QuickSpecs
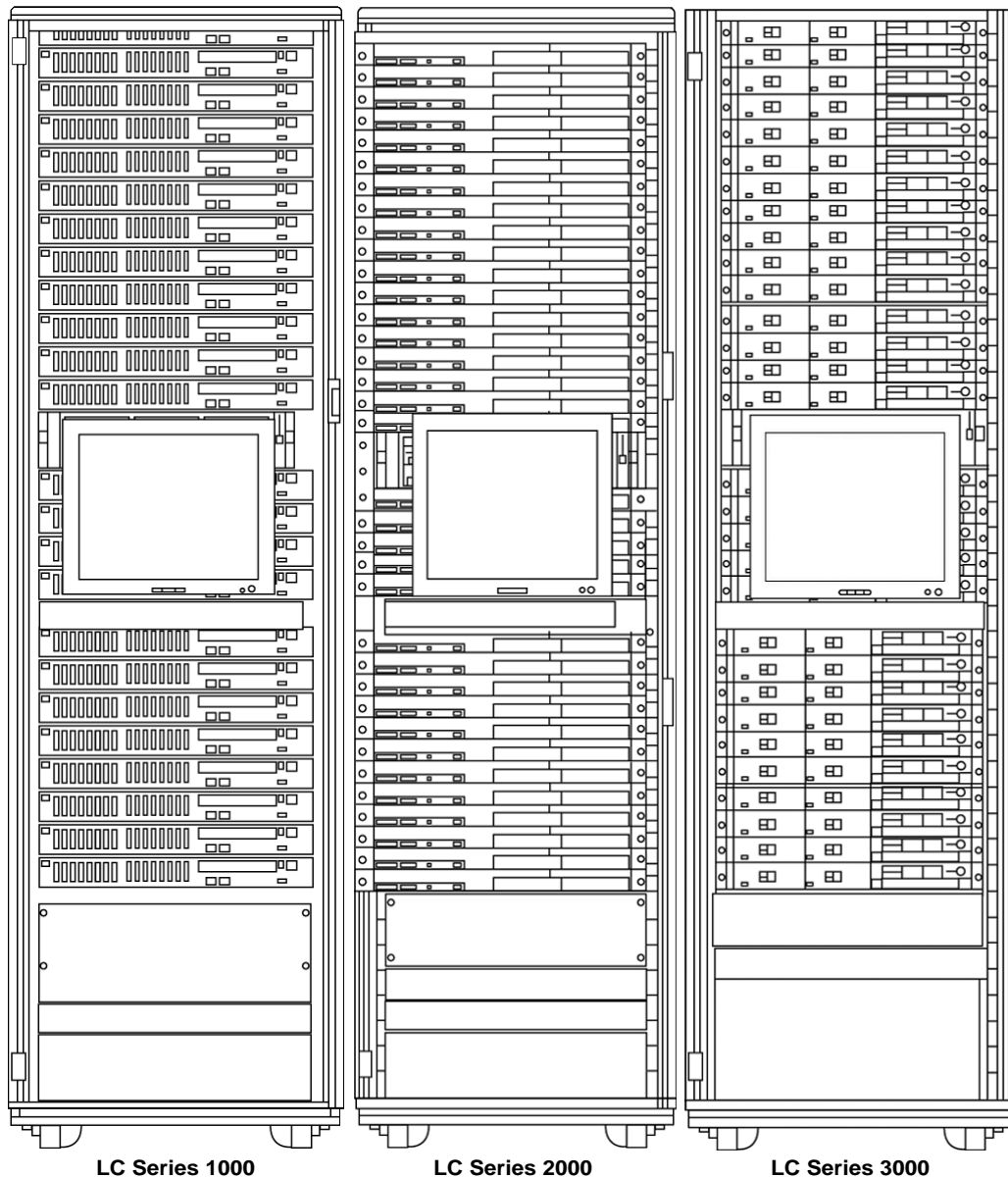
Overview

| LC Series 1000 | LC Series 2000 | LC Series 3000 |

The LC Series family of High Performance Clusters. On the left is the LC Series 1000 32 Node cluster based on the ProLiant DL140 server. In the middle is the LC Series 2000 32 Node cluster based on the ProLiant DL360 server. On the right is the LC Series 3000 32 Node cluster based on the ProLiant DL145. The ProLiant DL140 and DL145 have been announced to provide new levels of feature set and price performance for the LC Series as a complement to the original ProLiant DL360 offering giving the customer more flexibility and choice from HP. The addition of the DL140 and DL145 as LC Series compute nodes provides the broadest portfolio of any Tier 1 vendor in the High Performance Computing marketplace. The addition of the specialty priced High Performance Linux and Windows 2003 Server Operating Systems offerings for both 32 bit and 64 bit computing as well as a complement of Strategic Partner Driven software offerings for both Linux and Windows 2003 Server provide a complete integrated compute farm solution from HP.

The Hewlett Packard High Performance Clusters LC Series is a family of compute farm configurations based on HP's industry leading ProLiant 1U dense servers. The LC Series introduced with the LC 2000 Series last year has now been extended with two additional offerings: the LC Series 1000 based on the ProLiant DL140 and the LC Series 3000 based on the newly announced ProLiant DL145. The ProLiant DL140 and DL145 have been added to the ProLiant 100 Server portfolio specifically for high performance computing customers. Both offer unique characteristics focused on different customer needs.

In addition, with the restructuring of the number of single part number SKU's to three and with the edition of the LC Series Design and Configuration Guide HP offers a wider more varied number of LC Series configuration solutions providing the same turn-key implementation approach. Now with

Overview

orderable Linux and Windows Server 2003 operating system components and cluster management software using the same ordering mechanism makes the LC Series even more attractive in its ease of design and ordering.

The LC Series is designed to give the entry to mid range high performance computer customer a range of cluster performance choices. The node types and sizes and interconnect options to satisfy a range of uses and application environments from 16 node non blocked switched 10/100 Fast Ethernet clusters to 128 node high bandwidth low latency message passing clusters using the de facto compute cluster interconnect standard Myrinet 2000 Fibre NIC's and Switches. The unique design of the ProLiant DL line, developed for dense computing, minimizes components that are not needed for compute farm use. The DL140 provides IA32 Xeon DP performance with minimal management overhead and expandability. It was designed to add memory to four GB in four Memory DIMMs and an additional 80GB ATA drive for scratch disk operations. The DL145 provides Opteron 200 performance with added IPMI 1.5 manageability and up to eight GB DDR 2700 memory per processor as well as an option for an additional 40 or 80GB ATA disk. The DL360 is the enterprise featured server with IA32 Xeon DP processors and interleaved memory, combined with the built in reliability and remote management capabilities that make the DL360 an industry leader in commercial and now technical computing applications.

The Hewlett Packard High Performance Clusters LC Series supports the industry-standard Enterprise Linux distributions from Red Hat and Novell. In addition, HP has negotiated a special High Performance Computing Enterprise Edition from both Red Hat and Novell for LC Series 32 bit and 64 bit Compute nodes, bringing cost effective enterprise Linux software to the LC Series. The newly announced Microsoft Windows Server 2003 Standard Edition for High Performance Computing for base operating systems support is also provided for LC Series Compute nodes when combined with a regular priced Windows Server 2003 Server used on the LC Series Control node.

We also provide a Linux HPTC cluster manager: Scali Manage, as well as Linux GRID Managers. United Devices GRID Manager with associated Client licenses for AIX, Solaris, Microsoft and Linux client machines. Axceleon Enfuzion parametric scheduler and job manager providing a wide range of client attachability and extended computing capability. In support of scalable or serial cluster based applications, we also offer the Meiosys Metacluster HPC virtualization offering for application checkpoint restart as well as a job and work management offering from Altair Engineering - PBS Pro. Engineered Intelligence CxC parallel development utility and run time system environment as well as their MPI X/F protocol stack have been added as orderable software options.

These partner-developed applications have been certified to operate on these clusters and are available to be installed on the LC Series thru our HP factory integration services. In addition, the NPACI/SDSC ROCKS freeware cluster management offering can also downloaded from the SDSC Web site and installed as a custom cluster installation.

The HP Consulting & Integration Services organization also offers a range of service engagements that have been developed for the LC Series. These offerings range from on site planning and architecture consulting, software installation and training and on site cluster education and administration training. Following are sample performance measurements tested on both the LC1000 Series and LC 2000 Series clusters. As HP offers a range of price performance options which can be ordered either as a stand alone 32 Node cluster SKU for the ProLiant DL140, DL145 or DL360 or over 180 different configuration combinations using the LC Series Design and Configuration Guide. These matrices are included to provide you with a range of cluster size and performance. The LC 1000 matrix used the ProLiant DL140 3.0GHz processor in one and two processor configurations. The LC 2000 matrix used the ProLiant DL360 3.0GHz processor in one and two processor configurations on early production models. Results will vary and this data is included to provide a rule of thumb assessment.

At A Glance

- The HP High Performance Clusters LC Series is a range of Xeon DP and Opteron 200 Pre-configured Compute Cluster SKU's. These single SKU compute clusters are offered as a complete unit, assembled, integrated, tested and shipped ready for immediate use. The LC Series supports three different cluster configurations based on the type of ProLiant Compute Node desired each offering a different HPC value. These SKU's can be ordered with two Cluster Interconnect Options: Gigabit Ethernet or Myrinet. Designed for moderate to high computational applications, the user can select either Ethernet or Myrinet communications depending upon their application need for high speed inter node communications and latency. The LC Series cluster SKU's utilize the Xeon DP 3.0GHz processors in the ProLiant DL380, ProLiant DL140 and DL360. In the LC Series 3000, the ProLiant DL145 supports the Opteron 200 Series chip set at 2.2 GHz. These processors can be substituted with the newly announced ProLiant DL380 G4, DL360 G4 and ProLiant DL145 SCSI model thru the Factory Express Custom Solution Design process and using the LC Series Design and Configuration Guide for the LC Series 2000 and LC Series 3000.

  Using the LC Series Design and Configuration Guides, available on the web at http://www.docs.hp.com/ , you have over 180 choices of cluster configurations to choose from. The Design and Configuration Guide allows the customer to define their own cluster configuration from 16 to 128 compute nodes (DL140, DL360 or DL145) with a range of processor speeds, disk capacities, cluster interconnect choices, as well as optional operating system, cluster management, GRID management, job management, and development software offerings. For the control node, the customer chooses a DL380 for the LC1000 and LC2000 Series clusters and either a DL380 or a DL145 for the LC3000 Series clusters. These configurations when ordered, will be assembled, integrated, tested and shipped ready for immediate use as the above manufacturing methods proven for the initial LC Series and the newly announced LC Series 1000 and 3000 SKU's. In addition, a required component for these clusters is the LC Series Configuration Resource Kit, which contains all the manufacturing, network address, and cabling information for quick reassembly in the customer location after shipment from the HP factory. This kit developed during the initial LC 2000 introduction was found to be a great implementation tool when the cluster was ready for customer introduction, providing comprehensive cabling diagrams for efficient cluster interconnect network communications as well as for in band and out of band management. The LC Series 32 Node SKU's, referenced above, are designed for easy ordering and quick implementation. The LC Series Design and Configuration Guide solutions allow for an almost limitless configuration design. From 16, 32, 48, 64, 80, 96, 128 Compute nodes and Custer Interconnect of 10/100 Fast Ethernet, Gigabit Ethernet, and Myrinet XP gives the customer a wide range of nodal and communication choices. In addition the processor types also offer a range of functional difference from a cost efficient Xeon DP processor in the ProLiant DL140 offering the most cost effective GFLOP with minimal management overhead and designed specifically for HPC with clock

Overview

speeds of 2.4, 3.0. 3.2 GHz to the DL360 also based on the Xeon DP processor with enterprise class reliability and sophisticated remote management capabilities as well as enterprise SCSI storage and redundancy in power and cooling for uptime performance in long computational jobs. The DL360 also offers clock speeds from 2.8, 3.0 and 3.2 GHz. The ProLiant DL145, newly announced using the Opteron 248 and 250 Chip sets offers clock speeds of 1.6, 1.8, 2.2 , and 2.4 GHz performance with increased memory performance based on the Opteron integrated memory controller and Hyper transport communications within the system complex.

Each HP LC Series Cluster SKU is composed of:

- One ProLiant DL380 Control node/Management server - one Xeon DP - 3.06GHz processor, one GB DDR memory, as a base configuration starting point. This Control node is used as the interface to the user community for job dispatch, control, monitoring and job completion within the cluster. As this is a basic configuration with only one processor, minimal memory, and no embedded disks, the DL380 Control node can be expanded to two processors, up to 12 GB of memory and up to 756GB of Ultra 320 SCSI Disk Storage. In addition, the customer may wish to install additional NIC's as one of the on board NIC's is used by the LC Series In Band Management network.
- 32 ProLiant DL140, DL145, or DL360 Compute nodes - the DL140 has one Xeon DP - 3.06GHz processor and, one GB DDR memory as a base configuration starting point. The DL360 has one Xeon DP - 3.06 GHz processor and 512 MB of memory in its base configuration. The DL140 comes with an integrated 80GB ATA disk in the base node configuration. The ProLiant DL145 comes with one Opteron 2.2GHz processor and two GB DDR 2700 memory and one integrated 40GB ATA disk. Each Compute node has unique optional features as follows: The DL140 has an additional processor, up to 3GB of additional memory, an additional 80GB ATA disk as well as optional CD-ROM, but does come equipped with four USB ports which have been engineered in for portable USB devices such as a Floppy Drive, CD drive or other USB type devices. The DL145 also has an optional 2nd processor with up to 14GB additional memory, an additional ATA drive slot for either a 40 or 80GB ATA disk. The ProLiant DL360 can add an additional processor, up to 8 GB of DDR2100 memory, up to two hot plug SCSI Ultra 320 disk drives from 18.2 to 146GB and well as a range of network adapters.
- Cluster network communications consist of three networks. A primary Cluster Interconnect which can be either a Gigabit Ethernet or Myrinet 2000 option. The Cluster Interconnect is used to provide uninterrupted message passing and data between Compute nodes and is critical to the performance of your LC Series cluster. In addition the LC Series supports an In Band Management network using a ProCurve 2828 48 Port Gigabit Switch as well as a ProCurve 2650 Switch for Out of Band Management for the LC2000 and LC 3000 Series. The LC 1000 Series uses the Cyclades ATP0190 for Out of Band Management and Serial Terminal Serving.
- One R10000 Rack, three 24Amp for NA and Japan, and 32Amp for Europe, High Voltage PDU's, and rack-mount keyboard and rack monitor
- Optional software can be ordered and installed. The following 32 bit base operating system software: Red Hat EL 3 and SUSE SLES8 for LC Series Control nodes and Red Hat WS3.0 HPC Edition and SUSE 8 HPC Edition for LC Series Compute nodes. This Linux software comes with HP Incident support as well as 1 yr or 3 yr subscription services from Red Hat or Novell. Scali Manage / Connect are also supported for Linux based configurations. For customers interested in a Windows Server in an LC Series implementation, the newly announced Microsoft Windows Server 2003 Standard Edition for High Performance Computing as well as Windows Server 2003 - Standard Edition can be installed and tested prior to customer shipment.
- Newly announced 64 bit Linux base operating systems and HPC Editions can now be ordered and installed as well for both Red Hat and SUSE SLES9 specifically for the DL145 and DL585. This Linux software comes with HP 1yr 10 Incident support as well as 1 yr or 3 yr subscription services from Red Hat or Novell.
- Scali Manage / Connect for TCP/IP and Myrinet have been expanded to include Infiniband interconnect as well as educational offerings for higher education and university projects: which has been extended is also supported for Linux based configurations.
- For customers interested in a Windows Server in an LC Series implementation, the newly announced Microsoft Windows Server 2003 Standard Edition for High Performance Computing as well as Windows Server 2003 - Standard Edition can be installed and tested prior to customer shipment.
- All NA assembly for the LC Series SKU's uses HP's Factory Express process. The final product is integrated, tested and shipped as a single unit on a shock proof pallet completely assembled and ready for use. A similar service is offered in EMEA.
- Additional Partner Driven software options ordered thru HP and listed in the document: or customer software can also be installed, as well, providing a complete turn key experience, again at an additional charge through the American Integration Center or through the European Custom Solutions process.
- Additional Myrinet Interconnect NICs and expanded Switch also are being announced to supplement the current Myricom interconnect offerings in the LC Series Design Guide for clusters greater then 128 compute nodes or wanting dual port cluster interconnect.
- As referenced above, over 180 reference configurations can be designed configured and ordered using the LC Series Design and Configuration Guide. These configurations, although not a single SKU, are assembled using the same components listed above and are dependent on the type of Compute node chosen. With either an LC Series cluster SKU or a configured LC Series cluster from the LC Series Design and Configuration Guide, the customer will receive an LC Series Configuration Resource Kit containing: Server BIOS settings, Switch Settings and Addresses, Racking and Cabling layouts and diagrams, Data CD with cluster basic information, and Cluster Documentation and Set up Guide. This Configuration Resource Kit provides for ease of turnkey operation as well as support for HP Service personnel in the event of a service issue.
- Optional storage configuration options have also been designed to complement the LC Series of high performance clusters. These are defined in the LC Series Design and Configuration Guide as well. The seven configurations range from a simple NFS Server configuration using simple SCSI JBOD to Global File Systems solutions up to 48TB of Fibre Channel attached SCSI disks. These are also defined later in the document with associated Partner Driven software from PolyServe as an HP orderable option.

QuickSpecs

Overview

Performance Matrices

LC 1000 Series Model Matrix								
	Based on ProLiant DL140 2.8 GHz Servers	**Processors / Node**	**Memory / Node**		**Disk / Cluster**		**GFLOPS/ Cluster***	
Cluster	**Interconnect**		**Base**	**Max**	**Min GB**	**Max GB**	**1P**	**2P**
1 Control Node, 16 Compute Nodes								
	10/100 Fast Ethernet	2	1GB	4GB	131.6	329.6	**35.7**	**65.0**
	Gigabit Ethernet	2	1GB	4GB	131.6	329.6	**44.9**	**82.2**
	Myrinet 2000	2	1GB	4GB	131.6	329.6	**51.1**	**95.2**
1 Control Node, 32 Compute Nodes								
	10/100 Fast Ethernet	2	1GB	4GB	292	585.6	**68.6**	**137.6**
	Gigabit Ethernet	2	1GB	4GB	292	585.6	**87.1**	**177.0**
	Myrinet 2000	2	1GB	4GB	292	585.6	**102.8**	**213.4**
1 Control Node, 64 Compute Nodes								
	10/100 Fast Ethernet	2	1GB	4GB	515.6	1097.6	**131.6**	**237.5**
	Gigabit Ethernet	2	1GB	4GB	515.6	1097.6	**164.6**	**298.4**
	Myrinet 2000	2	1GB	4GB	515.6	1097.6	**205.7**	**384.1**
1 Control Node, 128 Compute Nodes								
	10/100 Fast Ethernet	2	1GB	4GB	1028	3616	**246.8**	**444.6**
	Gigabit Ethernet	2	1GB	4GB	1028	3616	**309.1**	**558.5**
	Myrinet 2000	2	1GB	4GB	1028	3616	**427.8**	**798.3**
*NOTE: Approximate GFLOPS based on Linpack N*N Calculations								

LC 2000 Series Model Matrix									
	Based on ProLiant DL360 2.8 GHz Servers	**Processors /Node**		**Memory/Node**		**Disk/Cluster**		**GFLOPS/Cluster***	
Cluster	**Interconnect**	**Base**	**Max**	**Base**	**Max**	**Min GB**	**Max GB**	**1P**	**2P**
1 Control Node, 16 Compute Nodes									
	10/100 Fast Ethernet	1	2	1GB	5GB	36.4	5135.2	**39.7**	**72.3**
	Gigabit Ethernet	1	2	1GB	5GB	36.4	5135.2	**49.9**	**91.4**
	Myrinet 2000	1	2	1GB	5GB	36.4	5135.2	**56.8**	**105.7**
1 Control Node, 32 Compute Nodes									
	10/100 Fast Ethernet	1	2	1GB	5GB	36.4	9813.6	**76.2**	**137.6**
	Gigabit Ethernet	1	2	1GB	5GB	36.4	9813.6	**96.8**	**177.0**
	Myrinet 2000	1	2	1GB	5GB	36.4	9813.6	**114.3**	**213.4**
1 Control Node, 64 Compute Nodes									
	10/100 Fast Ethernet	1	2	1GB	5GB	36.4	19170.4	**146.3**	**263.8**
	Gigabit Ethernet	1	2	1GB	5GB	36.4	19170.4	**182.8**	**331.3**
	Myrinet 2000	1	2	1GB	5GB	36.4	19170.4	**228.5**	**426.8**
1 Control Node, 128 Compute Nodes									
	10/100 Fast Ethernet	1	2	1GB	5GB	36.4	37884	**274.3**	**494.0**
	Gigabit Ethernet	1	2	1GB	5GB	36.4	37884	**347.2**	**614.4**
	Myrinet 2000	1	2	1GB	5GB	36.4	37884	**475.4**	**887.0**
*NOTE: Approximate GFLOPS based on Linpack N*N Calculations									

Models

LC 1000 32-node Configuration-base offering
350060-002 – NA
350060-422 – EMEA

The LC 1000 Series 32 Node cluster consists of: a DL380 Control node/Management Server, 32 DL140 Compute nodes, 1 HP ProCurve 2848 Non-Blocking Gigabit Ethernet Switch, 1 Cyclades ATP0190 Terminal Server Switch, a Rack-mount keyboard/ mouse and monitor, and 3, 24 or 32Amp PDU's in a R10642 (42U) Rack. The ProCurve 2848 switch provides for an additional 16 ports allowing additional nodes to be added to the cluster without replacing or adding additional switches or as access to file system servers as the main gateway for cluster data from a storage facility as a complement to the 32 node cluster.

The customer can order additional processors, memory and disk options and Operating System and Cluster Management software for the LC Series SKU. Any additional requirements must be configured and ordered through the LC Series Design and Configuration Guide and go through the American Integration Center or European Custom Solutions (EMEA HPTC Competency Center) process.

This model is designed as a low cost compute cluster using HPC designed compute nodes with Xeon DP optional 2P processor availability and up to 4GB optional DDR2100 memory. In Band Management is handled thru the ProCurve 2848 Gigabit Ethernet switch for cluster monitoring, management and optional storage subsystem access.
The LC 1000 is designed for users who do not need additional server features as offered in the ProLiant DL360 and are focused on the pure price performance. Customers will use simple administrative tools and utilities for In Band as well as Terminal Services for Out of Band Management. The Cyclades ATP0190 provides for local or remote CLI terminal services with local node administration thru the Control Node console or remote thru a telnet login to the Control Node via the Integrated Lights Out Service co-processor or directly to the Compute node providing administrative services and simple reboot capability. Additional node control thru the LC 1000 ProLiant DL380 Control Node also provides sophisticated GUI based management or text based administrative control as an alternative.

Gigabit Ethernet Cluster Interconnect Option Kit
361801-B21

Myrinet Cluster Interconnect Option Kit
361802-B21

A Cluster Interconnect option is required and the customer has a choice within the LC 1000 SKU to order either Gigabit Ethernet or Myrinet 2000 support. This option adds a Myricom 9 Slot chassis and back plane to the cluster and four Myricom 8 Port Gigabit Ethernet Line Cards or four Myricom Myrinet 2000 8 Port Line cards plus the Myricom SNMP Network Monitoring card for management and administration. For users who wish to operate using the Myrinet High Speed interconnect, they must also order the Myricom Myrinet 2000 adapters, which are an option and required with the Myrinet 2000 selection.

Gigabit Ethernet interconnect uses one of the onboard NIC ports on the Compute nodes so no additional options need to be ordered for this solution. The Myricom 9 Slot Chassis allows for expansion to 64 Compute nodes without having to replace the Network Chassis. The customer can extend their cluster by ordering an additional 32 Compute Nodes, rack and associated In Band and Out of Band Switches as well as four additional 8 Port Line cards of their choosing.

If the customer wishes a 10/100 Fast Ethernet Cluster Interconnect, or any additional nodes, or optional features they must use the LC Series Design and Configuration Guide for order purposes.

QuickSpecs

Models

LC 2000 32-node Configuration-base offering
361364-002 – NA
361364-422 – EMEA

The LC 2000 Series 32-node cluster consists of: a DL380 Control node/Management Server, 32 DL360 Compute nodes, 1 HP ProCurve 2848 Non-Blocking Gigabit Ethernet Switch, 1 HP ProCurve 2650 10/100 Fast Ethernet Switch, a Rack-mount keyboard/ mouse and monitor, and 3, 24 or 32Amp PDU's in a R10642 (42U) Rack.

The customer can order additional processors, memory and disk options and Operating System and Cluster Management software for the LC Series SKU. Any additional requirements must be configured and ordered through the LC Series Design and Configuration Guide and go through the American Integration Center or European Custom Solutions (EMEA HPTC Competency Center) process.

This model is designed as a high performance compute cluster using enterprise designed compute nodes with Xeon DP optional 2P processor availability, up to 8GB optional memory and from 18.2 to 292.4 GB optional hot plug SCSI disk storage with onboard RAID. In Band Management is handled thru the ProCurve 2848 Gigabit Ethernet switch for cluster monitoring, management and optional storage subsystem access. The HP ProCurve 2650 Switch is used for Out of Band Management with the ProLiant on board Integrated Lights Out (iLO) Service co-processor for sophisticated remote cluster administration and remote power sequencing.

The LC 2000, designed for users who require enterprise features in the Compute node. provides optional redundancy for power and cooling, hot plug disk drives, as well as ProLiant management agents and health driver support over what is provided in the DL140. The DL360 provides up to 6.4GFLOPs and over 5.0GFLOP sustained performance with its interleaved memory support, providing 8-11% better node performance over the DL140

Gigabit Ethernet Cluster Interconnect Option Kit
361801-B21

Myrinet Cluster Interconnect Option Kit
361802-B21

A Cluster Interconnect option is required and the customer has a choice within the LC 2000 SKU to order either Gigabit Ethernet or Myrinet 2000 support. This option adds a Myricom 9 Slot chassis and back plane to the cluster and four Myricom 8 Port Gigabit Ethernet Line Cards or four Myricom Myrinet 2000 8 Port Line cards plus the Myricom SNMP Network Monitoring card for management and administration. For users who wish to operate using the Myrinet High Speed interconnect, they must also order the Myricom Myrinet 2000 adapters, which are an option and required with the Myrinet 2000 selection.

Gigabit Ethernet interconnect uses one of the onboard NIC ports on the Compute nodes so no additional options need to be ordered for this solution. This Myricom 9 Slot Chassis allows for expansion to 64 Compute nodes without having to replace the Network Chassis. The customer can extend their cluster by ordering an additional 32 Compute Nodes, rack and associated In Band and Out of Band Switches as well as four additional 8 Port Line cards of their choosing. If the customer wishes a 10/100 Fast Ethernet Cluster Interconnect, they must use the LC Series Design and Configuration Guide for order purposes.

QuickSpecs

Models

LC 3000 32-node Configuration-base offering
361363-002 – NA
361363-422 – EMEA

The LC 3000 Series 32-node cluster consists of: a DL380 Control node/Management Server, 32 DL145 Compute nodes, 1 HP ProCurve 2848 Non-Blocking Gigabit Ethernet Switch, 1 HP ProCurve 2650 10/100 Fast Ethernet Switch, a Rack-mount keyboard/ mouse and monitor, and 3, 24 or 32 Amp PDU's in a R10642 (42U) Rack.

The customer can order additional processors, memory and disk options and Operating System and Cluster Management software for the LC Series SKU. Any additional requirements must be configured and ordered through the LC Series Design and Configuration Guide and go through the American Integration Center or European Custom Solutions (EMEA HPTC Competency Center) process.

This model is designed to provide the highest memory bandwidth and capacity performance in the LC Series family. Using the newly announced Opteron 200 series chip set in the ProLiant DL145 as a high performance compute node, the LC 3000 offers optional 2P processor availability, up to 16GB optional memory and a 40 to 80 GB optional ATA disk. In Band Management is handled thru the ProCurve 2848 Gigabit Ethernet switch for cluster monitoring, management and optional storage subsystem access. The HP ProCurve 2650 Switch is used for local or remote Out of Band Management with the ProLiant DL145's IPMI 1.5 management capabilities. The system administrator can also use remote telnet login to the Control Node via the Integrated Lights Out Service co-processor or directly to the Compute node providing administrative services and simple reboot capability. Additional node control thru the LC 3000 ProLiant DL380 Control Node also provides sophisticated GUI based management or text based administrative control as an alternative.

The LC 3000, designed for users who require the best on board nodal performance in a 32 to 64-bit scale up environment, provides enhanced memory management and hyper transport facility of the Opteron 200 chip set allowing for superior performance in most applications. Combined with the ability to run both 32 and 64 bit applications within a single compute farm is unique. In Band and Out of Band management is comparable to the other LC Series solutions. The LC 3000 Series family uses IPMI 1.5 for Out of Band support to provide remote access and power on capability.

Gigabit Ethernet Cluster Interconnect Option Kit
361801-B21

Myrinet Cluster Interconnect Option Kit
361802-B21

A Cluster Interconnect option is required and the customer has a choice within the LC 3000 SKU to order either Gigabit Ethernet or Myrinet 2000 support. This option adds a Myricom 9 Slot chassis and back plane to the cluster and four Myricom 8 Port Gigabit Ethernet Line Cards or four Myricom Myrinet 2000 8 Port Line cards plus the Myricom SNMP Network Monitoring card for management and administration. The user must also order the optional Myricom Myrinet 2000 adapters that are required with the Myrinet 2000 selection.

Gigabit Ethernet interconnect uses one of the onboard NIC ports on the Compute nodes so no additional options need to be ordered for this solution. This Myricom 9 Slot Chassis allows for expansion to 64 Compute nodes without having to replace the Network Chassis. The customer can extend their cluster by ordering an additional 32 Compute Nodes, rack and associated In Band and Out of Band Switches as well as four additional 8 Port Line cards of their choosing.

QuickSpecs

Systems/Options - LC Series Control Node

DL380 G3 Control Node Basic Specifications

Basic Model Description	Xeon DP single processor 3.06GHz/512KB
	1024 MB Memory standard (2 x 512 MB), 12 GB Memory maximum
	Up to 6 optional 1" SCSI hot plug hard drives
	Two NC7781 embedded PCI-X Gigabit NIC's 10/100/1000 WOL (Wake on LAN)
	Integrated Smart Array 5i Plus Controller
	Integrated ATI Rage XL Video Controller with 8MB Video Memory
	Dual Processor capability
	Xeon processors have a 533MHz FSB
	Square-holed rapid deploy rail kit
	Integrated Lights-Out (iLO) remote management embedded service coprocessor
	For a complete listing of server information and options see: http://h18000.www1.hp.com/products/quickspecs/11473_div/11473_div.HTML

DL380 G3 Control Node Options

Processors	Xeon 3.06 GHz-512KB Processor Option Kit	257916-B21

Memory	**Up to two additional memory increments from 1 to 8 GB. The DL380 supports up to 12GB of memory but will require replacement options for current memory supplied. With just adding memory options, the DL380 Control Node can support up to 9GB of memory**	
	1024MB of Advanced ECC PC2100 DDR SDRAM DIMM Memory Kit (2x512 MB)	300679-B21
	2048MB of Advanced ECC PC2100 DDR SDRAM DIMM Memory Kit (2x 1024 MB)	300680-B21
	4096MB of Advanced ECC PC2100 DDR SDRAM DIMM Memory Kit (2x 2048 MB)	300682-B21

Internal Disk Drives	**Up to 6 Universal Ultra 320 Hot Plug Drives**	
	72.8GB 10,000 rpm, U320 Universal Hard Drive (1")	286714-B22
	146.8GB 10,000 rpm, U320 Universal Hard Drive (1")	286716-B22
	300.0GB 10,000rpm, U320 Universal Hard Drive (1")	350964-B22
	36.4GB 15,000 rpm, U320 Universal Hard Drive (1")	286776-B22
	72.8GB 15,000 rpm, U320 Universal Hard Drive (1")	286778-B22

Network Interface Controllers	NC6170 Dual Port PCI-X 1000SX Gigabit Server Adapter	313879-B21
	NC6770 PCI-X Gigabit Server Adapter, 1000	244949-B21
	NC7170 Dual Port PCI-X 1000T Gigabit Server Adapter	313881-B21

Systems/Options - LC Series Control Node

Operating Systems	**Linux Enterprise Distribution 32 bit Support**	
	Red Hat Enterprise Linux ES 3 1-2CPU 1 Year All	351374-B21
	Red Hat Enterprise Linux ES 3 1-2CPU 3 Year All	351375-B21
	Red Hat Enterprise Linux ES 3 1-2 CPU 1 year pre install	365176-B21
	Red Hat Enterprise Linux ES 3 1-2 CPU 3 year pre install	365176-B22
	Red Hat Enterprise Linux AS 3 1-8CPU 1 Year All	351372-B21
	Red Hat Enterprise Linux AS 3 1-8CPU 3 Year All	351373-B21
	SUSE Linux Enterprise Server 8 for x86, 32 bit Support	
	SUSE LINUX Enterprise Server 8 (application worldwide): - 1-2 CPU 1 Year	344074-B21
	SUSE LINUX Enterprise Server 8 (application worldwide): - 1-2 CPU 3 Years	344075-B21
	Microsoft Windows Server 2003	
	Microsoft Windows Server 2003, Standard Edition with 5 client access licenses, English	339105-B21
	Microsoft Windows Server 2003, Web Edition with 25 client access licenses, English	339233-B21

LC Series Infrastructure Software: Following are partner driven software offerings that are applicable to LC Series pre-defined Cluster SKU's or can be used through the LC Series Design and Configuration Guide to further enable your LC Series cluster implementation. These products can be purchased thru our partners today or ordered thru HP beginning in September.

Linux Cluster Managers	Scali Manage/Connect For TCP/IP	359960-B21
	Scali Manage/Connect For Myrinet	359962-B21
	Scali Manage/Connect For Infiniband	359963-B21
	Scali Manage/Connect For TCP/IP - Educational Edition	372754-B21
	Scali Manage/Connect For Myrinet for Educational Edition	372755-B21
	Scali Manage/Connect For Infiniband for Educational Edition	372753-B21

Linux GRID Managers	United Devices Grid MP Manager for LC Series	359969-B21
	Axceleron Enfuzion 8.0 Grid Manager For LC Series	359970-B21

Linux Job Managers	Altair PBS PRO for LC Series	359968-B21

Linux Development Tools	Engineered Intelligence Enablement Pack for Linux - LC Series	359964-B21
	Engineered Intelligence CxC RTE LC Compute Nodes-16 2P Lic	361941-B21
	Engineered Intelligence CxC RTE LC Compute Nodes-16 1P Lic	361940-B21

Windows 2003 Development Tools	Engineered Intelligence Enablement Pack for Windows 2003 - LC Series	359966-B21
	Engineered Intelligence CxC RTE LC Compute Nodes-16 2P Lic	361941-B21
	Engineered Intelligence CxC RTE LC Compute Nodes-16 1P Lic	361940-B21

Cluster MPI Library	Engineered Intelligence MPI-XF Linux Enablement Pack LC Series	361939-B21
	EI MPI-XF Parallel Library LC Compute Nodes-16 2P Lic	361943-B21
	EI MPI-XF Parallel Library LC-Compute Nodes 16 1P Lic	361942-B21

Linux Checkpoint Restart	Meiosys MetaGRID Cluster HPC	372758-B21

Systems/Options - LC Series Control Node

Systems/Options - LC Series Compute Nodes

LC Series 1000 - DL140 Compute Node Basic Specifications

Basic Model Description	• ProLiant DL140 supporting Xeon DP single processor 3.06GHz/512KB 1-GB of PC2100 DDR SDRAM running at 266MHz with Advanced ECC capabilities, expandable to 4 GB
	• Integrated Dual Broadcom 10/100/1000 NICs (Wake on LAN and PXE capable)
	• Integrated Dual Channel Ultra ATA/100 Adapter (ATA Models)
	• Support for up to two 1" ATA/100 Non Hot Plug hard drives
	• One PCI-X 64-bit/133MHz PCI slot operating at 3.3 volts
	• Internal storage capacity of up to 160 GB (2 x 80-GB non-hot plug 1" ATA/100 HDDs)
	• Integrated ATI Rage XL with 8MB SDRAM video
	• 325W Power Supply (Non-Hot Plug, auto switching)
	• Four USB ports (two rear, two front)
	• ROM Setup Utility
	• For a complete list of server information and options see: http://h18000.www1.hp.com/products/quickspecs/11473_div/11473_div.HTML

DL140 Compute Node Options

Processors	Xeon DP 3.06 GHz-512KB Processor Option Kit	359047-B21

Memory (DIMMs)	1024MB of Advanced ECC PC2100 DDR SDRAM DIMM Memory Kit (1 x 1024 MB)	351109-B21
	512MB of Advanced ECC PC2100 DDR SDRAM DIMM Memory Kit (1 x 512 MB)	351108-B21

Optical Drives	24x CD-ROM Option Kit	349046-B21

Communications	Myrinet -Fiber/PCI-X interface, M3F-PCIXD-2	257894-006
	Myrinet 2XP PCI-X ,Fiber,E-series,4MB	373983-B21
	Myrinet 2XP PCI-X ,Fiber,E-series,2MB	360040-B21
	HP ProLiant NC1020 Cu Gigabit Server Adapter 32 PCI Single Port	353377-B21
	NC7771 PCI-X 10/100/1000-T Server Adapter	290563-B21

Operating Systems (stand-alone)

Linux Distribution Support	**NOTE:** The following 32 bit Operating Systems are compatible with HP ProLiant servers DL360, DL145, and DL140 and are orderable today and available for factory installation. We recommend ordering the High Performance 8 Pack versions beginning in May.	
	Red Hat Enterprise Linux ES 3 1-2CPU 1 Year	351374-B21
	Red Hat Enterprise Linux ES 3 1-2CPU 3 Year	351375-B21
	SUSE LINUX Enterprise Server 8 (application worldwide): - 1-2 CPU 1 Year	344075-B21

Systems/Options - LC Series Control Node

Operating Systems (factory installed)

Linux Distribution Support **NOTE:** The following 32 bit Operating Systems are compatible with HP ProLiant servers DL360, DL145, and DL140 and are specifically priced for High Performance clusters in packages of 8 registration licenses per copy. The first Operating System 8 Pack consists of Media, documentation, 8 license registration cards. The second 8Pack consists of 8 license registration cards.

Red Hat WS 3 - 1 Year Subscription	
Base: 8 pack & Media for ProLiant (32 bit)	366313-B21
HP Services 10 incident call pack, per cluster Phone	U3402A
HP Services 10 incident call pack, per cluster Electronic	U3402E
NOTE: Required 1 per cluster	
Additional 8 pack for ProLiant (32 bit)	359971-B21
Red Hat WS 3 - 3 Year Subscription	
Base: 8 pack & Media for ProLiant (32 bit)	366316-B21
HP Services 10 incident call pack, per cluster Phone	U3402A
HP Services 10 incident call pack, per cluster Electronic	U3402E
NOTE: Required 1 per cluster	
Additional 8 pack for ProLiant (32 bit)	359972-B21
SUSE SLES 8 HPC - 1 Year Subscription	
Base: 8 pack & Media for ProLiant (32 bit)	366319-B21
HP Services 10 incident call pack, per cluster Phone	U9935A
HP Services 10 incident call pack, per cluster Electronic	U9935E
NOTE: Required 1 per cluster	
Additional 8 pack for ProLiant (32 bit)	359973-B21
SUSE SLES 8 HPC - 3 Year Subscription	
Base: 8 pack & Media for ProLiant (32 bit)	366322-B21
HP Services 10 incident call pack, per cluster Phone	U9935A
HP Services 10 incident call pack, per cluster Electronic	U9935E
NOTE: Required 1 per cluster	
Additional 8 pack for ProLiant (32 bit)	359974-B21

Microsoft Windows Server 2003	Microsoft Windows Server 2003, Standard Edition for High Performance Computing, 16-license pack - factory installation required.	354663-B21

Linux Cluster Managers (factory installed or standalone)	Scali Manage/Connect - Compute Node License	366382-B21
	Scali Manage/Connect - Compute Node - Education License	372756-B21

Linux GRID Managers	United Devices Grid MP Manager RTE 8Pack License	372741-B21
	Axceleron Enfuzion 8.0 Grid Manager For LC Series - Compute Node 8Pack License	372746-B21

Linux Job Managers	Altair PBS PRO for LC Series - Compute Node 8Pack License	372740-B21

Linux Development Tools	Engineered Intelligence CxC RTE LC Compute Nodes-16 2P Lic	361941-B21
	Engineered Intelligence CxC RTE LC Compute Nodes-16 1P Lic	361940-B21

QuickSpecs

Systems/Options - LC Series Control Node

Windows 2003 Development Tools	Engineered Intelligence CxC RTE LC Compute Nodes-16 2P Lic	361941-B21
	Engineered Intelligence CxC RTE LC Compute Nodes-16 1P Lic	361940-B21

Cluster MPI Library	EI MPI-XF Parallel Library LC Compute Nodes-16 2P Lic	361943-B21
	EI MPI-XF Parallel Library LC-Compute Nodes 16 1P Lic	361942-B21

Linux Checkpoint Restart	Meiosys MetaGRID Cluster HPC Compute Node 8Pack License	372756-B21

LC Series 2000 - DL360 G3 Compute Node Basic Specifications

Basic Model Description

- ProLiant DL360 supporting Xeon DP single processor 3.06GHz/512KB
- 1/3 height bay with 1.44MB floppy drive (fixed)
- 2 x 1" hot plug Wide Ultra320 SCSI drive support (The DL360 G3 ONLY supports U320 drives)
- 512 MB Memory standard (2x 256 MB) base memory; 8 GB maximum capacity
  NOTE: Maximum memory capacity achieved using 2048 MB DIMMs.
- Triple Peer PCI Bus Architecture (double memory bandwidth & allows two 64-bit slots)
- Two - Embedded NC7780 5703 Gigabit Ethernet NIC Embedded 10/100/1000-T
- Integrated ATI Rage XL Video Controller with 8MB Video Memory
- Dual Processor capability; Xeon processors have a 533MHz FSB
- Smart Array 5i Plus Controller (integrated on system board)
- Integrated Lights-Out (iLO) remote management embedded
- 2 full length 64bit/100MHz PCI-X slots available when HP RPS is not installed
- 5 Front Panel Status Indicators (power/standby; NIC link/activity; Internal Health; Unit ID)
- For a complete list of server information and options see:
  http://h18000.www1.hp.com/products/quickspecs/11473_div/11473_div.HTML

DL360 G3 Compute Node Options

Processors	Xeon DP 3.06 GHz-512KB Processor Option Kit	257916-B21

Memory	**One additional memory increment from 1 to 4 GB. The DL360 supports up to 8GB of memory but will require replacement options for current memory supplied. With just adding memory options, the DL360 Compute Node can support up to 4.5 GB of memory.**	
	1024MB of Advanced ECC PC2100 DDR SDRAM DIMM Memory Kit (2x512 MB)	300679-B21
	2048MB of Advanced ECC PC2100 DDR SDRAM DIMM Memory Kit (2x 1024 MB)	300680-B21
	4096MB of Advanced ECC PC2100 DDR SDRAM DIMM Memory Kit (2x 2048 MB)	300682-B21

Internal Disk Drives	**Up to 2 Universal Ultra 320 Hot Plug Drives**	
	72.8GB 10,000 rpm, U320 Universal Hard Drive (1")	286714-B22
	146.8GB 10,000 rpm, U320 Universal Hard Drive (1")	286716-B22
	300-GB 10,000 rpm, U320 Universal Hard Drive (1")	350964-B22
	36.4GB 15,000 rpm, U320 Universal Hard Drive (1")	286776-B22
	72.8GB 15,000 rpm, U320 Universal Hard Drive (1")	286778-B22

Systems/Options - LC Series Control Node

Network Interface Controllers	NC6170 Dual Port PCI-X 1000SX Gigabit Server Adapter	313879-B21
	NC6770 PCI-X Gigabit Server Adapter, 1000-SX	244949-B21
	NC7170 Dual Port PCI-X 1000T Gigabit Server Adapter	313881-B21
	NC7770 PCI-X Gigabit Server Adapter	244948-B21

Communications	Myrinet -Fiber/PCI-X interface, M3F-PCIXD-2	257894-006

Operating Systems (stand-alone)

Linux Distribution Support **NOTE:** The following 32 bit Operating Systems are compatible with HP ProLiant servers DL360, DL145, and DL140 and are orderable today and available for factory installation. We recommend ordering the High Performance 8 Pack versions beginning in May.

Red Hat Enterprise Linux ES 3 1-2CPU 1 Year	351374-B21
Red Hat Enterprise Linux ES 3 1-2CPU 3 Year	351375-B21
SUSE LINUX Enterprise Server 8 (application worldwide): - 1-2 CPU 1 Year	344074-B21
SUSE LINUX Enterprise Server 8 (application worldwide): - 1-2 CPU 1 Year	344075-B21

Operating Systems (factory installed)

Linux Distribution Support **NOTE:** The following Operating Systems are compatible with HP ProLiant servers DL360, DL145, and DL140 - Orderable and available in May

Red Hat WS 3 - 1 Year Subscription

Base: 8 pack & Media for ProLiant (32 bit)	366313-B21
HP Services 10 incident call pack, per cluster Phone	U3402A
HP Services 10 incident call pack, per cluster Electronic	U3402E
NOTE: Required 1 per cluster	
Additional 8 pack for ProLiant (32 bit)	359971-B21

Red Hat WS 3 - 3 Year Subscription

Base: 8 pack & Media for ProLiant (32 bit)	366316-B21
HP Services 10 incident call pack, per cluster Phone	U3402A
HP Services 10 incident call pack, per cluster Electronic	U3402E
NOTE: Required 1 per cluster	
Additional 8 pack for ProLiant (32 bit)	359972-B21

SUSE SLES 8 HPC - 1 Year Subscription

Base: 8 pack & Media for ProLiant (32 bit)	366319-B21
HP Services 10 incident call pack, per cluster Phone	U9935A
HP Services 10 incident call pack, per cluster Electronic	U9935E
NOTE: Required 1 per cluster	
Additional 8 pack for ProLiant (32 bit)	359973-B21

SUSE SLES 8 HPC - 3 Year Subscription

Base: 8 pack & Media for ProLiant (32 bit)	366322-B21
HP Services 10 incident call pack, per cluster Phone	U9935A
HP Services 10 incident call pack, per cluster Electronic	U9935E
NOTE: Required 1 per cluster	
Additional 8 pack for ProLiant (32 bit)	359974-B21

Microsoft Windows Server 2003	Microsoft Windows Server 2003, Standard Edition for High Performance Computing, 16-license pack - factory installation required.	354663-B21

QuickSpecs

Systems/Options - LC Series Control Node

Linux Cluster Managers	Scali Manage/Connect - Compute Node License	366382-B21
	Scali Manage/Connect - Compute Node - Education License	372756-B21
Linux GRID Managers	United Devices RTE 8 Pack License	372741-B21
	Axceleron Enfuzion 8.0 Grid Manager For LC Series - Compute Node 8Pack License	372746-B21
Linux Job Managers	Altair PBS PRO for LC Series - Compute Node 8Pack License	372740-B21
Linux Development Tools	Engineered Intelligence CxC RTE LC Compute Nodes-16 2P Lic	361941-B21
	Engineered Intelligence CxC RTE LC Compute Nodes-16 1P Lic	361940-B21
Windows 2003 Development Tools	Engineered Intelligence CxC RTE LC Compute Nodes-16 2P Lic	361941-B21
	Engineered Intelligence CxC RTE LC Compute Nodes-16 1P Lic	361940-B21
Cluster MPI Library	EI MPI-XF Parallel Library LC Compute Nodes-16 2P Lic	361943-B21
	EI MPI-XF Parallel Library LC-Compute Nodes 16 1P Lic	361942-B21
Linux Checkpoint Restart	Meiosys MetaGRID Cluster HPC Compute Node 8Pack License	372758-B21

LC Series 3000 - DL145 Compute Node Basic Specifications

Basic Model Description   ProLiant DL145 supporting single Opteron 2000 2.2GHz processor, 2GB DDR2700 Memory, 1MB L2 Cache, 40GB ATA drive

- 2GB of PC2700 DDR SDRAM running at 333MHz with Advanced ECC capabilities standard, expandable to 16GB
- Embedded dual channel Broadcom 5704 Gbit NICs, capable of Wake on LAN and PXE
- One 40GB ATA hard drive standard with support for up to two Non Hot Plug ATA or SCSI (future support) hard drives
- One PCI-X 64-bit/133MHz PCI slot
- Integrated ATI Rage XL with 8MB SDRAM video
- 500W Power Supply (Non-Hot Plug, auto-switching)
- 1 x Front and 1 x Rear USB and serial ports
- Rear accessible shared serial port
- ROM Setup Utility
- For a complete list of server information and options see:
  http://h18000.www1.hp.com/products/quickspecs/11473_div/11473_div.HTML

Note: For orders to be placed thru a partner, please use 360520-B21 as the base SKU for a 2.2GHz DL145

Step 1: Base Configuration

Models	HP ProLiant DL145 Rack Chassis (North America)	365172-405
	Factory Integrated Model ships with:	
	Integrated Dual Broadcom 5704 10/100/1000 NICs (Wake on LAN and PXE capable)	
	Integrated Dual Channel Ultra ATA-100 IDE	
	500 Watts, auto-switching, PFC (Power Factor Correcting)	
	Rack Mount (1U)	

Systems/Options - LC Series Control Node

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

Base Processors	AMD O242 1.6GHz/1MB DL145 FIO BASE	361034-L21
	AMD O242 1.8GHz/1MB DL145 FIO BASE	361035-L21
	AMD O248 2.2GHz/ 1MB DL145 FIO BASE	361036-L21
	AMD O250 2.4GHz/ 1MB DL145 FIO BASE	366619-L21
Base Memory	HP ProLiant 1GB PC2700 2x512KB FIO BASE	361037-L21
	HP ProLiant 2GB PC2700 2x1GB FIO BASE	361038-L21
	HP ProLiant 4GB PC2700 2x2GB	361039-B21
Base Hard Drives	**Non-Hot Plug Hard Drives**	
	40-GB ATA 100 7,200 RPM Hard Drive (1"), FIO BASE	230534-L21
	80-GB ATA 100 7,200 RPM Hard Drive (1")	278424-B21
	160-GB ATA 100 7,200 RPM Hard Drive (1")	366486-B21
	Hot Plug Hard Drives	
	72.8-GB 10,000 rpm Ultra320 SCSI Hard Drive (1")	332751-B21
	146.8-GB 10,000 rpm, U320 SCSI Universal Hard Drive (1")	356990-B21
	36.4-GB 15,000 rpm Ultra320 SCSI Hard Drive (1"), FIO BASE	357012-L21
	146.8-GB 15,000 rpm, U320 SCSI Universal Hard Drive (1")	344708-B22

Step 3: Choose Additional Factory Integratable Options

Controllers	Z2-ch U320 SCSI HBA PR ALL FIO BASE	268351-L21
	NOTE: Must select if choosing SCSI Drives in Step 2.	
	DL145 U320 INT CABLE ALL	370520-B21
	NOTE: Must select if choosing 268351-L21	
Processor Upgrade	DL145 2.2GHz Processor Option Kit	361036-B21
Memory (DIMMs)	PC2700 1GB (2 x 512MB) Memory Option Kit	361037-B21
	PC2700 2GB (2 x 1GB) Memory Option Kit	361038-B21
	PC2700 4GB (2 x 2GB) Memory Option Kit	361039-B21
Optical Drives	DVD-ROM Option Kit	361040-B21
Communications	Myrinet -Fiber/PCI-X interface, M3F-PCIXD-2	257894-006
	NC7771PCI-X 10/100/1000-T Dual Gigabit Copper Server Adapter	290563-B21
Hard Drives	40GB ATA Non Hot Plug Hard Disk Drive	230534-B21
	80GB ATA Non Hot Plug Hard Disk Drive	278424-B21
Storage Controllers	Ultra320 SCSI Host Bus Adapter	365289-B21

QuickSpecs

Systems/Options - LC Series Control Node

Operating Systems (stand-alone)

Linux Distribution Support

NOTE: The following 32 bit Operating Systems are compatible with HP ProLiant servers DL360, DL145, and DL140 and are orderable today and available for factory installation. We recommend ordering the High Performance 8 Pack versions beginning in May.

Red Hat Enterprise Linux ES 3 1-2CPU 1 Year	351374-B21
Red Hat Enterprise Linux ES 3 1-2CPU 3 Year	351375-B21
SUSE LINUX Enterprise Server 8 (application worldwide): - 1-2 CPU 1 Year	344074-B21
SUSE LINUX Enterprise Server 8 (application worldwide): - 1-2 CPU 1 Year	344075-B21

Operating Systems (factory installed)

Linux Distribution 32 bit Support

NOTE: The following 32 Operating Systems are compatible with HP ProLiant servers DL360, DL145, and DL140 - Orderable and available in May

Red Hat WS 3 - 1 Year Subscription

Base: 8 pack & Media for ProLiant (32 bit)	366313-B21
HP Services 10 incident call pack, per cluster	U3402A
HP Services 10 incident call pack, per cluster Electronic	U3402E
NOTE: Required 1 per cluster	
Additional 8 pack for ProLiant (32 bit)	359971-B21

Red Hat WS 3 - 3 Year Subscription

Base: 8 pack & Media for ProLiant (32 bit)	366316-B21
HP Services 10 incident call pack, per cluster	U3402A
HP Services 10 incident call pack, per cluster Electronic	U3402E
NOTE: Required 1 per cluster	
Additional 8 pack for ProLiant (32 bit)	359972-B21

SUSE SLES 8 HPC - 1 Year Subscription

Base: 8 pack & Media for ProLiant (32 bit)	366314-B21
HP Services 10 incident call pack, per cluster Phone	U9935A
HP Services 10 incident call pack, per cluster Electronic	U9935E
NOTE: Required 1 per cluster	
Additional 8 pack for ProLiant (32 bit)	366315-B21

SUSE SLES 8 HPC - 3 Year Subscription

Base: 8 pack & Media for ProLiant (32 bit)	366317-B21
HP Services 10 incident call pack, per cluster Phone	U9935A
HP Services 10 incident call pack, per cluster Electronic	U9935E
NOTE: Required 1 per cluster	
Additional 8 pack for ProLiant (32 bit)	366318-B21

Linux Distribution 64 bit Support

NOTE: The following 64 Operating Systems are compatible with HP ProLiant DL145

Red Hat WS 3 - 1 Year Subscription

Base: 8 pack & Media for ProLiant (64bit)	372724-B21
HP Services 10 incident call pack, per cluster Phone	U3402A
HP Services 10 incident call pack, per cluster Electronic	U3402E
NOTE: Required 1 per cluster	
Additional 8 pack for ProLiant (64 bit)	372725-B21

Red Hat WS 3 - 3 Year Subscription

Base: 8 pack & Media for ProLiant (64 bit)	372728-B21
HP Services 10 incident call pack, per cluster Phone	U3402A
HP Services 10 incident call pack, per cluster Electronic	U3402E

Systems/Options - LC Series Control Node

	NOTE: Required 1 per cluster	
	Additional 8 pack for ProLiant (64 bit)	372729-B21
	SUSE SLES 9HPC - 1 Year Subscription	
	Base: 8 pack & Media for ProLiant (64 bit)	366320-B21
	HP Services 10 incident call pack, per cluster Phone	U9935A
	HP Services 10 incident call pack, per cluster Electronic	U9935E
	NOTE: Required 1 per cluster	
	Additional 8 pack for ProLiant (64 bit)	366321-B21
	SUSE SLES 8 HPC - 3 Year Subscription	
	Base: 8 pack & Media for ProLiant (64 bit)	366323-B21
	HP Services 10 incident call pack, per cluster Phone	U9935A
	HP Services 10 incident call pack, per cluster Electronic	U9935E
	NOTE: Required 1 per cluster	
	Additional 8 pack for ProLiant (64 bit)	366324-B21
Microsoft Windows Server 2003	Microsoft Windows Server 2003, Standard Edition for High Performance Computing, 16-license pack - factory installation required.	354663-B21
Linux Cluster Managers (factory installed)	Scali Manage/Connect - Compute Node License	366382-B21
	Scali Manage/Connect - Compute Node - Education License	372756-B21
Linux GRID Managers	United Devices - RTE 8 Pack License	372741-B21
	Axceleron Enfuzion 8.0 Grid Manager For LC Series - Compute Node 8Pack License	372746-B21
Linux Job Managers	Altair PBS PRO for LC Series - Compute Node 8Pack License	372740-B21
Linux Development Tools	Engineered Intelligence CxC RTE LC Compute Nodes-16 2P Lic	361941-B21
	Engineered Intelligence CxC RTE LC Compute Nodes-16 1P Lic	361940-B21
Windows 2003 Development Tools	Engineered Intelligence CxC RTE LC Compute Nodes-16 2P Lic	361941-B21
	Engineered Intelligence CxC RTE LC Compute Nodes-16 1P Lic	361940-B21
Cluster MPI Library	EI MPI-XF Parallel Library LC Compute Nodes-16 2P Lic	361943-B21
	EI MPI-XF Parallel Library LC-Compute Nodes 16 1P Lic	361942-B21
Linux Checkpoint Restart	Meiosys MetaGRID Cluster HPC	372758-B21

LC Series Design and Configuration Guide and Orderable Options

The LC Series Design and Configuration offers the customer the opportunity to design and configure their own customer cluster with the ability to extend a LC Series pre-defined SKU as well as build a cluster to meet their own environmental needs. There is a Design Guide for each type of cluster: LC 1000 Series, LC 2000 Series, and LC 3000 Series as well as Cluster Design Consideration and Setup Guides and Cabling Guides. These are available on the HP Web site at http://www.hp.com/techservers/clusters/linux_clusters .

Following are the Optional part numbers which have been defined for the LC Series Clusters which are required when designing your customized LC Series Cluster. They are included in the Pre defined LC Series Cluster SKU's but are now available for order with the LC Series Customized Design and Configuration Guide Worksheets;

Cluster Interconnect Options	GigE Option Kit	361801-B21
	Myrinet Option Kit	361802-B21
Shortened Processor Power Cord - Rack Mount Solutions	IEC C13-C14, 0.5m, WW	142257-B28
LC 1000 - Cyclades Terminal Server Switch and RJ 45 Adapter	Cyclades - ATP1200 (with rail kit brackets)	355477-B21
	Cyclades RS-232 to RJ45 Adapter	365242-B21
	Kit, ProCurve, 1U Switch Rack Mount, 10K	356578-B21
ProCurve 2824, 2848 Rail Kit	Kit, Procurve 1U Switch, Rack Mount, 10K	356578-B21
Myrinet Components Switch Chassis	Myrinet 2000 Enclosure, 5-slot	257896-002
	Myrinet 2000 Enclosure, 9-slot	257896-003
	Myrinet 2000 Enclosure, 17-slot	257896-004
	Myrinet Switch rail kit	360363-B21
Myrinet GigE Line Card and SNMP Monitor Card	Myrinet Line Card, 8-port GigE	356921-B21
	Myrinet Line Card, SNMP Monitor	262818-001
	Myrinet Line Card, Blank Panel	337807-001
Myrinet 2000 Adapter, Line Card, SNMP Monitor Card	Myrinet XP PCI-X , Fiber, D-series, 2MB	257894-006
	Myrinet Line Card, 8-port Fiber	257895-001
	Myrinet Line Card, 8-port Fiber, no xbar	257895-002
	Myrinet Line Card, SNMP Monitor	262818-001
	Myrinet Line Card, Blank Panel	337807-001
Required Configuration Resource Kit	Configuration Resource Kit	359578-B21
Optional Myrinet Components for Customized LC Series	RM Kit Multi Use 10K HP Rack	337808-002
	Myrinet 2XP PCI-X, Fiber, E-series, 2MB	360040-B21
	Myrinet 2XP PCI-X, Fiber, E-series, 4MB	
	Myrinet Quad fiber cable	372723-B21
	Myrinet Cable, LC, Fiber, 2Gb, 5 meter	360041-B21
	Myrinet switch enclosure 21-slot, 14U	372716-B21
	Myrinet spine enclosure 21-slot, 14U	372717-B21
	Myrinet switch linecard 16-port	372718-B21
	Myrinet spine linecard 16 quad-port	372719-B21
	Myrinet Spine Thru module	372720-B21
	Myrinet Blank panel with Airdam	372721-B21
	Myrinet Dual SW32 line card	372722-B21

LC Series Storage Subsystems Configuration Guide and Orderable Options

Technical computing applications are among the most demanding for any storage system constructed today. This is especially true for technical applications that use parallel computing, where multiple machines work together to compute some part of a parallel calculation. Parallel computing has become more popular for technical computing as both the software and hardware required has matured. Technical computing using parallel Linux computers has become popular due to the potential for lower hardware costs and scalable performance using commodity Intel or AMD

Systems/Options - LC Series Control Node

processors. Large clustered machines with hundreds of nodes have been constructed; many with impressive peak compute performance. In fact, they dominate the SPEC Top 500 in 2004.

A software layer (usually including MPI, the Message Passing Interface) allows the applications running on the nodes to communicate and coordinate their activity as the parallel calculation proceeds.

It's important to remember that fast compute performance is only part of the technical computing challenge: efficient and fast parallel computers can generate enormous amounts of data while running parallel simulations of three-dimensional, time-dependent data. Fluid dynamics and electromagnetics are two application areas where these kinds of parallel calculations are commonly used. Some technical computing applications are focused on ingesting and filtering large amounts of data received from sources as varied as satellites, network analyzers, or genome databases. In both cases, generating the data from a simulation or ingesting it from an external source, the data must be post-processed, analyzed, and archived for future reference.

To implement this task, very large storage systems with petabytes of on-line storage and hundreds of petabytes of off-line (archival tape or optical disk) storage are not uncommon. Data is often moved between the parallel computer and pre- and post-processing machines. Pre-processing computers often interface to some kind of data input device or may be dedicated to filtering the input data sets in some way. Post-processing often consists of graphical analysis or visualization or to database updates of some kind. This means that the data scattered across the separate file systems on each compute node must be transferred between the pre- and post-processing computers across one or more of the Cluster compute networks.

File serving over Ethernet networks using Network Attached Storage (NAS) filers or UNIX file servers is ubiquitous in today's data center. However, as its usage has grown, IT organizations have faced multiple challenges:

- Manageability. Ever-larger numbers of clients have driven many IT organizations to deploy multiple UNIX or NAS servers, introducing management complexity and overhead in maintaining redundant copies of data.
- Scalability. Some users have turned to very high-end servers and NAS appliances to simplify the provisioning of file services to a large number of clients or to support heavy workloads. However, this comes at a steep cost and, in some cases; this high-end hardware still represents a performance bottleneck between clients and data.
- Availability. As NAS has increasingly come to be used for mission-critical tasks, it has been necessary to purchase hardware in pairs to provide high availability, introducing yet more expense.

What is needed is a way to provide scalable, highly available file services using inexpensive, industry-standard servers that can be added incrementally as demands require, all while retaining the management simplicity of a single server and a single pool of exported file systems.

LC Series offers a range of complementary storage configurations spanning from entry level NFS storage to Multi Terrabyte scalable NFS storage and Global File System (GFS) storage using the Gigabit Ethernet In Band Network as local attach for this storage. The In Band Management Network as it has extra capacity for I/O data and bandwidth to meet most data transfer need.

Storage configurations from 1TB to 48 TB are documented in the LC Series 1000, 2000, 3000 Design and Configuration Guides. These can be configured using the LC Series Design Worksheets in each Guide.

Software to support this large scale storage environment is provided by PolyServe as well as Red Hat with their acquisition of Sistina Software. At present, we have announced a relationship with PolyServe for their Matrix File Server Product for Linux.

The PolyServe NAS Cluster is a software only solution that allows a customer to leverage the volume economics of industry standard servers and storage and couple those components into a single high performance NAS system. At its core, the PolyServe NAS Cluster solution integrates Network File System (NFS) functionality or Common Internet File System (CIFS) protocol with a true symmetric cluster file system, high-availability services and cluster and storage management capabilities. The product aggregates up to 16 low-cost Linux- or Windows-based servers for high-performance, fault-tolerant file serving across a SAN. Shared data and management capabilities ease IT administration by enabling servers and storage to be managed as one.

PolyServe Matrix Server NAS Cluster Support   PolyServe Matrix Server is shared data clustering software that incorporates several key technologies:

- A high-performance, symmetric cluster file system. With Matrix Server, a cluster of industry-standard servers can share concurrent read/write access to file systems resident in a SAN, as shown in Figure 1. Matrix Server provides very high throughput for even the most demanding workloads, with direct disk access speeds and complete cache consistency among servers in the cluster.*
- High availability infrastructure. Matrix Server protects against server, network and storage interconnect failures. It provides automatic restart of servers and services, immediate fail-over of clients to surviving nodes, and support for Multi-Path I/O (MPIO).
- Integrated cluster-wide management. The management infrastructure enables a single console to provide an overview of server status. Cluster operations can be reconfigured either from the console or using a command line tool, from any member of the cluster.

PolyServe Matrix Server - 2 Node Linux User	372747-B21
PolyServe Matrix Server - 4 Node Linux User	372748-B21

Systems/Options - LC Series Control Node

PolyServe Matrix Server - 8 Node Linux User	372749-B21
PolyServe Matrix Server - 16 Node Linux User	372752-B21

Myrinet High-speed Connections

NIC
These universal, 64/32-bit, 66/33MHz, Myrinet2000-Fiber/PCI interfaces are ideal for the most demanding cluster and distributed-Clusters applications. The interface includes a fast RISC to execute the Myrinet control program, a versatile DMA controller to support zero-copy APIs, and a complete set of high-availability and data-integrity features. The difference between the PCI64B and PCI64C interfaces is the allowed clock rate of the RISC and local memory: 133MHz for the PCI64B and 200MHz for the PCI64C.

Myrinet High-speed Interconnects Specifications

PCI-bus Interface
64/32-bit, 66/33MHz, supports all burst modes and write-invalidate, master or slave. These interfaces are capable of sustained PCI data rates approaching the limits of the PCI bus (528 MB/s for 64-bit, 66MHz; 264 MB/s for 64-bit, 33MHz or 32-bit, 66MHz; 132 MB/s for 32-bit, 33MHz). However, the data rate to/from system memory will depend upon the host's memory and PCI-bus implementation. These interfaces function correctly in all PCI slots that are compliant with PCI specifications (version 2.2), with either 3.3V or 5V PCI-bus signal levels. (3.3V signaling is required of 66MHz PCI slots, but 33MHz PCI slots may use either 5V or 3.3V signaling.) PCI parity generation and detection is provided. The interface provides a 64-bit Base Address Register (BAR), but will also function properly when programmed with a 32-bit address, per the PCI specifications.

DMA controller
Traverses multiple lists in the interface's local memory to initiate DMA transfers, thus allowing multiple pending DMA operations. In order to support zero-copy APIs efficiently, the DMA operations can be performed with arbitrary byte counts and byte alignments. The DMA controller computes the IP checksum for each transfer. The DMA controller also provides a "doorbell" signaling mechanism that allows the host to write anywhere within the doorbell region, and have the address and data stored in a FIFO queue in the local memory.

Interface processor
LANai 9 RISC operating at up to 133MHz for the PCI64B interfaces, or at up to 200MHz for the PCI64C interfaces.
NOTE: the RISC in the LANai 9 is similar to but is not binary-compatible with earlier LANai RISCs.

Local memory
2MB (256Kx8B) in the -2 version Is supported in the LC Series. The local memory operates from the same clock as the RISC, i.e., at up to 133 MHz for the PCI64B interfaces, or at up to 200MHz for the PCI64C interfaces. Up to 1,067 MB/s (PCI64B) or 1,600 MB/s (PCI64C) of memory bandwidth is available to support the Myrinet port, the host DMA, and the RISC processor. Byte parity is generated and checked.

Local optical memory
2.0+2.0 Gb/s. An "LC" optical connector attaches to a fiber pair up to 200m of 50/125 multi-mode fiber. This is a Class I Laser Product (no biological hazard)

Physical dimensions
PCI Short Card: height 10.7cm, length 18.0cm, total thickness 2.5cm, weight 120g

Power
The interface is powered from the 5V PCI power: 1.9A (9.5W) maximum for the M3F-PCI64B-2; 2.2A (11.0W) maximum for the M3F-PCI64C-2.

Regulatory Approvals
Fully compliant with EN55024 (1998), EN55022 Class A (1995), VCCI Class A (May 1999), FCC Part 15 Subpart B Class A, CISPR 22/85 Class A, ICES-003 Class A (ANSI C63.4 1992), and AS/NZS 3548 Class A (w/A1 & A2 1997). CE Declaration of Conformity

Systems/Options - LC Series Control Node

Myricom-supported software	Open source, distributed from the Myricom Software & Customer Support page. These interfaces require the use of the GM software; the MyriAPI software is not available for the PCI64 family of interfaces.

Switches

Switches and switch networks	Myrinet 2000 switches and switch networks are highly modular. These switches and their enclosures are complete with power supply, fan cooling, and a backplane, which you can think of as a pre-wired network between the line cards. The backplanes of the M3-E32, M3-E64, and M3-E128 include 16-port crossbar switches that form the Spine of a Clos network. The top slot is reserved for a monitoring line card. The other slots accept port line cards with up to 8 ports on the front panel, and 8 SAN ports that connect to the backplane. Additional Information can be found at http://www.myricom.com/myrinet/full_product_list.html.

ProCurve Fast Ethernet and Gigabit Ethernet High-speed Interconnects

ProCurve 2650	The HP ProCurve Switch 2650 is a low-cost, stackable, multi-layer, managed 50-port switch with 48 auto-sensing 10/100 ports and 2 dual personality ports for 10/100/1000 or mini-GBIC connectivity. With its 50 ports, the Switch 2650 offers the highest port density per 1U rack height in the industry.

Specifications	2 dual personality ports-can be used as either RJ-45 10/100/1000 ports (IEEE 802.3 Type 10Base-T; 802.3u Type 100Base-TX; 802.3ab 1000Base-T Gigabit Ethernet), or open mini-GBIC slots (for use with mini-GBIC transceivers), or one of each

Physical characteristics	Dimensions	17.32 x 12.8 x 1.73 in (44.25 x 32.5 x 4.4 cm)
	Weight	9.78 lb (4.44 kg)
	Memory and processor	Motorola MPC8245 PowerPC Flash capacity: 16 MB

ProCurve 2848	The HP ProCurve Switch 2848 is a low-cost, stackable, multi-layer, managed 48-port switch with 44 auto-sensing 10/100/1000 ports and 4 dual personality ports for 10/100/1000 or mini-GBIC connectivity. Ideal for medium to large networks, the Switch 2848 cost effectively offer the maximum in bandwidth performance with 10 times the speed of 100 Mbit switches.

Specifications	44 Gigabit ports and 4 dual personality ports-Each port can be used as either a 10/100/1000 ports (IEEE 802.3 Type 10Base-T; 802.3u Type 100Base-TX; 802.3ab 1000Base-T Gigabit Ethernet), or an open mini-GBIC slot (for use with mini-GBIC transceivers)

Physical Characteristics	Dimensions	17.32 x 16.9 x 1.7 in (44 x 43 x 4.4 cm)
	Weight	10.75 lb (4.88 kg)
	Memory and processor	Flash capacity: 16MB
	Additional Information can be found at http://www.hp.com/go/hpprocurve	

Cyclades AlterPath™ Advanced Console Server (ACS 48) - LC1000 Only

The AlterPath™ ACS 48 enables secure connectivity and access to any serial device or equipment console port. PCMCIA slots allow for enhanced functionality with support for many interface cards, such as Ethernet, modem (V.90, CDMA, GPRS, GSM and ISDN) and wireless LAN. Security features include secure clustering for up to 1024 devices, SSH v2 (Secure Shell), RADIUS authentication, IPSec, IP filtering, and user access lists per port. This allows the data center managers and system administrators to remotely manage the network and servers with greater control and peace of mind.

Console management features include native support for the EMS protocols included with the Windows® Server 2003, plus data buffering, direct access methods to the serial ports (such as the TCP port and server name) and event notification. This improves monitoring capabilities, allowing faster problem solving and higher network uptime.

Instead of using proprietary software technologies, the AlterPath™ ACS leverages on Open Source software (Linux), giving users the freedom to

Systems/Options - LC Series Control Node

customize its operation, modifying or adding features as needed.

Available in the LC Series as a 48-port model that fits in 1U of rack space, the AlterPath™ ACS helps maximize network and server availability while providing scalability and cost effectiveness. Using the AlterPath™ ACS for secure data center management decreases network maintenance costs while increasing efficiency and productivity.

Applications	• Console Management • Server and Network Management • Terminal Server • Industrial/Commercial Automation • Ethernet-attached Serial Board Replacement
Benefits	• Windows® Server 2003 EMS support • Improved availability (dual power supply) • Secure In-band and Out-of-band Network Management • Rock-solid stability (Linux Inside) • Rack space savings (1U form factor) • Improved network monitoring • Flexibility to support existing and future interface types (PCMCIA support)
Operating System	• Linux
Accessibility	• In-Band (Ethernet) and Out-of-band (Dial-up modem) support • PCMCIA support allows for alternative access interfaces, such as GSM modem, CDMA, V.90 modem, ISDN and wireless Ethernet (Click here for a list of supported PCMCIA cards.)
Security	• SSH v1 and v2 • Local, RADIUS, TACACS+, LDAP, NIS, and Kerberos Authentication • Token-based strong authentication (SecurID) • Local backup user authentication support • PAP/CHAP authentication (for dial-up lines) • Dial back support • IP Packet and Security Filtering • User Access Lists per port • System Event Syslog • IPSec support
Console Management	• Sun break-safe (Solaris Ready™ Certified) • Break Over SSH support • Windows® Server 2003 EMS Support • Off-line data buffering - Local or Remote (NFS/Syslog) • Timestamp for data buffering • Unlimited number of simultaneous sessions • Simultaneous access on the same port (port sniffing) • Secure clustering (central access to multiple console servers) • Event notification (email, pager, SNMP trap)
Port Access	• Directly by TCP port, IP address or server name • Telnet/SSH with menu • HTTP/HTTPS
System Management	• Configuration wizard for first time users • Command Line Interface (Linux Shell) • Web Management Interface (HTTP/HTTPS) • SNMP

Systems/Options - LC Series Control Node

Cabling	● CAT5 compatible adapters for simpler cabling (sold separately)

Upgrades	● Upgrades available on FTP site, no charge ● Flash upgradeable ● TFTP support for network boot

Customization	● Cyclades Development Kit (CDK) available for custom applications, no charge

Additional Protocols Supported	● DHCP for dynamic IP address assignment ● PPP/SLIP for dial-up ● NTP for time server synchronization

RFC2217 support for remote serial port access

Product Highlights

Monitors and Keyboards	One Rack-mount/Keyboard/Monitor (RKM). The RKM is required to be installed in the Head node/ Management system Rack.

Rack and Power	42U Rack-10642 (42U) Rack with Shock Pallet Blanking panels (graphite) Side Panel 42U 10K series All Stabilizer kit for rack 10K series Power cord, Terminated, 3 conductor, SPT-2, IEC320-C13	
	Power Distribution Unit with 12 IEC-320-C13 receptacles-PDU, 24 Amp-High, North America, Japan 32Amp-High Europe	Three PDU's are part of the LC Series base SKU. This is a basic power requirement for a 32 Node cluster.

Factory Systems Integration Services

Factory Integration in the Americas- This part number is unique to NA orders for Factory Integration charges. To order an LC Series cluster, this Part Number is required by the Order Entry System to Flag the order for Factory Integration quoting and administration.

Factory Integration in EMEA- To order an integrated LC Series Cluster or for additional LC Series requests, send the required specifications in an email to HPTC-EMEA@HP.com (EMEA HPTC Competency Center). A quotation will be provided containing the appropriate configuration and integration charges for approval.

Factory Integration - A required part number for standard integration of LC Series Clusters - Americas Only 325733-888	Standard LC Series Factory Integration in the Americas: Staging and Integration of the HP LC Series order ● Review customer order for required licenses, cables/cable lengths, software revisions, and hardware. ● Thoroughly exercise the systems, running extensive diagnostics and system exercisers for an extended period of time to reasonably assure a problem free installation and ongoing reliability ● Configuration of an LC Series Cluster includes: 　○ Hardware configuration verification 　○ Cable all inter-Rack cabling for entire cluster for test and de-cabled for shipment 　○ Configure cluster interconnect network (Myrinet, Fast Ethernet, or GigE switches) 　○ Configure cluster in band management and monitoring network 　○ Configure out of band management network 　○ Configure console interface 　○ Configure management and control nodes 　○ Load Optional Linux (Red Hat or SUSE operating system 　○ Load Optional Windows Server 2003 Server operating system 　○ Set up IP addresses for systems and all network equipment 　○ Load and configure Optional SCALI cluster software 　○ Verify Cluster configuration 　○ Perform Network tests across all networks 　○ Perform Cluster operations tests across all Nodes 　○ System labeling, including point-to-point labels of all cables. 　○ These services do not include configuration of any external storage.
Cluster Customization in the Americas	For additional LC Series optional requests, please contact the Americas Integration Center (AIC) 1-800-837-8036 for additional information such as loading other software offerings, adding optional Control Nodes or Storage Subsystem interfaces, customer software, partitioning disk subsystems, UPS installations.

QuickSpecs

Product Highlights

System Software and Consulting and Integration Services

Introduction

This section describes the systems level software and partner proven software currently supported on the LC Series. There are current product part numbers for the Operating Systems supported and can be ordered thru the traditional Order Entry Systems. Additionally, there are HP Consulting and Integration Services part numbered offerings that are geared towards a Services led engagement model for current partner products from Scali, United Devices, and Sistina. These products require an order thru HP's C&I organization. The Americas contact is Frank Pietryka at Frank.Pietryka@hp.com. For Consulting and Integration services in EMEA, send your request detailing your requirements via email to HPTC-EMEA@HP.com. A quotation for Consulting and Integration services will be provided for approval.

Also available from the Consulting and Integration Services organization are a series of professional service offerings covering site and architecture planning and analysis, training, and exploitation of the LC Series clusters. These offerings must be coordinated and ordered thru Frank Pietryka or HPTC-EMEA@HP.com

Linux Distributions

If you are a customer that is only interested in Linux, HP supports the enterprise versions of both Red Hat and SUSE distributions. In addition, the newly announced Red Hat and SUSE High Performance Computing license agreements provide for low cost enterprise operating system software on these clustered configurations. Please review these part numbers in the Compute Node specifications listed above. Other Linux variants such as community distributions or vendor Professional offerings have also been tested on these machines but HP does not offer support for these variants. Please refer to the Linux Certification matrix for current certification status - http://h18004.www1.hp.com/products/servers/linux/hpLinuxcert.html

Microsoft Windows Server 2003, Standard Edition for High Performance Computing

Microsoft Windows Server 2003, Standard Edition for High Performance Computing, 16-license pack, is an attractively priced, edition of Windows Server 2003 for use on HPC cluster compute nodes. It is only available factory-installed on HPC clusters. Licensing restrictions prevent its use for general purpose computing such as web hosting, file-and-print serving, databases, etc. The 16-license pack consists of one copy of the OS media, one Getting Started manual, and 16 Certificates of Authenticity, which are attached to the servers during the factory installation process. Order one 16-license pack for each multiple of 16 compute node servers in the cluster. Note: Not for use on the control node due to licensing restrictions. Use either Windows Server 2003 Standard Edition (339105-B21) or Windows Server 2003 Enterprise Edition (339233-B21) on the control node instead.

Scali Manage and Connect

Scali Manage™ enables rapid installation and configuration of clusters including the operating system, middleware, communication modules, third party applications and user data. Companies benefit from having their clusters up and running quickly, reducing the total cost traditionally associated with cumbersome installations. The clusters and applications are brought online quickly and the organization is able to actively predict and prevent system failures through advanced monitoring and alarms. Scali Manage provides a centralized point of installation and ongoing management for clusters, applications, interconnects and industry-standard hardware platforms.
The Scali MPI Connect™ implementation is built on a direct data transfer model that leverages the standardized API intermediate layer based on the Direct Access Transport (DAT) specification. Highly optimized algorithms for message passing through the direct data transport mechanism eliminates overhead and reduces latency. Scali MPI Connect is fully integrated and compatible with the leading underlying inter connect hardware, which enables customers to select the best solution for their applications. The MPI includes a directly attached driver for channel bonded Gigabit Ethernet, as well as 10/100 Fast Ethernet, Myrinet, and Infiniband enabling high performance clusters to run over commodity interconnect technology as well as specialty cluster interconnect hardware.
A sophisticated, integrated, full-featured Cluster Management software package for clusters using standard Ethernet, Gigabit Ethernet, or Myrinet. Scali supports a specific MPI library which is included with the Scali Manage / Connect package. Scali is offered for the two specified interconnects in the LC SKU's (Gigabit Ethernet or Myrinet) as well as 10/100 Fast Ethernet for those using the LC Series Design and Configuration Guide.

Scali Manage features include:

- Installation, reinstallation and configuration of the operating system, middleware, communication modules, third party applications and user data
- Ability to manage multiple and mixed interconnect environments
- Resource management, system monitoring and alarms, job management, remote out-of-band operations and software distribution functionality
- Consistent interface regardless of interconnect or cluster
- Monitoring of variables, such as, CPU load, traffic, disk space, swap usage, fan-speed and temperature Parallel shell tools for cluster wide command execution

Product Highlights

- Interface to any external data source including SNMP
- GUI and command line interfaces for system administrators and application users
- 2D and 3D bar and histogram graphs and charts

Scali MPI Connect features include:

- Dynamic binding to operator- or user-selected interconnects
- Support for key interconnects and standards, including TCP/IP, Direct over Ethernet, SCI, Myrinet and Infiniband
- Single binary, multiple interconnect architecture enables single instances of ISV applications to be interconnect independent
- Channel bonding and out-of-order package handling in the DET enables near linear scalability
- Support for IA32 and IA64 processing architectures
- Transparency to transient network errors, interconnect resets or change of routing tables
- Dynamic selection of optimal transport medium at runtime
- Failover between interfaces by automatic switching to alternate networks
- Built-in tracing and timing facilities for performance tuning and debugging of parallel codes
- Integration with the Etnus' Total View and GNU gdb debuggers and the Pallas' Vampir MPI analysis tool
- Full compliance with the MPI 1.2 specification from the Message Passing Interface Forum

Please refer to the Software Specifications under the DL380 Control Node for associated part numbers. Scali Manage and Scali Connect are also offered thru HP Consulting and Integration Services and can be ordered thru the HP C&I order process. All third-party software products supplied by HP shall be governed exclusively by the manufacturer's license terms and other documentation accompanying such third-party software.

Scali Manage/Connect Control Node Offerings	Scali Manage/Connect For TCP/IP	359960-B21
	Scali Manage/Connect For Myrinet	359962-B21
	Scali Manage/Connect For Infiniband	359963-B21
	Scali Manage/Connect For TCP/IP - Educational Edition	372754-B21
	Scali Manage/Connect For Myrinet for Educational Edition	372755-B21
	Scali Manage/Connect For Infiniband for Educational Edition	372753-B21
Scali Manage/Connect Compute Node Offerings	Scali Manage/Connect - Compute Node License	366382-B21
	Scali Manage/Connect - Compute Node - Education License	372756-B21

Product Highlights

Engineered Intelligence Parallel Development CxC for Linux and Windows 2003 Server	CxC Enablement Pack for LC Series is an implementation of parallel programming language CxC that allows scientists and engineers to model and simulate the behavior of particles and their interaction.

Easy to learn and use: CxC's simplified syntax and semantics are derived from the programming language C. It is easier to learn and use than C or other languages. Whether you are learning parallel programming, doing research on simulations of complex parallel systems, or are an experienced developer of sequential programs, you can intuitively use the powerful parallel programming concepts and capabilities.

Innovative architecture: CxC is equipped with Connected Memory Architecture (CMA), the powerful patent-pending parallel programming paradigm now available for use by scientists and engineers. When originally invented, CMA was designed to solve the most fundamental science and engineering problems complying with the government-approved definition of grand challenges.

Simplified development: CxC allows you to develop, test and execute parallel algorithms on your PC or laptop, even with a single processor. Since algorithms in CxC are not hardware dependent and have unlimited scalability, you can run the same executable that you create on your laptop on hundreds of clustered computers without dead-locks and synchronization problems.

CxC Run Time Micro-Kernal
Professional optimizing CxC Compiler and high-performance Run-Time-Microkernel. Build and run professional high-performance parallel applications with the industry leading CxC Compiler, which generates the highest performing executables to run on the high-performance Run-Time-Microkernel. Parallel applications will run with highest performance on SMP or cluster systems between 1 and 1024 processors

NOTE: Each processor needs a valid license for the parallel CxC Run-Time Microkernel.
Please refer to the Software Specifications under the DL380 Control Node for associated part numbers; including Run Time Environment (RTE) required on LC Series Compute Nodes for proper execution of parallel applications developed using Engineered Intelligence CxC Enablement Pack for Linux or Windows Server 2003. All third-party software products supplied by HP shall be governed exclusively by the manufacturer's license terms and other documentation accompanying such third-party software.

Linux Development Tools	Engineered Intelligence Enablement Pack for Linux - LC Series	359964-B21
	Engineered Intelligence CxC RTE LC Compute Nodes-16 2P Lic	361941-B21
	Engineered Intelligence CxC RTE LC Compute Nodes-16 1P Lic	361940-B21
Windows 2003 Development Tools	Engineered Intelligence Enablement Pack for Windows 2003 - LC Series	359966-B21
	Engineered Intelligence CxC RTE LC Compute Nodes-16 2P Lic	361941-B21
	Engineered Intelligence CxC RTE LC Compute Nodes-16 1P Lic	361940-B21

QuickSpecs

Product Highlights

Engineered Intelligence MPI X/F for Linux Series

Engineered Intelligence, offers a fully supported solution based on the well known Message Passing Interface (MPI) that enables programmers to realize higher throughput than ever before. MPI-XF delivers high bandwidth, low latency performance in a thread-safe environment for high performance users looking to optimize their parallel computing environment. Programs linking to the Engineered Intelligence MPI-XF library and utilizing the MPI-XF Run Time Environment will experience performance improvements, over tradition MPI implementations.

MPI-XF's unique XFC Extremely Fast Compression algorithms deliver high throughput for the most demanding applications providing the highest recorded bandwidth utilizing general interconnect cabling.
Engineered Intelligence's patent-pending Connected Memory Architecture (CMA) provides the basis for direct protocol communications that offer substantial improvements over TCP/IP using Direct Transfer Protocol
Thread-safe capabilities to request services, conduct communication, and execute applications with support for multi-threading
MPI-XF Performance Results:
Interconnect Latency Bandwidth
100Mbps Ethernet with MPI-XF <60µsec >20 MByte/sec
Gigabit Ethernet with MPI-XF <25µsec 300 MByte/sec
Please refer to the Software Specifications under the DL380 Control Node for associated part numbers, including Run Time Environment (RTE) required on LC Series Compute Nodes for proper execution of parallel applications developed using Engineered Intelligence CxC Enablement Pack for Linux or Windows Server 2003. All third-party software products supplied by HP shall be governed exclusively by the manufacturer's license terms and other documentation accompanying such third-party software

Cluster MPI Library

Engineered Intelligence MPI-XF Linux Enablement Pack LC Series	361939-B21
EI MPI-XF Parallel Library LC Compute Nodes-16 2P Lic	361943-B21
EI MPI-XF Parallel Library LC-Compute Nodes 16 1P Lic	361942-B21

Product Highlights

Axceleon Enfuzion For LC Series Linux and Windows Server 2003 Support	EnFuzion is a powerful, secure and flexible high performance-computing solution that enables applications to be executed on multiple processors. EnFuzion offers end-users exponential gain in application performance, while maximizing all compute resources. EnFuzion is ideal for organizations that require critical data to be processed in real-time.

EnFuzion offers easy application integration through its very intuitive application programming interface (API), which allows applications to be quickly grid enabled. EnFuzion offers built in features that deliver fault tolerance, so that corporate networks are always operating at peak performance. Most importantly, EnFuzion delivers an immediate return on investment and accelerates the most important factor - profits!
Product features include:

Application performance acceleration - Run applications parametrically on multiple processors automatically. Share and manage processing resources across your organization while maintaining full inter-departmental control.

Integration - EnFuzion was designed to be easily integrated with existing applications. EnFuzion's API supports a wide range of application development.

Automation - EnFuzion provides complete scheduling tools for automated runtime environments and fail-over functionality for guaranteed results.

Resource Management - Administer computing resources and run your network at peak efficiency.

Flexibility - Very low overhead on system resources, yet still provides full features that can be tailored to each individual environment

Mixed Environments - Works flawlessly with heterogeneous environments, supporting Windows, Unix, and Linux operating environments and all major hardware platforms.

Please refer to the Software Specifications under the DL380 Control Node for associated part numbers. All third-party software products supplied by HP shall be governed exclusively by the manufacturer's license terms and other documentation accompanying such third-party software.

Control Node Offering	Axceleron Enfuzion 8.0 Grid Manager For LC Series	359970-B21
Compute Node Offering	Axceleron Enfuzion 8.0 Grid Manager For LC Series - Compute Node 8Pack License	372746-B21

Product Highlights

United Devices GRID Manager

United Devices combines industry-leading technology with extensive domain experience to offer customers and partners the widest range of secure grid computing solutions available today. The company's flagship platform, Grid MP™, enables any organization to coordinate and share existing computing, application, data, storage, and network resources across departmental and geographically dispersed organizations - or to outsource processing needs to a secure private grid.

The end result is a virtual supercomputer that increases in power over time and never depreciates in value.

Many enterprises struggle to balance the requirement for additional compute power with the need to control costs. By better utilizing existing compute resources or outsourcing their processing needs, United Devices customers can alleviate bottlenecks and tackle complex computational problems with greater success.

Features include:
Provisioning - Balances power and control by enabling users to seamlessly share resources across multiple organizations -- without losing territorial control over when and how they are used.

Virtualization - Provides a single virtual user interface to compute resources, applications, and data -- allowing administrators and users to securely access resources in the grid from any remote location.

Secure Execution and Automation Layer (SEAL) - Provides a secure runtime environment via state-of-the-art technology for executing grid applications on compute resources.

Easy to Use Application Framework - Enables customers to get batch, MPI and data parallel applications running on the Grid MP platform quickly and easily with industry-leading tools and interfaces. Includes a well-documented Software Developer's Kit (SDK) to support application development.

Please refer to the Software Specifications under the DL380 Control Node for associated part numbers. All third-party software products supplied by HP shall be governed exclusively by the manufacturer's license terms and other documentation accompanying such third-party software.

Control Node Offering	United Devices Grid MP Manager for LC Series	359969-B21
Compute Node Offering	United Devices Grid MP Manager for LC Series Compute Node - Single License	359969-B21
Client agent offerings to attach to the LC Series GRID MP Manager	AIX Client License for GRID Mgr	372742-B21
	Solaris Client License for GRID Mgr	372743-B21
	WIndows Client License for GRID Mgr	372744-B21
	Linux Client License for GRID Mgr	372745-B21

Altair Engineering - PBS Pro for LC Series

The Portable Batch System, PBS, is the leading workload management solution for HPC systems and Linux clusters. PBS was originally designed for NASA because existing resource management systems were inadequate for modern parallel/distributed computers and clusters. From the initial design forward, PBS has included innovative new approaches to resource management and job scheduling, such as the extraction of scheduling policy into a single separable, completely customizable module

Key Features
User Interfaces - Designed for production environments, xPBS provides a graphical interface for submitting both batch and interactive jobs, querying job, queue, system status, and tracking the progress of jobs. Also available is the PBS command line interface (CLI) providing the same functionality as xPBS.

Product Highlights

Job Priority - Users can specify the priority of their jobs, and defaults can be provided at both the queue and system level.

Job-Interdependency - enables the user to define a wide range of interdependencies between batch jobs. Such dependencies include: execution order, synchronization, and execution conditioned on success or failure of a specified other job.

Cross-System Scheduling - provides transparent job scheduling on any system by any authorized user. Jobs can be submitted from any client system or any compute server.

Security and Access Control Lists - Configuration options permit the administrator to allow or deny access on a per-system, per-group, and/or per-user basis.

Job Accounting - maintains detailed logs of system activity for charge back or usage analysis. Custom charges can be tracked per-user, per-group, and/or per-system.

Comprehensive API - a complete Application Programming Interface (API) for sites who desire to integrate PBS with their applications, or have unique job scheduling requirements.

Automatic Load-Leveling - The cluster jobs scheduler provides numerous ways to distribute the workload across a cluster of machines, based on hardware configuration, resource availability and keyboard activity (all of which information is available via PBS).

Enterprise-wide Resource Sharing - PBS does not require that jobs be targeted to a specific computer system. This allows users to submit their job, and have it run on the first available system that meets their resource requirements. This also prevents waiting on a busy system when other computers are idle.

Username Mapping - provides support for mapping user account names on one system to the appropriate name on remote server systems. This allows PBS to fully function in environments where users do not have a consistent username across all the resources they have access to.

Parallel Job Support - supports parallel programming libraries such as MPI, MPL, PVM, and HPF. Such applications can be scheduled to run within a single multiprocessor system or across multiple clustered systems.

Automatic File Staging - provides users with the ability to specify any files that need to be copied onto the execution host before the job runs, and any that need to be copied off after the job completes. The job will be scheduled to run only after the required files have been successfully transferred. Broad Platform Availability

Please refer to the Software Specifications under the DL380 Control Node for associated part numbers. All third-party software products supplied by HP shall be governed exclusively by the manufacturer's license terms and other documentation accompanying such third-party software.

Control Node Offering	Altair PBS PRO for LC Series	359968-B21
Compute Node Offering	Altair PBS PRO for LC Series - Compute Node 8Pack License	372740-B21

Meiosys MetaCLuster HPC Checkpoint Restart

MetaCluster provides transparent, non intrusive middleware solutions to optimize and protect business critical applications. There are three main products within the MetaCluster solutions portfolio: MetaCluster-HPC addresses the needs of high performance computing, MetaCluster-UC addressed the needs of Utility Computing and finally, MetaCluster-FT which provides fault tolerance to Enterprise applications.

MetaCluster is designed for scalability and modularity and is totally non-intrusive to the applications and to the operating system. As such, applications do not need to be modified, re-installed or re-linked.

Product Highlights

At the core of the MetaCluster architecture, lie MetaProcess which enables an open "software back-plane", and several functional modules.

This simple, yet powerful design, allows new modules to be "plugged" in the "software backplane" to augment its functionality over time. Today MetaCluster incorporates five independent modules: Virtualization, Checkpoint, Application Relocation Agent, Record & Replay and Monitoring.
MetaProcess™ enables a "Software Backplane"

MetaProcess is based on a unique interposition agent technology. Its main function is to dynamically introspect all resources (system and function level) used by a given application. The same principle is applied to the kernel, where MetaProcess extends the semantic of the original system calls, to provide the services that will be used by the MetaCluster Modules.
Virtualization Module

This module virtualizes the hardware environment from the application. Each resource used by the application is virtualized as to eliminate any dependency to the underlying hardware and operating system. It encompasses memory, inter-process communications (IPCs) and files used by applications. Additionally, it virtualizes any network connection applications maintain with the external world.
Checkpoint Module

The MetaCluster Checkpoint Module gathers and saves the state of an application at a given time. It is holistic in nature as it captures the state of all resources used by the application, including open TCP/IP connections with the external world. The Checkpoint Module offers great flexibility in storing the checkpoint file either locally, on remote or shared storage (NAS, SAN) within the network. MetaCluster is designed to limit the impact on application performance through four major techniques:

- Quasi-synchronous algorithm: ensures consistency between processes while reducing the amount of time they are blocked.
- Parallelization: resources and memory dumps are performed in parallel and in the background.
- Copy on write technology to further limit performance impacts
- Memory incremental checkpoint: only save in the checkpoint file the pages in memory that have actually been modified since the last checkpoint.

Meiosys's checkpoint module supports single and multi-process, single and multithread as well as sequential and distributed (MPI-based) applications.
Application Relocation Agent

Once an application has been check pointed, MetaCluster verifies that it can be restarted on an alternative node. At the time an application migration is launched, the Application Relocation Agent is copied from the source node onto the target node and verifies that the environment (versions of operating systems and libraries) is compatible with the source node. It then supervises the migration. The Application Relocation Agent supports multiple migration mechanisms including:

- local memory to local disk
- local memory to remote memory or
- local memory to remote disk.

Since the Application Relocation Agent supports open TCP/IP sockets, it also controls the flow of network communications while it is relocating the application from the source node to the target node. This ensures, for example, that client applications (i.e. computation visualization) are not interrupted during the migration of the application.
Record and Replay Module (*)

Unlike high performance computing applications that tend to be autistic in nature, transactional applications generate a number of non deterministic events. In order to insure coherency, the Record and Replay module logs these events as they occur between checkpoint intervals. Should there be a failure, the application can restart from its last checkpoint, and the Record and Replay Module will replay all the non deterministic events in the same order they occurred to ensure coherency. (*) The Record and Replay Module is utilized in MetaCluster - FT (Fault Tolerant) product only.
Monitoring Module

The MetaCluster Monitoring Module monitors hardware, operating system, networking environment as well as

Product Highlights

MetaCluster processes and the application itself. It provides a publish-and-subscribe notification bus (XML interface), as well as application level dynamic, non intrusive, probes using MetaProcess technology. The MetaCluster modules also interface with standard batch managers like Platform Computing LSF, Altair Engineering PBS and Sun Microsystems SGE. As such, when the batch manager is present, users can invoke MetaCluster through a familiar user interface.

Please refer to the Software Specifications under the DL380 Control Node for associated part numbers. All third-party software products supplied by HP shall be governed exclusively by the manufacturer's license terms and other documentation accompanying such third-party software.

Control Node Offering	Meiosys MetaGRID Cluster HPC	372757-B21
Compute Node Offering	Meiosys MetaGRID Cluster HPC Compute Node 8Pack License	372756-B21

Product Highlights

PolyServe Matrix Server Scaleable NFS System	The PolyServe NAS Cluster solution powered by PolyServe Matrix Server provides a unique solution that addresses the scalability, availability, and manageability of file serving in the enterprise. NAS Clusters addresses the scalability and performance bottleneck posed by the most demanding, data intensive applications. In addition, the PolyServe NAS Cluster can be utilized to consolidate numerous disparate NAS filers or NFS servers onto a single centrally managed NAS cluster that provides inherent high availability and a clear growth path. Unlike some cluster file systems.

Matrix Server is implemented with a completely symmetric architecture in which there is no bottleneck "master node" on which the other cluster members depend. In a Matrix Server cluster, each cluster member is equally able to perform all file system operations on behalf of its clients, and every incremental server added to the cluster enhances the bandwidth available to clients.

Simplifying NAS Deployments- Improving Manageability
Traditionally, multiple NAS filers or UNIX NFS servers have required administrators to divide data and clients among them, perhaps replicate data among servers, and monitor and provision free space separately on each server or filer. In a PolyServe NAS Cluster environment, none of this is required:

- Because all servers in the cluster can export a single set of file systems simultaneously, there is no need to divide data among separate servers, nor to replicate data among servers.
- Similarly, since any server can service any client's requests, there is no need to assign clients manually to individual servers. Clients can be balanced among servers automatically using DNS round robin or a hardware load-balancer. In either case, no manual intervention is required.
- Free space is shared amongst all servers, simplifying storage provisioning.

Affordable High-Availability
Matrix Server includes built-in high-availability functionality that permits the cluster to detect and respond to failures of network interfaces, storage interfaces, servers and operating systems within the cluster. The PolyServe NAS Cluster solution builds on this infrastructure to provide transparent failover of NFS sessions.

A single server can provide failover protection for the entire cluster. If a server fails, Matrix Server will automatically reassign the failed server's IP address to the standby server, allowing affected clients to continue making NFS requests without any interruption of service. In fact, typically a client will have no indication that a server failure has occurred.

Because a single machine can provide failover protection for the entire cluster, it is not necessary to buy hardware in pairs to achieve high-availability. For example, in Figure 3, one server could provide fail-over protection for the other nine, giving just a 10% overhead for availability, as opposed to 50% in a typical, paired configuration.

In addition to protecting clients from failures, Matrix Server also enhances availability by reducing the need for scheduled downtime. Online addition of servers and storage is supported, making it possible to grow from, say, a three-node cluster supporting just a few hundred gigabytes of storage to a 10-node cluster hosting many terabytes, with no interruption of service for system upgrades, and with no need to reconfigure or restart any client

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Storage Processor Offerings	PolyServe Matrix Server - 2 Node Linux User	372747-B21
	PolyServe Matrix Server - 4 Node Linux User	372748-B21
	PolyServe Matrix Server - 8 Node Linux User	372749-B21
	PolyServe Matrix Server - 16 Node Linux User	372752-B21

Product Highlights

Red Hat Sistina Global File System	Red Hat Global File System (GFS) is an open source, POSIX-compliant cluster file system and volume manager that executes on Red Hat Enterprise Linux servers attached to a storage area network (SAN). It works on all major server and storage platforms supported by Red Hat. The leading (and first) cluster file system for Linux, Red Hat GFS has the most complete feature set, widest industry adoption, broadest application support, and best price/performance of any Linux cluster file system today.

Red Hat GFS allows Red Hat Enterprise Linux servers to simultaneously read and write to a single shared file system on the SAN, achieving high performance and reducing the complexity and overhead of managing redundant data copies. Red Hat GFS has no single point of failure, is incrementally scalable from one to hundreds of Red Hat Enterprise Linux servers, and works with all standard Linux applications.

Red Hat GFS is tightly integrated with Red Hat Enterprise Linux and distributed through Red Hat Network. This simplifies software installation, updates, and management. Applications such as Oracle 9i RAC, and workloads in cluster computing, file, web, and email serving can become easier to manage and achieve higher throughput and availability with Red Hat GFS.

Highlights

- **Performance**
  - Red Hat GFS helps Red Hat Enterprise Linux servers achieve high IO throughput for demanding applications in database, file, and compute serving. Performance can be incrementally scaled for hundreds of Red Hat Enterprise Linux servers using Red Hat GFS and storage area networks constructed with iSCSI or Fibre Channel.
- **Availability**
  - Red Hat GFS has no single-point-of-failure: any server, network, or storage component can be made redundant to allow continued operations despite failures. In addition, Red Hat GFS has features that allow reconfigurations such as file system and volume resizing to be made while the system remains on-line to increase system availability. Red Hat Cluster Suite can be used with GFS to move applications in the event of server failure or for routine server maintenance.
- **Ease of Management**
  - Red Hat GFS allows fast, scalable, high throughput access to a single shared file system, reducing management complexity by removing the need for data copying and maintaining multiple versions of data to insure fast access. Integrated with Red Hat Enterprise Linux (AS, ES, and WS) and Cluster Suite, delivered via Red Hat Network, and supported by Red Hat's award winning support team, Red Hat GFS is the world's leading cluster file system for Linux.
- **Advanced Features**
  - Scalable to hundreds of Red Hat Enterprise Linux servers.
  - Integrated with Red Hat Enterprise Linux 3 and delivered via Red Hat Network, comprehensive service offerings, up to 24x7 with one-hour response.
  - Supports Intel X86, Intel Itanium2, AMD AMD64, and Intel EM64T architectures.
  - Works with Red Hat Cluster Suite to provide high availability for mission-critical applications.
  - Quota system for cluster-wide storage capacity management.
  - Direct IO support allows databases to achieve high performance without traditional file system overheads.
  - Dynamic multi-pathing to route around switch or HBA failures in the storage area network.
  - Dynamic capacity growth while the file system remains on-line and available.
- **Can serve as a scalable alternative to NFS.**

Community Software Offerings

Red Hat and Oscar High-Performance Cluster Software Freeware	If you are a customer that has Linux cluster experience, you can download a Red Hat-Oscar combination and configure your own cluster. Red Hat offers technology solutions built on the benefits of Linux and open source software. Oscar consists of a fully integrated and easy to install software bundle designed for high performance cluster Clusters. Everything needed to install, build, maintain, and use a modest sized Linux cluster is included in the suite, making it unnecessary to download or even install any individual software packages on your cluster. Oscar v1.4 works with Red Hat 7.2 and Red Hat 7.3. http://redhat.com http://www.oscar.sourceforge.net/software.php

Product Highlights

Red Hat and Rocks High-Performance Cluster Software Freeware	If you are a customer that has Linux cluster experience, you can download a Red Hat-Rocks combination and configure your own cluster. Red Hat offers technology solutions built on the benefits of Linux and open source software. Rocks consists of a fully integrated and easy to install software bundle designed for high performance cluster Clusters. Everything needed to install, build, maintain, and use a modest sized Linux cluster is included in the suite, making it unnecessary to download or even install any individual software packages on your cluster. ROCKS v2.3.2 works with Red Hat 7.3. http://redhat.com Cluster software distribution site at - http://rocks.npaci.edu/Rocks/ ROCKS User Documentation at - http://rocks.npaci.edu/papers/rocks-documentation/book1.html

HP Consulting and Integration Service Offerings

HP LC Services ensure customer satisfaction of HP Linux clusters by validating clusters are configured correctly for the customer's environment and through knowledge transfer.

Requirements: LC software is loaded in the factory staging prior to delivery of these services.

Exceptions: LC services are time and material services. A; deliveries requiring usability and performance acceptance require a custom statement of work

Recommended Services - Customer Integration and Knowledge Transfer

Product Number	Description	Node Count
U5628A 001	LC - one day on-site systems software knowledge transfer and five hours of customer integration management	Required for up to 16 nodes
U5628A 002	LC - two days on-site systems software knowledge transfer and six hours of customer integration management	Required for up to 32 nodes
U5628A 003	LC -three days on-site systems software knowledge transfer and six hours of customer integration management	Required for up to 64 nodes
U5628A 004	LC -five days on-site systems software knowledge transfer and six hours of customer integration management	Required for up to 128 nodes
U5628A 005	LC -ten days on-site systems software knowledge transfer and twelve hours of customer integration management	Required for up to 256 nodes

Recommended Services - (For clusters up to 32 nodes)

Product Number	Description	Duration
U5617A	LC Implementation Program Management	40 hours implementation management consulting
U5618A	LC cluster systems software QuickStart	5 days on site consulting and six hours management coordination
U5619A	LC Cluster Applications Migration, Development, and Optimization QuickStart	5 days on site consulting six hours management coordination
U5626A	LC Applications Programming and Migration	2 days on-site formal customer training
U5627A	LC Cluster Systems Administration Course	4 days on-site formal customer training

Recommended Services - (For clusters from 33 nodes up to 128 nodes)

Product Number	Description	Duration
U5620A	LC Implementation Program Management	80 hours implementation management consulting
U5621A	LC Cluster Systems QuickStart	10 days on site consulting and twelve hours management coordination
U5622A	LC Cluster Applications Migration, Development, and Optimization QuickStart	10 days on site consulting and twelve hours management coordination
U5626A	LC Applications Programming and Migration	2 days on-site formal customer training
U5627A	LC Cluster Systems Administration Course	4 days on-site formal customer training

Recommended Services - (For clusters from 129 nodes up to 256 nodes)

Product Highlights

Product Number	Description	Duration
U5623A	LC Implementation Program Management	120 hours implementation management consulting
U5624A	LC Cluster Systems QuickStart	15 days on site consulting and sixteen hours management coordination
U5625A	LC Cluster Applications Migration, Development, and Optimization QuickStart	15 days on site consulting and sixteen hours management coordination
U5626A	LC Applications Programming and Migration	2 days on-site formal customer training
U5627A	LC Cluster Systems Administration Course	4 days on-site formal customer training

Customer Support

HP provides on-site hardware break-fix support and remote remedial software call center support. HP off-site software services will provide and assist level 1 and 2 support:

The Cyclades ATP 0190 is an IHV supported device. HP will pass through the call to Cyclades Support for technical questions that can not be answered or handled by the HP support team.

The LC Series software except for Incident bundling included in the Linux HPC offerings and any additional HP support you wish to purchase, is handled as a pass thru to ISV customer support. In the case of Scali it is three years. Please contact the appropriate ISV for support conditions. Usually the first year or two are included in the pricing of the LC Series Partner driven software.

- Level 1 is defined as everyday user/system administration issues.
- Level 2 is defined as issues relating to installation and configuration problems, along with other problems not being solvable by following the Vendor supplied documentation.

The HP software support team will work in parallel with the appropriate Vendor and development groups to address level 3 and 4 support elevations:

- Level 3 elevations typically will require patches and modifications to be generated by the Vendor to resolve deficiencies in the product.
- Level 4 elevations deal with enhancements in functionality of the product and will typically be included in future releases.

Software contracts can be also obtained to meet any and all needs of customers, to include remedial break/fix along with migration and upgrade planning along with a full suite of proactive deliverables. These services can be obtained through HP Care Pack Services to cover all needed levels of services for a limited number of instances or through software contracts from the Bronze up to and including Platinum/Custom levels of service. Following are the HP Care Pack offerings defined for the LC Series of High Performance Clusters. These specific Care Packs will reach End of Life on April 30, 2004 and HP support team will offer new Care Pack Services based on individual device content. Please check with your HP support representative for cluster offerings in the future.

Description-North America-Valid until April 30, 2004	US Part Number
4-Hour On-site Service, 5-Day x 13-Hour, 3 Years - ProLiant lc2016	344561-001
4-Hour On-site Service, 7-Day x 24-Hour Coverage, 3 Years - ProLiant lc2016	344562-001
4-Hour On-site Service, 5-Day x 13-Hour, 3 Years - ProLiant lc2032	344563-001
4-Hour On-site Service, 7-Day x 24-Hour Coverage, 3 Years - ProLiant lc2032	344564-001
4-Hour On-site Service, 5-Day x 13-Hour, 3 Years - ProLiant lc2064	344565-001
4-Hour On-site Service, 7-Day x 24-Hour Coverage, 3 Years - ProLiant lc2064	344566-001
4-Hour On-site Service, 5-Day x 13-Hour, 3 Years - ProLiant lc2128	344567-001
4-Hour On-site Service, 7-Day x 24-Hour Coverage, 3 Years - ProLiant lc2128	344568-001

QuickSpecs

Product Highlights

CarePack	CPL Description	HW Family	Delivery Mechanism
U6459A	HP CP 3Y 4H 13x5 ProLiant lc2016	ProLiant lc 2016	Boxed version
U6459E	HP CPe 3Y 4H 13x5 ProLiant lc2016	ProLiant lc 2016	Electronic version
U6460A	HP CP 3Y 4H 24x7 ProLiant lc2106	ProLiant lc 2016	Boxed version
U6460E	HP CPe 3Y 4H 24x7 ProLiant lc2016	ProLiant lc 2016	Electronic version
U6461A	HP CP 3Y 4H 13x5 ProLiant lc2032	ProLiant lc 2032	Boxed version
U6461E	HP CPe 3Y 4H 13x5 ProLiant lc2032	ProLiant lc 2032	Electronic version
U6462A	HP CP 3Y 4H 24x7 ProLiant lc2032	ProLiant lc 2032	Boxed version
U6462E	HP CPe 3Y 4H 24x7 ProLiant lc2032	ProLiant lc 2032	Electronic version
U6463A	HP CP 3Y 4H 13x5 ProLiant lc2064	ProLiant lc 2064	Boxed version
U6463E	HP CPe 3Y 4H 13x5 ProLiant lc2064	ProLiant lc 2064	Electronic version
U6464A	HP CP 3Y 4H 24x7 ProLiant lc2064	ProLiant lc 2064	Boxed version
U6464E	HP CPe 3Y 4H 24x7 ProLiant lc2064	ProLiant lc 2064	Electronic version
U6465A	HP CP 3Y 4H 13x5 ProLiant lc2128	ProLiant lc 2128	Boxed version
U6465E	HP CPe 3Y 4H 13x5 ProLiant lc2128	ProLiant lc 2128	Electronic version
U6466A	HP CP 3Y 4H 24x7 ProLiant lc2128	ProLiant lc 2128	Boxed version
U6466E	HP CPe 3Y 4H 24x7 ProLiant lc2128	ProLiant lc 2128	Electronic version

Technical Specifications

LC Series System Physical information:
- Weight is actual system not shipping
- BTU is a total accumulative and does not include Procurve Switches
- Rack Foot Print 39.37 in x 24 in

32 Node System Configuration Totals

Description	Rack 10642 Shock Pallet	Total
Weight (lb)	1373.25	1576.00
BTU	27803.00	34103.00
Amps	37.00	45.40
Watts	8152.50	10000.50
Leakage Current	20.80	25.48

NOTE: Node Technical Specifications - Please refer to the individual Control Node (DL380) and Compute Node (DL140, DL145, and DL360) for Technical specifications at
http://h18004.www1.hp.com/products/servers/platforms/index-dl.html