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# QUOTATION

Quote # MWYQ18816

Date: 11/10/2014

Microway Confidential

## Quote To:

Princeton Plasma Physics Laboratory  
 Paul G Henderson  
 Princeton, NJ 08543-0451  
 (609)243-2412  
 phenderson@pppl.gov

## Ship To:

Princeton Plasma Physics Laboratory  
 Paul G Henderson  
 Princeton, NJ 08543-0451  
 (609)243-2412  
 phenderson@pppl.gov

## Sales Rep.

Jan Smith  
 508-732-5523  
 jan.smith@microway.com

Qty	Description	Unit Price	Extended Price
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Microway is a small business, woman owned and operated. We are building many clusters at any one time and have built thousands of custom clusters for universities, government research labs and agencies, and corporations. Microway has been in the scientific computing business since 1982.

### Total of 500 nodes, 10,000 cores and 64,000GB of memory (6.4GB per core)

125	<b>Microway Xeon 2U Twin<sup>2</sup> Servers (Four Nodes per 2U)</b>	\$23,865	\$2,983,125
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NumberSmasher-4X Intel Xeon Twin<sup>2</sup> Servers  
 2U Rackmount Chassis with  
 1620W Platinum High-Efficiency Hot-Swap 1+1 Power Supply  
 (power supplies may not be redundant under full load)  
 26.5" - 36" Rackmount Rail Kit



Four Hot-Pluggable Compute Nodes, each with:

- Up to two Intel Xeon E5-2600 Socket R3 processors (up to 120W)
- Intel C612 Express chipset
- Intel QuickPath Interconnect (QPI) with system bus up to 9.6GT/s
- Eight slots for up to 512GB ECC DDR4-2133/1866 memory
- One low-latency InfiniBand port (Mellanox ConnectX-3 FDR QSFP)
- Dual Integrated Intel i350-AM2 Gigabit Ethernet ports
- One PCI-Express 3.0 x16 slot (Low Profile; Half-Length)
- Integrated ASPEED AST2400 Graphics
- IPMI 2.0 w/ Virtual Media, KVM and Dedicated LAN Support
- Three hot-swap 3.5" 6Gbps SATA3 Drive Bays (2.5" and SAS3 support optional)
- Two Stacked USB 3.0 Connectors; One Serial Port; One VGA Port

(8) Intel Xeon E5-2650v3 Haswell-EP 2.30 GHz Ten Core 22nm CPU  
 with 25MB L3 Cache, DDR4-2133, 9.6 GT/sec QPI, 105W  
 Supports Hyper-Threading and Turbo Boost up to 3.0 GHz

#### (2 CPUs per Node)

(32) 16GB DDR4 2133 MHz ECC/Registered Memory (Dual Rank, 1.2V)

#### (64GB Total Memory per Node @ 2133MHz)

(4) 120GB Intel Pro 2500 Series 2.5" SATA III MLC Solid State Drive (20nm)  
 SATA 6Gb/s Interface (Supports 3Gb/s)  
 Solid State Disk (SSD), 1.2 Million Hours Mean Time Before Failure (MTBF)  
 Uncorrectable Bit Error Rate (UBER): <1 sector per 10<sup>16</sup> bytes read  
 Sustained sequential read: up to 540 MB/s (280 MB/s for 3Gb/s)  
 Sustained sequential write: up to 480 MB/s (260 MB/s for 3Gb/s)  
 Random 4 KB Reads (8GB Span): Up to 24,000 IOPS; Writes: Up to 80,000 IOPS  
 Read latency: 80 microseconds  
 Write latency: 85 microseconds

(4) 2.5" HDD Adapter for 3.5" HDD Carrier Tray

#### (One Hard Drive per Node)

(4) InfiniBand 4x QDR Cable, QSFP, 2 meter, 30 AWG

(4) Cat 6 Ethernet Cable (10 ft, or appropriate length)

**Test with Linux. Customer intends to network boot nodes.**

IPMI management capability is integrated on the motherboard. IPMI allows administrators to remotely monitor and control each computer individually. Capabilities include:

- \* System Power On, Power Off and Reset
- \* Monitor Fan Speeds, Component Temperatures and Voltages
- \* Remote Serial Console and KVM Access
- \* Virtual Media: local devices (CD, USB, etc) appear as directly connected to remote system

### **Cluster Configuration & Shipping**

Microway's software integrators will communicate with a designated system administrator to ensure the cluster configuration meets the needs of the users. The cluster will be delivered with the operating system and cluster software tools fully integrated.

A cluster configuration questionnaire will be sent to you once your order has been placed. This questionnaire provides the opportunity for you to customize storage, disk partitioning, mount points, network names & addresses and cluster software.

For safety, systems are boxed and shipped on pallets separately from the rackmount cabinet(s). Factory pre-wiring of the cabinets and/or onsite installation services are available for an additional fee.

### **Microway Cluster Management Software (MCMS) installed.**

MCMS is a monitoring and control software package that integrates the tools needed to understand what events are taking place on the cluster and the tools to control the cluster itself.

The monitoring tools provide the administrator with the capability of monitoring the cluster from any location via a web based interface. This allows for checking on the cluster through a web browser and securely logging directly to the machine. Once into the monitoring mode, critical statistics are displayed to you that show global cluster stats, current load, memory utilization, and which nodes are on or off line. In addition to the global parameters you can see the same statistics on a local node basis. The package can be extended from the default parameters to allow execution of additional tasks that are of interest to the administrator.

The control portion of the package allows the administrator to control the cluster from the master node. Among those features available are:

- Backup and Restore Node System Images
- Copy files to all nodes
- Execute commands on all or a particular node
- Test rsh connectivity and authorization
- Test TCP/IP networking connectivity
- Reboot the entire cluster or specific nodes
- Shutdown nodes or the cluster in entirety

The combination of these tools allows for extended control of the cluster as a single unit and gives the administrator the tools he needs to analyze the usage of the complete system.

### **Complete Cluster Manual**

Microway's cluster manual includes installation, usage, maintenance and troubleshooting instructions. Special instructions pertaining to your cluster, as well as a rackmount cabinet layout, will be provided as necessary.

Manuals for chassis, motherboards and other hardware components are available in electronic form.

### **Microway Testing Procedure**

Each computer system is network booted to execute low-level memory tests for 12+ hours.

Once passed, operating systems are loaded and Linux stress tests are executed for 24+ hours. These tests include processor and memory intensive applications that have been shown to cause faults in the field. A separate set of tests accesses all sectors on each hard drive and runs filesystem-intensive applications to ensure drive and filesystem reliability.

Finally, cluster utilities, compilers, libraries and applications are installed and configured. The cluster network and node software is configured for optimal latency/throughput. Cluster applications are executed for 48+ hours. These tests insure the final network, hardware and software configurations are stable and reliable.

As a full service provider, Microway offers a broad range of commercial and open source applications. This quote includes the installation of open source and commercial applications purchased from Microway onto the cluster. If a compiler is not purchased with this order, the GNU compiler will be installed. Other arrangements are made at the time of purchase to install other compilers not sourced by Microway, but may incur additional charges. Upon receipt of your order, we will request additional information for our assembly, integration, and quality control teams to insure proper configuration and on-time delivery.

**Microway provides lifetime technical support on all clusters. Out-of-warranty repairs are available for a nominal fee. Microway's hardware warranty may be extended on an annual basis for up to 5 years total warranty.**

**Shipping and Insurance: prepay and add**

**Total (Academic Pricing)**

**\$2,983,125**

**Estimated Cluster Power Consumption at Full Load: 187,500 Watts, 639,776 BTUs/hour**

**FOB:** Destination, Prepay and Add

**Ship Date:** 3 - 4 Weeks after receipt of order and documentation

**Warranty:** Two years offsite with replacement components typically cross-shipped within 24 hours of problem determination by Microway Tech Support.

**Technical Support:** Lifetime technical support via telephone, fax, or email.

**Terms:** Net 30

**Shipping Method:** FedEx Freight - Prepay & Add

The Buyer is responsible for any sales taxes or duties related to the purchase.

Since 1982 Microway has been a leader in providing high performance computing solutions. Microway specializes in building complex clusters, servers, and workstations. We are unique in having Linux expertise throughout our organization to provide testing of all systems at our assembly and integration center at our headquarters in Plymouth, Massachusetts. Our validation suite includes a number of MPI applications and Microway proprietary software, including MPI Link-Checker and InfiniScope.



Microway is classified as a small business - woman owned and operated.

Microway welcomes our customers (and potential customers) to personally visit our manufacturing facility. We value the opportunity to share our understanding of the systems we build, and to demonstrate our dedication to quality in our design, fabrication, final testing and technical support. Please contact me if you plan to be in or near Massachusetts and would like to make an appointment.

Prices subject to review at time of order due to potential short term memory and hard drive price volatility.

**GSA quotes are available upon request. Microway's GSA Contract Number is GS-35F-0431N.**

**This quote is valid for 30 days.**