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Architecting software applications in containerized environment for CMS data acquisition

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The data acquisition (DAQ) system stands as an essential component within the CMS experiment at CERN. It relies on a large network system of computers with demanding requirements on control, monitoring, configuration and high throughput communication. Furthermore, the DAQ system must accommodate various application scenarios, such as interfacing with external systems, accessing custom electronics devices for data readout, and event building. We present a versatile and highly modular programmable C++ framework designed for crafting applications tailored to various needs, facilitating development through the composition and integration of modules to achieve the desired DAQ capabilities. This framework takes advantage of reusable components and readily available off-the-shelf technologies. Applications are structured to seamlessly integrate into a containerized ecosystem, where the hierarchy of components and their aggregation is specified to form the final deployable unit to be used across multiple computers or nodes within an orchestrating environment. The utilization of the framework, along with the containerization of applications, enables coping with the complexity of implementing the CMS DAQ system by providing standardized structures and components to achieve a uniform and consistent architecture.

Authors: SIMELEVICIUS, Dainius (Vilnius University (LT)); SIMELEVICIUS, Dainius (CERN, Vilnius University); ORSINI, Luciano (CERN)

Co-authors: COROMINAS I MARISCOT, Albert (CERN); BOCCI, Andrea (CERN); PETRUCCI, Andrea (UCSD); DVORAK, Antonin (CERN); GAILE, Antra (CERN); RACZ, Attila (CERN); ODETAYO, Babatunde John (CERN, University of Benin); DELDICQUE, Christian (CERN); PAUS, Christoph (MIT); SCHWICK, Christoph (CERN); EMMANOUIL, Christos (CERN); VAZQUEZ VELEZ, Cristina (CERN); RABADY, Dinyar Sebastian (CERN); GIGI, Dominique (CERN); MESCHI, Emilio (CERN); CANO, Eric (CERN); GLEGE, Frank (CERN); MEIJERS, Frans (CERN); DARLEA, Georgiana-Lavinia (MIT); GOMEZ-CEBALLOS, Guillelmo (MIT); IZQUIERDO MORENO, Guillermo (CERN); SAKULIN, Hannes (CERN); ALAWIEH, Jaafar (CERN); BRANSON, James Gordon (UCSD); BUGAJSKI, Jan Andrzej (CERN); HEGEMAN, Jeroen (CERN); ARUTJUNJAN, Kareen (CERN); LONG, Kenneth (MIT); DOBSON, Marc (CERN); PIERI, Marco (UCSD); BACHAROV DURASOV, Miguel (CERN); GORNIAK, Patrycja (CERN); ZEJDL, Petr (CERN); BRUMMER, Philipp Maximilian (CERN); TZANIS, Polyneikis (CERN); KRAWCZYK, Rafal (Rice University); CITTOLIN, Sergio (UCSD); MOROVIC, Srecko (UCSD); JAYAKUMAR, Tejeswini (CERN); RIZOPOULOS, Theodoros (CERN); JAMES, Thomas Owen (CERN); BEHRENS, Ulf (Rice University); KARIMEH, Wassef (CERN); LI, Wei (Rice University)

Presenters: SIMELEVICIUS, Dainius (Vilnius University (LT)); SIMELEVICIUS, Dainius (CERN, Vilnius University)

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