

Information Technology Management Council April 29, 2013



High Performance Research Computing

- XSEDE & SeWHiP, David Stack
- UW-Eau Claire, Peter Bui
- UW-Milwaukee, Dan Siercks
- UW-Madison, Bruce Maas

web.uwsa.edu/itmc/meetings/spring-2013-joint-meeting/



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Have you ever heard...

My SAS program takes 3 weeks to run on my office computer, do you have a faster Windows machine I could use?

No-charge Federal Resources



Extreme Science and Engineering Discovery Environment



17-Jul-12

XSEDE Computing Resources



CONTACT: HELP@XSEDE.ORG



Data Storage and Transfer

- SDSC Gordon
 - SSD system with fast storage
- NCSA Mass Storage System
 - <u>http://www.ncsa.illinois.edu/UserInfo/Data/MSS</u>
- NICS HPSS
 - http://www.nics.utk.edu/computing-resources/hpss/
- Easy data transfer
 - In-browser SFTP or SCP clients through Portal SSH
- Standard data transfer
 - SCP to move data in/out of XSEDE systems
 - Requires SSH key setup
 - Rsync to move data in
- High performance data transfer
 - Globus Online: <u>https://www.globusonline.org/</u>



Support Resources

- Local Campus Champions
 - Dan Siercks & David Stack, UW-Milwaukee
 - Peter Bui, UW-Eau Claire
- Centralized XSEDE help
 - help@xsede.org
- Extended one-on-one help (ECSS):
 - https://www.xsede.org/ecss
- Training
 - http://www.xsede.org/training





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Southeast Wisconsin High Performance Cyberinfrastructure sewhip.org

UW-Milwaukee Marquette University BloodCenter of Wisconsin Milwaukee Institute, Inc

Medical College of WI Milwaukee School of Engineering



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Training and Development Collaborations

2010 Wisconsin Cyberinfrastructure Day Data Symposium 2012 Bootcamps: Parallel Programming Bootcamp: Research Data Management Cloud Computing for Scientific Research Matlab Optimization and Scaling Supercomputing in Plain English

High Performance Computing at UW-Eau Claire

Peter Bui



University of Wisconsin - Eau Claire

Liberal arts primarily undergraduate institution



UW System Center of Excellence for Faculty and Undergraduate Student Research Collaboration



Current HPC Infrastructure

Ad-Hoc Fiefdoms

 Each system is configured and managed separately

Inconsistent system administration

 Each system belongs to a particular researcher or department

Lack of collaboration



Future HPC Infrastructure

Blugold Commitment SuperComputer

• \$100,000 Hardware

- 0 100-200 CPUs
- 0 2-4 GPUs

• \$20,000 Software

- Specialized compilers
- Domain specific applications

Computational Science Working Group

- Interdisciplinary collaboration
- **Consolidate** management and administration
- Promote HPC research and teaching

General Purpose HPC cluster and a supportive computational science community.

HPC in Research







HPC in Teaching

- Incorporating HPC into STEM curriculum
 - **Chemistry:** molecular dynamics
 - **Physics:** simulations
 - **Geology:** data visualization and manipulation
 - **Computer Science:**
 - **CS 170:** Computing for the Sciences and Mathematics
 - CS 252: Systems Programming
 - CS 352: Computer Organization and Design
- Reaching out to humanities
 - Arts and multimedia
 - Digital humanities

Conclusion

UW-Eau Claire is investing in the infrastructure and developing the knowledge base necessary to support high performance computing in both research and teaching.

We are looking to **collaborate** with other UW institutions in pursuing these interests.



HPC Resources at UWM

- "Avi" research cluster
 - 1,142 cores
- "Peregrine" educational cluster
 - 96 cores
- "Meadows" grid
 - Elastic resource, 200-700 cores



HPC Utilization at UWM

- "Avi" research cluster
 - **153 Users**
 - 6.5M core hours utilized in 2012
 - ~70% of jobs utilized OpenMPI
- "Peregrine" educational cluster
 - 120 users



HPC Governance at UWM

- HPC Governance Group
 - Director of Research Cyber Infrastructure
 - IT administrators
 - Select faculty stakeholders
- HPC Sponsors Group
 - · CIO
 - Director of RCI
 - Academic Deans



HPC Support at UWM

- Facilitator model
 - Central cluster administrator
 - Engineering Facilitator
 - Jason Bacon
 - L&S Facilitator
 - Dan Siercks
 - Educational Cluster Facilitator
 - Ke Liu



HPC Facilitation at UWM

- In Person availability
- User environment management
 - Software installation
 - Compiler/OpenMPI management
- Code review
- Workflow assistance



HPC Outreach at UWM

- 5x 2 day HPC "Bootcamps"
 - Introduction to *nix
 - Introduction to parallel computing
- 3x1 hour workshops
 - HPC in Social Sciences
 - Matlab
 - HPC brown bag session

Vision at UW-Madison

Through our partnership between a world class group of domain scientists and a nationally respected enterprise team of network engineers and systems engineers, and private sector partnerships with companies such as Cisco, and with the support of donors, combined with over 25 years of evolving HTCondor, and successfully running GLOW and Open Science Grid, we are creating the leading Advanced Computing Infrastructure model in support of science.



Taking an Holistic Approach

Integrated approach to Advanced Computing Infrastructure (ACI) that brings together Networking, Computing and Storage

- The CIO and Campus Researchers are fully aligned in ACI activities
- ACI faculty governance has domain science driving our agenda.
- Building on a campus wide laboratory to drive ACI innovation through experimentation.

Leverage, leverage, leverage



New Sponsorship at UW-Madison

Miron Livny

Professor – Computer Science

CTO - Wisconsin Institutes for Discovery

Director – Center for High Throughput Computing Principal Investigator-Open Science Grid (OSG) and the HTCondor project

Bruce Maas

Vice Provost for Information Technology and CIO

Co Principal Investigator – CCNIE and EAGER Science DMZ Grants with CS Dept



With Key Stakeholders

- Paul Wilson Professor of Nuclear Engineering Faculty Director of ACI
- Pat Christian- Network Engineering CTO for ACI
- Aditya Akella-Associate Professor of CS SDN http://pages.cs.wisc.edu/~akella/
- Suman Banerjee-Associate Professor of CS- WiFi http://pages.cs.wisc.edu/~suman/
- Steve Krogull Director of Systems Engineering
- Larry Landweber-UW CS Professor Emeritus and Consultant NSF GENI Project
- **Already in Place!**



Leadership for Experimental ACI

The synergy of being one of the lead institutions for the OSG (Livny PI and technical Director), along with the Grid Laboratory of Wisconsin (GLOW), and world class domain scientists who are actively engaged in adopting the end-to-end capabilities we offer and the ACI framework we have put in place, makes UW-Madison unique.



What are we Doing At UW-Madison?

- We have brought the computer scientists and network engineers together in partnership.
- Aditya Akella's team is working on SDN and worked with our network engineers and Cisco on the early SDN design of Cisco controllers
- Network Engineers and Akella team working on the UW Science DMZ architecture
- Enterprise storage and compute teams being integrated into ACI planning and execution



What Else is Wisconsin Doing?

- 100 gb campus backbone & I2 connection underway
- Experimental Science DMZ network underway funded by NSF CC-NIE Grant (Maas-Livny co-PIs)
- Collaborating with University of Nebraska on CC-NIE LARK which is proposed to make HTCondor more network aware
- Immersion of Network Engineers into OSG planning occurring
- Regular participation by researchers in Network Engineering meetings occurring
- NSF EAGER grant with GENI (Maas-Banerjee co-PIs)
- Cisco and HP GENI racks soon, Dell, maybe IBM
- Dell and Cisco shared HPC up and running
- Funding for 3 FTE for 2 yrs, possibly permanent



Specific Cisco-Wisconsin Actions

- We have partnered with Cisco on their Software Defined Networking endeavors
- Presently providing feedback on SDN controller
- Testing alpha software on 3750x series switches; waiting on Cisco 3850x, 4500x, ASR and Nexus platforms
- Participated in London CISCO Live! January 2013 demo. Showed how HTCondor <u>http://research.cs.wisc.edu/htcondor/</u> could be network aware and use best path for processing (created a slice to end around firewall) using Cisco controller and Open Vswitch

Wisconsin-Summary and New Plans

- Building an Advance Computing Infrastructure Laboratory
- Campus investments and governance
- Small campus shared HPC-Firm bet on future
- Huge HTCondor capacity (400K+ hrs per day) (HTCondor continuing to evolve)
- Condo of Condos grant
- Related mid-size Infrastructure grant
- Amazon on-ramp (I2 Net+, plus NDA)





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