



# LHC Computing Grid Project

## Resources at the Regional Centers

## LCG-LHCC Referees Meeting

Christoph Eck  
IT Department, CERN  
7 March 2005

[www.cern.ch/lcg](http://www.cern.ch/lcg)

Christoph Eck – CERN-IT 1





# Tier 1 Centres

| <i>Institution</i> | <i>Experiments served with priority</i> |              |            |             |
|--------------------|---|--------------|------------|-------------|
|                    | <i>ALICE</i>                            | <i>ATLAS</i> | <i>CMS</i> | <i>LHCb</i> |
| ASCC, Taipei       |   | X            | X          |             |
| CNAF, Italy        | X                                       | X            | X          | X           |
| PIC, Spain         |   | X            | X          | X           |
| CC_IN2P3, France   | X                                       | X            | X          | X           |
| GridKA, Germany    | X                                       | X            | X          | X           |
| RAL, UK            | X                                       | X            | X          | X           |
| BNL, US            |   | X            |            |             |
| FNAL, US           |   |              | X          |             |
| <i>CHEP, Korea</i> |   |              | X          |             |
| TRIUMF, Canada     |   | X            |            |             |
| NIKHEF/ SARA, NL   | X                                       | X            |            | X           |
| Nordic Centre      | X                                       | X            |            |             |

*CHEP, Korea needs to confirmed.*





# Tier 2 Centres

- The list of Tier 2 centres is still incomplete.
  - A preliminary list shows ~110 institutes in 22 countries.
  - It is expected that a certain number of these institutes will join together into T2 federations.
- Not knowing yet the names of all the T2 centres we know even less the amount of resources they will be able to provide.
- A major effort is underway in the GDB and the Phase 2 Planning group to collect as much T2 information as possible before the April 2005 C-RRB.





# Tier 1 Planning

- Since August 2004 the Phase 2 Planning (P2P) group collects the capacity planning figures of all confirmed T1 centres.
  - These figures are collected for the years 2004 to 2010.
  - By necessity a large part of them are not yet based on approved budgets.
    - These "assumed" capacities are marked with a yellow background in the tables attached to the agenda.
- The P2P will present the outcome of their data collection to the C-RRB in April as first assessment of how far the LHC computing requirements seem to be funded.
- The first official pledges of computing resources will be recorded in Annex 6 of the signed MoU.
- The following slides show how to interpret the current state of the T1 data collection by P2P in the capacity tables.





# Tier 1 Requirements

- The table below shows the requirements of the experiments in all T1 centres, excluding CERN.
  - These figures have been extracted by Jamie Shiers from the Computing Models presented for the LHCC review in January.
- The requirements are for the first year of full capacity running, 2008 for ATLAS, CMS, LHCb; 2009 for ALICE.

| Requirements 2008/9 | ALICE | ATLAS | CMS   | LHCb | SUM   |
|---------------------|-------|-------|-------|------|-------|
| CPU (kSI2K)         | 14000 | 27000 | 15000 | 4400 | 60400 |
| Disk (Tbytes)       | 6500  | 15500 | 7800  | 2400 | 32200 |
| Tape (Pbytes)       | 6.4   | 10    | 12.9  | 2.1  | 31.4  |
| Number of T1s       | 6     | 10    | 7     | 6    | n/a   |





# Sample T1 Pledge Table

- The left part shows the planned ramp-up of capacities, covered by approved budgets until 2008.
  - The row Tape (Mbytes/sec) shows the tape access bandwidth offered and required for the sum of the experiments.
- The right part shows the split of the capacity for the first full year.
  - Giving the percentage of the total T1 requirements of each experiment provided by this T1 and the percentage of the overall requirements provided by this T1.

| IN2P3 Lyon        | 2004 | 2005 | 2006  | 2007  | 2008  | 2009  | 2010  | Split 2008/9 | ALICE | ATLAS | CMS  | LHCb | SUM 2008/9 |
|-------------------|------|------|-------|-------|-------|-------|-------|--------------|-------|-------|------|------|------------|
| CPU (kSI2K)       | 247  | 700  | 1540  | 4312  | 12100 | 15730 | 20450 | Offered      | 2360  | 5445  | 3025 | 1815 | 12645      |
|                   |      |      |       |       |       |       |       | % of Total   | 17%   | 20%   | 20%  | 41%  | 21%        |
| Disk (Tbytes)     | 42   | 110  | 242   | 677   | 1970  | 2561  | 3330  | Offered      | 384   | 887   | 492  | 295  | 2058       |
|                   |      |      |       |       |       |       |       | % of Total   | 6%    | 6%    | 6%   | 12%  | 6%         |
| Tape (Pbytes)     | 0.14 | 0.40 | 1.00  | 3.00  | 4.5   | 5.85  | 7.6   | Offered      | 0.9   | 2.0   | 1.1  | 0.7  | 4.7        |
|                   |      |      |       |       |       |       |       | % of Total   | 14%   | 20%   | 9%   | 32%  | 15%        |
| Tape (Mbytes/sec) |      | 280  | 350   | 400   | 500   | 600   | 700   | Offered      |       |       |      |      | 500        |
|                   |      |      |       |       |       |       |       | Required     |       |       |      |      | 2320       |
|                   |      |      |       |       |       |       |       | Balance      |       |       |      |      | -78%       |
| WAN (Mbits/sec)   | 2500 | 5000 | 10000 | 10000 | 10000 | 10000 | 10000 |              |       |       |      |      |            |





# The Summary Table

- The left part of the summary table is just the sum of all the pledged capacities where summing up is meaningful.
  - Years 2009 and 2010 are obviously too small, as several centres have not provided the corresponding input.
- The right side provides the split onto the experiments for the reference year.
  - Again, as some centres do not provide this split, the sum of the experiments is smaller than the totally "pledged" resource.

| Summary Tier1s | 2004 | 2005 | 2006  | 2007  | 2008  | 2009  | 2010  | Split 2008/9 | ALICE | ATLAS | CMS   | LHCb | SUM 2008/9 |
|----------------|------|------|-------|-------|-------|-------|-------|--------------|-------|-------|-------|------|------------|
| CPU (kSI2K)    | 1140 | 5077 | 10642 | 24276 | 49431 | 55503 | 68660 | Offered      | 11882 | 16693 | 7662  | 6058 | 51865      |
|                |      |      |       |       |       |       |       | Required     | 14000 | 27000 | 15000 | 4400 | 60400      |
|                |      |      |       |       |       |       |       | Balance      | -15%  | -38%  | -49%  | 38%  | -14%       |
| Disk (Tbytes)  | 204  | 1326 | 3127  | 6644  | 13399 | 16846 | 13552 | Offered      | 5334  | 5710  | 2320  | 1089 | 16503      |
|                |      |      |       |       |       |       |       | Required     | 6500  | 15500 | 7800  | 2400 | 32200      |
|                |      |      |       |       |       |       |       | Balance      | -18%  | -63%  | -70%  | -55% | -49%       |
| Tape (Pbytes)  | 0.37 | 2.31 | 5.64  | 12.34 | 21.27 | 27.72 | 31.17 | Offered      | 7.9   | 8.5   | 2.5   | 1.4  | 26.2       |
|                |      |      |       |       |       |       |       | Required     | 6.4   | 10.0  | 12.9  | 2.1  | 31.4       |
|                |      |      |       |       |       |       |       | Balance      | 23%   | -15%  | -81%  | -36% | -17%       |





## The Summary Table (2)

| <b>Split 2008/9</b> | <b>ALICE</b> | <b>ATLAS</b> | <b>CMS</b>  | <b>LHCb</b> | <b>SUM 2008/9</b> |
|---------------------|--------------|--------------|-------------|-------------|-------------------|
| <b>Offered</b>      | 11882        | 16693        | 7662        | 6058        | 51865             |
| <b>Required</b>     | 14000        | 27000        | 15000       | 4400        | 60400             |
| <b>Balance</b>      | <b>-15%</b>  | <b>-38%</b>  | <b>-49%</b> | <b>38%</b>  | <b>-14%</b>       |
| <b>Offered</b>      | 5334         | 5710         | 2320        | 1089        | 16503             |
| <b>Required</b>     | 6500         | 15500        | 7800        | 2400        | 32200             |
| <b>Balance</b>      | <b>-18%</b>  | <b>-63%</b>  | <b>-70%</b> | <b>-55%</b> | <b>-49%</b>       |
| <b>Offered</b>      | 7.9          | 8.5          | 2.5         | 1.4         | 26.2              |
| <b>Required</b>     | 6.4          | 10.0         | 12.9        | 2.1         | 31.4              |
| <b>Balance</b>      | <b>23%</b>   | <b>-15%</b>  | <b>-81%</b> | <b>-36%</b> | <b>-17%</b>       |







# Comments/Remarks

- It is difficult to get figures from certain centres.
  - US-CMS (FNAL) has provided once an incomplete set of figures. No update could be obtained.
  - CNAF is unable to give the split between experiments.
- A standard recipe for calculating the tape bandwidth reachable with a given configuration will be used.
  - There are differing opinions on how to provide this figure, which influences the cost of the tape system in a massive way.
- The overall offer so far is not bad for CPU and Tape (at least for mere tape capacity).
- Yet, only half of the required disk space has been pledged until now.

