Welcome to NICS
Bruce Loftis
National Institute for Computational Sciences

University of Tennessee and ORNL partnership

- NICS is the 2nd NSF Track 2 center
  - Builds on strengths of UT and ORNL
- NICS operates the first academic petascale supercomputer in the world
Guiding Considerations at NICS

- Leverage NICS resources to enable a wide range of computational science: small to petascale
  - Cray architecture, Accelerators, Data analysis
- Work-force development
- Collaboration with partners – cyberinfrastructure development, operational policies and procedures, training, outreach, documentation, proposal opportunities, ...
- Nationwide outreach including State of Tennessee
HPC Has a Lot of Moving Parts
Kraken

- legendary sea monsters of gargantuan size said to have dwelt off the coasts of Norway and Iceland
Kraken Becomes First Academic Machine to Achieve Petascale

- The first academic system to surpass a thousand trillion calculations a second, or one petaflops, a landmark achievement that will greatly accelerate science and places Kraken among the top five computers in the world
- Peak performance of 1.03 petaflops
- Nearly 100,000 compute cores
- 129 terabytes of memory
- Researchers are running some of the world’s most sophisticated 3-D scientific computing applications on Kraken
Keeneland: National Institute for Experimental Computing

Keeneland Project

- Five-year, $12 million TeraGrid Track-2D grant awarded to GaTech by NSF for the deployment of an experimental high performance system

- Initially acquire and deploy a small experimental system with NVIDIA Fermi accelerators

- Develop scientific libraries and programming tools to facilitate science and engineering research applications.

- In 2012, upgrade the heterogeneous system to a larger and more powerful system based on a next-generation CPU platform and NVIDIA accelerators.

- It is anticipated that the final system will have a peak performance of roughly 2 petaflops.
Remote Data Analysis and Visualization Center

- RDAV will provide a range of software services including:
  - SGI Ultraviolet
    - 1024 processors – 4 TB memory
  - TeraGrid XD Core Services
  - Remote visualization and image generation
  - Interactive and batch image generation tools
  - Remote parallel visualization (VisIt, ParaView, ...)
  - Tools for custom application development

- Data analysis and statistical analysis
  - Octave, Parallel R, Matlab, ...

- Workflow systems

- Portal system
Challenges at NICS

- Helping researchers take advantage of multicore architectures
- Adapting scientific codes to use new technologies
- Moving and analyzing mass quantities of data
- Space, power, and cooling
- Storage
- Economic development in State of Tennessee
Exponential Growth of Stored Data at ORNL

1\textsuperscript{st} PB = 3,046 days
2\textsuperscript{nd} PB = 608 days
3\textsuperscript{rd} PB = 186 days
4\textsuperscript{th} PB = 129 days
5\textsuperscript{th} PB = 92 days

Data is doubling every year
Allocations by Discipline

- **Physics** - 130, 73M, 30%
- **Atmospheric Sciences** - 510, 20%
- **Astronomical Sciences** - 120, 13%
- **Molecular Biosciences** - 410, 12%
- **Chemistry** - 140, 4%
- **Earth Sciences** - 520, 4%
- **Advanced Scientific Computing** - 340, 4%
- **Materials Research** - 150, 3%
- **Staff Accounts** - 940, 4%
- **Chemical, Thermal Systems** - 610, 2%
- **Cross-Disciplinary Activities** - 360
- **Design and Manufacturing Systems** - 640
Southern California Earthquake Center
An International, Dedicated High-End Computing Project to Revolutionize Climate Modeling

Collaborators

<table>
<thead>
<tr>
<th>Collaborator</th>
<th>Description</th>
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<tbody>
<tr>
<td>COLA</td>
<td>Center for Ocean-Land-Atmosphere Studies, USA</td>
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<tr>
<td>ECMWF</td>
<td>European Center for Medium-Range Weather Forecasts</td>
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<tr>
<td>JAMSTEC</td>
<td>Japan Agency for Marine-Earth Science and Technology</td>
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<tr>
<td>UT</td>
<td>University of Tokyo</td>
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<tr>
<td>NICS</td>
<td>National Institute for Computational Sciences, University of Tennessee</td>
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Project
Use dedicated HPC resources at NICS – to simulate global climate change at the highest resolution ever

Expected Outcomes
• Better understand global mesoscale phenomena in the atmosphere and ocean
• Understand the impact of greenhouse gases on the regional aspects of climate
• Improve the fidelity of models simulating mean climate and extreme events

Codes

<table>
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<tbody>
<tr>
<td>NICAM</td>
<td>Nonhydrostatic, Icosahedral, Atmospheric Model</td>
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<tr>
<td>IFS</td>
<td>ECMWF Integrated Forecast System</td>
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We Can’t Do Everything !!
Southern California Earthquake Center

Dynamic Rupture simulation showing location of fault surface slip, wave propagation, and ground velocities.
Center for Analysis and Prediction of Storms (CAPS) – U of Oklahoma

- Providing Athena in dedicated mode for 8 hours, 5 days a week for the CAPS 2010 Spring Forecast Experiment
  - Producing 1-km and 4-km resolution continental US scale real-time weather predictions

- Using new version of WRF and Advanced Regional Prediction System (ARPS)

08 May 09 Forecast
High Performance Computing

Time Was Invented To Keep Everything from Happening All at Once

— Anonymous
I'd like to start with a diagram.

It's a bunch of shapes connected by lines.

Now I will say some impressive words.

Synchronized incremental digital integrated dynamic e-commerce space.

Any questions?

May I have a copy of your presentation?

The results of my experiment are disturbing.