Module 1: Getting Familiar with RC

Meet the User Support Team

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Learning Goals

1. Understand CURC Resources & the Alpine cluster
2. Getting an account & logging in
3. Navigate the RC system

Ask Questions

Discuss Ideas

RC Resources

Tech Support

- High Performance Computing
- Data Management
- Cloud Computing
- Secure Research

Human Support

- Training Materials & Workshops
- Consultations & Office Hours
- Help Tickets

High Performance Computing (HPC)

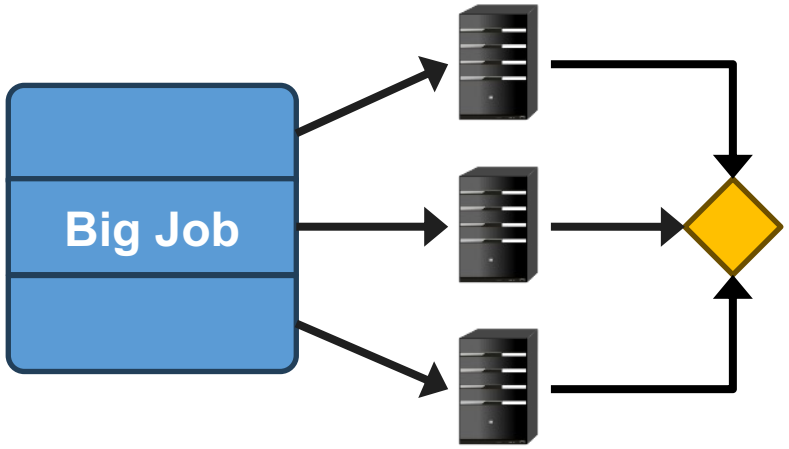
Traditional vs HPC

Fewer Computing Resources, Fast Sprinter*

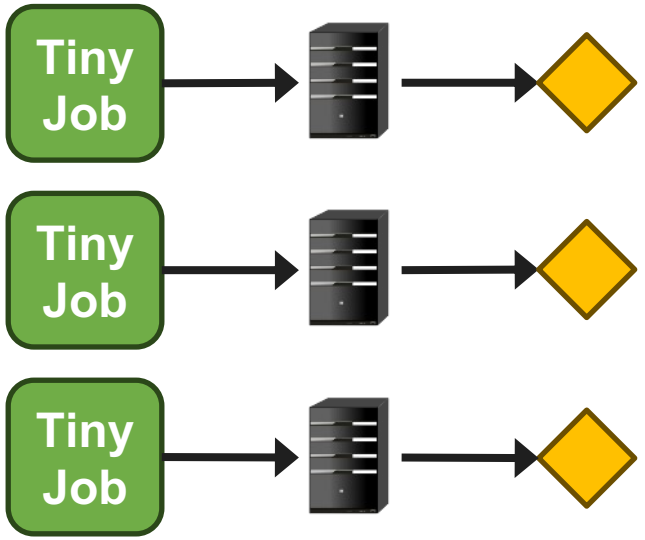
More Computing Resources, Steady Marathon Runner*

***Potentially**

What can / use HPC for?

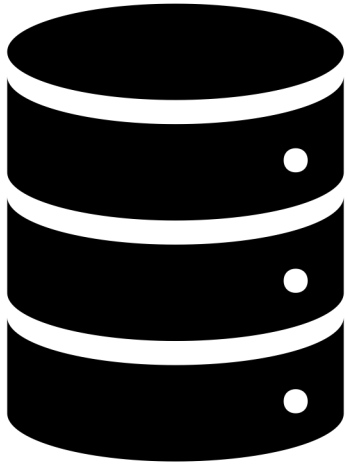


Parallel Jobs

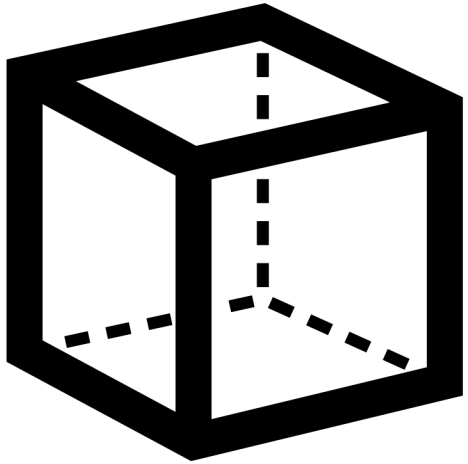


Serial Jobs

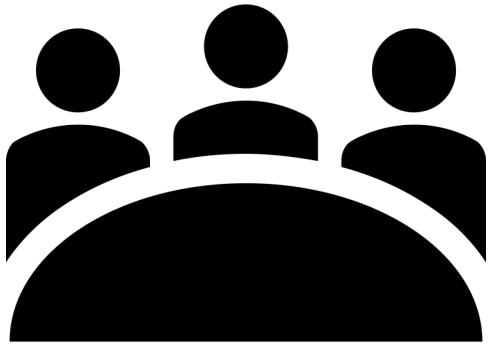
What can / use HPC for?



Big Data



Viz/Rendering



Shared Work Environment

HPC Cluster: Alpine

- 3rd-generation HPC cluster
  - Janus (2012)
  - RMACC Summit (2017)
- Heterogeneous cluster with hardware currently provided by CU Boulder, CSU, and Anschutz
- Access available to CU Boulder, CSU, AMC and RMACC users

Alpine Partitions

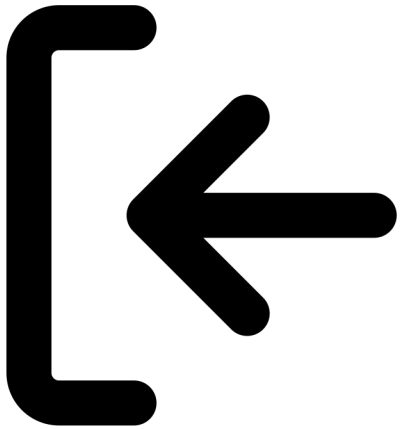
Partition	Description	# of nodes	RAM/core (GB) (qty.)	cores/node (qty.)	GPUs/node
amilan/amilan128c	General Compute Node: AMD Milan	390 (amilan), 16 (128c)	3.74 (390), 2.01 (16)	128 (16), 64 (313), 48 (28), 32 (49)	0
ami100	GPU Node: 3x AMD MI100	8	3.74	64	3
aa100	GPU Node: 3x Nvidia A100	12	3.74	64	3
amem	High-memory node	24	21.5 (12), 16 (12)	128 (2), 64 (10), 48 (12)	0
al40	GPU Node: 3x Nvidia L40	3	3.74	64	3

HPC Cluster: Alpine

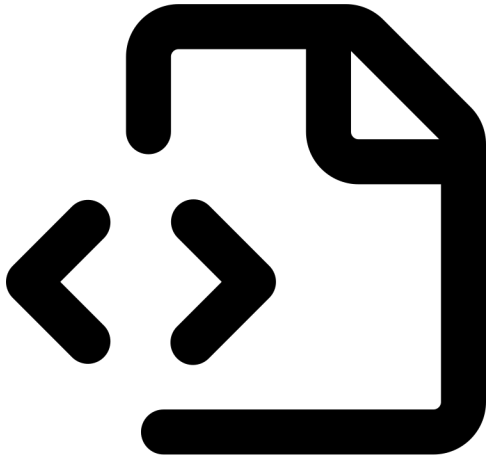
- Interconnect
  - **CPU nodes**: HDR-100 InfiniBand* (200Gb inter-node fabric)
  - **GPU nodes**: 2x25 Gb Ethernet +RoCE
  - **Scratch Storage**: 25Gb Ethernet +RoCE
- Operating System
  - RHEL 8 - **R**ed**H**at **E**nterprise **L**inux Version 8

* Not all CPU Nodes have Infiniband

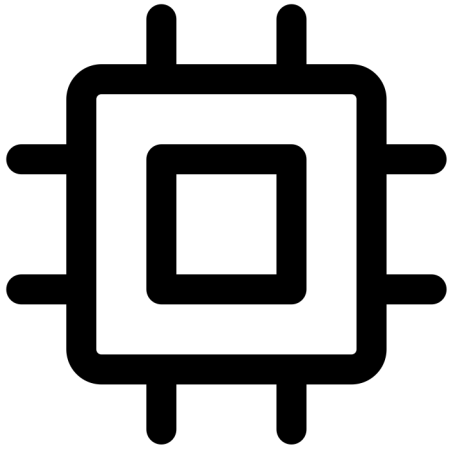
Node Types



LOGIN

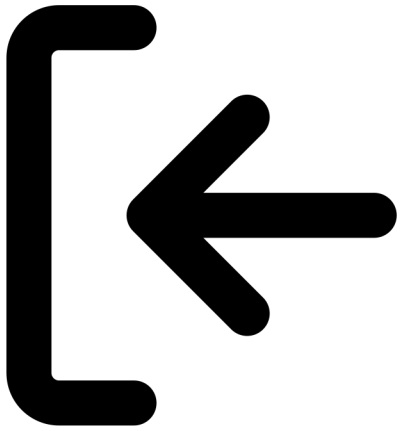


COMPILE

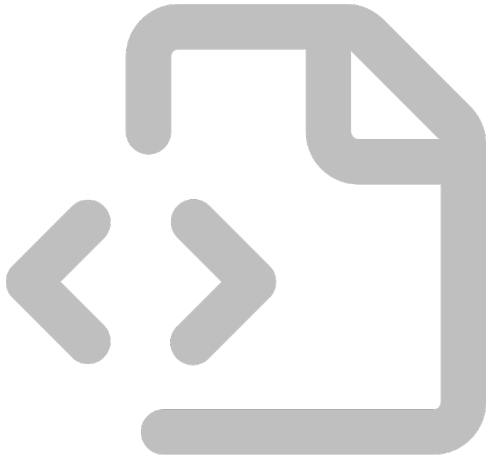


COMPUTE

Node Types



LOGIN



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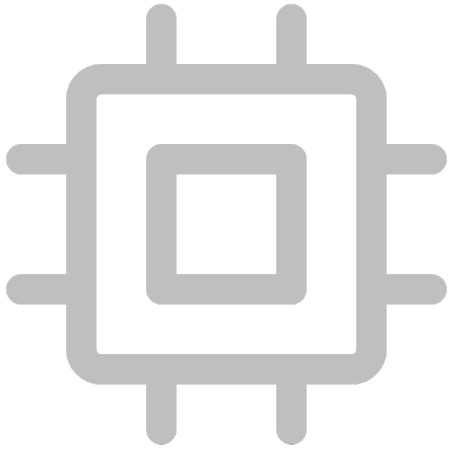
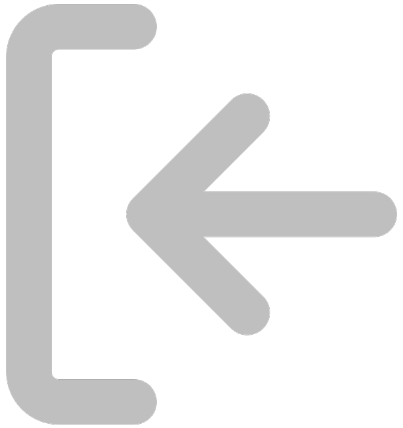


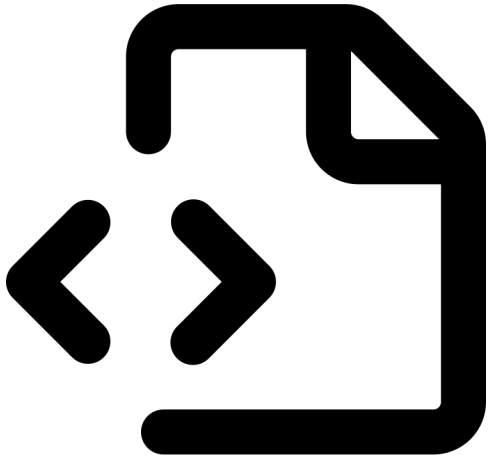
COMPUTE

- Entry to system
- View or edit files
- Submit jobs

Node Types

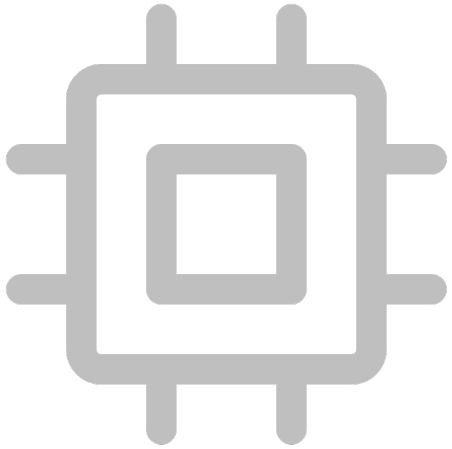


LOGIN



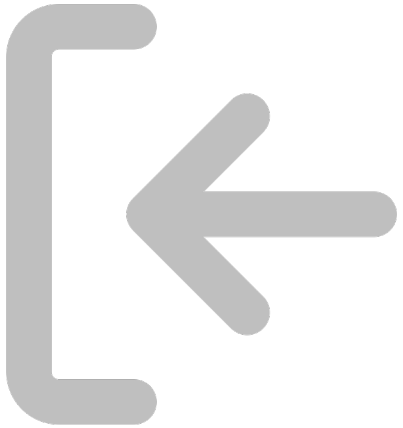
COMPILE

- View or edit files
- Submit jobs
- **Compile code**
- **Install software**



COMPUTE

Node Types



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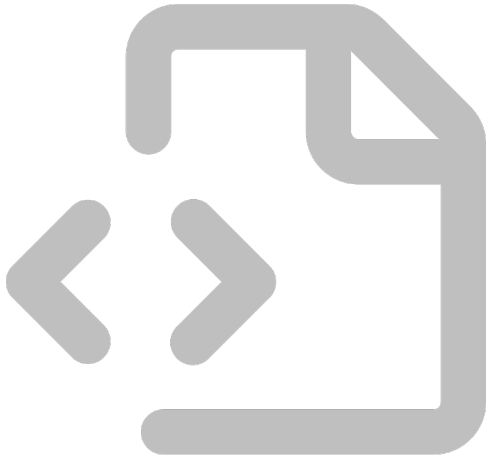
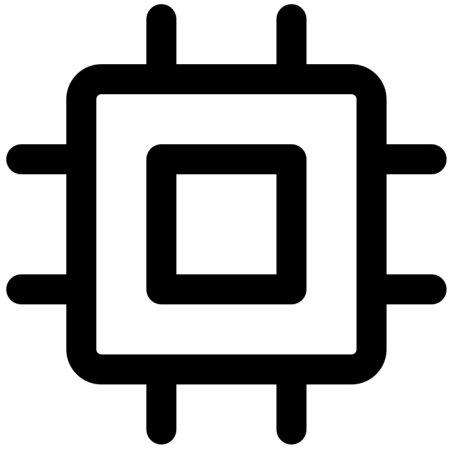


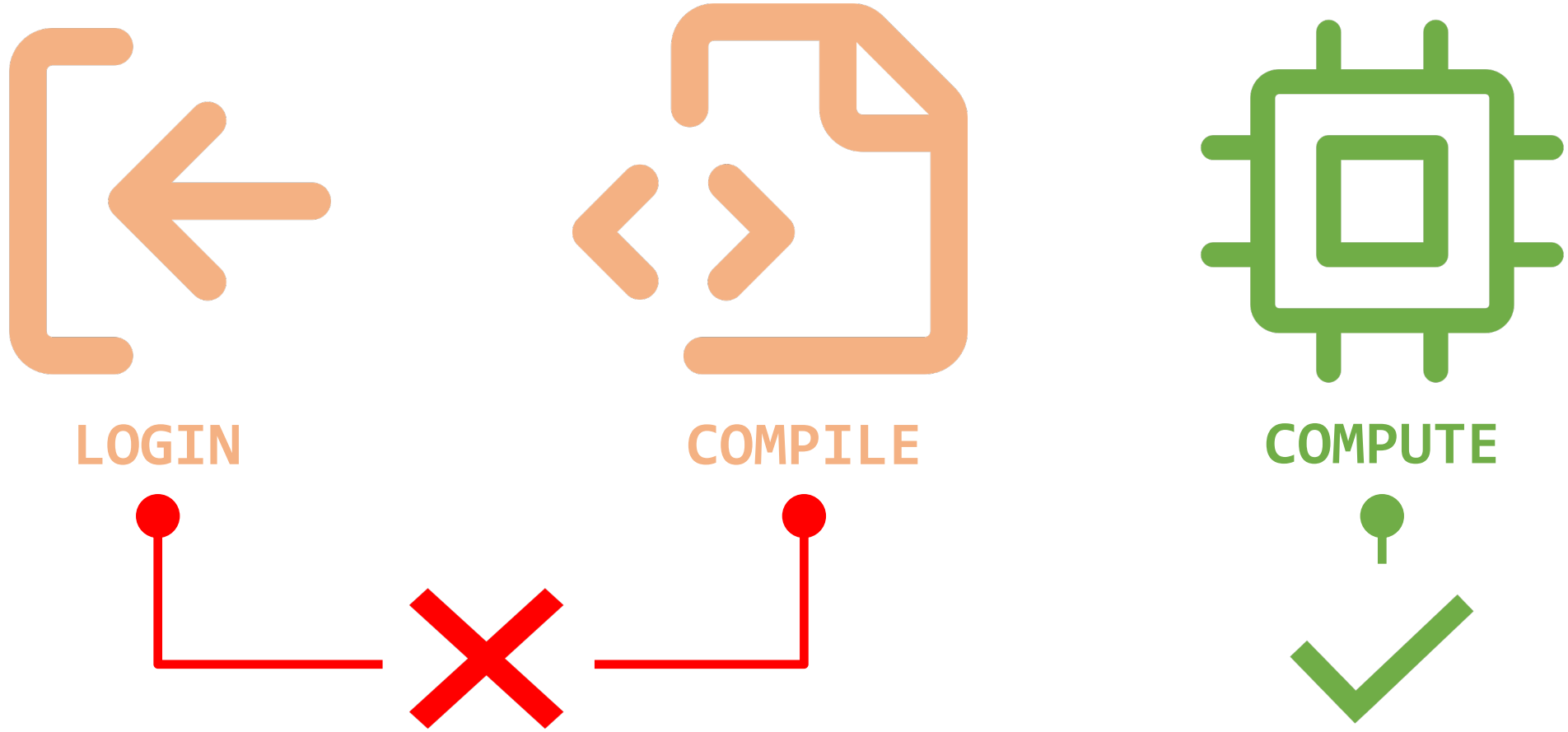
COMPILE



COMPUTE

- Run scheduled jobs
- Handle calculations

Where do I run jobs?



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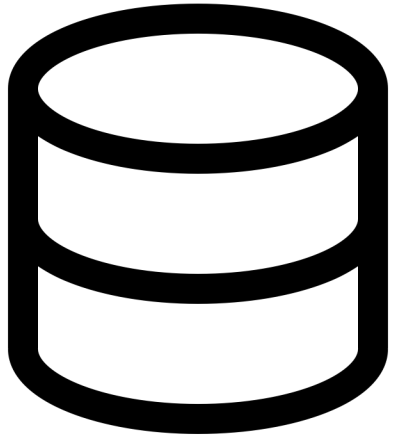
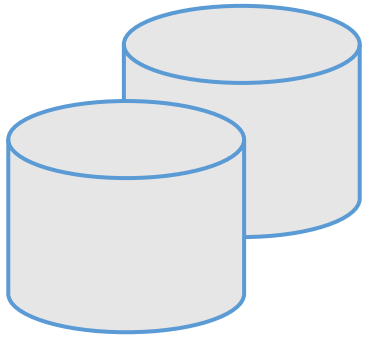


DATA (DTN)

- Support data transfers
- Can be selected when using scp, sftp, or ssh transfers

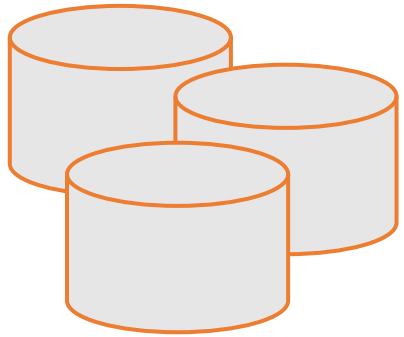
Storage at CURC



Core

Included with RC account

- /home
- /projects
- /scratch



PetaLibrary

Paid Service for large data

- Storage
- Archival Backup
- Sharing

Core Filesystem Structure

/home (2GB)	/projects (250GB)	/scratch/alpine (10TB)
• Scripts and Code • Important files (small)		
Not for: • File Sharing • Large Files		
Configuration Files, Notes		

Core Filesystem Structure

/home (2GB)	/projects (250GB)	/scratch/alpine (10TB)
• Scripts and Code • Important files (small)	• Code/files/libraries • Software you are installing • Sharing files	
Not for: • File Sharing • Large Files	**Not for** • Job Output • Temporary Files	
Configuration Files, Notes	Job Scripts, Shareable Files	

Core Filesystem Structure

/home (2GB)	/projects (250GB)	/scratch/alpine (10TB)
• Scripts and Code • Important files (small)	• Code/files/libraries • Software you are installing • Sharing files	• Output from running jobs • Large files/datasets • Sharing files
Not for: • File Sharing • Large Files	**Not for** • Job Output • Temporary Files	**Not for** • Long Term Storage
Configuration Files, Notes	Job Scripts, Shareable Files	Job Output Files, Data Files

PetaLibrary Tiers

Active	Archive	Active + Archive	Archive + DR
• Performance Tier[1] • Accessible by All Nodes • No File Limit • Double Parity • lz4 compression			

[1] Slower than /scratch, [2] Per Terabyte

PetaLibrary Tiers

Active	Archive	Active + Archive	Archive + DR
• Performance Tier[1] • Accessible by All Nodes • No File Limit • Double Parity • lz4 compression	• Integrity Tier • Accessible by Login Nodes Only • 10,000 File Limit[2] • Triple Parity • zstd compression		

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PetaLibrary Tiers

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• Performance Tier[1] • Accessible by All Nodes • No File Limit • Double Parity • lz4 compression	• Integrity Tier • Accessible by Login Nodes Only • 10,000 File Limit[2] • Triple Parity • zstd compression	• Replicate Active into Archive • Updated every 15 minutes • No File Limit	

[1] Slower than /scratch, [2] Per Terabyte

PetaLibrary Tiers

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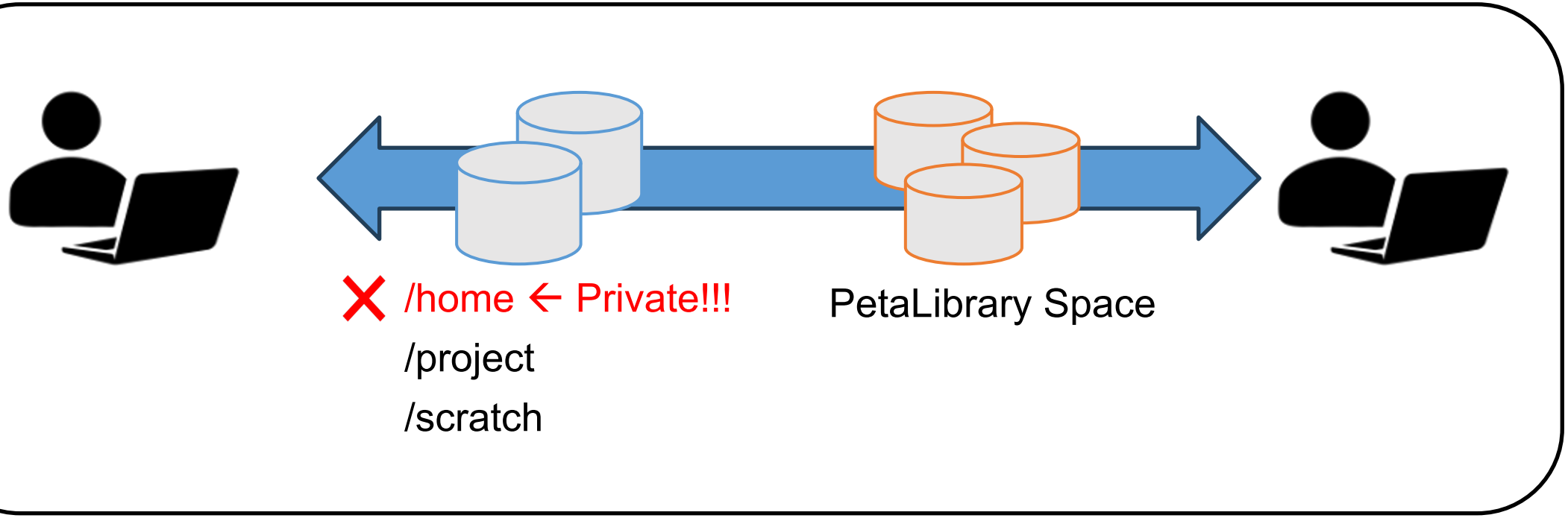
[1] Slower than /scratch, [2] Per Terabyte

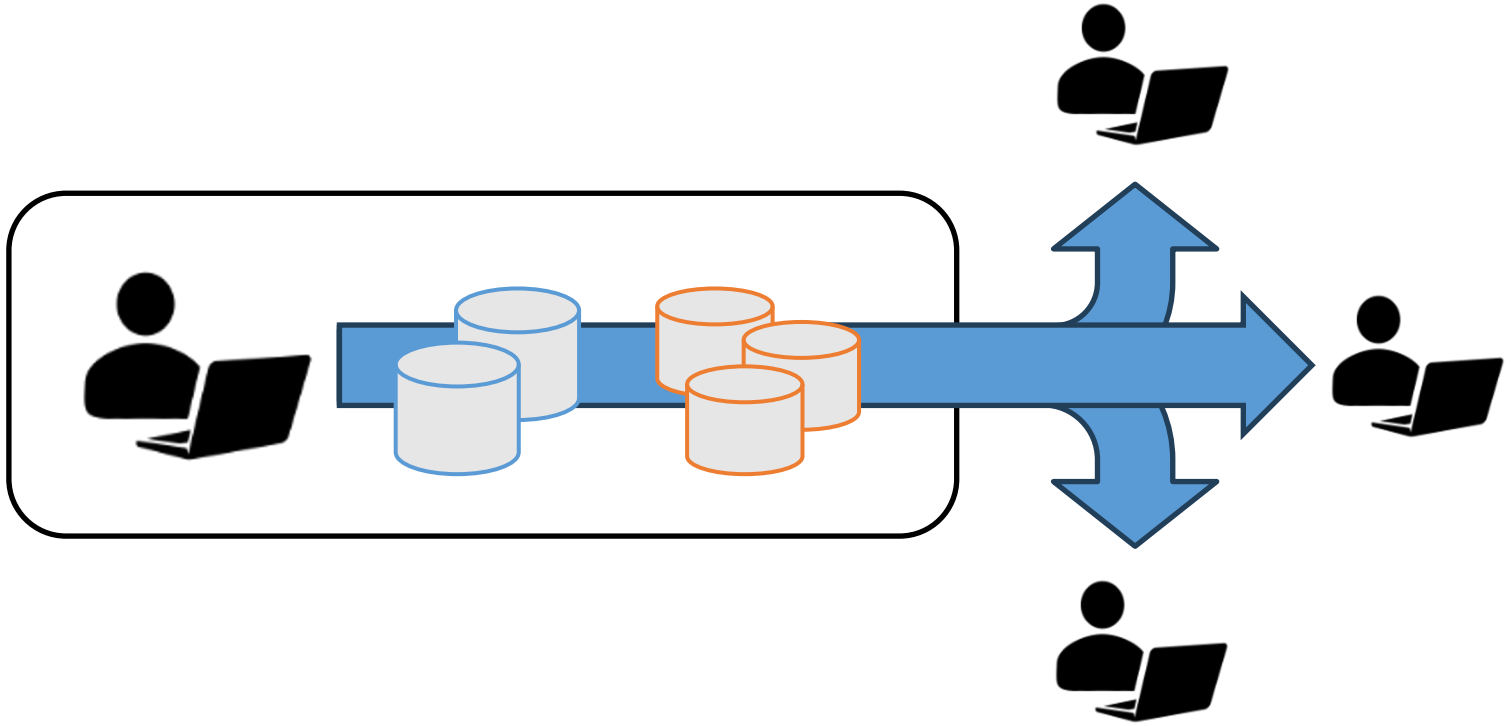
Data Sharing: Within RC



Data Sharing: Outside RC

Large Data Transfers:

- Globus (Recommended)
- Data Transfer Nodes (DTN)
- Terminal/Command Line:
  - rsync
  - rclone
  - sftp
  - scp



Acceptable data storage and use

CURC systems and services **should not be used to store** any data that is US government Classified, nor any Controlled Unclassified Information.

For users requiring storage for sensitive data types, please see the secure research computing resources:

https://www.colorado.edu/rc/secure-research-computing-resources

Cloud Computing

- CURC supports AWS, Azure, and GCP
- Alternative to HPC
- Enhance HPC

How to Access RC Resources?

1. Get an RC account
2. Set up two-factor authentication with Duo
3. Log in
4. Create greatness! (responsibly)

Getting an Account

- CU Boulder, CSU users and affiliates:
  - Request an account through the RC Account request portal: https://rcamp.rc.colorado.edu/accounts/account-request/create/organization
- AMC, RMACC users and affiliates:
  - Request an account through the ACCESS-CI User Registration Portal: https://identity.access-ci.org/new-user.html

Your RC Account

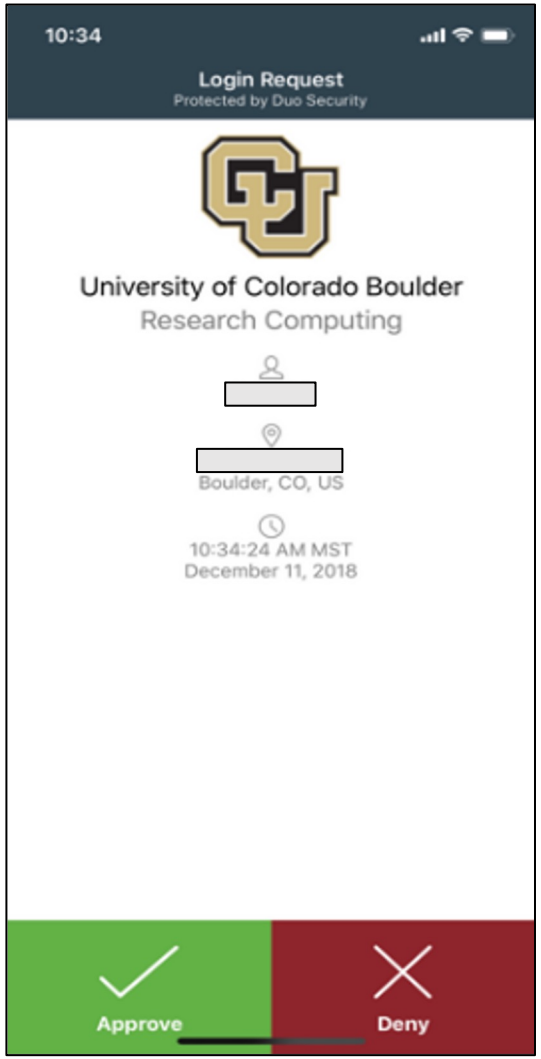
Access to:

1. Alpine Cluster
2. Core Storage
3. PetaLibrary Storage*
4. Open OnDemand
5. Approximately 2,000 Service Units (SUs) per month

*If purchased

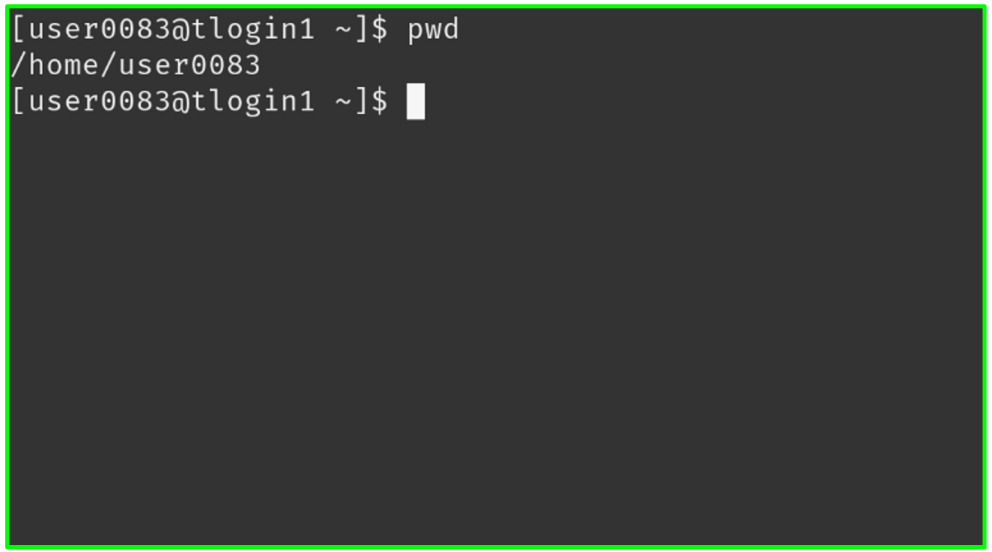
Duo Authentication

1. **Duo smartphone app (recommended)**
2. Phone Call/Text is an alternatives



Terminal Access

- Mac or Linux
  - Terminal application
- Windows
  - PuTTY
  - Powershell



- Open OnDemand (*alternative for CU affiliates*)
  - For those less familiar with Linux (ondemand.rc.colorado.edu/)

Demo: Logging in via Terminal

To login to an RC login node:

```
$ ssh <username>@login.rc.colorado.edu
```

Supply your IdentiKey* password and your Duo app will alert you to confirm the login

* Exclusive to CU and CSU accounts

Demo: logging in with OnDemand

CURC Open OnDemand is a browser based, integrated, single access point for all of your HPC resources at CU Research Computing.

- CU Boulder: Visit https://ondemand.rc.colorado.edu.
- Other RMACC Institutions: Visit https://ondemand-rmacc.rc.colorado.edu/

Asking for Help

Help! I'm stuck, where do I go?

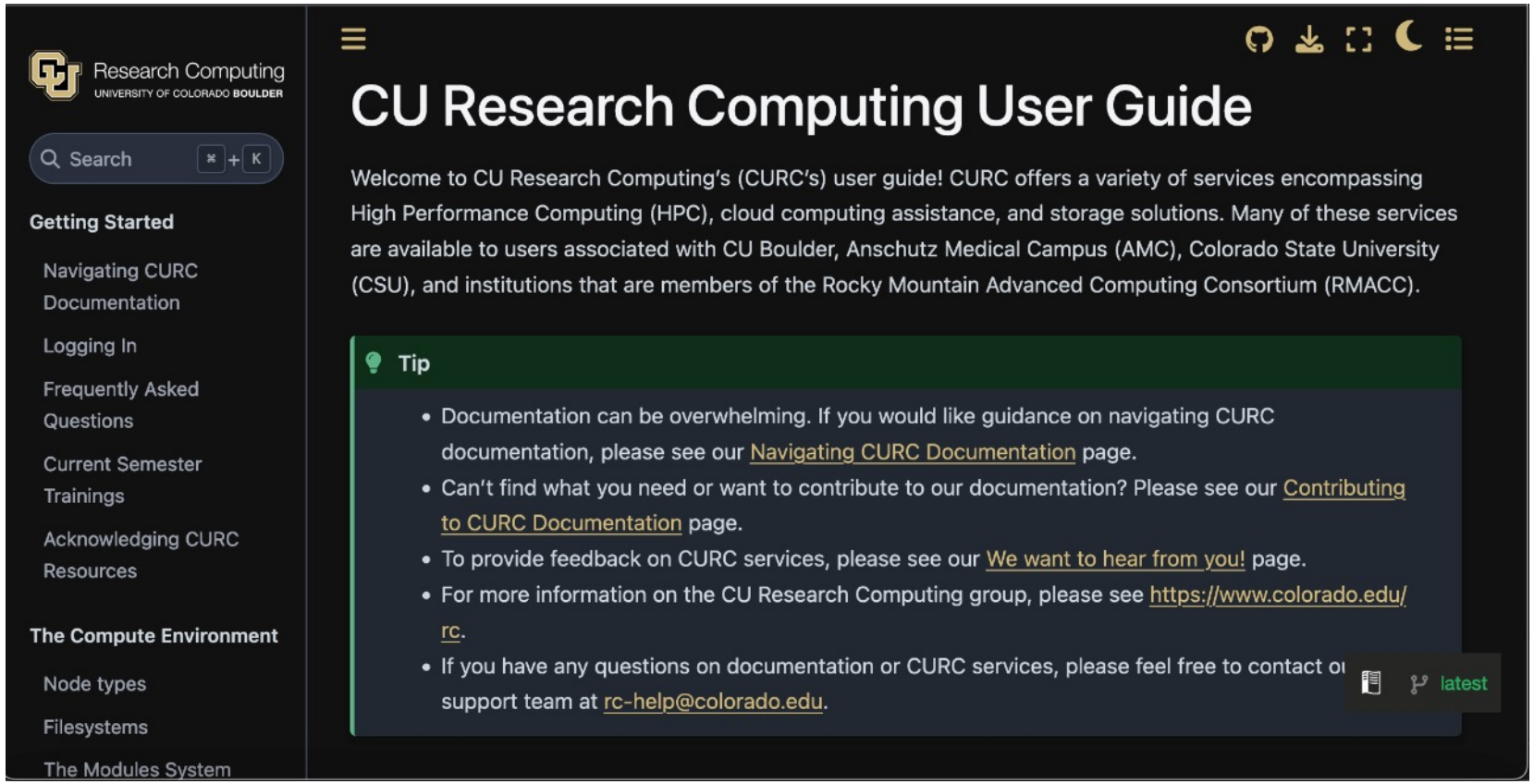
- **CURC Documentation**: curc.readthedocs.io
- **External Resources**
  - The Internet! (Stack Overflow, YouTube, etc.)
- **Trainings & Consults with Center for Research Data and Digital Scholarship (CRDDS)**
- **CURC Helpdesk**: rc-help@colorado.edu

When should I use these?

- **Documentation**: curc.readthedocs.io
  - Useful at any time! Check the documentation first when you run into issues.
- **External Resources**
  - Useful for learning a new skill or initial troubleshooting.
- **Trainings with Center for Research Data and Digital Scholarship**
  - Useful for broad, long-term learning
  - Drop-in consult hours are held Tue (12-1p) and Thu (1-2p) during the Fall and Spring semesters
- **CURC Helpdesk**: rc-help@colorado.edu
  - Useful for quick, personalized assistance. We can schedule Zoom consults if needed.

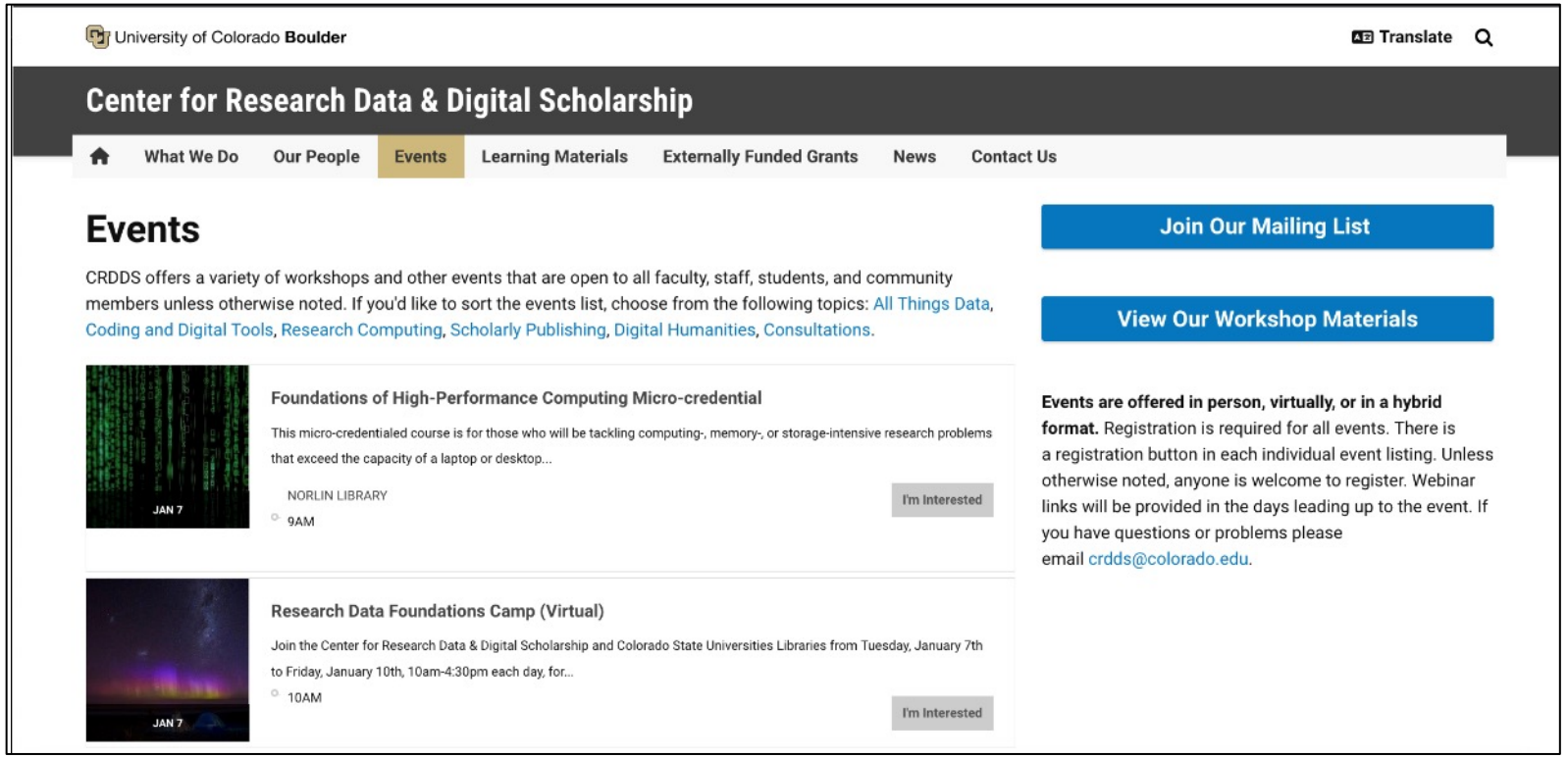
Our Documentation

Located at: https://curc.readthedocs.io



CRDDS trainings and consult hours

View upcoming events at: https://buff.link/crddsevents



Helpdesk Tickets: sub-optimal vs optimal

To: rc-help@colorado.edu

Dear Research Computing,

Help! My code won't run! Help!

Help please,
Andy

To: rc-help@colorado.edu

Dear Research Computing,

I am running into issues running my Python script. I am using a conda environment called my_python_env with the pytorch software, and I am receiving the following error. I am not sure how to troubleshoot. My job ID is 620350. Let me know what I can try!

srun: fatal: SLURM_MEM_PER_CPU, SLURM_MEM_PER_GPU, and SLURM_MEM_PER_NODE are mutually exclusive.

Thanks,
Andy

Helpdesk Tickets: sub-optimal vs optimal

To: rc-help@colorado.edu

Dear Research Computing,

Can you install pytorch for me?

Thanks,
Andy

To: rc-help@colorado.edu

Dear Research Computing,

I am looking to utilize PyTorch to use in conjunction with AMD GPUs. I have tried an anaconda installation and have so far been unsuccessful. Could you please help me complete this install?

Thanks,
Andy

How can I compose an effective ticket?

- Provide detail!
- Scale down your workflows for testing!
- Email our helpdesk!
- Try a few things and let us know what you've tried!
  - We are not just being lazy – it helps us contextualize the issue.
  - We would likely try the same things as you – if you can eliminate potential solutions, it will help us get to a solution more quickly.

Documentation

https://curc.readthedocs.io/en/latest/