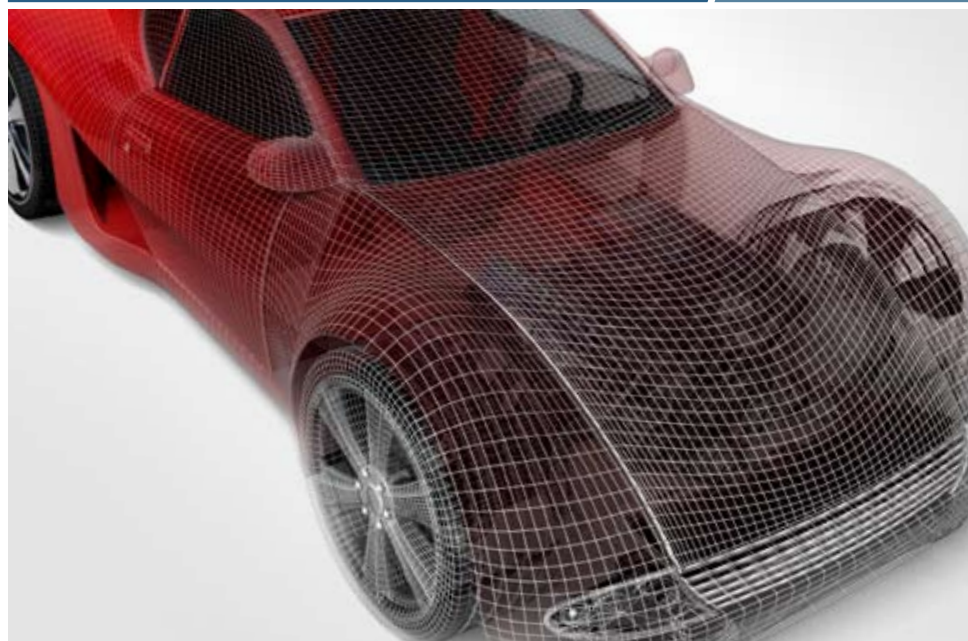


Sun Business Ready HPC Solutions for MCAE



Highlights

- Scalable efficiency — optimized compute, storage, networking, and software components deliver maximal application performance
- Dramatically reduced complexity — fully integrated hardware and software eases deployment and use
- Breakthrough economics — Sun Open Network Systems architecture provides industry-leading price/performance
- Increased productivity — run more simulations and computational jobs, get more work done faster
- Rapid deployment — factory integration and professional services available for faster, easier installation
- Reduced risk — preintegration and factory testing decrease installation issues

Target applications

- Crash/impact analysis
- Computational fluid dynamics (CFD)
- Structural analysis

> Manufacturers have never before faced such intense economic and competitive pressures. Shrinking budgets, reduced resources, and tougher regulations, combined with tight schedules, force engineers to further embrace modeling and simulation as a way to drastically reduce their reliance on costly build-and-bust product design cycles.

In today's marketplace, the use of mechanical computer-aided engineering (MCAE) to model structures, simulate fluid dynamics, and analyze complex impacts is no longer exclusive to large manufacturers. All manufacturing companies, no matter what their size, need to use modeling and simulation as a competitive weapon in order to stay profitable and get ahead of their competition. As a result, businesses cannot afford to rely on a patchwork of commodity servers, software, and storage to power their business-critical MCAE applications.

Sun Business Ready HPC infrastructure

Traditionally, compute clusters built with commodity servers, networking, and storage have been used to run MCAE applications. Although cost effective, these systems frequently do not scale well and are challenging to design and deploy. For maximal efficiency and performance, it is

necessary to balance application characteristics with processing power, interconnects, and storage I/O. Sun Business Ready High Performance Computing (HPC) addresses



Sun Blade 6048 modular system

these challenges by providing an integrated and optimized, end-to-end approach that invokes Sun's broad experience in deploying some of the world's largest supercomputers, and applies it to MCAE systems.

Sun integrates its portfolio of efficient systems, innovative file storage solutions, high-speed networking, and comprehensive

software and management stack into an easy-to-deploy, easy-to-use HPC platform that delivers new levels of application performance with breakthrough economics and reliability.

Improving competitiveness for manufacturers

The Sun vision for manufacturers is to provide open, integrated, end-to-end HPC and data management solutions that help businesses become more competitive by accelerating product design cycles.



Sun Blade X6275 blade server

Crash/impact analysis

In today's regulatory and consumer-safety-driven world, there is an increased focus on how things behave during impacts and collisions. Crash/impact analysis is used for everything from drop testing to failure analysis. Practical examples include the automotive industry's modeling collisions of moving vehicles that could result in occupant safety concerns and vehicle damage, and the aerospace industry's simulating bird strikes, jet engine blade containment, and structural failures. The use of modeling and simulation offers a big ROI since it reduces the number of costly destructive tests required to develop a design that meets both customer and regulatory requirements.

Impact simulation requires significant processing power to crunch through the modeling of detailed physics and element characteristics. These codes are typically very

CPU intensive, with good scalability across cores in a node or nodes in a compute cluster. While crash codes can be deployed on a single large system, it is often more cost effective to use several nodes connected with a fast interconnect fabric such as InfiniBand (IB). Sun Compute Cluster uses Sun's record-breaking x64 (x86, 64-bit) product line of blade and rackmount servers, based on AMD Opteron™ or Intel® Xeon® processor technology, with the option of using the IB interconnect, and makes the perfect building block for crash/impact analysis systems.

Computational fluid dynamics (CFD)

CFD is the study of how fluids, such as air, liquids, and gases, move in and around solid objects, such as airplane wings, automobile bodies, or petroleum pipelines. In an era of increased competitive pressure to get quality products to market faster, CFD is very much a part of the product design cycle for companies that require accurate and efficient analysis of fluid flow.

CFD codes can easily be broken up and solved in a parallel manner. These codes are typically excellent candidates for clustered environments, where they can take advantage of fast CPUs, large quantities of memory, fast storage, and high-performance interconnects. Application performance scales well as more nodes are added to the cluster.

Sun Business Ready HPC offerings deliver record-breaking performance for CFD applications, with scalable multicore systems, more memory per node, and the industry's highest-bandwidth I/O capabilities. Matched with Sun's Open Storage Solutions, storage bottlenecks are easily eliminated with industry-leading throughput and price per gigabyte of capacity.



Sun StorageTek tape libraries for archiving of life sciences data

Structural analysis

Structural analysis applies a wide range of static and dynamic models to simulate how a structure will behave under expected operating conditions. Manufacturers in such diverse industries as aerospace, automotive, energy, consumer products, and medical devices use structural analysis to optimize product life, performance, and quality. By simulating the application of loads and restraints on structures such as buildings, bridges, aircraft, and ships, the soundness of a design can be tested without the need to build and test costly physical prototypes. These benefits enable engineers to identify and correct potential design problems prior to final product design and manufacturing, substantially reducing development costs and decreasing time to market.

Structural analysis codes are typically compute- and I/O-intensive applications where jobs can run from hours to several days, generating terabytes of I/O and requiring several gigabytes of real memory (RAM) for optimal performance. In the past,

structural codes did not scale well due to I/O bottlenecks, and engineers were limited to four- or eight-processor systems. However, Sun studies show that recent improvements in compute processing power, large memory configurations, and hybrid storage systems can lead to surprisingly good performance on much larger systems.

Improving application performance minimizes job runtimes, enabling faster time to results and increased simulation capacity. To minimize job runtimes, structural codes need extremely high-performance I/O capabilities to store runtime data. Meeting the intense I/O demands requires large quantities of server memory balanced with a hierarchical storage architecture that includes local and NAS storage that leverages the cutting-edge performance of SSDs.

Sun Business Ready HPC offerings are the perfect platform for running structural codes with scalable multicore systems, more memory and memory bandwidth per-node, and the industry's highest-bandwidth I/O capabilities. Matched with Sun Storage 7000 Unified Storage Systems, structural codes can use NAS to realize exceptional performance with industry-leading storage throughput and price per gigabyte of capacity.

Efficient and scalable application performance

With a host of world-record benchmarks, Sun Fire rackmount servers and Sun Blade systems, in combination with Sun Open Storage products, are especially suited to delivering application performance and scalability. Sun's innovative servers combine the power and communication bandwidth needed for CFD, the I/O speed needed for crash and impact simulations, and the memory capacity needed for structural analysis.

Sun's latest storage products, including Sun Storage 7000 Unified Storage Systems, take full advantage of Flash technology to deliver high-performance storage with up to 75% lower cost than traditional storage solutions, with recent benchmarks using solid-state drive (SSD) disk technology showing a 2x performance gain for I/O-intensive manufacturing applications.



Sun Storage 7000
Unified Storage System

Making MCAE easy

Sun Business Ready HPC Solutions are designed to be easy to deploy, use, and manage. You can expect out-of-the-box performance, ease of use, and reliability from these factory-built and -tested systems. By leveraging the Sun Compute Cluster and Sun Open Storage Systems, you can quickly deploy an MCAE infrastructure that delivers breakthrough economics with the power to run more simulations, speed intricate business analysis, and bring new products to market faster.

Sun Professional Services provides the flexibility to customize solutions to specific application requirements. Sun offers a range of services to help enable successful deployments, including:

- Professional services, including project management and field installation support services for ongoing maintenance.
- Sun HPC Quick Start Services make it easy for you to adopt, implement, and optimize HPC solutions, helping to decrease deployment time by up to 80%.

Sun Open Storage Solutions for HPC

Design and simulation applications need to process large and exponentially expanding amounts of data. Attempting to scale these applications without considering underlying data requirements is a recipe for poor performance. For this reason, Sun Business Ready HPC Solutions incorporate Sun's industry-leading open-storage offerings for local, NAS, and parallel file storage, with integration to Sun's cost-effective archiving solutions.

Costly proprietary solutions lock you in and limit your ability to scale your infrastructure or adapt to changing business needs. Sun Open Storage Solutions for HPC combine open-source software with industry-standard hardware, enabling you to reduce your reliance on high-priced systems and to save up to 90% on storage costs. SSD disks also dramatically increase performance while cutting power consumption by up to 80% compared to spinning disks. They're just what you need to reduce space and energy costs and improve scalability.

Sun's offerings include:

- **Flash-based storage** — The latest Sun Open Storage solutions, including Sun™ Storage 7000 Unified Storage Systems, take advantage of Flash technology and ZFS™ File System to deliver high performance at up to 75% lower cost than traditional storage solutions. Sun has also fully integrated Flash technology into its new Sun Blade™, x64, and CoolThreads™ technology-based servers to help customers boost application performance without adding more servers or more high-speed disk drives to their HPC environment. Flash technology can be used with HPC applications to accelerate hot data files, alleviate the need to overbuy disks for performance, and reduce the need for installing large memory pools in compute nodes.



Sun Grid Engine
qmon Job Submission GUI

- **Network storage** — For home directories and shared scratch on small HPC clusters, Sun Storage 7000 Unified Storage Systems offer tremendous performance, scaling, reliability, and ease of management at a fraction of the cost of traditional NAS filers. Sun Unified Storage Systems utilize Hybrid Storage Pools and ZFS File System to provide high-performance NFS storage with industry-leading throughput and price per gigabyte of capacity.
- **Parallel storage** — For scalable environments with thousands of cores that need fast I/O, the Sun Lustre Storage System uses an easy-to-deploy, modular architecture to scale from 1 GB/sec to 100 GB/sec of performance and from tens of terabytes to petabytes of capacity. The Sun Lustre Storage System provides superior throughput for applications, as well as access to a single global name space. Based on the Lustre file system and Sun Open Storage disk subsystems, the Sun Lustre Storage System can deliver I/O performance in excess of 100 GB/sec.

- **Archive storage** — To address the escalating cost of storing large volumes of HPC data, Sun has a complete line of tape and archive products and software solutions for archival management. Sun StorageTek™ tape drives and libraries provide power-efficient and cost-effective media for storing large volumes of data. Built around Sun StorageTek™ Storage Archive Manager software, the Sun Storage and Archive Solution for HPC provides automated, policy-based archiving and on-demand, transparent file retrieval — so the cost of building and managing large data repositories can be reduced through low power consumption, low-cost media, and reduced effort for data management and operations.

Sun and manufacturers

As manufacturers seek new ways to cut costs while remaining competitive, MCAE applications continue to be used more and more. These applications require an optimized infrastructure that balances compute, memory, storage, and networking to the needs of the application.

Sun's Business Ready HPC offerings deliver no-compromise versatility that supports MCAE applications with any mix of high-throughput, high-performance, large-memory, and I/O-intensive applications. These systems leverage the innovative Sun Open Network Systems architecture, open-source software, and high levels of systems integration to deliver unsurpassed performance and value. Sun HPC and storage systems are easy to deploy, manage, and use, so manufacturers can focus on their business rather than on the business of managing computers.

Learn More

To learn more about Sun Business Ready HPC Solutions, go to: sun.com/hpc.