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A scalable online monitoring system based on Elasticsearch for distributed data acquisition in CMS

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The part of the CMS data acquisition (DAQ) system responsible for data readout and event building is a complex network of interdependent distributed programs. To ensure successful data taking, these programs have to be constantly monitored in order to facilitate the timeliness of necessary corrections in case of any deviation from specified behaviour. A large number of diverse monitoring data samples are periodically collected from multiple sources across the network. Monitoring data are kept in memory for online operations and optionally stored on disk for post-mortem analysis.

We present a generic, reusable solution based on an open source NoSQL database, Elasticsearch, which is fully compatible and non-intrusive with respect to the existing system. The motivation is to benefit from an off-the-shelf software to facilitate the development, maintenance and support efforts. Elasticsearch provides failover and data redundancy capabilities as well as a programming language independent JSON-over-HTTP interface. The possibility of horizontal scaling matches the requirements of a DAQ monitoring system. The data load from all sources is balanced by redistribution over an Elasticsearch cluster that can be hosted on a computer cloud.

In order to achieve the necessary robustness and to validate the scalability of the approach the above monitoring solution currently runs in parallel with an existing in-house developed DAQ monitoring system. The effectiveness and reusability of such a distributed monitoring solution is demonstrated by the current usage of the same system within the CMS BRIL subsystem. Another Elasticsearch based system is used for the High-Level-Trigger (HLT) part of the DAQ system monitoring, which also benefits from this off-the-shelf solution facilitating data storing and load balancing.

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