DEVELOPMENT OF DAQ TO DCS COMMUNICATION IN THE ATLAS INNER TRACKER

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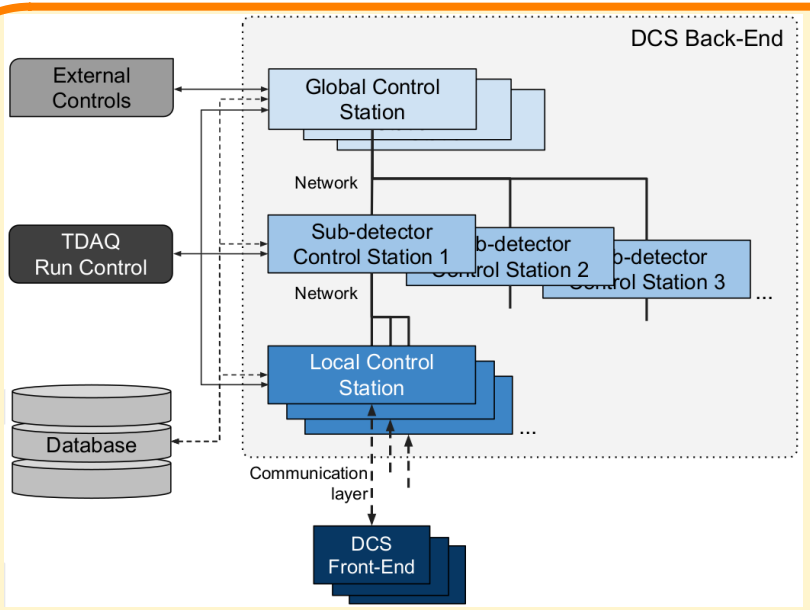


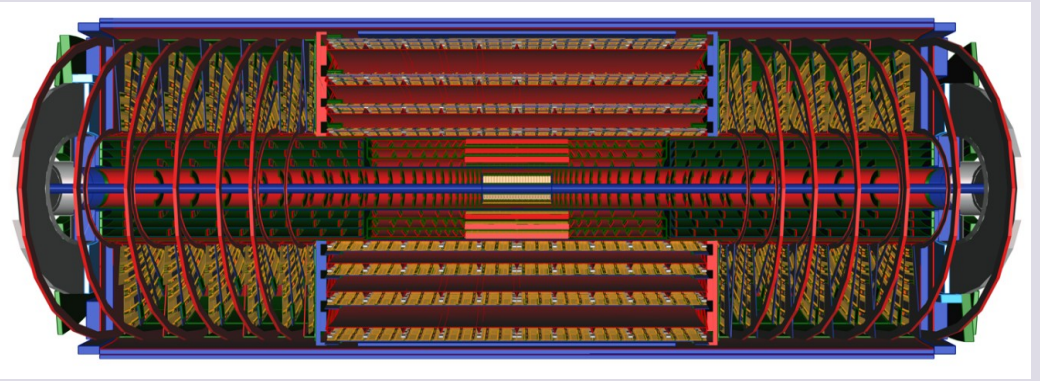
THE ATLAS DETECTOR CONTROL SYSTEM

The *Detector Control System* (DCS) allows for ATLAS coherent and safe operation. It brings the detector into any desired operational state, continuously monitors and archives the operational parameters, signals any abnormal behaviour and allows for manual or automatic actions to be taken. It is divided into *Front End*, which includes the DCS hardware, and *Back End*, which consists of control stations.

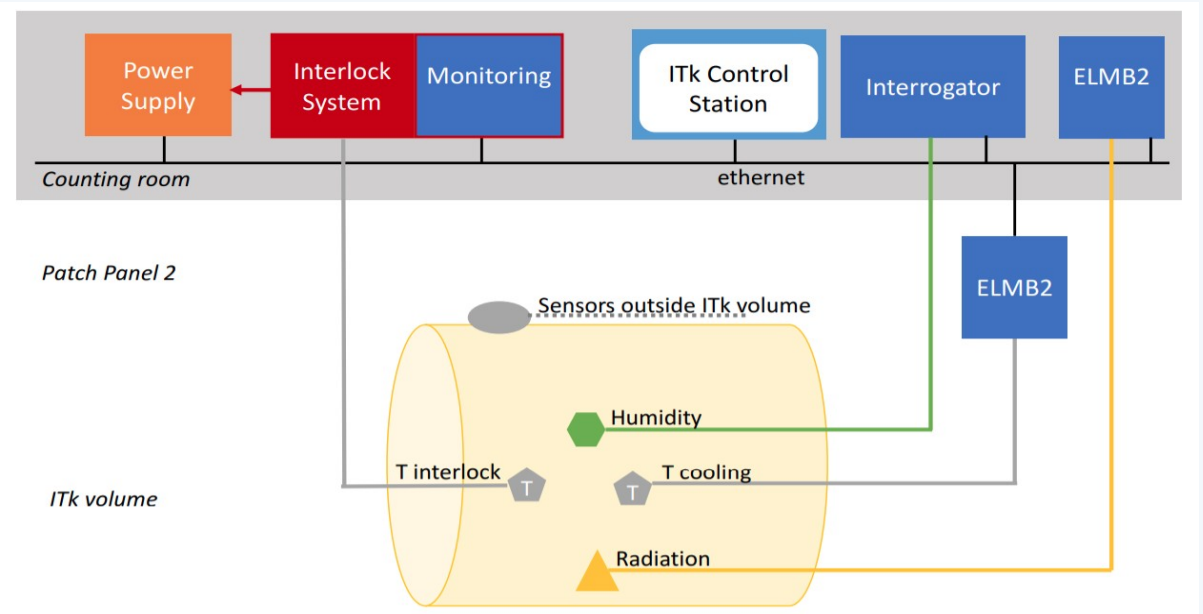
The ATLAS Collaboration, "*Technical Design Report for the Phase-II Upgrade of the ATLAS Trigger and Data Acquisition System*" (2018)

THE INNER TRACKER DETECTOR

For the upgrade of the LHC to the High Luminosity LHC the ATLAS Inner Detector will be replaced by a new *Inner Tracker* (ITk) detector, an all-silicon system that will allow to obtain high tracking performance in a harsh environment. The innermost section is composed by pixel detectors, the outer part by strip detector elements.



See also: O. Solovyanov, "Status and progress on the ATLAS Phase-II detector upgrades" (LHCP2021)



THE ITk COMMON DCS

Pixel and strip detectors share a common DCS. It consists of various monitoring systems, which control the temperature, the radiation and the humidity in the tracker volume, and of the interlock system, a hardwired protection system against various upcoming risks, such as excessive temperatures.

S. Kersten et al., "*The ITk Common monitoring and interlock system*", ICALEPS 2019

DCS MIDDLEWARE STANDARD

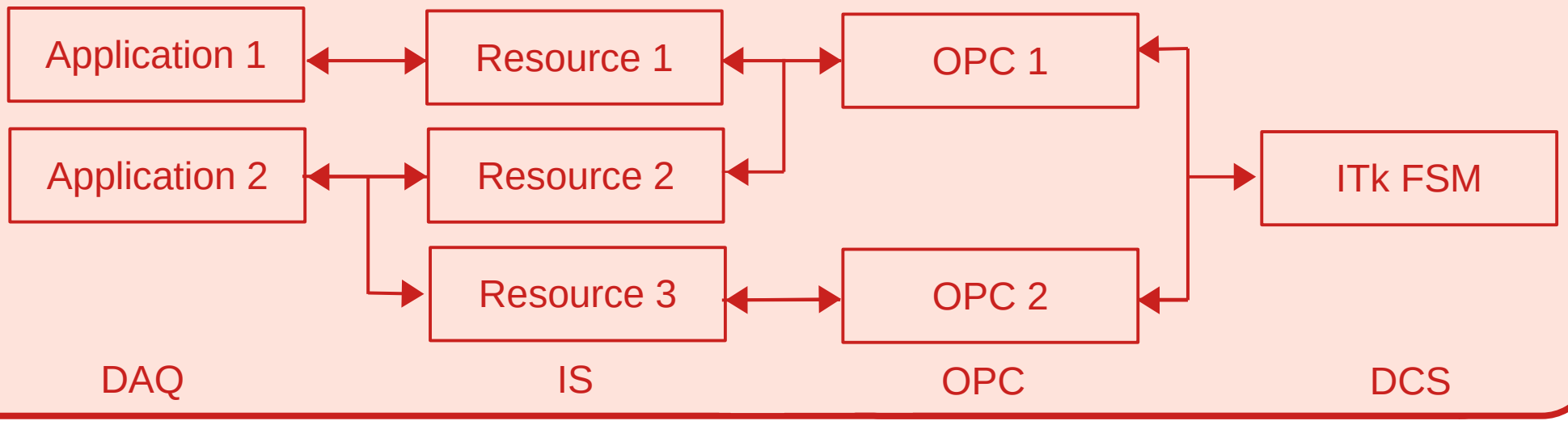
The hierarchical structure of ATLAS DCS is modeled by a Final State Machine. The communication to different subdetectors is performed through WinCC, a commercial SCADA (*Supervisory Controls and Data Acquisition*) system. The middleware standard for DCS systems is OPC UA, which is a platform independent industrial standard for intercommunication between different devices based on a client/server model.

DAQ TO DCS COMMUNICATION

ITk DAQ system needs to communicate to DCS. This could be done through an OPC server connected to the TDAQ *Information Service* (IS), which is a component of the ATLAS TDAQ Online Software that allows one to share information between software applications in the distributed environment. The development of OPC UA servers can be easily performed through the QUASAR (*quick OPC UA server generation framework*) framework using LCG software and almost latest versions of python 3, gcc and boost.

COMMUNICATION PROTOTYPE

QUASAR is used in order to build the OPC server that listens to IS: it can read (write) from (to) IS a predefined set of information. For example, DAQ writes to the IS the status of the run and reads from the DCS the status of the power. ITk FSM can read the values from the OPC server. It is a distributed system in which each tool can run on a separate computer (DAQ, IS, OPC server, WinCCOA).



CONCLUSION

An IS object that can be written (read) to (from) the IS has been created. A prototype OPC server that can read (write) ITk resources from (to) the IS has been generated through QUASAR. Two example tools have been created: the first one to write variables on IS addresses and the second one to read the state of the resources from the OPC server.
The communication of real power supplies to the IS has also been tested.

NEXT STEPS

- Describe the information we want to exchange: type, number of messages...
- Create an ITk PIXEL FSM in WinCCOA
- Integrate the OPC server into the ITk PIXEL FSM