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www.hpcuniv.org

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What is HPC University?

A **Virtual Organization** of people and institutions committed to preparing knowledgeable & skilled HPC (Digital Services) professionals, researchers, educators, and students.

Assess learning and workforce development needs

Assess requirements of a large and diverse computing community of practice

Define a roadmap for acquiring HPC competencies according to needs and requirements.

Provide a catalog of high quality, peer-reviewed training and education resources

Provide a calendar of live and synchronous events

Identify gaps to drive development of new EOT resources

Open a forum for community sharing

Incorporate HPC across all disciplines



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Who is Involved?

- TeraGrid Resource Providers
- NCSA Blue Waters project
- Department of Energy HPC Centers
- State and regional HPC Centers
- Current and potential HPC community of practice
- Shodor
- Computational Science Education Reference DeskTM (CSERD) Pathway
- *We welcome contributions and participation by all interested organizations*



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A Brief History

HPC University RAT

Charter: The HPC Training RAT will identify successful paths to creating qualified, effective HPC professionals, capable of exploiting current terascale and upcoming petascale technologies for the advancement of scientific research. Gaps in training materials and delivery methods will be identified, and recommendations for filling these gaps will be presented.

Report Topics:

- Catalog Map
 - Topics
 - Mastery Levels
- Quality Assurance
- Delivery Methodologies
- Target Populations
 - Demographics
 - Disciplines
- Scaling & Dissemination
- Getting to Petascale

Key Issues Identified:

- *Gaps* – Identifying and plugging gaps is a critical and ongoing requirement for viability
- *Persistence* - Are the materials available when users need them?
- *Quality assurance* – Do the materials provide a validated, verifiable experience for the users?
- *Delivery methods* – Are the materials available to the users independent of geography or temporality?
- *Scaling the training* – Are good trainers and training practices being identified and made available to new trainers?
- *Petascale Preparation* – Effective use of petascale resources require proactive efforts now and into the future

The RAT Report will be on hpcuniv.org shortly.



Report Recommendations

- Create persistent inventory of resources and events
- Ensure Quality Assurance via VV&A process
- Provide Multiple Delivery Methodologies
 - Support a variety of teaching methods and styles
 - Redesign materials for effective interactive online learning
- Broaden participation across under-served demographics and fields of science
 - Eliminate geographic and temporal boundaries
- Scale best practices of content and delivery
 - Provide education accounts and HPC University Portal
- Advance Petascale Learning
 - Engage HPC and petascale experts for guidance
 - Include petascale apps and scaling experiences via case studies



Build on strong CSERD Foundation

Expand the HPC University offerings
for the community

Catalog

The screenshot shows the CSERD Catalog interface. The search results for 'agent modeling' include:

- agent modeling
- agent based
- agent based economic modeling
- agent based economics modeling
- at quality modeling

Below the search results, there is a section titled "A Better Fire!!" with a description: "Students run a simulation of how a fire will spread through a stand of trees based on wind direction, size of forest." and a link to "View Website".

Infrastructure



Verification Validation & Accreditation

Roadmap



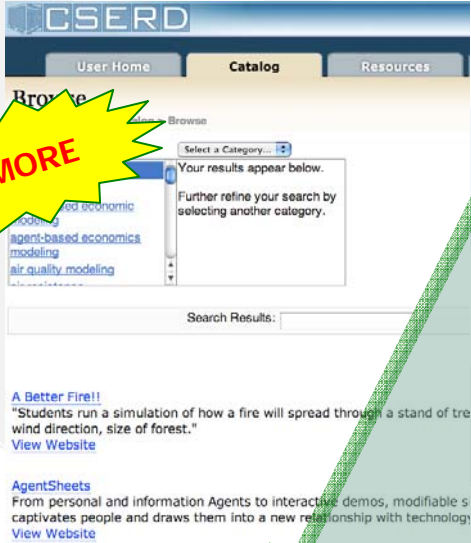
Date	Location	Leaders	Deadlines	Details	Registration
Jun 15 - Jun 21	Navajo Technical College Crowpoint, NM	Local Coordinators: Coleen Arviso and Jared Ribbis Lead Instructors: Tom Murphy, Kenneth Craft, Henry Neeman, Charles Peck and David Joiner	Notify By: May 26 Cancel By: May 28	Workshop topics focus on educational grid deployment consisting of LittleFe construction, cluster software configuration, grid configuration, cluster curricula, and grid curricula. [details...]	Registration is closed.
Jul 6 - Jul 12	Grand Valley State University Allendale, MI	Local Coordinators: Greg Wolfe and Christian Trettitz Lead Instructors: Tom Murphy, Erin Hodgess, Kay Wanous and Paul Gray	Notify By: Jun 9 Cancel By: Jun 18	[details...]	Log in to Register
Jul 20 - Jul 26	NCSA ACCESS Arlington, VA	Local Coordinators: Bob Panoff Lead Instructors: Erin Hodgess, Bob Panoff and Charles Peck	Notify By: Jun 15 Cancel By: Jun 29	[details...]	Log in to Register



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Address Community Needs & Services

Catalog



MORE

Competencies
Computational
Science

PETASCALE

New & Improved
Materials
&
Content

Increased
Participation

Evaluation
&
Assessment
Data

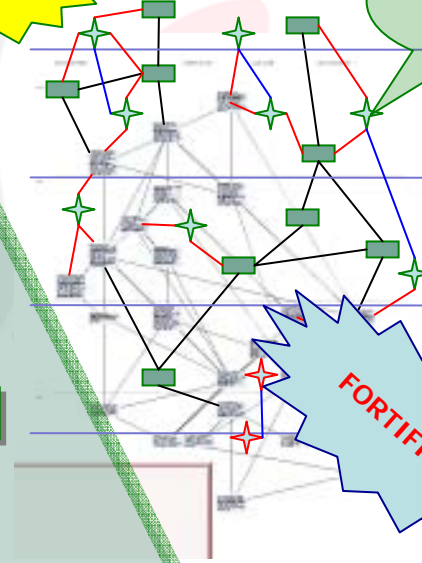
Needs
Community & Users

IMPROVED

V V & A

Roadmap

NEW



FORTIFIED



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Short-Term Activities

- Establish resource archive – persistent training materials
 - Train the trainer sessions to improve delivery
- Establish mentoring program
 - Identify mentors who can make the commitment
- Identify reviewers who can verify/validate existing offerings
 - Begin VVA process
- Formative evaluation and assessment
- Petascale survey and computational science survey
 - we would appreciate your help to disseminate these!



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Long-Term Activities

- Iterative process to identify and fill gaps
- Use evaluation to study longitudinal impact
- Coordinate with professional societies on program accreditation
- Share meta-data with ACM and IEEE Digital Libraries

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SC07-SC10 Education Program

- Multi-year, year-long, Education Programs to provide continuity and sustained impact
- Integrate computational science into high school and undergraduate STEM classrooms
- Use digital libraries for teaching and learning - CSERD/NSDL
- Sponsors: ACM, IEEE, TeraGrid, Blue Waters, NCSI, CSERD, Krell, and NSF
- Recruiting faculty to create innovative curriculum



CSERD Computational Science
Education Reference Desk

NSDL



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Virtual School of Computational Science and Engineering

- A multi-state, multi-institutional organization
- Led by University of Michigan and Great Lakes Consortium for Petascale Computation
- Driven by faculty and graduate students needs
- Goal: prepare the current & next generation of scientists and engineers to utilize leading edge computer systems.
 - Initial focus: graduate & postgraduate education, & beyond
 - Develop core competencies for HPC and petascale
 - Create new curriculum
 - Offering Summer Schools and on-line learning materials



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TeraGrid Campus Champions Program

- Training program for campus representatives
- Campus advocate for HPC and CI
- TeraGrid ombudsman for local users
- Quick start-up accounts for campus
- TeraGrid contacts for problem resolution
- We're looking for interested campuses!
- Over thirty institutions are joining to date!



TM



Science Gateways - Broadening Participation



- Special PRiority and Urgent Computing Environment (SPRUCE)
- National Virtual Observatory (NVO)
- Linked Environments for Atmospheric Discovery (LEAD)
- Computational Chemistry Grid (GridChem)
- Computational Science and Engineering Online (CSE-Online)
- GEON(GEOsciences Network)
- Network for Earthquake Engineering Simulation (NEES)
- SCEC Earthworks Project
- Network for Computational Nanotechnology and nanoHUB
- GIScience Gateway (GISolve)
- Biology and Biomedicine Science Gateway
- Open Life Sciences Gateway
- The Telescience Project
- Grid Analysis Environment (GAE)
- Neutron Science Instrument Gateway
- TeraGrid Visualization Gateway, ANL
- BIRN
- Gridblast Bioinformatics Gateway
- Earth Systems Grid
- Astrophysical Data Repository (Cornell)



For Additional Information

<http://www.hpcuniv.org> (Beta Version)

<http://www.teragrid.org>

<http://cserd.nsdsl.org>

<http://www.nsdsl.org>

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Petascale Education Challenge

- Petascale computing is more complex than previous computing paradigms.
 - Wholly new approaches to computing are required.
 - No single university has the expertise and experience needed to fully exploit this extraordinary capability.
- Preparation for petascale computing requires solid grounding in CSE, especially HPC and HPC-related curricula, and these are still evolving.
 - CSE education not keeping up with Moore's Law.
 - We can leverage expertise to establish best practices, fill gaps, and modernize the CSE & HPC curriculum.



Extending the value of the CSERD-NSDL Infrastructure to HPC Professionals

CSERD-NSDL (<http://cserd.nsd.org>) has created a strong foundation for the teaching and learning of computational science resources, tools, and methods among K-12 teachers, undergraduate faculty, and their students.

We are extending this foundation to directly benefit graduate students, post-docs and scientists applying high performance computing (HPC) and the emerging national cyberinfrastructure including TeraGrid to advance scientific discovery.

The ambitious efforts of NSF's Office of Cyberinfrastructure to significantly expand high-end Digital Services in support of computational science and engineering creates a critical need for education and training opportunities at all levels of learning (from K-12 to professionals) in all fields of science.

In the recent Computing in Science and Engineering (CiSE) journal special edition on High Performance Computing Education, nearly every article references CSERD-NSDL.



Sampling of Training

- HPC Computing

- Introduction to Parallel Computing
- Toward Multicore Petascale Applications
- Scaling Workshop - Scaling to Petaflops
- Effective Use of Multi-core Technology

- Domain-specific Sessions

- Petascale Computing in the Biosciences
- Workshop on Infectious Disease Informatics
- Computational “X” to address multiple fields

- Visualization

- Introduction to Scientific Visualization
- Intermediate Visualization
- Remote/Collaborative Visualization



HPC University: On-Line Access

- Goal is to reach significantly larger audiences
 - To reach people that can't attend live in-person sessions
- Synchronous sessions
 - Training sessions
 - Seminars
- Over 30 on-line asynchronous tutorials
 - CI-Tutor launched to expand access
 - 4,570 accesses in 2007



Computational Science

Explore educational resources on computational science for Faculty, Teachers, and Students.



CSERD User Home

Log in to review and build the CSERD catalog.

[Become a reviewer](#) | [CSERD Catalog](#) | [CSERD Resources](#) | [Help](#)

Announcing the Interactivate Assessments Toolkit!

Explore all of the Interactivate activities which can be used to examine your skills on a wide variety of mathematical topics.

What is CSERD?

The Computational Science Education Reference Desk, a Pathways project of the National Science Digital Library and funded by the National Science Foundation, aims to help students learn about computational science and to help teachers incorporate it into the classroom. [\[more...\]](#)



A Pathways Portal of the National Science Digital Library



Funded by the National Science Foundation



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Programming Languages

- Serial Programming Languages
 - C/C++, FORTRAN, Scripting Languages
- Parallel Programming Languages

Development Tools

- Compilers
- Development environments
- Building Tools
- Debuggers
- Code Management

Software Engineering

Code optimization

Technology

- Processor
 - Multi-core
- Network
 - Routers
 - Network Topologies
- Memory

Parallel Architectures

- Fault Tolerance
- Parallel I/O

Performance Analysis

- Serial Performance
- Parallel Performance
- Performance Modeling

Verification and Validation

- Mathematical Precision
- Numerical Stability of Algorithms

Canned (Third-Party) Codes Workflow Management

- Data Management
- Grid Technology
- Queuing systems

Machine Interface

- SSH
- Unix
- Gateways

Visualization

Allocations process

- How-to's
- Grant writing guidelines

Support



Backup Slides

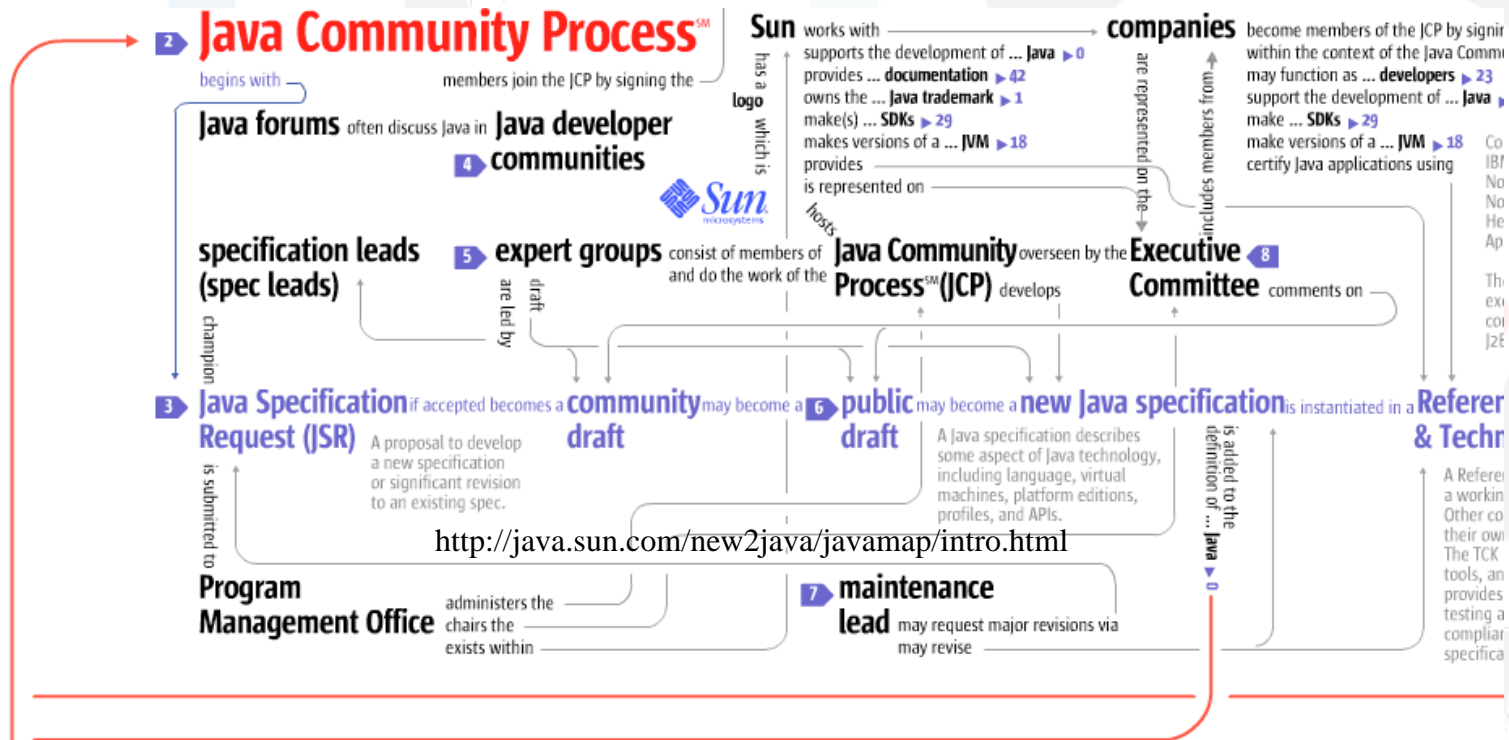
1. What's a Concept Map?
2. What's an ontology?

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What's a Concept Map?



Development process



<http://java.sun.com/new2java/javamap/intro.html>



Catalog Map

Novice Undergrad	Apprentice Master	Journeyman Ph.D.	Master Post-doc/Prof
Modeling/simulation	HPC Technology (hardware)	Domains	Software engineering
Operational issues	Architectures	Performance analysis	Scalable computing
Application packages	Programming/Algorithms	Code optimization	<div style="border: 1px dotted black; padding: 5px;"> <p>At least 10 offerings Less than 10 offerings No offerings</p> </div>
Science gateways	Development tools		
Workflow management	Visualization		
Data analysis/Post-processing	Verification/validation		
Collaboration			



Delivery Methodologies

Topic	Number of Entries	Delivery Method		
		Asynchronous	Synchronous	Face-to-Face
Operational Issues	60	✓		
Programming & Algorithms	40	✓		✓
Development Tools	37	✓		
Architectures (Parallel, Dist, Grid)	21			✓
Science gateways & resources	18	✓		✓
Performance Analysis	12	✓		
Visualization	10	✓		
Data Considerations	8	✓		✓
Scalable Computing	7	✓		✓
HPC Application packages	7			
Collaboration	5	✓		
Modeling & Simulation	4	✓		✓
Code Optimization	4	✓		
HPC Technology (hardware)	3	✓		
Domains (physics, chem, etc.)	2			✓
Other	1	✓		✓
Workflow management	0			
Software Engineering	0			
Verification & Validation	0			
Data analysis/post processing	0			

Total number of offerings: 239

This is a hole



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