ABoVE Science Cloud: VM sizing and Batch Processing

Mark Carroll

Hoot Thompson

Garrison Vaughan

Scott Sinno

ABoVE Science Cloud: Assumptions

- User has a need to process a large volume of data
- User intends to run in the Linux operating system primarily from a terminal window
- User has a working knowledge of:
  - The linux/unix operating system
  - Some scripting language (shell, perl, python, etc)

ABoVE Science Cloud: Resources

- There are currently ~100 physical nodes
  - Each physical node has:
    - 24 processors with 64 GB RAM
- There is 1 Petabyte of storage allocated to ABoVE
  - 50% currently in use for static/archived data products (such as Landsat surface reflectance) and scratch space allocations
  - Each user has 5.5 TB allocation in their “nobackup” space to use as scratch space
    - Additional space can be made available as needed
    - Request for additional space vetted through ABoVE project office

ABoVE Science Cloud: VM allocation

- Virtual machines (VMs)are created from the physical nodes described earlier
- Max configuration is ~10 % less than the size of a physical node
  - Some space on the physical node is required to keep it running
- Total number of possible VMs is limited by the configuration of the VM itself divided by the total number of physical nodes available
  - Some physical nodes will already be actively in use by other VMs

ABoVE Science Cloud: VM sizing

- Base configuration is small: 2 CPUs with 10GB RAM
- Required software is built-in to the configuration of the VM
  - hdf libraries, python, perl, gdal, R, QGIS, etc. are identified as required components when the VM is initially configured
    - If you need specific packages for software like R you need to request that be part of the configuration
    - Proprietary software can be installed but consideration has to be given to where the licenses will come from and how they can be distributed in a multi-system (cloud) environment
  - Realistically it could take several iterations to configure the VM to emulate the environment you may be used to

ABoVE Science Cloud: VM sizing

- Process for building VM cluster

Sketch out overall goals: "I need to process 10 years of 3 path/rows of Landsat data"

Move code over (or write code) to test VM

Adjust for paths etc.

Test

Identify any missing components of software/packages

Iterate

ABoVE Science Cloud: Batch testing

- Once your code runs, you need to get some timing metrics so you can optimize
- Define your minimum processing unit
  - Do you need to process a tile through time or do you need to process all tiles for a single time before moving forward?
- How long does it take to process 1 unit?
- Can you process more than 1 unit simultaneously?
  - Of particular interest here is if you use temporary files you need to ensure that you aren't inadvertently overwriting them

ABoVE Science Cloud: Batch testing

- Total processing time = total number of processing units X processing time per unit
  - This gives you the length of time needed to process on a single machine
- How soon do you need your results?
  - If you are able to spread over 10 machines, it will be done 10 times sooner…
- **You need to invest time up front to figure out how to implement your code in the cloud and get the most out of it!**

ABoVE Science Cloud: Tools for timing/monitoring processes

- Timing your run can be as simple as using the "date" command or "time" command
  - date; sh myshellscript.sh; date> textfile.txt
  - time; sh myshellscript.sh
- Launching processes across all machines can be done with
  - pupsh or ppdsh
    - pupsh "hostname ~ 'condjess[0-9]'" "perl <full path>/file.pl"
- Monitoring processes on your cluster of VMs can be done through "Ganglia"
  - https://internal.nccs.nasa.gov/internal/monitoring/dsc/ganglia-test/

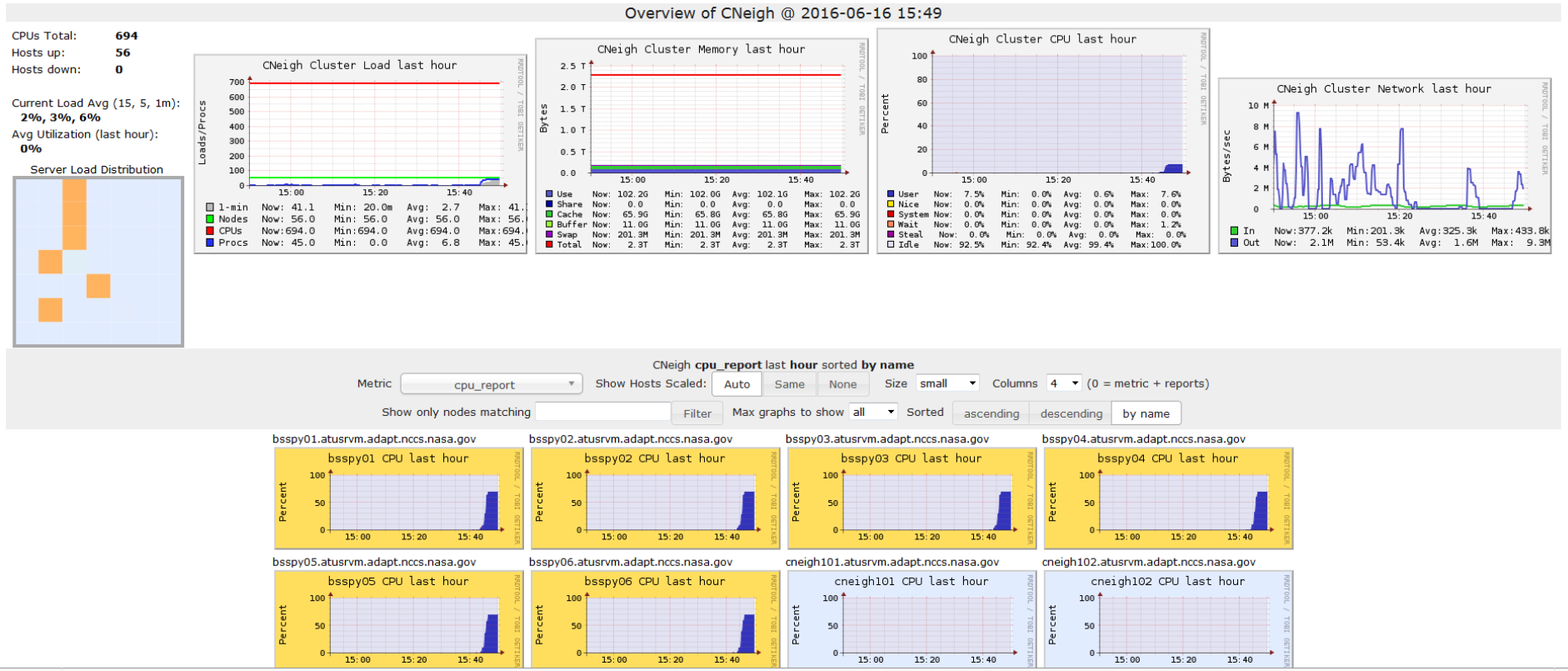
ABoVE Science Cloud: Misc.

- Ganglia access requires your token (In spite of what the login screen says about smart card access)
- Use screen or nohup to launch jobs
  - Jobs will stop if your terminal session ends otherwise
- Use hostname to get unique identifiers for temp files
  - Perl
    - $host=`/bin/hostname`;#identify the hostname of the machine you are running on
    - $nid=substr($host,8,2);#capture the 2 digit "ID" of the hostname
  - bash
    - host=`/bin/hostname`
    - nid=`/bin/hostname -s | /usr/bin/rev | sed -e 's/[[:alpha:]].*//' | rev`

ABoVE Science Cloud: Misc.

- Remember there are interdependencies between software
  - Python and R both bind to gdal
    - Sometimes this causes conflicts and version dependencies
- System related questions should go to support@nccs.nasa.gov
  - Access to system, installation of software, VM is running out of memory
- Coding/software questions should be addressed with your peers
  - How do I do ____ in R?
  - How do I build a nested for loop in bash?

ABoVE Science Cloud: Ganglia



ABoVE Science Cloud: Ganglia

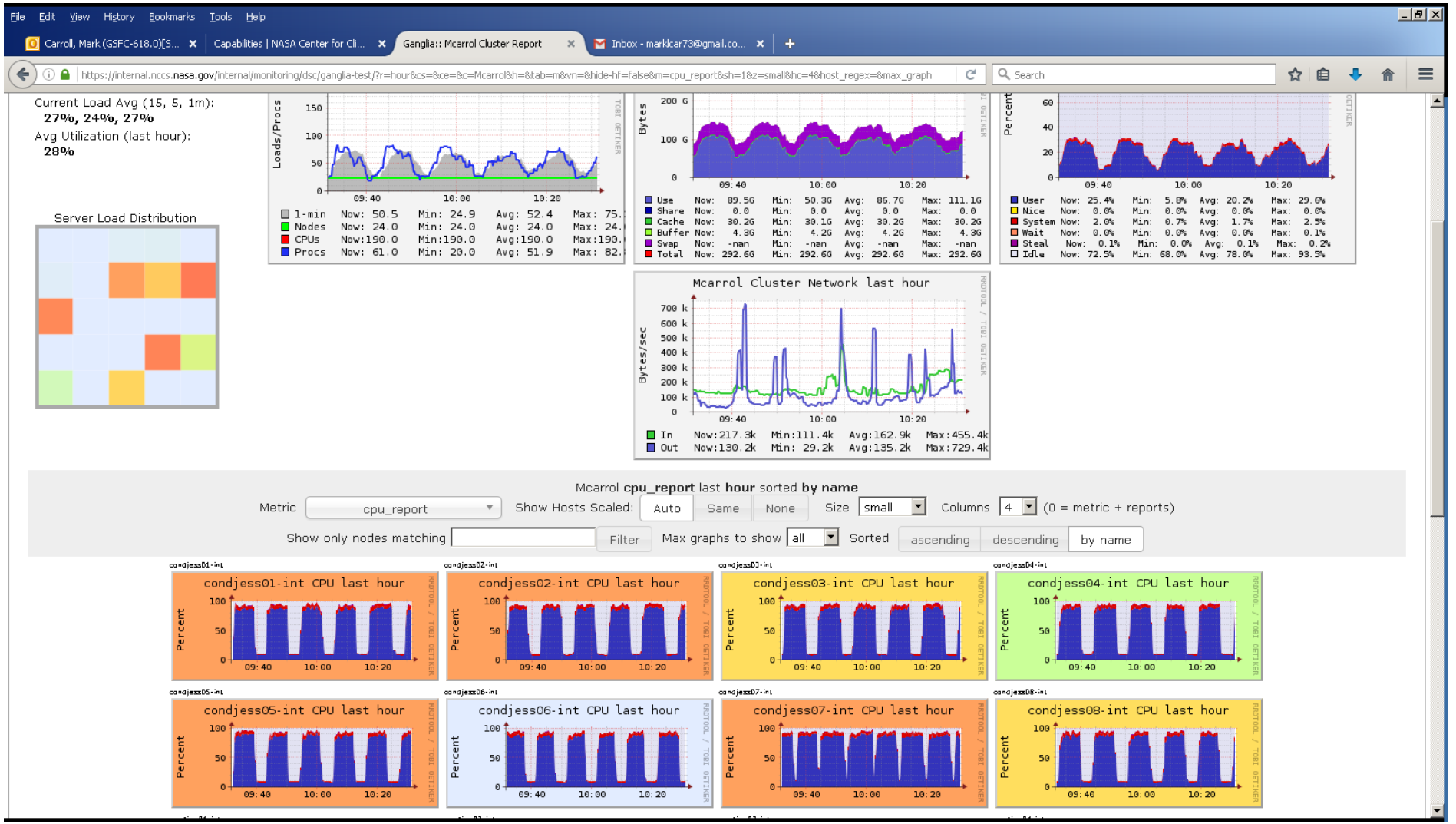
ABoVE Science Cloud: Ganglia

```
#note that 'pupsh' may be invoked with no commands to simply display a list of
#what nodes would be utilized based on the query
[ssinno@dsclogin01 ~]pupsh "hostname ~ 'bsspy'"
bsspy01
bsspy02
bsspy03
bsspy04
bsspy05
bsspy06

#Lets run 6 instances of a job called 'coin', redirecting output to our
#$NOBACKUP space, using the hostnames to create distinct logfiles.
[ssinno@dsclogin01 ~]pupsh "hostname ~ 'bsspy'" "~/coin > $NOBACKUP/coin_output_%h.run1" &
[1] 5619
[ssinno@dsclogin01 ~]pupsh "hostname ~ 'bsspy'" "~/coin > $NOBACKUP/coin_output_%h.run2" &
[2] 5648
[ssinno@dsclogin01 ~]pupsh "hostname ~ 'bsspy'" "~/coin > $NOBACKUP/coin_output_%h.run3" &
[3] 5677
[ssinno@dsclogin01 ~]pupsh "hostname ~ 'bsspy'" "~/coin > $NOBACKUP/coin_output_%h.run4" &
[4] 5831
[ssinno@dsclogin01 ~]pupsh "hostname ~ 'bsspy'" "~/coin > $NOBACKUP/coin_output_%h.run5" &
[5] 5867
[ssinno@dsclogin01 ~]pupsh "hostname ~ 'bsspy'" "~/coin > $NOBACKUP/coin_output_%h.run6" &
[6] 5895

[ssinno@dsclogin01 ~]ls -lh $NOBACKUP/coin_output*
-rw------- 1 ssinno attadm 4096 Jun 16 15:44 /att/nobackup/ssinno/coin_output_bsspy01.run1
-rw------- 1 ssinno attadm 4096 Jun 16 15:44 /att/nobackup/ssinno/coin_output_bsspy01.run2
-rw------- 1 ssinno attadm 4096 Jun 16 15:45 /att/nobackup/ssinno/coin_output_bsspy01.run3
-rw------- 1 ssinno attadm 4096 Jun 16 15:45 /att/nobackup/ssinno/coin_output_bsspy01.run4
-rw------- 1 ssinno attadm 4096 Jun 16 15:45 /att/nobackup/ssinno/coin_output_bsspy01.run5
-rw------- 1 ssinno attadm 4096 Jun 16 15:45 /att/nobackup/ssinno/coin_output_bsspy01.run6
-rw------- 1 ssinno attadm 4096 Jun 16 15:44 /att/nobackup/ssinno/coin_output_bsspy02.run1
-rw------- 1 ssinno attadm 4096 Jun 16 15:44 /att/nobackup/ssinno/coin_output_bsspy02.run2
```

ABoVE Science Cloud: Ganglia



ABoVE Science Cloud: Summary

- ADAPT is a large processing resource available to ABoVE scientists
- Can be an effective tool for processing large volumes of data
- Users need to allocate time up front to get their VM configuration right and to optimize their code for distribution or parallelization
- Admins are there to administer the system but they do not use science software so they cannot help with debugging scripts