IRIX® 6.5 Technical Brief

IRIX 6.5: Breakthrough Scalable Performance and Reliability for High-Performance Computing and Visualization

IRIX 6.5 provides a consistent operating system base for all Silicon Graphics® systems. With IRIX 6.5, Silicon Graphics focused on increasing its industry-leading performance and reducing the cost of system ownership through advances in scalability, reliability, and availability, data center resource management, heterogeneous enterprise integration, Web-enabled visual desktop, and a rich development environment.

IRIX 6.5 is a mature 64-bit UNIX® operating system whose roots originate from IRIX 6.0, introduced in 1994. IRIX 6.5 is UNIX 95 and Year 2000 certified from The Open Group™ as well as many major industry standards. Silicon Graphics continues to innovate and refine IRIX, the leading 64-bit operating system, to provide users and developers the most optimized, high-performance operating system platform for workstations, servers, and supercomputers.

New Packaging

With IRIX 6.5, Silicon Graphics is introducing new packaging for IRIX that provides greater added value to the IRIX operating environment with the Advanced Server Environment (ASE) and the Advanced Workstation Environment (AWE). AWE supports all workstations, including O2™, OCTANE™, Onyx2™, Indy®, Indigo™, Indigo2™, and Onyx® workstations. Also, additional software products are planned to be included with ASE and AWE.

Supported Software

	ASE	AWE
Mature Operating Environment		
• IRIX 6.5	X	X
• XFS™ 64-bit filesystem	X	X
TCO/Enterprise Management		
• NFS™	X	X
• EnlightenDSM® Basic	X (Server)	X (Client)
• Computer Associates® Unicenter® TNG™ Framework	X	
• HP-UX MIB (SNMP)	X	X
Interoperability		
• Novell NetWare™ Client	X	X
• SAMBA	X	X
• Xinet AppleTalk®	X	X
Web Tools		
• Netscape® Communicator	X	X
• Netscape Fast Track Server	X	X
• Cosmo™ Create	X	X
• Outbox	X	X
Desktop Productivity		
• Adobe Acrobat Reader™	X	X
• IRIS Showcase™	X	X
• Digital Media Tools	X	X
• Personal System Administration Tools	X	X

Scalability and Performance

Silicon Graphics is unrivaled in delivering high-performance, scalable solutions. Efficient parallel processing, high-bandwidth I/O, and high-performance graphics are essential elements of this scalable performance.

SMP Scalability

IRIX 6.5 provides breakthrough SMP application scalability by supporting up to 128 processors in a single system implementation. Through the use of fine-grained multithreading as well as innovative scheduling and virtual memory enhancements, we have extended IRIX to efficiently deliver industry-leading scalable SMP performance for parallel applications and complex workloads. This single-system implementation simplifies usability and system management for the system administrator, application developer, and end user.

IRIX 6.5 provides the ability to scale memory-intensive applications by offering virtual memory scalability to 256GB. The industry-leading Silicon Graphics cache-coherent nonuniform memory access (CC-NUMA) architecture combines the best features of shared-memory processing, distributed-memory parallel processing, and clusters. The convergence of these technologies into a single system allows unparalleled performance, scalability, and bandwidth.

IRIX 6.5 is a proven, full 64-bit UNIX implementation. Full 64-bit UNIX means scalability for large complex workloads as well as resource-intensive applications with virtually no system file or table limitations.

Graphics Scalability

The combination of industry-leading scalable software and hardware enables Silicon Graphics systems to continue to be the system of choice for 2D and 3D visualization solutions.

For O_2 desktop workstations, IRIX 6.5 enables end users to take full advantage of system features such as a standard 32-bit buffered graphics subsystem, native OpenGL® support, hardware support for texture mapping and z-buffering, and a dedicated image compression engine. For the OCTANE power desktop workstation, E-series graphics support native OpenGL, high-performance Geometry Engine® hardware, texture mapping hardware, lighting features (spot lighting, eight light sources, two-sided lighting, ambient, diffused, and specular), stereo graphics, pan and zoom, and many other features. The Onyx2 visualization supercomputer supports an advanced visualization pipeline with advanced texture mapping, native OpenGL, the high-performance Geometry Engine, and parallel processing across multiple graphics pipelines. Features and applications performance metrics common to these systems include systems that can provide three independent graphics pipelines that are running at 30 frames per second, each graphics pipeline displaying unique and heavily textured data in real time. These systems represent the graphics standards by which all systems are measured.

High Bandwidth, Large-Capacity I/O, and Networking

64-Bit Filesystem

XFS, the Silicon Graphics advanced 64-bit journalled filesystem, is a standard feature of IRIX 6.5. XFS ensures fast recovery and filesystem integrity through journaling technology, eliminating the traditionally slow UNIX filesystem checking utility. XFS supports:

• Virtually unlimited filesystems and file sizes proven to hundreds of terabytes today, capable of expanding to more than 100 times that size

- Millions of files in a single directory

- Logical block sizes from 512 bytes to 64KB

- Parallel dump and restore

- Guaranteed-rate I/O, enabling applications to reserve a specific bandwidth to or from the filesystem

- Scalable Hierarchical Storage Management (HSM), which manages up to a petabyte or more of online data

- Software for RAID 0 disk striping and RAID 1 disk mirroring via XLV volume manager (optional plexing software license required)

High-Performance Networking

Silicon Graphics has been a leader in providing connectivity and support for high-bandwidth network connections. IRIX 6.5 continues this tradition with its support for asynchronous transfer mode (ATM) at OC-3 and OC-12 bandwidth and 100BaseT Ethernet. IRIX also supports FDDI and HIPPI-800 with a roadmap to HIPPI-6400 in the future.

Performance

For the industry-standard benchmarks, world-class performance was achieved with Origin200™ and Origin2000™ systems and IRIX 6.5 for SPECweb96 benchmark, LADDIS, SPECrate, and AIM 7.

Reliability and Availability

Silicon Graphics is committed to delivering the most reliable and available solutions in the market. To achieve this goal we are aggressively investing in IRIX reliability, availability, and serviceability (RAS) capabilities that deliver OS reliability and resiliency, data availability, application availability, and application recovery. Many of the important reliability and availability features of IRIX are discussed below.

OS Reliability

IRIX 6.5 is the most reliable operating system ever released by Silicon Graphics. It has undergone months of testing to ensure it can interoperate in a host of heterogeneous environments without difficulties. Additional error recovery code has been added to the operating system to allow applications to gracefully recover from a variety of errors and conditions. In addition, the system can automatically perform predictive analysis on certain components to identify problems before they affect the availability of the system (e.g., floating point unit). Availmon, a support diagnostic tool, sends electronic messages to the Silicon Graphics service organization if it believes a failure is imminent due to a high number of errors (i.e., router link errors, recoverable cache errors, and so on).

XLV, the IRIX volume manager, has features to ensure reliability of data. XLV can automatically provide mirroring of important data to ensure no data will be lost in the event of a disk failure. If disks do fail, they can be replaced without taking the system down. Special commands built into IRIX allow hot plugging of disk drives in Silicon Graphics disk vaults to allow the replacement of failed drives. XLV is optionally available from Silicon Graphics.

At system restart, there are sophisticated power-on diagnostics to check for any problems. Detected problems can be deconfigured from the system, allowing the system to start and continue to function. In the event of a kernel crash, IRIX automatically analyzes the failure to determine which components have most likely failed. If the failed component is identified with enough certainty, IRIX deconfigures the failed component from the system before rebooting. This allows the system to resume services and continue until service personnel repair the problem.

IRIX 6.5 now provides support for a watchdog timer built into the system controller (MSC). When activated, the watchdog timer requires periodic heartbeat messages from the system. If the heartbeat does not arrive, the MSC performs a nonmaskable interrupt, which dumps memory for debugging and restarts the system. This timer allows a hung system to be automatically restarted and services restored without operator intervention.

Serviceability

IRIX supports a variety of tools to monitor the system to help prevent failures and provide more efficient problem solving. Performance monitoring tools such as Performance Co-Pilot™ (optional product from Silicon Graphics) can identify problems before they affect system operation. IRISconsole™ provides console services to any Origin™ system and supports remote service and console monitoring. Origin servers also support a remote access tool for Silicon Graphics service personnel that integrates with the system controller and allows quick diagnostics and repairs before someone arrives on-site.

In addition, the new software release structure being introduced with IRIX 6.5 will deliver IRIX updates to customers in a more easily managed and consistent fashion. In this new architecture, an IRIX release is a family of releases anchored with the initial base release. The updates to the base release are cumulative, so there is no need to archive a library of IRIX release update media. The family of releases is backward and forward binary compatible. The benefit to the software developer is fewer application certification projects. The benefit to the system administrator is one set of operating system media to support all Silicon Graphics systems and peripherals. All users will benefit from the increased reliability provided by this new process.

System and Application Availability with IRIS FailSafe™

One hundred percent system availability does not guarantee application availability. For important applications, high availability is provided using IRIS FailSafe software, an optional product from Silicon Graphics. With IRIS FailSafe, two systems run as a cluster, sharing a disk and exchanging a heartbeat. In the event of a failure in one of the systems, the surviving system will take over the failed system's network address and filesystem, restart the failed application, and resume services to clients on the network. The IRIX XFS journaled filesystem allows the system to quickly ensure filesystem consistency after a failure, allowing many applications to recover from failure in less than a minute. Clients see a very short period of application unavailability and then continue to receive services transparently from the backup server. Data availability is supported through the XFS filesystem and RAID subsystems.

Application Availability via Advanced Cluster Environment

IRIX 6.5 allows Origin2000 customers greater flexibility for system configurations and provides enhanced fault isolation through the partitioning of a single Origin2000 into multiple hosts. For example, administrators can partition their system into separate interactive and batch systems during the day and restore it to a single

system image at night to run overnight batch workloads. Partitioning a system involves dividing a single large system into multiple systems, each with its own IP address, root disk, and other components and connected with a very fast CrayLink™ interconnect. Each partition runs an independent copy of IRIX 6.5. The individual partition can be rebooted, power cycled, and loaded with software independently of another partition. To reconfigure the system, a reboot is required. When a single partition is brought down due to problems such as software or hardware failure or a controlled shutdown, the rest of the systems are not affected, thus providing higher availability for a partition than a single large system.

Application Recovery through Checkpoint/Restart

Checkpoint/Restart provides facilities to take a snapshot or checkpoint of an application periodically so if the application is stopped, it can be restarted to the checkpointed state. Large jobs that require many days to run can be suspended and restarted from where they left off. With Checkpoint/Restart, users can:

• Run large jobs over several days or weeks during periods of inactivity, stopping the job when necessary to free up system resources and restarting at other times

• Shut down systems for scheduled maintenance without causing large jobs to fail: they can be checkpointed before shutdown and restarted later at the checkpoint

• Take periodic checkpoints so in the event of a failure, a job can be restarted from the last checkpoint

• Integrate Checkpoint/Restart with IRIS FailSafe so jobs can maintain state (from the last checkpoint) during a failover

Real Time

IRIX 6.5 has achieved guaranteed 1 millisecond total interrupt response for real-time applications running on a single processor on an Origin or Onyx2 system. In addition, a new tool for real-time performance monitoring, IRIXView, will be available optionally from Silicon Graphics for use with IRIX 6.5.

Data Center Resource Management

The world's most demanding technical data centers rely on Silicon Graphics systems to serve as the central computing resources for mission-critical work such as national weather forecasting or product development. Large Origin servers or Cray® supercomputers can handle the around-the-clock workload requirements of hundreds of simultaneous users.

In demanding environments where multimillion-dollar projects are at stake, efficient resource management is critical. Silicon Graphics has benefited from Cray Research's 20-year data center experience to provide industry-leading resource management capabilities, including:

• Efficient scheduling of high-priority, complex workloads

• Effective resource allocation, tracking, and accounting, simplifying the management of centralized resources and addressing multiple projects, budgets, and priority issues

• Efficient batch scheduling and workload distribution, ensuring effective system utilization across heterogeneous systems across the network

- C2 security certification of standard IRIX 6.5, with B1/CMW available with Trusted IRIX™ 6.5

- Integration with the industry-leading administration frameworks, including HP OpenView, Tivoli, and CA Unicenter

Scheduling and Prioritization

Scheduling and prioritization are supported by Miser, which is a new feature of IRIX 6.5. Miser is a dynamic batch process scheduler that provides deterministic batch scheduling and increased system throughput without static partitioning of a system. Static partitioning allows resources to be targeted at specific classes of processes, thus allowing deterministic run times, but can lead to waste. Miser gives submitted batch jobs processing priority over the required resources needed to complete on schedule, but reduces waste by allowing idle resources to be used. The batch scheduler consists of a user process that schedules job resources and kernel support for delivering resources to jobs on schedule. The combination allows flexibility while improving responsiveness and performance.

Hierarchical Storage Management (HSM)

Customers are experiencing an explosion in the amount of data that they generate and use every day, and the large I/O bandwidth of Silicon Graphics system environments can easily overrun disk resources. An integral part of Silicon Graphics' technical computing vision is to provide data management capabilities in a manner that enables supercomputer users to concentrate on science and engineering rather than administering storage resources. Cray Data Migration Facility (DMF), originally developed for the Cray UNICOS® supercomputing operating system, is an industry-leading, high-performance HSM now available for Silicon Graphics systems running IRIX.

Cray DMF provides virtually unlimited online disk space by monitoring disk space usage and automatically moving less frequently used data to offline storage. Cray DMF provides positive, verifiable safety of data, while presenting a transparent data access scheme to the user.

Online Tape Support

For customers who have magnetic tapes as a component part of their storage management strategy, IRIX 6.5 offers connectivity to and support for a broad selection of industry-leading online and offline magnetic tapes, loaders, and robotic tape libraries.

As a recognized leader in providing advanced tape processing capabilities, Silicon Graphics continues with IRIX 6.5 its commitment to high-performance tape processing with the Tape Management Facility (TMF). Advanced tape operations such as label processing, EOT/EOV processing, absolute block positioning, multivolume/multi-file support, checkpoint/restart, loader domains, front-end servicing, and volume stacking are essential customer requirements for virtual-tape processing.

Enterprise Integration

Managing distributed enterprises of computer systems is a challenge for all corporations. With the help of tools and a well-designed infrastructure, enterprise integration can be streamlined into easy-to-manage automated tasks. You will discover long-term efficiencies in the resources required for system and network management and interoperability between heterogeneous systems.

Silicon Graphics recognizes that many different problems can arise in enterprise integration; the solutions detailed below address some of the areas. Silicon Graphics continues to investigate new solutions for solving enterprise integration problems and will deliver them over the lifetime of IRIX 6.5 and beyond.

UNIX, PC, and Macintosh Interoperability

Support for heterogeneous networks of UNIX workstations, PCs, and Macintosh computers is a requirement for today's work group and enterprise environments. Systems must be able to run applications from different systems, share files, share external devices such as printers, and in general have transparent interoperability. All solutions need to be accessible from your personal system and easy to install and use. For your convenience, Silicon Graphics offers some of these solutions with IRIX.

IRIX 6.5 ASE and AWE contain:

- Network File System (NFS)—mount and access files between UNIX workstations or with PCs (PC-NFS)

- SAMBA—Silicon Graphics workstations and servers act as file servers for Windows NT® and Windows® 95 (on Silicon Graphics Freeware CD)

- Novell NetWare Client—mount and access files on a Novell NetWare server; send print jobs to a NetWare server

- Xinet AppleTalk—Silicon Graphics workstations can act as AppleShare clients and servers, including support for file mounting, data sharing, and local printing

- Interactive guides—help you set up access to files on your Apple Macintosh or PC

- Drive support—automatically mount PC or Apple Macintosh floppies, zip drives, and CDs from the IRIX Interactive Desktop

Enterprise System Management

Enterprise System Management addresses heterogeneous networks of hundreds to thousands of systems. Silicon Graphics' strategy is to leverage the expertise of the industry-leading solutions. Alliances with Computer Associates, Tivoli, and Hewlett-Packard enable the best-of-breed tools to support small to large enterprise networks. To help you get started, Origin systems include the Computer Associates Unicenter TNG Framework with the IRIX 6.5 Advanced Server Environment. Some other leading enterprise management products are planned to be integrated into the IRIX 6.5 Advanced Server Environment over time.

Workgroup System Management

Workgroup System Management supports groups of hundreds of systems sharing a local network. Silicon Graphics has provided a host of tools from Silicon Graphics and from third-party partners. Enlighten Software's EnlightenDSM server and client will be bundled with IRIX 6.5 on servers and workstations. EnlightenDSM Basic offers:

• User configuration—password management and template accounts

• DNS and NIS+—server creation and management of NIS+ clients, host network configuration, and remote file distribution

• Printer definition—job/queue management

In addition, Silicon Graphics supports software installation and licensing.

Software installation:

• Inst and Software Manager—enable software installation from a command line, Inst, or from the GUI-interface Software Manager. Inst and Software Manager provide the ability to install software from any device, allow selective installation of subsystems on the media, check for incompatibilities, and delete previous versions of software

• RoboInst—introducing RoboInst, a new tool for automated network installations of IRIX 6.5, updates to IRIX 6.5, unbundled software products, and patches. RoboInst automates tasks at the IRIX miniroot level that include the ability to repartition the disk, create filesystems, install software, and execute any other shell scripts you provide

Software licensing:

• GLOBEtrotter® FLEXlm®—electronic licensing technology for managing software applications. FLEXlm has been adopted by many software companies, including Silicon Graphics. IRIX has supported FLEXlm since IRIX 5.3

• License Manager—a graphical tool for installing and managing FLEXlm and NetLS software licenses

Desktop System Management

Personal System Administration Tools guide the users through tasks to manage their systems without requiring help from a system administrator. The System Manager contains information about your system and tools for software installation and licensing, adding and removing hardware and devices, managing security and access control, setting up network connections, backing up files and data, and monitoring system performance.

Standards

Support for industry standards is important to maintain a consistent interface across the popular operating system environments to provide cross-platform portability. IRIX 6.5 supports the following standards.

The Open Group UNIX 95 Branding

The Open Group UNIX 95 brand certification states that IRIX 6.5 is certified for the Single UNIX Specification. This branding is essential to provide a consistent core operating system interface for all UNIX applications across the various UNIX systems. Also included in IRIX 6.5 are some UNIX 98 features.

UNIX System V Release 4

As with all IRIX releases, IRIX 6.5 continues to be based upon UNIX System V Release 4.

Year 2000 Certification

With the next millennium approaching, checking that software operating systems and applications are Year 2000 compliant is extremely important to ensure that the tools running your business experience no downtime. The Silicon Graphics systems, IRIX 6.5, and its bundled applications are Year 2000 compliant. Beyond these products, application developers still need to certify their applications to make sure that dates are represented and managed properly. Scanning tools for checking an application's Year 2000 compliance are available at www.sgi.com/Technology/year2000. Third-party application certification status will also be listed on the Silicon Graphics Year 2000 Web page as the information becomes available.

POSIX

IRIX 6.5 is certified for POSIX 1003.1, 1003.2, and 1003.3.

DII-COE

IRIX 6.5 is certified for the United States Government Defense Information Systems Agency's Defense Information Infrastructure (DII) Common Operating Environment (COE). DII-COE specifies a POSIX-based application platform for procurement by United States government agencies. DII-COE Kernel version 3.2 will be available for development projects.

Security

IRIX 6.5 security has been enhanced to allow for DoD C2-level security certification. Many features of the Commercial Security Pack are being bundled into IRIX 6.5, including least-privilege capabilities (POSIX P1003.1e/2c), which allow allocation of system privileges individually, rather than setuid and access control lists (ACL) (POSIX P1003.1e/2c). Additionally, a new desktop security GUI has been added.

Trusted IRIX 6.5 includes significant enhancements to our industry-leading secure operating system environment. This optional IRIX configuration provides DoD B1-level security. Formal NSA and ITSEC evaluations are in progress for Trusted IRIX 6.5.

X11 and Motif™

The basic toolkit for the IRIX Interactive Desktop is the visually enhanced Silicon Graphics version of the Motif 1.2.4 toolkit rendered using the X11 version 6 window system.

OpenGL

Silicon Graphics developed the industry-standard graphics API OpenGL. OpenGL is cross-platform and portable, supporting over 30 platforms. OpenGL enables 2D, 3D, and imaging applications to be developed once for deployment to many hardware platforms running different operating systems and windowing environments. IRIX 6.5 supports OpenGL 1.1.

OpenMP™

OpenMP is a new industry-standard application programming interface (API) for portable shared-memory parallel programming. OpenMP gives shared-memory programmers a simple and flexible interface for developing parallel applications for UNIX and Microsoft Windows NT platforms ranging from the desktop to the supercomputer. MIPSpro™ Fortran compilers implementing OpenMP are available for all Silicon Graphics IRIX systems.

MPI

MPI is a portable standard programming interface for the construction of a portable, parallel application in Fortran 77 or in C, especially when the application can be decomposed into a fixed number of processes operating in a fixed topology (for example, a pipeline, grid, or tree). A highly tuned, efficient implementation of MPI is included with the Array software CD for Array systems. MPI is the recommended parallel model for use with Array products.

NFS Version 3

IRIX 6.5 supports NFS version 2 and version 3. NFS version 3 has been optimized for 64-bit operating systems through support for 64-bit file addressing to enable file transfers of larger than 2GB files. NIS+ supports IRIX 6.5 but is an optionally available product from Silicon Graphics.

TCP/IP

Transmission control protocol and internet protocol (TCP/IP) are the networking protocols used by UNIX systems and PCs. TCP/IP is fully supported in IRIX 6.5.

DCE and DFS

IRIX 6.5 will support DCE and DFS client version 1.2.2. This is the most current release of DCE/DFS available from The Open Group.

ANSI C and C++

MIPSpro compilers support full ANSI C (ANSI X3.129-1989) and continue to support ANSI C++ to the specifications in the draft standard.

Fortran 77/90

MIPSpro compilers support the full Fortran 77 (ANSI X3.9-1978/ISO 1539-1980 (E)) and Fortran 90 (ISO/IEC 1539:1991 and ANSI X3.198-1992) languages as well as some newly defined Fortran 95 (ISO/IEC 1539-1:1997) features.

Visual Desktop

The interactive, multimedia visual desktop is a requirement for all graphical workstations. Silicon Graphics offers two solutions: IRIX Interactive Desktop and Common Desktop Environment.

IRIX Interactive Desktop

The Web-aware IRIX Interactive Desktop that was introduced in IRIX 6.3 and IRIX 6.4 is now available for all Silicon Graphics systems supported by IRIX 6.5. IRIX Interactive Desktop offers increased value in the areas of Web integration, system administration, network awareness, and multimedia support. IRIX Interactive Desktop includes:

Essential Desktop Tools

- File Manager, enabling viewing, access, and manipulation of directories of files with many data types, including text, audio, video, 3D, HTML, and any other file on an intranet or the Internet

- Task-based graphical personal system administration environment

- InfoSearch, enabling searchable Web-based documentation and help delivery

- Proactive system monitoring to alert you to system problems

- AccessX, providing a graphical user interface for users who are disabled or movement-impaired; there are special keyboard features to make the mouse and keyboard behave differently

- Macintosh Connectivity for Desktop Systems with Xinet AppleTalk

- SoftWindows 95 for running Windows 3.1 and Windows 95 applications (bundled with O_2 systems, available separately for other platforms)

Multimedia, Collaborative, and Web Publishing Tools

- Digital media tools—browse and manipulate video, audio, and image files; in IRIX 6.5, Mediaplayer now supports movies played to video output, Movielib File now supports QuickTime™ MJPEG-A files, and Mediaplayer, Moviemaker, and Movielib now support DV DIF files

- IRIS Showcase—integrated multimedia presentation tool that includes support for audio, video, and 3D graphics images

- InPerson™—video conferencing tool with fully visual real-time collaboration that spans any geographical distance

- OutBox—Web publishing tool for creating personal home pages to share information across corporate intranets; uses Netscape FastTrack Server for managing the Web site

- Cosmo Create—graphical (WYSIWYG) HTML authoring tool for easy creation and preview of Web-based documents

- Netscape Communicator™—the Web tools suite including Netscape Navigator® for HTML browsing, Messenger for electronic mail, Collabra® for newsgroups, and Page Compose for HTML document authoring and support for Java™ and JavaScript™ and plug-ins including IV Plug (3D), Cosmo™ Worlds (VRML 2.0), XPMPlug, MoviePlug, and Shockwave (from Macromedia)

- Cosmo™ Player—graphical VRML browser to view 3D Web-based documents

- IRIS Annotator™—Multimedia tool for sharing ideas and information about 3D models in the Inventor™ file format

- Adobe Acrobat Reader—desktop document browser for Adobe Portable Document Format (PDF) files

Common Desktop Environment (CDE)

Silicon Graphics users have the choice of desktop environments. For users who require CDE, it is available as an option for all Silicon Graphics platforms from Silicon Graphics or Triteal Corporation (known as Triteal Enterprise Desktop (TED)).

Development Environment

The Silicon Graphics software development environment encompasses UNIX standard components with industry-leading software technology. IRIX 6.5 offers an improved binary compatibility model, high-performance compilers, and continued support for rich 3D graphics APIs.

Binary Compatibility

IRIX is the first 64-bit operating system to support both the 32-bit and the 64-bit binary formats. Silicon Graphics believes it is important for a 64-bit operating system to run legacy 32-bit applications without modifications and to allow the software developers to choose the binary format that best meets their needs. In addition, the IRIX n32, 32-bit binary format, is tuned for best performance on the 64-bit operating system.

Historically, IRIX releases have always supported backward binary compatibility. For example, IRIX 5.3 binaries run as-is on IRIX 6.2, IRIX 6.3, IRIX 6.4, and IRIX 6.5. With IRIX 6.5, Silicon Graphics supports forward binary compatibility along with backward binary compatibility. This provides cost savings in software development and faster time-to-market for software developers that enables end users to get the latest products and features more often.

Proven High-Performance 64-Bit Computing

IRIX 6 supports 64-bit registers, data manipulation, application development, and access to local and remote 64-bit files and filesystems. The visualization systems (Onyx2 and Onyx), the distributed servers (Origin2000, Origin200, CHALLENGE® DM, L, XL, and POWER CHALLENGE™), and the desktop workstations (OCTANE, Indigo2 IMPACT™ 10000, and POWER Indigo2™) fully support 64-bit computing.

The desktop workstations, O2, Indigo, Indigo2, Indigo2 IMPACT (excluding Indigo2 IMPACT 10000), and Indy, and the distributed servers, CHALLENGE S and CHALLENGE M, support 64-bit computing, but do not support the 64-bit virtual address space. On these systems, users get the best of 32-bit and 64-bit computing while maintaining an economical system configuration. Software developers have a choice of supporting 32-bit or 64-bit computing and can continue to develop 32-bit and 64-bit applications on all systems.

MIPSpro Compilers

The MIPSpro 7.2.1 compilers let developers create and support high-performance, standards-based applications more efficiently and at a lower cost. In addition, the MIPSpro 7.2.1 Fortran, C, and C++ compilers have remarkable performance improvements.

Developers can use advanced language features today on Silicon Graphics systems. MIPSpro C++ compilers feature run-time type information (RTTI), exception handling, namespaces, partial specialization of templates, and other advanced features. MIPSpro 7.2.1 Fortran 90 supports a new Fortran 90 front end, based on CRAY CF90™ version 3.0, and supports classic Cray Fortran extensions such as Fast Fortran I/O. Compilation speeds and run-time performance have also improved between 10 percent and 50 percent. In fact, run-time performance has been improved in all of the MIPSpro compilers, with enhancements to integer performance, better branch prediction facilities, and new data locality features standard for Origin systems.

The new, unified Silicon Graphics automatic parallelization option (APO) replaces the previously separate Power Fortran (PFA) and Power C (PCA) compilers of earlier MIPSpro releases. PFA and PCA were source-to-source preprocessors that automatically decomposed loops for parallelization, and a separate product was required for each language. With APO, auto-parallelization happens in the MIPSpro back end: customers can buy or upgrade to one product that handles four languages (F77, F90, C, and C++). Higher performance applications are one result: parallel optimizations are now integrated with any other optimizations specified by the developer.

Industry-Leading Graphics APIs

In addition to the widely available, cross-platform, industry-standard OpenGL, Silicon Graphics has developed a number of other graphics software libraries that enable a software developer to build advanced 3D applications to provide solutions for markets such as CAD/CAM, visual simulation, and entertainment. These graphics APIs were developed on OpenGL, the industry standard for graphics application development, pioneered by Silicon Graphics.

An extension of OpenGL, the OpenGL Optimizer™ development environment is a multiplatform toolkit providing higher-level constructs for interacting with extremely large geometric databases. Applications in CAD/CAM, digital prototyping, and architecture, engineering, and construction (AEC) will achieve optimal graphics performance. OpenGL Optimizer includes multiprocessing support, occlusion culling, topological synthesis, and full support for all complex higher-order trimmed parametric curves and surfaces.

IRIS Performer™ is the renowned 3D rendering toolkit for developers of real-time, multiprocessed, interactive graphics applications. IRIS Performer dramatically simplifies development of complex applications in visual simulation, simulation-based design, virtual reality, interactive entertainment, broadcast video, and architectural walk-throughs. This unique API provides efficient access to Onyx2 capabilities by automatically managing multiple levels of detail, paging of huge textures, and dynamic animated geometry.

Additionally, Silicon Graphics has added a new volume imaging API that exists as a library of C++ classes that facilitate visualization of voxel-based data sets common in geoscience, medical, and scientific and engineering applications such as computational fluid dynamics and finite element analysis, as well as those implementing physics-based models for special effects such as smoke, fog, and liquid. The volume-imaging API's use of tetrahedral primitives is an innovative and powerful approach to volume imaging.

Device Drivers

IRIX 6.5 supports user-level device drivers for any PCI device. User-level device drivers provide lower mainte-nance and easier development of device drivers.

Internationalization and Localization

IRIX 6.5 supports the EUC internationalization format for all locales. In addition, SHIFT-JIS and BIG5 interna-tionalization formats are supported for Japanese and Chinese, respectively. Future support for Unicode is planned.

The IRIX Interactive Desktop is localized for French, German, Japanese, Chinese, and Korean. The WorldView language modules for these languages enable easy development of localized GUIs. The IRIX 6.5 Advanced Workstation Environment will be available with support for French, German, Japanese, Chinese, and Korean desktops.

TECHNICAL SPECIFICATIONS

TECHNOLOGY

UNIX SVR4, Distributed Shared Memory (DSM), multithreaded, virtual memory scalability, with fine-grained kernel locking

PRODUCT SPAN

OS base for Origin2000 R10000®, Origin200 R10000, Onyx2 R10000, OCTANE R10000, O2 R5000®, O2 R10000, CHALLENGE R4x00, CHALLENGE S/M R4x00, CHALLENGE S R5000, CHALLENGE R10000, POWER CHALLENGE R8000®, POWER CHALLENGE R10000, Indigo R4x00, Indigo2 R4x00, Indigo2 R10000, POWER Indigo2 R8000, Indy R4x00, Indy R5000, Onyx R4x00, Onyx R10000, POWER Onyx™ R8000

SUGGESTED MEMORY

A minimum of 64MB is highly recommended for all systems. The minimum memory requirement for Indy, Indigo R4000, and Indigo2 is 32MB.

FILESYSTEMS

VFS (vnode) interface, XFS filesystem support for 9 million TB filesystems, NFS, xlv for striping, mirroring, and concatenation, FAT (MSDOS), HFS (Macintosh) support on removable devices, CD support for ISO 9660 and Rockridge format

LOADABLE DEVICE DRIVERS

SVR4.0 MP DDI/DKI, device drivers

TERMINAL SUPPORT

STREAMS, international support

IPC

SVR4 messages, semaphores, shared memory, FIFOs, BSD sockets

REAL-TIME SUPPORT

Preemptable kernel, fixed-priority scheduling, memory lockdown, high-resolution timers, multithreaded application support, queued signals, POSIX 1003.1b

USER MP FACILITIES

Lightweight process parallelism, memory-based synchronization, processor affinity, parallelizing compilers (C** and Fortran*), POSIX threads

DISTRIBUTED COMPUTING

ONC 4.1* (NFS, NIS, RPC, automount, locked, etc.) ONC+* (NFS version 3 protocol, Caching File System (CFS)), DCE, and DFS

NETWORKING

Sockets TCP/IP stack, TLI, DLPI driver interface, Ethernet, SLIP, PPP, HIPPI*, FDDI*, BDS*, Token Ring*

NETWORK MANAGEMENT

SNMP with MIB II, HP OpenView*

ENTERPRISE SYSTEM MANAGEMENT

Task-based personal administration tools (System Manager, Printer Manager, Process Manager, Filesystem Manager, Software Manager, License Manager), EnlightenDSM, Computer Associates Unicenter Framework, Performance Co-Pilot*, Performance Management tools, Software Installation tools (Inst, Software Manager, RoboInst)

SECURITY

Auditing, shadow passwords, password aging, expanded login options, B1 and CSP versions, Gauntlet™ firewall*

BACKUP/RESTORE

Dump/restore, bru, cpio (backup/restore), tar, IRIS NetWorker for IRIX*, xfsdump, xfsrestore

PRINTING SUPPORT

lpd, lpdsched, Printer Manager, IRIS Impressario™ printer management system

INTERNATIONALIZATION

XPG4-compliant message catalogs, locale support for currency, date, etc., wide-character support, country kits*, EUC, SHIFT-JIS, and BIG5 internationalization formats

GRAPHICS SUPPORT

OpenGL 1.1, Performer™*, Open Inventor™*, ImageVision Library®*, X11R6, PEX, IRIX IM (Motif 1.2.4), Display PostScript

SOFTWARE DEVELOPMENT

Developer Magic™, ProDev™ Workshop*, ANSI C*, C++*, Fortran 77*, Fortran 90*, Pascal, Ada

COLLABORATIVE AND DIGITAL MEDIA SOFTWARE

IRIX Interactive Desktop, Adobe Acrobat Reader, Netscape Communicator, IRIS Showcase, InfoSearch, SoftWindows 95, Cosmo Player, Cosmo Create, Digital Media Tools, Macromedia MoviePlayer

* Denotes unbundled products

SiliconGraphics
Computer Systems