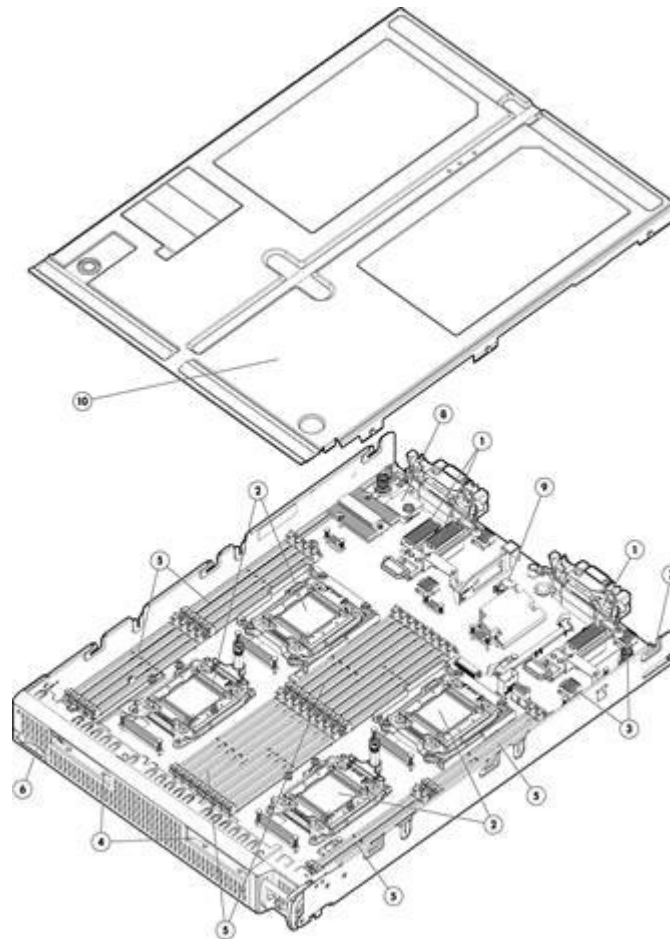


### Overview



### HP ProLiant BL660c Generation 8 (Gen8) Server Blade

- |   |  |
|---|--|
| 1. Three (3) PCIe 3.0 mezzanine I/O expansion slots         | 6. HP c-Class Blade SUV (Serial, USB, VGA) connector |
| 2. Up to four (4) Intel® Xeon® E5-4600 family processors    | 7. MicroSDHC card connector                          |
| 3. Two FlexibleLOM connectors                               | 8. Trusted Platform Module (TPM) connector           |
| 4. Two (2) small form factor (SFF) hot-plug drive bays      | 9. Internal USB 2.0 connector                        |
| 5. Thirty-two (32) DDR3 DIMM memory slots (8 per processor) | 10. Access panel                                     |

### Standard Features

**NOTE:** This document covers the HP ProLiant BL660c Gen8 server blade only. For information on HP BladeSystems c-Class Enclosures and HP BladeSystem c-Class interconnect and mezzanine options, please see the following:

HP BladeSystem c-Class Enclosures QuickSpecs:

- HP BladeSystem c3000 Enclosure QuickSpecs at [http://h18000.www1.hp.com/products/quickspecs/12790\\_na/12790\\_na.html](http://h18000.www1.hp.com/products/quickspecs/12790_na/12790_na.html)  
**NOTE:** The c3000 HP c-Class enclosures have full backwards and forwards compatibility, existing server blades are supported in the new enclosures and any future server blades will be supported in the existing enclosures.  
**NOTE:** The ProLiant BL660c Gen8 requires the c3000 Enclosure to be configured with 6 fans.
- HP BladeSystem c7000 Enclosure QuickSpecs at [http://h18000.www1.hp.com/products/quickspecs/12810\\_na/12810\\_na.html](http://h18000.www1.hp.com/products/quickspecs/12810_na/12810_na.html)  
**NOTE:** The c7000 HP c-Class enclosures have full backwards and forwards compatibility, existing server blades are supported in the new enclosures and any future server blades will be supported in the existing enclosures.  
**NOTE:** The ProLiant BL660c Gen8 requires the c7000 Enclosure to be configured with 10 fans.
- HP BladeSystem c-Class interconnect and mezzanine options at <http://h18004.www1.hp.com/products/blades/components/c-class-interconnects.html>  
<http://h18004.www1.hp.com/products/blades/components/c-class-adapters.html>

**NOTE:** For proper BladeSystem operation, the minimum required versions of HP Onboard Administrator and HP Virtual Connect are required and available via the HP Service Pack for ProLiant, please see <http://www.hp.com/go/spp/download>.

#### Processor

One of the following depending on Model

#### Eight-Core Processors

Intel® Xeon® E5-4650 (2.7GHz/8-core/20MB/130W) Processor  
Intel® Xeon® E5-4650L (2.6GHz/8-core/20MB/115W) Processor  
Intel® Xeon® E5-4640 (2.4GHz/8-core/20MB/95W) Processor  
Intel® Xeon® E5-4620 (2.2GHz/8-core/16MB/95W) Processor

#### Six-Core Processors

Intel® Xeon® E5-4617 (2.9GHz/6-core/15MB/130W) Processor  
Intel® Xeon® E5-4610 (2.4GHz/6-core/15MB/95W) Processor  
Intel® Xeon® E5-4607 (2.2GHz/6-core/12MB/95W) Processor

#### Four-Core Processors

Intel® Xeon® E5-4603 (2.0GHz/4-core/10MB/95W) Processor

#### Cache Memory

One of the following depending on Model

16MB or 20MB L3 cache  
**NOTE:** For eight-core processors.  
12MB or 15MB L3 cache  
**NOTE:** For six-core processors.  
10MB L3 cache  
**NOTE:** For four-core processors.

### Standard Features

**Chipset** Intel® C600 Series Chipset  
**NOTE:** For more information regarding Intel chipsets, please see the following:  
<http://www.intel.com/products/server/chipsets/>.

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**Upgradeability** Upgradeable to four (4) processors

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**On System Management Chipset** HP iLO (Firmware: HP iLO 4)  
**NOTE:** For more information, visit: <http://www.hp.com/go/ilo>

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**Memory Protection**

- Data bus ECC protection
- Advanced ECC / SDDC
- Rank sparring (on line spare)
- Lockstep mode
- DIMM address/control bus parity protection
- Failed DIMM isolation
- Demand scrubbing
- Patrol scrubbing
- Memory thermal control

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**Memory**  
One of the following depending on Model

Type	HP SmartMemory
Standard (Pre-configured Models)	DDR3 Load Reduced (LRDIMM) and Registered (RDIMM)
Maximum (LRDIMM)	128GB (8 x 16GB) DDR3 1600MHz RDIMMs at 1.5V 128GB (8 x 16GB) DDR3 1333MHz RDIMMs at 1.35V
Maximum (RDIMM)	1.0TB (32 x 32GB) up to 1333MHz at 1.35V 512GB (32 x 16GB) up to 1600MHz at 1.5V 768GB (32 x 24GB) up to 1333MHz at 1.35V

**NOTE:** HP memory from previous generation servers are not qualified or warranted with this server. **NOTE:** HP SmartMemory is required to realize the memory performance improvements and enhanced functionality listed in this document for Gen8. For additional information, please see the HP SmartMemory QuickSpecs at: [http://h18000.www1.hp.com/products/quickspecs/14225\\_na/14225\\_na.html](http://h18000.www1.hp.com/products/quickspecs/14225_na/14225_na.html)

**NOTE:** LRDIMMs and RDIMMs are distinct memory technologies and cannot be mixed within a server.

**NOTE:** Depending on the memory configuration and processor model, the memory speed may run at 1600MHz, 1333MHz, or 1066MHz. Please see Memory Population Table later in this document or the Online Memory Configuration Tool at: [www.hp.com/go/ddr3memory-configurator](http://www.hp.com/go/ddr3memory-configurator).

**NOTE:** For additional memory rules and guidelines, see the "Memory" section later in this document.

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### Standard Features

#### Network Controller

Two (2) HP FlexibleLOM connectors for one or two dual-port FlexibleLOMs

**NOTE:** FlexibleLOM options include 10Gb FlexFabric, 10Gb Flex-10, and 10Gb Ethernet.

**NOTE:** FlexFabric capabilities require the use of an HP Virtual Connect FlexFabric module. Learn more at: <http://www.hp.com/go/bladesystem/interconnects>

**NOTE:** The server supports one or two FlexibleLOMs.

**NOTE:** For Pre-configured Model configurations, two FlexibleLOMs are already included; no additional FlexibleLOMs are added.

**NOTE:** For a Factory Integrated Model configuration with one FlexibleLOM, it is added in the HP Networking section of "Step 2" in the Factory Integrated Models section.

**NOTE:** For a Factory Integrated Model configuration with two FlexibleLOMs, the second FlexibleLOM is a different part number. You must select the first FlexibleLOM in the "Step 2" HP Networking section and select the second FlexibleLOM in the "Step 4" HP Networking section.

**NOTE:** All FlexibleLOMs are dual port: one port is routed to interconnect module bay 1 and the other to bay 2.

#### Expansion Slots

Three (3) I/O expansion mezzanine slots:

- x8 PCIe 3.0 Type A (supports Type A mezzanine cards) (expansion slot 1).
- x16 PCIe 3.0 Type B (supports Type A and Type B mezzanine cards) (expansion slot 2).
- x16 PCIe 3.0 Type B (supports Type A and Type B mezzanine cards) (expansion slot 3).

Mezzanine card options include:

- Dual-port to quad-port (depending on the model) 10Gb FlexFabric, 10Gb Flex-10, 10Gb Ethernet, and 1Gb Ethernet for additional Ethernet network ports.
- Dual-port 8Gb and 16GB Fibre Channel HBAs for SAN connectivity.
- QDR and FDR InfiniBand for low latency and high bandwidth server interconnectivity.
- HP Smart Array P721m Controller for direct attached SAS Storage
- HP I/O Accelerator Options for higher I/O performance and low latency access to storage, with the reliability of solid state

#### HP Server ROM

HP ROM (read only memory) is now digitally signed using HP's Corporate Signing Service. This signature is verified before the flash process starts, reducing accidental programming and preventing malicious efforts to corrupt system ROM.

HP ROM provides for essential initialization and validation of hardware components before control is passed to the customer-installed operating system. The ROM also provides the capability of booting from various fixed media (HDD, CD-ROM) and removable media (USB), to continue operation to the operating system.

HP ROM performs very early configuration of the video controller, to allow monitoring of initialization progress via an attached monitor. If configuration or hardware errors are discovered during this early phase of hardware initialization, suitable messages are now displayed on the connected monitor. Additionally, these configuration or hardware errors are logged to the Integrated Management Log (IML) to assist in diagnosis.

HP's ProLiant ROM is used to configure the following:

- Processor and chipset status registers

### Standard Features

- System memory, memory map, and memory initialization
- System hardware configuration (integrated PCI devices and optional PCIe cards).
- Customer-specific BIOS configuration using the HP ROM-Based Setup Utility (RBSU).

**NOTE:** For further information, please refer to HP's RBSU (ROM based setup utility) user guide at [www.hp.com/support/rbsu](http://www.hp.com/support/rbsu).

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### Storage Controller

All Models

One (1) embedded HP Smart Array P220i Controller

**NOTE:** The HP Smart Array P220i supports RAID 0 and 1. It includes 512MB flash-backed write cache (FBWC) on pre-configured models and is optional on factory integrated models. The FBWC is not required for RAID capability. The purpose of the cache is it can increase hard drive write performance and provides data protection in case the server losses power.

**NOTE:** The HP Smart Array P220i supports upgradeable firmware with recovery ROM.

**NOTE:** The HP Smart Array P220i supports two (2) small form factor (SFF) hot plug drive bays.

Available Options: Smart Array Advanced Pack 2.0 Software for enhanced performance, reliability, availability, and security of system data

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### Maximum Internal Storage

Hot Plug SFF SAS	2.4TB	2 x 1.2TB
Hot Plug SFF SATA	2.0TB	2 x 1.0TB
Hot Plug SFF SAS SSD	1.6TB	2 x 800GB

**NOTE:** The ProLiant BL660c Gen8 server includes the new HP hot plug small form factor (SFF) SmartDrive carrier for enhanced management and reduced maintenance errors. HP drives from previous generation servers are not compatible with the ProLiant BL660c Gen8 drive bays.

**NOTE:** The mixing of standard SAS drives with SAS SSD drives is supported within the server, but limits the RAID configuration to two separate RAID 0 volumes. Mixing of other drives types is not supported.

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### Interfaces

Micro SDHC Slot

One (1) internal Micro Secure Digital High Capacity (Micro SDHC) card slot

USB 2.0 Port

One (1) internal USB 2.0 connector for USB flash media drive keys

**NOTE:** The above options are for integrated hypervisor virtualization environments needing a low cost boot solution with the highest performance and reliability.

### Standard Features

#### Industry Standard Compliance

ACPI 2.0  
Microsoft® Logo certifications  
USB 2.0 Support  
IMPI 2.0  
Secure Digital 2.0  
TMP 1.2 Support  
IEEE (specific IEEE standards depending on Ethernet adapter card(s) installed)  
Advanced Encryption Standard (AES)  
Triple Data Encryption Standard (3DES)  
SNMP  
SSL 2.0  
DMTF Systems Management Architecture for Server Hardware Command Line Protocol (SMASH CLP)  
Active Directory v1.0  
PCIe 3.0  
SR-IOV capability (requires network adapter and operating system support)

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#### Operating Systems and Virtualization Software Support for ProLiant Servers

[Microsoft Windows Server](#)  
[Red Hat Enterprise Linux \(RHEL\)](#)  
[SUSE Linux Enterprise Server \(SLES\)](#)  
[Oracle Solaris](#)  
[VMware](#)  
[Citrix XenServer](#)

**NOTE:** For more information on HP's Certified and Supported ProLiant Servers for OS and Virtualization Software and latest listing of software drivers available for your server, please visit our [Support Matrix](http://www.hp.com/go/ossupport) at: <http://www.hp.com/go/ossupport> and our [driver download page](http://www.hp.com/support/BL660cGen8) <http://www.hp.com/support/BL660cGen8>.

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#### Enclosures

Enclosures HP offers two different c-Class server blade enclosures to meet your individual needs:

- The HP BladeSystem c7000 rack enclosure is 10U high and holds up to eight (8) ProLiant BL660c Gen8 servers plugged vertically.
- The HP BladeSystem c3000 rack enclosure is 6U high and holds up to four (4) HP ProLiant BL660c Gen8 servers plugged horizontally.
- Server blades, storage blades, interconnect modules, power supplies, fans, and redundant Onboard Administrator modules are all designed to fit into the c3000 and c7000 enclosures.

**NOTE:** For additional enclosure information, please see <http://h18004.www1.hp.com/products/blades/components/enclosures/c-class/index.html>.

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### Standard Features

#### Graphics

Integrated Matrox G200 video standard

- 1280 x 1024 (32 bpp)
- 1920 x 1200 (16 bpp)

HP iLO 4 On System Management Memory

- 16 MB Flash
- 256 MB DDR 3 with ECC (112 MB after ECC and video)

#### Form Factor

HP ProLiant BL660c Gen8 is a single-wide, full-height server blade that plugs into the HP BladeSystem c3000 and c7000 enclosures.

#### On System Management

HP iLO Management Engine

HP iLO Management Engine is a comprehensive set of embedded management features supporting the complete lifecycle of the server, from initial deployment, through ongoing management, to service alerting and remote support. HP iLO Management Engine comes standard on all HP ProLiant Gen8 servers. The HP iLO Management Engine portfolio includes:

- **HP iLO:** The HP iLO (Integrated Lights-Out) management processor is the core foundation for the HP iLO Management Engine
- **HP Agentless Management:** Provides built in server health monitoring and alerting capability without OS agents, that starts working the moment a power cord and an Ethernet cable are connected.
- **HP Active Health System:** Always on, continuous monitoring for increased stability and shorter downtimes; 100% configuration history; Health and service alerts and easy export and upload to Service and Support.
- **HP Intelligent Provisioning:** Lets customers provision and configure a single server without any separate media. No more SmartStart CDs or firmware DVDs are needed.
  - To start Intelligent Provisioning:
    - Press the F10 key during the ProLiant Gen8 server boot process (also known as power on self test or POST).
    - Please go to the Intelligent Provisioning website at [www.hp.com/go/intelligentprovisioning](http://www.hp.com/go/intelligentprovisioning) for additional information and to view usage videos.
    - Use the Service Pack for ProLiant (SPP) at [www.hp.com/go/spp](http://www.hp.com/go/spp) to get firmware and software updates.
  - **HP iLO Mobile App:** Enables the ability to access, deploy, and manage your server anytime from anywhere from select smartphones and mobile devices. For additional information please visit: [www.hp.com/go/ilo/mobileapp](http://www.hp.com/go/ilo/mobileapp)

**NOTE:** For more information, visit: <http://www.hp.com/go/ilo> or HP iLO Management Engine technologies whitepaper

### Standard Features

**HP Insight management software** HP Service Pack for ProLiant (SPP)

HP Service Pack for ProLiant (SPP) and HP Smart Update Manager (HP SUM) provide a comprehensive approach to firmware and system software maintenance. Together they provide better operating stability and ensure maximum uptime. The SPP will be updated at a predictable cadence, typically coinciding with new HP server hardware launches. By enabling firmware to be updated online and integrating firmware and system software updates in one operation, HP SUM and the SPP offer faster updates of individual servers and dramatically faster updates of entire BladeSystem enclosures. Further improving system uptime and stability is the fact that HP provides 12 months of support for each Service Pack for ProLiant release.

The user experience around HP SUM and the SPP has been improved in several ways, starting with the web download. A single web page provides access to a single download containing both the latest version of HP SUM and the latest SPP. Optional smaller subsets with only specific types of servers or specific operating systems are offered to save on download time. The HP SUM application provides a straightforward, intuitive user interface that guides the user through the steps of discovery, analyses and update, providing comprehensive information on available updates, criticality and interdependencies. This information is also available in reports. By providing the option of multiple local or shared repositories which can be easily updated from hp.com, HP SUM provides the tools to optimize stability and consistency throughout the company. While HP SUM and the SPP recommend the combinations of firmware and system software that HP has found to be the best practice, the application gives customers the flexibility to set their own specific baseline.

The Service Pack for ProLiant has been rigorously tested with specific attention for interaction between firmware, drivers and agents both within the server as well as in interaction with the BladeSystem enclosure components (Onboard Administrator and Virtual Connect). This testing ensures the highest quality as well as providing the input for HP SUM to deploy updates taking into account all interdependencies, when determining the correct updates and order of update deployment.

**NOTE:** The Service Pack for ProLiant (which includes HP SUM) can be downloaded from [www.hp.com/go/spp/download](http://www.hp.com/go/spp/download). More information can be found: <http://www.hp.com/go/SmartUpdate>, [www.hp.com/go/spp](http://www.hp.com/go/spp) and <http://www.hp.com/go/hpsum>

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### Standard Features

#### Security

- Power-on password
- Administrator's password
- Keyboard password (QuickLock)
- HP iLO 4 On System Management Chipset with:
  - SSL encryption
  - Secure Shell version 2
  - Advanced Encryption Standard (AES) and Triple Data Encryption Standard (3DES) on browser, CLP and XML scripting interface
  - AES and RC4 encryption of video
- External USB port enable/disable
- Network server mode
- Serial interface control
- TPM (Trusted Platform Module) 1.2 option
- Advanced Encryption Standard (AES)
- Intel® Advanced Encryption Standard–New Instructions (AES-NI)
- Intel TXT (require the TPM module option)

#### Availability

#### Memory

- Data Bus ECC protection provides automatic correction from a single data bit error and detection of double data error bits. Often called single error correction/double error detection (SEC/DED).
- Advanced ECC uses single device data correction (SDDC) to detect and correct single and all multi-bit error that occurs within a single DRAM chip. Both x4 and x8 SDDC are supported (x8 requires lockstep mode).
- Memory online spare mode (also known as rank spare mode) detects a rank that is degrading and switches operation to the spare rank. HP offers the rank sparing rather than DIMM sparing as rank sparing uses less spare memory resulting in reduced overhead.
- Memory lockstep mode is used to correct a single x8 DRAM device failure on a DIMM. The DIMMs in each paired memory channel must have identical HP part numbers.
- Memory demand and patrol scrubbing prevent accumulation of correctable errors and reducing the likelihood of unplanned downtime.
- Failed DIMM isolation improves the service time thus improving the overall system availability.
- Address parity protection available on RDIMMs and LRDIMMs detects address bit errors to improve service time and overall system availability.
- Memory thermal control is used to prevent DIMMs from overheating. Achieved by slowing down the memory access rate per the temperature monitored by DIMM sensor.

#### Mezzanine options and I/O

- One or two FlexibleLOM connectors each supporting two (i.e. redundant) Ethernet ports routed to redundant interconnect modules.
- Multiple mezzanine I/O expansion slots that support a wide variety of mezzanine cards each supporting multiple data paths routed to redundant interconnect modules.
- Network Adapter Teaming (bonding) provides network fault tolerance, transmit load balancing, and switch-assisted load balancing.

#### Storage

- Two (2) hot-plug SAS/SATA/SSD drive bays.
- Integrated HP Smart Array P220i Controller with 512MB FBWC capability, RAID 0 and 1, and upgradeable firmware with recovery ROM capability.

**NOTE:** The 512MB flash-backed write cache (FBWC) is included on pre-configured models and is

### Standard Features

optional on factory integrated models. The FBWC is not required for RAID capability. The purpose of the cache is it can increase hard drive write performance and provides data protection in case the server loses power.

- Up to eight optional HP D2200sb and/or D22020sb Storage Blades for attachment of up to 12 drives per Storage Blade (up to 96 drives total) within the c-Class enclosure.
- Optional dual-port Fibre Channel mezzanine card(s) for redundant SAN connections.

### Processor/Chipset

- Processor internal sensors & thermal control protection against over-temperature conditions.
- Cache parity/ECC protects cache data from accidental data corruption.
- Machine Check Architecture (MCA) detects and captures hardware errors such as system bus, memory ECC, parity, and cache, and improves service time.
- Intel® QPI Protocol Protection allows detection of data errors using a checksum of 8-bits.
- Core Disable for FRB (fault resilient boot) allows a system to power-on despite a failing core-pair. It uses BIST (built-in self test) results to detect a failure and disables the target core-pair upon subsequent boot.

### Server Blade Enclosure Infrastructure

- Pooled power for true N+N power redundancy through up to six (6) hot-plug, high-efficiency, common slot enclosure-based power supplies (configuration dependent).
- Up to ten (10) redundant enclosure-based hot-plug HP Active Cool fans that scale to meet future demands and optimize airflow, reduce power draw, and improve acoustic performance.
- Dual grid power providing redundant rack enclosure power feeds to the server blade enclosure.
- HP Dynamic Power Saver Mode the total enclosure power consumption is monitored in real time and automatically adjusted with changes in demand for improved efficiency and reliability.
- HP Dynamic Power Capping safely limits power usage without impacting performance by capping peak usage instead of average power usage, removes risk to electrical infrastructure with a fast-acting, hardware-based capping algorithm, and reclaims more power by dynamically controlling power limits based on workload demand.
- Up to eight interconnect modules per server blade enclosure providing four simultaneous redundant fabrics for FlexFabric, Virtual Connect Ethernet, Fibre Channel, InfiniBand, Pass Thru Ethernet, etc.
- Enclosure crosslinks between adjacent enclosures to provide interconnect module-to-module connections or as Virtual Connect module stacking links.
- Optional enclosure redundant Onboard Administrator system management module.

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### Warranty

This product is covered by a global limited warranty and supported by HP Services and a worldwide network of HP Authorized Channel Partners. Hardware diagnostic support and repair is available for three years from date of purchase. Support for software and initial setup is available for 90 days from date of purchase. Enhancements to warranty services are available through HP Care Pack services or customized service agreements. Certain restrictions and exclusions apply. Hard drives have either a one year or three year warranty; refer to specific hard drive QuickSpecs for details.

**NOTE:** Server warranty includes 3 year Parts, 3 year Labor, 3-year on-site support. Warranty repairs may be accomplished through the use of Customer Self Repair (CSR) parts. These parts fall into two categories: 1) Mandatory CSR parts are designed for easy replacement. A travel and labor charge will result when customers decline to replace a Mandatory CSR part; 2) Optional CSR parts are also designed for easy replacement but may involve added complexity. Customers may choose to have HP replace Optional CSR parts at no charge. Additional information regarding worldwide limited warranty and technical support is available at <http://h18004.www1.hp.com/products/servers/platforms/warranty/index.html>.

### Optional Features

<b>Fibre Channel Support</b>	Up to three (3) optional Fibre Channel mezzanine HBAs are supported on the HP ProLiant BL660c Gen8.	
<b>Compatible SAN</b>	HP ProLiant BL660c Gen8 server blades are optimized for HP MSA, EVA and XP.  HP ProLiant BL660c Gen8 server blades are compatible with select 3rd party SANs. Please see blade storage page for more details at <a href="http://h18004.www1.hp.com/products/blades/components/c-class-sans.html">http://h18004.www1.hp.com/products/blades/components/c-class-sans.html</a> .	
<b>HP Virtual Connect</b>	HP Virtual Connect is an interconnect option for BladeSystem c-Class that simplifies server connectivity to data and storage networks, and reduces costs. Unique HP Flex-10 technology makes maximum use of network bandwidths, provide dynamic tuning and enable extreme flexibility to meet individual server and infrastructure requirements by allocating up to 4 network connections per server port. Virtual Connect FlexFabric modules extend those capabilities to allocate one function per port to storage connections. HP Virtual Connect Enterprise Manager (VCEM) provides server management software with a central console to administer network connections and workloads for thousands of servers. For more information on Virtual Connect Enterprise Manager, see <a href="http://www.hp.com/go/vcem">http://www.hp.com/go/vcem</a> . For more information on Virtual Connect Ethernet, Fibre Channel, Converged Network and management options, see <a href="http://www.hp.com/go/virtualconnect">http://www.hp.com/go/virtualconnect</a> .	
<b>HP Insight management software</b>	HP Insight Control	HP Insight Control, a product option, delivers essential infrastructure management that can help save time and money by making it easy to deploy, migrate, monitor, remote control, and optimize your IT infrastructure through a single, simple management console. For more information, see <a href="http://www.hp.com/go/insightcontrol">http://www.hp.com/go/insightcontrol</a> .  HP Insight Control includes one year of 24 x 7 HP Software Technical Support and Update Service ensuring rapid access to HP support staff and proactive delivery of software updates. For more information about this service, see <a href="http://www.hp.com/services/insight">http://www.hp.com/services/insight</a> .
	HP Matrix Operating Environment	The HP Matrix Operating Environment (Matrix OE) for ProLiant and Integrity servers is an integrated command center that helps you instantly adjust to dynamic business demands. This advanced infrastructure management software lets you reduce the cost of common data center tasks by up to 40 percent while keeping pace with your changing business.  The HP Matrix OE includes the automated provisioning, optimization, and recovery management capabilities for HP CloudSystem Matrix, the ideal platform for private cloud and Infrastructure as a Service (IaaS). For more information, see <a href="http://www.hp.com/go/matrixoe">http://www.hp.com/go/matrixoe</a> .
	HP iLO Scale-Out	The HP iLO Scale-Out license ideal for web/hosting/cloud service providers and High Performance Computing environments. This license is a specific subset of iLO Advanced functionality, provides fast remote access through Text Console via SSH, lower operational cost with Dynamic power capping, and faster time to resolution through Email-based Alerting and proactive notifications. With this newly designed HP iLO Scale-Out license HPC customers now have a server management package solely design and priced for their massive data environments. HP iLO Scale-Out is available on all HP

### Optional Features

HP iLO Advanced	ProLiant Gen8 BL and SL platforms. For more information, see: <a href="http://www.hp.com/go/iLO/scale-out">www.hp.com/go/iLO/scale-out</a> HP Integrated Lights-Out Advanced License a product option, providing smart remote server management without compromise. iLO Advanced unlocks the full set of remote administration functionality for all HP ProLiant servers by activating the full Virtual Keyboard Video and Mouse remote console, multi-user collaboration, console record and replay, GUI-based and scripted virtual media and virtual folders, and enhanced security and power management functionality. For more information, see: <a href="http://www.hp.com/go/iloadvance">http://www.hp.com/go/iloadvance</a>
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### High Performance Clusters

HP Cluster Platforms	HP Cluster Platforms are specifically engineered, factory-integrated large-scale ProLiant clusters optimized for High Performance Computing, with a choice of servers, networks and software. Operating system options include specially priced offerings for Red Hat Enterprise Linux and SUSE Linux Enterprise Server, as well as Microsoft Windows HPC Server. A Cluster Platform Configurator simplifies ordering. <a href="http://www.hp.com/go/clusters">http://www.hp.com/go/clusters</a>
HP HPC Interconnects	HP HPC Interconnects High Performance Computing (HPC) interconnect technologies are available for this server as part of the HP Cluster Platform portfolio. These high-speed InfiniBand and Gigabit interconnects are fully supported by HP when integrated within an HP cluster. Flexible, validated solutions can be defined with the help of configuration tools. <a href="http://www.hp.com/techservers/clusters/ucp/index.html">http://www.hp.com/techservers/clusters/ucp/index.html</a>
HP Insight Cluster Management Utility	HP Insight Cluster Management Utility (CMU) is an HP-licensed and HP-supported suite of tools that are used for lifecycle management of hyperscale clusters of Linux ProLiant systems. CMU includes software for the centralized provisioning, management and monitoring of nodes. CMU makes the administration of clusters user friendly, efficient, and effective. <a href="http://www.hp.com/go/cmu">http://www.hp.com/go/cmu</a>

### Storage Software

Whether you need to solve a specific data protection, archiving, or storage command and control challenge, or deliver on strategic consolidation, compliance, or continuity initiatives, look no further than HP storage software. Our storage software helps you reduce costs, simplify storage infrastructure, protect vital assets and respond faster to business opportunities.

Storage software that gets the job done:

- **Data Protection and Recovery Software**  
Whether you're a large enterprise or a smaller business, HP data protection and recovery software will cost-effectively protect you against disaster and ensure business continuity.
- **Data Archive and Migration Software**  
HP's storage software enables you to comply with data retention and retrieval requirements, improve application performance, and reduce costs by efficiently migrating infrequently accessed or less valuable data to lower cost storage.
- **Storage Resource Management Software (SRM)**  
HP's storage resource management software reduces operational costs and provides the command and control foundation you need to efficiently manage and visualize your physical and virtual environments.
- **Data Replication Software**  
HP offers array-based and host-based replication software for use in disaster recovery, testing,

### Optional Features

- application development and reporting.
- Storage Device Management Software  
Maximize your investment in HP storage and networking with software that enables hardware-specific configuration, performance tuning and connectivity management.
- HP StoreVirtual VSA  
With HP StoreVirtual VSA you can use the power of virtualization to turn a set of heterogeneous and disconnected physical disk drives in your servers and storage devices into a single pool of logical storage capacity.

**NOTE:** For more information available Storage Software including QuickSpecs, please see: [www.hp.com/go/storage/software](http://www.hp.com/go/storage/software).

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#### HP Insight Online

HP Insight Online is a new addition to the HP Support Center for one stop, secure access to product and HP support information personalized to your IT environment. Insight Online can automatically display devices remotely monitored by HP Insight Remote Support. With Insight Online's easy navigation you can efficiently track your IT support contracts and device status from anywhere and at anytime. <http://www.hp.com/go/insightonline>.

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#### HP Proactive Insight experience

Prevent problems with innovative, automated monitoring tools and proactive services. The HP Proactive Insight experience consist of using Insight Online, Insight Remote Support, and Proactive Care Support Service as one integrated solution. The Proactive Insight experience provides you with expert advice and personalized, cloud-based automated IT support, helping to prevent unplanned down time and solve problems quickly. For more information, visit: [www.hp.com/go/proactiveinsightexperience](http://www.hp.com/go/proactiveinsightexperience)

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#### Factory Express Portfolio for Servers and Storage

HP Factory Express offers configuration, customization, integration and deployment services for HP servers and storage products. Customers can choose how their factory solutions are built, tested, integrated, shipped and deployed.

Factory Express offers service packages for simple configuration, racking, installation, complex configuration and design services as well as individual factory services, such as image loading, asset tagging, and custom packaging. HP products supported through Factory Express include a wide array of servers and storage: HP Integrity, HP ProLiant, HP ProLiant Server Blades, HP BladeSystem, HP 9000 servers as well as the MSAxxxx, VA7xxx, EVA, XP, rackable tape libraries and configurable network switches.

For more information on Factory Express services on your specific server model please contact your sales representative or go to: <http://www.hp.com/go/factory-express.html>

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#### HP Simple Configurator

SCE is a guided self service tool to help sales and non technical people provide customers with initial configurations in 3 to 5 minutes. You may then send the configuration on for configuration help, or use in your existing ordering processes. If you require "custom" rack configuration or configuration for products not available in SCE, please contact HP's Customer Business Center or an Authorized Partner for assistance. <http://www.hp.com/products/configurator>

### Service and Support

#### Service and Support

##### **HP Technology Services for Industry Standard Servers and BladeSystem**

Capitalizing on HP ProLiant server and HP BladeSystem capabilities requires a service partner who understands your increasingly complex business technology environment. That's why it makes sense to team up with the people who know HP infrastructure hardware and software best - the experienced professionals at HP Services.

##### **Protect your business beyond warranty with HP Care Pack Services**

HP Care Pack services offer complete care and support expertise with committed response choices designed to meet your IT and business needs.

HP Foundation Care services offer scalable reactive support-packages for HP industry-standard servers and software. You can choose the type and level of service that is most suitable for your IT and business needs. HP Proactive Care delivers high levels of system availability through proactive service management and advanced technical response.

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#### Recommended HP Care Pack Services for your HP product

##### Optimized Care

##### **3-Year HP 6 hour Call to Repair Response, Proactive Care**

Combined reactive and proactive support for hardware and software helping optimize your systems and delivering high levels of availability through proactive service management and advanced technical response. Hardware problem resolution to return the hardware in operating condition within 6 hours of the initial service request. A Technical Account Manager, as your single point of contact, will own your call or issue end to end until resolved.

<http://h20195.www2.hp.com/v2/GetPDF.aspx/4AA3-8855EEE.pdf>

##### **HP Install c-Class Server Blade Service**

This easy-to-buy, easy-to-use HP Care Pack service helps ensure that your new HP hardware is installed smoothly, efficiently, and with minimal disruption of your IT and business operations.

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##### Standard Care

##### **3-Year HP 24x7 4 hour response, Proactive Care Service**

This service gives you combined reactive and proactive support including rapid access to our Advanced Solution Center to manage and prevent problems and a Technical Support Specialist with a broad level of technical knowledge that will engage with additional technical expertise as needed from HP's vast global resources.

<http://h20195.www2.hp.com/v2/GetPDF.aspx/4AA3-8855EEE.pdf>

##### **HP Install c-Class Server Blade Service**

This easy-to-buy, easy-to-use HP Care Pack service helps ensure that your new HP hardware is installed smoothly, efficiently, and with minimal disruption of your IT and business operations

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### Service and Support

#### Related Services

##### **HP Proactive Care Personalized Support - Environmental Option**

The Personalized Support option provides an assigned Account Support Manager who can bring best practices from across the industry plus extra technical skills to your IT team. This option is only available as an add-on to HP Proactive Care Support.

##### **HP Proactive Select Service**

Provides a flexible way to purchase HP best-in-class consultancy and technical services. You can buy Proactive Select Service Credits when you purchase your hardware and then use the credits over the next 12 months. <http://h20195.www2.hp.com/V2/GetPDF.aspx/4AA2-3842ENN.pdf>

Additional HP Care Pack services can be found at: <http://www.hp.com/go/cpc>

#### **Insight Online/Insight Remote Support**

HP Insight Remote Support provides 24 X 7 remote monitoring, proactive notifications, and problem resolution. This comes at no additional cost with your HP solution. Learn more about Insight Remote Support <http://www.hp.com/go/insightremotesupport> and Insight Online <http://www.hp.com/go/insightonline>

**NOTE:** Insight Remote Support is a prerequisite for Proactive Care. All blades within a single HP BladeSystem enclosure must be at the same service level.

#### **HP Support Center**

Personalized online support portal with access to information, tools and experts to support HP business products. Submit support cases online, chat with HP experts, access support resources or collaborate with peers. Learn more <http://www.hp.com/go/hpsc>

HP's Support Center Mobile App allows you to resolve issues yourself or quickly connect to an agent for live support. Now, you can get access to personalized IT support anywhere, anytime.

HP Insight Remote Support and HP Support Center are available at no additional cost with a HP warranty, HP Care Pack or HP contractual support agreement.

**NOTE:** HP Support Center Mobile App is subject to local availability.

#### **Parts and Materials**

HP will provide HP-supported replacement parts and materials necessary to maintain the covered hardware product in operating condition, including parts and materials for available and recommended engineering improvements.

Parts and components that have reached their maximum supported lifetime and/or the maximum usage limitations as set forth in the manufacturer's operating manual, product quick-specs, or the technical product data sheet will not be provided, repaired, or replaced as part of these services.

The defective media retention service feature option applies only to Disk or eligible SSD/Flash Drives replaced by HP due to malfunction.

#### **For more information**

To learn more on HP ProLiant servers and HP BladeSystem servers, please contact your HP sales representative or HP Authorized ServiceOne Channel Partner. Or visit: [www.hp.com/services/bladessystem](http://www.hp.com/services/bladessystem)

### Pre-configured Models

**NOTE:** For the Standard Features shipped in the "Factory Integrated Models", please see the "Configuration Information - Factory Integrated Models" section.

**NOTE:** Pre-configured models ship with the configurations below. Options can be selected from the Core or Additional options section of this QuickSpecs.

**NOTE:** HP does not allow factory integration of options into pre-configured models. Any additional options purchased will be shipped separately.

**NOTE:** If you desire a custom configuration please see "Configuration Information - Factory Integrated Models" section of this QuickSpecs.

**NOTE:** Not all Pre-configured Models are available in all regions. Check with your local country HP offices for availability.

### Performance Models

<b>HP ProLiant BL660c Gen8 E5-4650 4P 128GB-R Server 679114-B21</b>	<b>Processor(s)</b> <b>Cache Memory</b> <b>Memory</b>  <b>Network Controller</b> <b>Storage Controller</b> <b>Hard Drive</b>  <b>Internal Storage</b> <b>Optical Drive Bay</b> <b>Expansion Slots</b>  <b>Management</b>  <b>Form Factor</b>  <b>Warranty</b>	<p>Four (4) Intel® Xeon® E5-4650 (2.7GHz/8-core/20MB/130W)</p> <p>20MB Level 3 cache</p> <p>128GB (16x 8GB) PC3-12800R (DDR3-1600) Registered DIMMs at 1.5V <b>NOTE: Total of 32 DIMM slots.</b></p> <p>Two (2) HP FlexFabric 10Gb 2-port 554FLB FlexibleLOMs</p> <p>HP Smart Array P220i Controller with 512MB FBWC and RAID 0, 1</p> <p>None ship standard; includes 2 SFF hard drive blanks Supports up to two (2) HP hot-plug SFF SAS/SATA/SDD drives</p> <p>SAS: 2.4TB; SATA: 2.0TB; SAS SSD: 1.6TB; SATA SSD: 1.6TB</p> <p>None</p> <p>3 standard - Slot 1 supports Type A mezzanine Cards. Slots 2 and 3 support Type A and Type B mezzanine cards.</p> <p>HP iLO Management Engine (standard) Optional: HP iLO Scale-Out or HP Insight Control</p> <p>Up to four (4) full-height server blades supported in the HP BladeSystem c3000 Enclosure Up to eight (8) full-height server blades supported in HP BladeSystem c7000 Enclosure</p> <p>Server warranty includes 3 year parts, 3 year labor, 3-year on-site support.</p>
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<b>HP ProLiant BL660c Gen8 E5-4620 4P 128GB-R Server 679115-B21</b>	<b>Processor(s)</b> <b>Cache Memory</b> <b>Memory</b>  <b>Network Controller</b> <b>Storage Controller</b> <b>Hard Drive</b>  <b>Internal Storage</b> <b>Optical Drive Bay</b> <b>Expansion Slots</b>	<p>Four (4) Intel® Xeon® E5-4620 (2.2GHz/8-core/16MB/95W)</p> <p>16MB Level 3 cache</p> <p>128GB (16x 8GB) PC3L-10600R (DDR3-1333) Registered DIMMs at 1.35V <b>NOTE: Total of 32 DIMM slots.</b></p> <p>Two (2) HP FlexFabric 10Gb 2-port 554FLB FlexibleLOMs</p> <p>HP Smart Array P220i Controller with 512MB FBWC and RAID 0, 1</p> <p>None ship standard; includes 2 SFF hard drive blanks Supports up to two (2) HP hot-plug SFF SAS/SATA/SDD drives</p> <p>SAS: 2.4TB; SATA: 2.0TB; SAS SSD: 1.6TB; SATA SSD: 1.6TB</p> <p>None</p> <p>3 standard - Slot 1 supports Type A mezzanine Cards. Slots 2 and 3 support Type A and Type B mezzanine cards.</p>
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### Pre-configured Models

<b>Management</b>	HP iLO Management Engine (standard) Optional: HP iLO Scale-Out or HP Insight Control
<b>Form Factor</b>	Up to four (4) full-height server blades supported in the HP BladeSystem c3000 Enclosure Up to eight (8) full-height server blades supported in HP BladeSystem c7000 Enclosure
<b>Warranty</b>	Server warranty includes 3 year parts, 3 year labor, 3-year on-site support.

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<b>HP ProLiant BL660c Gen8 E5-4617 4P 128GB-R Server</b> 679116-B21	<b>Processor(s)</b>	Four (4) Intel® Xeon® E5-4617 (2.9GHz/6-core/15MB/130W)
	<b>Cache Memory</b>	15MB Level 3 cache
	<b>Memory</b>	128GB (16x 8GB) PC3-12800R (DDR3-1600) Registered DIMMs at 1.5V <b>NOTE: Total of 32 DIMM slots.</b>
	<b>Network Controller</b>	Two (2) HP FlexFabric 10Gb 2-port 554FLB FlexibleLOMs
	<b>Storage Controller</b>	HP Smart Array P220i Controller with 512MB FBWC and RAID 0, 1
	<b>Hard Drive</b>	None ship standard; includes 2 SFF hard drive blanks Supports up to two (2) HP hot-plug SFF SAS/SATA/SDD drives
	<b>Internal Storage</b>	SAS: 2.4TB; SATA: 2.0TB; SAS SSD: 1.6TB; SATA SSD: 1.6TB
	<b>Optical Drive Bay</b>	None
	<b>Expansion Slots</b>	3 standard - Slot 1 supports Type A mezzanine Cards. Slots 2 and 3 support Type A and Type B mezzanine cards.
	<b>Management</b>	HP iLO Management Engine (standard) Optional: HP iLO Scale-Out or HP Insight Control
	<b>Form Factor</b>	Up to four (4) full-height server blades supported in the HP BladeSystem c3000 Enclosure Up to eight (8) full-height server blades supported in HP BladeSystem c7000 Enclosure
	<b>Warranty</b>	Server warranty includes 3 year parts, 3 year labor, 3-year on-site support.

### Configuration Information - Factory Integrated Models

**NOTE:** This section lists some of the steps required to configure a Factory Integrated Model or configure-to-order (CTO) server. To ensure only valid configurations are ordered, HP recommends the use of an HP approved configurator. Contact your local sales representative for information on CTO product offerings and requirements.

**NOTE:** Configure-to-order server blades must start with a CTO Blade Server

**NOTE:** FIO indicates that this option is only available as a factory installable option.

**NOTE:** All CTO (Configure to Order) systems will be populated with sufficient hard drive blanks based on the number of initial hard drives ordered with the server.

### Step 1: Base Server Blade Configuration (Select a configurable Blade)

<b>Models</b>	HP ProLiant BL660c Gen8 10Gb FlexibleLOM Configure-to-order Blade Server	679118-B21
	<b>Each configurable model ships with:</b>	
	Two (2) FlexibleLOM connectors providing a choice of supported FlexibleLOMs (see Step 2)	
	One (1) embedded HP Smart Array P220i Controller with RAID 0, 1	
	Optional HP Smart Array P220i Controller 512MB FBWC (listed in step 4)	
	Two (2) HP small form factor hot-plug SAS/SATA/SSD hard drive bays	
	Three (3) PCIe Gen 3.0 I/O expansion slots (one x8 Type A, two x16 Type B)	
	One (1) integrated USB connector and one (1) MicroSDHC connector	
	One (1) TPM connector	
	HP iLO Management Engine (standard)	

### Step 2: Choose Required Options (one of the following from each list unless otherwise noted)

<b>HP Processors</b>	<p><b>NOTE:</b> The BL660c Gen8 supports two or four processors; one and three processor configurations are not supported.</p> <p><b>NOTE:</b> All processor kits contain two (2) processors.</p> <p><b>NOTE:</b> If four processors are desired, select one 2P xxxxxx-L21 processor kit here in Step 2 and one xxxxxx-B21 2P processor kit in Step 3.</p> <p><b>NOTE:</b> All processors within the server must be identical.</p> <p><b>NOTE:</b> The processor model as well as the memory configuration determines the maximum speed memory can operate. Please see the see the "Memory" section later in this document.</p>	
	<b>Eight-Core Processors</b>	
	HP BL660c Gen8 Intel® Xeon® E5-4650 (2.7GHz/8-core/20MB/130W) FIO 2-processor Kit	679098-L21
	HP BL660c Gen8 Intel® Xeon® E5-4650L (2.6GHz/8-core/20MB/115W) FIO 2-processor Kit	679110-L21
	HP BL660c Gen8 Intel® Xeon® E5-4640 (2.4GHz/8-core/20MB/95W) FIO 2-processor Kit	679100-L21
	HP BL660c Gen8 Intel® Xeon® E5-4620 (2.2GHz/8-core/16MB/95W) FIO 2-processor Kit	679102-L21
	<b>Six-Core Processors</b>	
	HP BL660c Gen8 Intel® Xeon® E5-4617 (2.9GHz/6-core/15MB/130W) FIO 2-processor Kit	679112-L21
	HP BL660c Gen8 Intel® Xeon® E5-4610 (2.4GHz/6-core/15MB/95W) FIO 2-processor Kit	679104-L21
	HP BL660c Gen8 Intel® Xeon® E5-4607 (2.2GHz/6-core/12MB/95W) FIO 2-processor Kit	679106-L21

### Configuration Information - Factory Integrated Models

#### Four-Core Processors

HP BL660c Gen8 Intel® Xeon® E5-4603 (2.0GHz/4-core/10MB/95W) FIO 2-processor Kit 679108-L21

#### HP Memory

**NOTE:** HP memory from previous generation servers are not qualified or warranted with this HP ProLiant Server.

**NOTE:** HP SmartMemory is required to realize the memory performance improvements and enhanced functionality listed in this document. For additional information, please see the HP SmartMemory QuickSpecs at:

[http://h18000.www1.hp.com/products/quickspecs/14225\\_na/14225\\_na.html](http://h18000.www1.hp.com/products/quickspecs/14225_na/14225_na.html)

**NOTE:** LRDIMMs and RDIMMs are all distinct memory technologies and cannot be mixed within a server.

**NOTE:** A minimum of one DIMM is required per processor.

**NOTE:** Depending on the memory configuration and processor model, 1600MHz and 1333MHz memory may operate at a lower speed. Please see the "Memory" section later in this document and the Online Memory Configuration Tool for details at [www.hp.com/go/ddr3memory-configurator](http://www.hp.com/go/ddr3memory-configurator).

**NOTE:** For additional memory rules and guidelines, see the "Memory" section later in this document.

#### HP SmartMemory

#### Load Reduced DIMMs (LRDIMMs)

HP 32GB (1x32GB) Quad Rank x4 PC3L-10600L (DDR3-1333) Load Reduced CAS-9 Low Voltage Memory Kit 647903-B21

#### Registered DIMMs (RDIMMs)

HP 4GB (1x4GB) Single Rank x4 PC3L-10600R (DDR3-1333) Registered CAS-9 Low Voltage Memory Kit 647893-B21

HP 4GB (1x4GB) Single Rank x4 PC3-12800R (DDR3-1600) Registered CAS-11 Memory Kit 647895-B21

HP 8GB (1x8GB) Dual Rank x4 PC3L-10600R (DDR3-1333) Registered CAS-9 Low Voltage Memory Kit 647897-B21

HP 8GB (1x8GB) Single Rank x4 PC3-12800R (DDR3-1600) Registered CAS-11 Memory Kit 647899-B21

HP 8GB (1x8GB) Dual Rank x4 PC3-12800R (DDR3-1600) Registered CAS-11 Memory Kit 690802-B21

HP 16GB (1x16GB) Dual Rank x4 PC3L-10600R (DDR3-1333) Registered CAS-9 Low Voltage Memory Kit 647901-B21

HP 16GB (1x16GB) Dual Rank x4 PC3-12800R (DDR3-1600) Registered CAS-11 Memory Kit 672631-B21

HP 24 GB (1x24GB) Three Rank x4 PC3L-10600R (DDR3-1333) Registered CAS-9 Low Voltage FIO Memory Kit 716324-B21

**NOTE:** When HP 4GB (1x4GB) Three Rank x4 PC3L-10600R (DDR3-1333) Registered CAS-9 Low Voltage FIO Memory Kits are used, all 32 DIMM slots on the BL660c Gen8 must be fully populated with these 24GB DIMMs.

#### HP Networking

#### FlexibleLOM Adapters

**NOTE:** The ProLiant BL660c Gen8 supports one or two FlexibleLOMs.

**NOTE:** For a single FlexibleLOM Factory Integrated Model configuration, select the option here in the "Step 2" HP Networking section.

**NOTE:** For a two FlexibleLOM Factory Integrated Model configuration, the second FlexibleLOM is a different part number. When two FlexibleLOMs are needed you must

### Configuration Information - Factory Integrated Models

select the first FlexibleLOM here in the "Step 2" HP Networking section and the second FlexibleLOM from "Step 4" HP Networking section.

**NOTE:** All FlexibleLOMs are dual port: one port is routed to interconnect module bay 1 and the other to bay 2.

#### 10GbE Ethernet FlexibleLOMs

HP Flex-10 10Gb 2-port 530FLB FIO Adapter 684211-B21

**NOTE:** For a two FlexibleLOM configuration, the HP Flex-10 10Gb 2-port 530FLB FIO Adapter may be configured with the HP Flex-10 10Gb 2-port 530FLB Adapter (656590-B21) or the HP 10Gb 2-port 560FLB Adapter (655639-B21).

HP FlexFabric 10Gb 2-port 534FLB FIO Adapter 700742-B21

**NOTE:** For a two FlexibleLOM configuration, the HP FlexFabric 10Gb 2-port 534FLB FIO Adapter may be configured with the HP FlexFabric 10Gb 2-port 534FLB Adapter (700741-B21).

HP FlexFabric 10Gb 2-port 554FLB FIO Adapter 684212-B21

**NOTE:** For a two FlexibleLOM configuration, the HP FlexFabric 10Gb 2-port 554FLB FIO Adapter may be configured with the HP FlexFabric 10Gb 2-port 554FLB Adapter (647586-B21) or the HP 10Gb 2-port 560FLB Adapter (655639-B21).

HP Ethernet 10Gb 2-port 560FLB FIO Adapter 684214-B21

**NOTE:** For a two FlexibleLOM configuration, the HP 10Gb 2-port 560FLB FIO Adapter may be configured with the HP 10Gb 2-port 560FLB Adapter (655639-B21).

#### HP Storage Controllers

#### Optional Upgrades

HP 512MB FBWC for BL660c FIO Kit 694033-B21

**NOTE:** Please see the Smart Array Advanced Pack 2.0 QuickSpecs for Technical Specifications and additional information at [http://h18000.www1.hp.com/products/quickspecs/13200\\_na/13200\\_na.html](http://h18000.www1.hp.com/products/quickspecs/13200_na/13200_na.html). (Smart Array Advanced Pack)

### Step 3: Choose Additional Factory Integration Options

**HP Insight Software** HP Insight Control including 1yr 24x7 Support ProLiant ML/DL/BL-bundle Single Server FIO License C6N36A

**HP Storage Blades** HP D2220sb Configure-to-order Storage Blade QW918A

**NOTE:** The ProLiant BL660c Gen8 supports up to two expansion blades (Ultrium Tape Blade(s), HP D2200sb/D2220sb Storage Blade(s), and/or PCI Expansion Blade(s) that directly connect to the server via the enclosure midplane

**NOTE:** Please see the QuickSpecs for technical specifications and additional information at <http://h18006.www1.hp.com/storage/bladesystem/index.html>

### Configuration Information - Factory Integrated Models

#### Step 4: Choose Additional Options for Factory Integration

**NOTE:** For additional options, including server blade enclosures interconnect, mezzanine options and power subsystem options; please see the Core Options and Additional sections below; or the following:

- HP BladeSystem c3000 Enclosure QuickSpecs:  
[http://h18000.www1.hp.com/products/quickspecs/12790\\_na/12790\\_na.html](http://h18000.www1.hp.com/products/quickspecs/12790_na/12790_na.html)  
**NOTE:** The c3000 HP c-Class enclosures have full backwards and forwards compatibility, existing server blades are supported in the new enclosures and any future server blades will be supported in the existing enclosures.  
**NOTE:** The ProLiant BL660c Gen8 requires the c3000 Enclosure to be configured with 6 fans.
- HP BladeSystem c7000 Enclosure QuickSpecs:  
[http://h18000.www1.hp.com/products/quickspecs/12810\\_na/12810\\_na.html](http://h18000.www1.hp.com/products/quickspecs/12810_na/12810_na.html)  
**NOTE:** The c7000 HP c-Class enclosures have full backwards and forwards compatibility, existing server blades are supported in the new enclosures and any future server blades will be supported in the existing enclosures.  
**NOTE:** The ProLiant BL660c Gen8 requires the c7000 Enclosure to be configured with 10 fans.
- HP BladeSystem c-Class Interconnect and Mezzanine Components:  
<http://h18004.www1.hp.com/products/blades/components/c-class-interconnects.html> and  
<http://h18004.www1.hp.com/products/blades/components/c-class-adapters.html>

### Core Options

#### HP Networking

##### 10Gb Ethernet Mezzanines

**NOTE:** All 10Gb Ethernet adapters are Type A mezzanine cards that can be installed in any of the BL660c Gen8 mezzanine slots.

**NOTE:** Each 10 Gigabit Ethernet adapter requires a minimum of 2GB of server memory.

**NOTE:** A 10 Gigabit Ethernet adapter supports linking at 1Gbps or 10Gbps when connected to an interconnect module with 10Gb Ethernet downlinks.

**NOTE:** A 10 Gigabit Ethernet adapter supports linking at only 1Gbps when connected to an interconnect module with 1Gb Ethernet downlinks.

**NOTE:** The 10 Gigabit Ethernet adapters on each server blade connect to a 10Gb interconnect in bays 3-6 (HP BladeSystem c7000 Enclosure) or bays 2-4 (HP BladeSystem c3000 Enclosure).

HP Ethernet 10Gb 2-port 560M Adapter

665246-B21

**NOTE:** Please see QuickSpecs for technical specifications and additional information at:

[http://h18004.www1.hp.com/products/quickspecs/14478\\_na/14478\\_na.html](http://h18004.www1.hp.com/products/quickspecs/14478_na/14478_na.html).

HP FlexFabric 10Gb 2-port 554M Adapter

647590-B21

**NOTE:** Please see QuickSpecs for technical specifications and additional information at:

[http://h18000.www1.hp.com/products/quickspecs/14221\\_na/14221\\_na.html](http://h18000.www1.hp.com/products/quickspecs/14221_na/14221_na.html).

HP Flex-10 10Gb 2-port 552M Adapter

674764-B21

**NOTE:** Please see QuickSpecs for technical specifications and additional information at:

[http://h18000.www1.hp.com/products/quickspecs/14218\\_na/14218\\_na.html](http://h18000.www1.hp.com/products/quickspecs/14218_na/14218_na.html).

HP FlexFabric 10Gb 2-port 534M Adapter

700748-B21

**NOTE:** Please see QuickSpecs for technical specifications and additional information at:

[http://h18000.www1.hp.com/products/quickspecs/14617\\_na/14617\\_na.html](http://h18000.www1.hp.com/products/quickspecs/14617_na/14617_na.html).

HP Flex-10 10Gb 2-port 530M Adapter

631884-B21

**NOTE:** Please see QuickSpecs for technical specifications and additional information at:

[http://h18000.www1.hp.com/products/quickspecs/14217\\_na/14217\\_na.html](http://h18000.www1.hp.com/products/quickspecs/14217_na/14217_na.html).

##### 1Gb Ethernet Mezzanines

**NOTE:** All 1Gb Ethernet adapters are Type A mezzanine cards that can be installed in any of the BL660c Gen8 mezzanine slots.

HP Ethernet 1Gb 4-port 366M Adapter

615729-B21

##### 10Gb Ethernet FlexibleLOM Adapters

**NOTE:** The server supports one or two FlexibleLOMs.

**NOTE:** For Pre-configured Model configurations, two FlexibleLOMs are already included; no additional FlexibleLOMs are added.

**NOTE:** For a Factory Integrated Model configuration with one FlexibleLOM, it is added in the HP Networking section of "Step 2" in the Factory Integrated Models section earlier in this document; it is not added here.

**NOTE:** For a Factory Integrated Model configuration with two FlexibleLOMs, the second FlexibleLOM is a different part number. You must select the first FlexibleLOM earlier in this document in the "Step 2" HP Networking section and select the second FlexibleLOM here in the "Step 4" HP Networking section.

**NOTE:** The FlexibleLOMs here can also be used change the FlexibleLOM(s) that original came with the server.

**NOTE:** All FlexibleLOMs are dual port: one port is routed to interconnect module bay 1 and the other to bay 2.

HP Flex-10 10Gb 2-port 530FLB Adapter

656590-B21

### Core Options

**NOTE:** Please see QuickSpecs for technical specifications and additional information at: [http://h18000.www1.hp.com/products/quickspecs/14216\\_na/14216\\_na.html](http://h18000.www1.hp.com/products/quickspecs/14216_na/14216_na.html).

HP FlexFabric 10Gb 2-port 534FLB Adapter 700741-B21

**NOTE:** Please see QuickSpecs for technical specifications and additional information at: [http://h18000.www1.hp.com/products/quickspecs/14617\\_na/14617\\_na.html](http://h18000.www1.hp.com/products/quickspecs/14617_na/14617_na.html)

HP FlexFabric 10Gb 2-port 554FLB Adapter 647586-B21

**NOTE:** Please see QuickSpecs for technical specifications and additional information at: [http://h18000.www1.hp.com/products/quickspecs/14219\\_na/14219\\_na.html](http://h18000.www1.hp.com/products/quickspecs/14219_na/14219_na.html).

HP Ethernet 10Gb 2-port 560FLB Adapter 655639-B21

**NOTE:** Please see QuickSpecs for technical specifications and additional information at: [http://h18000.www1.hp.com/products/quickspecs/14331\\_na/14331\\_na.html](http://h18000.www1.hp.com/products/quickspecs/14331_na/14331_na.html).

#### 1Gb Ethernet FlexibleLOM Adapters

**NOTE:** The server supports one or two FlexibleLOMs. Two are already included in the Pre-configured Models and the first one is added per Step 2 for Factory Integrated Models. The 1GbE FlexibleLOM option below is used to change the original 10Gb FlexibleLOM(s) that originally came with the server.

**NOTE:** For a two FlexibleLOM configuration, the two FlexibleLOMs must be identical.

HP Ethernet 1Gb 2-port 361FLB Adapter 652500-B21

**NOTE:** Please see QuickSpecs for technical specifications and additional information at: [http://h18000.www1.hp.com/products/quickspecs/14333\\_na/14333\\_na.html](http://h18000.www1.hp.com/products/quickspecs/14333_na/14333_na.html)

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### HP Fibre Channel

HP LPe1205A 8Gb Fibre Channel Host Bus Adapter for BladeSystem c-Class 659818-B21

**NOTE:** This is a Type A mezzanine card that can be installed in any of the BL660c Gen8 mezzanine slots.

**NOTE:** Please see QuickSpecs for technical specifications and additional information at [http://h18000.www1.hp.com/products/quickspecs/14338\\_na/14338\\_na.html](http://h18000.www1.hp.com/products/quickspecs/14338_na/14338_na.html)

HP QMH2572 8Gb Fibre Channel Host Bus Adapter for BladeSystem c-Class 651281-B21

**NOTE:** This is a Type A mezzanine card that can be installed in any of the BL660c Gen8 mezzanine slots.

**NOTE:** Please see QuickSpecs for technical specifications and additional information at [http://h18000.www1.hp.com/products/quickspecs/14230\\_na/14230\\_na.html](http://h18000.www1.hp.com/products/quickspecs/14230_na/14230_na.html)

HP QMH2672 16Gb Fibre Channel Host Bus Adapter 710608-B21

**NOTE:** This is a Type A mezzanine card that can be installed in any of the BL660c Gen8 mezzanine slots.

**NOTE:** Please see QuickSpecs for technical specifications and additional information at: [http://h18000.www1.hp.com/products/quickspecs/14622\\_na/14622\\_na.html](http://h18000.www1.hp.com/products/quickspecs/14622_na/14622_na.html)

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### Core Options

#### HP Processors

**NOTE:** The BL660c Gen8 supports two or four processors; one and three processor configurations are not supported.  
**NOTE:** All processor kits contain two (2) processors.  
**NOTE:** All processors within the server must be identical.  
**NOTE:** The processor model as well as the memory configuration determines the maximum speed memory can operate. Please see the see the "Memory" section later in this document.

#### Eight-Core Processors

HP BL660c Gen8 Intel® Xeon® E5-4650 (2.7GHz/8-core/20MB/130W) 2-processor Kit	679098-B21
HP BL660c Gen8 Intel® Xeon® E5-4650L (2.6GHz/8-core/20MB/115W) 2-processor Kit	679110-B21
HP BL660c Gen8 Intel® Xeon® E5-4640 (2.4GHz/8-core/20MB/95W) 2-processor Kit	679100-B21
HP BL660c Gen8 Intel® Xeon® E5-4620 (2.2GHz/8-core/16MB/95W) 2-processor Kit	679102-B21

#### Six-Core Processors

HP BL660c Gen8 Intel® Xeon® E5-4617 (2.9GHz/6-core/15MB/130W) 2-processor Kit	679112-B21
HP BL660c Gen8 Intel® Xeon® E5-4610 (2.4GHz/6-core/15MB/95W) 2-processor Kit	679104-B21
HP BL660c Gen8 Intel® Xeon® E5-4607 (2.2GHz/6-core/12MB/95W) 2-processor Kit	679106-B21

#### Four-Core Processors

HP BL660c Gen8 Intel® Xeon® E5-4603 (2.0GHz/4-core/10MB/95W) 2-processor Kit	679108-B21
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#### HP Memory

**NOTE:** HP memory from previous generation servers are not qualified or warranted with this HP ProLiant Server. HP SmartMemory is required to realize the memory performance improvements and enhanced functionality listed in this document. For additional information, please see the HP SmartMemory QuickSpecs at:

[http://h18000.www1.hp.com/products/quickspecs/14225\\_na/14225\\_na.html](http://h18000.www1.hp.com/products/quickspecs/14225_na/14225_na.html)

**NOTE:** LRDIMMs and RDIMMs are all distinct memory technologies and cannot be mixed within a server.

**NOTE:** A minimum of one DIMM is required per processor.

**NOTE:** For additional memory rules and guidelines, see the "Memory" section later in this document.

#### HP SmartMemory

##### Load Reduced DIMMs (LRDIMMs)

HP 32GB (1x32GB) Quad Rank x4 PC3L-10600L (DDR3-1333) Load Reduced CAS-9 Low Voltage Memory Kit	647903-B21
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##### Registered DIMMs (RDIMMs)

HP 4GB (1x4GB) Single Rank x4 PC3L-10600R (DDR3-1333) Registered CAS-9 Low Voltage Memory Kit	647893-B21
HP 4GB (1x4GB) Single Rank x4 PC3-12800R (DDR3-1600) Registered CAS-11 Memory Kit	647895-B21
HP 8GB (1x8GB) Dual Rank x4 PC3L-10600R (DDR3-1333) Registered CAS-9 Low Voltage Memory Kit	647897-B21
HP 8GB (1x8GB) Single Rank x4 PC3-12800R (DDR3-1600) Registered CAS-11 Memory Kit	647899-B21
HP 8GB (1x8GB) Dual Rank x4 PC3-12800R (DDR3-1600) Registered CAS-11 Memory Kit	690802-B21



### Core Options

HP 16GB (1x16GB) Dual Rank x4 PC3L-10600R (DDR3-1333) Registered CAS-9 Low Voltage Memory Kit	647901-B21
HP 16GB (1x16GB) Dual Rank x4 PC3-12800R (DDR3-1600) Registered CAS-11 Memory Kit	672631-B21
HP 24 GB (1x24GB) Three Rank x4 PC3L-10600R (DDR3-1333) Registered CAS-9 Low Voltage FIO Memory Kit	716324-B21
<b>NOTE:</b> When HP 24GB (1x24GB) Three Rank x4 PC3L-10600R (DDR3-1333) Registered CAS-9 Low Voltage FIO Memory Kits are used, all 32 DIMM slots on the BL660c Gen8 must be fully populated with these 24GB DIMMs.	

### HP Hard Drives

**NOTE:** The ProLiant BL660c Gen8 server includes the new HP hot-plug small form factor (SFF) SmartDrive carrier for enhanced management and reduced maintenance errors. HP drives from previous generation servers are not compatible with the BL660c Gen8 drive bays.

**NOTE:** HP hard drives have either a one year or three year warranty; refer to the specific hard drive QuickSpecs for details.

**NOTE:** The hard drive options are not required when configuring a drive-less model.

**NOTE:** The mixing of standard SAS drives with SAS SSD drives is supported within the server, but limits the RAID configuration to two separate RAID 0 volumes. Mixing of other drives types is not supported.

#### HP SAS Hot Plug SmartDrive Carriers for Gen8 Servers only

##### SAS Hot Plug with SmartDrive SFF (2.5-inch) Enterprise Drives

HP 1.2TB 6G SAS 10K rpm SFF (2.5-inch) SC Enterprise 3yr Warranty Hard Drive	697574-B21
HP 900GB 6G SAS 10K rpm SFF (2.5-inch) SC Enterprise 3yr Warranty Hard Drive	652589-B21
HP 600GB 6G SAS 10K rpm SFF (2.5-inch) SC Enterprise 3yr Warranty Hard Drive	652583-B21
HP 450GB 6G SAS 10K rpm SFF (2.5-inch) SC Enterprise 3yr Warranty Hard Drive	652572-B21
HP 300GB 6G SAS 10K rpm SFF (2.5-inch) SC Enterprise 3yr Warranty Hard Drive	652564-B21
HP 300GB 6G SAS 15K rpm SFF (2.5-inch) SC Enterprise 3yr Warranty Hard Drive	652611-B21
HP 146GB 6G SAS 15K rpm SFF (2.5-inch) SC Enterprise 3yr Warranty Hard Drive	652605-B21

##### SAS Hot Plug SmartDrive SFF (2.5-inch) Midline Drives

HP 1TB 6G SAS 7.2K rpm SFF (2.5-inch) SC Midline 1yr Warranty Hard Drive	652749-B21
HP 500GB 6G SAS 7.2K rpm SFF (2.5-inch) SC Midline 1yr Warranty Hard Drive	652745-B21

**NOTE:** Please see QuickSpecs for technical specifications and additional information at [http://h18000.www1.hp.com/products/quickspecs/12244\\_na/12244\\_na.html](http://h18000.www1.hp.com/products/quickspecs/12244_na/12244_na.html).

##### 6G SATA Hot Plug with SmartDrive SFF (2.5-inch) Midline (MDL) Drives

HP 1TB 6G SATA 7.2K rpm SFF (2.5-inch) SC Midline 1yr Warranty Hard Drive	655710-B21
HP 500GB 6G SATA 7.2K rpm SFF (2.5-inch) SC Midline 1yr Warranty Hard Drive	655708-B21

**NOTE:** Please see the QuickSpecs for technical specifications and additional information at [http://h18000.www1.hp.com/products/quickspecs/13021\\_na/13021\\_na.html](http://h18000.www1.hp.com/products/quickspecs/13021_na/13021_na.html).

##### 6G SATA Value Endurance Hot Plug SFF (2.5-inch) Enterprise Value Solid State Drives

### Core Options

HP 800GB 6G SATA Value Endurance SFF 2.5-in SC Enterprise Value 3yr Wty Solid State Drive	717973-B21
<b>NOTE:</b> This drive supports Gen8 servers only.	
HP 480GB 6G SATA Value Endurance SFF 2.5-in SC Enterprise Value 3yr Wty Solid State Drive	717971-B21
<b>NOTE:</b> This drive supports Gen8 servers only.	
HP 240GB 6G SATA Value Endurance SFF 2.5-in SC Enterprise Value 3yr Wty Solid State Drive	717969-B21
<b>NOTE:</b> This drive supports Gen8 servers only.	
<b>NOTE:</b> Please see the QuickSpecs for technical specifications and information at: <a href="http://h18000.www1.hp.com/products/quickspecs/14038_na/14038_na.html">http://h18000.www1.hp.com/products/quickspecs/14038_na/14038_na.html</a> .	
<b>3G SATA MLC Hot Plug SFF (2.5-inch) Enterprise Mainstream Solid State Drives</b>	
HP 400GB 3G SATA MLC SFF (2.5-inch) SC Enterprise Mainstream 3yr Warranty Solid State Drive	653120-B21
HP 200GB 3G SATA MLC SFF (2.5-inch) SC Enterprise Mainstream 3yr Warranty Solid State Drive	653118-B21
HP 100GB 3G SATA MLC SFF (2.5-inch) SC Enterprise Mainstream 3yr Warranty Solid State Drive	653112-B21
<b>6G SATA ME Hot Plug SFF (2.5-inch) Enterprise Mainstream Solid State Drives</b>	
HP 800GB 6G SATA Mainstream Endurance SFF 2.5-in SC Enterprise Mainstream 3yr Wty Solid State Drive	691868-B21
HP 400GB 6G SATA Mainstream Endurance SFF 2.5-in SC Enterprise Mainstream 3yr Wty Solid State Drive	691866-B21
HP 200GB 6G SATA Mainstream Endurance SFF 2.5-in SC Enterprise Mainstream 3yr Wty Solid State Drive	691864-B21
HP 100GB 6G SATA Mainstream Endurance SFF 2.5-in SC Enterprise Mainstream 3yr Wty Solid State Drive	691862-B21
<b>6G SAS ME Hot Plug SFF (2.5-inch) Enterprise Mainstream Solid State Drives</b>	
HP 800GB 6G SAS Mainstream Endurance SFF 2.5-in SC Enterprise Mainstream 3yr Wty Solid State Drive	690829-B21
HP 400GB 6G SAS Mainstream Endurance SFF 2.5-in SC Enterprise Mainstream 3yr Wty Solid State Drive	690827-B21
HP 200GB 6G SAS Mainstream Endurance SFF 2.5-in SC Enterprise Mainstream 3yr Wty Solid State Drive	690825-B21
<b>6G SAS SLC Hot Plug SFF (2.5-inch) Enterprise Performance Solid State Drives</b>	
HP 400GB 6G SAS SLC SFF (2.5-inch) SC Enterprise Performance 3yr Warranty Solid State Drive	653082-B21
HP 200GB 6G SAS SLC SFF (2.5-inch) SC Enterprise Performance 3yr Warranty Solid State Drive	653078-B21
<b>NOTE:</b> Please see the QuickSpecs for technical specifications and information at: <a href="http://h18000.www1.hp.com/products/quickspecs/14038_na/14038_na.html">http://h18000.www1.hp.com/products/quickspecs/14038_na/14038_na.html</a> .	

### Additional Options

#### HP Insight Software

#### HP Insight Control

HP Insight Control including 1yr 24x7 Technical Support and Updates Single Server License C6N27A

HP Insight Control including 1yr 24x7 Technical Support and Updates Electronic License C6N28ABE

HP Insight Control including 1yr 24x7 Support ProLiant ML/DL/BL-bundle FIO Electronic License C6N36ABE

HP Insight Control Server Provisioning Media Kit BD883A

HP Insight Management Media Kit C6N31A

**NOTE:** HP Insight Management Media Kit contains DVDs without licenses. Contains HP Systems Insight Manager, HP Insight Control, HP Matrix Operating Environment, and Virtual Connect Enterprise Manager software. Uses an integrated installer to perform quick and accurate software installation and updates.

**NOTE:** HP Insight Control 7.2 introduces Insight Control server provisioning, a new capability ideal for multi-server OS and firmware provisioning to ProLiant and BladeSystem servers. Insight Control server provisioning is included and licensed as part of HP Insight Control. A media kit, "HP Insight Control server provisioning USB media kit" (# BD883A), including a USB, is available for customers who require a physical copy of the media loaded with Insight Control server provisioning software. Please note that this media kit is separate and in addition to the "HP Insight Management DVD media kit" (#C6N31A).

**NOTE:** Electronic and Flexible-Quantity licenses can be used to purchase multiple licenses with a single activation key.

**NOTE:** Customer will receive a license entitlement certificate. The license entitlement certificate must be redeemed online or via fax in order to obtain the license activation key(s). Includes one year of 24 x 7 HP Software Technical Support and Update Service.

**NOTE:** Licenses ship without media. The HP Insight Management Media Kit can be ordered separately, or can be downloaded at: <http://www.hp.com/go/insightupdates>.

**NOTE:** For additional license options please see the Insight Control QuickSpecs at: [http://h18000.www1.hp.com/products/quickspecs/12631\\_na/12631\\_na.html](http://h18000.www1.hp.com/products/quickspecs/12631_na/12631_na.html)

#### HP Insight Control server deployment

HP Insight Control Server Deployment including 1yr 24x7 Support Electronic License T9082AAE

HP Insight Control Server Deployment including 1yr 24x7 Support Single Server License 452151-B21

**NOTE:** Licenses ship without media. The HP Insight Management Media Kit can be ordered separately, or can be downloaded at <http://www.hp.com/go/insightupdates>.

**NOTE:** Customer will receive a license entitlement certificate, which must be redeemed online or via fax in order to obtain the license activation key(s). Includes one year of 24 x 7 HP Software Technical Support Service.

**NOTE:** For additional license kits please see the Insight Control QuickSpecs at [http://h18004.www1.hp.com/products/quickspecs/12631\\_na/12631\\_na.html](http://h18004.www1.hp.com/products/quickspecs/12631_na/12631_na.html).

### Additional Options

<b>HP iLO Advanced License</b>	<b>HP Integrated Lights-Out (iLO) Advanced for ProLiant BladeSystem Remote Management</b>	
	HP iLO Advanced Blade including 3yr 24x7 Tech Support and Updates Electronic License	E6U63ABE
	HP iLO Advanced Blade 1 Server License with 3yr 24x7 Tech Support and Updates	BD502A
	HP iLO Advanced for BladeSystem including 1yr 24x7 Tech Support and Updates Electronic License	E6U60ABE
	HP iLO Advanced for BladeSystem including 1yr 24x7 Support Single Server License	512488-B21
	HP iLO Advanced for BladeSystem including 1yr 24x7 Support Eight Server License	512489-B21
	<b>HP Integrated Lights-Out (iLO)</b>	
	<b>HP iLO Scale Out</b>	
	HP Integrated Lights-Out Scale-Out 3yr 24x7 Tech Support and Updates Flex Quantity License	BD776A
	HP Integrated Lights-Out Scale-Out 1yr 24x7 Tech Support and Updates Flex Quantity License	BD778A
	HP Integrated Lights-Out Scale-Out including 3yr 24x7 Tech Support and Updates Flex Qty E-LTU	BD776AAE
	HP Integrated Lights-Out Scale-Out including 1yr 24x7 Tech Support and Updates Flex Qty E-LTU	BD778AAE
	HP Integrated Lights-Out Scale-Out including 3yr 24x7 Tech Support and Updates Tracking License	BD777A
	HP Integrated Lights-Out Scale-Out including 1yr 24x7 Tech Support and Updates Tracking License	BD779A
	<b>NOTE:</b> Customer will receive a license entitlement certificate, which must be redeemed online or via fax in order to obtain the license activation key(s). Includes one or three years of 24 x 7 HP Software Technical Support Service.	
	<b>NOTE:</b> For additional license kits, including electronic delivery options, please see the iLO QuickSpecs at <a href="http://www.hp.com/go/iLO">http://www.hp.com/go/iLO</a>	

### High Performance Clusters

<b>HP Cluster Management Utility</b>	
HP Insight Cluster Management Utility 1yr 24x7 Flexible License	QL803B
HP Insight Cluster Management Utility 3yr 24x7 Flexible License	BD476A
<b>NOTE:</b> These part numbers can be used to purchase one certificate for multiple licenses and support with a single activation key. Each license is for one node (server). Customer will receive a printed end user license agreement and license entitlement certificate via physical shipment. The license entitlement certificate must be redeemed online in order to obtain a license key. Customer also will receive a support agreement.	
HP Insight Cluster Management Utility Media	BD477A
<b>NOTE:</b> For additional license kits please see the QuickSpecs at <a href="http://h18004.www1.hp.com/products/quickspecs/12612_na/12612_na.html">http://h18004.www1.hp.com/products/quickspecs/12612_na/12612_na.html</a> .	

### Additional Options

#### HP I/O Accelerator Options

**NOTE:** The HP I/O Accelerator Options are Type B mezzanine cards that can be installed in BL660c Gen8 mezzanine slots 2 and 3.

HP 1.2TB Multi Level Cell IO Accelerator for BladeSystem c-Class	QK763A
HP 785GB Multi Level Cell IO Accelerator for BladeSystem c-Class	QK762A
HP 365GB Multi Level Cell IO Accelerator for BladeSystem c-Class	QK761A

#### HP Security

HP Trusted Platform Module Option

488069-B21

**NOTE:** The TPM (Trusted Platform Module) is a microcontroller chip that can securely store artifacts used to authenticate the server platform. These artifacts can include passwords, certificates and encryption keys. Windows® BitLocker™ Drive Encryption (BitLocker) is a data protection feature available in Windows Server® 2008. BitLocker leverages the enhanced security capabilities of a Trusted Platform Module (TPM) version 1.2. The TPM works with BitLocker to help protect user data and to ensure that a server running Windows Server 2008 has not been tampered with while the system was offline.

**NOTE:** For more information about TPM, including a white paper, go to <http://www.hp.com/go/TPM>.

**NOTE:** ProLiant OS pre-installed units will come with the partition required for TPM deployment.

**NOTE:** The TPM key is unique to every TPM deployed server and must be retained. Misplacing or losing the key could result in data loss.

#### HP Storage Controller

##### HP Smart Array P731m Controller

**NOTE:** The HP Smart Array P731m Controller is a Type B mezzanine card that can be installed in BL660c Gen8 mezzanine slots 2 and 3.

**NOTE:** The BL660 has three installation locations for the "capacitor pack" that comes with the FBWC on Smart Array controllers. The first install location is for the embedded Smart Array P220i Controller. The second install location is for an optional Smart Array controller Type A or B mezzanine card with FBWC installed in mezzanine slot 3. The third install location is for an optional Smart Array controller mezzanine card with FBWC installed in either mezzanine slot 1 (Type A only) or slot 2 (Type A or B).

HP Smart Array P731m/2GB FBWC 6Gb 4-ports Ext Mezzanine SAS Controller

698535-B21

##### HP Smart Array P721m Controller

**NOTE:** The HP Smart Array P721m Controller is a Type B mezzanine card that can be installed in BL660c Gen8 mezzanine slots 2 and 3.

**NOTE:** The BL660 has three installation locations for the "capacitor pack" that comes with the FBWC on Smart Array controllers. The first install location is for the embedded Smart Array P220i Controller. The second install location is for an optional Smart Array controller Type A or B mezzanine card with FBWC installed in mezzanine slot 3. The third install location is for an optional Smart Array controller mezzanine card with FBWC installed in either mezzanine slot 1 (Type A only) or slot 2 (Type A or B).

HP Smart Array P721m/2G FBWC 4-ports Ext Mezzanine SAS Controller

650072-B21

HP Smart Array P721m/512 4-ports Ext Mezzanine SAS Controller

655636-B21

**NOTE:** For additional information, please see the HP BladeSystem c7000 Enclosure and InfiniBand QuickSpecs at:

[http://h18000.www1.hp.com/products/quickspecs/14626\\_na/14626\\_na.html](http://h18000.www1.hp.com/products/quickspecs/14626_na/14626_na.html).

### Additional Options

(Smart Array P731m Controller)

[http://h18000.www1.hp.com/products/quickspecs/14404\\_na/14404\\_na.html](http://h18000.www1.hp.com/products/quickspecs/14404_na/14404_na.html)

(Smart Array P721M Controller)

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**HP InfiniBand Mezzanines** **NOTE:** When an InfiniBand adapter is installed in mezzanine slot 1, only one port is active (regardless of operating mode). When installed in any other mezzanine slot, both ports are active.

**NOTE:** InfiniBand QDR and FDR speeds are only supported on the HP BladeSystem c7000 Enclosure. For additional information, please see the HP BladeSystem c7000 Enclosure and InfiniBand QuickSpecs at:

[http://h18004.www1.hp.com/products/quickspecs/12586\\_na/12586\\_na.html](http://h18004.www1.hp.com/products/quickspecs/12586_na/12586_na.html)

[http://h18000.www1.hp.com/products/quickspecs/13078\\_na/13078\\_na.html](http://h18000.www1.hp.com/products/quickspecs/13078_na/13078_na.html)

HP Infiniband QDR/Ethernet 10Gb 2-port 544M Adapter

644160-B21

**NOTE:** The QDR InfiniBand adapter may be installed in any mezzanine slot of the server.

HP Infiniband FDR/Ethernet 10Gb/40Gb 2-port 544M Adapter

644161-B22

**NOTE:** The FDR InfiniBand adapter must be installed in mezzanine slot 1 for FDR mode and may be installed in any mezzanine slot if operated in any other mode.

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**HP Ultrium Tape Blades** **NOTE:** The ProLiant BL660c Gen8 supports up to two expansion blades (Ultrium Tape Blade(s), HP D2200sb/D2220sb Storage Blade(s), and/or PCI Expansion Blade(s) ) that directly connect to the server via the enclosure midplane.

**NOTE:** For the above Ultrium tape drives, please see the QuickSpecs for technical specifications and additional information at:

[http://h18000.www1.hp.com/products/quickspecs/12729\\_na/12729\\_na.html](http://h18000.www1.hp.com/products/quickspecs/12729_na/12729_na.html)

HP StoreEver LTO-4 Ultrium SB1760c Tape Blade

AQ697B

**NOTE:** LTO-4 Ultrium tape technology.

HP StoreEver LTO-5 Ultrium SB3000c Tape Blade

BS580B

**NOTE:** LTO-5 Ultrium tape technology.

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**HP Storage Blades** **NOTE:** The ProLiant BL660c Gen8 supports up to two expansion blades (Ultrium Tape Blade(s), HP D2200sb/D2220sb Storage Blade(s), and/or PCI Expansion Blade(s) ) that directly connect to the server via the enclosure midplane

**NOTE:** Please see the QuickSpecs for technical specifications and additional information at: <http://h18006.www1.hp.com/storage/bladeSystem/index.html>

HP D2200sb PCIe Storage Blade

AP880A

HP D2220sb PCIe and StoreVirtual VSA Bundle with SAAP License

QW914A

HP D2220sb PCIe w/(12) 900 GB 6G SAS HDD Bundle with SAAP License

QW915A

HP D2220sb Storage Blade Bundle with SAAP License

QW916A

HP D2220sb Build-to-order Storage Blade

QW917A

**NOTE:** For additional information, please see the QuickSpecs for technical specifications and additional information at:

[http://h18000.www1.hp.com/products/quickspecs/14507\\_na/14507\\_na.html](http://h18000.www1.hp.com/products/quickspecs/14507_na/14507_na.html)

### Additional Options

<b>HP Expansion Blade</b>	<p>HP BLc PCI Expansion Blade <span style="float: right;">448018-B21</span></p> <p><b>NOTE:</b> The PCI Expansion Blade provides PCI card slots for an adjacent c-Class Server Blade.</p> <p><b>NOTE:</b> The ProLiant BL660c Gen8 supports up to two expansion blades (Ultrium Tape Blade(s), HP D2200sb/D2220sb Storage Blade(s), and/or PCI Expansion Blade(s) that directly connect to the server via the enclosure midplane.</p> <p><b>NOTE:</b> The PCI Expansion Blade ships with one pre-installed PCI-X connect board. Also includes one PCIe connect board which requires installation.</p> <p><b>NOTE:</b> Please see the QuickSpecs for technical specifications and additional information at <a href="http://h18000.www1.hp.com/products/quickspecs/12753_na/12753_na.html">http://h18000.www1.hp.com/products/quickspecs/12753_na/12753_na.html</a></p>
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<b>HP USB and SD Options</b>	<p>HP 32GB microSD Enterprise Mainstream Flash Media Kit <span style="float: right;">700139-B21</span></p> <p>HP 2GB USB Flash Media Drive Key Kit <span style="float: right;">608447-B21</span></p> <p><b>NOTE:</b> HP qualified blank USB key for use with HP ProLiant servers that support the VMware virtualization environment. HP value-add software like SmartStart. HP recommends this industry standard USB flash device for use with VMware ESXi. USB device must be installed in the internal slot of the ProLiant server for use with VMware ESXi. Refer to HP VMware Getting Started Guide for installation instructions.</p> <p>HP 4GB microSD Enterprise Performance Flash Media Kit <span style="float: right;">647444-B21</span></p> <p><b>NOTE:</b> The USB flash media and Secure Digital cards are for integrated hypervisor virtualization environments needing a low cost boot solution with the highest performance and reliability. Learn more at <a href="http://h18004.www1.hp.com/products/servers/options/flash_drives.html">http://h18004.www1.hp.com/products/servers/options/flash_drives.html</a>.</p>
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<b>HP Care Pack Services</b>	<p><b>Proactive Care</b> - Collaborative Support plus Proactive services delivered by the on shore/near shore Advanced Solution Center (ASC) and backed by the global delivery organization, end-to-end case ownership from a Technical Solution Specialists and Technical Account Manager who remotely delivers firmware/software revision management, proactive scans and incident trend reports. Recommended for customers running a virtualized infrastructure and/or customers who desire an enhanced call support experience.</p> <p>HP 3 year 4 hour 24x7 ProLiant BL6xxc Proactive Care Service <span style="float: right;">U3B32E</span></p> <p>HP 3 year 4 hour 24x7 with Defective Media Retention ProLiant BL6xxc Proactive Care Service <span style="float: right;">U3B35E</span></p> <p>HP 3 year 6 hour Call To Repair 24x7 ProLiant BL6xxc Proactive Care Service <span style="float: right;">U3B38E</span></p> <p>HP 3 year 6hr Call To Repair 24x7 with Defective Media Retention ProLiant BL6xxc Proactive Care SVC <span style="float: right;">U3B41E</span></p> <p><b>Proactive Care Personalized Support Environmental Option</b> - to add an onsite Account Support Manager (ASM) to Proactive Care. ASM is an assigned resource who delivers support planning and brings technical expertise and best practices advice for the customer's environment.</p> <p>HP 3 year ISS ProactiveCare Personalized Support <span style="float: right;">U6W98E</span></p> <p><b>Installation Services</b> - reduce the time required to get your system up and running and help minimize disruptions to your business.</p> <p>HP Install c-Class Server Blade Service <span style="float: right;">UE493E</span></p>

### Additional Options

HP Hardware Installation during Non Standard Hours c-Class Enclosure and Server Blade Service

UG869E

Additional HP Care Pack services can be found at: <http://www.hp.com/go/cpc>



### Memory

For detailed memory configuration rules and guidelines, please use the Online DDR3 Memory Configuration Tool:

[www.hp.com/go/ddr3memory-configurator](http://www.hp.com/go/ddr3memory-configurator)

#### Memory Subsystem Architecture

Each Intel® Xeon® E5-4600 family processor socket contains four memory channels that support two DIMMs each for a total of eight (8) DIMM per installed processor or a grand total of thirty-two (32) DIMMs for the server. Up to 32GB capacity DIMMs are supported for 1.0TB of memory (32 DIMM slots x 32GB per DIMM).

#### Memory Population Rules and Guidelines:

- A minimum of one DIMM is required per processor.
- Install DIMMs only if the corresponding processor is installed.
- DIMM slots attached to each processor socket are only available if a processor is installed in that socket.
- DIMM sizes can be mixed in channel. To maximize performance, it is recommended to balance the total memory capacity between all installed processors and to load the channels similarly whenever possible.
- RDIMMs operating at either 1.35V or 1.5V may be mixed in any order, but the system will power them at the higher voltage.
- LRDIMMs and RDIMMs are distinct memory technologies and cannot be mixed within a server.
- DIMMs of different speeds may be mixed in any order; the server will select a common optimal speed.
- The maximum memory speed is a function of the memory type, memory configuration, and processor model.
- The maximum memory capacity is a function of the memory type and number of installed processors.
- HP memory from previous generation servers is not compatible with the BL660c Gen8 Server Blade.
- When HP 24GB (1x24GB) Three Rank x4 PC3L-10600R (DDR3-1333) Registered CAS-9 Low Voltage FIO Memory Kits are used, all 32 DIMM slots on the BL660c Gen8 must be fully populated with these 24GB DIMMs.
- To realize the performance memory capabilities listed in this document, HP SmartMemory is required. For additional information, please see the HP SmartMemory QuickSpecs at: [http://h18000.www1.hp.com/products/quickspecs/14225\\_na/14225\\_na.html](http://h18000.www1.hp.com/products/quickspecs/14225_na/14225_na.html).
- For memory population rules and additional memory guidelines, please see the BL660c Gen8 user guide at <http://www.hp.com/support>.

BL660c Gen8 Supported Memory Bandwidth									
DIMM Type	Registered DIMMS (RDIMMs)							Load Reduced (LRDIMMs)	
	Single Rank (1R)			Dual Rank (2R)				Three Rank (3R)	Quad Rank (4R)
DIMM Capacity	4GB	4GB	8GB	8GB	8GB	16GB	16GB	24GB	32GB
DIMM Native Speed (MHz)	1333	1600	1600	1333	1600	1333	1600	1333	1333
Voltage*	LV	Std	Std	LV	Std	LV	Std	LV	LV
* LV= low voltage at 1.35V; Std = standard voltage at 1.5V.									
Slots That Can Be Populated	32	32	32	32	32	32	32	32	32
Maximum Capacity (GB)	128	128	256	256	256	512	512	768	1024
Populated DIMM Speed (MHz)									
1 DIMM Per Channel	1333	1600	1600	1333	1600	1333	1600	N/A	1333

### Memory

2 DIMM Per Channel	1333**	1600	1600	1333**	1600	1333**	1600	1333	1333**
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\*\* Using HP SmartMemory, 1333MHz DIMMs operate at 1.35V for 2 DIMMs per channel (2DPC). Third party 1333MHz DIMM memory may only support 1.5V at 2DPC.

**NOTE:** Memory speed is a function of the processor QPI bus speed; see the table below "Memory Speed by Processor Model".

### Memory

#### Memory Speed by Processor Model

##### Processor Models

E5-4650, E5-4650L, E5-4640, E5-4617

E5-4620, E5-4617, E5-4610, E5-4607

E5-4603, E5-4607

##### Supported Memory Speeds

1600/1333/1066MHz

1333/1066MHz

1066MHz

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### Memory

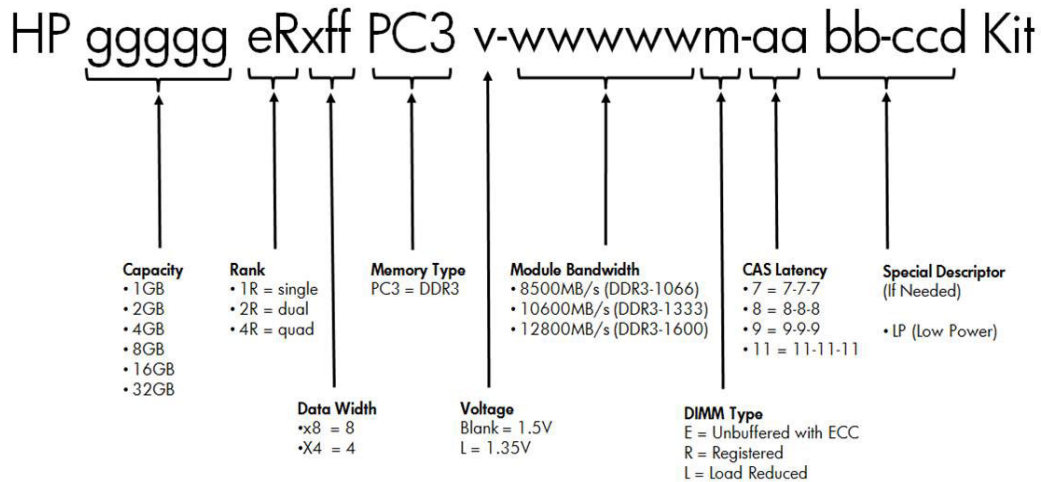
#### Standard and Maximum Memory Capacity (Pre-configured Models)

Pre Configured Models	Standard Memory	Maximum Memory Plus Optional Memory	Standard Memory Replaced with Optional Memory
Intel Xeon E5-4650, E5-4620, and E5-4617	128GB (16x 8GB)	384GB (16x 8GB + 16x 16GB)	1024GB (32x 32GB)

**NOTE:** Capacity references are rounded to the common gigabyte (GB) values.

- 4GB = 4,096MB
- 8GB = 8,192MB
- 16GB = 16,384MB
- 24GB = 24,576MB
- 32GB = 32,768MB

#### Memory options part number decoder



Following are memory options available from HP:

#### HP Memory

**NOTE:** HP memory from previous generation servers are not qualified or warranted with this HP ProLiant Server. HP SmartMemory is required to realize the memory performance improvements and enhanced functionality listed in this document for Gen8. For additional information, please see the HP SmartMemory QuickSpecs at: [http://h18000.www1.hp.com/products/quickspecs/14225\\_na/14225\\_na.html](http://h18000.www1.hp.com/products/quickspecs/14225_na/14225_na.html)

**NOTE:** LRDIMM, RDIMM and UDIMMs are all distinct memory technologies and cannot be mixed within a server. The majority of ProLiant Gen8 servers support RDIMM, UDIMM and LRDIMM.

**NOTE:** A minimum of one DIMM is required per server.

**NOTE:** For additional memory rules and guidelines, see the "Memory" section later in this document.

#### HP SmartMemory

##### Load Reduced DIMMs (LRDIMMs)

HP 32GB (1x32GB) Quad Rank x4 PC3L-10600L (DDR3-1333) Load Reduced CAS-9 Low Voltage Memory Kit

647903-B21

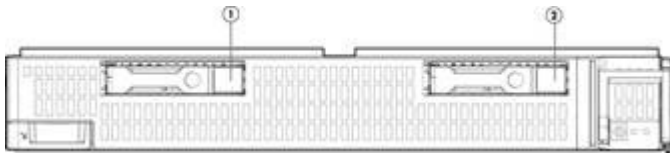
##### Registered DIMMs (RDIMMs)

### Memory

HP 4GB (1x4GB) Single Rank x4 PC3L-10600R (DDR3-1333) Registered CAS-9 Low Voltage Memory Kit	647893-B21
HP 4GB (1x4GB) Single Rank x4 PC3-12800R (DDR3-1600) Registered CAS-11 Memory Kit	647895-B21
HP 8GB (1x8GB) Dual Rank x4 PC3L-10600R (DDR3-1333) Registered CAS-9 Low Voltage Memory Kit	647897-B21
HP 8GB (1x8GB) Single Rank x4 PC3-12800R (DDR3-1600) Registered CAS-11 Memory Kit	647899-B21
HP 8GB (1x8GB) Dual Rank x4 PC3-12800R (DDR3-1600) Registered CAS-11 Memory Kit	690802-B21
HP 16GB (1x16GB) Dual Rank x4 PC3L-10600R (DDR3-1333) Registered CAS-9 Low Voltage Memory Kit	647901-B21
HP 16GB (1x16GB) Dual Rank x4 PC3-12800R (DDR3-1600) Registered CAS-11 Memory Kit	672631-B21
HP 24 GB (1x24GB) Three Rank x4 PC3L-10600R (DDR3-1333) Registered CAS-9 Low Voltage FIO Memory Kit	716324-B21

**NOTE:** Depending on the memory configuration and processor model, 1600MHz and 1333MHz memory may operate at a lower speed. Please see the "Memory" section later in this document and the Online Memory Configuration Tool for details at [www.hp.com/go/ddr3memory-configurator](http://www.hp.com/go/ddr3memory-configurator).

### Storage



1-2 2 x SFF hot-plug SAS, SATA, SAS SDD; and SATA SSD hard drives

#### Hard Drives

**NOTE:** The ProLiant BL660c Gen8 server includes the new HP hot-plug small form factor (SFF) SmartDrive carrier for enhanced management and reduced maintenance errors. HP drives from previous generation servers are not compatible with the BL660c Gen8 drive bays.

**NOTE:** Hard drives have either a one year or three year warranty; refer to the specific hard drive QuickSpecs for details.

**NOTE:** The hard drive options are not required when configuring a drive-less model.

**NOTE:** The mixing of standard SAS drives with SAS SSD drives is supported within the server, but limits the RAID configuration to two separate RAID 0 volumes. Mixing of other drives types is not supported.

#### SAS Hot Plug SmartDrive SFF (2.5-inch) Enterprise Drives

	Quantity Supported	Position Supported	Controller
1.2TB 6G SAS 10K	2	1-2	HP Smart Array P220i Controller
900GB 6G SAS 10K			
600GB 6G SAS 10K			
450GB 6G SAS 10K			
300GB 6G SAS 10K			
300GB 6G SAS 15K			
146GB 6G SAS 15K			

#### SAS Hot Plug SmartDrive SFF (2.5-inch) Midline Drives

	Quantity Supported	Position Supported	Controller
1TB 6G SAS 7.2K	2	1-2	HP Smart Array P220i Controller
500GB 6G SAS 7.2K			

#### 6G SATA Hot Plug with SmartDrive SFF (2.5-inch) Midline Drives

	Quantity Supported	Position Supported	Controller
1TB 6G SAS 7.2K	2	1-2	HP Smart Array P220i Controller
500GB 6G SAS 7.2K			

#### 6G SATA VE Hot Plug SFF (2.5-inch) Enterprise Value Solid State Drives

	Quantity Supported	Position Supported	Controller
800GB 6G SATA VE	2	1-2	HP Smart Array P220i Controller
480GB 6G SATA VE			
240GB 6G SATA VE			

### Storage

#### 6G SATA ME Hot Plug SFF (2.5-inch) Enterprise Mainstream Solid State Drives

	<b>Quantity Supported</b>	<b>Position Supported</b>	<b>Controller</b>
800GB 6G SATA ME	2	1-2	HP Smart Array P220i Controller
400GB 6G SATA ME			
200GB 6G SATA ME			
100GB 6G SATA ME			

#### 6G SAS ME Hot Plug SFF (2.5-inch) Enterprise Mainstream Solid State Drives

	<b>Quantity Supported</b>	<b>Position Supported</b>	<b>Controller</b>
800GB 6G SAS ME	2	1-2	HP Smart Array P220i Controller
400GB 6G SAS ME			
200GB 6G SAS ME			

#### 6G SAS SLC Hot Plug SFF (2.5-inch) Enterprise Performance Solid State Drives

	<b>Quantity Supported</b>	<b>Position Supported</b>	<b>Controller</b>
400GB 6G SAS SLC	2	1-2	HP Smart Array P220i Controller
200GB 6G SAS SLC			

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### Technical Specifications

<b>System Unit</b>	<b>Dimensions</b> (H x W x D) (with bezel)	366.27mm (14.42") x 56.54mm (2.23") x 516.67mm (20.34")
	<b>Weight</b> (approximate)	Maximum: 4 processors, 2 FlexibleLOMs, 32 DIMMs, 2 hard drives, 3 mezzanine cards, and 2 flash cache batteries installed 27.1 lb (12.3 kg) Minimum: 2 processors, 1 FlexibleLOM, and 2 DIMMs installed 20.2 lb (9.2 kg)
	<b>Power Specifications</b>	For power specifications including input requirements, BTU rating, and power supply output, please see the: <ul style="list-style-type: none"><li>• HP BladeSystem c3000 Enclosure QuickSpecs at <a href="http://h18000.www1.hp.com/products/quickspecs/12790_na/12790_na.html">http://h18000.www1.hp.com/products/quickspecs/12790_na/12790_na.html</a> <b>NOTE:</b> The ProLiant BL660c Gen8 requires the c3000 Enclosure to be configured with 6 fans.</li><li>• HP BladeSystem c7000 Enclosure QuickSpecs at <a href="http://h18000.www1.hp.com/products/quickspecs/12810_na/12810_na.html">http://h18000.www1.hp.com/products/quickspecs/12810_na/12810_na.html</a> <b>NOTE:</b> The ProLiant BL660c Gen8 requires the c7000 Enclosure to be configured with 10 fans.</li></ul> To review typical system power ratings use the HP Power Advisor which is available via the online tool located at <a href="http://www.hp.com/go/hppoweradvisor">www.hp.com/go/hppoweradvisor</a> .
	<b>System Inlet Temperature</b>	Operating 10° to 35°C (50° to 95°F) at sea level with an altitude derating of 1.0°C per every 305 m (1.8°F per every 1,000 ft) above sea level to a maximum of 3,050 m (10,000 ft), no direct sustained sunlight.  Maximum rate of change is 10°C/hr (18°F/hr). The upper limit may be limited by the type and number of options installed.  System performance may be reduced if operating with a fan fault or above 30°C (86°F). Non-operating -30° to 60°C (-22° to 140°F). Maximum rate of change is 20°C/hr (36°F/hr).
	<b>Relative Humidity</b> (non-condensing)	Operating 10 to 90% relative humidity (Rh), 28°C (82.4°F) maximum wet bulb temperature, non-condensing. Non-operating 5 to 95% relative humidity (Rh), 38.7°C (101.7°F) maximum wet bulb temperature, non-condensing.
	<b>Altitude</b>	Operating 3,050 m (10,000 ft). This value may be limited by



### Technical Specifications

		the type and number of options installed. Maximum allowable altitude change rate is 457 m/min (1,500 ft/min).
	Non-operating	9,144 m (30,000 ft). Maximum allowable altitude change rate is 457 m/min (1,500 ft/min).
<b>Acoustic Noise</b>		For acoustic noise specifications, please see the HP BladeSystem c-Class Enclosures QuickSpecs located at: HP BladeSystem c3000 Enclosure QuickSpecs: <a href="http://h18000.www1.hp.com/products/quickspecs/12790_na/12790_na.html">http://h18000.www1.hp.com/products/quickspecs/12790_na/12790_na.html</a> HP BladeSystem c7000 Enclosure QuickSpecs: <a href="http://h18000.www1.hp.com/products/quickspecs/12810_na/12810_na.html">http://h18000.www1.hp.com/products/quickspecs/12810_na/12810_na.html</a>
<b>HP Smart Array P220i Controller</b>	<b>Disk Drive Interface</b>	6G SAS (Serial Attached SCSI)
	<b>Server Interface</b>	x4 PCI Express host interface
	<b>Cache Memory Speed</b>	512MB flash backed write cache (FBWC) cache standard with Pre-configured Models and optional on Factory Integrated Models
	<b>Logical Drives Supported</b>	64 (with included 512MB cache)
	<b>Host Memory Addressing</b>	64-bit, supporting servers memory space greater than 4GB
	<b>RAID Support</b>	RAID 1 (mirroring) and RAID 0 (striping) <b>NOTE:</b> The FBWC is not required for RAID capability. The purpose of the cache is it can increase hard drive write performance and provides data protection in case the server losses power.
	<b>Other</b>	Upgradeable firmware with recovery ROM Online drive flash (with SAS drives)
<b>HP FlexFabric 10Gb 2-port 554FLB FlexibleLOM (Included with Pre-configured Models)</b>	<b>Type</b>	Integrated dual-port KR 10Gb FlexibleLOM with FlexFabric (Flex-10, FCoE, hardware-based iSCSI, iSCSI boot, TCP/IP offload engine, and autosensing 1Gb/10Gb Ethernet capability)
	<b>Network Processor</b>	Emulex BE3
	<b>Data Transfer Method</b>	x8 PCI Express 2.0
	<b>Network Transfer Rate</b>	Two ports, each at 20Gbps full duplex; 40Gbps aggregate full duplex theoretical bandwidth <b>NOTE:</b> Each port is autosensing 1Gb/10Gb, and can interoperate with 1Gb or 10Gb HP BladeSystem c-Class interconnect components. Both ports will operate at the same speed. <b>NOTE:</b> Each port on the 554FLB adapter transmits from the server at 20Gbps (theoretical) full duplex.
	<b>IEEE Compliance</b>	802.1p, 802.1q, 802.1qau, 802.3ad, 802.3ae, 802.3ap (10GBase-KX4) and 802.3x
	<b>Standard Features</b>	ProLiant Teaming including Network Fault Tolerance, Transmit Load Balancing, and Switch-Assisted Load Balancing 9K Jumbo frames (4K Jumbo frames when in FCoE mode) Microsoft Windows Receive Side Scaling (RSS)

### Technical Specifications

Hardware-based accelerated iSCSI  
iSCSI boot  
Flex-10 capability  
Fibre Channel over Ethernet (FCoE)  
TCP/IP offload engine (stateless TCP/IP)  
Autosensing 1Gb/10Gb Ethernet

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**Environment-friendly  
Products and Approach****End-of-life Management  
and Recycling**

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The EU WEEE directive (2002/95/EC) requires manufacturers to provide treatment information for each product type for use by treatment facilities. This information (product disassembly instructions) is posted on the Hewlett Packard web site at: <http://www.hp.com/go/green>. These instructions may be used by recyclers and other WEEE treatment facilities as well as HP OEM customers who integrate and re-sell HP equipment.

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For hard drives, 1GB = 1 billion bytes. Actual formatted capacity is less.