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## Optimizing the CMS Offline Software Infrastructure for Run 3

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The CMSSW framework has been instrumental in data processing, simulation, and analysis for the CMS detector at CERN. It is expected to remain a key component of the CMS Offline Software for the foreseeable future. Consequently, CMSSW is under continuous development, with its integration system evolving to incorporate modern tools and keep pace with the latest software improvements in the High Energy Physics (HEP) community. This contribution presents an in-depth examination of the recent enhancements made to the CMSSW infrastructure. Technical improvements, such as advanced compiler techniques like Link Time Optimization (LTO) and Profile-Guided Optimization (PGO), have been successfully integrated into the CMSSW infrastructure. Additionally, the adoption of heterogeneous resources and multi-vectorization architectures has contributed to a variety of software flavors and architectures, providing different approaches to identify bugs and legacy code at an early stage. To efficiently accommodate the increasing workloads of such techniques, the migration of the CernVM File System to a parallel publishing setup has also been engineered according to the experiment's needs. We will finally discuss the enhancement of the CMS Continuous Integration infrastructure, focusing on the adoption of new methods for monitoring and scheduling, testing, and integrating the software stack. Overall, these advancements in CMSSW have not only prepared it for the ongoing Run 3 but also underscore our commitment to continuously optimizing the CMS software infrastructure.

### Significance

This contribution includes all the improvements made to the CMS Offline Software infrastructure to prepare it for the challenges of Run 3 and builds upon the last progress report at CHEP 2019. We believe that the novel techniques adopted will be of significant interest to the HEP community.

### References

Last reporting at CHEP 2019: “Modernizing the CMS software stack”(<https://indico.cern.ch/event/773049/contributions/3473267/>) Preliminary results of the compiler techniques Link Time Optimization (LTO) and Profile-Guided Optimization (PGO) were presented at ACAT 2022: “Speeding up CMS simulations, reconstruction and HLT code using advanced compiler options”(<https://indico.cern.ch/event/1106990/contributions/4991214/>)

### Experiment context, if any

This contribution is set in the context of the CMS experiment at CERN. It has been submitted on behalf of the CMS Collaboration. The abstract has been approved by the CMS Conference Committee.

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