HL-LHC Computing Review Stage-2: Common Software Projects

The HL-LHC Computing Review Process is expected to culminate in 2024 with Technical Design Reports (TDRs) from ATLAS and CMS that document their plans for Computing and Software in the HL-LHC era. Under the auspices of the LHCC, a review panel will assess the TDRs, expected to be submitted in the first half of 2024 in a similar process as was used to review the detector TDRs. This process will provide a comprehensive and independent assessment of the planning and estimated resource needs. The TDRs will be preceded by a number of steps, including Conceptual Design Reports (CDRs) and two reviews of the Common Software Projects. The notional review timeline is given below. The first stage of this process took place on May 18-20, 2020 in a virtual format (https://cds.cern.ch/record/2725487/files/LHCC-G-177.pdf) and focused on establishing a baseline for the ATLAS and CMS HL-LHC computing models. This document describes the second stage, which will focus on a review of the Common Software Projects.

The second review will take place in the week of November 1 - 5, 2021 with the intention of an in-person review at CERN. It will focus on the requirements, plans and readiness of activities that are common to the experiments, including those under the WLGC umbrella, but will also request an update from ATLAS and CMS on progress since the last meeting. The main goal of this review is to ensure the experiments, WLCG, and the relevant software projects, have common and realistic expectations of requirements and timescales. This review, therefore, is expected to help the experiments plan their strategies and assist the projects in focusing on priorities and identifying any pinch-points. The review is intended to establish that there is a credible plan and that all parties are "on the same page".

The first step of this review is to identify the list of common software activities (CSAs) to be reviewed. This will be proposed by the WLCG Software Liaisons working with the experiments and the HEP Software Foundation. Next, the experiment requirements need to be defined and possibly negotiated. It is anticipated that the list of CSAs under review will be presented at the LHCC WLCG meeting March 2021.

The common activities are expected to include:
- Event Generators
- Geant 4
- Data Organization, Management and Access (DOMA) software components:
  - Rucio
  - File Transfer Service (FTS)
  - Storage interfaces and caching layers
  - Network technologies including monitoring and software defined networks.
- ROOT:
  - IO/persistency
  - Framework for Data Analysis
- Data Science Tools in use for analysis (such as data frames and python bindings).

Documentation Guidance:

Common Software Activity (CSA) documentation should:
- Include a description of the project and present plans and timelines to deliver the agreed functionality and performance.
- Describe how the project is managed, including how it will set priorities, monitor progress, and communicate with stakeholders.
- Present the current status of the development teams and note any gaps in skills or effort.
- Describe any major risks, potential functionality gaps, and dependencies on other projects.

While the focus of this review is on common activities, an update is also requested from ATLAS and CMS. These updates should follow the recommendations made in the July 2020 report and should include a description of any progress towards the use of HPC systems and heterogeneous architectures.

Experiment Update documentation should:
- Outline of high-level requirements, expected timelines, and any contributions they intended to make to the Common Software Activities. Please note dependencies and any special functionality, external packages, or interfaces required.
  o Describe progress towards establishing common LHC machine parameters (*Common Recommendation 1* from the first review).
  o Describe progress towards establishing a framework to assess the impact of software developments on future compute and storage needs (*Common Recommendation 2*)
  o Present the status of the R&D programs to make use of heterogeneous architectures and HPC Centers, outlining any common (or potential common) projects.
- Provide an assessment, as far as is currently possible, of the potential impact of this R&D on the overall computing resource requirements.
- Note briefly any progress towards the experiment specific recommendations from the first review.

All supporting documentation should be made available to the review team by October 1, 2021. It is expected that CSA documentation for related topics can be grouped or combined, as appropriate. The documentation should be concise. It would not be unreasonable to assume such input would be between 20-30 pages.

Proposed Review Timeline:

May 2020	Baseline review for CMS and ATLAS
November 2021	Common software projects and WLCG software
October 2022	HL-LHC Computing CDRs for ATLAS and CMS
October 2023	HSF, Common Software Projects, WLCG facilities
April 2024	Delivery of the HL-LHC ATLAS and CMS Computing TDR
October 2024	Review of the HL-LHC ATLAS and CMS Computing TDRs