High Performance Computing and Data Visualization using Graphics Processing Units for Oklahoma Researchers

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Evan Lemley, Ph.D.
Asst. Dean, UCO College of Mathematics and Science
Prof., Department of Engineering and Physics

UNIVERSITY OF CENTRAL OKLAHOMA

Rationale

Computational and Data-Enabled Science and Engineering (new NSF term for Computational Science)

- ***Applications:*** Finite Element, Stochastic Simulation, CFD, Informatics, GIS, phylogeny, multiscale modeling, etc...

Platforms and Statewide Infrastructure

- Individual PC's and Macs
- Workstations

Clusters for problems where network latency is too much

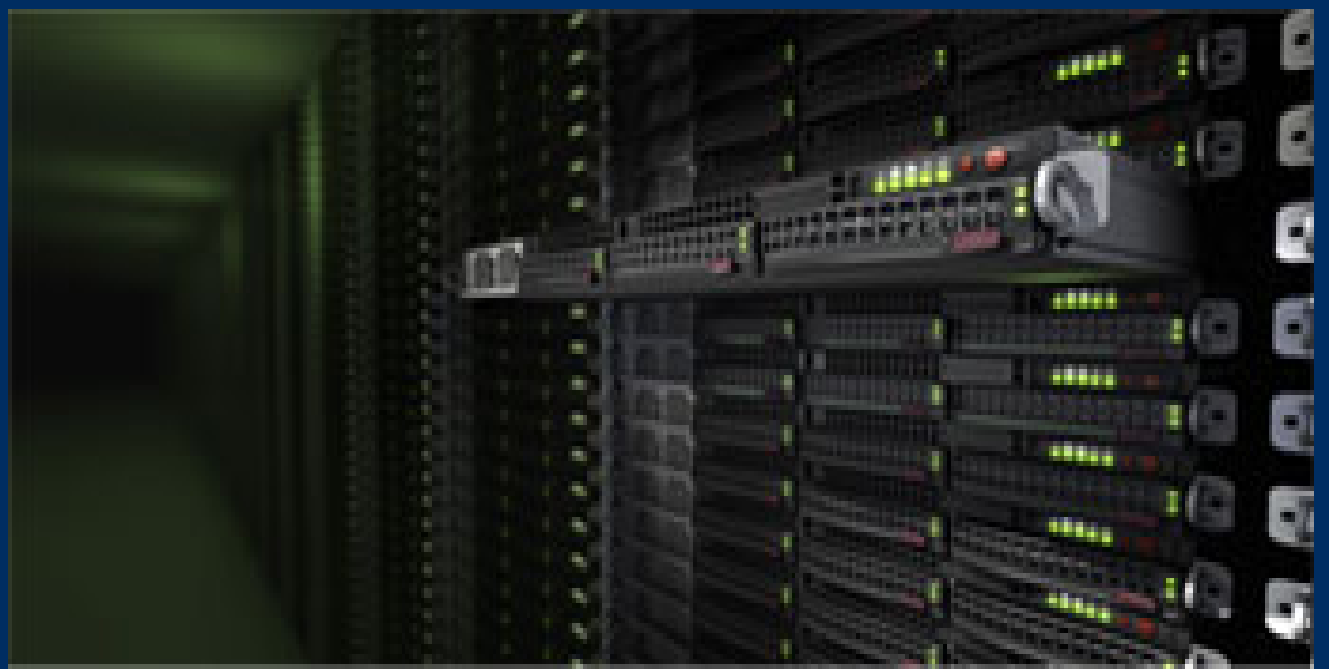
- Specific Research-Dedicated Clusters
- General Purpose Clusters available to many
- General GPU Clusters
- Visualization Clusters

ONE GPU CARD

Tesla - M2070

- 448 cores per card
- 515 GFlops DP
- 1030 GFlops SP

How many cards?



Graphics Processing Units

We probably all have them in our laptops and soon in our cell phones

PC Gamers Drove Development

- NVIDIA, AMD/ATI/, Intel (new)
- Lots of parallel processing units
- Very fast for vector calcs
- single precision, but.... new ones support double
- take advantage of local cache and fast dram connect to gpu
  - First success was with Molecular Dynamics
- program with CUDA - parallel programming architecture
- MATLAB and Mathematica support now!
- ANSYS will be supporting more and more

GPU == Real-time graphics rendering = VIS

UCO

- PUI
- Dynamic Metropolitan University
- Very Involved in Undergraduate Research
- Significant Number of Faculty Collaborating with OU, OSU, Others
- 48% growth in STEM majors in last five years
- GPU hardware plans
  - Computational NSF MRI resubmittal in Jan 2012
  - INBRE Equipment Grant submission in Jan 2012
  - Others (price point on small-expandable cluster is good)

Training Graduate Students ***and*** Oklahoma's Workforce
Large Percentage of Bachelor's working in OK are UCO grads.

Current Projects

- Microfluidics
- Blood Flow near renal artery aneurysms (with OU)
- Eco-niche modeling
- Solving Hamilton's Equations with a Hydrodynamics formulation
- Pore scale two-phase transport Lattice Boltzmann (with OU)
- Medical Image Processing
- Algorithms for gene database searching
- Spinal Column Modeling
- Molecular Dynamics

GPU Project has been discussed with Dr. Neeman at OU and Dr. Brunson at OSU (each will serve on our NSF MRI Advisory Board)

Other Projects: OU, OSU, Regionals, Privates