



Appro Supercomputer Solutions

Best Practices

Appro 2012 Deployment Successes

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About Appro

Over 20 Years of Experience



1991 – 2000

OEM Server
Manufacturer

2001-2007

Branded servers
Clusters solutions
Manufacturer

2007 to 2012

End-To-End
Supercomputer Solutions

Moving Forward....



Appro Solution Overview

End-To-End Supercomputer Solutions



Appro Xtreme-X™ Supercomputer

- Based on industry standard, optimized server platforms with the latest processor and system cooling solutions
- Features extreme compute density, best performance/watt, multiple HPC network connectivity, I/O and disc options
- Combines great performance, power efficiency, HPC SW stack and configuration flexibility with support & services
- Based on cutting-edge building blocks server platforms
- Features up to four processors per server with choice of co-processing technologies
- Superior floating point performance, peak and operational efficiency

Coupled with Appro HPC Software Stack



- Power an HPC Cluster with network, server, cluster, and storage management
- Includes performance monitoring, development tools and application libraries
- Features instant node provisioning, resource management and job scheduling, network load balancing, failover, remote and revision control, advanced power functions with Linux OS support

Appro HPC Software Stack



- Offers the necessary HPC software with multi Linux OS support to run large applications
- Powers the HPC Cluster with network, server, cluster, and storage management featuring instant node provisioning, sub-cluster management with network load balancing, failover, and recovery

Appro HPC Software Stack

Performance Monitoring	HPCC	Perfctr	IOR	PAPI/IPM	netperf
Development Tools	Intel® Cluster Studio	PGI (PGI CDK)		GNU	PathScale
Application Libraries	MVAPICH2		OpenMPI	Intel® MPI-(Cluster Studio)	
Resource Management/ Job/Scheduling	Grid Engine		SLURM	PBS Pro	
Parallel File System	NFS (3.x	Local FS (ext3, ext4, XFS)	PanFS		Lustre
Cluster Monitoring	ACE™ (iSCB and OpenIPMI)				
Remote Power Mgmt	ACE™		PowerMan		
Remote Console Mgmt	ACE™		ConMan		
Provisioning	Appro Cluster Engine (ACE™) management software				
Operating System	Linux (Red Hat, CentOS, SuSE)				

Appro Xtreme-X™ Supercomputer

Appro Turn-Key Integration & Delivery Services

Appro HPC Professional Services

- On-site Installation services and/or Customized services

Appro Recent Win by HPC Workload

- Early engaged with several customer pre-evaluation and co-development of future Appro Xtreme-X™ architecture based on the latest processing technologies
- Delivered in the last year over 6 PFlops of supercomputing performance



TLCC2
University of California
Lawrence Livermore
National Laboratory
Sandia
National
Laboratories
Los Alamos
NATIONAL LABORATORY

**Capacity
Computing**




GORDON
SDSC

**Data-Intensive
Computing**



Hybrid
Computing

**Hybrid
Computing**



Capability
Computing

**Capability
Computing**









DOE Sandia's First
Intel Many Integrated
Core (Intel MIC)
Architecture based
Experimental Testbed
System
intel
MIC
Partner

**Hybrid
Computing**

Appro's Top100 Success







:: HPC Market Snapshot

Top 100 Supercomputers – Rank by # of Systems

Rank	Company	# of Systems	System Share (%)
1		31	31.0%
2		17	17.0%
#3		10	10.0%
4		7	7.0%
5		6	6.0%
6		4	4.0%

Appro has the 3rd Largest Number of Systems in the Top 100

Top 500 Supercomputers – Rank by # of Systems

Rank	Company	# of Systems	System Share (%)
1		213	42.6%
2		138	27.6%
3		26	5.2%
#4		19	3.8%
5		16	3.2%
6		16	3.2%

Successful Deployment



1. The NNSA, Three National Labs selected Appro Xtreme-X™ Next Generation Supercomputer for the TLCC2 Project

2. SDSC, selected Appro Next Generation supercomputer to meet the requirements of their one of a kind Data Intensive Supercomputer based on a massive amount of Flash.



3. Appro and Intel collaborated in meeting the specific design configuration of the Appro Next Generation supercomputer based on the new Intel Xeon processor E5 product family

SDSC Gordon

Initiated in 2008- Deployed 2012

- **Goals / Challenge:**

Funding by the NSF through the Extreme Science and Engineering Discovery Environment program (XSEDE)

- Meet future needs of Scientific Community

- High FLOPS requirement, must be over 200 TFlops Peak
- High IOPS to “local storage” and High Bandwidth to “local storage”
- Creation of virtual SMP “supernodes”

- Architecture needed to be planned 3 years before deployment

- Initially designed in 2008 and deployed in 2011/2012

- Take advantage of future technologies: New Intel® Xeon® Processors, Infiniband Interconnect , 3D Torus network topology, Intel® SSDs

Solution:

- Appro Xtreme-X™ Supercomputer

- Based on the new Intel Xeon processor E5 product family

- Integrated, tested, validated and Proven volume shipment

- Full HPC software stack compatibility

- Provided the latest technology features, reliability, configuration flexibility, high speed networking and memory density to meet the customer requirements



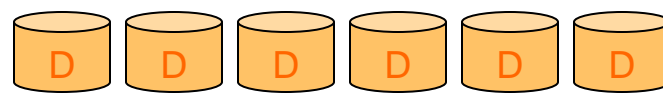
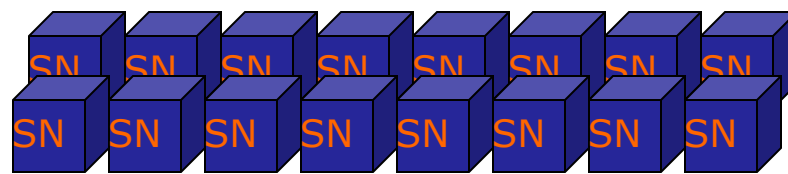
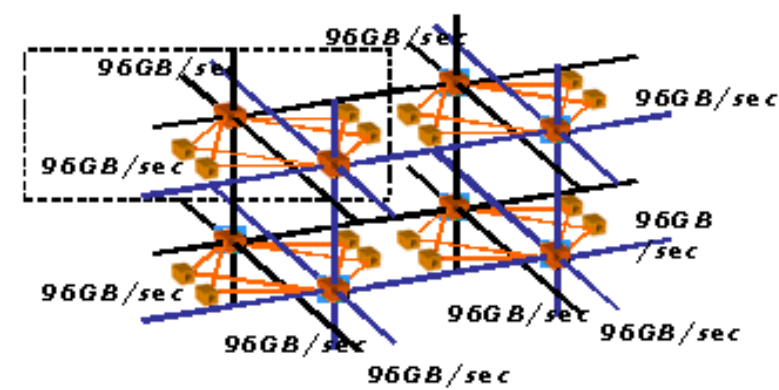
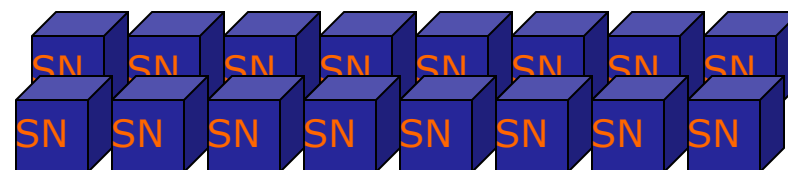
SDSC
SAN DIEGO SUPERCOMPUTER CENTER



**Data-Intensive
Computing**

Appro Xtreme-X™ Supercomputer Gordon Architecture

Speed	>200 TFLOPS
Mem (RAM)	64 TB
Mem (SSD)	256 TB
Mem (RAM+SSD)	320 TB
IO rate to SSDs	35 Million IOPS
Network bandwidth	16 GB/s bi-directional
Network latency	1 msec.
Disk storage	4 PB
Disk IO Bandwidth	>100 GB/sec



DOE NNSA- TLCC2 Procurement

LLNL, Sandia and Los Alamos National Labs



Challenge

- Reduce cluster Total Cost of Ownership (TCO)
- Improve Linux cluster availability and scalability
- Minimize integration effort and elapsed time
- Procurement requirements:
 1. NNSA ASC Investment for GFY11+12
 2. ~\$39 - \$90M procurement (~\$39M + options) reaching up to 6PFlops of computing
 3. Single contract with multiple delivery sites
 4. Needed cluster architecture based on “scalable unit” concept
 5. Reduce power, floor space
 6. Long term vendor partnership based on a proven model



TLCC2



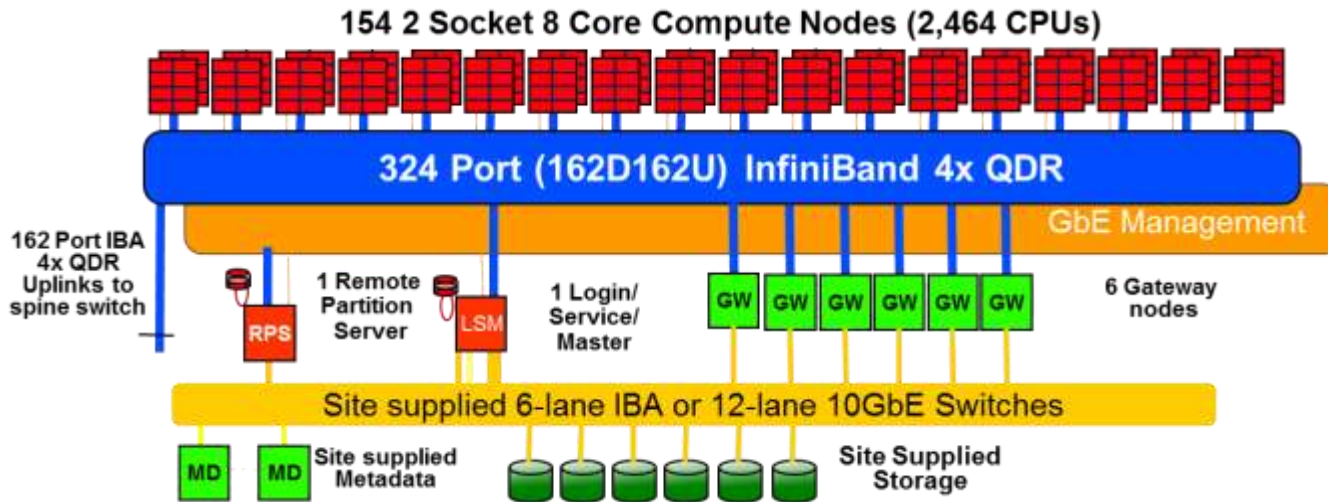
Capacity Computing

Solution

- Appro Xtreme-X™ Supercomputer
- Based on the new Intel Xeon processor E5 product family
- Integrated, Tested, Validated and proven volume shipment
- Full HPC Software stack compatibility
- Provides the latest technology features, reliability, flexibility, energy efficiency and density that meets the customer requirements



TLCC2- From 1 Scalable Unit Configuration Multiple Scalable Units Created



System Parameters: ~50 TF/s SU

- Dual socket Intel Sandy Bridge 2.6GHz nodes; 32 GB DDR3-1600 SDRAM
- InfiniBand; 4+4GB/s Bandwidth over IBA 4x QDR
 - Built from 648, 324, and 36-port IBA switches
- Compute and gateway nodes. Remote boot from RPS nodes
- IO Bandwidth ~20 GB/s delivered parallel I/O performance
- Software for build and acceptance TOSS 2.0
- GPU node option with 2xGPUs per node
- Some clusters may have SSD in compute nodes for accelerated checkpoint capabilities

#SU's	# Nodes
1	162
2	324
4	648
8	1,296
12	1,944
18	2,916



Questions?

Appro Supercomputer Solutions

Anthony Kenisky, VP of North America Sales

Learn More at www.appro.com

