Enabling Computational Research and Education at the University of Central Oklahoma

Oklahoma Supercomputing Sympoisum
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UNIVERSITY OF CENTRAL OKLAHOMA

Overview

- Background
- College of Mathematics and Science (CMS)
- CREIC
- MRI

Background

- UCO est. in 1890 - Normal Territorial School for Teacher's
- Became a Univ. (with MS programs) in 1971
  - Central State Univ.
- Became UCO in 1990
- Currently 17,000 students
- Recognized as a Metropolitan Univ.

Background

- Colleges
  - Business, Fine Arts & Des., Education and Prof. Studies, Liberal Arts, *Math and Science*
- Coll. of Math and Sci. contains all STEM majors -- over 50% growth in CMS majors over last 7 years.

College of Mathematics & Science

- CMS for short
- House of STEM
- 7 departments
  - Biology
  - Chemistry
  - Computer Science
  - Engineering & Physics
  - Funeral Service
  - Mathematics & Statistics
  - Nursing
- ~ 3,300 undergraduates
- ~ 75 graduate students (Master of Science)
- ~ 100 full-time faculty

College of Mathematics and Science

- Dean, Dr. Charlotte Simmons
  - Previous Dean, Dr. John Barthell is now Provost and VP of Acad. Affairs
- CURE-STEM
  - Center for Undergraduate Research and Education in STEM - ⅓ of faculty involved
- CIBER *(Dr. Wei Chen - Asst. Dean)*
  - Center for Interdisciplinary Biomedical Education and Research - 20% of faculty are members
- CREIC *(Dr. Evan Lemley - Asst. Dean)*
  - Center for Research and Education in Interdisciplinary Computation - 20% of faculty

College of Mathematics and Science

- Undergraduate Research (UGR)
  - Strong theme in CMS and UCO-wide

- NSF-funded *STEP* Program
  - STEP = STEM Talent Expansion Program
  - Summer Bridge (STEP@UCO) -- incoming freshmen work with faculty and UCO students on research projects before starting their first class at UCO.

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CREIC (Center for Research and Education in Interdisciplinary Computation)

- Overarching Goals
  - Research Education (Workforce Devel.)
  - Attract Top Notch Faculty & Students
  - Increase Faculty Research Productivity
  - Return on Investment - grant productivity
  - Student Retention Through UGR Opportunities
  - Create Interdisciplinary Opportunities
  - STEM Enhancement - complement existing programs with computational component

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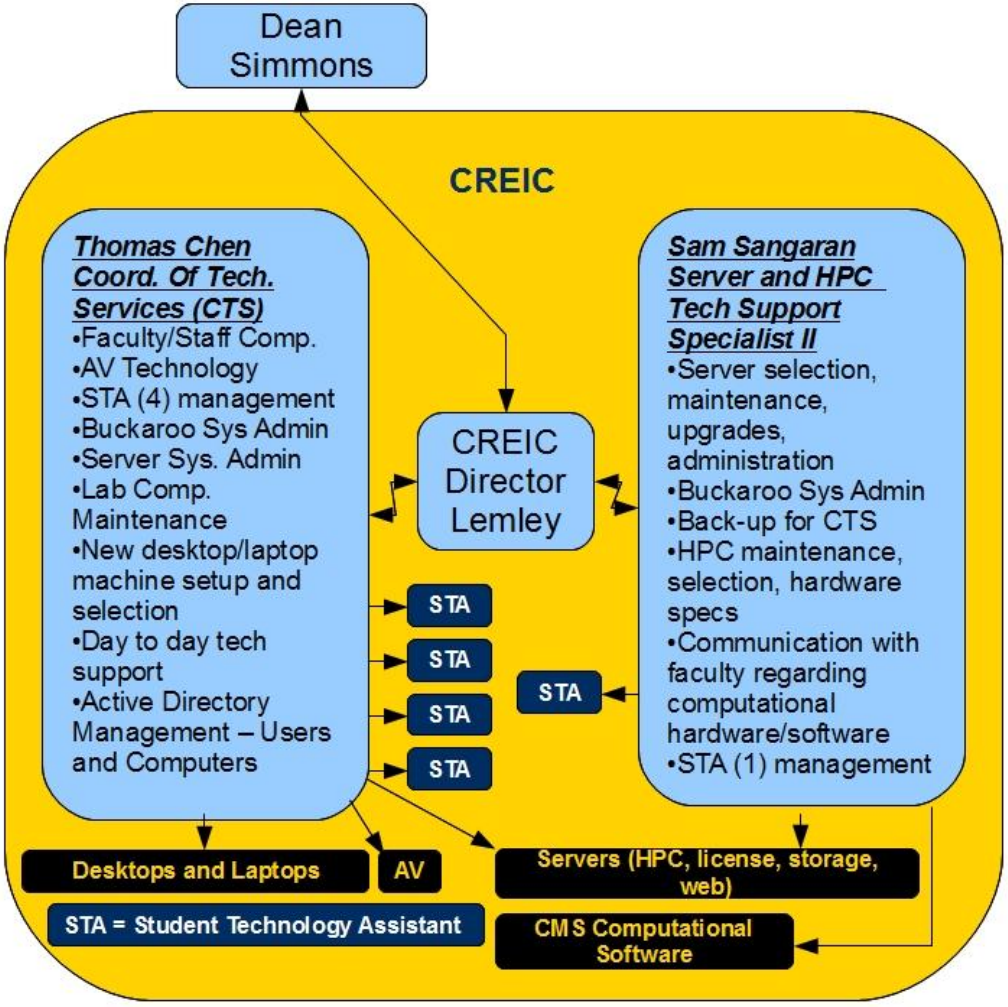
- Operational Objectives
  - Develop computational tools to extend scientific, technological, engineering, and mathematical projects.
  - Support faculty-student collaborative projects with training, software setup, and technical support.
  - Provide quality HPC educational outreach programs for UCO faculty and students that enhance both the research and educational environments.
  - Serve as a central point of contact for computational projects and other academic computing issues.
  - Grow computational, networking, and storage capabilities to support the institutional and academic mission.
  - Identify and disseminate external funding opportunities that add to the capabilities of UCO HPC facilities and support interdisciplinary computational research and research educational outreach.

UCO College of Mathematics and Science



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- `cmstech` - tech. support for CMS
  - Thomas Chen - Coord. of Tech. Services
  - Sam Sangaran - Tech. Support Specialist II
  - ~4 Student Tech. Assistants
    - Training Program for CS and Engr students in the Coll. - Hone IT and troubleshooting skills

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Resources

- Deploy/Maintain ~600 desktop and laptop machines
- Laptop Carts - ~63 machines for computational exercises in classrooms and labs
- Storage Servers, Print Servers, License Servers
- Older Small Cluster - 28 core - 3 node Xeons
- Linux server for machine cloning
- New Remote Access Linux server -- 64 GB RAM

  Dual hex core Xeon -- will support Matlab, ANSYS, Fluent, etc…
- Software - ANSYS, Fluent, Multisim, Labview, Sigmaplot, Arc-GIS, Mathematica, MATLAB, Maple, …

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- Faculty Needs
  - ~ At least 25 faculty across departments in CMS
  - Range of commercial and home grown software
    - Commercial parallelized code mostly runs on general purpose nodes
    - Homegrown code can take advantage of newer accelerator technology (e.g. GPU)
  - Large scale parallel to concurrent batch runs needed
  - Our new server can barely accommodate Finite Element Runs for one particular project - much less the other faculty
  - Significant Training Needs for Faculty and their students

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- Resources - Needed
  - Hardware
    - Additional Storage ~ 50 TB fast network storage to connect through at least GigE to new cluster
    - We plan (more in a minute!)
      - Cluster to support computational needs across CMS.
      - Hybrid - CPU/GPU requested ~$210K.
      - 35 nodes
      - 10 Gbs interconnects
  - Software - parallel & cluster versions of compilers and cluster licenses for MATLAB, ANSYS, etc…

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- OneOCII
  - One Oklahoma Cyberinfrastructure Initiative
  - Statewide CI network/community
    - Stimulates collaboration and grants
- OFFN - Oklahoma Friction Free Network
  - OU, OSU, TSC, Langston -- NSF CC-IIE
  - *Now UCO!*
  - 10 Gbps dedicated research and education network
- ***NSF Grant Applications - MRI - …. application has ~$300k over 3 years***
  - Internal Funding Applications from OIT - ***this has been funded!! $54k***

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- NSF MRI
  - The Major Research Instrumentation Program serves to increase access to shared scientific and engineering instruments for research and research training in our Nation's institutions of higher education, and not-for-profit museums, science centers and scientific/engineering research organizations.
  - One solicitation per year (4th Thurs. in Jan. typically)
  - $100,000 - $4 million

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- NSF MRI
  - Type I = Instrument Acqusition (2 per instit.)
  - Type II = Instrument Development (1 per instit.)
  - For both Types I & II:
    - Single instrument or for equipment that, when combined, serves as an integrated research instrument.
    - Does not support the acquisition or development of a suite of instruments to outfit research laboratories/facilities or that will be used to conduct independent research activities simultaneously.

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- NSF MRI
  - Ph.D.-granting instit. -- > 20 Ph.D.'s or D.Sci.'s awarded in supported NSf fields in last two years.
    - Must cost share at 30%
  - Non-Ph.D.-granting
    - No cost share
  - Cannot build or renovate buildings or upgrade infrastructure.
  - Uses of instrument have to be research or research education - not primarily to support courses.
  - Cannot be used primarily for NIH-type research (clinical)...

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- Why do you need the Instrument?
  - Clear and compelling users & needs
  - Solid research projects
  - Your strongest researchers with peer-reviewed track record, but…
  - Include other users that are just getting started, changing directions, are being supported internally but not externally.
  - Establish institutional support for the proposal and of the users.
  - If a PUI - what is the UG research landscape?
    - Is it tied to Instit. Missions / Values / etc

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- More needs:
  - Quantify the need in excruciating detail -- do your homework!!
  - For a cluster - Core Hours needed from real data - runs on comparable hardware.
  - Match a quoted instrument to the detailed needs analysis.
  - Document research projects (major = more space & minor = more condensed format)

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- Where will it go?
  - Be very specific room number in given bldg.
  - Are there any infrastructure upgrades to room required for instrument?
  - How will the instrument be delivered? - Entry paths, dock heights and access, door widths, and heights.
  - Draw a picture of the room - location of instrument and any other pertinent room info (if space allows)
  - Even if you don't include this - get agreement from Dean/Chair/etc… that the room is available
    - And if upgrades are required - a commitment to get them done.

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- How will it be operated?
  - Technician Available?
    - This person could be partially funded, but how will you sustain it.
  - How will users gain access / get trained?
  - How is maintenance and setup being done and who is doing it?
  - What warranties? -- see useful life of the instrument.
  - Useful life of the instrument - define this somewhere (your activities and planning should be based on this)

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- Institutional Support
  - Dean and upper level VP (if a cluster, the CIO is good)
  - Buy in from institution needs to be demonstrated.
  - You are excited about --- then and they are excited about it!
  - IT
    - It can be work for IT to help you, but…
    - #1 you will need their help,
    - #2 they will glad for the positive publicity of having helped move the acad. mission forward. . .

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- Broader Impacts
  - How will what you are doing affect?
    - Research education landscape internal/external.
    - How will you impact underrepresented groups?
      - Existing strong networks/communities connecting multi-institutions to students.
    - Presentations, Tours, etc…
    - Dissemination
    - Need numbers
    - Leverage existing regional/state conferences
      - Okla. Supercomputing Symp.
      - Oklahoma Research Day
      - Oklahoma Academy of Science...

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- Nearby Similar Instruments
  - Have to be described
  - Challenge- Why can't your users just use this other resource?
    - Ask the folks in charge of instruments at other nearby instit. be on an external advisory panel for the grant.
    - They might even be quoted that they could not help your users to the scale needed to do the proposed work.
    - What makes your instrument different - new state/regional capability, e.g.

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- OneOCII
  - Unbelievable Support from OneOCII in our case.
  - Henry Neeman & Dana Brunson helped a lot!
  - Much of the changes in my last proposal were driven by OneOCII discussions.
  - If OneOCII is not appropriate for you -- find something/someone like it.

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- We finally got one… but it took a long time
  - Lessons learned
    - Persistence, Persistence, Persistence
    - Internal Help/Support
    - External Help/Support (OneOCII)
    - Pay attention to reviews
      - If it's clear someone did not read what you wrote -- figure out why… for some
    - Line-by-line read throughs
    - Visit a Program Officer after you get turned down (but quite a bit before next proposal is due)
    - Leverage existing funding, activity, momentum on your campus.

Discussion

- Questions?
- Feedback?

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