# Technologies for HP ProLiant 300-series servers

technology brief, 3rd edition

# Abstract

This paper describes the major technologies implemented in the latest generation of HP ProLiant 300-series servers. These technologies include dual-core and quad-core processors, Double Data Rate-2 (DDR2) and Fully-Buffered memory modules, Integrated Lights Out 2 management, multifunction network interface cards, and the latest serial input/output (I/O) technologies.

# Introduction

HP constantly advocates, tests, and adopts new industry-standard server technologies that improve the performance, capacity, and reliability of ProLiant servers. This paper summarizes the technologies implemented in the latest generation of the ProLiant 300-series servers, which include:

- Processors
- Memory
- I/O
- Networking
- Management

For complete specifications of all ProLiant-300 series servers, see the HP website at www.hp.com/products/servers/platforms.

# Processor technologies

ProLiant 300 series servers use the latest multi-core technologies from Intel and AMD. A multi-core processor has two or four separate execution cores on the same physical die so that it can perform more work within a given clock cycle. To take advantage of multi-core processing, software must be "multi-threaded" so that it can be spread across multiple execution cores.

## Intel Xeon dual-core and quad-core processors

The dual-core Intel Xeon 3000, 5000, and 5100 Sequence processors and quad-core Intel Xeon 5300 Sequence processors are based on the Intel® Core™ microarchitecture. The Core microarchitecture features lower power usage and heat production than previous generation Intel processors. Using Hyper-Threading technology, dual-core processors (with the exception of the Xeon 3000 Sequence processors) can simultaneously execute four software threads, thereby increasing processor utilization. To avoid saturation of the Front Side Bus (FSB), the Intel 5000 chipset widens the interface by providing dual independent buses. The Intel Core microarchitecture features additional technologies that improve per-watt performance and energy efficiency. These technologies include Hardware Virtualization, Enhanced Intel Speed-Step® Technology, Supplemental Streaming SIMD Extension 3 (SSSE3), and Intel Execute Disable Bit technology.[1]

### Xeon dual-core processors

The 64-bit Intel Xeon 3000 Sequence processors combine performance and power efficiency to enable smaller, quieter systems. Xeon 3000 Sequence processors run at a maximum frequency of 2.66 gigahertz (GHz), with 2 megabytes (MB) of L2 cache per core (Figure 1 left) and a maximum front-side bus speed of 1066 megahertz. These processors are compatible with IA-32 software and support single-processor operation. Xeon 3000 Sequence processors use the Intel 3000 or 3010

[1] For additional information about Intel processors, see the HP technology brief titled "The Intel processor roadmap for industry-standard servers" at www.hp.com/servers/technology.

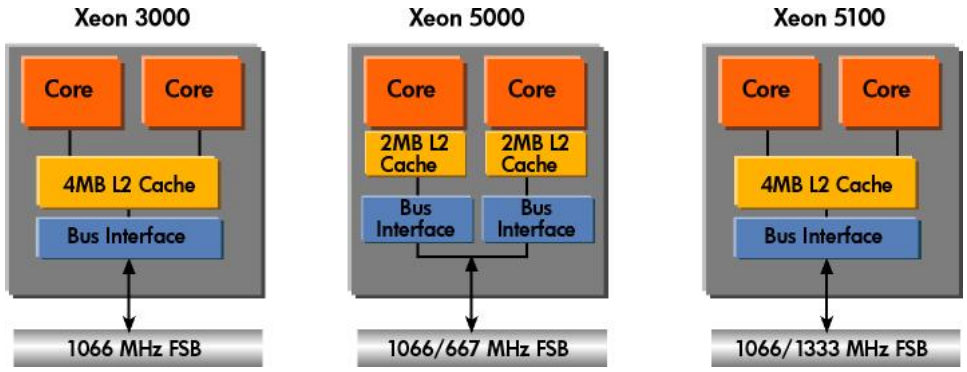
chipsets, which support Error Correction Code (ECC) memory for a high level of data integrity, reliability, and system uptime. ECC can detect multiple-bit memory errors and locate and correct single-bit errors to keep business applications running smoothly.

The 64-bit Intel Xeon 5000 Sequence processors have two complete processor cores, including caches, buses, and execution states. The Xeon 5000 Sequence processors run at a maximum frequency of 3.73 GHz, with 2 MB of L2 cache per core. The processor supports maximum front-side bus speeds of 1066 megahertz (Figure 1 center).

The 64-bit Xeon 5100 Sequence dual-core processor runs at a maximum frequency of 3.0 GHz with 4 MB of shared L2 cache and a maximum front-side bus speed of 1333 megahertz (Figure 1 right).

The Xeon 5000 and 5100 Sequence processors use the Intel 5000 series chipsets. These chipsets contains two main components: the Memory Controller Hub (MCH) and the I/O controller hub. The new Northbridge MCH supports DDR2 Fully-Buffered DIMMs (dual in-line memory modules).

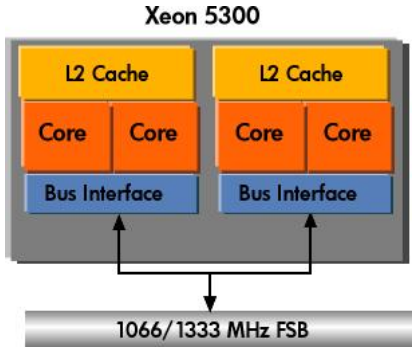
**Figure 1.** Diagram representing the major components of dual-core Intel Xeon 3000, 5000, and 5100 Sequence processors




**Xeon quad-core processor**

The quad-core Intel Xeon 5300 sequence processor is the first quad-core processor for dual-socket platforms (Figure 2). The Xeon 5300 Sequence processor has two dual-cores. Each pair of cores shares a L2 cache. The processors run at a maximum frequency of 2.66 GHz, with 2 MB of L2 cache per core. This configuration delivers a significant increase in processing capacity utilizing the Intel 5000 series chipsets. ProLiant 300 series servers use the Intel 5000P and 5000Z chipsets. These chipsets support 1066-MHz and 1333-MHz Dual Independent Buses, DDR2 FB-DIMMs, and PCI Express I/O slots.

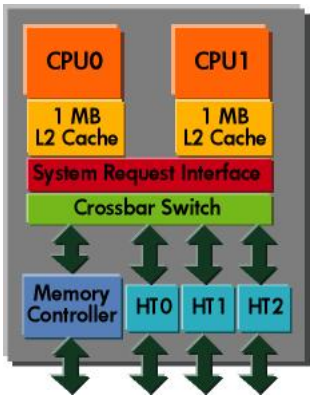
**Figure 2.** Quad-core Intel Xeon 5300 sequence processor



## AMD Opteron™ dual-core processor

The dual-core AMD Opteron Rev. F 2000 series processors feature HyperTransport™ technology, which provides a direct, scalable bandwidth interconnect between the processor, I/O subsystem, and chipset.[2] The Opteron Rev. F processor runs at speeds up to 2.8 GHz with 1 MB of L2 cache per core (Figure 3). The processor features an integrated memory controller that allows for the use of PC2-5300 (DDR2-667) DIMMs. The AMD Direct Connect™ architecture replaces the FSB with direct communication links between each CPU, between CPU and I/O, and between CPU-and memory.

**Figure 3.** Diagram representing the major components of an AMD Opteron Rev. F processor




## New processor socket technology

The latest Intel 5000 and 5100 Sequence processors and AMD Opteron Rev. F processor packages use a processor socket technology called Land Grid Array (LGA) to enable higher CPU bus speeds. The processor package designs no longer have pins. Instead, they have pads of gold-plated copper that touch processor socket pins on the motherboard.

The processors must be carefully installed to avoid damage to the delicate processor socket pins, which could require replacement of the motherboard. HP engineers developed a special installation tool to simplify processor installation and reduce the possibility of damage to the socket pins.

[2] For additional information about AMD processors, see the HP technology brief titled "The AMD processor roadmap for industry-standard servers" at www.hp.com/servers/technology.

# Memory technologies

The ProLiant 300-series servers support unbuffered, registered, and Fully-Buffered PC2-5300 (DDR2) DIMMs as indicated in Table 1. Unbuffered DDR2 DIMMs place the load of all the DDR2 devices on the address bus, so they are typically used in systems with four memory slots or less. Registered and Fully-Buffered (FB) DIMMs are used in systems with more than four memory slots. Registered DDR2 DIMMs place a maximum of two loads per DIMM on the memory bus, regardless of how many DDR2 devices are on each DIMM. The point-to-point FB-DIMM architecture enables the electrical load (and signal integrity) for each channel to remain constant, even as FB-DIMMs are added.

**Table 1.** Memory technologies supported by ProLiant 300-series servers

| ProLiant server | Unbuffered PC2-5300 (DDR2-667) | PC2-5300 (DDR2-667) | Fully-Buffered PC2-5300 (DDR2-667) |
|---|---|---|---|
| ML310 G4 | X | | |
| DL320 G5 | X | | |
| DL320s | X | | |
| ML350 G5 | | | X |
| DL360 G5 | | | X |
| DL365 | | X | |
| ML370 G5 | | | X |
| DL380 G5 | | | X |
| DL385 G2 | | X | |

In contrast to the first generation of DDR memory, DDR2 memory devices operate at a lower voltage (1.8V) to further reduce power consumption. [3] DDR2 devices also use higher clock frequencies to increase data transfer rates and uses on-die termination control to improve signal quality. At 200 MHz (double-clocked to an effective frequency of 400 MHz), DDR2 increases memory bandwidth to 3.2 GB/s.

[3] For additional information about DDR2 memory technology, refer to the HP technology brief titled "Memory technology evolution: an overview of system memory technologies" at www.hp.com/products/servers/technology.

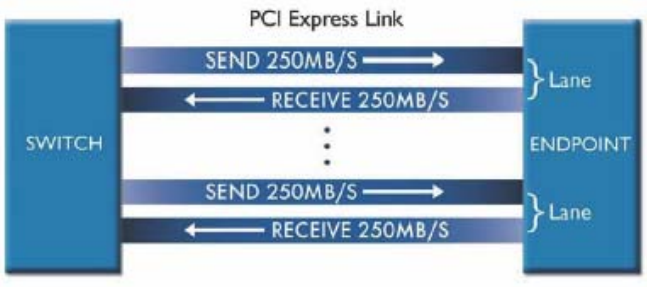
# I/O technologies

The latest generation of ProLiant 300 series servers feature PCI Express, Serial-Attached SCSI (SAS), and Serial ATA (SATA) I/O technologies. PCI Express allows expansion cards with various capabilities to be added to the system. SAS is a serial communication protocol for direct attached storage devices such as SAS and SATA small form factor (SFF) hard drives.

## PCI Express technology

The PCI Express (PCIe) serial interface provides point-to-point connections between the chipset I/O controller hub and I/O devices. Each PCIe serial link consists of one or more dual-simplex lanes. Each lane contains a send pair and a receive pair to transmit data at the signaling rate in both directions simultaneously (Figure 4). PCI Express 1.0 has a signaling rate of 2.5 Gb/s per direction per lane, resulting in an effective maximum bandwidth of 2 Gb/s (250 MB/s) per direction per lane after accounting for 20 percent serial encoding overhead. Therefore, a x4 link—with 4 send and receive pairs—has an effective bandwidth of 2 GB/s and a x8 link has an effective bandwidth of 4 GB/s. This flexibility allows slower devices to be given a single lane with a relatively small number of pins while faster devices can be given more lanes as required. For example, the latest Smart Array SAS controllers have x4 and x8 PCIe I/O connectors.[4]

**Figure 4.** PCI Express has an effective bandwidth of 250 MB/s per direction per lane after accounting for the overhead of serializing/deserializing encoding.




| **Link size** | **Max. bandwidth** (Send or receive) | **Total** (Send and receive) |
|---|---|---|
| x1 | 250 MB/s | 500 MB/s |
| x4 | 1 GB/s | 2 GB/s |
| x8 | 2 GB/s | 4 GB/s |

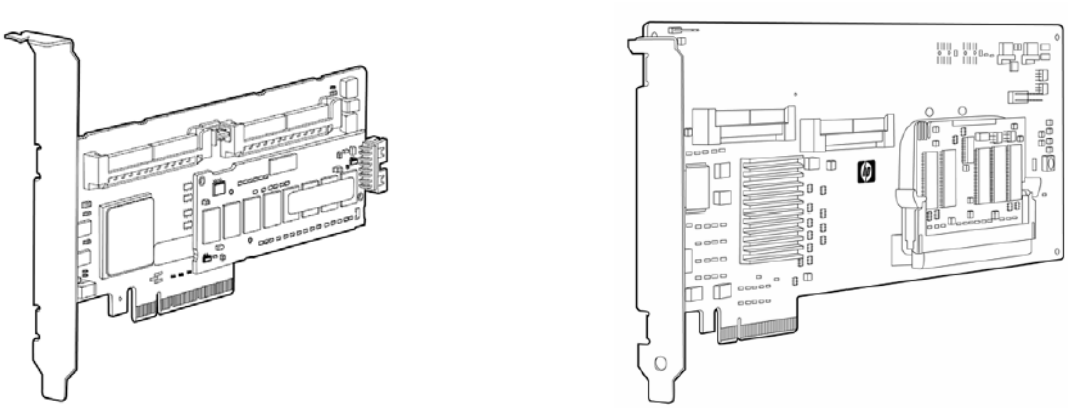
## Serial Attached SCSI technology

SAS is a point-to-point architecture in which each device connects directly to a SAS port rather than sharing a common bus like parallel SCSI devices. Point-to-point links increase data throughput and improve the ability to locate and fix disk failures. More importantly, the SAS architecture solves the parallel SCSI problems of clock skew and signal degradation at higher signaling rates.[5]

The ProLiant 300 series servers support SAS and SATA SFF drives through the use of the Smart Array E200 or P400 SAS Controller (Figure 5). For the 1U ProLiant DL365 and DL360 G2 servers, the controller logic is embedded on a Smart Array E200i or P400i Controller mezzanine card. The ProLiant ML350 server has the Smart Array E200 controller embedded on the system board.

[4] For additional information about PCI Express technology, see the technology brief titled "HP local I/O strategy for ProLiant servers" available at http://h18004.www1.hp.com/products/servers/technology/whitepapers/ .
[5] For more information about SAS technology, refer to the HP technology brief titled "Serial Attached SCSI technology".

**Figure 5.** HP Smart Array P400 controller (left) and E200 controller with battery-backed write cache (right).



A battery-backed write cache (BBWC) is available as an option for the Smart Array E200 and P400 controllers. The cache buffers disk writes so that disk I/O can be handled efficiently. The battery prevents information in the buffer from being lost in case of an unexpected shutdown of the system. In the case of a complete system failure, the controller and disks can be moved to a different server, where the controller will flush out the cache to the disks after power has been restored. In the case of a controller failure, the cache module and disks can be moved to a working controller, where the cache will be flushed out to the disks. The battery will last up to two days without receiving any power from the computer.

**HP Smart Array E200 controller**

The E200 controller provides the best price/performance. The E200 controller has a x4 PCIe I/O connector and is available in full-size and mezzanine card (E200i) form factors. The full-size E200 card has 8 SAS ports and utilizes DDR1-266 cache memory. The E200i mezzanine card has 4 SAS ports. The E200 supports RAID 0/1 and can be upgraded for RAID 5 with the 128-MB BBWC module.

**HP Smart Array P400 controller**

The P400 controller is ideal for internal disk storage and storage enclosures that require advanced RAID capability. The P400 controller has a x8 PCIe I/O connector and supports RAID levels 0, 1, 1+0, and 5. Mirror splitting is available for RAID 1 arrays. This functionality allows the user to split a RAID 1 mirror into two separate RAID 0 arrays (breaking the mirror). Mirror recombining is the opposite, combining two RAID 0 arrays into a RAID 1 mirror. The battery-backed write cache is not required for this feature. RAID 6 (double parity) is available when using the BBWC.[6] Some server configurations include a BBWC on the P400 controller. The BBWC is also available as an option.

The BBWC is required for capacity expansion, which allows the user to add a physical disk to an existing array. The controller then recalculates parity and balances the data across the disks. During the expansion, data and logical structures on the array are preserved.

The P400 controller supports a recovery and Online Drive Flashing. In the event of a failed attempt to flash the controller's ROM, the recovery ROM reverts to the previous good ROM. With Online Drive Flashing, disk drive firmware updates can be pre-loaded onto the controller and the controller will flash the firmware onto the disk drives at the next reboot.

[6] For detailed information about RAID 6, refer to the HP technology brief titled "RAID 6 with HP Advanced Data Guarding technology: a cost-effective, fault-tolerant solution" available at www.hp.com/servers/technology.

**SAS and SATA Small Form Factor (SFF) hard drives**

The SAS architecture enables system designs that deploy high-performance SAS[7] and high-capacity SATA[8] SFF drives. This capability provides a broad range of storage solutions that give IT managers the flexibility to choose storage devices based on reliability, performance, and cost.

SFF 2.5-inch drives offer several advantages over 3.5-inch drives. The smaller physical size of the drives increases the number of gigabytes per U that can be implemented in a server rack. SFF drives have been shown to be more reliable than their larger counterparts, primarily due to the use of smaller parts and better control of vibration.

Power consumption and heat generation are also reduced by using SFF drives. SFF SAS drives consume approximately half of the power used by a 3.5-inch drive of comparable capacity. This reduction in power consumption allows SFF drives to run cooler than 3.5-inch drives.

SFF drives also deliver higher performance because the smaller platter size reduces seek times as the heads have a shorter distance to travel. The peak data transfer rate for the current generation of SAS drives is 3 Gb/s in full duplex mode. RAID performance naturally benefits from having more spindles; and with SFF, more disks can fit into a given amount of space.

# Power management

Power management tools from HP help to accurately monitor server power usage, improve server power efficiency, and provision power usage of one or more ProLiant servers. These tools include

- Power Meter for monitoring server power usage
- Power Regulator for higher server efficiency
- High-efficiency power supplies
- A new Power Cap feature for provisioning power to groups of ProLiant servers

## Power meter

Most new ProLiant 300 servers enable the analysis of actual server power usage by integrating a power meter. The power meter is accessible through iLO and through external power management software such as HP Insight Power Manager (IPM). IPM also enables consolidating the power data for multiple servers to a central location. This information can also be used to charge business units or third parties with the actual energy operational costs associated with workload processing.

As of the publication date of this paper, the ProLiant 300-series servers that include the power meter are the ML350 G5, ML370 G5, DL360 G5, DL365, DL380 G5, and DL385 G2.

## HP Power Regulator

The latest server processors from Intel and AMD have power state hardware registers that are available (exposed) to allow IT organizations to control the performance and power consumption of the processor. These capabilities are implemented through Intel's Enhanced Intel SpeedStep® Technology and demand-based switching and through AMD's PowerNow with Optimized Power Management (OPM). With the appropriate ROM firmware or operating system interface, programmers can use the exposed hardware registers to switch a processor between different performance states, also called P-states[9], which have different power consumption levels. For

[7] Please refer to the technology brief "Serial-Attached SCSI technology" for more information about these features.
[8] Please refer to the technology brief "Serial ATA technology" at www.hp.com/servers/technology for more information about these features.
[9] The ACPI body defines P-states as processor performance states. For Intel and AMD processors, a P-state is defined by a fixed operating frequency and voltage.

example, HP developed a power management feature called HP Power Regulator that utilizes P-state registers to control processor power usage and performance. These capabilities have become increasingly important for power and heat management in high-density data centers. When combined with data-center management tools like Insight Power Manager, IT organizations have more control over the power consumption of all the servers in the data center.

HP Power Regulator[10] is included as a standard feature on HP ProLiant servers. Using the P-states implemented in the CPUs, Power Regulator allows IT organizations to minimize power consumption, maintain desired performance levels, and maximize facility resources. Power Regulator is implemented in firmware and is therefore not affected by operating system or application upgrades.

Power Regulator can be configured for Static Low Power Mode, Static High Performance Mode, or Dynamic Power Savings Mode. It can also be set to OS Control mode, to allow for OS control of the processor P-states. With HP Static Low Power Mode, the processors are configured to run continuously in a lower power state. This is useful for customers with power-constrained data centers who require the most efficient use of power for each server. For servers that operate in moderately or minimally loaded environments, there will be little, if any, performance degradation in Static Low Power Mode. Alternatively, in HP Static High Performance mode, the processors operate continuously at the highest power and performance.

HP Dynamic Power Savings Mode lowers overall power usage of the server without noticeably affecting system performance. When this mode is enabled, the system ROM uses CPU performance registers to monitor the utilization of the processor up to eight times a second, and dynamically modifies the frequency and voltage of each processor based on the processor workload. The processor operates in a high power state only when needed, thus reducing the overall system power usage. As of the publication date of this paper, the ProLiant ML310, DL320, DL365, and DL385 servers do not support Dynamic Power Savings Mode.

HP Dynamic Power Savings Mode is the default HP Power Regulator Mode for the latest generation of Intel-based 300-class HP ProLiant servers. These servers save power and money out of the box with no configuration required by the customer.

OS Control Mode enables operating systems with OS Power Management features to control the CPU P-states. When enabled and appropriately configured, the operating system will modify the frequency and voltage of the processors to achieve similar power savings to the HP Dynamic Power Savings Mode. This is the default mode for HP ProLiant servers with CPUs that do not support HP Dynamic Power Savings mode.

For more information about Power Regulator modes, read the technology brief "HP Power Regulator for ProLiant servers" at http://h20000.www2.hp.com/bc/docs/support/SupportManual/c00593374/c00593374.pdf.

## High-efficiency power supplies

All ProLiant servers are equipped with high-efficiency switch-mode power supplies, when compared to typical power supplies in the industry. For example, a typical white-box server power supply has an efficiency rating between 65 percent and 70 percent. ProLiant servers operate with efficiencies of 85 percent or greater when connected to a high-line voltage source.

ProLiant-server power supplies operate at maximum efficiency when connected to high-line input power (200 to 240 VAC). As with typical power supplies in the industry, operating at low line power (100 to 120 VAC) causes the power supply to operate at a lower efficiency and to draw more current for the same power output.

[10] Available online at http://h18013.www1.hp.com/products/servers/management/ilo/power-regulator.html

## Power Cap

Using updated iLO 2 firmware (version 1.30) and update System ROM/BIOS (dated 5/1/2007), selected HP ProLiant servers now have the ability to limit the amount of power consumed. Customers may set a limit in Watts or Btu/hr. The purpose of this limit is to constrain the amount of power consumed, which reduces the heat output into the data center. The iLO 2 firmware monitors the power consumption of the server, checks it against the power cap goal, and, if necessary, adjusts the server's performance to maintain an average power consumption that is less than or equal to the power cap goal.

As of the publication date of this paper, the ProLiant 300-series servers that support the Power Cap feature include the ML350 G5, DL360 G5, ML370 G5, and DL380 G5.

Using the IPM v1.10 plug-in to Systems Insight Manager v5.1, customers may set power caps on groups of supported servers. The IPM software statically allocates the group power cap among the servers in the group. The group cap is allocated equitably among all servers in the group based on a calculation using each server's idle and maximum measured power consumption.

The latest iLO 2 firmware may be found at http://www/hp.com/go/ilo. Updated System ROM/BIOS may be found on the Software and Drivers download page for each server model at http://www.hp.com/go/proliant. The latest Insight Power Manager software may be found at http://www.hp.com/go/ipm.

# Updated networking technologies

The embedded NC373i and NC371i Gigabit Server Adapters have been upgraded to include support for TCP/IP Offload Engine technology as well as future support for iSCSI and Receive Side Scaling.

## TCP/IP Offload Engine

The increased bandwidth of gigabit Ethernet networks has resulted in increased demand for CPU cycles to manage the network protocol stack. This means that even a fast CPU will show degraded performance in processing application instructions while data is being transferred to or from the network. Computers most susceptible to this problem are application, web, and file servers that have a high number of concurrent network connections.

The TCP/IP Offload Engine, or TOE, helps speed up network intensive applications by offloading TCP/IP-related tasks from the processors onto the network adapter. TOE network adapters are designed with on-board logic to process common and repetitive tasks of TCP/IP network traffic. This effectively eliminates the need for the CPU to segment and reassemble network data packets, which significantly increases application performance of servers attached to gigabit Ethernet networks.

TOE is supported on Microsoft Windows Server 2003 with the Scalable Networking Pack installed.

## iSCSI

iSCSI is a standard that implements the SCSI protocol for interacting with storage devices over a TCP/IP network. While iSCSI can be implemented over any TCP/IP network, the most common implementation is over gigabit Ethernet. iSCSI serves the same purpose as Fibre Channel in building storage area networks (SANs), but iSCSi avoids the cost, complexity, and compatibility issues associated with Fibre Channel SANs.[11]

iSCSi devices (initiators) access storage resources (targets) using the iSCSI protocol. While the target is usually a hard drive enclosure or another computer, it can also be any other storage device that supports the iSCSI protocol, such as a tape drive.

Initiators include software initiators and Host Bus Adapters (HBAs). Software initiators require CPU resources to manage the protocol stack. A more efficient approach is to offload the management of the protocol to an iSCSI HBA, such as the NC373i Integrated Multifunction Gigabit Server Adapter. An iSCSI HBA appears to the operating system as a SCSI HBA.

## Receive Side Scaling (RSS)

The Network Driver Interface Specifications (NDIS) define a common Application Programming Interface for network interface cards on Microsoft operating systems. Early versions of NDIS did not differentiate between computers with single or multiple CPUs. The result was that one CPU was forced to handle the entire network processing load. NDIS v6.0 includes support for multiple processors. With NDIS v6.0, RSS can dynamically balance the processing of received network packets across multiple processors. The Scalable Networking Pack for Windows Server 2003 is required for RSS support.

# Mechanical design for serviceability

Whenever possible, ProLiant 300 series servers use common hardware components. This requires customers to keep fewer spare parts in stock and greatly simplifies ordering and storage of replacement parts. Common hardware components include power supplies, SAS and SATA SFF drives, Smart Array RAID controllers, the Systems Insight Display, and rails and racks.

[11] For more information about iSCSI, refer to the HP technology brief titled "iSCSI technology: A convergence of networking and storage" available at www.hp.com/servers/technology.

# Improved manageability

The latest generation of ProLiant servers features Integrated Lights-Out 2 (iLO 2) remote management, the fourth generation of Lights-Out for HP servers. iLO 2 is a combination of hardware and firmware integrated into the server to provide remote management capabilities over Ethernet. iLO2 is active even when the OS not operating. The iLO 2 management processor obtains its power from the auxiliary power plane of the server, so it is always available when the server is plugged into a power source. There are three levels of licensing for iLO 2: iLO 2 Standard, iLO 2 Select Packs, and iLO 2 Advanced Packs. Each offers different levels of remote access capabilities.

iLO 2 provides full graphics support using either a dedicated iLO 2 port or a shared network connection. To allow for easy, direct connection and to aid in troubleshooting, the latest ProLiant 300 series servers have a front video connector in addition to two USB 2.0 ports.[12]

The latest generation of ProLiant 300 series servers, except for the ML310 and DL320, have a Systems Insight Display located on the front of the unit (see Figure 6). This display puts all system health information on one convenient location without having to open the server. For some servers, the Systems Insight Display is mounted on a hidden slide-out assembly so that it can be viewed by pressing an eject button.

**Figure 6.** Systems Insight Display


# Latest-generation ProLiant 300 series servers

The latest generation of ProLiant 300-series servers include three tower models—the ML370 G5, ML350 G5, and ML310 G4—and six dense rack-based models—the DL385 G2, DL380 G5, DL365, DL360 G5, DL320 G5 and DL320s. Some of these platforms include high-performance models with the latest performance technologies and enterprise-class availability features pre-installed for convenience and value.

[12] For more information about iLO 2, refer to the HP technology brief titled "Integrated Lights-Out technology: enhancing the manageability of ProLiant servers" available at www.hp.com/servers/technology.

## ProLiant ML 300 series servers

ProLiant ML servers are optimized for expansion. The ProLiant ML370 G5 provides the best dual-processor performance with room to expand. The ML350 G5 server provides excellent price/performance features, and it has a new bezel featuring a pop-out for access to five media bays and the SFF drives. The ProLiant ML310 G4 server is a secure, affordable foundation for small businesses and remote sites.

**Table 2.** ProLiant ML 300 server series comparison

| | ML370 G5 | ML350 G5 | ML310 G4 |
|---|---|---|---|
| Processors (maximum) | (2) Intel Xeon 5000 or 5100 dual-core or (2) Intel Xeon 5300 quad-core | (2) Intel Xeon 5000 or 5100 dual-core or (2) Intel Xeon 5300 quad-core | (1) Intel Xeon 3000 Sequence dual-core<br>(1) Intel Pentium D 800 or 900 Series |
| Maximum frequency | Xeon 5000 – 3.73 GHz<br>Xeon 5100 – 3.0 GHz<br>Xeon 5300 – 2.66 GHz | Xeon 5000 – 3.73 GHz<br>Xeon 5100 – 3.0 GHz<br>Xeon 5300 – 2.66 GHz | Xeon 3000 – 2.66GHz<br>Pentium D 800 – 2.8GHz<br>Pentium D 900 – 3.0GHz |
| Front side bus | Up to 1333 MHz | Up to 1333 MHz | Up to 1066 MHz |
| L2 cache | Xeon 5000 – 2 x 2MB<br>Xeon 5100 – 1 x 4MB<br>Xeon 5300 – 2 x 4MB | Xeon 5000 – 2 x 2MB<br>Xeon 5100 – 1 x 4MB<br>Xeon 5300 – 2 x 4MB | Xeon 3000 – 2 x 2MB<br>Pentium D 800 – 2 x 1MB<br>Pentium D 900 – 2 x 2MB |
| Chipset | Intel 5000P | Intel 5000Z | Intel 3000 |
| Memory | PC2-5300 DDR2 FB-DIMMs | PC2-5300 DDR2 FB-DIMMs | PC2-5300 unbuffered (DDR2-667) |
| Max. memory | 64 GB | 16 GB (dual core)<br>32 GB (quad core) | 8 GB |
| Max. internal drives | 16 SAS or SATA SFF | 8 SAS or SATA SFF or 6 3.5-in (optional) | 4 SAS or SATA SFF |
| I/O slots | (2) PCI-X 133 MHz<br>(7) PCIe x4 (6 available) | (3) PCI-X 100 MHz<br>(3) PCIe x4 | (2) PCI-X 100 MHz<br>(2) PCIe - x4 and x1 |
| Disk controller | Smart Array E200 or P400 | Smart Array E200i | Integrated SATA RAID 0/1 or<br>Integrated SAS RAID 0/1 |
| Network adaptor | NC373i Multifunction Gigabit Adapter with TOE | NC373i Multifunction Gigabit Adapter with TOE | NC320i |
| Form factor | Tower and 5U rack | Tower and 5U rack | 5U |

## ProLiant DL 300 series servers

ProLiant DL servers are density optimized for rack installations. The DL380 G5 improves on the G4 server with faster processors and memory, a bigger memory footprint, more I/O slots, support for more drives, and improvements in server management. The DL385 G2 improves on the first generation server by offering the latest AMD processor technology, higher-speed memory, and eight SAS SFF drives.

The front panels of both servers feature two USB connectors, a video connector, and a clearly visible Systems Insight Display.

**Table 3.** ProLiant DL 380 G5 and DL385 G2 server series comparison

| | DL380 G5 | DL385 G2 |
|---|---|---|
| Processors (maximum) | (2) Xeon 5000 or 5100 dual core or<br>(2) 5300 quad-core | (2) dual-core AMD Opteron Rev.F 2000 series |
| Maximum frequency | Xeon 5000 – 3.73 GHz<br>Xeon 5100 – 3.0 GHz<br>Xeon 5300 – 2.6 GHz | 2.8 GHz |
| Front Side Bus | 1333 MHz | — |
| L2 cache | 2x2MB L2 (Xeon 5000)<br>4MB L2 (Xeon 5100)<br>2x4MB L2 (Xeon 5300) | 2x1MB |
| Chipset | Intel 5000P | ServerWorks HT-2100 Northbridge |
| Memory | PC2-5300 DDR2 FB-DIMMs | PC2-5300 (DDR2-667) |
| Max. memory | 32 GB | 32 GB |
| Max. internal drives | 8 SFF SAS | 8 SFF SAS |
| I/O slots | (1) low profile PCI-Express x8<br>(1) PCI-Express x4<br>(2) PCIe x8 | (2) PCI-Express x8<br>(2) PCI-Express x16 |
| Smart Array disk controller | P400 or E200 | P400 or E200 |
| Network adaptor | (2) NC373i Multifunction Gigabit Adapters with TOE | (2) embedded NC371i Multifunction Gigabit Adapters with TOE |
| Form factor | 2U | 2U |

The ProLiant DL365 is a new offering in the 1U server space that features the AMD Opteron Rev. F processors. The DL365 leverages the same chassis as the DL360 and therefore fits into existing server racks.

The front panels of the servers feature a dedicated USB port, a video port for direct connection, and a Systems Insight Display mounted on a slide-out assembly. On the DL365, the Systems Insight Display provides system operational status specific to the AMD-based motherboard.

**Table 4.** ProLiant DL365 and DL360 G5 server series comparison

| | DL365 | DL360 G5 |
|---|---|---|
| Processors (maximum) | (2) AMD Opteron Rev.F dual-core processors with Direct Connect Architecture | (2) Intel Xeon 5000 or 5100 dual core with VT technology or (2) 5300 quad-core |
| Front Side Bus | — | Up to 1333 MHz |
| L2 cache | 2x1 MB L2 | 2x2MB L2 (Xeon 5000)<br>4MB L2 (Xeon 5100)<br>2x4MB L2 (Xeon 5300) |
| Memory | PC2-5300 (DDR2-667) | PC2-5300 DDR2 FB-DIMMs |
| Chipset | ServerWorks HT-2100 Northbridge | Intel 5000P |
| Max. memory | 32 GB | 32 GB |
| Max. internal drives | 6 SFF SAS or SATA drives | 6 SFF SAS or SATA drives |
| I/O slots | (2) PCIe x8 | (2) PCIe x8 |
| Smart Array controller | P400i (RAID 0,1,5) or E200i (RAID 0,1) | P400i (RAID 0,1,5) or E200i (RAID 0,1) |
| Network adaptor | (2) NC371i Multifunction Gigabit Adapters with TOE | (2) NC371i Multifunction Gigabit Adapters with TOE |
| Form factor | 1U | 1U |

The ProLiant DL320 G5 server is a low-cost, single socket 1U server for a highly manageable IT infrastructure, and for Internet and edge applications for SMB and OEM appliance customers. The ProLiant DL320s is a high-density server that is ideal for servicing large data farms.

**Table 5.** ProLiant DL320 G5 and DL320s server series comparison

| | DL320 G5 | DL320s |
|---|---|---|
| Processors (maximum) | (1) Dual Core: Intel® Xeon™ 3000 series or<br>(1) Single core: Intel Pentium-4 processor 651 or<br>(1) Dual-Core Pentium-D 820 or Celeron-D 352 processor | Intel Xeon 3000 series or Pentium 4 processor |
| Front side bus | 1066 MHz | 1066 MHz |
| L2 cache | up to 4MB of L2 Cache | 4MB (2Mx2M) Level 2 |
| Chipset | Intel 3000 | Intel 3010 |
| Memory | PC2-5300 DDR2 Unbuffered ECC | PC2-2400 533MHz DDR2 RAM |
| Max. memory | 8 GB | 8 GB |
| Max. internal drives | 2 SFF SAS or SATA | 12 SFF SAS or SATA |
| I/O slots | (1) full-length/full height PCI-Express x8 or optional PCI-X 64/133;<br>(1) half length/low-profile PCI-Express x8 | (2) PCIe: x8 and x1 |
| Disk controller | Embedded SATA controller with RAID 0/1 | Smart Array P400 Controller with 256MB cache (RAID 0/1/5) |
| Network adaptor | NC324i PCIe Dual Port Gigabit Adapter | NC324i PCIe Dual Port Gigabit Adapter |
| Remote management | iLO 2 | iLO 2 |
| Form factor | 1U | 2U |

# Conclusion

The latest generation of ProLiant 300-series servers continue to build on the success of their predecessors, offering both high performance and reliability. With the introduction of new industry-standard technology, HP has refreshed and expanded its ProLiant 300 Series Server line to take advantage of these advances and to improve on existing features. The new generation of the ProLiant 300 series servers continues to offer customers the most choices in the dual-processor server arena. The new servers also reflect the continued movement towards serial I/O technologies by incorporating them as standard features.

# For more information

For additional information, refer to the resources listed below.

| Resource description | Web address |
|---|---|
| HP Advanced Data Guarding Web site | http://h18004.www1.hp.com/products/servers/proliantstorage/arraycontrollers/adg/ |
| "Serial ATA technology" technology brief | www.hp.com/servers/technology |
| "Serial-Attached SCSI technology" technology brief | www.hp.com/servers/technology |
| Smart Array P600 array controller | http://h18004.www1.hp.com/products/servers/proliantstorage/arraycontrollers/index.html |
| "iSCSI technology: A convergence of networking and storage" | iSCSI technology: A convergence of networking and storage |
| "Fully-Buffered DIMM technology in HP ProLiant servers" | http://h18004.www1.hp.com/products/servers/technology/whitepapers/adv-technology.html |
| "HP Power Regulator for ProLiant servers" technology brief | http://h20000.www2.hp.com/bc/docs/support/SupportManual/c00593374/c00593374.pdf |

# Call to action

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