ORNL.site.survey.2003

1. General Identification

Site name: Oak Ridge National Laboratory
Site Division or Group: Computer Science and Mathematics Division
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2. What Does Your Group Do?

Define the ongoing mission of your site and group.

ORNL's Computer Science and Mathematics Division (CSMD) performs basic and applied research in high-performance computing, applied mathematics, and intelligent systems. Research groups in CSMD explore computational solutions for climate, Genomes to Life (GTL), biology, chemistry, material science, and nanotechnology, as well as network and cluster computing, and tools for high-performance heterogeneous distributed computing, including component technology and basic visualization research. We hope to create a formal "Visualization Research Group" as our program grows.

ORNL's Center for Computational Sciences (CCS) houses a state-of-the-art high-performance computing facility, for production scale scientific simulation runs including data archiving, analysis and visualization. As part of the growing Genomes to Life (GTL) effort, ORNL will supplement its mass storage capabilities to hold and serve petabytes of genomic data.

Describe the past year's activities of your group.

ORNL has been involved in a number of production visualization efforts, in support of DOE SciDAC and other scientific applications, including but not limited to astrophysics (TSI - Terascale Supernova Initiative), climate (CCSM - Community Climate System Model), and fusion.

Visualization research efforts have been ramping up the past year at ORNL. We hired Stewart Dickson from Disney Animation using ORNL Strategic Hire LDRD funds for research in application-specific visualization and large-scale display hardware, and have built a collaborative relationship with Prof. Jian Huang (Univ. Tennessee) and Prof. Han-Wei Shen (Ohio State), including several summer student interns and a potential postdoc.

On the software side, the CUMULVS system (a software infrastructure for interacting with scientific simulations for visualization, computational steering and application fault tolerance) has been applied with the SciDAC Common

Component Architecture (CCA) effort to produce rudimentary parallel data exchange and visualization components. Research into a parallel rendering algorithm using occlusion culling was performed by Ms. Jinzhu Gao (OSU, ORNL summer intern), culminating in a paper for Vis 2003. Two proposals have been submitted to DOE MICS, one for research into a parallel image-based rendering algorithm for remote visualization (for postdoc Lining Yang, OSU). The second proposal is to explore the "Scalable Visualization Cache", an integrated data analysis and visualization architecture that utilizes collections of computational clusters to incrementally analyze, reduce and render very large data sets for interactive exploration.

On the hardware side, we have assembled a small "viz cluster" to drive our CAVE, as an alternative to the SGI Origin 2000. This simple (and inexpensive :-) 5-node system consists of 1.5GHz dual-AMDs with Nvidia 750 XGL and software gen-lock.

What are the plans and priorities for the upcoming year?

The coming year will (hopefully) see an explosion of activity in visualization infrastructure and research, as ORNL steps up to support the growing SciDAC application visualization needs, as well as impending Cray X-1 evaluation experiments. We hope to begin the development of a Viz Cache prototype, along with continued scalable rendering algorithm development. We're planning on building several powerwalls and converting our CAVE into a pseudo-RAVE, upon moving into our new Computational Sciences Building (CSB) at ORNL this summer, where we'll have a 36'x59' CAVE lab as well as a 14'x24' general viz lab.

3. What's in Your Stable?

Hardware:

CAVE
- 5-node 1.5GHz dual-AMD viz cluster
  * Nvidia 750 XGL and ATI FireGL4 cards
- 32 processor SGI Origin 2000
  * 3 infinite reality pipes

ImmersaDesk
- 1.5GHz dual-AMD node, Nvidia 750 XGL

IBM T221 "Big Bertha" Monitor

Xtreme TORC (XTORC) Cluster
- 64 2GHz IBM PCs @ 768MB RAM
- 2 head nodes: 2GHz @ 1GB RAM, Dual GigE and T100.

Software:

Ensight
Chromium
Virginia Tech's DIVERSE
AVS/Express & AVS 5.3

Current Staff?

Ross Toedte (100%)
- Production Viz, Astrophysics
- Facility Manager

Stewart Dickson (100%)
- Viz Research, GTL/Bio

- Large Displays

Ray Flanery (50%)
- Viz Lab Administration

George Fann (-10%)
- Leader, ORNL Visualization Task Force

Jim Kohl (10%)
- HPC Infrastructure in support of Viz

4. Planned acquisitions in:

Hardware:

Mini-Powerwall (short term)
- 4 high-quality projectors, t.b.d. (est. $30K ea)
- 12 node HP/Compaq Sepia cluster (requested)
  * 4 display nodes, 8 back-end nodes.
- Shmem Server, 8 CPU, 64GB RAM, Madison or Optiron
  * CEI Ensight

Powerwall
- 12 Christie projectors (est. $12K ea), 10'x7.5' glass
  * passive stereo
- 2 IBM SGE3 pixel compositors (4 dual DVI out ea)
- 12 PC viz cluster
  * Dual P4 / Optiron / Madison...? (est. $8K ea)
  * Nvidia NV30 or Quadro4 1000XGL...?
  * 4GB DDR, hardware raid, GigE Jumbo or Infiniband

CAVE foldout wall brackets and actuators (pseudo-RAVE)
- custom, local company, $10K
- upgrade PCs/cards/network, $40K

Also, we are acquiring an SGI Altix system and a PC-based cluster, appropriately sized to serve CCS's data analysis and visualization needs.

Software:

ParaView / Parallel VTK, Ice-T (SNL)
- including integration with Chromium / SGE3 / Sepia...

Terascale Browser...
OpenDX?

Personnel:

Postdoc - Lining Yang, Ohio State

5. Miscellaneous:

Describe how you are using the Web and related tools at your site.

Using standard Access Grid technology for tele/videoconferencing. Plans to explore more powerful remote and distributed visualization algorithms and protocols, possibly using variants on image-based rendering.

Also, surfing NewEgg.com for spare parts. :-)

Describe one positive experience with a vendor this past year.

Acquisition of Cray X-1 system for evaluation, including a well-organized usage tutorial.

Describe one negative experience with a vendor this past year.

But that would be wrong.

Anything else to say?

What could you possibly want with a Petabyte?
Where would you put it?!
(Hopefully at ORNL soon... :-)

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