CERN-RRB-2008-104
October 2008

LHC Computing Grid Project

Status of Resources and Financial Plan

Computing Resources Review Board (C-RRB) – November 2008

1. Introduction

The following report summarises the current signature status of the Worldwide LHC Computing Grid (WLCG) Memorandum of Understanding (MoU), WLCG funding and expenditure estimates at CERN up to 2012, resource accounting for Tier-1 and Tier-2 sites and summarises the current computing requirements and resource pledges following recent input from Tier-1 and Tier-2 sites available as an annex to the report. This pledge collection exercise leads to a proposal for change to the timescale currently defined in paragraph 4.5 of the WLCG MoU for consideration at the C-RRB meeting.

Complementary information can be found on the new WLCG website http://lcg.web.cern.ch/LCG/

2. WLCG Memorandum of Understanding Signature Status

Since the April 2008 C-RRB meeting, the Czech Republic has signed the WLCG MoU supporting the ALICE and ATLAS experiments. As already reported in April, all 11 Tier-1 Federations have signed, and apart from one exception which is currently being handled, all Tier-2 Federations have signed. The exception is Austria. At the time of writing this report a commitment has been made by the Austrian Ministry to sign before the C-RRB meeting about which progress will be reported on at the meeting. Table 1 summarises the current signature status.

As already mentioned in April, there is still consideration for the extension of the Korean Federation to support CMS and some recent exchanges of information suggest that this might happen soon. Any evolution will be reported on at the C-RRB meeting.

Finally, Brazil is still planning to join WLCG supporting all 4 experiments, however agreement to the signature of the WLCG MoU has not been reached. A letter was sent by J. Engelen in June 2008 to the President of CNPq, the National Financial Support Agency, encouraging signature of the document.

	Country	Funding Agency/Signatory	Signature status	Comments
Member States	Austria	BMWF	N	Commitment to sign before 11/11/2008
	Belgium	FNRS	Y	
	Belgium	FWO	Y	
	Czech Rep.	MSMT CR	Y	Signed since last C-RRB
	Denmark	National Science Research Council	Y	
	Finland	HIP	Y	
	France	CEA/DSM/DAPNIA	Y	
	France	CNRS/IN2P3	Y	
	Germany	ALU/DESY	Y	
	Germany	BUW/DESY	Y	
	Germany	DESY	Y	
	Germany	FZK	Y	
	Germany	GSI	Y	
	Germany	MPG	Y	
	Germany	LMU	Y	
	Germany	RWTH/DESY	Y	
	Italy	INFN	Y	
	The Netherlands	NIKHEF	Y	
	Norway	Research Council of Norway	Y	
	Poland	The Minister of Science & Education	Y	
	Portugal	GRICES/FCT/UMIC	Y	
	Spain	MEC	Y	
	Sweden	Swedish Research Council	Y	
	Switzerland	SER/SNF/ETH/CSCS	Y	
	United Kingdom	STFC	Y	
Non-Member States	Australia	AusHEP	Y	
	Canada	CFI	Y	
	China	MoST/NSFC	Y	
	Estonia	NICPB	Y	
	Hungary	NKTH	Y	
	India	DAE	Y	
	Israel	ICHEP	Y	
	Japan	Univ. Tokyo	Y	
	JINR, Dubna	JINR	Y	
	Korea *	KICOS	Y	
	Pakistan	PAEC/NCP	Y	
	Romania	National Authority for Scientific Research	Y	
	Russia	Federal Agency for Science & Innovation	Y	
	Slovenia	Ministry of Higher Education, Science and Technology	Y	
	Taipei	Academia Sinica	Y	
	Turkey	TAEK	Y	
	Ukraine	National Academy of Sciences	Y	
	USA	DOE	Y	
	USA	NSF	Y	

* Korean T2 Federation extension supporting CMS currently under consideration

Table 1: Signature Status of WLCG Memorandum of Understanding as of 24/10/2008

In summary progress has continued, all Tier-1 MoU signatures and hopefully by the time of the meeting all of the Tier-2 signatures are now obtained. Follow-up is required with Brazil and Korea.

3. Funding and Expenditure for WLCG at CERN

The cost and funding estimates for LCG Phase 2 at CERN covering the years 2005-2008 are shown in Table 2. As stated in previous reports to the C-RRB, the personnel planning to complete LCG Phase 2 and continue in the next phase of the project relies on EGEE3 to fund an estimated 14 Full Time Equivalent (FTE) collaborators to GRID deployment activities. The EGEE3 project runs from May 2008 to April 2010.

The estimated balance at the end of Phase 2 is 1.4 MCHF to be carried over to the next phase of the project including estimated spending up to end 2008. Final 2008 figures will be presented at the April C-RRB meeting following the book-closing exercise.

Table 3 shows future funding and estimated expenditure for the years 2009-2012 and predicts an overall balance at the end of 2012 of 0.2 MCHF. This includes expenditure for the adaptation of the CERN infrastructure to cope with the power and cooling requirements necessary for the expected data from the experiments.

LCG Phase 2 at 31/08/08

(in MCHF)

	2005	2006	2007	2008	TOTAL
Funding					
From CERN Budget					
Personnel	***1.5***	***16.5***	***17.1***	***17.9***	***53.0***
- *Physics Computing*		***11.6***	***12.0***	***13.2***	***36.8***
- IT		8.4	8.8	9.7	**26.9**
- PH		3.3	3.2	3.5	**9.9**
- *LCG Project*	***1.5***	***4.9***	***5.1***	***4.7***	***16.2***
- IT	1.2	3.6	3.9	3.6	**12.3**
- PH	0.3	1.2	1.2	1.1	**3.9**
Materials	***1.8***	***21.3***	***18.6***	***26.6***	***68.2***
- *Physics Operations*		***5.0***	***5.1***	***5.0***	***15.1***
- IT		4.5	4.6	4.5	**13.7**
- PH		0.5	0.5	0.4	**1.4**
- *Tier 0 and CERN Analysis Facility*	1.8	16.3	13.5	21.6	**53.1**
Contributions via Team Accounts*					
- Personnel		2.0	2.2	1.1	**5.3**
- Material			0.0	1.0	**1.1**
In-kind Contributions*					
- Personnel		1.4	1.7	1.0	**4.1**
Total					
- **Personnel**	**1.5**	**19.8**	**21.1**	**20.0**	**62.4**
- **Materials**	**1.8**	**21.3**	**18.6**	**27.6**	**69.3**
Total Funding	**3.3**	**41.1**	**39.7**	**47.5**	**131.7**
Expenditure					
- Personnel **	**1.5**	**19.8**	**21.1**	**19.8**	**62.3**
- Materials	**1.8**	**21.3**	**18.6**	**26.3**	**68.0**
- *Physics Operations*		5.0	5.1	4.7	**14.9**
- *Tier 0 and CERN Analysis Facility*	1.8	16.3	13.5	21.6	**53.1**
Total Planned Expenditure	**3.3**	**41.1**	**39.7**	**46.1**	**130.3**
Balance Personnel	**0.0**	**0.0**	**0.0**	**0.1**	**0.1**
Balance Materials	**0.0**	**0.0**	**0.0**	**1.2**	**1.3**
Balance	**0.0**	**0.0**	**0.0**	**1.3**	**1.4**

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

** - Personnel from EGEE, EGEE-II and EGEE-III will participate in LCG at CERN during this phase of the project
- Operators Support from Computer Centre will participate in LCG at CERN during this phase of the project
These resources are not included in this Table.

Table 2: Cost and funding estimates for LCG Phase 2

LHC Future Computing Funding and Expenditure Estimates

(all figures in MCHF at 31/08/2008)

	2009	2010	2011	2012	TOTAL
Funding					
From CERN Budget					
- Personnel	12.1	13.8	13.8	13.8	**53.5**
- Materials	22.5	22.5	22.5	22.5	**90.1**
- Carry-over from Phase 2					
- Personnel	0.1				**0.1**
- Materials	0.3				**0.3**
Contributions via Team Accounts*					
- Personnel	1.5	0.7	0.1		**2.3**
- Carry-over from Phase 2 Materials	0.9				**0.9**
In-kind Contributions*					
- Personnel	1.1	1.1			**2.2**
Total					
- Personnel	**14.8**	**15.6**	**13.9**	**13.8**	**58.1**
- Materials	**23.8**	**22.5**	**22.5**	**22.5**	**91.3**
Total Funding	**38.6**	**38.1**	**36.4**	**36.3**	**149.4**
Expenditure					
- Personnel **	**15.6**	**15.6**	**14.2**	**13.7**	**59.1**
- Materials	**23.7**	**22.1**	**22.7**	**21.6**	**90.1**
Total Planned Expenditure	**39.2**	**37.7**	**36.9**	**35.3**	**149.2**
Balance Personnel	**-0.8**	**0.0**	**-0.4**	**0.1**	**-1.0**
Balance Materials	**0.1**	**0.4**	**-0.2**	**0.9**	**1.3**
Balance	**-0.6**	**0.4**	**-0.5**	**1.0**	**0.2**

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

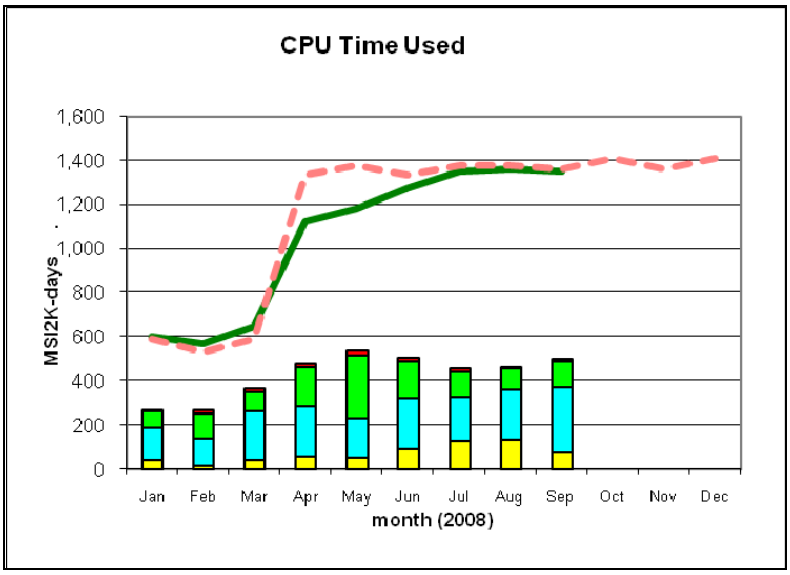
** - Personnel from EGEE-III will participate until April 2010 in LCG at CERN during this phase of the project
- Operators Support from Computer Centre will participate in LCG at CERN during this phase of the project
These resources are not included in this Table.

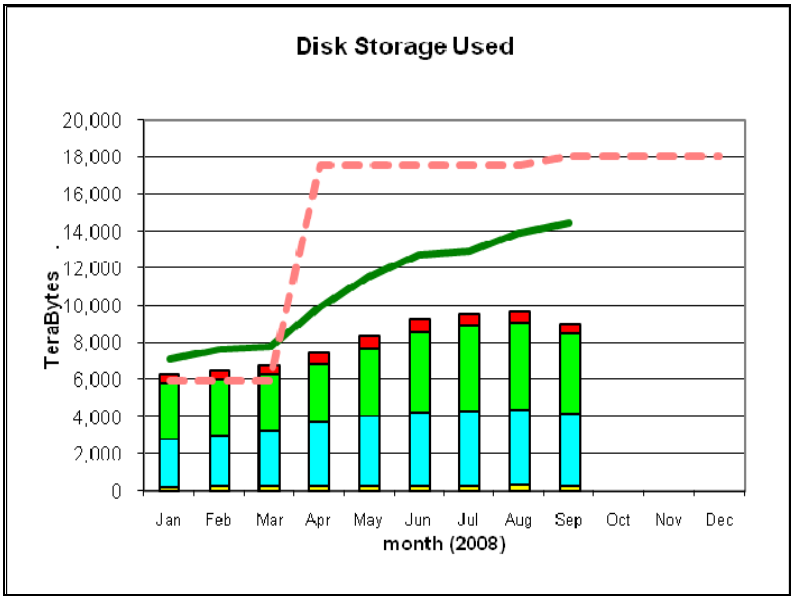
Table 3: LHC Computing Budget Estimates for 2009-2012

4. Resource Accounting

4.1 CERN and External Tier-1 Accounting

Accounting data for CERN and External Tier-1 sites has been reported at the last C-RRB meetings, and full accounting reports covering 2006, 2007 and 2008 are available on the LCG website Accounting page http://lcg.web.cern.ch/LCG/accounts.htm. Figure 1 shows the CPU delivered, Disk and Tape used at CERN and the external Tier-1s for the period January-September 2008.





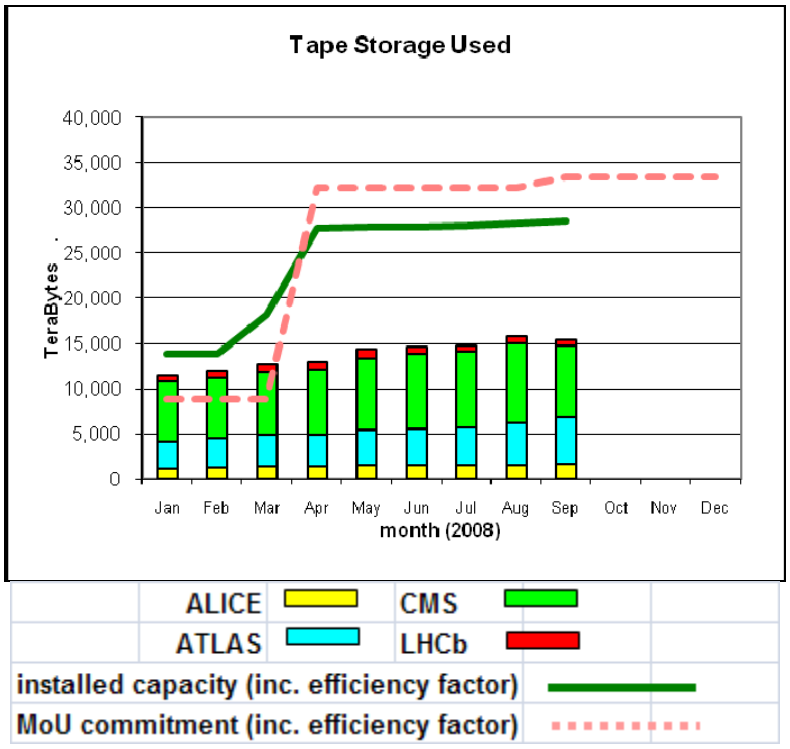


Figure 1: Accounting for CERN and External Tier-1s January- September 2008

4.2 Tier-2 Accounting

Tier-2 accounting began in September 2007 following an information campaign and some test reporting during the summer of 2007. In some Federations sites are being added, removed or renamed so the situation is not yet fully stable, however there is mainly positive evolution on a monthly basis since reporting began.

At the last C-RRB meeting it was reported that certain Federations had not yet started to report, and this was encouraged to begin as soon as possible. In the meantime all are now reporting with the exception of Ukraine with which follow-up is currently ongoing to ensure they will begin reporting before the end of 2008.

It should be noted that work has started to more fully automate Tier-1 and Tier-2 accounting, particularly to obtain the installed capacity at Tier-2 sites.

Figure 2 shows the 10 Federations with MoU pledge values higher than 1000 KSI2K. Figure 3 shows all the others, in both cases ordered by pledge value. The data is for September 2008.

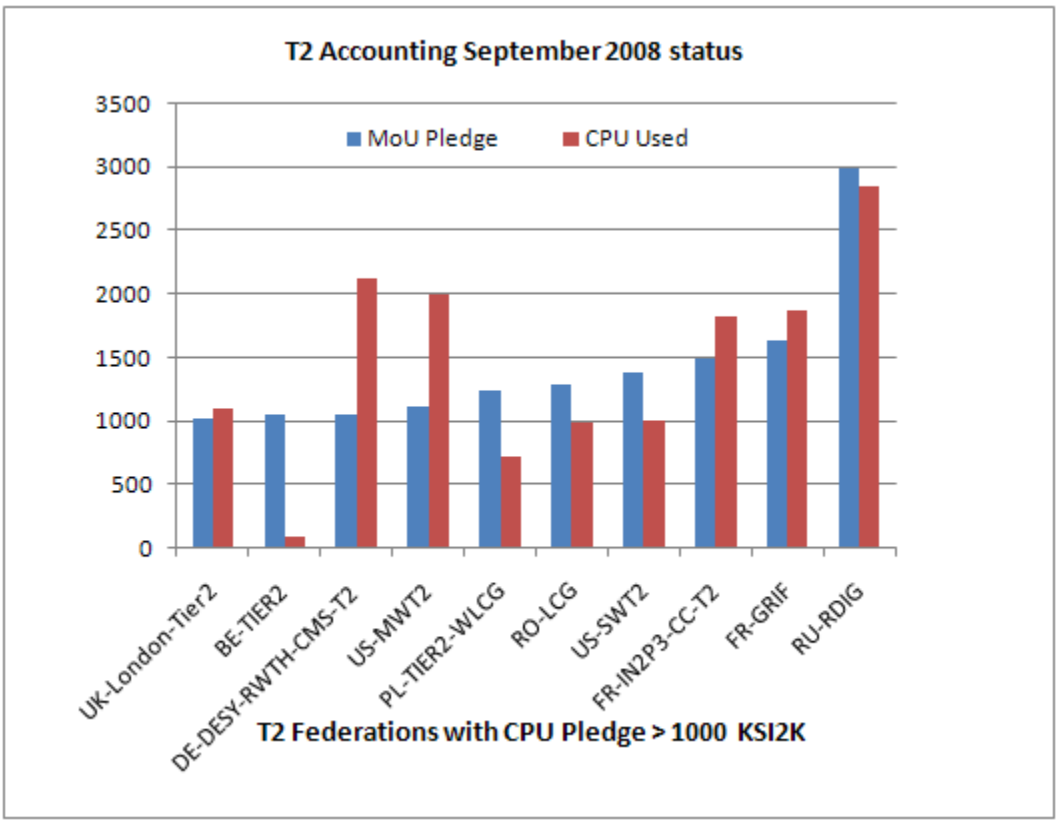


Figure 2: Accounting for Federations with CPU Pledge > 1000 KSI2K in September 2008

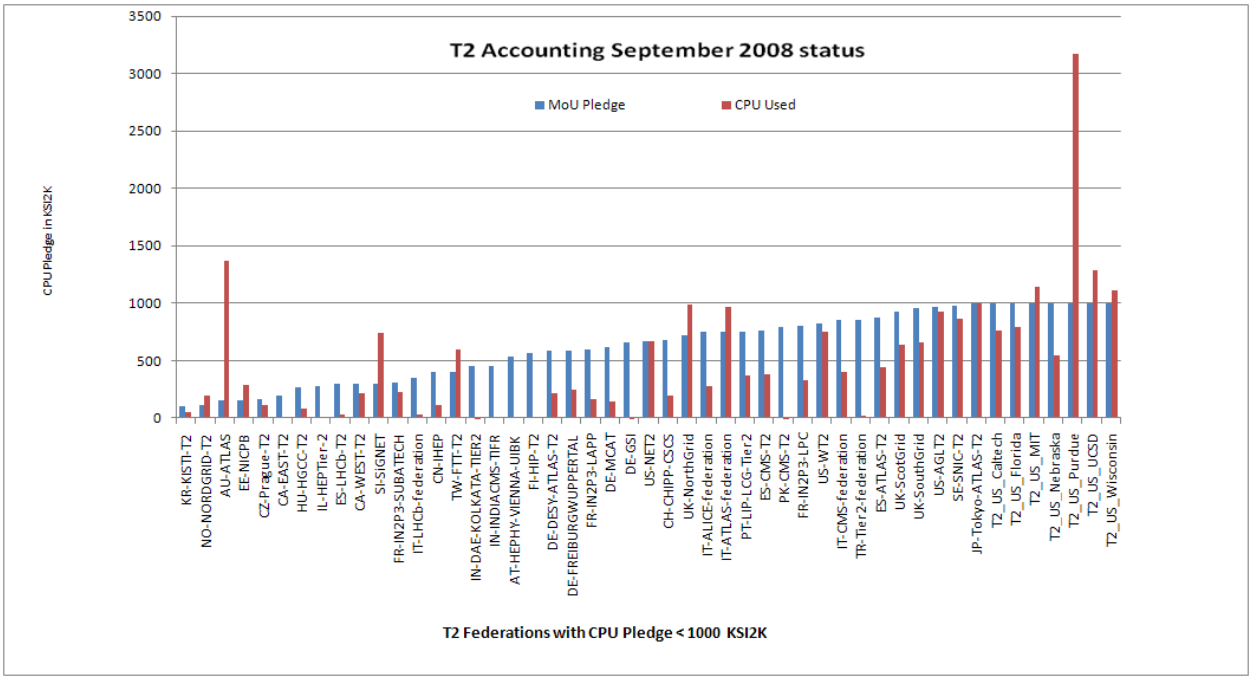


Figure 3: Accounting for Federations with CPU Pledge <1000 KSI2K in September 2008

5. Revised Computing Requirements and Pledges

The last C-RRB meeting marked the launch of the annual resource pledge collection exercise. At the time it was felt necessary to recall the process, timescale and expectations to ensure that by Autumn 2008 there were fewer surprises with respect to the last exercise. The following 2 points were shown:

- Autumn C-RRB meeting: firm commitment to pledge values for the following year and planned pledge values for the subsequent 4 years. For the Autumn C-RRB meeting of 11/11/08 all Federations must have provided their confirmed pledge values for 2009 and planned values for 2010-2013 by 27/10/08.
- Spring C-RRB: confirmation that pledge values are installed and running a production service since 1st April of the same year or eventually explanation of any change.

Globally as a result of this advance preparation and good collaboration from WLCG representatives, most of the pledge data was received by the deadline.

At the WLCG Management Board it was agreed that experiment requirements would not be revised until initial data-taking had begun, therefore for this exercise experiments were only asked to provide requirements for 2013, in addition to their requirements already published since summer 2007. Requirements up to and including 2013 were circulated during the summer 2008 with a reminder of the deadline for input from the Federations for the C-RRB meeting.

Table 4 shows the status of the resources for 2009, including a split across the experiments, for CERN, Tier-1 and Tier 2 sites at 27/10/08. Table 5 shows the resources for 2010-2013 summed over all experiments for the External Tier-1 and Tier-2 sites. The full result of the campaign from which Tables 4 and 5 are derived is dated 27/10/08 and available as an annex to this report. It is felt necessary to include the resource tables due to the importance of the data contained therein, and to ensure the commitment to 2009 pledge data is fully visible and understood.

Needless to say 2008 has been a special year, and collecting this information on time in parallel to LHC events was non-negligible. On the one hand experiment requirements data is based on Technical Design Report assumptions and also does not take into account the work of the Resource Scrutiny Group. On the other hand a delay to the LHC start-up and initial data taking was seen by some Federations as a reason to change procurement plans. At the WLCG Management Board meeting of 22/10/08 and the Overview Board meeting of 27/10/08 the current LHC start-up schedule and information available was discussed and it was agreed that a change to procurement plans is unjustified.

In several cases the overall timescale of the exercise was commented on, with several Federations pointing out that due to funding cycles within their country, pledge data provided on the short-term (2009-2011) was reliable with an agreed budget basis. It was very often pointed out that on the medium term (2012-2013), and due to the lack of agreed budget, planned pledges provided were very approximate estimations with little significance.

This therefore puts into question the timescale of the exercise according to WLCG MoU paragraph 4.5 which defines the timescale for Computing Resource and Service Levels to be those pledged in the next year and planned to be pledged in each of the four subsequent years.

The proposal to be discussed at the C-RRB meeting is to reduce the subsequent years from four to two to be more consistent with funding cycles and to give a more accurate overall picture.

CERN Tier0	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	Offered	9000	4058	9800	1050	23908
	Required	9000	4058	9800	1050	23908
	% of Req.	100%	100%	100%	100%	100%
Disk (Tbytes)	Offered	4200	265	200	991	5656
	Required	4200	265	200	991	5656
	% of Req.	100%	101%	100%	100%	100%
Tape (Tbytes)	Offered	7300	5562	7300	2270	22432
	Required	7300	5562	7300	2270	22432
	% of Req.	100%	100%	100%	100%	100%

CERN Analysis Facility	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	Offered	2600	2562	3900	0	9062
	Required	2600	2562	3900	0	9062
	% of Req.	100%	100%	100%	100%	100%
Disk (Tbytes)	Offered	300	1809	2300	0	4409
	Required	300	1809	2300	0	4409
	% of Req.	100%	100%	100%	100%	100%
Tape (Tbytes)	Offered	0	651	2000	0	2651
	Required	0	651	2000	0	2651
	% of Req.	100%	100%	100%	100%	100%

Summary Tier-1 Sites	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	Offered	10231	30226	15939	5054	61450
	Required	19900	28430	16300	4970	69600
	Balance	-49%	6%	-2%	2%	-12%
Disk (Tbytes)	Offered	3881	19864	8436	2709	34890
	Required	6800	20920	9700	2759	40179
	Balance	-43%	-5%	-13%	-2%	-13%
Tape (Tbytes)	Offered	6181	14723	16021	3264	40189
	Required	12400	15790	15000	3070	46260
	Balance	-50%	-7%	7%	6%	-13%

Summary Tier-2 Sites	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	Offered	8070	26919	25768	6843	71400
	Required	14300	26970	28100	11380	80750
	Balance	-44%	0%	-8%	-40%	-12%
Disk (Tbytes)	Offered	2242	10705	7673	189	22509
	Required	4000	13300	5700	23	23023
	Balance	-44%	-20%	35%	721%	-2%

Table 4: 2009 Computing Requirements and Pledges for CERN, Tier-1 and Tier-2 sites – status 27/10/08

External Tier-1 Sites		SUM 2008	SUM 2009	SUM 2010	SUM 2011	SUM 2012	SUM 2013
CPU (kSI2K)	Offered	37568	61450	101541	129667	153262	194106
	Required	39590	69600	114720	152230	191810	261330
	Balance	-5%	-12%	-11%	-15%	-20%	-26%
Disk (Tbytes)	Offered	20221	34890	60336	79682	94377	130276
	Required	22955	40179	71000	96791	123892	182693
	Balance	-12%	-13%	-15%	-18%	-24%	-29%
Tape (Tbytes)	Offered	21303	40189	65938	89805	115423	142731
	Required	24530	46260	78664	114610	152396	185403
	Balance	-13%	-13%	-16%	-22%	-24%	-23%
Tier-2 Sites		SUM 2008	SUM 2009	SUM 2010	SUM 2011	SUM 2012	SUM 2013
CPU (kSI2K)	Offered	45892	71400	111446	143578	177208	201262
	Required	47960	80750	164540	218720	275010	349090
	Balance	-4%	-12%	-32%	-34%	-36%	-42%
Disk (Tbytes)	Offered	12573	22509	34741	44610	57055	65395
	Required	14579	23023	34243	47903	61963	83310
	Balance	-14%	-2%	1%	-7%	-8%	-22%

Table 5: 2008-2013 Computing Pledges and Requirements for External Tier-1 and Tier-2 sites – status 27/10/08

With respect to the status on 10/10/07 presented at the last C-RRB meeting, the 2009 situation has remained very similar for CPU, Disk and Tape at the Tier-1s and slightly improved at the Tier-2s. From 2010-2013 while there is still an increasing shortfall in resources, the situation has slightly improved, particularly at the Tier-2s with respect to the status on 10/10/07.

It should be noted that the newly-formed Resource Scrutiny Group will report first conclusions at the C-RRB meeting which could impact future experiment requirement requests. Following LHC start-up and initial data-taking the experiments will all revise their computing models and their requirements. For the next resource pledge exercise in 2009 many contributing factors could have changed and it is expected that the conclusions as reported in Tables 4 and 5 could look quite different.

At the April 2009 C-RRB meeting, Federations are reminded that those computing resources pledged for 2009 which are not operational must be declared before or at the meeting.

6. Conclusion

The MoU signatures are now well advanced with just a couple of Federations (Brazil, Korea) still needing follow-up.

The WLCG Funding and Expenditure situation up to and including 2012 as laid out in Tables 2 and 3 illustrate that globally the project will not run into major financial difficulties, however this should continue to be monitored and reviewed frequently.

Tier-1 and Tier-2 accounting over the past months shows that despite some delays in installing 2008 resources the situation is closely monitored. The WLCG accounting will be enhanced to automatically obtain installed capacity for Tier-1 and Tier-2 sites which should lead to more reliable and harmonised accounting reporting in the future.

The Computing requirements and pledge data for 2008-2013 inclusive still shows significant shortfall. The timescale for the pledge revision exercise is deemed unrealistic with respect to national funding cycles and it is proposed to aim in future for a shorter but more realistic timescale to enable more accurate data to be obtained: resource pledge commitment for next year and planned resource commitment for the following two years.

At the C-RRB meeting in April 2009, resources pledged and not yet installed must be declared before or at the meeting by each Federation as a follow-up to the commitment to 2009 pledges formally approved on 11/11/08.

The conclusions of the Resource Scrutiny Group and the revised experiment requirements should lead to a major update of computing requirements in 2009 which should offer a more accurate and realistic picture for the 2009 resource pledge exercise.

LCG Tier 0 and 1 Resources

CERN Tier0	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	11170	23908	35310	37410	40910	45470	Offered	9000	4058	9800	1050	23908
							Required	9000	4058	9800	1050	23908
							% of Req.	100%	100%	100%	100%	100%
Disk (Tbytes)	2423	5656	5542	5942	6142	7200	Offered	4200	265	200	991	5656
							Required	4200	265	200	991	5656
							% of Req.	100%	100%	100%	100%	100%
Tape (Tbytes)	10780	22432	36090	51120	66760	83500	Offered	7300	5562	7300	2270	22432
							Required	7300	5562	7300	2270	22432
							% of Req.	100%	100%	100%	100%	100%
Nominal WAN (Mbits/sec)	120000	140000	160000	160000	160000	160000						

CERN Analysis Facility	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	4680	9062	18090	25120	31930	39700	Offered	2600	2562	3900	0	9062
							Required	2600	2562	3900	0	9062
							% of Req.	100%	100%	100%	100%	100%
Disk (Tbytes)	3126	4409	7865	11136	14022	16500	Offered	300	1809	2300	0	4409
							Required	300	1809	2300	0	4409
							% of Req.	100%	100%	100%	100%	100%
Tape (Tbytes)	1270	2651	6960	10480	14850	18700	Offered	0	651	2000	0	2651
							Required	0	651	2000	0	2651
							% of Req.	100%	100%	100%	100%	100%

Canada Tier1	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	910	1420	2480	3540	4600	5660	Offered		1420			1420
							% of Total		5%			5%
Disk (Tbytes)	500	990	1980	2810	3650	4490	Offered		990			990
							% of Total		5%			5%
Tape (Tbytes)	390	750	1440	2245	3180	4110	Offered		750			750
							% of Total		5%			5%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000	10000						

FZK-GridKa	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	5672	10355	15381	20440	25843	34643	Offered	4900	2843	1800	812	10355
							% of Total	25%	10%	11%	16%	15%
Disk (Tbytes)	2933	5142	9177	12429	16081	23187	Offered	1530	2092	1060	460	5142
							% of Total	23%	10%	11%	17%	13%
Tape (Tbytes)	3629	7190	11667	16518	21543	26126	Offered	3100	1578	2000	512	7190
							% of Total	25%	10%	13%	17%	16%
Nominal WAN (Mbits/sec)	20000	30000	30000	30000	30000	30000						

IN2P3 Lyon	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	4240	7998	13441	17955	22460	29779	Offered	1592	3240	1824	1342	7998
							% of Total	8%	11%	11%	27%	11%
Disk (Tbytes)	2375	4600	8224	11322	14400	21125	Offered	544	2244	1067	745	4600
							% of Total	8%	11%	11%	27%	11%
Tape (Tbytes)	2470	5175	9180	13756	18356	24851	Offered	992	1704	1650	829	5175
							% of Total	8%	11%	11%	27%	11%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000	10000						

INFN CNAF (Note1)	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	3000	5300	8500	12500	16000	18000	Offered	1166	1696	1855	583	5300
							% of Total	6%	6%	11%	12%	8%
Disk (Tbytes)	1300	2300	4100	6800	9500	11500	Offered	506	736	805	253	2300
							% of Total	7%	4%	8%	9%	6%
Tape (Tbytes)	1500	2600	4200	7100	11000	14000	Offered	572	832	910	286	2600
							% of Total	5%	5%	6%	9%	6%
Nominal WAN (Mbits/sec)	20000	30000	40000	40000	40000	40000						

Netherlands LHC/Tier1 (Note2)	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	4382	7544	12305	12305	12305	12305	Offered	793	5474		1277	7544
							% of Total	4%	19%		26%	14%
Disk (Tbytes)	2510	3753	6149	6149	6149	6149	Offered	431	2656		666	3753
							% of Total	6%	13%		24%	12%
Tape (Tbytes)	1813	3548	5736	5736	5736	5736	Offered	430	2132		986	3548
							% of Total	3%	14%		32%	11%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000	10000						

NDGF Tier1	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	2172	3030	4200	5400	5900	5900	Offered	1560	1470			3030
							% of Total	8%	5%			6%
Disk (Tbytes)	1079	1580	2480	3210	3460	3460	Offered	750	830			1580
							% of Total	11%	4%			6%
Tape (Tbytes)	930	1660	2770	4040	4640	4640	Offered	980	680			1660
							% of Total	8%	4%			6%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000	10000						

Spain PIC	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	1509	2591	5109	6941	8731	12336	Offered		1226	1058	307	2591
							% of Total		4%	6%	6%	5%
Disk (Tbytes)	967	1702	3009	4090	5176	7880	Offered		902	630	170	1702
							% of Total		4%	6%	6%	5%
Tape (Tbytes)	953	1844	3402	5249	7253	10986	Offered		681	974	189	1844
							% of Total		4%	6%	6%	5%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000	10000						

Taipei ASGC	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	3400	5000	7000	8000	9000	10000	Offered		2500	2500		5000
							% of Total		9%	15%		11%
Disk (Tbytes)	1500	3000	3500	4000	4500	4500	Offered		1500	1500		3000
							% of Total		%	15%		10%
Tape (Tbytes)	1300	3000	3500	4500	4500	4500	Offered		1500	1500		3000
							% of Total		9%	10%		10%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000	10000						

UK Tier1	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	3139	5775	9260	13293	16191	22183	Offered	220	3020	1802	733	5775
							% of Total	1%	11%	11%	15%	8%
Disk (Tbytes)	1921	3401	5980	8263	10396	16285	Offered	120	2092	774	415	3401
							% of Total	2%	10%	8%	15%	8%
Tape (Tbytes)	1903	4045	6757	9841	13130	18152	Offered	107	1589	1887	462	4045
							% of Total	1%	10%	13%	15%	9%
Nominal WAN (Mbits/sec)	10000	10000	10000	40000	40000	40000						

US-ATLAS Tier1	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	4844	7337	12765	18193	21132	32200	Offered		7337			7337
							% of Total		26%			26%
Disk (Tbytes)	3136	5822	11637	16509	16965	27600	Offered		5822			5822
							% of Total		28%			28%
Tape (Tbytes)	1715	3277	6286	9820	15085	18630	Offered		3277			3277
							% of Total		21%			21%
Nominal WAN (Mbits/sec)	19904	29856	39808	39808	39808	39808						

US-CMS Tier1	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	4300	5100	11100	11100	11100	11100	Offered			5100		5100
							% of Total			31%		31%
Disk (Tbytes)	2000	2600	4100	4100	4100	4100	Offered			2600		2600
							% of Total			27%		27%
Tape (Tbytes)	4700	7100	11000	11000	11000	11000	Offered			7100		7100
							% of Total			47%		47%
Nominal WAN (Mbits/sec)												

Summary Ext. Tier1s	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	37568	61450	101541	129667	153262	194106	Offered	10231	30226	15939	5054	61450
							Required	19900	28430	16300	4970	69600
							Balance	-49%	6%	-2%	2%	-12%
Disk (Tbytes)	20221	34890	60336	79682	94377	130276	Offered	3881	19864	8436	2709	34890
							Required	6800	20920	9700	2759	40179
							Balance	-43%	-5%	-13%	-2%	-13%
Tape (Tbytes)	21303	40189	65938	89805	115423	142731	Offered	6181	14723	16021	3264	40189
							Required	12400	15790	15000	3070	46260
							Balance	-50%	-7%	7%	6%	-13%

Summary Ext. Tier1s	2008	2009	2010	2011	2012	2013		SUM 2008	SUM 2009	SUM 2010	SUM 2011	SUM 2012	SUM 2013
CPU (kSI2K)	37568	61450	101541	129667	153262	194106	Offered	37568	61450	101541	129667	153262	194106
							Required	39590	69600	114720	152230	191810	261330
							Balance	-5%	-12%	-11%	-15%	-20%	-26%
Disk (Tbytes)	20221	34890	60336	79682	94377	130276	Offered	20221	34890	60336	79682	94377	130276
							Required	22955	40179	71000	96791	123892	182693
							Balance	-12%	-13%	-15%	-18%	-24%	-29%
Tape (Tbytes)	21303	40189	65938	89805	115423	142731	Offered	21303	40189	65938	89805	115423	142731
							Required	24530	46260	78664	114610	152396	185403
							Balance	-13%	-13%	-16%	-22%	-24%	-23%

Note 1: 50% of the INFN 2009 disk and tape resources will be made available in April-May, the remainder in December
Note 2: Netherlands LHC/Tier 1 2009 resources are planned to be installed by July 2009. To be confirmed in Spring 2009.

Ext. Tier1 Requ. 2009	ALICE	ATLAS	CMS	LHCb	SUM
CPU (kSI2K)	19900	28430	16300	4970	69600
Disk (Tbytes)	6800	20920	9700	2759	40179
Tape (Tbytes)	12400	15790	15000	3070	46260
Number of T1s	6	10	7	6	n/a

LCG Tier 2 Resources

Austria, Austrian Tier-2 Federation	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	540	1060	1200	1300	1300	1300	Offered		79	981		1060
							% of Total		0%	3%		2%
Disk (Tbytes)	110	295	330	390	440	440	Offered		27	268		295
							% of Total		0%	5%		2%
Nominal WAN (Mbits/sec)	1000	1000	1000	1000	1000	1000						

Australia, University of Melbourne	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	150	200	450	860	860	860	Offered		200			200
							% of Total		1%			1%
Disk (Tbytes)	70	110	280	370	370	370	Offered		110			110
							% of Total		1%			1%
Nominal WAN (Mbits/sec)												

Belgium, Belgian Tier-2 Fed. FNRS	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	700	1000	1500	1500	1500	1500	Offered			1000		1000
							% of Total			4%		4%
Disk (Tbytes)	180	300	450	450	450	450	Offered			300		300
							% of Total			5%		5%
Nominal WAN (Mbits/sec)	1500	2000	2000	2000	2000	2000						

Belgium, Belgian Tier-2 Fed. FWO	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	350	500	750	750	750	750	Offered			500		500
							% of Total			2%		2%
Disk (Tbytes)	90	150	220	220	220	220	Offered			150		150
							% of Total			3%		3%
Nominal WAN (Mbits/sec)	1500	2000	2000	2000	2000	2000						

Canada, Canada-East Federation	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	200	810	1545	2070	2600	3130	Offered		810			810
							% of Total		3%			3%
Disk (Tbytes)	13	360	610	850	1100	1350	Offered		360			360
							% of Total		3%			3%
Nominal WAN (Mbits/sec)												

Canada, Canada-West Federation	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	300	485	930	1250	1565	1880	Offered		485			485
							% of Total		2%			2%
Disk (Tbytes)	146	270	455	640	825	1010	Offered		270			270
							% of Total		2%			2%
Nominal WAN (Mbits/sec)												

China, IHEP, Beijing	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	400	1400	2000	2000	2200	2500	Offered		700	700		1400
							% of Total		3%	2%		3%
Disk (Tbytes)	200	400	600	600	700	800	Offered		200	200		400
							% of Total		2%	4%		2%
Nominal WAN (Mbits/sec)	1000	1000	1000	1000	1000	1000						

Czech Rep., FZU, Prague	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	164	376	637	996	1517	2235	Offered	220	156			376
							% of Total	2%	1%			1%
Disk (Tbytes)	35	72	201	367	584	867	Offered	35	37			72
							% of Total	1%	0%			0%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000	1000						

Estonia, NICPB, Tallinn	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	750	800	800	800	800	800	Offered			800		800
							% of Total			3%		3%
Disk (Tbytes)	80	80	80	80	80	80	Offered			80		80
							% of Total			1%		1%
Nominal WAN (Mbits/sec)	2000	2000	2000	2000	2000	2000						

Finland, NDGF/HIP Tier-2	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	564	670	670	670	670	670	Offered			670		670
							% of Total			2%		2%
Disk (Tbytes)	97	210	210	210	210	210	Offered			210		210
							% of Total			4%		4%
Nominal WAN (Mbits/sec)												

France, CC-IN2P3, Lyon	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	1500	4090	6786	10157	11874	14060	Offered	1001	539	843	1707	4090
							% of Total	7%	2%	3%	15%	5%
Disk (Tbytes)	180	544	687	1149	1352	1734	Offered	280	18	171	75	544
							% of Total	7%	0%	3%	326%	2%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000	10000						

France, GRIF, Paris	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	1642	2793	5301	7014	8723	10954	Offered	314	1381	784	314	2793
							% of Total	2%	5%	3%	3%	3%
Disk (Tbytes)	568	938	1404	1872	2384	3033	Offered	83	681	173	1	938
							% of Total	2%	5%	3%	4%	4%
Nominal WAN (Mbits/sec)	1000	1000	1000	1000	1000	1000						

France, LAPP, Annecy	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	600	1000	1300	1700	2100	2600	Offered		733		267	1000
							% of Total		3%		2%	3%
Disk (Tbytes)	70	140	230	330	430	530	Offered		138		2	140
							% of Total		1%		9%	1%
Nominal WAN (Mbits/sec)	1000	1000	1000	1000	1000	1000						

France, LPC, Clermont (Note 1)	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	800	1340	1770	2180	2660	2660	Offered	402	670		268	1340
							% of Total	3%	2%		2%	3%
Disk (Tbytes)	110	210	370	470	750	750	Offered	63	145		2	210
							% of Total	2%	1%		9%	1%
Nominal WAN (Mbits/sec)	1000	1000	1000	1000	1000	1000						

France, Subatech, Nantes	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	312	430	430	430	430	430	Offered	430				430
							% of Total	3%				3%
Disk (Tbytes)	43	140	140	140	140	140	Offered	140				140
							% of Total	4%				4%
Nominal WAN (Mbits/sec)	1000	1000	1000	1000	1000	1000						

Germany, DESY, ATLAS (Note 2)	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	583	899	1718	2304	2304		Offered		899			899
							% of Total		3%			3%
Disk (Tbytes)	258	437	737	1036	1036		Offered		437			437
							% of Total		3%			3%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000							

Germany, CMS Federation DESY (Note 2)	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	600	1000	1800	2300	2300		Offered			1000		1000
							% of Total			4%		4%
Disk (Tbytes)	170	340	530	850	850		Offered			340		340
							% of Total			6%		6%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000							

Germany, CMS Federation Aachen (Note 2)	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	450	700	700	700	700		Offered			700		700
							% of Total			2%		2%
Disk (Tbytes)	100	150	150	150	150		Offered			150		150
							% of Total			3%		3%
Nominal WAN (Mbits/sec)	2000	2000	2000	2000	2000							

Germany, GSI, Darmstadt	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	660	860	1100	1320	1700	2210	Offered	860				860
							% of Total	6%				6%
Disk (Tbytes)	200	260	340	450	590	770	Offered	260				260
							% of Total	7%				7%
Nominal WAN (Mbits/sec)	1000	1000	1000	1000	1000	1000						

Germany, ATLAS Fed. Munich MPI/RZG	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	332	529	860	1150	1450	1450	Offered		529			529
							% of Total		2%			2%
Disk (Tbytes)	146	265	370	520	670	670	Offered		265			265
							% of Total		2%			2%
Nominal WAN (Mbits/sec)	1000	1000	1000	1000	1000	1000						

Germany, ATLAS Fed. Munich LMU/LRZ	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	290	450	860	1150	1450	1450	Offered		450			450
							% of Total		2%			2%
Disk (Tbytes)	130	220	370	520	670	670	Offered		220			220
							% of Total		2%			2%
Nominal WAN (Mbits/sec)	1000	1000	1000	1000	1000	1000						

Germany, ATLAS Fed. FR/W Wuppertal	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	292	450	859	1152	1152	1152	Offered		450			450
							% of Total		2%			2%
Disk (Tbytes)	129	219	369	518	518	518	Offered		219			219
							% of Total		2%			2%
Nominal WAN (Mbits/sec)	1000	1000	1000	1000	1000	1000						

Germany, ATLAS Fed. FR/W Freiburg	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	292	450	859	1152	1152	1152	Offered		450			450
							% of Total		2%			2%
Disk (Tbytes)	129	219	369	518	518	518	Offered		219			219
							% of Total		2%			2%
Nominal WAN (Mbits/sec)	1000	1000	1000	1000	1000	1000						

Hungary, HGCC Federation	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	270	300	360	450	500	700	Offered	100		200		300
							% of Total	1%		1%		1%
Disk (Tbytes)	70	100	120	150	200	250	Offered	33		67		100
							% of Total	1%		1%		1%
Nominal WAN (Mbits/sec)	1000	1000	1000	1000	1000	1000						

India, VECC/SINP, Kolkata (Note 3)	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	450	350	600	600	600	600	Offered	350				350
							% of Total	2%				2%
Disk (Tbytes)	180	120	240	240	240	600	Offered	120				120
							% of Total	3%				3%
Nominal WAN (Mbits/sec)	155	180	180	180	180	180						

India, TIFR, Mumbai	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	450	600	800	1000	1000	1000	Offered			600		600
							% of Total			2%		2%
Disk (Tbytes)	300	450	600	750	750	750	Offered			450		450
							% of Total			8%		8%
Nominal WAN (Mbits/sec)	1000	1000	1000	1000	1000	1000						

Israel, HEP-IL Tier-2 Federation	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	280	360	700	950	1300	1300	Offered		360			360
							% of Total		1%			1%
Disk (Tbytes)	120	200	340	480	660	660	Offered		200			200
							% of Total		2%			2%
Nominal WAN (Mbits/sec)												

Italy, INFN ALICE Federation	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	750	1450	2700	3750	5000	6000	Offered	1450				1450
							% of Total	10%				10%
Disk (Tbytes)	250	550	800	1200	1550	1800	Offered	550				550
							% of Total	14%				14%
Nominal WAN (Mbits/sec)	1000	1000	1000	1000	1000	1000						

Italy, INFN ATLAS Federation	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	750	1480	2700	3750	5000	7000	Offered		1480			1480
							% of Total		5%			5%
Disk (Tbytes)	350	700	1150	1600	2000	2400	Offered		700			700
							% of Total		5%			5%
Nominal WAN (Mbits/sec)	1000	1000	1000	1000	1000	1000						

Italy, INFN CMS Federation	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	850	3300	3600	5300	6600	7500	Offered			3300		3300
							% of Total			12%		12%
Disk (Tbytes)	350	640	950	1400	1700	2000	Offered			640		640
							% of Total			11%		11%
Nominal WAN (Mbits/sec)	1000	1000	1000	1000	1000	1000						

Italy, INFN LHCb Federation	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	350	600	900	1200	1200	1200	Offered				600	600
							% of Total				5%	5%
Disk (Tbytes)	0	0	0	0	0	0	Offered				0	0
							% of Total				0%	0%
Nominal WAN (Mbits/sec)	1000	1000	1000	1000	1000	1000						

Japan, ICEPP, Tokyo	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	1000	1000	3000	3000	3000	7500	Offered		1000			1000
							% of Total		4%			4%
Disk (Tbytes)	400	400	600	600	600	1500	Offered		400			400
							% of Total		3%			3%
Nominal WAN (Mbits/sec)	2000	2000	2000	2000	2000	2000						

Republic of Korea, KISTI, Daejeon	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	100	150	150	150	150	150	Offered	150				150
							% of Total	1%				1%
Disk (Tbytes)	30	50	50	50	50	50	Offered	50				50
							% of Total	1%				1%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000	10000						

Norway, UNINETT SIGMA Tier2	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	110	320	450	650	850	850	Offered		320			320
							% of Total		1%			1%
Disk (Tbytes)	60	90	130	180	230	230	Offered		90			90
							% of Total		1%			1%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000	10000						

Pakistan, Pakistan Tier-2 Federation	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	795	820	870	1088	1360	1360	Offered			820		820
							% of Total			3%		3%
Disk (Tbytes)	200	200	200	250	300	300	Offered			200		200
							% of Total			4%		4%
Nominal WAN (Mbits/sec)	42	42	42	53	66	66						

Poland, Polish Tier-2 Federation	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	1250	1780	2635	3265	3940	4500	Offered	360	562	496	362	1780
							% of Total	3%	2%	2%	3%	2%
Disk (Tbytes)	202	340	599	808	1019	1247	Offered	50	184	106	0	340
							% of Total	1%	1%	2%	0%	1%
Nominal WAN (Mbits/sec)	1000	2000	2000	2000	2000	2000						

Portugal, LIP Tier-2 Federation	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	750	1600	1600	1600	1600	1600	Offered		1120	480		1600
							% of Total		4%	2%		3%
Disk (Tbytes)	160	700	700	700	700	700	Offered		481	219		700
							% of Total		4%	4%		4%
Nominal WAN (Mbits/sec)	1000	1000	1000	1000	1000	1000						

Romania, Romanian Tier-2 Federation	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	1300	2321	3023	3633	4213	4833	Offered	1379	625		317	2321
							% of Total	10%	2%		3%	4%
Disk (Tbytes)	263	576	816	989	1241	1509	Offered	378	192		6	576
							% of Total	9%	1%		26%	3%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000	10000						

Russian Federation, RDIG (Note 4)	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	3000	3800	6500	12000	17000	17000	Offered					3800
							% of Total	0%	0%	0%	0%	5%
Disk (Tbytes)	600	1700	3000	4000	5700	5700	Offered					1700
							% of Total	0%	0%	0%	0%	7%
Nominal WAN (Mbits/sec)	2500	2500	5000	10000	10000	10000						
Tape (Tbytes)			1500	2000	3000	3000						

Slovenia, SiGNET, Jozef Stefan Inst.	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	300	450	600	900	1200	1500	Offered		450			450
							% of Total		2%			2%
Disk (Tbytes)	150	200	300	450	600	750	Offered		200			200
							% of Total		2%			2%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000	10000						

Spain, ATLAS Federation	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	875	1349	2577	3456	4336	4336	Offered		1349			1349
							% of Total		5%			5%
Disk (Tbytes)	387	656	1107	1555	2003	2003	Offered		656			656
							% of Total		5%			5%
Nominal WAN (Mbits/sec)		10000										

Spain, CMS Federation	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	760	1280	2260	5290	6740	6740	Offered			1280		1280
							% of Total			5%		5%
Disk (Tbytes)	210	420	670	670	720	720	Offered			420		420
							% of Total			7%		7%
Nominal WAN (Mbits/sec)												

Spain, LHCb Federation	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	296	740	740	740	740	740	Offered				740	740
							% of Total				7%	7%
Disk (Tbytes)	1	1	1	1	1	1	Offered				1	1
							% of Total				4%	4%
Nominal WAN (Mbits/sec)												

Sweden, SNIC Tier2	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	981	1500	3060	4070	4070	4070	Offered	600	900			1500
							% of Total	4%	3%			4%
Disk (Tbytes)	364	430	640	890	890	890	Offered	110	320			430
							% of Total	3%	2%			2%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000	10000						

Switzerland, CHIPP, Manno	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	680	1440	2640	2640	2640	2640	Offered		419	519	502	1440
							% of Total		2%	2%	4%	2%
Disk (Tbytes)	225	490	910	910	910	910	Offered		196	196	98	490
							% of Total		1%	3%	426%	3%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000	10000						

Taipei, Taiwan Analysis Facility Federation	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	400	580	800	1120	1520	2020	Offered		290	290		580
							% of Total		1%	1%		1%
Disk (Tbytes)	150	250	350	480	650	850	Offered		125	125		250
							% of Total		1%	2%		1%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000	10000						

Turkey, Turkish Tier-2 Federation	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	850	1350	2450	2450	2450	2450	Offered		700	650		1350
							% of Total		3%	2%		2%
Disk (Tbytes)	310	550	900	900	900	900	Offered		340	210		550
							% of Total		3%	FALSE		3%
Nominal WAN (Mbits/sec)	1000	1000	1000	1000	1000	1000						

UK, London	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	1017	1584	2638	3315	4304	5331	Offered		266	964	354	1584
							% of Total		1%	3%	3%	2%
Disk (Tbytes)	227	428	780	1110	1273	1450	Offered		130	297	1	428
							% of Total		1%	5%	4%	2%
Nominal WAN (Mbits/sec)												

UK, NorthGrid	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	725	1139	2077	2749	3420	4642	Offered		1030		109	1139
							% of Total		4%		1%	3%
Disk (Tbytes)	290	501	846	1188	1530	2134	Offered		501		0	501
							% of Total		4%		0%	4%
Nominal WAN (Mbits/sec)												

UK, ScotGrid	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	925	1585	2256	2736	3216	4091	Offered		736		849	1585
							% of Total		3%		7%	4%
Disk (Tbytes)	213	360	606	851	1095	1527	Offered		358		2	360
							% of Total		3%		9%	3%
Nominal WAN (Mbits/sec)												

UK, SouthGrid	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	959	1509	2314	2851	3552	4466	Offered	204	412	439	454	1509
							% of Total	1%	2%	2%	4%	2%
Disk (Tbytes)	231	394	669	927	1111	1384	Offered	57	200	136	1	394
							% of Total	1%	2%	2%	4%	2%
Nominal WAN (Mbits/sec)												

Ukraine, Ukrainian Tier-2 Federation	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	250	302	360	408	420	450	Offered	250		52		302
							% of Total	2%		0%		1%
Disk (Tbytes)	60	78	108	110	150	170	Offered	33		45		78
							% of Total	1%		1%		1%
Nominal WAN (Mbits/sec)												

USA, Northeast ATLAS T2	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	665	1049	1592	1966	3990	5474	Offered		1049			1049
							% of Total		4%			4%
Disk (Tbytes)	244	445	727	1024	1851	2578	Offered		445			445
							% of Total		3%			3%
Nominal WAN (Mbits/sec)												

USA, Southwest ATLAS T2	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	1386	1734	1966	2514	3990	5474	Offered		1734			1734
							% of Total		6%			6%
Disk (Tbytes)	256	328	650	1103	1851	2578	Offered		328			328
							% of Total		2%			2%
Nominal WAN (Mbits/sec)												

USA, Midwest ATLAS T2	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	1112	978	1262	1785	3990	5474	Offered		978			978
							% of Total		4%			4%
Disk (Tbytes)	282	358	362	512	1851	2578	Offered		358			358
							% of Total		3%			3%
Nominal WAN (Mbits/sec)												

USA, Great Lakes ATLAS T2	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	965	1406	1670	2032	3990	5474	Offered		1406			1406
							% of Total		5%			5%
Disk (Tbytes)	322	542	709	914	1851	2578	Offered		542			542
							% of Total		4%			4%
Nominal WAN (Mbits/sec)												

USA, SLAC ATLAS T2 (Note 5)	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	820	1202	1191	1685	3990	5474	Offered		1202			1202
							% of Total		4%			4%
Disk (Tbytes)	462	413	619	928	1851	2578	Offered		413			413
							% of Total		3%			3%
Nominal WAN (Mbits/sec)												

USA, Caltech CMS T2 (Note 6)	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	1000	1100	1940	1940	1940	1940	Offered			1100		1100
							% of Total			4%		4%
Disk (Tbytes)	200	360	570	570	570	570	Offered			360		360
							% of Total			6%		6%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000	10000						

USA, Florida CMS T2 (Note 6)	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	1000	1100	1940	1940	1940	1940	Offered			1100		1100
							% of Total			4%		4%
Disk (Tbytes)	200	360	570	570	570	570	Offered			360		360
							% of Total			6%		6%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000	10000						

USA, MIT CMS T2 (Note 6)	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	1000	1100	1940	1940	1940	1940	Offered			1100		1100
							% of Total			4%		4%
Disk (Tbytes)	200	360	570	570	570	570	Offered			360		360
							% of Total			6%		6%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000	10000						

USA, Nebraska CMS T2 (Note 6)	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	1000	1100	1940	1940	1940	1940	Offered			1100		1100
							% of Total			4%		4%
Disk (Tbytes)	200	360	570	570	570	570	Offered			360		360
							% of Total			6%		6%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000	10000						

USA, Purdue CMS T2 (Note 6)	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	1000	1100	1940	1940	1940	1940	Offered			1100		1100
							% of Total			4%		4%
Disk (Tbytes)	200	360	570	570	570	570	Offered			360		360
							% of Total			6%		6%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000	10000						

USA, UC San Diego CMS T2 (Note 6)	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	1000	1100	1940	1940	1940	1940	Offered			1100		1100
							% of Total			4%		4%
Disk (Tbytes)	200	360	570	570	570	570	Offered			360		360
							% of Total			6%		6%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000	10000						

USA, U. Wisconsin CMS T2 (Note 6)	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	1000	1100	1940	1940	1940	1940	Offered			1100		1100
							% of Total			4%		4%
Disk (Tbytes)	200	360	570	570	570	570	Offered			360		360
							% of Total			6%		6%
Nominal WAN (Mbits/sec)	10000	10000	10000	10000	10000	10000						

Summary Tier2s with Split in 2009	2008	2009	2010	2011	2012	2013	Split 2009	ALICE	ATLAS	CMS	LHCb	SUM 2009
CPU (kSI2K)	45892	71400	111446	143578	177208	201262	Offered	8070	26919	25768	6843	71400
							Required	14300	26970	28100	11380	80750
							Balance	-44%	0%	-8%	-40%	-12%
Disk (Tbytes)	12573	22509	34741	44610	57055	65395	Offered	2242	10705	7673	189	22509
							Required	4000	13300	5700	23	23023
							Balance	-44%	-20%	35%	721%	-2%
Tape (Tbytes)	0	0	1500	2000	3000	3000						

Summary Tier2s with Requ. Balance	2008	2009	2010	2011	2012	2013		SUM 2008	SUM 2009	SUM 2010	SUM 2011	SUM 2012	SUM 2013
CPU (kSI2K)	45892	71400	111446	143578	177208	201262	Offered	45892	71400	111446	143578	177208	201262
							Required	47960	80750	164540	218720	275010	349090
							Balance	-4%	-12%	-32%	-34%	-36%	-42%
Disk (Tbytes)	12573	22509	34741	44610	57055	65395	Offered	12573	22509	34741	44610	57055	65395
							Required	14579	23023	34243	47903	61963	83310
							Balance	-14%	-2%	1%	-7%	-8%	-22%
Tape (Tbytes)	0	0	1500	2000	3000	3000							

Requirements 2009	ALICE	ATLAS	CMS	LHCb	SUM
CPU (kSI2K)	14300	26970	28100	11380	80750
Disk (Tbytes)	4000	13300	5700	23	23023
Number of T2s	16	38	31	14	

Note 1: France LPC: Clermont 1200/1770 CPU and 173/370 disk fully operational for April 2009
Note 2: These German Federations/sites are currently being reorganised, pledges will be provided as soon as possible
Note 3: India VECC: due to purchase and installation difficulties only 270 kS2K CPU and 90 TB Disk are available in 2008
Note 4: Russia: capacities are available in January of the indicated year. The experiment split for 2009 will be confirmed in December 2009
Note 5: USA SLAC ATLAS: only 274/462 disk pledged available in 2008
Note 6: US CMS T2 Federations: Updates to pledge numbers for 2010-2013 will be provided after initial data taking