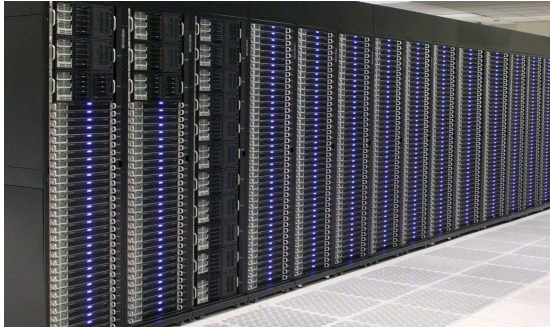


Appro Turnkey Solutions

Based on 1U and 2U Servers



Appro is committed to revolutionizing the data center with its open and flexible energy-efficient HPC Solutions. Our leading edge servers and turn-key cluster solutions combine the latest green technologies with outstanding price/performance and engineering expertise aimed at improving customers' applications performance while reducing energy bills in the data center. Appro's new energy-efficient and power-optimized turnkey rack-mount servers are part of the Go-Green initiative to address the HPC environmental challenges and business needs at a lower TCO.

Appro builds, test and deploys various sizes of HPC turnkey solutions easily by using Scalable Units (SUs) concept. The SU concept is based on a standard 42U rack cabinet architecture that groups together clusters with the same configuration to make a unified and fully integrated stand-alone supercomputing that can be provisioned and managed to meet a specific computational requirement. With these flexible SU recipes, small and large clusters can be built and deployed very rapidly delivering outstanding scalable performance up to 500TF.

Turnkey Solution Benefits

- Hardware and Software can be preloaded and tested at the factory for more agile deployment making Appro Scalable Units an easy-to-use building block for HPC cluster installations
- Agile Deployment: Ready to network and power on by the HPC Professional Services team
- Simple to order and put to work in the datacenter, speeding time to results
- Higher quality and lower risk, with pre-tested, standardized systems
- Flexible architecture with a choice of AMD Opteron™ or Intel® Xeon® processors and Linux OS
- Ready for building or expanding complete HPC cluster architectures for a rapidly changing data center environment
- A volume purchase of Appro Scalable Units offers a lower total cost of ownership (TCO)

Appro HPC Server Building Blocks for “Scalable Units”

The following is Appro general “recipes” for building a complete Turnkey Solution Architecture:

- 1U performance servers for performance clusters
- 2U servers a management and head nodes
- Configure RAID6 for data redundancy if needed
- Switches: QLogic or Flextronics IB switches
- Customer choice for Ethernet switches
- Cluster Management Software: ClusterCorp ROCKS+ and MOAB cluster management suite optional
- Server Management: IPMI implementation with functions such as power control and console redirection. A Linux utility will be used (such as IPMITools, FreeIPMI)

Appro 1U Servers - Greater Flexibility and Choice

Appro offers a variety of 1U servers ranging from 2 to 4 processor rack-mount servers providing outstanding performance, power efficiency and configuration flexibility. Deploy for clusters in capacity computing environments, front-end network applications and compute server farms.



	1343H	1400X	1424X
Processor	AMD Opteron 6100 Series processor	Intel Xeon processor 5600 series	Intel Xeon processor 5600 Series
Cores/Processor	8 or 12	4 or 6	4 or 6
Processor Capacity	4	2	4
Max. Memory	512GB in 32 DIMM sockets	32GB in 8 DIMM sockets	48GB in 12 DIMM sockets
Storage Capacity	6.0TB SATA	2.0TB SATA	2.0TB SATA
Power Supply	1400W	400W	1200W
Processors/42U Rack	168	84	168
Warranty	2 years parts and labor	2 years parts and labor	2 years parts and labor

Appro 2U Servers – Reliability, Flexibility and Choice

Appro 2U servers represent a versatile platform that meets the performance, energy-efficiency and reliability requirements of a broad range of enterprise and technical computing applications. Deploy for cluster supercomputing head nodes, e-commerce, domain controllers, exchange servers, web servers and database servers.









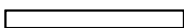

	2320HT	2328H	2346H	2426X
Processor	AMD Opteron 6100 Series processor	AMD Opteron 6100 Series processor	AMD Opteron 6100 Series processor	Intel Xeon processor 5600 Series
Cores/Processor	8 or 12	8 or 12	8 or 12	4 or 6
Processor Capacity	2/board, 8/chassis	2	4	2
Max. Memory	256GB in 16 DIMM sockets	256GB in 16 DIMM sockets	512GB in 32 DIMM sockets	48GB in 12 DIMM sockets
Storage Capacity	46.0TB SATA	16.0TB SATA	12.0TB SATA	6.0TB SATA
Power Supply	1400W	720W	1400W	750W
Processor/42U Rack	168	42	84	42
Warranty	2 years parts and labor	2 years parts and labor	2 years parts and labor	2 years parts and labor

The Scalable Unit Recipe

Appro Turnkey Solutions based on Scalable Units generally consist of three major components:

- Management Rack (MR)
- Compute Rack (CR)
- Spine Rack (SR)

In this next section, you will find a sample turnkey cluster configuration for the Appro Scalable Unit concept. The color-coded legend below will help guide you through the different components contained in each cluster rack.

Legend			
	1U Compute Node		1U 24p IB Switch
	2U Master Node		14U 288p IB Switch
	1U RM APC KVM		1U Cyclades Switch (as needed)
	Blank RU		1U Ethernet Switch

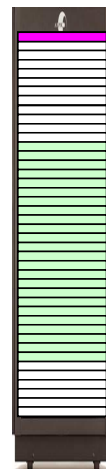
Management Rack

- One 2U Management Server
 - Hot-swap HDDs, fans & PS
 - RAID6 in N + 2P drives configuration
- Switches
 - One 48p Ethernet switch: All cables are contained within the rack
 - Infiniband switch may or may not be needed. Dependant on the size of the cluster
- Requires two APC AP7598 – Basic rack PDU, therefore rack requires two 208V 50A 3P circuits (rack max is 24kW)



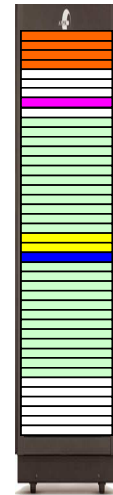
Compute Rack

- Contains up to 24 Compute Servers
 - Single or Twin servers
 - For Twin, this is the maximum # of nodes that can be contained in a 24kW rack
- Switches
 - One 48p Ethernet switch: All cables are contained within the rack
 - Infiniband switch may or may not be needed. Dependent on the size of the cluster
 - If <288 nodes then all cables go to central SR
 - If >288 nodes then install appropriate # of edge switches in rack. Location determined by whether it is overhead or under floor cabling

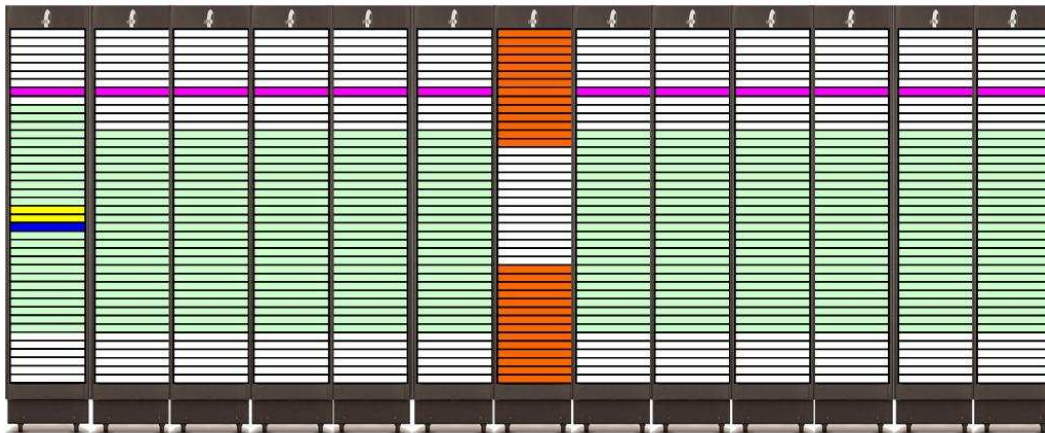


Spine Rack

- For clusters <144 nodes, the IB SW can be installed in the Management Rack (144p IB SW is 7U)
- For clusters >144 nodes, a SR is required to hold the IB switches
- One APC AP7594 – Basic rack PDU, therefore rack requires one 208V 20A 3P circuits (rack max is 5.7kW). This is sufficient to hold up to two 288p switches
- Use copper Infiniband cables for all in-rack cabling. Use fiber cables for all rack to rack cabling
- Two APC AP7598 – Basic rack PDU, therefore rack requires two 208V 50A 3P circuits (rack max is 24kW)



Sample Solution based on Scalable Units



574 Node Cluster – Approximately 55TF computing power

Cluster Management

With flexible configuration designs and integrating industry standard technologies, Appro offers complete turnkey cluster solutions with open source cluster management options for our 1U/2U cluster projects. Appro works with open source and commercially supported software such as ROCKS+ and MOAB from ClusterCorp to deploy a full service open source, customized and self-maintained cluster environment.

Rocks+ = Flexibility and Scalability

The design specification of a Rocks+ Cluster can vary from a small 16-node system built with a local Gigabit Ethernet network to a large-scale supercomputing cluster with thousands of cores and high-end interconnect such as InfiniBand. Rocks+ can manage each type of system with equal efficiency.

Rocks+ includes important additional software (i.e. Rolls – modular plug-ins to Rocks), which add a number of items to Rocks, to include:

- Intel Cluster Ready Roll
- Intel Developer Roll (Compilers)
- PGI Roll (Portland Group Compilers)
- Moab Roll (Cluster Resources)
- LSF Roll (Platform)
- TotalView Roll (Debugger)
- CUDA Roll (NVIDIA/Tesla)
- Absoft Roll (Compilers)
- Support Roll

Mellanox OFED Roll (there is no support for IB in Open Source Rocks). Rocks+ clusters may supplement a GbE management with a dedicated InfiniBand IPC fabric with fast switching and native RDMA capabilities to ensure maximum performance.

MOAB Cluster Suite = Efficiency

Moab Cluster Suite incorporates the following industry-leading applications from Cluster Resources:

- Moab Workload Manager® — a policy-based workload management and scheduling engine
- Moab Workload Manager® — a policy-based workload management and scheduling engine
- Moab Cluster Manager® — a powerful graphical cluster admin interface, monitor & reporting tool
- Moab Access Portal® — a web-based end-user job submission and management portal

System Compatibility

Operating system support for Linux (all), Unix (AIX, IRIX, HP-UX, FreeBSD, OSF/Tru-64, Solaris, etc.), Mac OSX & limited Windows support.

Resource Manager support for LSF, TORQUE, PBSPro, SGE, SLURM, LoadLeveler, OpenPBS, BProc, and custom resource managers.

Appro Professional Services and Support

Appro Turnkey Solutions using Scalable Units for HPC arrive ready to switch on, helping enable more productivity and faster time to results allowing organizations to concentrate on their core business while leaving the racking, stacking, cabling and integration tasks to the specialists at Appro. Networking and interconnect options are available as part of the system integration and management software. Appro service and warranty offerings are available for all Appro components within the scalable units. Third-party products, such as networking equipment, carry the original manufacturer's warranty.

Appro HyperCluster 1343H – [US List Price for Standard Configuration](#)

For more information about Appro Turnkey Solutions or warranty and support, please contact an Appro Sales Representative at sales@appro.com or visit www.appro.com .