Extended Collaborative Support Service (ECSS)

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ECSS Mission

The Extended Collaborative Support Service *improves the productivity* of the XSEDE user community through successful, *meaningful collaborations* to optimize their applications, improve their work and data flows, and *increase their effective use* of the XSEDE digital infrastructure and broadly expands the XSEDE user base by engaging *members of underrepresented communities and domain areas*. 

64 individuals work on projects
ECSS areas

ECSS consists of five areas. End users don’t need to be aware of the areas and our staff will figure out where a project fits best:

- **Extended Support for Research Teams (ESRT):** “Traditional” ECSS projects to improve software and make best use of XSEDE resources
- **Extended Support for Community Codes (ESCC):** Similar to ESRT, but with emphasis on codes available for public use
- **Extended Support for Science Gateways (ESSGW):** Application of technologies that enable access to HPC through web interfaces
- **Novel and Innovative Projects (NIP):** Assistance to users from domains that are relatively new to XSEDE and high performance computing
- **Extended Support for Training, Education and Outreach (ESTEO):** Training and technical support for use of advanced cyberinfrastructure
ECSS Expertise

Expertise available in wide range of topics
- Performance analysis and optimization
- Porting to new architectures
- Software parallelization and scalability improvements
- Gateway and web portal development
- Specialized scientific software
- Visualization
- Workflows
- Technical training
ECSS is an Allocated Service

• Expert staff can be requested for collaborations lasting from months to a year
  – requests made through the XSEDE resource allocation system (XRAS) either a part of proposal for computational resources or at any time as a supplement
• Typical collaborations require 20-25% staff time for one year
• Critical mass engenders success
  – 26 FTEs (64 individuals) for project work at 10 sites
    • +4 ECSS Affiliates (skilled volunteers)
  – advanced degrees in a variety of science and technology fields
    • some staff co-author publications or write proposals with PI team, a few are later funded by PI team
Requesting ECSS – the five questions

1. What do you want to accomplish with the help of expert staff? Have you already done any work on this aspect of your software?

2. How would the success of this collaboration benefit your project?

3. Which member(s) of your team would collaborate with ECSS staff?

4. Have you had significant interaction on previous projects related to your current proposal or discussed your extended support needs with any XSEDE staff? If so, please indicate with whom.

5. Have you received XSEDE advanced support in the past? If so, please indicate the time period, and how the support you received then relates to the support you request now.
Who qualifies for ECSS?

- **All** XSEDE PIs can qualify for ECSS
- ECSS is not limited to only the most advanced users, projects with the largest allocations or particular fields of science
- Users who are new to XSEDE, in the early stages of their computational work or making the transition from small-scale to large-scale computing often benefit the most from ECSS.
Diverse Array of ECSS Projects

- Domains shown here
- But technology needs are also varied
- Scale of ECSS and training of ECSS are both important
ECSS: Successful Evolution Over Time - Over 700 cumulative requests since 2010

- Program builds on many years of experience
  - adapted from the Advanced Support for TeraGrid Applications (ASTA) program, 2005-2011
  - leadership team has decades of expertise from NSF Centers
- Today, ECSS is
  - highly regarded by science PIs
  - reviewed positively by independent panels
  - highlighted in NAS study
  - replicated by others (DesignSafe)

"NSF should explore ways to provision expertise in more effective and scalable ways to enable researchers to make their software more efficient; for instance, by making more pervasive the XSEDE (Extreme Science and Engineering Discovery Environment) practice that permits researchers to request an allocation of staff time along with computer time."

Future Directions for NSF Advanced Computing Infrastructure to Support U.S. Science and Engineering in 2017-2020, National Academy of Sciences
ECSS BY THE NUMBERS | REPORTING YEAR 2

- 64 Individuals at 9 Different Sites
- 35 Training Events
- 539 Adaptive Reviews
- 47 ECSS Projects
- 388 Attendees at ECSS Symposium
- 42 New NIP Projects
- 129 NIP Projects Mentored

PI Ratings
- 4.47 Satisfaction
- 4.03 Impact

NSF XSEDE
ESRT: 40% Performance Improvement to Earthquake Wave Propagation Code

- PI Morgan Moschetti, US Geological Survey
- ECSS staff Yifeng Cui (SDSC) and Lars Koesterke (TACC)
- Resources: Stampede 1 and 2, TACC
- Optimized and added features to the Hercules finite-element seismic wave propagation code, path to port to KNL
- New “multi-event” capability allowing team to run many ensemble simulations in a single execution. For N simulation events, saves meshing time for N-1 events.
- XRAC reviewers highlighted the need for ECSS
  - PI reports he could not have achieved his results without ECSS
- **Efficient use of XSEDE resources to generate and update USGS seismic hazard maps**
  - display earthquake ground motions for various probability levels across the United States
  - applied in building codes, insurance rate structures, risk assessments, and other public policy
NIP: Understanding of Juvenile Delinquency Accelerates Through Digitized Data and Big Data Analytics

• PI: Yu Zhang, Criminal Justice, The State University of New York at Brockport
• ECSS staff: Sandeep Puthanveettil Satheesan, NCSA
• Resource: Bridges, PSC
• PI learned about XSEDE through CEE outreach event at Jackson State
• Presented at May ECSS symposium

Slide content adapted from Sandeep Puthanveettil Satheesan
ESTEO: Campus Champions Fellows Program

• Established in 2012
• Pairs ECSS staff with Campus Champions in a one-year intensive collaboration
• Goal is to develop new skills among the Champions expand service to their campus communities
  – and scale out the impact of ECSS work
  – $15k stipend helps cover ~20% time commitment expected of Fellows
  – travel support as well
• Program expanded in 2015 to include
  – Fellow-designed projects
  – collaborations with others in XSEDE
    • e.g. educational program development, sys admin type support
28 Trained Fellows so far!

- Dirk Colbry, Michigan State (2012)
- Naseer Idrisi, U Virgin Islands (2012)
- Liwen Shih, U Houston-Clear Lake (2012)
- Jack Smith, Marshall U (2012)
- James McClure, Virginia Tech (2013)
- Ben Ong, Michigan State (2013)
- Eric Shook, Kent State (2013)
- Shawn Duan, South Dakota State (2013)
- Alla Kammerdiner, New Mexico State (2013)
- Luis Cueva-Parra, Auburn-Montgomery (2013)
- Hadrian Djohari, Case Western (2014)
- Justin Oelgoetz, Austin Peay State (2014)
- Brian Couger, Oklahoma State (2014)
- Neranjan Edrisinghe, Georgia State (2014)
- Kevin Abbey, Rutgers (2015)
- Erin Hodgess, U Houston Downtown (2015)
- Don McLaughlin, West Virginia U (2015)
- Nitin Sukhija, Mississippi State (2015)
- Craig Tanis, U Tennessee Chattanooga (2015)
- Emily Dragowsky, Case Western (2016)
- Xinlian Liu, Hood College (2016)
- Francesco Pontiggia, Brandeis (2016)
- Jack Smith, Marshall (2016)
- Tsai-wei Wu, Purdue (2016)
- Richard Gayler, Kennesaw State (2017)
- Chet Langin, Southern Illinois U (2017)
- Semir Sarajlic, Georgia State (2017)
- Dan Voss, U Kansas (2017)
ESCC: Checkpoint-Restart at Exascale
Ensuring that CPU Time is Not Wasted at Scale

- PI: Gene Cooperman, Computer Science, Northeastern University
- ECSS staff: Jerome Vienne, formerly of TACC
- Resource: Stampede 1 and 2
- Gene and Jerome met at an MVAPICH event at Ohio State
  - Advantage of having ECSS-ers involved in multiple projects
- Goal is scalable, transparent checkpoint-restart at > 100k cores
Huge Impact: Likely Incorporation Into Major Resource Scheduler

• Scheduled checkpointing to avoid flooding Lustre
• Investigated practicality of full and partial memory dumps
• Demonstrated at 32,758 cores on Stampede1
• Extended work to KNL, CPUs with MCDRAM and Omni-Path
• Several papers
ESSGW: Understanding Fluid Flow Over Earth’s Surface Critical as Extreme Events (Fires, Floods) Increase

• PI: Jon Pelletier, Geosciences, U Arizona
• ECSS staff: Mats Rynge (workflows, USC), Yan Liu (gateways, NCSA)
• Resources: Jetstream (IU), Comet virtual cluster (SDSC), OSG
• Development of new equation by NSF-funded Santa Catalina Mountains-Jemez River Basin Critical Zone Observatory
• Major improvements to modeling Earth’s soil formation and landscape erosion processes

Slide content adapted from Mats Rynge, Jon Pelletier, Tyson L Swetnam
Major Improvements in How Rates of Soil Formation and Landscape Erosion are Quantified

• Environmental Energy and Mass Transfer (EEMT) equation calculates the available free energy for physical and chemical work
  – uses observations of mean monthly air temperature, precipitation, and solar radiation
  – radiation calculations introduce huge computational load
  – small changes in the quantity and timing of solar energy, temperature and precipitation in complex terrain can result in micro-climates with very different rates of Critical Zone evolution
  – high spatial and temporal resolution energy/surface models are not possible without supercomputers


Swetnam et al. 2016 used their XSEDE start-up allocation to demonstrate a distributed GIS calculation for solar irradiation and effective energy and mass transfer (EEMT) (Rasmussen et al. 2015). We received an XSEDE research allocation to further develop the tool in summer 2016.
ECSS Symposium Series

The ECSS Symposium allows the over 70 ECSS staff members to exchange on a monthly basis information about successful techniques used to address challenging science problems. The series is open to everyone.
Questions?