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Optimal XCache deployment for the CMS experiment in Spain

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The Large Hadron Collider at CERN in Geneva is poised for a transformative upgrade, preparing to enhance both its accelerator and particle detectors. This strategic initiative is driven by the tenfold increase in proton-proton collisions anticipated for the forthcoming high-luminosity phase scheduled to start by 2029. The vital role played by the underlying computational infrastructure, the World-Wide LHC Computing Grid, in processing the data generated during these collisions underlines the need for its expansion and adaptation to meet the demands of the new accelerator phase. The provision of these computational resources by the worldwide community remains essential, all within a constant budgetary framework. While technological advancements offer some relief for the expected increase, numerous research and development projects are underway. Their aim is to bring future resources to manageable levels and provide cost-effective solutions to effectively handle the expanding volume of generated data. In the quest for optimised data access and resource utilisation, the LHC community is actively investigating Content Delivery Network (CDN) techniques. These techniques serve as a mechanism for the cost-effective deployment of lightweight storage systems that support both, traditional and opportunistic compute resources. Furthermore, they aim to enhance the performance of executing tasks by facilitating the efficient reading of input data via caching content near the end user. A comprehensive study is presented to assess the benefits of implementing data cache solutions for the Compact Muon Solenoid (CMS) experiment. This in-depth examination serves as a use-case study specifically conducted for the Spanish compute facilities, playing a crucial role in supporting CMS activities. Data access patterns and popularity studies suggest that user analysis tasks benefit the most from CDN techniques. Consequently, a data cache has been introduced in the region to acquire a deeper understanding of these effects. In this contribution we will focus on the remote data accesses from users that execute tasks in the Spanish CMS sites, in order to simulate and discern the most optimal requirements in both size and network connectivity for a data cache serving the whole Spanish region. This is a mandatory step towards a better understanding of the service to be deployed in a federated fashion in the region.

Significance

This study is pioneer, never done and presented before, and a similar approach can be used by other countries who would like to explore CDNs/XCache solutions.

References

Experiment context, if any

CMS

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