



Appro **Xtreme-X1**
Supercomputer

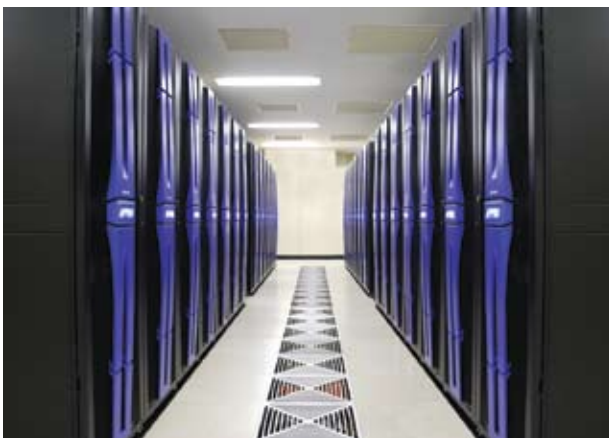
- Balanced Scalable System based on Cluster Architecture
- Combines High Performance and High Availability
- Options of Single or Dual Rail InfiniBand™ Networks
- Scalable and Robust Remote Management Software
- Reduced TCO with Improved Performance and Reliability

Outstanding Performance, Availability and Easy Management for Medium to Large-Scale HPC Installations

The Appro Xtreme-X™ Supercomputer is a highly scalable architecture that groups High Performance servers together into a unified, fully integrated Scalable Unit (SU) that can be provisioned and managed as a stand-alone supercomputer.

The Appro Xtreme-X combines high performance capacity computing and capability computing, with superior fault-tolerant in a well balanced system architecture.

The system is supported by the Appro Cluster Engine™ (ACE) Management Software. ACE supports multiple networking topologies and diskless configuration architecture in a complete remote management package delivering system high availability, scalability and manageability.



Simplifies IT Management and Administration

Appro Cluster Engine™ Management Software

- Network Management
- Server Management
- Cluster Management
- Storage Management

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

Ideal Environment

For demanding applications that require higher reliability and better system management. Delivers a balanced supercomputer cluster building block for a wide range of HPC 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, weather and environmental sciences, defense and classified research/production, and financial modeling and risk management.

Modular Scalable Performance



Designed for HPC and Built to Scale

- Delivering 6TF to over 1,100TF of combined capability and capacity computing power
- InfiniBand™, PCI-Express Gen 2, and the latest Intel® Xeon® multicore technologies to deliver outstanding performance, and scalability to 1000s of nodes
- Dense architecture combines an innovative new board design, delivering 64 nodes/128 CPUs/512 cores in a standard rack cabinet
- Appro cluster Management architecture offering scalable configurations, diskless operation, multiple network topologies, and fault tolerance
- Single or Dual-Rail InfiniBand Network options

Energy-Efficient (Green) Architecture

- Reduced total cost of ownership with improved system density, reliability and computing capability while keeping the datacenter cool
- Shared cooling reduces individual server power consumption by up to 30%
- Appro Directed Airflow™ or Water Cooled cabinet options improves cooling efficiency of the entire system by up to 8X
- “Power-Factor-Corrected” redundant power supplies that are 94% efficient compared to the 70% to 80% of regular power supplies
- All critical components are easily accessible and hot-swappable including power supplies, fans and switches for reliability and serviceability

Scalable and Balanced Architecture

The usable performance of a large cluster depends on a balanced architecture and well designed support software. The memory and I/O system must support the performance of the processors or the entire machine will run no faster than the slowest components.

Scalable Interconnect Performance

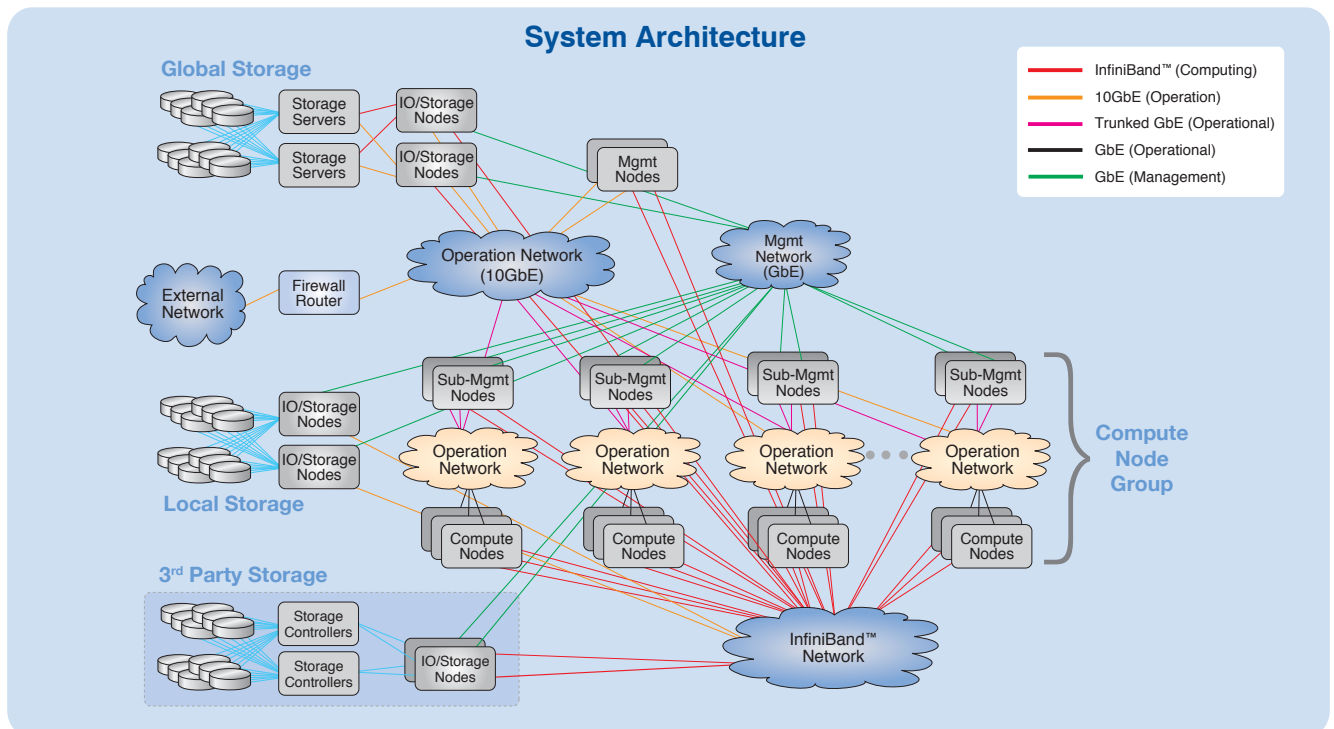
The interconnect fabric for the system can be configured as single or dual rail InfiniBand™ Networks. If single rail, the compute nodes have a Gigabit Ethernet management port and a dual data rate (DDR) or quad data rate (QDR) connection to the InfiniBand interconnect fabric. If dual rail, the compute nodes have 2 Gigabit Ethernet management ports instead of one. The InfiniBand I/O channels on the Xtreme-X1 compute nodes are based on low-latency Mellanox ConnectX host channel adapters. The modular 6TF rack system configuration, Scalable Compute Unit, can be replicated over and over to build systems with over 200 racks using multiple network topologies. The architecture of the Xtreme-X supercomputer maximizes the performance of off-the-shelf components and provides reliability similar to mainframes. The Appro Xtreme-X1 can deliver both the capacity and capability of expensive custom designs at one-quarter the cost.



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

Scalable Processor Performance

The Appro Xtreme-X1 Supercomputer is based on Intel® Xeon® processor 5500 series. The system 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 Xtreme-X1 Supercomputer is a dual-socket quad-core module with 84GFof peak processing capability. Each module has up to 48GB of ECC memory with a peak bandwidth of 32GB/second.



Appro Xtreme-X1 System Scalability (Dual Rail InfiniBand™ Networks)

	1 Rack	2 Racks	4 Racks	8 Racks	24 Racks	36 Racks	96 Racks
Number of Processors	128	256	512	1,024	2,304	4,608	12,288
Number of Cores	512	1,024	2,048	4,096	9,216	18,432	49,152
Peak Performance	6TF	12TF	25TF	49TF	111TF	221TF	576TF
Max Memory Capacity	4TB	8TB	16TB	33TB	74TB	147TB	590TB
Peak Bi-Sectional BW	512GB/s	1024GB/s	2048GB/s	4096GB/s	9216GB/s	18TB/s	37TB/s
Max Node-Node Latency	<1.2us	<1.25us	<1.3us	<1.4us	<1.5us	<1.6us	<1.8us

Appro Xtreme-X1 System Scalability (Single Rail InfiniBand™ Networks)

	1 Rack	2 Racks	4 Racks	8 Racks	24 Racks	36 Racks	96 Racks
Number of Processors	70	140	280	560	1,680	2,520	6720
Number of Cores	560	1,120	2,240	4,480	13,440	20,160	53,760
Peak Performance	6.6TF	13.1TF	26.3TF	52.5TF	157.5TF	236.3TF	630.1TF
Max Memory Capacity	3.36TB	6.72TB	13.44TB	26.88TB	80.64TB	120.96TB	322.56TB
Peak Bi-Sectional BW	280GB/s	560GB/s	1120GB/s	2240GB/s	6720GB/s	10080TB/s	26880TB/s
Max Node-Node Latency	<1.3us	<1.3us	<1.3us	<1.5us	<1.5us	<1.5us	<1.5us

Appro Cluster Engine™ Management Software

Appro Cluster Engine™ (ACE) Management Software features a complete lights-out management solution. This software suite offers a web-based management interface that is easy-to-use, making it possible to control the Appro Xtreme-X™ from any location.

The management modules include Network Management, Server Management, Cluster Management and Storage Management. In addition, ACE supports multiple networking topologies, diskless configuration and network failover to achieve maximum reliability, performance and high availability.

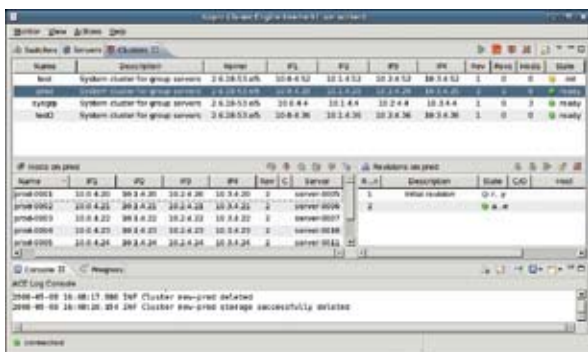
It supports root file systems offering instant provisioning for rapid, standard Linux installs on large diskless systems allowing them to boot 64 to 6,400 blades in the same time.

Features

- **Two Tier Management Architecture:** Scalable to large numbers of servers, minimal overhead and complete remote lights-out control
- **High Availability, High Performance:** Redundant management servers and redundant networks
- **Diskless Operation**
 - Improves performance
 - Lower administrative overhead
 - Multi-level cached root file system
 - Local storage supported
- **Instant Cluster Provisioning**
 - Multiple clusters with the same configuration
 - Revision management with roll-back capability
 - Cluster hosts added or subtracted dynamically

Appro Cluster Engine™ Management Software

System Management	<p>Management of overall system configuration</p> <p>Supports redundant management servers with automatic failover</p> <p>Designed to anticipate and tolerate failures</p> <p>Supports enterprise level availability requirements with 24 hr MTTR</p>
Network Management	<p>Automatic discovery of interconnect hardware</p> <p>Supports multiple interconnect fabric topologies</p> <p>Supports redundant paths and networks</p> <p>Supports load balancing and failover</p> <p>Provides network status to the management system</p>
Server Management	<p>Automatic discovery of server hardware</p> <p>Remote server control (Power On/Off, Cycle)</p> <p>Remote server initialization (Reset, Reboot, Shut Down)</p> <p>Support for scalable fast diskless or dataless booting for large node count systems</p> <p>Supports server redundancy and failover</p> <p>Provides server status to the management system</p>
Cluster Management	<p>Supports partitioning a cluster into multiple logical computers</p> <p>Maps logical computers (clusters) onto servers (nodes)</p> <p>Supports multiple independent OS configurations</p> <p>Manages and monitors logical computer (clusters) status</p> <p>Provides cluster status to management system</p> <p>Integrated job scheduling and management</p> <p>Manages and monitors operating system instances (nodes)</p> <p>Provides node status to management system</p>
Storage Management	<p>Supports scalable root file systems for diskless or dataless nodes</p> <p>Supports multiple global storage configurations</p> <p>Supports high BW to secondary storage for data and check pointing</p> <p>Provides server status to the management system</p>
GUI	Web Based
Reliable, Available, Serviceable (RAS)	<p>Redundant management network (GbE and 10GbE) with failover</p> <p>Redundant high bandwidth network (InfiniBand™) with failover</p> <p>Redundant management servers (two levels) with failover</p> <p>Redundant root file system with failover</p> <p>Built-in multi-generation configuration management for software</p> <p>Redundant storage via RAID</p>



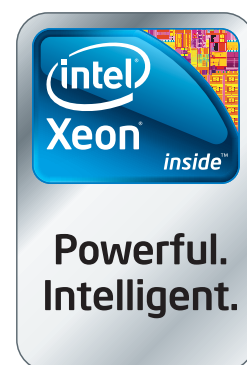
System Configuration

Nodes	64 nodes per rack cabinet Full ECC memory protection, redundant power supplies and cooling fans
CPU	Quad-Core Intel® Xeon® Processors 5500 Series: 128 sockets/512 cores per rack cabinet
Cache	8MB L3 cache per processor
FLOPs	6TF peak performance per cabinet
Main Memory	Up to 3TB fully-buffered ECC DDR3 SDRAM per rack
IPC Network	Options of single or dual-rail Fat Tree DDR or QDR InfiniBand™ 3D Torus option for 2010 product roadmap
External I/O Interfaces	Gigabit Ethernet, 10 Gigabit Ethernet DDR or QDR InfiniBand™ with ConnectX host channel adapters
File System	XFS file system for root and temp NFS, pNFS, LUSTRE and Panasas ActiveStor available as Global File System
System Administration	Appro Cluster Engine™ Management Software - complete lights-out remote management capability for server, network, cluster and storage with ease to use with web based interface
Operating System	RedHat AS
Message Passing Libraries	MVAPICH2 or Intel® MPI Library 3.1
Compilers	Intel® Cluster Toolkit Compiler Edition
Power	22KW per cabinet, Input: Dual 208V 3 phase, Connectors: NEMA L15-30P
Cooling Requirement	Air cooled or water cooled options
Cabinet Options	Standard 42U/19" - Water cooled rear cabinet door options 44U rack cabinet - Air cooled cabinet cooling options
Cabinet Weight (maximum)	1,650 lb. (748.4 kg) per cabinet
Regulatory Compliance	FCC Class A, CISPR 22, CE (EMC) : EN55022 (EMI), EN55024 (EMS), EN61000-3-2 (Harmonic), EN61000-3-3 (Flicker), MIC : KN22 (EMI), KN24 (EMS)
Safety	UL 60950-1, CAN/CSA - C 22.2 No 60950-1 CE (LVD) : EN60950, CB : IEC 60950, RoHS, WEEE
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.



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