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PRINCIPAL LHCC DELIBERATIONS

19TH MEETING OF THE COMPUTING RESOURCES REVIEW BOARD

12 APRIL 2011

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GENERAL

This document summarizes the principal LHCC deliberations concerning the World-wide LHC Computing Grid (W-LCG) Project at the Committee's sessions in November 2010 and March 2011.

The W-LCG continues to operate very well. The LHCC congratulates the W-LCG project team and the experiments in their successes at processing and analyzing the LHC data.

CONCERNS FROM THE PREVIOUS COMPUTING RESOURCES REVIEW BOARD

SUB-SYSTEM	CONCERN	STATUS
Resources for ALICE	The pledged resources do not fully match the ALICE requirements for the long term.	Computing resource availability remains a long-standing problem for ALICE.

STATUS OF THE W-LCG

GRID OPERATIONS

The W-LCG has been running smoothly. No problems were encountered processing the proton and heavy-ion data, including the transfer of ALICE Pb-Pb data to Tier-1 sites and the transfer of CMS Pb-Pb data to FNAL following zero-suppression. The system remained busy through-out the 2010-2011 Technical Stop, with full reprocessing of most of the 2010 data and major simulation campaigns. The usage of installed Tier-1 and Tier-2 resources was close to 100% by the end of 2010. CERN usage peaked during data-taking, but overall was below 100%.

EXPERIMENTS

GENERAL

The LHCC referees met with Ian Bird and computing representatives from the four main experiments in March 2011. Several members of the Computing Resources Scrutiny Group (CRSG) also attended, including its Chairperson. The experiments were asked to report on any evolution of or changes to their computing models, in light of the experience gained in 2010, and to discuss their requests for computing resources for 2012-13, which have recently been submitted to the CRSG in preparation for the Computing Resources Review Board meeting in April 2011. Since the previous requests were submitted one year ago, there have been changes to the LHC schedule, with running now expected in 2012 and a shutdown in 2013, so that more resources will be required in 2012. In addition, the LHC beam parameters used to optimize the luminosity in 2010 produced higher pile-up rates (μ = average number of interactions per bunch crossing) than had been anticipated at this stage in the LHC programme. This has resulted in increases in event sizes and processing times by factors of two or more.

In the longer term, all experiments are encouraged to develop more sustainable computing models, with the aim of limiting the further increase in resources required at CERN and at Tier-1 and Tier-2 sites, in light of the restricted funding available.

ALICE

The ALICE CPU requirements have had major increases due to a new vertex finder, improved Monte Carlo simulation, data from new detectors, changes to the trigger mix and the introduction of new calibration procedures. Currently, the experiment has a shortfall of around 40-50% in its pledged computing resources compared to what was requested for 2011. This is expected to be partially mitigated by new contributions from some countries. Additional resources will be required for 2012. If these are not forthcoming then ALICE will reduce the amount of simulated data and the number of reconstruction passes in order to remain within available resources. Such measures will delay ALICE physics output.

The LHCC observes that the computing resources pledged to ALICE fall considerably short of those requested, although measures have been taken to mitigate the impact of this. Nevertheless, ALICE continues to produce a rich variety of physics results. The evolution of ALICE resources requested for 2011-2012 would place a heavy load on the central CERN computing.

ATLAS

ATLAS expects pile-up rates of $\mu=10-15$ at the start of fills in 2011, which increases event sizes and reconstruction times by factors of 2-2.5. This has been partially mitigated for 2011 by tightening cuts, optimizing analysis methods, eliminating Event Summary Data (ESD) copies and significantly reducing the number of Analysis Object Data (AOD) copies stored on disk, with dynamic data placement used on demand. These measures will impact the physics and the speed of analysis. ATLAS physics sensitivity would benefit from running with low trigger thresholds even at high luminosity, which results in a higher trigger rate than the nominal 200 Hz, but this is not possible within the currently budgeted computing resources. The additional resources requested for 2012 are much like the previous expectations for 2013, with as little increase as is feasible, in light of the current financial challenges for funding. ATLAS wants to keep open the possibility of requesting further resources for 2012, to allow running at a higher trigger rate, after having gained more experience in 2011.

The LHCC encourages ATLAS to explore ways to record the data needed to maintain high sensitivity to new physics at low thresholds as the luminosity increases. Such an initiative is supported to fulfill the physics goals of the 2011-2012 run. In case the available computing resources are restricted, the Committee recommends delaying the processing, analysis or simulation, as necessary.

CMS

CMS now calculates its required computing resources month-by-month through the year, taking into account the anticipated evolution of the pile-up rate. A fast ramp-up is assumed in 2011 and a high rate through-out 2012. To reduce data storage requirements, the majority of analyses will be based on the AOD data format by June 2011, and the numbers of replica copies and old versions of data stored on disk will be substantially reduced. Data will be copied between Tier-1 and Tier-2 sites as required, depending on the demand for particular datasets. CMS is studying the possibility of increasing its trigger rate from 300 Hz to 400 Hz, to maintain sensitivity to light Higgs, SUSY and exotic particles in high pile-up conditions as the instantaneous luminosity increases. Two sets of

resource requirements have been submitted, for 300 Hz and 400 Hz rates, but the 400 Hz scenario should be considered preliminary at present, rather than a request. At 300 Hz the requested resources increase by about 30% in 2012, compared to 2011, with further increases needed to run at 400 Hz.

The LHCC encourages CMS to explore ways to record the data needed to maintain high sensitivity to new physics at low thresholds as the luminosity increases. Such an initiative is supported to fulfill the physics goals of the 2011-2012 run. In case the available computing resources are restricted, the Committee recommends delaying the processing, analysis or simulation, as necessary.

LHCB

In 2010 LHCb experienced pile-up rates of $\mu=2$ and higher, compared to their design value of $\mu=0.4$, and they expect to continue to collect data at $\mu=2$ through-out 2011-2012. This increases the input parameters to the LHCb computing model by factors of roughly 2 or more. To remain within their installed storage resources LHCb has reduced the number of replica data copies and the number of versions kept on disk. The baseline trigger rate is about 2 kHz for the primary b-physics programme. LHCb wants to add another 1 kHz trigger stream to collect data for charm physics. Together with the additional simulated data, this will increase the required LHCb computing resources. This could be mitigated in 2011 by extending the duration of the planned reprocessing, but additional resources will be required in 2012 and have been requested.

The LHCC endorses the inclusion of charm as a valuable extension to the LHCb physics programme and encourages the Collaboration to explore ways to record these extra data. In case the computing resources are restricted then the Committee recommends delaying the processing and analysis of these data, or reducing the amount of simulation, as necessary.