MSU Tier 3 Usage and Troubleshooting

James Koll

Overview

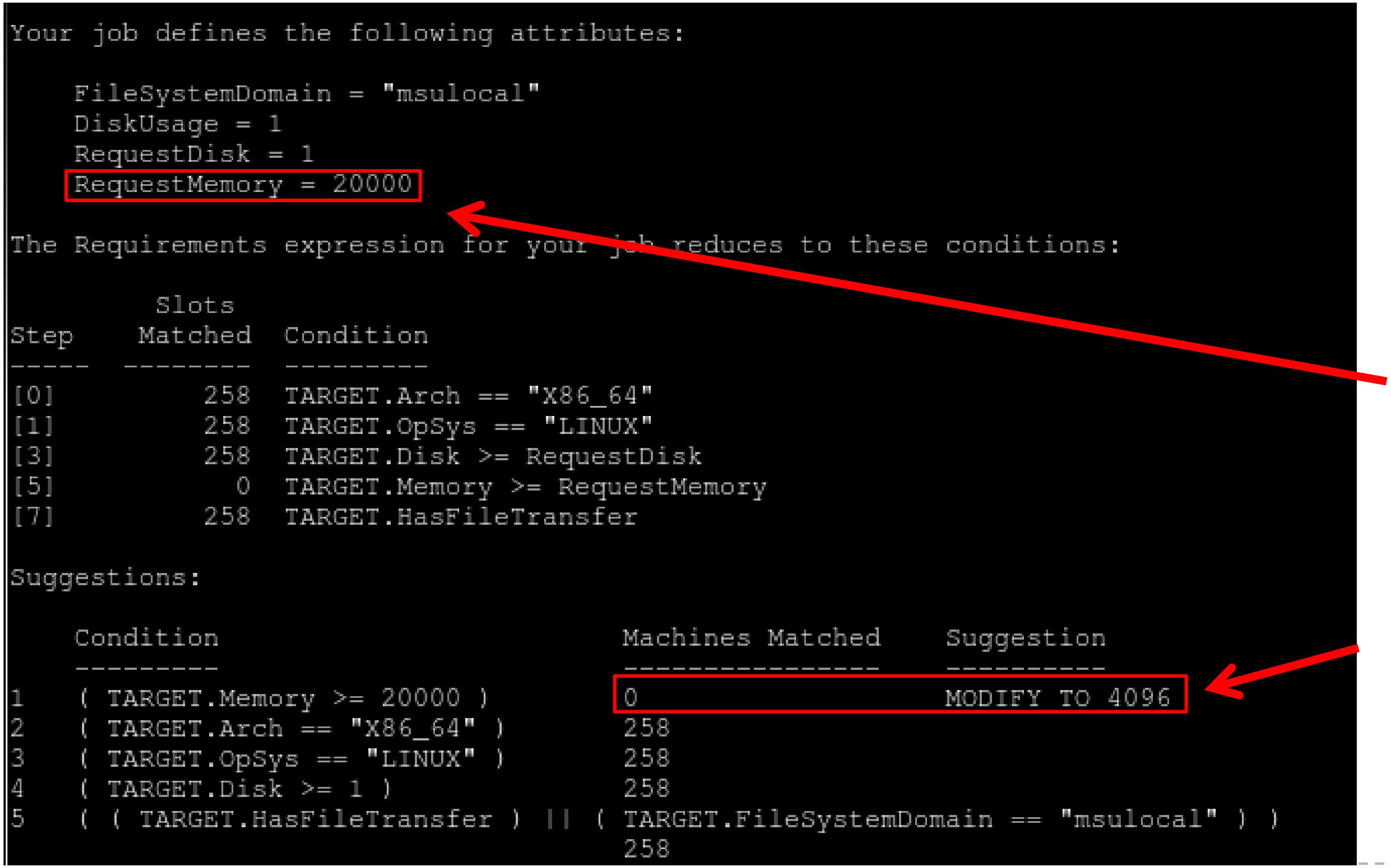
- Dedicated computing for MSU ATLAS members
- Flexible user environment
- ~500 job slots of various configurations
- ~150 TB disk space

Condor commands

- \`condor_q\` : What jobs have been submitted from this machine?
- \`condor_q –global\` : What jobs have been submitted to the cluster?
- \`condor_q –better-analyze [jobid]\` : What is the status of this job and why?
- \`condor_status\` How many job slots are available?
- Read the user section of the manual:
  - http://research.cs.wisc.edu/htcondor/manual/v8.0/2_Users_Manual.html

Condor Commands

- condor_q –better-analyze



```
Your job defines the following attributes:

    FileSystemDomain = "msulocal"
    DiskUsage = 1
    RequestDisk = 1
    RequestMemory = 20000

The Requirements expression for your job reduces to these conditions:

         Slots
Step    Matched  Condition
-----  --------  ---------
[0]         258  TARGET.Arch == "X86_64"
[1]         258  TARGET.OpSys == "LINUX"
[3]         258  TARGET.Disk >= RequestDisk
[5]           0  TARGET.Memory >= RequestMemory
[7]         258  TARGET.HasFileTransfer

Suggestions:

    Condition                            Machines Matched    Suggestion
    ---------                            ----------------    ----------
1    ( TARGET.Memory >= 20000 )           0                   MODIFY TO 4096
2    ( TARGET.Arch == "X86_64" )          258
3    ( TARGET.OpSys == "LINUX" )          258
4    ( TARGET.Disk >= 1 )                 258
5    ( ( TARGET.HasFileTransfer ) || ( TARGET.FileSystemDomain == "msulocal" ) )
                                          258
```

That's why my job isn't running – I asked for too much memory.

Job constraints

- Memory constraints
  - Add to submit file:
    - Request_memory = 4000

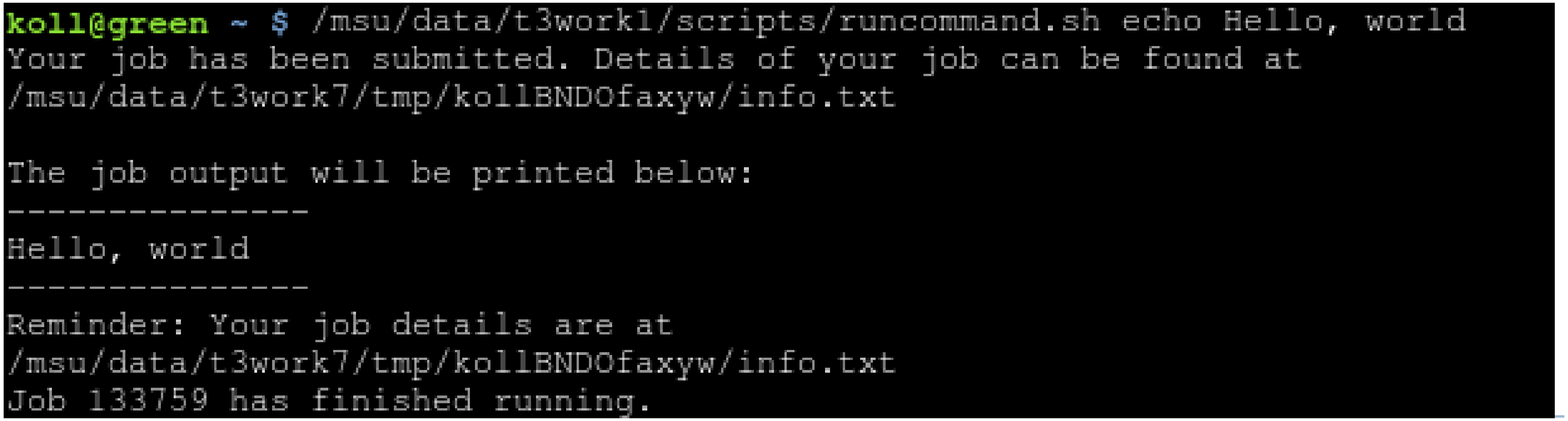
Memory*	# of slots (approximate)
1GB	150
4GB	350

*How we define these slot types is malleable to user needs.

- 30 of the slots are available for quick jobs
  - To use them, just add +MSU_QUEUE = "short" to the submit file prior to the queue statement.
  - Jobs marked as "short" will still run on other slots if no short slots are available.

One line submit

- /msu/data/t3work1/scripts/runcommand.sh [Command you want to run]
  - Runs as “short” queue
  - Brings over environmental variables
  - Prints location of further information, such as log files
  - Prints output text to screen until job is finished
  - Ctrl-C before job is finished will remove job from condor



```
koll@green ~ $ /msu/data/t3work1/scripts/runcommand.sh echo Hello, world
Your job has been submitted. Details of your job can be found at
/msu/data/t3work7/tmp/kollBNDOfaxyw/info.txt

The job output will be printed below:
---------------
Hello, world
---------------
Reminder: Your job details are at
/msu/data/t3work7/tmp/kollBNDOfaxyw/info.txt
Job 133759 has finished running.
```

Disk concurrency limits

- Disk I/O is tricky.
- There are voluntary parameters you can set to tell condor how many units of disk I/O your job uses.
  - Instructions to add are on the wiki (link on last slide).
  - It is good practice to include concurrency limits even if you aren't submitting very many jobs.
- Each disk has 10,000 units of disk I/O available.
  - "Unit" is difficult to define.
    - Random vs sequential operations
    - Reads vs writes

Estimating concurrency limits

- Use this calculator to create a conservative estimate of how many units your job uses.
  - http://hep.pa.msu.edu/concurrencycalc.html
- Probably okay to use this number by default if your jobs do not use a lot of I/O.
- If they do use a lot of I/O, you will want to optimize it.
  - You can try decreasing the concurrency limit and see when you run into CPU wait problems .
  - How to detect CPU wait is discussed in a few slides.

Improving disk performance

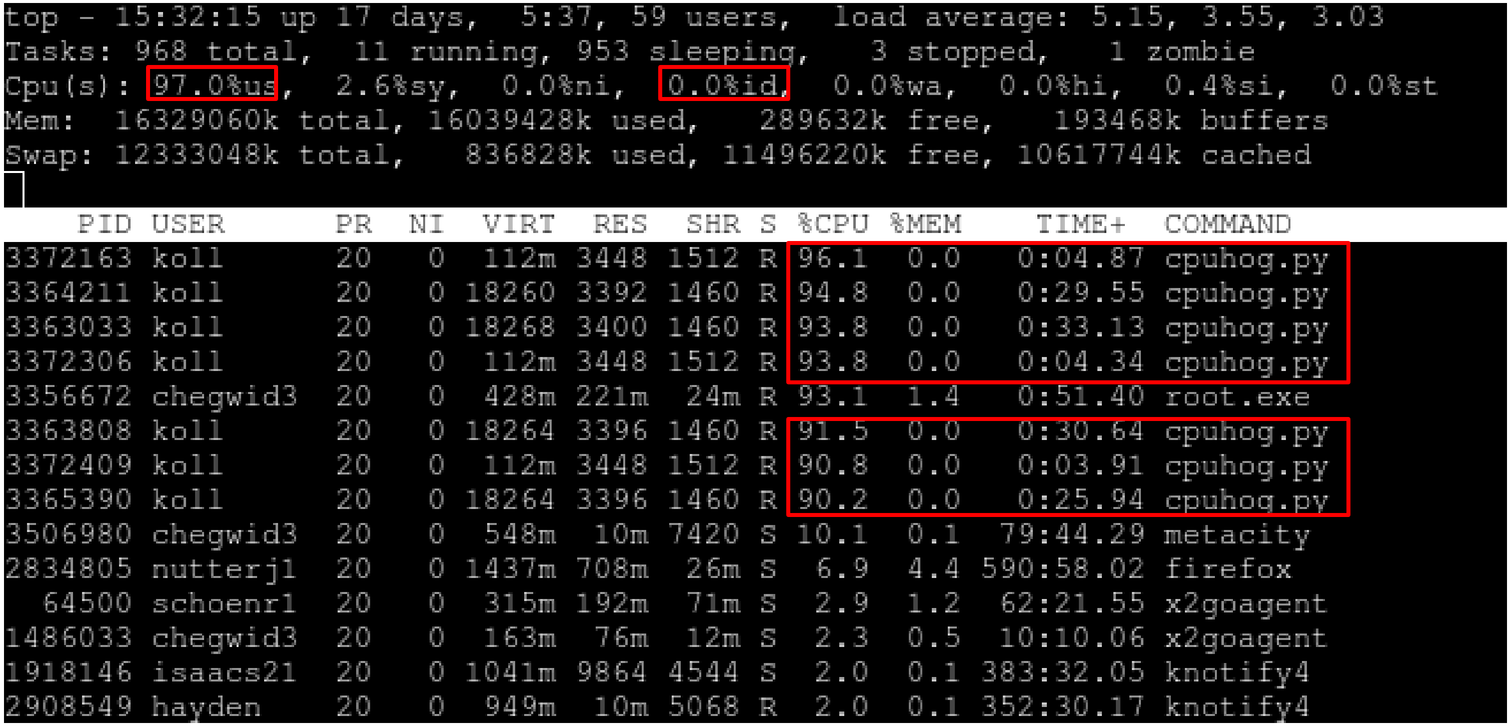
- There are tricks you can use to improve disk performance.
  - Slim and skim datasets.
  - Remember sequential reads/writes are faster than random ones.
    - Stagger job submission times and have your jobs copy their input files to local scratch.
    - Produce output files locally, then copy output to remote work directory.
  - Split input files between many work disks.
  - Use faster disks (t3fast vs t3work).

“Green is slow”

- Flexible resources => Lots of user freedom => We can run into problems
- If green is slow, there are a number of things you as a user can do to see what may be wrong.
- There are three things you can check:
  - CPU
  - Memory
  - Disk I/O** (sort of)
- Once you identify the problem, you can identify the responsible user and contact them directly.

Troubleshooting CPU load

- Run `top`, then press shift-p to sort by CPU usage:



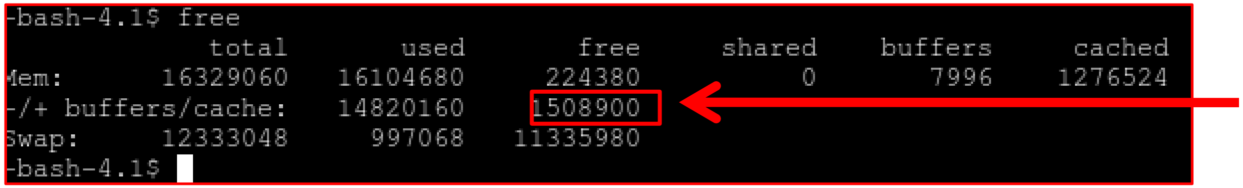
```
top - 15:32:15 up 17 days,  5:37, 59 users,  load average: 5.15, 3.55, 3.03
Tasks: 968 total,  11 running, 953 sleeping,   3 stopped,   1 zombie
Cpu(s): 97.0%us,  2.6%sy,  0.0%ni,  0.0%id,  0.0%wa,  0.0%hi,  0.4%si,  0.0%st
Mem:  16329060k total, 16039428k used,   289632k free,   193468k buffers
Swap: 12333048k total,   836828k used, 11496220k free, 10617744k cached

    PID USER      PR  NI  VIRT  RES  SHR S %CPU %MEM    TIME+  COMMAND
3372163 koll      20   0  112m 3448 1512 R 96.1  0.0   0:04.87 cpuhog.py
3364211 koll      20   0 18260 3392 1460 R 94.8  0.0   0:29.55 cpuhog.py
3363033 koll      20   0 18268 3400 1460 R 93.8  0.0   0:33.13 cpuhog.py
3372306 koll      20   0  112m 3448 1512 R 93.8  0.0   0:04.34 cpuhog.py
3356672 chegwid3  20   0  428m 221m  24m R 93.1  1.4   0:51.40 root.exe
3363808 koll      20   0 18264 3396 1460 R 91.5  0.0   0:30.64 cpuhog.py
3372409 koll      20   0  112m 3448 1512 R 90.8  0.0   0:03.91 cpuhog.py
3365390 koll      20   0 18264 3396 1460 R 90.2  0.0   0:25.94 cpuhog.py
3506980 chegwid3  20   0  548m  10m 7420 S 10.1  0.1  79:44.29 metacity
2834805 nutterj1  20   0 1437m 708m  26m S  6.9  4.4 590:58.02 firefox
  64500 schoenr1  20   0  315m 192m  71m S  2.9  1.2  62:21.55 x2goagent
1486033 chegwid3  20   0  163m  76m  12m S  2.3  0.5  10:10.06 x2goagent
1918146 isaacs21  20   0 1041m 9864 4544 S  2.0  0.1 383:32.05 knotify4
2908549 hayden    20   0  949m  10m 5068 R  2.0  0.1 352:30.17 knotify4
```

- koll is the bad user. Contact him and tell him to submit his CPU-intensive jobs to condor.

Troubleshooting memory usage

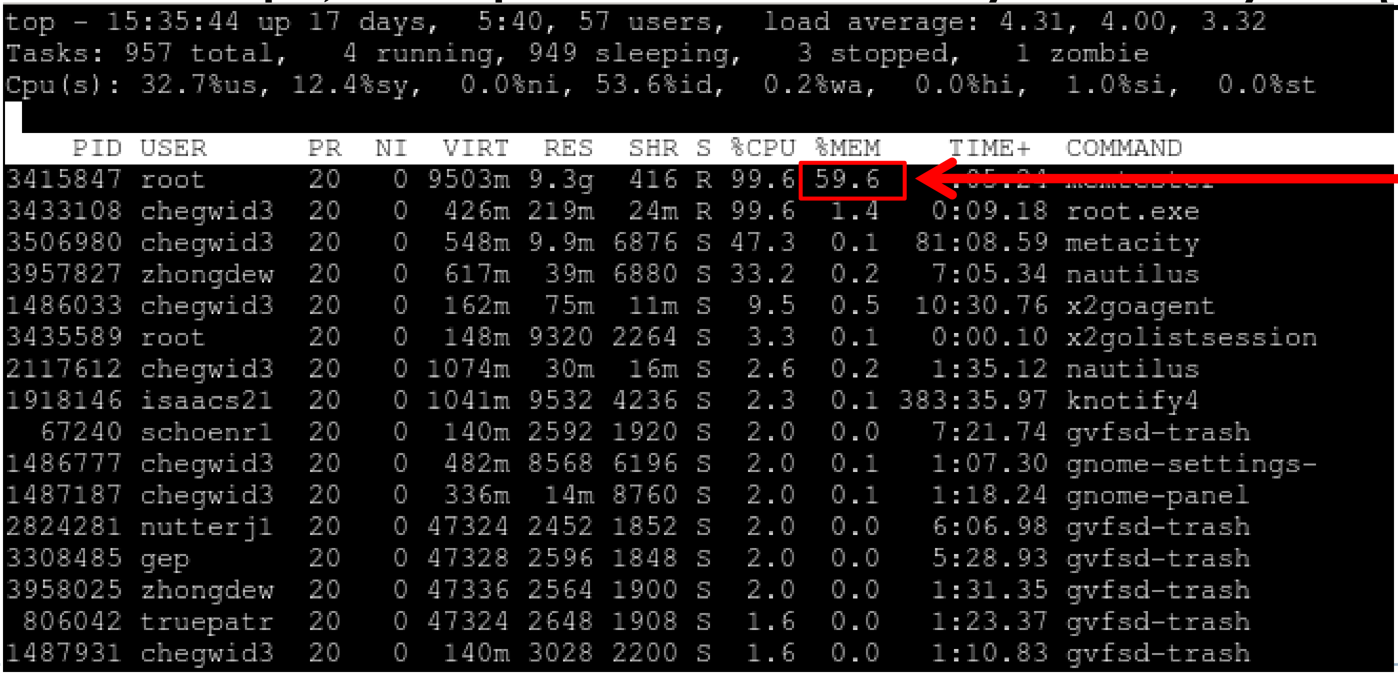
- Is there a memory problem? Run `free`:



```
-bash-4.1$ free
                    total       used       free     shared    buffers     cached
Mem:             16329060   16104680     224380          0       7996    1276524
-/+ buffers/cache:          14820160    1508900
Swap:            12333048     997068   11335980
-bash-4.1$
```

Not critically low, but lower than it should be

- Run `top`, then press m to sort by memory usage:



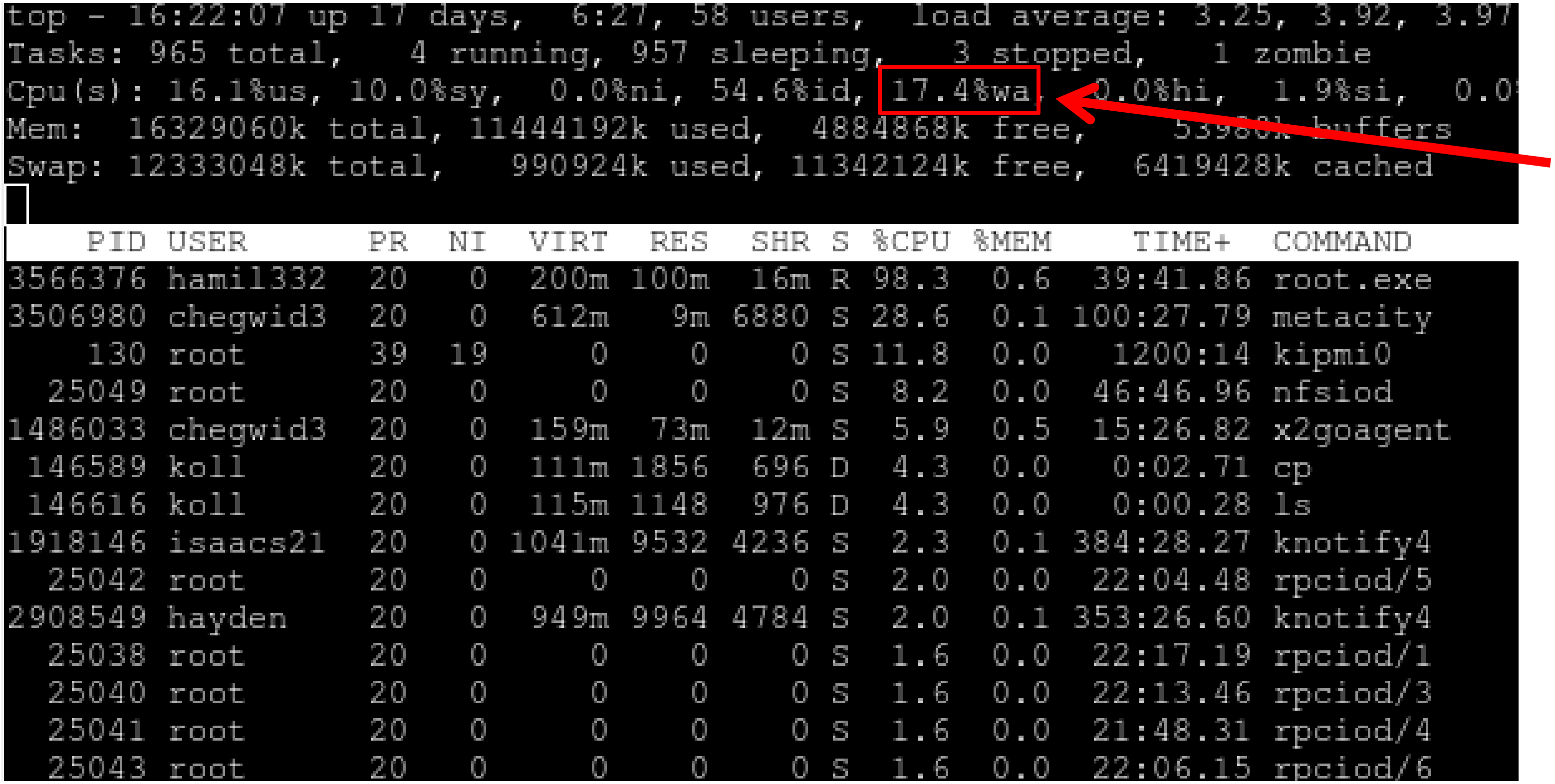
```
top - 15:35:44 up 17 days,  5:40, 57 users,  load average: 4.31, 4.00, 3.32
Tasks: 957 total,   4 running, 949 sleeping,   3 stopped,   1 zombie
Cpu(s): 32.7%us, 12.4%sy,  0.0%ni, 53.6%id,  0.2%wa,  0.0%hi,  1.0%si,  0.0%st

    PID USER      PR  NI  VIRT  RES  SHR S %CPU %MEM    TIME+  COMMAND
3415847 root      20   0 9503m 9.3g  416 R 99.6 59.6  [illegible]:05.24 memtester
3433108 chegwid3  20   0  426m 219m  24m R 99.6  1.4   0:09.18 root.exe
3506980 chegwid3  20   0  548m 9.9m 6876 S 47.3  0.1  81:08.59 metacity
3957827 zhongdew  20   0  617m  39m 6880 S 33.2  0.2   7:05.34 nautilus
1486033 chegwid3  20   0  162m  75m  11m S  9.5  0.5  10:30.76 x2goagent
3435589 root      20   0  148m 9320 2264 S  3.3  0.1   0:00.10 x2golistsession
2117612 chegwid3  20   0 1074m  30m  16m S  2.6  0.2   1:35.12 nautilus
1918146 isaacs21  20   0 1041m 9532 4236 S  2.3  0.1 383:35.97 knotify4
  67240 schoenr1  20   0  140m 2592 1920 S  2.0  0.0   7:21.74 gvfsd-trash
1486777 chegwid3  20   0  482m 8568 6196 S  2.0  0.1   1:07.30 gnome-settings-
1487187 chegwid3  20   0  336m  14m 8760 S  2.0  0.1   1:18.24 gnome-panel
2824281 nutterj1  20   0 47324 2452 1852 S  2.0  0.0   6:06.98 gvfsd-trash
3308485 gep       20   0 47328 2596 1848 S  2.0  0.0   5:28.93 gvfsd-trash
3958025 zhongdew  20   0 47336 2564 1900 S  2.0  0.0   1:31.35 gvfsd-trash
 806042 truepatr  20   0 47324 2648 1908 S  1.6  0.0   1:23.37 gvfsd-trash
1487931 chegwid3  20   0  140m 3028 2200 S  1.6  0.0   1:10.83 gvfsd-trash
```

Whoa, way too high! Tell this user to check for memory leaks and/or submit to condor!

Troubleshooting Disk I/O

- Easy to cause by accident.
- Check for wait I/O greater than a few percent.



```
top - 16:22:07 up 17 days,  6:27, 58 users,  load average: 3.25, 3.92, 3.97
Tasks: 965 total,   4 running, 957 sleeping,   3 stopped,   1 zombie
Cpu(s): 16.1%us, 10.0%sy,  0.0%ni, 54.6%id, 17.4%wa,  0.0%hi,  1.9%si,  0.0
Mem:  16329060k total, 11444192k used,  4884868k free,   539860k buffers
Swap: 12333048k total,   990924k used, 11342124k free,  6419428k cached

    PID USER      PR  NI  VIRT  RES  SHR S %CPU %MEM    TIME+  COMMAND
3566376 hamil332  20   0  200m 100m  16m R 98.3  0.6  39:41.86 root.exe
3506980 chegwid3  20   0  612m   9m 6880 S 28.6  0.1 100:27.79 metacity
    130 root      39  19     0    0    0 S 11.8  0.0   1200:14 kipmi0
  25049 root      20   0     0    0    0 S  8.2  0.0  46:46.96 nfsiod
1486033 chegwid3  20   0  159m  73m  12m S  5.9  0.5  15:26.82 x2goagent
 146589 koll      20   0  111m 1856  696 D  4.3  0.0   0:02.71 cp
 146616 koll      20   0  115m 1148  976 D  4.3  0.0   0:00.28 ls
1918146 isaacs21  20   0 1041m 9532 4236 S  2.3  0.1 384:28.27 knotify4
  25042 root      20   0     0    0    0 S  2.0  0.0  22:04.48 rpciod/5
2908549 hayden    20   0  949m 9964 4784 S  2.0  0.1 353:26.60 knotify4
  25038 root      20   0     0    0    0 S  1.6  0.0  22:17.19 rpciod/1
  25040 root      20   0     0    0    0 S  1.6  0.0  22:13.46 rpciod/3
  25041 root      20   0     0    0    0 S  1.6  0.0  21:48.31 rpciod/4
  25043 root      20   0     0    0    0 S  1.6  0.0  22:06.15 rpciod/6
```

Too high. Look for a user with a large number of jobs running on the condor queue.

- If you can't identify the source, contact me.

Resources

- https://www.aglt2.org/wiki/bin/view/AGLT2/MSUTier3
  - If you think of something that should be in the wiki, please add it.
  - Contact me if you need an account.
- Please feel free to use my contact details, located on the wiki