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#04-63 CAREDAS: a Comprehensive Architecture for a Redondant and Evolutive Data Acquisition System for JHR reactor and measuring bench for CEA Cadarache facilities

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A new material testing reactor Jules Horowitz Reactor (JHR) is under construction at CEA Cadarache. The materials to be irradiated will be placed into experimental devices around the reactor. Process and measurements of experimental devices will be carried out by command control. Programmable Logic Controller (PLC) dedicated on each experimental device will realize this function. Some experiment devices will need to achieve complex real time processing that PLC cannot reach. A data acquisition system (DAS) having these processing performances will be associated to the PLC. This system will realize measurements and processing. The challenge is to design and realize for twenty experiment devices a high availability data acquisition system architecture for 50 years of sustainability. The real time target will achieve 24/7 data acquisition and real time processing. The other components will be in charge of data storage, online and offline data visualizations, experiment setting and processing without modifying software core.

A proof of concept have been realized by the end of 2019. This scalable architecture could be use as well for JHR experimental devices with high availability as for testbed. This architecture could be run on a standalone station for a measuring bench or deployed on cluster with redundant data acquisition system for high availability. CAREDAS's design is modular and use proven widely used open source solutions of IIoT world (Industrial Internet of Things). All parts are independent from each other and can be replaced with another technology with the same functionalities. This ensures sustainability and control of software sources.

The heart of CAREDAS is the communication between functions. It is based on MQTT (Message Queuing Telemetry Transport) for message transmission and Google Protocol Buffer for data serialization. Data are stored in InfluxDB time series database. Offline data visualization is achieve with Grafana to compose dashboards that query directly InfluxDB databases. Only three software in C++ language are homemade to ensure sustainability: real time data acquisition, writing data into InfluxDB, tools for experiment setting and supervision. All software run on station or cluster nodes on the Linux operating system (Red Hat distribution).

Real time data acquisition software is modular and technology independent. The operating system is Linux with real time functionality. For instance, technologies implemented are PXIe bus, CompactRIO/CompactDaq from National Instruments, Ethercat, various measurement units over Ethernet.

Now, CAREDAS is under development and a first stable version is planning for September of 2021. Meanwhile, a beta version was deployed on five measuring bench on some CEA Cadarache facilities.

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