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Advanced Process Control With Redundant DCS Communication using OPC UA

Abstract: This paper describes how redundant communication can be established between Advanced Process Control (APC) application and Distributed Control System (DCS) using OPC UA communication protocol.

Keywords: OPC UA, Digitalization, Process Control, Automation, Redundancy

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Extended abstract. Typically communication between APC and DCS is not critical for safe operating of the process and hence communication is without redundancy. Nature of APC is such that if communication between APC and DCS is lost, normally the plant operators can still control the process of the plant. The Consequences of communication breaks are normally economic costs due to process optimization problems. Economic costs may be significant and also the operators trust towards APC may decrease and benefits of using APC diminish. However communication breaks between APC and DCS seldom lead to plant downtime or hazards to people and environment. In addition, redundant communication increases the availability of APC because communication application and operating system updates can be installed to DCS OPC Servers without APC downtime.

The solution presented in this paper bases on OPC UA which is successor to common OPC Classic standards. OPC UA has many benefits over OPC Classic main benefits being platform independent, cyber security features and firewall friendliness. OPC UA is firewall-friendly because only single TCP port opening is normally needed to establish OPC UA communication between server and client residing in different sides of provided by different vendor. OPC UA is international standard and has IEC standard code IEC 62541. At the moment OPC UA has already specification how to implement the redundancy of server and client side in an OPC UA standard conforming way.

The solution presented in this paper is partly based on mechanisms presented in the OPC UA specification. DCS OPC UA server redundancy is based on two parallel OPC UA servers provided by the DCS vendor. Both of these OPC UA servers provide the same OPC UA address space making it possible to access same DCS positions. DCS OPC UA servers do not provide transparent redundancy so the switch over logic is built on the APC server which implements both OPC UA server and OPC UA client. OPC UA client connection is established to each redundant DCS OPC UA server from the APC server. All communications to and from DCS is done using these client connections. The actual data flow is implemented using proprietary OPC UA information model from the APC vendor which defines a variable type that can be connected from APC side to DCS variable using OPC UA client connections which were described earlier. Instances of aforementioned variable type are called communication variables. Communication variable can be defined to monitor the same DCS variable using separate client connections to redundant DCS OPC UA server. In practice the configuration is done by defining primary and secondary source node for the communication variable. Communication variable handles the communication redundancy itself by automatically switching to use another client connection if communication loss is detected with the active connection. This way communication loss is transparent to the APC client software that is monitoring the communication variable. It is also possible to manually switch communication between primary and secondary OPC UA server. Results from the redundant communication between APC and DCS are very promising and it was noted that already in the commissioning phase where frequent changes and updates are needed both in DCS and APC side the redundant communication has provided smoother an faster workflow.