Success Story

University of Minnesota

SGI® Altix® 350 Cluster Maximizes Processing Power and Delivers 64-bit Linux® Applications Availability

"With the Altix 350 cluster, the Supercomputing Institute gets two to three times the processors of a single SMP machine."

– Barry Schaudt, Chief of Technology, University of Minnesota

The Supercomputing Institute at the University of Minnesota Deploys a 128 Processor Altix 350 Cluster to Accelerate Scientific Research

Founded in 1984, the Supercomputing Institute for Digital Simulation and Advanced Computation is an interdisciplinary research program spanning all colleges of the University of Minnesota. The Supercomputing Institute's research utilizes high-performance computing (HPC) environments to address otherwise unsolvable problems in physical, biological, medical, mathematical, and computing sciences and engineering, as well as other disciplines that rely on HPC to advance learning.

The Supercomputing Institute provides University of Minnesota researchers with a full complement of leading-edge supercomputers with which to perform a range of both academic and industrial research. Among the newest of the HPC solutions to be added to the Supercomputing Institute is a cluster of eight, 16-processor SGI Altix 350 shared-memory systems, each with 16 1.5 GHz Intel® Itanium® 2 processors sharing 32 GB of memory. The Altix 350 nodes are clustered together using Voltaire's InfiniBand cluster interconnect. The new 128 processor cluster adds significant computing power to the Supercomputing Institute's existing 48-processor Altix® 3700 compute server and four-processor Altix® 3000 interactive systems.

The Supercomputing Institute has a long history of working with SGI, first with using SGI® workstations. Then in 1997, the Institute purchased its first SGI supercomputer, an SGI® Origin® 2000 system.

"The Supercomputing Institute's resources are available to faculty members at all University of Minnesota campuses and other post-secondary educational institutions in the State of Minnesota."

– Barry Schaudt, Chief of Technology, University of Minnesota

Promoting the Supercomputing Institute

A top promoter of the Supercomputing Institute is its long-time Chief of Technology, Barry Schaudt. According to Schaudt, "The Supercomputing Institute's resources are available to faculty members at all University of Minnesota campuses and other post-secondary educational institutions in the State of Minnesota." Currently, some 1,700 researchers conduct academic research at the Supercomputing Institute.

Leveraging Altix Processor Power and Applications Availability

Significant among the many considerations the Supercomputing Institute's Planning Committee must take into account when deciding the supercomputing technology to purchase are system performance, scalability, ease of use, software availability, the need to support a large user base across a broad band of disciplines, and pricing.

According to Schaudt, "The Altix 350 system provides a mid-range price/performance combination that fits neatly between the Supercomputing Institutes small cluster systems and its larger and more expensive SMP systems. With the Altix 350 cluster, the Supercomputing Institute gets two to three times the processors of a single SMP machine." The modular "expand on demand" architecture – up to thousands of processors – will allow the Supercomputing Institute to independently scale processors, memory, and I/O in a cost-effective manner as system requirements change.

Because Altix 350 is based on industry standard Intel Itanium 2 processors and the Linux operating system, researchers at the Supercomputing Institute can take advantage of a range of 64-bit Linux applications available in commercial and open-source communities. Unlike small-cluster machines, the Supercomputing Institute's Altix 350 systems each currently share 32 GB of memory, readily accommodate Supercomputing Institute researchers who often develop, test, and use their own codes.

To date, much of the research done on the Altix 350 systems focuses on biomedical engineering, biochemistry, computational fluid dynamics, computational chemistry, physics, and astronomy.

The Supercomputing Institute's nine-person support staff provides researchers assistance in all aspects of scientific computing and visualization, including general user support, writing and porting serial and parallel codes to the super-computers, user training, code optimization, parallel model building, and more.

Each staffer also provides technical assistance in their area of expertise – Computational Chemistry, Computational Fluid Dynamics, Structure Mechanics, Design Optimization, Structural and Molecular Biology, Data Mining, Bioinformatics, Computational Biology, Genomics, Scientific Visualization, and Geophysics.

"The Altix 350 system provides a mid-range price/performance combination that fits neatly between the Supercomputing Institutes small cluster systems and its larger and more expensive SMP systems.

– Barry Schaudt, Chief of Technology, University of Minnesota

Scaling Out While Lowering Cost

The University of Minnesota Altix system leverages the Altix 350 systems' SGI® NUMAflex™ shared-memory architecture in combination with Voltaire's InfiniBand clustering interconnect technology to deploy the eight Altix 350 systems as a high-performance cluster. According to Dave Parry, Senior Vice President and General Manager, Server and Platform Group, SGI, Scaling out in high-performance computing environments requires extremely high I/O rates, which presents particular difficulties to many clustering environments. The powerful combination of SGI's new Altix 350 server and InfiniBand interconnect from Voltaire enables our customers to deploy a complete scaling out solution that handles complex applications and workloads convincingly. "By choosing Altix 350 systems configured as large nodes within a cluster, the University of Minnesota was able to obtain a 128-processor cluster with significantly lower interconnect fabric and fabric management costs than would be available using other two-processor or four-processor nodes.

Schaudt plans to conduct extensive testing of the InfiniBand interconnect over the next several weeks, with full implementation expected for later this year, Schaudt believes that Voltaire InfiniBand will significantly reduce interconnect and system management costs for the Supercomputing Institute, and will also enable University of Minnesota researchers to use the Altix 350 systems as an efficient, multi-node HPC solution to tackle their increasingly complex data sets and throughput challenges.

Storing the Data

The Supercomputing Institute integrated their Altix systems via a Storage Area Network (SAN) and SGI® InfiniteStorage Shared Filesystem CXFS™. CXFS allows multiple computers direct access to shared files. This means that all systems in a SAN enabled by CXFS have access to the same file at the same time, at local or near-local filesystem speeds. Data sharing using CXFS is also more efficient than traditional methods. CXFS is designed to reduce overall costs by centralizing and consolidating storage, reducing data duplication, lowering administration costs, removing LAN bottlenecks, and reducing time wasted waiting for data.

University of Minnesota

The SAN integrates the Altix cluster with 5TB of storage located on a previously installed SGI® InfiniteStorage TP9400 storage array.

Total Solution Support

The Supercomputing Institute cluster was designed, integrated, and implemented onsite by SGI Professional Services in close cooperation with Voltaire. Mike Moline, the Minneapolis-based SGI System Support Engineer (SSE) heading up the hardware installation, said the Altix 350 cluster was up and running in less than a day. Moline and fellow SSE, John Smith, are also part of a monthly effort to review the SGI hardware needs and efficiencies of the Supercomputing Institute, and will be actively involved in the upcoming InfiniBand interconnect tests. The strong engineering and service relationship between the two companies allows SGI to provide total solution support for the entire Altix 350 cluster, thereby giving University of Minnesota researchers the reassurance that support for their entire cluster solution is available with a single phone call to SGI.

Scientific Tools for the Future

The addition of SGI Altix 350 systems provides a cost-effective mid-range HPC solution that significantly increases the ongoing ability of the Supercomputing Institute to support and promote interdisciplinary research programs for the University of Minnesota. With the convenience of “on-demand” scalability, the Altix 350 system furthers SGI's long-term commitment to delivering the processing power necessary to take on a growing mix of complex data sets and turn them into scientific discovery.

Corporate Office
1500 Crittenden Lane
Mountain View, CA 94043
(650) 960-1980
www.sgi.com

North America +1 800.800.7441
Latin America +55 11.5509.1455
Europe +44 118.925.7500
Japan +81 3.5488.1811
Asia Pacific +1 650.933.3000

3689 [09/29/2004]

J14629