Operating the UK Particle Physics Grid in 2011

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Overview

- The problems of scale
- Utilisation
- Large site hurdles – RAL T1
- Wider problems in the grid world
- Some upcoming challenges
- New communities
- Project changes
- Summary
Scaling of resources from 2005 to 2011...

**CPU**
- Sites are larger – not manpower
- Outages are more noticeable
- Procurement issues more likely

**Storage**
- Institutes rewarded for investing
- DB recovery takes longer
- Sites more wary of updates
UKI Normalised Elapsed time (HEPSPEC06) by VO and DATE
TOP10 VOs. April 2006 - February 2011
This is against a background of good reliability

- Dips are usually monitoring issues not site problems
- The red line shows the RAL Tier-1 reliability whereas the green shows the UK average over the period 2009 to 2011.
• Dips here are usually for scheduled maintenance. Seems to have reached a plateau.
We still do not see saturation of resources but 2011 LHC running may change this situation. It is interesting to see the differences in utilisation between sites of all sizes. This view covers Q4 2010.
Tier-1 infrastructure issues

• **Ongoing changes for UPS**
  
  Leading power factor due to switch-mode PSUs in systems. Causes 3KHz ringing on current. Most kit stable but EMC AX4-5 FC arrays unpredictably detect supply failure and shut down arrays. Longer feed cable from UPS to PDU has made 50% reduction in distortion. Proposed long-term solution: isolation transformer

• **WAN developments**
  
  Existing 10Gb/s site link to SuperJanet5 doubled to 20Gb/s. Failover capacity maintained
  LHCOPN failover link @ 10Gb/s

• **Storage commissioning** – disk acceptance issues (plus need to keep diverse suppliers)

• **Dust** in machine room from lagging – still a concern for the tape systems

**Ongoing work:**
- Quattor (fabric management. ~5200 cores, 700+ systems)
- Virtualisation study of Hyper-V as possible virtualisation platform
- CVMFS (A caching, http based read-only filesystem. Removes the need for local software install jobs at every site)
- Whole node reservation
- File system efficiency and using many core nodes (48-core being tested at some sites). The problem of meta-data/data/ bandwidth and I/O limits (e.g. cache) and tuning.
Wider infrastructure issues (some examples)

- VO user jobs using remote SEs in a manner that overloads site WAN links
- Lcg-infosites too old on some sites leading to reduction in supporting sites
- Re(chasing) the same problems! (See diagram). NAT SACK/DSACK configuration changes reset!
- Confidence & security – dealing with Multi-user pilot jobs (glexec etc.)
- Convergence of monitoring/publishing accuracy
- Full disk tokens at many sites (ATLAS)
- T1 impacts (site access router & LFC)
- Network problem ownership
- Various WMS issues (inc. pheno impact)
- Patching for vulnerabilities
- Adapting as computing models change…
  - Higher trigger rates wanted. Larger pileup.
  - Network: Flatter hierarchy; Dynamic data caching; remote data access.
One challenge – LHC Open Network Environment

Results do not suggest network bandwidth limitations but hint at the need for improved tuning across the transfer chain (e.g. buffer sizes, FTS settings).

<table>
<thead>
<tr>
<th>Source Site</th>
<th>RAL-LCG2_DATADISK</th>
<th>FZK-LCG2_DATADISK</th>
<th>INFN-T1_DATADISK</th>
<th>PIC_DATADISK</th>
<th>NDGF-T1_DATADISK</th>
<th>TAINAN-LCG2_DATADISK</th>
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<th>INFN-CC_DATADISK</th>
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http://lhcone.net/
Neutrino facility - SNO+ will be a new kilo-tonne scale liquid scintillator detector that will study neutrinos. The experiment will be located approximately 2km underground in VALE's Creighton mine near Sudbury, Ontario, Canada.  
http://snoplus.phy.queensu.ca/Home.html

CERN@school gives secondary schools across the UK the opportunity to become engaged in university level physics research. It makes use of Medipix detector chips to observe cosmic rays.
http://194.81.239.119/

NA62 proposes to measure the very rare kaon decay $K^+ \rightarrow \pi^+ \nu n\bar{\nu}$ at the CERN SPS to extract a 10% measurement of the Cabibbo–Kobayashi–Maskawa matrix parameter $|V_{td}|$.
National e-Infrastructure for Social Simulation
NeISS project will build a generic production quality social simulation e-Infrastructure covering the social simulation lifecycle. Social Simulation is an expanding field due to its forecasting applications for scenarios in transport, housing, education, healthcare etc.

http://www.geog.leeds.ac.uk/projects/neiss/about.php

Landslides: Field evidence shows the complex relationships between precipitation, soil properties, vegetation and slope geometries in respect of potential failure. These can be modelled to help assess risks.

http://www.mossaic.org/landslide/
The landslide example

Project Objectives

Software as a Service model

Geographical sciences → Release → QUESTA binary
- Geographic data
- Slope definitions
- Simulation inputs
- Simulation outputs

Output → Job manager → Jobs

LHC computing grid

Local government | Civil engineers | Disaster planners

Jeremy Coles – Taipei – 23/03/2011
GridPP is funded in (approximately) 4 year cycles. GridPP3 finishes this month. The collaboration has received funding for GridPP4 “Computing in the LHC era”.

Contains 6 work packages (T1, T2, Deployment ops & support, Expt. Support, Management, Impact.)

But after funding agreed... hardware costs coming in more expensive recently than expected on historical projections.... LHC running in 2012 has increased demands....

Funding is more targeted based on experiment requirements for stability/specialist sites. We are currently developing an algorithm to keep funding allocations transparent.
• Spot the difference!
GridPP operational changes

- In GridPP4 we differentiate sites based on their use for analysis.
• Sites become larger and face new challenges
• Still no saturation but that may change very soon
• Many problems remain for sites from both middleware and hardware changes
• Interest in opportunistic use of resources is growing
• The UK physics grid has secured funding for the next project phase