Supercomputer Solutions

- Power-Efficient, Green Clusters
- Based on Appro GreenBlade™ System
- For Medium- to Large-Scale HPC Installations
- Fully Integrated and Pre-Packaged Solution

Outstanding Performance, Flexibility, and Choice for Medium to Large-scale HPC Installations

The Appro HyperGreen™ Cluster solution is based on the Appro GreenBlade™ system solution building block offering a modular, flexible and energy-efficient cluster architecture that addresses today's natural business growth from mid to large-scale high performance and high-density computing applications.

The Appro HyperGreen Cluster provides flexibility with a choice of servers, networking, interconnects with an open commercially supported cluster management solution that can be easily configured and pre-integrated as a part of a complete package to include HPC professional services and support.

The Intel® Xeon® processor 5500 series can dramatically advance the efficiency of IT Infrastructure and provide unmatched business capabilities.

Ideal Environment

Best for high performance computing applications such as electronic design automation, aerospace and automotive engineering simulations, petroleum exploration and production, scientific visualization for oil discovery and recovery, research in seismic, health and sciences, research projects, financial modeling and risk management.

Appro Support and Services

- Closed-loop solution management, up-front consulting, pre-integration and testing with pre-sales and post-sales support.

- Support for Linux operating environments, with configurations that provide exceptional performance across a wide range of HPC applications.

Simplifying Cluster Integration for Faster Deployment

The Appro HyperGreen™Clusters based on the GreenBlade System ™ is simply a smarter way to build cluster solutions providing the capacity computing that HPC applications require while offering better value compared to traditional rack mounted servers.

Each GreenBlade system represents the evolution of traditional turnkey rack mounted server clusters. It consolidates server, storage, network, power and simplified management capabilities into one building block solution making it easy to test, configure and integrate as a pre-packaged turnkey solution.

Mid- to Large Data Centers Scaling up to 1000 nodes

Appro HyperGreen™ Cluster

Appro GreenBlade™ System

Refreshing ROI with a Green and Modular Architecture

- Consolidates Server, storage, network – all in a shared environment utilizing 90%+ efficient power supplies.

- Increase server count up to 60% while reducing electricity costs up to 30%

- It boasts up to 20% power consumption reduction per node compared to equally configured 1U servers, significantly reducing energy bills in the datacenter.

- Delivers hot-swappable and redundant core components such as cooling fans, power supplies and blade nodes offering superior reliability, availability and serviceability.

- Takes full advantage of the latest Intel Technologies minimizing power consumption, increasing memory capacity while improving system I/O bandwidth for high performance computing applications.

Flexibility, Performance and Efficiency to meet Customers Needs

- Clusters based on the Appro GreenBlade™ System (total of 10 server blades per 5U System) delivering scalability, flexibility and power efficiency in a dense cluster architecture

- Supports Dual/Quad-Core Intel Xeon Processors 5500 series offering up to 80 GreenBlades, 640 cores in a standard 42U rack configuration, doubling the density per rack compared to 1U servers

- Supports up to 1.0TB SATA with up to 48GB of DDR3 memory per compute blade while offering improved RAS with hot-swappable and redundant fans, power supplies and blade nodes.

- Supports a variety of configuration and interconnect options and choice of management options such as Server Mgmt: Standards-based IPMI or Appro BladeDome remote server management and/or Cluster Mgmt options based on open source software solutions such as Rocks+ and MOAB from ClusterCorp.

- Fully integrated, tested and pre-packaged solution to include HPC professional services and support

Performance That Adapts to Your Software Environment

Application performance is critical for day-to-day business operations, as well as creating new products and reaching new customers. But many data centers are now at capacity, and new ones are expensive to build. By refreshing data center infrastructure with more efficient servers, customers can deliver additional performance and scalability within the same energy and space footprint.

The Appro HyperGreen Cluster based on Intel Xeon processor 5500 series, formerly code name Nehalem, is capable of executing 64bit IEEE floating point operations at a rate of 47GF per second. The processor has an integrated memory controller and three 1,333MHz DDR3 memory channels. It is supported by the Intel 5520 chipset and PCI Express 2.0 I/O channels. The peak capability per processor core is up to 12GF per second while executing IEEE 754 64bit floating point instructions. Each compute node in the HyperGreen Cluster is a dual-socket quad-core module with 84GF of peak processing capability. Each module has up to 48GB of ECC memory with a peak bandwidth of 32GB/second.

Appro HyperGreen based on Intel Xeon processor 5500 series delivers intelligent performance:

- Intel Intelligent Power Technology makes power available for critical workloads while conserving power where there is less demand, delivering as much as 2.25x more performance in a similar power envelope.

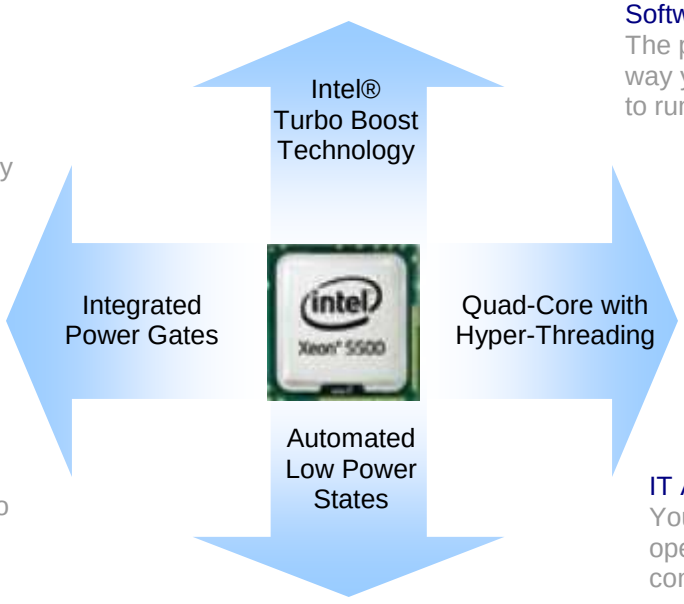
- Intel Turbo Boost Technology increases performance by automatically increasing core frequencies and enabling faster speeds for specific threads and mega-tasking workloads.

- Intel Hyper-Threading Technology benefits from larger caches and massive memory bandwidth, delivering greater throughput and responsiveness for multi-threaded applications.

- Intel QuickPath Technology and integrated memory controller speed traffic between processors and I/O controllers for bandwidth-intensive applications, delivering up to 3.5x the bandwidth for technical computing.

Performance
Maximizes performance by adapting to the workload through Intel® Turbo Boost Technology and Intel® Hyper-Threading Technology

Software Adaptable
The processor adapts to the way your application wants to run



Energy Efficiency
Automatically puts CPU into the lowest available power state while still meeting performance requirements

IT Adaptable
You can enable automatic operation or selectively configure for manual control

Appro HyperGreen Clusters

(Number of Scalable Compute Nodes per Standard 42U Rack Cabinet)

	1 Rack	2 Racks	4 Racks	8 Racks	12 Racks
Cores	640	1280	2560	5120	7680
Processors	160	320	640	1280	1920
Nodes	80	160	320	640	960
Memory Capacity	4TB	8TB	16TB	32TB	48TB

Computational Density and Flexible Interconnect Options

The Appro HyperGreen Cluster provides an extremely flexible and manageable way to create high-density computing. It is designed to scale, with little effort or re-configuration. It is based on the Appro GreenBlade System building block solution supporting up to 10 dual socket blades per subrack allowing 8 subracks in one standard rack cabinet with 2 rack unit spaces left for switches. Working through the cores-per-rack arithmetic, (8x2x10x4) yields 80 blades with 640 processing cores per 42U rack cabinet, twice the density that you can get with 1U servers.

The Appro HyperGreen cluster offers a variety of interconnect options to include only standard 1U Ethernet or 1U Infiniband (IB) switches. This is accomplished by pre-allocating space in each rack cabinet for two standard 24-port Infiniband or Ethernet switches. This offers flexibility for customers who may choose to deploy either an Ethernet or IB-based HPC cluster. Appro also offers variations in the Infiniband Interconnect with ConnectX DDR single IB, DDR dual IB or QDR single IB configurations. This provides excellent network bandwidth and low latency to many HPC workloads that require higher performance for their applications.

Better Virtualization Support in I/O Devices

As businesses deploy more and more applications in virtualized environments and as they take advantage of live migration to save power or boost availability, the demands on virtualized I/O increase significantly. Intel VT-c optimizes the network for virtualization by integrating extensive hardware assists into the I/O devices that are used to connect your servers to your data center network, storage infrastructure and other external devices. Intel VT-c includes two key technologies that are now supported in all Intel® 10 Gigabit Server Adapters and selected Intel® Gigabit Server Adapters.

The Appro HyperCluster based on Intel Xeon processors 5500 series offers Intel VT-c that can more than double the I/O throughput and achieve near-native throughput for virtualized applications so more applications can be consolidated per server with fewer I/O bottlenecks. These Intel technologies are fully integrated, thoroughly tested and widely supported by leading virtualization software solutions. They provide IT organizations with a proven, industry-leading foundation for optimizing the value of their server and virtualization investments.

Open Standards and Commercially Supported Cluster Management Options

Appro offers standards-based IPMI or Appro BladeDome remote server management and/or cluster mgmt options based on open source software solutions such as Rocks+ and MOAB from ClusterCorp.

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) etc.

Rocks+ and MOAB Cluster Suite® = Efficiency

Rocks+ is the only licensed open source commercial solution based on Rocks+ that is designed specifically for HPC clusters. Moab Cluster Suite® is a professional cluster management solution that integrates scheduling, managing, monitoring and reporting of cluster workloads. Moab Cluster Suite simplifies and unifies management across hardware, operating system, storage, network, license and resource manager environments to increase the ROI of cluster investments. Its task oriented graphical management and flexible policy capabilities provide an intelligent management layer that guarantees service levels and speeds job processing.

Simplified Server Management Options

The Appro BladeDome Server Management software is designed exclusively for the Appro GreenBlade System to provide system administrators with in-depth understanding and notification of the entire system while delivering a simplified and cost-effective management solution.

Features

- Offers platform management and monitoring with status summary, and remote management capabilities

- Remotely manages up to thousands of compute nodes through support for Management and Sub-management servers

- Security via user ID/Password using SSH/SHA

- Utilizes system and node management monitoring through an iSCB (intelligent Shelf Controller Board) that is part of the GreenBlade system.

- Web interface option

Cluster and Blade System Configuration

Cluster Configuration	
Blades	80 blade nodes per system
Processors	160 Intel Xeon processors 5500 Series
Cores	640 processing cores per rack cabinet
Memory Capacity	7.68TB max. per system (using 8GB DIMMs)
Storage Capacity	Up to 160 internal 2.5" HDDs, equal to 80TB of local storage
Networking	Gigabit or Infiniband high speed interconnects, networking, storage, operating system, cluster management software
Rack Configuration	Standard 42U/19" rack, 2U space available for switches
RAS Features	Improved Reliability, Availability, and Serviceability with: Hot-swappable blades nodes Hot-swappable, redundant power supplies Hot-swappable, redundant cooling system
Power Consumption	16kW to 32kW, depending on system configuration

Subrack System Configuration	
Device Bays	Up to 10 blade nodes
Form Factor	5U
Power Supply	Up to four 1625W high-efficiency PSUs in N+1 configuration Maximum power delivery is 4.707kW
Cooling	Up to three cooling fan units (CFU); Each CFU has redundant cooling fans
Ethernet I/O	On-board 2 port GbE LAN (RJ45)
Fibre I/O	Optional add-on low-profile FC HCA; PCIe x8 Gen1
Infiniband I/O	Optional one Mellanox MT25408A0-FCC-QI Dual-port DDR Optional two Mellanox MT25408A0-FCC-QI Dual-port QDR Optional Mellanox or QLogic add-on low-profile IB HCA PCIe x8 Gen1
Dimensions	8.75"H x 19"W x 26"D
Weight	149lbs (67.05kg) max
Management	Supports high-speed interconnects; Appro Cluster Management; Windows or Linux OS

Compute Blade Configuration

Compute Blade Configuration	
Processor	Dual/Quad-Core Intel Xeon processor 5500 series
Processor Capacity	2
Chipset	Intel 5520 chipset
System Bus	Intel QuickPath Interconnect (QPI)
Memory Type	Support for 800/1066/1333 MT/s ECC RDIMM DDR3 memory
Memory Capacity	Up to 48GB in 12 DIMMs across six memory channels (3 channels per processor)
Disk Controller	Intel I/o controller hub (ICH10R)
Drive Bays	Up to two fixed 2.5" SATA HDDs
Storage Capacity	1.0TB SATA
Graphics	Aspeed AST1100 controller with 64MB memory
Network Interface	Two 10/100/1000 ports, Intel 82576EB PHYs supporting Intel I/OAT Optional: Single or Dual port Mellanox Connect-X Infiniband (DDR) with CX4 connectors
Input/Output	1 RJ-45 serial and DB-15 video port, 2 USB 2.0 connectors and RJ-45 LAN ports Optional: Single or Dual port Infiniband (DDR) with CX4 connectors
Expansion Slots	One x16 PCIe Gen2 PCI riser clot capable of supporting a low-profile add-in card
Power and Cooling	Cooling and Power provided on GreenBlade subrack
Weight	8.7 lbs (3.9kg) per node
Dimensions (HxWxD)	5" x 1.75" x 25" (127 x 44.5 x 635 mm)
Temperature	Operating: 10 - 35℃ Storage: 70℃
Remote Server Mgmt	IPMI 2.0 compliant, integrated baseboard management controller (Integrated BMC)

APPRO
Supercomputer Solutions

Appro International, Inc.
446 South Abbott Avenue | Milpitas, CA 95035, USA
800.927.5464 (US only) | 408.941.8100 Main | 408.941.8111 Fax
info@appro.com | www.appro.com

intel Xeon inside™ Powerful. Intelligent.