Argonne NATIONAL LABORATORY

SYSTEM OVERVIEW: OLCF SUMMIT

MOCHI BOOTCAMP
ECP Annual Meeting

6 Feb 2020
Houston TX

SUMMIT

- 200 PF [HPL I presume]
- 4608 Nodes
- 2 POWER9 CPU per node (9,216 total)
- 6 NVIDIA Volta per node (27,648 total)
- Mellanox EDR Infiniband
- 1600 GB NVRAM per node
- 250 PB GPFS, 2.5 TB/sec advertised bandwidth

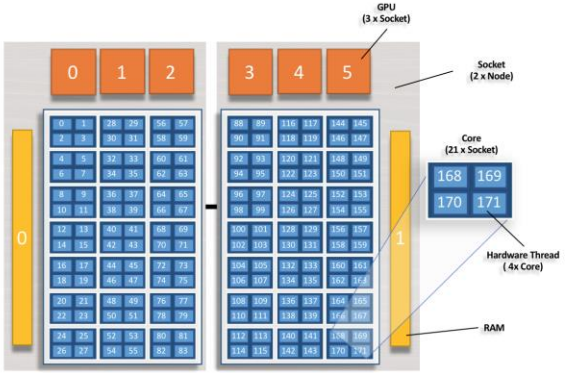
JOB SUBMISSION

- Three kinds of nodes on summit:
  - Login: everyone starts here
  - Launch: service nodes. Shared among all users (play nice)
  - Compute: where all the fun happens. Users request an allocation of compute nodes from the LSF scheduler (via `bsub`) and run commands on those nodes with `jsrun`
- Check job with `bjobs`
- Interactive example:

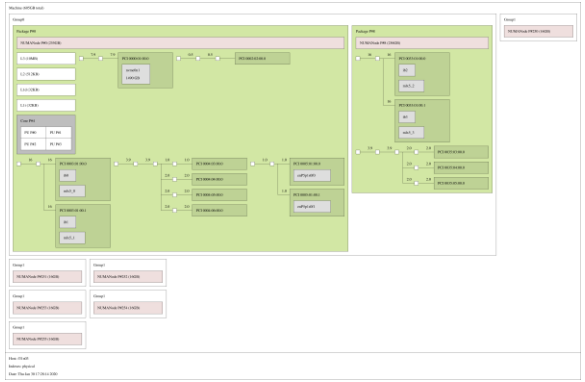
```
[robl@login1]% bsub -Is -W 0:15 -nnodes 2  -P CSC332 $SHELL
Job <843986> is submitted to default queue <batch>.
<<Waiting for dispatch ...>>
<<Starting on batch4>>
[\u@batch4.summit \W]\$ jsrun -r 1 hostname
b29n05
b29n04
```

RESOURCE SETS

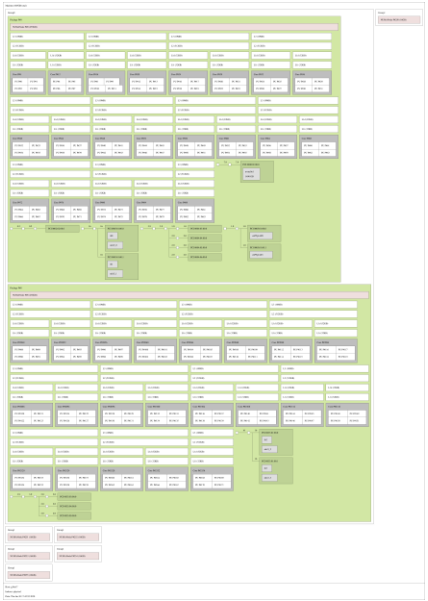
- Lots of ways to carve up nodes allocated with 'bsub'
- "Resource Sets" describe how many cores/threads per node to use
  - e.g. "One GPU per task" vs
  - "I will manage GPU and CPU resources myself"
- Our Mochi services will run with one resource set per node
  - `bsub –nnodes=2...`
  - `jsrun -n 1 -a 1 -c ALL_CPUS -g ALL_GPUS`
  - Your own code might demand other layout.



RESOURCE SET DEMONSTRATION



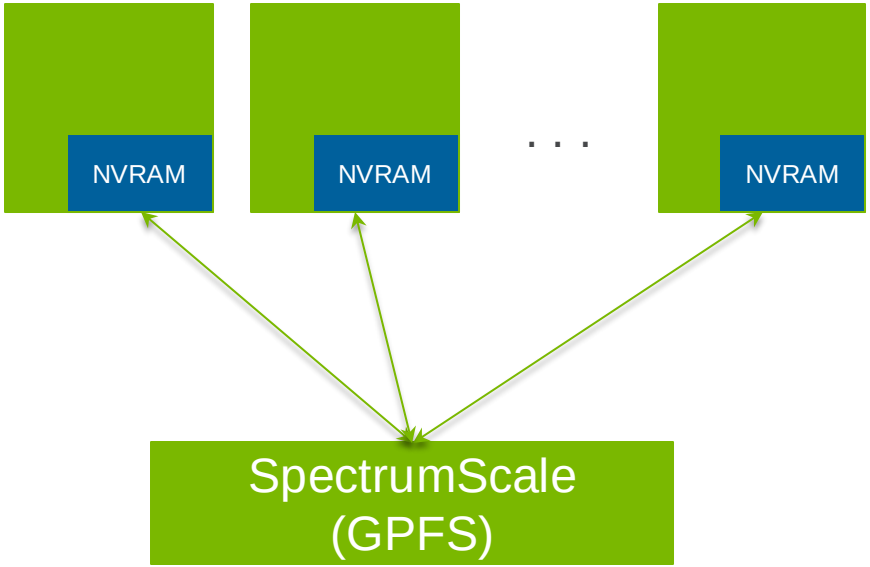
```
jsrun –n1 –r1 lstopo
```



```
jsrun -n 1 -a 1 -c ALL_CPUS -g ALL_GPUS
```

SUMMIT STORAGE

- 1.6 TB NVRAM
  - /mnt/bb/$USER
  - Request with `-alloc_flags NVME`
  - Only supports file-per-process or file-per-node
  - ‘Spectral’ library can help with stage-in and stage-out
- 250PB SpectrumScale (GPFS)
  - `/gpfs/alpine/$PROJECT/scratch/$USER`
  - Usual GPFS behavior
    - File per process will take “forever”
    - Shared file writes require 16 MiB block alignment



SPACK ON SUMMIT

- Just highlighting Summit-specific information: hopefully you already did the homework!
- Review https://xgitlab.cels.anl.gov/sds/mochi-boot-camp/blob/master/ecp-am-2020/sessions/hands-on/README.md : anything stump you?
- Libfabric: use verbs variant, not ucx to drive infiniband
- Almost everything you need is available as a module.
- .. but there's a bug with cmake, so spack has to build that one itself

```
libfabric:
      variants: fabrics=verbs,rxm,mrail

automake:
    modules:
        automake@1.16.1: automake/1.16.1
    buildable: False
```

SUMMIT NETWORKING

The "Multi-rail" bonus exercise

- 2 CPU per node, 1 network card (HCA)
- Each node sees 4 Infiniband ports
- Careful selection will result in one CPU driving both HCA ports
- Otherwise, will only see about half of advertised performance
- See if you can find the right value/config for `FI_OFI_MRAIL_ADDR`

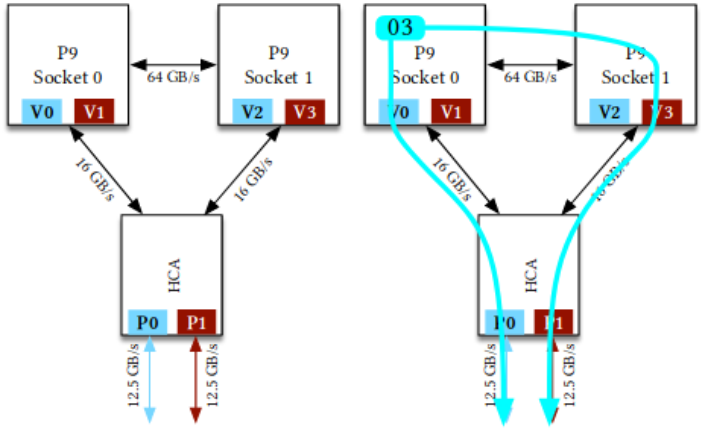


Figure 2: The left image shows the mapping of virtual to physical ports for both sockets. The right image shows socket 0 striping data over virtual ports V0 and V3.

Image from Zimmer, Atchley, et. al "**An evaluation of the CORAL interconnects**", SC2019

RESOURCES

- https://docs.olcf.ornl.gov/systems/summit_user_guide.html
  - One-stop survey of just about anything you need
- https://dl.acm.org/doi/10.1145/3295500.3356166
  - In-depth study of Summit (and Sierra) networking
- https://ofiwg.github.io/libfabric/master/man/fi_mrail.7.html
  - Libfabric documentation for the “multi-rail” protocol
- https://www.olcf.ornl.gov/wp-content/uploads/2018/12/spectrum_scale_summit_workshop.pdf
  - Lots of Spectrum-Scale (GPFS) tuning parameters
- https://www.olcf.ornl.gov/calendar/jsrun-tutorial/
  - 3 hour class on jsrun features. In-person and remote. 18 Feb 2020