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ATLAS High Level Trigger within the multi-threaded software framework AthenaMT

Athena is the software framework used in the ATLAS experiment throughout the data processing path, from the software trigger system through offline event reconstruction to physics analysis. The shift from high-power single-core CPUs to multi-core systems in the computing market means that the throughput capabilities of the framework have become limited by the available memory per process. For Run 2 of the Large Hadron Collider (LHC), ATLAS has exploited a multi-process forking approach with the copy-on-write mechanism to reduce the memory use. To better match the increasing CPU core count and the, therefore, decreasing available memory per core, a multi-threaded framework, AthenaMT, has been designed and is now being implemented. The ATLAS High Level Trigger (HLT) system has been remodelled to fit the new framework and to rely on common solutions between online and offline software to a greater extent than in Run 2.

We present the implementation of the new HLT system within the AthenaMT framework, which is going to be used in ATLAS data-taking during Run 3 (2021 onwards) of the LHC. We also report on interfacing the new framework to the current ATLAS Trigger and Data Acquisition (TDAQ) system, which aims to bring increased flexibility whilst needing minimal modifications to the current system. In addition, we show some details of architectural choices which were made to run the HLT selection inside the ATLAS online data-flow, such as the handling of the event loop, returning of the trigger decision and handling of errors.

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