XSEDE: An Advanced and Integrated Set of Digital Resources for Science and Engineering

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What is XSEDE?

Foundation for a National CI Ecosystem

- Comprehensive suite of advanced digital services that federates with other high-end facilities and campus-based resources

Unprecedented Integration of Diverse Advanced Computing Resources

- Innovative, open architecture making possible the continuous addition of new technology capabilities and services
Partnership led by NCSA, NICS, PSC, TACC and SDSC

Partners with Complementary Expertise

- Argonne National Laboratory
- Cornell: Center for Advanced Computing
- Georgia Institute of Technology: Center for Education Integrating Science, Mathematics, and Computing
- Indiana University: Pervasive Technology Institute
- National Center for Atmospheric Research
- Ohio Supercomputer Center
- Oklahoma State University: High Performance Computing Center
- Purdue: Rosen Center for Advanced Computing
- Shodor
- SURA
- University of Arkansas: Arkansas High Performance Computing Center
- University of Chicago
- University of Georgia: Terry College of Business
- University of Oklahoma: Supercomputing Center for Education & Research
- University of Southern California: Information Sciences Institute
XSEDE Mission and Goals

Mission: Accelerate scientific discovery

Goals:

- Deepen and Extend Use
  - Raise the general awareness of the value
  - Deepen the use and extend use to new communities
  - Contribute to the preparation of current and next generation scholars, researchers, and engineers
- Advance the Ecosystem
- Sustain the Ecosystem
$2.21 billion in research supported by XSEDE
July 2011-May 2016

Research funding only. XSEDE leverages and integrates additional infrastructure, some funded by NSF (e.g. Track 2 systems) and some not (e.g. Internet2).
XSEDE Supports a Breadth of Research

Earthquake Science
Molecular Dynamics
Nanotechnology
Plant Science
Storm Modeling
Epidemiology
Particle Physics
Economic Analysis of Phone Network Patterns
Large Scale Video Analytics (LSVA) Decision Making Theory
Library Collection Analysis

Three-dimensional model of major vessels and bifurcations of the human arterial tree reconstructed with gOREK from a set of computed tomography (CT), digital subtraction angiography CT and magnetic resonance angiography images.

A snapshot of an animation for water level prediction including the wind-wave signature.
Ruby Mendenhall, an associate professor of sociology, African American studies and urban and regional planning at the University of Illinois (UI) at Urbana-Champaign, is leading a collaboration of social scientists, humanities scholars and digital researchers that hopes to harness the power of high-performance computing to find and understand the historical experiences of black women by searching two massive databases of written works from the 18th through 20th centuries.
Why XSEDE?
Compute and Analytics Resources

Featuring interactive on-demand access, tools for gateway building, and virtualization.

**Comet**: hosting a variety of tools including Amber, GAUSSIAN, GROMACS, Lammps, NAMD, and VisIt.

**A self-provisioned, scalable science and engineering cloud environment**

**Stampede-2**: Intel's new innovative MIC technology on a massive scale

**Super Mic**: Equipped with Intel's Xeon Phi technology. Cluster consists of 380 compute nodes.

**Wrangler**: Data Analytics System combines database services, flash storage and long-term replicated storage, and an analytics server. IRODS Data Management, HADOOP Service Reservations, and Database instances.
High Throughput Computing

- Governed by the OSG consortium
- 126 institutions with ~120 active sites collectively supporting usage of ~2,000,000 core hours per day
- High throughput workflows with simple system and data dependencies are a good fit for OSG
- Access Options:
  - OSGConnect available to any researcher affiliated with US institutions and who are funded by US funding agencies
  - OSG Virtual Organization such as CMS and ATLAS
  - XSEDE
XSEDE Visualization and Data Resources

Visualization

Maverick@ TACC
- HP/NVIDIA cluster
- 132 TB memory
- VisIt
- ParaView
- Interactive Data Language

Visualization Portal
- Remote, interactive, web-based visualization
- iPython / Jupyter Notebook integration
- R Studio Integration

Storage

- **Resource file system storage**: All compute/visualization allocations include access to limited disk and scratch space on the compute/visualization resource file systems to accomplish project goals.

- **Archival Storage**: Archival storage on XSEDE systems is used for large-scale persistent storage requested in conjunction with compute and visualization resources.

- **Stand-alone Storage**: Stand-alone storage allows storage allocations independent of a compute allocation.
Science Gateways

The CIPRES science gateway: A NSF investment launching thousands of scientific publications with no sign of slowing down.

Science Gateways Community Institute

Designed to help the community build gateways more effectively

Longer-term, hands-on support

Extended Developer Support

Software & visibility for gateways

Scientific Software Collaborative

Diverse expertise on demand

Incubator

Sharing experiences & knowledge as a community

Workforce Development

Community Engagement & Exchange

Student opportunities & educator resources

FREE services for the research community, [http://sciencegateways.org](http://sciencegateways.org)
Allocations

Champion

Education

Startup

Research

\[ V = \frac{4}{3} \pi r^3 \]
User Support Resources

- Technical information
- Training
- Help Desk/Consultants
- Extended Collaborative Support Services
Community Engagement & Enrichment (CEE)

- Broadening Participation
- Campus Engagement
- User Engagement
- User Interfaces & Online Information
- Workforce Development
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![Campus Visits Image](image1)

![Community Listserv Image](image2)

![Conference Exhibiting Image](image3)

![Consulting Image](image4)

![Diversity Forum Image](image5)

![Travel Support Image](image6)

![Training Events Image](image7)
Campus Engagement: Champions Program

- Campus Champions
- Student Champions
- Regional Champions
- Domain Champions
Workforce Development: Education Program

- Develop, identify, & maintain computational science program competencies
- Promote computational science
- Provide consulting for program development and plans
- Facilitate Collaborative Online Courses
Workforce Development: Training

XSEDE provides extensive training

• Covering every major resource
• From beginner to advanced classes
• At locations across the country
• Online via:
  • asynchronous technologies
  • Webcasts

Web-based education credit courses
Workforce Development: Student Programs - EMPOWER

**PROJECTS:** Computational, Data Analytics, Visualization Research or Networking and System Maintenance

**MENTORS** are XSEDE staff, researchers, and educators who recruit and mentor undergraduate students.

**STUDENTS** are undergraduates who participate as a learner, apprentice or intern participation for students.

**COMPENSATION:** Ranges from $750 to $3,000 (based on student level and duration)

**PROJECT PROPOSALS** must contain a training plan for the student.
What Can I Do?
Faculty Opportunities

- Use XSEDE Resources for research or teaching
- Attend a webinar or in-person training
- Use online training materials (XSEDE and HPC University)
- Participate in a faculty development workshop
- Attend PEARC18, Pittsburgh, July 22 – 27, 2018 (call for contributions deadline is December 1, 2018)
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<td>XSEDE’s Empower Student Internship Program</td>
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<td>PEARC18 Student Program</td>
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<td>Blue Waters Graduate Fellowship Program</td>
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<td>Blue Waters Student Internship Program</td>
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<td>SIParCS (Summer Internships in Parallel Computational Sciences)</td>
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<td>Training events, <a href="https://www.xsede.org/web/xup/course-calendar">https://www.xsede.org/web/xup/course-calendar</a></td>
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More Information


XSEDE Website – https://www.xsede.org/

HPC University – http://hpcuniversity.org/

People

- Linda Akli, akli@sura.org, Community Engagement & Enrichment-Broadening Participation
- Jay Alameda, alameda@illinois.edu, Extended Collaborative Support Services
- Kate Cahill, cahill.167@osu.edu, Education
- Vetria Byrd, vbyrd@purdue.edu, Scientific Visualization
- Damian Clarke, DClarke5@scsu.edu, Campus Champion
Questions
Our reach will forever exceed our grasp, but, in stretching our horizon, we forever improve our world.