04 September 2013

Minutes of the 23rd LHC Computing Resources Review Board Meeting
(CERN, Geneva, 16th April 2013)

Present:

G. Taylor (University of Melbourne, Australia)
J. Lemonne (FWO, Belgium)
J. Sacton (FNRS, Belgium)
D. Wayner (NSERC, Canada)
R. Teuscher (University of Toronto, Canada)
M. Vetterli (Simon Fraser University/TRIUMF, Canada)
Y. Zhang (National Natural Science Foundation, China)
N. Fejksova (Ministry of Education, Youth and Sports, , Czech Republic)
D. Adamova (Institute of Physics AS CR, Czech Republic)
M. Lokajicek (Institute of Physics AS CR, Czech Republic)
J. Aysto (Helsinki Institute of Physics, University of Helsinki, Finland)
P. Eerola (University of Helsinki, Finland)
P. Chomaz (CEA/IRFU, France)
D. Vilanova (CEA/IRFU, France)
L. Serin (CNRS/IN2P3, France)
F. Malek (CNRS/IN2P3, France)
H. Prasse (Federal Ministry of Education and Research, Germany)
M. Fleischer (DESY, Germany)
V. Guelzow (PT-DESY, Germany)
A. Streit (BMBF/Karlsruhe Institute of Technology, Germany)
C. Fountas (University of Ioannina, Greece)
G. Vesztergombi (Wigner RCP, RMKI, Hungary)
K. Mazumdar (Tata Institute of Fundamental Research, TIFR, India)
T. Nayak (Variable Energy Cyclotron Centre, India)
L. Levinson (Weizmann Institute of Science, Israel)
A. Zoccoli (INFN, Italy)
M.Taiuti (INFN, Italy)
N. Pastrone (INFN, Italy)
T. Kawamoto (University of Tokyo, ICEPP, Japan)
B. Lee (Sogang University, Korea)
S. Yu (KISTI, Korea)
A. Van Rijn (NIKHEF, Netherlands)
F. Ould-Saada (University of Oslo, Norway)
F.D. Buzatu (Institute of Atomic Physics, Romania)
M. Dulea (IFIN-HH, Romania)
V. Savrin (Institute of Nuclear Physics, Moscow State University, Russia)
I. Golutvin (JINR, Dubna, Russia)
V. Shevchenko (National Research Centre, Kurchatov Institute, Russia)
L. Sandor (Institute of Experimental Physics, SAS, Slovakia)

D. Bruncko (Institute of Experimental Physics, SAS, Slovakia)
F. Del Aguila (Ministry of Economy and Competitiveness, Spain)
N. Colino (CIEMAT, Spain)
P. Karlsson (Swedish Research Council, Sweden)
M. Nylen (Umea University, Sweden)
P. Burkhard (Swiss National Science Foundation, Switzerland)
C. Grab (ETH Zurich, Switzerland)
S. Lee (Academia Sinica, Taiwan)
G. Zinovjev (Bogolyubov Institute for Theoretical Physics, National Academy of Sciences, Ukraine)
G. Blair (STFC, United Kingdom)
A. Medland (STFC, United Kingdom)
C. Parkes (University of Manchester, United Kingdom)
J. Butler (Fermilab/Department of Energy, United States of America)
J. Cochran (Iowa State University, United States of America)
S. Gonzalez (National Science Foundation, United States of America)
S. Rajagopalan (Brookhaven National Laboratory, United States of America)
M. Procario (Department of Energy, United States of America)
T. Wenaus (Brookhaven National Laboratory, United States of America)
M. Tuts (Columbia University, United States of America)

WLCG
I. Bird, S. Foffano,

CERN
S. Bertolucci, F. Hemmer, T. Lagrange, J. Salicio-Diez, E. Tsesmelis, E. Van Hove

Computing Resources Scrutiny Group
J. Flynn, D. Lucchesi

Resources Scrutiny Group
C. Touramanis, E. Iacopini

ALICE: P. Giubellino
ATLAS: D. Charlton, B. Kersevan, T. Wengler
CMS: I. Fisk, P. Kreuzer, D. Bonacorsi
LHCb: P. Campana. M. Cattaneo

Excused
R. Heuer (CERN), S. Lettow (CERN), S. Bethke (Max-Planck Institut fuer Physik, Germany), F. Linde (NIKHEF, Netherlands) B. Jacobsen (Research Council, Norway)

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1. Introduction S. Bertolucci, Director of Research and Scientific Computing.

S. Bertolucci welcomes delegates to the meeting and invites I. Bird to present the status of the WLCG Project.

2. Approval of the minutes of the last meeting S. Bertolucci, Director of Research and Scientific Computing CERN-RRB-2013-001.

The minutes of the last Computing CERN-RRB are approved without comments.

3. Status of the WLCG Project and Financial Status Report I. Bird, WLCG Project Leader. CERN-RRB-2013-015 (Report), CERN-RRB-2013-016 (Slides).

I. Bird informs delegates on the status of WLCG MoU signatures or preparation since the last meeting; Slovakia signed the MoU as a Tier-2 supporting the ALICE & ATLAS experiments and the MoU for Russia to become Associate Tier-1 is in preparation. Delegates are reminded all Federations, sites, WLCG Collaboration Representative names and Funding Agencies are documented in WLCG MoU Annex 1 and Annex 2 visible on-line via the LCG website, corrections should be sent to lcg.office@cern.ch.

In February Academia Sinica, Taipei (ASGC) withdrew their Tier-1 and Tier-2 support for CMS following a reduction in funding from the National Science Council. CMS is in the process of transferring data from ASGC to CERN and FNAL. I. Bird regrets this decision and hopes it is not an indication for the future.

There is good progress on the KISTI Associate Tier-1 in South Korea, the MoU is signed and resource deployment is going to plan with successful functional tests and integration into the WLCG reporting. Concerning networking, the upgrade from 1-2 Gb/s has been delayed and the upgrade to 10 Gb/s is not yet planned. Resources at the Russian Associate Tier-1 at the Kurchatov Institute and JINR, Dubna are ramping up according to plan, the tape system is installed and functional testing is currently on-going. Network connection to CERN at 2 Gb/s is established with integration into LHCOPN delayed due to network restructuring.

General WLCG progress is presented including statistics on data transfers, resource usage at CERN and the Tier-1 sites and resource use compared to the pledges at CERN, the Tier-1 and Tier-2 sites. On average up to 4.6 PB of data is written to tape each month. Resources are fully occupied and the ALICE efficiency, which has been a concern for some time, has been worked on with significant improvements and is no longer a cause for concern.

The 2013 pledge situation is shown, delegates are reminded that pledge information can be consulted on-line via the REBUS tool. LHCb, ATLAS and CMS are all commissioning their High-level trigger farms for simulation, re-processing and analysis during LS1. ATLAS and CMS were able to make use of opportunistic resources at Amazon and SDSC respectively. While it is useful to be able to use such resources, this is not a long-term solution to compensate for future resources.

The evolution of currently understood needs in 2015 is shown to be within a factor of 2 compared to 2013 capacities, and should therefore be achievable within a flat budget if planned together with 2014, however many issues need to be addressed to ensure significant improvements during LS1. I. Bird underlines the importance of maintaining funding at a reasonable level in 2015 and advises planning 2014 and 2015 together.

A concurrency forum has been established to share knowledge within the HEP community and build up expertise to eventually fully benefit from many new core and other architectures requiring significant and expensive code re-writes. The computing models are being updated at the request of the LHCC for September 2013. Work is on-going and builds on the work of

the Technical Evolution groups and the technology review performed in 2012. The result will give a framework to drive commonalities between experiments, describe the WLCG needs over the next years, review the structure of the collaboration, the scale and quality of the service, and raise concerns.

The EMI middleware project and the EGI-SA3 support for heavy user communities EC projects end in April 2013 requiring re-prioritisation of activities in the short term. There will be a funding gap of at least 1 year even if more EC funding is attracted for the future. Product teams will provide basic support and maintenance for all middleware needed by WLCG and WLCG operations can be independent of EGI.eu if necessary if important operations such as GGUS and accounting are maintained. On the longer term there is a need to consider how to engage with the EC and other potential funding sources. The update of the computing models will help to define the desired strategy on the long-term for WLCG.

The Wigner Data Centre has been fully refurbished and equipment is currently being installed ready for testing deployment scenarios for services in 2013. 2 100 Gb connections have been procured from 2 different providers with good latency measurements and no problems anticipated. The CERN Building 513 consolidation project is in its final phase to increase the power capacity to 3.5 MW, resolve the cooling for the critical UPS room, and increase the UPS capacity to 600 kW. Significant work was required to install the new computer room and all associated electrical equipment.

The funding and expenditure for WLCG at CERN is presented showing a balanced situation foreseen for personnel up to 2018, with more fluctuations foreseen in the materials budget based on the currently understood accelerator schedule and procurement of full resource requests. It remains important to maintain flexibility between financial years to balance the budget as optimally as possible.

In summary I. Bird confirms that WLCG successfully supported the first LHC run and it is time to look forward to the future. Infrastructure use by the experiments is consistent with resources continually used. There is some concern about available resources in the future, particularly for 2014 and 2015, therefore it is important that the funding levels stay at a reasonable level to fully benefit from the very high performance of the accelerator. The Tier-0 and HLT farms are being used during the shutdown to supplement the Tier-1 and Tier-2 resources, with concrete steps being taken to ensure optimized resource use for the future.

4. LHCC Deliberations E. Tsesmelis, LHCC Scientific Secretary. CERN-RRB-2013-017 (Report)

E. Tsesmelis reports on the document summarizing the LHCC deliberations following meetings in December 2012 and March 2013, with a report on the WLCG status and the interactions with the experiments in general, and with each of the experiments in particular. The LHCC congratulates WLCG and the experiments for the efficient data taking and for the successful completion of the first LHC running period. Documentation for the revised computing models will be submitted by the experiments for discussion in September 2013 in preparation for the October C-RRB.

5. Status of Common Projects accounts T. Lagrange, CERN Finance and Procurement Department. CERN-RRB-2013-018 (Report)

T. Lagrange confirms he has nothing to add to the written report.

6. Report from the Computing Resources Scrutiny Group. J- Flynn, C-RSG Chair. CERN-RRB-2013-008 (Report and Slides)

J. Flynn reports on the extended 2012 pp run at 8 TeV CM energy, noting the maximum luminosity more than doubled compared to 2011. At the end of the pPb run which took place in January and February 2013, 25 ns bunch spacing was demonstrated. The effective overall trigger rates are shown by experiment with individual specificities highlighted; ALICE records after the luminosity declines, ATLAS and CMS parked data for reconstruction during LS1, LHCb deferred events were buffered in the HLT for processing in the inter-fill periods. Overall the assessment of the Computing Resources Scrutiny Group concludes that the computing resources have been extensively used with evidence of optimized use of resources e.g. reduced CPU per event, fewer re-processings, a reduced number of copies of data and fewer data types saved on tape.

The computing models and analysis strategies will be reviewed over the summer months to improve the speed of the algorithms and libraries, improve software code, reduce memory consumption and adapt to changing architectures. J. Flynn underlines the importance of these efforts to optimize future resource usage, strongly supported by the Computing Resources Scrutiny Group. There is a high expectation that exploitation of the physics potential of the LHC when it restarts will require a significant increase in resources from 2015, achievable if the 2012 funding level can be maintained in 2013 and 2014. The experiments anticipate more information and certainty about 2015 requests for the next C-RRB meeting.

The overall resource usage compared to pledges for 2012 is shown with the following averages based on time-integrated usage of CPU power or storage capacity, taken from the WLCG accounting data

- CPU: CERN 61%, T1 116%, T2 171%
- Disk: CERN 104%, T1 135%
- Tape: CERN 88%, T1 71%

Generally the resources were well used and the usage pattern was similar to that of 2011 with more use of pledged tape resources in 2012 due to more data. Usage of CPU, Disk and Tape at CERN and the Tier-1s is shown per experiment with ATLAS dominating CPU and Disk usage and CMS dominating Tape usage. ALICE uses more of its CPU at CERN then any of the other experiments, a similar trend to that of 2011. For Tier-2 usage again ATLAS dominated. Efficiency at the Tier-1s has settled down and in general efficiency at the Tier-2's is less stable but has progressed.

J. Flynn presents individual experiment usage compared to pledged resources in 2012 reporting that ALICE made good use of their resources; they saturated disk resources and tape usage was reduced compared to the predicted amounts leading to a reduction in the 2014 tape resource request. ATLAS was very successful in using resources beyond those pledged, they reduced CPU use and improved their distribution of jobs between the Tier-1s and Tier-

2's. CMS's estimation of resource use was quite accurate proving their computing model solid in terms of assessment of resource needs. The longer pp run was compensated by reducing the parked data rate and the lower than expected pileup. LHCb's CPU use continued to peak, twice as many events were taken with respect to 2011 and the extended pp run led to 40% more data putting pressure on storage resources and leading to a reduction in the copies on disk and tape.

Concerning the future resource needs, the scrutinized view is presented by experiment showing the finalized CRSG numbers for 2014 compared to the estimated experiment values with the following experiment-specific remarks:

ALICE: The request to trade tape for disk in 2013 is endorsed by the CRSG; it could help meet the increase in disk for 2015. The CRSG strongly supports the efforts on the computing model improving CPU efficiency at end of 2012. As ALICE reduced their requests to better match anticipated pledges, the CRSG hopes Funding Agencies can, in principle, fully fund the scrutinized requests.

ATLAS: The CRSG strongly supports the activity to adjust the computing model and improve software to reduce resource usage, benefits are already assumed in constraining the resource needs from 2015 onwards. Use of the HLT farm in 2013 and 2014 is acknowledged and ATLAS is encouraged to further develop the ability to increase the Tier-1 capacity with the farm during periods without beam from 2015 onwards. The CRSG encourages further work to reduce data replication taking into account popularity of access.

CMS: The 2014 request allows for a complete reprocessing pass on all real and simulated data accumulated to date leaving a consistent legacy archive. The CRSG supports the plan to use the HLT farm to increase Tier-1 processing capacity by around 40% in 2013/14 and is very encouraged by the speed of reconfiguring the farm and the plans to use it in no-beam periods from 2015 onwards. The CRSG strongly supports the CMS software development programme during LS1 and notes improvements are already assumed in planning for the next LHC run such as reducing the impact of out-of-time events on reco time at 25ns bunch spacing.

LHCb: The 2014 requests are solidly based on experience from 2012 processing and known amount of data collected therefore a reduction in requests is unlikely. The use of unpledged resources is acknowledged. Bearing in mind about 70% of LHCb resources comes from Tier-1's, there is concern that scrutinised Tier-1 requests cannot be met and the CRSG encourages the RRB to address this.

As a result of the scrutiny process the following global comments and recommendations are made:
- There is a strong expectation that exploitation of the LHC and the experiments from 2015 will require significantly increased computing resources; achievable if stable funding at the 2012 level can be maintained in 2013 and 2014.
- ALICE and LHCb's scrutinised requests have not been fully met at the Tier-1's and it looks impossible in principle for 100% of the scrutinised levels to be met. To be urgently addressed by the RRB.
- The CRSG is very willing to work with WLCG management to review the overall request/review/pledge process in light of experience over the first period of LHC running.

- Improving software efficiency is essential to meet the 2015 requests as the resulting gains are already assumed within the requests. The CRSG strongly supports the software engineering efforts necessary and hopes sufficient effort can be funded.
- The agreed efficiency factor of 0.7 has been used when calculating disk space requirements however in practice disks are used more efficiently than at 0.7. The CRSG welcomes a change to reflect more efficient use while maintaining the ability to compare experiments on an equal footing.
- The effectiveness of disk usage is only partly captured by disk occupancy figures. A metric also taking frequency of use into account would be highly desirable.
- The CRSG welcomes the effort to produce a new documentary description of the experiments' computing models and looks forward to the results which are expected before the next RRB meeting.

J. Flynn ends his presentation by showing the CRSG membership, remarking on the change of chairman and representatives from Canada and Spain since the last RRB meeting. CRSG members from the Netherlands and the Nordic Countries will be replaced after the current scrutiny. D. Espriu, chairman since the group was established, is thanked for his hard work and contribution.

S. Bertolucci thanks J. Flynn for his presentation and invites questions or comments to either I. Bird or J. Flynn. A. Van Rijn asks if the role of WLCG can become more active rather than passive in the future of EGI. I Bird explains WLCG runs an operation making use of the resources made available, with significant effort already invested into making it work through EGEE then continuing into the EGI era, questioning what more can be done. S. Bertolucci adds reflection is necessary to ensure EGI does not get dispersed. There is a gap between FP7 and Horizon 2020, with ideas for development in the field therefore collaboration with other interested communities and environments is encouraged within the frame of EGI for the future.

A. Zoccoli remarks on how well the computing is working and its key role in the achievement of the physics results to date. He explains the critical economical situation and how budget allocation is organized in Italy, pointing out funding for experiment upgrades or for computing resources comes from the same source, also used to replace ageing hardware after 5 years, which should not be forgotten when funding requests are made. A. Zoccoli adds an additional potential problem concerns manpower as funding must now be found for developers working on middleware who were supported by EU projects in the past. A coordinated effort is needed to define the future computing strategy, possibly enlarging the scope, to attract EU funding. I. Bird agrees there is no short-term solution to bridge the funding gap between EC projects, the strategy needed to secure additional future funding based on a broader scope than grid middleware is being worked on.

On behalf of CEA Ph. Chomaz expresses satisfaction for the work of the grid, the plan presented and analysis of the various future scenarios, he reiterates the message that several countries face financial difficulties and concludes a flat budget is key for the future for computing, which should be added as a constraint in the future planning and scenarios to be presented at the next C-RRB meeting.

T. Medland echoes these concerns and comments on the key role of computing in the exploitation of the LHC underlining future computing requirements must be balanced with

the M&O expectations and upgrade requests from the experiments. Software optimization must continue and Horizon 2020 opportunities exploited as early as possible.

7. Summary. S. Bertolucci, Director of Research and Scientific Computing.

S. Bertolucci summarises there is a lot of work ahead, the work of the LHCC and Computing Resources Scrutiny Groups which will be reported on in October will help understanding of the future of this large scale computing project.

There being no further business, S. Bertolucci thanks the delegates and closes the meeting.