

# Powerful HP-UX cluster technologies

Clustering with HP Integrity Servers



No matter which computing challenges you face—capability or capacity—clustered HP Integrity servers from HP will increase performance for your most challenging computational problems.

## Performance, capacity, and capability

Clustering multiple symmetric multiprocessing (SMP) nodes to form a large, scalable system is increasingly popular among engineering and technical computing users. With recent advances in interconnect technologies, system management software, and distributed-memory applications, clusters provide attractive and cost-effective solutions for the high-performance, capacity, and capability requirements of many engineering and technical computations.

## HP Integrity servers—a strong foundation for your cluster solution

HP Integrity servers provide an industry-leading foundation for your cluster environment. The HP Integrity servers provide not only more power, but also more applications, additional features, and a broader range of solutions.

Processor technology is only part of HP's performance leadership. HP completes the story with the HP Scalable Processor Chipset zx1 and the HP Super-Scalable Processor Chipset sx1000. Invented by HP, these chipsets fully unleash the power of Intel Itanium 2 processors by lowering memory latencies, increasing memory subsystem scalability, and enhancing I/O availability and throughput. The end result is excellent performance and system scalability for high performance computing workloads.

**Industry-leading ClusterPack features include the following capabilities:**

Installation and configuration	System administration—single point of administration		Distributed workload management
<ul style="list-style-type: none"> <li>• Intel Itanium 2 processor management server support</li> <li>• Automatic management processor (MP) setup</li> <li>• Automated cluster setup (multiple NICs, system files setup, and more)</li> <li>• DHCP leasing management</li> <li>• Optionally setup network services (NFS, DNS, NTP, NIS,)</li> <li>• Remote console interface launcher</li> <li>• Remote power on/off</li> </ul>	<ul style="list-style-type: none"> <li>• HP System Insight Manager</li> <li>• Automatic non-interactive boot-up of compute nodes</li> <li>• Role-based management</li> <li>• Software and patch management</li> <li>• Event monitoring service</li> <li>• User account maintenance</li> <li>• Resource control (TCP Wrappers)</li> <li>• Cluster health monitoring</li> <li>• Golden (system) image creation and distribution</li> </ul>	<ul style="list-style-type: none"> <li>• Automated cluster reconfiguration (e.g., adding or deleting compute nodes without interruption)</li> <li>• Cluster-aware common UNIX<sup>®</sup> commands</li> <li>• Optimized system cloning control</li> </ul>	<ul style="list-style-type: none"> <li>• Cluster resource scheduling</li> <li>• Policy-based queues and multiple queue management</li> <li>• Job submission, monitoring, and consistency checking</li> <li>• User-specified job priority</li> <li>• Application restart file migration</li> </ul>

**HP Unified Cluster Portfolio**

The HP Unified Cluster Portfolio (UCP) is a comprehensive, modular package of tested and pre-configured hardware, software and services for scalable computation, data management and visualization. It features flexible platforms, a wide range of open source and commercial middleware, and the latest in industry-standard technology—all with the simplicity and affordability of a factory-built, tested, and supported solution. HP-UX is one of the OS choices for HP Cluster Platform 6000 (CP6000) within the UCP family. Customers can also choose other HP Integrity servers to build their customized HP-UX clusters to meet their high performance computing requirements.

**Outstanding price/performance**

By clustering HP Integrity servers that have Intel Itanium 2 processors, you achieve industry-leading price/performance. Clustering software and interconnects allow

you to mix and match individual Itanium-based system nodes to achieve the best performance and consolidation results. A single point of system administration and job submission reduces IT costs, increases reliability, and improves user productivity.

**Capacity and capability increases**

HP Integrity servers in a cluster environment improve both computing capability and capacity. Improvements in computing capability (increased absolute performance) allow users to solve computing challenges that were too large to be explored in the past. Improvements in computing capacity (increased throughput) allow users to solve more problems in a shorter amount of time. No matter which computing challenges you face—capability or capacity—clustered Itanium-based systems from HP will increase performance for your most challenging computational problems.

	Feature	Benefit
<b>Simplicity</b>	Clusterpack Management Software	Provides a single point of access, cluster system resource control and monitoring, and distributed workload management
	Choice of management interfaces (Web-enabled GUI, X Window, CLI)	Provides multiple options for remote management
	Customizable scripts and commands	Saves time
<b>Agility</b>	Choice of InfiniBand and Gigabit Ethernet high-performance interconnects	Low latency, high bandwidth, and low CPU consumption during message-passing, multiple HCAs per server
	Secure authentication between agent and central management server	Provides confidence that communication is from an authorized user
	Role-based management	Increases security and optimizes use of IT staff skill sets and experience
	Mix and match nodes and technologies	Smooths upgrade path
<b>Value</b>	Fully integrated with HP warranty and support	Provides industry-leading expertise for reduced TCO
	Partnerships with leading suppliers of software development tools	Offers customers a powerful set of tools for developing cluster applications
	HP zx1 chipset for up to 4-way systems; HP sx1 chipset for up to 64-way systems	Scalability without sacrificing performance; Industry-leading price/performance

### High-performance interconnects

Clusters of HP Integrity servers can be highly customized and interconnected using networking technologies such as Gigabit Ethernet or high-performance InfiniBand interconnect. These choices in networking technologies allow customers to choose which cluster solution best meets their needs.

InfiniBand is an industry-standard, point-to-point switched high-performance interconnect. It is based on the

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remote direct memory access (RDMA) technology that provides protocol offloading, OS bypassing, and zero-copy capabilities to achieve very low latency and very high bandwidth message-passing between compute servers in a cluster. HP InfiniBand products are based on InfiniBand 4X specifications, with a speed of 10 Gb/s. They are supported on HP Integrity servers running HP-UX 11i v2. Up to 8 host channel adapters (HCAs) are supported per scalable HP Integrity Superdome. HP-MPI, a HP implementation of MPI standard, is supported on InfiniBand to allow both end-user customers and ISV partners to take full advantage of InfiniBand.

### Simple manageability for administrators and users

Although server clusters improve price/performance and consolidate resources, one of the biggest concerns for both IT administrators and end users is the manageability of the cluster environment. HP has solved the problems associated with managing clusters by providing the ClusterPack advanced cluster management software. The ClusterPack provides a single point of access for cluster system administration, cluster system resource control and monitoring, and distributed workload management, all through an Itanium 2-based server running HP-UX, such as the HP Integrity rx2600-2 server.

### Exceptional flexibility

All current and future Itanium-based systems running HP-UX can be part of the cluster environment.

- HP Integrity rx1620 server: 2-way with up to 16 GB of memory, 1U rack-optimized
- HP Integrity rx2620 server: 2-way with up to 32 GB of memory, 2U rack-optimized
- HP Integrity rx4640 server: 4-way with up to 128 GB of memory, 4U rack-optimized
- HP Integrity rx7620 server: 8-way with up to 128 GB of memory, 10U rack-mountable
- HP Integrity rx8620 server: 16-way with up to 256 GB of memory, 17U rack-mountable
- HP Integrity Superdome: Up to 64-way with up to 1 TB of memory, standalone cabinet

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## HP Integrity Servers Specifications



	<b>HP Integrity rx1620 Server</b>	<b>HP Integrity rx2620 Server</b>	<b>HP Integrity rx4640 Server</b>	<b>HP Integrity rx7620 Server</b>	<b>HP Integrity rx8620 Server</b>	<b>HP Integrity Superdome</b>
<b>Scalability</b>	2-way	2-way	4-way	8-way	16-way	16-, 32-, 64-way
<b>Peak FLOPS</b>	12.8 GFLOPS	12.8 GFLOPS	25.6 GFLOPS	51.2 GFLOPS	102.4 GFLOPS	409.6 GFLOPS
<b>Processor</b>	Intel® Itanium 2	Intel® Itanium 2	Intel® Itanium 2	Intel® Itanium 2	Intel® Itanium 2	Intel® Itanium 2
<b>Processor Specifications</b>	1.3 GHz w/ 3MB cache and 400MHz FSB 1.6 GHz w/ 3MB and 533MHz FSB	1.3 GHz w/ 3MB cache and 400MHz FSB 1.6 GHz w/ 3MB and 400MHz FSB 1.6 GHz w/ 6MB cache and 400MHz FSB	1.5 GHz w/ 4MB L3 cache 1.6 GHz w/ 6MB L3 cache 1.6 GHz w/ 9MB L3 cache	1.5 GHz w/ 4MB L3 cache 1.6 GHz w/ 6MB L3 cache	1.5 GHz w/ 4MB L3 cache 1.6 GHz w/ 6MB L3 cache	1.6 GHz/9 MB
<b>Maximum Memory</b>	16 GB	32 GB	128 GB	128 GB	256 GB	1024 GB
<b>Cluster Configuration</b>	CP6000	CP6000	CP6000	Custom	Custom	Custom

### Management node

Interconnect choices include the features listed below. Any HP-UX Integrity server can be used as a management node.

### Network switch

#### HP ProCurve Networking Switch 5308xl

Performance	76.8 Gbps non-blocking crossbar switching fabric
Total open slots	8 open module slots
10/100Base-T connection	24-port 10/100-TX module
100/1000Base-T connection	4-port 100/1000-T module
System dimensions	5U rack-mountable
Services	HP Integration Service available

### High-performance cluster interconnect

#### InfiniBand 4X

Performance	MPI ping-pong latency: 5.7 μs; MPI sendrecv bandwidth: 773 MB/s.
Scalability	Up to 64 nodes supported in standard configuration; higher node count support via special arrangement
Switch ports	24-port InfiniBand 4X switch. 3rd party large port count switches certified for HP-UX and available through resell and reference sale program (for more details on HP-UX certified InfiniBand switches, please visit <a href="http://www.hp.com/go/hphp">www.hp.com/go/hphp</a> )
Meshed fabric	InfiniBand switch cascading is supported.
System dimensions	InfiniBand 24-port 4X switch is a 1U form factor.
Cable length	Various cable lengths from 1 meter to 15 meters
Services	HP Integration Service available

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