An Introduction to Supercomputing at IU

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Changes (i.e. why to do this presentation again)

- Carbonate is gone
- Quartz is useful now
- HPC Everywhere is gone
- Found nice visualization
- Added huge slurm cheatsheet

Carbonate

Big Red 200

- bigred200.uits.iu.edu
- 640 compute nodes
  - 256 GB RAM
  - 2 64-core CPUs
  - 4 day time limit
- 64 GPU nodes
  - 256 GB RAM
  - 4 NVIDIA A100 GPUs (~$9000 each)
  - 2 day time limit
- `https://kb.iu.edu/d/brcc`

Quartz

- quartz.uits.iu.edu
- large amounts of processing capacity over long periods of time
- 92 General Compute Nodes
  - 2 64 Core CPUs
  - 512GB RAM
  - 4 day time limit
- 22 GPU Nodes
  - 4 Nvidia V100s
  - 768GB RAM
  - 2 day time limit

Slate

- Slate offers additional storage attached to the supercomputers if needed
- You can create a Slate account at `https://access.iu.edu/Accounts/Create`
- When on the supercomputer, slate storage is available at /N/slate/[username]
- You can see how much space you have used with the `quota` command

Acknowledgements

Important Note

When using any of the IU supercomputers for research, you must include a blurb in your acknowledgements section of the paper.

`https://kb.iu.edu/d/anwt`

Command Line Cheatsheet

- ls - Show what is in this folder/directory
- cd [directory] - Change directory to [directory]
- cd .. - Go to the parent directory
- ssh [servername] - Connect to [servername]
- scp [file] [server]:[directory] - Copy [file] to [directory] on [server]
- scp -r [folder] [server]:[directory] - Copy a folder instead of a file
- mkdir [name] - Make a new directory named [name]
- rm [file] - Delete [file]
- rm -r [folder] - Delete [folder]

Getting your Accounts

There are 2 kinds of accounts:

Personal:

1. Visit `https://access.iu.edu/Accounts/Create`
2. Select the accounts you'd like to add
3. Fill in the form
4. They usually respond within a business day

Getting your Accounts

There are 2 kinds of accounts:

Lab:

1. After you get the confirmation email of your personal account
2. Ask Fran or Sandra to add you to their lab "project"
3. Fran/Sandra: Visit `https://hpcprojects.uits.iu.edu/`
4. **Note the project id, you will need it later!**

Logging In

- All of the computers have a terminal interface (shell)
- On Macs and Linux, use ssh
- On Windows you can use PuTTy `https://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html`
- Use your iu network id as the username
  - $ ssh [username]@bigred200.uits.iu.edu

The File System

- Use git, scp, or sftp to down/upload files/folders
  - $ scp file.file [username]@bigred200.uits.iu.edu:
  - $ scp -r folder [username]@bigred200.uits.iu.edu:
- For Windows, use winSCP

  `https://winscp.net/eng/index.php`

The Module System

- module list - List loaded modules
- module avail - Show available (compatible) modules
  - On Big Red 200: module spider - show all modules
- module load [module] - Load [module]
- module swap [old module] [new module] - Unload [old module] and load [new module]
  - If add fails because of a module conflict, use this
- module unload [module] - Unload [module]

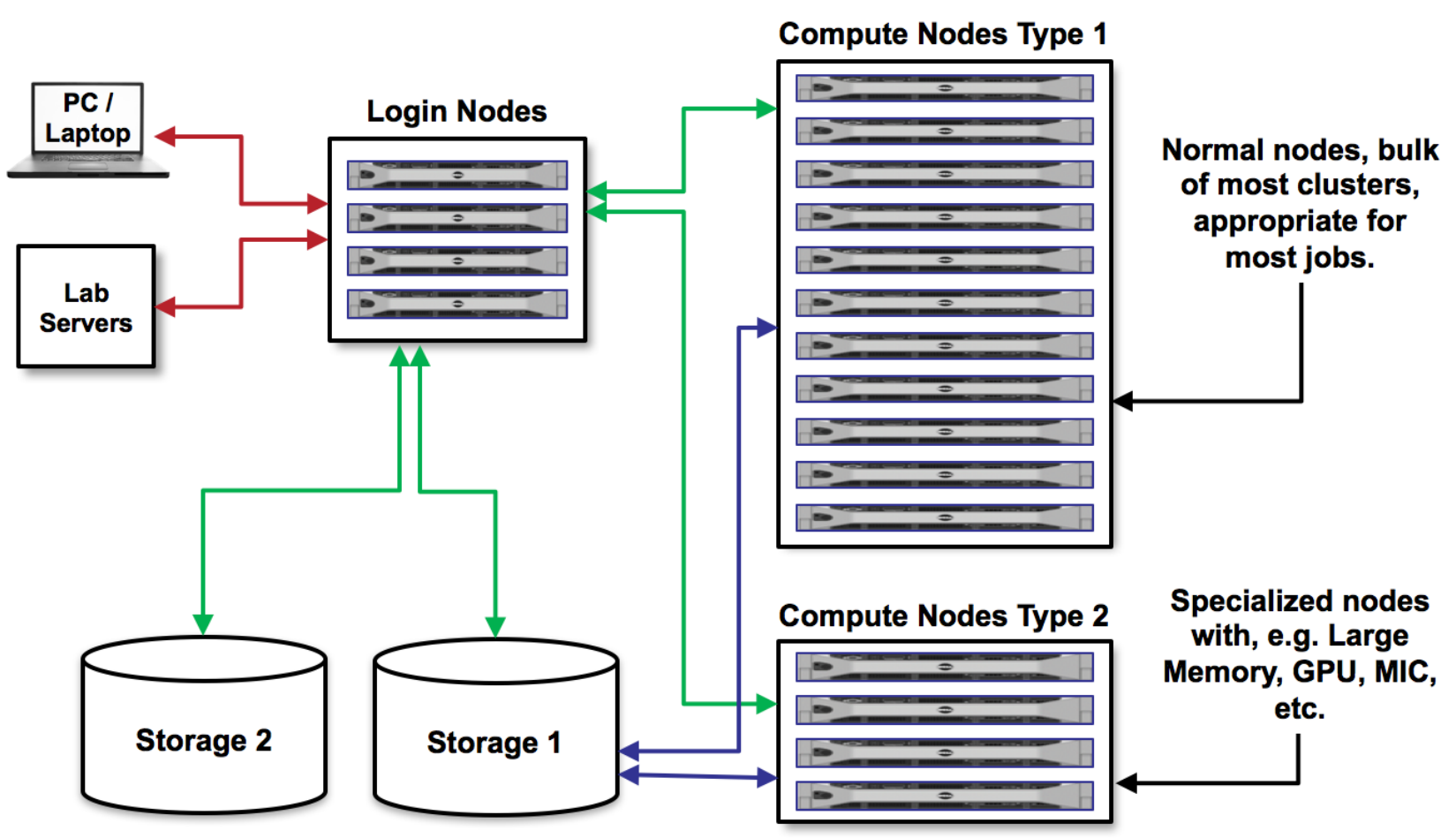
The Module System

- You can edit the .modules file in your home directory to set up modules every time you log in
  - Just type the commands you want to run
- Only Professors can request new software be installed
- There are Python GPU modules - use these for DL

my .modules file

```
module swap python deeplearning/1.13.1
module load libsndfile/1.0.28
```

Visualization



The Queue

- When you log onto the supercomputer, you're on a login node. These are for configuring your environment and up/downloading data, **not** running code
- Jobs that run on the login nodes are limited to 20 minutes of cpu time. After that you'll get booted
- To use the high performance nodes, you enter the queue

Slurm Cheatsheet

- sinfo - View partition information
- squeue - View queue info
  - -u [username]
  - -p [partition]
- srun - Run an interactive session
- sbatch [job script] - Submit [job script] as a batch job
- scancel [jobid] - Cancel a job with id [jobid]
- And so much more

Submitting Interactive Jobs

- Interactive Jobs let you open a terminal on a compute node
- srun -p general --time=00:05:00 -A [project id] --pty bash
  - 'srun' : submit a job
  - '-p general' : open on the general partition
  - '--time=00:05:00' : request 5 minutes
  - '--pty' : keeps the terminal open
  - 'bash' : run bash on the terminal
  - '-A' : required, the project ID to use
    - » Fran's lab's: r00027
- More options available here `https://kb.iu.edu/d/awrz`

Batch Jobs

- Batch Jobs send a job to Slurm without opening a terminal
- To run them, you have to prepare a script
- To submit the script, type 'sbatch <script>'
- More options available here `https://kb.iu.edu/d/awrz`

Example batch script

```
#!/bin/bash

#SBATCH -J [job_name]
#SBATCH -p general
#SBATCH -o filename_%j.txt
#SBATCH -e filename_%j.err
#SBATCH --mail-type=ALL
#SBATCH --mail-user=[username]@iu.edu
#SBATCH --nodes=1
#SBATCH --ntasks-per-node=1
#SBATCH --time=2-02:00:00
#SBATCH --mem=16G
#SBATCH -A [slurm-account-name]

#Load any modules that your program needs
module load modulename

#Run your program
srun ./my_program my_program_arguments
```

Sources

- Supercomputers Overview - https://kb.iu.edu/d/alde
- Big Red 200 - https://kb.iu.edu/d/brcc
- Slate - https://kb.iu.edu/d/aqnk
- Modules - https://kb.iu.edu/d/bcwy
- Slurm - https://kb.iu.edu/d/awrz