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CUSTOMER PROFILE

The Laboratory of Neuro Imaging (LONI) at the University of California, Los Angeles, uses high-performance computing to better understand the structures, functions, and diseases of the human brain. www.loni.ucla.edu

CHALLENGE

Advance the study of brain structure and function through analysis using a scalable high-performance computing (HPC) cluster that delivers exceptional performance without increasing maintenance costs

SOLUTION

Dell Infrastructure Consulting Services (ICS) designed and installed a 60-node HPC cluster using Dell™ PowerEdge™ servers and Dell PowerVault™ disk storage

BENEFITS

The Dell HPC cluster delivers 15 times better performance at a tenth of the maintenance costs of the previous system, enabling LONI scientists to conduct more research within the lab's limited budget; the Dell cluster provides a foundation to upgrade to even faster quad-core processors within the same footprint so the lab can increase processing power in the future

Mapping Minds

A Dell PowerEdge server cluster improves compute performance by 15 times to help advance the study of brain structure and function

At the Laboratory of Neuro Imaging (LONI) at the University of California, Los Angeles (UCLA) School of Medicine, a cross-disciplinary team of more than 100 scientists—including neurologists, biologists, radiologists, mathematicians, and computer scientists—work to advance the understanding of the structures, functions, and diseases of the human brain. By taking detailed neurological images of brain anatomy and activity and using computers to identify patterns among individuals, the scientists at LONI have made important contributions to the understanding of normal brain function as well as schizophrenia, autism, and Alzheimer's disease.

High-performance computing is essential to the research conducted at LONI. The lab's scientists are assembling an enormous database of brain scans, and they are using advanced algorithms to create a representative model of normal brain function. "We execute very complex image and pattern recognition programs on thousands of brain scans," says Dr. Arthur Toga, director of LONI. "Like most researchers, we want to have the most computing power our budgets will allow."

For several years, LONI researchers had relied on older generation SMP and small clusters for their research. But the aging system was not offering the performance, value, and uptime the researchers required. "Our former computing platform had limited processing scalability," explains Toga. "In addition, there was no obvious growth path."



“The Dell ICS team implemented the cluster and performed acceptance testing to ensure that the cluster worked perfectly. The project was completed within two weeks, which helped the researchers continue their research with minimal interruptions.”

— **Dr. Arthur Toga**
Director of the Laboratory of Neuro Imaging
UCLA School of Medicine

Because the lab is funded by research grants, keeping research flowing is essential in maintaining funding. The more research scientists can perform, the more funding they can attract. “Downtime was having a detrimental effect on our researchers’ productivity,” says Toga. “When the older systems went down for maintenance, research computations had to be put on hold.”

Dell servers give new meaning to “high-performance computing”

When evaluating alternatives for a new HPC infrastructure, the LONI staff conducted its research scientifically: the lab sent benchmark tests to all the vendors and collected quantitative results. “The Dell PowerEdge servers performed very well in our benchmark tests, and we felt very comfortable with our working relationship with Dell,” Toga explains. “That relationship is essential, because our research needs are always changing. We have ready access to the Dell support staff for help making quick changes to the cluster.”

Fast installation by Dell keeps research going

Dell Infrastructure Consulting Services (ICS) designed a 60-node HPC cluster to meet the lab’s requirements. Compute nodes were based on Dell PowerEdge servers with two Intel® Xeon® processors. “The cluster was designed to meet our specifications and fit into the limited space available,” adds Toga. “The Dell ICS team implemented the cluster and performed acceptance testing to ensure that the cluster worked perfectly. The project was completed within two weeks, which helped the researchers continue their research with minimal interruptions.”

Dell ICS also trained the LONI IT staff on techniques to manage the cluster. “The Dell ICS consultants had an expert understanding of the cluster management software and the version of Linux we use,” says Rico Magsipoc, chief technology officer at LONI. “Dell really helped accelerate our ability to manage the new platform.”

LONI selected a Dell PowerVault disk storage enclosure as the repository for the brain image database. The 4 TB storage array is linked to the cluster and managed by a Dell PowerEdge server node. “We’ve seen excellent performance from the Dell storage array, and it is impressive to see that

amount of storage in a 3U disk enclosure,” says Magsipoc. “We have experience with storage from several vendors, but the performance of Dell systems is leading us to choose Dell more often. In fact, today, about 80 percent of our research workstations are from Dell.”

Dell HPC cluster helps boost performance by 15 times

The Dell HPC cluster has helped achieve impressive performance gains for the lab. “We’ve seen just phenomenal increases in the amount of work the cluster can do,” says Magsipoc. “The Dell cluster is 15 times faster than the old system. That means our researchers can conduct more analysis, get results faster, and develop more complex software algorithms.”

The new cluster also enables multiple researchers to use the system concurrently. “It is easy to partition the cluster for use by multiple researchers,” says Magsipoc. “The ability to simultaneously support multiple scientists increases the utilization of the cluster and simply increases the amount of research the lab can conduct.”

The new Dell cluster also has proven to be very reliable. “We have yet to experience a server failure, but if it should happen, the cluster management software enables the rest of the cluster to continue to crunch numbers,” notes Magsipoc. “Research is not often considered a ‘mission-critical’ operation, but downtime definitely affects the productivity of our research staff. Their work is so important that we want them to be as productive as possible.”

New Dell cluster cuts maintenance costs by 90 percent

For a research organization with a limited budget, the operating cost savings afforded by the Dell cluster are significant. “The previous system cost more than US\$100,000 per year to maintain,” says Magsipoc. “The Dell HPC, on the other hand, costs less than a tenth of that. That money now goes directly toward funding our research.”

Looking ahead, the LONI team knows that Dell HPC cluster has the scalability to keep pace with research in the future. “Space in our data center is limited, but with Dell servers and storage, we can install quad-core processors in the same form factor, in the same racks,” states Toga. “With many times the processing power, who knows what mysteries of the human brain we may unlock.”



Improved computing performance is not only facilitating more scientific research but also helping the never-ending quest for research grants. "Like other research institutions, our lab depends on our ability to raise money through grants," concludes Toga. "The discoveries we make are what attract grant money. If we can improve our understanding of how Alzheimer's disease affects the brain, for example, we will undoubtedly have additional funding opportunities from government and private foundations. The Dell HPC cluster is the engine behind that research. We could not be more optimistic about the opportunities to sustain this important research well into the future."

HOW IT WORKS

HARDWARE:

- Dell™ PowerEdge™ 1850 servers with Intel® Xeon® processors
- Dell PowerVault™ 220s disk storage enclosure

SOFTWARE:

- NPACI Rocks
- Sun Grid Software

SERVICES:

- Dell Infrastructure Consulting Services



July 2007

Printed in the U.S.A.

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