Science & Technology Facilities Council

LWG – Can We Deliver?

Neil Geddes

STFC Director, e-Science

With thanks to:

Ian Bird, Bob Jones, Les Robertson, Sue Foffano

Federico Carminati, Philippe Charpentier, Dario Barberis

David Colling, Mike Vetterli, Glenn Patrick

And many others who may recognise their slides

Outline

A personal review of WLCG and the readiness for first, and continuing, LHC data. Highlighting some particular successes, concerns and challenges that lie ahead

WLCG – Can we deliver ...

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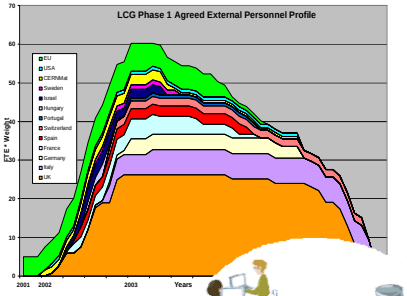
Deliver What ?

The LCG project was created by Council in 2001 (CERN/2379/Rev. 5.Sept. 2001)

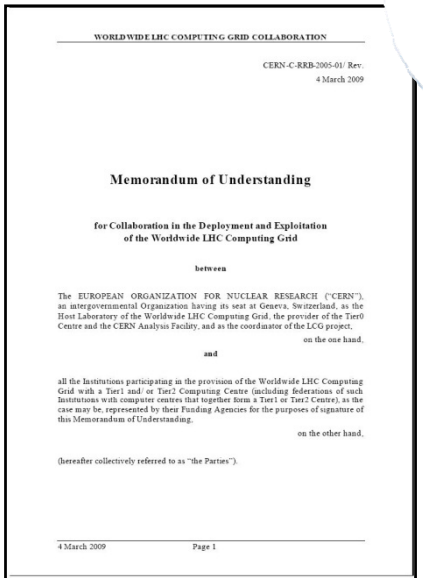


Phase 1: 2002 – 2005

- Build a service prototype
- Gain experience in running a service
- Produce the TDR for the final system

Phase 2: 2006 – 2008

- Build and commission the initial LHC computing environment



WORLDWIDE LHC COMPUTING GRID COLLABORATION

CERN-C-RRB-2005-01/ Rev.
4 March 2009

Memorandum of Understanding

for Collaboration in the Deployment and Exploitation of the Worldwide LHC Computing Grid

between

The EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH ("CERN"), an intergovernmental Organization having its seat at Geneva, Switzerland, as the Host Laboratory of the Worldwide LHC Computing Grid, the provider of the Tier0 Centre and the CERN Analysis Facility, and as the coordinator of the LCG project,

on the one hand,

and

all the Institutions participating in the provision of the Worldwide LHC Computing Grid with a Tier1 and/ or Tier2 Computing Centre (including federations of such Institutions with computer centres that together form a Tier1 or Tier2 Centre), as the case may be, represented by their Funding Agencies for the purposes of signature of this Memorandum of Understanding,

on the other hand,

(hereafter collectively referred to as "the Parties").

4 March 2009 Page 1

WLCG MoU

- The purpose of the LHC Computing Grid is
  - To provide the computing resources needed to process and analyse the data gathered by the LHC Experiments.
  - to provide common software for this task and to implement a uniform means of accessing resources
- The LCG project [aided by the experiments] is addressing this by
  - assembling at multiple inter-networked computer centres the main offline data storage and computing resources needed by the experiments and operating these resources in a shared grid-like manner

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Tiers

- Tier0 is at CERN
  - receives the raw and other data from the Experiments' online computing farms and records them on permanent mass storage. It also performs a first-pass reconstruction of the data
- Tier1 Centres
  - provide a distributed permanent back-up of the raw data, permanent storage and management of data, a grid-enabled data service, perform data-heavy analysis and re-processing, and may undertake national or regional support tasks, as well as contribute to Grid Operations Services.
- Tier2 Centres
  - provide well-managed, grid-enabled disk storage and concentrate on tasks such as simulation, end-user analysis and high-performance parallel analysis

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RESOURCES

MoU Signatories

- 33 countries have signed the MoU
  - 1 more in progress
  - In many cases several signatures
- Tier-0
- 11 Tier-1 sites
- 61 Tier 2 federations
  - 120 individual Tier 2 sites
- Accounting and reliability reported.
- Quite a few more that run WLCG

Australia	Netherlands
Austria	Norway
Belgium	Pakistan
Canada	Poland
China	Portugal
Czech	Romania
Denmark	Russia
Estonia	Slovenia
Finland	Spain
France	Sweden
Germany	Switzerland
Hungary	Taipei
Italy	Turkey
India	UK
Israel	Ukraine
Japan	USA
Korea	

CERN

Amsterdam/NIKHEF-SARA

Taipei/ASGC

Bologna/CAF

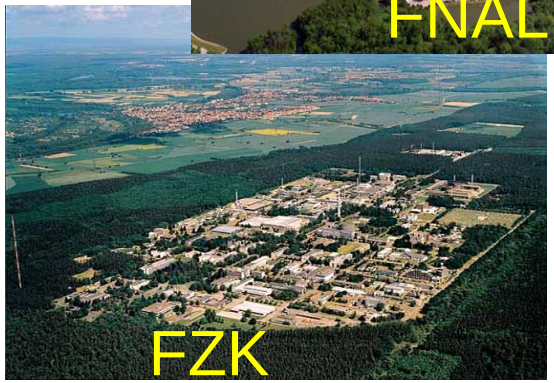
BNL

TRIUMF

FNAL

Lyon/CCIN2P3

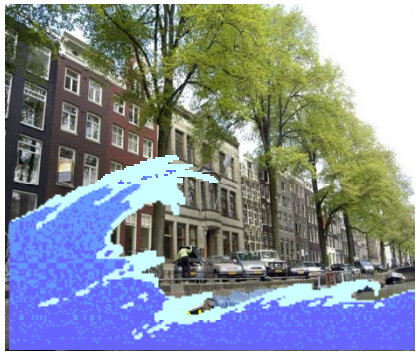
NGDF
Suomi
Finland
Sverige
Sweden
Norge
Norway
Helsinki
Tallinn
Eesti
Estonia
Latvija
Latvia
Lietuva
Lithuania
Danmark
Denmark
København
Göteborg
Oslo
Bergen
Stockholm
Riga
Vilnius
Kaunes
Minsk
Gdańsk
Terms of Use

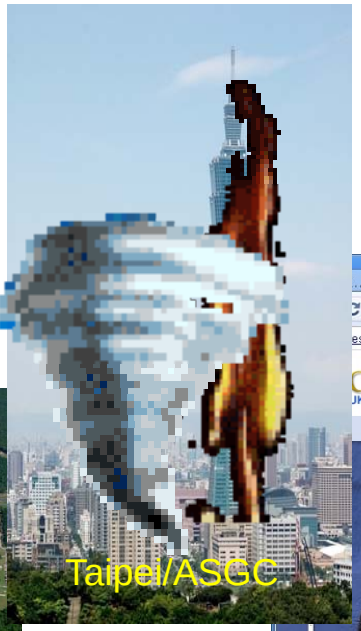

FZK

Barcelona/PIC

RAL

CERN




Taipei/ASGC

Bologna/CAF

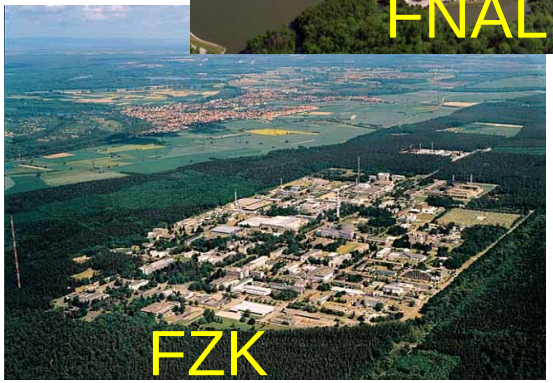
TRIUMF

BNL

Suomi
Finland
Sverige
Sweden
Norge
Norway
Danmark
Denmark
Eesti
Estonia
Latvija
Latvia
Lietuva
Lithuania
Helsinki
Oslo
Bergen
Stockholm
Göteborg
København
Riga
Tallinn
Vilnius
Minsk
NGDF

FNAL

Lyon/CCIN2P3


FZK

Barcelona/PIC

RAL

Grid Monitor
Tasks
LCG World Real Time Monitor
LCG
eGee
GridPP
Statistics:
Submitted: 51
Waiting: 16
Ready: 134
Java Applet Window
eGee
Enabling Grids for E-sciencE
Greenland
Iceland
Sweden
Norway
Russia
Canada
United States
North Atlantic Ocean
Mexico
Cuba
Venezuela
Colombia
Brazil
Peru
Bolivia
Algeria
Libya
Egypt
Saudi Arabia
Mauritania
Mali
Niger
Chad
Sudan
Nigeria
Ethiopia
DR Congo
Kenya
Tanzania
Angola
Kazakhstan
Mongolia
China
India
Myanmar
Thailand
Pakistan
Iran
Iraq
Turkey
Ukraine
Japan
Indonesia
Papua New Guinea
eGee
Enabling Grids
London
GridPP

Pledge Balance in 2009

- The table below shows the status at 27/10/08 for 2009 from the responses received from the Tier-1 and Tier-2 sites
- Experiment Requirements mainly date from TDRs and will be updated in 2009, also taking Scrutiny Group recommendations into account
- % indicates the balance between offered and required.

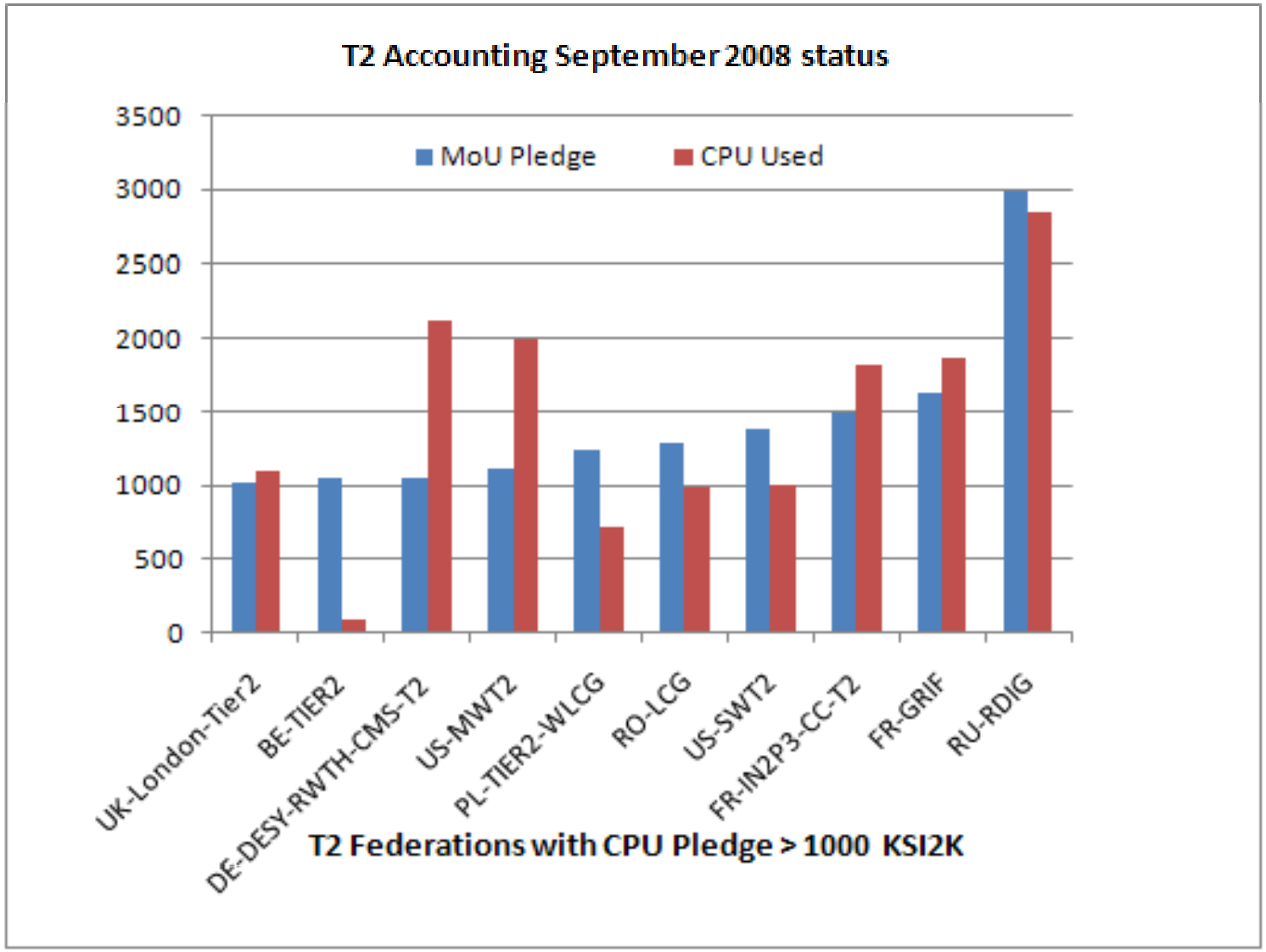
	ALICE	ATLAS	CMS	LHCb	Sum 2009
T1 CPU	-49%	6%	-2%	2%	-12%
T1 Disk	-43%	-5%	-13%	-2%	-13%
T1 Tape	-50%	-7%	7%	6%	-13%
T2 CPU	-44%	0%	-8%	-40%	-12%
T2 Disk	-44%	-20%	35%	-	-2%

Pledge Balance 2008-2013

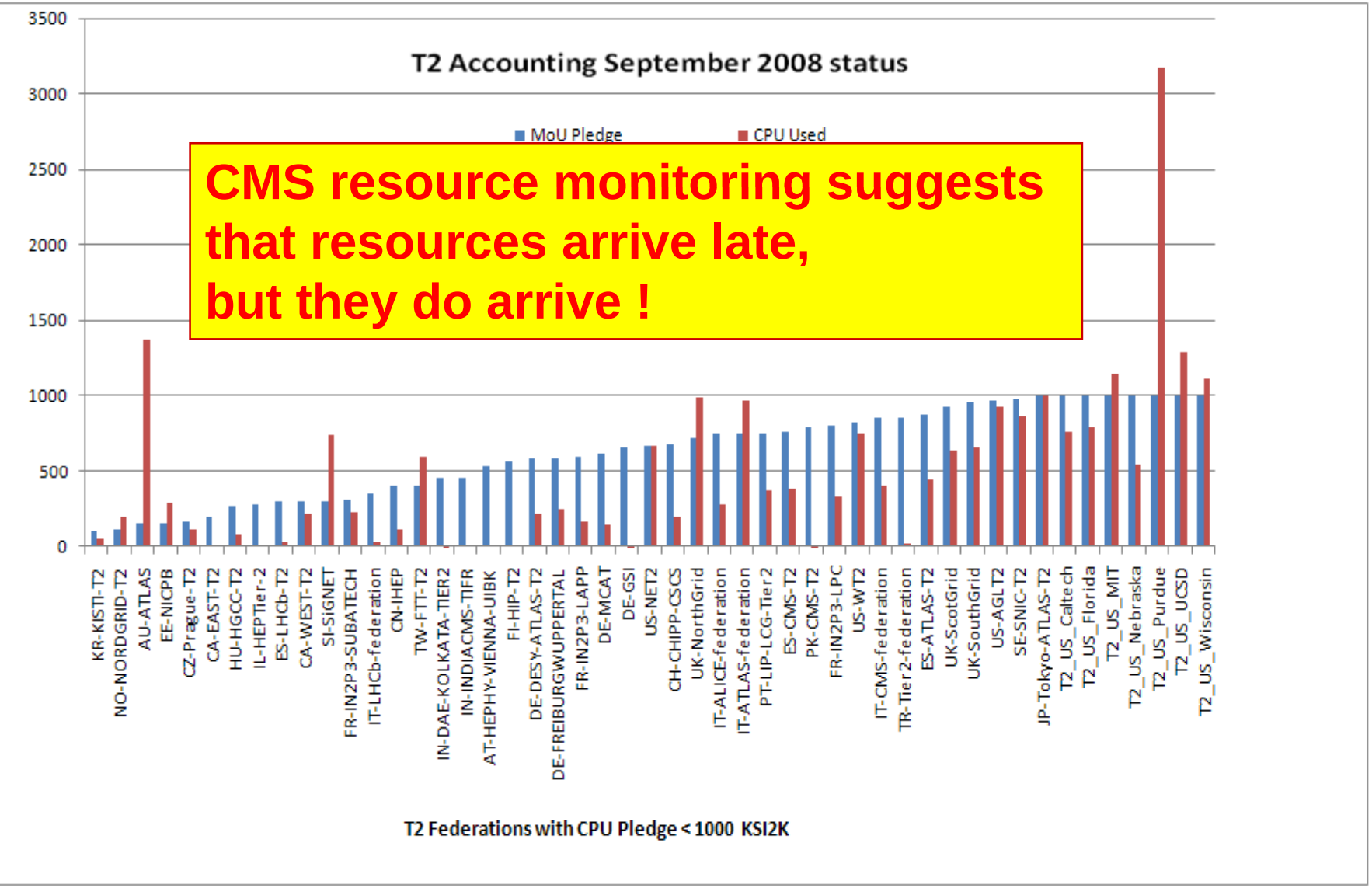
- Global picture for 2008-2013, as of 27/10/08.
- No modifications for 2009 LHC Schedule
- Next exercise for Autumn 2009 - different status?
- No indication here of where the resources are (not) !

	2008	2009	2010	2011	2012	2013
T1 CPU	-5%	-12%	-11%	-15%	-20%	-26%
T1 Disk	-12%	-13%	-15%	-18%	-24%	-29%
T1 Tape	-13%	-13%	-16%	-22%	-24%	-23%
T2 CPU	-4%	-12%	-32%	-34%	-36%	-42%
T2 Disk	-14%	-2%	1%	-7%	-8%	-22%

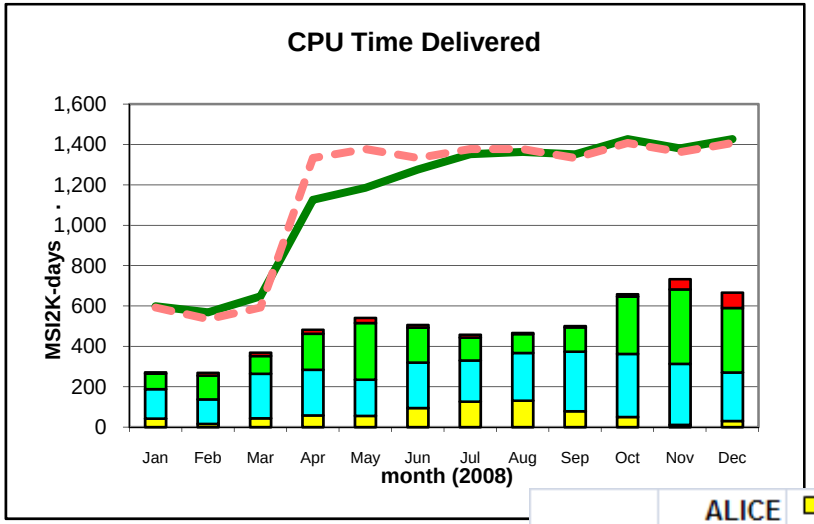
Accounting for Tier-2s (2)

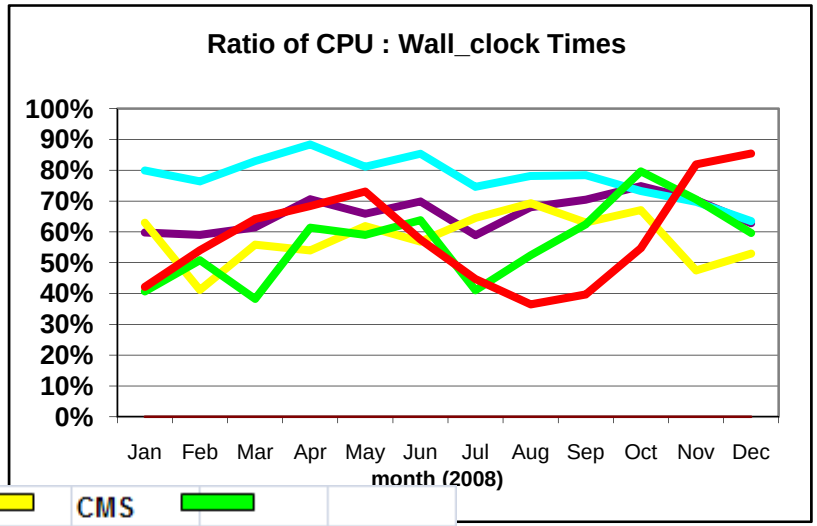


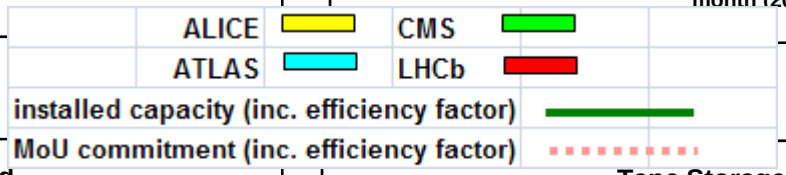
Accounting for Tier-2s (3)

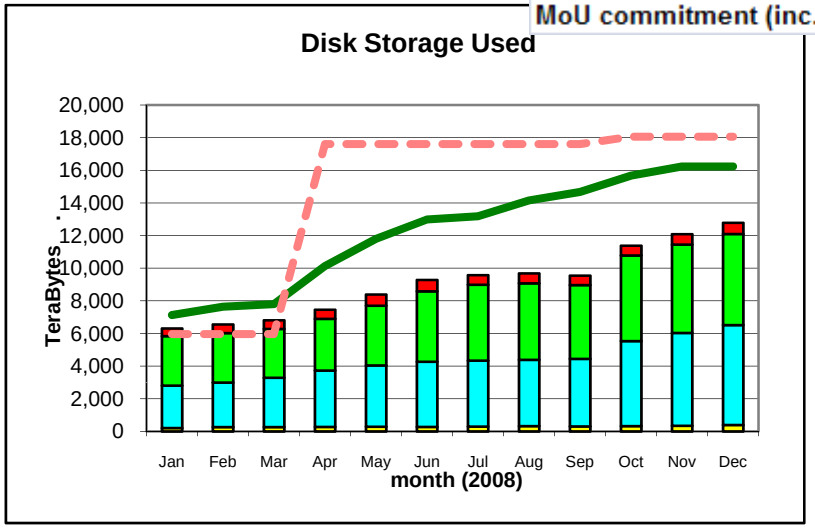


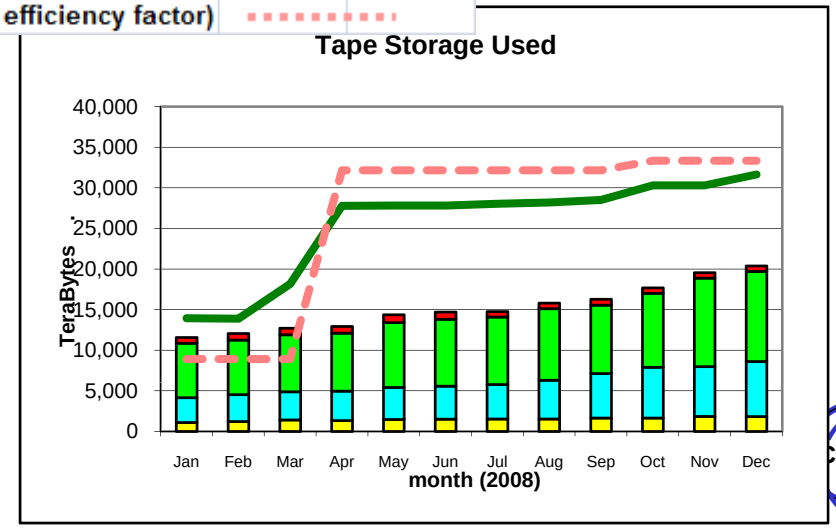
CERN + Tier 1 accounting - 2008











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...in a shared grid-like manner...

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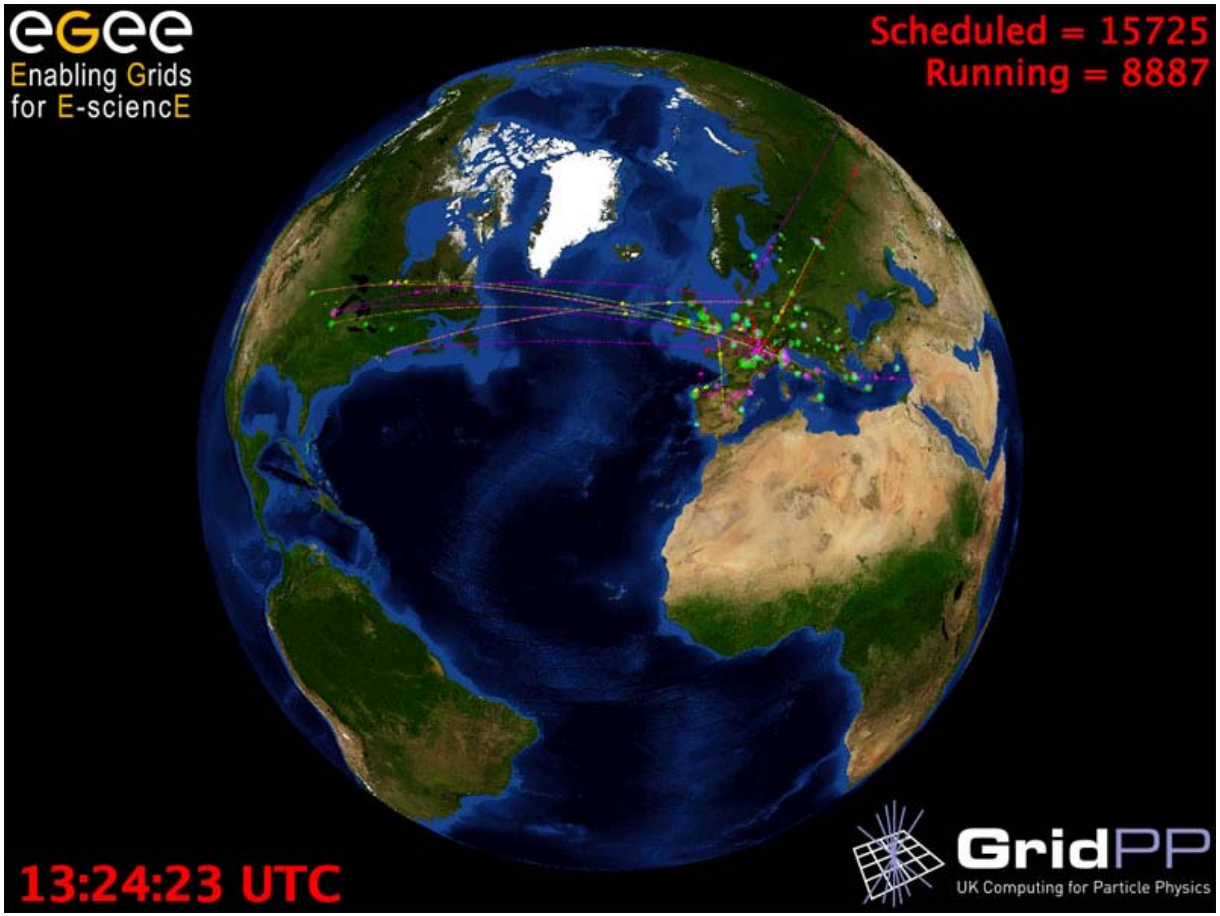
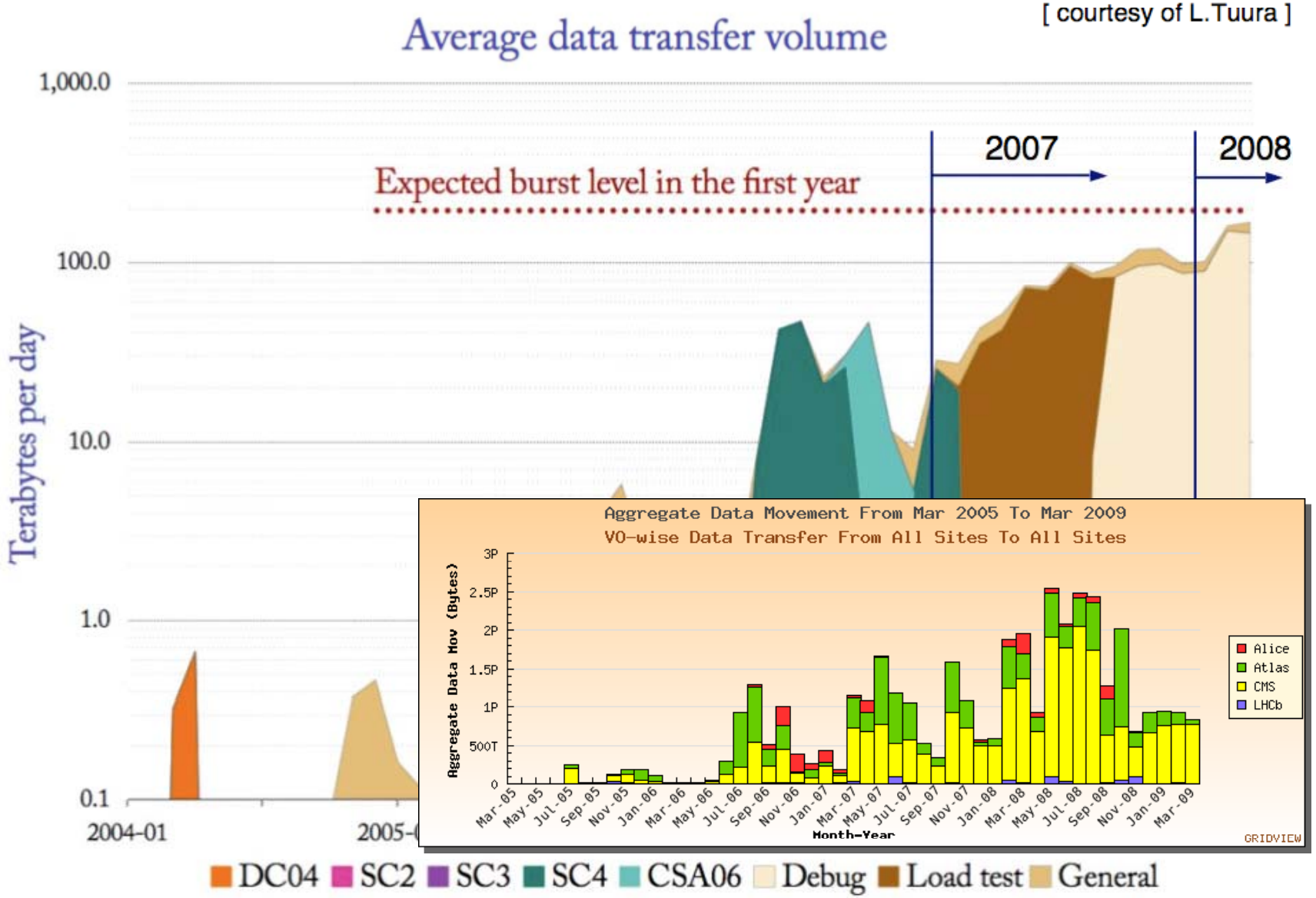
We have the resources, can we use them ?

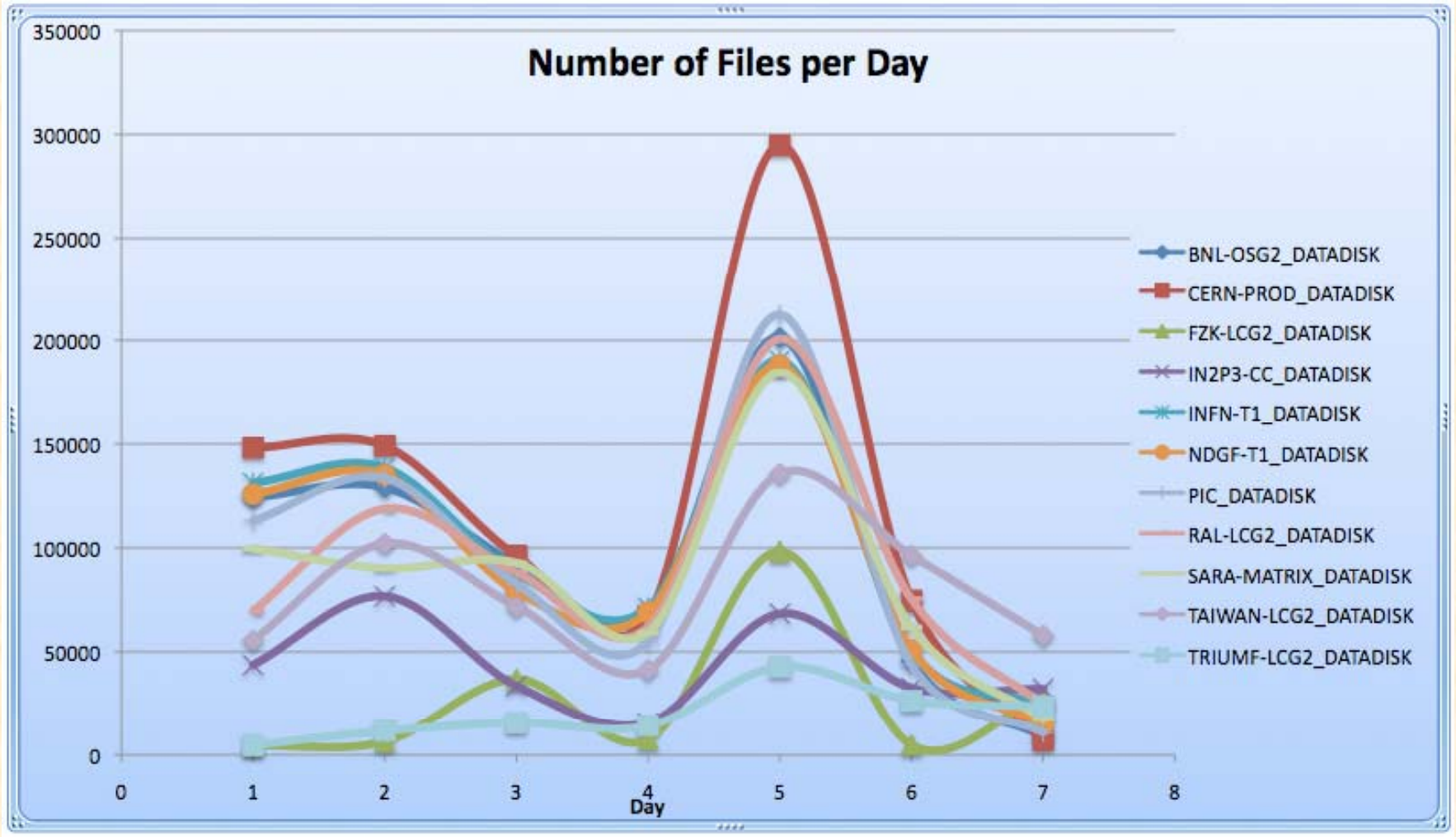


CMS Data Transfer History

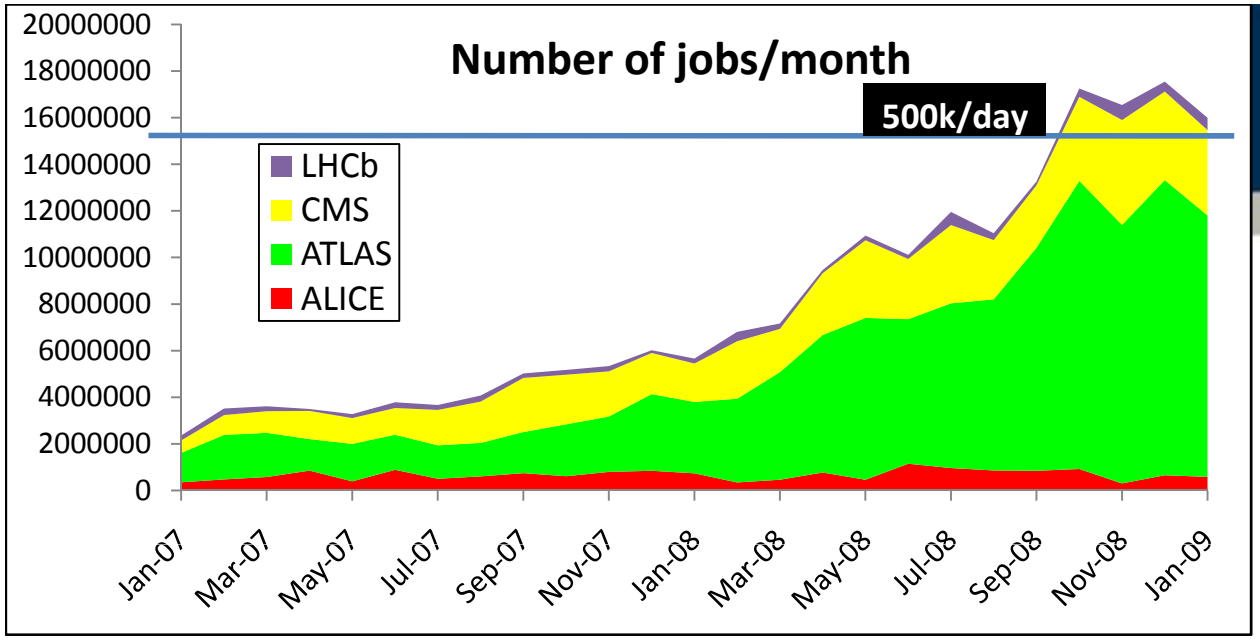
[courtesy of L.Tuura]



10M files Test @ ATLAS



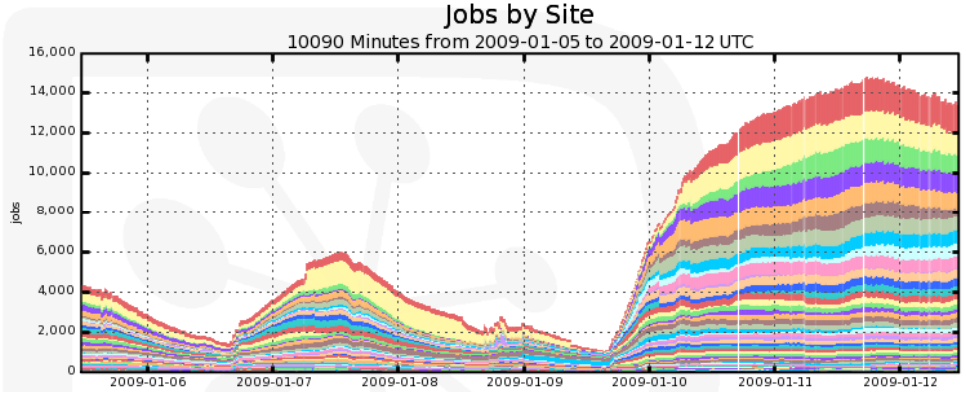
(From S. Campana)



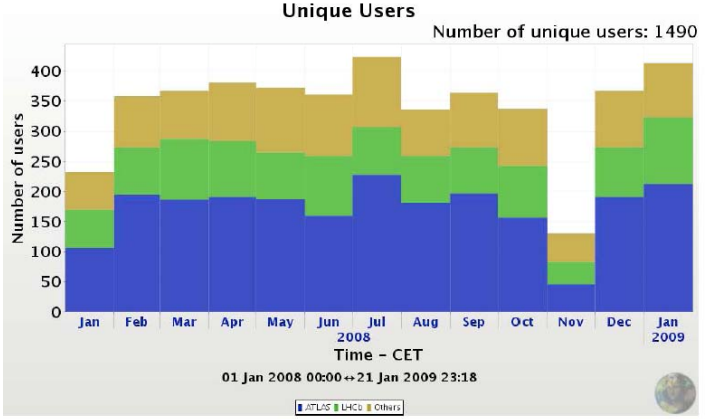
Main outstanding issues related to service/site reliability

	Alice	ATLAS	CMS	LHCb	Total	
Tier-1s	6.24	32.03	30.73	2.50	71.50	34.3%
Tier-2s	9.61	52.23	55.04	20.14	137.02	65.7%
Total	15.85	84.26	85.77	22.64	208.52	

From APEL accounting portal for Aug.'08 to Jan.'09; #s in MSI2k

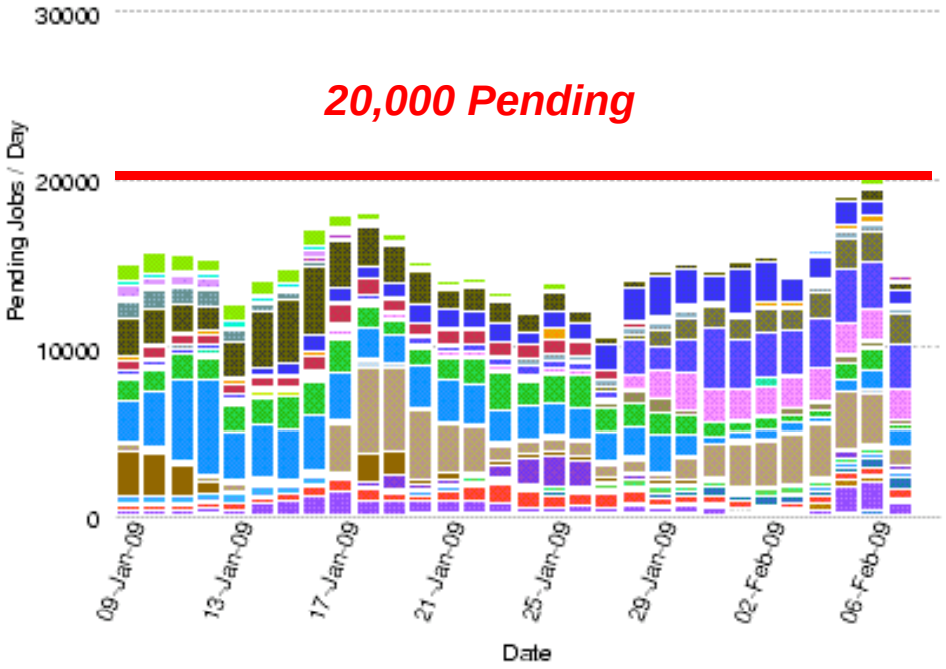


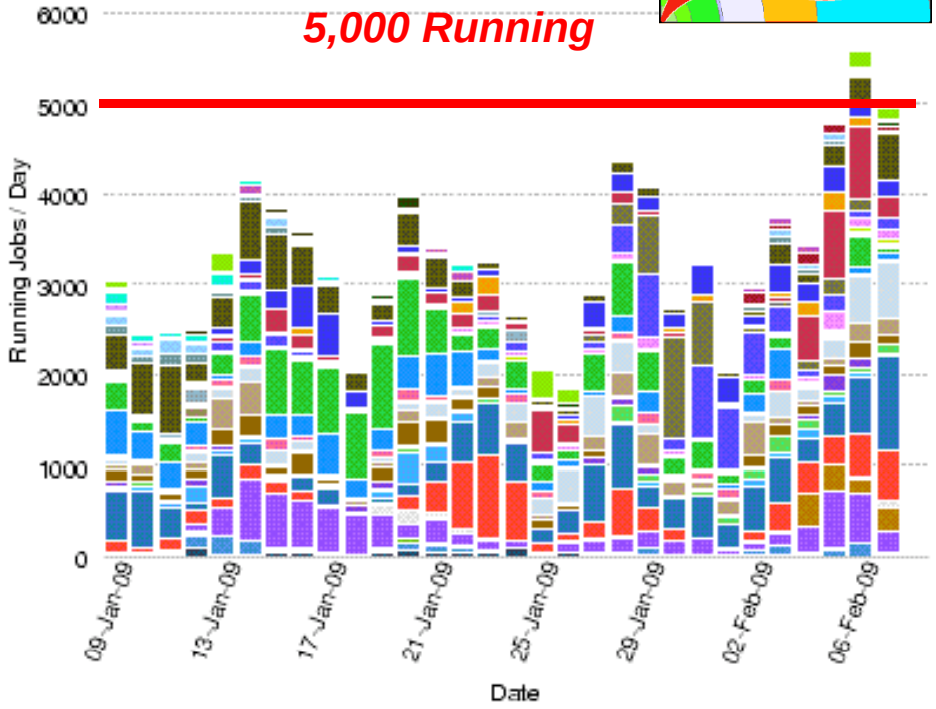
Number of Users:



Analysis jobs last month

From F. Wuerthwein (UCSD-CMS)



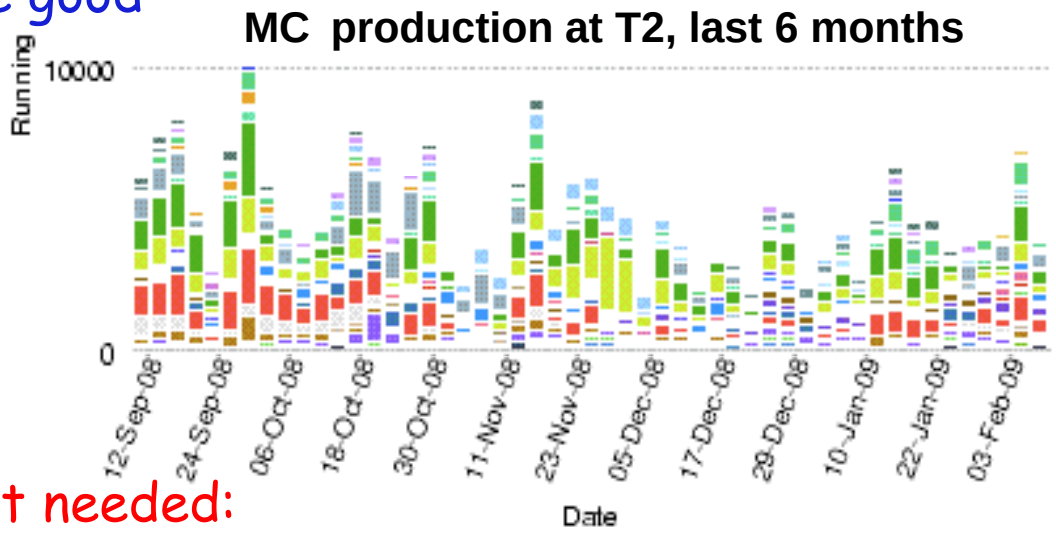


BEIJING-LCG2, BEgrid-ULB-VUB, BUDAPEST, BelGrid-UCL, CIEMAT-LCG2, CIT_CMS_T2, CSC, CSCS-LCG2, DESY-HH, GLOW-CMS, GRIF, HEPGRID_UERJ, Hephy-Vienna, IFCA-LCG2, IN2P3-CC-T2, IN2P3-IRES, INDIACMS-TIFR, INFN-BARI, INFN-LNL-2, INFN-PISA, INFN-ROMA1-CMS, ITEP, JINR-LCG2, Kharkov-KIPT-LCG2, LCG_KNU, LIP-Lisbon, MIT_CMS, NDGF-T1, Nebraska, Purdue-RCAC, Purdue-Steele, RRC-KI, RU-Protvino-IHEP, RWTH-Aachen, SPRACE, T2_Estonia, TR-03-METU, TW-FTT, UCSDT2, UFlorida-HPC, UFlorida-IHEPA, UKI-LT2-Brunel, UKI-LT2-IC-HEP, UKI-LT2-IC-LeSC, UKI-SOUTHGRID-BRIS-HEP, UKI-SOUTHGRID-RALPP, WARSAW-EGEE, ru-Moscow-SINP-LCG2, ru-PNPI, ucsdt2-b

Note: We do not have stats for jobs that do not report to dashboard.
We know that such jobs exist.
⇒ Need WLCG <-> dashboard comparison !

CMS Computing: Data Operations

- Re-reconstructions of [cosmic] data (~700 TB of RAW, RECO, Skims):
  - First round completed in January
  - Second round just started, to complete in 2 weeks
- Monte Carlo production ongoing:
- Production rate is quite good **(~100M FullSim/month)**



- Continuous improvement needed:
  - latencies of tails, request tracking, reporting, develop metrics, QA, production tools

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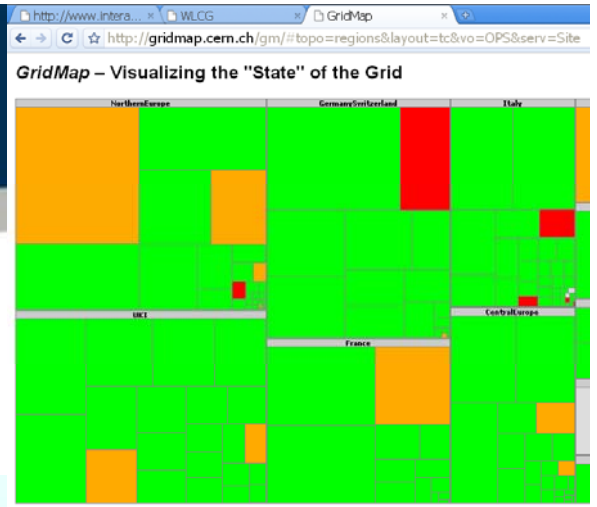
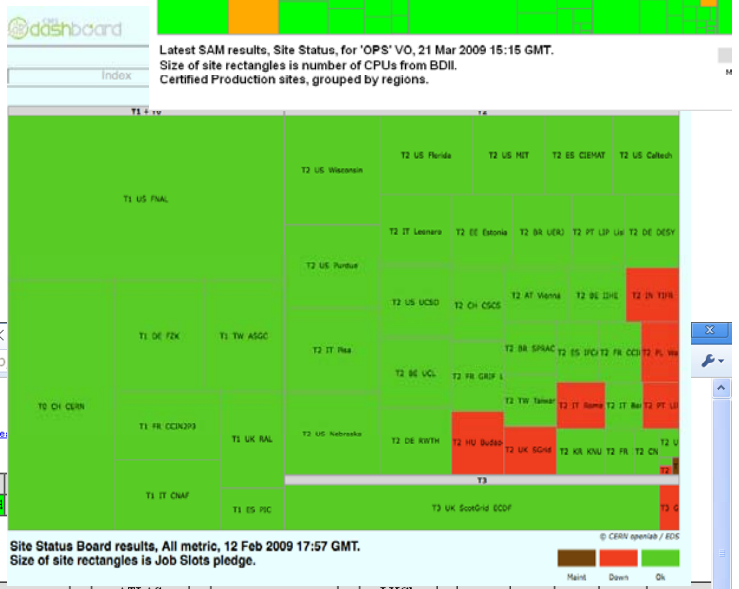
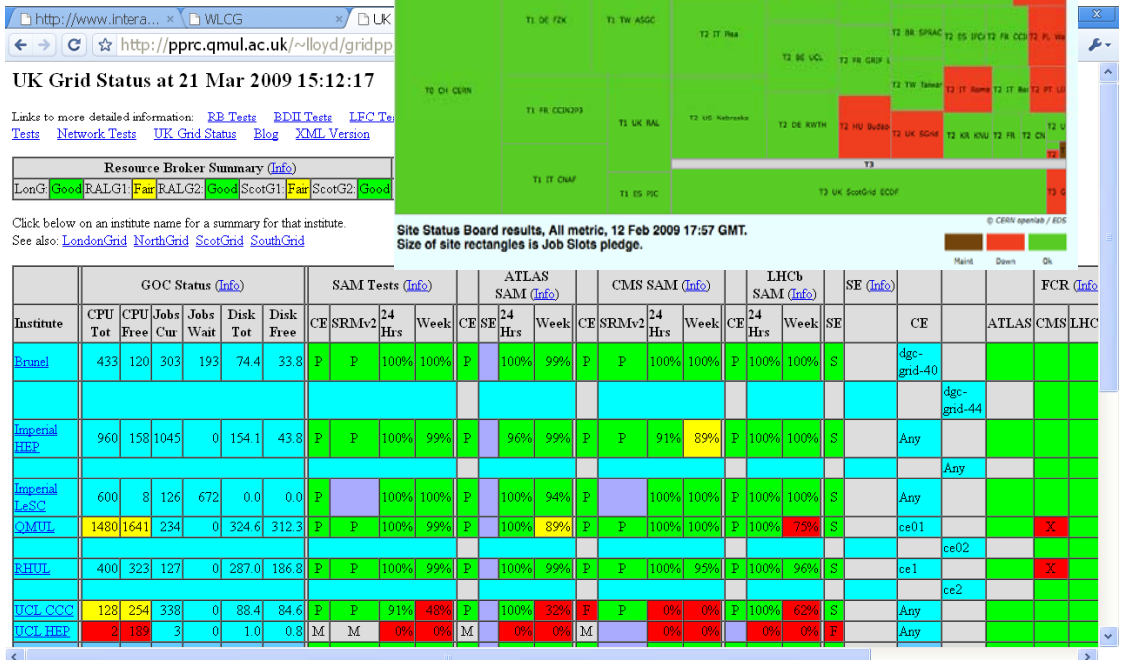
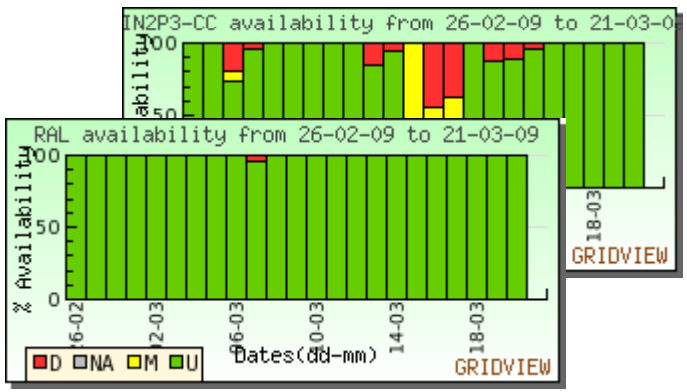
Improving Reliability

- Testing
- Task forces/challenges
- Monitoring
  - Appropriate
  - Followed up

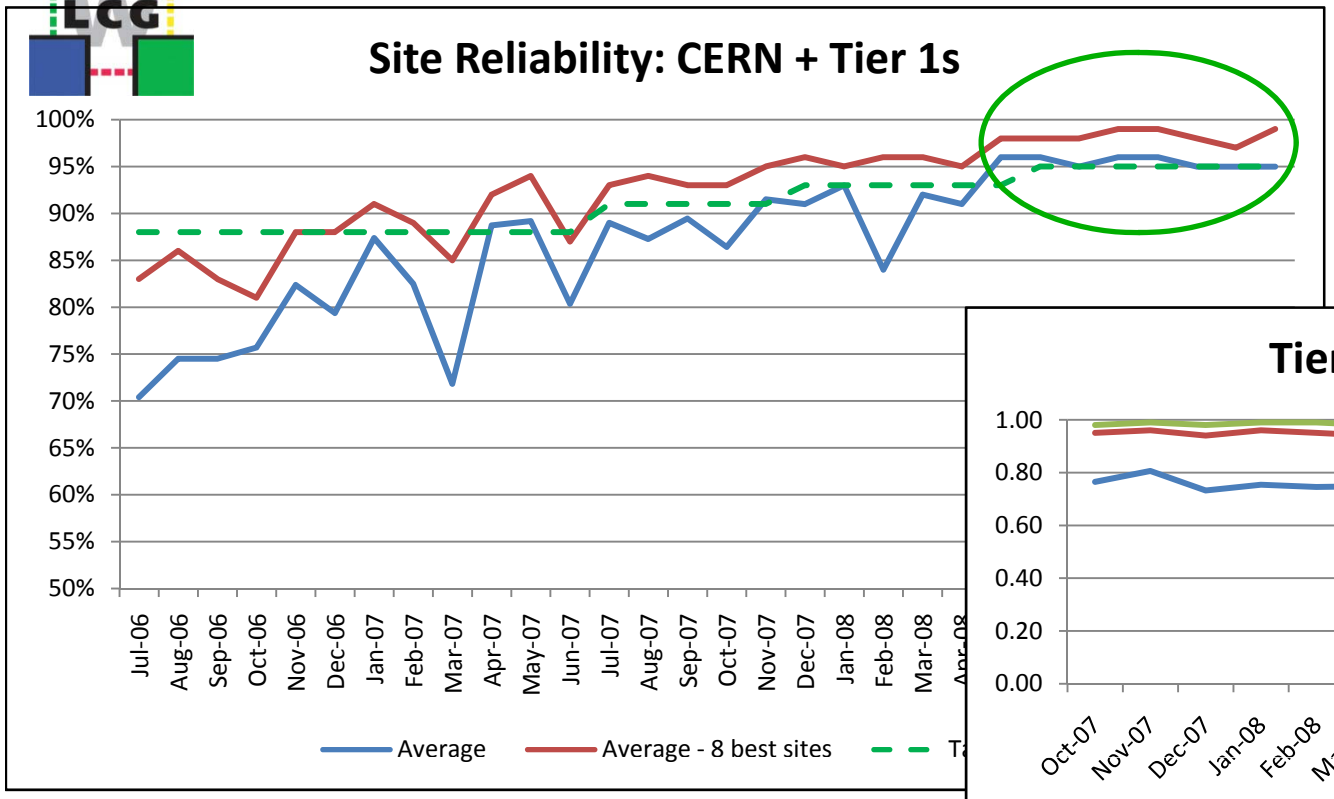


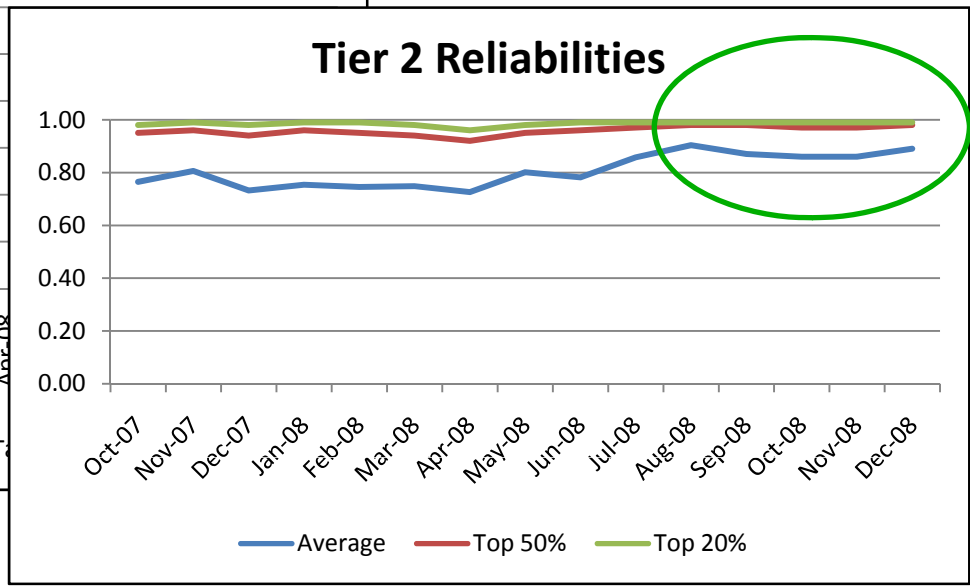






Reliabilities





Improvement during CCRC and later is encouraging

-Tests do not show full picture – e.g. Hide experiment-specific issues,

- “OR” of service instances probably too simplistic

-**We are not there yet !**

a) publish VO-specific tests regularly;

b) rethink algorithm for combining service instances

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...common software for this task and to implement a uniform means of accessing resources...

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A uniform means of accessing resources ?

- X509 and Grid Certificates
  - Worldwide trust/authentication
- Virtual Organisations and VOMS
  - Authorisation (course grained)
  - Missing effective management of job queues and privileges.
- Practical structures for the implementation of federated trust

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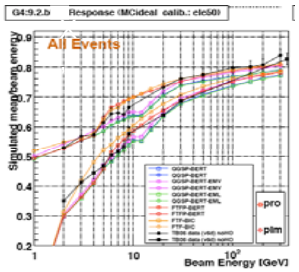
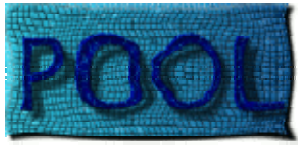
Common software

- wLCG Applications Area
  - LHC Simulation
    - Physics generators
      - Genser, HepMC
    - Detector
      - Geant4, FLUKA, Garfield
  - Pool
  - Core Libraries and Services - ROOT



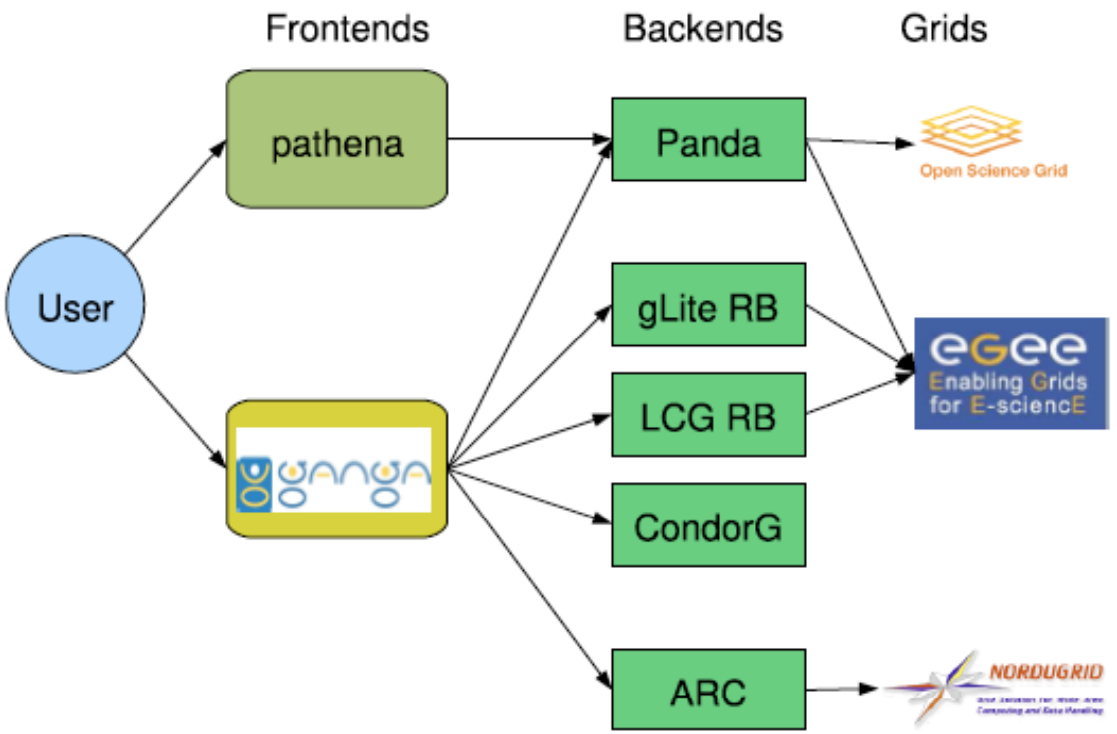


Common software - II

- Grid Stacks
  - In practice a set of low level services
  - Not directly controlled by WLCG
- Much frustration on all sides
  - Lack of consistent/agreed requirements
  - Lack of responsiveness
- Experiments have deployed higher level systems
    - Panda, AliEn, DIRAC, Crab...
    - Missed opportunities?
- Better feedback re DPM, LFC, FTS ..
  - WLCG controlled – more responsive ?

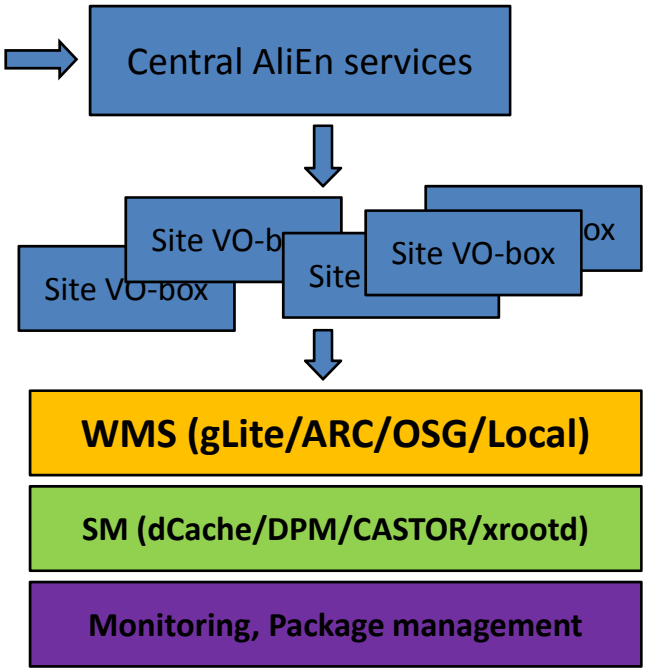
User Issues: It's all still a little complicated

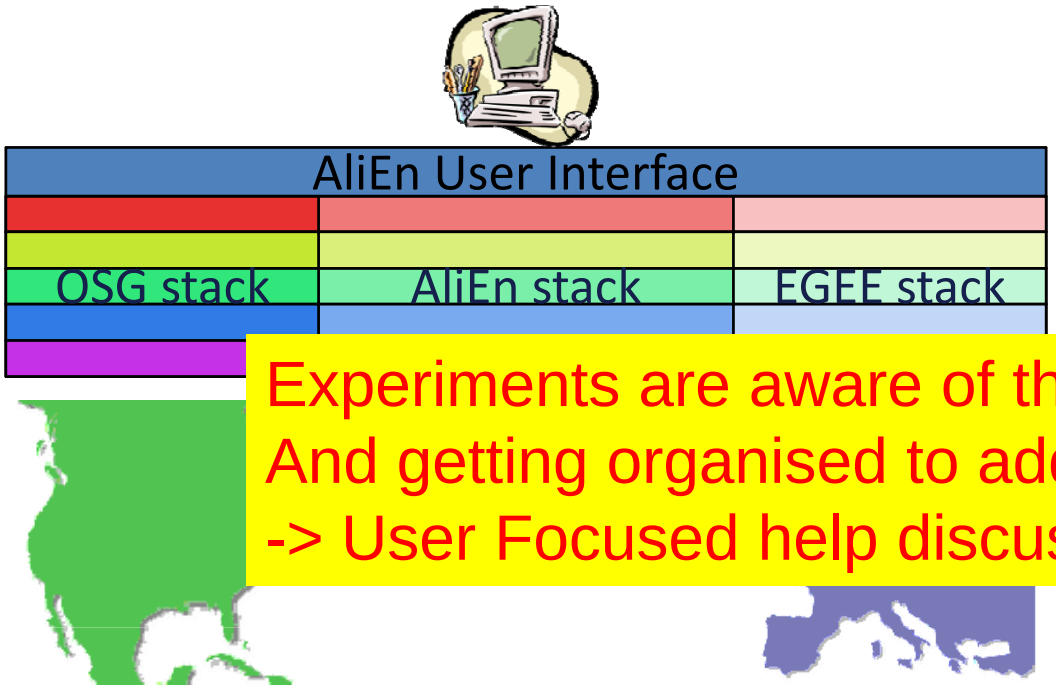
Distributed Analysis - Current Situation



Seeing an increased number of user in the last few months - but we expect many more !

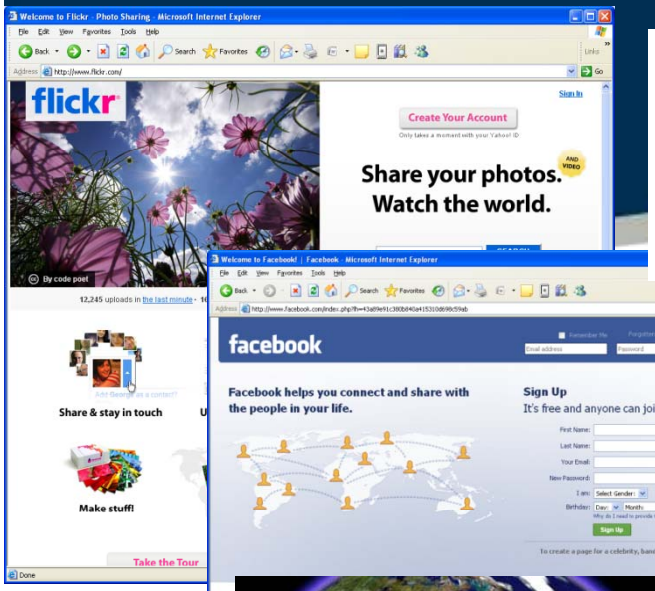
- The VO-box system (very controversial in the beginning)
  - Has been extensively tested
  - Allows for site services scaling
  - Is a simple isolation layer for the VO in case of troubles

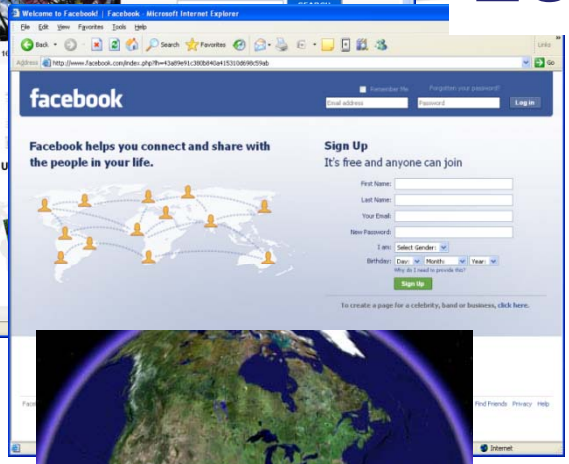


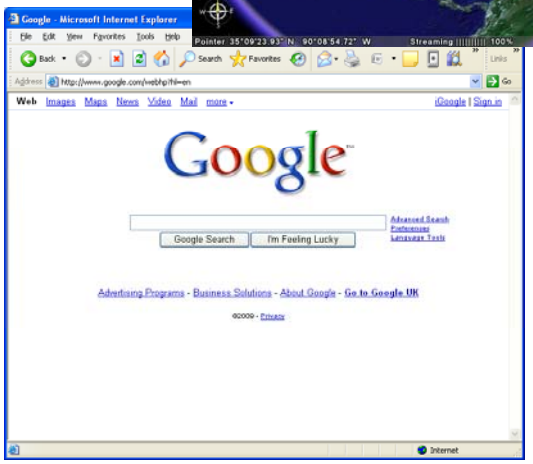


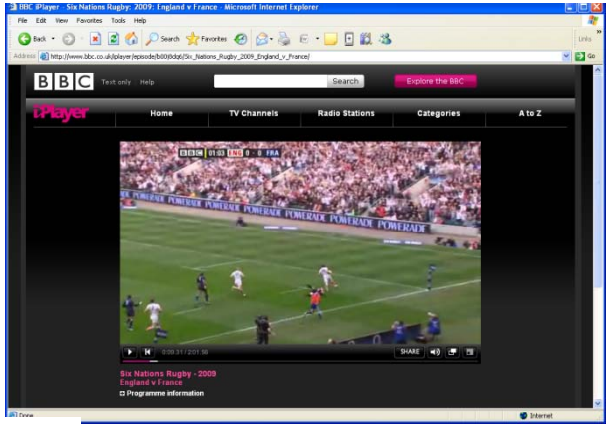
Experiments are aware of the issues
And getting organised to address them
-> User Focused help discussed yesterday

Interfaces and Requirements Lessons?









Achievements and Challenges

Science & Technology
Facilities Council

Science & Technology Facilities Council

Airline Evacuation 101

- US FAA require airplane evacuation tests
  - The early US evacuations looked like nice & orderly.
- UK CAA study – post 1985 air crash
  - The UK study film footage is a different scene.
  - "passengers" scrambling over the tops of seats and each other to get out the exits.
  - It's pure chaos
  - First 75% out got £5
- *International Journal of Aviation Psychology* by Muir et al (vol 6, no 1; 1996);
  - "blockages adjacent to the exits were more likely to occur when space was at a minimum...serious blockages occurred only when volunteers were competing with one another."
- But there is hope ...

Conclusions

My 2 main messages (as an LHC physicist and end-user):

- LHC has unprecedented and highly compelling physics goals
  → Software/Computing should not limit the detector performance and LHC physics reach
- In spite of challenges and difficulties, the Software must be easy-to-use and stable

My 2 main worries today (as an LHC physicist and end-user):

- End-users not yet exposed to massive use/navigation of database and of GRID
  → what will happen when $O(10^3)$ physicists will simultaneously access these systems ?
- Software and Computing Model developed for steady-state LHC operation (≥ 2009 ?)

But : at the beginning they will be confronted with most atypical (and stressful) situations, for which a lot of flexibility will be needed:

-- staged, non-perfect, non-calibrated, non-aligned detectors with all sorts of problems
-- cosmic and [illegible] chine commissioning
-- machine ba[illegible]
-- fast/frequ[illegible] streams)
-- $O(10^3)$ phys[illegible] nd accessing the database, GRID ...

Fabiola Gianotti
CHEP 2004

⇒ it is time for the Software/Computing to address the early phase of LHC operation, not to hinder the fast delivery of physics results (and a possible early discovery ...)

Challenges

- Biggest short term problems:
  - Large influx of new untrained users
  - Failure to appreciate how complicated it looks to a beginner.
  - More and more people wanting access to the same data.
  - Users who do not realize the magnitude of the computing problem they (we) face.
- Biggest long term problems:
  - Resourcing
  - Flexibility

Conclusions

Can WLCG deliver for the LHC ?

Yes

Will WLCG deliver for the LHC ?

Yes

Will it be a challenge?

Yes – but we already knew that !