

# Implementation of a Multi-Vendor Substation Automation Solution Using IEC 61850

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**Summary-** Electrica Azogues utility in Ecuador was dealing with the challenge of integrating devices from different vendors using legacy communication protocols and IEC 61850 MMS. Azogue II substation has a large variety of protection devices needed to be integrated into a unified Substation Automation solution, including substation Gateway and protocol translation. This paper outlines the lifecycle of the project, including a description of the interoperability challenges and how they were solved during the implementation of the Substation Automation system.

**Keywords – Substation Automation, IEC 61850, Interoperability, SCADA.**

## I. INTRODUCTION

One of the main goals of IEC 61850 standard is to achieve seamless interoperability between IEDs and unlock utilities from proprietary solutions. However, when it comes to the implementation, there is still a long way to go and multiple challenges for utilities to achieve this integration when having a multivendor environment.

Electrica Azogues has recently achieved this goal, leveraging IEC 61850 integration capabilities while keeping some of the existing DNP3 and Modbus devices.

## II. GLOSSARY

DNP3 Distributed Network Protocol V3

HMI Human Machine Interface

MMS Manufacturing Message Specification

WAN Wide Area Network

IED Intelligent Electronic Device

IEC International Electrotechnical Commission

CENACE Centro Nacional de Control de la Energía

## III. EMPRESA ELECTRICA AZOGUES

The company Empresa Electrica Azogues C.A. is primarily engaged in electric power generation, transmission and distribution. It currently has more than 30,000 customers within a 1700 km<sup>2</sup> area.

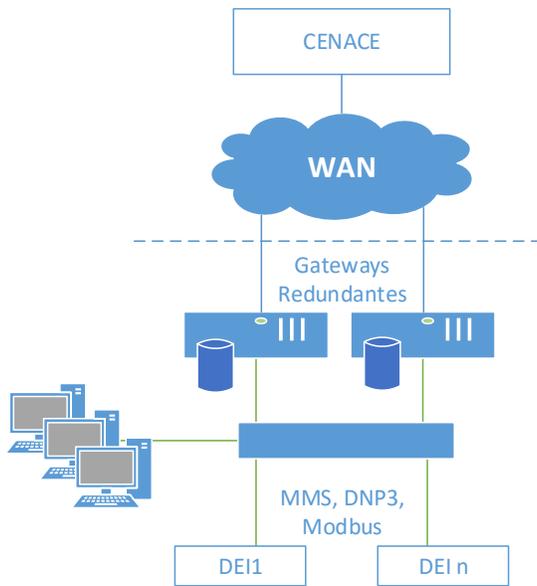
## IV. AZOGUES II SUBSTATION

Azogues II 69/22 KV Substation consists of six (06) bays and 16/20 MVA power transformers. In order to assure high reliability and mitigate the risk of service disruption, Electrica Azogues has started the Digital Substation IEC 61850 initiative that will improve interoperability and communication issues.

Problems representing the integration of multiple vendor's devices using the IEC 61850 protocol were resolved during project implementation with the participation of the contractor in charge.

Currently, most SAS projects for 69 kV substations under IEC 61850 developed in Ecuador correspond to the concept of being locked into a single vendor to provide devices for protection and control.

## SUBSTATION ARCHITECTURE



**Figura 1 –Azogues II Architecture**

Azogues II architecture consist of a variety of IEDs devices as follows;

- Bay Controllers F650 with IEC 61850 (MMS).
- Schneider Power Quality Meters ION 8600 with DNP3
- GE Differential Protection Relays B30 with IEC 61850 (MMS)
- ABB Line Differential Protection Relays Red 670 with IEC 61850 (MMS)
- GE Transformer Protection Relays T60 with IEC 61850 (MMS)
- Schneider Power Quality Devices PM800 with Modbus
- Hanyoung Nux Meters with Modbus
- Calisto gas meters with IEC 61850 (MMS)
- Deep Sea meters with Modbus
- Rochester Mimic displays with Modbus

The SAS of the S/E Azogues, in addition to the devices in station, the data (status, analog values, controls) of the S/E Azogues I and reclosers that are located at different points also integrate the distribution network medium voltage,

allowing control over the entire electrical system of the Company; it also allows the creation of Scrip's machines that start with the performance of one or more protections and end with the opening and / or closing of the switchgear available in order to optimally isolate the network segment involved in any potential failure.

The Automated System S/E Azogues 2 has been developed as a multi-brand system implementing a system with IEDs, Measurement, SCADA and Gateways communications devices from different vendors using the IEC 61850 standard, and implementing the concept of interoperability. This has resulted in useful insights for companies in the energy sector with the idea of implementing similar applications.

## V. AZOGUES II MAIN CHALLENGES

1. Even though 61850 provides a solid foundation, the reality is that not every device we needed fully supports 61850, or made all the data we wanted fully available over MMS so the ability to still use other protocols turned out to be very convenient.
2. Historian reports for measurements and other analogs is a main requirement and current challenge for the company.
3. Gateway redundancy is required to achieve a high availability concept.
4. Simplified engineering is required to improve productivity and reliability. Graphical configuration and automation is needed to contribute to straightforward parameter definition, thus reducing engineering times.

## VI. KEY TO SUCCESS

Implementation of a unified and vendor agnostic Substation Automation System (SAS) which allowed the integration of multiple devices and equipment of different manufacturers utilizing the IEC 61850 standard.

The project has been a positive application in the activities of the Electric Company Azogues. Being a Distribution Company (ED) since it has decreased time in the care of contingencies and contributed significantly to the perception of service and quality.

FAT conducted in Calgary, Canada, which assured a smooth SAT implementation due to the IEC 61850 configuration tools and pre-testing activities. Both locally and remotely, optimized diagnostic tools provided in-depth information about processes and the system. Extensive and clear data visualization supported timely and accurate decision-making.

## VII. CONCLUSION

IEC 61850 multi-vendor interoperability is achievable, but it is not seamless

IEC 61850 is not yet the answer to every problem. A gateway that integrates into other protocols as well is very valuable and can save the project

This project has demonstrated problems, strengths, and weaknesses of the IEC 61850 standard and its implementation in the intelligent electronic devices from different vendor solutions. This is the differentiating factor as vendor's implementation of communications protocol; SCADA and GOOSE messaging based on the standard differ between IED vendors.