Solutions Brief

Visual Area Networking
Solutions for Manufacturing Departments

The Problem

The unrelenting quest for competitive advantage amongst manufacturing companies has made innovative design and maximum product quality powerful differentiators. Leading companies try to simultaneously maximize both differentiators, leading to massive increases in design complexity and the detailed engineering analysis of those designs. Modern design and analysis tools like CATIA® V5, EnSight Gold, and CoVISE are designed to handle large models through the use of multiple CPUs, large shared memories, and parallel graphics pipelines. However, the average workstation available to most designers and engineers often does not allow them to effectively work with complete, high-resolution models.

According to Andreas Wierse, managing director and founder of VirCinity, a leading supplier of mechanical computer-aided engineering [MCAE] visualization software, "MCAE visualization is extremely demanding. A single model may contain several million cells and a time-dependent simulation can yield tens of gigabytes of results. These results must be quickly postprocessed for visualization, placing a huge burden on the visualization system in terms of storage, I/O bandwidth, memory, CPU power, and graphics power."

Engineering departments wishing to work with large models often implement dedicated advanced visualization systems that are used by cross-functional teams to reach group consensus. While these solutions have proven impacts in increasing quality and shortening decision cycles, they do not address the day-to-day needs of individual engineers—each of whom would benefit from a dedicated advanced visualization system for several hours per day. While engineers recognize advanced visualization and virtual reality as the future of MCAE visualization[1], department managers are caught in a dilemma. The work of their departments demands that individuals have access to advanced visualization, but their budgets do not allow them to purchase a system for each of the engineers who needs one.

Furthermore, rapidly increasing model sizes threaten to limit the benefits achievable with MCAE simulation and visualization. Result data sets on the order of 10GB to 50GB are becoming routine, and data sets in the 100GB to 1TB range are commonly forecasted for 2005. The rapid growth in the size of today's design and engineering problems means that today's desktop workstations cannot effectively analyze today's 50GB data sets, let alone the 1TB data sets. Organizations cannot afford tens to hundreds of gigabytes of memory and terabytes of disk space for each user, and networks do not exist that can affordably transfer enormous data sets over either the local or wide area networks that link today's globally distributed companies and suppliers.

The solution to these problems is called Visual Area Networking [VAN]. VAN is available from and deliverable by SGI and delivers the power of centralized, departmental advanced visualization systems to existing desktop UNIX® OS-based workstations and PCs over standard networking infrastructure. Departmental VAN solutions allow designers to work with 10GB CATIA models from a two-year-old Sun™ workstation and engineers to study 100GB time-dependent fluid flows from a standard Windows® OS-based PC.

Fig. 1.
An SGI Onyx 350 system with InfinitePerformance graphics supporting four virtual power users at a time in a departmental setting

Solution Description

SGI has developed departmental VAN solutions that are powerful yet cost-effective. These solutions combine the large-data-manipulation and visualization power of SGI® Onyx® family advanced visualization systems with the interactive remote access and collaboration capabilities of SGI® OpenGL Vizserver™ software and deliver them in a compact, departmental-friendly form.

Each departmental Onyx advanced visualization system can start out small and grow to support expanding workloads. For example, the SGI® Onyx® 350 system with InfinitePerformance™ graphics supports one to eight graphics pipes, 2 to 32 CPUs, up to 64GB of shared memory, and 20GB per second of I/O. A single SGI Onyx 350 system has the power to analyze large, complex problems for multiple simultaneous users or one incredibly large problem that brings together all of the needs of the organization. VAN then makes this flexibility and power available directly to desktops throughout the department and the extended organization.

Onyx system-based VAN solutions use the SGI® NUMAflex™ architecture and offer high-performance computing (HPC) capabilities in addition to visualization power. These systems can act as departmental compute servers at night and on weekends, reducing the need for dedicated computational resources. Onyx systems are also full members in SGI® SAN environments that eliminate data copying between compute, storage, and visualization systems within a computer room. This allows results generated on HPC solutions like IRIX® OS-based SGI® Origin® 3000 servers or Linux® OS-based SGI® Altix™ 3000 servers to be visualized anywhere in an organization without time-consuming data copying between systems. SGI departmental VAN solutions also eliminate data copying from centralized data servers to end-user workstations, because only a stream of images representing the final 3D visual results are delivered to those devices. The delivery of this image stream provides an effective compression of between 100x to 1000x when compared with shipping the raw data, so end users can be located on a high-bandwidth LAN or low-bandwidth WAN.

Benefits

There are three main business benefits and two IT benefits from the use of departmental VAN solutions. The business benefits are accelerated data access, complete problem design and analysis, and collaborative decision making. The IT benefits are streamlined data and system management and reduced expenses.

Accelerated data access is achieved by the elimination of data copying between systems within computer rooms and between the computer room and the desktop. This means that HPC results are instantly available, accelerating the data access part of the workflow by 10, 100, or even 1,000 times, which can reduce portions of the product development cycle by as much as 30% or more.

Complete problem design and analysis is achieved by applying the scalable compute, I/O, memory, and compute power of the SGI Onyx systems to a small number of problems at a time. Engineers have access to between 4 and 32 times the capabilities available on their desktops, allowing them to examine full-resolution MCAE results rather than cutting the job into a large number of low-resolution and partial-model analyses. Engineers who work with full models have been shown to be more productive, reducing this portion of the development cycle by up to 20%.

Collaborative decision making allows designers and engineers to rapidly benefit from experts throughout their departments or the rest of a larger organization. They are able to remain at their desks and interactively work through complex issues with individuals or teams located in a different building or a different country, and they can do this without the need to schedule weeks or months in advance.

Streamlined data and system management is possible because engineering departments that currently support both UNIX workstations and Windows PCs on each engineer's desktop can begin to eliminate the workstations and move to a unified PC desktop environment. The SGI VAN environment runs UNIX applications and delivers visual results to the PC desktop while centralizing data on a single system instead of on a collection of individual workstations. The reduction in the number of systems being supported, and the simplified data management environment lead to a reduced load on IT staffs.

Departmental VAN solutions allow engineering departments to reduce overall IT expenses by as much as 30% when compared with existing environments with both PCs and workstations on each desktop and separate data management and HPC systems. Most of this reduction is achieved by the elimination of workstations from end-user desktops and the associated system management costs, but the SGI Onyx system that forms the core of a VAN solution can also be used as an HPC server, which reduces the need for dedicated HPC resources.

1. FEA Information Monthly Newsletter: Post Processing—A tool for solving problems through visualization. *www.feainformation.com*

sgi®

Corporate Office
1600 Amphitheatre Pkwy.
Mountain View, CA 94043
(650) 960-1980
www.sgi.com

North America 1(800) 800-7441
Latin America (52) 5267-1387
Europe (44) 118.925.75.00
Japan (81) 3.5488.1811
Asia Pacific (65) 6771.0290

3466 (05/05/2003)

J14236