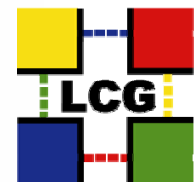
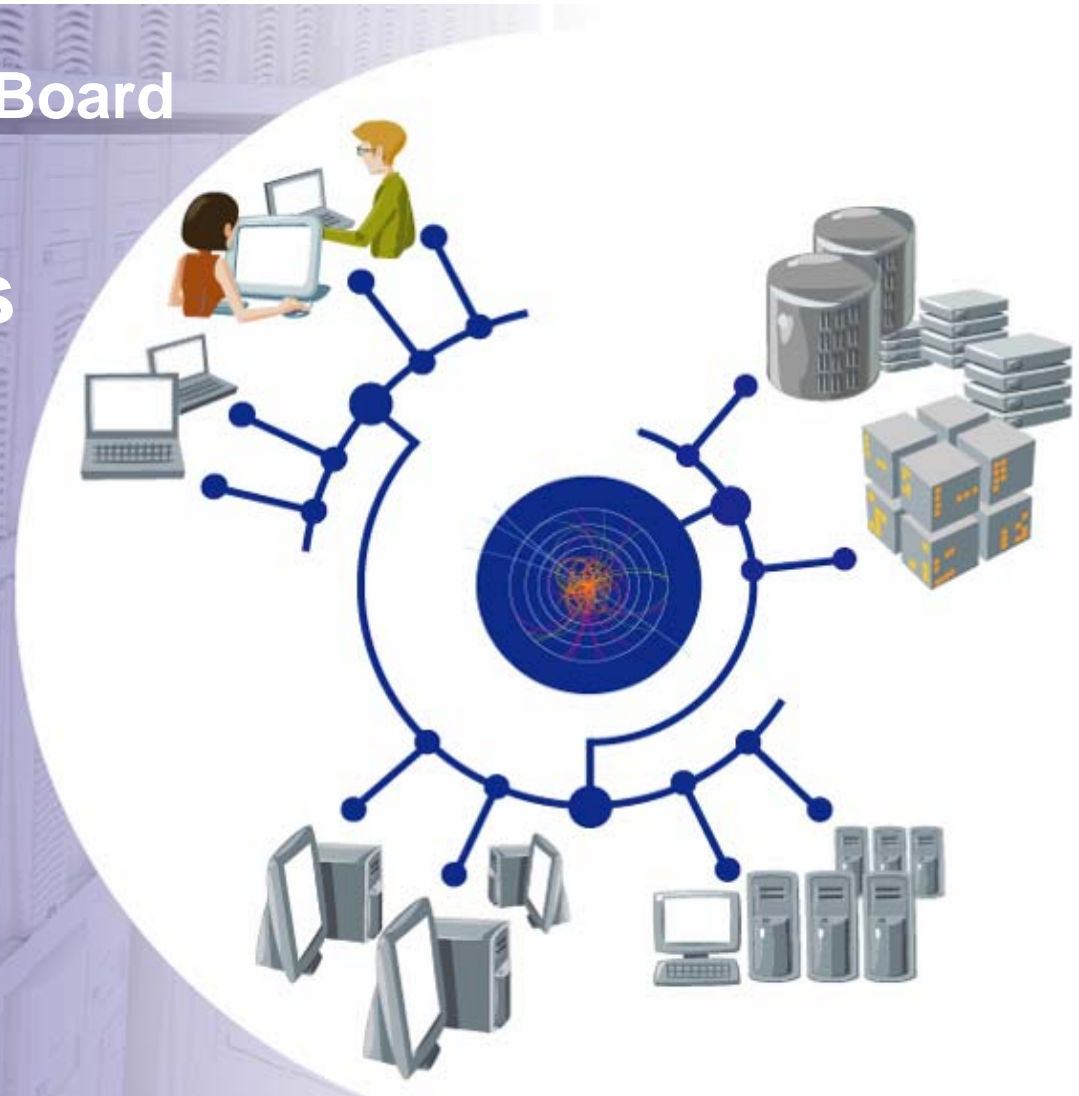


# LCG - The Worldwide LHC Computing Grid

Resource Review Board

Project Status

CERN  
25 April 2006  
Les Robertson  
LCG Project Leader





# Phase 2 Management Structure

## Collaboration Board

Experiments, Tier-1s and Tier-2 federations

First meeting 3 February

Chair - Neil Geddes (RAL)

## Management Board

Replaces the former PEB

Expanded to include Tier-1 management

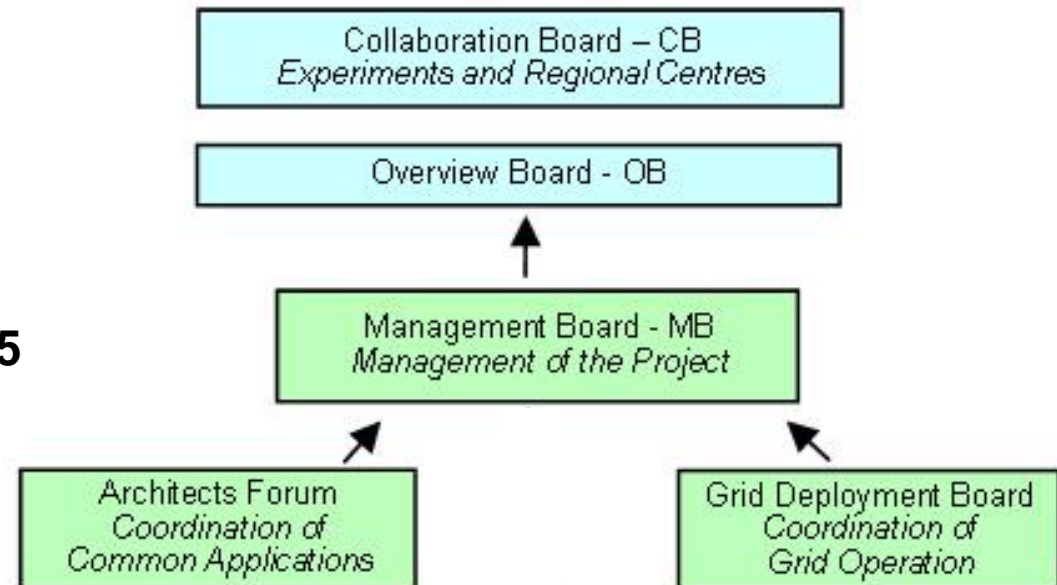
First meeting on 31 October 2005



## Worldwide LCG Organisation

LHC Committee - LHCC  
Scientific Review

Computing Resources  
Review Board - C-RRB  
Funding Agencies





# Planning, Reporting, Monitoring


- New process established in December
- Plans agreed by MB:  
**High Level Plan, Activity Areas, Tier-1s, Experiments**  
 Tier-2s will be added later

CC-IN2P3_Plan.xls						INFN_Plan.xls			
A B C D E F G H						A B C D			
1 CC-IN2P3						1			
2 Plans and Schedule						2			
3						3			
4 Expected install capacity/performance Milestones: Description and Verification						4 Expected install ca Milestones: Descrip			
5 ID Date CPU Disk WAN->Disk Tape WAN->Tape						5 ID Date CPU Disk WAN- (kSI2K) (TB) (MB)			
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# Planning, Reporting, Monitoring

- Quarterly Progress Report
- Reviewed by Planning Officer and assessors
  - summary report for Management Board and Overview Board



**LHC Computing Grid Project**  
**Quarterly Status & Progress Report**  
 2005 Q4 – Executive Summary

Alberto Aimer  
 Les Robertson  
 7 March 2006

### 1 Introduction

This is the first of the LCG quarterly reports using the new format, including the Tier-1 content, and emphasizing the progress in comparison with the detailed medium term planning. The format of the report was designed to make it easy to be completed by the sites, experiments and projects, but in practice many of the contributions were late and the analysis phase was also delayed. While the Christmas break and the Member CHIP no doubt contributed to the delay, we must do better next time, with a target of completing the process within 4 weeks of the end of the quarter.

The milestones in the report are as they were at the end of 2005. Changes requested in the report will be implemented before the end of March, along with significant changes to the future milestones that result from the completion of the planning for Service Challenge 4 (SC4), which has been completed during the past two months.

### 2 Level-1 Milestones


The criteria for milestone SC3-2 - *successful completion of Service Challenge 3 (SC3)*, was agreed at the GDB in October 2005 as follows:

*3 Tier-1s and 3 Tier-2s must have achieved the following targets:*

- (a) *appropriate baseline services operational*
- (b) *availability better than 99%*
- (c) *success rate of standard application test jobs greater than 90% (excluding failures due to the application environment and non-availability of sites)*

By the end of SC3 all Tier-1 and around 20 Tier-2 sites were active.

The measurement framework for the last two criteria, the Site Functional Test (SFT) framework, was still being developed during SC3, and was only in operation for the BOSS grid. Using the SFT tests, by



**LHC Computing Grid Project**  
**Quarterly Status and Progress Reports**  
 2005 Q4  
 7 March 2006

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Grid Sites

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3. CERN.....	9
4. FZK.....	11
5. INFN.....	13
.....	12



## More information on the collaboration

### Boards and Committees

All boards except the  
OB have open access to  
agendas, minutes,  
documents

### Planning data:

MoU Documents and  
Resource Data  
Technical Design Reports  
Phase 2 Plans  
Status and Progress Reports  
Phase 2 Resources and costs at CERN

The screenshot shows the LCG website interface. The browser address bar displays <http://www.cern.ch/lcg>. The main navigation bar includes links for [LCG home](#), [Calendar](#), [Meetings](#), and [Contact Us](#). The 'Project Structure' menu is expanded, showing 'Boards' (CRRB, MB, CB, OB, GDB) and 'Committees' (LHCC, Architects Forum, SC2). The 'Project Planning' section is also visible, containing links for Documents, Dissemination, and Related Projects. The 'Activities' section lists various tasks such as Distributed Analysis (ARDA), Grid Deployment, LCG Middleware, Security, Service Challenges, Physics Application Software, and LCG Optical Private Network. The 'LCG Users' section provides links for User Registration, User Support, and Experiments Integration Support. The 'LCG Sites' section includes links for Getting Started, Software Releases, Site Guides and FAQ, and Site Security. The 'LCG Operations' section lists Monitoring, Core Infrastructure Center, Regional Centers, and Security Incidents. The footer features the 'LCG news' logo.



# Applications Support

- good progress on the merge of the ROOT and SEAL packages
- first release of the re-engineered common relational database interface package (CORAL)
- at end 2005 major releases of ROOT and Geant4
- all products now in production use by experiments

## Persistency Framework

POOL

Conditions Database

## Core libraries and services - ROOT

analysis framework

components for experiment frameworks

maths library

dictionary, ..

## Simulation

Simulation framework

GEANT4

Fluka

Physics validation

Garfield

MC generator services

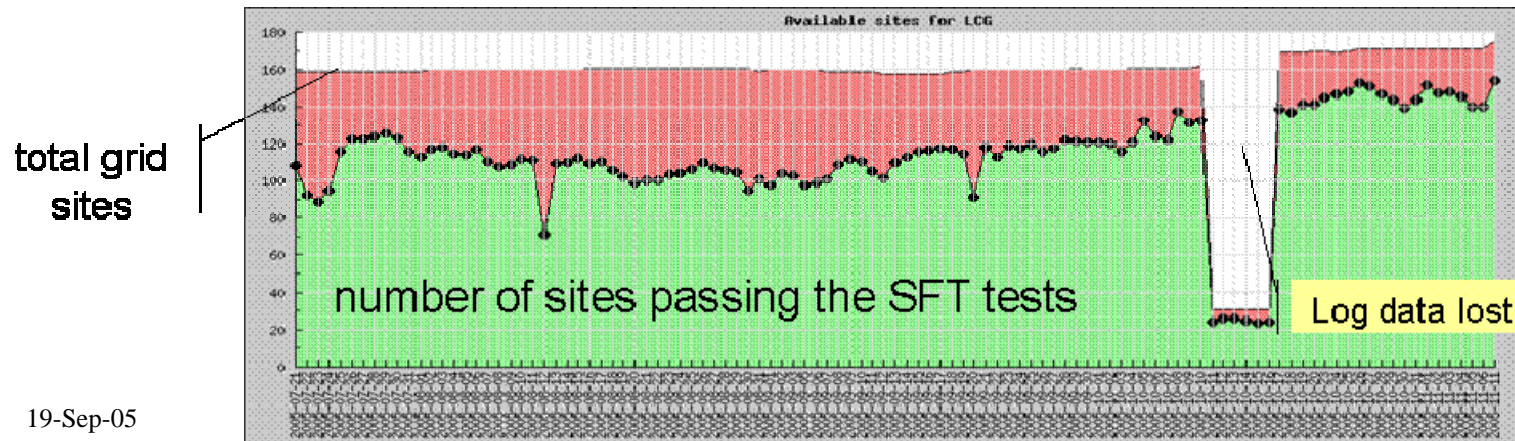
## Software Process & Infrastructure



## Service Challenge 3 (SC3)

- Continuous service September-December 2005
- Over 30 centres active, including all Tier-1s
- Experience during SC3 led to improved reliability and performance
  - Improved middleware reliability
  - Better software testing and distribution
  - Pro-active grid operations process
  - Improved site operation

Overall reliability target for SC3 achieved though still far from the level required for LHC operation

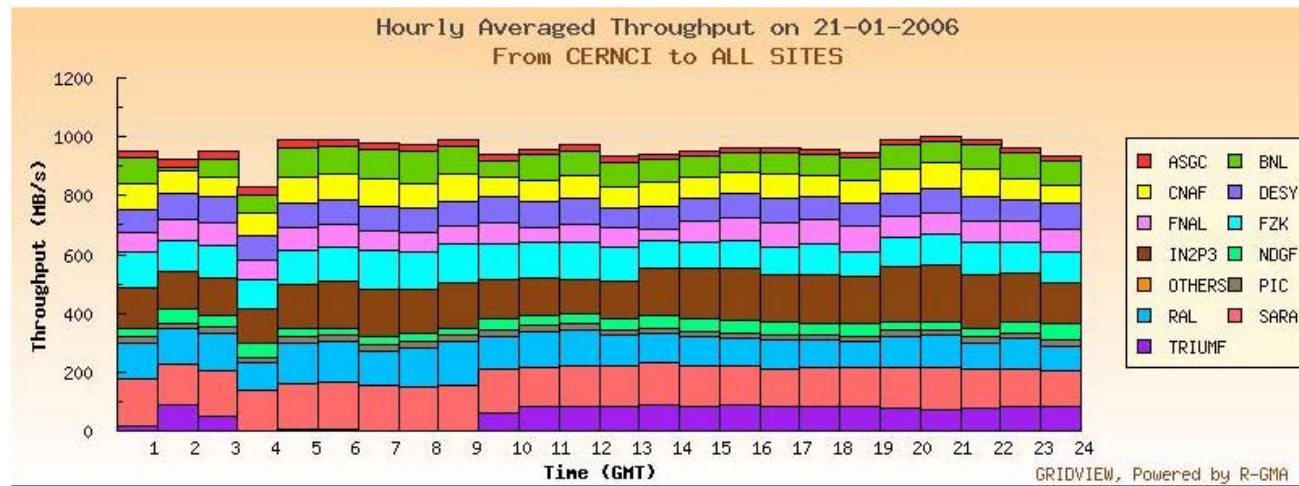
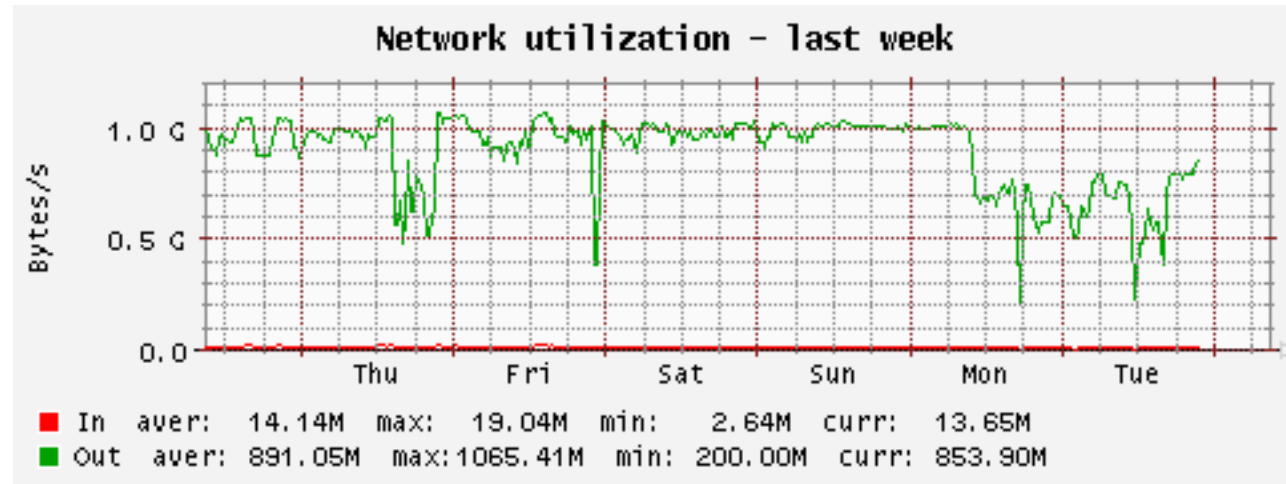


**All EGEE sites,  
not only SC3  
participants  
(no OSG sites)**



# Service Challenge 3 Throughput Tests January 2006

- Distribution of data from CERN to Tier-1s
- Target
  - all Tier-1s
  - 1 GB/sec
- *Nominal/LHC* rate in 2008 is 1.6 GB/sec
- Previous attempt in July 2005 achieved only 600 MB/sec



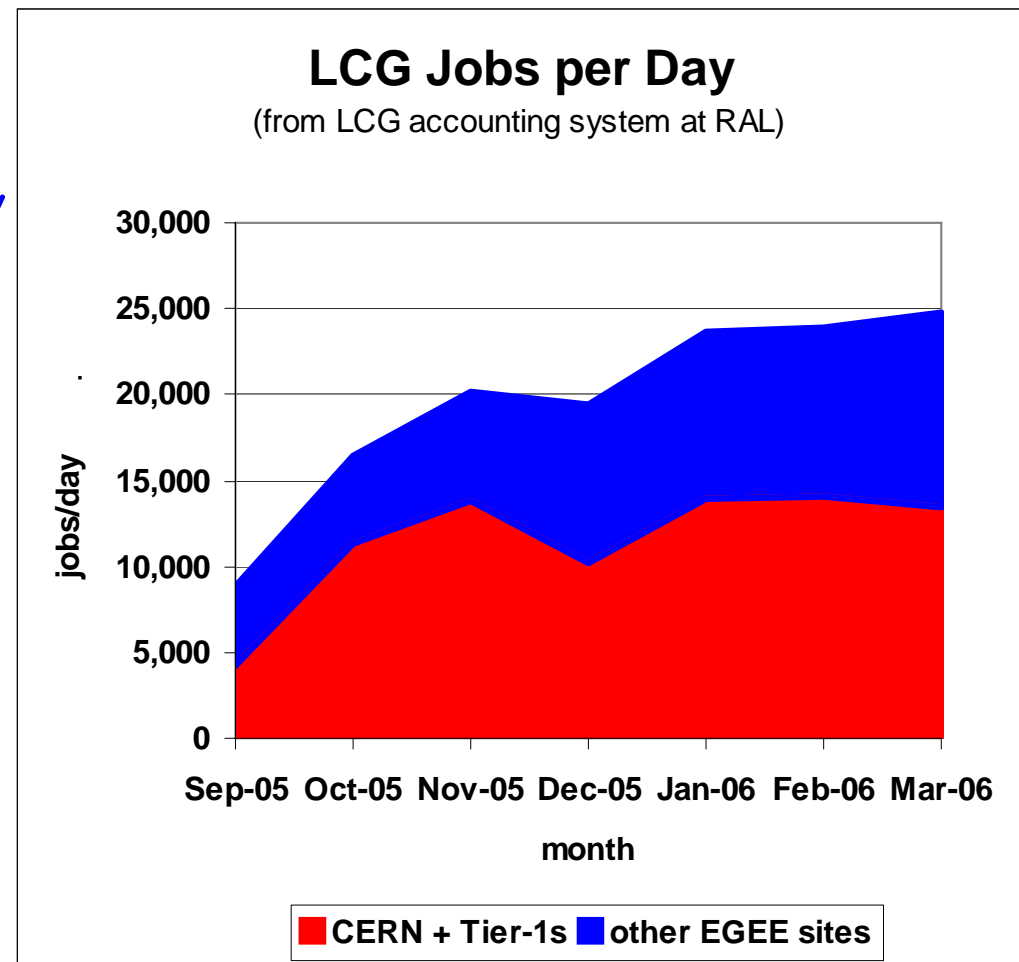
(OTHERS: Sites giving throughput less than 5% of max, [click here for names](#))





# Production Grids for LHC what has been achieved

- Basic middleware
- A set of *baseline services* agreed and initial versions in production
- All major LCG sites active
- Sustained > 20K LCG jobs/day
- > 10K *simultaneous* jobs during prolonged periods on the EGEE grid
- 1 GB/sec T0→T1s data rate  
mass storage to mass storage,  
> 50% of the nominal  
LHC data rate





# CERN Data Recording Challenge

- Run during Christmas shutdown (to get access to tape equipment)
- Generated data written to magnetic tape through CASTOR mass storage system
- Configuration:
  - 34 CPU data sources, 46 disk servers (~230 TB)
  - 18 tape drives (3 different types of drive, 2 different robots)



**Achieved:**

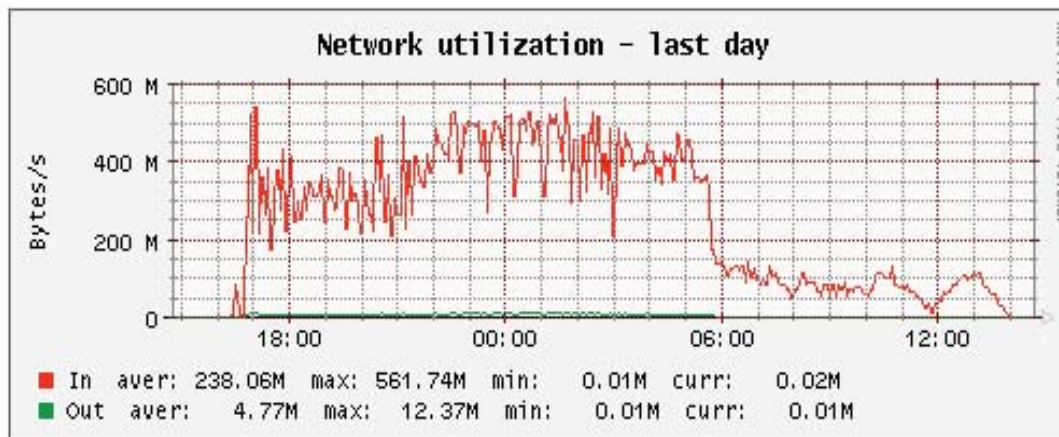
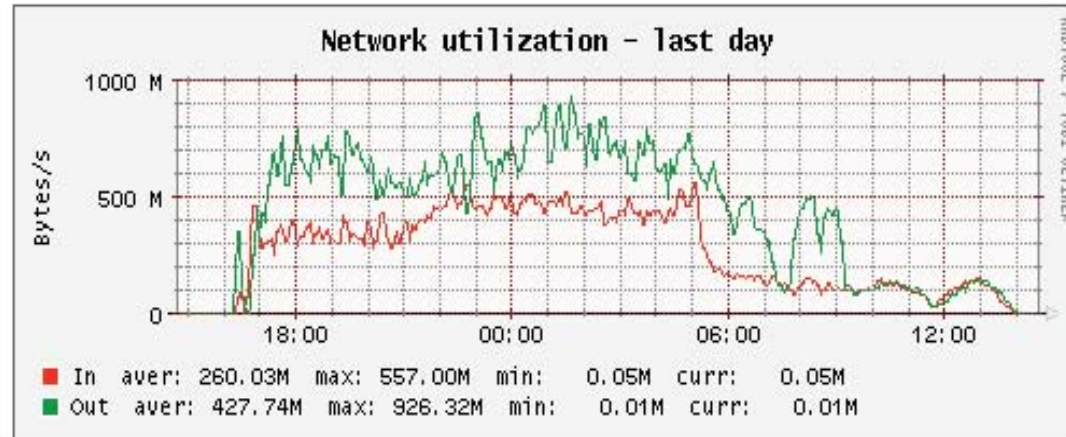
→ stable running for  $\geq$  one week at 950 MB/s  
(target was 750 MB/sec)

# ATLAS Tier-0 "internal" data transfers



**Disk to WN (340 MB/s)**  
**Disk to Tape (440 MB/s)**  
**Total (780 MB/s)**

**SFO to Disk (320 MB/s)**  
**WN to Disk (140 MB/s)**  
**Total (460 MB/s)**



**Disk to Tape**

**Nominal rates were reached and held for >24 hours;**

**Tier-0 only - no distribution of data to Tier-1s**

ATLAS Tier-0 Team



## Service Challenge 4 (SC4) the Pilot LHC Service from June 2006

A stable service on which experiments can make a full demonstration of experiment offline chain

- DAQ → Tier-0 → Tier-1  
data recording, calibration, reconstruction
- Offline analysis - Tier-1 ↔ Tier-2 data exchange  
simulation, batch and end-user analysis

And sites can test their operational readiness

- LCG services -- monitoring → reliability
- Grid services
- Mass storage services, including magnetic tape

Extension to most Tier-2 sites

Target for service by end September -

- Service metrics → 90% of MoU service levels
- Data distribution from CERN to tape at Tier-1s at nominal LHC rates



# Status of SC4

Guidelines & principles -

agreed with experiments and MB in January

- Realistic expectations - realistically achievable goals

Final planning workshop in February -

3 days in Mumbai prior to CHEP

- 150 people attended - regional centres, experiments, developers
- Storage management, service issues
- Experiment computing model implications at Tier-1s
- conclusions and agreements endorsed by the MB - 7 March

SC4 is an evolution of SC3 rather than lots of new functionality

Current status

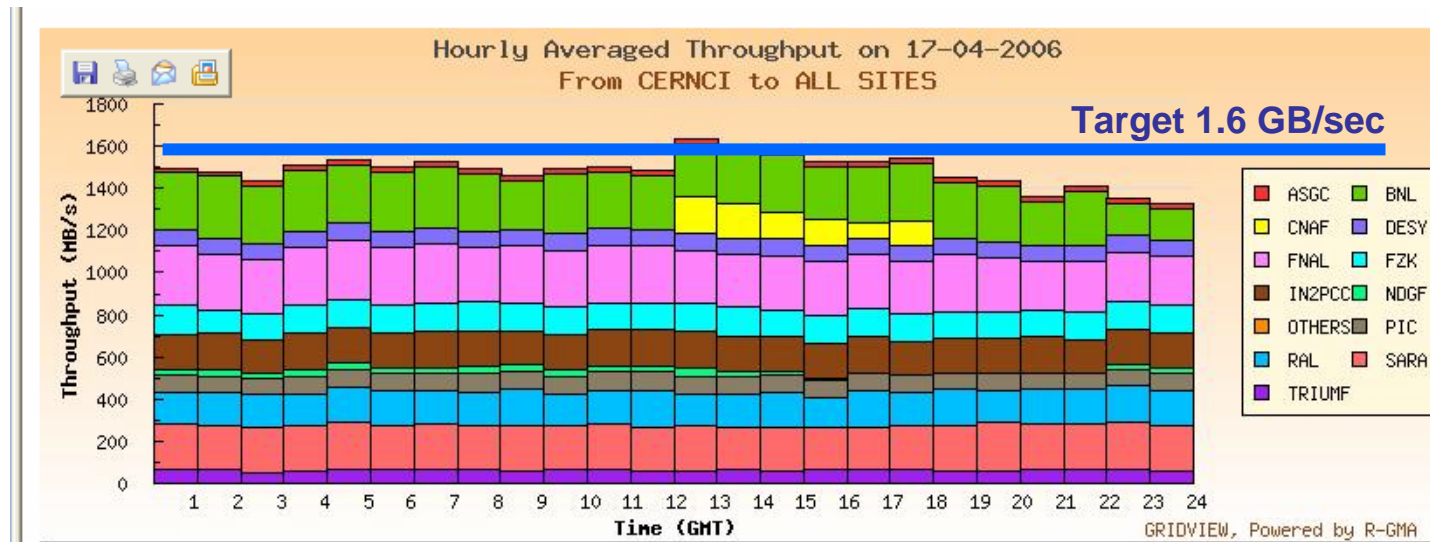
- Delays in integrating and testing the middleware distribution package
- Discussing options to maintain the 1 June date for opening the service



# Data distribution tests in SC4

Ongoing work

- Target 1.6 GB/sec aggregate throughput from CERN to Tier-1s
- Results so far - (compare with 1 GB/sec in January)
  - Target achieved for short periods
  - 80% average during one week
  - 6 Tier-1s achieved their individual targets

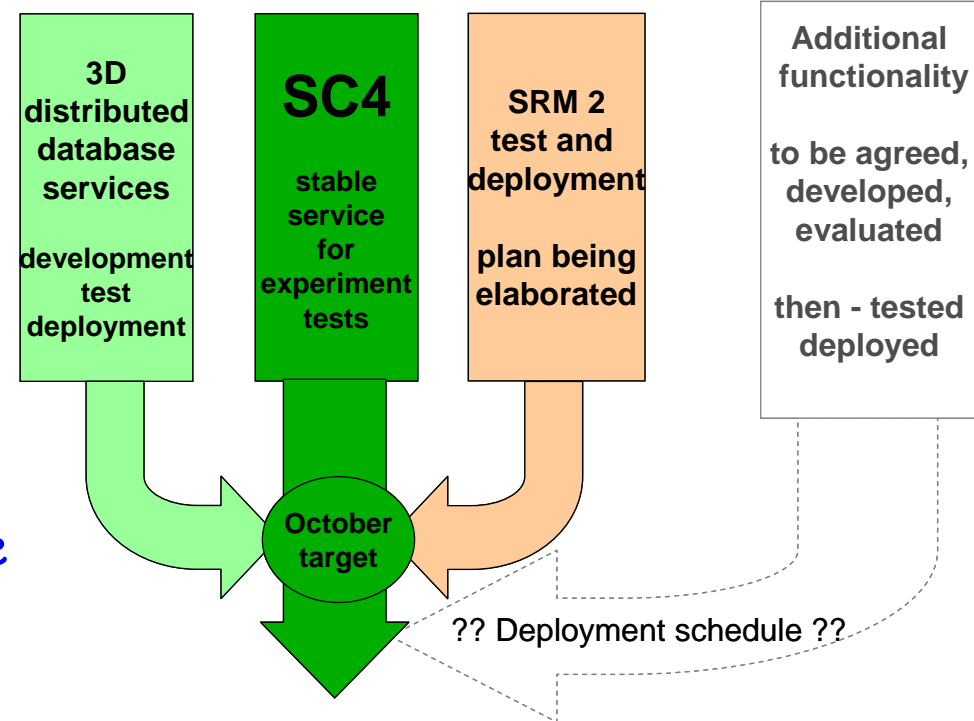




# Medium Term Schedule

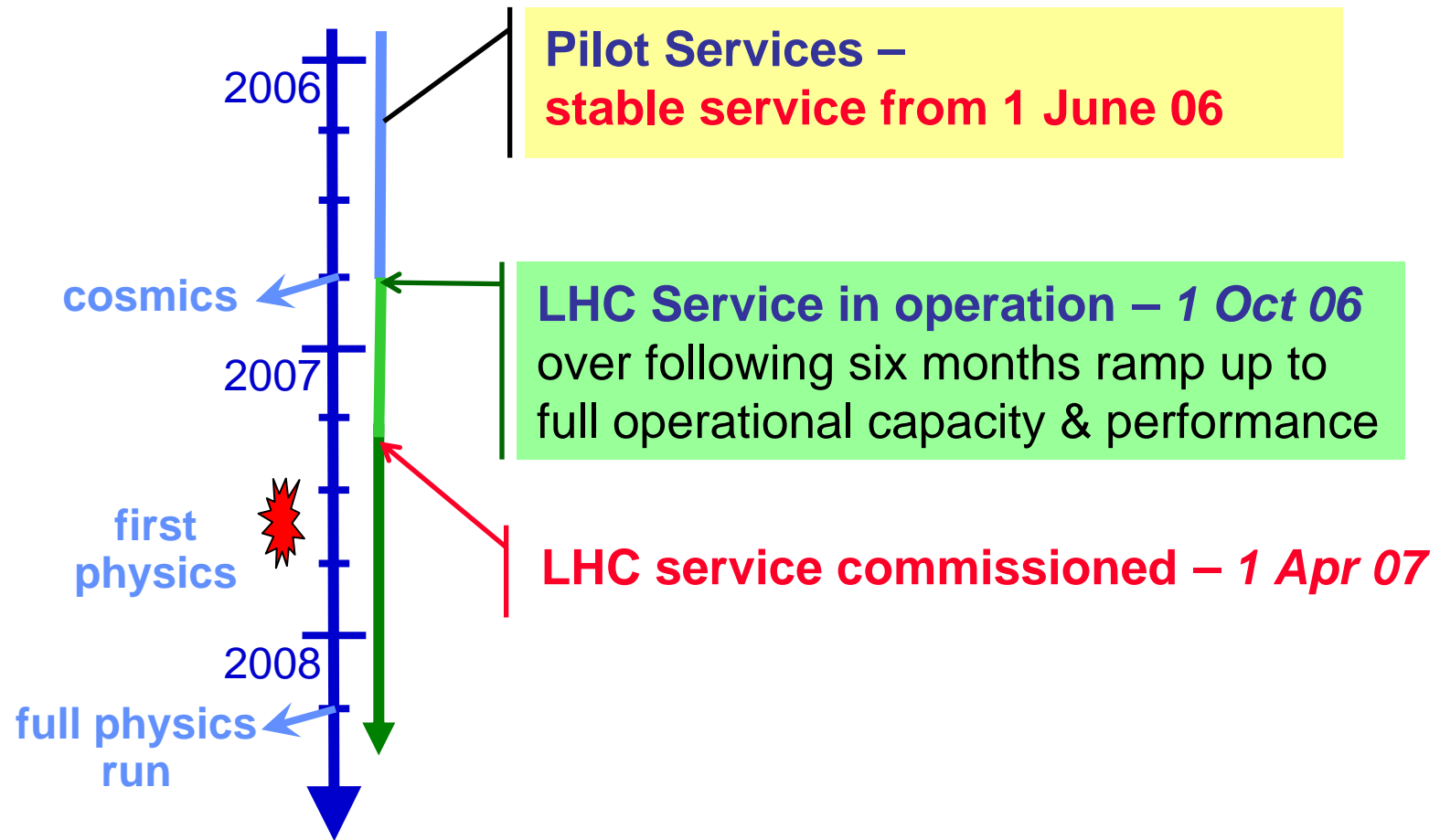
In parallel with SC4, two other important services are being set up

- Development and deployment of distributed database services (3D project)
- Testing and deployment of new mass storage services (SRM 2.1)
- Target is to bring all of these together in October





# LCG Service Deadlines



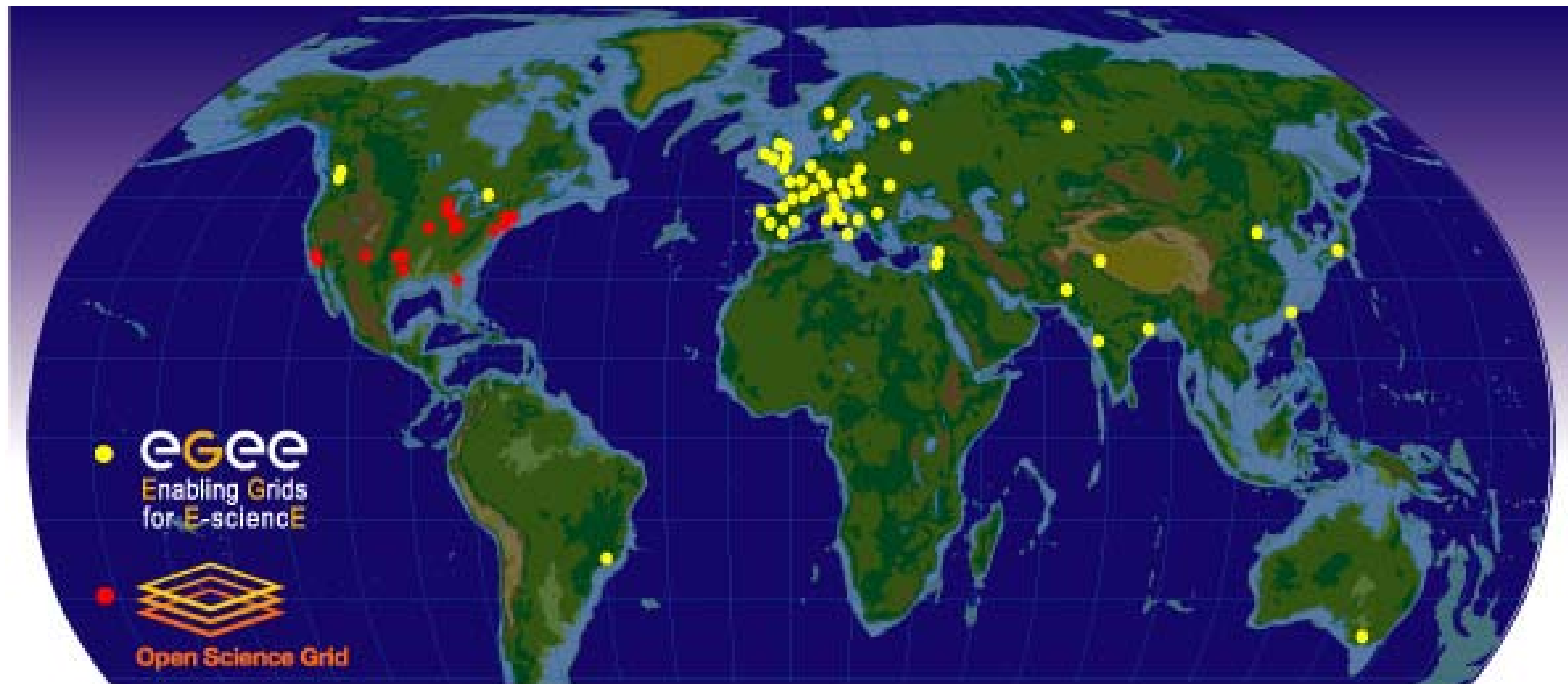




LCG depends on long term funding of two major science grid infrastructures to provide the basic operational environment

**EGEE** - Enabling Grids for E-Science

**OSG** - US Open Science Grid



*A map of the worldwide LCG infrastructure operated by EGEE and OSG.*



# Summary

- Grids are now operational
  - ~200 sites between EGEE and OSG
  - Grid operations centres running for well over a year
  - > 20K LCG jobs per day accounted

## **BUT – a long way to go on reliability**

- Data recording and Tier-0 testing at CERN on target
- Data distribution from CERN to Tier-1s close to the nominal rates required for LHC operation
  - Still have to push rates up to full target, achieve continuous operation at these levels, and include recording to tape at the Tier-1s.
- Next 6 months – Service Challenge 4 – will be crucial
  - Stable environment for experiments – including Tier-2s
  - Final test phase for sites to validate their operation