Product Guide

Remanufactured SGI™ Origin™ 2000

High-Performance Server


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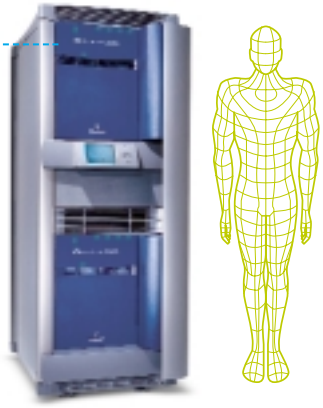


Origin 2000 Rack
The rack-mounted Origin 2000 system is the industry's most powerful and flexible shared-memory server. Easily expand the system by adding additional racks.

Multirack System
Connect multiple racks as a shared-memory powerhouse or redeploy those assets into multiple, tightly integrated departmental servers. Add IRIS FailSafe™ software to provide failover between systems, and Origin 2000 becomes the ultimate high-availability server for critical computational and business solutions.

Origin 2000 Deskside
With its outstanding price/performance, the deskside Origin 2000 server is ideal for evolving applications requiring expansion capability. Seamless upgradability to larger rack-based configurations supports your growing requirements.

SGI™ Origin™ 200
Origin 200 is the entry-level server system from SGI based on the ccNUMA architecture. It fulfills the processing and I/O demands of shared-use workgroup and departmental applications, client/server applications, or dedicated applications such as file and Web serving.

Revolutionary Server for Your Expanding Business
Today's corporate environment is characterized by a rapid growth in communications requirements and continual organizational change. A great deal of energy is spent planning future system purchases in an ongoing effort to keep system capabilities ahead of application demands. Corporations require scalable, flexible computer systems that can adapt to business change and satisfy growing server requirements. SGI offers you a proven, more adaptable way to purchase your data processing, computation, and communications capabilities. You can fulfill the hardware needs of your evolving applications by building on your previous purchases.

The SGI™ line of Origin servers easily adapts to your ever-changing business environment. These servers utilize the revolutionary ccNUMA architecture from SGI, allowing fast growth or redeployment of your computing assets to meet your growing needs. Origin 2000 servers, part of the high-performance SGI server family, can expand from dual-processor deskside systems to powerful 512-processor scalable servers without disruptive and expensive box-swaps common with other server solutions. System resources can be deployed as tightly integrated arrays of small Origin 2000 systems or as single large shared-memory systems capable of meeting the most demanding data processing and computing requirements.

SGI pioneered the development and delivery of shared-memory parallel processing systems. Since the deployment of its first symmetric multi-processing (SMP) systems in 1988, SGI has become both the high-performance computing leader and a major server supplier to the technical marketplace. Origin 2000 reinvents the parallel computer, further demonstrating SGI's commitment and innovation in markets as diverse as high-performance computing, data warehousing, and database, file, Web, and media serving.

Inherent Reliability
To provide extremely high levels of application availability, the Origin 2000 server offers a comprehensive set of hardware and software reliability features. ECC memory, redundant power and cooling, hot-pluggable disks, and RAID storage options allow the system to tolerate failures without affecting important applications.

Grows with Your Business
SGI Origin 2000 servers utilize the unique, scalable ccNUMA architecture to provide the most flexible and modular servers in the world. The cornerstone of this architecture in the Origin 2000 family is the Origin 2000 module. A module can hold up to eight MIPS® R10000® or R12000™ processors and up to 16GB of fast-access memory on four dual CPU node cards. Each module also provides 6.24GB-per-second peak I/O bandwidth through 12 XIO slots, providing the industry's most powerful I/O capabilities. Each module can hold up to five internal 3.5-inch Ultra SCSI devices and a CD-ROM and has independent power and cooling (redundant power optional). CrayLink™ Interconnect ports extend the connection fabric to multiple modules in a large hardware cache-coherent, shared-memory system. This allows you to seamlessly enlarge your system in all dimensions when adding additional modules.

Origin 2000 modules can be mounted in either a deskside or a rack enclosure. In the deskside enclosure, the module becomes a fully functional deskside server, ideal for both compute- and I/O-intensive applications, including intranet database and Web, file, and deployable compute serving.

In a rack enclosure, you can connect multiple modules in a variety of configurations to create a system perfectly sized for any workload. With SGI CrayLink Interconnect, each module can be combined with other modules as part of a large shared-memory system for tackling extremely demanding jobs. Each rack can hold up to two modules, and multiple racks can be connected with CrayLink Interconnect. In addition to modules, each rack can also hold Ultra SCSI or Fibre Channel disk enclosures, giving you a choice of high-performance and fully compatible peripheral technologies, as demanded by your applications.

The deskside system contains a single Origin 2000 module and supports up to five 3.5-inch Ultra SCSI devices and a CD-ROM within the module.

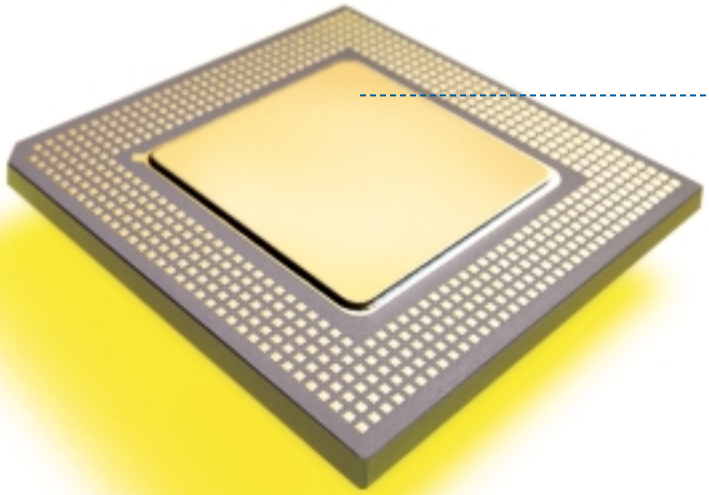
Each module provides redundant cooling and optional redundant power.

Each module holds up to eight CPUs on four node cards.

Each module supports up to 12 XIO devices with peak I/O bandwidth of 6.24GB/second, while each slot has a peak bandwidth available of 1.6GB/second.

Origin 2000 Rack System

- Holds up to two modules per rack; each module has independent power and cooling
- Supports an Ultra SCSI or Fibre Channel disk vault; single module racks can hold up to four disk enclosures
- CrayLink cables provide interconnect between modules; interconnect bandwidth grows linearly with system size
- Each module is part of a larger single-system image server, connected by CrayLink Interconnect; up to 64 modules containing 512 CPUs can connect as a single shared-memory system with 1 Terabyte memory, 399.36GB/second peak I/O bandwidth, and 712TB disk



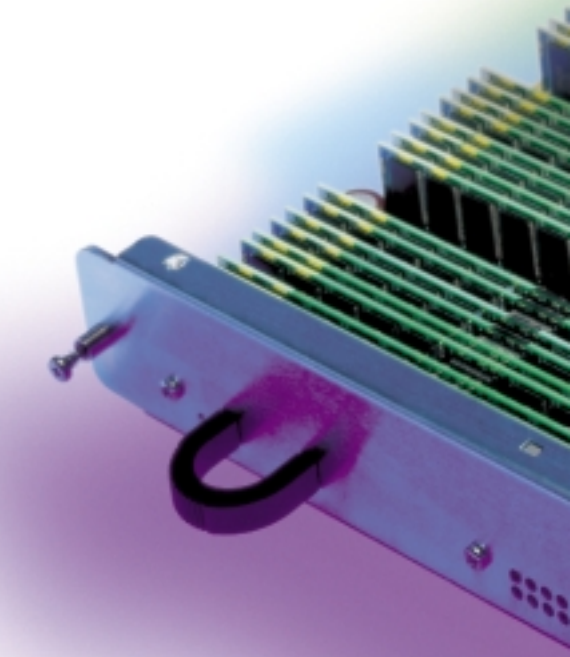
The superscalar R10000 and R12000 CPUs support advanced memory latency tolerance features such as out-of-order execution and advanced branch prediction to address real-world application demands.

Node Cards Extend Power
Easily extend your system's capabilities by adding node cards to the module. The ccNUMA architecture delivers increased performance and scalability by distributing memory on the CPU boards. Each board contains two high-performance MIPS R10000 or MIPS R12000 CPUs, a 4MB or 8MB secondary cache per CPU, and from 256MB to 4GB ECC main memory. The HUB, a four-ported 1.6GB-per-second nonblocking crossbar switch that connects the processors to the memory and I/O subsystems, is the basic building block of the ccNUMA extensible architecture. Hardware cache coherency is provided using onboard directory memory, which improves performance and scalability in high-performance multiprocessing systems. The combination of performance and scalability built into the Origin 2000 node card provides unmatched flexibility in building high-performance systems.

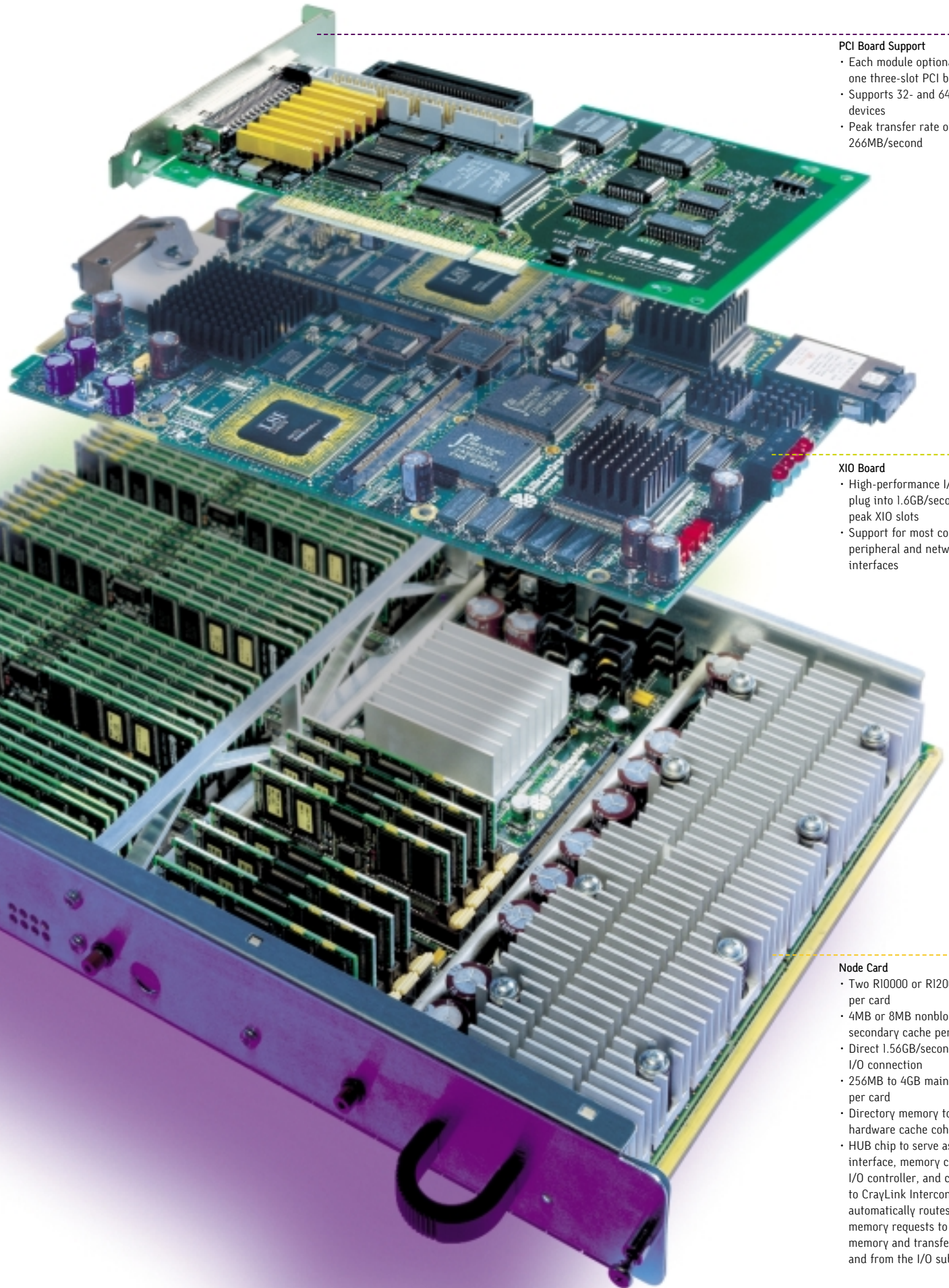
Designed for High-Performance I/O
Each module provides 6.24GB-per-second peak I/O bandwidth via 12 high-performance XIO slots. Specially designed to take advantage of the high-bandwidth I/O ports of Origin 2000, XIO boards maximize I/O throughput and device density. SGI provides Ultra SCSI and Fibre Channel XIO for high-speed peripheral connectivity. XIO boards also support 100Base-T Ethernet, serial HIPPI, ATM, GSN, Gigabit Ethernet, HDTV, and serial CCIR601 digital video, ensuring high-performance communications in a heterogeneous networked environment.

Each module also supports industry-standard expansion through optional PCI or VME XIO adapters. The PCI adapter provides I/O support for three 32- or 64-bit PCI cards. PCI card support offers a convenient standard for third-party I/O board manufacturers, which ensures a ready supply of specialized and industry-standard I/O devices for any application.

High-Performance Visualization
A full spectrum of high-performance visualization capabilities are supported for customers who need integrated graphics. Options range from a high-performance desktop graphics workstation to tightly integrated InfiniteReality2™, the world's most innovative graphics subsystem.



Visual Supercomputing
SGI's robust implementation of the ccNUMA architecture provides breakthrough bandwidth and data access, enabling high-performance network connectivity to graphics workstations or tight integration with multiple independent InfiniteReality2 graphics pipelines. This provides unlimited possibilities to interact with virtual environments.



PCI Board Support

- Each module optionally supports one three-slot PCI bus
- Supports 32- and 64-bit PCI devices
- Peak transfer rate of 266MB/second

XIO Board

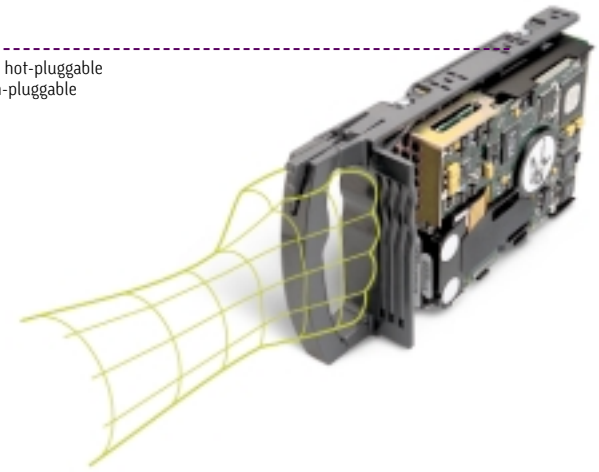
- High-performance I/O boards plug into 1.6GB/second peak XIO slots
- Support for most common peripheral and network interfaces

Node Card

- Two RI0000 or RI2000 CPUs per card
- 4MB or 8MB nonblocking secondary cache per CPU
- Direct 1.56GB/second peak I/O connection
- 256MB to 4GB main memory per card
- Directory memory to control hardware cache coherency
- HUB chip to serve as processor interface, memory controller, I/O controller, and connection to CrayLink Interconnect; it automatically routes global memory requests to physical memory and transfers data to and from the I/O subsystem

Origin Storage Vaults

- Differential Origin Vault holds up to six 3.5-inch devices and two 5.25-inch devices; the single-ended vault can stand next to the deskside, and the differential can mount inside the system rack or expansion rack
- The Fibre Channel RAID controller supports RAID levels 0, 1, 0+1, 3, and 5, up to 100 disks, hot global sparing, dual hosting, and redundant power, cooling, and controllers
- Origin FibreVault holds up to 10 hot-pluggable 3.5-inch Fibre Channel disks; the vault can stand next to the deskside or mount inside the system or an expansion rack

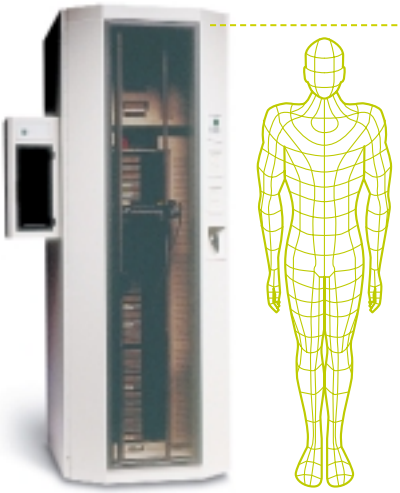


Disk connector supports hot-pluggable Fibre Channel and warm-pluggable Ultra SCSI.

Comprehensive Storage Devices
Demanding, data-intensive applications require state-of-the-art, high-performance storage technologies. The Origin 2000 server supports the latest technology in high-performance storage—from 100MB/second Fibre Channel to low-cost 40MB/second Ultra SCSI. You can increase your disk storage with additional Ultra SCSI and Fibre Channel disk enclosures, which are available as free-standing deskside expansion enclosures or rack-mounted within a system or an expansion rack. With internal and external storage, each 10-drive enclosure supports up to 360GB of directly connected disk storage, which can support even the most data-intensive applications. Up to 11 enclosures fit into a standard rack configuration.

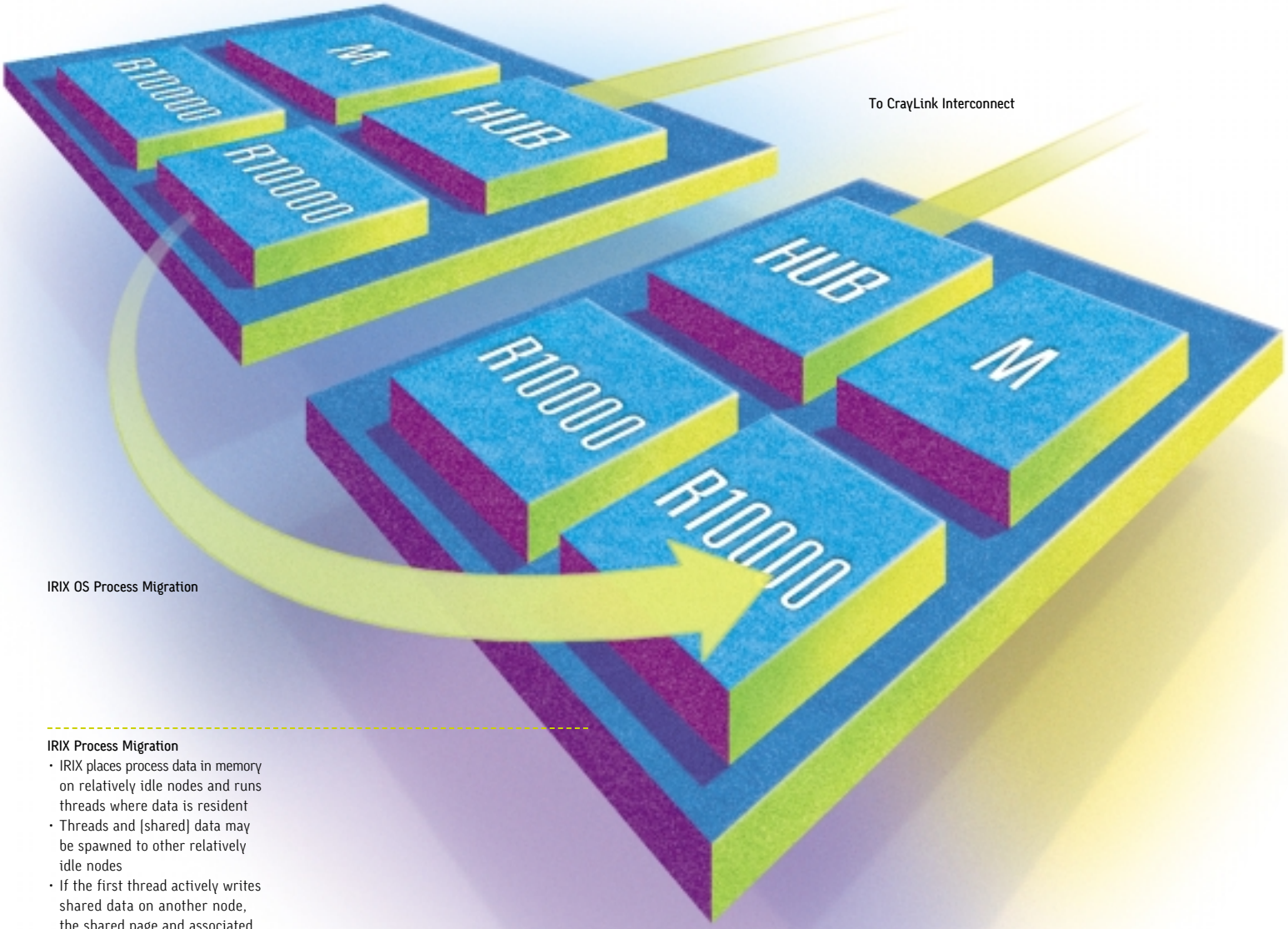
Guaranteed Data Security: RAID
Protect your data with the SGI RAID disk array. Each RAID controller supports RAID levels 0, 1, 0+1, 3, and 5, as well as global hot sparing across all disk drives. The information stored on the RAID array disk drives remains intact, even if a disk drive, power supply, RAID controller, or fan fails. The RAID array is available in a deskside unit or can be rack-mounted. You can manage single or multiple RAID disk arrays with the easy-to-use Graphical User Interface (GUI)-based RAID software.

Extend Capacity with Removable Media
Origin 2000, like other SGI servers, supports a variety of removable media storage devices. In addition to disks, a module can hold a CD-ROM and 3.5-inch DDS-2 tape. External SCSI-attached DLT tape is also available. The system can also connect to a variety of tape and robotics devices to access large amounts of near-line storage. OpenVault™ software technology from SGI facilitates tertiary storage management application development and ensures support for a wide variety of storage management applications.



OpenVault is SGI software technology that manages removable media and a variety of automated tertiary storage systems from small stackers to large robotic libraries. It is portable and designed to run on or across different versions of UNIX®, Linux®, NetWare™, and Windows NT®. It also allows applications from different developers to share automated tertiary storage systems and their devices. OpenVault makes tertiary storage management application development much easier and ensures support for a wide variety of storage management applications and devices.

Origin FibreVault is available in both deskside and rack-mount configurations.



IRIX Process Migration

- IRIX places process data in memory on relatively idle nodes and runs threads where data is resident
- Threads and (shared) data may be spawned to other relatively idle nodes
- If the first thread actively writes shared data on another node, the shared page and associated threads will be migrated to minimize interconnect traffic

Powerful, Familiar Operating Environment

Origin 2000 servers use IRIX® 6.5, an advanced UNIX system-based 64-bit operating system. This operating system is designed to take advantage of the scalability of the Origin 2000 system, while providing compatibility with previous versions of IRIX and compliance with X/Open and Posix standards. IRIX includes unique memory management features to maximize performance in a distributed computing environment by placing and migrating application memory and process threads to minimize latencies throughout the system. Additionally, IRIX provides an enhanced scheduler to ensure that system resources are best utilized and allocated to critical jobs and applications.

IRIX is a full 64-bit operating system that supports a virtual address space of 1 Terabyte, ensuring plenty of memory for even the most demanding applications. The 64-bit XFS™ journaled filesystem is standard with IRIX, enabling fast recovery and high performance with even the largest filesystems. To maximize filesystem availability and performance, XFS supports striping, concatenation, and mirroring.

Finally, XFS offers guaranteed rate I/O, important for constant bit-rate applications such as media serving that need to reserve a specific bandwidth to or from the filesystem.

Origin 2000 also supports a suite of mature, high-performance parallelizing compilers. The MIPSpro™ compilers facilitate application porting and development to the Origin 2000 family and have built-in logic to automatically take advantage of the ccNUMA architecture for maximum application performance.

IRIX 6.5 Advanced Server Environment (ASE) is built on an open architecture for a heterogeneous environment and serves as the infrastructure for supporting system management, applications management, network management, and site management facilities in a heterogeneous client/server environment.

High Availability with IRIS FailSafe
The modular architecture and inherent reliability features of Origin 2000 make the system naturally resilient to failures. IRIS FailSafe software can further increase the availability of your critical applications and provide automatic failover of applications between systems, offering unmatched availability in an extremely efficient and affordable solution. IRIS FailSafe software supports NFS™, Web, and popular database software (for failover).

Superior Network Performance
A server is only as fast as its network connections. With Origin 2000, you can be sure your system will not become bottlenecked on a slow-performing network. Origin 2000 supports all the latest high-performance networking protocols, including NFS versions 2 and 3, for high-performance file serving. SGI is also leading the way in improving NFS performance over high-speed networks, such as GSN, Gigabit Ethernet, and HIPPI using Bulk Data Service (BDS). BDS is an NFS extension that breaks the NFS performance barrier and offers you network file access comparable to locally connected disks.

IRIS FailSafe software provides failover from one Origin 2000 server to another Origin 2000 or Origin 200 server, providing uninterrupted availability of critical applications.

Origin 2000 and SGI Servers Do It All
Origin 2000 and SGI servers are the perfect solution for your evolving computing requirements. Whatever your needs, no matter how often they change, servers from SGI provide an unmatched combination of performance, flexibility, availability, and compatibility with industry standards and your existing applications. Finally you can focus on running your business, not your server.

SGI Origin 2000
Technical Specifications

Processor Data

- Microprocessor: MIPS RISC R10000 or R12000 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 or 8MB cache per CPU

Node Card

- CPU capacity: 2 R10000 or R12000 CPUs
- Memory capacity: Up to 4GB ECC SDRAM
- Hardware cache coherency: Yes
- Interleaving: 4-way per node card
- Memory bandwidth: 680MB/sec sustained, 780MB/sec peak

Deskside System or Rack Module

- Processors: 1 to 4 node cards, 2 to 8 CPUs
- I/O bandwidth: 5.0GB/sec sustained, 6.24GB/sec peak
- I/O boards: 12 XIO or 11 XIO and 3 PCI 32- or 64-bit
- Internal peripherals: 5 3.5" Ultra SCSI devices, 1 5.25" CD-ROM
- Independent power: Yes
- Redundant power: Optional
- Redundant cooling: Yes

Maximum Rack System

- Processors: 1 to 256 node cards, 2 to 512 CPUs
- I/O bandwidth: 80GB/sec sustained, 100GB/sec peak
- I/O boards: 192 XIO or 184 XIO and 24 PCI 32- or 64-bit
- Internal peripherals: 512 3.5" Ultra SCSI devices, 64 5.25" 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, 10/100Base-TX, two 460Kb/sec serial ports
- 4-port Ultra SCSI (3 differential, 1 SE or differential)
- 2-port Fibre Channel (copper or optical) for direct attach
- 2-port Fibre Channel (optical only) for fabric attach
- 1-port Fibre Channel for direct and fabric attach

PCI-64 Cards Supported

- 2-port Fibre Channel (copper or optical) for direct attach
- 2-port Fibre Channel (optical only) for fabric attach
- 1-port Fibre Channel (copper or optical) for direct and fabric attach

Network I/O Devices

XIO Cards Supported

- Base I/O includes internal SE Ultra SCSI, external SE Ultra SCSI, 10/100Base-TX, two 460Kb/sec serial ports
- 4-port 100Base-TX and 6 460Kb/sec serial ports
- Gigabit Ethernet
- 1-port dual-attached FDDI
- 1-port single-attached FDDI
- 1-port or 4-port ATM OC3
- 1-port ATM OC12
- GSN (Gigabyte System Network, 800MB/sec)
- 1-port HIPPI serial (100MB/sec)
- Digital video I/O (CCIR601)

PCI-64 Cards Supported

- 1-port dual-attached FDDI
- 1-port single-attached FDDI

I/O Expansion Devices

- XIO to internal PCI (3 slots) adapter
- XIO to external VME adapter (6U and 9U)

Mass Storage

- Interfaces: Ultra SCSI and Fibre Channel
- Maximum bandwidth: 40MB/sec Ultra SCSI, 100MB/sec Fibre Channel
- Device capacity: 4.0GB, 18.2GB
- External storage: Rack-mount vaults, 6 3.5" devices Ultra SCSI, 10 3.5" devices Fibre Channel
- RAID: Fast/Wide SCSI rack (80 3.5" devices)
- Maximum capacity: 8.6TB per module (Ultra SCSI), 43.6TB per module (Fibre Channel), 171.8TB per module (Fibre Channel RAID)

Graphics

- IRISconsole™, InfiniteReality2

Dimensions and Weights

- Deskside system: 25.5" H, 23" D, 21" W (65 cm H, 58 cm D, 53 cm W), 215 lb (98 kg)
- Rack system: 73" H, 40" D, 28" W (185 cm H, 102 cm D, 71 cm W), 700 lb (317 kg)

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

Environmental (Nonoperating)

- Temperature: -20° to +60°C
- Humidity: 10% to 95% noncondensing
- 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% noncondensing
- Noise: 50 dBa (deskside), 55 dBa (rack)

System bandwidth

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

System size (CPUs)	Bisection bandwidth without Xpress links	Bisection bandwidth with Xpress links
8	1.25GB/sec (1.56)	2.5GB/sec (3.12)
16	2.5GB/sec (3.12)	5GB/sec (6.24)
32	5GB/sec (6.24)	10GB/sec (12.5)
64	10GB/sec (12.5)	N/A
128	20GB/sec (25)	N/A
256	40GB/sec (50)	N/A
512	80GB/sec (100)	N/A

Electrical and Power

- Voltage (deskside): 110-220 VAC (configuration limits apply at 110 VAC)
- Voltage (rack): 220 VAC single-phase
- Frequency: 50-60 Hz
- Heat/power: 2,500 W, dissipation 8,500 BTU/hr (deskside); 5,500 W, 18,750 BTU/hr (rack)
- Electrical service/type: NEMA 5-20, type 110 VAC @ 20 amp (deskside); NEMA 6-20, 208 VAC @ 20 amp (deskside); NEMA 6-30, 208 VAC @ 30 amp (rack)

Software

- System software: IRIX 6.5 ASE, X/OPEN XPG4 BASE 95, IEEE POSIX 1003.2, and 1003.1b, 1003.1c FIPS 151-2, UNIX System V.4, 4.3 BSD extensions, MIPS ABI, SVID issue 3, X11R6, Motif Window Manager 1.2, IRIS GL™, OpenGL®
- Networking: TCP/IP, NFS V2/V3, RSVP, DHCP, Bulk Data Service (BDSpro), NetVisualyzer™, 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)
- 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®, Samba environments for PC and Macintosh
- Security: Trusted IRIX™ B1 security, Commercial Security Pack (CSP)
- Web server: Netscape® Enterprise server

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