HLT as a cloud status

(update of the presentation at CMS computing meeting 14th June 201)

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People contributing …

- Adam Huffman (Imperial College, Grid/Cloud devops),
- Alison McCrea (CERN, CMS operations),
- Andrew Lahiff (RAL and CMS Operations),
- Mattia Cinquilli (CERN, IT Support for Distributed Computing),
- Stephen Gowdy (CERN),
- Jose Antonio, Coarasa (CERN, CMS Online devops),
- Anthony Tiradani (Fermilab, CMS glideinWMS),
- Wojciech Ozga (CERN and AGH University of Science And Technology in Krakow, CMS Online devops)

- (and anybody I have missed)

So why use the HLT?

Clearly this is taking effort from (parts of) several people so why bother?

The simple answer is that it is a big resource that we cannot afford not to use:

Node type	Number	cores/node	HS06/core	Total HS06	Disk/node (GB)
c1950	720	8	9.1	52416	72
c6100	288	12	17.3	59788.8	225
c6220	256	16	24.1	98713.6	451

- Total ~200K HS06 (of which ~150K HS06 is easily available - more than T0 and comparable with the total T1 cpu request)
- (Essentially) no storage available
- 2 Network paths available to CERN – 1 Gb/s Control Network, 2x10Gb/s data network
- All nodes have 2GB/core

OpenStack (Essex) installed in 2012 and initial tests with protein folding were very promising so we decided to go ahead with trying to use it for real CMS work.

Using the HLT

The plan is to have the HLT available as a resource for (nearly) all of LS1, but then to use it as opportunistically after LS1 (in machine breaks etc, even for interventions that last more a few hours). However, when it is need as an HLT there must be no interference from this parasitic use. It is hoped that a cloud infrastructure will help to enable this.

The HLT was a single use cluster which meant that it didn't need the monitoring infrastructure that you would expect/need for a multipurpose

Only CMS data going from the detector to CERN IT went over the data and all other data went over the control network.

We decided to focus on reprocessing (to start with at least) and to reprocess the 2011 data.

Initial Configuration

- CMSSW served over CvmFS
- Data read from and written to EOS over xrootd
- All data read and written over 1Gb/s link
- Single frontier server installed (on cms-srv-c2c01-14)
- Submission via glideinWMS
- Images are SL5 (built with BoxGrinder)

Initial results

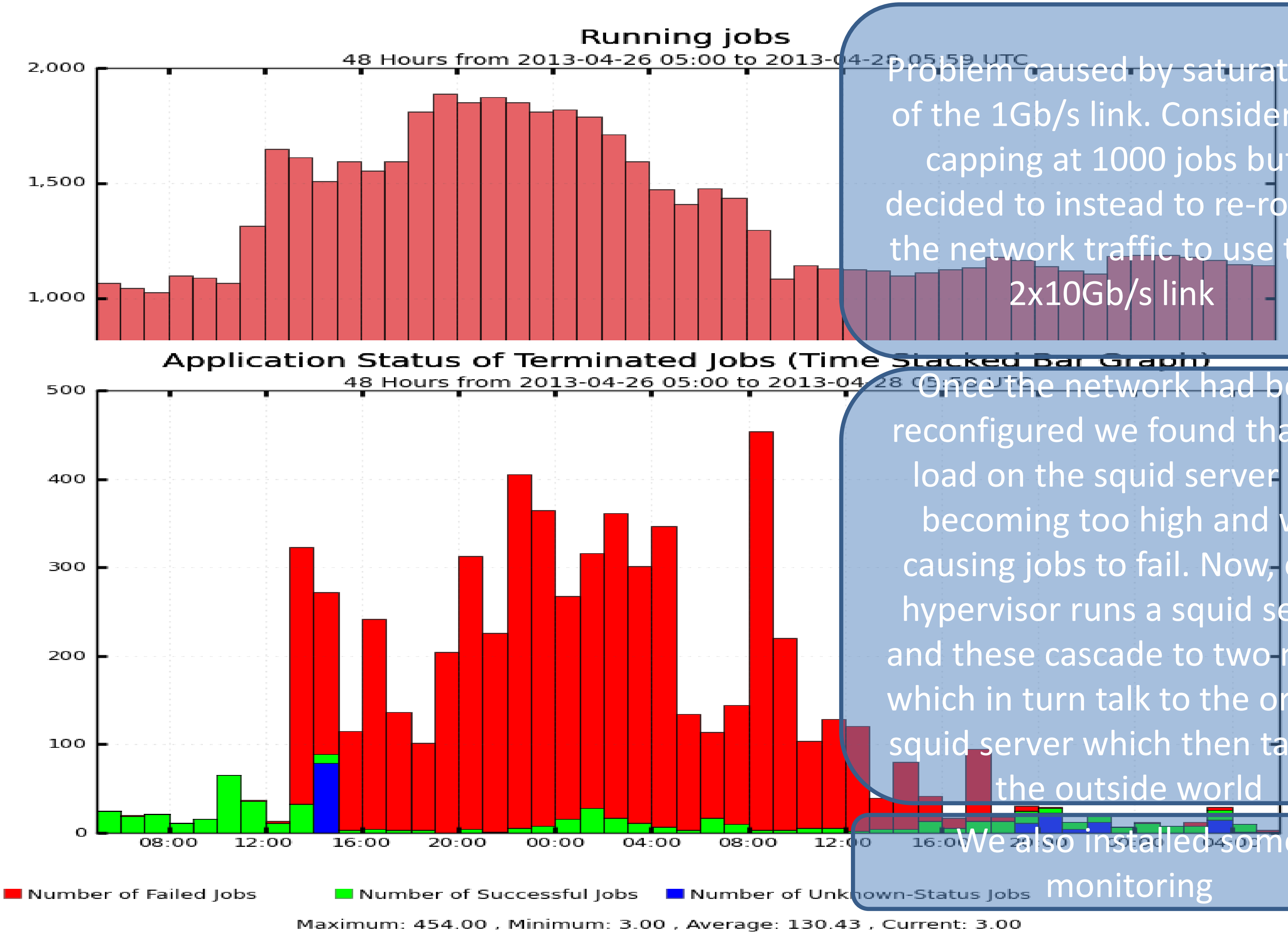
Found many, often minor but annoying, problems.

These include:

- Permissions problems with xrootd and EOS
- VMs dying because access to CvmFS was not available fast enough
- OpenStack EC2 not Amazon EC2 causing many minor problems all of which required modifications to the glideinWMS.
- Behaviour in clouds is different from behaviour in Grids so glideinWMS needed to learn how to handle the situations differently
- OpenStack controller can be "rather fragile" when asked to do things at scale so glideWMS learnt to treat it gently.
- glideinWMS loosing track of jobs (often through fragility of OpenStack) and jobs ending up in "shutoff" state
- ...

Gradually been working our way through these with the set up becoming functional and then more robust as we go...

Initial results – basic limitations



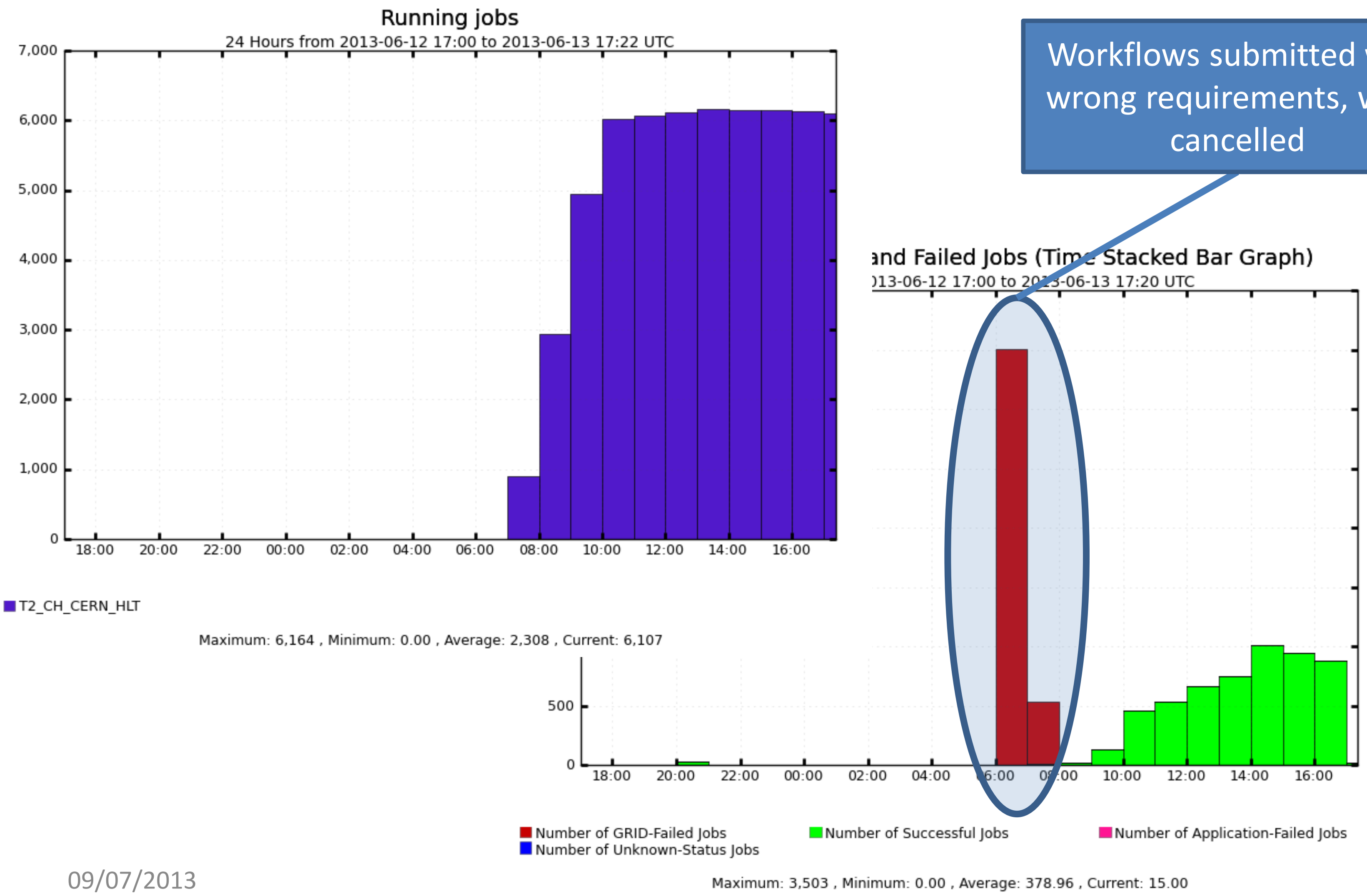
Problem caused by saturation of the 1Gb/s link. Considered capping at 1000 jobs but decided to instead to re-route the network traffic to use the 2x10Gb/s link

Once the network had been reconfigured we found that the load on the squid server was becoming too high and was causing jobs to fail. Now, each hypervisor runs a squid server and these cascade to two nodes which in turn talk to the original squid server which then talks to the outside world

We also installed some monitoring

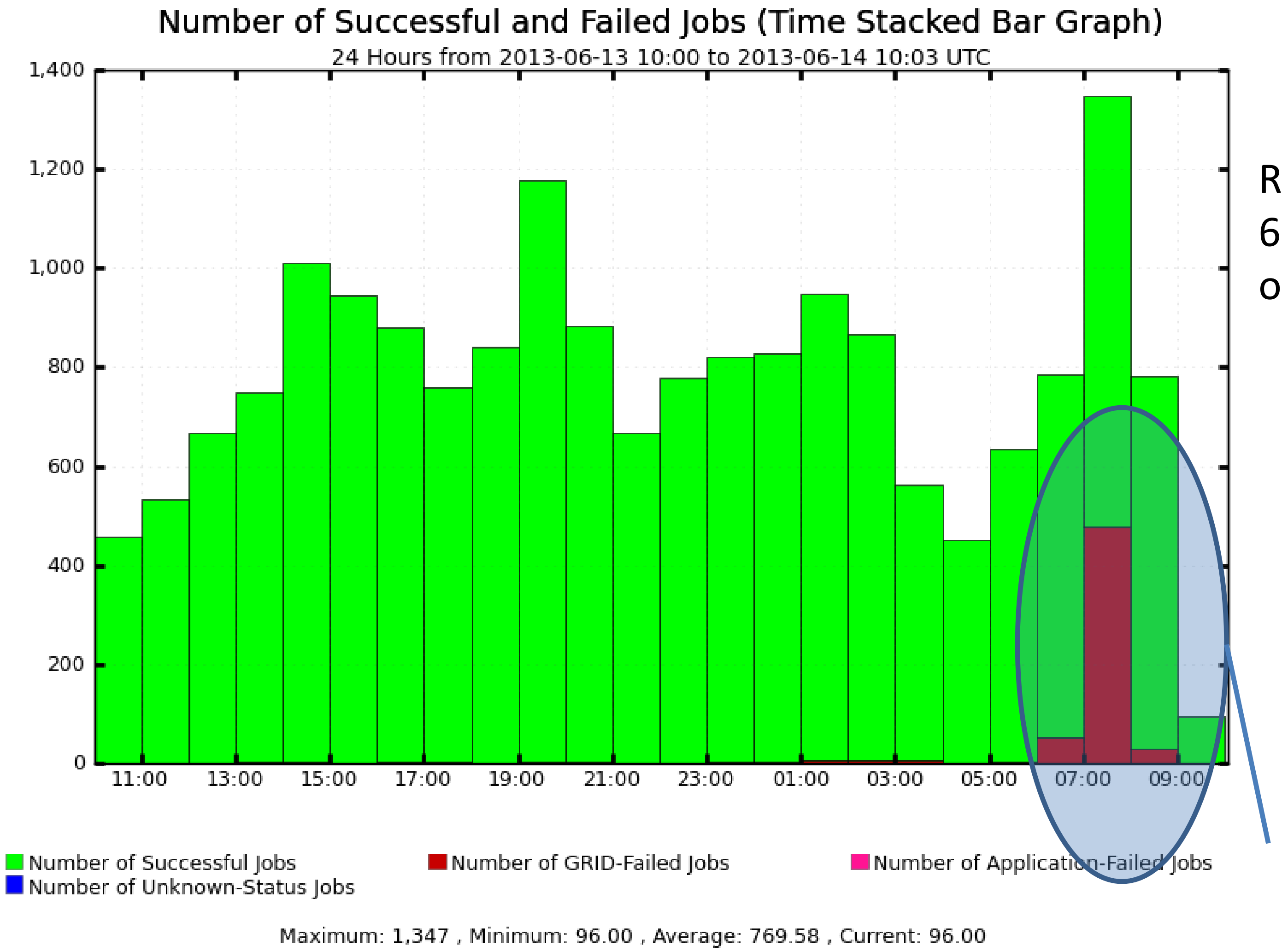
~~Current~~ Status at 14th June

As of ~~yesterday,~~ 13th June we are running with a new pre-release of condor and



Workflows submitted with wrong requirements, were cancelled

Overnight (of 14th June)

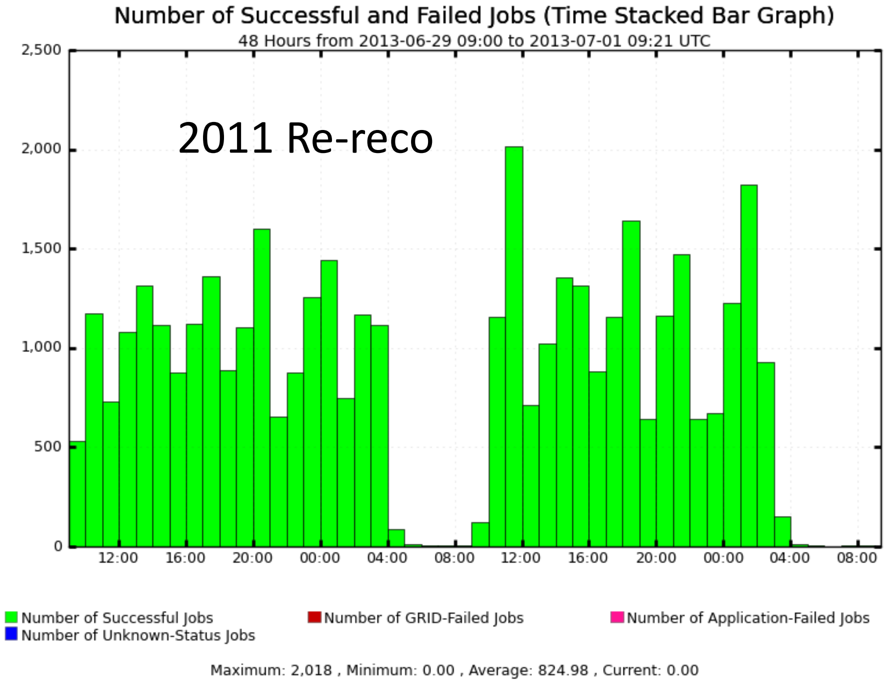


Ran a steady 6000 jobs overnight.

Some problem at ~7am (being investigated) but did recover, still 97% successful!

Current status

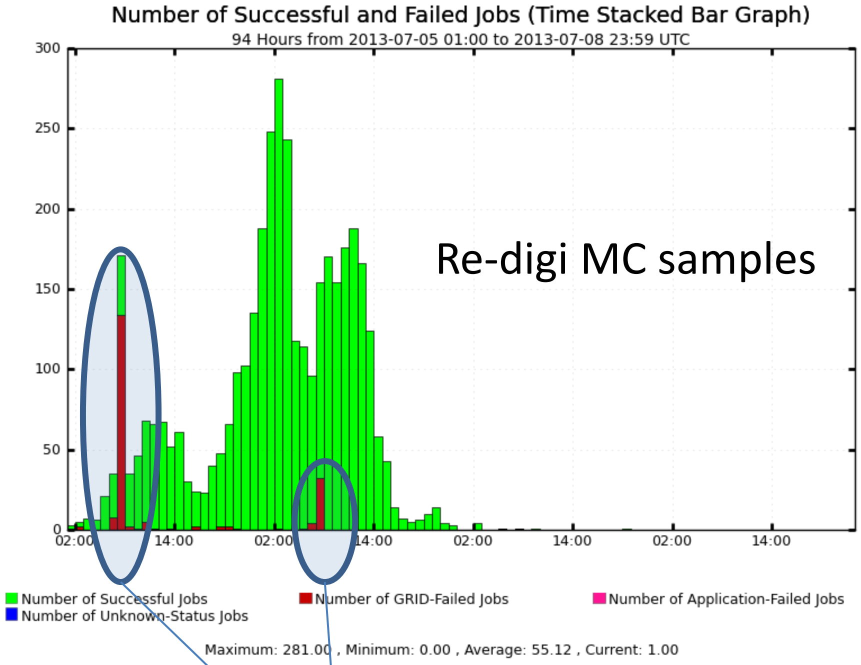
- Being used as a production resource


Number of Successful and Failed Jobs (Time Stacked Bar Graph)

48 Hours from 2013-06-29 09:00 to 2013-07-01 09:21 UTC

2011 Re-reco

Maximum: 2,018 , Minimum: 0.00 , Average: 824.98 , Current: 0.00


Number of Successful and Failed Jobs (Time Stacked Bar Graph)

94 Hours from 2013-07-05 01:00 to 2013-07-08 23:59 UTC

Re-digi MC samples

Maximum: 281.00 , Minimum: 0.00 , Average: 55.12 , Current: 1.00

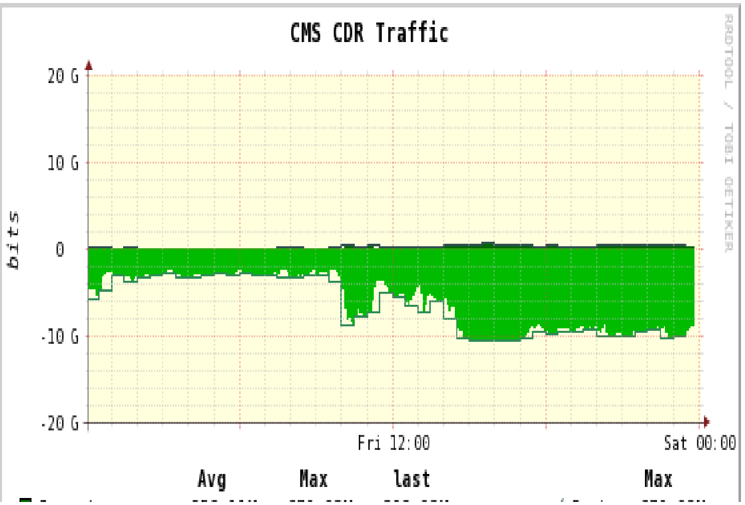
7am failures back. A mystery that we need to investigate

Current status

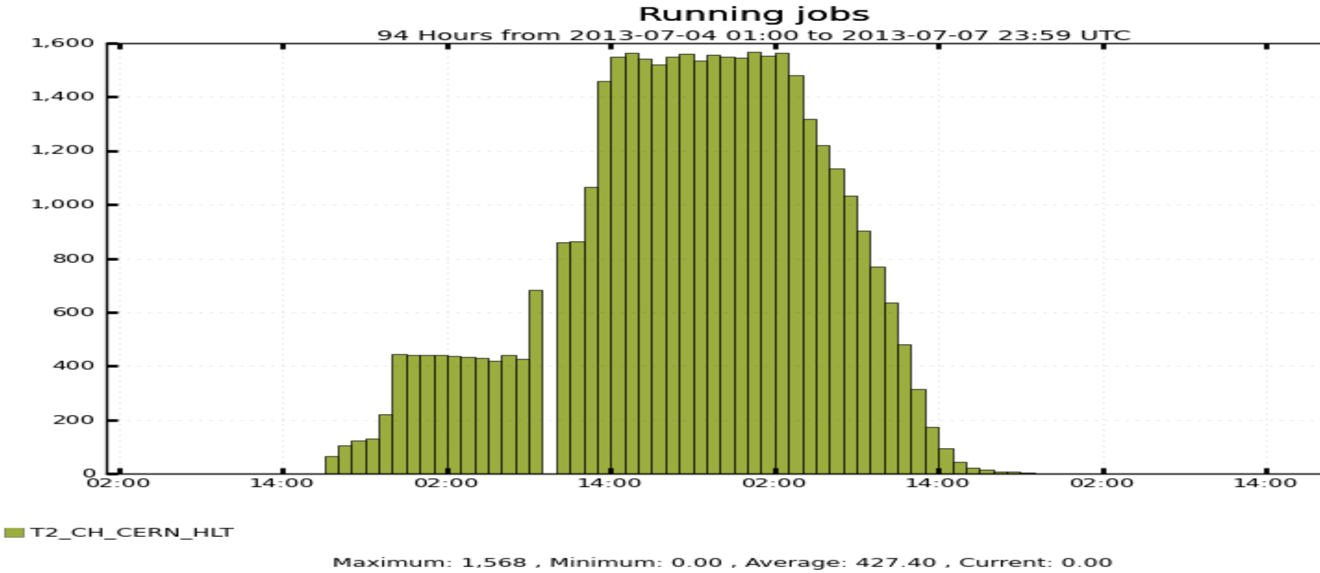
Data access (network or something else) limited, for some jobs at least

- Should have 20Gb/s but do not seem to be able to above ~11Gb/s from EOS.

- Investigating...



(Note one graph in UTC other in local time)



Next...

- Continue debugging file access (and mystery 7am crashes)
- Consider whether or not it is worth upgrading the network
- Less effort from HLT core staff (as this is not their core activity)
- Start to look at migration strategies

Side Note.

Similar infrastructure already being used to submit analysis jobs to clouds in Italy and UK