Expt SC3 Status

Nick Brook

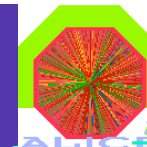In chronological order:

ALICE

CMS

LHCb

ATLAS

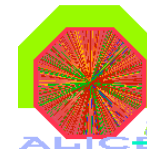# Alice Physics Data Challenge '05 - goals

- PDC'05 : Test and validation of the remaining parts of the ALICE Offline computing model:
  - Quasi-online reconstruction of RAW data at CERN (T0), without calibration
  - Synchronised data replication from CERN to T1's
  - Synchronised data replication from T2's to their 'host' T1
  - Second phase (delayed) reconstruction at T1's **with calibration** and remote storage
  - Data analysis

- Data production:
  - List of physics signals defined by the ALICE Physics Working Groups
  - Data used for detector and physics studies
  - Approximately 500K Pb+Pb events with different physics content, 1M p+p events, 80TB production data and few TB user generated data
  - Structure – divided in three phases:
  - Phase 1 – Production of events on the GRID, storage at CERN and at T2s.
  - Phase 2 (synchronized with SC3) – Pass 1 reconstruction at CERN, push data from CERN to T1's, Pass 2 reconstruction at T1s with calibration and storage:
    - Phase 2 (throughput phase of SC3) – how fast we can push data out
  - Phase 3 – Analysis of data (batch) and **interactive analysis with PROOF**
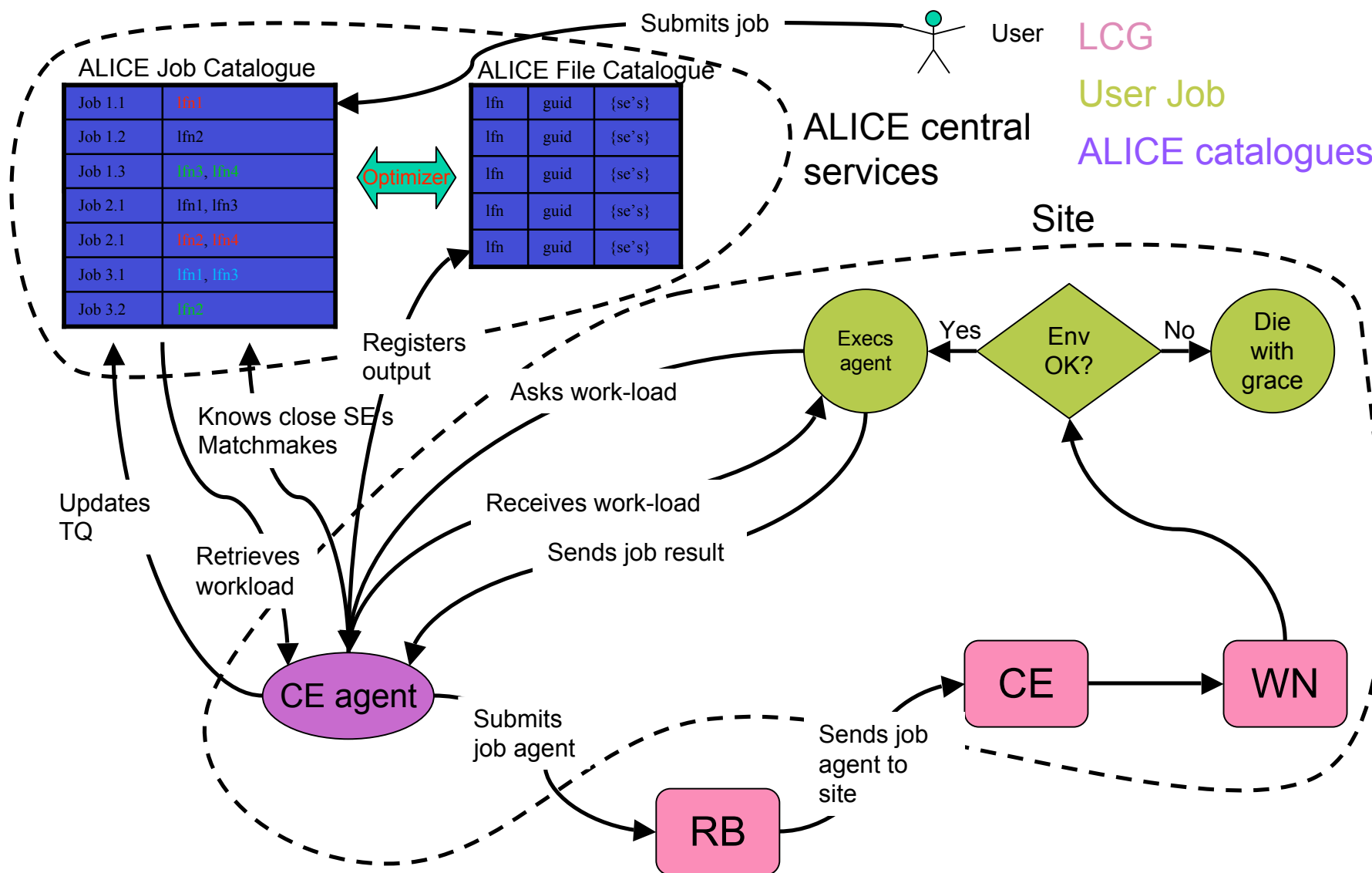
Methods of operation
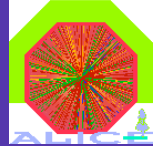
- Use LCG/EGEE SC3 baseline services:
  - Workload management
  - Reliable file transfer (FTS)
  - Local File Catalogue (LFC)
  - Storage (SRM), CASTOR2
- Production and data replication phases are synchronised with LCG/EGEE SC3
- Operation of PDC'05/SC3 coordinated through ALICE-LCG Task Force
- Run entirely on LCG resources:
  - Use the framework of VO-boxes provided at the sites
- Require approximately 1400 CPUs (but would like to have as much as possible) and 80 TB of storage capacity
- List of active SC3 sites for ALICE:
  - T1's: CCIN2P3, CERN, CNAF, GridKa (up to few hundred CPUs)
  - T2's: Bari, Catania, GSI, JINR, ITEP, Torino (up to hundred CPUs)
  - US (OSG), Nordic (NDGF) and a number of other sites joining the exercise presently
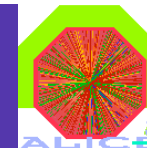 - SC3 + others – approximately 25 centres

Job submission

Submits job — User

VO-Box
LCG
User Job
ALICE catalogues

ALICE central services

ALICE Job Catalogue

Job 1.1	lfn1
Job 1.2	lfn2
Job 1.3	lfn3, lfn4
Job 2.1	lfn1, lfn3
Job 2.1	lfn2, lfn4
Job 3.1	lfn1, lfn3
Job 3.2	lfn2

Optimizer

ALICE File Catalogue

lfn	guid	{se's}
lfn	guid	{se's}
lfn	guid	{se's}
lfn	guid	{se's}
lfn	guid	{se's}

Site

Registers output

Knows close SE's
Matchmakes

Asks work-load

Execs agent

Yes — Env OK? — No — Die with grace

Updates TQ

Retrieves workload

Receives work-load

Sends job result

CE agent

Submits job agent

Sends job agent to site

CE → WN

RB

Status of production

- Setup and operational status of VO-boxes framework:
  - Gained very good experience during the installation and operation
  - Interaction between the ALICE-specific agents and LCG services is robust
  - The VO-box model is scaling with the increasing load
  - In production since almost 1 ½ months
- Many thanks to the IT/GD group for the help with the installation and operation
- And to the site administrators for making the VO-boxes available
- Setup and status of storage:
  - ALICE is now completely migrated to CASTOR2@CERN
  - Currently stored 200K files (Root ZIP archives), 20TB, adding ~4K files/day
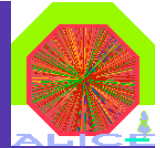- Operational issues discussed regularly with IT/FIO group, ALICE is providing feedback

Status of production
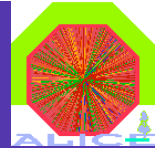
- ## Current Job status:
  - Production job duration: 8 ½ hours on 1KSi2K CPU, output archive size: 1 GB (consists of 20 files); Total CPU work: 80 MSi2K hours; Total storage: 20 TB

Running Jobs

Last 24 hours of operation

ALICE plans:

- File replication with FTS:
  - FTS endpoints tested at all ALICE SC3 sites
  - Start data migration in about 10 days, initially T0->T1
  - Test, if possible, migration Tx->Ty
- Re-processing of data with calibration at T0/T1:
  - AliRoot framework ready, currently calibration and alignment algorithms implemented by the ALICE detector experts
  - Aiming for GRID tests at the end of 2005
- Analysis of produced data:
  - Analysis framework developed by ARDA
  - Aiming at first controlled tests beginning of 2006

SC3 Aims

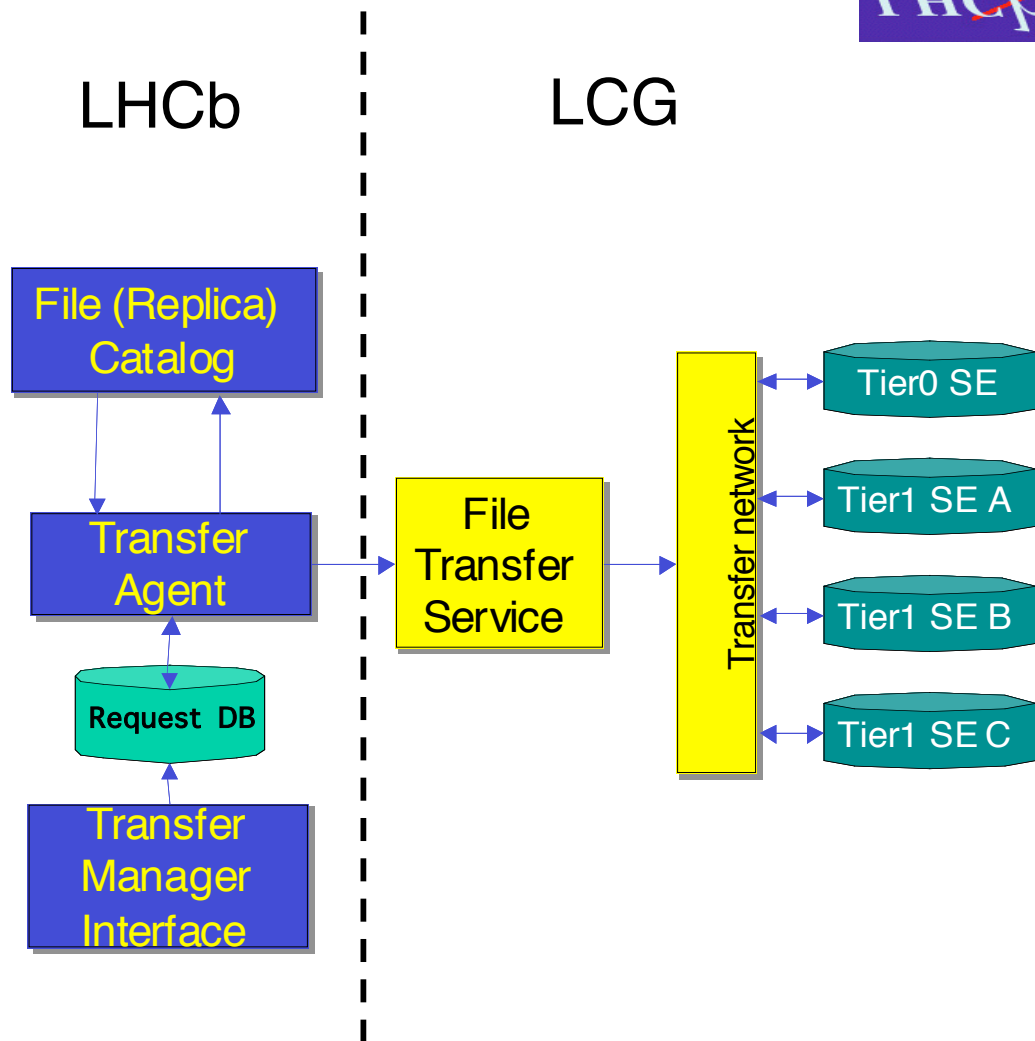- ## Phase 1: (Data Moving)
  - Demonstrate Data Management to meet the requirements of the Computing Model
  - Planned: October-November
- ## Phase 2: (Data Processing)
  - Demonstrate the full data processing sequence in real time
  - Demonstrate full integration of the Data and Workload Management subsystems
  - Planned: mid-November + December

Currently still in Phase 1 - Phase 2 to start soon

LHCb Architecture for using FTS

LHCb   LCG

- Central Data Movement model based at CERN.
  - FTS+TransferAgent+ RequestDB
- TransferAgent+ReqDB developed for this purpose.
- Transfer Agent run on LHCb managed lxgate class machine

File (Replica) Catalog

Transfer Agent

Request DB

Transfer Manager Interface

File Transfer Service

Transfer network

Tier0 SE

Tier1 SE A

Tier1 SE B

Tier1 SE C

DIRAC transfer agent

- Gets transfer requests from Transfer Manager
- Maintains the pending transfer queue
- Validates transfer requests
- Submits transfers to the FTS
- Follows the transfers execution, resubmits if necessary
- Sends progress reports to the monitoring system
- Updates the replica information in the File Catalog;
- Accounting for the transfers
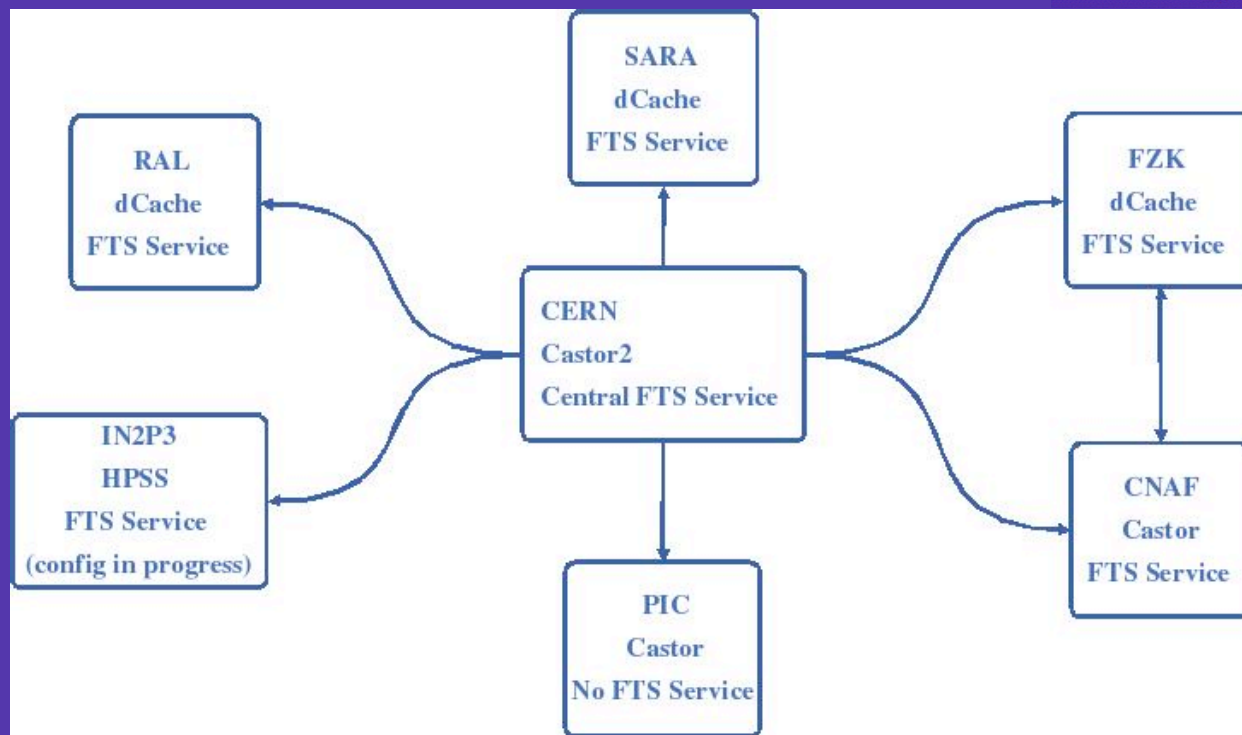 - http://fpegaes1.usc.es/dmon/DIRAC/joblist.html

Phase 1

- Distribute stripped data Tier0 →Tier1's (1-week). 1TB
  - The goal is to demonstrate the basic tools
    - Precursor activity to eventual distributed analysis
- Distribute data Tier0 → Tier1's (2-week). 8TB
  - The data are already accumulated at CERN
  - The data are moved to Tier1 centres in parallel.
  - The goal is to demonstrate automatic tools for data moving and bookkeeping and to achieve a reasonable performance of the transfer operations
- Removal of replicas (via LFN) from all Tier-1's
- Tier1 centre(s) to Tier0 and to other participating Tier1 centers
  - data are already accumulated
  - data are moved to Tier1 centres in parallel
  - Goal to meet transfer need during stripping process

Participating Sites

Tier0-Tier1 channels over dedicated network links

Bi-directional FZK-CNAF channel on open network

Tier1-Tier1 channel matrix requested from all sites - still in the process of configuration - central or expt coordination ?

SARA
dCache
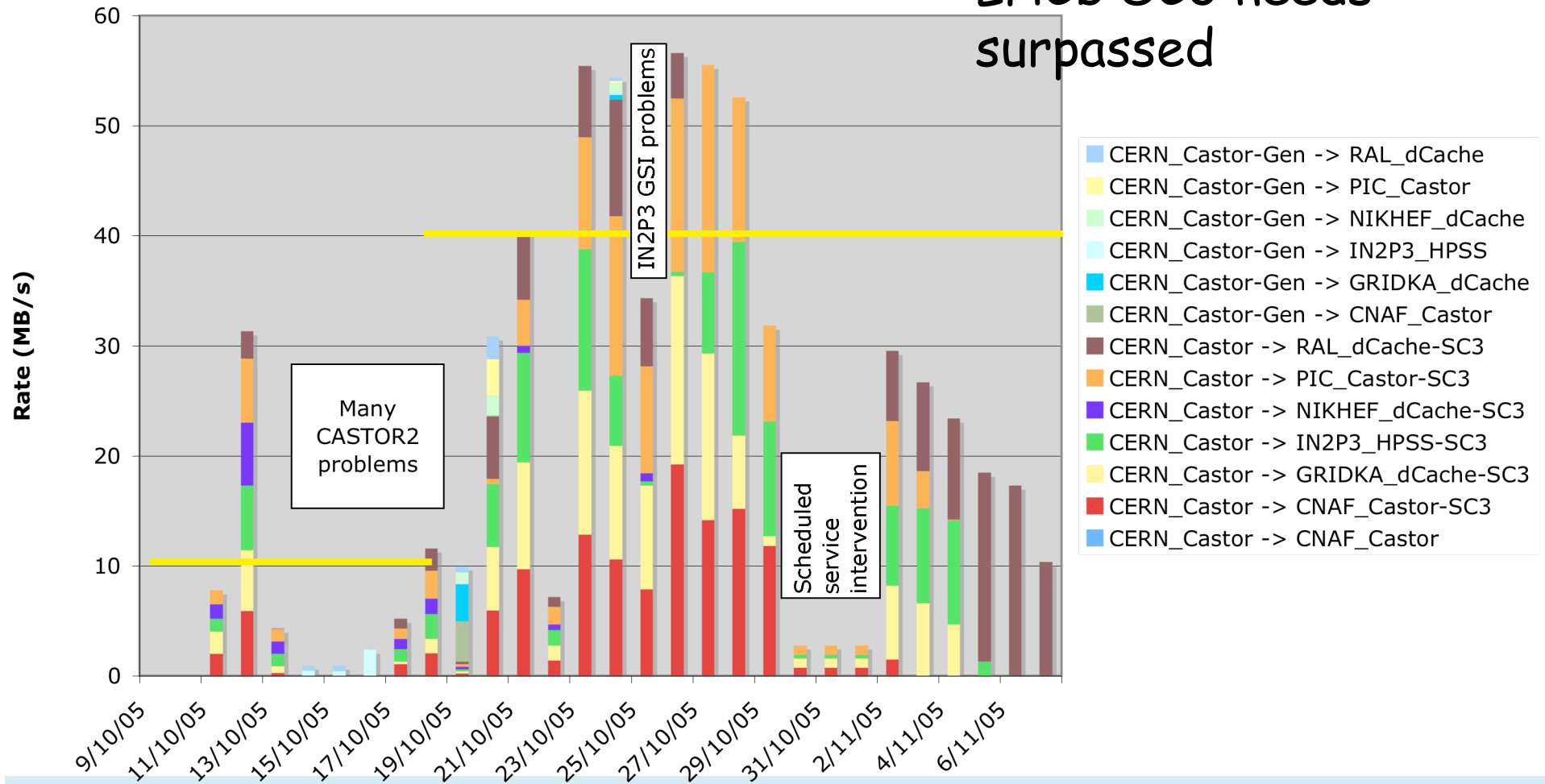FTS Service

RAL
dCache
FTS Service

FZK
dCache
FTS Service

CERN
Castor2
Central FTS Service

IN2P3
HPSS
FTS Service
(config in progress)

CNAF
Castor
FTS Service

PIC
Castor
No FTS Service

Need for central service for managing T1-T1 matrix ??

Overview of SC3 activity

SARA show almost no effective bandwidth from 25/10

When service stable - LHCb SC3 needs surpassed

LHCb SC3 Activity

Rate (MB/s)

Many CASTOR2 problems

IN2P3 GSI problems

Scheduled service intervention

Legend:
- CERN_Castor-Gen -> RAL_dCache
- CERN_Castor-Gen -> PIC_Castor
- CERN_Castor-Gen -> NIKHEF_dCache
- CERN_Castor-Gen -> IN2P3_HPSS
- CERN_Castor-Gen -> GRIDKA_dCache
- CERN_Castor-Gen -> CNAF_Castor
- CERN_Castor -> RAL_dCache-SC3
- CERN_Castor -> PIC_Castor-SC3
- CERN_Castor -> NIKHEF_dCache-SC3
- CERN_Castor -> IN2P3_HPSS-SC3
- CERN_Castor -> GRIDKA_dCache-SC3
- CERN_Castor -> CNAF_Castor-SC3
- CERN_Castor -> CNAF_Castor

Date

Problems...

FTS files per channel dramatically effects performance
- By default set to 30 concurrent files per channel
- Each file with 10 GridFTP streams
- 300 streams proved to be too much for some endpoints
  - PIC and RAL bandwidth stalled with 30 files
  - 10 files gave good throughput

Pre 19/10 many problems with Castor2/FTS interaction
- Files not staged cause FTS transfers to timeout/fail
  - Current not possible to transfer files from tape directly with FTS
  - Pre-staged files to disk - ~50k files for transfer (~75k in total: 10 TB)
- CASTOR2 too many problems to list …
  - Reliability of service increased markedly when ORACLE server machine upgraded

Problems...

srm_advisory_delete

- Inconsistent behaviour of SRM depending on "backend" implementation
  - Not well - defined functionality in SRM v1.1
- Not possible to physically delete files in consistent way on the Grid at the moment
  - dCache can "advisory delete" and re-write - can't overwrite until an "advisory delete"
  - CASTOR can simply overwrite !

FTS failure problems

- Partial transfer can't re-transfer after failure
  - FTS failed to issue an "advisory delete" after a failed transfer
  - Can't re-schedule transfer to dCache sites until an "advisory delete" issued manually

Problems…

LFC registration/query

- This is currently limiting factor in our system
  - Moving to using "sessions" - remove authentication overhead for each operation
    - Under evaluation
  - (another approach read-only insecure front-end for query operations)

The ATLAS Experiment

ATLAS SC3 goals

- Exercise ATLAS data flow

- Integration of data flow with the ATLAS Production System

- Tier-0 exercise

- Completion of a "Distributed Production" exercise
  – Has been delayed

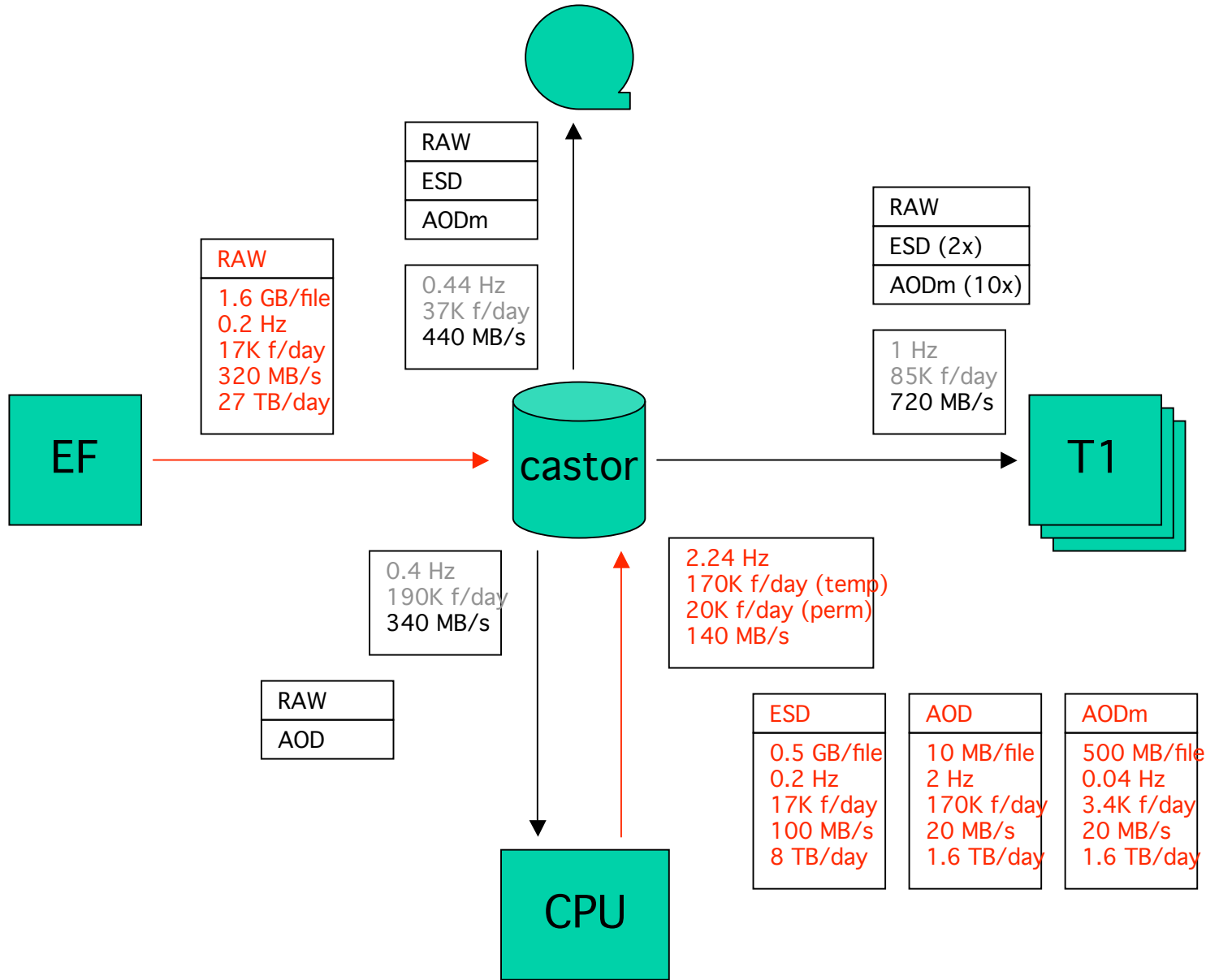**Following slides on Tier0 dataflow exercise which is running now!**

- More information:
  – https://uimon.cern.ch/twiki/bin/view/Atlas/DDMSc3

ATLAS-SC3 Tier0

- Quasi-RAW data generated at CERN and reconstruction jobs run at CERN
  - No data transferred from the pit to the computer centre
- "Raw data" and the reconstructed ESD and AOD data are replicated to Tier 1 sites using agents on the VO Boxes at each site.
- Exercising use of CERN infrastructure …
  - Castor 2, LSF
- … and the LCG Grid middleware …
  - FTS, LFC, VO Boxes
- … and expt Distributed Data Management (DDM) software

ATLAS Tier-0

RAW
ESD
AODm

0.44 Hz
37K f/day
440 MB/s

RAW
ESD (2x)
AODm (10x)

1 Hz
85K f/day
720 MB/s

RAW
1.6 GB/file
0.2 Hz
17K f/day
320 MB/s
27 TB/day

EF → **castor** → **T1**

0.4 Hz
190K f/day
340 MB/s

2.24 Hz
170K f/day (temp)
20K f/day (perm)
140 MB/s

RAW
AOD

CPU

ESD	AOD	AODm
0.5 GB/file	10 MB/file	500 MB/file
0.2 Hz	2 Hz	0.04 Hz
17K f/day	170K f/day	3.4K f/day
100 MB/s	20 MB/s	20 MB/s
8 TB/day	1.6 TB/day	1.6 TB/day

ATLAS-SC3 Tier-0

- Main goal is a 10% exercise
  - Reconstruct "10%" of the number of events ATLAS will get in 2007 using "10%" of the full resources that will be needed at that time
- Tier-0
  - ~300 kSI2k
  - "EF" to CASTOR: 32 MB/s
  - Disk to tape: 44 MB/s (32 for raw and 12 for ESD+AOD)
  - Disk to WN: 34 MB/s
  - T0 to T1: 72 MB/s
  - 3.8 TB to "tape" per day
- Tier-1 (in average):
  - ~1000 files per day
  - 0.6 TB per day
 - At a rate of ~7.2 MB/s

SC3 pre-production testing

- For 2/3 weeks up to 1st November tested the functionality of SC3 services integrated with ATLAS DDM (FTS, LFC etc..)

- Very useful to have this testing phase with pilot services since there were many problems…

  - On expt side, good test of deployment mechanism - fixed bugs & optimised

  - on sites - mainly trivial like SRM paths etc.

  - A point on mailing lists…

    - There are too many

    - For official problem reporting: lcg-sc.support@cern.ch - sometimes ticketing system doesn't work and response is slow

- Better coordination needed when deploying components to avoid conflicts (for example LCG/POOL/Castor)
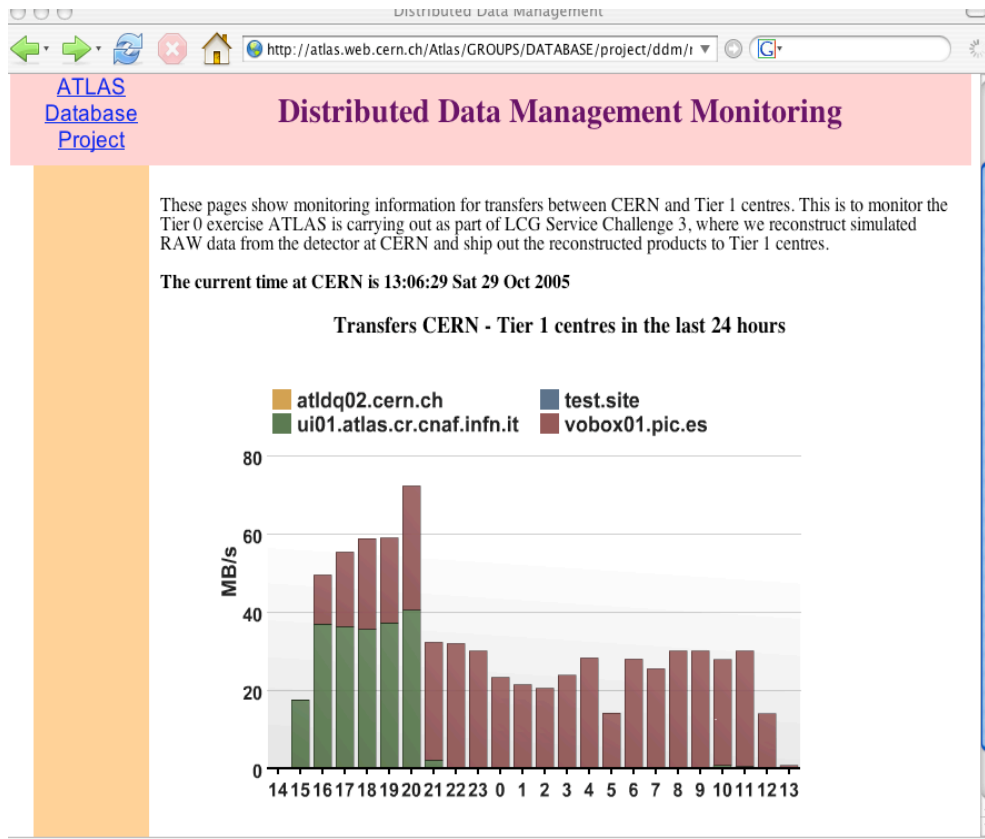
Data transfer

Data Transfer Exercise, from WNs to Castor
(Oct 27-29, 2005)
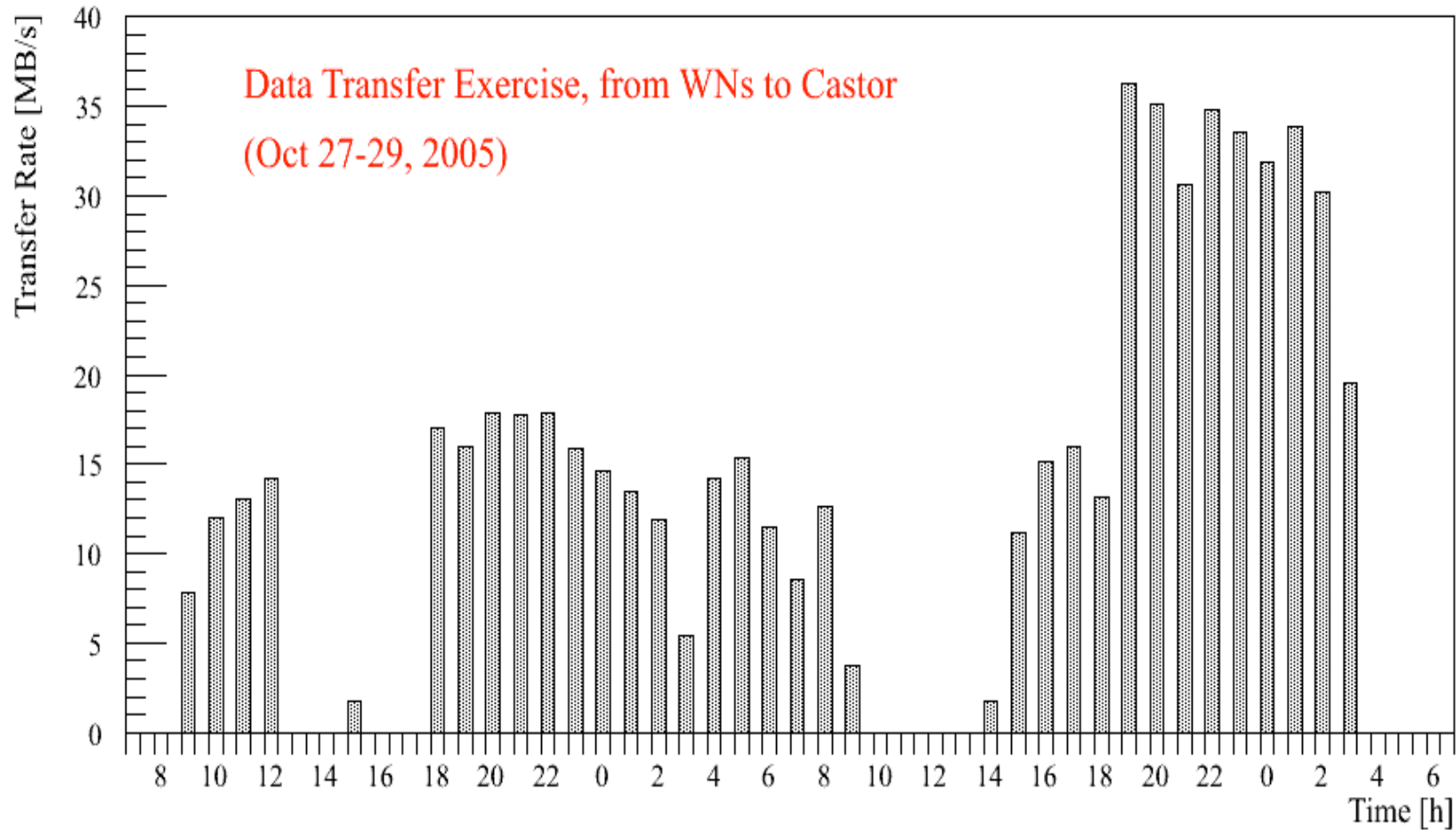
# 24h before 4 day intervention 29/10 - 1/11

We achieved quite good rate in the testing phase (sustained 20-30 MB/s to one site (PIC))

SC3 experience in 'production' phase

- Started on Wed 2nd Nov - ran smoothly for ~24h (above bandwidth target) until… problems occurred with all 3 sites simultaneously
  - CERN: power cut and network problems which then caused castor namespace problem
  - PIC: Tape library problem meant FTS channel switched off
  - CNAF: LFC client upgraded and not working properly

- It took about 1 day to solve all these problems

- No jobs running during the last weekend.
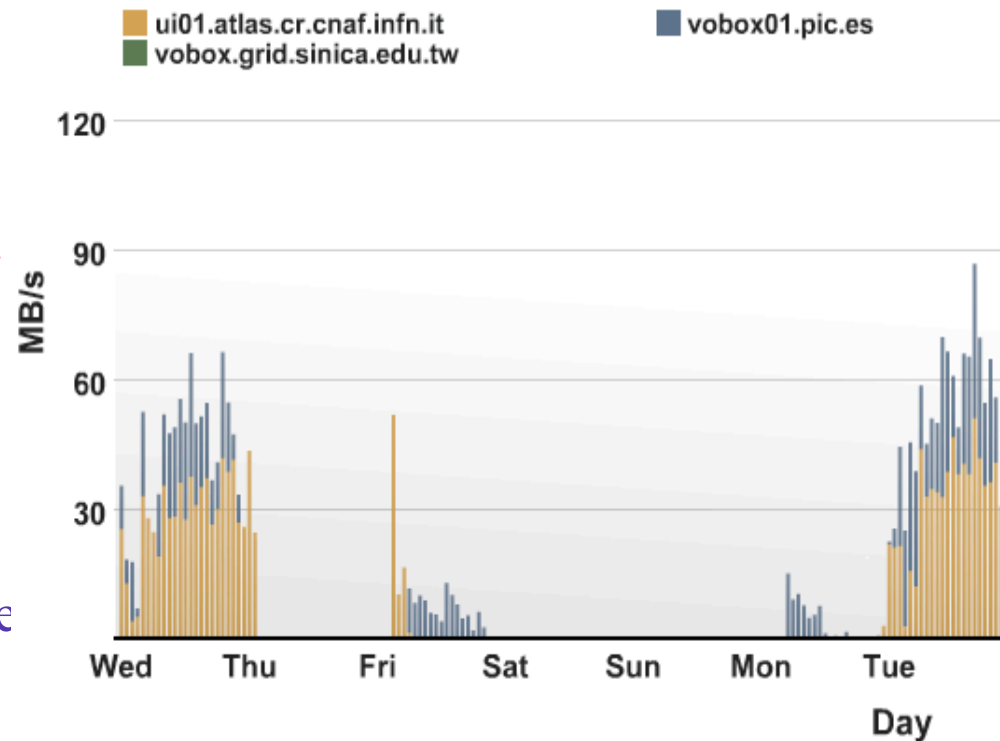
Data Distribution

- Use a generated "dataset"
  - Contains 6035 files (3 TB) and we tried to replicate it to CNAF and PIC

- PIC: 3600 files copied and registered
  - 2195 'failed replication' after 5 retries by us x 3 FTS retries
    - Problem under investigation
  - 205 'assigned' - still waiting to be copied
  - 31 'validation failed' since SE is down
  - 4 'no replicas found' LFC connection error

- CNAF: 5932 files copied and registered
  - 89 'failed replication'
  - 14 'no replicas found'

General view of SC3

- When everything is running smoothly ATLAS get good results
- The middleware (FTS, LFC) is stable but the sites' infrastructure is still very unreliable
  - ATLAS DDM software dependencies can also cause problems when sites upgrade middleware
- good response from LCG and sites when there are problems (proviso earlier email list comment)
  - But the sites are not running 24/7 support
  - Means a problem discovered at 6pm on Friday may not be answered until 9am on Monday so we lose 2 1/2 days production
- Good cooperation with CERN-IT Castor and LSF teams.
- not managed to exhaust anything production s/w; LCG m/w)
- Still far from concluding the exercise and not running stably in any way - cause for concern
- Exercise will continue adding new sites.

General Summary of SC3 experiences

Reliability seems to be the major issue:

- CASTOR2 - still ironing out problems, but big improvements in service

- Coordination issues

- Problems with sites and networks

  - MSS, security, network, services…

FTS:

- For well-defined site/channels performs well after tuning

- Timeout problems dealing with accessing data from MSS

- Clean-up problems after transfer failures

- Ability for a centralised service for 3rd party transfers

- Plenty to discuss at next week's workshop

SRM:

- Limitations/ambiguity (already flagged) in functionality