



# National Energy Research Scientific Computing Center (NERSC)

## Visualization Tools and Techniques on Seaborg and Escher

Wes Bethel & Cristina Siegerist  
NERSC Center Division, LBNL  
24 June 2004



# Outline

- **NERSC has visualization capabilities?**
- **Overview of NERSC visualization resources.**
  - The Visualization Group.
  - [Escher.nersc.gov](http://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 Ensign (Cristina's talk).
- **Request: provide feedback on the annual survey.**



# NERSC Visualization Resources

## Staff

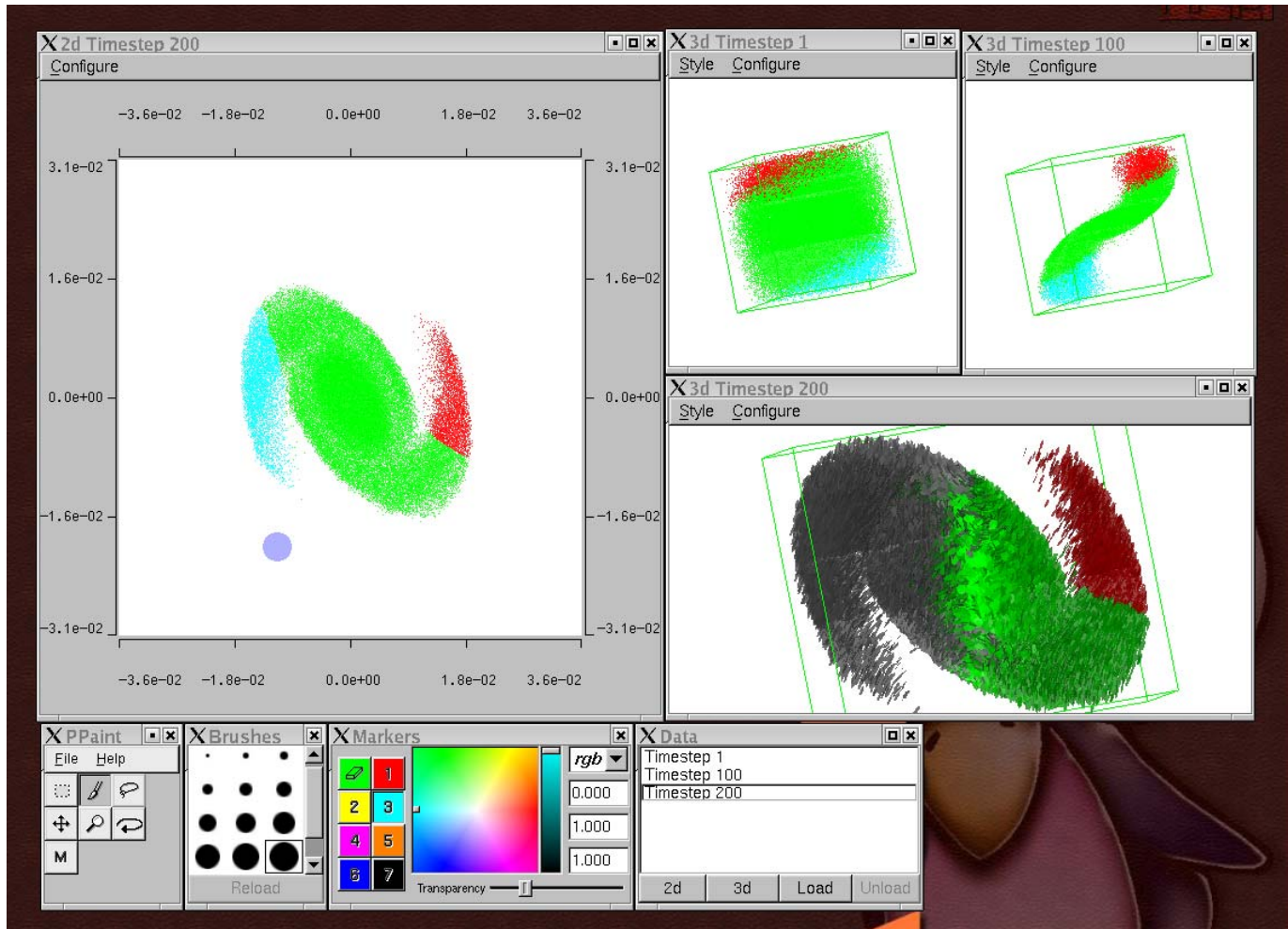
- **The Visualization Group**
  - Website: <http://vis.lbl.gov/>
  - Email: vis@lbl.gov
  - Visgroup Staff: Cristina Siegerist, John Shalf, Wes Bethel
  - USG Staff: Harsh Anand, David Turner
  - Scope of activities:
    - Institutional visualization support for the NERSC user community in the form of 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, ctd.

## Accelerator SciDAC







# NERSC Visualization Resources

## *Escher.neresc.gov – Visualization Server*

- **Dedicated for interactive analysis and visualization.**
  - <http://www.neresc.gov/nusers/resources/servers/escher.php>
  - **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!)



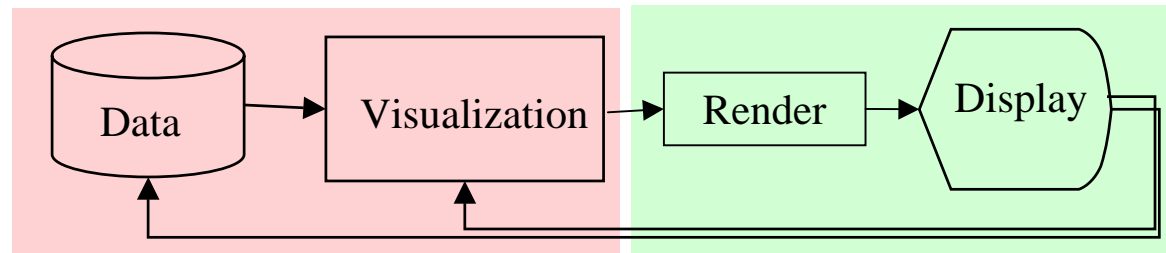
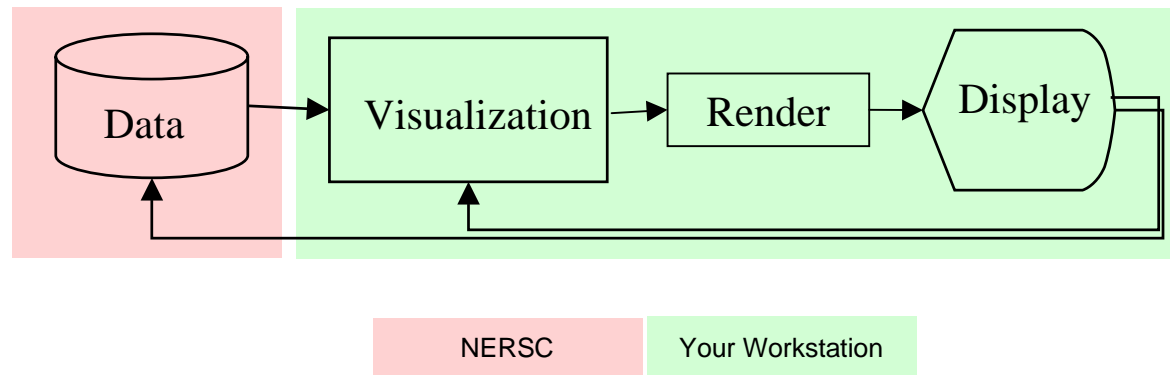
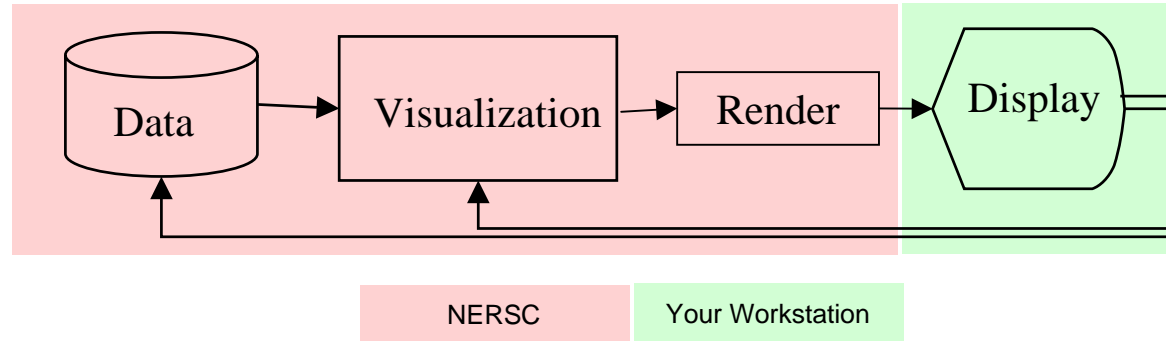
# NERSC Visualization Resources

## *Visualization Software*

- See <http://vis.lbl.gov/NERSC/Software> for a complete list.
- Taxonomy:
  - Applications for interactive 2D and 3D visualization
    - 3D – CEI Enight, IDL, AVS, AVS/Express.
    - 2D – Gnuplot, IDL, grace, gsharp.
  - Domain-specific applications – molecular visualization: VMD, garlic, rasmol.
  - 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 Enight







# 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/users/services/licenses/>
    - Requires you to install the app on your workstation. No NERSC help is available for that activity.



# Remote Visualization Tactics

## *Hybrid Strategies*

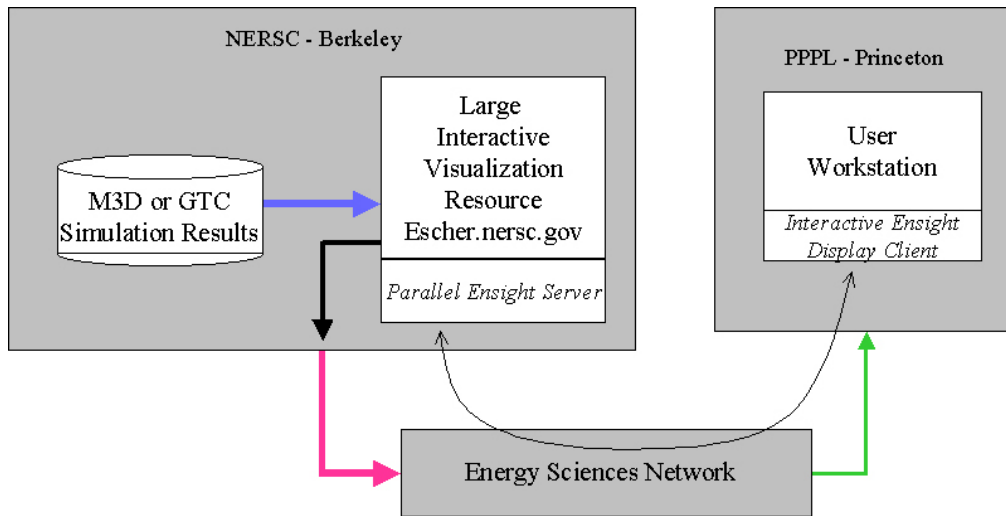
- **Perform some visualization processing at NERSC, and then the rendering on your workstation.**
  - Best for data intensive visualization where high frame rates are required.
  - Can leverage parallel platforms (escher, seaborg) at NERSC for high aggregate I/O rates and processing capabilities.
  -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



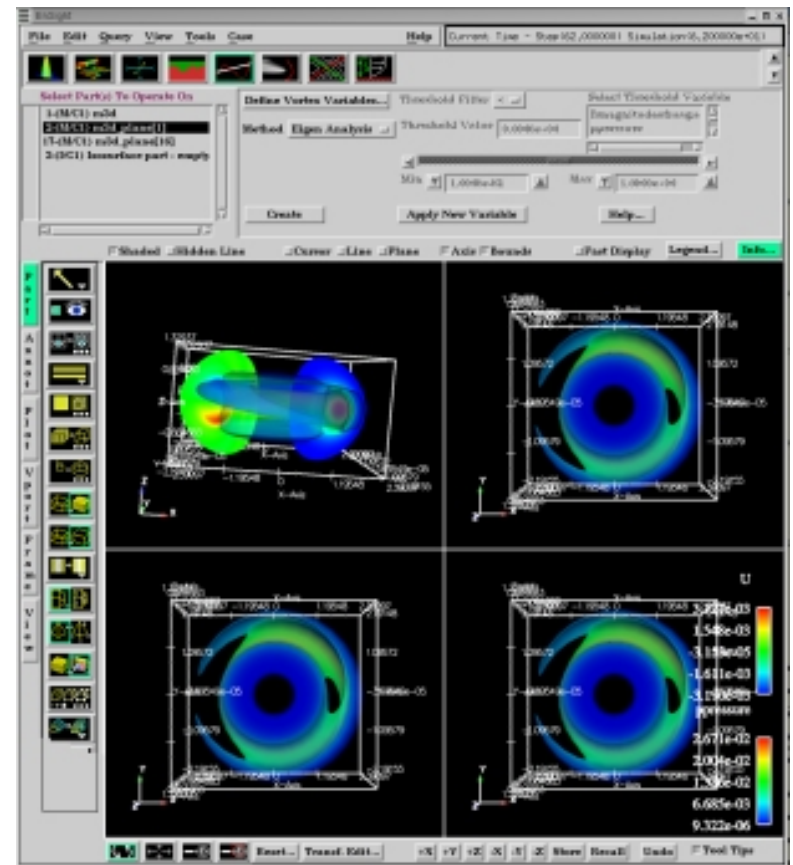
# Remote Visualization Tactics

## Hybrid Strategies, ctd.

- Distributed, pipelined-parallel remote and collaborative visualization with PPPL.



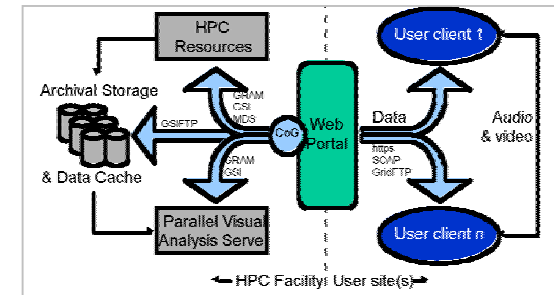
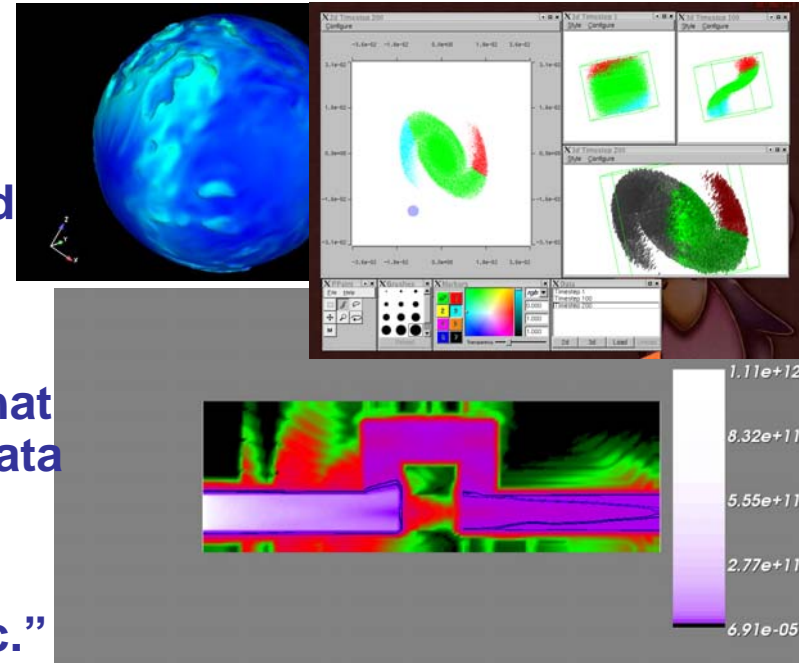
- ➡ Fiberchannel RAID, 2GB/s
- ➡ Gigabit Ethernet, 1Gb/s
- ➡ Esnet OC-48, 2.4 Gb/s
- ➡ Esnet OC-3, 135Mb/s
- ➡ Logical TCP connection, control and geometry





# 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?

