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the magazine of imagination, innovation, and insight

synergi

Leading the World in Modular Supercomputing – **pg. 4**

Uniting Mexico City's Past and Present – **pg. 12**

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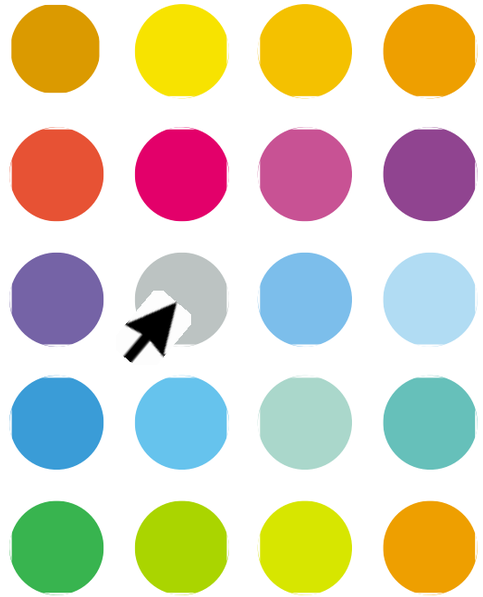

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Welcome to the winter edition of SYNERGI, the magazine of imagination, innovation, and insight from SGI.

This winter issue has at its heart the revolutionary modular supercomputing technology that is serving the needs of some of the world's most demanding customers. The SGI 3000 family of servers and visualization systems has been chosen by organizations such as the U.S. Air Force to power its F-16 and F-22 pilot training devices; NASA to achieve monumental goals in technology research areas; and BMW to conduct crash testing to reduce injuries in real life.

In the "News" section, we uncover the new Silicon Graphics Zx10 visual workstation family and the world's most advanced desktop graphics features recently added to the Silicon Graphics Octane2 visual workstation. With these announcements, SGI has solidified its position as the leader in desktop visualization.

Read our Dossier section to understand how virtual reality has helped Tetra Pack to get it right the first time – from the drawing board directly to the production line.

Turn to page 20 to find out what's new in brain mapping techniques. A group of dedicated physicians and scientists in Canada is using cutting-edge medical technologies to complete maps of the brain and its inner workings.

Also in this issue, we analyze the widespread demand for smaller, faster electronic devices that use less power and give higher performance. EDA (electronic design automation) is the key to continuing improvements in information technology and electronics. Find out why, and how SGI is taking a lead in this industry, on page 32.

I hope you enjoy reading this latest edition of SYNERGI.
If you'd like to see particular topics covered in future issues, send your comments to *synergi_us@sgi.com.*

Mar Garcia
U.S./Canada Editor
SYNERGI

News

Leading the World in

Modular Supercomputing

The new family of SGI™ Origin™ 3000 series servers and SGI™ Onyx® 3000 series graphics systems is serving the needs of some of the world's most demanding customers.

Such exacting customers don't entrust their computer simulations and visualization solutions to just any technology.

"Whether our customers are modeling the world's financial markets or designing safer automobiles, the SGI Origin 3000 series and SGI Onyx 3000 series systems are able to take research and development and other core business functions to unprecedented levels, processing enormous amounts of data more quickly and more efficiently than any other solution," said Jan Silverman, vice president, Advanced Systems Marketing, SGI. "The modular supercomputing architecture gives our new and existing customers much-needed reliability, scalability, flexibility, and performance for their computationally intensive needs."

Flying High with the U.S. Air Force

SGI™ Onyx® 3400 was designed to meet the most demanding and changing needs of customers such as the U.S. Air Force, which ordered five SGI Onyx 3000 series high-performance graphics systems for its F-16 Mission Training Centers (MTCs). With the ability to scale from 4 to 32 CPUs and drive up to eight full graphics pipelines and eight simultaneous graphics users, the SGI Onyx 3000 series of high-performance graphics systems has the power and real-time visualization capability to concurrently process imagery, video, 3D terrain, and geospatial data.

The SGI™ technology powering these F-16 simulators will enable pilots to operate realistically, from low-altitude, on-the-deck, air-to-ground missions to high-altitude air-to-air combat. "We selected SGI because it is a world leader in real-time computational systems and represents the best value solution for the Air Force," says Charles McCoy, program director, Lockheed Martin F-16 MTC. "SGI Onyx 3400 will supply a high-end image generator for photo-realistic, out-the-window visual scenes that will support air-to-air and air-to-ground scenarios in a full-scene (360-degree) environment."

Two SGI Onyx 3000 series high-performance graphics systems will power the U.S. Air Force's F-22 pilot training devices. Under an initial engineering, manufacturing, and development contract, Link Simulation & Training is building a Full Mission Trainer and Weapons Tactics Trainer that will help hone the skills of F-22 fighter pilots. The stealthy, next-generation F-22 air superiority fighter aircraft will fly complex, integrated missions ranging from single-ship operation to large force coalition strike actions.

The Air Force is also in the midst of replacing its Defense Support Program, a nearly 30-year-old satellite constellation that has served as the primary initial warning system for ballistic missile attacks on the United States. The Air Force's new Space-Based Infrared System, the U.S.'s next-generation ballistic missile early warning system, will be using the breakthrough SGI™ NUMAflex™ modular technology to power 18 SGI Origin 3000 series servers in mobile ground stations and 27 SGI Onyx 3000 series visualization systems, which will display the satellite images for U.S. military operators. The fixed satellite ground stations already have more than 50 SGI™ Origin™ 2000* servers and more than 250 Silicon Graphics® Onyx2® systems in place.

Orbiting the World with NASA Scientists

NASA's Ames Research Center is working collaboratively with SGI, and pushing the boundaries of high-performance computing, to develop a 1,024-processor SGI Origin 3000 series system based on the revolutionary NUMAflex modular technology. NASA Ames has ordered two 512-processor SGI™ Origin™ 3800 systems—the largest shared-memory configurations currently available in the new SGI Origin 3000 series—and will combine them to serve as a test bed for the 1,024-processor supercomputer.

A 512-processor SGI Origin 2000 system called Lomax—the largest single-system image in existence today—has already helped NASA Ames scientists achieve monumental goals in such technology research areas as computational fluid dynamics, global climate modeling, and computational astrobiology. But researchers are predicting even greater performance from their

new system. “According to our projections, the SGI NUMAflex architecture is going to deliver about six times the performance at 1,024 processors as the 512-processor system,” says Bill Feiereisen, chief, Numerical Aerospace Simulation Systems Division at NASA Ames in Moffett Field, California.

Helping the U.S. Navy Weather Any Storm
The U.S. Navy is combining the best available environmental science with high-performance computing technology to provide accurate weather and oceanographic information to the U.S. Department of Defense any time of the day or night. The Navy’s Fleet Numerical Meteorology and Oceanography Center (FNMOC) is one of only a handful of operational numerical weather prediction centers in the world and is widely acclaimed as the world leader in modeling that treats the air–ocean environment as a totally integrated system, from the top of the atmosphere to the bottom of the ocean, with special emphasis on the air–ocean interface. FNMOC operates its sophisticated suite of coupled air–ocean models on supercomputers to produce and distribute weather and ocean products that are essential for ensuring the safety of the Naval fleet. FNMOC also serves as a crucial source of information for the U.S. National Weather Service. By exploiting the power of its two new SGI Origin 3000 series systems—one 128 processors, the other with 512 processors, and both utilizing SGI NUMAflex technology—FNMOC will be able to implement the next generation of coupled air–ocean models, taking a big step forward in improving the accuracy of its products.

Modeling Hurricane Behavior for NOAA
SGI was recently selected to supply the National Oceanic and Atmospheric Administration’s (NOAA) Geophysical Fluid Dynamics Laboratory with 10 SGI Origin 3800 supercomputers, with a total of 1,152 processors that will be on-site at the time of system acceptance. The total performance of the systems to be installed is 922 GFLOPS.

Replacing a number of Cray computers, the SGI systems will be used for the computationally intensive modeling and simulation of the Earth separated into large interacting regions. The NOAA will use the models for analyzing and forecasting weather phenomena such as hurricanes and climatic trends such as global warming. The SGI modular supercomputers will be able to perform simulations four times faster than the older machines, giving the NOAA a key advantage in its research.

Crash testing at BMW to Reduce Injuries in Real Life
Using the latest generation SGI Origin 3000 series systems with 96 processors and 400 MHz MIPS® processors, SGI and ESI, a manufacturer of virtual prototyping software, achieved an unprecedented sustained performance of more than 12 GFLOPS, the highest level of performance ever achieved in a crash simulation. BMW was also able to significantly shorten the design-cycle time using the SGI Origin 3000 series rather than conventional design analysis technology.

The crash simulation engine originally installed at BMW consisted of 12 SGI Origin 2000 servers running in parallel with PAM-CRASH software from ESI. Additionally, a farm of 40 SGI™ Origin™ 200 servers was dedicated to stochastic simulation projects aimed at improving the robustness of the new designs. BMW recently conducted a performance investigation of a 35-mph front-end vehicle crash. The vehicle model contained 120,000 elements with 117,500 contact segments split into 11 contact interfaces. The simulation was conducted for 70 msec of real time, which required an estimated 58,000 time cycles. SGI Origin 2000 was able to achieve a sustained performance of 3.2 GFLOPS with 32 R12000™ 300 MHz MIPS processors and 5.4 GFLOPS with 64 processors.

“The key to our success in superior solutions for engineering is always having the best compute resources,” says Touraj Gholami, head of BMW’s crash simulation department. “The SGI Origin 3000 series servers, coupled with the MPP version of PAM-CRASH from ESI, enable extremely fast simulations at very reasonable costs. BMW’s engineering teams are extremely excited about the possibilities that the SGI Origin 3000 series offers.”

Building the Next-Generation National Supercomputer for SARA in the Netherlands
The Netherlands Organization for Scientific Research and the Netherlands Computing Facilities Foundation selected SGI to supply and service their next-generation national supercomputer. The computer features 1,024 MIPS microprocessors that are slated to deliver 1 TFLOPS (one trillion operations per second) of peak performance, 10TB (10,000GB) of online storage, and 100TB of near-line StorageTek storage.

The SGI supercomputer will be used by the Dutch academic community in its quest to understand and resolve the most complex scientific, technical, and medical issues affecting the world today, such as bone growth under stress and climate prediction.

Leading the Industry
“SGI technology is second to none,” says Bob Bishop, SGI chairman and CEO. “In fact, since the recent upgrade of our entire product line earlier this year, SGI is at least one full generation ahead of its competition, particularly in high-performance computing and high-end graphics solutions.”

The SGI 3000 family of systems marks SGI’s return to its time-honored leadership position in the realm of technical and creative computing in five vertical markets: manufacturing, science, government, media, and telecommunications. “We are the only company that focuses exclusively on these markets,” Bishop says.

“It is very exciting for us to see that SGI is once again really becoming true to the mission it had years ago, that of leading the industry in technical computing,” says Debra Goldfarb, group vice president, IDC. “SGI, with this product, is really ahead of the curve in the market. We are seeing the rest of the industry absolutely trying to catch up with SGI. This company has really hit it this time. We believe this is the right technology at the right point in time.”

For more information:
www.sgi.com/products

*Origin 2000 is now being marketed and sold as the SGI™ 2000 series.

Images courtesy of SARA

Best Performance
for Visual Computing

The Silicon Graphics Zx10™ family of workstations is beating competitors' performances on industry-standard benchmarks.

The Silicon Graphics Zx10 family delivers unparalleled system throughput and I/O bandwidth in an industry-standard architecture. Powered by the latest single or dual Intel® Pentium® III processors, Silicon Graphics Zx10™ VE is equipped with a robust 400 W power supply and supports an unprecedented 200.2GB of internal storage (Silicon Graphics Zx10 features a 300 W power supply and offers up to 109.2GB of storage). Designed to support the latest Wildcat 4210 3D graphics from 3Dlabs, Silicon Graphics Zx10 VE offers the highest performance available in an Intel architecture-based workstation today.

For example, Silicon Graphics Zx10 VE with a Pentium III 933 MHz processor and Wildcat 4210 3D graphics performed up to 7% faster on the SPECgpc benchmark than Dell Precision 420 with a Pentium III 1 GHz processor and Wildcat 4210 graphics (see the scores by visiting *www.spec.org/gpc/*). Furthermore, real-world application benchmark performance confirms that the Silicon Graphics Zx10 VE visual workstation is the performance leader for visual computing applications. On the industry-standard Viewperf MeDMCAD-01 benchmark, Silicon Graphics Zx10 VE beat all other similarly configured systems by up to 18%.

The workstation is now available with the latest Pentium III 1 GHz processor, which delivers even higher performance for visual computing professionals.

One key to the Silicon Graphics Zx10 performance is the use of Wahoo Technology™, an innovative approach to design integration and tuning. This enables Silicon Graphics Zx10 to eliminate bottlenecks inherent in other architectures and to deliver unprecedented system throughput and graphics performance in an industry-standard workstation.

The industry-leading performance of the Silicon Graphics Zx10 workstation family is a real asset to those working in the digital media, MCAD, publishing and prepress, and visual simulation fields. The family's unparalleled graphics performance, system bandwidth, and internal storage enable creative, technical, and scientific professionals in these areas to accelerate the most demanding applications, such as virtual sets, real-time motion capture, visual simulation, mechanical CAD, and 3D animation for film and broadcast.

The system architecture is engineered to provide the highest possible graphics performance and memory bandwidth using industry-standard components. It provides up to 5GB-per-second system bandwidth and fully utilizes processors, graphics, memory, and I/O subsystems. This results in faster throughput, fewer delays, and greater productivity.

Flexibility—The Key to Success

The Silicon Graphics Zx10 family provides flexibility as well as performance. It comprises the Silicon Graphics Zx10 workstation, the Silicon Graphics Zx10 VE workstation and the SGI Zx10™ server for Windows®.

Customers can select the best graphics option for their application. Wildcat 4210 sets the standard for 3D graphics performance. It features a highly tuned 6,400 MFLOPS geometry pipeline, 128MB frame buffer, 128MB texture memory, and a rich feature set.

Wildcat 4110 VIO, on the other hand, features specialized extensions for video I/O cards, while the Matrox Millennium G400 (moving soon to the G450) offers optimal price/performance for 2D and 3D graphics applications.

In other words, the scalable design and flexible architecture of this family allow the customer to add exactly the amount of processing power needed. The flexible expansion platform is designed to accommodate high-bandwidth I/O devices, and the memory bus has a staggering bandwidth of 2.1GB per second. As a result, the processors can stream data while simultaneously satisfying the demands of peripheral devices such as shared disks and I/O devices. This allows users to work with large data sets and the most memory-intensive visual computing applications.

The Silicon Graphics Zx10 line is marketed exclusively by SGI and complements its line of Intel-based workstations, the Silicon Graphics® 230, Silicon Graphics® 330, and Silicon Graphics® 550 visual workstations featuring VPro™ graphics.

For more information:
www.sgi.com/workstations/zx10

The Ultimate in

3D Graphics

The State-of-the-Art Desktop Gets Even Better

Initially introduced in June 2000, Silicon Graphics® Octane2™ is a highly scalable workstation tailored for high-end applications such as CAD styling, digital prototyping, geospatial exploration, medical imaging, and visual simulation. Octane2 was designed with future product enhancements in mind, and, given that it allows easy upgrades to more processors, memory, and new graphics, it comes as no surprise that it can now capitalize on the latest innovations in SGI VPro graphics technology.

The two new additions to the SGI VPro graphics family for Octane2 are called V10 and V12. The new Octane2 V10 and V12 visual workstations combine the groundbreaking VPro 3D graphics system, an industry-leading crossbar architecture, and the latest high-performance MIPS processor. They offer the fastest graphics performance available anywhere in a desktop system with two times the geometry performance of the already industry-leading V6 and V8 graphics. Like the V6 graphics, the high-performance V10 graphics offer 32MB configurable graphics memory with up to 8MB texture memory; like the V8, the high-performance V12 graphics offer 128MB configurable graphics memory, with up to 104MB of texture memory.

All the Octane2 VPro graphics products offer an unprecedented feature set that includes many industry firsts. A recently introduced feature for advanced texture management is called asynchronous texture download, which is available for all Octane2 VPro graphics as of IRIX® 6.5.9. When implemented in an application, this unique capability streamlines texture downloads for optimum graphics performance when processing large textures. Other VPro features for Octane2 include:

- Hardware acceleration of all OpenGL® 1.2 core features and ARB (Architectural Review Board) imaging extensions
- Hardware-accelerated specular shading with normal interpolation for Phong effects without a performance penalty
- 12 bit per component RGBA
- Abundant, configurable graphics memory

Octane2 customers, who need the ultimate in 3D graphics performance on the desktop, can therefore expect unsurpassed 3D texturing, visual precision, and exceptional value from these systems.

With SGI V12 graphics, Octane2 workstations draw 15.3 million 1 pixel lit triangles per second and maintain an industry-leading pixel-fill rate of 448 megapixels per second. This geometry and fill-rate performance firmly establishes Octane2 V12 above the measured results of other UNIX® graphics workstations.

The leading geometry and fill-rate performance combined with its rich, progressive feature set make Octane2 V12 the industry's most advanced visualization platform on the desktop.

Octane2 V12 offers customers the most advanced 48-bit RGBA capabilities with support for double-buffered 16-bit Z for the most advanced imaging operations.

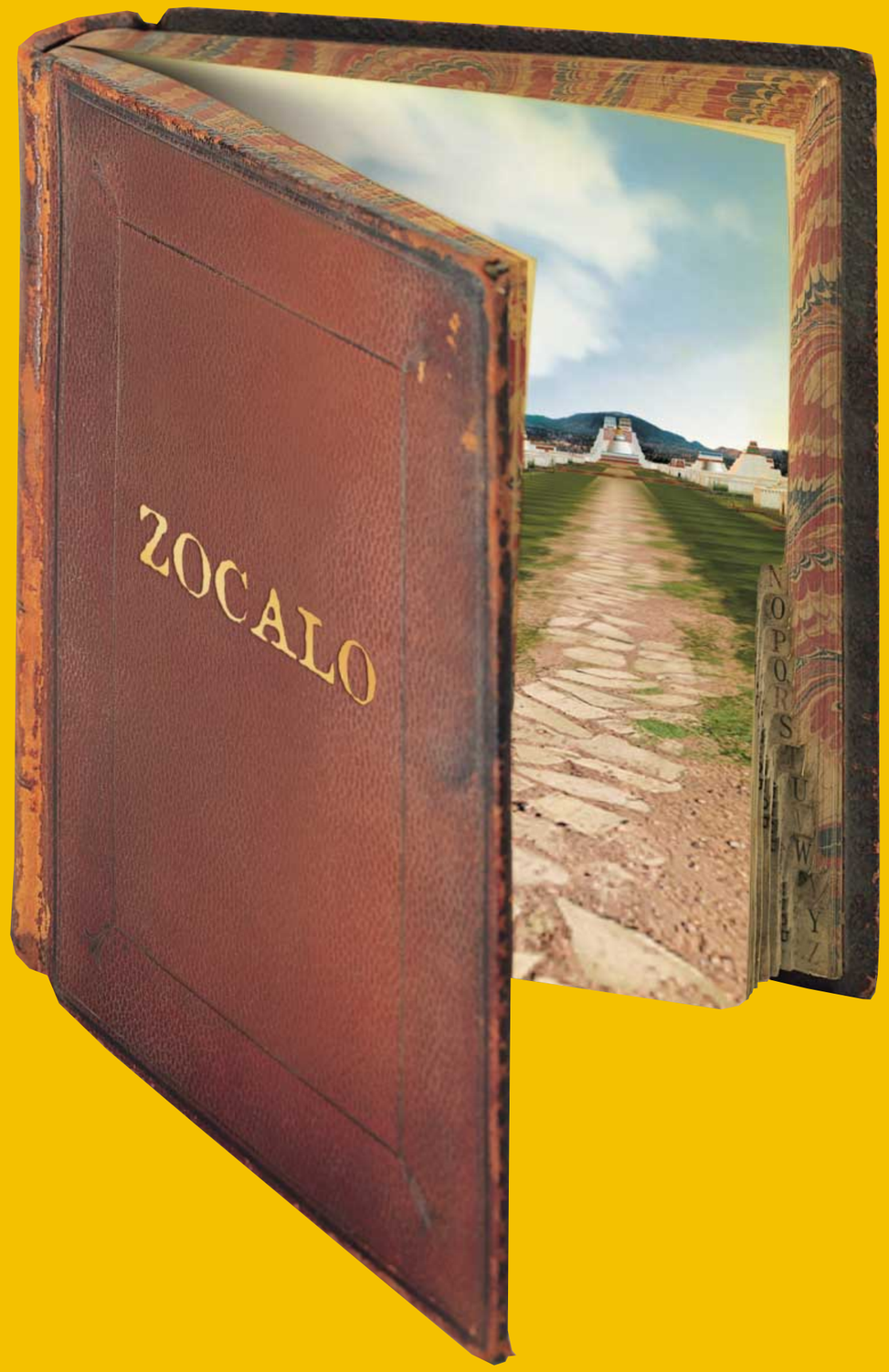
The medical community is one example of the many professions that stand to reap additional benefits from the Octane2 V12 workstation as application developers take advantage of new features in the hardware. The new asynchronous texture download feature, for example, gives developers much more flexibility in the order operations are performed. Octane2 V12 allows medical staff to look at an MRI or CT study and volume render in near real time, and Octane2 can also serve as a scanner control. The system delivers unprecedented imaging performance for image processing, superb hardware support for 3D textures uploads and downloads, and 12 bit per component image accuracy.

In addition to new graphics, SGI also announced a new Dual Channel Display option available immediately for Octane2 V12. The Dual Channel Display supports CRT and digital screen resolutions of up to 1920x1200 at 72 Hz on each screen. With this option, 80MB of texture memory is available. The Dual Channel Display option features a unified display manager for efficient information management on each screen and a three-way display splitter for increased sharing and collaboration. The SGI Dual Channel Display option does not require an XIO™ slot, additional software, or additional drivers to function. This option is valuable in many markets, including oil and gas and editing and compositing.

Octane2 V12 is already proving its worth in the oil and gas industry, where identifying and analyzing new drilling sites is a meticulous and time-consuming process. Octane2 V12 enables drilling experts to manipulate large data sets and 3D volumetric images interactively in real time. With the Dual Channel Display, Octane2 V12 offers more real estate to enable multiple views of prospect locations for efficient and cost-effective workspace management.

Octane2 workstations can be configured with single or dual MIPS R12000A™ 360 MHz or 400 MHz processors and feature an optimized crossbar architecture, four SGI VPro graphics options to choose from, a rich feature set, outstanding imaging capabilities, and multiple display options.

For more information:
www.sgi.com/workstations/octane2/



Over the past two decades, interactive 3D technology has percolated through much of modern culture. Lately, expositions, museums, and art galleries around the world are taking the medium in astonishing new directions.

The Millennial Construction:

Uniting Mexico City's *Past and Present*

At the Expo 2000 world's fair in Hanover, Germany, an international exposition, nations competed for public attention. Dramatic architecture and compelling presentations abounded. But an unforgettable immersive experience, called the Millennial Construction, helped Mexico's pavilion to draw crowds far beyond any predictions. The large-screen theater drew audiences into filmed footage of life today on the Zocalo—Mexico City's renowned central plaza. Real-time 3D images sharper than HDTV, driven by a Silicon Graphics Onyx2 system, enabled the audience to travel through time. Suddenly the Zocalo of today became the sacred pre-Columbian Zocalo, alive with texture, throbbing with Aztec life, worship, and culture. The visitors were then returned to the startlingly different Zocalo of today—which in turn became the colonial Zocalo of the eighteenth century, with fashionable ladies strolling the plaza. The message was powerful and clear: the Mexico of the Aztecs and the Mexico of today are one.

The Pavilion: A Dazzling National Accomplishment

Mexico's pavilion at Expo 2000 was a technical and cultural triumph. It quickly became one of the fair's top attractions, and the Millennial Construction experience, powered by SGI, was a prime reason for its popularity. The purpose of the experience was to give visitors a strong cultural context for the other rooms of the pavilion, which included bronze artifacts, a description of today's Mexico, and video images of Mexico's Night of the Dead celebration. Although the Millennial Construction's 70-visitor theater was designed to accommodate 8,500 visitors a day, on many days it handled 10,000. Surveys found that almost all visitors considered it the pavilion's prime exhibit.

The experience was created by de pinxi, a Belgian company specializing in immersive exhibits. The archaeological, artistic, and photographic research, as well as the screenplay, was developed by a Mexican team led by the Papalote Children's Museum located in Mexico City. The project was financed by Mexico's Expo Hanover 2000 trust.

"We wanted to do away with the misconception of the two unrelated Mexicos—an ancient, glorious country and the Mexico of today," said Raul Cid, deputy general director of the Papalote Children's Museum. "We wanted to show that today's Mexico is the product of more than a thousand years of constant construction; that Mexico is a modern country deeply and firmly rooted in its past. And we wanted to convey that message in a five-minute show to the unpredictable audience of a world expo." The experience was highly successful on all counts.

Creating a Virtual Architectural Reconstruction
The Millennial Construction experience required highly detailed interactive visualizations, which made Silicon Graphics Onyx2 the technology of choice. "Both de pinxi and the customer wanted to do a show for large audiences, which means a big screen and high resolution," says Phillipe Chiwy of de pinxi. "Not only that, but the archaeological, artistic, and cultural content, especially the frescoes, was very detailed."

To populate the virtual world, de pinxi integrated original drawings from a codex book drawn by Aztecs in the 15th century. The drawings were rich with detail and texture. de pinxi also used digital techniques to reconstruct the sacred suite of Tenochtitlan, its Templo Mayor, and 17 other temples using the Aztec drawings and other archaeological documents. "This kind of content, and the fact that it was displayed on a 160-degree, 12-meter by 4-meter screen, made SGI the unique choice among visualization computers," says Chiwy. "We needed high resolution, high detail, perfect sharpness, anti-aliasing, and enough bandwidth to load the images interactively." The Millenial Construction is an SGI™ Reality Center™ facility driven by a three-pipe Onyx2 InfiniteReality2™ system. The three-projector, high-definition Barco system was installed by Trimension, Inc.

The experience was controlled by the guide, who used a joystick control to alter the viewing path through the virtual world to make the experience unique for every audience. The system can also run unattended or be controlled by visitors on special occasions.

The Future: A Bonus for Mexico's People
Mexico takes pride in the high-tech, high-quality nature of the Millennial Construction experience. "The things I liked best about it," says Cid, "are the flexibility of the production, the outstanding quality of the graphics, the opportunity to alter it for different audiences, the opportunity of making the show interactive for small groups, and the spontaneous applause of most audiences, a rare occurrence in an expo presentation."

Many of the experiences at Expo 2000, which cost millions to produce, lived only as long as the exposition. But the Onyx2 visualization system that thrilled more than one million visitors with the Millennial Construction experience will soon be serving a bigger and more enduring purpose. Mexico is installing the system at the well-known National Museum of Anthropology and History in Mexico City. Many people, from foreign visitors to schoolchildren, will experience the immersive presentation. "I cannot conceive the future of museography without the use of the powerful resources offered by immersive visualization technology," says Cid. "Our master plan for the renovation of Papalote includes a multipurpose, real-time computer graphics display for 300 people in a full dome. This technology lends itself to the re-creation of the rings of Saturn, Mayan palaces, or a DNA recombination. There are no limits to the possibilities."

For more information:
www.depinxi.com
www.sgi.com/entertainment/museums/

From the Printed Page *to the* Silver Screen

One of the latest, most effects-intensive movies, *X-Men,* is based on characters from the hugely successful comic book series. The tools needed to visualize the fantastic world of *X-Men* have been provided by SGI technology.

The movie *X-Men,* directed by Bryan Singer, is based on characters from a very successful comic book series. Taking the characters from printed page to screen in a realistic way while preserving their unique characteristics meant calling on numerous special-effects experts.

Due to *X-Men's* extremely tight schedule, the work was spread among seven facilities—Digital Domain, Cinesite, Kleiser-Walczak, Matte World Digital, Core Digital, Hammerhead, and POP FILM (now known as R!OT—whose workload ranged anywhere from a dozen shots to 200, all created using Silicon Graphics® workstations.

In one of the most remarkable shots, Mystique —a blue mutant woman, nearly nude save for a few thousand strategically placed scales— transforms from the burly mutant biker Wolverine. How to make that shot—and 11 others just as complex—look absolutely real was a question that challenged *X-Men* even before principal photography started on the ambitious film. The dozen shape-shifting shots were so demanding that *X-Men's* overall visual effects supervisor, Mike Fink, assigned them to Kleiser-Walczak early on, and they were still being finished as the delivery date loomed nearly a year later. Fortunately, an arsenal of SGI hardware and software rose to the challenge with spectacular results. "The obvious way to do it was with a two-dimensional morph from one plate to another," says Kleiser-Walczak's visual effects supervisor, Frank Vitz, "but Mike and Bryan wanted something that looked more alive, really cool, beautiful, three-dimensional, subtle, and graceful."

The first step was to cyberscan actors Rebecca Romijn-Stamos (Mystique) and Hugh Jackman (Wolverine), as well as the other actors/characters used to create Mystique's transformations. Once downloaded into Kleiser-Walczak's Silicon Graphics® O2® and Silicon Graphics® Octane® workstations, that data became the jumping-off point for the complex transformation effect.

"First we refined those models on our SGI workstations to create a correspondence between their skeletons, so that we could three-dimensionally blend from one to the other," Vitz says. "We used Nurbs models, which made things easier than they would have been with polygons, and created a really beautiful way of orchestrating that blend from one character to another."

First Kleiser-Walczak's animators superimposed Mystique's digital Maya® skeleton model over the photographic background plate of Wolverine, then keyframe animated her movements to exactly track his, again using their O2 and Octane workstations. "Octane is our workhorse," Vitz affirms. "Our best animators worked on our dual-processor Octane workstations, while people that didn't need quite as much horsepower used O2 workstations."

The animators then superimposed the digital Wolverine model onto Mystique's digital Maya skeleton model and refined the animation even further, essentially creating a synthetic Wolverine whose edges perfectly matched those of the real Wolverine. The technical directors next created a texture map from the plate of Wolverine and mapped that back onto their synthetic character. "Now it looks just like Wolverine, except he's synthetic," Vitz says. "From there, we could distort and change his shape into Mystique starting from the real plate. It was fully procedural: once the models corresponded to each other, we could actually put them on a slider in Maya and transition from one to the other. But we choreographed everything by hand, so it didn't happen at once, by gradually moving virtual lights over an all-white version of Mystique. As the lights passed over her body, they defined the edge of the effect, so by choreographing the lights we choreographed the progression of the effect. Once all that was set up, the actual mechanics of changing from one character to the other, including the scales coming out, were procedurally driven."

Although Kleiser-Walczak used both O2 and Octane workstations for animation, the final rendering required Octane because the shaders were so complex and the databases were so heavy. "Those shots were running somewhere around an hour per frame to render," Vitz recalls. "SGI's cross-platform portability came into play, enabling us to submit our work over the Internet to WAM!NET, which rendered the frames on SGI servers and shipped them back to us. Then G.G. Heitmann Demers did the compositing for us in-house on an Octane workstation using Chalice, which runs only on UNIX and really is right at home on the SGI box. Chalice also had a great facility for handling our Vistavision background plates, which were scanned as Cineon files."

To add dimensionality to the transition from the leather-clad Wolverine (and other characters) into the nearly nude Mystique, Kleiser-Walczak's animators spent a month digitizing the 10,000 scales on Mystique's body on O2 workstations, so they could animate them erupting from her skin. "The scales are the heart of the effect," Vitz insists. "There's no way to do that with texture maps and painting, so they actually had to be physical scales. Each scale is very simple, but there were 10,000 of them, and each one had its own little pivot and could animate individually. They actually grew out of her skin like feathers, then ruffled and laid back down. As the effect came up over the horizon of her shoulders, you really got the feeling of perspective and dimension, which made it much more alive. We used our O2 workstations for planning animation paths and digitizing, then the Octane workstations came into play when they were absolutely needed as we got down close to completion, when the databases got big."

Although the *X-Men* effects workload was spread out among seven different facilities, they all used Media Commerce™ solutions from SGI. That comes as no surprise to Vitz. "We have been SGI users since the beginning," he concludes. "I've always loved using the SGI operating system, and all the work was done in Maya. We're SGI all the way."

Images courtesy of Kleiser-Walczak

Dossier

Chiseled into the façade of the Montreal Neurological Institute and Hospital (MNI) is the phrase, “The problem of neurology is to understand man himself”—words penned by the MNI’s founder, Wilder Penfield. Through new funding from the Canadian Foundation for Innovation (CFI), the MNI’s McConnell Brain Imaging Centre will acquire new computers from SGI to tackle this problem on a worldwide scale

Charting the

How and Where

of Thought

Dossier

The McConnell Brain Imaging Centre (BIC), established in 1984, is a multidisciplinary institution where physical, computational, neurobiological, and clinical investigators engage in both basic and clinical brain research. These dedicated physicians and scientists use cutting-edge medical technologies such as magnetic resonance imaging (MRI) and positron emission tomography to study the brain in its normal and diseased state. By combining anatomical with functional techniques and by studying the brain's changing activity in response to cognitive tasks, they are working toward complete maps of the brain and its inner workings.

As early as 1986, the BIC realized the importance of Silicon Graphics technology. "Medical imaging is inherently three-dimensional, and with functional imaging's added dimension of time it's critical that our computers are able to handle the resulting huge amounts of data," said the BIC's Dr. Alan Evans. The BIC's early adoption of SGI technology has made it a world leader in the analysis of these complex data, and today, over 60 laboratories around the world are using visualization and analysis tools developed at the BIC.

The use of common tools and analytical procedures has resulted in the evolution of a highly interactive international community devoted to the mapping of the human brain. Recently formalized as the Organization for Human Brain Mapping, this community includes notable sites such as the Albert Einstein College of Medicine of Yeshiva University, the Institut für Neuroanatomie at the Heinrich-Heine-Universitat, Massachusetts General Hospital and Harvard University, the Research Imaging Center at the University of Texas Health Sciences Center, the UCLA Laboratory of Neuro Imaging, and the Wellcome Department of Cognitive Neurology, University College at London as well as many other universities.

Functional Brain Mapping

To identify the regions of the brain involved in a certain task, first structural images are acquired using high-resolution MRI. These serve as anatomical bases for interpreting lower-resolution functional data. Functional data record the changes in activity of the brain over time, such as increases or decreases in the amount of blood flowing through particular regions or the amount of electromagnetic activity. These methods are applied while the subject performs a series of mental exercises. The resulting collection of three-dimensional images is aligned in the same reference frame in order to allow the comparison of changes across time and to remove the gross differences in overall brain size between people. The remaining subtle differences indicate the differing activities of various brain regions during the study.

The computationally demanding identification of these regions and their interrelationships has required the development of new mathematical and statistical theories and new computational strategies to solve them. These complex analyses would be extremely difficult, if not impossible, to interpret without the ability to visualize them in three and four dimensions. Most importantly, multiple overlaid images must be displayed with the ability to roam through them while simultaneously superimposing statistical results. As the amount of data and the statistical demands increase, more and more power is required to make sense of the experiments. SGI's leadership role in high-performance computing and long experience solving the world's biggest computational problems make its systems ideal for the brain mapping and medical imaging communities.

Modeling the Brain

Human brain mapping can strain the capabilities of even the biggest computing centers. To truly represent different populations, structural brain mapping studies require the analysis of increasingly large numbers of subjects, while in functional imaging, large data sets (1GB to 3GB) can be collected in a matter of moments. While computing the solutions to even single brain problems may take days or even weeks, neurosurgeons deciding where to operate need the brain activation maps immediately. Greater computational power is needed to allow researchers to modify and extend their experiments while the subject is still in the scanner. The combination of these computational demands generates such a huge computing burden that smaller centers or individual scientists can no longer attempt advanced studies alone.

In the past, the BIC has used both dedicated servers as well as a distributed network of SGI workstations to apply more than 80 separate software modules to the collected image data. By chaining these techniques together in "brain mapping pipelines," BIC scientists can now perform these complex analyses automatically. In 1997, the BIC completed the first fully automated clinical trial based on functional brain mapping, requiring the analysis of over 6,000 data sets. To perform this type of study on an ongoing basis, however, new computational and data storage systems are required.

A New Tool for a New Frontier

The SGI Origin 3800 server is ideally suited to solve the problems of advanced medical imaging research. Its SGI™ NUMA architecture allows the scalability and performance necessary to process massive data volumes. Its modularity enables optimal configurations to solve the problems at hand, while permitting easy pathways to growth in the future. SGI's experience storing, managing, and manipulating extensive data archives in an integrated computing environment will accelerate the implementation of international collaborations. The combination of this compute power with the advanced visualizations made possible by the SGI™ InfiniteReality® family of graphics subsystems permits unsurpassed possibilities for new discoveries in brain science. "Your eyes deliver more information to your brain than any other method," pointed out Janet Matsuda, director of Advanced Systems Product Marketing at SGI. "With the powerful visualizations that are possible only on the SGI 3000 family of products, you gain deeper and more immediate insight into computational and experimental results." It is entirely appropriate that the power of SGI visualization systems be used to fully engage the brain's most important sense in the search to understand the brain itself.

Financial Support—Industry Combines with Academics to Make It Happen

The new computational challenges faced in human brain mapping require that leading centers acquire and share the computational resources of modern supercomputers to continue their work. The Canada Foundation for Innovation provides financial support for university research centers and their industrial partners to solve some of the most difficult problems in science. SGI is collaborating with the McConnell Brain Imaging Centre to establish a major new computational imaging facility for the pursuit of brain mapping—the Montreal Consortium for Brain Imaging Research (MCBIR).

Spearheaded by Dr. Evans and Dr. Bruce Pike of the MNI, the MCBIR will be founded with support from the CFI, the government of the Province of Quebec, and several industrial partners, including SGI. MCBIR will involve five universities and five neuroscience institutes based within Canada and provide support to more than 100 scientists. The total cost of over $33,000,000 CDN (about $23,000,000 U.S.) will be shared between the CFI ($23,000,000 CDN) and the industry partners ($10,000,000 CDN). To address the computational and data storage challenges of this cross-disciplinary consortium, MCBIR will purchase an SGI Origin 3800 server along with Silicon Graphics Octane2 and Silicon Graphics O2 advanced graphics workstations for visualization.

These extensive new resources will be used to enable many national and international collaborations and facilitate the quest to understand the workings of the human brain. Dr. Evans said: "We still do not understand the relationship between brain structure and function, especially on the cortical surface. The CFI funds and SGI's commitment to medical research will allow us to address questions such as: Why does the cortex fold the way it does? Why is it different among individuals? Is this what makes us unique?" The committed support of SGI to academic and medical research is helping to find the answers to these challenging problems and foster a new understanding of the human mind.

For more information:
www.bic.mni.mcgill.ca
www.sgi.com/solutions/sciences

Packaging
Virtual Reality

There are few people who have not used a Tetra Pak product. During the last 40 years the company has engineered and installed more than 10,000 food and dairy production systems worldwide.

Every day more than 200 million Tetra Pak items are distributed in more than 150 countries. Now Tetra Pak is bringing virtual reality to the packaging industry.

Founded in Sweden in 1951, Tetra Pak provides processing, packaging, and distribution solutions for all kinds of climates and conditions. These can be complete production lines that turn raw materials into end products or stand-alone equipment. Tetra Pak, famous for its cartons, also has a large plastic packaging division that specializes in HDPE and PET packaging systems. The principle of the company is that a package should save more than it costs, and Tetra Pak's aim is to give customers short start-up times and problem-free production.

Customer and supplier feedback plays a key role in product development, and Tetra Pak's success depends very much on its constant innovations. One of these is aseptic technology. First introduced in the 1960s, this is a method of processing liquid food so that it remains fresh, tasty, and nutritious for months, without refrigeration and without the addition of preservatives. It is now used in conjunction with both cartons and plastics, and there are customer installations all over the globe.

Aseptic technology requires the utmost levels of cleanliness. All the aseptic processing machines that Tetra Pak manufactures are designed to the highest hygiene standards. Moving parts are kept to a minimum in the sterile environment.

Pierre Huser is product manager for linear aseptic systems within the plastic packaging division. He is responsible for ensuring that aseptic bottle-filling machines meet the needs of customers today and tomorrow. "Development time is critical. Our customers are continuously introducing new juices, milk drinks, and other beverages in all kinds of bottle shapes, and they regularly need to change production lines. Because time to market is so important, they want a quick response. At the same time, building a new plant or updating existing lines is a complex undertaking and requires a large investment. There is a definitive need to decrease the development time and increase the level of performance for any new system."

Huser saw the potential for SGI Reality Center technology. "For a long time I had wanted to introduce virtual reality into our technology unit at Darmstadt in Germany, but there was simply no application in the packaging world, where virtual reality is regarded as a marketing gimmick. I was convinced that it could cut development times by improving teamwork on complex systems and helping us to work more closely with our customers and suppliers at a very early stage in the development process."

Earlier this year, Huser was able to share his vision when a temporary virtual reality facility was set up on the company's Darmstadt site. During Anuga 2000, a major food machinery and packaging exhibition held in Cologne, more than 50 customers were invited to a special presentation to mark the launch of Tetra Pak's latest aseptic filling machine, the Tetra Plast LFA 20, specifically designed to fill UHT milk and dairy products into multilayer HDPE bottles.

A Silicon Graphics Onyx2 system powering a 6 x 3 meter screen, supplied by Tan, Dusseldorf, was used in conjunction with Tetra Pak's 3D CAD packages, Pro-ENGINEER, and dV MockUp from PTC. With the installation of back projection, a full stereoscopic image was obtained. Wearing shuttle glasses to gain the full 3D effect, viewers were shown the route and speed of the liquid as it flowed through the machine as well as all major machine functions. Huser says, "It was a unique opportunity for our customers to step into the filling machine and to get a very good understanding about all the steps we take to ensure proper bottle sterilization, filling, and closing in order to guarantee product safety."

According to Huser, customers were both intrigued and impressed, and many asked for a second visit. "There were managing directors, technical staff, and marketing directors, all fascinated and asking questions about the future of virtual reality in the packaging industry. They immediately saw the potential—from improving development to operative training and supply of spare parts. Many asked if they could have access to this facility."

"Overall the launch helped to position us even more strongly as a state-of-the-art company," says Dr. Peter Scherb, vice president of technology, Tetra Pak Plastic Packaging. According to Huser there was also much excitement within Tetra Pak. "Everyone could see the benefits—the designers, the training department, and the marketing team. So much interest was generated internally that other development sites are now keen to introduce virtual reality in their development process" said Huser.

In all the anticipation, Huser remains calm and firm in his beliefs. "Today in many industries it is not always clear why virtual reality is used, as people have not determined their primary objective. Is it just for marketing, for R&D, or for both? The most obvious thing is to use virtual reality for a press gimmick, but that isn't the complete story. Virtual reality's full power is within the development process of complex systems, very often shared between delocalized R&D teams, including suppliers and customers. That's where this tool has the highest return on investment. This is clearly the point where virtual reality in the packaging machine industry has its place in the future. Using the application for marketing purposes comes as a bonus."

Tetra Pak now has a small screen on a lease basis in Darmstadt, and with SGI's help it is deciding how and where to establish a more permanent facility. "We will soon launch a new range of machines, and we want to use virtual reality to share our thoughts with other Tetra Pak R&D centers, suppliers, and customers," says Huser. "Virtual reality is now part of our future."

For more information:
www.tetrapak.com
www.sgi.com/realitycenter

Images courtesy of Tetra Pak

2001 SGI Global Developer Conference

Developing the future

imagine. create. amaze.

The SGI Global Developer Conference will be held in March, 2001.
This premier technical event is designed to provide software developers around the world with the information and tools they need to create superior application solutions on the SGI platform. Attend this SGI annual event to interact with industry experts, spend time in a hands-on lab, and schedule a one on one session with SGI's top engineers to discuss your toughest development problems.

"Software developers are one of our most highly valued partners. We realize that our success depends on how well we enable their success through facilitating their development efforts. Whether the choice is to develop solely for IRIX or to provide IRIX and Linux solutions, SGI is a leading development option", said Ken Jacobsen, Vice President of ISV Partner Programs.

SGI understands the importance of developers and is committed to providing product roadmaps and dedicated development support to ensure application availability and optimal performance on SGI systems.

The SGI
Global Developer
Conference

The SGI Global Developer Conference is scheduled for **March 19-22, 2001** at the Hyatt Regency San Francisco Airport, Burlingame, California, USA.

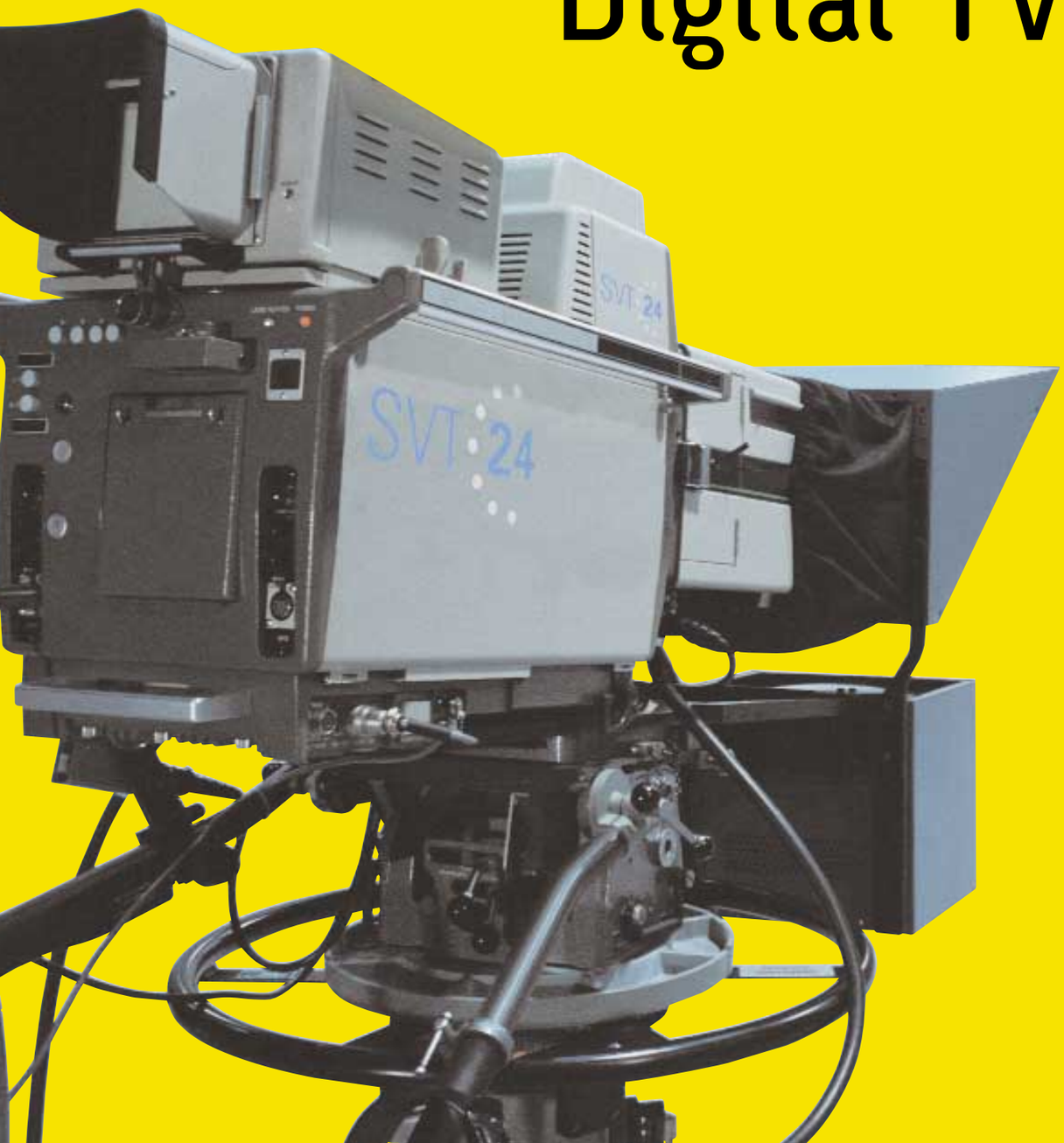
If you're developing on the SGI platform, you won't want to miss this event!

Register Today.

sgi™
One step ahead

A nationwide network of SGI video servers is helping Sveriges Television (SVT) revolutionize the production of its new 24-hour digital news channel.

From Video to Digital TV



A former monopoly, Swedish public service company SVT is today facing competition with commercial channels. In the struggle for efficiency it had two choices—abandon certain programs and make staff redundant or change the whole organization. SVT decided to opt for change and introduced technology that enabled radical new ways of working. The results are better quality broadcasting and lower costs.

SVT has been providing public broadcasting since 1956 and receives a fixed income from license fees. In the late 1990s, the company found that it was going over budget on the news section. During the same period the Swedish television industry was deregulating. SVT was facing competition for the first time and having to justify more closely how it spent public money.

"We were forced to review our whole organization," says Niklas Krantz, project manager for new technology. "We were due for an upgrade of technology and had begun to look at the options. We recognized that digital systems were the future but we were concerned about the upheaval that would be involved in the changeover. We also worked out that we would not save any money just by updating our technology. The only answer was to change the way we were structured and organized."

As a result of this review, SVT decided to give digital technology a trial when it launched a 24-hour news channel, SVT24. The concept for the channel requires that it broadcast news content from outside Stockholm, from regions as far away as the Arctic Circle. "For this reason we were clear that we wanted a server solution," said Krantz. "We knew we would be collecting material from nine different areas, plus Stockholm, and distributing it back to the same 10 regions. Apart from the fact that we did not have enough capacity in our existing microwave links, it would have been prohibitively expensive to use them for 10 different feeds on a 24-hour basis."

SVT chose to install 15 SGI Media Server™ systems connected over a high-speed computer network to create a contribution system so that it could collect news from the regions. Good networking is the key to a successful news service, according to Krantz. "We looked at other servers; they had the right disks and the required power but none of them could communicate as well."

At the same time, SVT started to implement a new control room system that would handle the broadcast of material back to the regions. Unfortunately this proved to be unstable. "We never got it to work. We had to develop a whole new system to meet our specific needs," said Krantz. "However, this setback actually showed us how to find a better way. Once we had installed the SGI servers as a means of gathering input, we were pleased to discover that, combined with our in-house control system, we could also use them to put material on air."

With a network, the quality of signal is better because it does not have to be decoded and reencoded, modulated and demodulated. The expensive alternatives, video and audio microwave and satellite links, are needed only for certain occasions, such as when there is a remote guest on a live show. The channel therefore operates with significantly reduced overhead. It is also more cost-effective because it can be run with a very small team.

SVT24 was launched from a new facility built by Sony. This includes a studio that can also be a newsroom, a control room that has production and master control capabilities, and media management and edit suites. With no established traditions, the channel was free to develop new ways of working. One of the key requirements was to train journalists to edit footage and to use SVT's new media management system. This led to the creation of several new professional roles such as media manager, media journalist, and on-air producer.

Krantz admits that he expected to meet some resistance. "I thought I would get some protests from the journalists, but everything went well. We developed our control system to make editing and scheduling a simple process, and we have automated many tasks such as archiving clips and creating Web pages."

The most important result for Krantz is that other people can now see that it is possible to run a television station in a different way. "In the beginning there were conflicts and, understandably, people were worried about change. We succeeded because we had people who were willing to try new approaches. When staff from SVT24 moved to other newsrooms and vice versa, understanding spread and things became much easier. This was critical because SVT24 was a pilot for what we want to do with our whole organization."

The launch of its 24-hour news channel has given SVT the confidence to embrace digital technology fully. It is creating a digital media management system to keep track of all its assets, and it has commissioned a new purpose-built center in Stockholm. By the summer of 2001 it will be moving all of its news, sports, and current events programming into this all-digital site. SVT expects to continue expanding its use of SGI servers for the broadcast and storage of material.

"Twenty years ago we moved from tape to video; now we are moving from video to IT," commented Krantz. "This is the way of the future. The broadcasting industry will rely on computer networks to distribute moving pictures just as offices use computer networks to distribute text. It's not about technology, it's about organizations changing; it's about people communicating and working together."

For more information:
www.svt.se

Images courtesy of SVT

Dossier

In the previous issue of SYNERGI we looked at the Human Genome Project, a marriage of biology and computing that has enabled scientists to transcribe the human genome—the book of human life.

Opening the Book of Human Life

Bioinformatics:

When Computers Really Count

The Human Genome Project began as a leap in the dark and has now introduced a new information age. Using awesome computing power, including technology supplied by SGI, teams in Europe, the U.S., and Japan have deciphered the three billion letter DNA alphabet that shapes and determines human existence.

Bioinformatics is a fairly new scientific realm, made possible by the convergence of data-intensive life sciences research, laboratory-automation technologies, and the development of computer databases and algorithms that can rapidly organize, process, and distribute enormous quantities of data.

SGI has been a leader in the life sciences community for more than 15 years. An example of SGI's ongoing commitment in this area is its work with the pharmaceutical multinational Bristol-Myers Squibb. SGI Global Services, working in partnership with Incyte Genomics Inc., has developed a powerful bioinformatics solution for Bristol-Myers Squibb that will bring efficiency and ease of use to genome research projects.

Bristol-Myers Squibb is typical of the companies at the forefront of the great changes that are sweeping biomedicine and, in turn, the pharmaceutical industry. With projects ranging from broad studies in Israel, the U.K., and Canada of human hereditary disorders to painstaking analyses of model genetic systems in fruit flies, worms, and yeast, Bristol-Myers Squibb is helping to shape a new understanding of genes and their role in health and disease.

Bristol-Myers Squibb bioinformatics research group will use a Linux® cluster software solution from Incyte that is deployed and supported by SGI's Professional Services team. Professional Services focuses on the unique and expert capability of SGI to deliver leading-edge bioinformatics solutions that integrate the hardware, software, and services required for the extensive computing utilized by the chemical and pharmaceutical industry.

SGI Professional Services deployed Incyte's software technology on a Linux cluster integrated with an SGI 2000 series server, which allows researchers to run specific applications in the Linux environment, freeing up resources on the SGI 2000 series server for applications that require intense threading or larger amounts of shared memory. For example, the combination increases Bristol-Myers Squibb's ability to run analyses and eliminates the administrative overhead of transferring data and calculations between computing platforms, making users more efficient.

"It is the ideal environment for the type of computational research we conduct," said Nathan Siemers, group leader of bioinformatics at Bristol-Myers Squibb. "The hybrid combination of Linux and SGI IRIX gives us the flexibility to do what we want, in a manner transparent to our researchers."

It is not surprising that SGI and Incyte Genomics should add up to a winning team in developing new bioinformatics solutions. Incyte is an industry leader as a genomic information provider and has engineered cutting-edge data processing systems to analyze and manage the increasing amount of genomic information becoming available.

SGI has been at the forefront in recognizing the exciting possibilities offered by Linux. SGI was quick to understand that the Linux cluster developed by Incyte enables leading life sciences clients such as Bristol-Myers Squibb to analyze large amounts of data faster and cheaper than ever before.

When Incyte systems are combined with the cost-effective SGI 2000 series, the goals of genomics research become more attainable—not just in technological but in economic terms. And in the end, it is bioinformatics developments like these that will help us understand how the genes work together to create a living, breathing organism.

The widespread demand for silicon in computers and in telecommunication and networking products has led to huge growth in the electronics industry. The American Electronics Association estimates that, worldwide, the industry will be worth $1.2 trillion by 2001, more than the automotive industry.

Smart Chips

with Everything

Human desire is the driving force. We want smaller, faster devices that use less power and give higher performance. At the same time the emergence of products such as intelligent home appliances and third generation mobile phones means that a wide range of new application specific chips (ASICs) are needed. Of course, we also want all of these products to cost less. Together, these market demands have put pressure on the electronics industry to squeeze more and more functionality onto a chip, and indeed, putting whole systems on a chip (SOC).

The electronic design automation (EDA) industry provides the critical technology to design the electronics that enable the Information Age. This includes communications, computers, space technology, medical and industrial equipment, and consumer electronics. As stated recently by the Nobel Prize Committee, "The integrated circuit is the basis for all modern technology."

Electronics engineers need to validate their concepts, model and analyze their designs, and identify and eliminate problems before making production commitments. EDA helps them get it done right. To understand the rapidly growing $5.7 billion EDA industry, it helps to define what we mean for the words behind those three letters, EDA:

Electronic—anything electronic from computer chips, cellular phones, pacemakers, controls for automobiles, and satellites to the servers, routers, and switches that run the Internet. Everything made by the electronics industry results from designers using EDA tools and services. As electronics become even more complex and pervasive, the EDA industry is more vital to the continued success of the global economy.

Design—the part of the production cycle where creativity, new ideas, ingenuity, and inspiration come to the fore. This is also where designers try to model the behavior of their designs and analyze the complex interactions of millions of constituent parts in their designs to ensure completeness, correctness, and manufacturability of the final product. Why? Because it is impossibly difficult, expensive and time consuming to "build it first and fix it later."

Automation—imagine the difference between designing a small house versus designing a skyscraper. For the skyscraper you need to design sophisticated structural, electrical, plumbing, security, and environmental systems, communications and computer networks, elevators, etc. all working together. This is analogous to the dramatic increase in complexity that designers must tackle in electronics today. It is this complexity—enabled by the relentless onslaught of Moore's Law*—that drives the need for automation.

*Moore's Law, A trend observed by Intel cofounder Gordon Moore in 1965 in which the number of transistors in integrated circuits doubles every 18 months. For more than 30 years this has been the driving force behind the electronics revolution.

Images courtesy of Ericsson

Chip size features continue to shrink, with current generation chips being based on 0.18 micron (a millionth of a meter) technology and next generation scaling down to 0.13 micron. This deep submicron regime poses new challenges to chip designers. As feature density increases, interconnect path lengths become quite long. Equally, as feature size decreases, the paths that connect functional blocks exhibit larger loading and delay characteristics. Under these conditions, much more complex physics effects must be factored into the design layout and verification processes. So, as feature sizes continue to shrink even further, these effects become ever more important.

To handle this daunting complexity issue of creating a chip with millions of transistors, very sophisticated EDA software tools have been developed and have become core tools in any design project. Yet as feature sizes decrease, and complexity grows, EDA tool developers are constantly challenged to handle the demands of the inherently changing physics and increasingly complex dependencies of ever larger systems.

The large amount of design data now associated with these tiny complex circuits means that the demand for computing power in the design process has increased sharply in recent years. In order to meet this need, new design methodologies are continuously evolving. A few years ago it was the norm for individual engineers to have their own powerful workstations for layout and verification processes. By the mid-1990s this was becoming less feasible and the EDA industry began to move from a workstation-centric model to a server/client setup, with design engineers using terminals connected to a powerful central server. It is clear that this trend is continuing and that larger and larger compute facilities will be needed to build increasingly complex chips.

While large servers began to do the number crunching, proprietary UNIX systems were still required for the EDA tools used. However, many companies have experienced frustration with traditional UNIX vendors as they have witnessed the astonishing development of extremely powerful and inexpensive personal computers based on the Intel IA-32 processor architectures.

Although it is suitable for business and commercial personal productivity markets, Windows NT® has not been well-received in the technical computing markets, especially the EDA industry. With its rather closed architecture, Windows NT can be a difficult operating system to set up and awkward to customize. The electronic design process is often very complex with designers using different applications, each with a particular strength, at various stages of development. Users do not get the flexibility, power and robustness they want from Windows NT and so have therefore remained loyal to UNIX OS-based platforms. However, with a proprietary UNIX system costing sometimes over five times that of a comparative Intel processor-based system, there exists a clear argument for a better price/performance ratio to be sought.

Enter Linux, regarded by many as a godsend. This UNIX type operating system was developed and optimized for the Intel architecture. As an open source development it benefits from the input of many people across the globe, the result being code with stability and integrity. Linux integrates well with other UNIX operating systems, which makes the issue of migration to a Linux OS-based EDA environment an easier exercise.

The availability of EDA software applications on Linux has been a critical factor for EDA users to make the transition. Fortunately, due to the easy porting issues to Linux from other UNIX versions, the majority of the principal EDA applications have already been ported by software vendors and at relatively little cost in comparison to the efforts employed for Windows NT.

With the need of electronics companies to get to market ever more quickly, the traditional EDA tools and processes are being challenged into even further intelligent design support. This demand is driving the EDA industry to look at the Linux environment as a real solution to faster design.

Shing Pan, EDA market segment manager at SGI commented, “There is already a recognition within the industry that Linux, as an enterprise-class solution, will fast become a dominant platform for the design environment. Equally, the performance of IA-32 chips is now world-class and is extremely well-suited to the techniques employed in EDA applications. SGI has recognized this trend and is moving to address it with its high-performance Intel processor-based servers. It is testament to this that developers from Intel Corporation themselves are already using Linux for internal development of their next-generation microprocessors and report capital savings, reliability, and ease of transition. It is clear that the combination of Intel processor-based hardware and Linux OS-based applications promises increased computing power and flexibility at much lower cost. Through this approach, the industry will be better able to meet the challenging demands of consumers and make products smaller, more powerful, and quickly available.”

If there is a downside to Linux, it is the fact that it has no corporate ownership, so support is not centralized. SGI regards this as an opportunity and has developed its expertise in Linux to the point that it provides total first, second, and third line support. SGI was the first major supplier to make this level of commitment to Linux, and it has more LPI (Linux Professional Institute)-qualified engineers than any other company. It has committed itself to education and training in the new operating system, and it is this commitment that is opening up the EDA market.

SGI will be demonstrating its full range of Linux OS-based solutions for the EDA market at the upcoming tradeshows: ASP-DAC 2001 in Japan in February, European DATE 2001 in Munich in March, and the 38th Design Automation Conference in Las Vegas in June.

For more information:
www.sgi.com/manufacturing/eda

One Army, One Simulator:

An Integrated Trainer Solution

Preparing Army and National Guard helicopter pilots for the intense conditions of wartime missions presents extraordinary challenges for military aviation trainers.

Never easy, training has become even tougher as escalating costs and tightening environmental restrictions continue to limit the use of live gunnery and field training exercises. While aviation simulators can complement live-action exercises, current-generation systems do not provide the realism, intensity, and integration necessary to prepare pilots to operate effectively on the combined arms battlefield.

A team at L-3 Communications, Link Simulation & Training has designed a breakthrough solution to meet these challenges. The reconfigurable Aviation Combined Arms Tactical Training–Aviation Reconfigurable Manned Simulator (AVCATT-A) employs high-performance SGI image-generation systems as the core of a sophisticated visual system. The Silicon Graphics Onyx2 image generator runs Links RightView software (based on SGI OpenGL Performer™) and drives a helmet-mounted visual display system. AVCATT-A uniquely combines a commercial off-the-shelf (COTS) solution with advanced features and full functionality, including complete interoperability with the Army's legacy Close Combat Tactical Training (CCTT) databases.

AVCATT-A presents a visually realistic environment that incorporates capabilities for advanced weaponry training, combat rehearsal with interactive opposing forces, and reconfigurable cockpits to enable training on the latest aircraft configurations. The AVCATT-A solution will help develop the skills of new pilots, as well as prepare experienced aviators, crews, and teams for specific combat or peacetime missions.

An Integrated Trainer Solution

The AVCATT-A program, based on the "one Army, one simulator" concept, will provide aviation training for both the active U.S. Army and National Guard units. Being developed by Link Simulation & Training under a contract award from the Army's Simulation, Training, and Instrumentation Command (STRICOM), AVCATT-A supports the full tactical mission spectrum of attack, reconnaissance, and utility helicopters.

The transportable simulator will operate stand-alone as well as networked to the Army's armored tank training system, the CCTT program. Interoperability with this system and the Army's command, control, communication, computers, and intelligence (C4I) systems allows battalion or brigade staff personnel to participate along with aviation crews in simulated engagements. Working at stations within administrative and tactical operations centers, headquarters staff and other personnel can participate in combined exercises, for example, controlling battlefield support elements and combat force deployments.

AVCATT-A also benefits by being able to take advantage of legacy CCTT database elements, including geo-specific terrain data and databases developed from standard digital topographic data. Converted to OpenFlight files, the legacy data can be leveraged to make the system ready sooner for mission rehearsals. The interoperability also protects the Army's investment in equipment, terrain, and cultural models—road, bridge, and runway data.

Choose Your Weapon, Cockpit, Airspace, and Terrain

Army trainers know that to ensure training effectiveness, a simulator must provide out-the-window and sensor displays with enough visual realism for pilots and their crews to effectively perform and practice aviation duties. The environment must be true-to-life, high-intensity, and task-loaded. AVCATT-A combines Links run-time software with high-performance SGI platforms for unprecedented realism to mimic real-world environments and events. Offering tremendous flexibility to trainers, AVCATT-A can simulate a wide array of mission equipment and virtually limitless environmental elements, including terrain, natural and cultural features, weather conditions and atmospheric effects, friendly and opposing weapon systems, aircraft configurations, vehicles and other equipment, and interactive competing forces. This capability lets aviators train under a broad set of conditions—smoke-filled battlefields, blowing-snow whiteouts, dust and sand storms, low cloud cover, high winds, etc.—replicated in daytime, dusk, or nighttime settings.

While most existing simulators support a single aircraft configuration, the reconfigurable AVCATT-A program offers highly realistic and functional cockpits representing the Army's Bell OH-58D Kiowa Warrior, Boeing AH-64A Apache, AH-64D Longbow Apache, CH-47D Chinook, Sikorsky UH-60A/L Blackhawk helicopters, and next-generation Comanche attack helicopters. Duplicating specific aircraft configurations in real-world situations helps helicopter pilots survive and successfully complete military missions in the dangerous and unpredictable settings they face defending national interests. AVCATT-A also provides performance feedback and theater or home station viewing for after-action reviews. This enables pilots, crews, and teams to not only develop and practice their flight skills but also fine-tune them for maximum effectiveness and safety.

State-of-the-Art Realism

To achieve the database interoperability, deployability, and configuration flexibility that characterize AVCATT-A, Link uses the image-generation technology of the Onyx2 visual workstation and the computational and I/O capacities of the SGI Origin 2000 server platform. Each simulator includes a dual-rack Onyx2 system and an SGI Origin 2000 deskside system. The Army will initially deploy six units with combined processing capacity of 18 graphics pipelines, 72 Raster Managers, and 72 CPUs.

Image-generation solutions for rotorcraft simulation are the most complex in the business. The operational mission of the helicopter ranges from low and slow in the trees, where high scene complexity is critical for providing necessary flight cues, to nap-of-the-earth flight where the visibility range is 12 kilometers. Correlated sensor visuals are also critical to simulate the variety of infrared, low-level television and radar displays available on the real aircraft. These demanding requirements necessitate systems that can provide power and flexibility. SGI meets these needs with an integrated hardware and software solution that uses terrain database elements to create map-accurate views complete with dense cultural objects.

Partnering for Worldwide Preparedness

The development of AVCATT-A represents the best in project team collaboration for delivery of a complete, customized solution. Working to meet the Army's extensive operational requirements, Link has integrated both technical and support resources to build, deploy, and maintain the sophisticated simulator. Link provided computer system integration and project management assistance, including engineering support for legacy database conversion. Additionally, Link and SGI have collaborated to provide worldwide support for the AVCATT-A solution, allowing the Army and National Guard to deploy the AVCATT-A solution wherever necessary to ensure preparedness against air defense threats.

On the Horizon

Additional AVCATT-A training systems will be deployed to Army and National Guard units over the next six years. These systems will not only provide flight training for current military aviation systems, but will offer the U.S. Army the scalability, portability, and maintainability needed to meet changing and expanding instructional requirements. AVCATT-A maximizes the Army's investment and ensures long-term system usefulness through its use of open-standard, modular COTS image-generation technology from SGI. Calm or storm, war or peace, Army and National Guard aviators trained using AVCATT-A will be better prepared to confidently carry out their missions of national concern and consequence.

For more information:
www.link.com

Images courtesy of L-3 Communications

Faxback Form

We hope you have enjoyed reading this issue of SYNERGI, the SGI magazine of imagination, innovation, and insight. For further information on solutions provided by SGI, please fax back the form to the number below.

Please continue to send SYNERGI to me:

Name _____ Title _____

Company _____

Address _____

_____

City _____ State _____ Zip _____

Phone _____ Fax _____ E-mail _____

(651) 683-7115

Attention: R. Fraser

1. What is your company's primary industry ? (Please circle one only.)

Aerospace	☐	Education	☐	Medical	☐
Arch/constr	☐	Entertainment	☐	Petroleum/energy	☐
Automotive	☐	Gov't defense	☐	S/W development	☐
Chemical	☐	Gov't research	☐		
Other	☐				

2. What applications best describe your interest areas? (Please circle all that apply.)

AEC	☐	Earth resources	☐	Publishing	☐
Animation	☐	ECAD	☐	S/W development	☐
Chem/bio, chem/tech	☐	MCAD	☐	Virtual reality	☐
Medical imaging	☐	Visual simulation	☐	Other	☐

3. Are you currently in the process of evaluating workstations or servers for purchase now or in the foreseeable future?

Yes ☐ No ☐ Don't know ☐

4. If yes, when do you expect to make a purchasing decision?

1-30 days ☐ 30-60 days ☐ 60-90 days ☐ 90+ days ☐

5. What type of systems or services are you evaluating?

UNIX workstations	☐	UNIX servers	☐
Linux workstations	☐	Linux servers	☐
Windows NT workstations	☐	Windows NT servers	☐
Storage	☐	Flat panel displays	☐
Professional services	☐	Education services	☐
Support services	☐	Productivity services	☐

6. Has a budget been approved for this time frame?

Yes ☐ No ☐ Don't know ☐

7. What is your IT budget for your current project?

$50K	☐	$50-100K	☐	$100-200K	☐
$200-300K	☐	$300-500K	☐	$500K+	☐
n/a	☐				

8. What is your role in the decision-making process?

Final decision maker	☐	Input only/recommender	☐
Purchaser/buyer	☐	Information gatherer	☐
End user	☐		

9. Please have an SGI representative contact me:

ASAP	☐	30-60 days	☐	60-90 days	☐
90+ days	☐				

10. Please contact me via e-mail regarding:

Linux	☐
SGI Internet Server™, SGI Media Server	☐
SGI customer services	☐
High-performance computing	☐
SGI Reality Center	☐
CFD	☐
CAD	☐
Silicon Graphics Onyx2	☐
Business intelligence, data mining	☐
Clustering	☐
Other_____	

11. Would you like to receive information via e-mail in the future?

Yes ☐ No ☐

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