

The Worldwide LHC Computing Grid

WLCG Milestones for 2007
Focus on Q1 / Q2

MB, February 6 2007



Worldwide LHC Computing Grid
Distributed Production Environment for Physics data Processing



Introduction

- These **high-level** milestones are complementary to the **experiment-specific** milestones and more detailed goals and objectives listed in the WLCG Draft Service Plan (see attachment to agenda)
 - Similar to that prepared and maintained in previous years
 - Regularly reviewed and updated through LCG ECM
 - Regular reports on status and updates to WLCG MB / GDB
- Focus is on **real production** scenarios & (moving rapidly to) **end to end testing**
 - Time for component testing is over - we learnt a lot but not enough!
 - Time before data taking is very short - let alone the dress rehearsals
- All data rates refer to the Megatable and to pp running
- Any 'factors', such as accelerator and/or service efficiency, are mentioned explicitly
 - N.B. 'catch-up' is a proven **feature** of the end-end FTS service



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

LHC Parameters (Computing Models)

Year	pp operations		Heavy Ion operations	
	Beam time (seconds/year)	Luminosity ($\text{cm}^{-2}\text{s}^{-1}$)	Beam time (seconds/year)	Luminosity ($\text{cm}^{-2}\text{s}^{-1}$)
2007	5×10^6	5×10^{32}	-	-
2008	(1.8 x) 10^7	2×10^{33}	(2.6 x) 10^6	5×10^{26}
2009	10^7	2×10^{33}	10^6	5×10^{26}
2010	10^7	10^{34}	10^6	5×10^{26}

(Real time given in brackets above)

Overview of pp running

VO	SIM	SIMESD	RAW	Trigger	RECO	AOD	TAG
ALICE	400KB	40KB	1MB	100Hz	200KB	50KB	10KB
ATLAS	2MB	500KB	1.6MB	200Hz	500KB	100KB	1KB
CMS	2MB	400KB	1.5MB	150Hz	250KB	50KB	10KB
LHCb		400KB	25KB	2KHz	75KB	25KB	1KB



What's Changed Since TDRs?

VO	SIM	SIMESD	RAW	Trigger	RECO	AOD	TAG
ALICE	400KB	40KB	1MB	100Hz	200KB	50KB	10KB
ATLAS	2MB	500KB	1.6MB	200Hz	1MB	100KB	1KB
CMS	2MB	400KB	1.5MB	300Hz	250KB	50KB	10KB
LHCb		400KB	25KB	2KHz	75KB	25KB	1KB

- **Main** changes (AFAIK) are:
 - Doubling of ATLAS ESD (of which 2 copies)
 - Explicit full ATLAS ESD to BNL (hence ~3 total)
 - Doubling of CMS trigger rate



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



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Tier1 Centre	ALICE	ATLAS	CMS	LHCb	Target
IN2P3, Lyon	5.8	109.2	31.5	10.5	157
GridKA, Germany	14.9	88.2	26.3	6.3	135.7
CNAF, Italy	4.6	88.2	36.8	6	135.6
FNAL, USA	-	-	105	-	105
BNL, USA	-	287.2	-	-	287.2
RAL, UK	0.3	102.2	26.3	6.3	135.1
NIKHEF, NL	1.7	109.2	-	9.1	120
ASGC, Taipei	-	65.1	26.3	-	91.4
PIC, Spain	-	49.7	10.5	3.5	63.7
Nordic Data Grid Facility	3.8	49.7	-	-	53.5
TRIUMF, Canada	-	48.3	-	-	48.3
US ALICE	0.2	-	-	-	9.2
TOTALS	40.3	997	262.7	41.7	1341.7



Adjust ALICE Rates (Multiply by 4... Unlike HI)

Tier1 Centre	ALICE	ATLAS	CMS	LHCb	Target
IN2P3, Lyon	23.2	109.2	31.5	10.5	174.4
GridKA, Germany	59.6	88.2	26.3	6.3	180.4
CNAF, Italy	18.4	88.2	36.8	6	149.4
FNAL, USA	-	-	105	-	105
BNL, USA	-	287.2	-	-	287.2
RAL, UK	1.2	102.2	26.3	6.3	136
NIKHEF, NL	6.8	109.2	-	9.1	125.1
ASGC, Taipei	-	65.1	26.3	-	91.4
PIC, Spain	-	49.7	10.5	3.5	63.7
Nordic Data Grid Facility	15.2	49.7	-	-	64.9
TRIUMF, Canada	-	48.3	-	-	48.3
US ALICE	36.8	-	-	-	36.8
TOTALS	161.2	997	262.7	41.7	1462.6



From discussion with Chris, only ATLAS has catchup included (implicitly) ☹️

Tier1 Centre	ALICE	ATLAS	CMS	LHCb	Target
IN2P3, Lyon	23.2	109.2	63	10.5	205.9
GridKA, Germany	59.6	88.2	52.6	6.3	206.7
CNAF, Italy	18.4	88.2	73.6	6	186.2
FNAL, USA	-	-	210	-	210
BNL, USA	-	287.2	-	-	287.2
RAL, UK	1.2	102.2	52.6	6.3	162.3
NIKHEF, NL	6.8	109.2	-	9.1	125.1
ASGC, Taipei	-	65.1	52.6	-	117.7
PIC, Spain	-	49.7	21	3.5	74.2
Nordic Data Grid Facility	15.2	49.7	-	-	64.9
TRIUMF, Canada	-	48.3	-	-	48.3
US ALICE	36.8	-	-	-	36.8
TOTALS	161.2	997	525.4	41.7	1725.3

Or multiply / divide all others by 2?



'Catch-up' for all...

Tier1 Centre	ALICE	ATLAS	CMS	LHCb	Target
IN2P3, Lyon	46.4	95.2	63	21	225.6
GridKA, Germany	119.2	83.3	52.6	12.6	267.7
CNAF, Italy	36.8	127.4	73.6	12	249.8
FNAL, USA	-	-	210	-	210
BNL, USA	-	355	-	-	355
RAL, UK	2.4	96.6	52.6	12.6	164.2
NIKHEF, NL	13.6	91.7	-	18.2	123.5
ASGC, Taipei	-	54.6	52.6	-	107.2
PIC, Spain	-	39.2	21	7	67.2
Nordic Data Grid Facility	30.4	91.7	-	-	122.1
TRIUMF, Canada	-	37.8	-	-	37.8
US ALICE	73.6	-	-	-	73.6
TOTALS	322.4	1072.5	525.4	83.4	2003.7



Conclusions

- We need to **agree** and **document** the basic input parameters to these calculations
- **Any changes must be announced & documented**
- It is understood that there are many more factors than just machine efficiency...
 - Reprocessing of data at the Tier0 and sending out updated copies has been mentioned - are the resources available?
- We need to work from the same **explicit** assumptions
- **Baseline assumption is that 65% (etc) applies to the final table (2GB/s out of CERN total pp)**
 - i.e. $2\text{GB/s} \times .65 \sim 1.3\text{GB/s}$ out of CERN
 - (1GB/s & 700MB/s respectively for M2/M3)



ATLAS Rates out of CERN

- Per second of 'normal operation' of the LHC:

$$(\text{RAW} + \sim 3 \times \text{ESD} + 10 \times \text{AOD}) * \text{TRIGGER_RATE}$$

$$(1.6 + 2.8 * 0.5 + 10 * 0.1) * 200 = 800\text{MB/s} \quad (\text{TDR}) \quad \text{MT}=1072.5$$

$$(1.6 + 2.8 * 1.0 + 10 * 0.1) * 200 = 1080\text{MB/s} \quad (\text{Dario} + \text{Miguel}=1060)$$

Accelerator efficiency ~ service efficiency ~ 50%

- We probably don't need a further factor 2 for recovery, but prolonged running at ~1.5GB/s out of CERN, including recovery from any backlogs (scheduled + unscheduled interventions), would be a reasonable target for end 2007...



ATLAS Rates - DDM Review

- RAW T0-T1 320MB/s (i.e. RAW x trigger rate) **16TB/day**
- ESD T0-T1 200MB/s (i.e. ESD x trigger x 2) **10TB/day**
- AOD T0-T1 200MB/s (i.e. AOD x trigger x N-T1s) **10TB/day**
- **Total: 720MB/s (full ESD to BNL not included in above)**

- Fraction to tape (RAW) was ~40%
- Now fraction is lower due to increase in ESD?

- Other VOs?

Experiment	SIM	SIMESD	RAW	Trigger	ESD	AOD	TAG
ALICE	400KB	40KB	1MB	100Hz	200KB	50KB	10KB
ATLAS	2MB	500KB	1.6MB	200Hz	500KB	100KB	1KB
CMS	2MB	400KB	1.5MB	150Hz	250KB	50KB	10KB
LHCb		400KB	25KB	2KHz	75KB	25KB	1KB



Rates per Site - Unrounded

Tier1 Centre	ALICE	ATLAS	CMS	LHCb	Target
IN2P3, Lyon	7	62	41	7	117
GridKA, Germany	16	54	34	4	108
CNAF, Italy	6	83	48	4	141
FNAL, USA	-	-	137	-	137
BNL, USA	-	231	-	-	231
RAL, UK	2	63	34	4	103
NIKHEF, NL	4	60	-	6	69
ASGC, Taipei	-	35	34	-	70
PIC, Spain	-	25	14	2	41
Nordic Data Grid Facility	6	60	-	-	65
TRIUMF, Canada	-	25	-	-	25
US ALICE	8	-	-	-	8
TOTALS	48	697	342	27	1114