Minutes of the 29th WLCG Resources Review Board Meeting
(CERN, Geneva, 26th April 2016)

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G. Levesque (Canada Foundation for Innovation, Canada)
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Y. Zhang (Natural National Science Foundation, China)
C. Jiang (Institute of High Energy Physics, Beijing, China)
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M. Lokajicek (Institute of Physics AS CR, Czech Republic)
P. Hansen (Niels Bohr Institute, Denmark)
P. Eerola (Helsinki Institute of Physics, University of Helsinki, Finland)
M. Raidal (NICPB, Estonia)
P. Verdier (CNRS/IN2P3, France)
S. Bethke (MPI, Germany)
M. Fleischer (DESY, Germany)
W. Ehrenfeld (BMBF/PT-DESY, Germany)
T. Mueller, A. Heiss (KIT, Germany)
T. Kolleger (GSI, Germany)
F. Siklér (Wigner RCP, Hungary)
K. Mazumdar (BARC, Mumbai, India)
Y. Rozen (Weizmann Institute of Science, Israel)
A. Zoccoli, N. Pastrone (INFN, Italy)
M. Cobal (INFN and University Trieste, Italy)
T. Kawamoto (University of Tokyo, Japan)
JongWoo Kang (National Research Foundation, Korea)
S. Noh (Ministry of Science, ICT and Future Planning, Korea)
A. van Rijn (NIKHEF, Netherlands)
B. Jacobsen (The Research Council of Norway, Norway)
G. Barreira (LIP, Portugal)
F.D. Buzatu, A. Fazacas (Institute of Atomic Physics, Romania)
V. Malinkin (Permanent Mission to the UN in Geneva, Russia)
V. Matveev, V. Savrin (JINR, Dubna, Russia)
V. Ilyin (NRC Kurchatov Institute, Russia)
D. Bruncko (Institute of Experimental Physics SAS, Slovakia)
D. Adams (Department of Science and Technology, South Africa)
M. Martinez Perez (Ministry of Economy and Competitiveness, Spain)
J. Flix (PIC/CIEMAT, Spain)
P. Karlsson (Swedish Research Council, Sweden)
M. Rännar (Umeå University, Sweden)
P. Vonlanthen (Swiss National Science Foundation, Switzerland)
C. Grab (ETH Zurich, Switzerland)
S.C. Lee (Academia Sinica, Taiwan)
A. Medland (STFC, United Kingdom)
C. Parkes (University of Manchester, United Kingdom)
A. Patwa, S. Rolli, M. Procario (Department of Energy, United States of America)
S. Gonzalez (National Science Foundation, United States of America)
J. Cochran (Iowa State University, United States of America)
S. Rajagopalan (Brookhaven National Laboratory, United States of America)
L. Bauerdick (Fermilab, United States of America)
M. Tuts (Columbia University, United States of America)

**WLCG**
I. Bird

**CERN**
G. Cavallo, E. Elsen (Chairman), S. Foffano (Scientific Secretary), F. Gianotti, F. Hemmer, M. Krammer, E. Tsesmelis, E. van Herwijnen, E. Van Hove, T. Wengler

**Computing Resources Scrutiny Group**
D. Lucchesi

**ALICE**: P. Buncic, P. Giubellino, Y. Schutz
**ATLAS**: S. Campana, D. Charlton, R. McPherson, T. Wenaus
**CMS**: D. Bonacorsi, D. Lange
**LHCb**: C. Bozzi, S. Roiser, G. Wilkinson

Excused:
I. Koca (Turkish Atomic Authority, TAEK, Turkey)

Documents can be found in the RRB indico pages; accessible via the LHC-RRB home page http://cern.ch/committees/LHCRRB

1. **Introduction** E. Elsen, Director for Research and Scientific Computing

E. Elsen opens the meeting and welcomes delegates.

2. **Approval of the minutes of the last meeting** E. Elsen, Director for Research and Scientific Computing

The minutes of the last Computing Resources Review Board meeting CERN-RRB-2015-122 are approved without comments.

3. **Status of the WLCG Project and Financial Status Report** I. Bird, WLCG Project Leader CERN-RRB-2016-044 (Report), CERN-RRB-2016-045 (Slides)

E. Elsen invites I. Bird to present the WLCG Project and financial status. The status of MoU signatures is given: 63 MoU’s covering 167 sites in 42 countries including one new additional Tier 2 in Taiwan for CMS since the last RRB meeting. The funding and expenditure outlook is given showing a relatively balanced situation for the future which includes provisioning for commercial cloud services, continuity for CERN-
Wigner networking, upgrades of network, tape technology and LHCOPN in preparation for Run 3 and the latest experiment requirements for 2017, 2018 extrapolated for 2019. Performance metrics are shown:

- 32 PB of data taken during 2015, on track for the 50 PB/year planned for Run 2
- Repacking tapes onto more modern media provoking impressive savings
- Global transfer rates have increased to > 20 GB/s, significantly higher than Run 1
- Continued ramp up of CPU from all 4 experiments (since 2010)

Highlights are given from the experiments including 2015 data processing, increased use of HLT’s, Clouds, volunteer computing projects, and other opportunistic resources, improved analysis frameworks and preparation for Run 3.

A well attended workshop in Lisbon devoted to discussions on the medium term, Run 2-3, and the longer term, Run 4, identified the need to instigate revolutionary changes in computing models while facing an evolutionary deployment. There were 4 main outcomes for the upgrade preparation work:

1. Establishment of a study group to define the problems
2. Improve software performance, understand architectures, goals and metrics, review technology and work on software development career recognition
3. Investigate the real-world performance of current systems for a better understanding and consolidation of existing efforts
4. Prototype demonstrators to address issues such as: how to federate data centres across Tier 2’s, how to decrease operational cost, how to optimize sites with little effort or expertise, how to exploit Machine Learning.

The HNSciCloud joint procurement project, co-founded via Horizon 2020, started in January 2016 to purchase common cloud services for use over HEP and other research communities. The main expected outcome is knowledge about procurement of large-scale cloud services and adaptation of funding schemes accordingly.

I. Bird points out concerns with the EGI supported accounting portal experienced over the past 18 months with improvement work delayed due to a move to multi-core workloads. A major review of the full process took place recently including a review of the monthly reports produced. The Tier 1 and Tier 2 reports are now well understood with useful and correct data, the new EGI portal will address the other concerns and requirements.

The initial requirements for 2018 have been given to the scrutiny group, however there has not yet been experience with full luminosity during Run 2, the coming weeks will provide a better understanding of how realistic the requirements are. In addition data preservation needs are not included in the resource requests and are expected to become significant. A document will be produced in the Autumn summarising the estimated additional needs to manage long-term data preservation and open access.

S. Bethke asks why the real-world performance differs from the expected performance. I. Bird points out this depends on the architecture, use of available CPU cycles, and use of new functionality in chips requiring software re-engineering by people with very specific skills.

P. Eerola asks about the future computing architecture and if expansion of the existing remote Tier 0 is preferable to a different approach. I. Bird replies the remote Tier 0 may not be the most effective model, the cost model needs to be looked at which is one of the reasons behind
the investigations with cloud service providers. It is not yet known if CERN will re-tender a remote Tier 0 solution. E. Elsen adds that the future computing model is a topical theme being discussed with several Funding Agencies addressing use of HPC and high throughput computing (HTC) organized nationally and globally via the cloud for areas beyond HEP. A thematic forum to discuss computing and define solutions for 2018/2019 and beyond will be organised.

4. LHCC Deliberations T. Wengler, LHCC Scientific Secretary. CERN-RRB-2016-046 (Report)

On behalf of the LHCC, T. Wengler congratulates WLCG and the experiments for continued optimised operation, and efficient data processing. Full use is made of available resources thanks to improvements in job execution and storage management. The LHCC will closely follow the work of the dedicated study group established to analyse HL-LHC computing needs, and encourages initiatives for medium to long term computing improvements however not at the expense of the on-going activities within the experiments.


G. Cavallo reports there have been no new contributions since the cut-off date, and there are no causes for concern concerning the accounts.


E. Elsen welcomes D. Lucchesi, new Chair of the Computing Resources Scrutiny Group (CRSG), who begins her presentation by introducing the current CRSG composition and by thanking her predecessor and the former members for their important respective contributions to the work of the CRSG.

By way of overall assessment, congratulations are extended to the experiments for their intensive use of WLCG resources, and to WLCG for providing them. The CRSG also acknowledges the use of beyond-pledge resources, including the successful use of commercial clouds by ATLAS and CMS, and the evolution of the computing models leading to operational savings.

D. Lucchesi mentions ongoing issues with the WLCG accounting portal leading to difficulties in understanding the data. Various statistics are shown including resource use for CPU, Disk and Tape in 2015 with beyond-pledge use of CPU at Tier 1 and Tier 2 sites and CPU efficiency history. Following requests from the CRSG to the experiments to provide data in a specific format, data popularity plots illustrating the volume of data with respect to the number of accesses over 3, 6 and 12 months are shown for each experiment. Resource use statistics for each experiment are also presented with specific comments from the CRSG:

- ALICE high tape usage due to unexpected high pileup in raw data; disk usage below expectation due to TPC related issues.
- ATLAS low efficiency at Tier 0 as event reconstruction requires >2GB/core of memory. HLT efficiency ranging from 70-93% used during the shutdown. CPU dominated by MC event production. Significant usage of beyond-pledge CPU.
• CMS good use of HLT farm and dynamic data management system implemented. The low CPU efficiency at Tier 1 problem has been solved. The deficit of pledged Tier 1 resources continues to cause concern for the CRSG.
• LHCb resource usage is in line with expectations, the HLT split concept was exercised.

Looking towards the future, the requests and conclusions of the scrutiny for each experiment are presented including the following experiment specific comments:

• ALICE new requests for 2016 to cope with RAW data size and more CPU due to TPC field distortion issues imply a 5% increase in CPU at the Tier 0 and Tier 1s and a 22% increase in Tape at the Tier 0 and 30% at the Tier 1s, with an important increase for 2017 requests. If these requests cannot be satisfied a redefinition of the physics program will be necessary. The CRSG will revise the 2017 request once the TPC calibration issues have been validated.
• ATLAS the CPU Tier 1 request was lowered due to the HLT farm CPU power. A significant CPU contribution is expected from beyond-pledged resources. The strategy to invest in CPU rather than disk will be verified in the next round.
• CMS The Tier 1 pledge deficit, particularly tape, is a source of concern for the CRSG. Tier 2 requests have been adapted: less CPU due to extensive use of MiniAOD, more Disk to exploit opportunistic use of Tier 2 CPU for simulation – this will be reviewed in the next round.
• LHCb software optimisations have resulted in important savings. Continued work on fast simulations is encouraged by the CRSG.

Finally D. Lucchesi concludes her presentation with the following comments and recommendations on behalf of the CRSG:

Resource Accounting: the CRSG relies heavily on this and important discrepancies have been observed with respect to the experiment data, therefore the experiments, WLCG and EGI should work together to ensure one reliable source of information for all the experiments for the future.

CMS Tier 1 pledges: continue to be below requests and should be met, particularly for Tape.

Software efficiency: The CRSG strongly supports funding the effort necessary to cope with the growth in requests.

Memory/core: ALICE and ATLAS request >2GB/core for event reconstruction, to be carefully monitored by the experiments and WLCG during data taking.

S. Bethke comments on the data popularity plots which have not changed significantly in structure during the last couple of years, it seems one third of the space is not used. D. Lucchesi recognises the difficulty for the experiments to delete data and move it to tape while maintaining high efficiency for analysis, and points out the ATLAS plots have changed more than the other experiments who are being encouraged. A new metric could be introduced to compare data popularity usage annually.

T. Medland thanks the CRSG for their report and underlying work. He questions the significant efficiency rate differences between experiments, and the considerable reliance on beyond-pledge resource use by ATLAS.
D. Lucchesi points out the efficiency rate depends on the workflow and different ratios of workloads which is difficult to compare over the experiments. CMS experienced certain issues with their efficiency rates, since resolved. I. Bird adds the ALICE efficiency was highlighted during several RRB meetings in the past, also since resolved; generally there is an improved trend.

E. Elsen questions the status of the accounting and I. Bird replies in the past the accounting system was very good and reliable, however trust has been lost in the data over the last 18 months. Following recent work the data is now understood, the problem lies in the portal. EGI have recognised the problem and are working to address it with short and longer-term solutions.

Regarding beyond-pledged ATLAS resources D. Lucchesi points out they are heavily used for Monte Carlo, D. Charlton adds opportunistic use is the preferred term, and that ATLAS works hard to identify additional CPU resources; while ATLAS cannot rely on such resources, they are of great benefit to the physics programme.

A. Zoccoli mentions the importance of a reliable number for monitoring and refers to the efficiency of the Tier 0 shown at 39% during the presentation. I. Bird comments this is due to the difficulty to provide the pledge for the Tier 0 of which about 50% covers services which do not provide compute capacity. He recognises the need to fix this.

A. Zoccoli also questions the new requests from ALICE, far beyond the flat budget model due to the TPC calibration, and the number of proton events analysed - what is the share of the increase between these effects, and what can be expected in the future with high intensity, high luminosity? He also remarks it will be difficult to meet the increased tape and CPU requested as the budget for this year has already been allocated. E. Elsen replies the ALICE problems should be fixed by their online system and not have a lasting impact on the computing resources.

7. Summary. E. Elsen, Director for Research and Scientific Computing

E. Elsen concludes the session by stating that the computing needs are more or less satisfied with some exceptions. Improved and reliable monitoring is needed, particularly for planning the long-term future.

E. Elsen thanks the delegates and closes the meeting.