GridPP

UK Computing for Particle Physics

RAL Site Report

HEPiX Spring 2018

University of Wisconsin - Madison

14-18 May 2018

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Overview

- Organisation
- Hardware
- Networking
- Storage
- Facilities
- Miscellaneous

Thanks to colleagues for contributions

New UK Research Organisation

- UK Research and Innovation, launched 1st April 2018, is the new funding organisation for research and innovation in the UK
- It brings together the seven UK research councils, Innovate UK and a new organisation, Research England, working closely with its partner organisations in the devolved administrations
  - Includes STFC, which runs RAL
- UK Research and Innovation intends to be an outstanding organisation that ensures the UK maintains its world-leading position in research and innovation
- Rising funding profile through 2020/21

- Not expecting any changes at facilities level

UK Research and Innovation

Tier1 Hardware

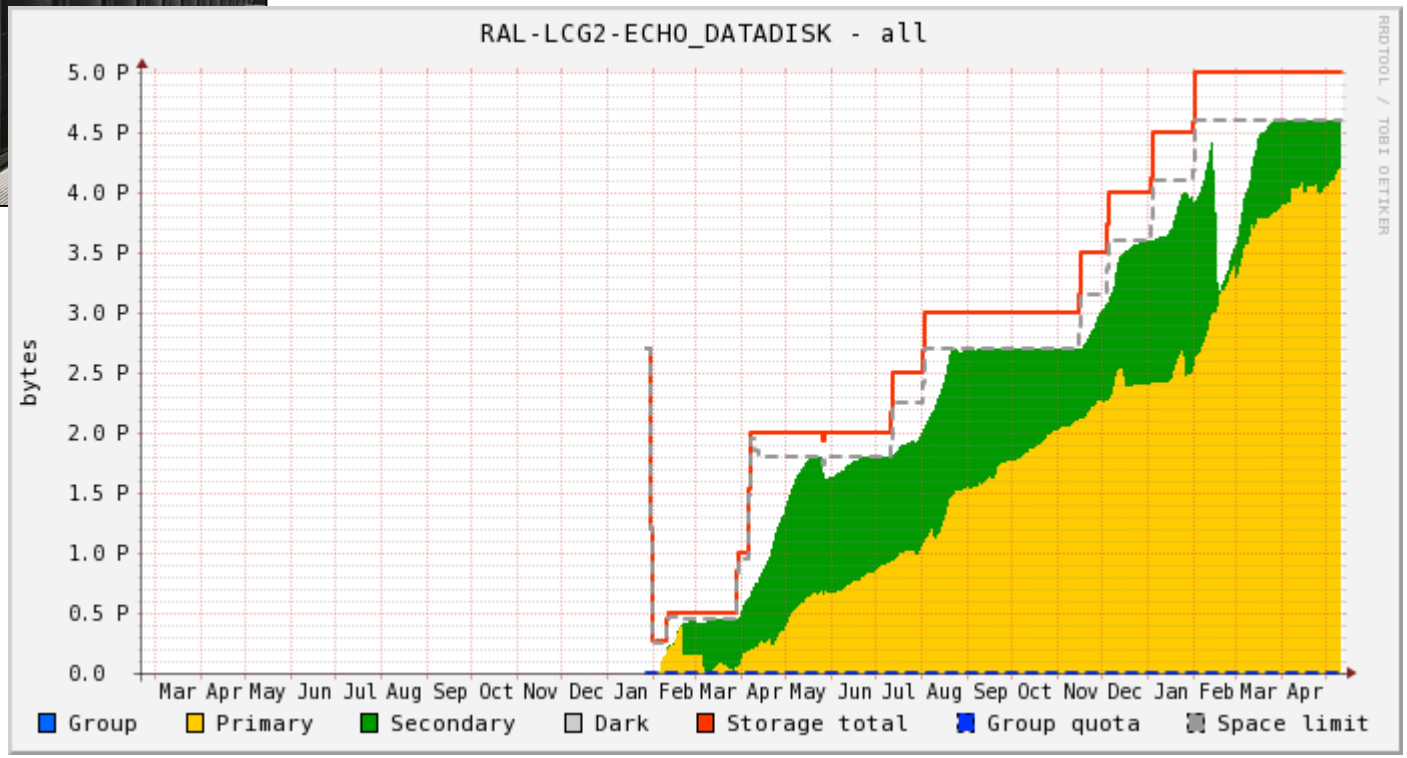
- CPU: ~236k HS06 (~22k cores)
  - FY17/18: procurement ~91k HS06 (Dell, XMA)
- Castor: ~16.5 PB useable
  - Dropping as older hardware is retired
- Ceph: ~20PB raw / ~13PB configured
  - FY 17/18:
    - 74 x Supermicro 24 bay units -> 19.5PB raw / 14.2PB configured
      - Acceptance testing
- Tape: 10k slot SL8500 (one of two in system)
  - 80PB capacity (T10KD), ~30PB physics data

Networking

- Tier1 WAN/LAN
  - No significant changes
- IPv6
  - IPv6 available on Tier1 network
  - All required services for WLCG now IPv6 dual stack
    - Not Castor
- RAL Site
  - Firewalls replaced, can now do IPv6 in ASIC, better performance
  - Recently, issues revealed in internal switching and border routing configuration, particularly with IPv6
    - Working to understand and provide long term fixes
  - 100Gbs connectivity to site early summer

Storage - CASTOR & ECHO

- CASTOR: disk-only service run-down continues
  - ~10PB data remains
  - Planning to rationalise 4 instances to one (for tape)
- ECHO: disk-only service - expansion continues
  - Possibly the largest CEPH Cluster using erasure coding
  - 30 more storage nodes added (24 x 8TB), total useable space now 13PB
  - Data held: Atlas @ 4.2PB, CMS @ 1.6PB
  - Working on improving disk replacement workflow for large clusters


RAL-LCG2-ECHO_DATADISK - all
bytes
5.0 P
4.5 P
4.0 P
3.5 P
3.0 P
2.5 P
2.0 P
1.5 P
1.0 P
0.5 P
0.0
Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr
Group
Primary
Secondary
Dark
Storage total
Group quota
Space limit
RRDTOOL / TOBI OETIKER

JASMIN

- UK's leading environmental science supercomputer
  - Supports UK and European climate and earth-system science communities
  - Access to very large environmental data sets
  - Power to process data very rapidly
- 2017: ~20PB useable, ~5000 cores
  - Mostly Panasas HPC storage
    - world's largest 'realm', largest single site installation
  - CPU split ~50/50:
    - batch computing and cloud (Openstack)
    - Virtualised environments (VMware

JASMIN4 (2018 Update)

- Added 30PB (useable) software defined scale out parallel file system storage from Quobyte
  - Dell and Supermicro Hardware
  - ~5PB targeted interchangeably for File or Object (S3)
  - Expected to deliver 200G-400GBytes/sec file throughput
    - all from HDDs
- Additional 5PB of a more traditional dedicated object store (S3 but with a unique direct NFS interface to the object data), from Caringo on Supermicro hardware
- JASMIN4 CLOS network spine
  - 8 x 32 x 100Gb port Mellanox switches w/Cumulus/BGP
- Additional ~5000 cores (Dell) for Openstack (RHEL/KVM)
- ~500TB useable high availability PURE all flash “FlashBlade” NAS
  - home and scratch small file/compilation/metadata heavy work loads

New Data Centre Network

- Added a third layer to the routed CLOS
  - Connecting as many JASMIN CLOS networks together at near line rate
  - All existing SCD STFC services connected at many 100's of Gbit/sec
    - 16 x 32 x 100Gb port Mellanox switches @ Data Centre layer
    - Will include Tier1
  - Total (so far) ~15Tbit/s spread over:
    - 1,600x 10Gb, 80x 50Gb, 100x 40Gb, ~500x 25Gb, 16x 100Gb server side connections all linked with 290x 100Gb links
- New high bandwidth pipe between new and old data centres
  - At least 3 x 144 fibre (72 link) 100Gb/s
  - Shared by JASMIN, Tier1, Site network

SCD Cloud

- OpenNebular:
  - reducing from ~700 to ~300 cores
- OpenStack:
  - Currently ~500 cores, growing to ~3500 end may and ~5000 by end 2018.
- Added
  - Hypervisors: 108 Dell 6420 sleds (27 x 4-up 2U 6400 chassis)
    - 16 physical cores each, 6GB RAM/core, 25G NIC
      - Testing complete, about enter production
  - Cloud Storage: 12 Dell R730xd (12 bay 2U)
    - 12 x 4TB each, total 576TB, 25G NICs
    - Replicated CEPH (3x), VM image storage
      - Testing complete, about enter production
  - Data Storage: 21 x (Dell R630 + 2 x MD1400) sets
    - Added to ECHO for UKT0 project
    - 4PB raw /~2.9TB configured
      - Just finished testing
  - Network:
    - 7 x Mellanox SN2100 16x100Gb port – Cumulus
- Typical load
  - ~130 VMs, currently quotas due to resource limits
    - Expect number increase sharply when new resources in production

SCARF

- 11000 HPC cores for STFC staff, collaborators and users of STFC Facilities
  - Added 3552 cores this year - Dual Intel Xeon 6126s, 192GB RAM, 10GbE, 4X EDR
  - Added 5 new shelves of Panasas ActiveStor 20 parallel storage connected via ethernet
  - Migrating applications serving from SPOF nfs server to Quobyte 4 node cluster (possibly integrated into Jasmin)
  - Network Overhaul - moving network core from pair of Dell S4810s to pair of Mellanox 2100s and (hopefully) pair of Mellanox 2700s to enable link into SCD Bridge network
- Investigating options to change batch system from LSF
- Interest in deploying storage attached to IB fabric, investigating options for linking multiple IB fabrics together

Spectre/Meltdown

	E5-2660	E5-2650v2	E5-2650v2	E5-2640v3	E5-2640v3	E5-2630v3	E5-2630v4
	lcg1555	**lcg1611**	**lcg1675**	**lcg1803**	**lcg1863**	**lcg1999**	***lcg2151***
Microcode original	0x710	0x428	0x428	0x38	0x38	0x38	*0xb000025*
Kernel (3.10.0-)	*693.1.1*	*693.1.1*	*693.1.1*	*693.1.1*	*693.2.2*	*693.2.2*	*693.11.6*
Geo Mean	332.84	369.02	368.86	378.83	382.78	349.89	*412.57*
	lcg1556	**lcg1612**	**lcg1676**	**lcg1804**	**lcg1864**	**lcg2000**	**lcg2152**
Microcode 20180312	0x715	0x42c	0x42c	0x3c	0x3c	0x3c	0xb000025
Kernel (3.10.0-)	*693.11.6*	*693.11.6*	*693.11.6*	*693.11.6*	*693.11.6*	*693.11.6*	*693.11.6*
Geo Mean	331.11	362.56	363.97	378.31	382.04	350.24	414.65
Difference (means)	-1.73	-6.46	-4.90	-0.51	-0.74	0.35	2.09
Difference New/Old	99.48%	98.25%	98.67%	99.86%	99.81%	100.10%	100.51%
	0.52%	1.75%	1.33%	0.14%	0.19%	-0.10%	-0.51%
	E5-2660	**E5-2650v2**	**E5-2650v2**	**E5-2640v3**	**E5-2640v3**	**E5-2630v3**	**E5-2630v4**

Normal expected variation

Storage

Read heavy	fdsstoraged19	fdsstoraged20		
Kernel	2.6.32-696.18.7.el6	2.6.32-696.13.2.el6		
Run1	91239.64	60612.30		
Run2	87037.08	55897.16		
Run3	89080.56	59659.83		
Run4	90038.61	56287.33		
Run5	87901.20	59635.84		
Geomean	89046.92	58386.19	-30660.73	152.51%

Write heavy	fdsstoraged19	fdsstoraged20		
Kernel	2.6.32-696.18.7.el6	2.6.32-696.13.2.el6		
Run1	21959.44	18486.96		
Run2	23705.30	18870.39		
Run3	22729.15	19431.89		
Run4	21425.90	21572.99		
Run5	23395.78	23621.89		
Geomean	22626.91	20308.47	-2318.44	111.42%

Opportunistic test - patched was faster!

Power problem

- Area-wide power outage @ lunchtime
- Generator UPS didn't start
  - Controlled panic
- Power comes back ~ 8 minutes – phew!
  - All of Ceph on UPS so it was unaffected
- Why didn't the generator start?
  - BMS noted power down, asserted generator start signal
  - In-cabin generator controller received signal, but…
  - Faulty EPO button in-cabin asserting 'off' so it didn't start
  - Red light on control box
- Lesson:
  - Expose the generator control system status where it can bee seen

Miscellaneous

- Tier1 move from Hyper-V to VMware for core infrastructure
  - Cluster testing complete, migration starting
- Oracle Databases
  - Plan to migrate to RH7 before ~~1 April 2018~~ 31 Dec 2018
- Patching for Spectre/Meltdown
  - And other fubars in the kernel…
- Mobile Device Management to be rolled out
  - WiFi infrastructure at RAL will refuse access to core services such as email from mobile devices (phones, tablets, laptops) not running vendor-supported OS versions.
    - Registration (enrolment) of devices will be required
    - Rollout starts 28th May

Questions?

- We are interested solutions for system inventory / asset management for Linux (desktop) estate, to provide ‘numbers’ for audits, FOI requests et al.