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Mordicus-dhsm: a Distributed State-Machine Framework for DAQ

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Data Acquisition (DAQ) softwares are heavily distributed applications, whether this is for performance reasons or because of the intrinsic spatial repartition of embedded software nodes. They have a strong requirement concerning the coherency of the system state: when a data acquisition run is started, all participating nodes are supposed to be acquiring data, when the system is configuring or when it is idle, all processes should be. This is why the behavior of such a system is accurately modeled using a finite state-machine (FSM).

However, implementing such a state-machine, enforcing synchronization of many distributed processes, is not a trivial task : it requires a robust communication protocol, a carefully crafted error handling strategy able to recover from the failure of any node subset, and a design that binds the application data state to the state-machine and minimizes harmful side effects between states that would compromise its integrity.

From this assessment, we developed DHSM (Distributed Hierarchical State Machine): a C++ state-machine framework aimed at easily creating robust, state-machine enabled, DAQ softwares.

The framework design, features and implementation will be presented, and its application to the MINOS experiment DAQ software will be detailed. There, we will expose the challenges and design decisions that were necessary to successfully take advantage of the framework features to create a robust a DAQ system.

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