National Energy Research Scientific Computing Center (NERSC)

Visualization Tools and Techniques on Seaborg and Escher

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• NERSC has visualization capabilities?
• Overview of NERSC visualization resources.
  – The Visualization Group.
  – Escher.nersc.gov.
  – Software resources.
• Talk focus: remote visualization strategies
  – Render remote, render local, and hybrid strategies.
  – Pipelined-parallel remote visualization using escher or seaborg and CEI’s Ensight (Cristina’s talk).
• Request: provide feedback on the annual survey.
The Visualization Group

- Website: [http://vis.lbl.gov/](http://vis.lbl.gov/)
- Email: vis@lbl.gov
- Visgroup Staff: Cristina Siegerist, John Shalf, Wes Bethel
- USG Staff: Harsh Anand, David Turner

Scope of activities:

- Institutional visualization support for the NERSC user community in the form of in-depth collaborative relationships to **provide solutions where none exist.**
- Technology pathfinding to determine solutions for tomorrow’s data analysis and visualization challenges.
Recent Collaborations
Recent Collaborations, ctd.
Accelerator SciDAC
NERSC Visualization Resources

Escher.nersc.gov – Visualization Server

• Dedicated for interactive analysis and visualization.
  – SGI Onyx3700 (upgraded in 2002)
    • 12x 600Mhz R14K MIPS CPUs
    • 24GB of RAM!!
    • 4TB of scratch disk (no quotas)!!
    • Dual IR4 graphics accelerators.
    • Dual GigE channels to HPSS (use hsi to move data).

• Performance notes:
  – Our internal benchmarks show ~1GB/s read rates from and ~600MB/s in write rates to escher’s local scratch storage.
  – Internal system bus bandwidth of about 1.2GB/s (cc-NUMA).
  – SMP system supports MPI as well as shmem/threaded codes.
  – (Escher is an I/O monster!)
NERSC Visualization Resources
Visualization Software

• See [http://vis.lbl.gov/NERSC/Software](http://vis.lbl.gov/NERSC/Software) for a complete list.

• Taxonomy:
  – Applications for interactive 2D and 3D visualization
    • 3D – CEI Ensight, IDL, AVS, AVS/Express.
    • 2D – Gnuplot, IDL, grace, gsharp.
  – Psuedo-development/programming environments: IDL, AVS, AVS/Express, vtk.
  – Image manipulation and format conversion.
Remote Visualization Tactics

- **Render Remote**
  - Move images:
    - setenv DISPLAY
    - SGI’s Vizserver
  - Data too big to move.

- **Render Local**
  - Move data
    - ftp, scp
    - Logistical networking

- **Hybrid approaches**
  - Move “vis results” for local rendering
  - CEI’s Ensight
Remote Visualization Tactics

Which Approach is Best?

- It depends, but we provide you with options in each category to best meet your needs.

- Some questions to consider:
  - Is moving the data even an option?
    - Do you have adequate local storage?
    - How long will it take to transfer the data?
  - Do you need a quick look, or will you perform repeated analysis?
  - Will you be performing solo analysis, or do you require the ability to perform collaborative visualization?
  - Does NERSC provide the analysis capabilities you need?
Remote Visualization Tactics

Render Remote

- Render pixels at NERSC, send images to your workstation.
  - Performance sensitive to network latency and bandwidth.
  - Count on no more than about 10fps at best.
  - Setenv DISPLAY yourworkstation:0

  - (BETA) Alternative implementation: SGI’s Vizserver
    - Uses escher’s graphics hardware to accelerate rendering.
    - Aggressive compression to achieve best possible fps throughput over a given network link.
    - Requires installing a Vizserver client on your workstation, all popular client architectures are supported (Windows, Linux, etc.)
    - Upper performance bound imposed by network latency and bandwidth. E.g.: 50ms one-way latency produces limit of 10fps.
Remote Visualization Tactics

*Render Local*

- Move data to your workstation, and run your analysis/vis locally.
  - Assumes it is possible/feasible to move data to your workstation.
  - Best for demanding, low-latency 3D interactive visualization tasks.

- *(BETA)* Need applications? NERSC is now offering remote use of licensed vis software for NERSC-hosted projects. For more information:
  - [http://www.nersc.gov/nusers/services/licenses/](http://www.nersc.gov/nusers/services/licenses/)
  - Requires you to install the app on your workstation. No NERSC help is available for that activity.
Remote Visualization Tactics

Hybrid Strategies

• Perform some visualization processing at NERSC, and then the rendering on your workstation.
  – Best for data intensive visualization where high frame rates are required.
  – Can leverage parallel platforms (escher, seaborg) at NERSC for high aggregate I/O rates and processing capabilities.

  – Cristina’s talk will explain how to do exactly this using escher and a workstation to implement a visualization task that is too large to fit on a workstation.
Distributed, pipelined-parallel remote and collaborative visualization with PPPL.
The Future (Next Year)

- **Technology “harvesting”**
  - VisIt from ASCI Views Program
  - ParaView from Kitware

- **Remote license server**
  - May increase demand for licensed software (a good thing).

- **User Collaborations**
  - Biggest challenges are in areas that combine data management and data analysis.
  - Pipelined-parallel architectures.
  - Fundamental visualization “magic.”

- **Deployment of Portal-Based Applications**
  - QTVR-like encoder; place more burden on the client while emphasizing retained-mode approaches.
The End

Comments/Questions while Cristina is setting up?

Did I remember to submit that big job?