Introduction to Data Transfer

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- *email: rc-help@colorado.edu*
- *RC Homepage: https://www.colorado.edu/rc*

Slides available on GitHub:

https://github.com/ResearchComputing/intro_to_data_transfer_fall_23

Outline

- Ways to access your data
- Data transfer using the command line
- Data transfer using Open OnDemand
- Data transfer using Globus
- Sharing Data
- Getting A Petalibrary Allocation

Accessing Data on RC Resources

- When you use RC resources the data is not on your local machine
- Ways to access the data from your local machine
  - Command line (a variety of tools)
  - Open OnDemand (straightforward GUI interface)
  - Globus (GUI interface with some set up required)

Access through the Command Line

- If you don’t need a *fancy* GUI
- Provides a larger variety of tools
  - SCP
  - SFTP
  - RSYNC
  - RCLONE
  - SSHFS
  - SMB
- The tools provided can improve your data workflow (more on this later)

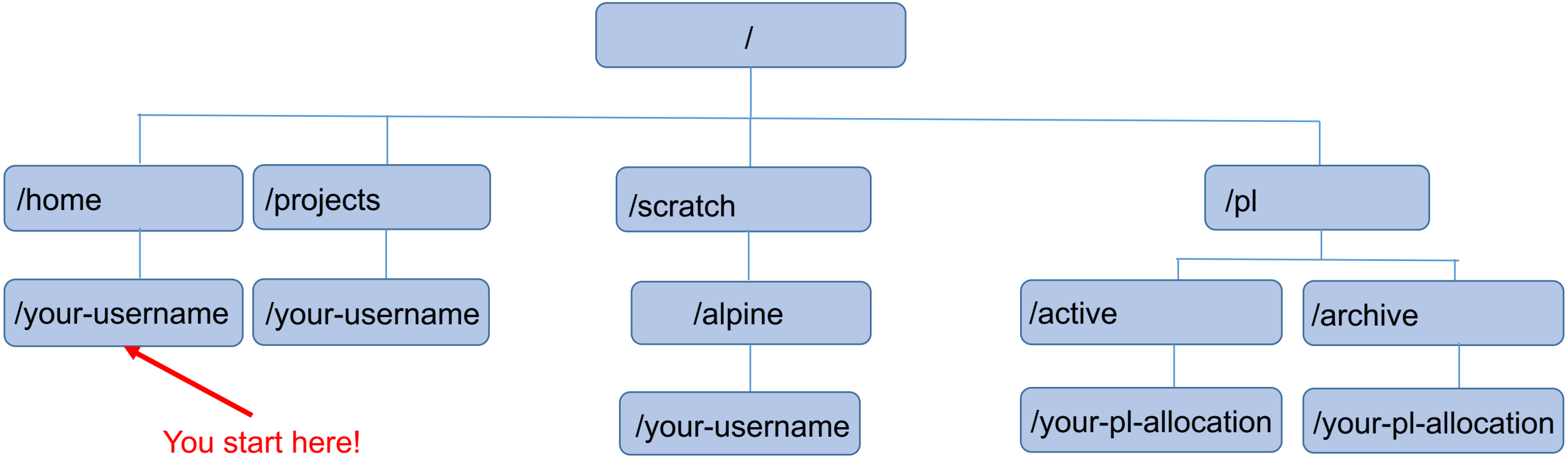
General Filesystem Structure

/home (2GB)	/projects (250GB)	/scratch/alpine (10TB)
• Small important data • Backed up frequently • Not for sharing files or job output	• Medium sized important data • Software • Can be shared with others • Backed up, but less frequently • Not for job output	• Large data • Can be shared with others • Fast Data transfer to compute nodes • Not backed up! • Purged after 90 days!
Filesystem documentation: https://curc.readthedocs.io/en/latest/compute/filesystems.html		

Let’s get on a login node!

```
ssh <your-username>@login.rc.colorado.edu
```

RC Filesystem Map



Basic Navigation Commands

- Change directories

```
cd <relative-or-full-path>
```

- List contents of a directory

```
ls <optional-path>
```

- Print current working directory

```
pwd
```

RC endpoints

Endpoint – one of the two file transfer locations i.e., it is either the source or the destination we want to copy data from or to.

- For data on RC resources, we have two endpoints
  - The login* nodes
    - Only use for small transfers!!

```
<your-username>@login.rc.colorado.edu
```

  - Data transfer nodes (DTNs)

```
<your-username>@dtn.rc.int.colorado.edu
```

    - CSU

```
<your-username>@dtn.rc.colorado.edu
```

RC Data transfer nodes (DTNs)

- Command line use of DTNs only available if you are on CU Boulder or CSU's network or VPN
- Dedicated nodes for transferring data
  - Faster transfers
  - More stable transfers
- Suitable for
  - Large and frequent transfers
  - Automated (passwordless) transfers
    - Only for CU Boulder folks
- Cannot ssh into the DTNs!

Command line option - SCP

SCP (Secure Copy Protocol) is a command line tool to transfer files/directories to, from, or between remote locations.

- Simple, but useful!
- Copying a local file to RC resources using a login node:

```
scp file1 <username>@login.rc.colorado.edu:<remote-path>
```

- Copying a directory from RC resources to local path via a DTN:

```
scp -r <username>@dtn.rc.int.colorado.edu:<path-to-directory> <local-path>
```

Command line option - SFTP

SFTP (Secure File Transfer Protocol) a command line tool that is similar to SCP, but provides an sftp session where both the local and remote filesystems are available

- Slightly more advanced than SCP
- Useful for multiple file/directory transfers
- Starting a SFTP session on a local machine

```
sftp <username>@login.rc.colorado.edu
```

- Demo time!

Command line option - Rsync

Rsync (remote sync) a command line tool that offers remote and local file synchronization.

- Only copies the portion of the files that have changed!
- Already installed on most Linux distributions and macOS
  - Needs to be installed on Windows
- Sync RC resources to local computer

```
rsync -av <username>@login.rc.colorado.edu:<remote-path> <local-path>
```

  - Flags:

```
-v    # verbose mode
-a    # archive mode
```

Command line option - Rclone

Rclone is a command line tool used to manage files on cloud storage.

- It is compatible with all major cloud storage solutions
  - Supported by over 40 cloud storage products!
- Created as a cloud equivalent to the UNIX commands:
  - rsync, cp, mv, mount, ls, ncdu, tree, rm, and cat
- Needs to be downloaded on your local machine
- Requires a more involved setup process but works great!
  - https://curc.readthedocs.io/en/latest/compute/data-transfer.html#rclone

```
rclone copy rclonetest.csv aws_s3:testbucket/
```

Command line option - mounting

Mounting is the process of attaching a file system to a directory on another system.

- SSHFS (secure shell filesystem)
  - Needs to be installed on Mac and Windows (available on most Linux distributions)
  - You need to be on the campus network or VPN!

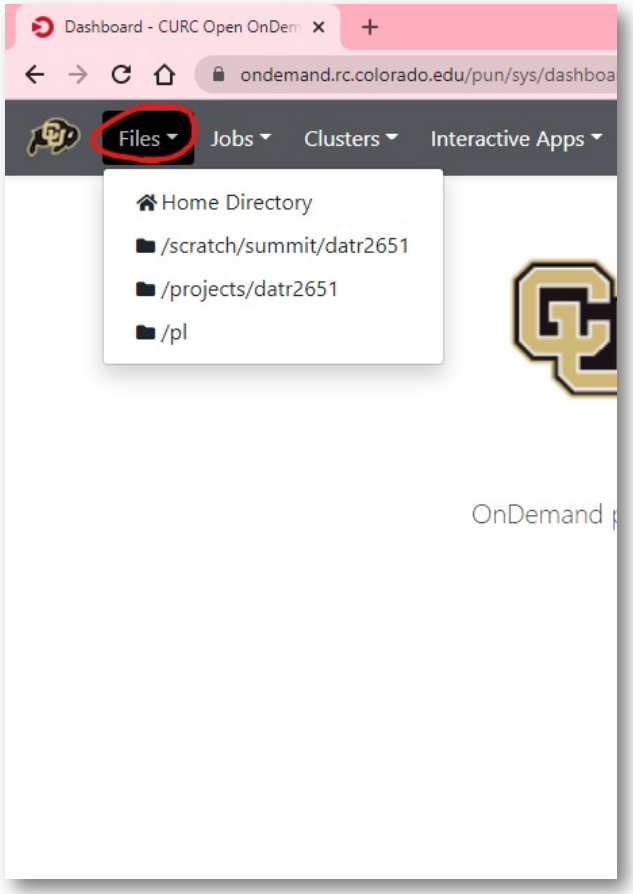
```
sshfs <username>@login.rc.colorado.edu:<path> <local-mountpoint>
```

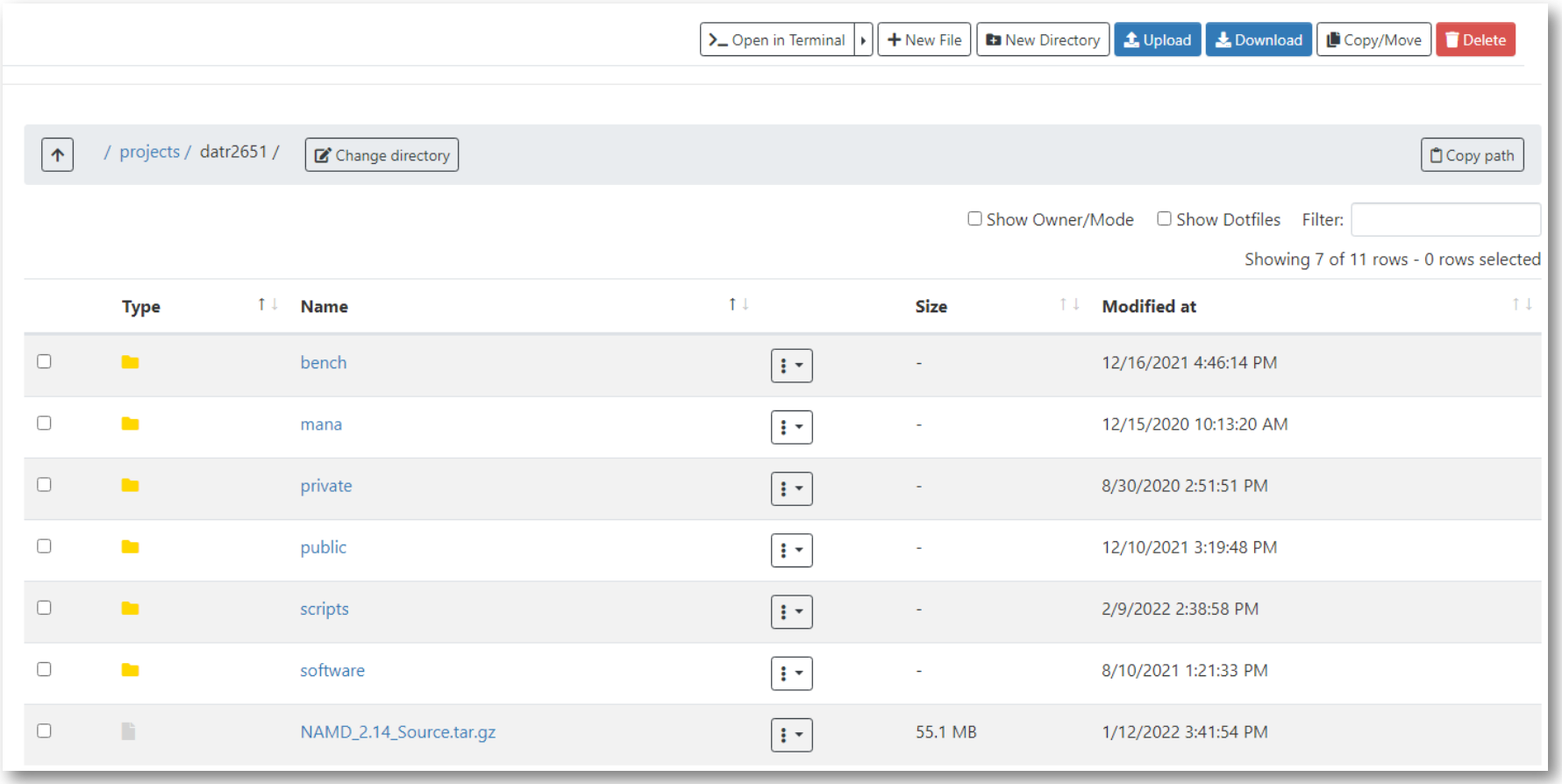
- SMB (server message block)
  - Built into all major operating systems
  - You need to be on the campus network or VPN!
  - Contact us if you want to use this

GUI based options

GUI option - Open OnDemand

- No command line required!
  - http://ondemand.rc.colorado.edu/
  - http://ondemand-rmacc.rc.colorado.edu/
- File management
  - Create, Delete, Move, and Rename
- File transfers
  - Upload and Download


Dashboard - CURC Open OnDem
ondemand.rc.colorado.edu/pun/sys/dashboa
Files
Jobs
Clusters
Interactive Apps
Home Directory
/scratch/summit/datr2651
/projects/datr2651
/pl
OnDemand


Open in Terminal
New File
New Directory
Upload
Download
Copy/Move
Delete
/ projects / datr2651 /
Change directory
Copy path
Show Owner/Mode
Show Dotfiles
Filter:
Showing 7 of 11 rows - 0 rows selected
Type
Name
Size
Modified at
bench - 12/16/2021 4:46:14 PM
mana - 12/15/2020 10:13:20 AM
private - 8/30/2020 2:51:51 PM
public - 12/10/2021 3:19:48 PM
scripts - 2/9/2022 2:38:58 PM
software - 8/10/2021 1:21:33 PM
NAMD_2.14_Source.tar.gz 55.1 MB 1/12/2022 3:41:54 PM

Let’s take a look!

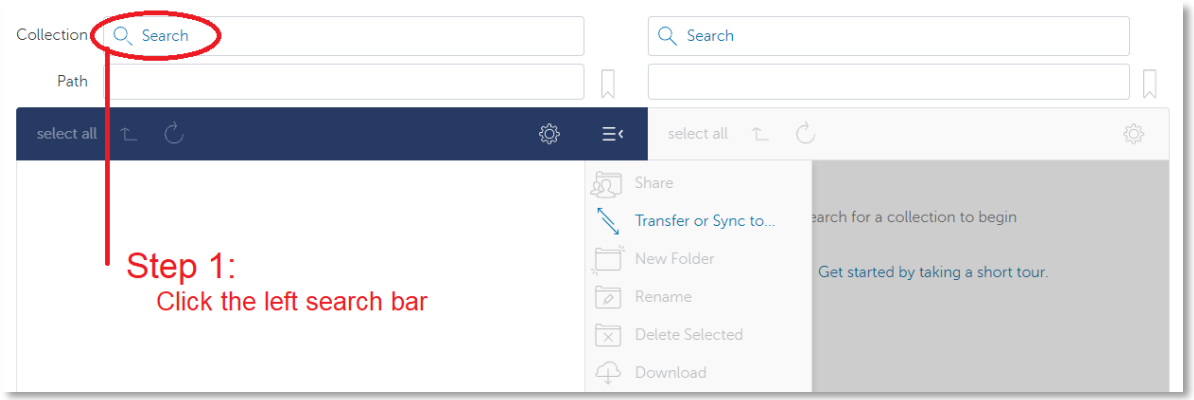
GUI option - Globus

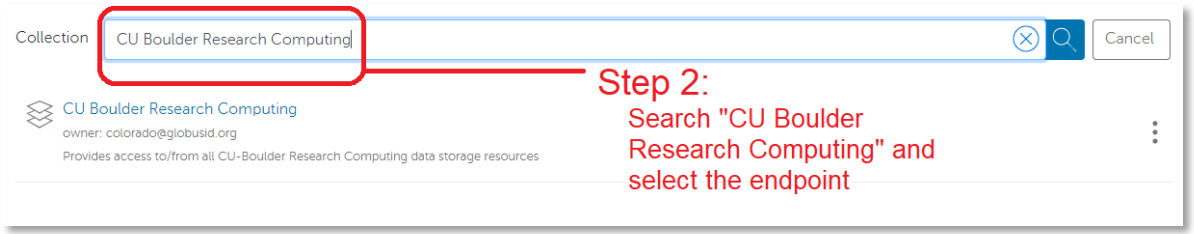
Globus is a service that allows for users to reliably move, share, and discover data

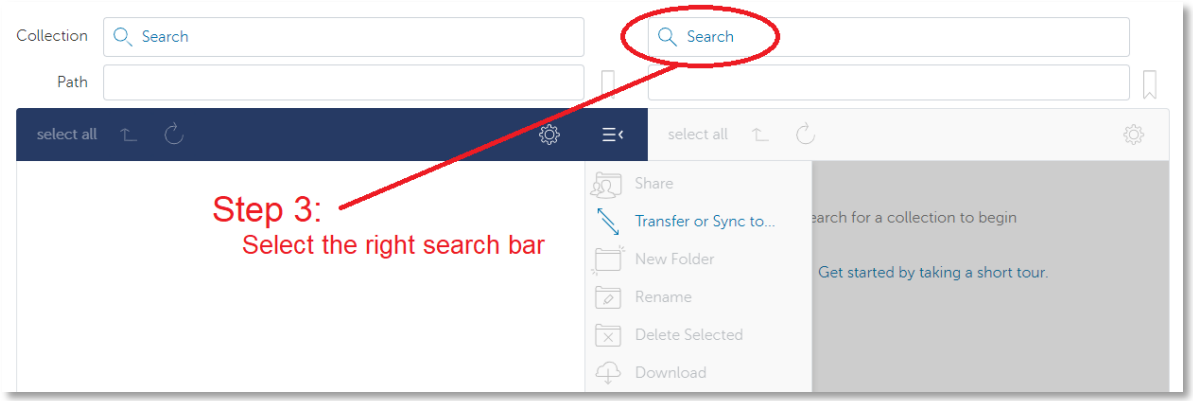
- Command line version is also available
- Our recommended way to transfer data
  - Stable and fast data transfers
  - Transfers continue if a user disconnects
  - Web GUI or Globus Connect Personal GUI
- Supported on all major operating systems
  - Works well with cloud storage providers

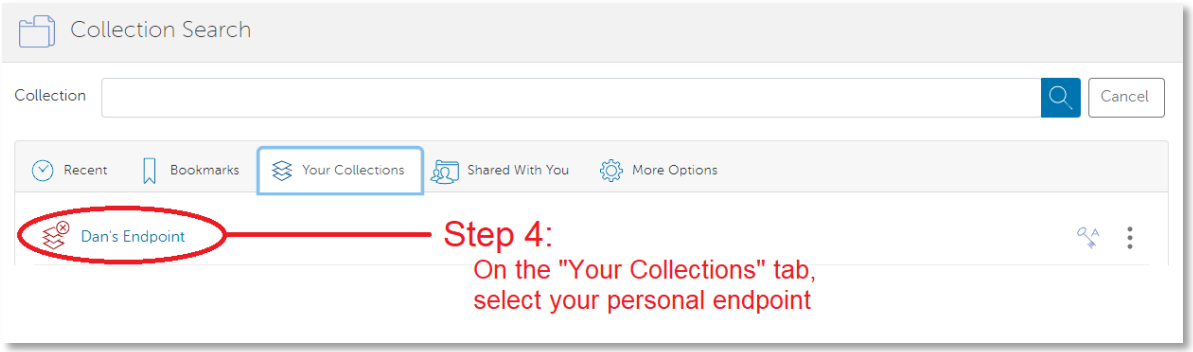
Globus Demo

- Globus login is simple and quick: https://app.globus.org
  1. CU Boulder users - select “University of Colorado at Boulder” in the dropdown menu
     - Other institutions should select “ACCESS”
  2. Login with your credentials
  3. Continue with onscreen prompts until you are brought to the Globus WebGUI
- Installing a Globus Endpoint on your local machine
  - Required if you want to transfer data to your machine
  - Navigate to https://www.globus.org/globus-connect-personal
    - Click on operating system specific version and follow install instructions


Collection
Search
Path
select all
Share
Transfer or Sync to...
New Folder
Rename
Delete Selected
Download
Get started by taking a short tour.
Step 1:
Click the left search bar


Collection
CU Boulder Research Computing
Cancel
CU Boulder Research Computing
owner: colorado@globusid.org
Provides access to/from all CU-Boulder Research Computing data storage resources
Step 2:
Search "CU Boulder Research Computing" and select the endpoint


Collection
Search
Path
select all
Share
Transfer or Sync to...
New Folder
Rename
Delete Selected
Download
Get started by taking a short tour.
Step 3:
Select the right search bar


Collection Search
Collection
Cancel
Recent
Bookmarks
Your Collections
Shared With You
More Options
Dan's Endpoint
Step 4:
On the "Your Collections" tab, select your personal endpoint

Let’s check it out!

The PetaLibrary

The PetaLibrary is a CU Boulder Research Computing service

- Expands the amount of storage space available to you
  - Confidential data should not be stored on PetaLibrary!!
- Aims to work seamlessly with all RC resources
- Supports the storage, archival, and sharing of data
- Available at a subsidized cost for researchers affiliated with University of Colorado
- New customer's initial upper limit:
  - 200 TB for Active storage (available to compute resources)
  - 100 TB for Archive storage (not available to compute resources)

Unix Groups

- Unix Groups
  - 3 Levels of permissions:
    - User
    - Group
    - Other
  - All users have a group associated with their username
  - Permissions can be set for an individual file with the `chmod` command

```
chmod g+rx file.exe
```

Documentation: https://curc.readthedocs.io/en/latest/compute/filesystems.html#file-permissions-ownership-and-group-membership

Sharing Data

- RC Users on RC resources
  - Send a request and a list of the users to rc-help@colorado.edu
    - RC will place the chosen users in your Linux group
      - Allows them to see your scratch and project directories
      - You can set permissions in the space, so items are hidden
  - On-premise collaborators can also access Petalibrary files with Globus Shared Endpoints
- Off-premise collaborators
  - Data sharing is only available if you have a PetaLibrary allocation
    - Data transfer is done through Globus Shared Endpoints

Globus Shared Endpoints

- Globus offers ‘shared endpoints’ which don’t require a user to have an account with RC.
- RC provides this capability for easy access of Data.
- PetaLibrary exclusive!
- Generates a shared collection that can be accessed with a link.
  - See https://scholar.colorado.edu/concern/datasets/9593tw13k
  - Can assign various permissions to specific users or all users withing Globus
  - More information on here: https://docs.globus.org/how-to/share-files/

Thank you!!

For more help contact rc-help@colorado.edu

Additional documentation: https://curc.readthedocs.io/en/latest/compute/data-transfer.html

Survey: http://tinyurl.com/curc-survey18