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Solutions Brochure

SGI® InfiniteStorage Solutions for Virtual Product Development

Achieving and Sustaining a Competitive Advantage

Turbine blade stress simulations can generate files that are hundreds of gigabytes or even terabytes in size.

Time to market, cost control, and product reliability are critical in a world where manufacturers compete globally. Rising consumer expectations and increased regulatory demands are adding to the pressure on product developers. Success in this challenging environment hinges on leveraging the latest technologies, such as system-based modeling, complex assembly design, computer-aided engineering, process simulation, multi-discipline analysis and optimization, and collaborative design review to achieve and sustain competitive advantage.

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Leading manufacturers increasingly depend on digital technology at all stages of product development—from concept to sign-off—to improve product performance and quality, reduce costs, and reduce time to market. The implementation of a Virtual Product Development (VPD) process allows engineers to consider more design alternatives and evaluate them more thoroughly, in less time without the need for expensive physical prototypes. The increased use of simulation and analysis technologies fosters innovation and ultimately leads to better products.

As a result of the growth of VPD, the entire product lifecycle has become data driven. Fast growing digital assets are now the lifeblood of modern manufacturing. Reliable storage systems, high-speed data delivery, and efficient data management are now critical to manufacturing success.

As a leading supplier of computing, visualization and storage solutions for manufacturing, SGI is committed to solve the data explosion problem created by VPD. SGI offers a full range of solutions to meet critical requirements through:

- Intelligent Consolidation
- Data Lifecycle Management
- Data Protection

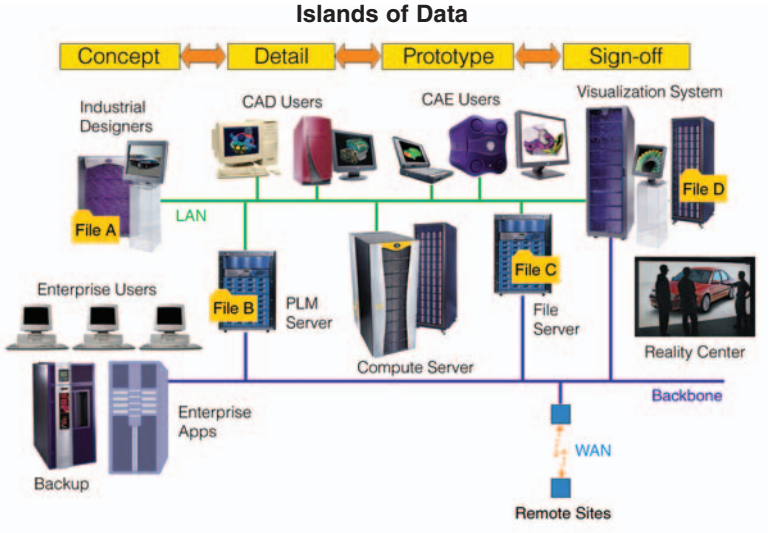
With a unique "data-centric" architecture, SGI creates a sustainable, easy-to-deploy storage infrastructure that helps today's manufacturers succeed. SGI InfiniteStorage delivers critical data where and when it is needed, so your product development team can focus on creativity and innovation—not data management.

Virtual Product Development: Data Management Challenges and Opportunities

Infrastructure Complexity

Deployment of VPD technologies has increasingly fragmented the storage infrastructure at most companies. Different groups have deployed their own storage solutions to meet specific platform requirements and local needs. Discrete "Islands of Data" have sprung up across most organizations, increasing infrastructure complexity, hampering data sharing, reducing efficiency, increasing costs and slowing time to market.

Islands of Data



For example, design data is stored in a design control database with associated design files stored on file servers. This design data is typically copied to prepare for simulation and digital prototyping using Computer Aided Engineering (CAE) software. Such copying not only wastes storage space, but valuable personnel time as well. This sort of inefficiency exists throughout the VPD lifecycle at most companies.

Data Explosion Creates Bottlenecks

The data storage problem is increasingly apparent in digital prototyping. Advanced computing systems—such as the SGI® Altix® 3000 family—are becoming more capable every year, enabling more-detailed engineering simulations that in turn require significantly greater storage resources. For example, a turbo-machinery company is currently using computational fluid dynamics to analyze one mode cycle of a model with 10 million points and five results variables. This requires 4GB of input and results in 220GB of output. The company's researchers would like to analyze more than one mode cycle with models of 50 million points and 20 results variables, but their current storage infrastructure is not adequate for handling the resulting 4TB data files; copying these files over the network would take over a day.

Globalization

The increasing trend toward globalization adds another layer of complexity. Modern manufacturing organizations have product design processes that span multiple development centers in different countries and many key product elements are outsourced to vendors worldwide. These complexities increase the need for 24X7 operations and improved data sharing while reducing the time available for data protection and management.

Storage Infrastructure Requirements for Virtual Product Development

To get the most value from VPD, and to remain competitive, manufacturers desperately need a scalable, cost-effective storage architecture capable of delivering:

- **High-performance data sharing in heterogeneous environments.** The same data is often required in different phases of the VPD lifecycle. With a variety of different software tools and hardware platforms in use, it is critical that the storage architecture supports this heterogeneity.
- **High-speed data access.** The inability to quickly access data frustrates engineers, reduces engineering productivity, and hampers the execution of automated processes and simulations.
- **Improved data management and administration.** Current fragmented environments make it difficult to maximize storage efficiency, meet service level agreements, and satisfy regulatory requirements.
- **Continuous data and application availability.** Important design and other data must be available and critical applications must be operational around the clock.
- **Protection against disaster**. Critical data must not only be protected; a company must be able to rapidly recover data and restart operations with minimum impact.

Deploying, managing and maintaining terabytes of active and archival storage is an expensive proposition. Controlling spiraling costs is critical too. SGI has the proven storage solutions to meet these requirements.

A Data-centric Storage Architecture for Virtual Product Development

SGI has developed a unique data-centric storage architecture that eliminates the storage fragmentation found in most VPD environments. This architecture solves the major challenges that manufacturers face today with innovative storage technologies that allow all groups involved in VPD to transparently share data.

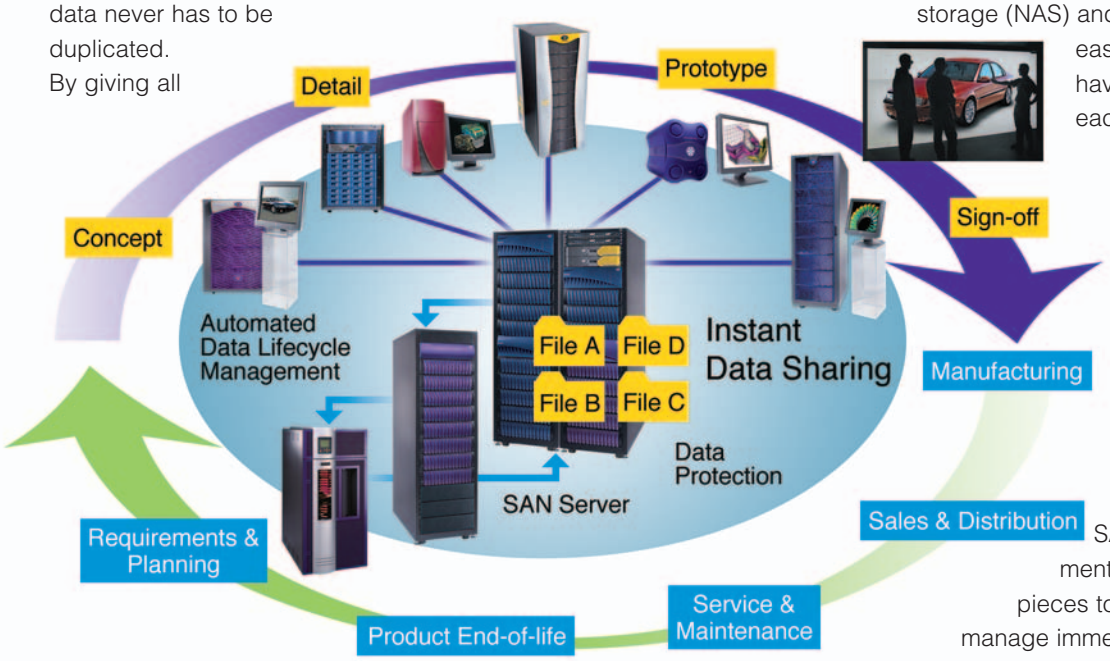
High-speed, Shared Access

A key element of the SGI solution is the SGI® InfiniteStorage Shared File System CXFS™. CXFS provides high speed, shared data access to eliminate the bottlenecks that hamper virtual prototyping and visualization operations. CXFS supports the most popular system platforms including SGI® IRIX®, Linux®, Windows®, and Solaris™, so it works seamlessly in heterogeneous environments. For operations that don't require the utmost data throughput, CXFS works in conjunction with NFS and other network protocols so data never has to be duplicated. By giving all systems on a storage area network (SAN) shared, high-speed access to data, CXFS avoids the bottlenecks associated with manual copying and dramatically streamlines workflow. The ability to concurrently access data without copying delays significantly improves productivity. More jobs can be completed in the same amount of time—even simulations of considerably greater complexity than were previously possible.

Unifying NAS and SAN

To gain the utmost benefit from VPD, all data must be easily accessible to anyone who needs it. At every step of the development process, users require access to outputs from previous design stages. Most users—including design engineers doing CAD, manufacturing engineers, and marketing planners—only need network data access, while higher speeds may be necessary for high-end simulations and real time visualization for design reviews, etc. However, traditional network-attached storage (NAS) and SAN storage systems do not easily interoperate. Most companies have separate storage pools for each function.

SGI brings NAS and SAN together with its data-centric architecture, unifying storage systems to enable efficient workflow, enhance collaboration, and improve data management. The architecture flexibly adapts to changing needs. Applications can quickly migrate from NAS to SAN storage if bandwidth requirements change. SGI pulls all the pieces together, making it much easier to manage immense volumes of critical data from both active and archived projects.



Centralized Storage

Contraves Space AG: Increasing Operating Efficiency with CXFS

Contraves Space AG, headquartered in Zurich, Switzerland, has been an important partner in the European space industry since the 1960s. Contraves Space specializes in the development, fabrication, and testing of components for space-launch vehicles and satellites and also manufactures precision devices and instruments for the scientific exploration of space. This demanding work requires high-performance computing and visualization systems for testing and evaluating thermal and dynamic behavior and results in enormous flows of data during product development.

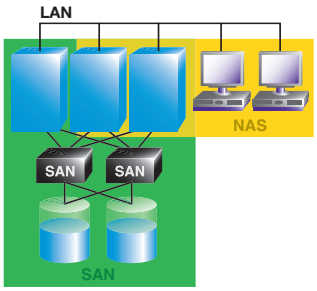
Contraves Space recently integrated its high-performance client and server systems with an SGI® SAN and CXFS. Ten Silicon Graphics® workstations, one SGI® Onyx® 3000 series visualization system, and one SGI® Origin® server currently share the same CXFS filesystem, facilitating workflow and eliminating bottlenecks. According to Andreas Herren, manager of dynamics and CAE research and development for Contraves Space, "The system installed enables us to save an enormous amount of time during interactive processing on our workstations. The implementation of CXFS has enabled Contraves Space to be in a position to avoid bottlenecks in its LAN. Moreover, the SAN implementation provides the prerequisite for LAN-free backup, which will in turn further reduce administrative costs for the next phase."

Intelligent Consolidation

SGI delivers optimal efficiency for storing, organizing, accessing and managing data. We tailor the storage architecture to reduce storage complexity—streamline management, increase performance, improve availability, and reduce TCO. By eliminating the bottlenecks that limit other storage solutions, SGI allows you to take your storage infrastructure to the next level, with unparalleled data performance that frees your organization to innovate and succeed.

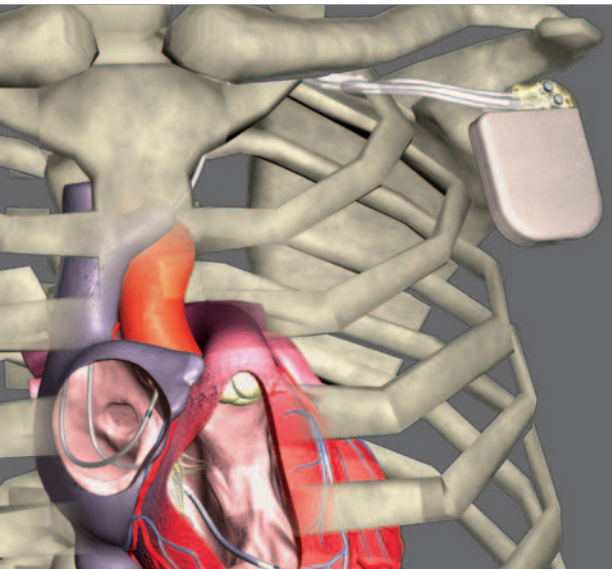
Our unique data-centric approach enables all data to be managed from a central consolidated storage architecture ensuring:

- Better disk utilization
- Improved load balancing
- Zero data replication
- Reduced storage capacity requirements
- Ongoing savings through reduced management costs



SGI can help you tackle your most critical storage challenges while increasing data integrity, security, and availability. SGI goes beyond the limits of traditional consolidation solutions with flexible, scalable architectures that improve productivity and deliver a sustainable advantage.

Intelligent Consolidation gives you the ability to scale independently in different dimensions over time including storage capacity, bandwidth, performance, connectivity, and supported operating systems—providing virtually unlimited growth paths and ongoing investment protection. Your file systems can grow within a live production environment—avoiding downtime, and ensuring high data availability and business continuity.



Medtronic, Inc.: Improving Productivity with Next-Generation Storage

Medtronic is a world leader in the design and manufacture of medical technology, including a variety of devices and systems to help treat cardiovascular disease. For the last 12 years, Medtronic has depended on SGI® technology for analysis, simulation, and product development for many cardiac products it has produced.

Data Access Bottlenecks
As the volume of information has grown over the years, data access has become a problem, putting an excessive burden on corporate networks and limiting the productivity of engineers who were spending increasingly large amounts of time transferring data over already overloaded network connections. Medtronic was highly dependent on what has become a typical engineering workflow. An engineer copied a data set to his local work station for preprocessing, copied it back to the Origin system for finite element analysis (FEA), and then copied the data set back again for postprocessing and visualization. This repeated copying was both inefficient and time-consuming.

CXFS: Optimizing Engineering Workflow
To solve these problems, Medtronic implemented a Fibre Channel SAN with CXFS to facilitate data sharing and alleviate network bottlenecks. The Origin® 3800 system and the Silicon Graphics workstations used by Medtronic engineers now share direct access to all data stored on SGI storage arrays. Engineers no longer waste valuable time copying data to their local disks, because the SAN with CXFS delivers exceptional I/O performance to all systems.

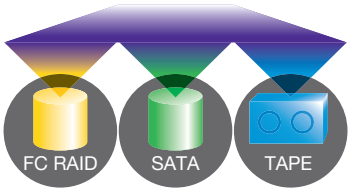
According to Tim Abraham, graphics resource manager for CRM therapy delivery, “With the addition of the SAN and CXFS, the return on investment for our existing equipment has gone way up. The new infrastructure has offloaded the Origin 3800 system, significantly reducing kernel activity and increasing user access to all processors. Overall utilization of the Origin system has increased substantially, because it is now so much easier for engineers to do their work, even from home. They no longer waste time copying data from one machine to the next. For Medtronic, the transition from NFS over a LAN to CXFS over a SAN has been like going from a gravel road to a six-lane freeway.”

Medtronic has recently extended the SAN to a number of Windows® 2000 systems that are used by groups who support the design activities, thereby improving their access to the data stored on the TP9400 arrays.

Future Plans
Medtronic is planning to add SGI® DMF software and a new StorageTek® tape library to create an automated hierarchical storage system that will serve as an archive for inactive historical data while still allowing data to be easily accessed. The addition of DMF will reduce the need for additional disk storage and help protect critical data from loss. Since inactive data is migrated to tape with duplicate copies, only active data needs to be regularly backed up. This significantly reduces the amount of data that must be transferred so backups complete much more rapidly than before.

Data Lifecycle Management

VPD is inundating manufacturers with mountains of data. This data has to be retained on appropriate media to provide a detailed record of each project and to meet growing regulatory compliance requirements. Cost-effective management of this data will be a critical element for manufacturing success in the coming years. Manufacturers must control and manage their data throughout its entire usable lifetime—from creation, storage and protection to eventual deletion.



SGI data lifecycle management (DLM) solutions integrate seamlessly with the SGI data-centric storage architecture to take the guesswork out of data management by automatically and transparently moving data from primary disk to secondary disk, tape or other storage devices according to your criteria, ensuring that data is always stored on the most appropriate and cost-effective media. Data is recalled to primary storage immediately on first access without the need for user or administrator intervention.

DLM solutions from SGI virtualize your storage assets, creating a scalable storage pool that is transparent to your users and applications. This fully automated, tiered approach to data storage adapts automatically to changing usage patterns to ensure data is always accessible and your users are always productive while greatly simplifying storage management and dramatically reducing the cost of your storage infrastructure.

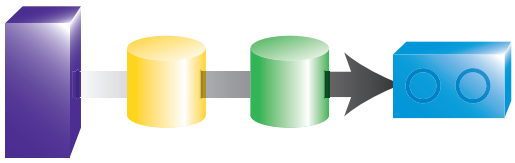
Only SGI DLM offers the scalability to tackle the challenges of today's most data-intensive VPD environments. SGI customers use DLM to manage hundreds of terabytes and even petabytes of storage at a fraction of the cost of disk-only solutions. Busy sites move as much as 3TB of data per day between primary and secondary storage with no administrator intervention and no loss of user or administrator productivity. SGI DLM creates a virtually infinite storage pool, ensuring that your investment today continues to scale with your needs into the future.

Data Protection

In today's global business environment critical data and applications must be protected from equipment failures or user error and be available around the clock. SGI offers a flexible range of options from simple offline tape solutions to 100 percent redundant environment to meet the needs of any VPD environment large or small.

SGI's modular Backup and Restore solutions combine world record performance with a choice of best-of-breed products from leading software vendors. SGI holds the world record with a sustained rate of 10TB per hour for disk-to-tape file backup and 8TB per hour for image restore. Faster backup and restore performance means shorter backup windows, increasing productivity and return on investment for global operations.

With SGI's modular Business Continuity solutions, you can select components according to the specific needs of each application and dataset:



- Synchronous mirroring for real-time data replication to a secure remote location.
- Fail-over technology to enable applications and services to achieve a projected 100 percent system uptime at a fraction of the cost of specialized fault-tolerant systems.
- A range of disaster recovery solutions to reduce the impact of outages that impact an entire site.

SGI InfiniteStorage Solutions for Rapid Storage Deployment

SGI offers complete, integrated solutions that make it easy for you to realize the benefits of our data-centric storage architecture. Architecting a complete storage solution can be difficult and time-consuming. Mistakes can be painful and have lasting impacts throughout your organization. SGI InfiniteStorage solution platforms eliminate these difficulties.

SGI® InfiniteStorage NAS 2000, NAS 3000 and NAS Gateway. For high-performance networked storage, SGI InfiniteStorage NAS solutions deliver scalability and performance that other NAS appliances can't touch. InfiniteStorage NAS takes the place of multiple conventional NAS servers, avoiding the headaches created by proliferating servers.

SGI® InfiniteStorage SAN 2000, SAN 3000 and SAN Gateway. InfiniteStorage SAN solutions include everything you need to immediately realize the benefits of CXFS data sharing including scalable storage and a complete 4Gb-per-second SAN infrastructure.

All InfiniteStorage SAN and NAS solutions are fully upgradeable. Any NAS or SAN system can be upgraded to incorporate both functions, so your investment is always protected. Solutions can be ordered pre-configured with options for high availability, network load balancing, backup, or data lifecycle management. You choose the capabilities you need for your VPD infrastructure today and flexibly extend your infrastructure with new capabilities as you need them.

SGI® InfiniteStorage DLM Server. The SGI InfiniteStorage Data Lifecycle Management Server combines all the elements of a successful DLM solution in an integrated and easy-to-deploy package that can be utilized with your existing storage infrastructure or as part of a complete SGI storage solution. The DLM server can be purchased for use in either NAS or SAN environments. SAN configurations include CXFS for heterogeneous DLM services for the entire environment.

DaimlerChrysler: A SAN for Data Availability and Protection

A DaimlerChrysler facility in Sindelfingen, Germany deployed an SGI SAN solution to improve levels of data availability and data protection. The facility stores critical engineering data and delivers it over corporate networks to engineers working at their desks or to design teams using DaimlerChrysler's SGI® Reality Center® facility. Like many automotive companies, DaimlerChrysler depends on the immersive visualization environment provided by Reality Center to improve the overall quality of its designs and streamline the design process.

An Architecture to Prevent Data Loss

Data loss would be disastrous to continuing operations. A storage architecture based on SAN technology was chosen because of the improved availability and data protection such a design provides, and because it gives the company greater flexibility to adapt to future needs.

Since this SAN serves critical engineering data to corporate networks, NFS and CIFS are considered mission-critical applications. SGI FailSafe™ high-availability software with HA-NFS and HA-SAMBA has been implemented between two Origin servers to ensure continuous data service. The two servers are in separate locations in the same building 250 meters apart, so any localized problem will only affect one of them. The configuration uses two independent SAN fabrics for the same reason.
SGI® InfiniteStorage Data Migration Facility Increases Storage Capacity

SGI® InfiniteStorage Data Migration Facility (DMF) software is used to provide data lifecycle management that extends the total storage capacity of the facility. Preferences have been set to automatically migrate infrequently accessed data out to a tape library. Because DMF is essential to the availability of offline data, it is also configured as an HA application with SGI FailSafe. DaimlerChrysler has also configured DMF to maintain two copies of every file (even files that are online) to ensure that critical data is always protected.

Mirroring for Disaster Protection

A TP9300S storage array has been deployed in the second location to mirror critical production data over the SAN. Because of the special design of the building, DaimlerChrysler considers this adequate isolation to achieve the desired level of protection against disaster. The two sides of the building are electrically and physically isolated so that fire or other localized disasters will not affect both locations.

SGI Professional Services

For complex technical situations, SGI Professional Services provides a complete suite of services to cover every aspect of storage infrastructure deployment from initial design and planning to ongoing optimization and support. Experienced SGI consultants work on-site to implement intelligent consolidation, DLM and data protection strategies specifically tailored for your environment.

Helping You Succeed with Virtual Product Development

Will your organization benefit from SGI's data-centric storage solutions? Ask yourself the following questions:I's data-centric storage solutions? Ask yourself the following questions:

- Is data access becoming a bottleneck to increased productivity?
- Is your current storage infrastructure able to accommodate the volumes of data and large individual files that result from VPD?
- Would a partial or complete loss of data impact your operations?
- Are you struggling to meet regulatory compliance requirements?
- Would you like to ensure that data is automatically migrated to the most cost-effective storage medium, based on your priority criteria?
- Are your storage costs growing out of control?

If you've answered "yes" to any of these questions, SGI InfiniteStorage solutions can help. SGI InfiniteStorage solutions can help.

Intel® Itanium® 2 Processors for Data-Intensive Applications

Data-intensive applications such as SGI InfiniteStorage Shared File System CXFS and SGI InfiniteStorage Data Migration Facility (DMF) benefit tremendously from the massive on-die resources and proven performance offered by the Intel® Itanium® 2 processor. Based on Explicitly Parallel Instruction Computing (EPIC), Intel Itanium architecture supports highly parallel processing, large memory addressability (up to 1,024TB), and innovative, compiler-based optimization that greatly improve performance for data-intensive operations. With up to 9MB of L3 cache, and 10.6GB/sec I/O bandwidth, the Intel Itanium 2 processor can readily cache the large volumes of metadata required to accelerate data management applications and move data on and off chip without bottlenecks. Because SGI technologies are frequently deployed in the most data-intensive environments in the world, SGI selected the Intel Itanium 2 processor to power all SGI InfiniteStorage SAN and NAS Solution Platforms.

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