



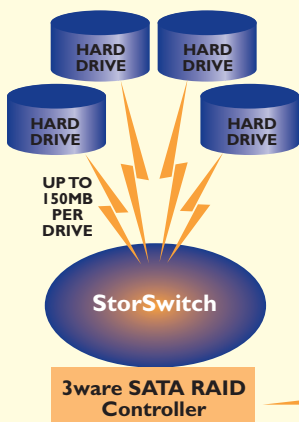
3ware ATA RAID Controllers Support the Supercomputing World

3ware® Supports the Demands of Pittsburgh Supercomputing Center

The 3ware solution offered several critical benefits to PSC's Terascale environment –

- Extraordinary performance thanks to 3ware's unique StorSwitch™ packet switching architecture
- Ease of integration into the existing environment
- Support for open source Linux (an essential factor for PSC)
- Straightforward yet powerful administration and monitoring tools under Linux
- Economic benefit - a storage system that satisfied PSC specifications at a fraction of the cost of competitive solutions

StorSwitch™ Architecture



In the world of supercomputing, Pittsburgh Supercomputing Center (PSC) is home to the most powerful computing system in the United States committed solely to public research. PSC is a collaborative effort of Carnegie Mellon University, the University of Pittsburgh and the Westinghouse Electric Company, and concentrates on providing an environment to the national science and engineering community that offers an integrated array of services and advanced computational capabilities. Users are scientists and engineers nationwide, most with National Science Foundation (NSF) research grants or with support from the National Institutes of Health.

In August 2000, PSC received a grant from the NSF to provide "terascale" computing capability for U.S. researchers in all science and engineering disciplines. PSC used this grant to deploy the Terascale Computing System (TCS) which boasts a peak capability of six teraflops. With three terabytes of RAM, and 70TB of disk storage, this system has 100,000 times the storage capacity, in addition to 10 million times the communications capability, of most PCs. The TCS is by far the most powerful system available as an open resource for researchers attacking a wide range of scientific problems.

Storage Challenges for a Supercomputer

Even with their extraordinary capabilities, PSC faces ongoing challenges in its effort to keep up with technology and satisfy the computational needs of users. Storage capacity and the ability to quickly provide users with requested data became one of these challenges. Active projects (data) are accessed directly from the Terascale system. Inactive data had traditionally been archived on magnetic tape. Users are allowed to keep any amount of data desired, creating a need for huge, low cost archival storage which tape sufficiently satisfied. However, there is a significant amount of data that may not be considered "working data" but is still necessary for users to access regularly for research purposes. Although tape had proved adequate for archival purposes, PSC felt the increased demand for this subset of data would necessitate a second tier of storage between the TCS and tape archival. This led to the development of an extended Hierarchical Storage Manager system (HSM).

Based on non-blocking switching technology, 3ware's StorSwitch architecture provides a dedicated port for each drive, which eliminates shared-bus arbitration and bottlenecks, thus maximizing performance and reliability while improving disk utilization.

“Our second tier of storage is growing by leaps and bounds and we need a highly reliable, cost effective solution to grow with us,” commented Michael Levine, co-scientific director of PSC. “3ware has delivered the performance and availability demanded in a supercomputing environment with ATA technology.”

The Terascale Computing System

SYSTEM: Consists of 750 interlinked Compaq AlphaServer computers housed in 150 6-foot-high cabinets.

SIZE: The 192 cabinets, arrayed in nine rows, occupy 3,500 square feet.

PROCESSORS: Each AlphaServer has four Alpha EV68 processors. Each processor can perform up to 2 billion floating-point calculations per second, or 2 gigaflops.

SYSTEM CAPABILITY: The 3,000 processors can perform up to 6 tera-flops, or 6 trillion calculations per second. Virtually every man, woman and child on earth would have to perform a thousand calculations each second to keep pace.

RANDOM ACCESS MEMORY: 3.0 trillion bytes, or terabytes

SYSTEM STORAGE CAPACITY: 70 terabytes primary storage; 150TB second tier disk storage; 1.6 petabytes on tape.

CABLES: About 6,000. The longest interconnect cable is 33 meters.

POWER DEMAND: Half a megawatt.

COOLING: 500 gallons of chilled water circulates through the computer room each minute, supplying 100 tons of cooling — equivalent to the energy released from melting 100 tons of ice in 24 hours.

PSC Develops Secondary Storage in a Hierarchical Storage Manager System

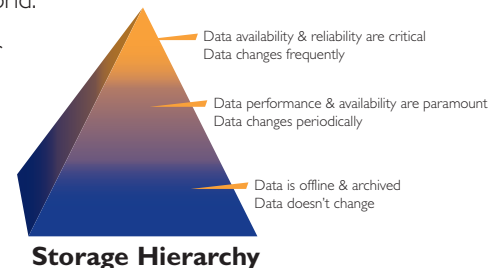
PSC evaluated a number of alternatives for the secondary storage solution including Fibre Channel to Fibre Channel, Fibre Channel to SCSI and Fibre Channel to ATA. After careful analysis they chose the 3Ware Escalade 7500-8 ATA RAID controller. 3ware was uniquely able to meet the storage capacity, performance, and price requirements set forth by PSC. With its unique switching technology and advanced management tools, 3ware demonstrated that ATA could support the intensive requirements of the supercomputing world.

The initial secondary storage installation included four 3ware Escalade 7500-8 controllers each with a full complement of 160GB drives formatted into a seven disk, RAID 5 volume, with one hot spare – a total of close to 4TB of useable ATA storage. Each card's RAID5 volume was partitioned in half and software [RAID] striping in the Linux kernel was used to combine the corresponding half volumes from each card into two useable file systems of nearly 2 terabytes each. The file systems are accessible to users from the Terascale Computing System over PSC's high-speed (400MBytes/s) Quadrics network, as well as externally via Gigabit Ethernet connections.

Another secondary storage system identical to this was built and is now being integrated with a traditional HSM in a unique approach to extending capacity and performance. PSC ultimately plans to supplement the core HSM with another sixteen similar systems with 3ware ATA controllers that can support an additional 150 terabytes of storage.

Success Achieved

PSC users now have ready access to large volumes of high availability data at performance levels they demand. PSC is able to remotely monitor and manage the secondary storage system to ensure reliability. In fact, the 3ware management tools not only alert PSC's IT staff to problems, but also provides them with information enabling preemptive action so problems don't occur. Ultimately, 3ware delivered on all technical specifications – RAID reliability, performance, capacity, and management tools – at a total cost of ownership that couldn't be matched.



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