Modular Sun™ x64 Servers for High-Performance Computing

Getting Ahead, Staying Ahead

Solution Overview

- Fast and scalable rack-mount servers—Based on 1-8 powerful AMD Opteron™ processors in single- or dual-core configurations, Sun Fire™ X2100, X4100, X4200, V40z, and X4600 servers deliver speed, power, platform/OS choice, and simultaneous 32-bit and 64-bit computing for demanding HPC.
- Innovative modular computing—By supporting up to 40 sockets in a single 19U chassis, the Sun Blade™ 8000 modular system provides performance, large memory support, and breakthrough I/O throughput in a modular package.
- World's first data server—With support for up to 24 terabytes of closely coupled storage in a compact 4U package, the Sun Fire X4500 data server combines the best aspects of AMD Opteron performance and fast access high-density modular storage.
- Sun™ Grid Rack System for HPC—This factory-integrated computer cluster delivers faster deployment and lower risk for high-performance computing applications
- Sun HPC Solutions—Sun's comprehensive strategy assesses customer needs, architects scalable infrastructure, and provides flexible, cost-effective HPC architecture suited to the specific environment.

> "Not only is the performance of the Sun Grid HPC environment extremely impressive today, but the ability of the architecture to scale rapidly is really phenomenal, and will enable us to grow our environment to meet our needs for many years to come—no matter how compute-intensive our projects may be."

—Professor Satoshi Matsuoka, Head of Research Infrastructure,
Global Scientific Information and Computing Center, Tokyo Institute of Technology

Getting More Answers... Faster

In today's complex, competitive, and regulated global economy, getting ahead and staying ahead is harder than ever. Scientific and commercial organizations alike need to innovate quickly, speed time to results, improve product quality, and reduce risks for their communities and their shareholders. For many organizations, high-performance computing (HPC) infrastructure plays a vital role, rapidly bringing the right resources to bear to help organizations ask more questions, run more simulations, and plumb complex worlds that have never been explored.

Unfortunately, even as legacy x86 platforms have helped to enable much of the growth in HPC, many data centers are experiencing fundamental challenges that limit their ability to scale and grow capacity. In spite of ever-increasing demand for computational resources, organizations must face very real limitations in terms of real estate, power, and cooling. Hot and crowded data centers are clogged with legacy servers that are now underpowered and overtaxed. In addition, disjointed additions to clusters and grids have resulted in a complex web of systems that are often difficult and expensive to manage.

As organizations seek to consolidate and scale HPC deployments, Sun can offer extreme power, flexibility, and choice with its complete portfolio of HPC technologies and solutions. With innovative and industry-leading modular x64 (x86, 64-bit) servers, resource and system management software, fast and reliable storage, and a world-class support and consulting practice, Sun has extensive experience designing and deploying HPC infrastructure.

Innovative Sun x64 servers and the factory-integrated Sun Grid Rack System for HPC provide a wealth of options for demanding HPC applications

Deploying Performance Under Pressure

As HPC infrastructure has evolved from scientific and research settings, it plays an essential role in commercial, financial, and manufacturing environments. Along the way, Sun has continued to innovate with a broad-based solution that solves key HPC problems.

- *Performance, scalability, and agility:* Increasingly, success and innovation are directly linked to the ability to deploy the fastest computing assets and maximize the utilization and value of computing infrastructure over time. Sun lends its customers considerable flexibility and agility by offering the latest and fastest AMD Opteron processors in innovative server architectures with a choice of the Solaris™ Operating System Linux, or Windows.

- *Reduced risk and time to deployment:* To remain competitive and productive, organizations must decrease the deployment time and operational costs of their IT infrastructure. For professionals involved in financial services, manufacturing, life sciences, government and educational research, and energy exploration, the focus should be on getting the job done, getting to market faster, and initiating breakthrough discoveries that may save lives—not on how technology needs will be met. With a comprehensive HPC solution, Sun delivers the industry-leading performance, efficient resource management, and rapid deployment that can give organizations the competitive edge that they need.

- *Eco-responsibility for increased density:* With innovative environmental design, Sun Fire x64 servers use up to 30 percent less power than equivalent Xeon based servers. Not only can customers save real money on each server per year in power and cooling costs, but increased performance, density, and decreased power utilization allow for more computational power within fixed real estate and power budgets.

- *Scalable, open architecture:* By using standard components and interfaces, Sun HPC solutions provide power and scalability without arbitrary limits and constraints. Customers can move quickly from legacy clusters and grids to deploy the latest high-performance Sun hardware, extending and adapting their clusters as needs dictate.

Sun x64 servers have set 65 world records (and counting) in industry-standard benchmarks

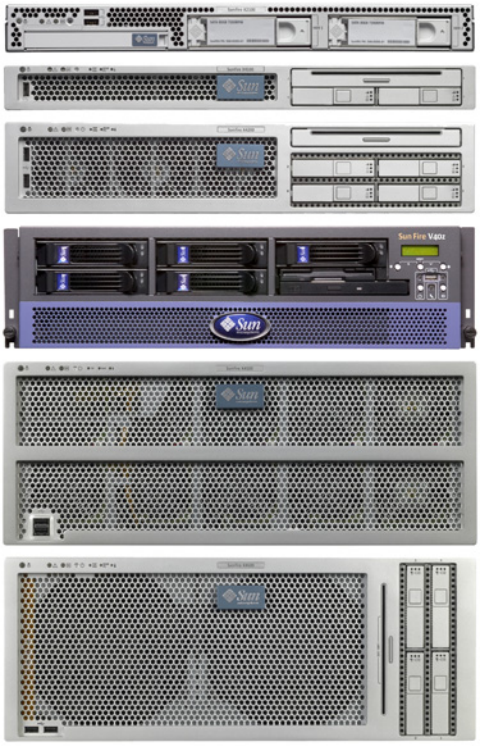
Sun and AMD Combine for Industry-Leading Performance

Its simple really, faster processors and systems deliver faster results. Sun x64 servers, featuring the AMD Opteron processor, have set the industry standard for performance, powering some of the fastest supercomputers on the planet. With innovative architecture and the latest 64-bit AMD Opteron processors, Sun x64 servers have set 65 world records, both in standard tests such as SPECfp_rate 2000 and SPEC CPU2000, as well as in commercial applications such as LS-DYNA and Fluent. For the latest results, see *sun.com/x64/benchmarks*.

More than just a family of servers, Sun provides the modular infrastructure that organizations need to rapidly deploy new and more competitive solutions. For example, the new TSUBAME supercomputer at the Tokyo Institute of Technology is now one of the fastest supercomputers outside the United States, and currently in seventh place on the TOP500 supercomputer list as of June, 2006. Based on Sun Fire X4600 servers and Sun Fire X4500 data servers powered by dual-core AMD Opteron processors, TSUBAME delivers a sustained Linpack performance of 38.18 TeraFLOPS with more than 21 Terabytes of memory, and 1.1 Petabytes of hard disk storage as of June 2006. In addition to raw capacity and performance, TSUBAME was installed and on-line in just *three weeks* using

"People using the Sun Grid Rack System for design work have access to a hundred times more compute power than they had previously. The same is true for computational chemistry. There were experiments we wouldn't have previously attempted because processing the data would take up to three years of compute time. Now we can conduct those experiments with perhaps two weeks of compute time."

Dr. Peter Jacobs
Senior Lecturer in Engineering, University of Queensland



Sun Fire X2100, X4100, X4200, V40z, X4500, and X4600 servers (top to bottom)

integration support from NEC along with Sun N1™ System Manager and Sun N1 Grid Engine software. The system can support both the Solaris 10 OS and Linux.

Scalable Rack-Mount Servers

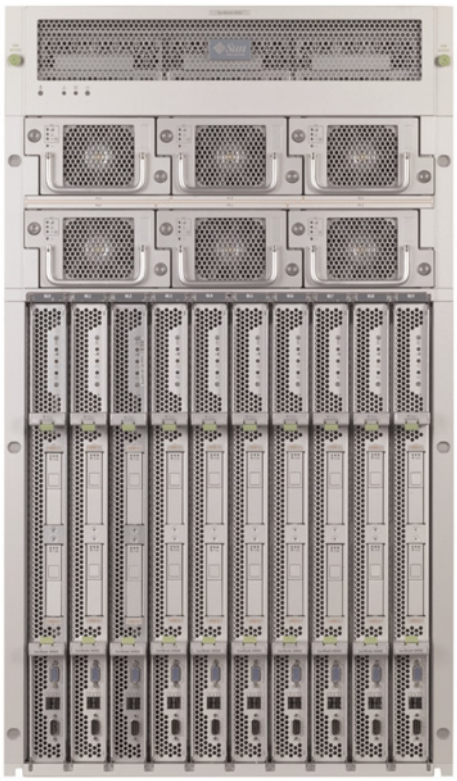
The Sun x64 product family is anchored by a broad range of industry standard rack-mount servers. Designed for low-cost deployment in environments that do not require redundant server components (such as compute clusters), the Sun Fire X2100 server is the lowest cost single-socket rack-mount server based on the AMD Opteron processor today. The Sun Fire X4100 and X4200 servers are among the fastest, most energy-efficient, and most reliable two-socket servers in their class. Designed to improve the economics of x64 systems while setting new standards for performance, reliability, and energy efficiency, the Sun Fire X4600 server scales quickly from four to eight sockets (up to 16 cores) simply by adding processor boards, all in a compact 4RU form factor (see back for system details).

The World's First x64 Data Server

Integrating powerful AMD Opteron processors with massive data storage and throughput, the Sun Fire X4500 server delivers extremely high storage density and throughput rates at a very low cost per gigabyte. By integrating state-of-the-art server and storage technologies, the Sun Fire X4500 server delivers the remarkable performance of a four-way x64 server, and the highest storage density available with up to 24 terabytes in a 4U form factor.

Reinventing the Modular Server

Unlike legacy blade servers, the Sun Blade 8000 modular system is designed with the performance and capacity to support high-performance, large-memory, and I/O-intensive applications such as those found in HPC. In fact, this innovative platform allows entire HPC grids or clusters to be consolidated into a single chassis or rack, greatly simplifying configuration and management. Individual Sun Blade X8400 server modules support four sockets for dual-core AMD Opteron processors, yielding up to 80 cores in a 19U chassis and 160 cores in a rack. Breakthrough I/O performance provides up to 1.92 Terabits per second of I/O throughput in a single Sun Blade 8000 chassis.



With up to 80 AMD Opteron processor cores in only 19 rack units, the Sun Blade 8000 modular system is a cluster in a box

Unified Management Architecture

To enhance and preserve customer investments and promote the longevity of deployments, Sun x64 servers feature common architecture that makes it easy to upgrade the components most likely to change, while retaining investments in management and other infrastructure. Sun x64 servers deliver complete remote management capabilities and consolidated management through a choice of interfaces, including GUI, CLI, SNMP, and web based management.

Added to basic system capabilities, Sun N1 management software helps to increase enterprise productivity, focus computational power, and manage disparate HPC resources effectively. Sun N1 Grid Engine software provides industry-leading distributed resource management, maximizing resource utilization and focusing computational power on important priorities. Sun N1 System Manager provides for bare-metal discovery and OS provisioning and management to rapidly deploy and re-deploy resources. The result is infrastructure that can scale and adapt as the business grows, without a corresponding growth in complexity.

Flexible and Manageable Storage

To complement Sun x64 servers and match the significant storage demands of HPC environments, Sun StorageTek offers a broad portfolio of disk and tape storage platforms along with innovative data management and protection software. Solutions include RAID disk systems for direct attached storage (DAS), service area networks (SAN), or network attached storage (NAS) that can scale from a Terabyte in a workgroup up to 330 Terabytes in a single StorageTek 9900 array. A single Sun StorageTek SL8500 tape library supports up to 150 petabytes. Sun also offers tiered storage of different classes of data with the Storage Archive Manager (SAM). In addition, advanced SAN based data access with QFS shared file systems allow up to 128 Sun x64 servers to have simultaneous read/write access at Fibre Channel speeds.

Fast, Low-risk HPC Deployments with Room to Experiment and Grow

Deploying and upgrading HPC clusters and grids can be difficult and complex. Sun HPC solutions maximize performance for initial grid deployments, and allow rapid expansion of HPC environments to deliver capacity where it is needed most. Whether populating an existing grid with Sun x64 servers, leveraging the Sun Grid Rack System for HPC, deploying Sun N1 Grid Engine software, or prototyping a grid deployment, customers can rely on Sun HPC solutions to save money, speed time to results, and improve quality.

Sun Grid Rack System for HPC

Featuring Sun x64 servers, the Sun Grid Rack System for HPC is a factory-integrated and tested computer cluster, developed by Sun experts to lower risk, speed deployment, and deliver high performance in a scalable, flexible HPC grid implementation. Sun offers different reference configurations that can be tailored depending on actual needs, with the option of preloaded Sun N1 Grid Engine and and Sun N1 System Manager.

Sun Solution Center for HPC

Sun offers the Sun Solution Center for HPC to demonstrate the performance of customer's applications with Sun's HPC products, including both x64 and SPARC technologies. An inventory of Sun's latest HPC products is pared with a selection of interconnect technologies including InfiniBand, Myrinet, and Gigabit Ethernet. All of the products in the center are refreshed on a regular basis to provide access to the latest server and interconnect technologies. Customers can also make use of the Sun Solution Center for HPC to build and test proof-of-concept systems to help explore design issues and get their HPC deployments right the first time.

Learn More

Learn more about Sun's x64 servers and grids for high-performance computing, featuring the AMD Opteron processor by visiting sun.com/servers/hpc, sun.com/storage, sun.com/grid, or talk to your local Sun representative about scheduling a half-day session.

Sun Grid Utility

Sun recently released the Sun Grid Compute Utility on *Network.com*. Sun is the first and only vendor to deliver easy, affordable access to compute power utility over the network for just $1/CPU-hour, with low barriers to entry and exit, and no long-term contract required. Through *Network.com*, software developers, scientists, and businesses alike can get instant access to a powerful compute utility without the need to invest in and operate expensive IT infrastructure. Access the Sun Grid Compute Utility at *www.network.com*.

Feature	Sun Fire X2100 Server	Sun Fire X4100 and X4200 Servers	Sun Fire V40z Server	Sun Fire X4500 Server	Sun Fire X4600 Server	Sun Blade™ 8000 Modular System
Sockets for AMD Opteron processors	One	Two	Four	Two	Four, upgradeable to eight	Four per Sun Blade x8400 server module (40 per chassis)
Memory	Up to 4 GB (4 GB per socket)	Up to 32 GB (16 GB per socket)	Up to 64 GB (16 GB per socket)	Up to 16 GB (8 GB per socket)	Up to 128 GB (16 GB per socket)	Up to 64 GB per server module
Rack Units	1 RU	1 RU/2 RU (X4200)	3 RU	4 RU	4 RU	19 RU (per chassis)

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