



## Technical Brief

**NVIDIA nForce4 MCPs**

Advanced Storage Solution with  
Support for SATA 3Gb/s



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## The Demands of System Architecture

The desktop experience is increasingly dependent on overall system performance, high-speed networking, rich streaming media, and a variety of multimedia capabilities. To address these needs, the speed and system capacities of CPUs and graphics processing units (GPUs) are advancing at an aggressive pace. However, basic system architecture is evolving slowly, and various critical devices and subsystems often degrade the overall experience.

NVIDIA nForce™ media communication processors (MCPs) have consistently met the challenges of the system architecture. The newest offerings, the NVIDIA nForce4 MCPs, extend the tradition of delivering advanced core technologies and industry-leading performance.

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## NVIDIA Leads in Innovation and Performance

NVIDIA pushes the limits of today's popular storage technologies, with the industry's first native support for Serial ATA 3Gb/s (SATA 3Gb/s). SATA 3Gb/s provides up to twice the bandwidth of current SATA products (3Gb/s versus 1.5Gb/s). The NVIDIA nForce4 MCP is the first MCP solution to incorporate this new higher-speed SATA 3Gb/s technology.

### Serial ATA 3Gb/s

SATA 3Gb/s is the next-generation storage technology, offering greater disk bandwidth that overcomes the growing limitations of Ultra ATA and SATA 1.5Gb/s. SATA 3Gb/s not only doubles the speed of the current SATA technology, but also offers more efficient bus utilization, faster data backup and retrieval, and faster recovery from signal drop/failure (asynchronous signal recovery). Overall, SATA 3Gb/s improves system responsiveness.

The NVIDIA nForce4 SATA 3Gb/s is the industry's most advanced storage solution incorporating the following features:

- ❑ Support for up to four native SATA2 3Gb/s devices.
- ❑ Hot-swap capability, allowing disks to be changed without powering down the system.
- ❑ Optimized for the high-performance NVIDIA® RAID technology.

## Dual Controller Architecture

NVIDIA storage also offers architectural advantages over other solutions in the market. Most notably, nForce4 MCPs spearheaded the use of a dual controller architecture instead of the common single controller architecture (Figure 1), as well as support for native command queuing.

The advantage of a dual controller architecture (Figure 2) is that it provides two separate and independent transfer paths to and from system memory. The availability of two separate pipes can result in twice the bandwidth to disk.

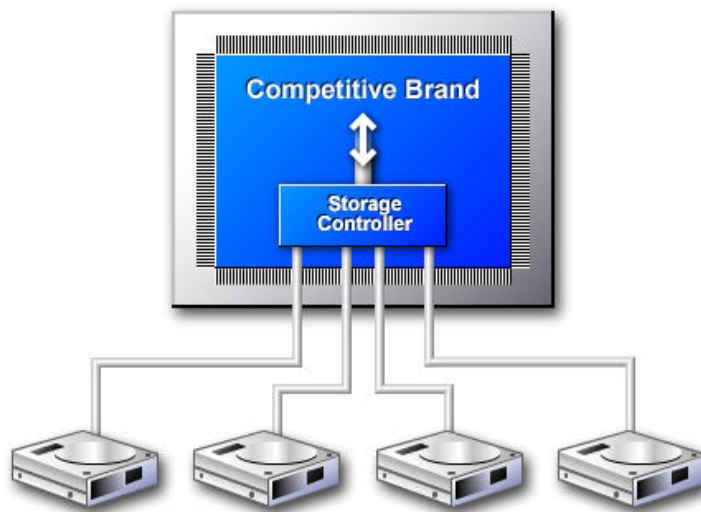


Figure 1. Single Controller Architecture

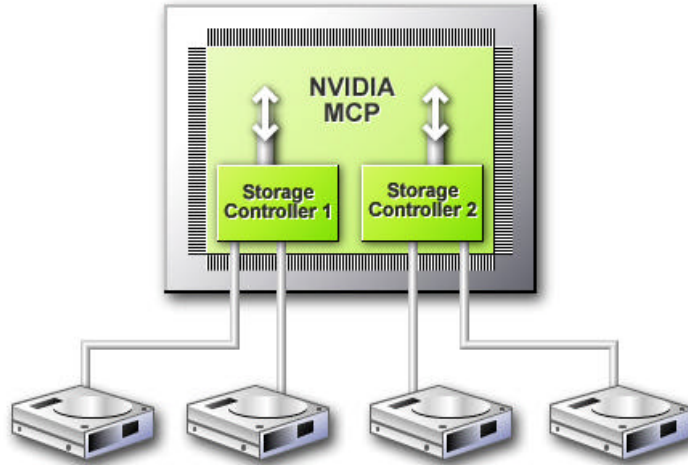


Figure 2. NVIDIA Dual Controller Architecture

## Native Command Queuing (NCQ)

Unlike purely electronic pieces of a computer, hard drives have a mechanical element and can suffer from the laws of physics. This characteristic limits how fast a hard drive can access media and retrieve data. Mechanical limitations can only be optimized to a certain degree, but the efficiency of the internal workflow can be dramatically increased by intelligently managing the workflow. For example, workflow can be managed by using Native Command Queuing (NCQ), a command protocol in Serial ATA that allows multiple commands to be simultaneously outstanding within a drive (Figure 3).

The best example of workflow management is the expedient transportation of elevator passengers. Imagine four people entering an elevator and successively pushing a button for one of the following floors: 4, 2, 6, and 3. In a non-NCQ environment, the elevator stops at the fourth floor (bypassing the second and third floors), goes down to the second floor, goes up to the sixth floor (again bypassing the third floor), and finally descends and stops at the third floor. This is not an efficient way of transporting passengers. In an NCQ environment, however, the elevator stops at the second, third, fourth, and sixth floors, in that order.

And for hard drives, NCQ can help overcome the drive's mechanical limitations and increase storage performance on random workloads by allowing the drive to internally optimize the order of the commands.

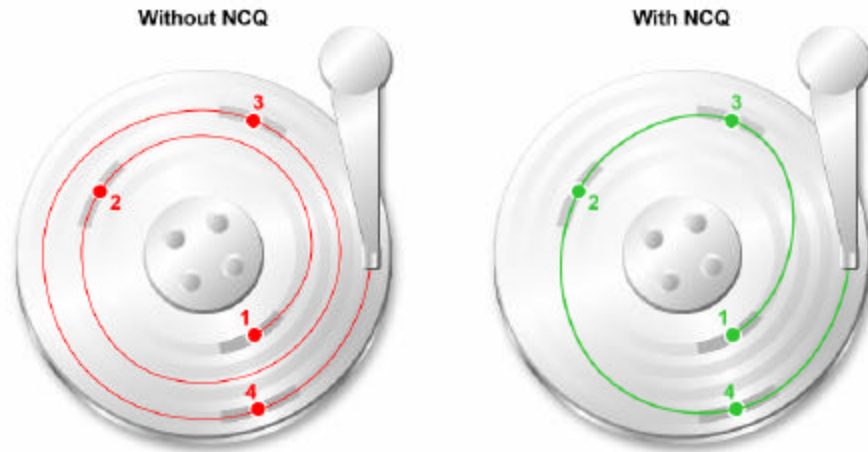


Figure 3. NVIDIA Native Command Queuing

## Partnerships with Top Hard Drive Vendors

Over the last year NVIDIA has partnered with the top hard drive vendors to ensure SATA 3Gb/s product development, interoperability, availability, and smooth transition. NVIDIA's partners include Hitachi, Maxtor, Samsung, Seagate, and Western Digital (Figure 4).



Figure 4. NVIDIA's Partnership with Top Hard Drive Vendors

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## Ultra ATA-133 Controllers

The NVIDIA nForce MCPs deliver a built-in Ultra ATA-133 IDE controller that supports standard programmable input/output (PIO) and Direct Memory Access (DMA) operations. UltraDMA 33/66/100/133 standards are also supported for a maximum data transfer rate of 133MBps per channel.

Separate independent datapaths for the IDE channels provide device configuration flexibility, with support for up to two devices per channel. Performance is further enhanced by many optimizations built into the NVIDIA IDE driver.

## Conclusion

The advanced storage capabilities of the NVIDIA nForce MCPs, including support for SATA 3Gb/s, native command queuing (NCQ), and a dual controller architecture, continue the NVIDIA tradition of building in functionality that lets users get the most out of systems.

These features of the NVIDIA nForce MCPs distinguish it as delivering industry-leading value to today's PCs and workstations:

- ❑ High-demand functionality
- ❑ Adherence to popular and emerging standards
- ❑ Ease of use

Plus, NVIDIA's proven record for optimizing the flow of data throughout the system now extends to the storage subsystem—a critical component for today's applications that handle increasingly large files, models, datasets, and digital environments. NVIDIA nForce MCPs contribute a vital technology that ensures optimized, balanced system performance for dynamic computing environments.



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