

IBM @server Cluster 1350



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Highlights

- ***Can help reduce time and resources necessary to deploy Linux clusters***
- ***Provides single point-of-control to simplify management and enhance cluster availability***
- ***Offers a highly scalable solution for high-performance or commercial computing workloads and server consolidation***

Outstanding price/performance

Clustering offers significant price/performance advantages for many high-performance workloads. Linux clusters can further extend these advantages by harnessing low-cost servers and Open Source software.

Today, many businesses are building their own Linux clusters using commodity hardware, standard interconnects and networking technology, Open Source software and in-house or third-party applications. Many discover that this activity consumes considerable resources to assemble,

integrate, test, manage and support the cluster. The cost of overcoming the complexity of assembling these piece parts themselves is often far greater than the benefit gained.

Now customers can benefit from IBM's extensive experience with clustered UNIX® computers to eliminate this complexity and risk. IBM has designed the IBM @server™ Cluster 1350 to address each of these challenges. Using advanced IBM @server xSeries™ Intel® processor-based server nodes, proven cluster management software and optional high-speed interconnects, the Cluster 1350 brings together the best of IBM and third-party technology. As a result, the installation of a Linux cluster can be greatly accelerated and its management and support simplified.

The Cluster 1350 is designed to be an ideal solution for industrial, financial services, life sciences, governmental and educational organizations requiring excellent price/performance for handling high performance computing (HPC) workloads. It is also an excellent choice for applications that

require horizontal scaling capabilities such as Web serving and collaboration.

A comprehensive solution

The Cluster 1350 is a flexible, integrated offering which includes all of the hardware necessary to create a comprehensive cluster system tailored to specific customer needs. When combined with the customer's choice of Linux operating system and IBM Cluster Systems Management (CSM) for Linux software, the Cluster 1350 provides an easy to configure platform to help customers rapidly deploy cluster applications.

By reducing time and resources required for configuring, assembling, integrating, testing and tuning a Linux cluster, the Cluster 1350 can help speed time-to-production. In addition, more servers can be added at any time to handle increasing workloads, consolidate more servers or add new applications.

IBM provides hardware installation support for the Cluster 1350. Customers must separately purchase one of the Linux distributions supported by the Cluster 1350 and have the option of installing Linux and CSM themselves or contracting with IBM or

IBM Business Partners. IBM installation services may also provide planning, installation and configuration of additional cluster software including IBM General Parallel File System (GPFS) for Linux. For even higher levels of support, the optional Support Line for Linux Clusters is staffed by experts who understand the entire cluster environment, not just the individual components. These Support Line Services cover all Cluster hardware components, the Linux operating system, CSM for Linux and GPFS for Linux software.

To further simplify the deployment effort, IBM can provide project management support to coordinate all aspects of delivery and installation, including hardware and software setup services. Attractive financing and leasing terms are also available.

High-performance cluster management

IBM offers CSM for Linux, advanced cluster management software that allows a cluster of supported xSeries servers running Linux to be managed from a single point-of-control. This capability simplifies the management of the cluster and easily scales with the cluster to improve the efficiency of the system administrator.

CSM provides a single point-of-control that allows the administrator to monitor both hardware and software events. In addition, CSM will trigger automated recovery actions when appropriate. These event monitoring and automated recovery features enhance the efficiency of the administrator and the reliability of the cluster by enabling rapid problem detection and resolution.

CSM for Linux is based on the architecture and design of the IBM Parallel System Support Programs for AIX® software product, which has been deployed on the IBM RS/6000® SP™—one of the world's most popular supercomputers.

CSM is also available for AIX, and allows non-switched clusters of both IBM @server pSeries™ servers running AIX and xSeries servers running Linux to be managed from a single point-of-control. xSeries cluster nodes running CSM for Linux can also be monitored and controlled using IBM Director, the leading management software for xSeries servers.

CSM contains several components designed to make managing a Linux cluster easier:

- **Distributed management server:**
provides a persistent repository of information about each node in the cluster, and maintains the status of each node.
- **Event response resource manager:**
provides the ability to run a rich set of pre-defined commands or scripts in response to user-defined events. Cluster resources that can be monitored include nodes, adapters, file systems and processes.
- **Remote hardware control:**
utilizes the integrated systems management processor in Cluster 1350 nodes. This feature enables the administrator to remotely reset or power the node on or off.
- **Configuration file management:**
provides a repository for files that are common between the nodes. CSM synchronizes changes to configuration files across the cluster.

- **Distributed shell:**
allows commands or scripts to be run remotely on all nodes in the cluster with options for combining output from multiple servers. Distributed command execution manager is an optional graphical user interface that integrates with the distributed shell, allowing easier management of nodes and node groups.

CSM provides node grouping, which is a convenient way to apply different rules to subsets of servers in the cluster. This capability is especially important when the cluster is deployed to consolidate multiple applications.

With node grouping, administrative commands can be applied to an individual node, the entire cluster as a unit, or to groups of nodes as defined by the system administrator.

By providing a single point-of-control with robust cluster management capabilities, CSM can dramatically simplify total systems management and help increase cluster availability.

Advanced server technology

The Cluster 1350 is based on exclusive X-Architecture™ technology from IBM, which combines key availability features of IBM @server zSeries™ servers with advanced scalability features of pSeries systems. As such, these industry standard Intel processor-based servers are designed to provide enterprise-inspired power, scalability, control and service at very attractive prices.

The new enhancements to the Cluster 1350 further expand the functionality and flexibility of the original Cluster 1350 solution by incorporating a broader range of both compute and storage nodes. For those customers who demand leading-edge compute performance and manageability, the Cluster 1350 now includes the new x335 rack-dense servers with high-speed Intel Xeon processors (processor speeds up to 3.06 GHz are available.)

Those customers who value the optimal combination of performance, density, integration and investment protection can now choose IBM @server BladeCenter™ as the primary building block for their cluster system. BladeCenter combines the performance of dual Intel

Feature	Benefits
Integrated and tested hardware supported by IBM	<ul style="list-style-type: none"> • Provides validated configuration with a single point-of-contact for continuing support • Can speed the time-to-production of high-performance Linux applications
Advanced IBM @server hardware	<ul style="list-style-type: none"> • Unique X-Architecture delivers powerful, scalable and reliable Intel processor-based nodes • Revolutionary BladeCenter design delivers the optimal combination of performance, density and integration
Industry leading components	<ul style="list-style-type: none"> • Provide a greater choice in configuration • Help keep costs down without sacrificing quality or performance
CSM for Linux	<ul style="list-style-type: none"> • Dramatically simplifies total systems management by providing a single point-of-control • Enables cost-effective server consolidation solutions
General Parallel File System	<ul style="list-style-type: none"> • Offers enhanced performance through concurrent access to files from multiple nodes.

Xeon processors with a revolutionary architecture that delivers double the compute density available with traditional rack-dense 1U servers.

Finally, the enhanced Cluster 1350 offers new choices to meet the range of customers' cluster management and storage requirements. The updated x345 server provides enhanced cluster management and cluster I/O performance. And the addition of the new SAN-optimized x360 rack-dense server delivers high-performance connectivity to large capacity storage area networks.

Tested, flexible configuration

Standard configurations of the Cluster 1350 include a management node and up to 512 cluster nodes, including up to 32 optional storage

nodes that provide shared file storage. A special order process is available for customers requiring larger or other non-standard configurations.

Each Cluster 1350 also includes a management Ethernet VLAN for highly secure internode communications, a cluster Ethernet VLAN for application internode communication and a terminal server network, which provides remote console capability. The cluster comes standard with one 10/100 Mbps Ethernet switch for the management VLAN and a choice of 10/100 Mbps Ethernet switch, Gigabit Ethernet switch or Myrinet™-2000 switch for the cluster VLAN.

Compute nodes (either xSeries 335 or BladeCenter Solutions) can be configured with either single or dual Intel

Xeon™ processors, with 512MB to 8GB of memory. Each compute node can be configured with either one or two disk drives (maximum storage capacity per node depends on choice of node type). The management node also has dual Intel Xeon processors, from 512MB to 8GB of memory, up to 880GB of hot-swappable disk storage and the appropriate adapter cards for cluster management.

As previously noted, additional disk storage is available through the use of optional storage nodes, which allow additional file system storage to be configured.

For example, an x345 storage node can be configured with single or dual Xeon processors, from 512MB to 8GB of memory and up to 880GB of hot-swappable disk storage.

IBM @server Cluster 1350 at a glance

Building Block	xSeries 345	xSeries 335	xSeries 360	BladeCenter
Node type	Management/compute/ storage	Compute	Storage	Compute
Packaging	Rack drawer (2U)	Rack drawer (1U)	Rack drawer (3U)	Rack drawer (7U)
Processor	2.4 GHz w/400 MHz FSB; 2.67, 2.8 GHz w/533 MHz FSB 2-way management node, 1- or 2-way compute or storage node	2.4 GHz w/400 MHz FSB; 2.8, 3.06 GHz w/533 MHz FSB 1- or 2-way compute node	2.0 GHz 1- to 4-way storage node	2.4, 2.6, 2.8 GHz 1- or 2-way compute node
L2 cache	512KB	512KB	1MB, 2MB	512KB
RAM memory	512MB	512MB	1GB, 2GB	512MB
Disk/media bays	Six (hot-swappable)	Two (hot-swappable SCSI)	Three (hot-swappable)	Two (fixed IDE) and optionally two (hot- swappable SCSI) ³
Expansion slots	Five PCI-X (one 32-bit, four 64-bit)	Two PCI-X (64-bit)	Six active PCI-X	One expansion card connection per blade
Integrated Controllers	Ultra320 SCSI and dual Gigabit Ethernet	Ultra320 SCSI and dual Gigabit Ethernet		2 Ethernet
System connectivity management VLAN	One 10/100 Mbps Ethernet switch standard	One 10/100 Mbps Ethernet switch standard	One 10/100 Mbps Ethernet switch standard	Gigabit Ethernet switch standard
System expansion				
RAM	8GB	8GB	8GB ²	8GB
SCSI internal storage	18.2GB-880.4GB	18.2GB-293.6GB	0-220.2GB	73.4/146.8 (with optional storage expansion unit)
IDE internal storage	—	40GB-240GB	—	40GB/80GB per blade
System connectivity cluster VLAN	Choice of 10/100 Mbps Ethernet, Gigabit Ethernet, Myrinet-2000	Choice of 10/100 Mbps Ethernet, Gigabit Ethernet, Myrinet-2000	Choice of 10/100 Mbps Ethernet, Gigabit Ethernet, Myrinet-2000	Gigabit Ethernet
Adapters	Gigabit Ethernet SX Myrinet 133 MHz 10/100 Mbps Ethernet FASTT FC-2 Host adapter ServerRaid-4LX	Gigabit Ethernet SX Myrinet 133 MHz ServerRaid-4LX	Gigabit Ethernet SX Myrinet 133 MHz 10/100 Mbps Ethernet FASTT FC-2 Host adapter	Fibre Channel expansion card (HBA)
Storage	FASTT200 storage controller with EXP500 expansion FASTT700 storage controller with EXP700 expansion			
Operating systems¹	Red Hat Linux 7.3, 8.0 and AS 2.1; SuSE Linux 8.0, 8.1 and SLES 7, SLES 8			
Systems mgmt. software	CSM for Linux Version 1.3.1			
System dimensions				
42U primary/expansion rack	79.5" H x 25.5" W x 43.3" D (2019.2 mm x 647.7 mm x 1099.8 mm), 736 lbs (333.8 kg)			
x345	3.36" H x 17.5" W x 27.5" D (85.3 mm x 444.2 mm x 697.4 mm), 62 lbs (28.1 kg)			
x335	1.72" H x 17.3" W x 25.7" D (43.7 mm x 439.9 mm x 653.3 mm), 26 lbs (11.8 kg)			
x360	5.25" H x 17.4" W x 27.6" D (133.35 mm x 441.9 mm x 701 mm), 70 lbs (31.7 kg)			
BladeCenter	12" H x 17.5" W x 28" D (304.2 mm x 444 mm x 711.2 mm), 270 lbs (122.47 kg)			
Scalability	One management node is required with a minimum of 4 and a maximum of 512 total nodes. This total can include up to 32 storage nodes. Therefore, the minimum configuration includes 5 nodes (1 management node and 4 compute nodes). The maximum configuration would include 513 nodes (1 management node, 512 nodes including compute and storage nodes). Larger configurations are available via a special bid process.			
Services	Cluster 1350 hardware installation included at no charge Linux cluster software services and Support Line for Linux Clusters are available as optional fee-based service			
Warranty	Basic limited warranty on most IBM and non-IBM components: three year, next business day, on-site support. Some xSeries 335 models have a one year warranty. Enhanced warranty plans are available.			

For increased capacity, these nodes can be configured to support externally attached Fibre Channel RAID storage subsystems. For high availability, they can be configured to provide redundant paths to all data. The standard configuration can support up to 32 storage nodes. In addition, the x360 can provide SAN-optimized, high-performance connectivity to large-capacity Storage Area Networks.

A minimum of one Keyboard/Video/Mouse (KVM) switch is required with the system. Remote console support is provided through the terminal server.

Expanding possibilities

The Cluster 1350 offers a number of optional components to meet specific computing requirements, including a choice of interconnect technologies.

In addition to standard 10/100 Mbps Ethernet or Gigabit Ethernet, customers can select Myrinet-2000—scalable interconnect technology from Myricom, Inc. Myrinet is a cost-effective, high-performance packet communication and switching technology that has been widely used in

Linux operating system-based clusters. It is particularly well suited for high-performance or high-availability clustering.

Companies can also take advantage of GPFS for Linux. GPFS is a high-performance, scalable, shared-disk file system that is designed to provide fast data access from all nodes in a Linux cluster environment. Parallel applications running across multiple nodes of the cluster as well as serial applications running on a single node can readily access shared files using standard UNIX file system interfaces. Furthermore, GPFS can be configured for failover from both disk and server malfunctions.

In short, GPFS for Linux offers world-class performance, scalability and availability for file systems. It scales with the size of the Linux cluster while providing NFS export capabilities outside the cluster.

Other optional cluster components include IBM FAStT200 storage subsystems with the FAStT EXP500 expansion unit, IBM FAStT700 storage subsystems with the FAStT EXP700 expansion unit and EXP300 storage expansion. Fibre Array Storage Technology provides highly

reliable data storage for business-critical applications that require high-speed transfer and large amounts of data.

Summary

Creating a computing infrastructure is an exercise in balancing price and performance to deliver the appropriate solution for any given task.

For some high-performance workloads, the most appropriate solution is clustering. By harnessing the power of many servers in parallel, it's possible to solve computationally intense problems with an excellent price/performance ratio. Clustering can also be an excellent approach for consolidating multiple workloads, which can provide enhanced manageability and high availability.

The advent of Linux has made it possible to build powerful clustered systems using affordable, Intel processor-based hardware. It also allows organizations to tap into the growing skill base and contributions of the Open Source community.

The IBM **@server** Cluster 1350 is a comprehensive solution that can greatly simplify and speed deployment of a Linux cluster. IBM provides

a single point-of-contact for the entire cluster, not just individual components, thus reducing risk for deployment of a Linux cluster solution.

For any organization looking for the economic advantages of deploying a Linux cluster, but concerned about the time and technical resources necessary, the Cluster 1350 is the right choice.

For more information

To learn more about the IBM **@server** Cluster 1350, contact your IBM marketing representative or IBM Business Partner or visit the following Web sites:

- ibm.com/eserver/clusters
- ibm.com/ibmlink



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¹ Other Linux distributions may be available by special order. Customers must obtain the version of the Linux operating system specified by IBM; Linux and CSM may be installed by IBM, a qualified business partner or the customer.

² 16GB when 2GB SDRAM DIMMs become available.

³ Optional SCSI Storage Expansion Unit impacts the number of blade servers per chassis.