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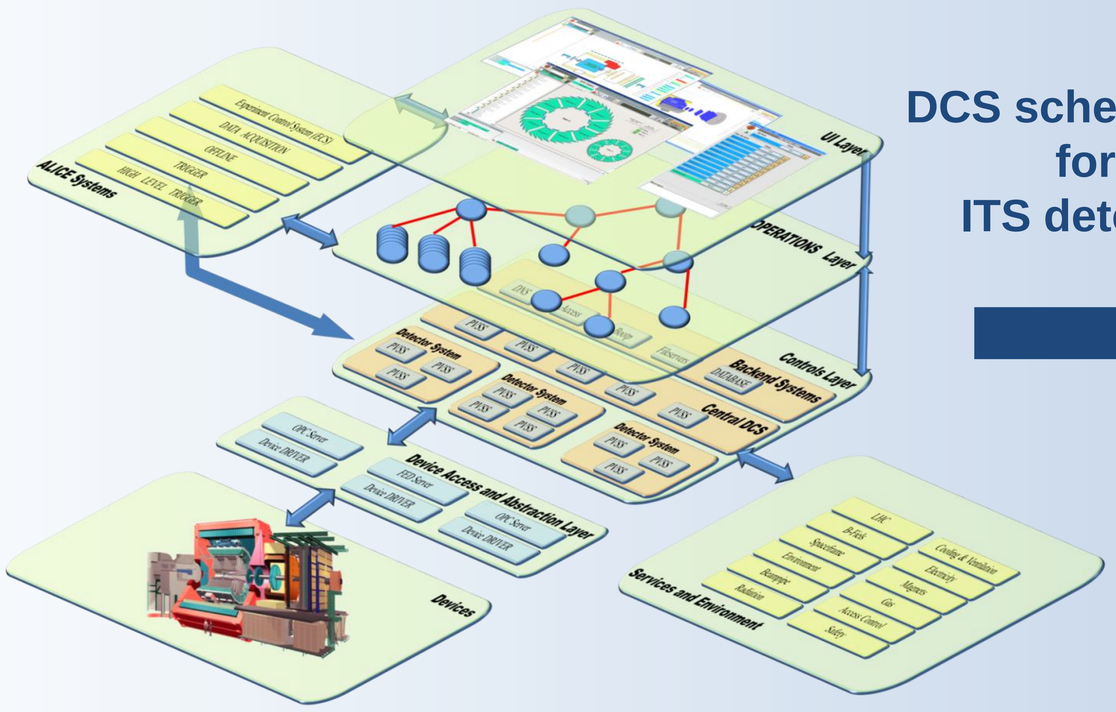
COMMUNICATION ARCHITECTURE OF THE DETECTOR CONTROL SYSTEM FOR THE INNER TRACKING SYSTEM

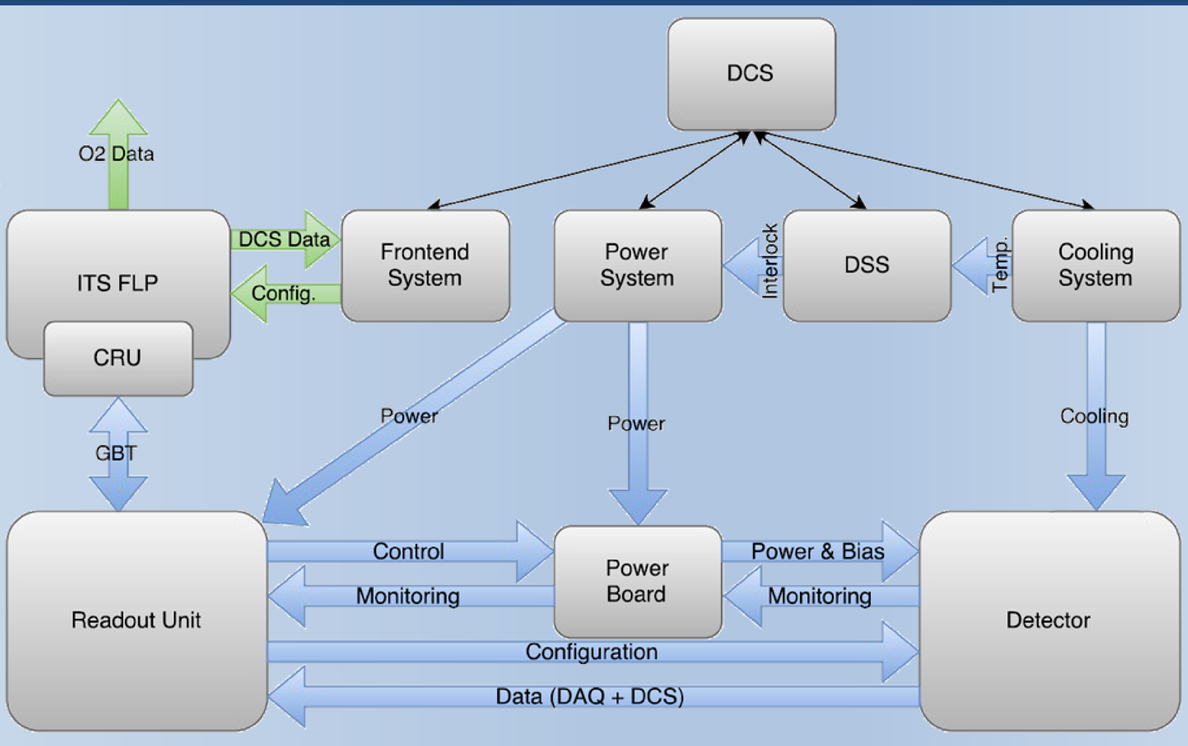
J. Jadlovsky, A. Jadlovska, S. Jadlovska, M. Oravec, D. Voscek, M. Kopcik, J. Cabala, M. Tkacik,
Technical University of Košice, Košice, Slovakia

P. Chochula, O. Pinazza, CERN, Geneva, Switzerland

Abstract - This paper presents the proposed communication architecture of the Detector Control System (DCS) for the Inner Tracking System (ITS). The purpose of the DCS is to acquire and control the states of the ITS. Since the ITS is not yet fully implemented, an emulator of the communication architecture is being developed. The proposed architecture comprises five levels. At the bottom, the detector is emulated by sensors connected to microcontrollers. Each microcontroller is then connected to a Raspberry Pi which represents the ALICE low-level front-end (ALF) electronics at the second level of communication architecture. The third level is represented by Front-End Device (FRED), a Linux server where more than one ALF device can be connected. FRED is then connected to the fourth level, implemented by the SCADA interface – WinCC OA. Above all these levels is an archiving and configuration database setup. Configuration bypasses the SCADA interface and is managed directly through FRED. The purpose of the emulator is to verify the proposed architecture in terms of data throughput and cooperation of the mentioned modules.



DCS schematics for ITS detector



ALFRED communication architecture for DCS of ITS detector testing workplace

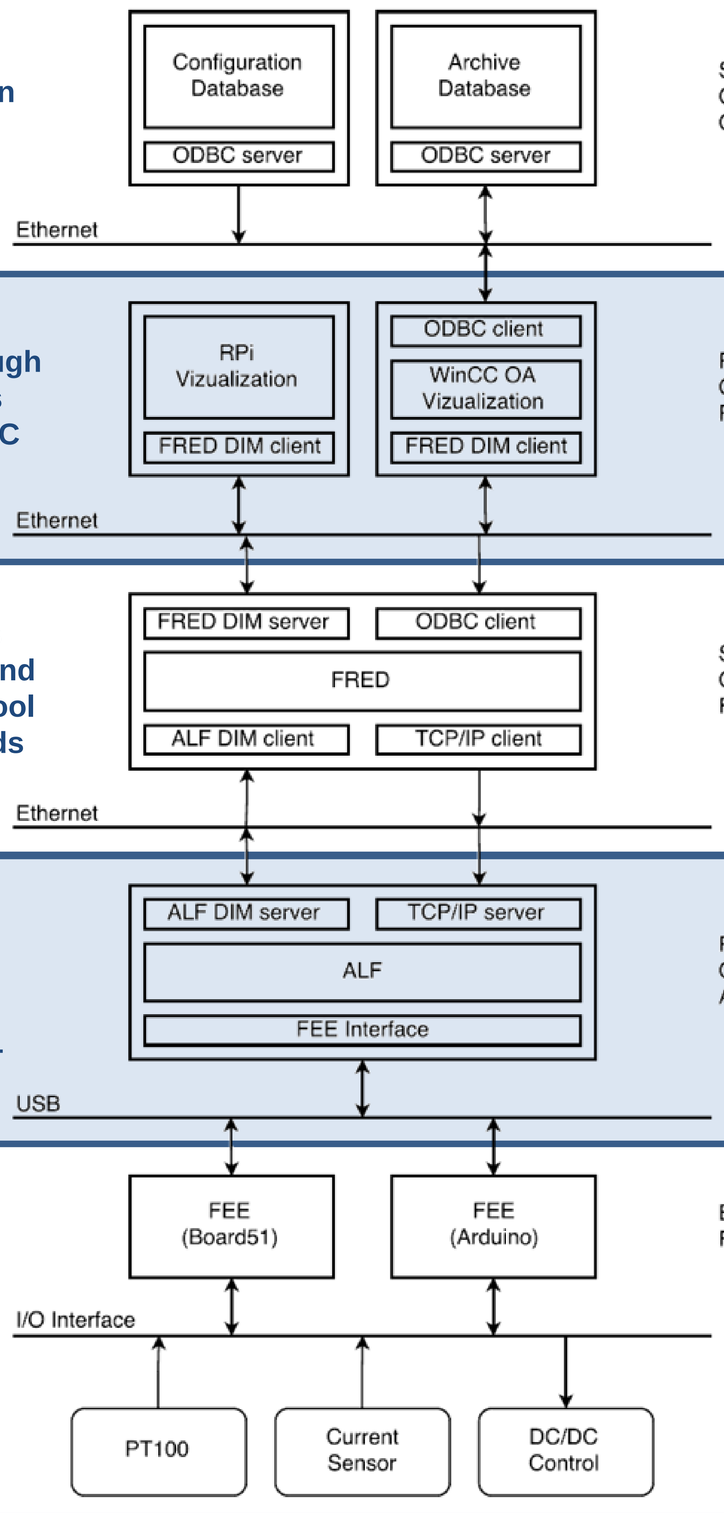
Database stores data for configuration electronics and archive data

Data from the FEE devices flows through the ALFRED infrastructure and it is visualized in SCADA / HMI tool WinCC OA

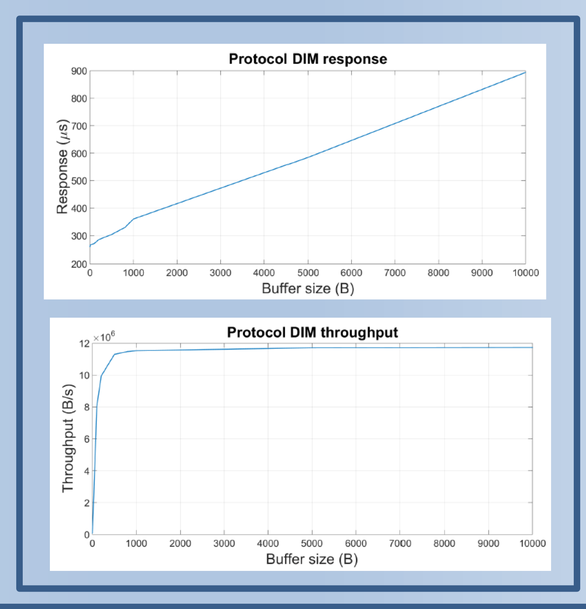
The FRED program module ensures collection of data from ALF modules and their distribution to the visualization tool WinCC OA as well as it also downloads the configuration data

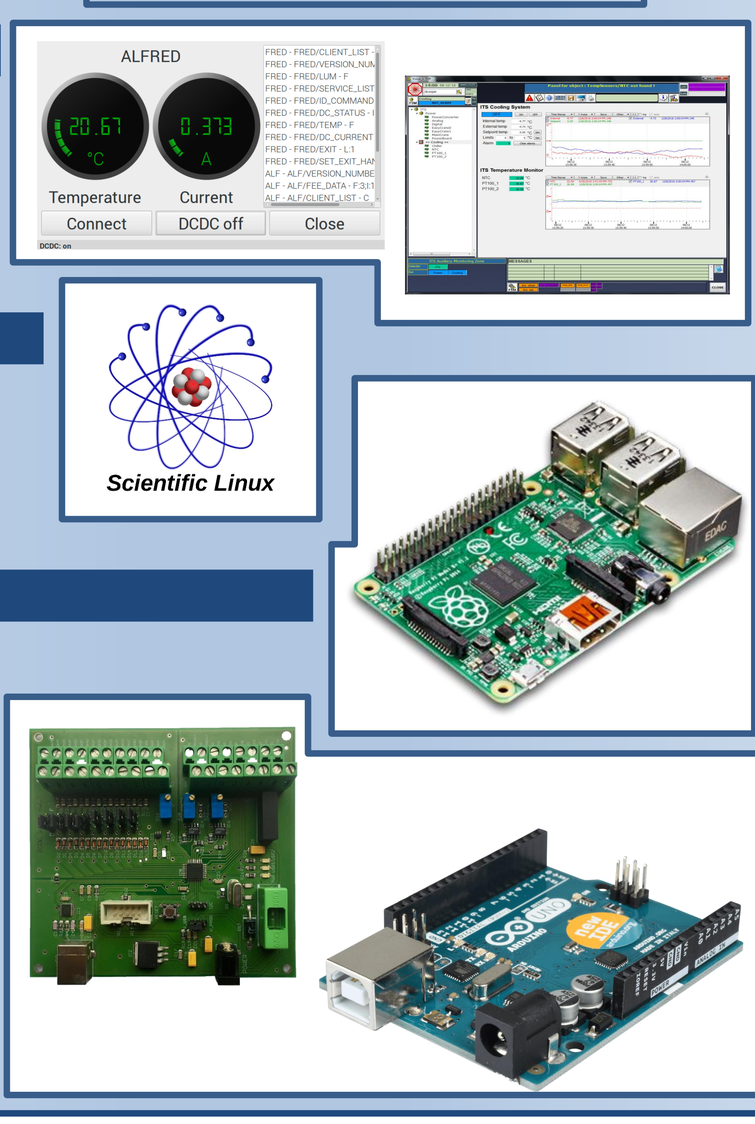
The ALF module provides communication between front-end electronics and FRED via DIM protocol and it is implemented in C++

The front-end electronics includes single-chip microcomputers such as Arduino or Board51 and acquire data from connected sensors



Protocol DIM throughput and response





Conclusion - The purpose of this paper was to present the proposed communication architecture of DCS for ITS and to describe its individual modules. The communication architecture is emulated within conditions which are expected to be present in the real ITS detector. Therefore complex conditions have to be met and taken into account. The architecture is based on several different implementations starting with Arduino MCU, Raspberry Pi, Linux server up to the WinCC OA SCADA/HMI system and databases. Tests validating throughput via DIM and OPC protocols were also conducted in the favour of DIM protocol.