Bridging the gap between workstations and supercomputers

The CRAY S-MP Superserver

CRAY RESEARCH, INC.

Cray Research has defined supercomputing over the past twenty years. As our customers explore new approaches to high-performance computing, we aim to provide the highest-power solution within each architecture.

We are the established leader in vector and parallel-vector computing. We have projects in place to couple the power of massively parallel architecture with our traditional vector architecture.

And now, with the CRAY S-MP system, we offer customers a superior solution for high-performance scalar processing and workstation interoperability using Sun Microsystems' SPARC technology.

## A seamless software environment

The capability of workstations has increased dramatically in recent years, and many organizations have found that workstations and supercomputers make an ideal partnership for scientific computing. The CRAY S-MP superserver system, with its seamless connections to SPARC workstations and use of SPARC technologies, opens the door to thousands of applications while providing a user friendly interface to the supercomputer. The superserver thus bridges the gap between today's supercomputers and high-powered workstations, providing an unprecedented level of interoperability.

The CRAY S-MP system fits easily into distributed, heterogeneous environments. It can handle the demands of multiple large multi-user applications, such as finite element analysis, computational fluid dynamics,

E-CAD, mass storage management, and distributed graphics. Its flexible, modular design allows it to be configured in ways that provide a wide range of capability and performance, satisfying requirements from those for departmental compute servers to those for central data center systems.

High-performance scalar processing

CRAY S-MP systems are built upon high-performance SPARC scalar processors, with 67 MIPS performance per processor. Systems can have up to eight of these 15-ns processors, yielding as much as 533 MIPS peak performance. The CRAY S-MP operating system provides symmetric multiprocessing capability, allowing multiple large jobs to be processed simultaneously for greater system throughput. All processors can work together to solve large, complex problems, or some or all processors may be applied to individual tasks.

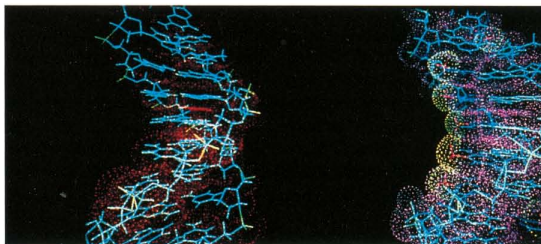

System configuration
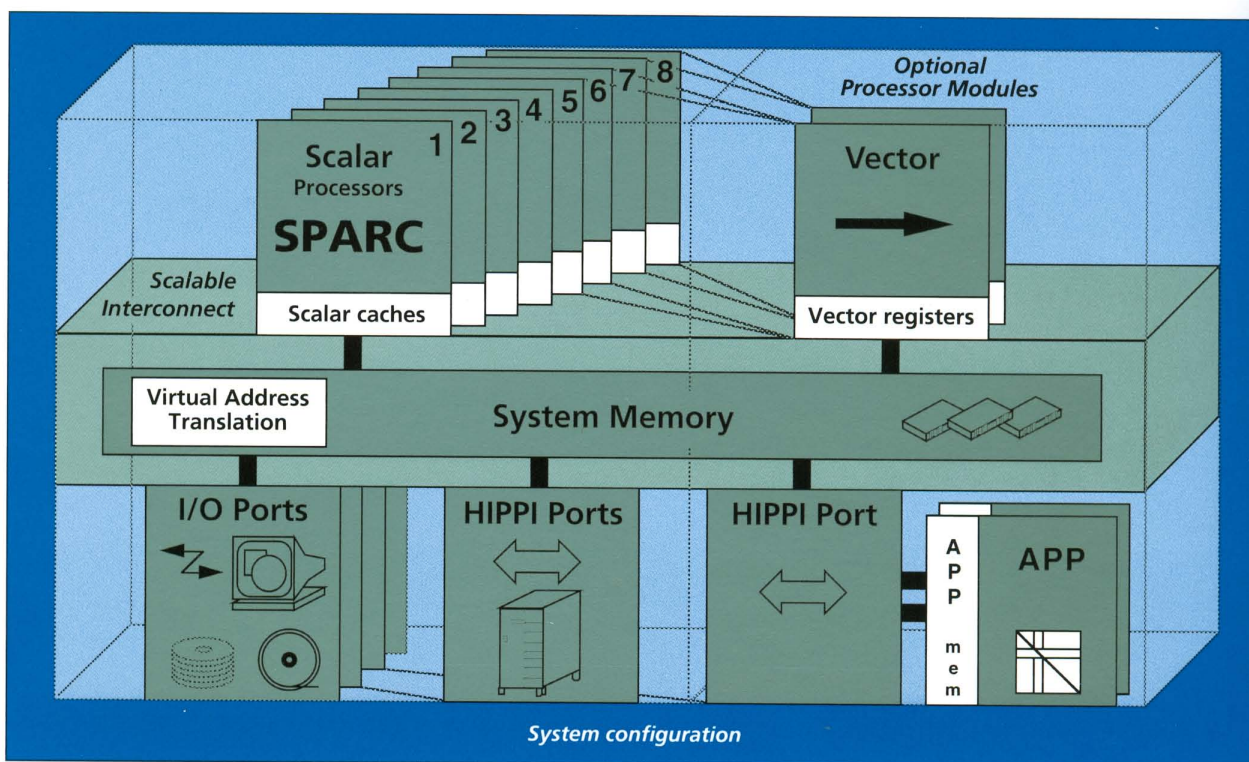
Right, flow front distribution in an injection-molded plastic computer case modeled with MOLDFLOW. Molding is an Apple Macintosh Classic front bezel.
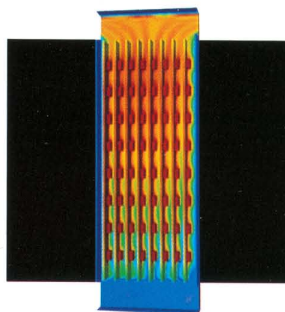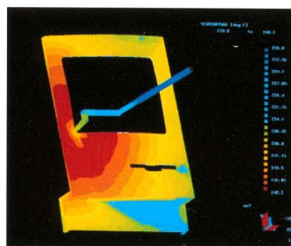
Left, natural convection heat transfer in a three-dimensional electronics enclosure, computed using FIDAP.

Methylation of DNA. The image shows methylated DNA (left) and normal DNA. Abnormal patterns of methylated DNA have been shown to occur in nearly all forms of human cancer. Computed using AMBER and displayed with MIDAS.

Add processor types to meet your needs

The CRAY S-MP system can be configured with vector and attached parallel processors (APPs) that complement the SPARC scalar processors to meet many types of application needs. Today many scientific computer centers contain networks that include scalar, vector, and specialized parallel processors. The CRAY S-MP system brings these heterogeneous processor types together into a unified architecture—in what can be thought of as a "network in a box"—with the different processors linked by a gigabyte-per-second system interconnect. More important, the CRAY S-MP system enables users to access the functionality of these different processor types from a common development environment.

SPARC vector processors can be configured on a CRAY S-MP system for significant speedups on problems solved with techniques such as computational fluid dynamics and finite element analysis. A system can accommodate one or two vector processors, each with sixteen 1024-element vector registers and a peak rate of 267 MFLOPS.

One or two APPs can be configured with as many as 84 Intel i860 processing elements each. These parallel processors deliver power of up to 6 GFLOPS and excellent price/performance to compute-intensive applications such as signal processing, image processing, and electromagnetics.

In addition to providing versatility for today, the field-upgradable, modular design of the CRAY S-MP system offers scalability for tomorrow's growth.

Large, efficient virtual memory

All processors share up to 4 gigabytes of real memory, supplemented by a robust virtual memory management system designed for large jobs in multiuser environments. The memory system provides the ease-of-use of virtual memory while delivering the performance associated with a real memory architecture.

A server for every purpose

The CRAY S-MP superserver is an ideal server for today's distributed environments.

High-performance compute server
Developers using SPARC workstations can use the CRAY S-MP system as a compute server to accelerate scalar applications, with no need to recompile them.

Powerful visualization server
A CRAY S-MP system can provide a high-performance departmental visualization facility, while freeing your supercomputer resources for large computational tasks. Computationally intensive visualization packages such as Applications Visualization System (AVS), which do not run efficiently on a workstation, perform well on a CRAY S-MP system—especially one equipped with an APP.

High-speed communications server
VMEbus and HIPPI channels, support for FDDI, TCP/IP, UltraNet, Ethernet, DECnet, and a suite of comprehensive networking software provide high-speed links to other computers and a variety of network products. The native HIPPI implementation employs four full simplex channels per interface, yielding an aggregate bandwidth of 400 megabytes per second. Using HIPPI connections, the CRAY S-MP system can provide up to 512 gigabytes of on-line disk storage at sustained bidirectional transfer rates of 128 megabytes per second.

Terabyte-capacity file server
A CRAY S-MP system running file storage and management software, combined with a range of supported peripheral units, can manage terabytes of data using high-performance communications to storage devices.
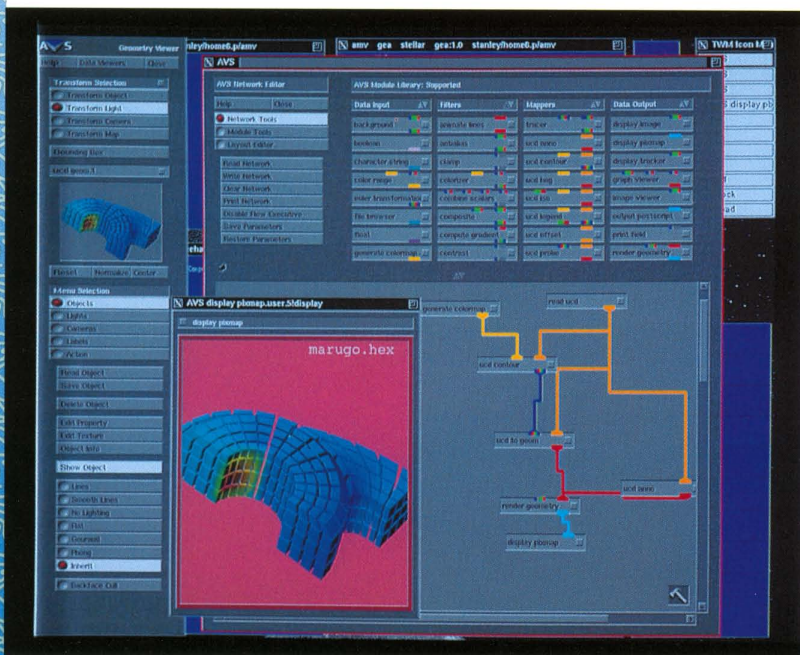
Scientific data enhancement using the AVS visualization system. An output from the ABAQUS finite element analysis program is integrated into an AVS network for analysis of the stress levels within each hexahedron cell of the structure. AVS provides a visual point-and-click interface to computing modules on both the workstation and the Cray Research system.

Rich, compatible system software

The operating system for the CRAY S-MP superserver is an enhanced implementation of the UNIX-based Solaris operating system from Sun Microsystems. Extensions enable parallel processing, symmetric multiprocessing, vector, and parallel-vector processing to take advantage of performance features of the hardware. Fortran and C compilers for the CRAY S-MP system are compatible with both Sun Microsystems and Cray Research compilers.

A wealth of applications

The CRAY S-MP system can run more than 4500 SPARC Application Binary Interface (ABI) applications—without modification. The performance of many applications can be enhanced further by utilizing optimized mathematical libraries, which are automatically loaded at run time—or by recompiling to take advantage of the processing capability of SPARC vector or APP. Imagine the versatility of a single platform that can accelerate vector and parallel applications while providing the breadth of software and productivity tools available for SPARC systems.

More than 3500 SPARCware solutions are available, including many in these common application areas:

Application	Number
Architecture & construction	57
Artificial intelligence	60
Data analysis	70
Data base management	57
Earth resources	86
Education	8
Electronic design	180
Electronic publishing	59
Financial services	33
Document management	26
Hardware manufacturing	85
Mapping	31
Mechanical engineering	134
Medical systems	6
Networking	123
Pharmaceutical & chemical	32
Physical sciences	8
Office productivity	158
Software engineering	236
Visualization	159
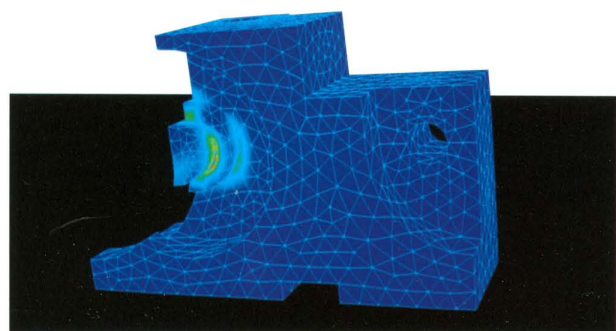
The ANSYS program was used to solve this linear elastic problem; colors signify the Von Mises stresses on the component—a tool holder
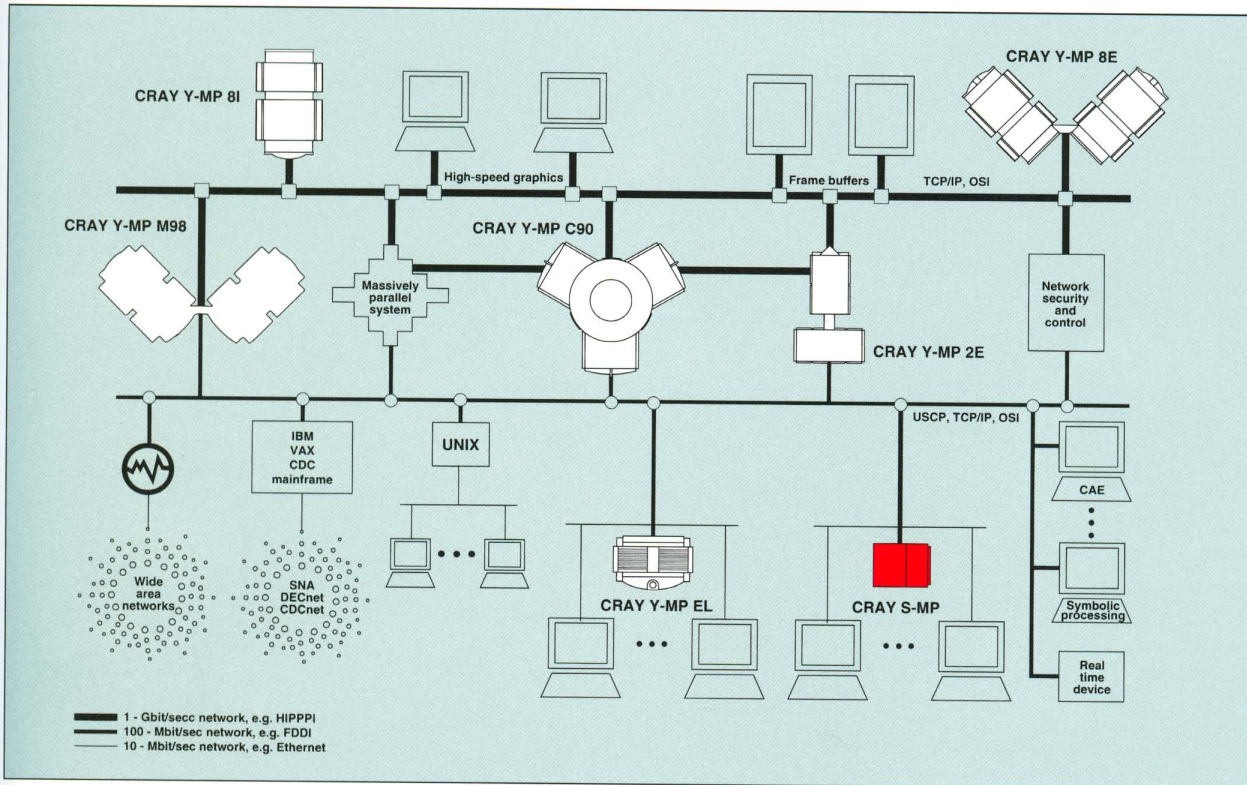
Equivalent plastic strain distribution during sheet metal forming, simulated with the MARC finite element analysis program
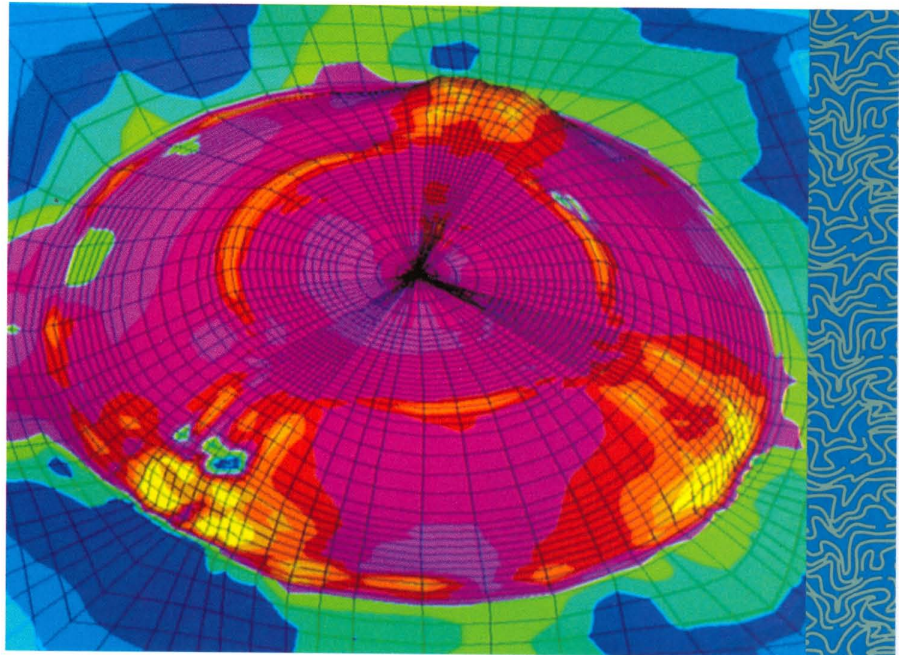
A cost-effective solution

The CRAY S-MP system's compliance with the SPARC standard protects long-term investment in hardware, software, and training. It simplifies system administration while holding down software maintenance costs and life cycle costs.

Whether used as a high-performance, high-bandwidth compute server, a powerful visualization server, a high-speed communications server, or a terabyte-capacity file server that fits seamlessly into a SPARC environment, the CRAY S-MP system provides the best solution.

CRAY Y-MP 8I

CRAY Y-MP 8E

High-speed graphics

Frame buffers

TCP/IP, OSI

CRAY Y-MP M98

CRAY Y-MP C90

Massively parallel system

Network security and control

CRAY Y-MP 2E

IBM VAX CDC mainframe

UNIX

USCP, TCP/IP, OSI

CAE

Wide area networks

SNA DECnet CDCnet

CRAY Y-MP EL

CRAY S-MP

Symbolic processing

Real time device

— 1 - Gbit/secc network, e.g. HiPPPI
— 100 - Mbit/sec network, e.g. FDDI
— 10 - Mbit/sec network, e.g. Ethernet

CRAY S-MP system integrated into a heterogeneous networking environment

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Image credits:

Computer case image courtesy of Apple Computer, Inc. Three-dimensional electronics module courtesy of Fluid Dynamics International. Sheet metal forming image courtesy of MARC Analysis Research Corporation. AVS image courtesy of Stardent Computer, Inc., and ABAQUS data courtesy of Hibbitt, Karlsson & Sorensen, Inc.