HP CLUSTER PLATFORMS

Foundation for the HP Unified Cluster Portfolio

Data sheet

Powerful choices for today's cluster computing

A well-designed and assembled cluster solution delivers powerful capabilities at an attractive price. However, achieving a state-of-the-art cluster requires a tremendous amount of knowledge, time, and resources. With so many choices available, how do you select the right cluster components to meet your business needs? How do you ensure that all the modules work together as planned, especially with the latest advances in technology such as GPU accelerators and new, faster interconnects?

The answer is simple: work with HP. As the leader in high-performance computing (HPC) and cluster solutions, HP provides a comprehensive portfolio of industry-standard components and the experience needed for successful deployment. To help you drive a competitive edge, while balancing the pressure on your budget, HP designed the HP Unified Cluster Portfolio (UCP). This innovative, modular package of hardware, software, and services is the perfect match for all your scalable computation, data management, and visualization needs.

The modular HP UCP framework is built on flexible HP ProLiant DL and SL servers, and the HP BladeSystem c-Class Infrastructure. In addition, HP UCP also offers a wide range of open source and commercial middleware, as well as the latest industry-standard technology—all with the simplicity and affordability of a pre-configured solution. As HP has extensive experience in assembling and installing thousands of cluster systems worldwide, you can trust that all the components will work together seamlessly, right out of the box.

Hardware engineered to deliver performance

The HP Cluster Platforms (CP) are the foundation of the UCP, providing you with a choice of processors, operating systems, and interconnects. The HP Cluster Platform 3000 and 4000 offer a choice of 1U and 2U rackmount servers as the basic compute building blocks, or modular HP BladeSystem c-Class nodes. With the ability to handle massive scale out requirements, the newest offerings are the HP Cluster Platform 3000SL and 4000SL, built on an efficient multi-mode chassis that lowers system costs and reduces power consumption. All servers contain multi-core processors to deliver the highest performance possible for your HPC applications. Interconnect choices include Gigabit Ethernet or InfiniBand (QDR or FDR[1]). Also, NVIDIA Tesla modules are available as supported and integrated options.

Rackmount option with HP Cluster Platform 3000 and 4000
The HP Cluster Platform 3000 and 4000 are available with HP ProLiant DL servers as compute nodes and one or more control or utility nodes. You can easily add optional control nodes to enable maximum flexibility and expansion for administrative functions, such as file services or additional login servers. Nodes feature multi-core processors from Intel® and AMD to deliver superior performance, improved power efficiency, and reduced facility requirements. The servers are optimized for rack mounting and provide critical features for clustering, such as embedded remote management and optional redundant power. The CP3000 nodes offer the new Intel® Xeon® processor E5-2600 family with up to 8 cores and 20 MB L3 cache. The CP4000 features the HP ProLiant G7 servers, with the AMD Opteron 6200 series of 8/12/16-core processors. This higher core count allows more performance with minimal impact on power consumption, and space. Also, systems support next generation DDR3 memory for more performance, capacity, and efficiency. Clusters support either Linux or Microsoft® Windows® environments.

[1] Option for featured ProLiant Gen8 nodes

HP Cluster Platform specifications

	HP Cluster Platform 3000	HP Cluster Platform 4000	HP Cluster Platform 3000SL and 4000SL
Processor[2]	Multi-core Intel Xeon E5-2600 family	Multi-core AMD Opteron 6200	CP3000SL: Intel Xeon E5-2600 family CP4000SL: AMD Opteron 6100 series
Compute node	HP ProLiant DL160 G6[3], BL460c Gen8	HP ProLiant DL165 G7 and DL585 G7; BL465c G7	CP3000SL: HP ProLiant SL230s, SL250s, SL270s (Half-width nodes in 4U chassis—8, 4 and 2 nodes per chassis, respectively) CP4000SL: ProLiant SL165s G7 (4 nodes per 4U chassis)
Visualization and/or GPU node	DL160 with graphics card; BL460c with Blade Expansion or WS460c Workstation Blade available by request	DL165 with graphics card; DL785 G6 available by request	Customize with DL160 or DL165 G7 and choice of graphic cards SL250s with up to three Tesla modules with 2U, eight modules with SL270s
Utility/Control node	HP ProLiant DL380p Gen8, DL160 G6, or BL460c Gen8 Servers	HP ProLiant DL165 G7, DL385 G7, HP ProLiant DL585 G7, or BL465c G7 (BL option available only with CP4000BL)	CP3000SL: HP ProLiant DL380p Gen8 or DL160 G6 CP4000SL: HP ProLiant DL385 G7 or DL165 G7
Number of processors (sockets) per node	Two	Two: DL165, DL385, BL465c Four: DL585	Two
Number of nodes	Minimum: One utility node and four compute or visualization nodes; maximum: total of 1024 nodes (utility + compute + visualization nodes)		
Memory per node	DL160: up to 192 GB DL380p: up to 768 GB BL460c: up to 512 GB	DL385 G7/BL465c: up to 512 GB DL165 G7: up to 384 GB DL585 G7: up to 1 TB	SL230s/SL250s/SL270s/SL165s: up to 512 GB DL380p: up to 768 GB DL165: up to 384 GB DL385: up to 512 GB
Number of I/O slots	DL160 G6: two PCIe Gen2 (2x16, 1x16, and 1x4) DL380p: six PCIe Gen 2 plus dual port FlexLOM adapter BL460c: two I/O expansion mezzanine slots, plus dual-port FlexLOM adapter	DL165: two PCIe Gen2 slots (1x16, 1x4) DL385: six PCIe Gen2 slots (1 optional PCI-X) DL585: up to 11 FL/FH I/O slots BL465c: two I/O expansion mezzanine slots and PCI Expansion Blade	SL230s/SL250s: 1x16 xLP PCIe Gen2 slot with optional 3 PCIe x16 Gen2 slots with 2U half-width tray—Plus dual-port FlexLOM adapter SL270s: 9 PCIe Gen2 slots, plus dual-port FlexLOM adapter SL165s: two PCIe Gen2 slots (1x16; 1x4) (See columns to left for specs for DL nodes)
Disk/Media bays	DL160: four drives (SAS or SATA) DL380p: up to 25SFF or 12 LFF (SAS, SATA) BL460c: two drives SAS or SATA or SSD	DL165: eight SFF or four LFF drives (SAS, SATA, or SATA SSD) DL385: (16) SFF (SAS, SATA, or SSD) or (6) LFF (SAS or SATA) DL585: eight drives (SAS, SATA, or SATA SSD) BL465c: two drives (SAS, SATA, or SSD)	SL230s 1U server: 2 NHP SFF or 4 LFF (SATA, SAS, or SSD), optional 2 SFF HP drives SL250s 2U server: 4 HP and 4 NHP SFF (SATA, SAS, or SSD) SL270s 4U server: 8 SFF SAS/SATA/SSD SL165s: SATA/SAS—6 LFF or 8 SFF drives (See columns to left for specs for DL nodes)
Cluster interconnect	QDR or FDR InfiniBand, Gigabit Ethernet	QDR or DDR InfiniBand, Gigabit Ethernet	QDR or FDR InfiniBand, Gigabit Ethernet
Management network	10/100 network or Gigabit Ethernet, 10/100 console network to node-based embedded management interfaces		
SAN storage in cab	Control node options: MSA2012 FC or SAS and MSA60 Direct Attached; SB40 Storage Blade for BL servers		
Operating system options	Linux: Red Hat Enterprise Linux 5 or 6, SUSE SLES 10 or 11; Microsoft Windows Server 2008		
Operating environment options	HP-MPI across all operating systems HP HPC Linux Value Pack with HP-MPI, Platform LSF, Application Portal Altair PBS Professional		
Cluster management software options	Linux: HP Insight Cluster Management Utility (Insight CMU); third-party and open source options available by request Windows: HPC Server 2008		
Form factor	DL1xx compute nodes are 1U nodes; blades packaged in c7000 enclosure for 16 blades per 10U, one node per blade		3000SL packaged in eight nodes per 4U s6500 chassis; two or four nodes per chassis with GPU extension; 4000SL packaged in four nodes per s6500 chassis
Packaging (available in two styles)	High-density packaging designed for optimal footprint and lowest entry price—available up to 128 compute nodes (delivered in four cabinets) Modular packaging designed for expandability with racks assembled as compute building blocks for compute nodes and network switches, utility building blocks for control nodes and other cluster administration tasks, optional racked monitor and keyboard, and interconnect building blocks for high-performance interconnect switches		
Services	HP Enhanced Services available for platforms. HP offers on-site field installation. HP Software support available for operating systems and HP software options		
Warranty	Standard HW warranties; software warranty specific to product options		

[2] Processor speed availability varies by node and reflects those offered on standalone servers. Visit hp.com for latest processor choices. Note that new generations and/or releases of servers are introduced regularly and will be offered as part of CP upon release.

[3] Check website for details regarding availability and specs for next generation of DL160, which will be offered in Cluster Platforms upon launch.

BladeSystem options with HP Cluster Platform
HP Cluster Platforms are available with the HP BladeSystem c-Class infrastructures—the most popular Blade Solution for high-performance computing. Over 18 percent of the Top500.org sites are powered by HP BladeSystem-based Cluster Platforms[4]. Highly adaptive infrastructures "in a box," HP BladeSystems provide outstanding manageability and density, as well as significantly reduced cabling. The innovative c-Class cooling technology uses built-in instrumentation to monitor changes in workload demand and environment.

The HP BladeSystem-based clusters combine power-efficient computing and high density with exceptional memory capacity and a large number of I/O slots. As with the rack-mounted CP3000 and CP4000, both Intel Xeon and AMD Opteron multi-core processors are available with BladeSystems, as well as a choice of Linux or Microsoft Windows operating systems.

HP Cluster Platform 3000SL and 4000SL
The HP Cluster Platform 3000SL and 4000SL are based on the newest family of HP ProLiant servers—the SL series. The core building block is the 4U s6500 chassis, providing a shared power and cooling infrastructure for up to eight nodes per chassis. This intelligent design enables considerable cost savings as well as more efficient cooling, which is not possible in discrete, standalone servers. The servers are packaged in trays, which slide into the chassis. This minimized packaging reduces weight, heat retention, and cost. Up to eight half-width 1U SL230s servers can be packaged in the 4U s6500 chassis. With 8 chassis per 42U rack, a typical CP3000SL design has 72 2-socket nodes per rack. The SL250s and SL270s servers use the same chassis but with 2U and a 4U half-width design to support up to three or eight Tesla GPU modules, respectively. The CP4000SL features HP SL165s G7 servers, featuring the AMD 6100 series processors (8/12 cores per socket). The SL165s supports up to eight SATA or SAS drives, and is packaged as four servers per 4U chassis, allowing up to 36 nodes per rack.

Your choice of high-speed interconnects
HP offers InfiniBand and Gigabit Ethernet interconnects across the entire line of HP Cluster Platforms.

The combination of high bandwidth, low latency, and excellent scalability has made InfiniBand the interconnect of choice for powering many of the world's largest and fastest computer systems. The HP Cluster Platforms feature the complete line of HP InfiniBand solutions, including the latest products from Mellanox and QLogic. For capability clusters, where latency is not mission critical, Gigabit Ethernet provides the necessary interconnect functionality at a very attractive price. The HP Networking family of switches can be deployed as a single cluster switch or in a tiered hierarchy utilizing larger HP Networking switches.

Extensive software options
HP Cluster Platforms are designed to support standard cluster deployments using popular open source Linux software stacks. HP complements this open source option with a set of commercial products for Linux and Microsoft Windows. All HP Cluster Platform software offerings are tested and verified by HP or our partners to run on the platform, enabling rapid deployment, and a comprehensive environment for high-performance computing.

Operating environments available from HP include a choice of Linux (Red Hat or Novell SUSE Linux Enterprise Server) and Microsoft Windows Server 2008. Included with the operating system, HP Services Care Packs provide fast access to HP service professionals and hands-on cluster expertise.

As part of the UCP, you can choose from these optional cluster management software products:

- HP Insight Cluster Management Utility (Insight CMU), an efficient, flexible, and robust tool for managing Linux-based nodes in HPC clusters and compute farms. HP CMU provides highly scalable provisioning and monitoring, support for multiple Linux distributions and packages, and an option for diskless compute nodes. HP CMU is part of the GPU ecosystem, with recent enhancements to simplify installation of GPU drivers and libraries, as well as to enable monitoring.
- Microsoft Windows HPC Server 2008 (HPCS), that provides an HPC platform that is simple to deploy, operate, and integrate within an existing Windows-based infrastructure and tools.

Built to adhere to industry standards and integrate with the most popular servers in the industry, you can deploy HP Cluster Platforms with alternate third-party and open source management stacks and schedulers. Working with partners such as Altair Engineering, Adaptive Computing, and Platform Computing, HP ensures nodes are qualified and available for customers choosing those options.

Production-quality HP-MPI
To ease the burden of supporting applications across multiple interconnects and platforms in a cluster-computing environment, HP offers HP-MPI—a high-performance and production-quality implementation of the Message-Passing Interface (MPI) standard. HP-MPI supports multiple interconnects, enabling you to build a single application executable that transparently and dynamically takes advantage of the highest-performing (supported) interconnect available on the cluster.

HP HPC Linux Value Pack
HP offers a specially priced bundle of popular cluster tools including HP-MPI, Platform/LSF, and Application Portal, enhanced for use with HP Insight CMU. With support from HP, this allows users to have a single contact for support of a comprehensive HPC environment.

Tested software development tools
To complete the software development portfolio, HP partners with leading suppliers of software development tools. Through these alliances, HP tests and qualifies a comprehensive portfolio of compilers, libraries, debuggers, and other HPC tools.

[4] Based on November 2011 Top500 list

HP Cluster Platform specifications

	Feature	Benefit
Market-changing innovation	Integrated, customer-ready solutions Tested advanced options, such as high-performance graphic servers and accelerators, can be easily integrated into the modular Cluster Platform system. Easily integrated with scalable file systems, such as HP Storage X9000/Fusion system or lustre-based options	Enables cost-effective, rapid deployment Boosts application performance with cost-effective and energy-efficient accelerators; simplifies and improves utilization of high-end graphics and new technologies Provides complete and balanced scalable solution—computation and data management in an integrated package
Standards-based economies	Broad choice of processors, interconnects, and middleware Servers based on multi-core Intel Xeon and AMD Opteron processors Clusters are built to uniform, worldwide specifications.	Provides a wide range of hardware and software to meet specific needs Outstanding price-performance; dramatic performance increase in the same form factor Eases and lowers costs of implementation and use
Time-proven confidence	Fully integrated with HP warranty and support All software is tested and verified by HP and/or HP partners to run on the HP Cluster Platforms. Optional on-site systems software support, applications development and optimization, and clusters training	Provides industry-leading expertise for reduced total cost of ownership (TCO) Provides a comprehensive environment for high-performance computing Enhances the HP Cluster Platforms to achieve the best possible results

Massively scalable storage
The Storage X9000 Network Storage Systems address the challenges of accessing, analyzing, and managing data across your infrastructure. The Storage X9000 Network Storage System is a highly scalable system designed to provide a highly available clustered NAS system with over 16 Petabytes in a single name space for CIFS and NFS services. It is available in three configurations: HP Storage X9320 high-performance systems, HP Storage X9720 high-capacity systems, and HP Storage X9300 gateway. The X9000 can help with all of your HPC workloads; small or large files, and I/Os reads and/or writes, and random and/or sequential access.

For customers requiring the unique and specialized characteristics of the Lustre file system (storage optimized for large file high-bandwidth I/O, many writers to a single file, single-stream performance of sustained high-speed bandwidth) that is closely coupled to an HPC Linux cluster solution, HP offers a packaged solution incorporating DataDirect Networks (DDN) hardware.

Accelerate your innovation with specialized options
For some HPC workloads, accelerators such as general-purpose GPUs offer a cost-effective and energy-efficient option for improving performance. HP works with the leaders in accelerator hardware and software developers to characterize and test these options. For the Cluster Platform SL, with the GPU-optimized ProLiant SL250s and SL270s, the latest Tesla modules from NVIDIA are offered as an integrated and supported option. By including graphics-enabled servers, the HP Cluster Platform enables organizations to centralize their high-end 3D resources, which simplifies management, optimizes utilization, and supports collaboration.

In addition, HP Remote Graphics Software enables multiple clients to access the same visualization node, and enables low-cost clients to access high-end graphics rendered on the cluster.

Tuning and customization with HP services

You can enhance your HP Cluster Platform by choosing HP custom services. Over the years, HP and its partners have implemented best practices associated with component choice, integration, power requirements, and maintainability. Service options include on-site systems software support, applications development and tuning, and clusters training. In addition, you can choose support from the HP Consulting and Integration Services team.

Putting it all together

The HP Cluster Platforms provide integrated, customer-ready solutions with a wide range of qualified options. Further assurance is provided with our Cluster Test Suite, used to validate performance of server and network components as a complete cluster solution during factory integration, and available to our customers and partners. As an integral component of the HP Unified Cluster Portfolio, HP Cluster Platforms offer flexible choices, simple implementation, and successful results.

To achieve innovation with a dynamic, scalable infrastructure for high performance computing, visit www.hp.com/go/HPC.

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