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Performance and evolution of the DAQ system of the CMS experiment for Run-2

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The data acquisition system (DAQ) of the CMS experiment at the CERN Large Hadron Collider assembles events at a rate of 100 kHz, transporting event data at an aggregate throughput of 100 GByte/s to the high-level trigger (HLT) farm. The HLT farm selects and classifies interesting events for storage and offline analysis at a rate of around 1 kHz.
The DAQ system has been redesigned during the accelerator shutdown (LS1) in 2013/14. In order to handle higher LHC luminosities and event pileup, a number of sub-detectors are upgraded, increasing the number of readout channels and replacing the off-detector readout electronics with a μTCA implementation. The new DAQ system support the read-out of of the off-detector electronics with point to point links of both the legacy systems, as well as the new uTCA based systems with a fibre based implementation up to 10 Gbps and reliable protocol.
The new DAQ architecture takes advantage of the latest developments in the computing industry. For data concentration, 10/40 Gbit Ethernet technologies are used, as well as an implementation of a reduced TCP/IP in FPGA for a reliable transport between DAQ custom electronics and commercial computing hardware. A 56 Gbps Infiniband FDR CLOS network has been chosen for the event builder with a throughput of ˜4 Tbps. The HLT processing is entirely file-based. This allows the DAQ and HLT systems to be independent, and to use the same framework for the HLT as for the offline processing. The fully built events are sent to the HLT with 1/10/40 Gbit Ethernet via network file systems. A hierarchical collection of HLT accepted events and monitoring meta-data are stored in to a global file system. The monitoring of the HLT farm is done with the Elasticsearch analytics tool.
This paper presents the requirements, implementation, and performance of the system. Experience is reported on the operation for the LHC pp runs as well as at the heavy ion Pb-Pb runs. The evolution of the DAQ system will be presented including the expansion to accommodate new detectors

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