
SDSC HPC Training

Week 1: January 10, 2020

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What is High Performance Computing?

High Performance Computing

- *Aggregating computing power*
- *Delivers much higher performance than desktop computer or workstation*
- *Solve large problems in science, engineering, or business.*

HPC Trainees will get to play on
Comet (and other machines)

- 2.762.6 PetaFlops (10^{15})
- 27 standard racks, ~6.7 TF /rack with
 - 1944 nodes, 46,656 cores
 - 249 TB DRAM, 622 TB SSD



Goals of the SDSC HPC Students Program

https://www.sdsc.edu/education_and_training/hpc_students.html

- To **facilitate** and increase interactions between the San Diego Supercomputer Center and UCSD students:
- To **educate and train** students in all things HPC: parallel programming, running applications, learning hardware.
- To **connect** students to the wider world of HPC through events, meetings, interactions with industry, attending meetings.
- To **mentor** students to help train the next generation of scientists

HPC Student Activities

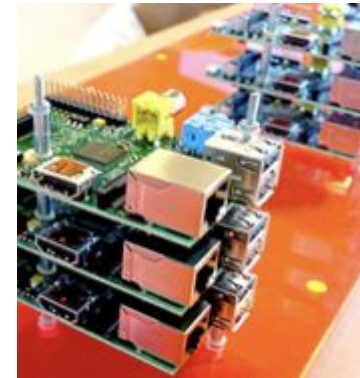
- HPC Training 2020 (CCR credit)
- Raspberry PI Cluster (with Club) - Spring'20
 - SDSC Supplies
hardware, location,
network, etc.
 - Supercomputing Club
students
build-out/admin
- Supercomputing:
 - Apply to be on the
student cluster

HPC Training 2020

- Series of 2 hour sessions:
 - SDSC Staff: Fridays from 1:00pm to 3:00pm from 1/20/2020 to 3/13/2020.
- Students will give accounts on Comet
 - Will complete several basic assignments
 - Some individual, some team
- Students who successfully complete the HPC Training program will:
 - Receive an SDSC Certificate of Completion in HPC Training.
 - Receive an UCSD Co-curricular Record of credit in HPC Training.
 - Become eligible to apply to be on the SCC Core team.
 - Note: the final SCC team who will travel to SCC20 will be chosen from this group.
- *Evaluation metrics* will include:
 - participation credits - e.g. attendance, helping other students, etc.
 - Completion of tasks
 - Credit for experience (working/internships, classes taken)
 - No grades, work in teams, finish within a few weeks of sessions being over

Raspberry PI Cluster

- Goal is to rebuild the Meteor PI Cluster (2013):
 - 15 PI devices + 15 monitors
 - MPI, visualization, WFI, TCP/IP
- New system will have
 - PI-4's + large screen monitor
 - Club members will admin
- Dedicated to student projects
- Running jobs displayed in lobby



Internships (

Summer Internships in Parallel Computational Sciences (SIParCS)

Due January 1, 2020

Paid internships for undergraduates and graduates at the National Center for Atmospheric Research (NCAR) facility in Boulder, CO. Projects cover topics such as augmented reality, machine learning, analysis of climate and weather model data, and more.

Apply: <http://tiny.cc/SIParCS>

Distributed Research Experiences for Undergraduates (DREU)

Due January 15, 2020

DREU is a highly selective program that matches students with a faculty mentor for a summer research experience at the faculty mentor's home institution. DREU interns have the opportunity to be directly involved in a research project in computing and interact with graduate students and professors on a daily basis. This experience is invaluable for those who are considering graduate school.

Apply: <https://cra.org/cra-wp/dreu/>

DesignSafe-CI Research 4 Social Change Research Experience for Undergraduates

Due February 1, 2020

Paid, 10-week summer research program at various NHERI multi-hazard engineering sites. The NHERI REU program is dedicated to helping undergraduate students experience multi-hazard engineering as well as cyber infrastructure, data management, and simulation sites. Hands-on, research based projects introduce participants to a network of engineers, scientists, and students working toward mitigating the effects of natural hazards.

Apply: <http://tiny.cc/DesignSafeCIREU>

NSF IRES ASSURE (Algorithms & Software for SUPERcomputers with emerging aRchitectures)

Due February 4, 2020

Paid, 10-week computational research opportunity for US graduate students and their research mentors to explore applications on China's home grown supercomputer. Application areas include: Earth & Weather Systems, Advanced Manufacturing, Big Data and Machine Learning. Students spend 8 weeks in China at either the National Supercomputing Center in China, Wuxi (NSCC-Wuxi) or East China Normal University, Shanghai (ECNU-Shanghai).

Apply: <https://ires-assure.msu.edu/apply/application/>

Supercomputing and the Student Cluster Competition



<http://www.studentclustercompetition.us/>

<https://sc20.supercomputing.org/>

SCC History/Background

- Began in 2007 to provide HPC experience to undergraduate and high school students.
- Students design and build small clusters, learn scientific computing, run applications.
- Compete in a non-stop, 48-hour challenge to complete a real-world scientific workload:
 - Operate and maintain the cluster
 - Run and test science applications
- Reproducibility Challenge: students attempt to reproduce a science paper
- Power outage challenge - restart system without warning



SCC: How to Compete

<http://www.studentclustercompetition.us/>

- Entering is competitive: we must write a formal application
- Max of 6 undergraduate students can be on the official team, at SC
 - All travel and expenses will be paid for (SCC, SDSC)
- Participation requires a *significant* level of commitment:
 - Learn HPC, applications, cluster hardware
 - Work during Fall to build competition cluster
 - Be able to travel to the meeting -- Atlanta, 11/14 - 11/20

HPC User Training: Overview

- SDSC supports training of its user community in all aspects of High-performance computing (HPC).
- The [HPC User Training](#) activity is designed to promote workforce development in technologies needed to work in HPC.
- Training is provided free to all users, including:
 - UCSD students (both graduate and undergraduate),
 - Post-docs
 - Researchers, faculty, staff, and collaborators on SDSC systems.
- To encourage student participation, special projects and activities are focussed on the Supercomputing/ACM clubs

HPC Training: Scope

The scope of the training effort includes several skill development activities, including:

- Study HPC architectures, software, and admin skills.
- Learn the basics of parallel programming, including MPI using C, Fortran, and possibly other languages.
- Running HPC applications in the areas of performance characterization of the cluster, bioinformatics, numerical methods, password security, and other applications.
- Visualization and analysis of big data sets.

HPC Training - How Does it Work?

- Participants will be given accounts on [Comet](#)
- Must attend most of the sessions and complete approximately 80% of the work.
- Complete weekly basic assignments/tasks.
- Participants are encouraged to work as teams
- Can work on the assignments past the last date of training sessions with the approval of the instructor.
- Those who successfully complete HPC Training:
 - *SDSC Certificate of Completion in HPC Training.*
 - UCSD Co-Curricular Credit (students)
 - There is no grade in the course.
- **Goal: To introduce participants to general HPC concepts**

HPC Students: Support and Services

- SDSC provides support to [UCSD](#) Supercomputing Club:
 - staff mentors, use of public spaces, access to HPC resources, and funding for some activities.
- The program is committed to supporting other relevant student organizations on campus with significant resources in support of common goals.
- Some of the benefits SDSC provides include:
 - Meeting and lab space
 - Access to [SDSC](#) (and the NSF-sponsored [XSEDE](#) project) supercomputing resources and expertise
 - Mentoring for projects, activities, and club events
 - Connections to industry and technology companies.
 - Funding for some activities.

HPC User Training 2020 Schedule

HPC User Training 2020 : HPC-Training-Schedule-Public

Week	DATE	SDSC HPC USER TRAINING*	
		Fridays (1:00-3:00 pm)	Instructors
1	Fri, 01/10/20	Program Orientation, history, plan ; Registration process & accounts; HPC overview & Comet Architecture	Mary Thomas
2	Fri, 01/17/20	Comet 101; Parallel Queues & batch scripting;	Mary Thomas
3	Fri, 01/24/20	GPU Architectures, CUDA	Andy Goetz
4	Fri, 01/31/20	NVIDIA RAPIDS Toolkit	Marty Kandes
		GPU accelerated computing with CUDA Python	Abe Stern (NVIDIA)
5	Fri, 02/7/20	Intro to Parallel Computing: OpenMP/Threads/MPI	Mary Thomas
6	Fri, 02/14/20	Profiling, monitoring, and optimization	Bob Sinkovits
7	Fri, 02/21/20	Cloud computing (AWS, OSG)	Marty Kandes
8	Fri, 02/28/20	Containers for CPU and GPU computing	Marty Kandes
9	Fri, 03/6/20	Visualization Using Python and Jupyter Notebooks	Jeff Sale
10	Fri, 03/13/20	Machine Learning	Mai Nguyen
		Tensor Flow	Mahi Tatineni

Getting Set up: Pizza, XSEDE, Enroll

1. Grab some pizza
2. Register for the Training:
 - a. <https://www.eiseverywhere.com/ereg/newreg.php?eventid=506193>
3. Setup XSEDE Portal Account:
 - a. <http://portal.xsede.org>
 - b. Get user account name
4. Confirm Enrollment (Google Form):
 - a. <http://bit.ly/hpc-enrollment-2020>



SCC Sponsors & Technologies



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