

1. Introduction

This report summarises the result of the first global Computing Capacity Pledge update for WLCG. In addition, it will cover the signature status of the WLCG MoU, funding and expenditure for Tier-0 and CERN Analysis Facility (CAF) until 2011 and an overview of Tier-1 accounting results.

2. Progress in Signing the WLCG Memorandum of Understanding

The total number of member state Funding Agencies (or groupings of FAs for one country) having announced to sign the WLCG MoU currently amounts to 21 for 7 Tier-1 and 28 Tier-2 centres/federations distributed over ~80 sites. Newcomers this time are Tier-2 federations in Austria, Norway and Sweden. The Italian federation is now split into four, one for each experiment. Seven of the required signatures are still lacking including signatures for two of the Tier-1s, but most of these are expected to be obtained before summer 2007.

Fourteen non-member state Funding Agencies have announced to sign the WLCG MoU, covering 4 Tier-1 and 23 Tier-2 centres/federations distributed over ~55 sites. Newcomers are the SiGNET Tier-2 in Slovenia, and the US Tier-2s SLAC and Great Lakes. Four of these signatures are still missing. Table 1 lists the received and lacking signatures.

Table 1: Signature Status of WLCG MoU

Member States

Country	Funding Agency/Signatory	Already Signed (Y/N)
Austria	bm:bwk	N
Belgium	FNRS	Y
Belgium	FWO	Y
Czech Rep.	MSMT CR	N
Denmark	National Science Research Council	Y
Finland	HIP	N
France	CEA/DSM/DAPNIA	Y
France	CNRS/IN2P3	Y
Germany	FZK	Y
Germany	DESY	Y
Germany	GSI	Y
Germany	MPG	Y
Italy	INFN	Y
The Netherlands	NIKHEF	Y
Norway	NRC	N
Poland	Ministry of Science & Education	Y
Portugal	GRICES/LIP	Y
Spain	MEC	N
Sweden	Research Council	N
Switzerland	SER/SNF/ETH/CSCS	N
United Kingdom	PPARC	Y

Non-Member States

Country	Funding Agency/Signatory	Already Signed (Y/N)
Australia	AusHEP	N
Canada	CFI	Y
China	MoST/NSFC	Y
India	DAE	Y
Japan	Univ. Tokyo	Y
JINR, Dubna	JINR	N
Pakistan	PAEC/NCP	Y
Romania	Natl. Authority for Scientific Research	Y
Russia	Federal Agency for Sc. & Innovation	N
Slovenia	Ministry of Higher Education, Science and Technology	N
Taipei	Academia Sinica	Y
Ukraine	National Academy of Sciences	Y
USA	US-ATLAS	Y
USA	US-CMS	Y

Table 2 lists additional Tier-2s which are not yet included in the current WLCG MoU tables, but plan to join later. Austria and Slovenia moved into the MoU since last October and Korea entered Table 2. Discussions are going on with a number of additional Tier-2 candidates. The number of WLCG sites will continue to grow.

Table 2: Planned Additional Tier2 Centres or Federations

<i>Institution</i>	<i>Experiments served with priority</i>			
	<i>ALICE</i>	<i>ATLAS</i>	<i>CMS</i>	<i>LHCb</i>
Brazil, Brazilian Tier-2 Federation - CBPF - UERJ - UFRJ - UNESP	X	X	X	X
Canada, Canada East Tier-2 Federation		X		
Canada, Canada West Tier-2 Federation		X		
Estonia, NICPB, Tallinn			X	
Hungary, Hungarian Tier-2 Federation - KFKI, Budapest - SZTAKI, Budapest - Eotvos Univ., Budapest - Debrecen Univ.	X		X	
Israel, HEP-IL Federation - Technion, Haifa - Weizmann, Rehovot - Tel Aviv Univ.		X		
Korea, KISTI, Daejeon	X			

3. Funding and Expenditure for WLCG at CERN

Table 3 shows the cost and funding estimates for LCG Phase 2 at CERN.

Table 3: LHC Computing Budget Estimates in MCHF (at 28/02/2007)

	2005	2006	2007	2008	TOTAL
Funding					
From CERN Budget					
- Personnel	1.519	16.472	18.550	17.225	53.766
- Physics	0.000	11.618	12.785	12.900	37.303
- IT		8.363	9.075	9.465	26.903
- PH		3.255	3.710	3.435	10.400
- Additional	1.519	4.854	5.765	4.325	16.463
- IT	1.173	3.614	4.425	3.215	12.427
- PH	0.346	1.240	1.340	1.110	4.036
- Materials	1.752	21.299	14.312	30.155	67.518
- Physics Operations		5.009	4.877	4.955	14.841
- IT		4.531	4.430	4.535	13.496
- PH		0.478	0.447	0.420	1.345
- Tier 0 and CERN Analysis Facility	1.752	16.290	9.435	25.200	52.677
Contributions via Team Accounts*					
- Personnel		1.990	2.250	1.430	5.670
- Material		0.016	1.089		1.105
In-kind Contributions*					
- Personnel		1.370	1.745	0.960	4.075
Total					
- Personnel	1.519	19.832	22.545	19.615	63.511
- Materials	1.752	21.315	15.401	30.155	68.623
Total Funding	3.271	41.147	37.946	49.770	132.134
Expenditure					
- Personnel **	1.519	19.832	22.545	19.615	63.511
- Materials	1.752	21.315	15.627	29.240	67.934
- Physics Operations		5.009	4.877	5.040	14.926
- Tier 0 and CERN Analysis Facility	1.752	16.306	10.750	24.200	53.008
Total Planned Expenditure	3.271	41.147	38.172	48.855	131.445
Balance Personnel	0.000	0.000	0.000	0.000	0.000
Balance Materials	0.000	0.000	-0.226	0.915	0.689
Balance	0.000	0.000	-0.226	0.915	0.689

* As pledged and planned to be pledged in the WLCG MoU (Annex 6.6)

** - Personnel from EGEE and EGEE-II at a cost of 2.9 MCHF will participate in LCG at CERN during the years 2006 - 2008

- Operators Support from Computer Centre at a cost of 1.4 MCHF will participate in LCG at CERN during the years 2006 - 2008
These resources are not included in this Table.

Details of the contributions via team accounts or in kind are contained in Annex 6.6 of the WLCG MoU, but are also shown in Annex 1 of this report. It should again be noted that the personnel planning for LCG Phase 2 at CERN relies on a successor EU project to EGEE II to deliver ~14 FTE to the Grid Deployment activities. The renewed planning after book-closing 2006 arrives now at a positive materials balance of 690 kCHF. This amount will be carried over to the first year of the maintenance and operation phase of WLCG at CERN, starting in 2009. Table 4 shows the expected funding and expenditure for the first three years of the WLCG operation at CERN.

Table 4: LHC Computing Budget Estimates in MCHF 2009 – 2011

	2009	2010	2011	TOTAL
Funding				
From CERN Budget				
- Personnel	14.5	15.0	15.0	44.6
- IT	11.1	11.6	11.6	34.3
- PH	3.4	3.4	3.4	10.2
- Materials	22.7	22.7	22.7	68.0
- IT	22.2	22.2	22.2	66.7
- PH	0.4	0.4	0.4	1.3
- Carry-over from Phase 2	0.7			0.7
Contributions via Team Accounts*				
- Personnel	1.1	0.7	0.1	1.9
In-kind Contributions*				
- Personnel	0.6	0.6		1.2
Total				
- Personnel	16.2	16.4	15.1	47.6
- Materials	23.3	22.7	22.7	68.6
Total Funding	39.5	39.0	37.8	116.3
Expenditure				
- Personnel	16.2	16.4	15.1	47.6
- Materials	21.8	27.5	25.4	74.7
Total Planned Expenditure	38.0	43.9	40.5	122.3
Balance Personnel	0.0	0.0	0.0	0.0
Balance Materials	1.5	-4.9	-2.8	-6.1
Balance	1.5	-4.9	-2.8	-6.1

* As planned to be pledged in the WLCG MoU (Annex 6.6)

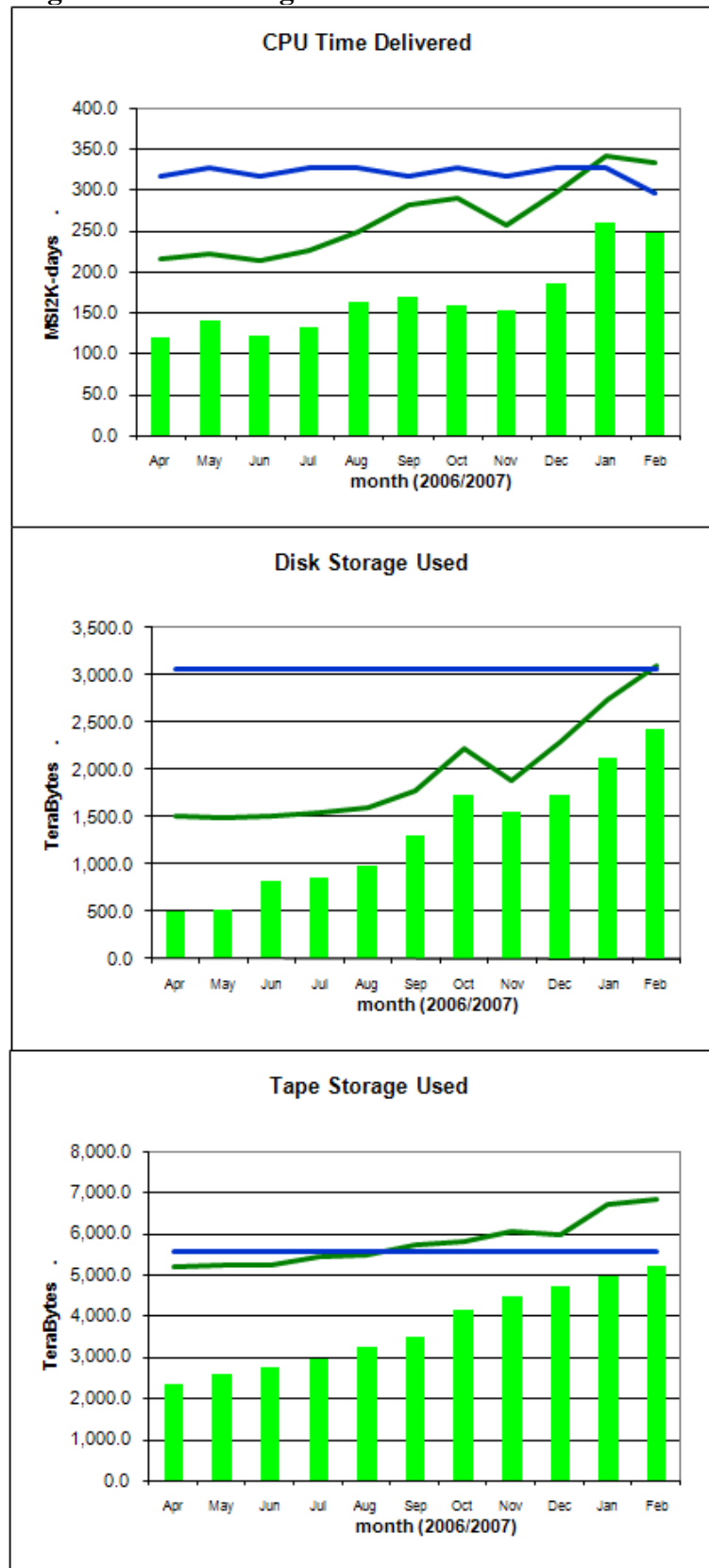
In 2010 a negative materials balance seems now probable, but an overall materials balance estimate of -8% over the years 2009 to 2011 should be monitored but is certainly not frightening. The shortfall in materials for 2010 will lead to a small cut in the CERN computing resource pledges for this year.

The personnel balance is still relying on a contribution of ~14 FTE per year to Grid Deployment funded outside the CERN budget. The current assumption is that this contribution will come from the planned European Grid Initiative.

4. Resource Usage Accounting for External Tier-1s and CERN

Figure 1 shows the sums of CPU time delivered to the experiments and disk and tape storage used by them at the external Tier-1s and at CERN in relation to the installed and pledged capacity over the period April 2006 to February 2007.

Figure 1: Accounting for External Tier-1s and CERN



installed capacity (inc. efficiency factor) —
 MoU commitment (inc. efficiency factor) —

Compared to the first presentation of these accounting data in October 2006 it is interesting to note that the installed capacities are now reaching or even exceeding the pledge values and that usage of the installed capacity is reaching ~75% towards the end of the reporting period. The kink in available CPU and disk in November 2006 is due to the allocation of a major part of CERN's capacity to a test of ATLAS online software during this month.

Table 5 gives the detailed usage by site in tabular format. The comparisons with the installed or pledged capacities is done by taking account of standard utilisation efficiency factors, and so it should be possible to reach 100% provided that there is a consistent load. Where the consumption exceeds 100% of the installed capacity this indicates that LHC experiments have been able to use resources more efficiently, or have used resources provided for other applications.

Until now accounting data have been collected from Tier-1 sites by filling out tables per month and site. Until May 2007 this procedure should be automated for CPU usage, requiring all Tier-1 sites to make their CPU accounting data available in the relevant data base. Storage accounting will still have to be reported by filling in tables. Once the Tier-1 CPU accounting is transferred successfully to an automatic procedure, we will start to include the Tier-2 CPU accounting data using the same procedure.

Table 5: Usage Details by Site

Site Summary April 2006 to February 2007	KS/2K- days	cpu		disk occupancy			tape occupancy		
		% of installed	% of pledge	TBytes at end of period	% of installed	% of pledge	TBytes at end of period	% of installed	% of pledge
CERN Tier-0+CAF	528,032	83%	55%	754	83%	140%	2,419	81%	161%
ASGC	57,445	44%	21%	60	27%	21%	15	5%	3%
BNL	177,732	67%	56%	423	116%	116%	432	72%	144%
CC-IN2P3	127,765	47%	38%	175	89%	48%	516	103%	96%
CNAF	153,296	36%	30%	148	47%	25%	319	64%	38%
FNAL	237,356	57%	115%	400	79%	571%	500	83%	200%
FZK-GridKA	157,641	66%	54%	156	78%	80%	519	81%	132%
NDGF	68,563	53%	46%	104	79%	87%	0	0%	0%
NL LHC/Tier-1	97,451	89%	112%	52	71%	44%	25	100%	17%
PIC	71,084	88%	100%	63	129%	64%	145	95%	92%
RAL	157,762	87%	57%	78	63%	25%	314	105%	47%
TRIUMF	16,844	51%	40%	22	137%	275%	0	0%	0%
Total	1,850,971	63%	52%	2,435	79%	79%	5,204	76%	94%

5. The Revised Computing Capacity Pledges

The Computing RRB of October 2006 decided that exceptionally the update of the WLCG MoU pledges (firm pledges for 2007 and planned pledges for 2008 until 2011) would be delayed until the April 2007 C-RRB due to the fact that the new requirement figures from the experiments had not been available for sufficient time to allow discussions between experiments, funding agencies and sites to conclude on the new pledge figures. At the same time a strong plea was addressed to the funding agencies not to reduce their overall pledge levels but to use this adaptation as a chance to cover the requirements of the experiments to a higher degree than before.

Table 6: Changes in Pledge Levels

Changes Oct. 2006 - Apr. 2007 Tier1s				
	2007	2008	2009	2010
CPU Pledges	-13%	-8%	-7%	0%
Disk Pledges	-12%	-6%	3%	9%
Tape Pledges	-14%	-6%	5%	13%

Changes Oct. 2006 - Apr. 2007 Tier2s				
	2007	2008	2009	2010
CPU Pledges	-11%	-6%	-1%	12%
Disk Pledges	-25%	-5%	7%	20%

Table 6 above shows that the funding agencies reacted very positively to the plea for keeping their overall investments constant. For a reduction of Tier-1 and Tier-2 requirements for 2008 of ~20% pledges for these centres in 2008 were only reduced by 5% to 8% and increases in the 2010 pledges typically more than compensate these small reductions. Pledges at CERN are following the requirements of the experiments with only a small cut likely in the year 2010.

Table 7: Comparison of Original to Updated Pledges for 2008

Summary of Regional Centre Capacities Old Requirements & Pledges							Summary of Regional Centre Capacities New Requirements & Pledges						
Tier-1 Planning for 2008							Tier-1 Planning for 2008						
		ALICE	ATLAS	CMS	LHCb	SUM 2008			ALICE	ATLAS	CMS	LHCb	SUM 2008
CPU - MSI2K	Offered	6.7	24.0	12.0	5.0	47.7	Offered	6.5	21.9	11.7	3.8	43.9	
	TDR Requirements	12.3	24.0	15.2	4.4	55.9	Requirements	10.2	18.1	12.4	1.8	42.5	
	Balance	-45%	-0%	-21%	13%	-15%	Balance	-36%	21%	-6%	115%	3%	
Disk - PBytes	Offered	2.8	13.1	5.7	2.5	24.1	Offered	2.7	12.3	5.5	2.0	22.5	
	TDR Requirements	7.4	14.4	7.0	2.4	31.2	Requirements	5.2	9.9	5.6	1.0	21.7	
	Balance	-63%	-9%	-18%	2%	-23%	Balance	-48%	24%	-2%	96%	3%	
Tape - PBytes	Offered	3.1	9.0	9.6	1.9	23.6	Offered	3.3	8.2	9.2	1.5	22.2	
	TDR Requirements	6.9	9.0	16.7	2.1	34.7	Requirements	7.0	7.7	13.1	0.9	28.7	
	Balance	-55%	-0%	-42%	-9%	-32%	Balance	-53%	6%	-30%	67%	-23%	
Includes current planning for all Tier-1 centres							Includes current planning for all Tier-1 centres						
Tier-2 Planning for 2008							Tier-2 Planning for 2008						
		ALICE	ATLAS	CMS	LHCb	SUM 2008			ALICE	ATLAS	CMS	LHCb	SUM 2008
CPU - MSI2K	Offered	6.0	19.5	19.7	3.7	48.9	Offered	5.7	17.9	17.1	3.6	44.3	
	TDR Requirements	14.4	19.9	19.3	7.7	61.3	Requirements	9.6	17.5	15.2	4.6	46.9	
	Balance	-58%	-2%	2%	-51%	-20%	Balance	-41%	2%	12%	-21%	-6%	
Disk - PBytes	Offered	1.4	5.9	5.0	0.7	13.0	Offered	1.3	5.8	4.3	0.2	11.6	
	TDR Requirements	3.5	8.7	4.9	n/a	17.1	Requirements	2.5	7.7	4.2	n/a	14.4	
	Balance	-59%	-32%	2%	n/a	-24%	Balance	-46%	-26%	1%	n/a	-20%	
# Tier-2 federations - included(expected)							# Tier-2 federations - included(expected)						
		16 (17)	24 (30)	27 (29)	11 (12)	42 (49)			17 (19)	30 (34)	30 (34)	11 (12)	51 (57)
Tier-0 Planning for 2008							Tier-0 Planning for 2008						
		ALICE	ATLAS	CMS	LHCb	SUM 2008			ALICE	ATLAS	CMS	LHCb	SUM 2008
CPU - MSI2K	Offered	3.3	4.0	4.6	0.6	12.5	Offered	3.3	3.7	3.9	0.4	11.3	
	TDR Requirements	3.3	4.0	4.6	0.6	12.5	Requirements	3.3	3.7	3.9	0.4	11.3	
	Balance	0%	0%	0%	0%	0%	Balance	0%	0%	0%	0%	0%	
Disk - PBytes	Offered	0.2	0.4	0.4	0.3	1.3	Offered	0.1	0.2	0.3	0.3	0.8	
	TDR Requirements	0.2	0.4	0.4	0.3	1.3	Requirements	0.1	0.2	0.3	0.3	0.8	
	Balance	0%	0%	0%	0%	0%	Balance	0%	0%	0%	0%	0%	
Tape - PBytes	Offered	2.5	5.7	4.9	0.5	13.6	Offered	1.2	2.4	3.6	0.6	7.8	
	TDR Requirements	2.5	5.7	4.9	0.5	13.6	Requirements	1.2	2.4	3.6	0.6	7.8	
	Balance	0%	0%	0%	0%	0%	Balance	0%	0%	0%	0%	0%	
CAF Planning for 2008							CAF Planning for 2008						
		ALICE	ATLAS	CMS	LHCb	SUM 2008			ALICE	ATLAS	CMS	LHCb	SUM 2008
CPU - MSI2K	Offered	3.9	2.1	3.8	0.3	10.0	Offered	3.9	2.1	3.8	0.0	9.8	
	TDR Requirements	5.0	2.7	4.8	0.3	12.8	Requirements	3.9	2.1	3.8	0.0	9.8	
	Balance	-22%	-22%	-22%	-21%	-22%	Balance	0%	0%	0%	0%	0%	
Disk - PBytes	Offered	1.2	1.5	1.2	0.4	4.2	Offered	1.0	1.0	1.3	0.1	3.3	
	TDR Requirements	1.5	1.9	1.5	0.5	5.3	Requirements	1.0	1.0	1.3	0.1	3.3	
	Balance	-20%	-20%	-20%	-20%	-20%	Balance	0%	0%	0%	0%	0%	
Tape - PBytes	Offered	0.9	0.4	1.5	0.7	3.4	Offered	1.2	0.4	1.5	0.0	3.0	
	TDR Requirements	1.2	0.5	1.9	0.9	4.4	Requirements	1.2	0.4	1.5	0.0	3.0	
	Balance	-23%	-23%	-23%	-23%	-23%	Balance	0%	0%	0%	0%	0%	

Table 7 above shows the effect in the reference year 2008 of changing from the old requirements and pledges to the new ones. One can immediately recognise the expected improvement in the sub-tables showing the new data. The Tier-1 situation looks splendid for ATLAS and LHCb whilst CMS is still missing some tape capacity. In the Tier-2 sub-table CMS requirements are fully satisfied with ATLAS missing some disk and LHCb some CPU capacity. The situation for ALICE has improved but stays problematic with still more than 40% of its requirements unsatisfied.

Annex 1: Pledges by Funding Agencies for Common WLCG Resources at CERN

BMBF, Germany	Pledged	Planned to be pledged				Comment
	2006	2007	2008	2009	2010	
Personnel (FTE)	3.8	1.7	0.4			
Materials (kCHF)						

DAE, India	Pledged	Planned to be pledged				Comment
	2006	2007	2008	2009	2010	
Personnel (FTE)	0+2.8	2+3	2+3	2+3	2+3	
Materials (kCHF)						

INFN, Italy	Pledged	Planned to be pledged				Comment
	2006	2007	2008	2009	2010	
Personnel (FTE)	15.5	17	12.3	11	6	
Materials (kCHF)		260				

GRICES/FCT/UMIC, Portugal	Pledged	Planned to be pledged				Comment
	2006	2007	2008	2009	2010	
Personnel (FTE)	3.5	2.3				
Materials (kCHF)						

FASI/JINR	Pledged	Planned to be pledged				Comment
	2006	2007	2008	2009	2010	
Personnel (FTE)	3.3	3	3			
Materials (kCHF)						

ASGC, Taipei	Pledged	Planned to be pledged				Comment
	2006	2007	2008	2009	2010	
Personnel (FTE)	4.2	5.4	4	4	4	
Materials (kCHF)						