OAK RIDGE National Laboratory

NOAA GPU Hackathon – Ascent Overview

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Oak Ridge Leadership Computing Facility

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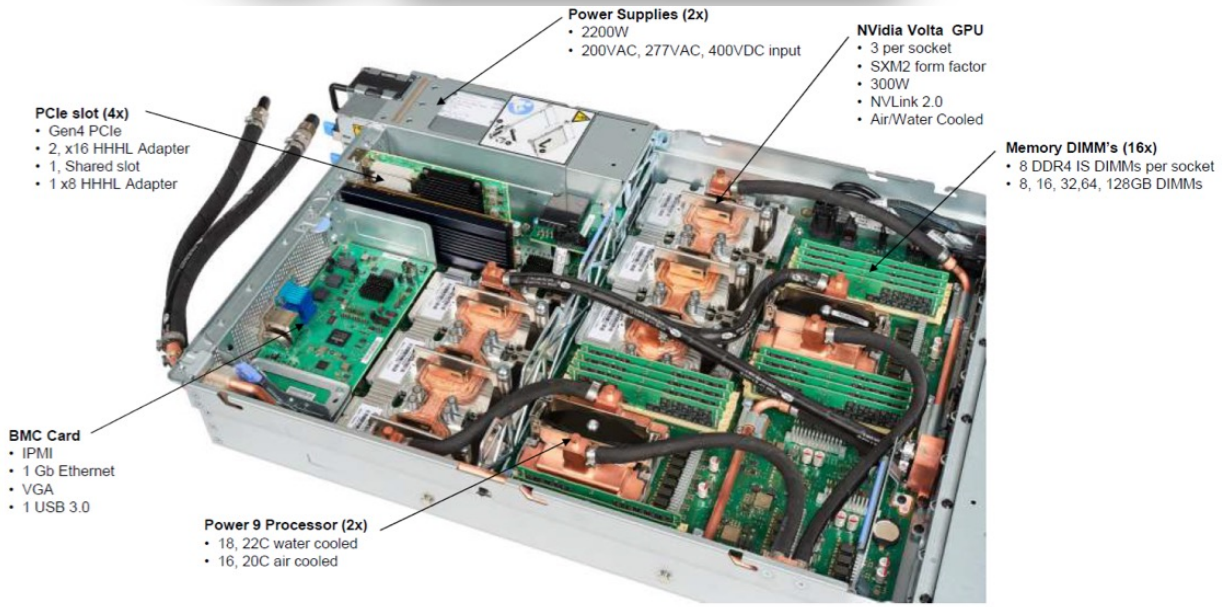
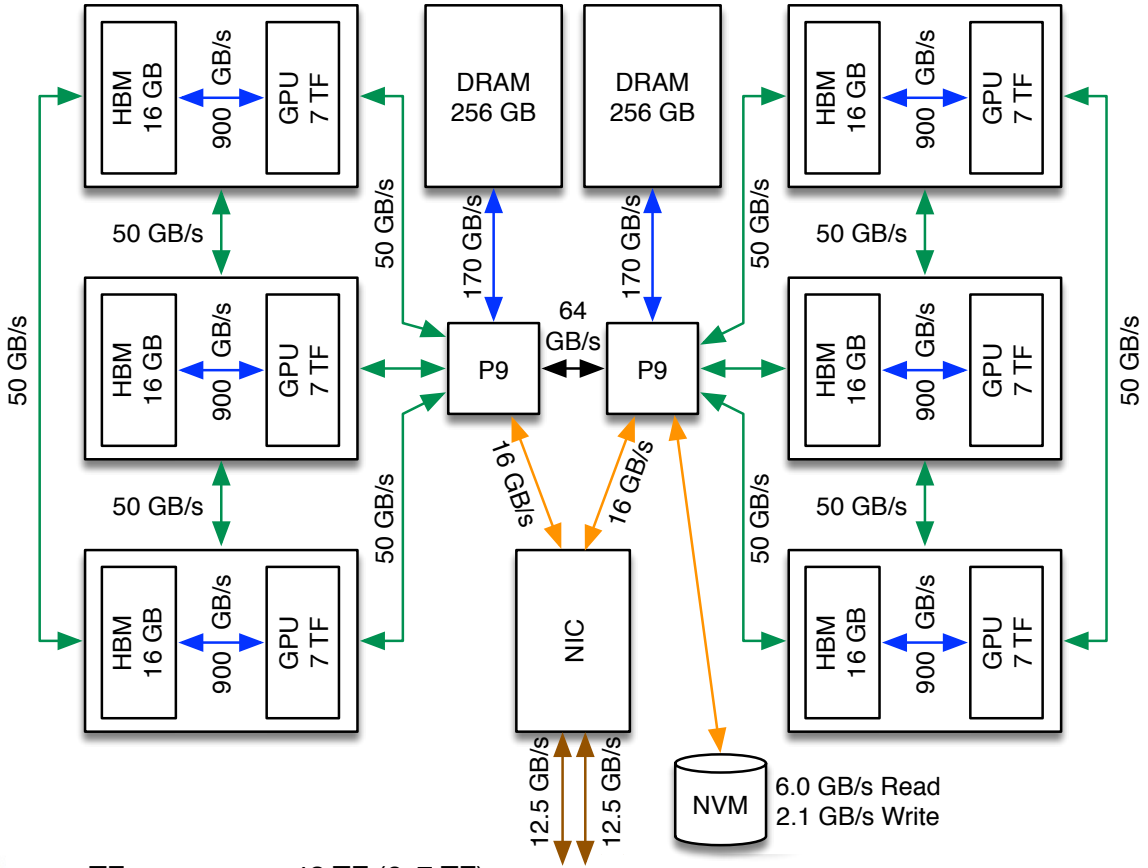
U.S. DEPARTMENT OF ENERGY

summit





TF	42 TF (6x7 TF)
HBM	96 GB (6x16 GB)
DRAM	512 GB (2x16x16 GB)
NET	25 GB/s (2x12.5 GB/s)
MMsg/s	83

- HBM/DRAM Bus (aggregate B/W)
- NVLINK
- X-Bus (SMP)
- PCIe Gen4
- EDR IB

HBM & DRAM speeds are aggregate (Read+Write).
All other speeds (X-Bus, NVLink, PCIe, IB) are bi-directional.

Node Overview

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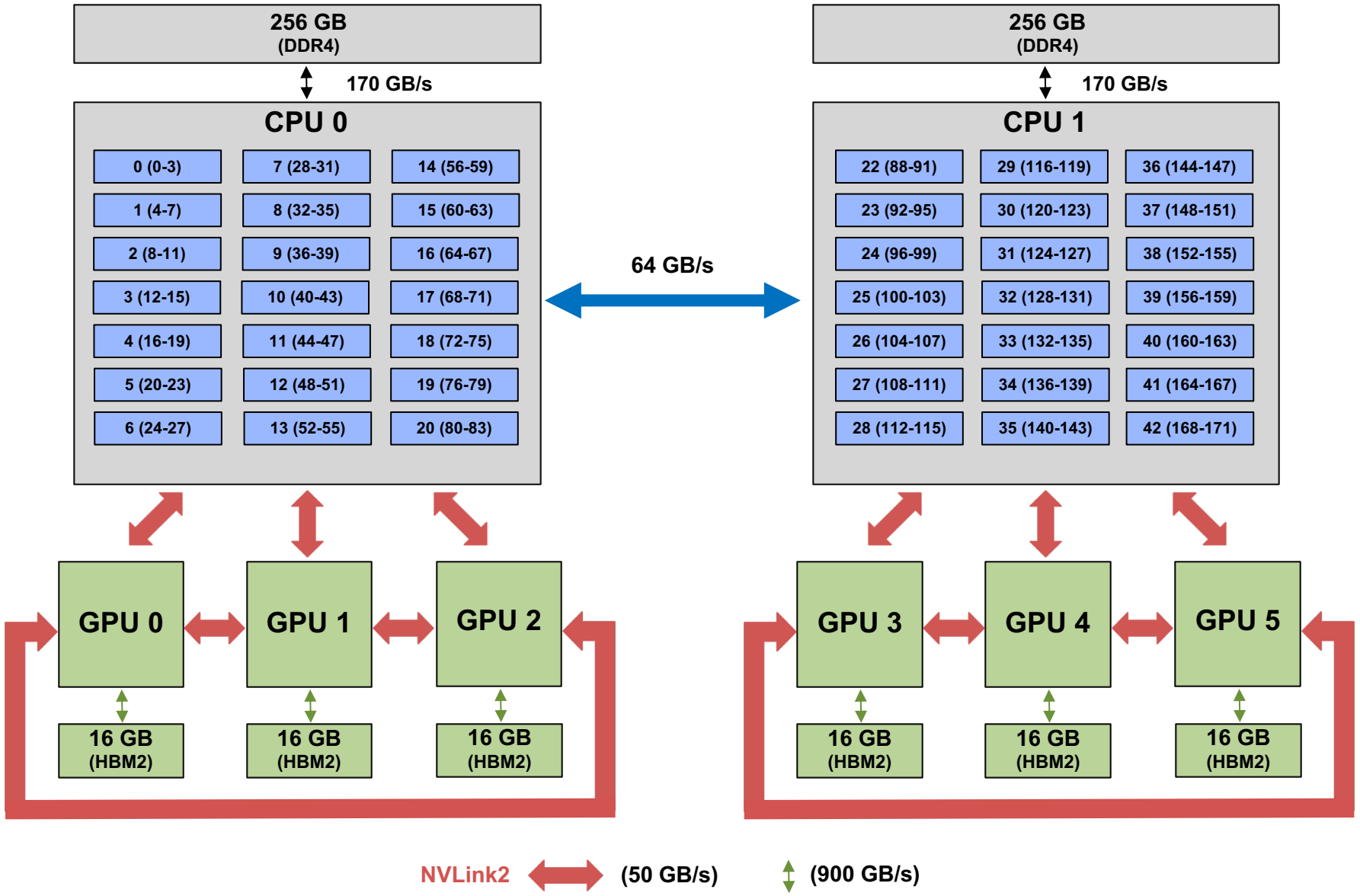
Summit Node

(2) IBM Power9 + (6) NVIDIA Volta V100



Available File Systems / Storage Areas on Ascent

NFS Directories – This is where you might want to keep source code and build your application.

NOTE: These directories are read-only from the compute nodes!

`/ccsopen/home/userid`

- Your personal home directory

`/ccsopen/proj/gen040`

- Can be accessed by all participants of this event
- You should create a directory here with your team name to collaborate (source code, scripts, etc.)

GPFS Directories (parallel file system) – This is where you should write data when running on Ascent's compute nodes.

`/gpfs/wolf/gen040/scratch/userid`

- Your personal GPFS scratch directory

`/gpfs/wolf/gen040/proj-shared`

- Can be accessed by all participants of the event
- You should create a directory here with your team name to collaborate (data written from compute nodes)

jsrun – Basic Options

```
jsrun [-n #resource sets] [CPU cores, GPUs, tasks in each resource set] program [program args]
```

jsrun Flags		Description	Default Value
Long	Short		
--nrs	-n	Number of RS	All available physical cores
--tasks_per_rs	-a	Number of MPI tasks (ranks) per RS	N/A (total set instead [-p])
--cpu_per_rs	-c	Number of CPUs (physical cores) per RS	1
--gpu_per_rs	-g	Number of GPUs per RS	0
--bind	-b	Number of physical cores allocated per task	packed:1
--rs_per_host	-r	Number of RS per host (node)	N/A
--latency_priority	-l	Controls layout priorities	gpu-cpu,cpu-mem,cpu-cpu
--launch_distribution	-d	Order of tasks started on multiple RS	packed

See `man jsrun` for full list of options

`jsrun` Job Launcher – Tools & Documentation

`hello_jsrun`

- https://code.ornl.gov/t4p/Hello_jsrun
- Simple "Hello World"-type program used to test layout of resources on a Summit node using `jsrun`.
- As stated in the README, be sure to start MPS server (`-alloc_flags "gpumps"`)

`job-step-viewer`

- https://jobstepviewer.olcf.ornl.gov/

"Job Launcher (jsrun)" section of the Summit User Guide

- https://docs.olcf.ornl.gov/systems/summit_user_guide.html#job-launcher-jsrun

Additional training materials to learn about `jsrun`

A (fairly) quick tutorial on using the `jsrun` job launcher on Summit/Ascent:

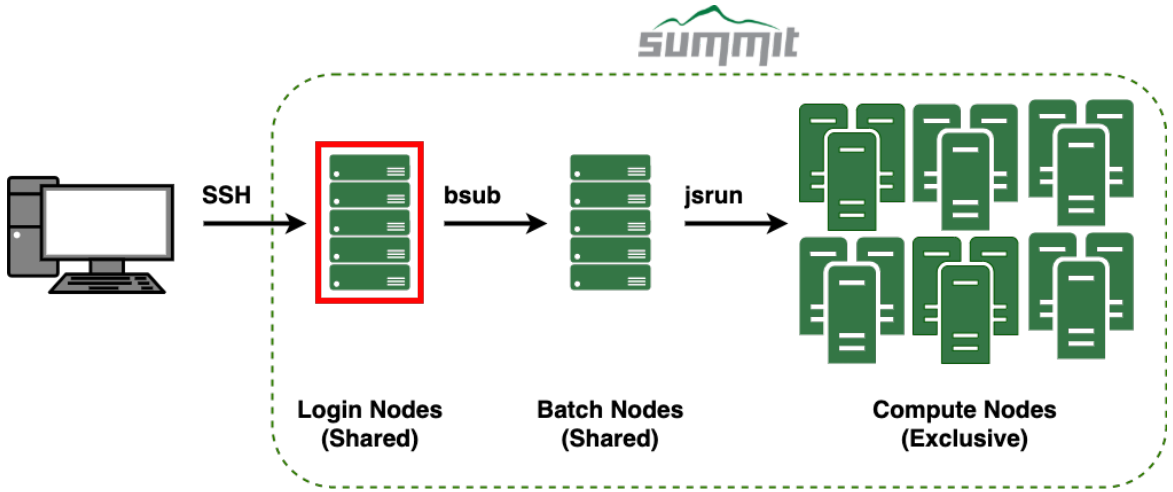
- https://github.com/olcf-tutorials/jsrun_quick_start_guide

Recent Presentation of "jsrun Basics"

- Slides: https://www.olcf.ornl.gov/wp-content/uploads/2019/12/jsrun_basics.pdf
- Recording: https://vimeo.com/393782415

Must use `jsrun` to run on compute nodes

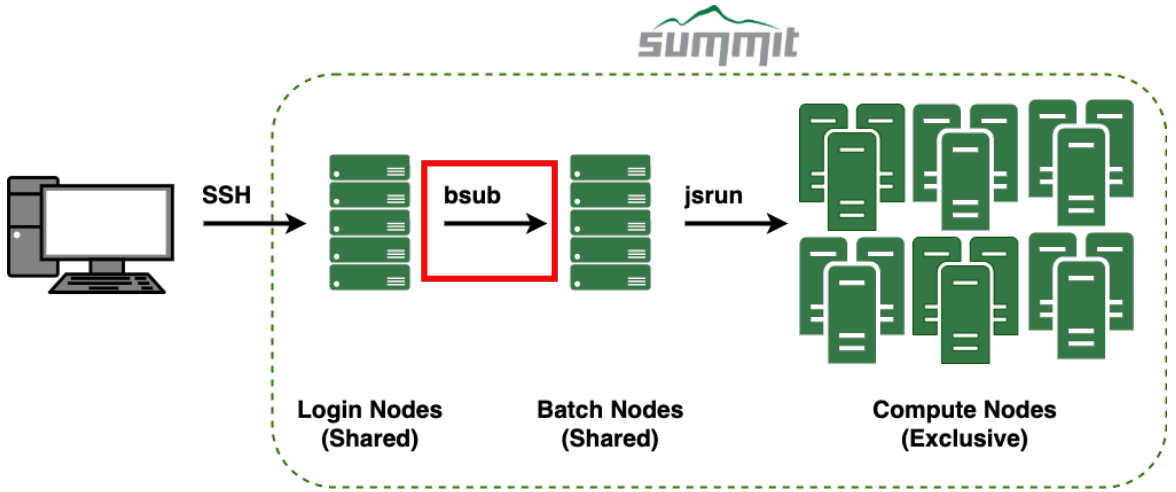
```
[t4p@login1: ~]$ hostname
login1
```



Must use `jsrun` to run on compute nodes

```
[t4p@login1: ~]$ hostname
login1

[t4p@login1: ~]$ bsub -P GEN040 -nnodes 1 -W 60 -Is /bin/bash
Job <15167> is submitted to default queue <batch>.
<<Waiting for dispatch ...>>
<<Starting on login1>>
```



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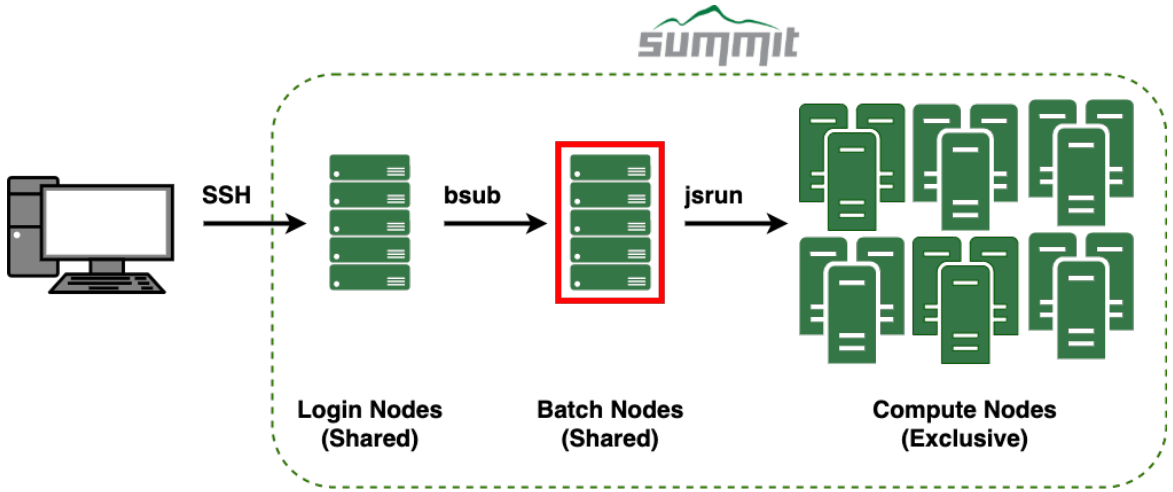


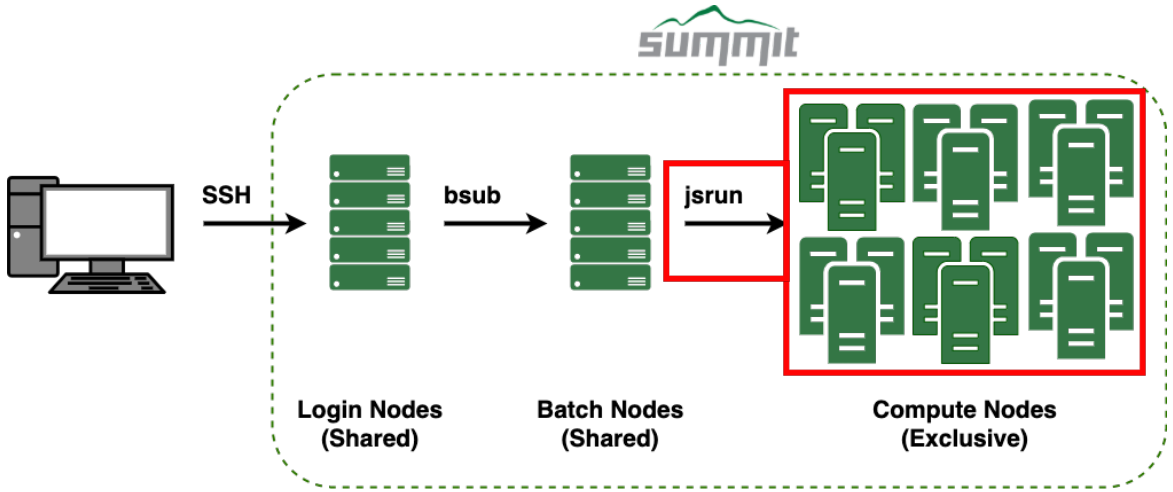
Must use `jsrun` to run on compute nodes

```
[t4p@login1: ~]$ hostname
login1

[t4p@login1: ~]$ bsub -P GEN040 -nnodes 1 -W 60 -Is /bin/bash
Job <15167> is submitted to default queue <batch>.
<<Waiting for dispatch ...>>
<<Starting on login1>>

[t4p@login1: ~]$ hostname
login1

[t4p@login1: ~]$ jsrun -n1 hostname
h49n16
```



The login nodes are shared among all participants (compiling, file editing, data analysis, etc.), so please **DO NOT RUN YOUR APPLICATIONS ON THE LOGIN NODES!!**

Some Useful Commands / Flags

`jobstat`

- Shows information about the jobs running on the system

`--smpiargs="-gpu"`

- `jsrun` flag that enables CUDA-Aware MPI
- If you are not familiar with CUDA-Aware MPI or GPUDirect, please see this tutorial: https://github.com/olcf-tutorials/MPI_ping_pong

`-alloc_flag "gpumps smt1"`

- `bsub` flag that allows you to start a CUDA MPS server or change the SMT mode of the physical CPU cores
- Multiple options are separated by a space-delimited list

Ascent Queue Policy

Number of Nodes	Max Walltime
1 – 2	2 hours
3 – 4	1 hour

There are a total of 16 schedulable compute nodes in Ascent, so please be respectful of others when requesting resources…

- Try to limit yourself to 1 compute node unless needed
- When you're finished with an allocation, please kill it (i.e., `exit` from within an interactive job or `bkill JOBID` for batch jobs).

Other Helpful Links

OLCF Summit User Guide

- https://docs.olcf.ornl.gov/systems/summit_user_guide.html
- NOTE: Ascent mounts different file systems than Summit, so please refer to info in these slides or the Training System (Ascent) section of the Summit User Guide for this information
  - https://docs.olcf.ornl.gov/systems/summit_user_guide.html#training-system-ascent
- NVIDIA's Nsight Profiling Tools
  - https://docs.olcf.ornl.gov/systems/summit_user_guide.html#profiling-gpu-code-with-nvidia-developer-tools

OLCF Training Archive

- Contains slides and recordings from previous OLCF training events.
- https://docs.olcf.ornl.gov/training/training_archive.html

Accounts

- Accounts will be active until Friday, Sept 10 2021

ML/AI/DL On Ascent

- IBM Provides the Open-CE Python Conda environment
  - Contains many common AI tools, e.g. TF, pyTorch, etc
  - More details here: https://docs.olcf.ornl.gov/software/analytics/ibm-wml-ce.html

Questions?