

HPC Workshop

January 18, 2023

11:30 – 12:30 pm (followed by lunch)

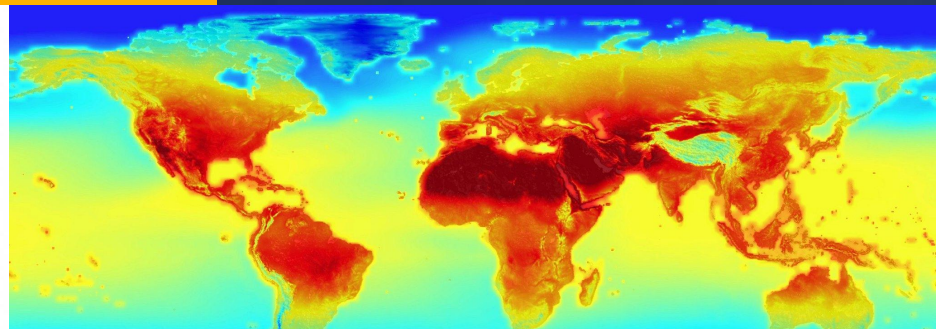
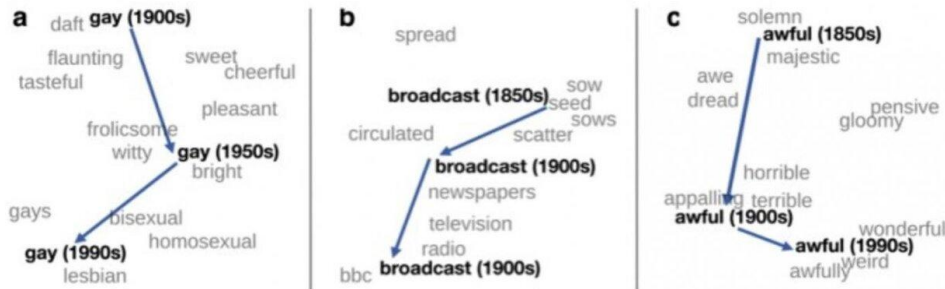
Location: Elings Hall 1605

Register @ <https://csc.cnsi.ucsb.edu>

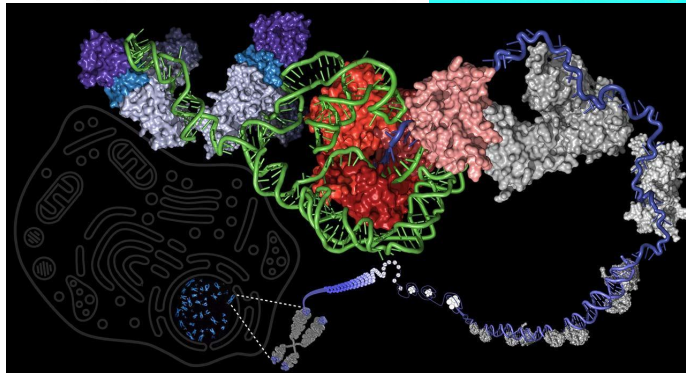
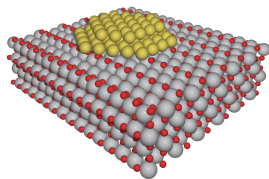
Quickly start using HPC resource at UCSB

- What is HPC?
- Quickly get Started to Use HPC
- Basic Linux Commands
- Basic Slurm Commands
- National HPC & Commercial cloud computing Resources

Computational Linguistics



KS-DFT



The total energy in Kohn-Sham Density Functional Theory (KS-DFT) is expressed as

$$E_{total} = T_s + \int d\mathbf{r} V_{ext}(\mathbf{r})\rho(\mathbf{r}) + E_{xc}[\rho] + \frac{1}{2} \int \int d\mathbf{r} d\mathbf{r}' \frac{\rho(\mathbf{r})\rho(\mathbf{r}')}{|\mathbf{r} - \mathbf{r}'|}$$

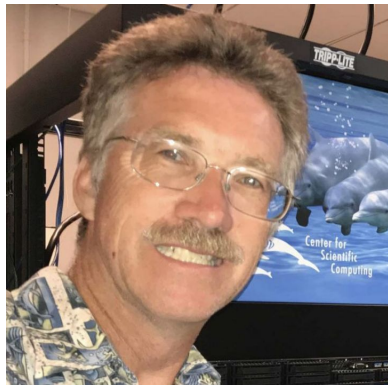


Introduction to High-Performance Computing (HPC) Resources and Linux

Paul Weakliem, Fuzzy Rogers, and Jay Chi

January 18, 2023

Speaker Introductions



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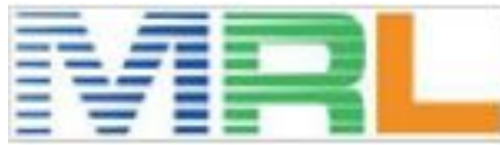
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Agenda

- What is the Center for Scientific Computing (CSC) at UCSB?
- Introduction to High-Performance Computing (HPC) at UCSB
- Goals of this workshop
 - Quickly get started to use cluster
 - Learn the basic of Linux Commands
 - Learn the basic of Slurm (Simple Linux Utility for Resource Management) commands to submit jobs to the cluster
 - File Transfer
 - Introduction to national and commercial HPC resources

What is Center for Scientific Computing (CSC)

What we are:

- A home for HPC and expertise with national supercomputing centers leveraging CNSI, MRL, and ETS resources to enable researchers to focus on the research project/education and not the infrastructure.

Support Capabilities

- We provide the computational infrastructure.
- We provide a large amount of data to store and/or process.
- We provide some expertise/assistance.
- **We work with your local IT staff to provide help.**
- Regular working hours, realistically, 8:30 am - 5 pm Monday through Friday. But we try to make sure the clusters are running near 24/7 (I'd say 365, but it's UCSB and we're a small group)

Scenario (Distributed Computing)

Professor



Exam:

15 Questions
300 Students



Scenario

Teaching Assistants



TA #1

TA #2

TA #3

Data Parallelism



TA #1

TA #2

TA #3

100 Exams per TA



Task Parallelism



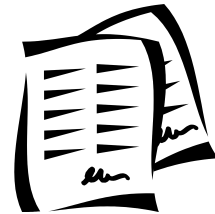
Question 1-5



Question 6-10



Question 10-15



Overview

- Most research now involve some form of computing
 - Often you're solving equations, or analyzing data/doing statistics ('data science'). Engineers often will model a device.
 - Some specific examples:
 - Protein Folding
 - Structure of crystal
 - Search for patterns in DNA
 - Predicting the spread of wildfire
 - Weather prediction
 - Natural Language Processing
- Like many parts of research, you often start a small, with a simple idea, but it grows beyond what you (or your computer) can do yourself!
- Solution:
 - Better Computer
 - High-Performance Computing (HPC)
 - Cloud (Can be both of above, with arbitrary size) - somebody else's computer!

What is High-Performance Computing (HPC)?

- High-Performance Computing (HPC) allows scientists and engineers to solve complex science, engineering, and business problem using applications that require high bandwidth, enhanced networking, and very high compute capabilities. Ref: <https://aws.amazon.com/hpc/>
- Multiple computer nodes connected by a very fast interconnect.
- Each node contains many CPU cores (around 12-40 cores) and 4-6G RAM.
- Allows many users to run calculations simultaneously on nodes.
- Allows a single user to use many CPU caress incorporating multiple nodes.
- Often has high end (64 bit/high memory) GPUs

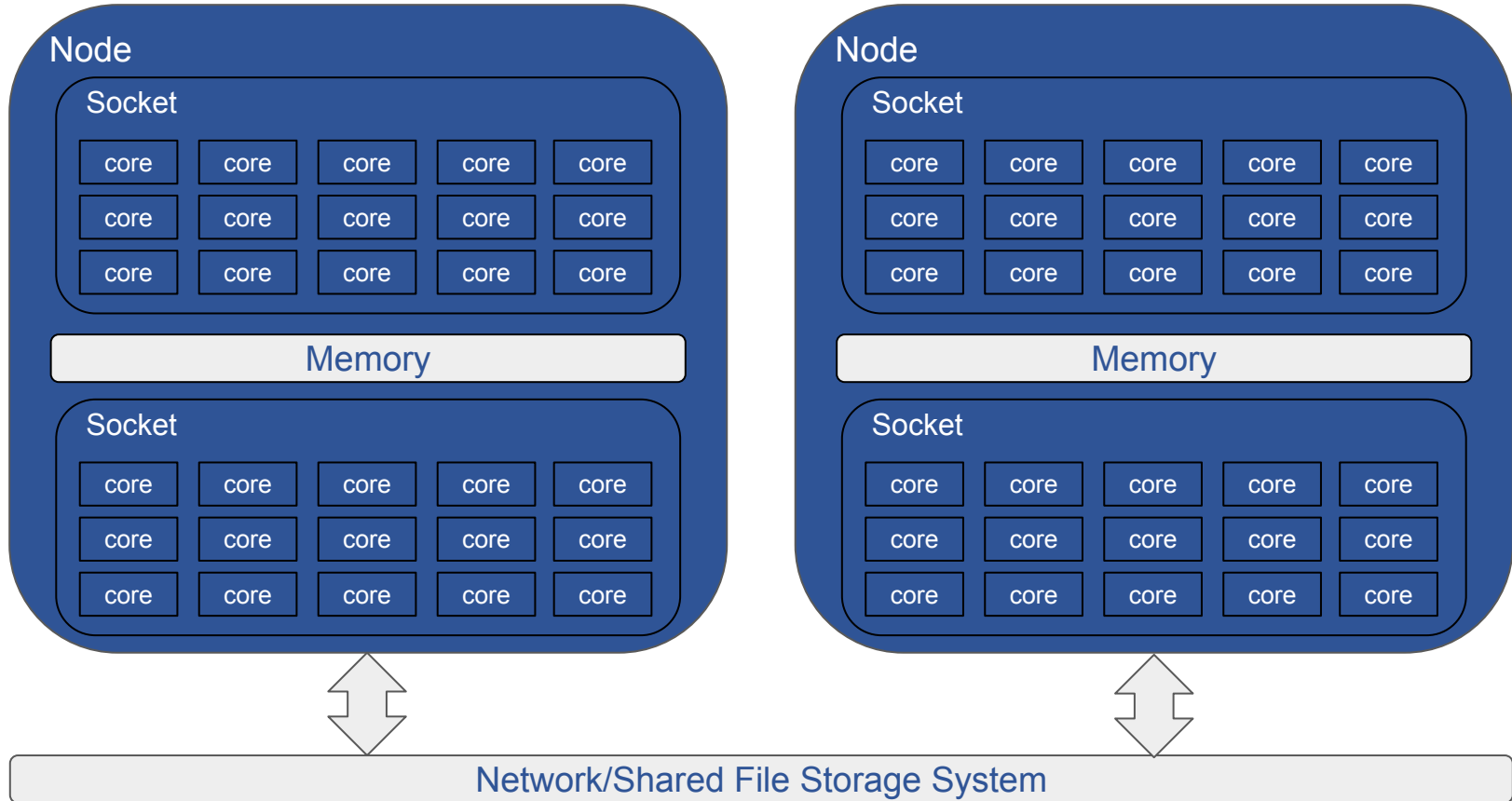


UCSB provides access and support for multiple HPC resources and educational/training/research support.

HPC is not always the only one solution!!!

- Sometimes you need a faster desktop workstation
- Sometimes 'Cloud' is the right solution (need 1000 nodes, but only once every 3 months)
- Sometimes you might even need your own cluster

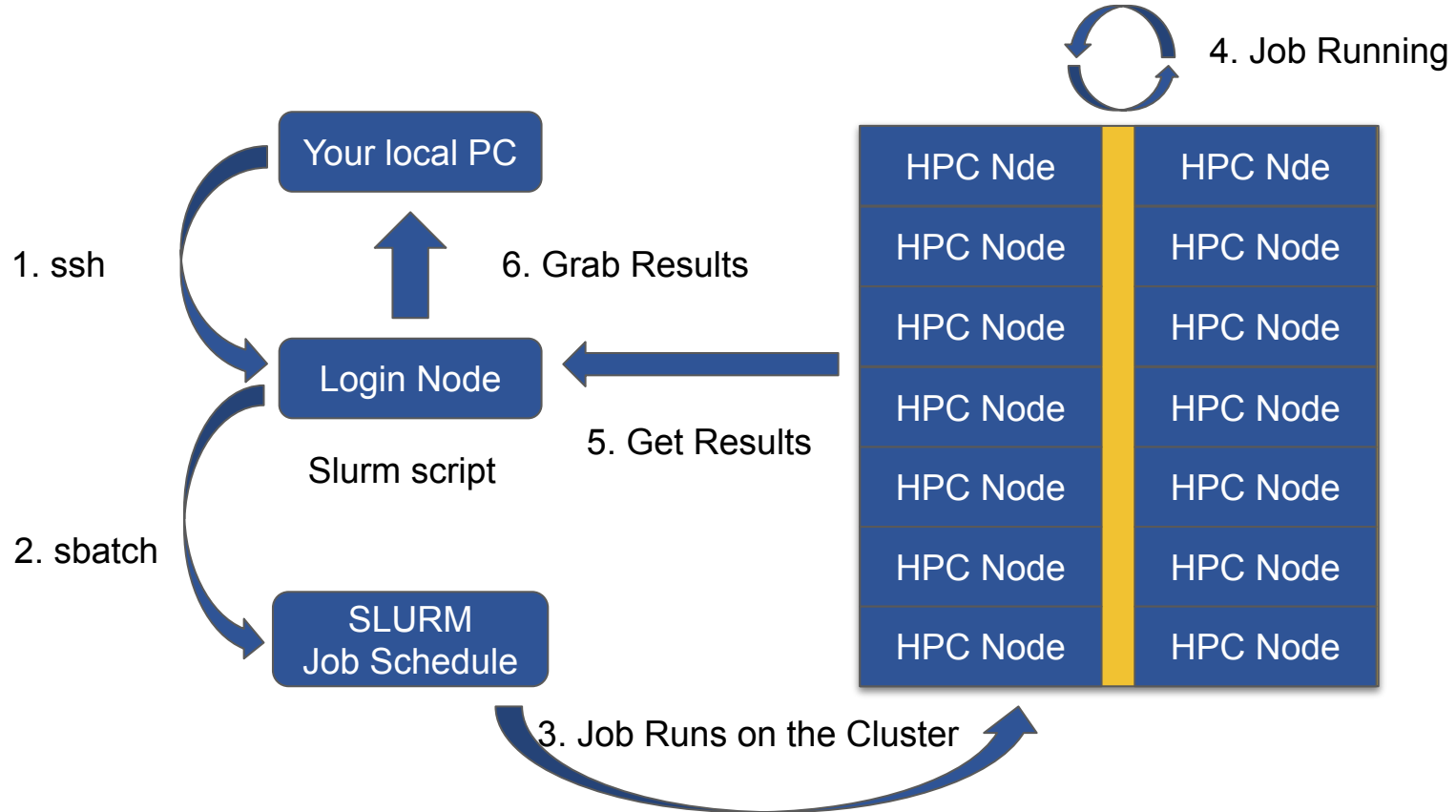
HPC Infrastructure



Terminologies Definitions

- **Core:** The smallest compute unit that can process logic and floating point (run a program).
- **CPU:** The chip that processes the basic instructions that drive a computer. The term *processor* is used interchangeably with the term **central processing unit (CPU)**. CPUs have many cores.
- **Socket:** A physical processor which includes multiple cores with sharing memory. Most of our stuff has 2 sockets, for 2 CPUs.
- **Node:** An individual computer that includes one or more sockets, memory, storages, etc. The fast network connects other nodes.

General HPC Workflow



HPC system at CSC

- Campus available cluster Knot (CentOS/RH 7):
 - 110 nodes with ~ 1400 cores system
 - 4 “fat” nodes with 1TB memory RAM
 - GPU nodes (12 M2050’s) (too old now)
- Campus available cluster Pod (CentOS/RH7)
 - 70 nodes with ~ 2600 cores system
 - 4 “fat” nodes with 1TB memory RAM
 - 15 GPU nodes (Quad NVIDIA V100/32GB with NVLINK)
 - GPU Development node (P100, T4)
- Published papers should acknowledge CSC - <https://csc.cnsi.ucsb.edu/publications>

Request access: <https://csc.cnsi.ucsb.edu/forms/user-account>

- Condo Clusters
 - Guild (70 nodes) EOL
 - Braid (120 nodes, also has GPUs) fairly old now
 - Braid2 (20 nodes with some GPUs)

Pls buy nodes in the clusters, CSC handles infrastructure.

What Computational Resources are available

- UCSB Center for Scientific Computing (CSC) HPC clusters
 - Access to all UCSB staff, Pod (free) and condo (PI) clusters.
- Advanced Cyberinfrastructure Coordination Ecosystem: Services & Support (ACCESS)
 - National HPC resources funded by NSF. Free*
- NRP Nautilus Cluster (Consumer GPUs)
 - National cloud computing resource for accelerating machine learning on the GPUs. Free*
- Aristotle Cloud (LSIT)
 - UCSB local cloud resource, e.g. [Jupyter hub](#)
- Secure Compute Research Environment (SCRE)
- Other discipline specific UCSB resources
 - NCEAS, ERI, ECI, your local department
- Commercial Cloud Computing Resources:
 - AWS, Microsoft Azure, google Cloud Platform

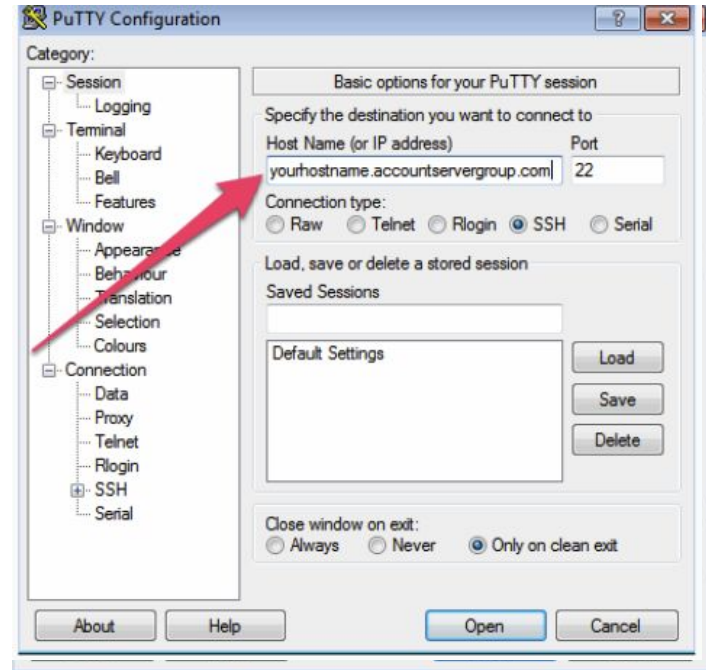
HPC Resources of Useful Information

- CSC Software Documentation
 - <https://csc.cnsi.ucsb.edu/docs>
- National HPC resources
 - ACCESS: <https://access-ci.org/>
 - San Diego Supercomputer Center: <https://www.sdsc.edu/>
 - NRP Nautilus: <https://portal.nrp-nautilus.io/>
- Transitioning from XSEDE to ACCESS by using Globus
 - <https://www.globus.org/advance-to-access>
- UCSB Aristotle Cloud (LSIT):
 - <https://www.aristotle.ucsb.edu/> and <https://help.lsit.ucsb.edu/hc/en-us/categories/360005255312-Jupyter>
- UCSB Campus Cloud Information:
 - <https://www.it.ucsb.edu/explore-services/ucsb-campus-cloud>
 - <https://docs.cloud.ucsb.edu/>
- More information, go to <https://csc.cnsi.ucsb.edu/resources>

Connecting to the POD

- For the Windows system, you can use PuTTY ssh client
 - Download the PuTTY (<https://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html>)

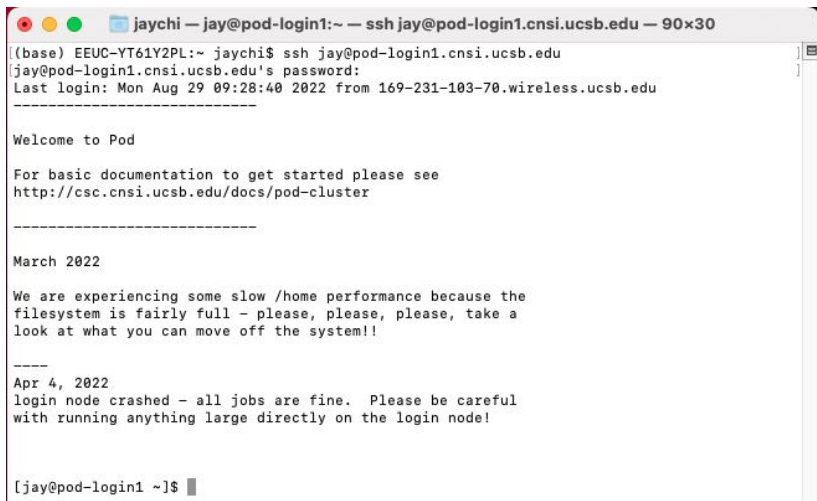
pod-login1.cnsi.ucsb.edu



Connecting to the POD

- For the Mac or Linux system, you can open the terminal

```
ssh your_user_name@pod-login1.cnsi.ucsb.edu
```



```
jaychi — jay@pod-login1:~ — ssh jay@pod-login1.cnsi.ucsb.edu — 90x30
(base) EEUC-YT61Y2PL:~ jaychi$ ssh jay@pod-login1.cnsi.ucsb.edu
jay@pod-login1.cnsi.ucsb.edu's password:
Last login: Mon Aug 29 09:28:40 2022 from 169-231-103-70.wireless.ucsb.edu

-----
Welcome to Pod

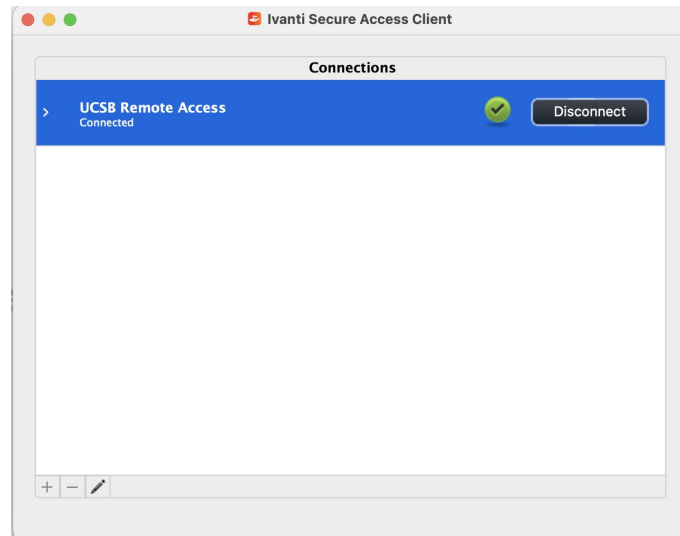
For basic documentation to get started please see
http://csc.cnsi.ucsb.edu/docs/pod-cluster

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March 2022

We are experiencing some slow /home performance because the
filesystem is fairly full - please, please, please, take a
look at what you can move off the system!!

-----
Apr 4, 2022
login node crashed - all jobs are fine. Please be careful
with running anything large directly on the login node!

[jay@pod-login1 ~]$
```



Important: Remote (non UCSB) login via VPN client:

<https://www.ets.ucsb.edu/pulse-secure-campus-vpn/get-connected-campus-vpn>

File Transfer

- How do I upload data & download my files?

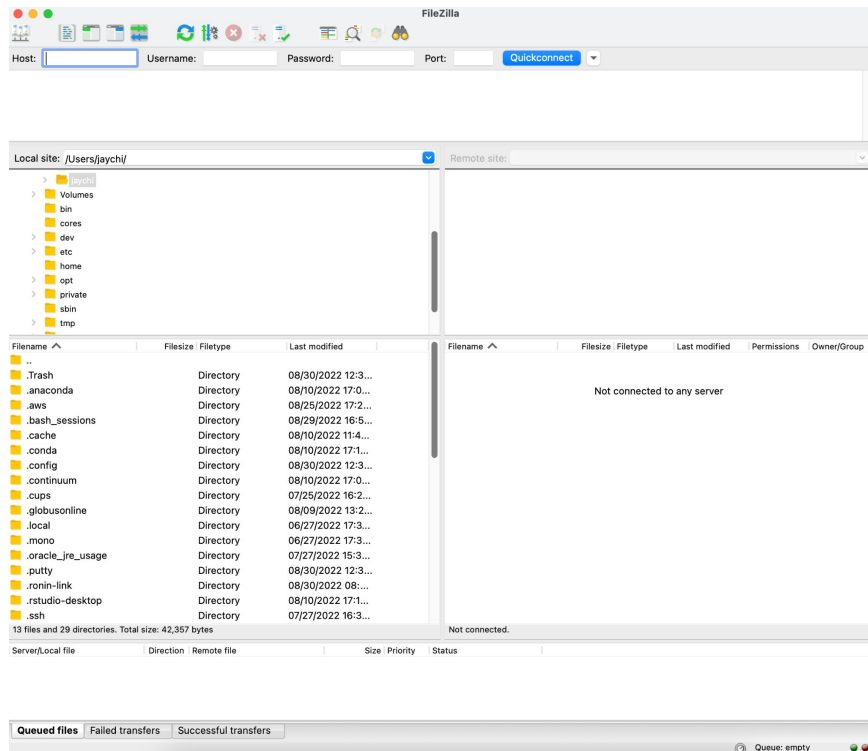
- Graphical User Interface (GUI)
 - Filezilla: <https://filezilla-project.org/>
 - Cyberduck: <https://cyberduck.io/>
- Command-Line Interface (CLI)
 - “scp” command

- FileZilla

- Host: pod-login1.cnsi.ucsb.edu
- Username: your_user_name
- Password: your_password
- Port: 22

- Globus (for larger files transfers)

- <https://csc.cnsi.ucsb.edu/docs/globus-v5-new>



Basic Linux Commands

- ls
- pwd
- cd
- mkdir
- cp
- mv
- rm
- scp
- nano, vim, or emacs to edit your file.

Basic Linux Commands (ls)

- The ls (list) command files and directories in a directory.

- General syntax:

ls [OPTIONS] [FILENAME]

- OPTIONS include:

-l long listing, includes file date and size

-a displays all files

-t show the newest files first

Basic Linux Commands (pwd & cd)

- pwd stands for print working directory.

pwd

- The cd (change directory) command is used to change one directory to another.

- General syntax:

cd [DIRECTORY]

- Change your present directory to the parent directory:

\$ cd ..

- Change your present directory to the home directory:

\$ cd ~

Basic Linux Commands (mkdir & cp)

- The mkdir (make directory) command creates a new directory.

- General syntax:

```
mkdir [OPTIONS] Folder_name
```

- The touch command creates a new file.

- General syntax:

```
touch file_name
```

- The cp (copy) command is used to copy a file or directory.

- General syntax:

```
cp [OPTIONS] Source Destination
```

- OPTIONS include:

-r recursively copy a directory, all files and subdirectories inside it.

Basic Linux Commands (mv & rm)

- The mv (move) command is used to move or rename a file or directory.

- General syntax:

mv Source Destination

- The rm (remove) command is used to delete a file or directory.

- General syntax:

rm [OPTIONS] file_name

- OPTIONS include:

- -r recursively delete a directory, all files and subdirectories inside it.

- **Important:** After **rm** or **rm -r** command is executed, all files are gone and can't find in recycle bin.

File Transfer

- The scp (secure copy) command is used to transfer files between two locations.

- General syntax:

scp [OPTIONS] LOCAL REMOTE

scp [OPTIONS] REMOTE LOCAL

scp [OPTIONS] REMOTE REMOTE

- OPTIONS include:

-r recursively copy a directory, all files and subdirectories inside it.

More Linux Resource Information

- UCSB Software Carpentries

- Introduction to the Unix Shell and Version Control with Git

(<https://ucsbcarpentry.github.io/2022-10-18-ucsb-bash-git/>)

Modules

- Module system provides for the dynamics modification of a user's environment.
- Module commands allow the user to add applications and libraries to your environment.
- This allows us to simultaneously and safely provides several versions of the same softwares.
- All clusters have a default programming environment loaded for you when you login.
- There are some functional software are not modularized in /sw directory. Please take a look if you need.

Modules

1. List available modules
2. Search available modules for MatLab
3. Load the MatLab module
4. Unload the MatLab module
5. Purge all modules
6. List currently loaded modules

Modules

1. List available modules

```
$ module avail
```

```
...
```

2. Search available modules for MatLab

```
$ module avail MatLab
```

```
----- /sw/modulefiles -----
```

```
MatLab/R2016b MatLab/R2018a MatLab/R2018b MatLab/R2019a MatLab/R2019b MatLab/R2021b
```

3. Load the MatLab module

```
$ module load MatLab/R2021b
```

Modules

4. Unload the MatLab module

```
$ module unload MatLab/R2021b
```

5. Purge all modules

```
$ module purge
```

6. List currently loaded modules

```
$ module list
```

Currently Loaded Modulefiles:

1) autotools 2) prun/1.2 3) gnu/5.4.0 4) ohpc

Job Submission Script

- When you login to the Cluster, you are on the login node. This node is **NOT** for running calculations!
- All jobs must be submitted to the queue - it just allocate nodes.
- Submission to the queue requires a job script to be written.
- Job script need to specify the resource that you need. There are three basic units:
 - Number of Nodes
 - Number of Cores
 - Time (Optional)
- Other resource you might need to add such as: job name, memory, reminder email, etc.

Example Slurm Job Submission script

Slurm job script file: job.s

```
#!/bin/bash
#SBATCH -J 'testJob'
#SBATCH --nodes=1
#SBATCH --ntasks=1
#SBATCH -p short
#SBATCH -o outLog
#SBATCH -e errLog
#SBATCH -t 00:10:00
#SBATCH --mail-user=username@ucsb.edu
#SBATCH --mail-type ALL

module purge
module load openmpi/2.1.0-opt

cd $SLURM_SUBMIT_DIR/

mpirun ./hello
```

Job Name
No. of Nodes
No. of Tasks
Submit the job to Partition (Optional)
Output Log File (Optional)
Error Log File (Optional but suggest to have it)
Job Execution Time
Mail to you (Optional)
Mail send you when the job starts and end (Optional)

Absolute path of the current working directory when you submit the job

How to Submit and Monitor Your Job

- Once you have a job script, you may submit this script to SLURM using the sbatch command. SLURM will find an available compute node or set of compute nodes and run your job there, or leave your job in a queue until some resources become available.

```
$ sbatch job.s  
Submitted batch job 1234567
```

- List all current jobs from the user.

```
$ squeue -u your_user_name  
$ showq your_user_name
```

- Stop and delete the Job

```
$ scancel 1234567
```


How to Submit and Monitor Your Job

- List all partitions on the cluster

\$ sinfo

PARTITION	AVAIL	TIMELIMIT	NODES	STATE	NODELIST
batch*	up	32-00:00:0	1	down*	node1
batch*	up	32-00:00:0	1	drng	node20
batch*	up	32-00:00:0	1	drain	node4
batch*	up	32-00:00:0	30	mix	node[6,8-9,11,13-16,19,22-23,26-28,32,36-39,42-44,49,52-56,58,60]
batch*	up	32-00:00:0	29	alloc	node[3,5,7,10,12,17-18,21,24-25,29-31,33-35,40-41,45-48,50-51,57,59,61-63]
batch*	up	32-00:00:0	1	idle	node2
short	up	2:00:00	1	mix	node64
largemem	up	37-12:00:0	4	mix	node[101-104]
gpu	up	7-00:00:00	1	down*	node117
gpu	up	7-00:00:00	13	mix	node[111-113,115-116,118-125]

- List the partition who are using

\$ squeue -p short

- Report the job expected start time

\$ squeue --start -j job_ID

Running Jobs on Pod (Slurm)

- Start/submit a job: `$ sbatch job.s`
- Check status of the running jobs: `$ squeue -u user_name`
`$ showq user_name`
- Delete a running job: `$ scancel job_id`
- Available partition:
 - Short partition: running under 2 hrs
 - `#SBATCH -p short`
 - Large memory partition: running the longest 37 days
 - `#SBATCH -p largemem`
 - GPU partition: running the longest 7 days
 - `#SBATCH -p gpu`

Other Computing Options

- National HPC Resource: ACCESS (Free)
- Cloud Computing: Amazon Web Services

National HPC Resources: ACCESS

Four Allocation Opportunities to suit a variety of needs (credit thresholds):

- **Explore (400,000)**
 - Best-suited for endeavors with light resource requirements
 - Grad students can be PIs
- **Discover (1,500,000)**
 - Minimal effort to start production research activities
 - Potential best-fit for Campus Champion Allocations
- **Accelerate (3,000,000)**
 - More substantial resource requirements
 - Multi-grant research, Gateways, etc.
- **Maximize (No upper limit)**
 - For large-scale research project with extreme resource needs
 - Will largely resemble XRAC process

The screenshot shows the ACCESS Allocations website. The top navigation bar includes links for ALLOCATIONS, SUPPORT, OPERATIONS, METRICS, ACCESS Home, About, News, and My ACCESS. The main header features the ACCESS Allocations logo. Below the header, a secondary navigation bar lists: Get started, Manage allocations, Prepare requests, Use credits, Updates, Policies, and FAQs. A dropdown menu is open under 'Prepare requests', showing options: Overview, Explore ACCESS, Discover ACCESS, Accelerate ACCESS, and Maximize ACCESS. The main content area contains text about the ACCESS Allocations Marketplace, stating that researchers and educators can gain access to advanced computing, visualization, and storage resources. It also mentions that resource providers are at the center of the marketplace and that reviewers provide a valuable service to ACCESS, the NSF, and the national research community. Below this text, there are five icons representing the allocation process: CREATE (two people with a plus sign), SET FCT (a person with a plus sign and a square), REQUEST (a document with a plus sign), RECEIVE (two coins), and EXCHANGE (a shopping cart). Below the icons, the section 'ACCESS Credits and Thresholds' is displayed, followed by a table.

Allocation	Credit Threshold
Explore ACCESS	400,000
Discover ACCESS	1,500,000
Accelerate ACCESS	3,000,000
Maximize ACCESS	Not awarded in credits.

National HPC Resources: ACCESS



[Get started](#) [Manage allocations](#) [Prepare requests](#) [Use credits](#) [Updates](#) [Policies](#) [FAQs](#)

[Get started](#)

[Manage allocations](#)

[Prepare requests](#)

[Use credits](#)

[Updates](#)

[Overview](#)

[Submit a request](#)

[Manage my projects](#)

[Manage users](#)

[Allocations Usage](#)

Researchers and educators can gain access to advanced computing, storage, and data resources to accomplish their research. **Resource providers** are at the center of the ACCESS Allocation system, enabling research possible for the diverse community. **Reviewers** provide a valuable service to ACCESS, the NSF-funded system, by participating in merit reviews of requests.

We hope you'll get involved! Let's get started.



CREATE



REQUEST



RECEIVE

Maximize ACCESS – March 2023

Submissions open: 2022-12-15 – 2023-01-15

For projects with resource needs beyond those provided by an Accelerate ACCESS project, a Maximize ACCESS request is required. ACCESS has an upper limit on the size of allocations that can be requested or awarded at this level, but resource providers may have limits on allocation amount and resources.

[SUBMIT A MAXIMIZE ACCESS – MARCH 2023 REQUEST](#)



Available Opportunities

Here are the open opportunities for which you may request an allocation. Find the opportunity that aligns with your best estimate of your resource needs. Don't worry about starting too small. As you clarify your needs, you can upgrade to a larger-scale opportunity when you're ready.

Explore ACCESS

Explore ACCESS allocations are intended for purposes that require small resource amounts. Researchers can try out resources or run benchmarks, instructors can provide access for small-scale classroom activities, research software engineers can develop or port codes, and so on. Graduate students can conduct thesis or dissertation work.

[SUBMIT AN EXPLORE ACCESS REQUEST](#)

Discover ACCESS

Discover ACCESS projects are intended to fill the needs of many modest-scale research activities or other resource needs. The goal of this opportunity is to allow many researchers to request allocations with a minimum amount of effort so they can complete their work. To submit a request, you will need to submit a one-page description of the project to address the review criteria. You can also ask for an advisory review from the community to guide you to appropriate resources.

[SUBMIT A DISCOVER ACCESS REQUEST](#)

Accelerate ACCESS

Accelerate ACCESS projects support activities that require more substantial resource amounts to pursue their research objectives. Researchers are expected to have reasonably well defined plans for their resource use and to submit a 3-page project description for merit review. Reviewers will look more closely at how your resource usage plan addresses the review criteria.

[SUBMIT AN ACCELERATE ACCESS REQUEST](#)



National HPC Resources: ACCESS

- ACCESS consists of a set of Resource Providers (PRs) that offer a wide range of computational resources including systems such as high-performance computing (HPC) clusters, virtualization (cloud-style) clusters, high throughput computing (HTC) clusters, massive storage clusters, large memory clusters, and composable clusters.
- ACES (Texas A&M)
- Anvil (Purdue)
- Bridges-2 (PSC)
- DARWIN (Delaware)
- Delta (NCSA)
- Expanse (SDSC)
- FASTER (Texas A&M)
- Jetstream2 (IU)
- OOKAMI (Stonybrook)
- KyRIC (Kentucky)
- Rockfish (JHU)
- Stampede-2 (TACC)
- RANCH (TACC)
- Open Science Grid (OSG)
- Open Storage Network (OSN)

National HPC Resources: ACCESS



Purdue Anvil CPU	▼
Purdue Anvil GPU	▼
SDSC Expanse CPU	▼
SDSC Expanse GPU	▲
Resource Type: Compute	
Resource Description:	Expanse GPU will be a Dell integrated cluster, NVIDIA V100 GPUs with NVLINK, interconnected with Mellanox HDR InfiniBand in a hybrid fat-tree topology. There are a total of 52 nodes with four V100 SMX2 GPUs per node (with NVLINK connectivity). There are two 20-core Xeon 6248 CPUs per node. Full bisection bandwidth will be available at rack level (52 CPU nodes, 4 GPU nodes) with HDR100 connectivity to each node. HDR200 switches are used at the rack level and there will be 3:1 oversubscription cross-rack. In addition, Expanse also has four 2 TB large memory nodes. The system will also feature 12PB of Lustre based performance storage (140GB/s aggregate), and 7PB of Ceph based object storage.
Recommended Use:	GPUs are a specialized resource that performs well for certain classes of algorithms and applications. Recommend to be used for accelerating simulation codes optimized to take advantage of GPUs (using CUDA, OpenACC). There is a large and growing base of community codes that have been optimized for GPUs including those in molecular dynamics, and machine learning. GPU-enabled applications on Expanse will include: AMBER, Gromacs, BEAST, OpenMM, NAMD, TensorFlow, and PyTorch.
Organization:	San Diego Supercomputer Center
Units:	GPU Hours
Description:	
SDSC Expanse Projects Storage	▼

allocations	Prepare requests	Use credits	Updates	Policies	FAQs
g, visualization, and data res		Overview	r research or classroom objectives...		
ketplace, making research p		Available resources	community that ACCESS serves...		
ditional research community		Exchange calculator	views of the largest allocation requests.		

REQUEST ALLOCATION

Exchange Calculator

Number of units on this resource:

10,000	ACCESS Credits
--------	----------------

Equals this many units on this resource:

186	SDSC Expanse GPU
-----	------------------

RESET



REQUEST
ALLOCATION

Exchange Calculator

Number of units on this resource:

10,000

ACCESS Credits

Equals this many units on this resource:

186

SDSC Expanse GPU

RESET

National HPC Resources: ACCESS

ACCESS HomeAboutNewsMy ACCESS

My Allocations

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Edit Profile

Logout

List of ACCESS Allocations Requests

Please click the View Actions link to see actions on each of your requests. You can use the Choose New Action arrow menu to add new actions to the request.

Discover ACCESS TRA220034 Chi

Active from 2022-11-16 to 2023-11-15

Type: New

Status: Approved

Submitted: 2022-10-12

Manage Users

Choose New Action

Supplement

Transfer

Available Resources

For a transfer, please indicate the resource you are **transferring from** with **negative number** (e.g., -1,000), and the resource you are **transferring to** with a **positive number** (e.g., 1,000).

To request a resource, select it and enter an amount. Comments are optional.[Exchange Calculator](#)

☒ ACCESS Credits

-46,080.00

ACCESS Credits

Comments

Transfer to 64 Cores f

☒ SDSC Expanse CPU

Expanse will be a Dell integrated compute cluster, with AMD Rome processors, interconnected with Mellanox HDR InfiniBand in a hybrid fat-tree topology. There are 728 compute nodes, each with two 64-core AMD EPYC 7742 (Rome) processors for a total of 93,184 cores. They will feature 1TB of NVMe storage and 256GB of DRAM per node. Full bisection bandwidth will be available at rack level (56 nodes) with HDR100 connectivity to each node. HDR200 switches are used at the rack level and there will be 3:1 oversubscription cross-rack. In addition, Expanse also has four 2 TB large memory nodes. The system will also feature 12PB of Lustre based performance storage (140GB/s aggregate), and 7PB of Ceph based object storage.

- SDSC Expanse Projects Storage is required if requesting this resource.

46,080.00

Core-hours

Comments

request 64 cores for running 30 days

☒ SDSC Expanse Projects Storage

Allocated storage for projects using Expanse Compute and Expanse GPU resources.

- SDSC Expanse CPU is required if requesting this resource.
- SDSC Expanse GPU is required if requesting this resource.

10.00

GB

Comments

Cloud Computing: Amazon Web Services (AWS)

- If you choose to use AWS, it is recommended to take advantage of the Campus Cloud Landing Zone (LZ) for AWS. A UCSB purchases order is required to request an Campus Cloud account (<https://ucsb.github.io/campus-cloud-docs/getting-started/#procurement>).

Campus Single Sign On for AWS: <https://aws.cloud.ucsb.edu>

- Supported Campus Cloud Regions:
 - **US-West-2 (Oregon)**
 - **US-East-1 (N.Virginia)**
- We recommend starting in *US-West-2*

The screenshot shows the AWS Management Console Home page. It includes a 'Recently visited' section with links to EC2, GuardDuty, AWS Budgets, AWS Cost Explorer, S3, Trusted Advisor, Simple Notification Service, AWS Health Dashboard, Amazon Simple Email Service, Security Hub, CloudWatch, S3 Glacier, IAM, and Elastic Container Service. There are also links for 'Welcome to AWS', 'Getting started with AWS', 'Training and certification', and 'What's new with AWS?'. At the bottom, there are sections for 'AWS Health' and 'Cost and usage'.

The screenshot shows the AWS Free Tier page. It features a 'Types Of Offers' section with three options: 'Free trials' (Short-term free trial offers start from the date you activate a particular service), '12 months free' (Enjoy these offers for 12 months following your initial sign-up date to AWS), and 'Always free' (These free tier offers do not expire and are available to all AWS customers). Below this is the 'Explore Top Product Categories' section with links to Compute, Database, Storage, Containers, Web & Mobile Apps, Serverless, and Machine Learning. The 'Free Tier details' section includes a 'Filter by' dropdown and a table of product categories with their respective free tier limits.

Product Category	Free Tier Limit
COMPUTE	Free Tier 12 MONTHS FREE Amazon EC2 750 Hours
STORAGE	Free Tier 12 MONTHS FREE Amazon S3 5 GB
DATABASE	Free Tier 12 MONTHS FREE Amazon RDS 750 Hours

Important: You may need the help of a PI or Department Purchasing person to create a Purchase Order which is necessary to request an account in the Campus Cloud.

Amazon Elastic Compute Cloud (Amazon EC2)

- Use Case:

- Run cloud-native and enterprise applications
- Scale for HPC applications
- Train and deploy ML applications

- EC2 Instance Types

- General Purpose
- Compute Optimized
- Memory Optimization
- Accelerated Computing
- Storage Optimized

- More Information

- Amazon EC2: <https://aws.amazon.com/ec2/>
- Amazon EC2 Pricing Estimation: <https://aws.amazon.com/ec2/pricing/on-demand/>
<https://instances.vantage.sh/>

On-Demand Plans for Amazon EC2

Select a location type and region

Location Type

AWS Region

Region

US West (Oregon)

Select an operating system, instance type, and vCPU to view rates

Operating system

Linux

Instance type

Compute Optimized

vCPU

36

Viewing 4 of 525 available instances

Q

< 1 >

Instance name ▲	On-Demand hourly rate ▼	vCPU ▼	Memory ▼	Storage ▼	Network performance ▼
c5.9xlarge	\$1.53	36	72 GiB	EBS Only	10 Gigabit
c5d.9xlarge	\$1.728	36	72 GiB	1 x 900 NVMe SSD	10 Gigabit
c5n.9xlarge	\$1.944	36	96 GiB	EBS Only	50 Gigabit
c4.8xlarge	\$1.591	36	60 GiB	EBS Only	10 Gigabit

Ronin Platform **RONIN**

ronin.ucsb.edu/login.php

View site information

- If you like to use AWS to be your cloud computing platform, RONIN removes the enormous complexity of AWS offerings and provides an easy-to-use self-service platform.
- UCSB provides RONIN information support if you like to use AWS to do your computing research via the RONIN platform.

UC SANTA BARBARA

LET'S GO!

Contact with Bill Doering: billd@ucsb.edu



RESEARCH IT BUILDERS

PROJECT MACHINES



JAY-UBUNTU
UBUNTU SERVER 20.04 LTS



STOPPED



jay-ubuntu.ronin.ucsb.edu



22 SSH ubuntu

RPID:RESEARCH-IT-BUILDERS:jay-ubunt



C4.8XLARGE



60 GiB RAM 36 vCPUs

Ubuntu Server 20.04 LTS



JAY-UBUNTU-/DEV/SDA1
100 GB SSD




/dev/sda1 Root Drive

Ubuntu Server 20.04 LTS

Delete On Termination

Ronin Platform: Control Your AWS Cost



JAY-UBUNTU
UBUNTU SERVER 20.04 LTS

STOPPED

LAST STOPPED BY
jaychi@ucsb.edu

SMART SCHEDULE IS DISABLED

SAVE 60% WITH A SINGLE CLICK

SMART SCHEDULE

CREATED BY
jaychi@ucsb.edu

SMART SCHEDULE
CHOOSE FROM OUR SMART SCHEDULE RECIPES BELOW TO SAVE ON YOUR MACHINE COSTS.

DISABLED


JAY-UBUNTU - STOPPED

TIMEZONE - AMERICA/LOS_ANGELES

The Early Bird
6am to 2pm
Schedule your machine to wake up as early as you do.
DISABLED

The All Business
9am to 5pm
Schedule your machine to cover the work day.
DISABLED

The Night Owl
2pm to 10pm
Schedule your machine to stay up late into the night.
DISABLED



24 Hour Uptime Costs
\$1161.43 per month

Scheduled Costs
\$0.00 per month

Potential Savings
\$0.00 per month

Manually set your machine smart schedule here.
STOP ONLY DISABLED

Weekly Schedule
Decide which days to run your machine smart schedule.

ALL MON TUE WED THU FRI SAT SUN

☐ ☐ ☐ ☐ ☐ ☐ ☐

SMART SCHEDULE
CHOOSE FROM OUR SMART SCHEDULE RECIPES BELOW TO SAVE ON YOUR MACHINE COSTS.

ENABLED


JAY-UBUNTU - STOPPED

TIMEZONE - AMERICA/LOS_ANGELES

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DISABLED

The All Business
9am to 5pm
Schedule your machine to cover the work day.
ENABLED

The Night Owl
2pm to 10pm
Schedule your machine to stay up late into the night.
DISABLED



24 Hour Uptime Costs
\$1161.43 per month

Scheduled Costs
\$276.53 per month

Potential Savings
\$884.90 per month

Manually set your machine smart schedule here.
STOP ONLY DISABLED

Weekly Schedule
Decide which days to run your machine smart schedule.

ALL MON TUE WED THU FRI SAT SUN

☐ ☒ ☒ ☒ ☒ ☒ ☐ ☐

CLOSE

SAVE CHANGES

Questions and Thought

- What else content should we cover?
- Other ideas for a workshop?
 - Running Parallel Python / Matlab / R on the Cluster, Mathematica, Lumerical, Singularity/Docker Container, etc.
- More Information:

<https://csc.cnsi.ucsb.edu/>

National HPC Resources: ACCESS

[Get started](#)[Manage allocations](#)[Prepare requests](#)[Use credits](#)[Updates](#)[Policies](#)[FAQs](#)

Researchers and educators can gain access to advanced

Resource providers are at the center of the ACCESS Alloc

Reviewers provide a valuable service to ACCESS, the NSF

We hope you'll get involved! Let's get started.



CREATE
ACCOUNT



SELECT
OPPORTUNITY



REQUEST
ALLOCATION

If you have questions, please use the ACCESS [Help Request Form](#).

[Overview](#)[Submit a request](#)[Manage my projects](#)[Manage users](#)[Allocations Usage](#)

, and data resources to accomplish their research or classroom objectives...

ing research possible for the diverse community that ACCESS serves...

a community by participating in merit reviews of the largest allocation requests

	Explore	Discover	Accelerate	Maximize
Possible purposes	Evaluation, courses, development, exploration	Small-scale research, Campus Champions, growing gateways	Mid-scale needs, consolidating related grants, collaborations	Largest-scale research activities
Credit threshold	400,000 Credits	1,500,000 Credits	3,000,000 Credits	No upper limit
Duration	Grant duration or 12 months	Grant duration or 12 months	Grant duration or 12 months	12 months
Number per PI	Multiple	Multiple	One (some exceptions)	One (limited exceptions)
Accepted	Continuously	Continuously	Continuously	Semi-annually
Proposal length	Abstract	1 page	3 pages	10 pages
Review	Eligibility	Advisory review requestable	Rolling panel review	Panel review