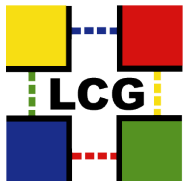


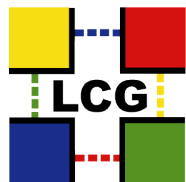
The Worldwide LHC Computing Grid

SRM 2.2 and WLCG Deployment Schedule

dCache Workshop, DESY, January 2007



Worldwide LHC Computing Grid
Distributed Production Environment for Physics data Processing



Outline

- Status of WLCG Service and Outlook for 2007
- Plans of LHC Experiments: **Now to Startup**
- **The Role of SRM v2.2 and dCache**
- WLCG Milestones for Q1 / Q2
- Conclusions
- Postscript...

LHCC Review Conclusions - Paul Dauncey

- A **lot of progress** since the last Comprehensive Review
 - Jamie Shiers: *“Despite the problems encountered – and those yet to be faced and resolved – I believe that it is correct to say we have a usable service (not a perfect one)”*
- Several **critical components** still be to deployed
 - Without disrupting services
 - With a somewhat uncertain schedule
- **Service problems** seen are amorphous and not easy to categorise
 - Many one-offs, so progress will be slow in fixing them
- The bottom line is that we **do** have a service – need to build on this and steadily improve it...

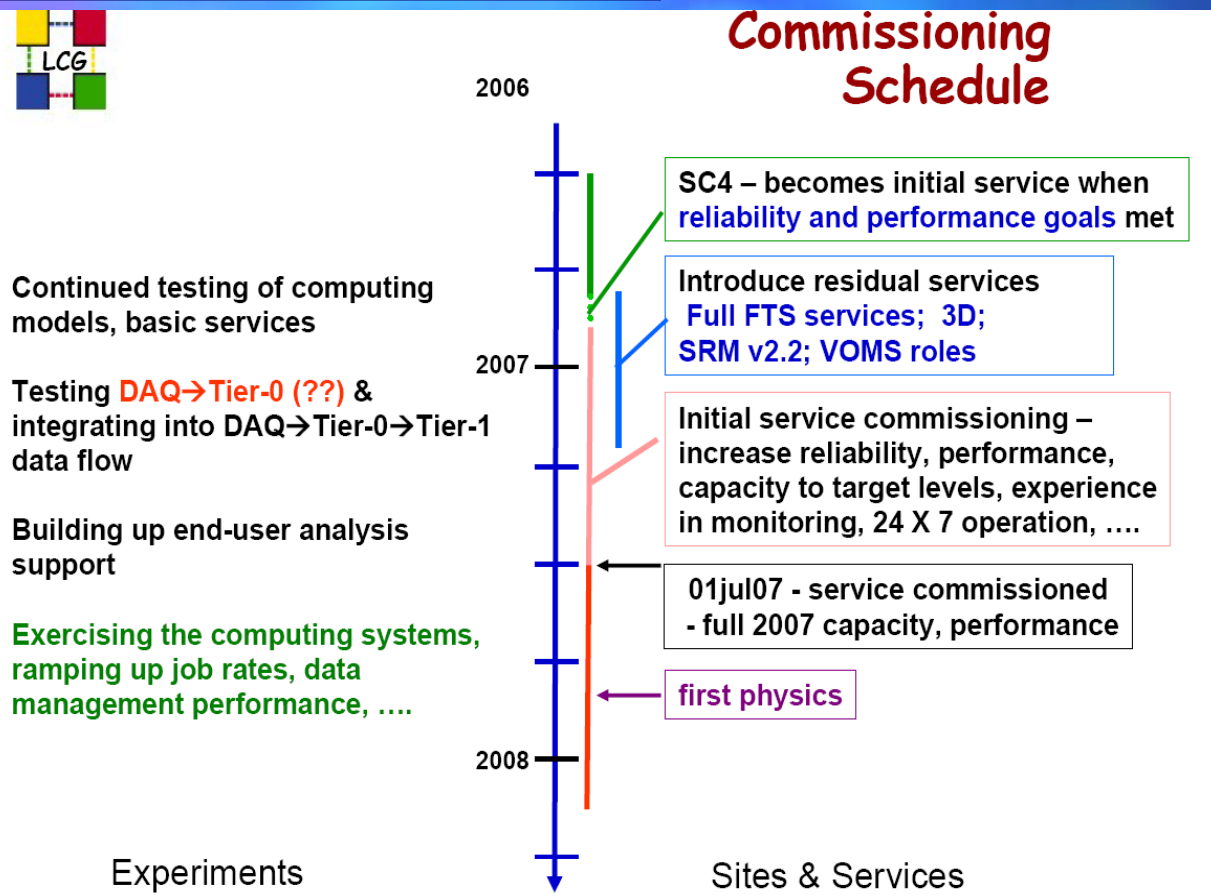
Includes SRM v2.2!



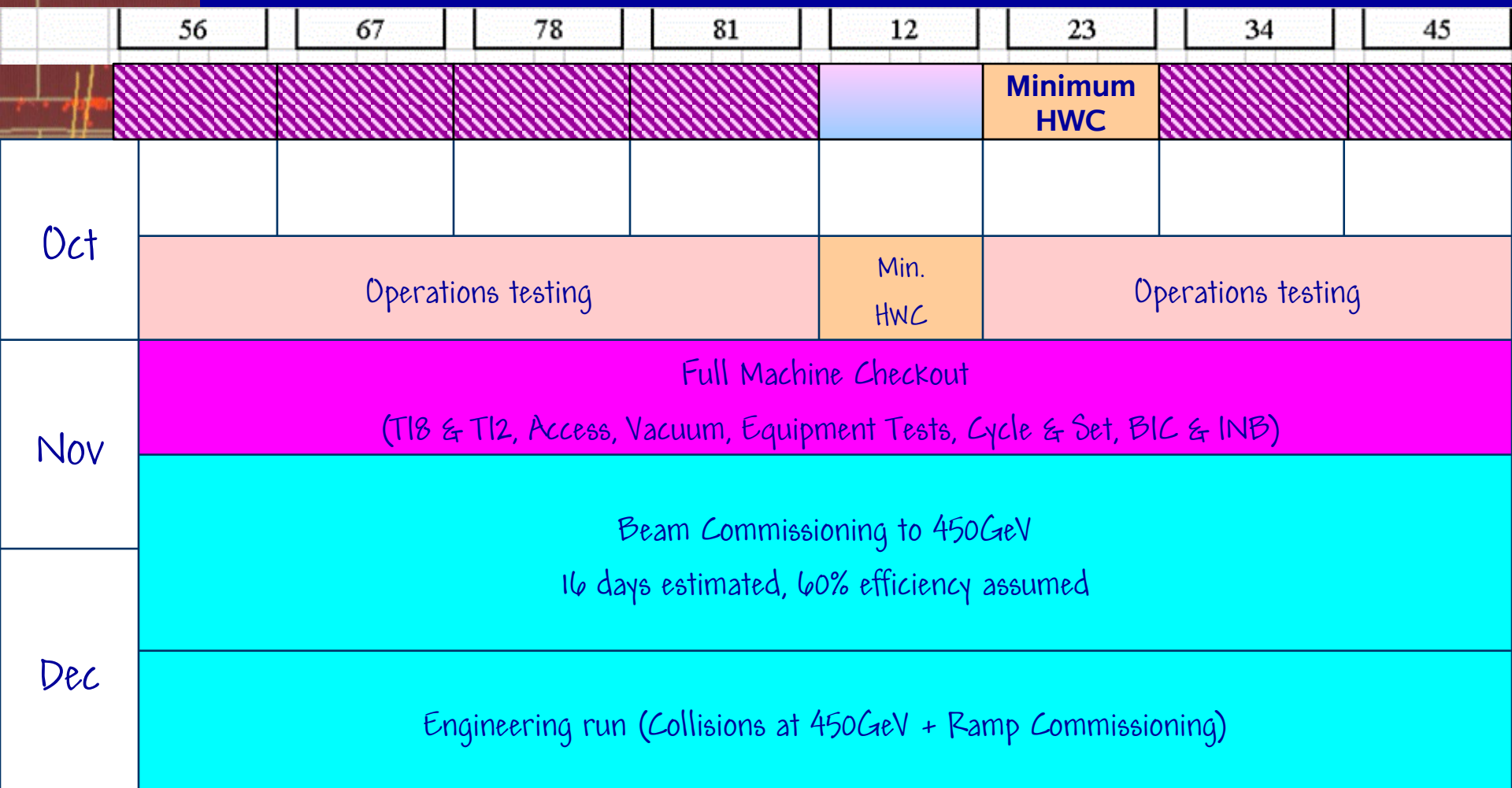
BACK



WLCG Commissioning Schedule



- **Still an ambitious programme ahead**
- Timely testing of full data chain from DAQ to T-2 chain was major item from last CR
 - DAQ→ T-0 still largely untested



Inter-Site Rates - Revised Megatable

Centre	T0->T1	T1->T2	T2->T1	T1<->T1
	Predictable – Data Taking	Bursty – User Needs	Predictable – Simulation	Scheduled Reprocessing
IN2P3, Lyon	220	286.2	85.5	498.0
GridKA, Germany	220	384.9	84.1	395.6
CNAF, Italy	190	321.3	58.4	583.8
FNAL, USA	110	415.0	52.6	417.0
BNL, USA	300	137.7	24.8	358.0
RAL, UK	120	108.3	36.0	479.4
NIKHEF, NL	160	34.1	6.1	310.4
ASGC, Taipei	120	128.5	19.3	241.2
PIC, Spain	100	167.1	23.3	294.5
Nordic Data Grid Facility	60	-	-	62.4
TRIUMF, Canada	60	-	-	59.0

Continued testing of computing models, basic services

Testing DAQ→Tier-0 (??) & integrating into DAQ→Tier-0→Tier-1 data flow

Building up end-user analysis support

Exercising the computing systems, ramping up job rates, data management performance,

WLCG Commissioning Schedule

2006

2007

2008



SC4 – becomes initial service when reliability and performance goals met

Introduce residual services
Full FTS services; 3D; gLite 3.x; SRM v2.2; VOMS roles; SL(C)4

Initial service commissioning – increase performance, reliability, capacity to target levels, experience in monitoring, 24 x 7 operation,

01jul07 - service commissioned - full 2007 capacity, performance

first collisions in the LHC. Full FTS services demonstrated at 2008 data rates for all required Tx-Ty channels, over extended periods, including recovery (T0-T1).



Looking further ahead: ‘The Dress Rehearsal’ (A Mid Summer Night’s Dream?)

A complete exercise of the full chain from trigger to (distributed) analysis, to be performed in 2007, a few months before data taking starts

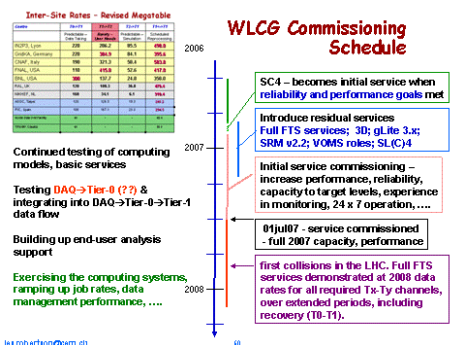
Some details for experts:

- **Generate $O(10^7)$ evts: few days of data taking, $\sim 1 \text{ pb}^{-1}$ at $L = 10^{31} \text{ cm}^{-2} \text{ s}^{-1}$**
- **Filter events at MC generator level to get physics spectrum expected at HLT output**
- **Pass events through G4 simulation (realistic “as installed” detector geometry)**
- **Mix events from various physics channels to reproduce HLT physics output**
- **Run LVL1 simulation (flag mode)**

- **Produce byte streams → emulate the raw data**
- **Send raw data to Point 1, pass through HLT nodes (flag mode) and SFO, write out events by streams, closing files at boundary of luminosity blocks.**
- **Send events from Point 1 to Tier0**

- **Perform calibration & alignment at Tier0 (also outside ?)**
- **Run reconstruction at Tier0 (and maybe Tier1s ?) → produce ESD, AOD, TAGs**
- **Distribute ESD, AOD, TAGs to Tier1s and Tier2s**
- **Perform distributed analysis (possibly at Tier2s) using TAGs**
- **MCTruth propagated down to ESD only (no truth in AOD or TAGs)**

Ambitious goals... need to plan it carefully (both in terms of effort needed and of technical issues and implications)



My Forecast... (IT POW)

- Main problem areas are ‘residual services’:
 1. Full FTS Services;
 2. SRM v2.2 Production Services;
 3. 3D Production Services.
 - We are **not** going to achieve all of this by “Dress Rehearsal” – 2 months
 - FTS: experiments will help to drive this **BUT...**
 - 3D: some ‘stripped’ scenarios offer themselves...
- SRM v2.2: without doubt the most urgent / critical of all ‘residual services’**

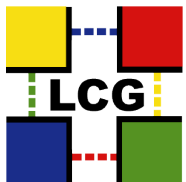
Possible Timeline

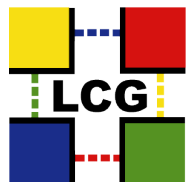
Q1: gLite 3.x + SL(C)4 deployment, SRM 2.2 testing

Q2: **SRM 2.2 deployment**, VOMS roles testing

Q3: VOMS roles support in production

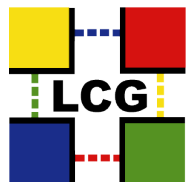
Ramp-up of **FTS**, 3D **services**, continued testing of computing models, improvements in monitoring, operations and support **in parallel** (and into 2008...)





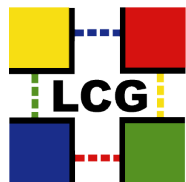
Q1 2007 – Tier0 / Tier1s

1. Demonstrate Tier0-Tier1 data export at **65%** of full nominal rates per site using experiment-driven transfers
 - Mixture of **disk / tape** endpoints as defined by experiment computing models, i.e. 40% tape for ATLAS; transfers driven by **experiments**
 - Period of at least one week; daily VO-averages may vary (~normal)
2. Demonstrate Tier0-Tier1 data export at **50%** of full nominal rates (as above) in conjunction with T1-T1 / T1-T2 transfers
 - Inter-Tier transfer targets taken from ATLAS DDM tests / CSA06 targets
3. Demonstrate Tier0-Tier1 data export at **35%** of full nominal rates (as above) in conjunction with T1-T1 / T1-T2 transfers **and** Grid production at Tier1s
 - Each file transferred is read at least once by a Grid job
 - Some explicit targets for WMS at each Tier1 need to be derived from above
4. Provide SRM v2.2 endpoint(s) that implement(s) all methods defined in SRM v2.2 MoU, **all critical** methods pass tests
 - See attached list; Levels of success: threshold, pass, success, (*cum laude*)



Q2 2007 – Tier0 / Tier1s

- As Q1, but using **SRM v2.2** services at Tier0 and Tier1, gLite 3.x-based services and SL(C)4 as appropriate
- Provide services required for Q3 dress rehearsals
 - Detail to be provided



>900MB/s (2/3) to dCache sites!

(A) Megatable Extract

Tier1 Centre	ALICE	ATLAS	CMS	LHCb	Target
IN2P3, Lyon	6	109.2	31.5	10.5	157.2
GridKA, Germany	11.9	88.2	26.3	6.3	132.7
CNAF, Italy	5.2	88.2	36.8	6	136.2
FNAL, USA	-	-	105	-	105
BNL, USA	-	287.2	-	-	287.2
RAL, UK	2.4	102.2	26.3	6.3	137.2
NIKHEF, NL	3.4	109.2	-	9.1	121.7
ASGC, Taipei	-	65.1	26.3	-	91.4
PIC, Spain	-	49.7	10.5	3.5	63.7
Nordic Data Grid Facility	4.7	49.7	-	-	54.4
TRIUMF, Canada	-	48.3	-	-	48.3
US ALICE	8.2	-	-	-	8.2
TOTALS	41.8	997	262.7	41.7	1343.2



Conclusions

- SRM v2.2 is **without doubt** the most **critical** of all remaining WLCG service enhancements
- SRM **as a standard** is arguably one of the **strongest** pillars on which WLCG stands (**later**)
- We need to remain strongly **focussed** on the production schedule / deadlines, **e.g.FDR(s)**
- May the **force** be with you...

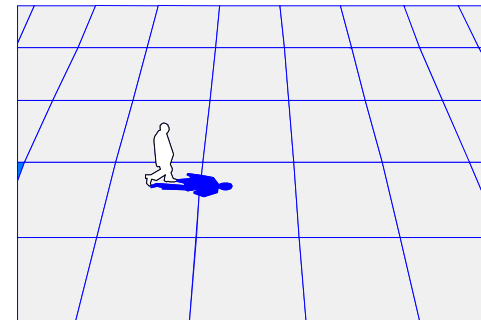
Grid Computing in 3 Easy Steps

- Today there are many definitions of *Grid computing*:
- “A distributed system is one in which the failure of a computer you didn't even know existed can render your own computer unusable.”

Leslie Lamport

➤ ... Some sort of Distributed System at least...

- that crosses Management / Enterprise domains

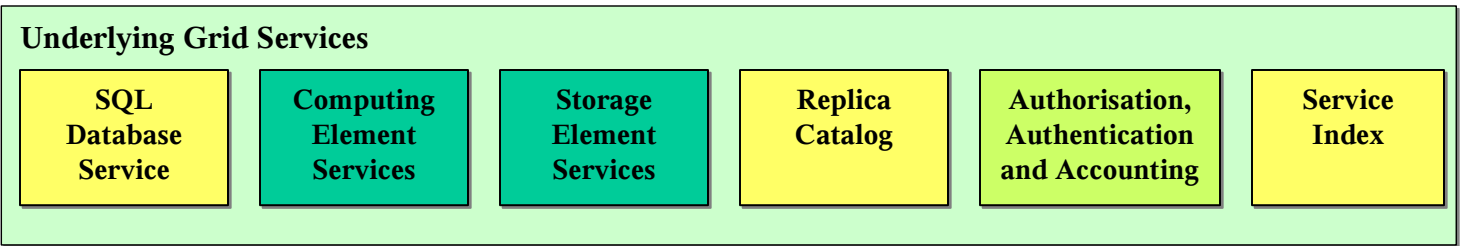
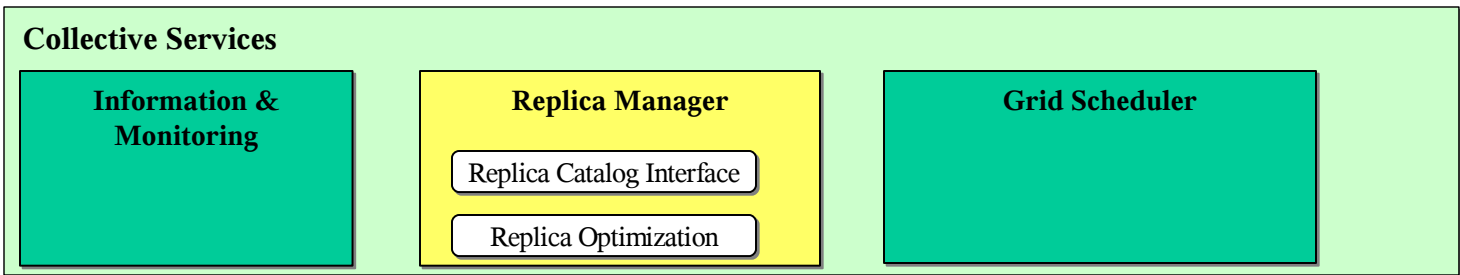
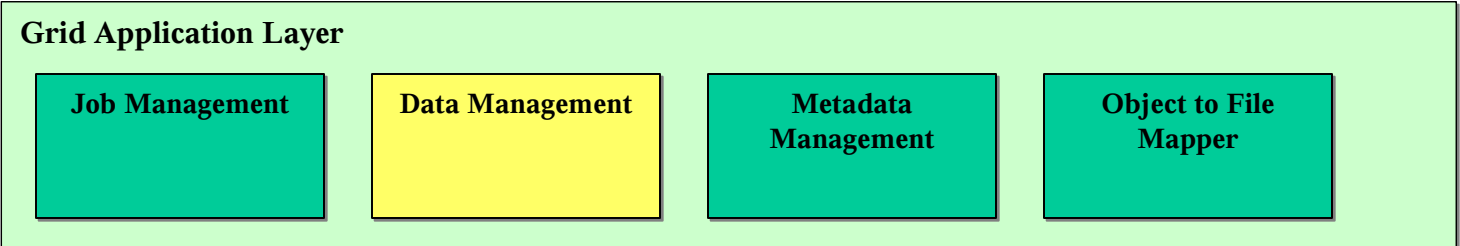


Local Application

Local Database

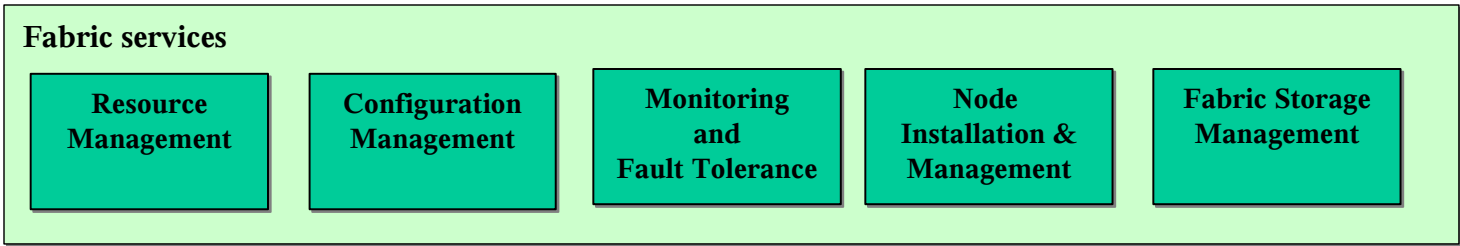
Local Computing

Grid

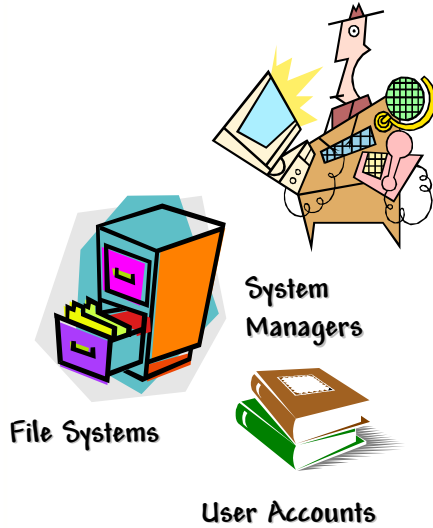


Grid

Fabric

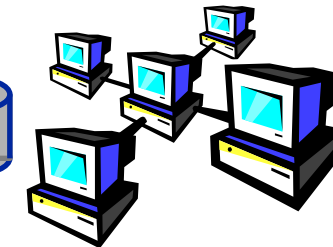
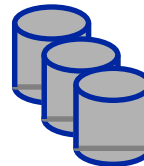
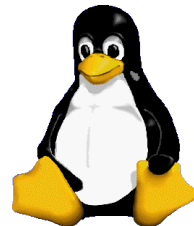
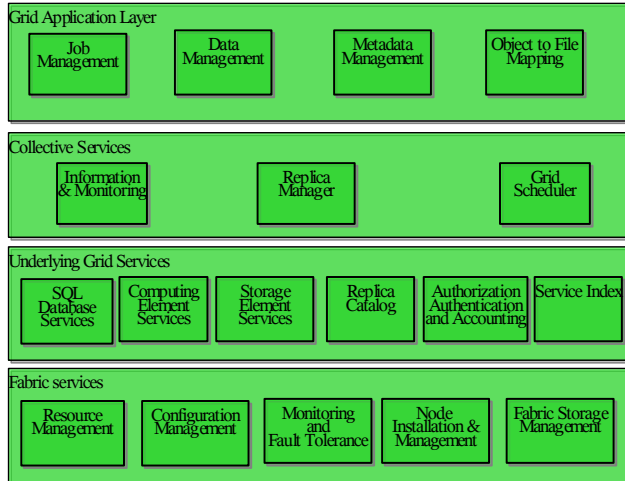


EDG Interfaces

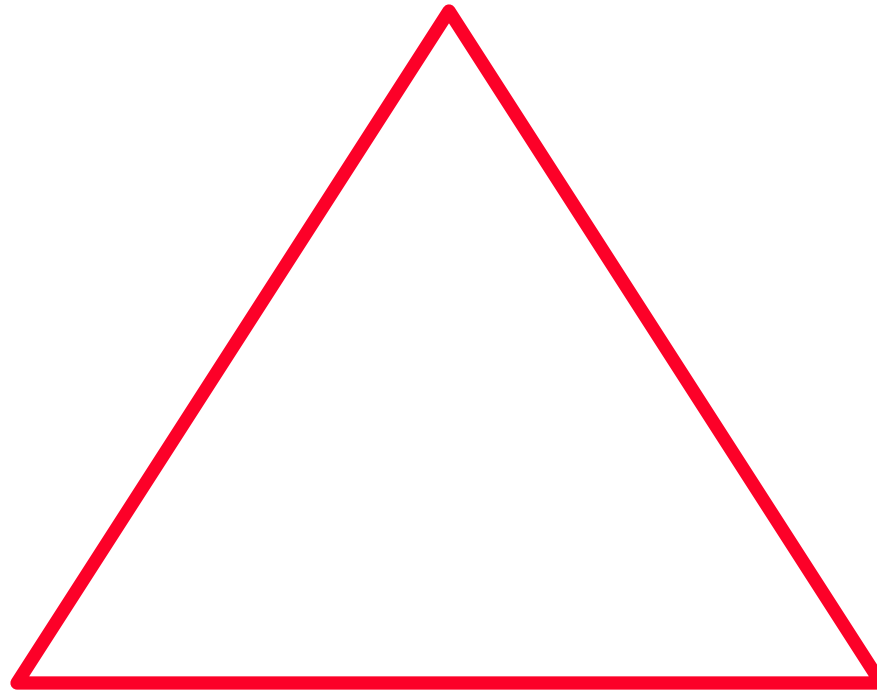


Local Application

Local Database



Computational resources



Network: FTS / RFT

GridFTP

TCP/IP

...

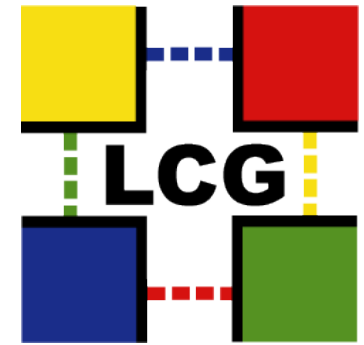
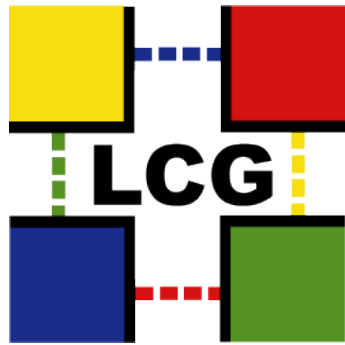
Storage: SRM

MSS adaptors

HPSS, ENSTORE, CASTOR, DMF,

OSM, TSM, ...

Resources, Services & Standards



The Grid

The Power of 3

