SLAC
NATIONAL ACCELERATOR LABORATORY

SLAC Deploys Two AMAX StorMax-X3 Petabyte Storage Racks for Data Acquisition

THE CHALLENGE

SLAC National Accelerator Laboratory is home to a two-mile linear accelerator — the longest in the world. Originally a particle physics research center, SLAC is now a multipurpose laboratory for astrophysics, photon science, and accelerator and particle physics research. SLAC explores the ultimate structure and dynamics of matter and the properties of energy, space and time – at the smallest and largest scales, in the fastest processes and at the highest energies – through robust scientific programs, excellent accelerator-based user facilities and valuable partnerships. Enormous amounts of information collected from analyzing vast amounts of research data left SLAC with the need to deploy a large multi-petabyte storage solution.

THE PROBLEM

With the 2 mile linear accelerator, the Linac Coherent Light Source (LCLS) located at SLAC produces pulses of X-rays more than a billion times brighter than the most powerful existing sources, the so-called synchrotron sources which are also based on large electron accelerators. The Photon Controls and Data Systems (PCDS) group at SLAC provides all the computing capabilities needed to operate the Linac Coherent Light Source (LCLS) instruments as well as to acquire and analyze the scientific data generated by these instruments. These acquisition and analysis activities correspond to the three core PCDS subsystem: controls, data acquisition and offline data analysis. The data acquisition system can acquire 2GB/s without introducing dead-time in the system.

In order to quickly, efficiently and reliably store all of the research data generated by SLAC equipment, SLAC engineers required a multi-petabyte storage solution capable of high sustained multi GB/s performance. While raw storage capacity

and high performance was a priority, developing a solution within a limited amount of rack space with redundant storage components at a relatively low cost per storage ratio was also a must for SLAC. Specifically, SLAC required 2 complete racks, each configured as dense one-petabyte usable storage per 42U rack, capable of a sustained 5GB/s read and write performance. SLAC also mandated that the solution be designed with simplicity in mind, such that management, performance tuning and troubleshooting would not require an extraordinary amount of resources. The solution goal was to engineer a high performance multi-petabyte storage solution necessary for SLAC's data acquisition system and also to provide read only access for their computing batch nodes. With limited resources available, SLAC required a total turnkey deployment that would result in a true plug-and-play installation experience. They needed a reliable partner who could quickly deploy high-level engineers to provide expert on-site installation, tuning and troubleshooting to meet their deadlines, as well as a stable company who could support the cluster for a minimum of 5 years for a truly worry-free solution.

THE SOLUTION

AMAX provided all the necessary services and expertise to deliver a complete turnkey working solution to SLAC based on its unique specifications. In order to ensure a successful deployment, AMAX's team of engineers and technical consultants worked with SLAC engineers beforehand to fully understand the requirements of the project, conducting a thorough analysis of SLAC's application and usage to come up with a suitable hardware architecture schematic and proposal. Based off the discussions, AMAX designed a petabyte-scale two-rack storage cluster, based off of the proven AMAX StorMax-X3 to fit SLAC's specific requirements of density, space, budget, performance and functionality with provisioning for future scalability. Once the cluster was built and tested in AMAX's ISO 9001 facilities, AMAX deployed a specialized team of certified HPC engineers with years of experience in network & infrastructure design, integration & configuration to meet the systems and engage in on-site installation and tuning services to help bring the multi-petabyte storage solution online. AMAX's HPC team of experts completed full onsite installation within a tight deadline, including racking the systems, cabling & labeling, configuration and troubleshooting of the server, network and storage components to ensure a fully working storage cluster. Once the installation was complete, SLAC's experience of deployment was as simple and painless as flipping a switch.
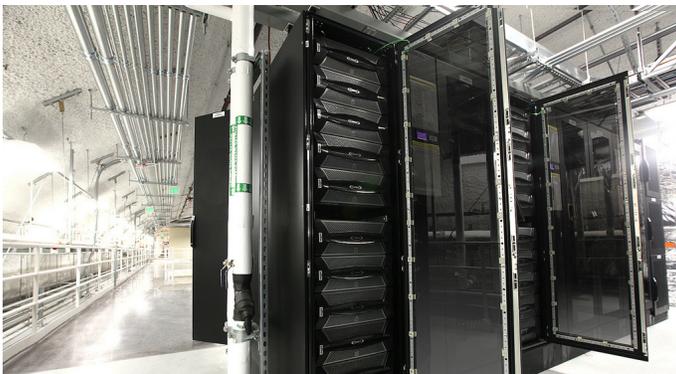
Beyond the setup, what mattered to SLAC was that this system would perform as advertised. In fact, the AMAX storage cluster exceeded the desired performance SLAC had hoped to achieve. "Our testing has shown significant improvement in performance, greatly exceeding our target – and this is before we've spent any effort in fine tuning the storage system," said Ling Ho, Systems Administrator, SLAC. The AMAX StorMax-X3 solution was able to achieve an astonishing 12.6GB/s read & 5.8 GB/s write throughput, more than doubling SLAC's requirement on read performance, and providing 16% more headroom for write performance.

SLAC demanded a solution that was simple to deploy and manage. AMAX's team of engineers developed a solution that not only met this requirement, but exceeded it with superior reliability, facilitating the use of fewer resources. "We had an unplanned power outage a few weeks ago, and the time it took us to bring the AMAX system back up compared to a competing storage system proved, without a doubt, that the AMAX engineered solution and open architecture design is the way to go," remarked Ling. "No file system repairs were necessary for the AMAX solution, while it was necessary to perform multiple RAID and file system repairs on the other."

AMAX was chosen as the supplier for the SLAC National Research Laboratory in part because of excellent pre-sale support, complete understanding of SLAC's requirements, a dedicated team of professional and technical engineers for pre- and post-sales support, a proposal catering to their unique environment, and competitive pricing. AMAX's well-trained IT consultants conducted a thorough analysis of SLAC's application requirements to propose an optimized solution to satisfy all requirements – from density & performance to price & reliability. "The AMAX StorMax-X3 has generated as good, if not better performance compared to the competitor solution," added Ling. "It is the quality and reliability that has proven to be far superior and administration much simpler – all of which goes a long way to differentiate AMAX solutions from its competitors."