WHITE PAPER

SGI® HPC Systems Help Fuel Manufacturing Rebirth

Created by insideHPC

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1.0 Introduction

After a long dry spell triggered in part by the global downturn in the economy, manufacturing is enjoying an economic and technological resurgence.

According to the Institute of Supply Management[1] (ISM), American manufacturing continues to improve. The ISM recently reported that manufacturing activity expanded in September 2014 for the 16th consecutive month, and that the overall national economy grew for the 64th consecutive month.

Part of this growth is being fueled by the adoption of computer aided engineering (CAE) and analysis solutions powered by high performance computing (HPC)—especially by the Tier One manufacturers. HPC is beginning to make some inroads into the ranks of the small to medium sized manufacturers (SMMs), but the going is slow.

2.0 Ongoing Challenges

Despite manufacturing's comeback, the industry is still facing some daunting challenges. Among the many hurdles that manufacturers have to overcome on a daily basis are stringent regulations imposed by federal, state and local governments dealing with product quality, safety and performance. According to the National Association of Manufacturers[2] (NAM), "Federal regulation is estimated to cost more than $1 trillion annually, according to a report by the Small Business Administration's Office of Advocacy. The study found that United States manufacturing comprised $162 billion of the $648 billion burden of environmental, economic, workplace and tax-compliance regulation."

NAM points out that dollars spent by manufacturers on regulatory compliance with cumbersome or duplicate regulations are dollars not spent on capital equipment or hiring new employees.

Another major consideration for today's manufacturers is to respond to the pressure to reduce costs. This, in turn, is driving the need to reduce expensive physical prototyping through the use of modeling and simulation earlier in the design process.

Intense competition on a global basis requires manufacturers to speed their time-to-market, which can only be accomplished by a more efficient IT infrastructure and a major boost in end user productivity.

Competitive advantage can also be gained by using HPC and CAE to address the complex physics inherent in the design of today's sophisticated products.

Meeting these challenges is far from easy. For example, computing larger models to generate more detailed simulations of both the product and the processes used on the factory floor, can take days, even weeks, to run on typical workstations or HPC cluster. And CAE workstations, the solution of choice for most small- to medium-sized manufacturers, are expensive and require costly and complex software licenses from the various ISVs.

[1] http://www.ism.ws/ISMReport/MfgROB.cfm?navItemNumber=12942

[2] http://www.nam.org/Issues/Legal-and-Regulatory/Manufacturing-Regulation.aspx

Because of the large datasets involved, sharing data among engineers is difficult. Also, as the computational capabilities of these users grow with access to ever more powerful workstations and software, the IT department is hard pressed to keep up with their demands. The fact is, in the world of manufacturing, HPC usually is not a core IT competency; the hiring and retention of experts in such disciplines as CFD and FEA modeling, simulation and analyses, is not a line item on most small- to medium-sized manufacturer's budgets.

3.0 Meeting the Challenge

In an ideal world, a CAE system that can address these challenges would not be a box of components and wires dropped off by the vendor that turns into a six month science project. Instead, the ideal system in an ideal world would be:

- Flexibly architected
- Resilient
- High performance
- Cost-effective
- Easy to deploy
- Easy to administer

With these goals in mind, SGI has created a solution that simplifies high performance computing for CAE. SGI has created an easy to deploy, unified platform that addresses a broad spectrum of CAE applications and workloads. It allows you to leverage your investments by simplifying integration with existing infrastructures and maximizing the efficiency of available licenses and personnel. The system optimizes your productivity by providing faster data access to do real work and increases the value of archived data.

4.0 SGI Solution Environment and CAE Applications

SGI's solution environment includes a variety of capabilities for making the most of your CAE applications. Included are:

4.1 HPC RESOURCE AND WORKLOAD SCHEDULING

Supports the management of large complex applications, dynamic and unpredictable workloads, and optimizes limited computing resources. SGI offers several solutions:

- *Altair Engineering PBS Professional* – SGI's preferred workload management tool for technical computing scaling across SGI's clusters and servers.
- *Adaptive Computing Moab HPC Suite Basic Edition* – Enables intelligent predictive scheduling for workloads on scalable systems.

4.2 CAE APPLICATION WEB PORTAL

- *SGI offers NICE Software EnginFrame* – Managed HPC and cloud environment and customizable web application portal.

4.3 REMOTE VISUALIZATION

- *SGI VizServer® system with NICE Desktop Cloud Visualization™ (DCV) software* is a commercially supported hardware and software solution that delivers efficient and optimized

remote access to graphic-intensive, off-the-shelf 3D applications running on both Windows® and Linux® desktop environments, including major CAD and CAE visualization software.

Key Features

- Hardware and software solution for optimized remote 3D visualization
- Full GPU acceleration for off-the-shelf OpenGL® applications
- GPU sharing across multiple users
- Collaborative session sharing of remote 3D data

4.4 HPC COMPUTING AND STORAGE CAPABILITIES

SGI also provides all the *HPC computing and storage capabilities* required to handle typical CAE workflows such as:

- CAD model creation
- Mesh generation
- Model decomposition
- Running solvers
- Viewing results
- Adjustment and repeat

5.0 SGI® UV™

A powerful HPC system that minimized time to solution, the SGI UV, comprised of Intel® Xeon® processors, provides ultimate flexibility for running both shared memory and distributed memory applications in one system using a single OS instance. Typical analysis types handled by a UV system include: bandwidth performance; large dynamics with Lanczos-Modal NVH; transient CFD; electromagnetics and multiphysics workloads.

6.0 SGI Rackable® or SGI® ICE™ X

SGI Rackable and SGI ICE X HPC clusters, which contain Intel® Xeon® processors, are a cost-effective solution and performance leader for most solver runs. Just a few of the analysis types that these systems are designed to handle include: general purpose CSM-Statics; direct frequency response; crash/impact analysis; and steady state CFD, as well as some transient CFD.

7.0 SGI® InfiniteStorage™ 5600

SGI's storage solution provides fast, scalable, and reliable storage for all CAE workloads. The SGI InfiniteStorage 5600 allows users to store and utilize vast amounts of engineering data for bandwidth-intensive applications and complex application processing. This is a high availability, highly reliable ultra-dense system that is modular in design enabling it to scale to meet future demand.

SGI also provides a wide range of storage software for creating and managing a variety of essential environments and tasks such as: virtualization; archiving; information lifecycle management; SAN file systems; and the management of digital assets.

8.0 Case Study Summary – SL-Rasch

SL-Rasch Designs a Better Umbrella

SL-Rasch (Institute for Scientific Architecture) specializes in buildings and lightweight structures that integrate architecture and engineering. ESI® PamCrash® and OpenFOAM are among the applications used to conduct their computer simulations.

To better understand the impact of various wind conditions on very large umbrella structures under stress, the Institute turned to SGI for a high performance solution.

Significant computing power is required for, amongst other tasks, long term wind simulation on highly flexible lightweight structures through large scale models with high numerical grid resolutions. To manage the huge quantities of different types of data involved and the specialist applications the company uses, SGI proposed a High Performance Computing (HPC) facility with:

- 64-node SGI ICE 8400 System
- 108-node SGI ICE X System, comprising of the Intel® Xeon® processor E5-2600 v3 series.
- 48 core SGI UV 100 System, comprising of the Intel® Xeon® Processor 7500 series, with 256 GB memory
- SGI InfiniteStorage 5000 Family

The SGI solution has enabled SL-Rasch to move beyond traditional, standardized engineering approaches that do not fully address the issues involved in designing and producing large lightweight structures. The company now has:

- Increased modelling, simulation, animation and rendering capability
- Reduced requirement for physical prototypes of large umbrella simulations saving time and costs
- Enhanced safety margins on designs and quotations
- Reduced per node energy cost
- Faster project turnaround times

9.0 Case Study Summary – Škoda

Škoda Auto Augments its CAE Systems with SGI Solutions

Škoda Auto, one of Europe's best known car companies, was in need of scalable, high performance computing systems to perform complex product performance and safety analysis using applications such as ANSYS® Fluent®, ESI® PamCrash® and OpenFOAM®.

The company chose SGI® ICE™ X and SGI® UV™ 2000 systems, which contain Intel® Xeon® processors, to achieve higher resolutions simulation and modeling, as well as substantially speeding up workflows. The new systems delivered in this and last year provided over 200 teraflops of processing power.

The head of Škoda's Process & System Integration-Product Process comments, "With new SGI computing power, we will be able to rapidly develop more innovative vehicles with excellent value-to-power ratios."

10.0 Made for Manufacturing

SGI offers a highly flexible framework of scale-up and scale-out servers and storage products ideally suited for CAE workloads from multiple disciplines. This includes the ability to maximize the efficiency of HPC infrastructures for CAE by seamlessly integrating all the requisite components — hardware, software and storage. In addition, the company has a long history of proven domain knowledge and key CAE application expertise. All of these capabilities are supported by strong ISV relationships and partner ecosystem.

SGI is delivering HPC productivity to manufacturers, both large and small, and, in the process, contributing to the resurgence of the manufacturing sector in the U.S. and around the world.

For More Information

For more information about how SGI can benefit your organization, visit sgi.com/manufacturing or call 1-800-800-7441.

About SGI

SGI is a global leader in high performance solutions for compute, data analytics and data management that enable customers to accelerate time to discovery, innovation, and profitability. Visit sgi.com/manufacturing for more information.

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