

# Appro HyperGreen™ Clusters



- 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.

### 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.



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

## 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.

### Intel® Cluster Ready Certified

The Intel Cluster Ready recipes give customers another reason to deploy the Appro GreenBlade System and HyperGreen Cluster solution by offering confidence that the cluster architecture and software are certified to work together. It also gives Independent Software Vendors (ISV) the ability to run their software in this certified cluster platform providing a fast and cost-effective implementation for industry-specific solutions.

## 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) deliver 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 software 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 a 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.

### World's Most Adaptable Server Platform

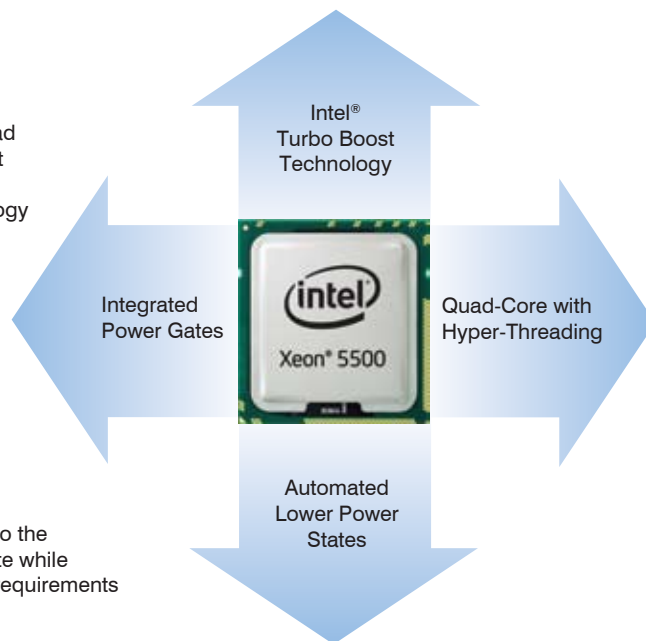
Intel®Xeon® Processor 5500 Series

#### 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



Integrated Power Gates

Intel® Turbo Boost Technology

Quad-Core with Hyper-Threading

Automated Lower Power States

#### 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
<b>Number of Cores</b>	640	1,280	2,560	5,120	7,680
<b>Number of Processors</b>	160	320	640	1,280	1,920
<b>Number of Nodes</b>	80	160	320	640	960
<b>Max Memory Capacity</b>	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.

*Appro offers server management options such as standards-based IPMI or Appro BladeDome remote server management and/or cluster management options based on open source software solutions such as Rocks+ and MOAB from ClusterCorp. In addition, the Appro GreenBlade™ is Intel® Cluster Ready certified giving customers the confidence to deploy a solution that hardware and software is certified to work together.*

## Open Standards and Commercially Supported Cluster Management Options

### 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

### Benefits of Intel Cluster Ready Certification:

- Simplification - Confidence - Productivity - Quality
- Intel Cluster Checker is shipped with each certified solution. It uses an automated and systematic method to ensure the system is operating as expected at all times.
- Appro quality team verifies each Intel Cluster Ready solution functions at expected levels and provides the standard interface that enables running registered applications.

# Appro HyperGreen™ Cluster, Blade System, and Node Configuration

## Cluster Configuration

<b>Processors</b>	160 Intel® Xeon® processors
<b>Cores</b>	640 processing cores per rack cabinet
<b>Memory Capacity</b>	7.68TB max. per system
<b>Storage Capacity</b>	Up to 160 internal 2.5" HDDs, equal to 80TB of local storage
<b>Networking</b>	Gigabit or InfiniBand high speed interconnects, networking, storage, operating system, cluster management software
<b>Rack Configuration</b>	Standard 42U/19" rack, 2U rack space available for switches
<b>RAS Features</b>	Improved Reliability, Availability, and Serviceability with: <ul style="list-style-type: none"> <li>• Hot-swappable blade nodes</li> <li>• Hot-swappable, redundant PS</li> <li>• Hot-swappable, redundant cooling system</li> </ul>
<b>Rack Level Power</b>	16kW to 32kW, depending on system configuration
<b>Certification</b>	Intel® Cluster Ready Certified

## Subrack System

<b>Device Bays</b>	Up to 10 blade nodes
<b>Form Factor</b>	5U
<b>Power Supply</b>	Up to four 1625W high-efficiency PSUs in N+1 configuration, Maximum power delivery - 4.707kW
<b>Cooling</b>	Up to 3 cooling fan units (CFU) Each CFU has redundant cooling fans
<b>Ethernet I/O</b>	On-board 2 port GbE LAN (RJ45)
<b>Fibre I/O</b>	- Optional add-on low-profile FC HCA - PCIe x8 Gen1
<b>Infiniband I/O</b>	- 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
<b>Dimensions</b>	8.75"H x 19"W x 26"D
<b>Weight</b>	173.6 lbs (78.4kg) max.
<b>Management</b>	Support for high-speed interconnects, Appro Cluster Management, Windows or Linux OS

## Appro gB222X - Blade Server

<b>Processor</b>	Dual/Quad-Core Intel® Xeon® processor 5500 series
<b>Processor Capacity</b>	Two
<b>Chipset</b>	Intel 5520 chipset
<b>System Bus</b>	Intel QuickPath Interconnect (QPI)
<b>Memory Type</b>	Support for 800/1066/1333 MT/s ECC RDIMM DDR3
<b>Memory Capacity</b>	Up to 48GB in 12 DIMMs across six memory channels (3 channels/processor)
<b>Disk Controller</b>	Intel I/o controller hub (ICH10R)
<b>Drive Bays</b>	Up to two fixed 2.5" SATA HDDs
<b>Storage Capacity</b>	1.0TB SATA
<b>Graphics</b>	Aspeed AST1100 controller with 64MB memory
<b>Network Interface</b>	Two 10/100/1000 ports, Intel 82576EB PHYs supporting Intel I/O Acceleration Technology <i>Optional: Single or Dual port Mellanox Connect-X Infiniband (DDR) with CX4 connectors</i>
<b>Input/Output</b>	One RJ-45 serial port, two USB 2.0 connectors, DB-15 video port, two RJ-45 LAN ports <i>Optional: Single or Dual port Infiniband (DDR) with CX4 connectors</i>
<b>Expansion Slots</b>	One x16 PCIe Gen2 PCI riser slot capable of supporting a low-profile add-in card
<b>Power and Cooling</b>	Cooling and Power provided on GreenBlade subrack
<b>Weight</b>	10.8 lbs (4.9kg) per node
<b>Dimensions</b>	5"H x 1.75"W x 25"D (127 x 44.5 x 635 mm)
<b>Temperature</b>	Operating: 10 - 35°C, Storage: 70°C
<b>Remote Server Mgmt</b>	IPMI 2.0 compliant, integrated baseboard management controller (Integrated BMC)



Appro International, Inc. | 1.800.927.5464 (US only) | 1.408.941.8100 Main | [www.appro.com](http://www.appro.com)

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**Appro International, Inc.** | 446 South Abbott Ave. | Milpitas, CA 95035, USA  
1.800.927.5464 (US only) | 1.408.941.8100 Main | 1.408.941.8111 Fax  
[info@appro.com](mailto:info@appro.com) | [www.appro.com](http://www.appro.com)