Family guide

Eight steps to building a BladeSystem

February 2013

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What's New

- 40% increase in performance with 56 Gb FDR InfiniBand support
- End-to-end with native 40 Gb Ethernet fabric capability for bandwidth intensive applications
- 2x storage bandwidth with 16 Gb Fibre Channel capability
- Industry's first location-based discovery and automated power intelligence across the data center

HP BladeSystem overview

With an unprecedented set of smart innovations, HP BladeSystem—including the new HP ProLiant Gen8 server family—provides the foundation of a self-aware and intelligent converged infrastructure. We're talking about a cloud-ready infrastructure that can support all your applications on a single platform, with both ProLiant and Integrity server blades and a range of storage and networking options. Architected for any workload from client to cloud, its modular, future-proof design takes advantage of proven innovations like Virtual Connect, Intelligent Infrastructure, and Insight Management. And it can be quickly scaled, repurposed, and upgraded to fit your changing business needs.

The proof is in the numbers

HP BladeSystem is engineered to maximize every hour, watt, and dollar, saving up to 68 percent total cost of ownership[1] over traditional infrastructures. Because the core infrastructure is shared, capital costs can be significantly lower. Blades share power, cooling, network, and storage infrastructure at the BladeSystem enclosure level. Since equipment is not needed for each server, there is a dramatic reduction in power distribution units, power cables, LAN and SAN switches, connectors, adapters, and cables. And you can bring in the newest-generation technologies by simply changing the components that need to be changed.

Making routine infrastructure changes takes up to 90 percent[2] less time with the wire-once connectivity only available with HP Virtual Connect. Virtual Connect simplifies and converges your server-edge connections, making server connections transparent to storage and networks. You can reduce server-edge infrastructure, like network interface cards, cables, and switches, by up to 95 percent.[2]

Take control of limited power resources with HP Intelligent Infrastructure and Thermal Logic technology inside HP BladeSystem. In fact, you can increase the capacity of your data center without adding power infrastructure and reduce power costs by 36 percent[1] vs. a traditional environment. HP Intelligent Infrastructure automates inventory management and power monitoring to speed implementation and reduce operating expenses, while eliminating downtime caused by error-prone manual processes. HP Thermal Logic technology lets administrators dynamically track and control power limits based on workload demand within the BladeSystem enclosure, so you can reclaim over-provisioned power and cooling capacity without impacting performance. Together, they track location, power, and cooling to give you better insight across your data center for the highest efficiency possible.

HP Insight Control unlocks the potential of your HP BladeSystem, cutting management time in half.[3] With HP Insight Control, you can provision servers quickly, manage health proactively, control servers from anywhere, and manage power confidently. With over seven million licenses shipped, Insight Control is the most broadly used systems management platform in the industry.

Learn how HP BladeSystem can help you drive business innovation by visiting hp.com/go/bladesystem.

Modular, future-proof design

HP's global community of business technology experts and partners is here to help you build a solution and support plan that is just right for your needs. And we do a lot of the hard work for you by integrating the infrastructure essentials inside the BladeSystem. It arrives at your door ready to deliver the best business results.

Building your ideal BladeSystem infrastructure solution begins with these eight simple steps:

- **Step 1:** Choose your operating environment
- **Step 2:** Choose your BladeSystem enclosure
- **Step 3:** Choose your interconnects
- **Step 4:** Choose your server blades
- **Step 5:** Choose your storage infrastructure
- **Step 6:** Choose your infrastructure management
- **Step 7:** Choose your power and cooling configurations
- **Step 8:** Choose your services

Step 1: Choose your operating environment

HP Integrity and HP ProLiant server blades run in almost the same operating environment as other HP servers, but with the advantages of a BladeSystem infrastructure. You can mix and match different Integrity and ProLiant server blades and run multiple operating environments in the same enclosure.

Supported operating systems (OS) and virtualization software

- Microsoft® Windows®: hp.com/go/wincert
- Red Hat Enterprise Linux (RHEL): hp.com/go/rhelcert
- SUSE Linux Enterprise Server (SLES): hp.com/go/slescert
- Oracle Linux Unbreakable Enterprise Kernel: hp.com/go/oelcert
- Oracle Solaris: hp.com/go/solaris
- VMware: hp.com/go/vmware

Integrity certifications

- Microsoft Windows: hp.com/go/integrity/windows
- HP-UX 11i: hp.com/go/integrity/hpux
- HP Integrity NonStop: hp.com/go/integrity/nonstop
- HP Open VMS: hp.com/go/integrity/openvms

Purchase your entire operating environment from HP

HP resells and provides full service and support for Microsoft Windows operating systems, Red Hat Linux subscriptions and support, SUSE Linux subscriptions and support, and VMware subscriptions and support.

Learn more at hp.com/go/ossupport.

Step 2: Choose your BladeSystem enclosure

HP offers versatile enclosures to match the unique need of large or small IT environments. The HP BladeSystem c7000 and c3000 Platinum Enclosures provide all the power, cooling, and I/O infrastructure required to support modular server, interconnect, and storage components. These enclosures help you simplify the infrastructure, reduce purchase and operating costs, adapt to changing business and infrastructure needs, and significantly lower energy consumption.

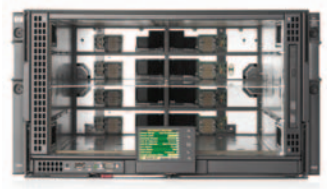
Intelligent Infrastructure support: Power Discovery Services allows BladeSystem enclosures to communicate information to HP Intelligent PDUs that automatically track enclosure power connections to the specific iPDU outlet to help ensure redundancy and prevent downtime. Location Discovery Services allows the c7000 to automatically record its exact location in HP Intelligent Series Racks, eliminating time-consuming manual asset tracking.

HP BladeSystem **Onboard Administrator** is the built-in enclosure management processor, subsystem, and firmware base used to support the HP BladeSystem c-Class enclosures and all the managed devices contained within them. Onboard Administrator provides a single point from which to perform management tasks on server blades or switches within the enclosure. Together with the enclosure's HP Insight Display, the Onboard Administrator has been designed for both local and remote HP BladeSystem c-Class administration.

This module and its firmware provide:

- Wizards for simple, fast setup and configuration
- Highly available and secure local or remote access to the HP BladeSystem infrastructure
- Security roles for server, network, and storage administrators
- Automated power and cooling of the enclosure
- Agentless device health and status
- Power and cooling information and control

Each enclosure is shipped with an Onboard Administrator module/firmware. HP BladeSystem Platinum enclosures can be configured with redundant Onboard Administrator modules to provide uninterrupted manageability of the entire enclosure and blades. When two Onboard Administrator modules are present, they work in an active-standby mode, assuring full redundancy of the enclosure's integrated management.



HP BladeSystem c3000 Platinum enclosure
Smaller, versatile design ideal for offices or branch locations that only need up to eight server or storage components at a time. Uses a standard power outlet, doesn't require special air conditioning, and includes features designed to help small staffs be more productive with less effort.

HP BladeSystem c7000 Platinum enclosure
Larger, modular block of infrastructure ideal for bigger data centers. Holds up to 16 types of server and storage blades and offers twice as many interconnect expansion slots to run nearly any application in a dynamic, high-performance IT environment.

	HP BladeSystem c3000 Platinum enclosure	HP BladeSystem c7000 Platinum enclosure
Device bays	Up to 8 server and storage blades, mixed configurations supported	Up to 16 server and storage blades, mixed configurations supported
Interconnect bays	4	8 (up to 4 redundant I/O fabrics)
Power supplies	Up to (6) 1200 W	Up to (6) 2400 W
Fans	Up to 6 hot-plug Active Cool fans	Up to 10 hot-plug Active Cool fans
Onboard Administrator	Up to 2	Up to 2
Height	6U	10U

Find a complete list of supported options at hp.com/go/BladeSystem.

Step 3: Choose your interconnects

HP Virtual Connect is an essential building block for any virtualized or cloud-ready environment. This innovative wire-once HP connection management simplifies server connectivity, making it possible to add, move, and change servers in minutes vs. hours or days. Virtual Connect is the simplest way to connect servers to any network and reduces network sprawl at the edge by up to 95 percent.[4]

Interconnects: Virtual Connect modules

	HP Virtual Connect FlexFabric 10 Gb/24-port Module Premium module for converged Ethernet and Fibre Channel, or iSCSI environments.	**HP Virtual Connect Flex-10 10 Gb Ethernet Module** Innovative module that introduced Flex-10 provides optimal support for Ethernet or converged iSCSI connectivity.	**HP Virtual Connect Flex 10/10D Module** Innovative module that introduced Flex-10 provides optimal support for Ethernet or converged iSCSI connectivity.
Blade type	Single bay	Single bay	Single bay
Network connections	16x10 Gb downlinks; 2x10 Gb cross connects; 4x10 Gb external SR, LR fiber and copper uplinks SFP+ (Enet/FC); 4x10 Gb external SR, LRM, and LR fiber and copper uplinks SFP+ (Enet); 1 internal interface to c-Class Onboard Administrator Module	16x10 Gb downlinks midplane; 2x10 Gb cross connects; 1x10 Gb copper uplink CX-4 8x10 Gb SR, LR, or LRM fiber uplinks SFP+ 1 management USB port; 1 internal interface to c-Class Onboard Administrator Module	16 x 10 Gb downlinks midplane 4 x 10 Gb cross connect 10 x 10 Gb SR, LR, or LRM fiber uplinks SFP+ 1 internal interface to c-Class Onboard Administrator Module
Media types	Fibre Channel SFP/SFP+ 2/4/8 Gb short wave up to 500 m; 1/2/4 Gb long wave up to 10 km Ethernet SFP/SFP+ 10GbE SR, LR, and LRM; 10GbE copper direct-attached cable; 1GbE SX; 1GbE 1000BASE-T copper; HP 7m C-series Active Copper SFP+ Cable; HP 10m C-series Active Copper SFP+ Cable; HP X242 SFP+ 15M DAC Cable; HP X242 SFP+ 7m DAC Cable	SFP+ SR, LR, LRM SFP SX, RJ-45 SFP + Copper Twinax CX-4 (IB4x) HP 7m C-series Active Copper SFP+ Cable HP 10m C-series Active Copper SFP+ Cable HP X242 SFP+ 15M DAC Cable HP X242 SFP+ 7m DAC Cable	SFP+ SR, LR, LRM SFP SX, RJ-45 SFP + Copper HP 7m C-series Active Copper SFP+ Cable HP 10m C-series Active Copper SFP+ Cable HP X242 SFP+ 15M DAC Cable HP X242 SFP+ 7m DAC Cable
Performance	Line rate, full-duplex; 480 Gbps bridging fabric; 1.2 µs on Ethernet-only ports; 1.7 µs Ethernet/FC ports; maximum Ethernet frame size 9216 (Jumbo Frame); maximum FC frame size 2148 bytes (2112 byte payload); buffer-to-buffer flow control management; packet prioritization	Line rate, full-duplex 480 Gbps bridging fabric, less than 1.5 µs latency	Line rate, full-duplex 600 Gbps bridging fabric Less than 0.9 µs with Ethernet-only ports Maximum Ethernet frame size 9216 (Jumbo Frame)
Protocol support	IEEE 802.1Qbb (preliminary), 802.1Qaz (preliminary), 802.1AB, 802.1D, 802.1Q, 802.2, 802.3ad; INCITS FC-BB-5 Rev 2.00, INCITS T11 N_Port ID Virtualization (NPIV)	IEEE 802.1AB, 802.1D, 802.1Q, 802.2, 802.3ad	IEEE 802.1AB, 802.1D, 802.1Q, 802.2, 802.3ad
Management	Simple and intuitive graphical user interface and setup wizards; embedded SNMP v1, v2; SMI-S; port mirroring—any uplink port can be used as a dedicated mirrored port from the server port(s)	Simple and intuitive graphical user interface and setup wizards; embedded SNMP v1, v2; port mirroring—any uplink port can be used as a dedicated mirrored port from the server port(s)	Simple GUI and setup wizards; embedded SNMP v1, v2; SMI-S; CLI port mirroring—any uplink port can be used as a dedicated mirrored port from the server port(s)
Extended management features	Virtual Connect Enterprise Manager (VCEM) support, supports PXE, WOL, port VLAN, VLAN Tagging, VLAN pass-through, IGMP Snooping, NIC Teaming; Integrated with Onboard Administrator, HP Systems Insight Manager, HP Storage Essentials (FC Management MIB), Telnet, and SNMP, FC port-telemetry via GUI, Telemetry support for port utilization including memory and CPU performance measurement	VCEM support, supports PXE, WOL, port VLAN, VLAN Tagging, VLAN pass-through, IGMP Snooping, NIC Teaming; Integrated with Onboard Administrator, HP Systems Insight Manager, Telnet, and SNMP. Telemetry support for port utilization including memory and CPU performance measurement	Virtual Connect Manager supports PXE, WOL, port VLAN, VLAN Tagging, VLAN pass-through, IGMP Snooping, NIC Teaming; Integrated with Onboard Administrator, HP Systems Insight Manager, Telnet, SNMP; Telemetry support for port utilization including memory and CPU performance measurement
High-availability features	Link Aggregation Protocol; automatic loop protection; mirrored profile database; multipath heartbeat between redundant modules	Link Aggregation Protocol; automatic loop avoidance; mirrored profile database; multipath heartbeat between redundant modules	Link Aggregation Protocol automatic loop protection mirrored profile database multipath heartbeat between redundant modules
Security	LDAP, SSL, TACACS+ and Radius role-based management including support for Network Access Group	LDAP, SSL, TACACS+ and Radius role-based management including support for Network Access Group	LDAP, SSL, TACACS+ and Radius role-based management including support for Network Access Group
Maximum per enclosure	8	8	8
Warranty in year(s)[8] (parts/labor/onsite)	1/1/1	1/1/1	1/1/1

Interconnects: Virtual Connect modules (continued)

	 **HP Virtual Connect 8Gb/20-Port Fibre Channel Module** Best cost per Fibre Channel port of Virtual Connect modules.	 **HP Virtual Connect 8Gb/24-Port Fibre Channel Module** Highest Fibre Channel port density of Virtual Connect modules.
Blade type	Single bay	Single bay
Network connections	16 internal 8 Gb downlinks presented as F_Ports 4 external 8 Gb uplinks presented as N_Ports	16 internal 8 Gb downlinks presented as F_Ports 8 external 8 Gb uplinks presented as N_Ports
Media types	8 Gb Optical Short Wave Transceiver (SFP+) 4/8 Gb Optical Short Wave Transceiver (SFP+)	4 Gb Optical Short Wave Transceiver (SFP+) 4/8 Gb Optical Long Wave Transceiver up to 10 km (SFP+)
Performance	Up to 1600 MB/s throughput per port; maximum frame size 2148 bytes (2112 byte payload); bandwidth of 852 MB at 8 Gbps; full-duplex aggregate bandwidth up to 17.04 GB; full-duplex fabric latency < 0.1 µs at 8 Gbps	Up to 1600 MB/s throughput per port; maximum frame size 2148 bytes (2112 byte payload); bandwidth of 852 MB at 8 Gbps full-duplex
Protocol support	NCITS T11 N_Port ID Virtualization (NPIV)	NCITS T11 N_Port ID Virtualization (NPIV)
Management	Simple and intuitive graphical user interface and setup wizards accessible through VC Ethernet module; command line interface accessible through VC Ethernet module; embedded SNMP v1 and v2 SMI-S	Simple and intuitive graphical user interface and setup wizards accessible through VC Ethernet module; command line interface accessible through VC Ethernet module; embedded SNMP v1 and v2 SMI-S
Extended management features	VCEM support; HP Storage Essentials (FC Management MIB)	VCEM support; HP Storage Essentials (FC Management MIB)
High-availability features	All VC-FC modules provide the highest levels of availability and reliability. Modules detect uplink port connectivity loss and automatically move server connections to another available uplink port within the same module. HBAs are dynamically re-mapped without downtime to the SAN.	All VC-FC modules provide the highest levels of availability and reliability. Modules detect uplink port connectivity loss and automatically move server connections to another available uplink port within the same module. HBAs are dynamically re-mapped without downtime to the SAN.
Security	LDAP, SSL, role-based management	LDAP, SSL, role-based management
Maximum per enclosure	6	6
Warranty in year(s)[8] (parts/labor/onsite)	1/1/1	1/1/1
HP related offerings		
Support services[5]	Enhanced Network Installation and Startup service for HP BladeSystem interconnect switches and modules	
Software	Virtual Connect Enterprise Manager centralizes connection management and workload mobility for thousands of servers	
External storage	iSCSI with StoreVirtual Storage or P2000 G3, P6000 EVA, XP, P9500	

Interconnects: Ethernet switches

					
	HP Networking 6120G/XG Ideal switch for mixed 1 Gb/10 Gb networks or data centers in transition	**HP Networking 6120XG** Layer 2 10 Gb Ethernet switch for BladeSystem	**HP Networking 6125G** Full feature stackable 1 Gb switch	**HP Networking 6125G/ XG** Stackable hybrid 1 Gb/10 Gb switch	**HP GbE 2c Layer 2/3** Ideal for low-cost 1 Gb aggregation
Performance	106 Gb switching fabric; 512 MB SDRAM; 256 MB flash memory	480 Gb switching fabric; 512 MB SDRAM; 640 MB flash memory; 16 internal 10 Gb downlinks FCoE	26 Gbps uplink port bandwidth; 16 Gbps downlink (server) port bandwidth; 1 GB Main, 256 MB flash and 3 MB packet buffer memory	44 Gbps uplink port bandwidth; 16 Gbps downlink (server) port bandwidth; 1 GB Main, 256 MB flash and 3 MB packet buffer memory	48 Gb switching fabric; 128 MB SDRAM; 16 MB flash memory
Port configuration	16 internal 1 Gb downlinks; 4 external 10/100/1000BASE-T uplinks; 2 external SFP uplinks; 2 external SFP uplinks; 1 external 10 Gb CX4 uplink; 2 external 10 Gb XFP ports; 1 internal 10 Gb cross-connect; 1 management console port	16 internal 10 Gb downlinks; 8 external, 10 Gb SFP+ (1 Gb SFP) ports including, one shared CX-4; port supports SR/LR/LRM; up to two internal 10 Gb cross-connects; 1 management console port	16 internal 1 Gb downlinks; 4 external 10/100/1000BASE-T uplinks; 2 external 1 Gb SFP uplinks; 2 external IRF/SFP uplinks (10 Gb for IRF only) ; 1 internal 10 Gb cross-connect; 1 management console port	16 internal 1 Gb downlinks; 4 external 10/100/1000BASE-T uplinks; 2 external 1 Gb/10 Gb SFP uplinks; 2 external SFP+ uplinks; 1 internal 10 Gb cross-connect; 1 management console port	16 internal 1 Gb downlinks; 5 external 10/100/1000BASE-T uplinks; 2 internal cross-connects; 1 management console port
Management	PCM/PCM+, SNMP v1, v2, v3, HTTP, HTTPS, NTP server support, RMON, sFlow, SNTP auth	PCM/PCM+, SNMP v1, v2, v3, HTTP, HTTPS, NTP server support, RMON, sFlow, SNTP auth	IMC, SNMP v1, v2, v3, HTTP, HTTPS, NTP server support, RMON, sFlow, SNTP auth	IMC, SNMP v1, v2, v3, HTTP, HTTPS, NTP server support, RMON, sFlow, SNTP auth	Dual-mode CLI—AOS and iSCLI, SNMP v1, v2, v3, HTTP, HTTPS, NTP server support, and RMON
High-availability features	Link Aggregation Protocol; Uplink failure detection; Spanning Tree		Intelligent Resilient Framework (IRF), Device Link Detection Protocol (DLDP), Rapid Ring Protection Protocol (RRPP), Virtual Router Redundancy Protocol (VRRP)		Link Aggregation Protocol; Uplink failure detection; Spanning Tree; Virtual Router Redundancy Protocol (VRRP)
Protocols supported	SSH v2, TACACS, TACACS+, RADIUS, IEEE 802.3, 802.3u, 802.3ab, 802.1ab, 802.1d, 802.1s, 802.1w, 802.1p, 802.1q, 802.3ac, and 802.1x	SSH v2, TACACS, TACACS+, RADIUS, IEEE 802.3, 802.3u, 802.3ab, 802.1ab, 802.1d, 802.1s, 802.1w, 802.1p, 892.1q, 802.3ac, and 802.1x, Converged Enhanced Ethernet (802.1Qaz - Data Center Bridging Capability Exchange Protocol (DCBX), 802.1Qbb—Priority-based Flow Control, 802.1Qaz - Enhanced Transmission Selection	IEEE 802.1ag Service Layer OAM; 802.1D MAC Bridges; 802.1p; 802.1Q; 802.1s (MSTP); 802.1v VLAN by Protocol and Port; 802.1w Rapid Reconfiguration of Spanning Tree; 802.1X PAE; 802.3ad (LACP); 802.3ae 10-Gigabit Ethernet; 802.3x Flow Control; 802.1r – GARP; RFC 4443 ICMPv6; RFC 4541 IGMP & MLD Snooping Switch; RFC 4861 IPv6 Neighbor Discovery; RFC 4862 IPv6 Stateless Address Auto-config		SSH v2, TACACS, TACACS+, RADIUS, IEEE 802.3, 802.3u, 802.3ab, 802.1d, 802.1s, 802.1w, 802.1p, 802.3ac, and 802.1x
Warranty in year(s)[8] (parts/labor/onsite)	1/1/1; Lifetime replacement	1/1/1; Lifetime replacement	1/1/1	1/1/1	1/1/1

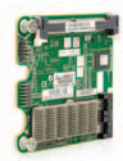
				
	Mellanox SX1018HP Highest bandwidth, lowest latency blade switch for c-Class	**Cisco Catalyst 3020** Cisco Catalyst for HP BladeSystem c-Class	**Cisco Catalyst 3120G/3120X** 1 Gb and 1 Gb/10 Gb versions with stacking	**Cisco Fabric Extender for HP** For use with Cisco Nexus 5000 series switches
Performance	1440 Gbps uplink port bandwidth; 640 Gbps downlink (server) port bandwidth; 230 ns latency at 40 Gb; 20 ns latency at 10 Gb; 2 Gb main, 2 MB flash memory	48 Gb switching fabric; 128 MB DDR SDRAM; 32 MB flash memory	80 Gb switching fabric; 256 MB SDRAM; 64 MB flash memory	106 Gb switching fabric; 512 MB SDRAM; 256 MB flash memory
Port configuration	16 internal 10 Gb/40 Gb downlinks; 18 40 Gb QSFP+ uplinks; 1 management console port (double bay width interconnect)	16 internal 1 Gb downlinks; 8 external 10/100/1000 SFP/BASE-T uplinks; 2 configurable as cross connects; 1 management console port	16 internal 1 GB downlinks; 4 external 10/100/1000/ BASE-T uplinks; 2 internal cross connects; 4 optional external 10/100/1000 SFP uplinks; 2 external 10 Gb X2 uplinks (3120X only)	16 internal 1 Gb/10 Gb downlinks; 8 external SFP+ uplinks
Management	GUI management via UFM; SNMP v1, v2c and v3; HTTPS; NTP; RADIUS	CiscoWorks, SNMP v1, v2, v3, Telnet, and CLI	CiscoWorks, SNMP v1, v2, v3, Telnet, and CLI	Managed through Cisco Nexus 5000
High-availability features	Rapid Spanning Tree Protocol (RSTP); Link Aggregation Control Protocol	Per VLAN Spanning Tree Plus; Uplink Fast; Port Fast; Bridge Protocol Data Unit	Per VLAN Spanning Tree Plus; Uplink Fast; Port Fast; Bridge Protocol Data Unit	Feature attributes derived from parent Nexus switch
Protocols supported	SSH v2, TACACS, TACACS+, RADIUS, IEEE 802.3, 802.3u, 802.3ab, 802.1d, 802.1s, 802.1w, 802.1p, 802.3ac, and 802.1x	SSH v2, IEEE 802.1s, 802.1w, 802.1x, 802.3ad, 802.3x, 802.1d, 802.1p, 802.1q, 802.3, 802.3u, 802.3ab, and 802.3z	SSH v2, IEEE 802.1s, 802.1w, 802.1x, 802.3ad, 802.3x, 802.1d, 802.1p, 802.1q, 802.3, 802.3u, 802.3ab, and 802.3z	Protocol attributes derived from parent Nexus switch
Warranty in year(s)[8] (parts/labor/onsite)	1/1/1	1/1/1; 3-year software updates	1/1/1; 3-year software updates	1/1/1

Direct Connect SAS Switch

	HP 6Gb SAS Switch for HP BladeSystem c-Class
Performance	6 Gbps SAS
Port configuration	16 internal (2x) SAS ports, 8 external (4x) SAS ports
Management features	Embedded Virtual SAS Manager (VSM) GUI & CLI interface, SNMP, SAS Fabric Topology View
Availability features	Redundant switches; hot-pluggable; nondisruptive software upgrades, dual domain support
Protocols supported	SAS
Warranty in year(s)[8] (parts/labor/onsite)	1/1/1
HP related offerings	
Capacity for server blades	External SAS JBOD (MD600, D6000), shared SAS storage: each BladeSystem enclosure supports up to four HP MSA P2000 G3 storage arrays.

Note: With a SAS mezzanine card and the new 6 Gb SAS BL switch, you can connect external disk and tape solutions with a simple cable connection.

Direct Connect SAS Controller



	HP 4X QDR IB Dual-Port Mezzanine HCA	HP IB 4X DDR Dual-Port Mezzanine HCA	HP Smart Array P711m Controller	HP Smart Array P721m Controller	HP Smart Array P712m Controller
Performance	3 Gbps SAS	6 Gbps SAS	6 Gbps SAS includes 1 GB FBWC	6 Gbps SAS includes 2 GB FBWC/512 MB	6 Gbps SAS available 256 MB cache
Port configuration	Eight 3 Gbps SAS ports	Eight 6 Gbps SAS ports	4 external (2x) SAS ports	4 external (2x) SAS ports	2 internal (1x) SAS ports, 2 external (2x) SAS ports (only enabled with cache)
Management features	Virtual SAS Manager	Virtual SAS Manager	Smart Array management with online array expansion, RAID migration, and online spares	Smart Array management with online array expansion, RAID migration, and online spares	Smart Array management with online array expansion, RAID migration, and online spares (with cache)
Availability features	Redundant switches for high-availability and path failover	Redundant switches for high-availability and path failover	Flash-backed write cache, RAID 0, 1, 5, 6, 50, and 60	Flash backed write cache, RAID 1, 10, 5, 50, 6, 60, RAID 1 (ADM), and RAID 10 (ADM)	RAID 0, 1, 10, 5, and 50 (on shared storage)
Protocols supported	3 Gbps SAS, 1.5 Gbps SATA	6 Gbps SAS, 3 Gbps SATA	3 6Gbps SAS, 1.5 3Gbps SATA	6 Gbps SAS, 3 6 Gbps SATA	6 Gbps SAS, 3 Gbps SATA
Warranty in year(s)[8] (parts/labor/onsite)	1/1/1	1/1/1	1/1/1	1/1/1	1/1/1

Interconnects: Fibre Channel switches

Brocade 8Gb SAN Switch
Next-generation, high-performance embedded Fibre Channel switch option for medium and enterprise-class customers.

Cisco MDS 8Gb Fabric Switch
High-performance Fibre Channel storage connectivity to HP BladeSystem c-Class in an embedded form factor.

Performance	8 Gbps, non-blocking and auto-sensing 2/4/8 Gb	8 Gbps, non-blocking and auto-sensing 2/4/8 Gb
Port configuration	384 Gbps (end-to-end)	384 Gbps (end-to-end)
Management features	Web Tools; Advanced zoning; Power Pack+ (bundled or optional): Adaptive Networking, Server Application Optimization, ISL Trunking, Advanced Performance Monitoring, Fabric Watch, Extended Fabrics; SAN Network Advisor (optional)	Cisco MDS 9000 Family Command Line Interface (CLI), Cisco Fabric Manager, Cisco Fabric Manager Server for HP BladeSystem c-Class (optional), Cisco Enterprise Package for HP BladeSystem c-Class (optional), Cisco Fabric Manager Server Enterprise Package Bundle for HP BladeSystem c-Class (optional)
High-availability features	Redundant switches; hot pluggable; non-disruptive software upgrades	Redundant switches; hot pluggable; non-disruptive software upgrades
Protocols supported	Fibre Channel	Fibre Channel
Warranty in year(s)[8] (parts/labor/onsite)	1/1/1	1/1/1
HP related offerings		
Support services[5]	3-year, 24x7 hardware support service	3-year, 24x7 hardware support service
Options	SFP+ (short wave) SFPs (short wave, long wave)	SFP+ (short range, long range) SFPs (short range, long range)
External storage	HP P2000 G3 FC/MSA2000 G2, P6000/EVA, and P9500/XP disk arrays	HP P2000 G3 FC/MSA2000 G2, EVA, P9500/XP disk arrays

Interconnects: Fibre Channel HBA mezzanine cards

HP BLc Emulex LPe1205-HP 8Gbps FC HBA[6]
Up to 200,000 I/Os per second per channel
Dual 8 Gb Fibre Channel ports
Emulex installation and management tools automate installation and provide local and remote HBA configuration and management
Multipath support for redundant HBAs and paths
Full support for both FC service class 2 and 3
1/1/1

HP LPe1205A 8Gb FC HBA
Up to 200,000 I/Os per second per channel
Dual 8 Gb Fibre Channel ports
Emulex installation and management tools automate installation, providing local and remote HBA configuration and management
Multipath support for redundant HBAs and paths
Full support for both FC service class 2 and 3
1/1/1

QLogic QMH2562 8Gb FC HBA[7]
Up to 200,000 I/Os per second per channel
Dual 8 Gb Fibre Channel ports
QLogic SANsurfer FC HBA Manager for centralized management and remote control of distributed HBAs
Multipath support for redundant HBAs and paths
Fibre Channel
1/1/1

Emulex LPe1105-HP 4Gb FC HBA
115,000 IOPS per port
Dual 4 Gb Fibre Channel ports
Emulex installation and management tools automate installation and provide local and remote HBA configuration and management
Multipath support for redundant HBAs and paths
Full support for both FC service class 2 and 3
1/1/1

HP QLogic QMH2462 4Gb FC HBA
150,000 IOPS per port
Dual 4 Gb Fibre Channel ports
QLogic SANsurfer FC HBA Manager for centralized management and remote control of distributed HBAs
Multipath support for redundant HBAs and paths
Full support for both FC service class 2 and 3
1/1/1

Brocade 804 8Gb FC HBA
Up to 500,000 IOPS per port
Dual 8 Gb Fibre Channel ports
Integrates into HP Data Center Fabric Manager
Multipath support for redundant HBAs and paths
Full support for both FC service class 2 and 3
1/1/1

HP QMH2572 8Gb FC HBA[7]
Up to 200,000 I/Os per second per channel
Dual 8 Gb Fibre Channel ports
QLogic SANsurfer FC HBA Manager for centralized management and remote control of distributed HBAs
Multipath support for redundant HBAs and paths
Fibre Channel
1/1/1

Performance	Up to 200,000 I/Os per second per channel	Up to 200,000 I/Os per second per channel	Up to 200,000 I/Os per second per channel	115,000 IOPS per port	150,000 IOPS per port	Up to 500,000 IOPS per port	Up to 200,000 I/Os per second per channel
Port configuration	Dual 8 Gb Fibre Channel ports	Dual 8 Gb Fibre Channel ports	Dual 8 Gb Fibre Channel ports	Dual 4 Gb Fibre Channel ports	Dual 4 Gb Fibre Channel ports	Dual 8 Gb Fibre Channel ports	Dual 8 Gb Fibre Channel ports
Management features	Emulex installation and management tools automate installation and provide local and remote HBA configuration and management	Emulex installation and management tools automate installation, providing local and remote HBA configuration and management	QLogic SANsurfer FC HBA Manager for centralized management and remote control of distributed HBAs	Emulex installation and management tools automate installation and provide local and remote HBA configuration and management	QLogic SANsurfer FC HBA Manager for centralized management and remote control of distributed HBAs	Integrates into HP Data Center Fabric Manager	QLogic SANsurfer FC HBA Manager for centralized management and remote control of distributed HBAs
High-availability features	Multipath support for redundant HBAs and paths	Multipath support for redundant HBAs and paths	Multipath support for redundant HBAs and paths	Multipath support for redundant HBAs and paths	Multipath support for redundant HBAs and paths	Multipath support for redundant HBAs and paths	Multipath support for redundant HBAs and paths
Protocols supported	Full support for both FC service class 2 and 3	Full support for both FC service class 2 and 3	Fibre Channel	Full support for both FC service class 2 and 3	Full support for both FC service class 2 and 3	Full support for both FC service class 2 and 3	Fibre Channel
Warranty in year(s)[8] (parts/labor/onsite)	1/1/1	1/1/1	1/1/1	1/1/1	1/1/1	1/1/1	1/1/1

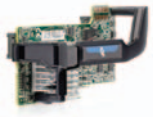
Interconnects: Ethernet network adapter mezzanines

					
	HP Ethernet 10Gb 2-port 560M Adapter	**HP NC325m PCI Express Quad Port Gigabit Server Adapter**	**NC360m Quad-Port 1GbE Adapter**	**NC364m Quad-Port 1GbE Adapter**	**HP NC382m PCI Express Dual Port Multifunction Gigabit Server Adapter**
Hardware features					
IEEE compliance	IEEE 802.3, 802.1ab, 802.3x, 802.3ad, 802.3p/802.1q, 802.3ae, 802.1qau, 802.3ap, 802.1as, 802.1qaz, 802.1Qbb	IEEE 802.1p, 802.1Q, 802.3, 802.3ad, and 802.3x	IEEE 802.1p, 802.1Q, 802.3, 802.3ad, and 802.3x	IEEE 802.1p, 802.1Q, 802.3, 802.3ad, and 802.3x	IEEE 802.1p, 802.1Q, 802.3, 802.3ad, and 802.3x
Ports and transfer rate	(2) 20,000 Mbps	(4) 2,000 Mbps	(2) 2,000 Mbps	(4) 2,000 Mbps	(2) 2,000 Mbps
Form factor	x8 PCIe 2.0 type A card	x4 PCIe, type I card	x4 PCIe, type I card	x4 PCIe, type I card	x4 PCIe, type I card
Network controller	Intel 82599 Controller	Dual Broadcom 5715S	Intel® 82571EB	Dual Intel 82571EB	Broadcom 5709S
Software features					
PXE	Yes	Yes	PXE boot with VC modules only	PXE boot with VC modules only	Yes
TOE, accelerated iSCSI, and iSCSI boot	TOE (Windows)	N/A	TOE (Windows)	TOE (Windows)	TOE (Windows), Accelerated iSCSI, and iSCSI boot (Windows and Linux)
Adapter teaming	Yes	Yes	N/A	N/A	Yes
Warranty in year(s)[8] (parts/labor/onsite)	1/0/0	1/0/0	1/0/0	1/0/0	1/0/0

Interconnects: Ethernet network adapter mezzanines

	 **NC542m Dual-Port Flex-10 10GbE Multifunction BLc Adapter**	 **NC532m Dual-Port Flex-10 10GbE Multifunction BLc Adapter**	 **HP NC550m 10Gb 2-port PCIe x8 Flex-10 Ethernet Adapter**	 **NC551m Dual-Port FlexFabric 10Gb Converged Network Adapter**	 **HP NC552m 10Gb 2-port Flex-10 Ethernet Adapter**	 **HP NC553m 10Gb 2-port FlexFabric Adapter**
Hardware features						
IEEE compliance	IEEE 802.1p, 802.1q, 802.3u, 802.3ad, 802.3ae, 802.3x, 802.3z, and 802.3ap (10GBASE-KX4)	IEEE 802.3u, 802.3x, 802.3ad, 802.1p, 802.1q, 802.3z, 802.3ae, and 802.3ap (10GBASE-KX4)	IEEE 802.3ae, 802.3ap (10GBASE-KX4), 802.1q, 802.1qau, 802.3x, 802.1p, 802.3ad, 802.3u, and 802.3z	IEEE 802.1p, 802.3ad, 802.3x, 802.1q, 802.1qau, 802.3u, 802.3ae, 802.3ap 10GBASE-KX4), and 802.3z	IEEE 802.3ae, 802.3ap (10GBASE-KX4), 802.1q, 802.1qau, 802.3x, 802.1p, 802.3ad, 802.3u, and 802.3z	IEEE 802.1p, 802.1q, 802.1qau, 802.3u, 802.3ad, 802.3ae, 802.3ap (10GBASE-KX4), 802.3x, and 802.3z
Ports and transfer rate	(2) 20,000 Mbps	(2) 20,000 Mbps	(2) 20,000 Mbps	(2) 20,000 Mbps	(2) 20,000 Mbps	(2) 20,000 Mbps
Form factor	x8 PCIe 2.0 type 1 card	x8 PCIe 2.0 type 1 card	x8 PCIe 2.0 type 1 card	x8 PCIe 2.0 type 1 card	x8 PCIe 2.0 type 1 card	x8 PCIe 2.0 type 1 card
Network controller	Mellanox ConnectX-2EN	Broadcom 57711	Emulex BE2	Emulex BE2	Emulex BE3	Emulex BE3
Software features						
PXE	N/A	Yes	Yes	Yes	N/A	N/A
TOE, accelerated iSCSI, and iSCSI boot	N/A	TOE (Windows), Accelerated iSCSI (Windows and Linux)	TOE (Windows)	TOE (Windows), Accelerated iSCSI (Windows and Linux)	TOE (Windows)	TOE, Accelerated iSCSI, and iSCSI boot
Adapter teaming	N/A	Yes	N/A	N/A	N/A	N/A
Warranty in year(s)[8] (parts/labor/onsite)	1/0/0	1/0/0	1/0/0	1/0/0	1/0/0	1/0/0

Interconnects: Ethernet network adapter mezzanines and FlexibleLOM

	 **HP Flex-10 10Gb 2-port 530FLB Adapter**	 **HP Flex-10 10Gb 2-port 530M Adapter**	 **HP Flex-10 10Gb 2-port 552M Adapter**	 **HP FlexFabric 10Gb 2-port 554FLB Adapter**	 **HP FlexFabric 10Gb 2-port 554M Adapter**
Hardware features					
IEEE compliance	IEEE 802.3, 802.1ab, 802.3x,802.3ad, 802.3p,802.1q, 802.3ae, 802.1au, and 802.3ap	IEEE 802.3, 802.3ab, 802.3u, 802.3x, 802.3ad, 802.3p, 802.1q, 802.3ae,and 802.3ap	IEEE 802.1p, 802.1q, 802.1qau, 802.3ad, 802.3ae, 802.3ap (10GBASE-KX4), and 802.3x	IEEE 802.1p, 802.1q, 802.1qau, 802.3ad, 802.3ae, 802.3ap (10GBASE-KX4), and 802.3x	IEEE 802.1p, 802.1q, 802.1qau, 802.3ad, 802.3ae, 802.3ap (10GBASE-KX4), and 802.3x
Ports and transfer rate	(2) 20,000 Mbps	(2) 20,000 Mbps	(2) 20,000 Mbps	(2) 20,000 Mbps	(2) 20,000 Mbps
Form factor	x8 PCIe 2.0 FlexibleLOM	x8 PCIe 2.0 type A card	x8 PCIe 2.0 type A card	x8 PCIe 2.0 FlexibleLOM	x8 PCIe 2.0 type A card
Network controller	Broadcom 57810S	Broadcom 57810S	Emulex BE3	Emulex BE3	Emulex BE3
Software features					
PXE	Yes	Yes	Yes	Yes	Yes
TOE, accelerated iSCSI, and iSCSI boot	TOE (Windows)	TOE (Windows)	TOE (Windows)	TOE, Accelerated iSCSI, and iSCSI boot	TOE, Accelerated iSCSI, and iSCSI boot
Adapter teaming	Yes	Yes	N/A	N/A	N/A
Warranty in year(s)[8] (parts/labor/onsite)	1/0/0	1/0/0	1/0/0	1/0/0	1/0/0

InfiniBand Switch Module

	HP BLc 4X QDR IB Switch	HP BLc 4X DDR IB G2 Switch
Performance	40 Gbps (QDR) per port, 2.5 TBps switching capacity	20 Gbps (DDR) per port, 1.28 TBps switching capacity
Port configuration	16 4X QDR QSFP uplink ports	16 4X DDR QSFP uplink ports
Management features	Externally managed	Externally managed
Support notes	Requires subnet manager on the fabric. Supported only on new RoSH 6 of 6 compliant c7000 enclosure	Requires subnet manager on the fabric
Protocols supported	IBTA	IBTA
Warranty[8]	1-year parts exchange	1-year parts exchange

Interconnects: InfiniBand Mezzanine HCA

	HP 4X QDR IB Dual-Port Mezzanine HCA	HP IB 4X DDR Dual-Port Mezzanine HCA
Performance	4x quad data rate (40 Gbps)	4x double data rate (20 Gbps)
Port configuration	Dual-port	Dual-port
Management features	OFED driver stack	OFED driver stack
Supported ProLiant BL	BL280c G6, BL460c G6, and BL490c G6	BL260c G5, BL280c G6, BL2x220c G5, BL460c, BL460c G5, BL460c G6, BL465c G5, BL480c, BL490c G6, BL495c G5, BL680c G5, BL685c, BL685c G5, and BL685c G6
Supported Integrity BL	N/A	BL860c
Warranty[8]	1-year parts exchange	1-year parts exchange

Step 4: Choose your server blades

Build and configure each server blade with the right features to fit your needs, without compromise.

HP ProLiant BL420c Gen8
Redefines the term "entry-level" in the blade market with breakthrough server blade economics for essential enterprise workloads.

HP ProLiant BL460c Gen8
The world's most popular server blade delivers the ideal balance of performance, scalability, and expandability, making it the standard for dense data center computing.

HP ProLiant BL465c Gen8
Unprecedented performance, enhanced flexibility, and simplified management. Ideal for virtual workloads, flexible enough for any application.

Number of processors	1 or 2	1 or 2	1 or 2
Maximum number of cores	16	16	32
Processor family	Intel Xeon® E5-2400	Intel Xeon E5-2600	AMD Opteron 6300 Series
Maximum processor frequency	2.4 GHz	3.3 GHz	3.5 GHz
Memory Slots	12	16	16
Maximum memory per server	384 GB	512 GB	512 GB
Networking ports (embedded)	None	None	None
Maximum FlexibleLOM ports	2	2	2
Maximum drive bays	2 SFF SATA/SAS/SSD	2 SFF SATA/SAS/SSD	2 SFF SATA/SAS/SSD
Maximum internal storage	2.0 TB	2.4 TB	2.4 TB
I/O expansion slots	2 PCIe 3.0 mezzanine	2 PCIe 3.0 mezzanine	2 PCIe 2.0 mezzanine
Form factor	Half-height server blade 16 per 10U enclosure 8 per 6U enclosure	Half-height server blade 16 per 10U enclosure 8 per 6U enclosure	Half-height server blade 16 per 10U enclosure 8 per 6U enclosure
Management	HP iLO Management Engine HP Systems Insight Manager Optional: HP iLO Scale-Out or HP Insight Control	HP iLO Management Engine HP Systems Insight Manager Optional: HP iLO Scale-Out or HP Insight Control	HP iLO Management Engine HP Systems Insight Manager Optional: HP iLO Scale-Out or HP Insight Control
Warranty in year(s)[8] (parts/labor/onsite)	3/3/3	3/3/3	3/3/3

Server blade options, including memory DIMMs and hard drives, are available on select models. For more information, visit hp.com/go/proliantoptions or hp.com/go/integrityblades.

Applications and virtual machines

The number of applications, virtual machines, and users supported by your solution will determine the number of server blades needed. Together with our channel partners, we can help you choose the right number of blades with our solution-sizing tools and expertise.

In addition, ActiveAnswers is an online resource with a variety of solutions to help you make the right choice. Learn more about ActiveAnswers or find simple solution help at hp.com/go/activeanswers.

	 **HP ProLiant BL620c G7** Provides an ideal combination of extensive scalability and performance, allowing you to do more with a two-processor server than ever before.	 **HP ProLiant BL660c Gen8** The ideal four-socket dense form factor without compromising on performance, scalability, and expandability.	 **HP ProLiant BL680c G7** The world's first ultra-terabyte memory 4S blade provides maximum performance and unparalleled expansion.	 **HP ProLiant BL685c G7** Cost-effective, dense, four-socket computing for virtualization and compute-intensive applications.
Number of processors	1 or 2	2 or 4	2, 3, or 4	2 or 4
Maximum number of cores	20	32	40	64
Processor family	Intel Xeon E7-2800	Intel Xeon E5-4600	Intel Xeon E7-4800	AMD Opteron 6100 Series AMD Opteron 6200 Series AMD Opteron 6300 Series
Maximum processor frequency	2.4 GHz	2.9 GHz	2.4 GHz	3.5 GHz
Memory Slots	32	32	64	32
Maximum memory per server	1.0 TB	1.0 TB	2.0 TB	1.0 TB
Networking ports (embedded)	(4) 10GbE FlexFabric	None	(6) 10GbE FlexFabric	(4) 10GbE FlexFabric
Maximum FlexibleLOM ports	None	4	None	None
Maximum drive bays	2 SFF SATA/SAS/SSD	2 SFF SATA/SAS/SSD	4 SFF SATA/SAS/SSD	2 SFF SATA/SAS/SSD
Maximum internal storage	2.0 TB	2.4 TB	4.0 TB	2.0 TB
I/O expansion slots	3 PCIe 2.0 mezzanine	3 PCIe 3.0 mezzanine	7 PCIe 2.0 mezzanine	3 PCIe 2.0 mezzanine
Form factor	Full-height server blade 8 per 10U enclosure 4 per 6U enclosure	Full-height server blade 8 per 10U enclosure 4 per 6U enclosure	Full-height, double-wide server blade 4 per 10U enclosure 2 per 6U enclosure	Full-height server blade 8 per 10U enclosure 4 per 6U enclosure
Management	HP iLO 3 HP Systems Insight Manager Optional: HP Insight Control	HP iLO Management Engine HP Systems Insight Manager HP iLO Scale-Out or HP Insight Control	HP iLO 3 HP Systems Insight Manager Optional: HP Insight Control	HP iLO 3 HP Systems Insight Manager Optional: HP Insight Control
Warranty in year(s)[8] (parts/labor/onsite)	3/3/3	3/3/3	3/3/3	3/3/3
HP related offerings				
Support services[5]	HP 3y 4h 24x7 Proactive Care Service and HP Startup BladeSystem or HP Install c-Class Server Blade Service			
Storage	Choose from a full portfolio of internal and external storage.			
Infrastructure management	HP Insight Control for essential infrastructure management across ProLiant blades. Matrix Operating Environment for advanced infrastructure management across ProLiant blades. Refer to the product documentation for the latest product support.			

Server blade options, including memory DIMMs and hard drives, are available on select models. For more information, visit hp.com/go/proliantoptions or hp.com/go/integrityblades.

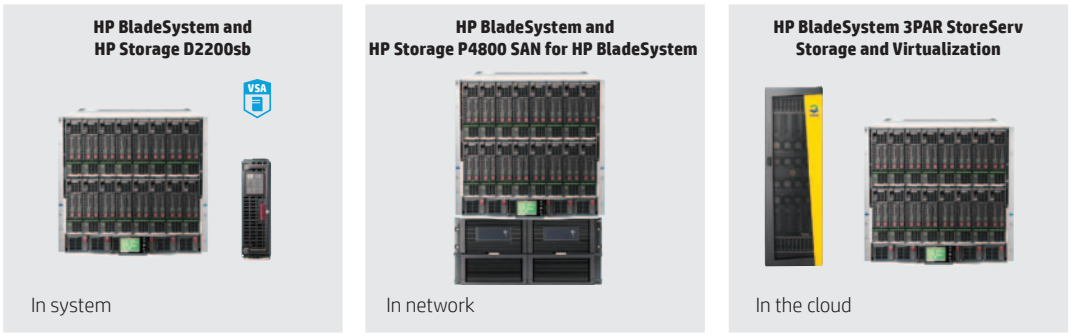
Step 5: Choose your storage infrastructure

Connect to external HP SAN, NAS, and backup solutions, or put storage solutions inside the BladeSystem enclosure, side by side with your server blades, to quickly add storage expansion and data protection—without adding a single cable.

HP BladeSystem data protection options
HP ProLiant Server and HP BladeSystem technology are foundational elements of the HP Converged Storage architecture. The Converged Storage portfolio, including HP 3PAR StoreServ Storage, StoreVirtual Storage, StoreOnce Backup, and StoreAll Storage, eliminates the boundaries between storage and the rest of IT. Built on modular, industry-standard hardware, scale-out federated software, and integrated management, HP Converged Storage delivers the simplicity, efficiency, and agility that you need to support virtualization, the cloud, and today's proliferation of data.

HP BladeSystem is one of the most affordable ways to connect servers to your Fibre Channel-based SAN. The BladeSystem architecture reduces cables and transceivers and can help you save up to 64 percent[9] compared to traditional rackmount environments. For more information on SAN options from HP, visit hp.com/go/storage.

Figure 1. Scalable storage solutions for HP BladeSystem



HP BladeSystem Storage options (internal)

	 **HP D2200sb Storage Blade** Delivers direct-attach storage for the adjacent server blade, and shared iSCSI storage with StoreVirtual VSA software	 **HP StoreEasy 3830 Gateway Storage Blade** A new breed of efficient, secure, and highly available NAS gateways to easily address the file and application storage for SANs	 **HP Tape Blades** Provides direct-attach data protection for the adjacent server and network backup protection for all data residing within the enclosure.
Interconnect	Direct-attach over PCIe. (iSCSI SAN storage when configured with HP StoreVirtual VSA on server blade)	SAN connect: iSCSI, FC, and SAS	Up to 6 Gbps SAS
Drives supported	Up to 12 SFF SAS, SATA, SAS/SATA SSD drives	Two local 450 GB SFF SAS drives are pre-installed with Microsoft Windows Storage Server 2008 R2, Enterprise x64 Edition	LTO-5 Ultrium SB3000c LTO-4 Ultrium SB1760c
Maximum capacity	Up to 10.8 TB raw SAS Up to 12 TB raw SATA	Gateway to unlimited external storage	1.6 TB to 3 TB (2:1 compression)
Form factor	Half-height storage blade	Half-height server blade	Half-height storage blade
RAID levels supported	RAID 0, 1+0, 5, and 6	OS drives configured with RAID 1	N/A
Warranty[8]	3-year parts exchange	Hardware—3 Software—1	3-year, next-day parts exchange
HP related offerings			
Support services[5]	Installation and Startup for HP BladeSystem Infrastructure and 3-year, 24x7 hardware support	3-year, Support Plus 24 and Enhanced 3-year, Proactive 24 service	3-year, 24x7 hardware support

HP BladeSystem Storage options (internal)

	 **HP IO Accelerator for HP BladeSystem c-Class** Ideal for organizations faced with increasing demands for better application performance from their technology infrastructure.	 **HP IO Accelerator G2 for HP BladeSystem c-Class** Ideal for organizations faced with increasing demands for better application performance from their technology infrastructure.
Capacity	320 GB, 640 GB Native maximum, depending on model	365 GB, 785 GB, 1.2 TB Native maximum, depending on model
BladeSystem supported	HP BladeSystem c3000 and c7000	HP BladeSystem c3000 and c7000
Servers supported	BL2x220c G6, BL280c G6, BL460c G6, BL460c G7, BL490c G6, BL490c G7, BL465c G6, BL465c G7, BL495c G6, BL620c G7, BL680c G7, BL685c G6, BL685c G7	BL420c Gen8, BL460c Gen8, BL465c Gen8, BL660c Gen8
Maximum IOPS	140,000 IO/sec	530,000 IO/Sec
Supported operating systems	Red Hat Enterprise Linux 4, Red Hat Enterprise Linux 5, Red Hat Enterprise Linux 6, Red Hat Enterprise Linux 6.1, SUSE Linux Enterprise Server 10, SUSE Linux Enterprise Server 11, Microsoft Windows Server 2003 (x86_64-bit only) SP2, Microsoft Windows Server 2008 (x86_64-bit only) R1 with SP2 or higher, Microsoft Windows Server 2008 (x86_64-bit only) R2, VMware ESX 4.0 Update 1, VMware ESXi 5.0	Microsoft Windows Server 2008 (x86_64-bit only) R1 with SP2 or higher, Microsoft Windows Server 2008 (x86_64-bit only) R2, Microsoft Windows Hyper-V, Red Hat Enterprise Linux 5.7 (AMD64/EM64T), Red Hat Enterprise Linux 6.1 (AMD64/EM64T), SUSE Linux Enterprise Server 10 (AMD64/EM64T), SUSE Linux Enterprise Server 11 (AMD64/EM64T), VMware ESX 4.1, VMware ESXi 5.x
Warranty[8]	3-year parts only	3-year parts only

HP BladeSystem Storage options (external)

				
	HP P4800 G2 SAN Solutions for BladeSystem Highly available storage converged with BladeSystem for virtual server environments.	**HP StoreAll X9000 Network Storage Systems** Simple, efficient, and adaptable scale-out NAS solution provides capacity and scalability.	**HP MSA P2000 G3 Storage** Storage consolidation for small to mid-sized companies and remote locations.	**HP StoreVirtual 4000 Storage** Highly available storage for virtual server environments.
Interconnect	(2) 10 Gb Flex-10 ports with each P4000sb blade	Ethernet 1 Gb, 10 Gb, InfiniBand. Supports CIFS, NFS, IBRIX, HTTP/S, FTP/S, NDMP, and WebDAV protocols	P2000 G3—8 Gb Fibre Channel, 6 Gb SAS, 1GbE and 10GbE iSCSI	(2) 1 Gb iSCSI ports with each StoreVirtual node; 10GbE standard on select models
Drives supported	Up to 1120 LFF SAS drives	24 to 656 drives depending on the model;1 TB 6 G 7.2 k LFF dual-port MDL SAS; 2 TB 6 G 7.2 k LFF dual-port MDL SAS; 600 GB 6 G 15 k LFF dual-port ENT SAS depending on the model	Up to 384 LFF MDL SAS, 256 SFF MDL SAS, or 800 SFF SAS drives depending on model	
Maximum capacity	2240 TB depending on model. Capacity, performance, and redundancy increase as additional nodes are added to the P4800 SAN	Up to 192 TB for the X9320 (2 TB MDL-SAS drives); up to 1.3 PB for the X9720 (2 TB MDL-SAS); up to 16 PB in the single namespace	57.6 TB with LFF SAS drives; 288 TB with LFF SAS MDL drives; 192 TB with LFF SATA MDL drives; 134 TB with SFF SAS drives; 149 TB with SFF SAS MDL drives; 74 TB with SFF SATA MDL drives	1152 TB depending on model. Capacity, performance, and redundancy increase as additional nodes are added to the StoreVirtual cluster
RAID levels supported	RAID 10, 5, and 6. Network RAID eliminates any single point of failure in the SAN	RAID 5 or 6 depending on the model	RAID 0, 1, 3, 5, 6, 10, and 50	RAID 10, 5, and 6. Network RAID eliminates any single point of failure in the SAN
Warranty in year(s)[8] (parts/labor/onsite)	3/3/3	3/3/3 1-year software	3/3/3	3/3/3
HP related offerings				
Support services[5]	Installation and Startup service, and 3-year Support Plus 24 service Installation and Startup and HP 3-year 6-hour Call To Repair Proactive Care Service	Installation and Startup service, and 3-year Support Plus 24 service. Required: Installation and startup service HP 3-year 6-hour Call To Repair Proactive Care Service	HP MSA P2000 G3 Storage service, Installation and Startup service, and 3-year Support Plus 24 service HP 3-year 6-hour Call To Repair Proactive Care Service	Installation and Startup service, and 3-year Support Plus 24 service HP 3-year 6-hour Call To Repair Proactive Care Service

For more information on SAN options from HP, visit hp.com/go/storage.

HP BladeSystem Storage options (external)

	 **HP EVA P6000 Storage** Helps reduce storage management burden for demanding application environments.	 **HP XP P9500 Storage** Storage for mission-critical applications that cannot afford downtime.	 **HP 600 Modular Disk System** High-density, cost-effective storage for BladeSystem.
Interconnect	8 Gbps Fibre Channel, 1 Gbps iSCSI, 10 Gbps iSCSI and FCoE	8 Gbps Fibre Channel, 10 Gbps FCoE, 4 Gbps FICON	Direct connect SAS1
Drives supported	Up to 450 SFF or 240 LFF SAS or midline SAS drives	SFF SAS HDDs and SSDs, up to 2048 SFF SAS drives	Up to 70 LFF SAS or SATA drives
Maximum capacity	Up to 480 TB	Up to 2 PB	Up to 1260 TB supported in a single BladeSystem enclosure
RAID levels supported	VRAID 0, VRAID 1, VRAID 0+1, VRAID 5, VRAID 0+5, VRAID 6, and Cross VRAID Snaps	RAID 1, RAID 5, and RAID 6	RAID functionality provided by P700m Smart Array controller installed in each server
Warranty in year(s)[8] (parts/labor/onsite)	3/3/3	3 year, 24x7, 4-hour response for hardware	3-year, next-day parts exchange
HP related offerings			
Support services[5]	Installation and Startup service, and 3-year Support Plus 24 service Installation and Startup included with P6300 EVA Installation and Startup Service and HP 3-year 6-hour Call To Repair Proactive Care Service	Required: Installation and Startup service. Recommended: 3-year Critical service	Installation and Startup service, and 3-year Support Plus 24 service Installation and Startup Service and HP 3-year 6-hour Call To Repair Proactive Care Service

	 **HP StoreOnce Backup** Disk-based data protection with data deduplication and low-bandwidth replication.	 **HP Tape Automation and Libraries** Tape autoloaders and libraries for efficient, unattended, cost-effective backups.	 **HP Data Protector Software** HP backup and recovery software for complete protection across the entire enterprise infrastructure.
Interconnect	10GbE x 16 ports; 1GbE x 16 ports; 8 Gb Fibre Channel x 16 ports; iSCSI on lower-end models	4x4 Gb Fibre Channel, 2x8 Gb; Fibre Channel, 6 Gb SAS	
Capacity	Scalable up to 768 TB (raw) or 512 TB (usable)	Up to 36.25 TB per drive tape cartridge (LTO-6 media), options include from 8 to 96 cartridges.	
Transfer rate	Up to 24 TB/hr	Up to 1.44 TB/hr per drive Max: 5.76 TB/hr with four LTO-6 drives	
Format	N/A	N/A	
Media compatibility/ RAID levels supported	Hardware RAID 6	LTO-6; LTO-5; LTO-4; LTO-3	
Form factor	Rack-based. 1U, 2U, 4U, and 42U depending on model	Rack-based external data protection	
Warranty in year(s)[8] (parts/labor/onsite)	1/1/1, next-day response with 9x5 phone support	1/1/1, next-day response with 9x5 phone support	
HP related offerings			
Support services[5]	3-year, 24x7 hardware support depending on model	3-year, 24x7 hardware support HP 3y 4h 24x7 Proactive Care Service	3-year HP Software Support 24x7

For more information

To see how other customers have benefited by implementing HP Insight Software, read the IDC white paper at **hp.com/go/insightroi**.

For more details:

- HP Insight Management: **hp.com/go/insight**
- HP Insight Control: **hp.com/go/insightcontrol**
- HP Insight Online: **hp.com/go/insightonline/info**
- HP Insight Control Services: **hp.com/services/InsightControl**
- HP iLO Advanced: **hp.com/go/iloadvanced**

Step 6: Choose your infrastructure management

HP Insight Management is a complete suite of ProLiant server lifecycle management capabilities that can flexibly operate from embedded on-system utilities, or your preferred CMS, and now even from the cloud. Managing ProLiant servers with Insight Management results in increased efficiency and precise control of your server infrastructure resources. With a rich set of capabilities that are easy to access and simple to use, it covers critical areas such as server deployment and configuration, health and alerting, energy, power, and remote management, and warranty and contract information. The core components that make up Insight Management are HP iLO Management Engine, HP Insight Control, and HP Insight Online. With Insight Management's proactive management and built-in automation, ProLiant Servers are so intelligent they practically manage themselves.

HP iLO Management Engine is a complete set of embedded management features supporting the complete lifecycle of the server, from initial deployment through ongoing management to service alerting and support. By delivering comprehensive embedded management, HP helps customers speed time-to-deployment, maximize server and application availability through proactive notification, and dramatically accelerate time-to-resolution when issues do arise.

HP iLO Advanced for BladeSystem, smart remote functionality without compromise, is available for all HP ProLiant servers. The license includes the full integrated remote console, virtual keyboard, video, and mouse (KVM), multi-user collaboration, console record and replay, and GUI-based and scripted virtual media and virtual folders. You can also activate the enhanced security and power management functionality.

HP Insight Control is essential server management that enables you to fully utilize the management capability built into your HP ProLiant servers. Insight Control allows you to proactively monitor ProLiant server health and performance (both physical and virtual), deploy ProLiant servers quickly, reduce energy costs, and control ProLiant servers from anywhere. HP Insight Control extends the ProLiant server management experience to customers who have standardized on HP Performance Suite, Microsoft System Center, and VMware vCenter Server.

HP Insight Online provides one-stop, secure access to the information you need to monitor the devices in your IT environment, along with standard warranty and contract services, from anywhere, anytime. Through the HP Support Center portal, Insight Online can automatically display devices remotely monitored by HP Insight Remote Support software, and it lets you easily track service events and support cases, view device configurations, and proactively monitor your HP contracts, warranties, and HP service credit balances. After installing Insight Online and Insight Remote Support, take advantage of the HP Proactive Insight experience by adopting Proactive Care Support.

Insight Management capabilities

	HP iLO Advanced	HP Insight Control[9]	HP Insight Online[10]
Service and support events			•
Channel partner access			•
Contracts and warranty management		•	•
VMware vCenter Server integration		•	
Microsoft System Center integration		•	
Server migration		•	
Health and alerting		•	•
Server deployment		•	
Virtual machine management		•	
Advanced power management		•	
Performance management		•	
Console record, replay, collaboration	•	•	
Virtual media, folders, keyboard, video, and mouse	•	•	
Alerting, syslog, power management	•	•	
HP iLO Management Engine[11]	•	•	

HP 8.6kVA 24A Three Phase Core Intelligent Modular Power Distribution Unit
Please note HP offers larger capacity intelligent PDUs. For more information: **hp.com/go/ipdu**

Step 7: Choose your power and cooling configurations

If you can't measure the power you use, you can't control it. But with HP Thermal Logic, you can do both. HP Intelligent Infrastructure technology combines energy-efficient design with accurate measurement and control—all without sacrificing performance. This means you can double the capacity of HP server blades in the data center with Dynamic Power Capping delivered through HP Insight Control. The combination of HP Intelligent Infrastructure with Insight Control software allows you to manage all of your HP servers and storage environments from a single console—so that you can easily do more with fewer resources. Save power every second with power configurations and redundancy levels to suit your needs.

HP has created the HP Power Advisor utility to provide more accurate and meaningful estimates of power needs for HP ProLiant server blades. It can even show you how HP Intelligent Infrastructure can help you save money by enhancing power and cooling. Learn more or download the HP Power Advisor at hp.com/go/hppoweradvisor.

HP Intelligent Infrastructure capabilities

Active Cool fans	Both high airflow and high pressure are delivered in a small size that can scale to meet future cooling needs. This technology provides the ability to optimize airflow, reduce power draw, and improve acoustic performance for any server blade configuration.
Parallel redundant scalable enclosure cooling (PARSEC) design	A hybrid model for cooling combines the best of local and centralized cooling in a single system to offer more effective airflow and cooling for all servers. Server blades get more cooling airflow where it is needed most and use less power than traditional rack servers.
Instant thermal monitoring	A real-time view of heat, power, and cooling data is provided. If the enclosure's thermal load increases, the Onboard Administrator's Thermal Logic feature instructs the fan controllers to increase fan speeds to accommodate the additional demand. Even better, it works in reverse, using all the features of Thermal Logic to keep fan and system power at the lowest level possible. Onboard Administrator monitors the thermal conditions on the hardware in real time, without a delay for a polling cycle.
Power pooled for true N+N power redundancy	All the power in the enclosure is provided as a single pool that any blade can access, providing increased flexibility when configuring the power in the system so that customers can choose the level of redundancy with which to operate. Because this power design has no zones, it facilitates both N+N and N+1 power modes, which future-proofs the enclosure for higher power requirements, if needed.
High-efficiency power supplies	High-efficiency power supplies can help you conserve power throughout your data center. These high-efficiency power supplies come standard with each BladeSystem enclosure. The c3000 power supplies are up to 90% efficient and the c7000 power supplies are up to 94% efficient. As a leader in energy-efficiency, HP is the first in the market to offer Platinum-level, 94% efficient power supplies for blade enclosures.
Dynamic power saver mode	Power load shifting improves power supply efficiency to provide real savings in power and costs. When enabled through Onboard Administrator, the total enclosure power consumption is monitored in real time and automatically adjusted with changes on demand.
Power Regulator	HP Power Regulator provides Integrated Lights-Out (iLO)-controlled speed-stepping for Intel x86, AMD x86, and Itanium® 9100 series processors. This feature improves server energy-efficiency by giving CPUs full power for applications when they need it and reducing power when they do not.
Power workload balancing	Power workload balancing improves performance per watt and uses HP Power Regulator technology to manage power at the enclosure level so that power usage stays within defined power caps. Using power caps, system administrators can constrain the most BTUs per enclosure and rack to enable the enclosure to fit in an existing rack power envelope. A simple power cap allows devices to power on until power usage reaches the specified power cap and then prevents any more devices from powering on. Power workload balancing is available now for ProLiant blades and will be available in the future for Integrity blades.
Enclosure Dynamic Power Capping	Safely limit power usage without impacting performance by capping peak instead of average power usage. Remove risk to the electrical infrastructure with a fast-acting, hardware-based capping algorithm. Reclaim more power with blades by dynamically controlling power limits based on workload demand.
HP Intelligent Power Distribution Unit (iPDU)	Brings state-of-the-art management and control to rack-mounted power distribution units (PDUs) to prevent over-provisioning of power from restricting growth in your data center. Using the core and stick architecture of HP Modular PDU line, the HP Intelligent PDU monitors power consumption at the core, load segment, stick, and outlet levels with unmatched precision and accuracy. Remote management is built-in and even enables power cycles on individual outlets on the Intelligent Extension Bars.
Location Discovery Services	Automatically record the exact location in HP Intelligent Series Racks, eliminating time-consuming manual asset tracking.

HP BladeSystem services

HP BladeSystem services include consulting, implementation, and support services for HP BladeSystems. As an important component of a total BladeSystem solution, these services put our experts to work, helping your customers reach the business goals that led you to choose blade technology in the first place—more computing capacity in less space, using less power, and with simpler cabling.

For more information

For more information, visit **hp.com/services/bladesystem**

Or contact your local HP sales representative or Authorized HP ServiceOne Partner.

To stay relevant, your employees need to quickly assimilate new IT skills. We offer a variety of HP training services, including instructor-led courses, customized onsite training, and innovative remotely assisted courses. For more information, visit **hp.com/learn**.

Step 8: Choose your services

With technology evolving at a rapid pace, it is increasingly important for companies to be able to rely on IT support services that are constantly adapting in order to address the complexities of today's evolved IT environment. HP Technology Support Services for ProLiant servers and BladeSystem redefines support, factoring in the breakthrough capabilities of HP ProLiant servers and BladeSystem. HP offers a comprehensive set of services to manage and optimize every aspect of the server environment. Our end-to-end lifecycle services include working with your IT team to design your environment from scratch or integrate new technology into your existing infrastructure. Our services help customers quickly get systems up and running, and provide ongoing reactive and proactive support.

HP Foundation Care: Customers receive cost-effective reactive services, with separate or integrated hardware and software support options. This support includes HP Collaborative Support, with independent software vendor (ISV) software problem resolution and enhanced call management.

HP Proactive Care: This advanced support integrates reactive and proactive support. It offers a single point of contact for remote and onsite hardware support delivered by HP technology experts to help customers proactively address potential issues and minimize downtime.

HP Datacenter Care: This service supports the customer's entire data center environment and is developed for HP and multivendor environments. It is customized for an organization's specific needs and SLAs.

HP Lifecycle Event Services: These services give customers a comprehensive end-to-end solution—covering strategy, planning, deployment, technical, and education services, which can be used at any stage of the solution lifecycle.

HP Proactive Insight experience: This experience allows customers to access their IT environments anytime, anywhere. It enables them to automate routine tasks to reduce costs and save time, and prevent problems before they occur to keep business running smoothly. Customers are able to take advantage of this experience by adopting Proactive Care in conjunction with HP Insight Online and HP Insight Remote Support.

HP offers easy-to-use, cost-effective support packages at various levels to meet your specific business needs. In addition, automated 24/7 support with HP Insight Software solutions are available at no additional cost and can be tailored to help you proactively monitor, and rapidly identify and resolve issues. And HP Education Services helps address the challenge of managing costs and resources while keeping up with the latest technology.

Installation and Startup for HP BladeSystem c-Class Infrastructure	Provides for the installation of an HP BladeSystem c-Class enclosure, ProLiant and Integrity c-Class server blades, storage blades, and SAN switch blades, Virtual Connect modules (Ethernet and Fibre Channel), Ethernet network interconnects, and InfiniBand, as well as deployment and basic configuration of HP Insight Control environment for HP BladeSystem software.
HP Installation and Startup Service for HP Insight Control	Provides for the deployment and basic configuration of HP Insight Control on HP ProLiant ML and DL series servers or HP BladeSystem servers.
Enhanced Network Installation and Startup Service for HP BladeSystem	Provides advanced network software configuration, including configuration of HP Virtual Connect options.
HP MSA Family Disk Array Installation and Startup Service	Includes service planning, service deployment, installation verification tests, and customer-oriented sessions.
HP Proactive Care	Combines reactive and proactive hardware and software support with access to local experts at the Advanced Solution Center when customers call HP, giving them fast answers, problem prevention, and global expertise locally.
HP Proactive 24 and Critical Service	Coverage options are available for HP BladeSystem enclosures, HP ProLiant and Integrity server blades, HP BladeSystem SAN switches, and HP Ultrium tape blades.
HP Support Plus 24	Provides integrated 24x7 4-hour response hardware support with 2-hour response software technical support and software update service.
HP Proactive Select	Flexible credit-based offering that enables you to purchase consultancy support to help optimize the performance of your blade environment. Consultancy options include IT service management, security, capacity planning, system health checks, optimization of storage, server, and network performance optimization, and more.
Services for NonStop BladeSystem	Three pre-defined service levels provide quick installation, customized configuration, rapid start-up, and 24x7 support: • Critical Service Solution • Proactive Service Solution • Foundation Service Solution **HP Evolution Services for NonStop BladeSystem** Mission-critical support addresses the diverse factors that impact system performance and availability. This encompasses not just hardware and system software, but also IT management processes, applications and databases, networks, environmental factors, and more. Learn how HP can help enhance uptime, performance, operations, and security across your NonStop system environment at hp.com/products1/evolution/9000. **HP Education Services for NonStop BladeSystem** HP NonStop Technology Education is your source for training on HP Integrity NonStop servers and software. Choose from a broad range of courses, locations, and training media to make sure your HP NonStop system education is perfectly tailored to your requirements, operations, and security. Learn more at hp.com/education/sections/nonstop.html.

Related offerings

HP Integrity NonStop BladeSystem servers
Today's complex architectures often force you to choose between availability and scalability—and you're still left with a complex, expensive-to-manage infrastructure. The HP Integrity NonStop BladeSystem platform delivers out-of-the-box capabilities, significantly simplifying your infrastructure and reducing costs.

The HP Integrity NonStop BladeSystem NB50000c and NB54000c servers are designed to deliver the industry's highest application service levels offering the best return on investment and lowest total cost of ownership in their class—based on standards such as the Intel Itanium processor, SQL, Web services, J2EE software architecture, and more.

Learn more about the advantages of HP Integrity NonStop BladeSystem servers at hp.com/go/integrity.

HP High Performance Computing (HPC) clusters
Scale out your HPC infrastructure with the fastest blade systems available, featuring more processors, greater energy-efficiency, and increased cooling capabilities. HP BladeSystem-based clusters are fully integrated, tested, and ready for the most demanding workloads.

Learn more about HP HPC clusters at hp.com/go/hpc.

HP client virtualization solutions
Until recently, most enterprises followed the common practice of tethering Microsoft Windows applications to the desktop. This model worked well when workers were tethered to their desks.

But today, the workforce is going global and mobile. Workers from evolving demographics have new expectations for data and application delivery. They demand support for next-generation applications that can transform the way they work. And they want the ability to work from any location, at any time, using any device.

Enterprises are trying to meet their workers' "need-it-now" demands by deploying new solutions, but they are discovering that the return on investment is challenging. Success requires organizations to deploy the right solution the first time, rather than spending unnecessary time and money on multiple iterations.

The bottom line: enterprises need a new way to increase flexibility and mobility without losing IT control and without having to manage the proliferation of devices. Now, HP has the answer: virtualize the client infrastructure.

HP delivers both enterprise and SMB reference architectures integrated with Citrix, Microsoft, and VMware software that explain how to:

- Provide secure access to applications and desktops by supporting hosted-shared, VDI desktops and application virtualization, while also optimizing the efficiency of the IT infrastructure.
- Improve efficiency using a single, common, modular, standards-based platform like HP BladeSystem to support all types of workloads, from task workers to workstation-class graphics users.
- Speed the deployment of client virtualization solutions, enhance the worker experience, and boost productivity.

Learn more about HP client virtualization solutions at hp.com/go/clientvirtualization.

HP ProLiant Gen8 WS460c Server Blades

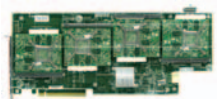
	HP ProLiant Gen8 WS460c Server Blade	HP ProLiant Gen8 WS460c Server Blade with Graphics Expansion*
	The newest generation of high-density workstation-class compute power with data center class security and scalability. And now with even more users per blade with HP MultiGPU Carrier supporting up to 8 GPUs.	
Number of processors	1 or 2	1 or 2
Maximum number of cores	16	16
Processor family	Intel Xeon E5-2600	Intel Xeon E5-2600
Maximum processor frequency	3.0 GHz	3.0 GHz
Memory Slots	16	16
Maximum memory per server	512 GB	512 GB
Maximum FlexibleLOM ports	2	2
Maximum drive bays	2 SFF SATA/SAS/SSD	2 SFF SATA/SAS/SSD
Maximum internal storage	2.4 TB	2.4 TB
I/O expansion slots	2 PCIe x16 (Gen3) mezzanine slots	2 full-size, full-height, PCIe x16 (Gen3) slots
Graphics	1 NVIDIA Quadro 3000M or up to 2 NVIDIA Quadro 1000M or up to 2 NVIDIA Quadro 500M	HP MultiGPU Carrier (6 NVIDIA Quadro 3000M) or HP MultiGPU (8 NVIDIA Quadro 1000M) or 1 NVIDIA Quadro 6000/5000
Form factor	Half-height server blade 16 per 10U enclosure 8 per 6U enclosure	Half-height, double-width server blade 8 per 10U enclosure 4 per 6U enclosure
Warranty in year(s) (parts/labor/onsite)	3/3/3	3/3/3

* Note: Photo shown with optional NVIDIA Quadro 5000 graphics installed

Mezzanine Graphics

	NVIDIA Quadro 3000M mezzanine graphics card	NVIDIA Quadro 1000M mezzanine graphics card	NVIDIA Quadro 500M mezzanine graphics card
Mezzanine slot	MXM3 type-B mezzanine, slot 2 only, single card only	MXM3 type-A mezzanine, dual graphics (quad-display) capable	
NVIDIA CUDA Cores	240	96	96
Memory size	2 GB (GDDR5)	2 GB (DDR3)	1 GB (DDR3)
PCI Express	X16 Gen2	X16 Gen2	X16 Gen2

Graphics for Expansion Blade



	HP MultiGPU Carrier with six NVIDIA Quadro 3000M (two carriers)	HP MultiGPU Carrier with eight NVIDIA Quadro 1000M (two carriers)	NVIDIA Quadro 6000	NVIDIA Quadro 5000
PCIe form factor	Single-width, dual cards	Single-width, dual cards	Double-width, single card only	Double-width, single card only
NVIDIA CUDA Cores	240 (per MXM card)	96 (per MXM card)	448	352
Memory size	2 GB (GDDR5, per MXM card)	2 GB (DDR3, per MXM card)	6 GB (GDDR5)	2.5 GB (GDDR5)
PCI Express	PCIe x16 (Gen3)	PCIe x16 (Gen3)	PCIe x16 (Gen2)	PCIe x16 (Gen2)

HP BladeSystem telecom solutions

The HP BladeSystem carrier-grade platform meets telecom-specific needs for a rugged solution, while providing an adaptable infrastructure to meet evolving requirements. HP BladeSystem provides technology building blocks that reduce the time and expense of building tomorrow's network data center.

Current HP BladeSystem architectures are renowned for being cost-savvy, change-ready, energy-thrifty, and time-smart. With the HP BladeSystem c7000 carrier-grade enclosure, and the HP ProLiant BL460c G6 and HP Integrity BL860c carrier-grade servers, those same benefits are now available for network equipment providers (NEPs) and communications service providers.

Designed for the specific requirements of the telecommunications industry, HP BladeSystem offers 48 VDC power, compliance with the European Telecommunications Standards Institute (ETSI) and the Network Equipment-Building System (NEBS), high reliability, enhanced support for OpenHPI, OpenSAF, and carrier-grade Linux—all at a fraction of the cost of traditional telecom infrastructure systems.

All HP BladeSystem carrier-grade components have been tested to the NEBS Level 3 criteria (GR-63-CORE and GR-1089-CORE), and ETSI certified to EN 300 019, EN 300 386, and EN 300 754.

HP carrier-grade solutions include a 36Ux1 meter deep, fully hardened HP seismic rack cabinet system designed to withstand the rigors of telecom environmental and seismic events. The cabinet can support payloads up to 1200 pounds, and can house the full line of carrier-grade products, including the HP BladeSystem c7000, HP ProLiant DL380, and HP P2000 G3 storage array. The cabinet can support two 48 VDC breaker systems, rated at 240 amps each.

HP BladeSystem c7000 carrier-grade enclosure

HP BladeSystem c7000—NEBS Level 3 tested components

Server blades	HP ProLiant BL460c Gen8, two Intel Xeon processors E5-2600 series, up to 256 GB memory	
	HP ProLiant BL620c G7, two Intel Xeon processors E7-2800 series, up to 256 GB memory	
	HP Integrity BL860c i2, two Intel Itanium processors 9300 series, up to 192 GB memory	
Mezzanine options	HP NC325m Quad-port 1GbE Adapter	NC552m 10 Gb 2-port Flex10
	HP NC360m Dual-port 1GbE Adapter	NC553m 10 Gb 2-port FlexFabric
	HP NC382m Dual-port 1GbE Multifunction Adapter	HP FlexFabric 10 Gb 2-port 554FLB Adapter
	QLogic QMH2562 8 Gb FC HBA	HP Flex-10 10 Gb 2-port 530FLB Adapter
	HP BLc Emulex LPe 1205-HP 8 Gb FC HBA	HP Ethernet 10 Gb 2P 560FLB Adapter
	NC542m Dual-port Flex-10 Mezzanine	HP FlexFabric 10 Gb 2-port 554M Adapter
	NC532m Dual-port Flex-10 Adapter	HP Flex-10 10 Gb 2-port 552M Adapter
	NC551m Dual-port FlexFabric Adapter	HP PCI Expansion Blade, for use with BL460c
Interconnect modules	HP Virtual Connect Flex-10 10Gb Ethernet Module	
	HP Virtual Connect FlexFabric 10Gb/24-Port Module	
	HP Virtual Connect 8Gb 24-Port Fibre Channel Module	
	HP Networking 6120XG	
	HP Networking 6120G/XG	
	HP GbE2c Layer 2/3 Ethernet Blade Switch	
	Cisco Catalyst Blade Switch 3020 for HP BladeSystem c-Class	
	Cisco Catalyst Blade Switch 3120 for HP BladeSystem c-Class	
	HP 10 Gb Ethernet BLc Switch	
	HP BLc 1 Gb Ethernet Pass-Thru Module	
	Brocade BLc 8 Gb SAN Switch	

HP carrier-grade server blades

	HP ProLiant BL460c G6 (NEBS certified)	HP ProLiant BL620 G7 (NEBS certified)	HP Integrity BL860 i2 (NEBS certified)
Number of processors	1 or 2	1 or 2	1 or 2
Maximum number of cores	6	8	4
Processor family	Intel Xeon E5-2600 series	Intel Xeon E7-2800 Series, 8867L	Intel Itanium 9300 series
Maximum memory (per server)	256 GB	256 GB	192 GB
Network ports	2	4	4
Internal storage	2 hot-plug SAS/SSD	2 hot-plug SAS/SSD	2 hot-plug SAS/SSD
I/O expansion	2 PCIe Mezzanine	3 PCIe Mezzanine	3 PCIe Mezzanine
Warranty in year(s) (parts/labor/onsite)	3/3/3	3/3/3	3/3/3

Interconnects (NEBS-tested)	
HP Virtual Connect Flex-10 10 Gb Ethernet Module for the BladeSystem c-Class	**Cisco Catalyst Blade Switch 3020 for HP BladeSystem c-Class**
HP Virtual Connect FlexFabric 10 Gb/24-Port Module	**Cisco Catalyst Blade Switch 3120 for HP BladeSystem c-Class**
HP Virtual Connect 8 Gb 24-Port Fibre Channel Module	**HP 10 Gb Ethernet BLc Switch**
HP Networking 6120XG	**HP BLc 1 Gb Ethernet Pass-Thru Module**
HP Networking 6120G/XG	**Brocade BLc 8 Gb SAN Switch**
HP GbE2c Layer 2/3 Ethernet Blade Switch	

HP Converged Systems

With a choice of solutions, from NonStop computing to virtual desktops, HP now brings the advantages of blades to a broad range of applications and environments. HP VirtualSystem and HP CloudSystem are available as fully customized solutions and delivered to you built according to your unique specifications.

HP VirtualSystem

- Best-in-class
  - Virtualization partners
  - HP Converged Infrastructure
  - Consulting and deployment services
- Open standards
  - Seamless integration with existing environments
  - Modular for easy scaling
  - Easily extensible to cloud
- Maximum performance
  - Purpose-built and optimized
  - Deep integration with virtualization software platforms
  - Converged storage architected for virtualized environments

HP VirtualSystem provides you with fast time-to-value for virtualization. It can save you months of integration work by selecting and integrating best-of-breed HP Converged Infrastructure and leading virtualization software in one solution delivered by HP. HP VirtualSystem is designed to help maximize performance, uptime, and scalability of virtualized workloads for small, medium, and large organizations.

Proven and optimized—HP VirtualSystem is part of the HP Converged Systems portfolio and is built on products and technologies optimized for virtualization to help you maximize performance, uptime, and scalability. We've combined leading virtualization software with HP FlexFabric, HP Converged Storage, and HP servers. Integrated HP management software gives you better control over VM and infrastructure tasks.

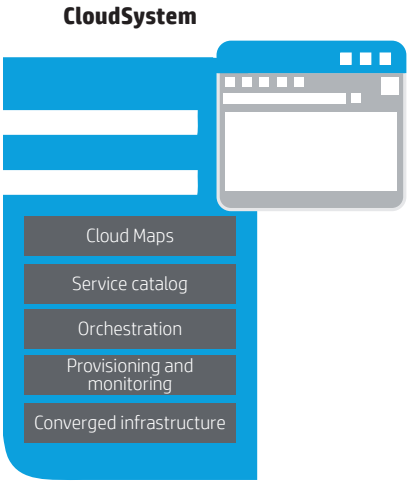
Integrated services to align virtualization to business goals—HP VirtualSystem includes installation and implementation services to get your new system up and running quickly and properly, and offers optional implementation services for the best possible experience.

VM storage with a scale-out approach—A lack of predictability in the data center has resulted in the need for more simple, agile, and efficient storage for virtualization and ITaaS. HP Converged Storage (HP StoreVirtual and HP 3PAR StoreServ) is built from the ground up for the needs of virtualization, cloud, and massive scaling.

Unified virtual and physical security and management—HP Insight Control enables holistic management of virtual and physical resources, with an integrated view from VM to the core of the network. It offers you deep insight across the complete network topology, as well as simplified troubleshooting and tuning.

Learn more at hp.com/go/virtualsystem.

Figure 2. HP CloudSystem



HP CloudSystem

HP CloudSystem is the most complete, integrated, and open platform, enabling enterprises and service providers to build and manage services across private, public, and hybrid cloud environments.

Based on proven, market-leading HP Converged Infrastructure and HP Cloud Service Automation, HP CloudSystem integrates servers, storage, networking, security, and management to automate the infrastructure-to-application lifecycle for hybrid service delivery management. The result is a complete cloud solution that lets enterprises gain agility and speed, and allows service providers to drive top-line growth.

As a part of the HP Converged Cloud architecture, clients have a simplified, integrated platform that is easier to manage and provides flexibility and portability between private, public, and managed clouds.

Key benefits include:

- Single services view across hybrid cloud
- Multi-hypervisor, multi-OS, heterogeneous infrastructure
- Intelligent automation and orchestration
- Rapid application and infrastructure deployment

Learn more at hp.com/go/cloudsystem

HP Financial Services

Not every technology acquisition has to be a traditional cash-and-carry transaction. HP Financial Services offers a variety of customized leasing and financing options to facilitate your HP BladeSystem purchase and keep your technology expenditures in line with your overall budget. For more information, visit hp.com/go/hpfinancialservices.

HP BladeSystem: your ultimate converged infrastructure

HP BladeSystem not only can handle any workload, but can also deliver the best value across workloads of any converged infrastructure on the market today. You will be able to transform the economics of your IT investment, large or small.

All of this adds up to big savings for your IT budget that can be reinvested back into your business. With HP Converged Infrastructure in place, you can also deliver top-line business results to grow, get to market faster, and empower your employees, partners, and customers.

Wherever you plan to take your business in the future, HP BladeSystem is ready to help you get there. Learn how HP BladeSystem can drive business innovation by visiting hp.com/go/bladesystem.

Learn more at
hp.com/go/bladesystem

[1] IDC white paper sponsored by HP, "Business Value of Blade Infrastructures," #227508R2
[2] HP BladeSystem and BladeSystem Matrix TCO Calculator, http://roianalyst.hp.com/bladesystemmatrixtco/
[3] Gaining Business Value and ROI with HP Insight Control, Doc #224704, IDC, September 2010
[4] HP internal calculations comparing number of hardware components of traditional infrastructure vs. HP BladeSystem with two Virtual Connect FlexFabric modules—January 2013
[5] All blades within a single HP BladeSystem enclosure must be at the same service level
[6] Not supported on any G5 server blade, nor the BL465c G6 or the BL495c G6
[7] Not supported on any G7 or earlier generation server blade
[8] Or the warranty of the server that holds the adapter, whichever is greater
[9] Windows and Linux-managed nodes
[10] Available with standard HP contract, warranty, and Care Pack services in the HP Support Center Portal
[11] HP iLO Management Engine, in all HP ProLiant Gen8 servers, includes: HP iLO (HP iLO Mobile App, Sea of Sensors Thermal management), HP Intelligent Provisioning, HP Agentless Management, HP Active Health System

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