

Digital Substation Deployment Using IEC 61850

Background

Customer:

Large electric power company

Region:

Colombia

Industry:

Power Distribution

Sales Partner:

Potencia y Tecnologías Incorporadas (PTI)

Solutions

- SYNC 3000

Challenge

The distribution utility was planning to deploy IEC 61850 in its substations and needed a solution that supported a wide range of different vendors legacy and digital IEDs.



Business Need

In 2012, one of the largest power distribution companies in Colombia began planning the modernization of its electrical infrastructure starting with digitization of its substations. Incorporating new technologies while maintaining compatibility with the existing control systems was identified as a significant challenge for the project.

The 64 substations had distributed RTUs, some of which used serial protocols while most others were in the final stages of their lifecycle. The control and protection systems were obsolete and many of them had no communications interface. The utility began its project by installing the latest generation IEDs that supported the IEC 61850 standard. They already had a large metro Cisco IP network infrastructure providing a foundation for control of the substations and automation via IEC 61850.

The objective was to deploy an IEC 61850 Station Bus that would allow communicating with the control centers, taking the information in IEC 60870-5-104 telecontrol protocol with a proprietary profile.

Objectives

- Implement a IEC 61850 Station Bus solution with technology that could be deployed in 64 substations
- System level redundancy
- Ability to support legacy products and tools based on IEC 101 and DNP3 to utilize their full lifecycle
- Implement IEC 61850 Process Bus solution where applicable for the integration of all IEDs with IEC 61850 support
- Scalable architecture for future growth
- Achieve interoperability with the proprietary profile of devices

Solution

The utility selected to implement a redundant and high availability solution, with Tier 3 redundancy technologies (IEC 62439-3 PRP / SHR) that would allow efficient, robust and safe control of their 64 substations. Kalkitech's SYNC 3000 gateways were selected as they offer flexibility in deployment and interoperability including support for the proprietary profile of the telecontrol system plus ability to communicate with IEDs from a variety of vendors. PTI designed the substation architecture and performed the integration and automation of the IEC 61850 Station Bus systems in 55 high voltage and 9 extra high voltage substations.

Architecture

The architecture replicated in each substation is a redundant system with hot standby mode, with tier level 3 characteristics (redundant devices, dual power supply). Implemented equipment is industrial grade with operating temperatures of -40 to 70° C and specifically designed to work in substation environments under the IEC 61850-3 standard. The substation architecture includes two Kalkitech SYNC 3000 gateways which feature high-performance and have no moving parts making it an ideal solution for data acquisition and monitoring in large substations. It also offers the computing power and extensibility to add support for more applications with support for APIs.

With fiber Ethernet interfaces in Parallel Redundancy Protocol (PRP) mode natively, it implements IEC 62439-3, enabling integration of IEDs and redundant networks with high availability and zero packet loss. The SYNC 3000 connects to a double ring network infrastructure based on Cisco Connected Grid Switches (CGS).

- Deployed SYNC 3000s at 64 remote 500kV, 230kV, 115kV, 57kV and 11.4kV substations to integrate SCADA devices.
- Integration of more than 700 IEDs using IEC 61850 and DNP3 protocols; more than 240 Elitel 5 RTUs using IEC 101 protocol

- More than 54,000 mapped signals for the entire system between states (positions of cutting elements, states), alarms (shots, events) and analogous values (Voltages, Currents, Powers, Frequency, others) providing real-time visibility to the data in the control center.
- Remote configuration management of IEDs
- Installed more than 250 IEDs per substation, with more than 450,000 signals for the entire system, for future scalability.
- Enabled interoperability of different brands of IEDs (Siemens, Areva, ZIV, SEL, ABB, Nulec, Noja, MR - Reinhausen, SEMI, Elitel, etc.).
- Interoperability with the IEC 101/104 owner profile.

Results

- Reduced time to deploy and maintain the substation protection systems
- Decreased the amount of wiring and therefore possible point of failure during the automation of substations and integration to SCADA (using GOOSE or terminal servers)
- Increased availability with system level redundancy



About PTI

PTI is dedicated to providing integrated engineering solutions for electrical infrastructures through technological innovation, knowledge management and sustainable development. It brings extensive experience in the design and implementation of industrial networking solutions of high availability and reliability, integration of control systems and protection for the automation and remote control of electrical systems with emphasis on real time and cybersecurity.

