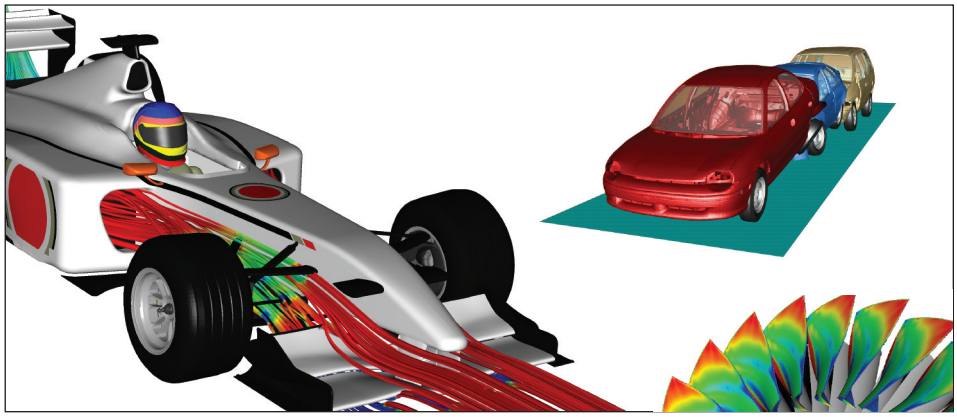
Solutions Brief

Enabling Better Design Decisions



Images courtesy of CEI.

SGI® Multi-Discipline Simulation Solution

Flexible Solutions for Multi-Workflow Environments

Virtual Product Development—for aerospace, automotive, consumer electronics, and other manufacturing industries—involves intensive collaboration between many disciplines to effectively account for the interactions between the disciplines and predict the system behavior accurately. Teams rely on a broad range of computer-aided engineering (CAE) applications for computational fluid dynamics (CFD), finite element analysis (FEA), and kinematics to evaluate performance, aerodynamics, structural fatigue, crash worthiness, and noise, vibration, and harshness characteristics. The computing demands for these large-scale, multi-discipline simulations are moving from mega-FLOPS to giga-FLOPS and beyond. High-fidelity CFD and FEA analyses can involve millions of state variables or hundreds of design variables and analyses for large, complex models. Inherently iterative processes require short turn-around times to enable systematic searches through the design spaces.

All of this is driving the increased use of high-performance computing (HPC) and data management solutions into the product development cycle. Simultaneously, HPC applications, and CAE applications in particular, continue to diverge in terms of processing, memory and I/O bandwidth and communication requirements. A multi-workflow architecture for high-performance computing offers an efficient and cost effective approach for today's diverging workflows and enables solutions suitable for today's manufacturing teams:

- **Capability workflows:** Solving large, complex problems requires the most powerful processing to minimize the time-to-solution duration. Typically, this would be dedicated to running one or a few problems simultaneously. These workflows benefit from big cache, big memory, big disk storage, and high-speed I/O.
- **Capacity workflows:** Capacity workflows, in contrast, involve a large number of parallel jobs where each job has moderate computational requirements. Less data sharing between applications and more parallel application threads (smaller, parallel jobs) set these workflows apart from capability workflows.

With multiple, diverse disciplines required to accurately evaluate product behavior and overcome the manufacturing industry challenges including product quality, cost and time-to-market, today's industries require HPC solutions that can accommodate a broad range of capability and capacity workflows.

Versatile, Standalone Configurations for Multi-workflow System Design

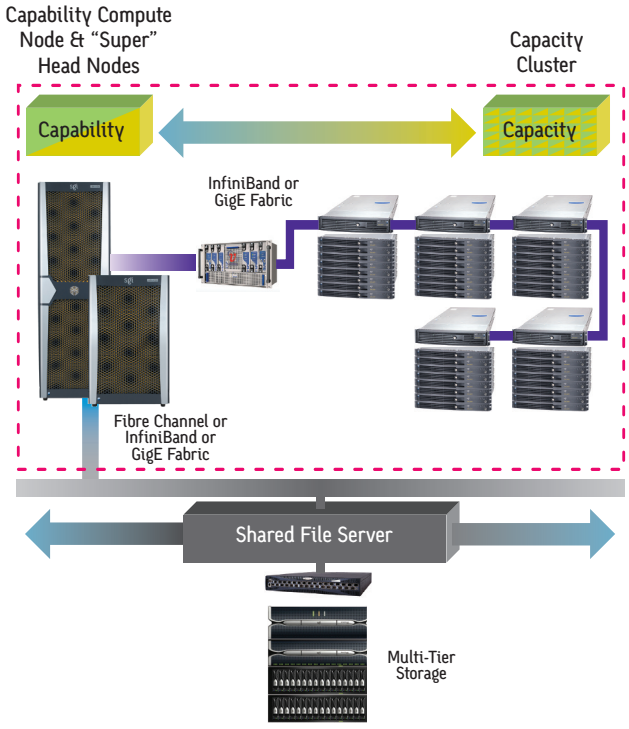
The SGI® Multi-Discipline Simulation (MDS) solution integrates a customized combination of computing and storage platforms with system management tools to address the demands of diverse disciplines, accelerate multiple workflows, and manage and share large data sets. A combined, next-generation balanced architecture enables both capability and capacity workflows for breakthroughs in efficiency and resource utilization. Each factory-integrated solution can be configured with complementary SGI® Altix® 450 and SGI® Altix® XE computers, SGI® InfiniteStorage solutions, and network

interfaces. For portability and ease of use, SGI MDS solutions have common software and system characteristics, including:

- A common industry-standard Linux® operating system,
- Common compilers, debuggers, and development tools,
- A single job scheduling/workload management system,
- A centralized systems management interface and operational dashboard.

Scalable Storage

Design of industrial manufactured systems also requires an understanding of interactions among all the various physical phenomena and how they might affect the behavior of the different components of the full system. As an example, providing various teams of engineers with simultaneous access to vehicle analysis data is required to effectively manage the complete mix of simulation data from all disciplines including NVH, durability, and crash worthiness. To address customer's Simulation Data Management (SDM) needs, the SGI MDS solution can also be configured to support commercially available SDM software tools such as SimManager from MSC.Software. The efficient integrated storage data management solution shields users from the complexities of data management and is well suited to iterative design environments. High-speed primary storage shortens critical processing, and cost-effective secondary storage handles lower-priority, occasionally accessed data.



SGI Altix 450 for High-Capability Shared-Memory Workflows

The SGI Altix 450 delivers industry-leading performance, efficiency, and versatility with a modular blade design and shared-memory SGI NUMAflex™ architecture. Plug-and-solve configuration flexibility is achieved with interchangeable computer, memory, I/O, and special-purpose blades. The SGI MDS solution can optionally integrate an SGI Altix 450 storage head node for file system sharing, data access, and connectivity to end-users through a corporate LAN. An Altix 450 compute head node controls dedicated high-capability processing for shared-memory design applications such as MD Nastran for structural and finite element analysis.

SGI Altix XE for High-Capacity Clustered and Distributed Memory Workflows

The SGI Altix XE offers superior performance and energy efficiency for small node cluster configurations. Dual-core Intel® Xeon® processors with 4MB L2 cache and 1333MHz front-side busses deliver productivity through faster information access and processing. For the SGI MDS solution, an Altix XE240 can be configured as the cluster head node. Scalable Altix XE210 compute nodes are particularly well suited for applications such as crash analysis and computational fluid dynamic applications.

Flexible and Comprehensive Data Management

SGI InfiniteStorage solutions offer a full line of state-of-the-art disk storage systems designed for data-intensive CAE environments. SGI Data Migration Facility (DMF) automates data migration for the highest possible capacity utilization across all storage. SGI MDS solutions configure InfiniteStorage systems dedicated to performance-oriented primary storage, capacity-oriented secondary storage, and scratch storage for the Altix servers. SGI XFS® provides a graceful, scalable path to large, terabyte file systems. Compatible with the industry-standard Network File System (NFS), SGI XFS adds powerful 64-bit addressing and journaling capabilities, as well as providing a path to SGI Clustered XFS (CXFS™) environments.

System Networking and External Storage Interconnects

All components in the SGI MDS solution are networked and interfaced to external storage systems:

- Fibre Channel interconnects to Altix servers and storage
- InfiniBand™ interconnects to the computer cluster and NAS/SAN head
- Gigabit Ethernet interconnects to clients

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