Linux Clusters Now Drive Metropolis Center Visualization

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Los Alamos National Laboratory's Nicholas C. Metropolis Center for Modeling and Simulation houses some of the world's most advanced supercomputing systems and hosts several world-class data visualization display facilities. These facilities include an 85-seat PowerWall theater with 24 Christie Digital Mirage Model 2000 projectors producing 31 million pixels spread across a 22 × 12-ft display screen. There is also a five-surface (left, front, right walls with floor and ceiling) display called La Cueva Grande (the big cave), with 33 Mirage projectors lighting 43 million pixels in a 15 × 12 × 10-ft display area. These facilities and direct KVM (keyboard-video-mouse) connections to the scientists' offices easily enable researchers to compute and analyze their data and share results with colleagues and sponsors. Until recently, these facilities were driven by large SGI (Silicon Graphics, Inc.) supercomputer systems designed and installed in the late 1990s as part of the DOE Accelerated Strategic Computing Initiative (ASCI) 1.608 teraFLOPS Blue Mountain system.

We have replaced three SGI Origin 2000 supercomputers and one (newer) SGI Onyx 4 3900 with a 264-node HP (Hewlett Packard) Linux cluster system we call ViewMaster. This system is based on the HP xw8200 workstation with the high-end Nvidia Quadro FX 4500 graphics cards that are more than 100 times faster than the SGI system's graphics hardware. We have dedicated 25 nodes in this cluster to drive the PowerWall theater and another 34 nodes are assigned to drive La Cueva Grande. This new technology allows us to visualize much larger data sets much more rapidly. We have waited a long time for cluster technology to be available that would allow us to assemble this system.

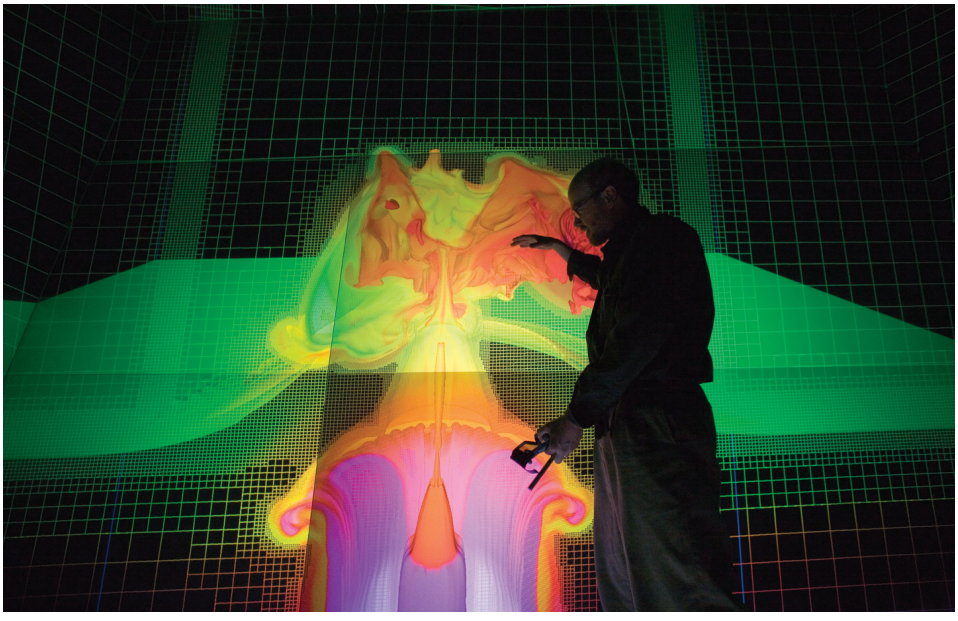

Fig. 1.
HPC-4 staff in an immersive CAVE visualization.

State-of-the-art computer graphics visualization and analysis requires enormous computing capability, including large amounts of memory per CPU, a high-speed network interconnect between the nodes in the cluster, and a high-end graphics card that is capable of 3-D stereo imaging with Frame Lock technology. Stereo imaging is a technology that allows us to display images in so-called "stereo pairs" (one image is rendered for the left eye and another image is rendered for the right eye of the observer). We use StereoGraphics CrystalEyes 3-D glasses and a synchronization signal from the graphics system to synchronize the glasses with the display screens.

Frame Lock is a technology that allows us to configure computer graphics hardware where images on different systems are synchronized so that each rendered frame spread across the display surface is locked and the images update together. Without this technology, 3-D stereo multipanel displays would be "out of sync" with the other panels, thus the whole displayed image would seem "jumpy." The SGI equipment from the 1990s provided us with Frame Lock 3-D stereo capability. Cluster technology, just recently available, allows us to update the systems we use for 3-D stereo multipanel display visualization work.

In December 2006 we completed the transition from the SGI systems to the HP/Nvidia-based Linux cluster.

For more information please contact David Modl at digem@lanl.gov.

Funding Acknowledgements
This research was supported by the NNSA tri-Lab Advanced Simulation and Computing Program.

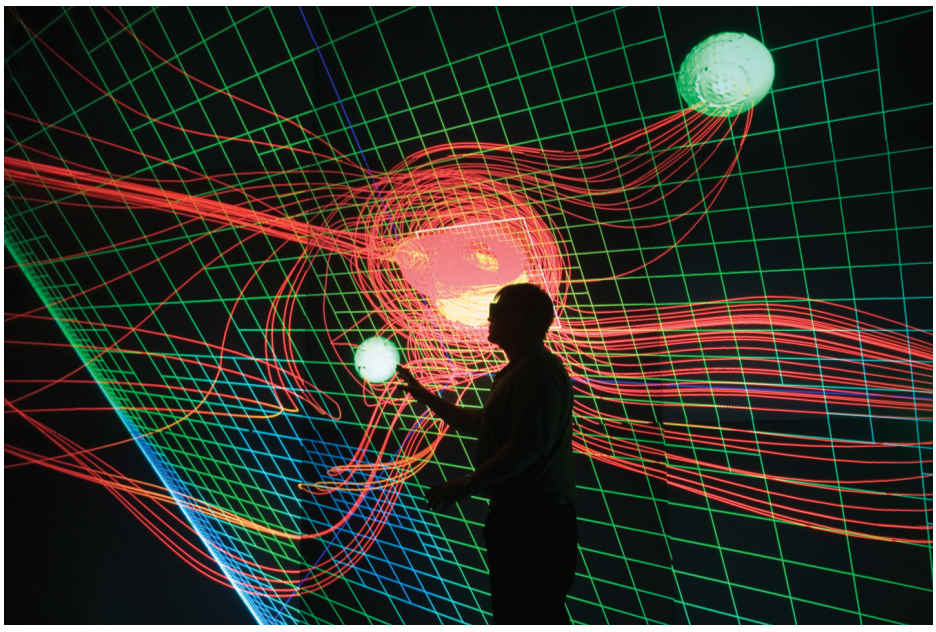

Fig. 2.
A demonstration simulation in the CAVE.

Photos by L. Sanchez