GridPP:
Executive Summary

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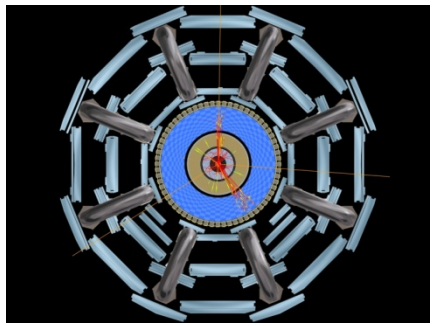
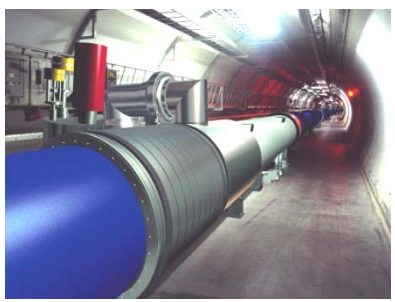
Science & Technology Facilities Council

GridPP
UK Computing for Particle Physics

Outline



The Icemen Cometh



Exec² Summary

Grid Status:

Geographical View: GridMap

High-level View: ProjectMap

Topical View: CASTOR

Performance Monitoring

Disaster Planning

Transition Point

Exec² Summary

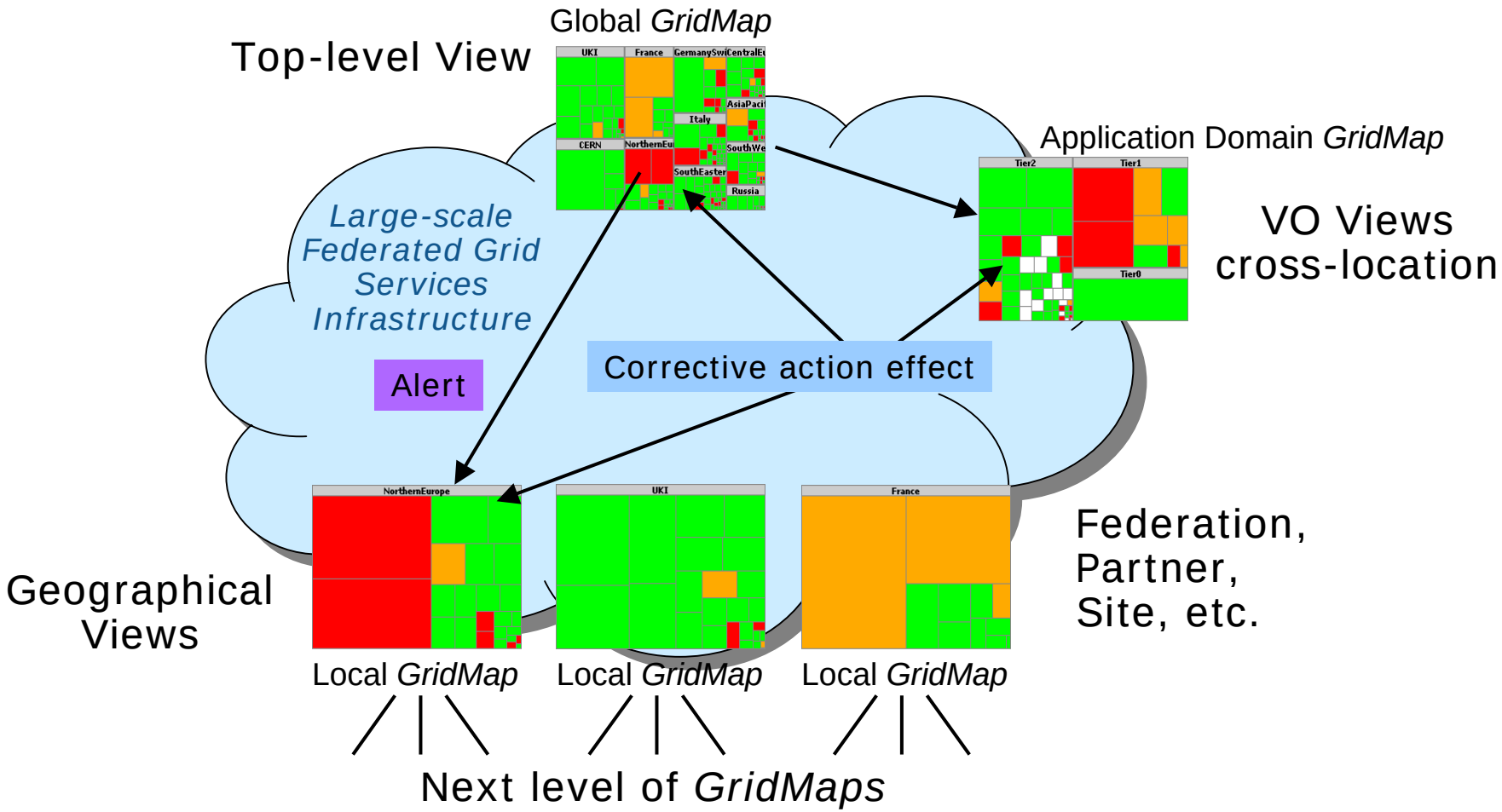
- 2007 is the third full year for the Production Grid
- More than 10,000 kSI2k and 1 Petabyte of disk storage
- The UK is the largest CPU provider on the EGEE Grid
- Total CPU used of 25 GSI2k-hours in the last year to Sept.
- The GridPP2 project has met 86% of its targets with 93% of the metrics within specification (up to 07Q2)
- The GridPP2 project has been extended by 7 months to April 2008
  - The LCG (full) Grid Service is underway
  - The aim is to continue to improve reliability and performance
- The GridPP3 proposal has been approved for 3 years through to March 2011 [total cost of £29.5m]
  - The aim is to provide a performant service to the experiments
- We anticipate a challenging period especially for the support of experiment applications running on the Grid

Context

- To create a UK Particle Physics Grid and the computing technologies required for the Large Hadron Collider (LHC) at CERN
- To place the UK in a leadership position in the international development of an EU Grid infrastructure

Views of the Grid

- View can be *geographical*, *high-level* or *topical*

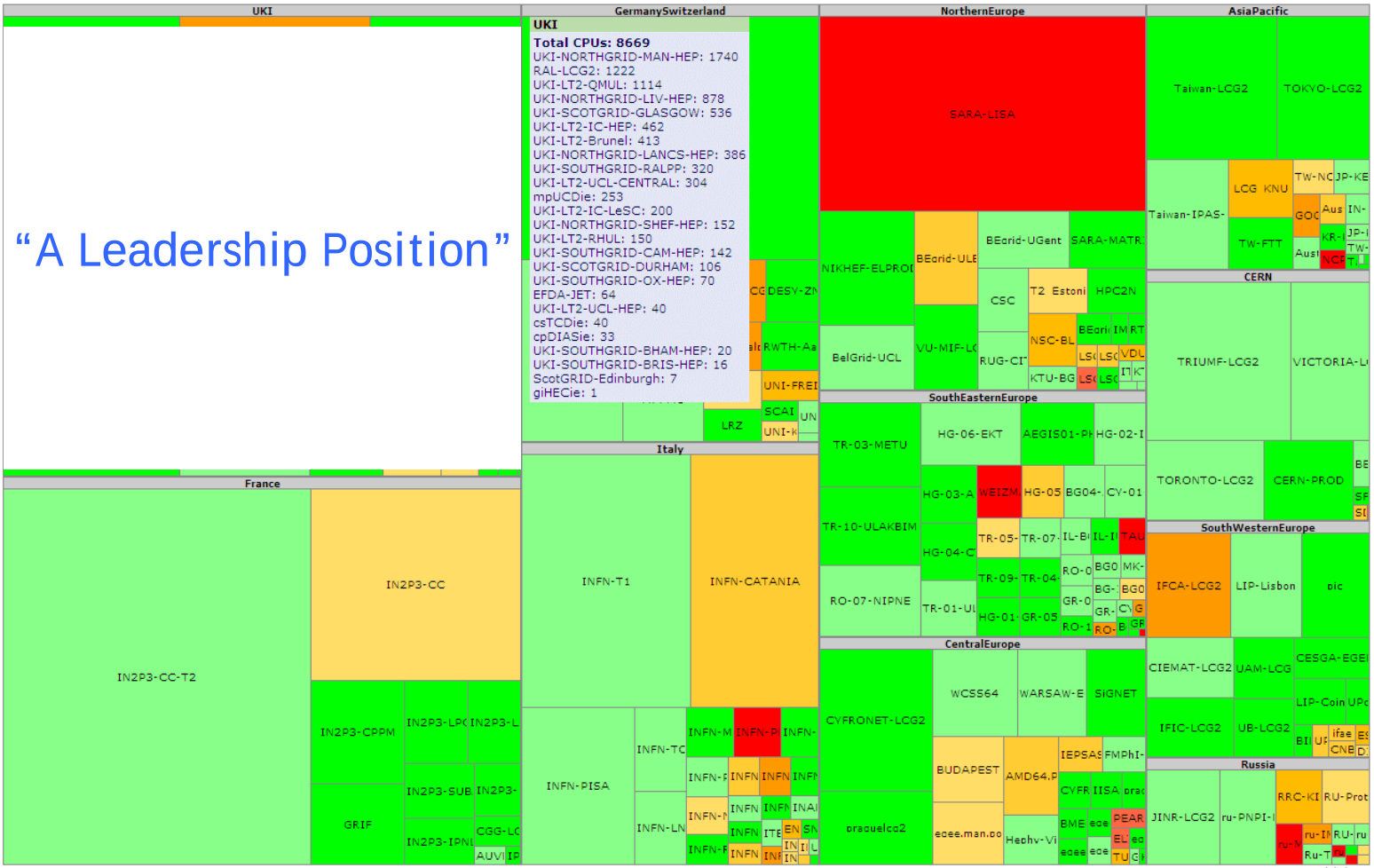


1. Geographical Status

***GridMap* Prototype – Visualizing the "State" of the Grid**

http://gridmap.cern.ch/gm/

"A Leadership Position"



see also EGEE'07 conference presentation on GridMaps

Site Availability, for 'OPS' VO, 01 Sep 2007 (whole month).
Size of site rectangles is number of CPUs from GStat.
Certified Production sites, grouped by regions.

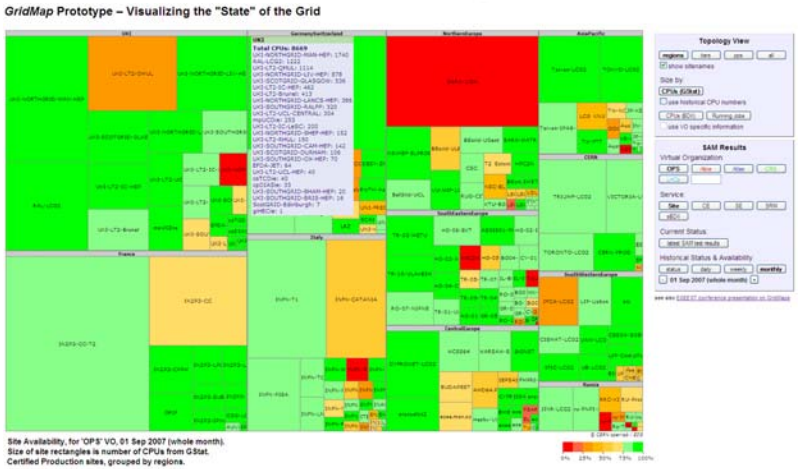
Resource Status

The latest availability figures are (approx. in case of Tier-1):

	Tier-1	Tier-2	Total
CPU [kSI2k]	1500	8588	10,088
Disk [TB]	750	743	1,493
Tape [TB]	>800		>800

- GridPP2 capacity targets met
- Combined effort from *all* Institutions

Grid Status



Aim: by 2008 (full year's data taking)

- CPU ~100MSI2k (100,000 CPUs)
- Storage ~80PB
- Involving >100 institutes worldwide
- Build on complex middleware being developed in advanced Grid technology projects, both in Europe (Glite) and in the USA (VDT)

Status in Oct 2007:
245 sites, 40,518 CPUs,
24,135 TB storage

1. Prototype went live in September 2003 in 12 countries
2. Extensively tested by the LHC experiments in September 2004
3. February 2006 25,547 CPUs, 4398 TB storage

Resource Accounting

Science & Technology Facilities Council

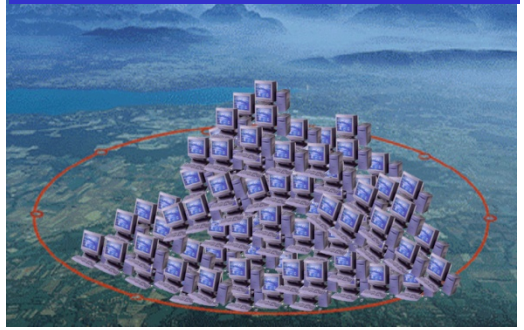
GridPP
UK Computing for Particle Physics

CPU

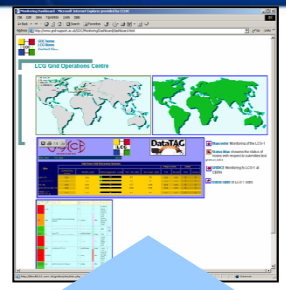
LHC start-up

CPU resources
at ~required levels
(just in time delivery)

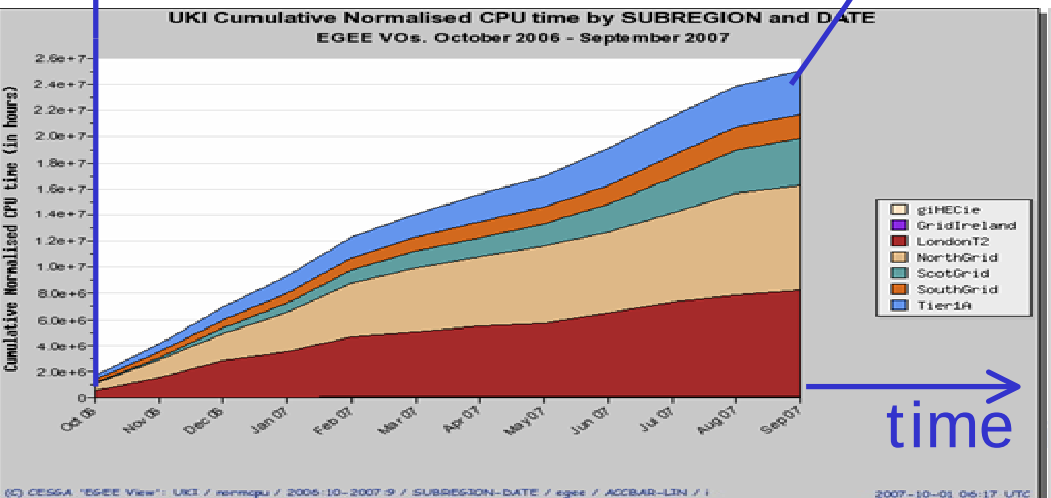
100,000 3GHz CPUs

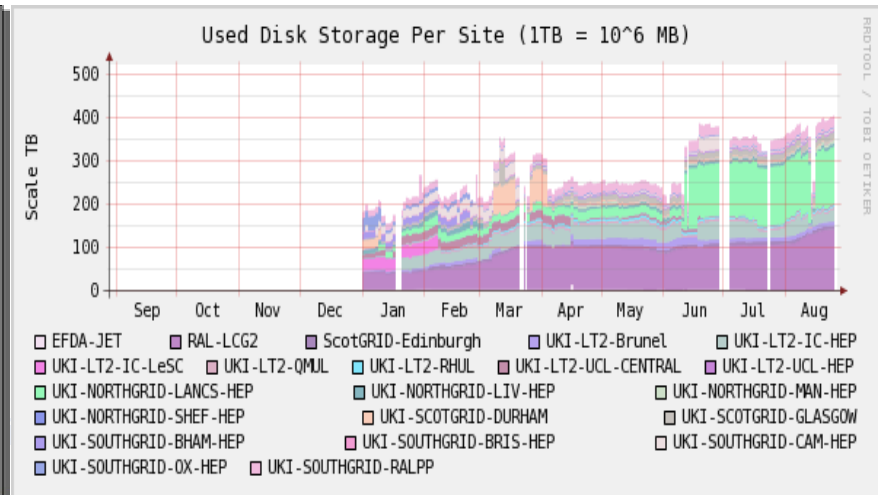


Grid Operations Centre

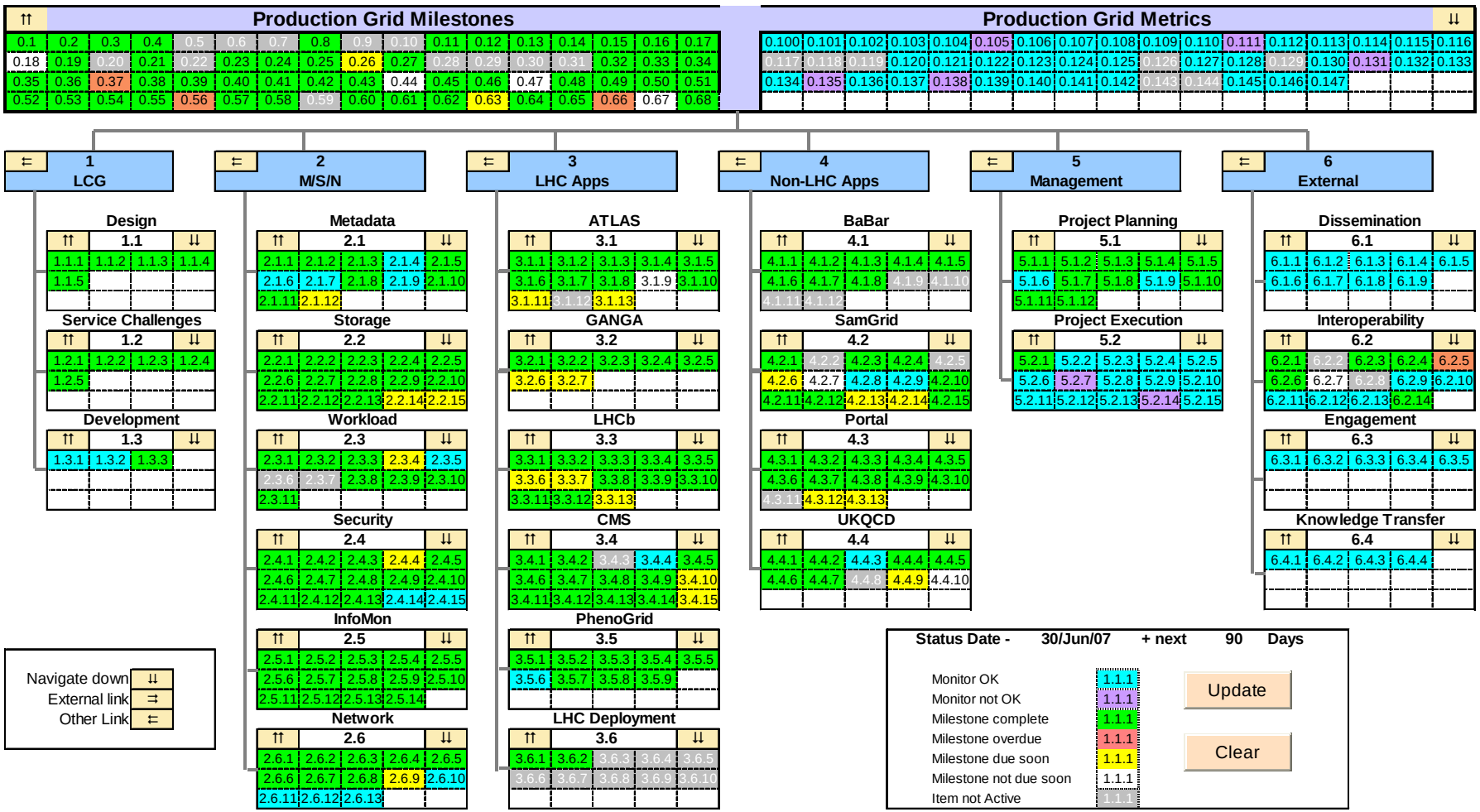


Grid-accessible disk accounting being improved

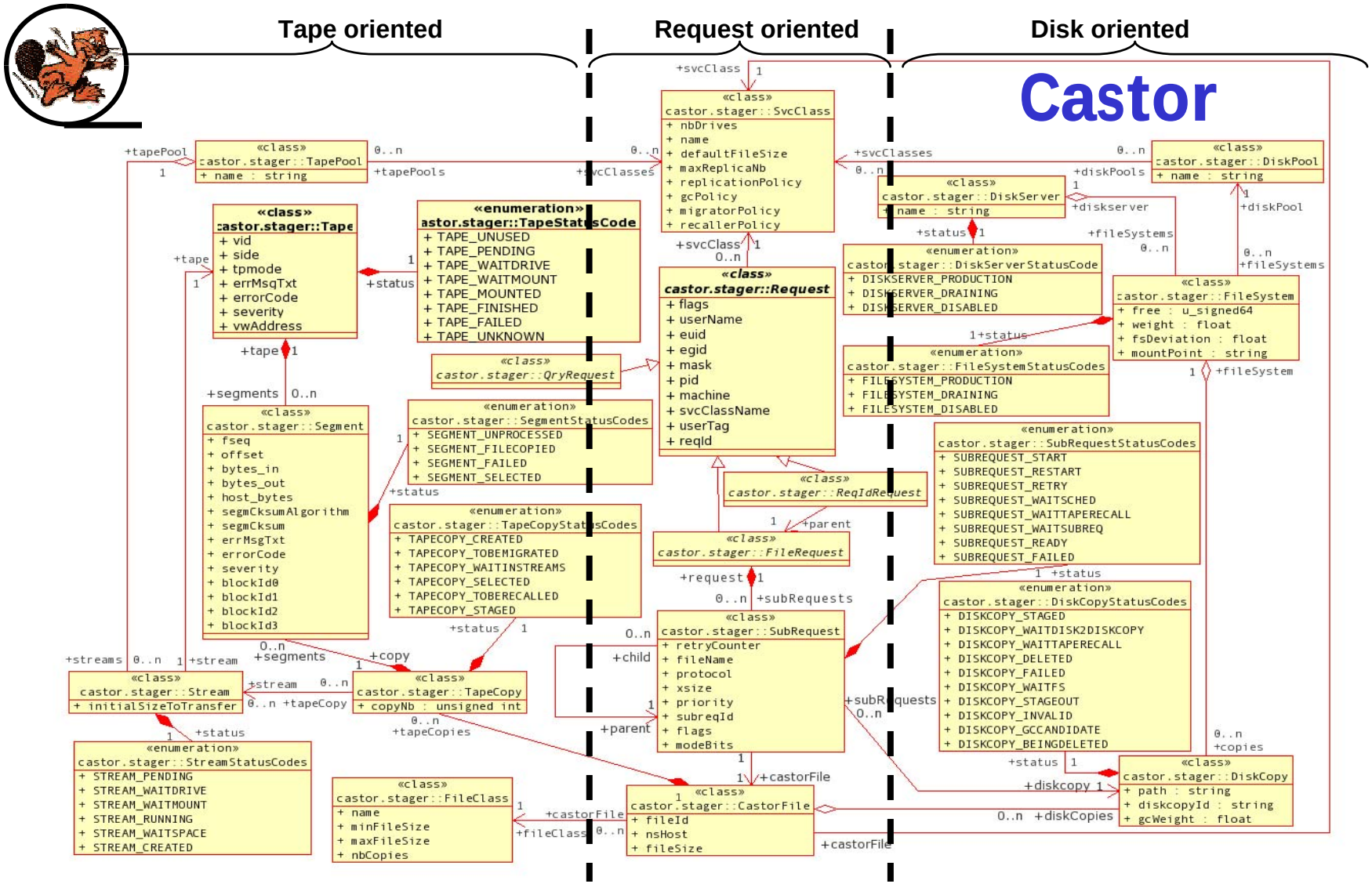




Production Grid project nearing successful completion…



3. Topical Status



Castor

Experiments

- migration to Castor is an important milestone
- weekly technical meetings set up
- deployment of separate instances of Castor 2.1.3 for ATLAS, CMS and LHCb
- The current progress, next steps and concerns of the experiments in this area are provided in the User Board report.

Tier-1

- http://www.gridpp.ac.uk/wiki/RAL_Tier1_CASTOR_Experiments_Technical_Issues

- CASTOR 2.1.3 has recently proven to be robust under test loads and early service challenge trials
- CASTOR 2.1.4 ready for deployment ("disk1" storage classes)
- Tier-1 review planned for November

Availability Status

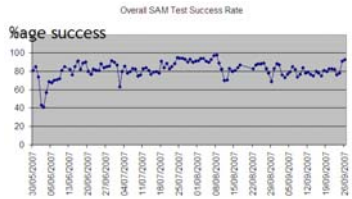
- Bridging the Experiment-Grid Gap..

GridPP UK Computing for Particle Physics

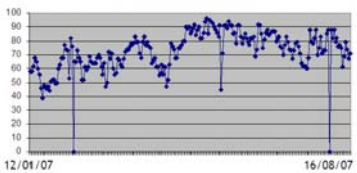
UK Grid Status at 10 Oct 2007 17:51:56

RB Tests SAM Tests Atlas Tests

RB Summary:	RAL1 :	Good	RAL2 :	Good	RAL3 :	Good	Scot :	Good	Lond :	Bad



	SAM Tests					ATLAS Tests						
Institute	CE	SE	SRM	24 Hrs	Week	CE	Release	Replica	HW	NP	UA	24 Hrs
Brunel	P	P	P	91%	98%	40.brunel.ac.uk	13.0.30	DPM	S	S	S	94%
						44.brunel.ac.uk	13.0.30	DPM	S	S	S	98%
Imperial HEP	W	P	P	100%	98%	hep.ph.ic.ac.uk	13.0.30	dCache	S	F	S	62%
Imperial LeSC	W			70%	93%	lesc.doc.ic.ac.uk	13.0.30	dCache	A	A	A	47%
QMUL	W	P	P	57%	70%	qmul.ac.uk	13.0.30	DPM	S	S	S	73%
RHUL	W	P	P	30%	62%	rhul.ac.uk	12.0.7	DPM	F	F	F	16%
UCL CCC	W	P	P	91%	56%	ccc.ucl.ac.uk	13.0.30	DPM	S	S	S	92%
UCL HEP	M	F	F	0%	0%	hep.ucl.ac.uk	13.0.20	DPM	A	A	A	0%
Lancaster	P	P	P	96%	96%	lancs.ac.uk	13.0.30	dCache	S	S	S	92%
Liverpool	W	P	P	96%	90%	liv.ac.uk	13.0.20	dCache	S	F	S	90%
Manchester	F	F	F	0%	0%	ce01.tier2.hep.manchester.ac.uk	13.0.30	dCache	S	S	S	92%
						ce02.tier2.hep.manchester.ac.uk	13.0.30	dCache	S	S	F	66%
Sheffield	P	P	P	52%	90%	shef.ac.uk	13.0.30	DPM	A	A	S	55%
Durham	W	P	P	91%	96%	dur.scotgrid.ac.uk	13.0.20	DPM	S	S	S	94%
Edinburgh	W	P	P	100%	43%	ed.ac.uk	13.0.30	dCache	A	A	A	0%
Glasgow	P	P	P	78%	93%	gla.scotgrid.ac.uk	13.0.20	DPM	S	S	S	76%
Birmingham	P	P	P	91%	94%	bham.ac.uk	13.0.20	DPM	S	S	S	96%
Bristol	P	P	P	87%	96%	bris.ac.uk	13.0.30	DPM	X	X	X	30%
Cambridge	P	P	P	70%	72%	cam.ac.uk	13.0.20	DPM	S	S	A	66%
Oxford	P	P	P	30%	4%	ox.ac.uk	13.0.30	DPM	S	S	S	87%
RAL PPD	W	P	P	78%	85%	pp.rl.ac.uk	13.0.30	dCache	S	S	S	94%
RAL Tier-1	W	P	P	96%	98%	gridpp.rl.ac.uk	13.0.20	dCache	S	F	S	64%
Total				70%	72%							68%



90% max
80% typical

c.f.
95% T2 target

98% T1 target

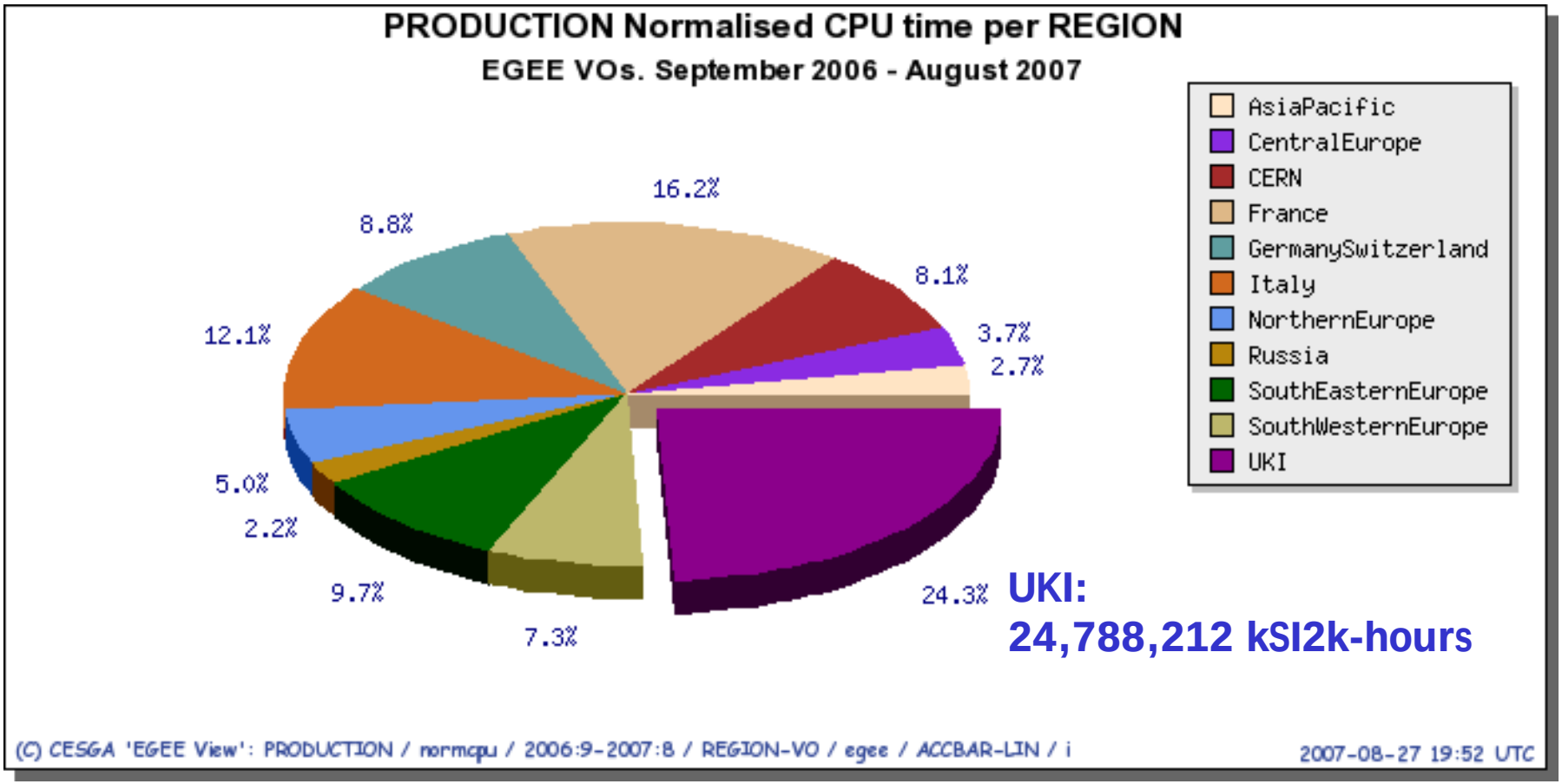
80% max
70% typical

c.f.
~95% target

http://hepwww.ph.qmul.ac.uk/~lloyd/gridpp/ukgrid.html

Resources

Accumulated EGEE CPU Usage 102,191,758 kSI2k-hours or >100 GSI2k-hours (!)



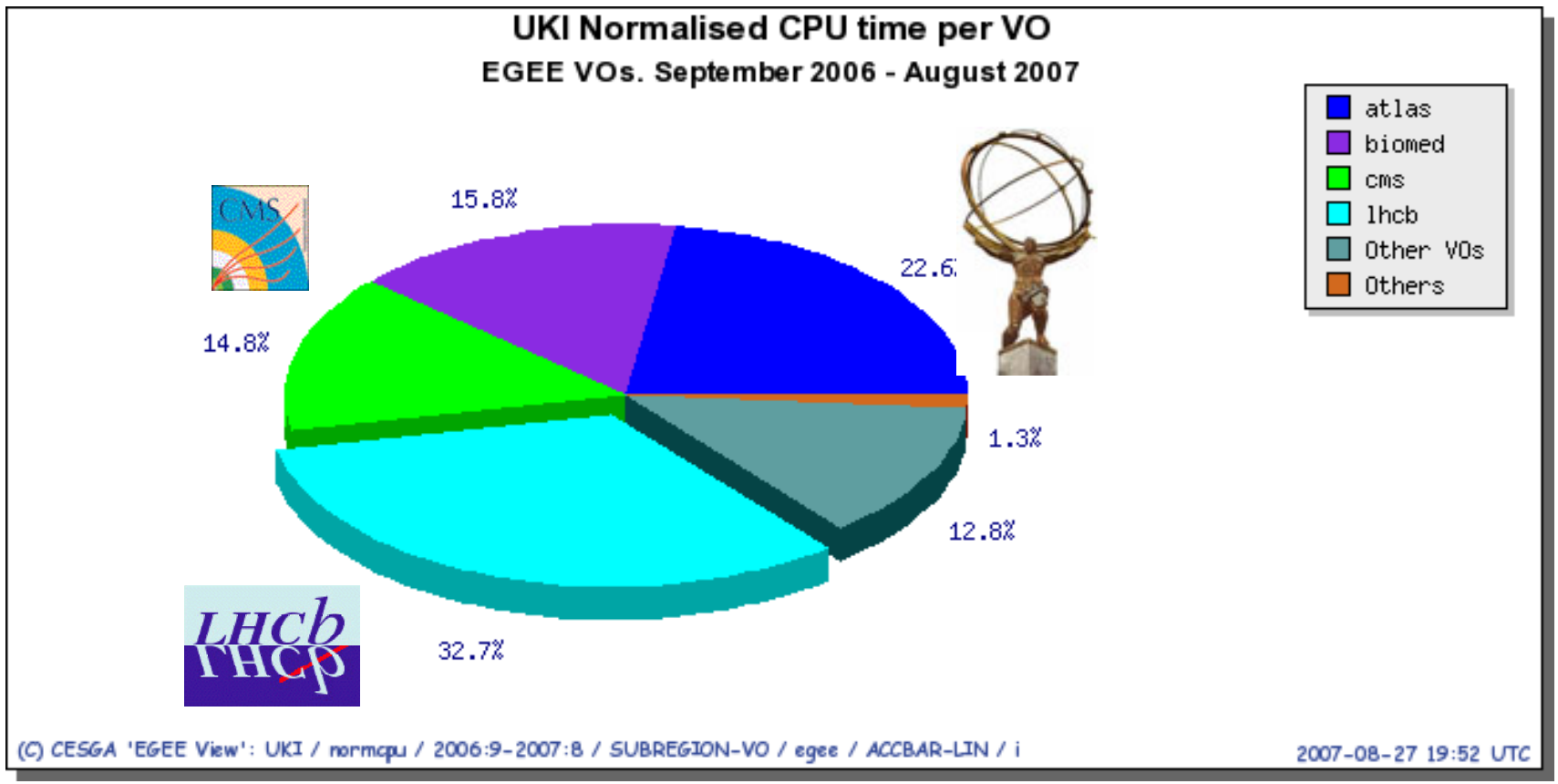
UKI: 24,788,212 kSI2k-hours

http://www3.egee.cesga.es/gridsite/accounting/CESGA/tree_egee.php

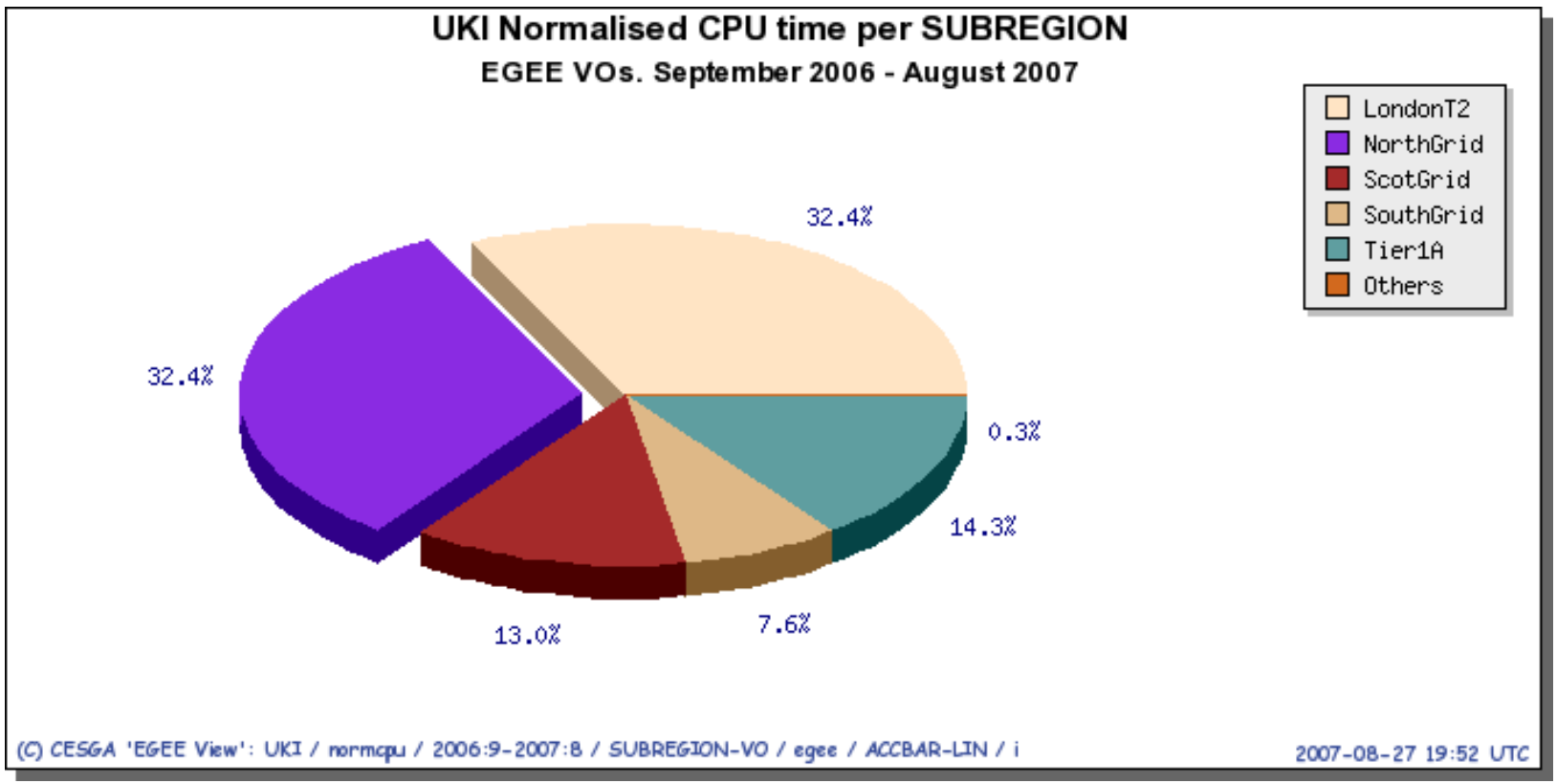
Via APEL accounting

UK Resources

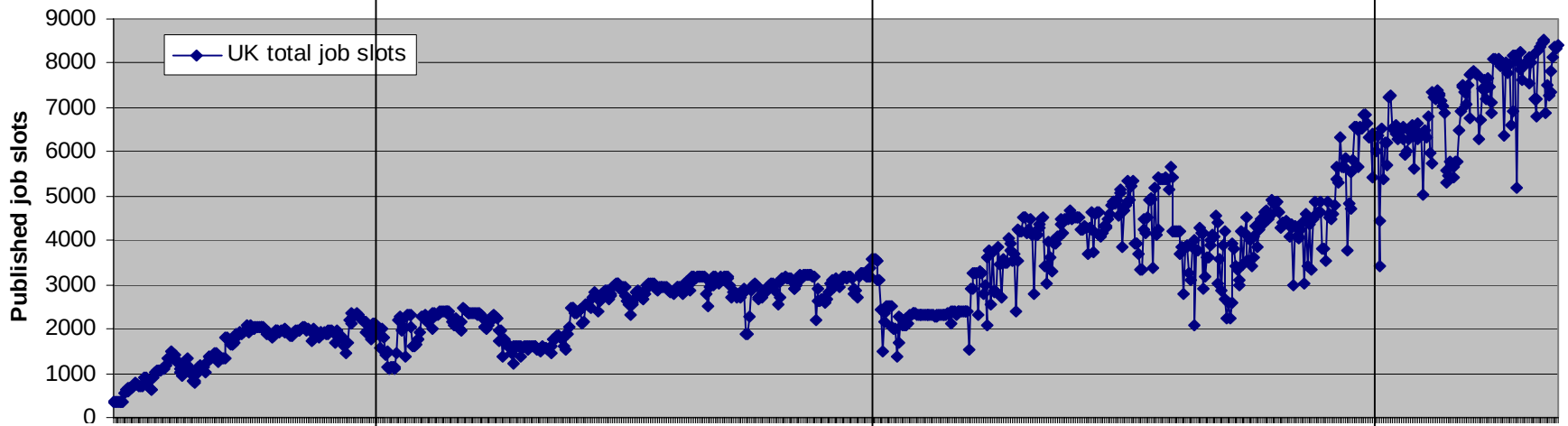
Past year's CPU Usage by experiment

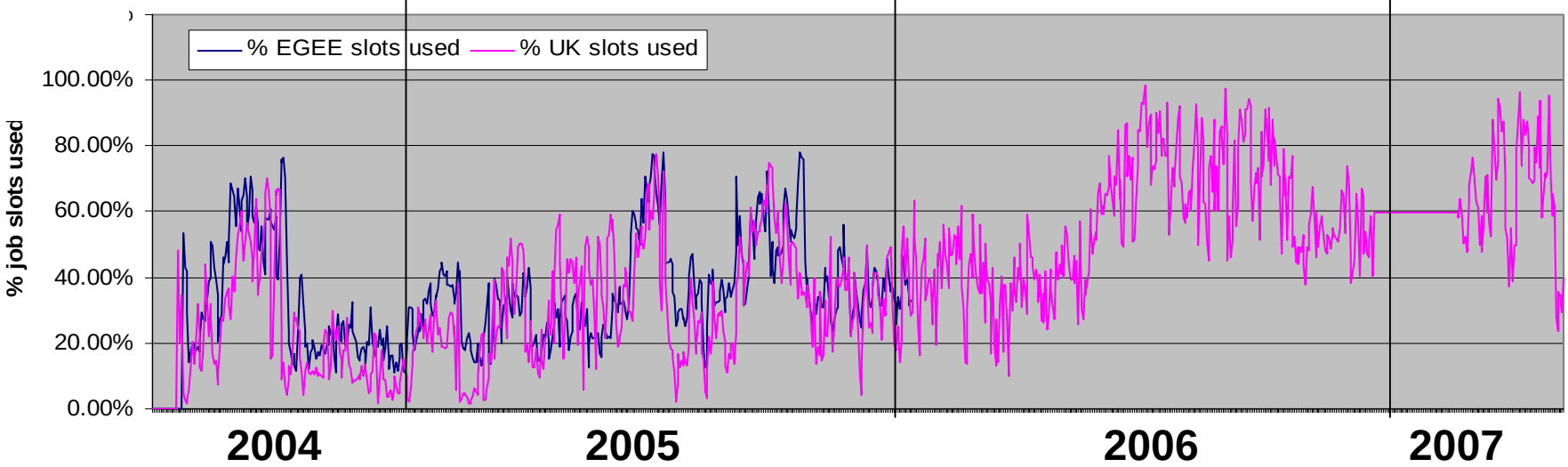


Past year's CPU Usage by Region

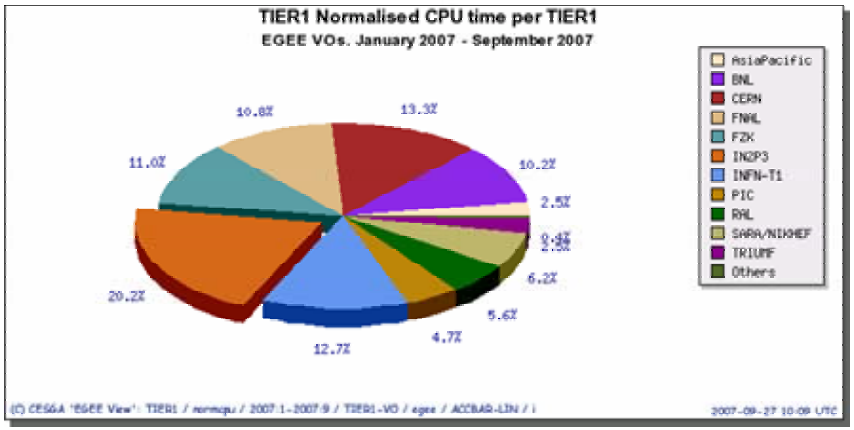


Job Slots and Use

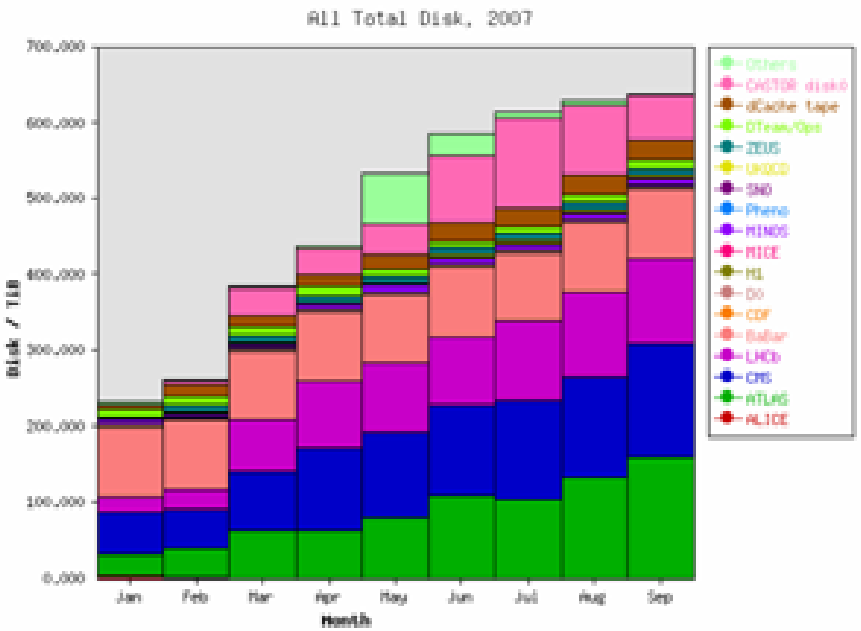


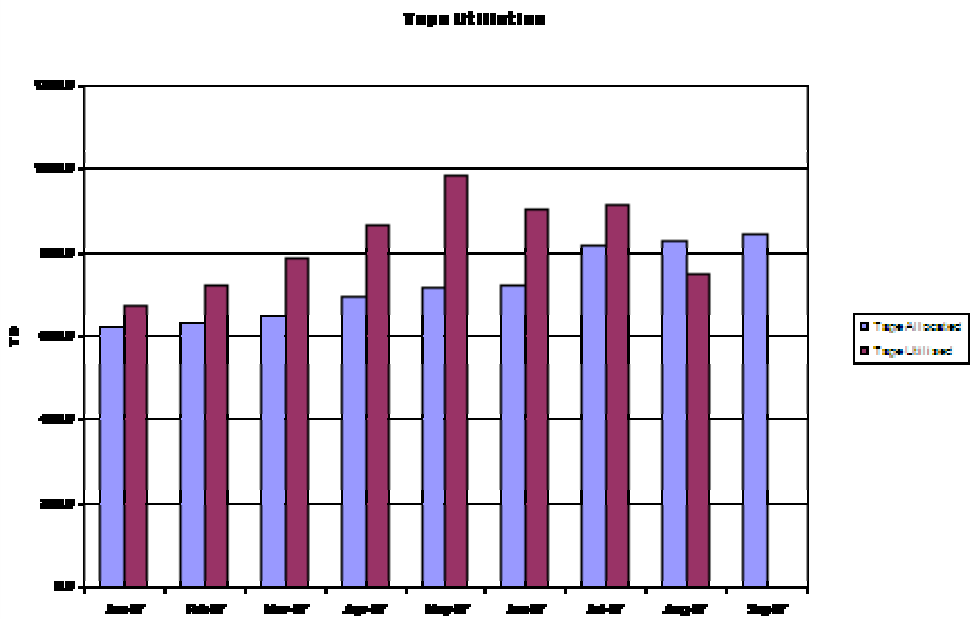


Currently ~51% which falls short of the 70% target



- CPU, disk and tape resources being built up according to plan
- 2008 procurement well underway





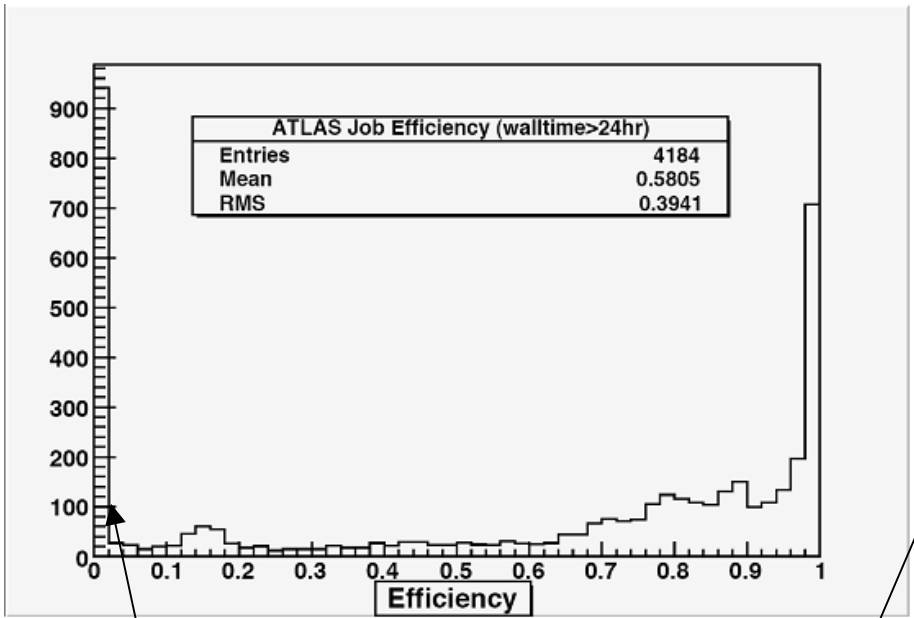
Efficiency

(measured by UK Tier-1 and Tier-2 for all VOs)

~90% CPU efficiency due to i/o bottlenecks

Concern that this is currently ~70% at the Tier-1

target



A big issue for the Tier-2s..
A bigger issue for the Tier-1..

Each experiment needs to work to improve their system/deployment practice anticipating e.g. hanging gridftp connections during batch work

http://www.gridpp.ac.uk/pmb/docs/GridPP-PMB-113-Inefficient_Jobs_v1.0.pdf

Stalled Jobs

Intervention Policy

All UK sites are given flexibility to deal with stalled jobs (in order that their CPUs are occupied more fully overall) according to the following *stalled job definition*:

Any job consuming **<10** minutes CPU over a given **6** hour period (efficiency < 0.027) is considered stalled

There is a recognised intervention scheme for UK sites

SAM site testing

	CE										SE										SRM										Availability			
Hours ago:	9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0	24 Hrs	Week	Month	6 Mon
UKI-LT2-Brunel	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	100%	99%	87%	92%
UKI-LT2-IC-HEP	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	100%	98%	97%	96%
UKI-LT2-IC-LeSC	P	P	P	P	P	P	P	P	P	P																					100%	97%	93%	90%
UKI-LT2-QMUL	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	F	P	F	F	P	P	P	P	P	P	70%	73%	48%	49%
UKI-LT2-RHUL	P	F	P	F	P	P	P	P	P	F	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	78%	71%	84%	85%
UKI-LT2-UCL-CENTRAL	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	87%	51%	86%	67%
UKI-LT2-UCL-HEP	M	M	M	M	M	M	M	M	M	M	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	0%	0%	58%	68%
UKI-NORTHGRID-LANCS-HEP	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	96%	97%	94%	78%
UKI-NORTHGRID-LIV-HEP	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	74%	86%	93%	91%
UKI-NORTHGRID-MAN-HEP	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	0%	0%	74%	93%
UKI-NORTHGRID-SHEF-HEP	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	96%	95%	20%	43%
UKI-SCOTGRID-DURHAM	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	100%	97%	98%	92%
ScotGRID-Edinburgh	P	P	P	P	P	P	P	P	P	M	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	96%	31%	78%	93%
UKI-SCOTGRID-GLASGOW	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	100%	95%	94%	92%
UKI-SOUTHGRID-BHAM-HEP	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	100%	92%	86%	88%
UKI-SOUTHGRID-BRIS-HEP	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	100%	98%	97%	94%
UKI-SOUTHGRID-CAM-HEP	F	P	P	P	P	P	P	P	F	F	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	70%	69%	71%	64%
UKI-SOUTHGRID-OX-HEP	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	0%	0%	48%	75%
UKI-SOUTHGRID-RALPP	P	P	P	P	P	F	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	F	P	P	P	P	P	P	87%	88%	86%	87%
RAL-LCG2_Tier-1	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	100%	98%	95%	93%
Total																															78%	72%	79%	81%

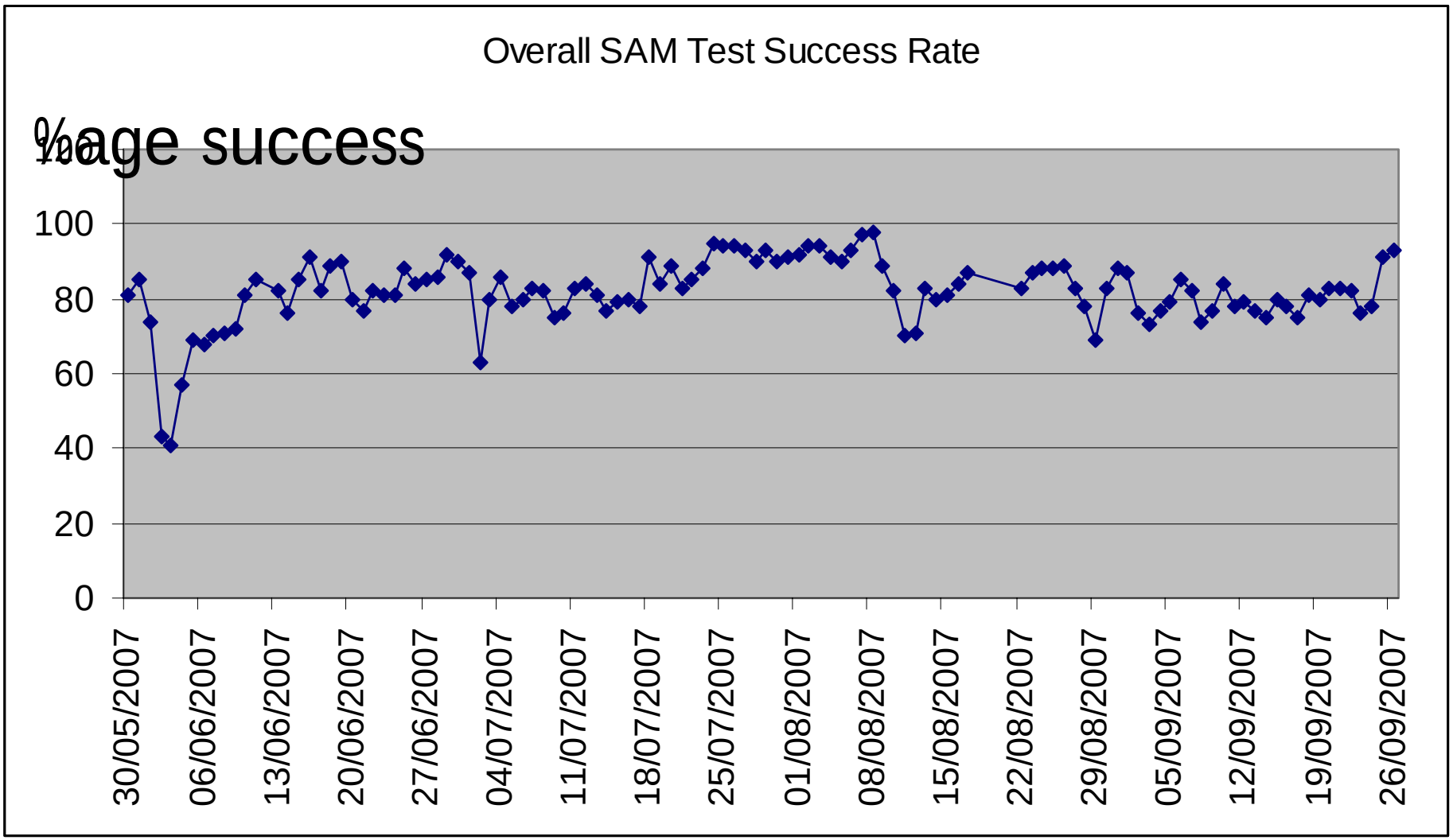
- Performance over past 6 months to be used for Tier-2 hardware allocations..

The metric is to be based on

SAM Test Efficiency x (CPU Delivered + Disk Available)

http://hepwww.ph.qmul.ac.uk/~lloyd/gridpp/sam.html

SAM site testing



http://hepwww.ph.qmul.ac.uk/~lloyd/gridpp/sam.html

Disaster Planning

Experiments categorisation:

- Non-scalability or general failure of the Grid data transfer / placement system.
- Non-scalability or general failure of the Grid workload management system.
- Non-scalability or general failure of the metadata / bookkeeping system.
- Medium-term loss of data storage resources.
- Medium-term loss of CPU resources.
- Long-term loss of data or data storage resources.
- Long-term loss of CPU resources.
- Medium- or long-term loss of wide area network.
- Grid security incident.
- Mis-estimation of resource requirements.

Disaster Planning

Disaster Modes:

ID	Cause	Explanation	Correlation between sites/services
1	Service failure	Loss of an individual Grid service due to a hardware failure	Random at individual sites, but may be correlated within a site
2	Site failure	Loss of an entire Grid site	Usually uncorrelated, although air conditioning failures may have some correlation
3	Software failure: new middleware	Vital new functionality is not available on time or fails in deployment	Changes are incremental and pre-tested and therefore usually uncorrelated Upgrades take place over a limited, controlled period
4	Software failure: load-related	Major bugs/limits are exposed as the load increases	Likely to appear at many sites
5	Software failure: OS-related	New versions of the OS require upgrades/porting which are not available	Correlated between sites, depending on hardware purchases and local policy
6	Software failure: usage	Usage patterns by individual users result in large numbers of job failures or resource exhaustion	May be correlated (common software or practices)
7	Loss or absence of key staff	Resignations or unavailability for an extended period	May be correlated due to holiday periods, epidemic illness or changes in employment conditions
8	Network failure: OPN	T0-T1 connection currently not redundant	Single point of failure
9	Network failure: JANET	T1-T2 (or T2-T2) connections fail	Depends on JANET/MAN topology
10	Security incident	An incident may close many sites until it is resolved	May be local or Grid wide
11	Procurement failure	Required increased capacity is not available on the required timescale through non-delivery or hardware not meeting specification.	There is a potential for correlation if the same supplier was being used by several sites.

Importance of Communication:

Further Introduction and Instructions

Organisational	Applications	Middleware	Infrastructure	Institutions	
All People	ALICE	InfoMon	Tier-1	Birmingham	Bristol
GridPP Post Holders	ATLAS	Metadata	Tier-2	Brunel	CERN
CB - members	CMS	Networking	London Tier 2	Cambridge	CCLRC
PMB - members	LHCb	Security	NorthGrid	Durham	Edinburgh
DB - members	BaBar	Storage	ScotGrid	Glasgow	Imperial
UB - members	CDF	WLMS	SouthGrid	Lancaster	Liverpool
OC - members	D0		T2 Hardware Support	Manchester	Oxford
Tier-1 Board Members	Other Applications		T2 Middleware Support	PPARC	QMUL
Tier-2 Board Members	PhenoGrid			RHUL	Sheffield
Deployment Team	UKQCD			Sussex	Swansea
EGEE	Portal	Dissemination	Security Contacts	Warwick	UCL
	Experiment Reps			Site SysAdmins	

If DataBase has been edited, click this button to update all lists: Update All Lists

Work in progress..

Transition Point

From UK Particle Physics perspective the Grid is *the* basis for computing in the 21st Century:

1. needed to utilise computing resources efficiently and securely
2. uses gLite middleware (with evolving standards for interoperation)
3. required significant investment from PPARC (STFC) – O(£100m) over 10 yrs - including support from HEFCE/SFC
4. required 3 years' prototype testbed development [GridPP1]
5. provides a working production system that has been running for three years in build-up to LHC data-taking [GridPP2]
6. enables seamless discovery of computing resources:
   utilised to good effect across the UK – internationally significant
7. not (yet) as efficient as end-user analysts require:
   ongoing work to improve performance
8. ready for LHC – just in time delivery
9. future operations-led activity as part of LCG, working with EGEE/EGI (EU) and NGS (UK) [GridPP3]
10. future challenge is to exploit this infrastructure to perform (previously impossible) physics analyses from the LHC (and ILC and νFact and..)

Transition Point

- *Planning..*
- *Good things take time.. ~20 months*

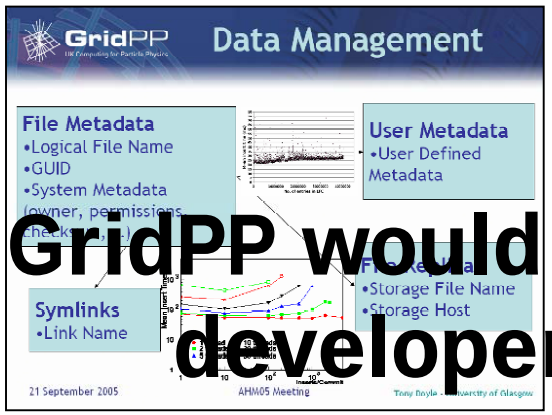
31st March 2006 – PPARC Call

31st October 2007? – Grants implemented

Proposal Writing | Proposal Defence | Proposal Approval | Implementation

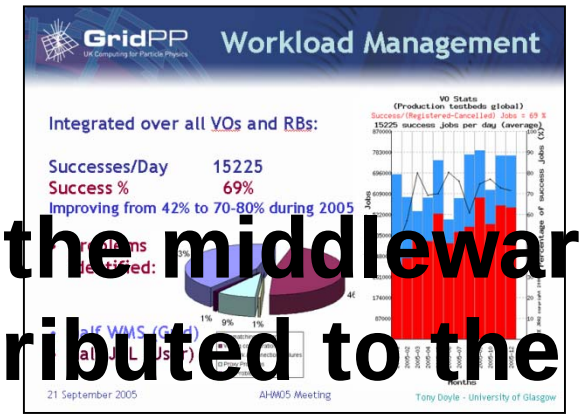
Transition Point

Grid Data Management



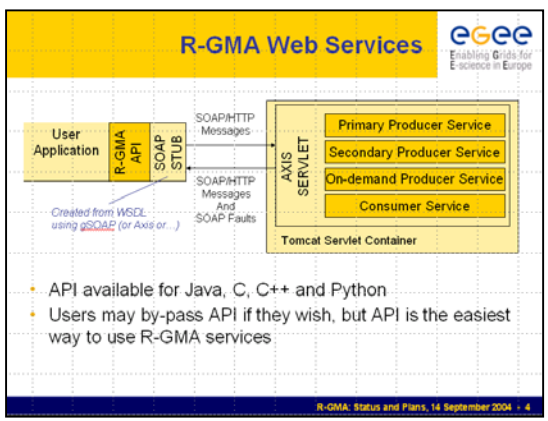
Network Monitoring

Workload Management

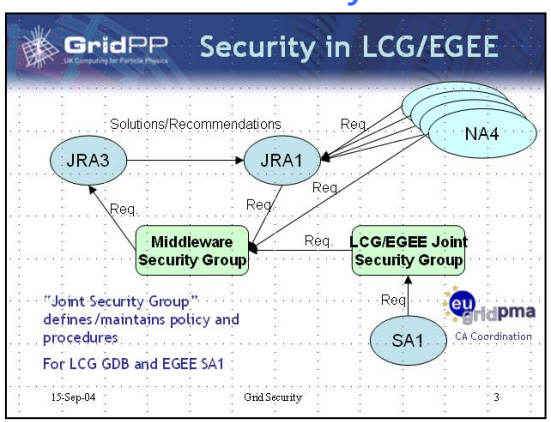


GridPP would like to thank all the middleware developers who have contributed to the establishment of the Production Grid

Information Services



Security



Storage Interfaces