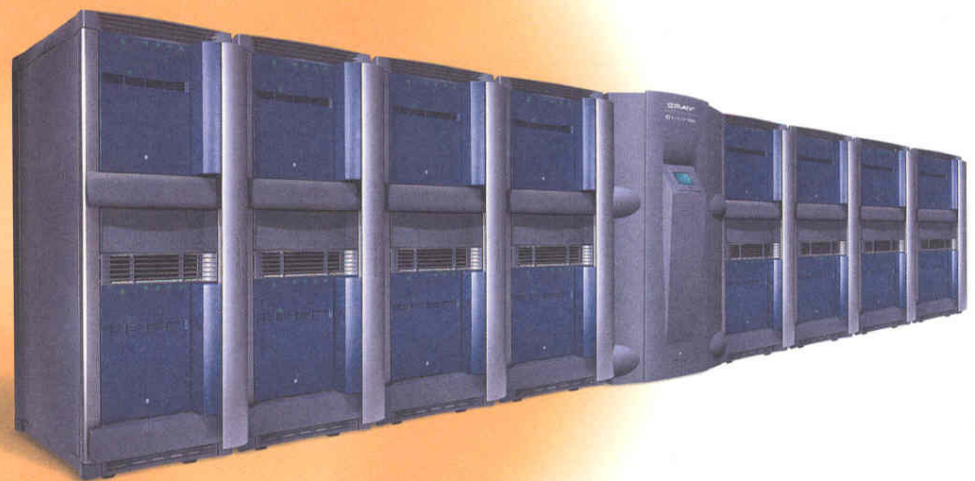


# CRAY® Origin2000™

Supercomputing Series



# CRAY Origin2000

## A Marriage of Winning Formulas



Cray Research is the premier producer of large-scale supercomputers—systems that deliver extreme performance to high-profile customers tackling the world's most challenging computing problems and workloads. Powerful processors alone aren't enough to achieve the highest performance. That's why Cray's success has resulted from balanced systems that match lightning-fast processors with equally fast I/O (input/output) bandwidth and memory interconnect technology—along with powerful, scalable open-systems software.

Silicon Graphics and Cray Research have joined forces to bring this balanced-systems approach to mainstream high-performance computing markets. The Silicon Graphics® Origin™ product family is a technological breakthrough that marries Silicon Graphics' leadership in powerful, affordable computing with Cray's design philosophy formerly available only to customers needing high-end supercomputer performance. CRAY Origin2000 products scale the innovative Origin RISC-based family well beyond the reach of competitors, giving customers the ease-of-use and programming benefits of a symmetric multiprocessing (SMP) system with the high-performance benefits of very broad scalability. Cray and Silicon Graphics call this revolutionary new architecture Scalable Shared-memory MultiProcessing (S<sup>2</sup>MP™).

**CRAY**

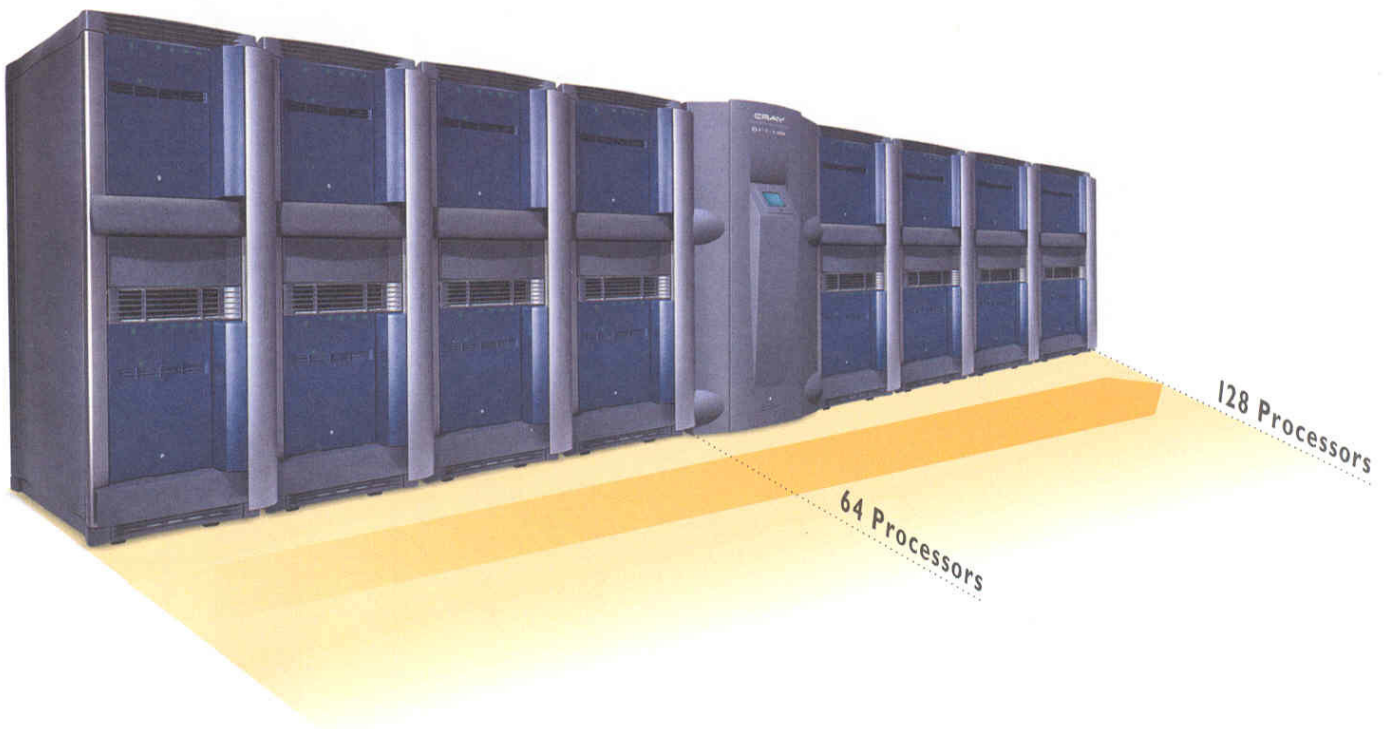
**ORIGIN 2000**

## Extending RISC-Based SMP in Every Dimension

The CRAY Origin2000 supercomputer series is a compatible extension of the Silicon Graphics Origin product line that scales to 64 processors. Running Cellular IRIX™, the same operating system (OS) used in Origin deskside products and midrange servers, CRAY Origin2000 systems are available with 65 to 128 processors—a new scalability benchmark for RISC-based SMP products. The entire Origin product family, including the CRAY Origin2000 Series, is compatible with all Silicon Graphics IRIX™ systems and exploits the company's broad catalog of third-party supercomputing applications and industry-leading visualization capabilities. Cray supercomputing software extends this environment to provide Cray source code compatibility and data center-quality resource management.

The CRAY Origin2000 Series complements the CRAY T3E™ system—the world's most powerful supercomputer product and the leader in extreme scalability—which scales to 2,048 processors and 1.8 teraflops of computing power. While the CRAY T3E system excels on select applications that exploit its distributed memory architecture, the CRAY Origin2000 Series is designed to run a full spectrum of third-party scalar applications with ease of programming, administration, and use.

The CRAY Origin2000 supercomputer scales the SMP architecture well beyond competing systems—up to 128 processors—with a revolutionary new architecture called S:MP.



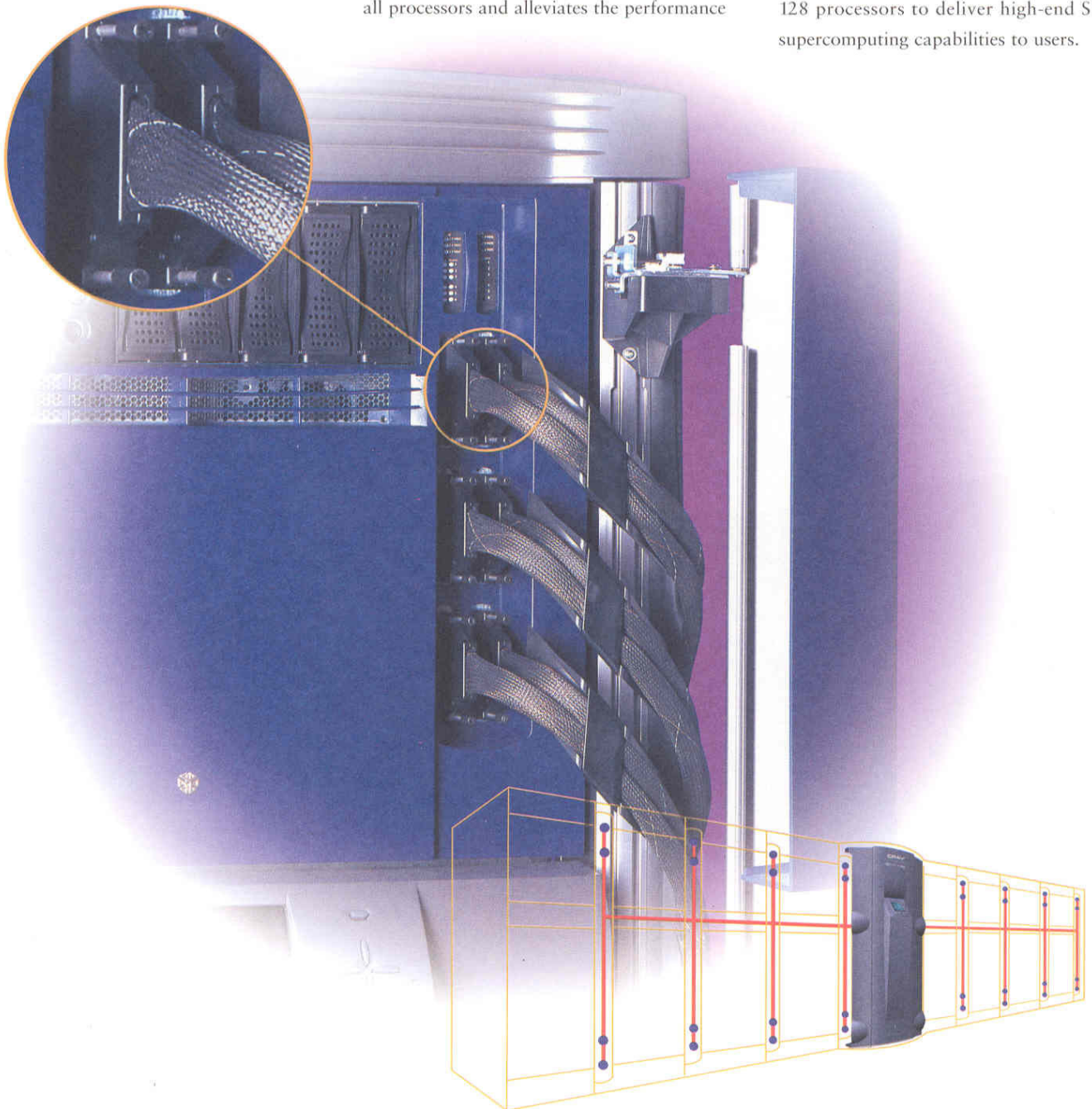
## CRAY...LINK

### Cray-Class Hardware

The primary component of the CRAY Origin2000 system is the Origin2000 Module, a modular building block supporting one to eight MIPS® R10000™ processors, 64MB to 16GB memory, and up to 6.4GB/second of peak I/O bandwidth. The revolutionary CrayLink™ Interconnect technology, a high-speed scalable interconnect fabric, provides a single system image across all processors and alleviates the performance

bottlenecks that plague competing products as processors are added.

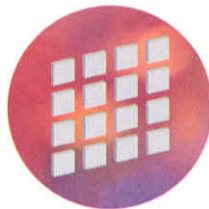
As the CRAY Origin2000 system scales upward, the CrayLink technology provides built-in capabilities for ensuring hardware cache coherency and interconnect capacity. The Meta Router, a key piece of the CrayLink technology, allows customers to easily grow the CRAY Origin2000 supercomputer to 128 processors to deliver high-end S2MP supercomputing capabilities to users.



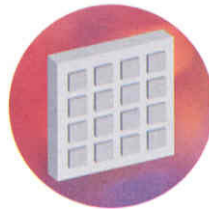
mainframe computing



clustered computing



cellular computing



Cellular IRIX combines the benefits of mainframe and cluster computing to bring forward a new breed of computing: cellular computing.

### More Than Just Fast Hardware

The CRAY Origin2000 Series unites exceptional SMP hardware and evolving production software capabilities with unrivaled customer service. The CRAY Origin2000 systems undergo Cray-class quality assurance testing to ensure that these large SMP configurations meet demands of high-end supercomputing environments.

The Cellular IRIX OS, a new distributed version of IRIX, supports the CRAY Origin2000 computing environment with unique modularity features that allow the hardware "cell" to be defined at any size from eight to 128 processors. Cellular IRIX provides this parallel system with a true single system image and a coherent set of globally shared resources. It essentially combines the benefits of mainframe and cluster computing to bring forward a new breed of computing: cellular computing.

Cray and Silicon Graphics software engineers are collaborating to ensure that Cellular IRIX for the CRAY Origin2000 Series incorporates the necessary software features from the Cray industry-leading high-end UNICOS® operating system. These supercomputing software features are aimed at providing Cray source

code compatibility and advanced data center resource management capabilities:

- Network Queuing Environment™ (NQE) software automatically and efficiently distributes workloads within the system and across heterogeneous networks.
- Data Migration Facility (DMF) manages terabytes of data.
- Tape management facility delivers production-quality on-line tapes.
- Cray Fortran 90 compiler technology (with Cray language extension support) provides the industry-leading F90 implementation and Cray source code compatibility to let users move Cray applications among systems without source code modifications.
- LibSci advanced scientific library, the most complete math library available, builds high-performance applications.
- Shared-memory (Shmem) data passing communications library provides better performance than message-passing communication.
- Flexible file I/O library transparently delivers high-performance I/O and data format translation to applications without source code modification.

These supercomputer software features combined with CRAY Origin2000 and Cellular IRIX result in a scalable computing environment capable of meeting the demands of supercomputing workloads.

# Cray and Silicon Graphics

## Roadmap to the Future



### The Category Leaders Today



#### Parallel Vector

The CRAY T90™ Series is the best-selling vector SMP product line on the planet. Offered with one to 32 processors, CRAY T90 systems typically reside in the technical data centers of large organizations and serve as company-wide resources for the most demanding supercomputing problems and workloads.



CRAY J90™ Series systems are scaled-down versions of Cray extreme-performance vector supercomputers aimed at small- to mid-sized organizations and departments within large organizations. CRAY J90 systems are air-cooled and easily fit into any office environment.



#### Distributed Memory Scalable Parallel

CRAY T3E Series systems are distributed-memory, highly scalable RISC-based products and the world's most powerful line of supercomputers. Available with six to 2,048 processors and 1.8 teraflops of peak power, the CRAY T3E Series delivers unrivaled scalable performance for targeted applications and is the extreme scalability leader.



#### S2MP

The CRAY Origin2000 Series is designed for a wide range of applications and exploits the Silicon Graphics' catalog of third-party supercomputing applications and visualization capabilities. Systems are offered with 65 to 128 processors and scale the symmetric multiprocessing (SMP) architecture well beyond the competition.

FUTURE

sustained  
gigaflops  
processor

premier  
OS  
for HPC

world's first  
binary-compatible  
desktop-to-teraflops  
product line

## The Winning Formula Continues

Silicon Graphics/Cray—together the world's number-one high-performance computing company—plans to deploy the world's first binary-compatible product family that extends from desktop products to multi-teraflops supercomputing systems. The Origin Series' new S2MP architecture will be the foundation for the company's future unified architecture. The product family will be MIPS microprocessor-based, multigenerational, and will incorporate the unique strengths of the company's current products with innovative enhancements currently under development.

# CRAY Origin2000

## Technical Specifications

### PROCESSOR DATA

Microprocessor	MIPS RISC R10000 64-bit CPU
Primary caches	32KB two-way set-associative on-chip instruction cache 32KB two-way set-associative on-chip data cache
Secondary cache	4MB two-way set-associative cache per CPU

### NODE CARD

CPU capacity	1 to 2 R10000 CPUs
Memory capacity	64MB to 4GB ECC protection SDRAM
HW cache coherency	yes
Interleaving	4- to 32-way per node card
Memory bandwidth	up to 800MB/sec peak

### ORIGIN2000 MODULE

up to 4 node cards

### CRAY Origin2000

Processors	65 to 128 CPUs
Number of processor racks	5 to 8
I/O bandwidth	up to 82GB/sec sustained, 102GB/sec peak
I/O boards	up to 192 XIO™ or 184 XIO and 24 PCI 32- or 64-bit
Internal peripherals	up to 128 3.5-inch Ultra SCSI devices, 16 5.25-inch SCSI devices
Independent power	yes
Redundant power	optional*
Redundant cooling	yes

### STORAGE I/O DEVICES

#### XIO cards supported

Base I/O includes internal SE Ultra SCSI, external SE Ultra SCSI, 100Base-TX, 2 460kbps serial ports  
4-port Ultra SCSI (3 differential, 1 SE or differential)  
2-port Fibre Channel (copper or fiber)

#### PCI-64 cards supported

2-port Fibre Channel

### GRAPHICS

Polygons/sec	11M
Pixel fill, smooth, Z	224M to 896M
Pixel fill, textured, AA	194M to 776M
Anti-aliased vectors/sec	7.4M
Trilinear interpolations/sec	200M to 800M
Convolutions/sec (5x5)	60M
Voxels/sec	200M to 800M
24-bit floating-point Z	yes
Color	48-bit RGBA
Overlay planes	16
Anti-aliasing multisampling	8x8
Max. bits/pixel	256 to 2048
Graphics pipelines	1 to 2 (1 4RM, 1 2RM)
Geometry Engine® processors/pipeline	4
Raster Managers/pipeline	1 to 4 and 1 to 2
Texture memory/pipeline	16 or 64MB
Frame buffer size/pipeline	80 to 320MB
Display channels/pipeline	2 or 8
Display capability	VGA to HDTV
Std. monitor size resolution	24" 1920x1200

### NETWORK I/O DEVICES

#### XIO cards supported

Base I/O includes internal SE Ultra SCSI, external SE Ultra SCSI, 100Base-TX, 2 460kbps serial ports

4-port 100Base-TX and 6 460kbps serial ports

4-port ATM OC3

DVS (Serial CCIR601 digital video)

HIPPI-Serial (200MB/sec)

#### PCI-64 cards supported

Dual attached FDDI; single attached FDDI; UTP FDDI; Token Ring; ISDN, high-speed synchronous serial

### I/O EXPANSION DEVICES

XIO to internal PCI (3 slots) adapter

XIO to external PCI adapter\*

XIO to external VME adapter

### MASS STORAGE

Interfaces Ultra SCSI and Fibre Channel

Max. bandwidth 40MB/sec Ultra SCSI  
100MB/sec Fibre Channel

Device capacity 4.5GB, 9.1GB

External storage Rack-mount vaults  
6 3.5-inch devices Ultra SCSI  
10 3.5-inch devices Fibre Channel

RAID Fast/Wide SCSI rack  
(80 3.5-inch devices)

Maximum configuration 14.5TB per module  
(Fibre Channel)

3.5TB per module  
(Ultra SCSI)

13.5TB per module  
(Ultra SCSI RAID)

### DIMENSIONS AND WEIGHTS

Rack system	73" H, 40" D, 28" W (185cm H, per rack) 102cm D, 71cm W)
	700 pounds (317kg)

Note: weights assume that modules are fully configured with processors, I/O, and peripherals.

### SYSTEM BANDWIDTH

#### System bus bandwidth as measured by bisection bandwidth sustained (peak)

System size (CPUs)	Bisection bandwidth without Xpress links
64	10.2GB/sec (12.8GB/sec peak)
128	20.5GB/sec (25.6GB/sec peak)

### ENVIRONMENTAL (NON-OPERATING)

Temperature	-20° to +60° C
Humidity	10% to 95% non-condensing
Altitude	40,000 MSL

### ENVIRONMENTAL (OPERATING)

Temperature	+5° to +35° C, altitude 5,000 MSL +5° to +30° C, altitude 10,000 MSL
Humidity	10% to 90% non-condensing
Noise	50 dBA (deskside) 55 dBA (rack)

### ELECTRICAL AND POWER

Voltage (rack)	220 VAC single-phase
Frequency	50 to 60Hz
Heat/power	5,500 watts, 18,750 BTU/hr (rack)
Electrical service/type	NEMA 6-30, 208VAC @ 30amp (rack)

### SOFTWARE

System software	Cellular IRIX
Networking	TCP/IP NFS™ V2/V3, RSVP, DHCP, Bulk Data Service (BD5pro), NetVisualizer™, SNMP management, SNMP MIB, NIS/ONC+
Server software	XFS™ 64-bit journaled filesystem with guaranteed rate I/O, IRIS NetWorker™, Performance Co-Pilot™ system and network performance monitoring software, System MIB (Provision), Software Distribution (Propel)
Supercomputing software	NQE, DMF, LibSci, tape management facility, flexible file I/O, Shmem Library
Compilers	ANSI C, C++, Fortran 77, Ada, Pascal, Power C Accelerator (PCA), Power Fortran 77, Fortran 90, Power Fortran 90
PC/Macintosh® integration	Syntax TotalNET Advance server, supports Windows® 95 and Windows NT® (SMB), NetWare™, AppleShare® environments for PC and Macintosh
Security	Trusted IRIX™ B1 security, Commercial Security Pack (CSP)
Web server	Netscape™ Enterprise server

### GENERAL AVAILABILITY

CRAY Origin2000 supercomputers are available for shipment in mid 1997.

\*available first half of 1997



CRAY  
RESEARCH  
A Silicon Graphics Company

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