Self-service Monitoring of HPC and Openstack Jobs for Users

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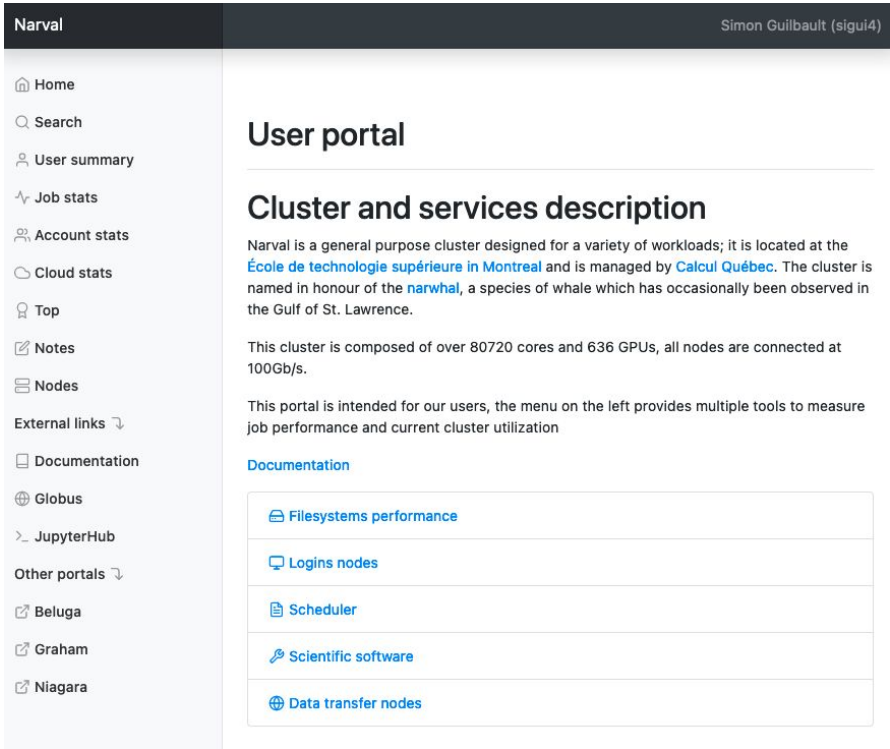
Quick overview of the portal

- Live demonstration of a staff view
- Public view of some information
  - https://portail.narval.calculquebec.ca/



Quick overview of the portal

Beluga

Simon Guilbault (sigui4)

- Home
- User summary
- Job stats
- Account stats
- Top
- Notes

External links

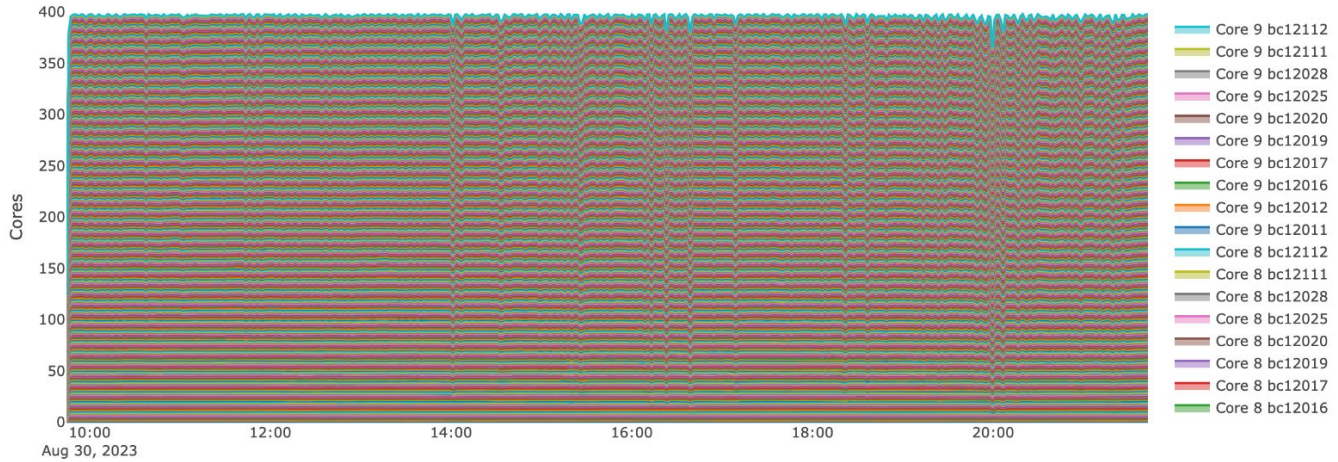
- Documentation
- Globus
- JupyterHub

Other portals

- Narval
- Graham
- Niagara

CPU

Ratio of cycles consumed on each CPU core by all processes in this job. This graph should be all filled up most of the time, if not, you can lower the cores requested to the scheduler. Unused cycles does not improve your job performance and will lower your priority when cores are wasted.



Memory

The max used memory should be close to the allocated memory. If the memory is not used by the job, ask a lower amount, your jobs will be able to start faster. Unused memory does not increase your job performance.

Graph legend and explanation

Data flow and collectors

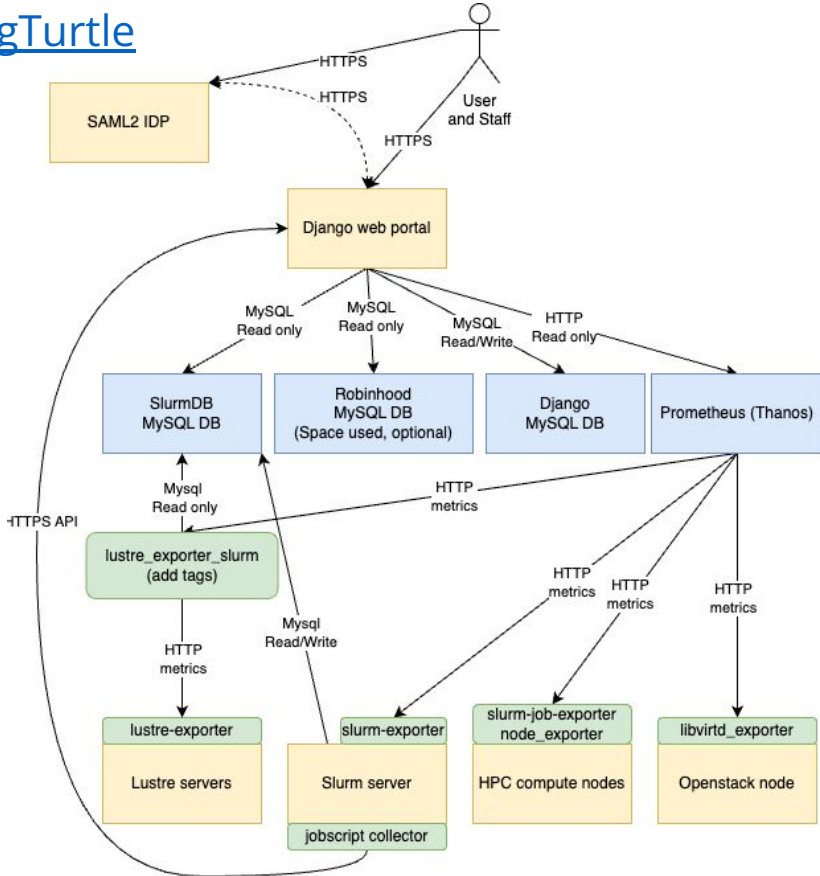
- The portal: github.com/guilbaults/TrailblazingTurtle

- slurm-job-exporter
- node_exporter

- slurm-exporter
- lustre_exporter + lustre_exporter_slurm
- redfish_exporter (power by node)

- libvirtd_exporter (openstack)

- pcm-sensor-server (Intel IPC/NUMA/Mem)



Prometheus

- 1866 nodes monitored
- 200k metrics per second

- 1 VM per cluster
  - 50GB of ram
  - 6 cores
  - 300GB of local disk
  - 10 IOPS

- Cardinality is not a issue for jobstats
  - Recorder rules to generate sums

Thanos

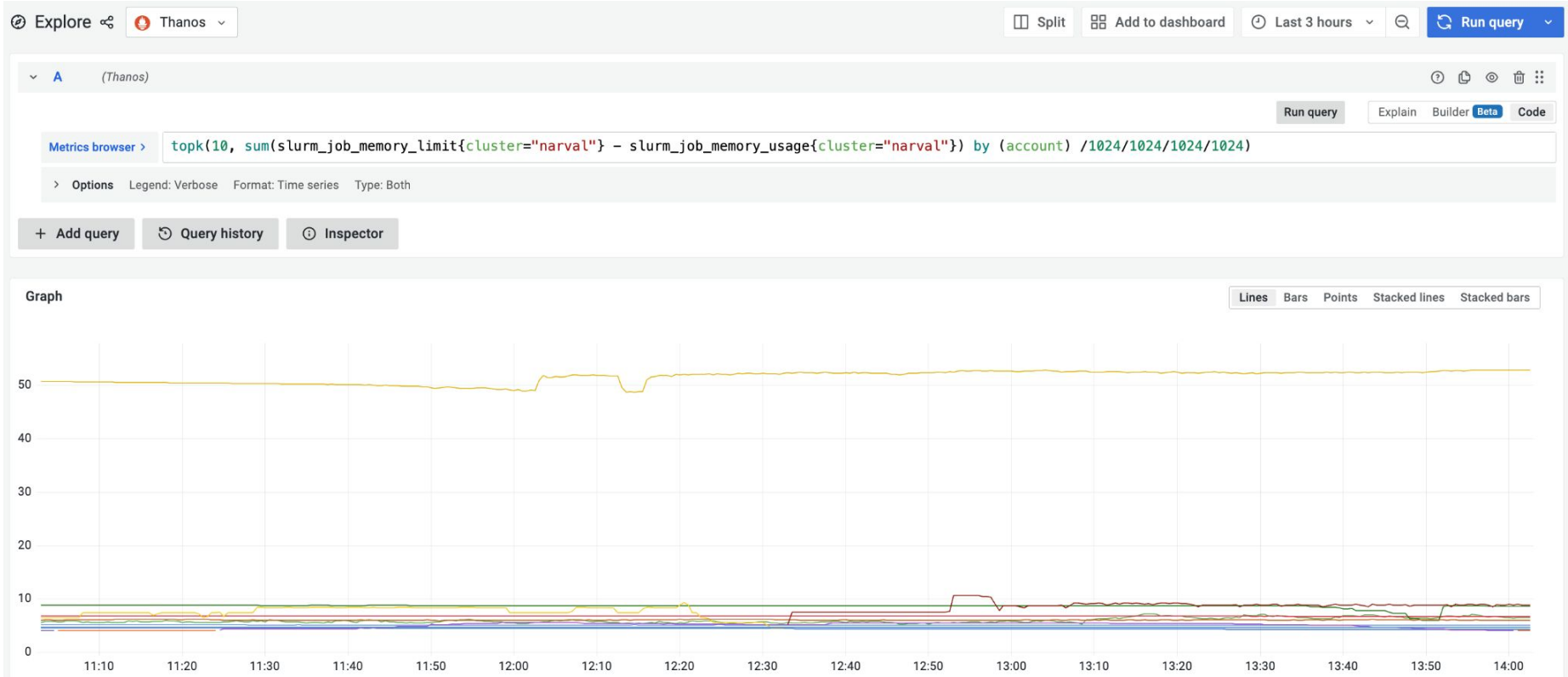
- Plugin over Prometheus for archival and multiple endpoints

- 3.5+ clusters monitored

- 27TB in S3 (ceph)
- 6 months of retention for everything
- Rewrite after 6 months to remove some stats
- Downsampling is disabled
  - Downsampling increase storage req.
  - Too many small jobs
  - Queries over the last year are rare

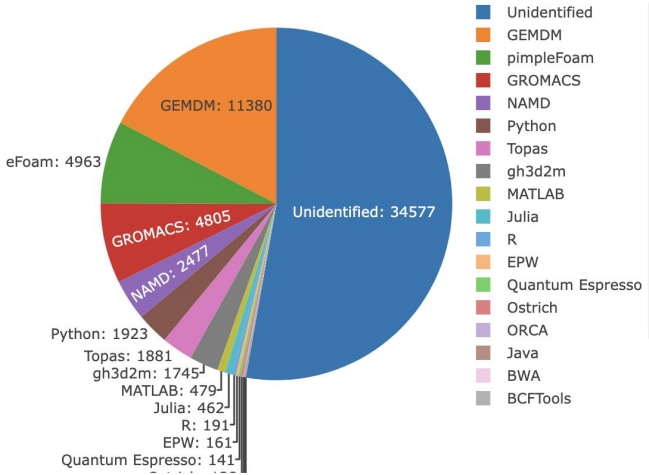
Initial prototype and exploration in Grafana

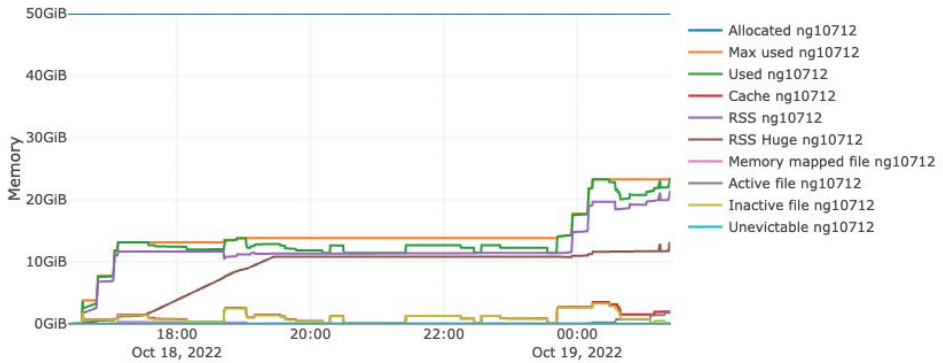
- Simple query to get the 10 worst memory waster by user
  - Not user friendly and only available to sysadmins



slurm-job-exporter

- cgroups statistics
  - CPU
  - Memory
  - Application name
  - Processes and threads count

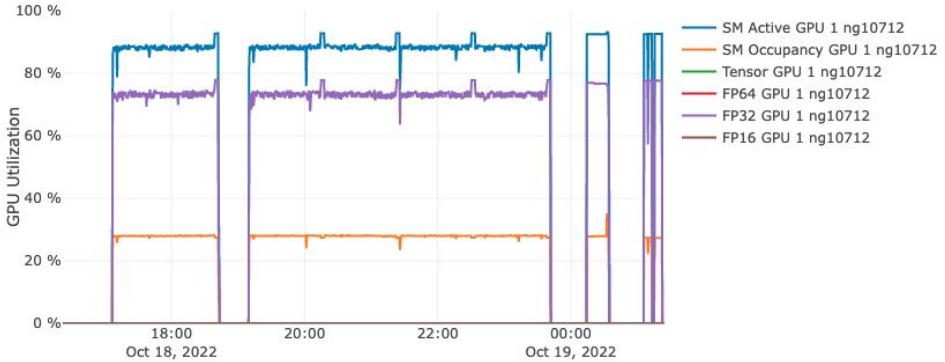


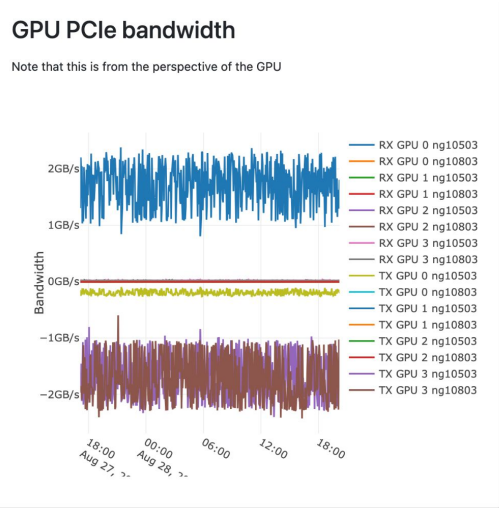


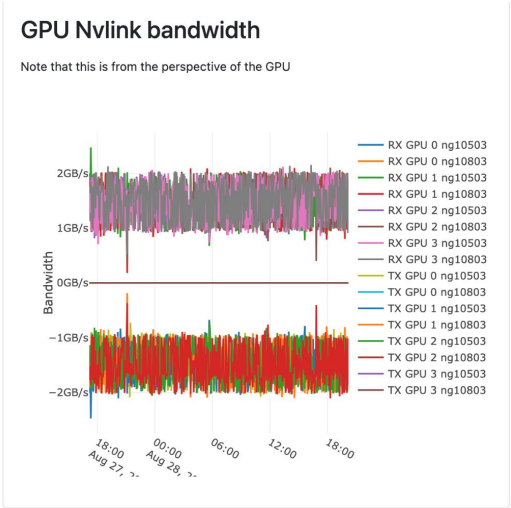
slurm-job-exporter

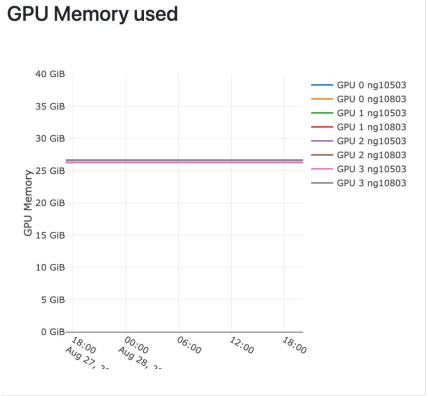
Use Nvidia DCGM, include MIG stats

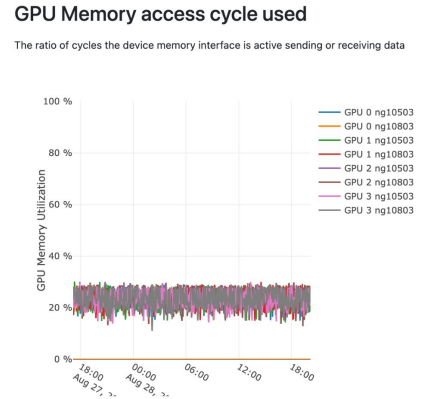
- SM active/occupied
- FP64/32/16/Tensors
- Memory bandwidth
- PCIe and Nvlink bandwidth











node_exporter

- Local disk
  - IOPS
  - Bandwidth
  - Used space
- Network
  - Ethernet and Infiniband
- Unix load
- CPU
- Memory + NUMA
- ZFS

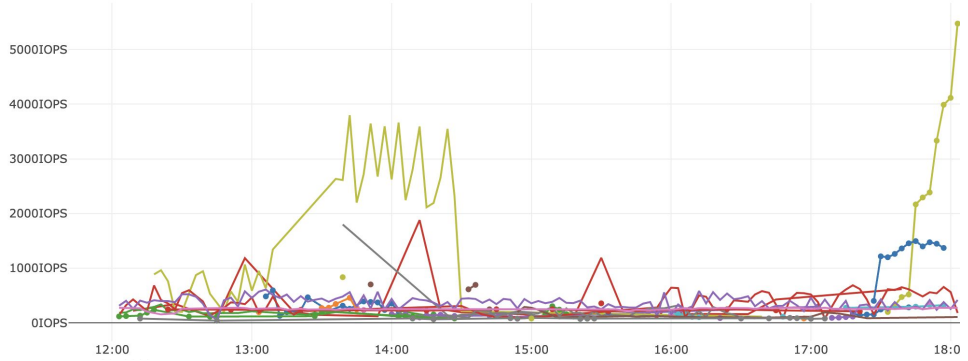
- Grafana node-exporter full

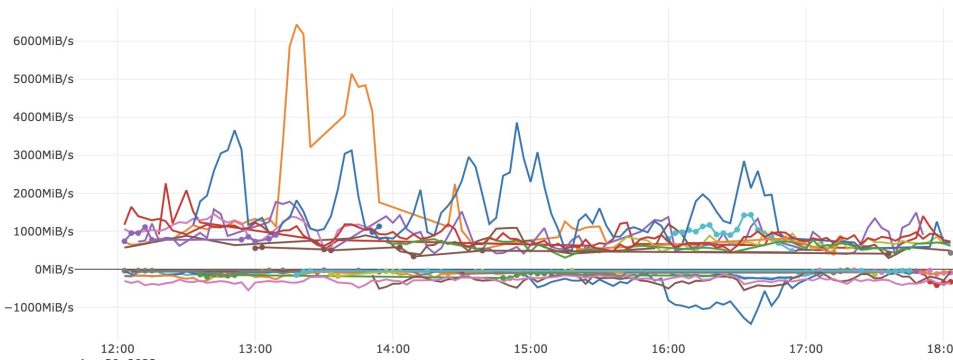
redfish_exporter

- Power
  - iDRAC does some averaging over time
- Fans
- Temperature

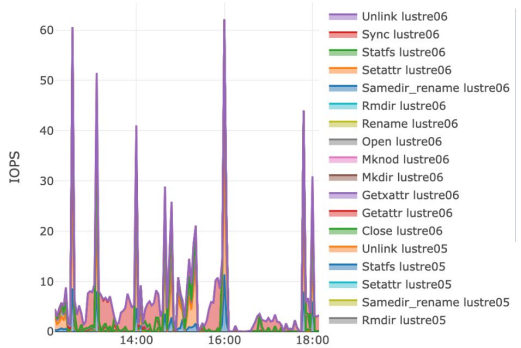
Lustre

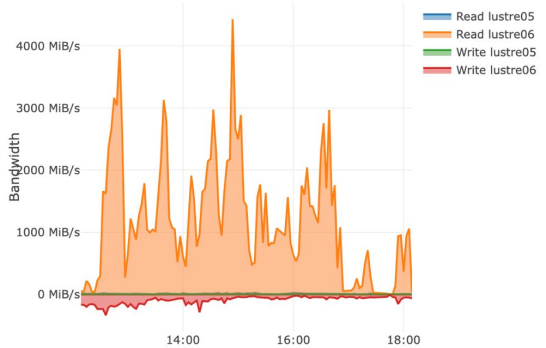
Top users for bandwidth and IOPS





Usage for a user or a job

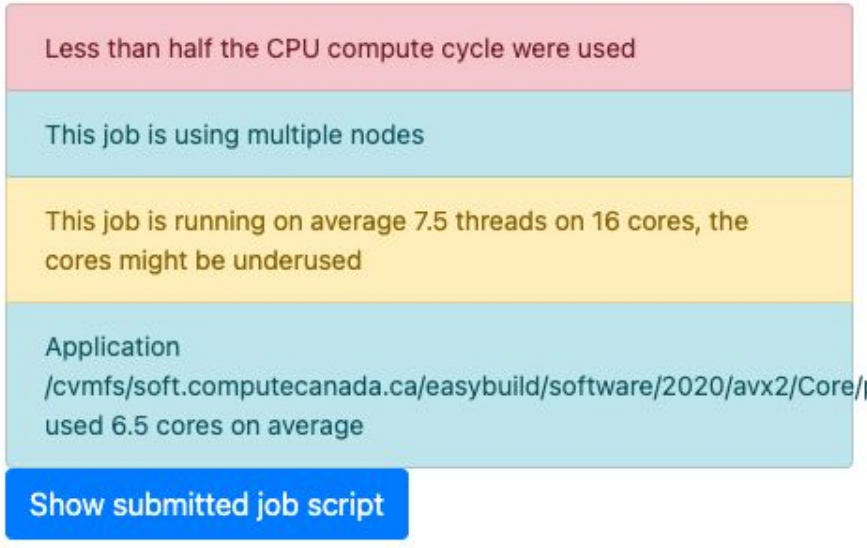


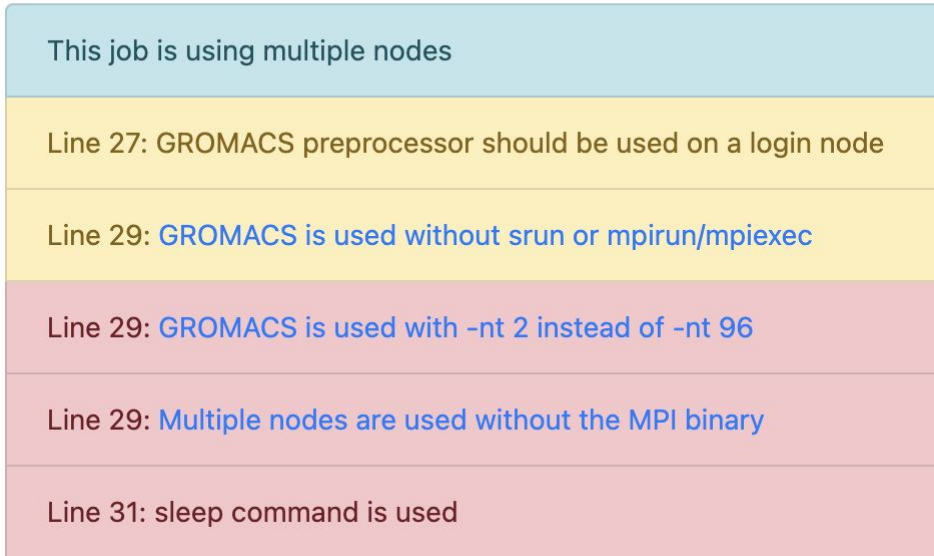


Automated Job analysis

- Regex on job script
- Stats from prometheus
- Application name

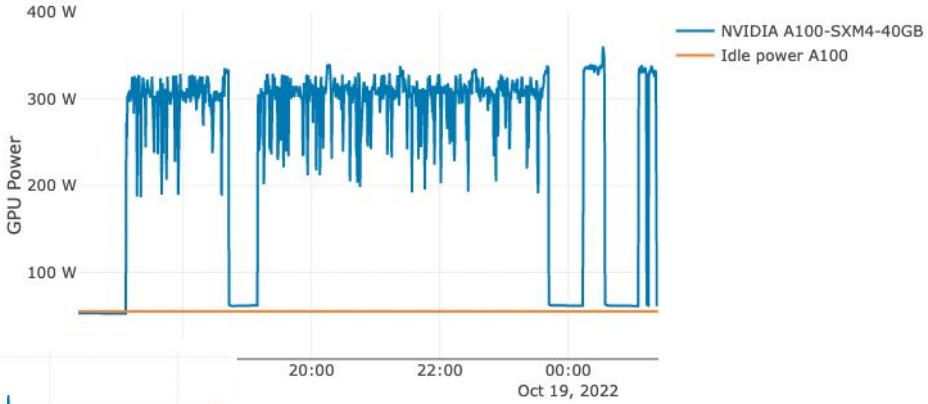
```
#SBATCH --ntasks=96          # number of MPI processes
module load  StdEnv/2020 gcc/9.3.0 openmpi/4.0.3
gromacs/2020.4
gmx grompp -f $mdp/emin_$LAMBDA.mdp
gmx mdrun -v -deffnm emin$LAMBDA -nt 2
sleep 10
```

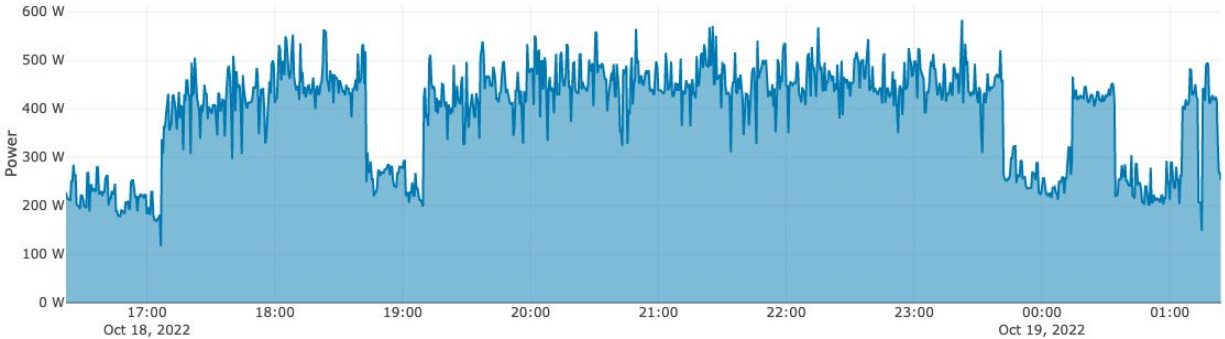




Power measurement

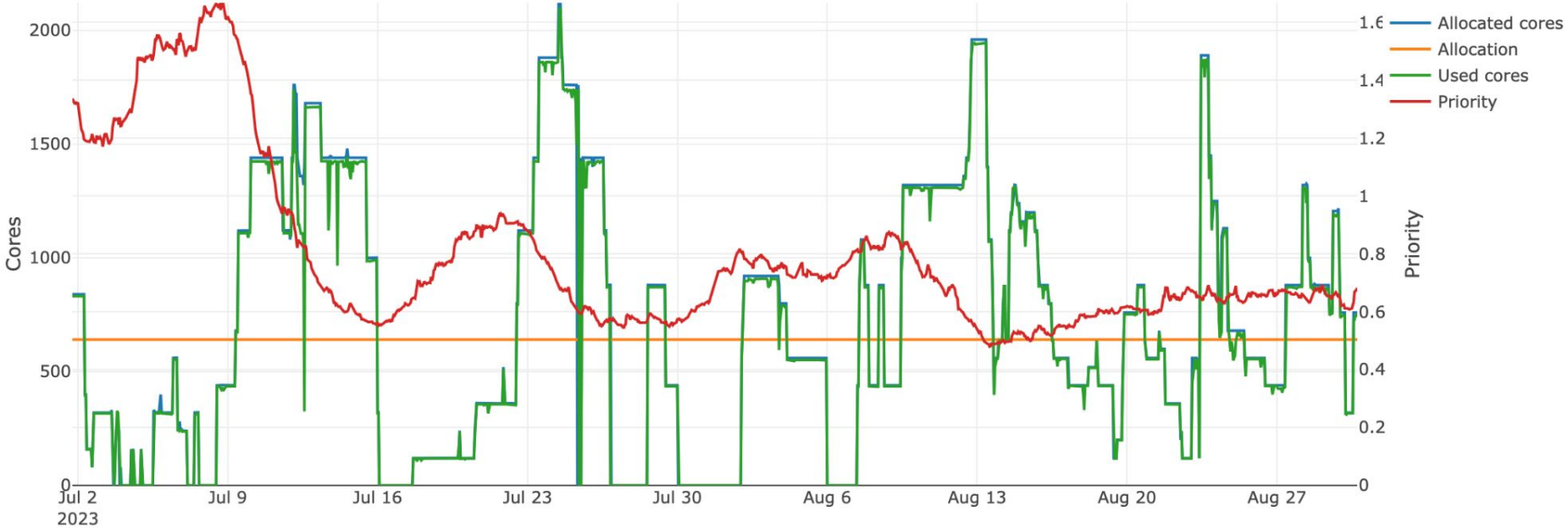
- Power by node and by GPU
- Allocate power of a shared nodes to the jobs running on it
  - based on % of cpu cores
  - by the GPU used





Priority and group use

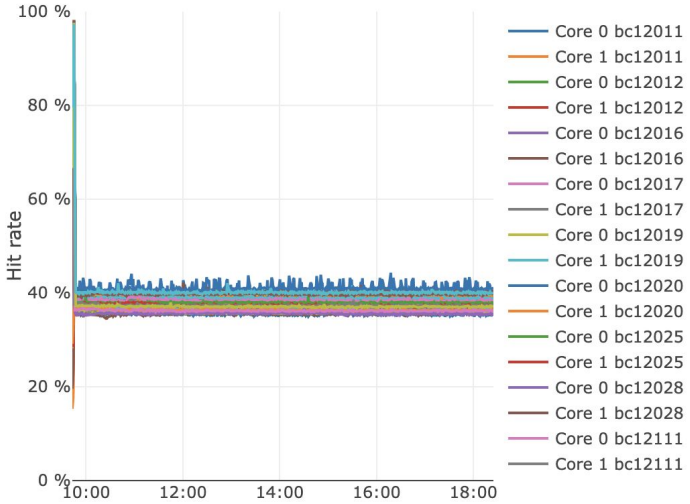
Priority (levelFS) is around 0.6 because this group is using more than their allocation



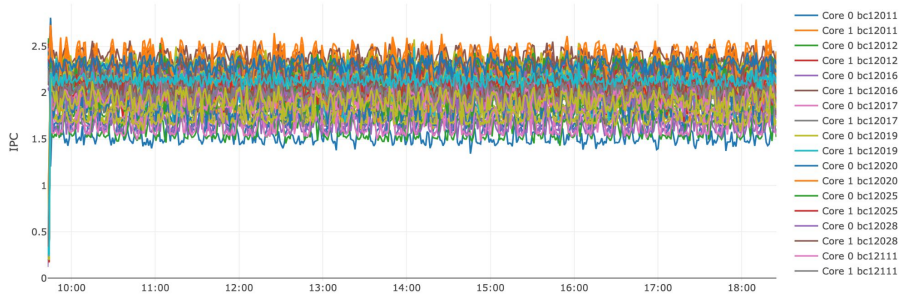
Intel pcm-sensor-server

AMD CPU are missing some counters for memory bandwidth and other metrics

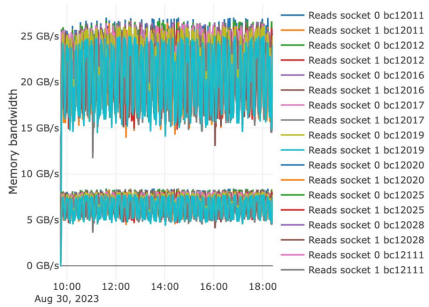
L3 cache hit rate



Instructions per cycle



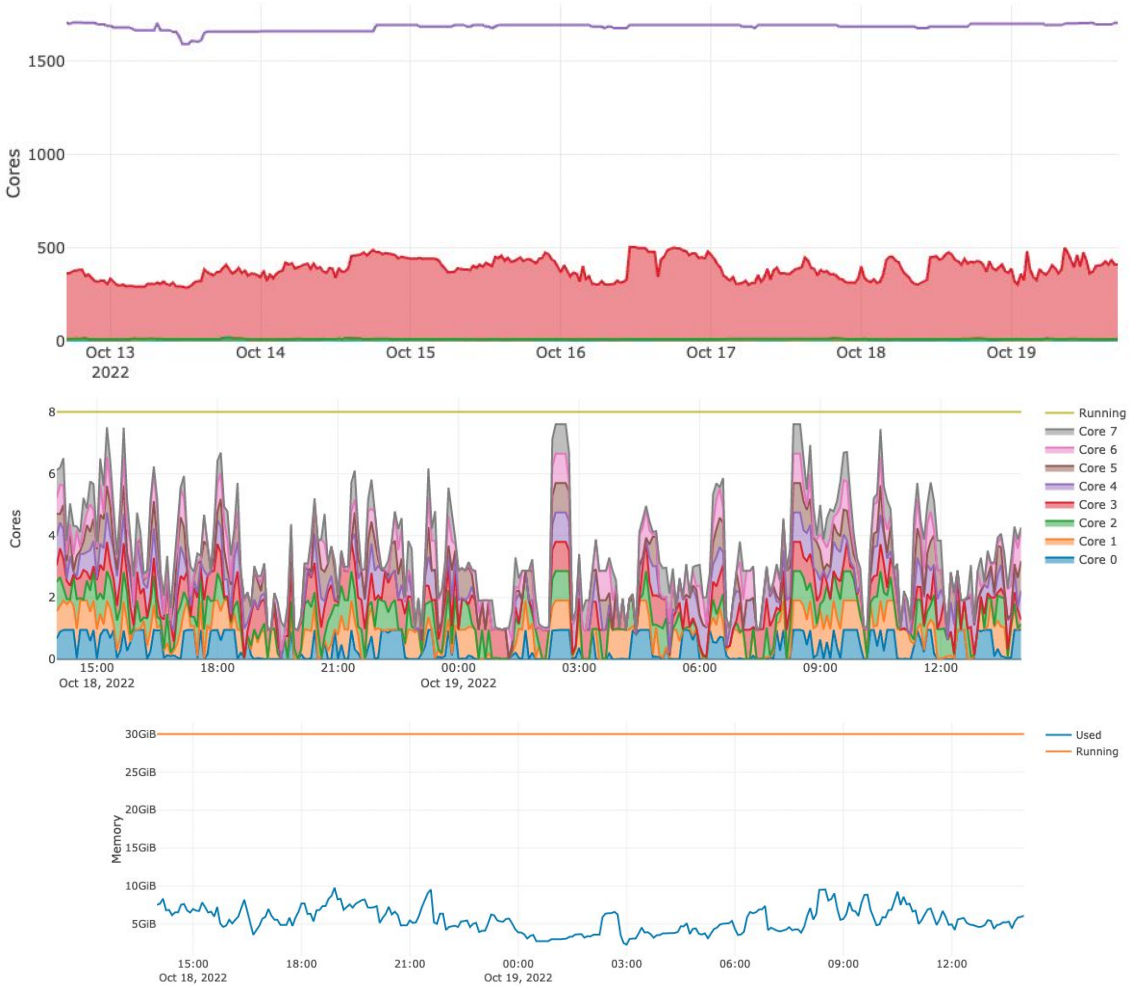
Memory bandwidth



CPU interconnect bandwidth

Openstack

- Overall utilization
  - by project
  - by VM
- Cores
- Memory
  - Allocated
  - Balloon to see used
- Network
  - Bandwidth
  - Packets
- Block devices
  - Bandwidth
  - IOPS



Future improvements

- Better automated job analysis
  - Simple score for each job/user/slurm account
  - Feedback on job script
- Automatic alerts and killing jobs
  - What count as not using a GPU correctly ?
- Improving the annual allocation process
- Improving the next RFP based on the resources being used
- Node fail additional informations from syslog
  - Tell the user the node died because of a DIMM
- Analyse compiled applications by used CPU time
  - Language
  - Compiler
- Clarification in MIG stats

Questions ?

- https://github.com/guilbaults/TrailblazingTurtle/