



CRAY
RESEARCH
A Silicon Graphics Company

Cray Research Hardware Solutions



Creating the Supercomputing Industry

For nearly a quarter of a century Cray Research, a Silicon Graphics® company, has been the world leader in providing supercomputing systems of unrivaled power to worldwide government, industry, and academia. The robust power of Cray® hardware and software solutions is used to model and analyze a broad range of phenomena that are too complex, costly, time-consuming, or simply impossible to analyze in any other way. Cray created an industry by providing supercomputing tools for simulation, which today is a common method for product development used by companies and organizations throughout the world. One by one, industries have begun to embrace supercomputing as a critical part of their businesses or missions. From automotive and aerospace design to the discovery of new drugs and materials, petroleum exploration, weather and climate research, Wall Street financial analysis, and advanced scientific research, Cray systems are giving these industries capabilities previously unimaginable.

FORD MOTOR COMPANY

CHRYSLER CORPORATION

NASA

ELECTRONIC DATA SYSTEMS

BAYER AG

UK METEOROLOGICAL OFFICE

PSA PEUGEOT CITROËN

PIRELLI

NATIONAL CANCER INSTITUTE

BEAR STERNS & COMPANY

MERRILL LYNCH

THE DOW CHEMICAL COMPANY

ISUZU MOTORS LTD.

JAGUAR

PHILLIPS PETROLEUM

MERCK & CO., INC.

NIPPON TELEGRAPH AND TELEPHONE

ELI LILLY COMPANY



CRAY T90



CRAY J90



CRAY T3E

Leading the Industry Having served the supercomputing needs of the world's most demanding customers for more than 20 years, Cray Research has developed a business model that focuses on high-end supercomputing customers and their requirements. Cray supercomputing products—each the global market leader in its category—include the CRAY T90™ Series of high-end vector processing systems; the CRAY J90™ Series of air-cooled vector processing systems; and the CRAY T3E™ Series of scalable parallel processing systems.

Each Cray supercomputer was designed to handle the unique needs of various high-performance computing users. The CRAY J90 system is geared toward small to medium vector problems; the CRAY T90 supercomputer is the worldwide leader in medium to the largest vector workload; and the CRAY T3E system is perfect for highly parallel problems.

All Cray systems are designed to support the open-systems standard and run the Cray high-end UNIX® operating system, UNICOS®, or its UNICOS/mk™ version, which scales to thousands of processors. Cray supercomputer systems uniquely support the most demanding applications, hundreds of users and processes, petabytes of data, and mission-critical requirements.

Performance Throughput Productivity

These are the benefits high-performance computing can bring to your organization. But delivering these benefits and keeping your valued computer resource operating at peak efficiency requires more than fast processors. Cray supercomputers are well-known for their balanced system designs that match fast processors with industry-leading input/output (I/O) and networking technology. Cray knows that getting data into the computer system and kicking solutions out is the key to your organization's overall productivity. That's why Cray developed the GigaRing I/O channel to support all of the Cray high-end supercomputing systems. The GigaRing channel helps Cray systems to be the highest performing in the industry. Another benefit to GigaRing technology is its scalability, allowing customers to buy only what they need when they need it. The GigaRing channel supports a wide variety of peripheral devices, including high-performance disks, tape devices and automated tape robot systems, and industry-standard networking protocols, including HIPPI, FDDI, Ethernet™, and ATM.

"THE CRAY J916 SYSTEM WILL ALLOW US TO SIMULATE ADDITIONAL DESIGN AREAS AND NEW TOOLING AND FABRICATION PROCESSES. THIS WILL RESULT IN AN AIRCRAFT THAT HAS MORE VALUE FOR OUR CUSTOMERS AND IS LESS EXPENSIVE FOR US TO PRODUCE."

David Bernsdorf, Manager
Special Projects
Raytheon Aircraft Company

"THE (CRAY) SYSTEMS HAVE PROVEN THAT THEY CAN TAKE ON THE CHALLENGE OF OUR BIGGEST, MOST COMPLEX PROBLEMS."

Dr. Bruce Ross, Assistant Director
National Oceanic and Atmospheric Administration
Geophysical Fluid Dynamics Laboratory (GFDL)

CRAY T90 Series

The **CRAY T90 Series** of supercomputers is the company's most powerful line of general-purpose supercomputing systems. This flagship series, based on Cray high-speed vector processors, provides nearly 60 billion calculations per second (gigaflops) of peak computing power on an unmatched range of third-party and proprietary supercomputing applications. CRAY T90 systems employ an array of innovative technologies, including pioneering connectors that eliminate internal wiring. The CRAY T90 Series includes three models: the CRAY T94™ system, offered in air- or liquid-cooling that scales up to four processors; the CRAY T916™ system, a liquid-cooled system that scales up to 16 processors; and the top-of-the-line CRAY T932™ system, also liquid-cooled with up to 32 processors. CRAY T90 system customers include large global organizations such as Ford Motor Company, Chrysler Corporation, Electronic Data Systems, Kia Motors, Nippon Telegraph and Telephone, Japanese auto firms, and national research centers and weather and climate organizations around the world.



	CRAY T94	CRAY T916	CRAY T932
No. of CPUs	1-4	8-16	16-32
PEAK PERFORMANCE	1.8-7.2 GFLOPS	14-28 GFLOPS	28-56 GFLOPS
MEMORY SIZE	.5 or 1GB	2 or 4GB	4 or 8GB
PEAK MEMORY BANDWIDTH	100GB/sec	450GB/sec	900GB/sec
MAX. NO. OF GIGARINGS™	8	16	32
PEAK I/O BANDWIDTH	8GB/sec	16GB/sec	32GB/sec
COOLING TECHNOLOGY	Air or liquid	Liquid	Liquid

Highlights:

- Based on Cray Vector Processor, the proven workhorse architecture for scientific, technical, and engineering applications
- Up to 32 processors and nearly 60 GFLOPS of peak performance, offering the highest sustained-to-peak performance on a wide range of supercomputing applications
- Nearly 1TB of memory bandwidth, speeding overall processing
- 512 to 8,192MB of central memory, giving customers expandable memory options for their varying workloads
- Aggregate I/O bandwidth of more than 30GB/sec, providing fast delivery of solutions to users
- Binary compatible with previous CRAY C90 line, saving time because no recompilation is needed for applications that run on CRAY C90 systems
- Data center-ready, runs proven UNICOS operating environment based on UNIX System V, providing customers with the software features needed to run mission-critical workloads at the enterprise level
- Runs fully optimized Cray applications suite of the most common scientific, technical, and engineering programs
- Field-upgradable performance increases are planned, preserving customer investments



CRAY

J90 Series



The **CRAY J90 Series** is ideal for organizations that have complex computing needs, but don't require the truly highest-end systems. CRAY J90 systems are lower-cost, air-cooled versions of the most powerful Cray supercomputers. They start at well below \$1 million and are inexpensive to maintain because they don't require special computing environments. The supercomputers run on standard power and are designed to fit into any office environment. CRAY J90 systems run the same operating system as high-end CRAY T90 supercomputers and the same full suite of applications software. CRAY J90 supercomputers support departments and mid-sized organizations with a few to hundreds of users running a range of challenging applications. The CRAY J90 Series has been a notable market success, with hundreds of systems installed in established supercomputing sectors and new markets, including the light aircraft and materials industries, as well as the automotive supplier market consisting of electronic and other component manufacturers, engineering specialists and consultants, and tire companies.

	CRAY J98se	CRAY J916se	CRAY J932se
NO. OF CPUs	4-8	4-16	16-32
PEAK PERFORMANCE	.8-1.6 GFLOPS	.8-3.2 GFLOPS	3.2-6.4 GFLOPS
MEMORY SIZE	5-2GB	1-4GB	2-8GB
PEAK MEMORY BANDWIDTH	12.8GB/sec	25.6GB/sec	51.2GB/sec
MAX. NO. OF GIGARINGS	2	4	7
PEAK I/O BANDWIDTH	440MB/sec	880MB/sec	1,540MB/sec
COOLING TECHNOLOGY	Air	Air	Air

Highlights:

- Based on a low-cost CMOS implementation of the Cray Vector Processor to provide the industrial workhorse supercomputer architecture at a low cost
- Up to 8,192MB of central memory to handle large problem sizes
- Fastest 1995 market share gainer in the midrange high-performance computing sector, showing the marketplace success and acceptance of this system
- Industry-leading memory bandwidth of 51.2GB/sec, delivering more overall performance
- Offered with 1-32 processors, providing scalability for customers' varying needs
- I/O bandwidth of 1.54GB/sec, sustains large production workloads
- 6.4 GFLOPS peak performance, offering substantial performance for small to medium problems
- Office environment-ready, air-cooled, and about the size of a large refrigerator, enabling organizations to easily operate the system without special computing rooms
- Field-upgradable performance increases are planned, preserving customer investments



CRAY

The **CRAY T3E Series**, the most powerful product line Cray offers, efficiently scales performance and price/performance from tens to thousands of processors and up to 1.2 trillion calculations per second (teraflops). This distributed-memory parallel processing series follows the successful CRAY T3D™ product line and is available in two models: an air-cooled version that scales from six to 128 processors and a liquid-cooled version that scales from 32 to 2,048 processors. Breakthrough technologies make CRAY T3E the world's first globally scalable supercomputer series—every element of the system (OS, I/O, memory, bandwidth) efficiently scales upward with the number of processors. The CRAY T3E system demonstrates superb performance for highly parallelized applications, such as 3D oil exploration and weather simulation. Customers include: Mobil Oil Company's Exploration and Producing Technical Center; Electronic Data Systems (EDS); and the National Oceanographic and Atmospheric Administration's Geophysical Fluid Dynamics Laboratory (NOAA/GFDL).

	CRAY T3E AC	CRAY T3E LC
No. of CPUs	6–128	32–2,048
Processor MHz	300/450*	300/450*
Peak Performance	3.8–76.8 GFLOPS	19.2–1,228 GFLOPS
Memory Size per Processor	64MB–2GB	64MB–2GB
Interconnect Typology	3D bidirectional Torus	3D bidirectional Torus
Max. Data Payload Bisection Bandwidth	32GB/sec	122GB/sec
Max. No. of GigaRings	16	128
Peak I/O Bandwidth	16GB/sec	128GB/sec
Cooling Technology	Air	Liquid

* Future field-upgradable performance enhancement

Highlights:

- The industry-leading highly scalable supercomputer
- Variable microarchitecture uses the Digital Equipment Corporation Alpha (EV5) processor, allowing for easy future planned upgrades
- Offered in configurations from six to 2,048 processors, providing flexibility for customer acquisitions
- Global scalability allows customers to buy what they need
- More than one TFLOPS peak performance, offering the greatest amount of power for parallel applications
- Up to 4TB central memory, supporting large parallel workloads
- Industry-leading bisection bandwidth in excess of 122GB/sec, speeding overall performance on applications
- I/O bandwidth of up to 128GB/sec, delivering solutions fast
- Field-upgradable performance increases are planned, preserving customer investments

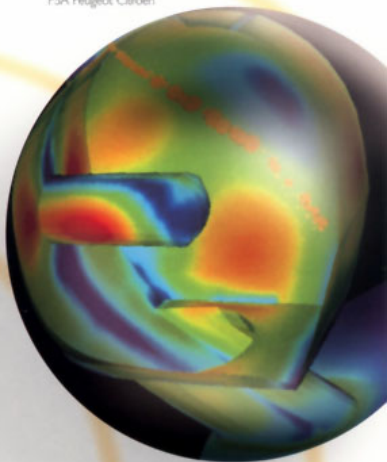


"USING OUR CRAY PARALLEL-VECTOR SYSTEM
TO SHORTEN DEVELOPMENT TIME ALLOWS US TO
BRING NEW PRODUCTS AND VEHICLES TO
MARKET MORE QUICKLY...REDUCING THE
NUMBER OF PROTOTYPES WE HAVE TO BUILD
AND SAVING MATERIALS IN ONE-STEP TOOLING
TRANSLATES TO SUBSTANTIAL COST SAVINGS."

Messaoud Youcef-Ouak, Manager
Scientific Computing Strategy
PSA Peugeot Citroën

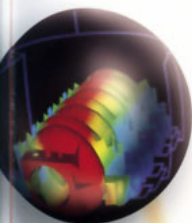
"THE CRAY SYSTEM IS USED...IN ANALYZING NEW
VEHICLE PLATFORMS TO MEET CORPORATE AND
CUSTOMER REQUIREMENTS. THIS WORK WOULD
BE NEXT TO IMPOSSIBLE WITHOUT THE CRAY
(SYSTEM)."

Ron Bienkowski, Executive Engineer
Technical Computing Center
Chrysler Corporation



"CRAY HAS MADE THE PARADIGM SHIFT FROM PURE
RESEARCH TO PROVIDING WHAT INDUSTRY NEEDS.
THEY UNDERSTAND WHAT IT TAKES TO PROVIDE
REAL-WORLD SOLUTIONS AND HAVE TAKEN BUSINESS
RISKS TO HELP MAKE DOW MORE COMPETITIVE."

Randy Collard, Director, Core R&D Computing
Modeling and Information Sciences
The Dow Chemical Company



Cray Research, Inc., a subsidiary of Silicon Graphics, Inc., is based in Eagan, Minnesota, a suburb of Minneapolis/St. Paul. Cray engineering, development, and manufacturing facilities are in Chippewa Falls, Wisconsin. Cray sells its products through the Silicon Graphics/Cray sales force.

For more information, please contact your Cray sales representative at a local Silicon Graphics office.



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