Technical white paper

HP ProLiant Gen9 servers technology and product overview

Delivering the right compute solutions for the right workloads

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Advancing technologies to transform your business

HP focuses on ensuring that our HP ProLiant Servers deliver what you need and expect from an industry leader. Whether your workloads revolve around Big Data, Cloud, virtualization, or core applications, ProLiant servers deliver the right compute for the right workload at the right economics. The newest additions to the ProLiant portfolio are the HP ProLiant Gen9 servers. ProLiant Gen9 servers continue to deliver on our vision of providing industry-leading compute innovation and leveraging technology to transform your business.

Introduction

To provide a cost-optimized solution for diverse workloads, HP has designed the ProLiant Gen9 servers to meet key customer needs, including:

- Reducing IT costs through increased compute and storage capacity that is more efficient than before. ProLiant Gen9 servers allow you to tailor your compute solution for efficiency by offering flexible choices for servers, storage, networking, power options and more.
- Delivering faster setup, deployment and system maintenance with major innovations in embedded management – as well as On Premise and On Cloud management platforms.
- Increasing workload performance across the ProLiant Gen9 architecture – including significant advances in processor and memory performance, as well as optimized storage performance and increased networking performance with lower latency capabilities.

These ProLiant Gen9 server design characteristics empower you to address the challenges that you face every day, without sacrificing the compute power that your workload requires in today's IT environment. In fact, ProLiant Gen9 servers are designed and optimized for the new compute approach. They provide optimum performance for diverse workloads and have the technical innovation to meet evolving workload requirements.

Whether your business needs focus on core applications, virtualization, Cloud, or Big Data, ProLiant Gen9 servers are designed to help you move towards a new approach to compute that reduces IT and data center inefficiencies while accelerating service delivery and optimizing application workload performance.

The goal of this paper is to help you understand the new technologies and innovations that HP has incorporated into ProLiant Gen9 servers bring to your datacenter and to provide guidance for choosing the right ProLiant Gen9 servers for your workload.

A closer look at the ProLiant Gen9 server advantage

ProLiant Gen9 Servers incorporate key technologies to help simplify your tasks while providing the agility and efficiency that your business requires. Key features that apply to all ProLiant Gen9 servers include advancements in all of the major server subsystems – including powerful new processors, HP DDR4 Smart Memory, Smart Storage, innovations in system management, and new networking technologies.

For ProLiant Gen9 servers, HP has also maintained and continued to refine the important technologies and features that we first introduced in ProLiant Gen8 servers – including Sea of Sensors, Advanced Power Management, Intelligent Provisioning and many others. For a review of the technologies introduced in ProLiant Gen8 servers, see the "Innovative technologies in HP ProLiant Gen8 servers" Technology brief at hp.com/ctg/Manual/c03227849.pdf.

Intel® Xeon® E5-2600 v3 Processors

Optimal performance is vital to your business. All HP ProLiant Gen9 2 socket servers use the new Intel® Xeon® E5-2600 v3 processor series, providing significant performance improvements over the E5 2600 and E5 2600 v2 series processors in ProLiant Gen8servers. E5-2600 v3 Series processors feature all of the following architectural improvements:

• An increase in the number of internal cores with a minimum of 4 and a maximum of 18

• CPU architectural improvements to deliver both improved legacy and floating point performance

• Use of next generation DDR4 HP Smart Memory with memory transfer rates of up to 2133 MT/s

• An increase to 40 PCIe 3.0 lanes, delivering in greater I/O throughput capability

• Faster 9.6 GT/s QPI links

• A new generation of processor power management with smarter power cores and Per Core P-states (PCPS) that delivers up to a 36% increase in power efficiency

Depending on the particular model, Intel Xeon E5-2600 v3 Series processors have shown up to a 70 percent gain[1] in workload performance over the comparable E5-2600 v2 Series processor.

HP DDR4 Smart Memory

 ProLiant Gen9 servers are the first to use HP Smart Memory that is based on DDR4 technology. DDR4 memory operates at 2133 MT/s when installed in 1 or 2 DIMMs per channel (DPC) configurations, delivering a 14% increase in memory performance over DDR3 memory for rack and tower servers and up to 33% better memory performance for HP ProLiant Blade servers[2]. Additionally, DDR4 memory design is more power efficient than ever, operating at 1.2V instead of the 1.5V of DDR3.

As we did for Gen8 servers, HP is also delivering HP Smart Memory DIMMs for ProLiant Gen9 servers. DDR4 HP Smart Memory provides the following advantages when used in ProLiant Gen9 servers:

• **Extended Performance.** In 2 or 3 DPC configurations, DDR4 Smart Memory will operate at a higher transfer rate than standard DDR4 DIMMs, delivering better memory performance.

• **Enhanced Manageability**. Integration with HP Active Health System for monitoring and problem diagnosis.

Table 1 shows the Extended Performance matrix for DDR4 HP Smart Memory on servers with Intel Xeon E5-2600 v3 Series processors that support 2133 MT/s operation. Some models of these processors may only support a maximum operating speed of 1866 MT/s.

Table 1. Enhanced Performance for DDR4 HP Smart Memory

DIMMs per Channel	Standard DD4 Memory	DDR4 HP SmartMemory (LRDIMMs)	DDR4 HP SmartMemory (RDIMMs)
1	2133 MT/s at 1.2V	2133 MT/s at 1.2V	2133 MT/s at 1.2V
2	1866 MT/s at 1.2V	2133 MT/s at 1.2V	2133 MT/s at 1.2V
3	1600 MT/s at 1.2V	1600 MT/s at 1.2V	1600 MT/s at 1.2V

For DDR4 on ProLiant Gen9 servers, only RDIMMs and LRDIMMs are available. ProLiant Gen9 servers with DDR4 Smart Memory maintain all of the advanced memory features introduced in HP ProLiant Gen8 servers, including Advanced Error Detection and Advanced Fault Resiliency.

[1] Software and workloads used in performance tests may have been optimized for performance only on Intel® microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. Results have been estimated based on internal Intel analysis and are provided for informational purposes only. Any difference in system hardware or software design or configuration may affect actual performance

[2] Based on HP internal calculations. Up to 14% better performance is based on similar capacity DIMM running on HP server compared to a non HP server with DDR4. Calculation: At 2DPC (2 DIMMs per channel), HP will perform with RDIMM and LRDIMM at 2133MHz whereas Intel suggests 2DPC at 1866MHz ((2133 − 1866)/1866)*100 = 14%. Up to 33% better performance is based on similar capacity DIMM running on HP server compared to a non HP server with DDR4 Calculation: In Blades under fully loaded system, HP Blades will work at 2133MHz whereas Intel suggested at 1600MHz ((2133-1600)/1600) * 100 = 33%.

HP Smart Storage

HP continues to make Smart Storage simpler to configure and mange while offering more flexibility in controller choices and greater performance across the entire controller line. For ProLiant Gen9 servers, we are offering three tiers of storage controllers – each intended to meet specific sets of workload requirements.

The HP Dynamic Smart Array B140i is the embedded storage controller on all ProLiant Gen9 servers, delivering a base level of storage functionality and performance. HP Smart SAS HBA controllers feature the new 12 Gb/s SAS channels and are designed to provide scalable high performance SAS storage solutions for environments that do not require the full feature set of HP's Smart Array controllers.

The new HP Smart Array controllers deliver improved performance, features, and reliability. For ProLiant Gen9 servers, all Smart Array controllers feature built-in flash-backed write cache memory (FBWC) that is backed up by the new HP Smart Storage Battery incorporated into the server itself. In addition, Smart Array controllers support advanced features, including HP SmartCache and HP secure Encryption. With their faster processers, memory, 12 Gb/s SAS channels – as well as optimized controller firmware – HP Smart Array controllers are capable of achieving over 1 million random IOPs performance.

Table 2. HP Smart Storage controllers for ProLiant Gen9 servers

	HP Dynamic Smart Array B140i	HP Smart SAS HBA	HP Smart Array
Storage Connections	6 Gb/s SATA (10 drives max.)	12 Gb/s SAS	12 Gb/s SAS
HBA Support	Yes	Yes	Yes
RAID Support	(Software RAID) RAID 0 RAID 1 and 10 RAID 5	(Controller based RAID) RAID 0 RAID 1 and 10 RAID 5	(Controller based RAID) RAID 1 and 10 RAID 1 ADM and 10 ADM RAID 5 and RAID 50 RAID 6 and RAID 60
Advanced Features		HP SmartPath (RAID mode only) HP Secure Encryption (RAID mode only)	Built-in Flash-backed Write Cache HP SmartCache (RAID mode only) HP SmartPath (RAID mode only) HP Secure Encryption (RAID mode only)

For more information on Smart Storage please see "HP Smart Storage for HP ProLiant Gen9 servers" technical white paper at hp.com/V2/GetDocument.aspx?docname=4AA5-4526ENW&cc=us&lc=en.

Networking

For ProLiant Gen9 servers, HP is providing next generation networking adapters designed to meet the needs of converged IT infrastructure with higher performance and support for key Ethernet features. Gen9 ML and DL servers come with embedded multi-port 1 Gb NICs, but can utilize the new Dual- and Quad-port FlexibleLOM and stand-up NICs. For Gen9 BladeSystem servers, there are the newer 20 Gb FlexFabric adapters to go with 10 Gb Ethernet and 10 Gb FlexFabric adapters.

The more advanced Gen9 networking adapters also feature several new capabilities such as NPAR and RoCE that deliver improved network performance and efficiency in specific environments.

Multi-rate Adapters
New HP FlexFabric adapters for ProLiant Gen9 server blades provide full-featured, high performance converged 20 Gb Ethernet that accelerates IT services and increases data center efficiency across a broad range of IO intensive enterprise, cloud and Telco workloads.

When connected to HP Virtual Connect FlexFabric-20/40 F8 Modules, the HP FlexFabric 650FLB and 650M adapters provide 20 GbE performance and when connected to HP Virtual Connect Flex-10/10D Modules or HP 6125XLG Ethernet switches, 10 GbE performance.

Flex-20

Virtual Connect Flex-20 is an HP network connection technology that's available only with Virtual Connect – and is built into FlexFabric modules, NICs and HP Servers. With Flex-20 each port of the network adapter becomes four individual NICs called FlexNICs that share 20 Gb of bandwidth. These FlexNICs can be configured for specific traffic types, such as storage, management, VM migration, and VM traffic, among others. Bandwidth is assigned to each FlexNIC to fine tune performance, and idle bandwidth is reallocated to maximize utilization.

FlexFabric

FlexFabric combines Flex-10, Flex-20, and Fibre Channel over Ethernet and accelerated iSCSI, HP FlexFabric adapters provide a lossless network environment for storage. Additionally, the FlexFabric adapters offload the storage protocols, improving CPU efficiency and storage performance.

The FlexFabric 20 Gb adapters do not just deliver twice the bandwidth of 10 GbE adapters. When connected with the new Virtual Connect FlexFabric 20/40 F8 interconnect module in the infrastructure, they can keep up with the demand for storage traffic without starving out LAN traffic.
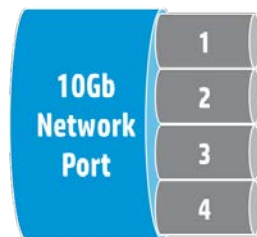
RDMA over Converged Ethernet (RoCE)

RoCE allows applications to directly access memory on other nodes across a fabric for very low latency communications. RoCE works well for endpoints that communicate frequently, such as storage functions, database environments, or virtual machine migrations. RoCE is available with the HP FlexFabric 20 Gb 2-port 556FLR-SRP+, HP 650FLB and 650M adapters.

NIC Partitioning

NIC Partitioning (NPAR) allows a single port to be presented to the operating system as four separate adapters – or partitions – per port. Each partition is an actual PCIe function that appears to the system ROM, OS, or virtualization OS as a discrete physical NIC with its own software driver, and each partition behaves as an independent NIC port. With NPAR, you must configure the partitions in a pre-boot environment, which you must also manage locally on each server. In comparison, Virtual Connect Flex-10, Flex-20, and FlexFabric can be centrally managed – giving you flexible management, configuration, and communication with upstream Ethernet switches.

Figure 1. NPAR NIC Partitioning

Tunnel offload for Overlay Networks

Tunnel offload minimizes the impact of overlay networking on host performance for Virtual Extensible LAN (VXLAN) and Network Virtualization using Generic Routing Encapsulation (NVGRE). By offloading packet processing to adapters, customers can use overlay networking to increase VM migration flexibility and network scale with minimal impact to performance. HP Tunnel Offloading increases I/O throughput, reduces CPU utilization, and lowers power consumption.

For more information on Networking for ProLiant Gen9 servers, see the "Networking innovations for HP ProLiant Gen9 servers" at hp.com/V2/GetDocument.aspx?docname=4AA5-4076ENW&cc=us&lc=en.

Managing HP ProLiant Gen9 servers

HP offers a set of server management capabilities that give you complete control of your IT infrastructure. For Gen9 servers, we have introduced a number of management innovations for ProLiant servers, all working together to give you complete control of the monitoring and management of the servers and infrastructure in your data center.

On System management

On System management consists of a set of essential yet powerful server management capabilities that are embedded on all HP servers. These capabilities are designed to meet the needs of any organization, from enterprise to smaller IT environments. On System management provides embedded tools and system utilities that increase server administrator productivity.

ProLiant Gen9 servers feature a wide range of embedded management features. HP introduced many of these capabilities with ProLiant Gen8 servers – further refining and enhancing them for Gen9. Others – such as iLO Federation and the HP RESTful API – are new for Gen9.

HP iLO and iLO Federation

For Gen9 servers, HP has added several new features to HP iLO as well as continued to make improvements to existing functionality. The most significant new feature is iLO Federation.

iLO Federation
iLO Federation is a new and powerful method for organizing and managing large numbers of ProLiant servers by using the iLO4 Management Engine in each server to discover and communicate with other ProLiant servers in the network. iLO Federation also allows you to organize servers into groupings of your choosing. The iLO web interface allows you to create iLO Federation Groups, with each group containing any number of ProLiant servers, and each server/iLO capable of being included in up to 10 groups.

The true power of iLO Federation lies in the ability to use the federated structure to perform distributed execution of iLO management functions to all of the systems in an iLO Federation Group. This distributed model is both faster and more efficient than using centralized control to serially perform management functions against a set of servers, enabling better management at scale for ProLiant Gen9 servers.

 iLO Federation capabilities enable you to perform many different iLO management functions – including Group Firmware Update, Group Power Capping and others – at scale across groups of servers. HP iLO Federation is also be leveraged by other HP management tools such as HP SUM to provide faster and more scalable System Update capability

Agentless Management.
Agentless Management allows HP ProLiant servers to collect and deliver hardware and other server management information to HP Management platforms without requiring the installation of traditional agents or providers on the host OS. For Gen9servers, Agentless Management has been enhanced to collect and display the following additional information:

- Health status and serial number for external storage attached to HP Smart Array controllers
- Health status, model, serial number & firmware version for storage attached to Gen9 Smart HBA controllers.
- Status, model, serial number & capacity of the HP Smart Storage Battery
- Health status of HP Smart Cache

For Gen9, Agentless Management also supports SNMP v3 and IPv6.

Additional iLO features for ProLiant Gen9 servers
In addition to iLO Federation and improvements to Agentless Management, HP iLO for ProLiant Gen9 servers also includes the following new features:

- iLO Reboot Switch, allowing you to reset the iLO or HP ProLiant hardware via the UID button when iLO is not responding.
- Pre-Boot Health Summary, allowing you to troubleshoot and view iLO diagnostic information through the server's external monitor prior to powering on.
- A 1 GB Embedded User partition that is accessible for storage (on select servers).

HP Smart Update Manager (SUM)

 HP SUM is the system maintenance tool for systematically updating firmware and drivers for HP server Infrastructure at data center scale. For Gen9 servers, HP SUM is being updated to deliver better performance when performing updates by using the new iLO Federation capabilities.

UEFI

For Gen9, HP ProLiant servers are transitioning to the Unified Extensible Firmware Interface (UEFI) as the new and default system firmware. UEFI is complete re-design and re-engineering of firmware and offers functionality, performance, and configuration management capabilities beyond those of legacy BIOS firmware. For ProLiant Gen9 servers, UEFI delivers a number of benefits, including the following:

- A new graphical pre-boot environment for configuring the server platform, NICs, and iLO
- HP UEFI Shell, which provides a command line and a scripting environment for server platform configuration. The UEFI Shell environment for ProLiant Gen9 servers provides enhancements over the standard UEFI Shell with additional commands and improved security.
- Implementation of Secure Boot functionality, which requires the BIOS to verify signatures on all UEFI drivers, OS boot loaders and UEFI applications as part of the boot process.
- Enhanced storage support, including the following:
  - Boot volumes over 2.2 Terabytes
  - Flexible boot order. Ability to boot from any device on any controller.
- Support for IPv6 PXE and USB 3.0 in the pre-boot environment.

ProLiant Gen9 servers support both UEFI Boot mode and Legacy Boot mode. HP recommends using the UEFI boot mode, which should work in almost all situations.

New RESTful compliant API for configuration scripting

Representational state transfer (REST) is an http-based web services architecture for that can be used to communicate information and commands across networks using the GET, PUT and POST commands within the http protocol. For Gen9 servers, HP has implemented a REST compliant (or RESTful) API in iLO for communicating and setting system configuration and management information across the network.

The new HP RESTful API delivers numerous benefits to enterprise users, including:

- Delivering a common remote configuration and management interface for configuring ProLiant systems – including the server platform, iLO and BIOS.
- Providing tool-less access to configuration and management. Enterprise customers can write their own configuration and management scripts directly to the API without having to adopt an HP tool.
- Replacing older, less flexible and extensible API's such as IPMI.

For ProLiant Gen9 servers, the HP RESTful API is available both in-band and out-of-band as well as through iLO when the server is offline (aux power). It is also serves as a base for the next generation of HP remote configuration tools, allowing HP to develop a more comprehensive and powerful utility for remotely managing and configuring the entire ProLiant platform.

On Premise Management

For data centers with a large number of devices that require 24x7 management, maximum uptime, and infrastructure management that spans servers, storage, and networking, HP delivers HP OneView. This converged management platform provides powerful software-defined process templates for automating infrastructure configuration and provisioning, as well as for robust infrastructure health and monitoring. HP OneView integrates into existing enterprise management tools such as VMware vCenter Server and Microsoft® System Center to streamline operations—saving you time and cost.

HP OneView is available for use with ProLiant Gen8 DL and BL servers now and available for use with ProLiant Gen9 DL and BL servers later in 2014.

HP Insight Control and Systems Insight Manager (SIM) also support the HP ProLiant server portfolio – including ProLiant Gen9 servers. While HP OneView can coexist with HP Insight Control, Virtual Connect Enterprise Manager, and SIM, it is designed to replace these products over time.

On Cloud management with HP Insight Online

HP Insight Online provides automated support for your converged infrastructure of servers, storage and networking devices via a personalized cloud-based dashboard available anywhere, anytime to save you time and resources and reduce unplanned downtime. It provides easy access to IT health and support information for small environments that have little or no IT staff, where a trusted channel partner assists with server monitoring and support, and enterprises that want a global support view of their IT infrastructure.   This is the ideal solution for providing 24x7 automated support and tracking device health and support status for faster problem resolution. In addition, you can use the HP Insight Online dashboard in the HP Support Center mobile app to remain up to date on what's happening with your IT environment, whether you're in the office or on the road.

For more details about ProLiant Gen9 management, see the "HP ProLiant Gen9 Server manageability innovations" technical white paper at hp.com/V2/GetDocument.aspx?docname=4AA5-4527ENW&cc=us&lc=en.

The HP ProLiant Gen9 server portfolio

ProLiant Gen9 servers are categorized into four different families to meet the needs of different workloads:

- Rack-optimized servers (DL series) are versatile with balanced efficiency, performance, and management
- Tower servers (ML series) are expandable and ideal for remote or branch offices, and growing business
- Server blades (BL series) are Cloud ready and maximize every hour, watt, and dollar
- Scalable servers (SL series) are density optimized servers delivering leading-edge performance and efficiency for scale-out environments
- Apollo Systems (XL series) are rack–scale systems for high performance computing and service provider workloads

The following sections will give you an overview of the ProLiant server families and the ProLiant Gen9 servers for each. For more information about the specific Gen9 servers, see the "Resources, contacts, or additional links" section.

To learn more about the HP ProLiant Gen9 family of servers see hp.com/go/proliantgen9.

ProLiant Gen9 Rack and Tower (DL and ML) servers

HP ProLiant DL rack series servers are versatile rack-optimized servers with a balance of efficiency, performance, and management.

HP ProLiant DL servers deliver decades of engineering knowledge and integration experience to speed the implementation of new business computing technology. The ProLiant DL family is ideal for performance-driven compute processes and storage in a dense rack package. ProLiant Gen9 DL servers offer an increased processor core count, memory, and internal storage capacities, as well as the next generation of embedded Smart Array technology.
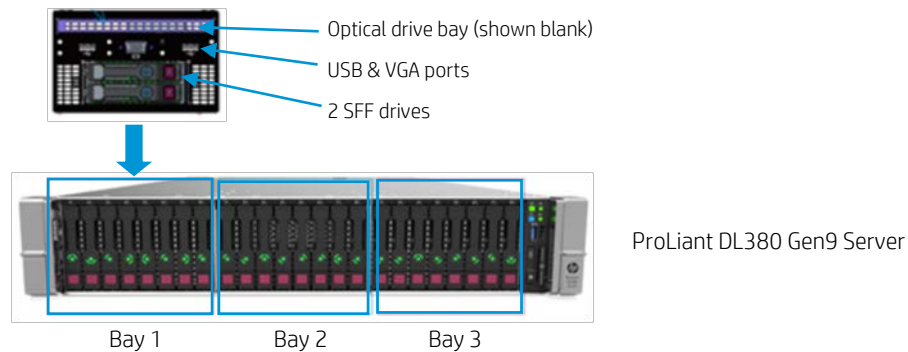
HP Flex Slot Power Supplies
Select ProLiant Gen9 servers feature HP Flex Slot power supplies. HP Flex Slot power supplies represent a new generation of tool-less, hot-swappable components that use the cross-platform interchangeability model introduced with our Common Slot power supplies. HP Flex Slot power supplies achieve the same degree of efficiency as Common Slot power supplies but use 25 percent less space, thus allowing more room for compute and I/O connectivity functions in the server chassis.

HP Universal Media Bay
The HP Universal Media Bay adds functional flexibility to ProLiant DL380 Gen9 and DL360 Gen9 Servers. The Universal Media Bay kits allow you to add an optical disk drive bay, USB, and/or VGA ports to the server while providing two drive bays for SFF drives. The kit Installs in bay 1 of the server (Figure 2).

Figure 2. HP Universal Media Bay for the HP ProLiant DL380 Gen9 Server.

HP DL380 Gen9 2SFF Universal Media Bay kit

Optical drive bay (shown blank)

USB & VGA ports

2 SFF drives

ProLiant DL380 Gen9 Server

Bay 1   Bay 2   Bay 3

With the introduction of the ProLiant Gen9 ML and DL servers, HP is re-introducing the 100-series server nomenclature to the product line. The 100 series servers occupy the same spots in the ProLiant server line as the entry level (300 series – e) servers did in Gen8 servers. Table 3 provides a detailed look at the server naming transitions.

Table 3. Gen8 to Gen9 HP ProLiant DL and ML server transitions

ProLiant Gen8 server	ProLiant Gen9 server
ProLiant DL360e	ProLiant DL160
ProLiant DL380e	ProLiant DL180
ProLiant DL360p	ProLiant DL360
ProLiant DL380p	ProLiant DL380
ProLiant ML350p	ProLiant ML350

HP ProLiant DL380 and DL360 Gen9 servers
The HP ProLiant DL380 and DL360 Gen9 servers offer exceptional flexibility for configuring their compute, storage, networking, and power capabilities, allowing you to "future proof" your investment. Supporting up to 32 processing cores and a large memory footprint, these servers provide the high performance you need in your data center. The ProLiant DL380 Gen9 Server offers the expandability required of a workhorse system.

The ProLiant DL360 Gen9 server comes with an industry-leading two-socket performance, efficiency, capacity, and reliability in a space-saving 1U size. It offers enterprise-class design for general-purpose applications, such as file/print or Web, as well as dynamic computing workloads, virtualization, and cloud solutions.

HP ProLiant DL180 and DL160 Gen9 servers
The ProLiant DL180 and DL160 Gen9 servers deliver essential performance, availability, and serviceability required by both SMBs and enterprise environments. The ProLiant DL180 Gen9 Server offers the performance and scalability to meet availability and dense storage requirements. The performance and density capabilities of the ProLiant DL160 Gen9 server make it optimized for hyperscale environments.

HP ProLiant ML350 server
The HP ProLiant ML350 server offers robust performance, expandability, and reliability in an all-in-one package for growing businesses and data centers. The ProLiant ML350 Gen9 server offers availability, expandability, and serviceability—plus the ability to be rack-mounted in a data center environment.

Table 4 provides quick overview and comparison of the ProLiant Gen9 rack and tower servers.

Table 4. Comparison of 2-socket HP ProLiant Gen9 rack and tower servers

	ProLiant DL380 Gen9	ProLiant DL360 Gen9	ProLiant DL180 Gen9	ProLiant DL160 Gen9	ProLiant ML350 Gen9
Form factor	2U Rack mount	1U Rack mount	2U Rack mount	1U Rack mount	Tower or 5U Rack mount
Processor:	One or two Intel Xeon E5-2600 v3	One or two Intel Xeon E5-2600 v3	One or two Intel Xeon E5-2600 v3	One or two Intel Xeon E5-2600 v3	One or two Intel Xeon E5-2600 v3
Cores per processor	4 to 18	4 to 18	4 to 12	4 to 12	6 to 14
Memory: Type # of sockets Max amount	DDR4 2133 MHz 24 DIMMs 768 GB	DDR4 2133 MHz 24 DIMMs 768 GB	DDR4 2133 MHz 16 DIMMs 512 GB	DDR4 2133 MHz 16 DIMMs 512 GB	DDR4 2133 MHz 24 DIMMs 768 GB
Max. internal drives	24+2 SFF or 12+3 LFF	8 +2 SFF or 4 LFF	16 SFF or 12 LFF	8 SFF or 4 LFF	48 SFF or 24 LFF
HP Universal Media Bay	Yes	Yes	No	No	No
Networking	Embedded quad-port 1GbE and FlexibleLOM	Embedded quad-port 1GbE and FlexibleLOM	Embedded dual-port 1GbE	Embedded dual-port 1GbE	Quad-port 1GbE
System ROM	UEFI (default) & legacy BIOS	UEFI (default) & legacy BIOS	UEFI (default) & legacy BIOS	UEFI (default) & legacy BIOS	UEFI (default) & legacy BIOS
Power supply Form factor Efficiency	Flex Slot Up to 96%	Flex Slot Up to 96%	1U ATX Up to 94%	RPS Up to 94%	Flex Slot Up to 94%

For more detailed information on HP ProLiant Gen9 rack and tower servers, see the "Technologies in 2-socket HP ProLiant Gen9 rack and tower servers" technical white paper at hp.com/V2/GetDocument.aspx?docname=4AA5-4487ENW&cc=us&lc=en.

Workloads for ML and DL servers
The HP ProLiant Gen9 ML and DL server family can meet a wide variety of workload requirements. 100-series servers – with their balance of performance, storage capabilities, and manageability – are ideally suited for the following workloads in smaller to mid-size environments:

- IT infrastructure – including file and print, networking and security
- Collaboration (email, workgroup)
- Web serving

HP ProLiant 300-series Gen9 servers offer more compute performance as well as better storage performance in order to meet the requirements of more demanding environments. With these capabilities, 300-series ProLiant Gen9 servers are better suited for workloads that include:

- Collaboration (e-mail, workgroup) in Enterprise environments
- Application development
- Database and Big Data applications in mid-sized Enterprise environments

HP maintains a number of sizing tools to help you determine the server requirements for many of the key applications and workloads that you may be deploying – from Virtualization implementations to Enterprise applications such as SAP® software. For a list of these sizers and links to them, please see the "Resources, contacts, or additional links" section at the end of this paper.

ProLiant Gen9 BladeSystem (BL) servers

HP BladeSystem is the ultimate converged infrastructure and is designed to reduce IT costs by up to 68 percent over traditional infrastructures with payback in just over seven months. The industry's most intelligent infrastructure—combined with comprehensive software-defined management—delivers unprecedented insight into your data center to ensure continuous business uptime. HP BladeSystem utilizes a modular design to share power, network, and storage infrastructure at the enclosure level delivering:

- The industry's most advanced bladed architecture with the latest end-to-end innovations
- Engineering with built-in intelligence to maximize every hour, watt, and dollar.
- One converged infrastructure, the foundation for industry-leading solutions from client to cloud.
- HP BladeSystem, built to simplify and address the issues of virtualization and consolidation projects, IT infrastructures, Web infrastructure, and collaboration applications.

The new HP ProLiant Gen9 server blades offer increased performance, capacity and storage flexibility, including:

- Increased memory footprints with DDR4 DIMMs that run up to 2133 MHz memory speeds
- Enhanced I/O mezzanine bandwidth, reduced latency, and enhanced processor throughput
- Improved integrated RAID controller performance and enhanced internal drive serviceability
- FlexibleLOM for the choice of embedded network technology, speed, and original equipment manufacturer (OEM) partner
- Advanced set of embedded and optional management features essential for a converged infrastructure

HP ProLiant BL460c Gen9 Server Blade

This server blade provides an ideal balance of 2P performance, scalability, and expandability, and offers a simpler way to manage a data center. This dual-socket server blade is engineered with enhanced memory and storage capacities, the next-generation HP iLO Management Engine, and cloud‑enabled Insight Management. With new features that give it improved flexibility and simplified management, the HP ProLiant BL460c Gen8 Server Blade is an ideal choice for data center computing.

HP ProLiant WS460c

The ProLiant WS460c is designed to deliver all of the processing performance and storage flexibility benefits of ProLiant Gen9 servers with support for high performance professional graphics GPUs.

Key features of the ProLiant BL460c and WS460c Gen9 server are outlined in Table 5.

Table 5. ProLiant Gen9 servers for the HP BladeSystem

	ProLiant BL460 Gen9	ProLiant WS460c
Form factor	5U two server node tray	5U two server node tray
Processor:	One or two Intel Xeon E5-2600 v3	One or two Intel Xeon E5-2600 v3
Cores per processor	4 to 18	4 to 18

Memory:
    Type
    # of sockets
    Max amount
	DDR4 2133 MHz
	16DIMMs
	512 GB
		DDR4 2133 MHz
		16 DIMMs
		512 GB

Networking	Choice of 2 x 10 GbE, FlexFabric 10 GB, FlexFabric 10/20 GB	Choice of 2 x 10 GbE, FlexFabric 10 GB, FlexFabric 10/20 GB
PCIe 3.0 mezzanine slots	2	
GPU Support	No	Yes NVIDIA Quadro (various) GRID K1, K2 AMD® FirePro S4000X

HP ProLiant Gen9 server blades and the HP BladeSystem infrastructure are best suited for the following workloads in larger Enterprise environments:

• Virtualization
• Cloud computing
• IT Infrastructure

For more detailed information on HP ProLiant Gen9 rack and tower servers, see the "Technologies in HP ProLiant Gen9 c-Class Server Blades" technical white paper at hp.com/V2/GetDocument.aspx?docname=4AA5-4485ENW&cc=us&lc=en.

HP Gen9 Density Optimized (SL and XL) servers

HP Density Optimized servers include both the SL server series and the XL servers. XL servers are designed to operate with the HP Apollo Systems.

HP Apollo 6000 System

The HP Apollo 6000 System is a scalable system from HP designed as rack-level solution for high-density computing within a shared infrastructure environment. Each Apollo 6000 uses a modular 5U chassis capable of holding up to 10 independent trays, each with two server nodes. With this new system design, server power is now provided through the external HP Apollo 6000 power shelf, a 1.5U unit capable of powering up to 120 total servers in six Apollo 6000 enclosures. The Apollo 6000 System's modular design enables you to lower your TCO by mixing servers, accelerators, storage and networking – for the right server for the right workload at the right economics.

Figure 3. HP Apollo 6000 System, Apollo 6000 power shelf and ProLiant XL230a server tray.

The ProLiant XL220a Server is the first Gen9 server introduced for the HP Apollo 6000 System. Using the Intel Xeon E3-1200 v3 (codename Haswell) processors and featuring 2 single-socket servers per tray, the ProLiant XL220a Server focuses on single-threaded application performance for workloads such as Electronic Design Automation (EDA), life sciences and risk modeling. The new ProLiant XL230a Server features Intel Xeon E5-2600 v3 processors. With one dual-socket server per tray, the ProLiant XL230a Server extends capabilities for high performance computing (HPC) and service provider workloads such as seismic processing, virtualized and/or dedicated hosting.

Table 6. ProLiant Gen9 servers for the HP Apollo 6000

	ProLiant XL220a	ProLiant XL230a
Form factor	5U two server node tray	5U two server node tray
Processor:	Two Intel Xeon E3-1200 v3	One or two Intel Xeon E5-2600 v3
Cores per processor	4	4 to 16

Memory:
  Type
  # of sockets
  Max amount
	DDR3 1280 MHz
	4 DIMMs
	32 GB per node
		DDR4 2133 MHz
		16 DIMMs
		512 GB

Networking	Network module supporting various FlexibleLOMs: 1 GbE and/or 10 GbE	Network module supporting various FlexibleLOMs: 1 GbE, 10 GbE, and/or InfiniBand

The HP Apollo 6000 System provides a high-density solution that delivers the right compute performance for high performance computing and service provider workloads with a low total cost of ownership. Typical environments and workloads for the Apollo 600 0 System include:

• Engineering design automation (EDA)
• Financial services
• Risk modelling
• Oil and Gas
• Virtualized or dedicated hosting

HP Apollo 8000
The HP Apollo 8000 System (Figure 4) is a converged system that uses warm-liquid cooling technology to enable a high-density and energy-efficient High Performance Computing (HPC) solution. Each Apollo f8000 rack is capable of housing up to a 144 2P servers, while using 28% less energy compared to air-cooled systems. The separate Apollo 800 iCDU Rack provides the cooling and can support up to four HP Apollo 8000 racks.

Figure 4. HP Apollo f8000 Rack and ProLiant XL730f Gen9 Server

For Gen9, the Apollo 8000 System begins with the ProLiant XL730f Server, which includes 2 server nodes (Table 7). Using the ProLiant XL730f, Apollo 8000 Systems are capable of delivering up to 144 teraflops of compute performance per rack.

Table 7. ProLiant Gen9 servers for the HP Apollo 8000

	ProLiant XL730f
Form factor	2 node server tray (the rack is the chassis)
Processor:	Two Intel Xeon E5-2600 v3 series per node
Cores per processor	4 to 18
Memory: Type # of sockets Max amount	DDR4 2133 MHz 16 DIMMs 256 GB per node
Max. internal drives	1 SFF SSD per server node Supports 80 GB, 120 GB, 240 GB, 480 GB, and 1.6 TB SSD
Networking	Integrated NIC: Single port 1 GbE per server InfiniBand Adaptor Kit: Single ConnectX-3 Pro InfiniBand FDR port per server

HP has designed the Apollo 8000 System to deliver the top of the line in High Performance computing. Typical uses and workloads for the Apollo 8000 include:

• Research and Scientific Computing
• Manufacturing
• Visualization and simulation

Summary

Designed to meet the requirements for a new style of IT, ProLiant Gen9 servers deliver more performance, greater flexibility and more efficient operation than ever before. With the broad range of HP ProLiant server families – from the traditional DL and ML rack and tower servers to the HP Apollo Systems with their HPC scale-out capabilities – HP offers a ProLiant Gen9 server solution to meet any IT infrastructure or workload requirement.

Resources, contacts, or additional links

HP ProLiant Gen9 Technology

Technical white paper – HP Smart Storage for HP ProLiant Gen9 servers
hp.com/V2/GetDocument.aspx?docname=4AA5-4526ENW&cc=us&lc=en

Technical white paper – Networking innovations for HP ProLiant Gen9 servers
hp.com/V2/GetDocument.aspx?docname=4AA5-4076ENW&cc=us&lc=en

HP ProLiant Gen9 product lines

Technical white paper – Technologies in 2-socket HP ProLiant Gen9 rack and tower servers
hp.com/V2/GetDocument.aspx?docname=4AA5-4487ENW&cc=us&lc=en

Technical white paper – Technologies in HP ProLiant Gen9 c-Class server blades
hp.com/V2/GetDocument.aspx?docname=4AA5-4485ENW&cc=us&lc=en

HP ProLiant servers
hp.com/go/proliant

HP BladeSystem servers
hp.com/go/bladesystem

HP Scalable Systems, including Apollo
hp.com/go/scalable

HP Server Buying Guide
hp.com/us/en/prodserv/serverbuyingguide/overview.html

System Management and Configuration

Technical white paper – HP ProLiant Gen9 Server manageability innovations
hp.com/V2/GetDocument.aspx?docname=4AA5-4527ENW&cc=us&lc=en

HP Insight Online
hp.com/go/insightonline/info

HP ProLiant UEFI page
hp.com/go/proliant/uefi

UEFI Shell Quick User Guide
hp.com/support/UEFI_SQR_en

HP RESTful Interface Tool
hp.com/go/restfulapi

HP SUM
hp.com/go/hpsum

Intelligent Provisioning
hp.com/go/intelligentprovisioning

HP ProLiant workload sizing tools

ActiveAnswers Solution sizers main page
hp.com/ActiveAnswers/secure/71110-0-0-225-121.html

Virtualization sizers

HP Sizer for Citrix XenApp and Microsoft Remote Desktop Services
HP Sizer for Citrix XenApp and Microsoft Remote Desktop Services

HP Sizer for Server Virtualization
HP Sizer for Server Virtualization

Citrix XenApp Virtualization
HP Sizer for Citrix XenApp and Microsoft Remote Desktop Services

VMware Virtualization
HP Sizing Tool for VMware vSphere

Microsoft Hyper-V Server Virtualization
HP Sizer for Microsoft Hyper-V 2008 R2

Enterprise applications sizers

Microsoft Exchange Server - IT Infrastructure/Collaboration
HP Sizer for Microsoft Exchange Server 2010
HP Sizer for Microsoft Exchange Server 2013

Microsoft SharePoint IT Infrastructure/Collaboration
HP Sizer for Microsoft SharePoint 2010

Microsoft Unified Communications IT Infrastructure/Collaboration
HP Sizer for Microsoft Lync Server 2013

SAP Database
SAP Business Suite powered by HANA
HP SAP Sizing Tool for ProLiant x86 Servers

Management and Infrastructure sizers

HP Insight Management
HP Insight Management Sizer

HP Power Advisor
HP Power Advisor

HP BladeSystem Power Sizer
HP BladeSystem Power Sizer

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