



Enabling Grids for  
E-science in Europe

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# Overview of data challenges

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# HEP applications and data challenges using LCG-2

- All have the same pattern of event simulation, reconstruction and analysis in production mode (as distinct from 'chaotic')
- All are testing their running models using Tier-0/1/2 with different levels of ambition
  - **Analysis to come with ARDA**
- ALICE and CMS started around February
- LHCb in May
- ATLAS just getting going
- D0 also making some use of LCG
- **Next slides give a broad overview of work done and 'results'**
  - This work will be the basis of 'production' reports for end of year deliverable reporting on production HEP use of LCG/EGEE
- **Regular reports in LCG GDB and PEB**
  - see reports of June 14 at LCG/GDB
  - <http://agenda.cern.ch/fullAgenda.php?ida=a04114>
- **All are happy about LCG user-support 'attitude' – very cooperative**

# ALICE PDC 2004: 3 Stages

- **Phase 1:** Production of RAW + Shipment to CERN
  - 1a: Central events (long jobs, large files)
  - 1b: Peripheral events (short jobs, smaller files)
- **Phase 2:** Merging + Reconstruction in all T1's
  - Events are redistributed to remote sites before merging and reconstruction
- **Phase 3:** Distributed Analysis
  - Towards the ARDA prototype

## ALICE data challenge Phase-1(combining use of LCG-2, Alien, INFN-Grid)

- AliEn
  - Tools OK for DC running and resources control
  - DM was working well (providing that underlying MSS systems work well)
  - File catalogue worked well, 4M entries and no noticeable performance degradation
- LCG-2
  - provided resources for about 20% of events
  - But required continuous efforts and interventions (ALICE and LCG)
  - Some instabilities came from the LCG-RB and/or its local configurations
  - The LCG-SE is still very “fluid”, so we may expect instabilities
  - LCG needed to be strongly “prompted” for resources
  - MonALISA is valuable for monitoring, GridICE is more opaque
- AliEn as meta-grid works well, across three grids, and this is a success in itself

**Characteristics of CMS Data Challenge DC04 (just completed).....run with LCG-2 and CMS resources world-wide ( US Grid3 was a major component)**

- **Data Challenge (Phase 2)**
  - **Ran the full data reconstruction and distribution chain at 25 Hz**
  - **Achieved**
    - 2,200 jobs/day (about 500 CPU's) running at Tier-0
    - Total 45,000 jobs Tier-0 and 1
    - 0.4 files/s registered to RLS (with POOL metadata)
    - Total 570,000 files registered to RLS
    - 4 MB/s produced and distributed to each Tier-1

# CMS Data Challenge

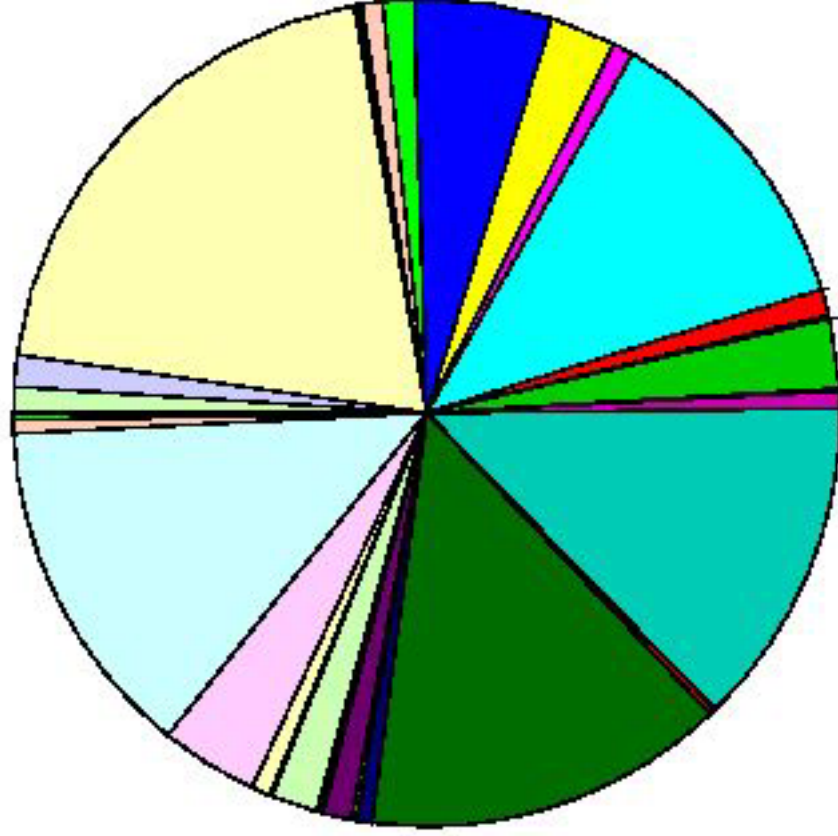
- ❖ Aspects of DC04 involving LCG-2 components
  - ◆ register all data and metadata to a world-readable catalogue
    - **RLS**
  - ◆ transfer the reconstructed data from Tier-0 to Tier-1 centers
    - **Data transfer between LCG-2 Storage Elements**
  - ◆ analyze the reconstructed data at the Tier-1's as data arrive
    - **Real-Time Analysis with Resource Broker on LCG-2 sites**
    - publicize to the community the data produced at Tier-1's
      - **Not done, but straightforward using the usual Replica Manager tools**
  - ◆ end-user analysis at the Tier-2's (not really a DC04 milestone)
    - **first attempts**
  - ◆ monitor and archive resource and process information
    - **GridICE**
- Full chain (except Tier-0 reconstruction) could be performed in LCG-2
- Issues involving use of RLS (metadata, bulk operations etc.) being analysed

# LHCb Production Snapshot



Grids for  
Europe

Total Running Jobs: 2980  
DIRAC: 63% LCG: 37%



Jun 14 2004, 12:20

DIRAC.Barcelona.es	1.006%
DIRAC.Bologna.it	1.241%
DIRAC.CERN.ch	19.93%
DIRAC.CracowAgu.pl	0.167%
DIRAC.IF-UFRJ.br	0.134%
DIRAC.IHEP-Protvino.ru	0.805%
DIRAC.IHEP2-Protvino.ru	1.208%
DIRAC.ITEP-Moscow.ru	5.402%
DIRAC.Imperial.uk	2.583%
DIRAC.JINR-Dubna.ru	0.805%
DIRAC.Karlsruhe.de	11.87%
DIRAC.LHCBNLINE.ch	1.040%
DIRAC.Liverpool.uk	0.134%
DIRAC.Lyon.fr	2.718%
DIRAC.Manno.ch	0.067%
DIRAC.Oxford.uk	0.033%
DIRAC.Santiago.es	0.671%
DIRAC.ScotGrid.uk	12.88%
DIRAC.Zurich.ch	0.268%
LOG.CERN.ch	14.12%
LOG.CNAF.it	0.604%
LOG.Cambridge.uk	0.201%
LOG.Imperial.uk	1.107%
LOG.Krakow.pl	0.134%
LOG.Legnaro.it	0.134%
LOG.Milano.it	1.812%
LOG.NCU.tw	0.100%
LOG.NIKHEF.nl	0.738%
LOG.PIC.es	3.825%
LOG.RAL.uk	13.42%
LOG.Torino.it	0.536%
LOG.Triumf.ca	0.201%
LOG.USC.es	0.067%

## LHCb LCG Production experience

- invaluable central LCG support
- No major problems with LCG
  - Very few jobs failing due to LCG problem
- **File Transfers !** - problems transfer with BBFTP, SFTP, GridFTP (not just a LCG problem)
  - This has led to many failed jobs
- Debugging problems is very time consuming and difficult
  - Lack of returned info & need to involve local LCG ops.



# ATLAS DC2: goals

- The goals include:
  - Full use of Geant4; POOL; LCG applications
  - Pile-up and digitization in Athena
  - Deployment of the complete Event Data Model and the Detector Description
  - Simulation of full ATLAS and 2004 combined Testbeam
  - Test the calibration and alignment procedures
  - Large scale physics analysis
  - Computing model studies (document end 2004)
  - **Use widely the GRID middleware and tools**
  - **Run as much as possible of the production on Grids**
  - **Demonstrate use of multiple grids**

# “Tiers” in ATLAS DC2 (rough estimate)



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Country	“Tier-1”	Sites	Grid	KS12K
Australia			NG	12
Austria			LCG	7
Canada	TRIUMF	7	LCG	331
CERN	CERN	1	LCG	<b>700</b>
China				30
Czech Republic			LCG	25
France	CCIN2P3	1	<b>LCG</b>	<b>~ 140</b>
Germany	GridKa	3	LCG	90
Greece			LCG	10
Israel		2	LCG	23
Italy	CNAF	5	LCG	200
Japan	Tokyo	1	LCG	127
Netherlands	NIKHEF	1	LCG	75
NorduGrid	NG	~30	<b>NG</b>	380
Poland			LCG	80
Russia			LCG	~ 70
Slovakia			LCG	
Slovenia			NG	
Spain	PIC	4	LCG	50
Switzerland			LCG	18
Taiwan	ASTW	1	LCG	78
UK	RAL	8	LCG	~ 1000
US	BNL	28	<b>Grid3/LCG</b>	~ 1000
<b>Total</b>				<b>~ 4500</b>

# Conclusions

- All experiments making positive use of LCG-2 – stability has steadily improved
- Some issues
  - *Mass Storage (SRM) (see ALICE comments)*
  - *Debugging is hard when problems arise*
  - *Flexible s/w installation for analysis still being developed*
  - *File transfer stability (see LHCb comments)*
  - *RLS performance issues (see CMS experience regarding metadata)*
- We are learning...data challenges continuing
- Experiments using multi-grids
- Looking to ARDA for user analysis