FOR RELEASE: Wednesday, February 20, 2008

University of Arkansas Installing Supercomputer; 'Star of Arkansas' to Be State's Fastest

Jeff Pummill, administrator for high-performance computing, stands with the Star of Arkansas supercomputer.

FAYETTEVILLE, Ark. - Scientists and engineers at the University of Arkansas will soon be able to conduct complex research projects using a new supercomputer system, dubbed the "Star of Arkansas." Once it is installed later this spring, the Star of Arkansas will be the fastest and most powerful computer in the state, allowing researchers to design vastly more complicated experiments, models and simulations than previously possible. The supercomputer will let scientists and engineers push the boundaries of knowledge in subjects ranging from bird flu to weather prediction.

The purchase of the Star of Arkansas was funded in part with an $803,306 grant from the National Science Foundation, with substantial matching funds from the University of Arkansas, and in partnership with Dell Corp. The supercomputer arrived on campus on Feb. 5, and Dell technicians will install the system later this month. The university's high-performance computing staff and researchers will then spend several weeks testing and evaluating the system.

"Science has reached the point where the key discoveries are possible only by studying extremely complex systems," said Amy Apon, who directs high-performance computing at the university. "These discoveries increase knowledge, of course, but they also fuel

economic development. The Star of Arkansas is essential to the future of both the university and the state of Arkansas."

Stan Ahalt, executive director of the Ohio Supercomputer Center, recently served as an external adviser to the state of Arkansas in the area of the resources and the personnel needed to support supercomputing in the state.

"Computer simulation and modeling, using computers like the Star of Arkansas make the impossible possible," said Ahalt. "These techniques give scientists the opportunity to 'see' and study things that cannot otherwise be seen or studied."

For example, some things are too small, such as molecules, atoms, or quarks; others, too large, like galaxies or even the universe. Some processes, like photosynthesis are too fast, while geological processes, for example, are too slow. Weather and climate are too complex to study except with computer simulation, while experiments involving toxic materials, viruses or earthquakes are a lot safer when scientists use a computer model instead of the real thing. No scientists would be allowed to experiment with actual economies or traffic systems, but they can try anything with a computer simulation, without harming anyone in the real world. Finally, most researchers don't have access to a multi-billion dollar particle accelerator, but with a supercomputer they can simulate the outcomes.

"Practically speaking," said Ahalt, "the Star of Arkansas has the potential to improve Arkansas' economic future through research in areas such as natural gas production, bird flu prevention, rice irrigation, nanotechnology, large-scale transportation and commerce systems, material design, sustainability, and personalized medicine."

The Star of Arkansas is the university's second supercomputer. The Red Diamond supercomputer was installed in 2005, and will continue to be available to researchers. The Star of Arkansas is approximately 8 times faster than the earlier supercomputer, and can hold more than five times the amount of data stored in the entire Library of Congress.

Like Red Diamond, Star will be connected to the Arkansas Research and Education Optical Network, making it accessible to scientists and engineers in Arkansas and the region to collaborate with university researchers. In addition, the supercomputer and optical network enable collaborative courses in high-performance and grid computing, as well as seminars and academic courses, attracting new users and building computational expertise in the region. The Star of Arkansas will also be used to teach undergraduate and graduate students how to perform complex modeling and simulations.

The names, Star of Arkansas and Red Diamond, were chosen as symbols of the state of Arkansas in the realm of new discoveries in science and engineering. Arkansas is the home of the world's only public diamond mine and the eighth largest diamond repository in the world. The Star of Arkansas is the name of one of the largest diamonds found in the state. The color red represents both the University of Arkansas school colors and the Arkansas state flag, which boasts a diamond on a red background.

Video of the Star of Arkansas being delivered to the University of Arkansas can be viewed on You Tube at http://www.youtube.com/watch?v=Ki8zQu6R7SA .

Technical information

The Star of Arkansas supercomputer is built from 157 compute nodes, each with dual quad-core Xeon E5430 processors, 2x6MB cache, 2.66GHz, 1333FSB. There are a total of 1,256 cores, and each core has 2GB of memory. Performance on supercomputers is

measured in "flops," or floating point operations per second. The theoretical peak performance of Star is 13.36Tflops, or 13.36 trillion floating point operations each second.

In comparison, Red Diamond has 256 cores and a theoretical peak performance of 1.638Tflops, with a measured sustained performance of 1.349Tflops.

The Star of Arkansas supercomputer is interconnected with an InfiniBand network that runs at 10Gbps, or 10 billions bits of information every second. The IB switch is from Qlogic and has expansion capacity up to 256 slots, of which only about 160 are used in the current configuration. With this switch additional compute nodes can be purchased incrementally and added to the cluster as additional hardware funds become available. The cluster is interconnected with an additional Gigabit Ethernet network for NFS access, and another Gigabit Ethernet network for management.

The Star of Arkansas has two file systems to handle computational and data-intensive applications. The NFS file system will be used for permanent storage and consists of 4TB of raw disk storage, or more than 4 trillion characters of data. The Lustre file system is used for fast temporary storage. The storage for Lustre comes from Data Direct Networks and includes 21 TB of raw disk storage. In addition, 50 nodes have local storage of 1TB, and 107 nodes have local storage of about 320GB, more than 320 billion characters of data. The total amount of storage potentially available on Star is more than 109TB. In comparison, the Library of Congress has estimated that it stores 20TB of text.

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