “12:00.”

Bridging the PC and Consumer Electronics

IEEE-1394 was architected from the start with an orientation for digital media. Because IEEE-1394 does not do digital-to-analog conversion, there is never a loss of data integrity. Applications that benefit from IEEE-1394 include digital video presentation and editing, desktop and commercial publishing, document imaging, home multimedia, and personal computing.

With IEEE-1394-compatible products and systems, you can transfer video or still images from a camera or camcorder to a printer, PC, or television, with no image degradation.

High Bandwidth and Isochronous

IEEE-1394 was architected to be an isochronous, high-bandwidth interface for digital media. Isochronous (iso = same, chronous = time) means guaranteed delivery. With IEEE-1394, motion video can be imported isochronously into the PC without frames dropping. NVIDIA’s implementation of IEEE-1394 on the nForce2 MCP-T Platform Processor is 100/200/400 Mbps (IEEE-1394).

IEEE-1394b, whose silicon is available now, promises to be faster, longer, simpler, and fully compatible with all previous versions of IEEE-1394. IEEE-1394b brings up to 800/1600/3200 Mbps. IEEE-1394b has a simpler bus arbitration scheme to enable true Plug and Play connectivity. One IEEE-1394b device may be connected to another IEEE-1394b device at a distance of over 300 feet.

Complementary with USB

Almost everyone who works with PCs considers IEEE-1394 a complement of Universal Serial Bus (USB) because it offers much higher speeds (up to 3.2 Gbps) and is designed for isochronous video/audio/data transfer. While USB is ideal for computer peripherals at speeds of approximately 12 Mbps (USB 2.0 improves bandwidth to 480 Mbps), IEEE-1394 has a different mission. The nForce2 MCP-T Platform Processor is the first processor to include ports for both standards.

The strong multimedia orientation, self-configurability, peer-to-peer connectivity, and high performance of IEEE-1394 have encouraged new, innovative product concepts that are under development or set to be released soon. With the advent this year of native IEEE-1394 support in Microsoft Windows operating systems, a number of new applications for IEEE-1394 will introduce that link the worlds of consumer and computer electronics.
USB 2.0

USB is the solution for anyone who dreams of an instant, no-hassle way to connect a new digital joystick, scanner, set of digital speakers, or digital camera to a PC. Adding an old-fashioned peripheral device can be challenging, requiring a great deal of computer savvy and a certain amount of luck. First, from a bewildering array of possibilities, you must figure which port to use. Then, in most cases, you have to pry open your PC to install an add-in card, set the dual inline package (DIP) switches, and configure interrupt request (IRQ) settings. It is enough to deter most users from even thinking about adding a new peripheral.

The original nForce MCP Platform Processor included support for USB 1.1. With the nForce2 MCP-T, however, you can take advantage of up to six USB 2.0 ports and an increased bandwidth of 480 Mbps. The new implementation supports smooth online video conferencing and video viewing from all sources.

As a leader in platform processor solutions, NVIDIA proudly incorporates USB 2.0 on its nForce2 MCP-T to replace all serial and parallel port connectors with one standardized plug and port combination.

Compatible

With more and more USB devices shipping annually, USB is the PC industry’s most popular external high-speed peripheral connection. USB 2.0, introduced this year, is 100 percent compatible with all USB 1.1 devices. USB 1.1 devices interoperate seamlessly with USB 2.0 devices.

With USB-compliant PCs and peripherals, you just plug them in and turn them on. USB makes the whole process automatic. It’s like adding instant new capabilities to your PC. You never need to open your PC, and you don’t need to worry about add-in cards, DIP-switch settings, or IRQs.

Simple and Expandable

Thanks to another USB feature known as “hot-swapping,” you don’t even need to turn off and restart your PC to attach or remove a peripheral. Just plug it in and start! The PC automatically detects the peripheral, and then configures the necessary software. This feature is especially useful for users of multiplayer games, as well as business and notebook PC users who want to share peripherals.

USB also lets you connect many peripherals at one time. Many USB PCs come with two or more USB ports. And external USB peripherals—called USB hubs—have additional ports that let you “daisy-chain” multiple peripherals (devices) together. USB distributes electrical power to many peripherals by sensing the power that’s required and delivering it to the device. This feature eliminates the clunky power supply boxes of many peripheral devices.

USB 2.0 (high-speed USB) products have a maximum bandwidth of 480 Mbps. At this bandwidth, video conferencing images are more vivid, archiving data on portable hard drives is quicker and easier, and uploading pictures from digital still cameras is a breeze.
cameras is no longer an endless wait. USB 2.0 is 100 percent compatible with USB 1.1 (full-speed USB) devices.

Complementary with IEEE-1394

USB and IEEE-1394 are complementary technologies. IEEE-1394 is for devices where high performance is a priority and price is not, whereas USB is for devices where price is a priority and high performance is not.

Applications that are best suited for IEEE-1394 are portable/removable disk drives, high-quality video streams, and other high-bandwidth applications for higher-end consumer devices. USB is appropriate for middle-bandwidth and low-bandwidth applications such as audio, scanners, printers, keyboards, and mice. The nForce2 MCP-T is the first processor to include ports for both these standards.

Ultra ATA/133

New PCs are pushing the limits of system performance. With today’s faster microprocessors, larger file sizes, and higher-performance hard drives, the data transfer speed between the host computer and the hard drive is becoming more critical. With more than one billion Ultra ATA devices installed to date, Ultra ATA is the industry’s most popular computer storage interface connection. NVIDIA continues its role as a leader in platform processing solutions by implementing Ultra ATA/133 in the nForce2 MCP-T.

Ultra ATA/133 clocks data at 133 MBps. It surpasses the current parallel ATA interface—Ultra ATA/100—which transfers data at 100 MBps. This increased data transfer speed is designed to meet all your needs for performance, without adding extra costs. Value and compatibility are achieved by maintaining the current technologies, interfaces, and connectors that are already in use today.

Other benefits include:

- Up to 33 percent faster performance than Ultra ATA/100
- Backward compatible with all Ultra ATA HDDs and controllers.
  Ultra ATA/133 is fully backward compatible with previous generations of parallel ATA/100, 66, and 33 storage and controllers. Backward compatibility is maintained to provide a risk-free solution to higher performance.

Increased Reliability

Ultra ATA/133 provides a set of enhanced design guidelines to PC designers. Electrical layouts on printed circuit boards have been optimized to reduce signal noise. Trace lengths requirements are more stringent to improve reliability. Ultimately, users benefit by gaining a more stable storage subsystem.
DualNet for Gateway Functionality

The original nForce MCP integrates support for one Ethernet port. On the nForce2 MCP-T, however, this standard NVIDIA Ethernet capability is extended with the addition of a 3Com® Ethernet MAC, which dramatically increases the configuration choices for PCs in corporate environments.

This DualNet capability also allows a PC to serve as a home gateway, managing traffic between two separate networks (Figure 2). The new implementation ensures rapid transfer of data from WAN to LAN, without any added arbitration or latency. You can now efficiently download MP3 and AVI data and distribute the information to locally networked PCs.

The NVIDIA nForce2 Platform Processors are the only processors to include this dual design, marking another first for the PC industry.

Figure 2. Using the PC As a Digital Gateway
Advanced Audio Features

With five digital signal processors (DSPs) dedicated to audio processing—three fixed, two programmable—the NVIDIA nForce APU surpasses the capabilities of any sound card on the market today. The APU supports the latest features in the DirectX 8 audio API, DirectSound® 3D (DS3D), with up to 256 hardware-processed voices (audio streams) or 64 hardware voices in 3D. Support for multispeaker 3D audio is available for up to six speakers. Furthermore, the APU can also process and output a Dolby Digital audio stream directly to a home theater system via a SPDIF connection (Figure 3). With this advanced feature set, the APU brings audio quality and performance to the same level as state-of-the-art graphics performance, completing the 3D experience.

For the most powerful integrated audio solution today, look for nForce systems featuring NVIDIA SoundStorm. PCs with the NVIDIA SoundStorm solution offer the most complete digital audio feature set for your desktop, delivering stunning audio and fantastic sound effects—all powered by the nForce APU.

Figure 3. Supports Six Speakers, Plus Dolby Digital Output via SPDIF

For more information on the nForce APU, read the APU Technical Brief available from www.nvidia.com.
Conclusion

The nForce2 MCP-T is the most powerful and flexible media and communications processor available.

The NVIDIA nForce2 MCP-T simultaneously handles LAN/WAN connections and multiple streams of audio and video from integrated IEEE-1394, USB 2.0, and Ultra ATA/133 ports by using StreamThru. And it delivers full-featured, high-quality, real-time-encoded Dolby Digital 3D (AC-3) audio via the APU with NVIDIA SoundStorm. The nForce2 MCP-T is truly the center of the digital media gateway.