CASE STUDY

QLOGIC®

PSU Builds Top 100 Supercomputer Using SilverStorm 10Gbps Switch Fabric

Technology Challenge

Accelerate the performance of a high performance computing cluster, using commodity networking components

Solution

A 10Gbps InfiniBand fabric using SilverStorm's 3000; Sun, and Dell multi-processor servers

Benefits

- Boosted bandwidth and peak performance by 50% - from 870 gigaflops to 1.3 TeraFlops
- Provided an ultra-scalable infrastructure capable of supporting the most computationally intense applications and workloads
- Implemented the new, higherperformance fabric at a fraction of the cost of a mainframe based machine

The Challenge: Leveraging High Performance Computing To Probe The Universe

Nearly nine decades ago, Albert Einstein predicted the existence of gravitational waves in his general theory of relativity. Today, researchers at The Pennsylvania State University's (PSU) Department of Physics are a part of a breakthrough collaborative effort, the Laser Interferometer Wave Observatory (LIGO), to directly detect and study gravity waves – ripples in the fabric of space/time that emanate from the most violent events the universe has to offer.

PSU maintains a supercomputing cluster known as Pleiades. It is part of the International Data Grid Laboratory, a computational laboratory comprised of computing and storage resources that are linked through high-speed networking and operated as a single system. As part of this grid, Pleiades sifts through data generated by LIGO's interferometers - laser-based instruments that receive and measure waves; interferometers are able to detect a change in space/time as small as a million trillionth of a meter. As LIGO, and other gravitational wave detectors worldwide, generate data streams, Pleiades crunches the inputs and compares them to gravity-wave templates or theoretical predictions of what gravity wave signals might look like.

The computing horsepower required in this quest to detect the first gravity wave is significant; LIGO needs to continually have its stream of data compared against some 20,000 to 30,000 possible signal patterns worked out by theorists. A single, mainframe-based computing machine for this scope of workload is prohibitively expensive, often costing tens of millions of dollars.

The Solution: Infiniband Based Clustering Of Industry Standard Servers

Penn State has opted to build its Pleiades supercomputer much more costeffectively; it has leveraged the technology developments of industrystandard processors from Intel, and married these with high-speed network technologies, to allow many inexpensive, small systems to function as one larger computing entity or cluster.

In its initial phase, Pleiades used a gigabit Ethernet network as its primary interconnect to link 160 low-cost servers from Sun and Dell. With this configuration, the cluster attained over 870 gigaflops (billions of floating point instructions per second) of peak performance. Recognizing that additional computing power was vital to enhancing Pleiades'

"Through the power of the SilverStorm switching systems, we are able to tap the awesome computing power of today's commodity chipsets, and effectively connect them together into a massive computing complex. SilverStorm's software ensures that the cluster is fast, stable, and manageable, mitigating our risk of implementing new technologies."

—Vijay Agarwala, Director of High Performance Computing Penn State University

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capability to accelerate the discovery process, the High Performance Computing Group at PSU's Information Technology Services turned to a more robust interconnect technology: InfiniBand. In January 2004, the Pleiades cluster was upgraded with a 10Gbps InfiniBand-based fabric, using the SilverStorm 3000 from SilverStorm Technology.

The migration to the higher-speed fabric has netted dramatic gains; Pleiades has attained peak performance of 1.3 TeraFlops (trillions of floating points per second). This bandwidth boost now makes it possible to carry out a far larger number of coupled computations on the same number of servers. Due in large part to its InfiniBand fabric, Pleiades is now counted among the world's Top 100 supercomputers worldwide.

Scalable To Thousands Of Nodes

Key to Penn State's selection of the SilverStorm switching series was the inherent scalability of InfiniBand (capable of supporting thousands of 10Gbs links), coupled with the flexible architecture of the SilverStorm solution, which allows optimum configurations that balance latency and bandwidth with application requirements. This level of scalability is not necessarily a farout requirement; upgrades to LIGO interferometers will increase its sensitivity tenfold, enabling LIGO to feel space/time rumbles emanating millions or even billions of light-years distant—and doubtlessly create more data for Pleiades to analyze.

Another key component to the selection was the maturity of the SilverStorm software suite, which provides the ability to install, configure, and manage the computing fabric. With SilverStorm's advanced FastFabric Toolset, the entire 160-node cluster can have software distributed, installed, and brought live in minutes. This means that as advanced technology and feature/functions are delivered over time, the Pleiades cluster can reap those enhancements with minimum disruption.

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