



Power Systems Automation

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integra

Pilot substation automation system project driven by IEC 61850



INTRODUCTION

integra is a pilot project promoted by Efacec, involving REN, the Portuguese electric power transmission utility, and FEUP, the Faculty of Engineering of Oporto University. It started in 2005 and it was concluded in 2008. During the project, the University of Minho participated as well.

This pilot project aims to demonstrate the adequacy of a Substation Automation System (SAS) implementation, and to enhance its added-value features by means of the application of the IEC 61850 standard.

The companies involved in this project are focused on reviewing the Substation Automation Systems requirements, specification and design, by means of the IEC 61850 standard. Another Efacec task is to integrate IEC 61850 communication capabilities in existing products and to develop new generation products and compliant engineering tools. REN's task is to demonstrate the new SAS implementation, confirming the interoperability between devices from different manufacturers.

KEY WORDS

IEC 61850, Pilot Project, Interoperability, Communications, Protection, Control, Automation, Substation

DESCRIPTION

This pilot project is the first IEC 61850 implementation in the Portuguese Transmission Network (400/220 kV). Aiming to evaluate the application of IEC 61850 technologies, *integra* players defined a framework targeted to adapt current SAS specifications and engineering methods to the new standard, including the definition of the information model, attaining added-value from effective interoperability in multi-vendor distributed systems for station and bay functional levels.

The project was divided in three main phases:

Phase 1: Development

During phase 1, besides the addition of new communications software capabilities to existing Ethernet based devices, a new device architecture was engineered allowing both flexible allocation of functions to devices and an internal object-oriented configurable model, aiming to provide added flexibility to SAS design, by better supporting requirements-driven implementations as opposed to product-driven implementations.

Phase 2: Pilot Project concerning a Substation Automation System implementation

The pilot system was installed in a substation having the highest voltage levels in the Portuguese transmission grid. The choice fell on Fanhões substation (400/220/150/60 kV) located near Lisbon.

The following bays were included in the pilot project:

- 400 kV transmission line
- 400/60 kV power transformer
- 400 kV bus coupler and by-pass
- 60 kV capacitor bank

The range of bays selected to integrate the pilot system was chosen according to the following criteria:

- All main protection and control functions should be included, meaning a transmission line and a transformer
- A bus coupler/by-pass bay should also be included, to test interlocking and other communicating functions with the transmission line and power transformer
- All bays should be in service
- The chosen line should be the one having the greater number of faults per year, so the performance of the pilot system could be properly evaluated
- Finally, it was decided to include a capacitor bank, as this type of bay has a daily routine of switching

The pilot system runs in parallel with the current substation automation system. With this scheme, it is possible to analyze the reaction of the pilot system to faults and disturbances faced by the selected bays, by comparing the data logs of both pilot and existing system.

Phase 3: Assessment of the industrial application of IEC 61850

The assessment of the system performance corresponds to the last phase of the project.

This important step allowed the team, particularly Efacec and REN, to better understand the major benefits and difficulties resulting from the application of the paradigms depicted in IEC 61850, aiming to optimize existing SAS operation and maintenance strategies.

CONCLUSION

IEC 61850 brings important benefits to utilities, however, prior to its practical application, a large investment has to be undertaken in order to take full advantage of the standard and deploying added-value systems.

This way, *integra* project played an important role in mitigating the risks associated to the implementation of innovative practices, according to IEC 61850, knowing that in the substations field, investments will be required due to the equipment ageing, new operating schemes needs, as well as legislation and deregulation.



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