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AZOGUES II – ECUADOR SUBSTATION PROJECT

1ST ECUADOR IEC 61850 PROJECT

Azogues II Substation

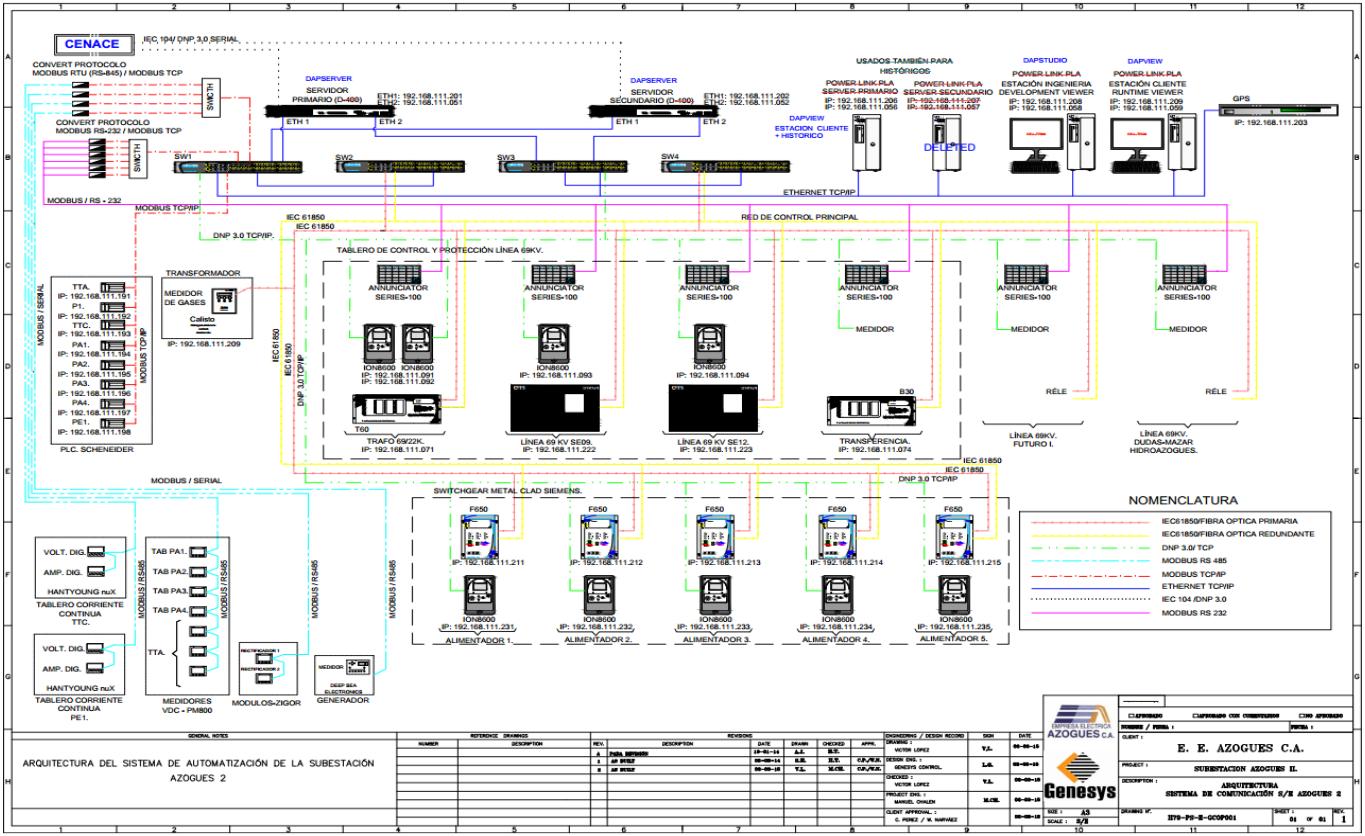
- Sub-transmission system
- 69/22 KV Substation
- 1 x 16/20 MVA power transformer
- 6 x 69 KV bays
- Transports power generated by the CELEC EP Alazán Hydro Plant
- Existing Substation Automation System
- Large variety of IEDs and protocols

Project Challenges

- Multi-vendor & Multi-Protocol approach:
  - Devices: GE, ION, ABB, Hanyoung, Calisto Meters, Deep Sea Meters and Rochester Alarm Annunciators
  - Protocols: IEC 61850 MMS, DNP3 and Modbus
- Existing SAS Solution did not meet customer expectations
  - Interoperability issues with IEC 61850 MMS
  - Lack of a historian database and CSV export
  - Inconsistent behavior of redundancy solution
- First IEC 61850 Substation for The Electrica Azogues Company

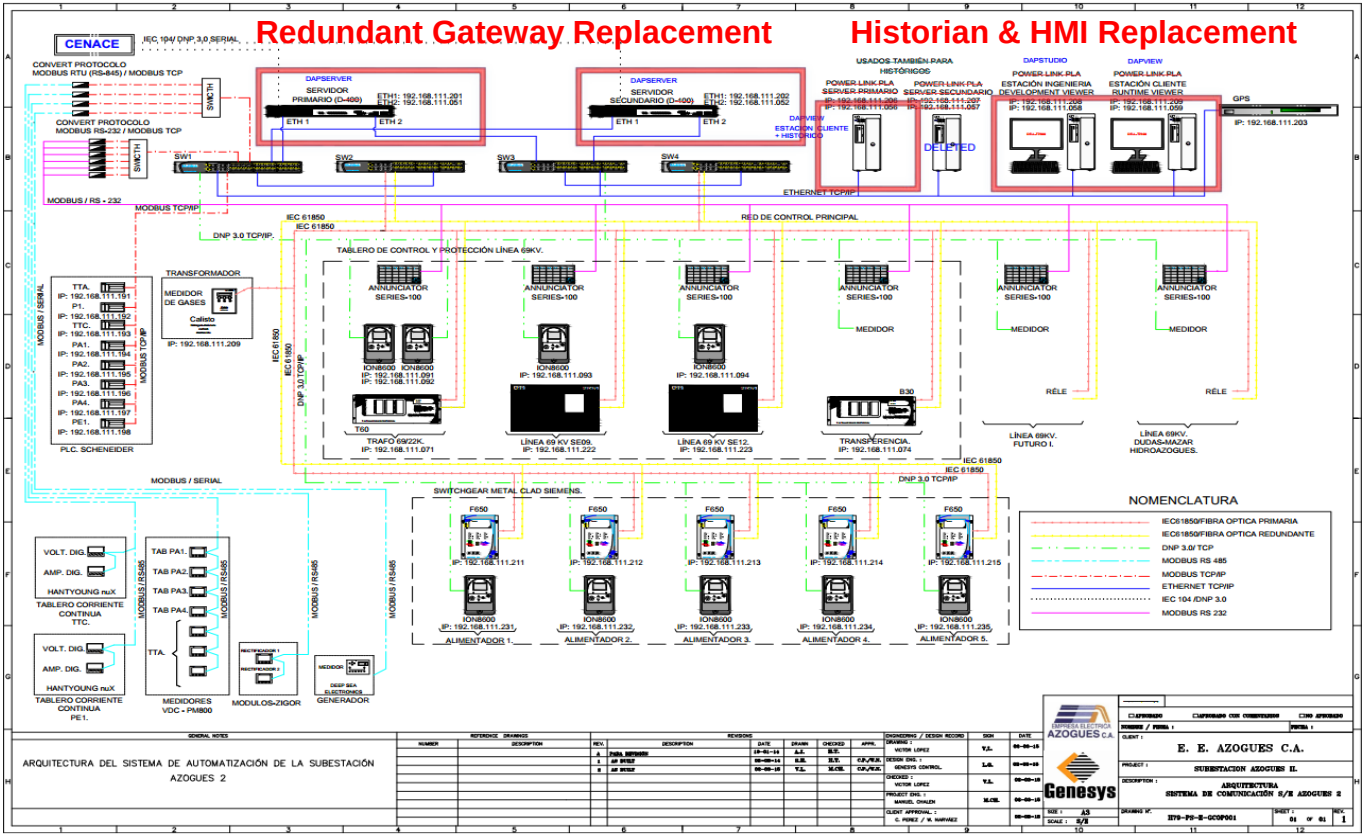
AZOGUES 2 SYSTEM ARCHITECTURE

- ORIGINAL -



AZOGUES 2 SYSTEM ARCHITECTURE

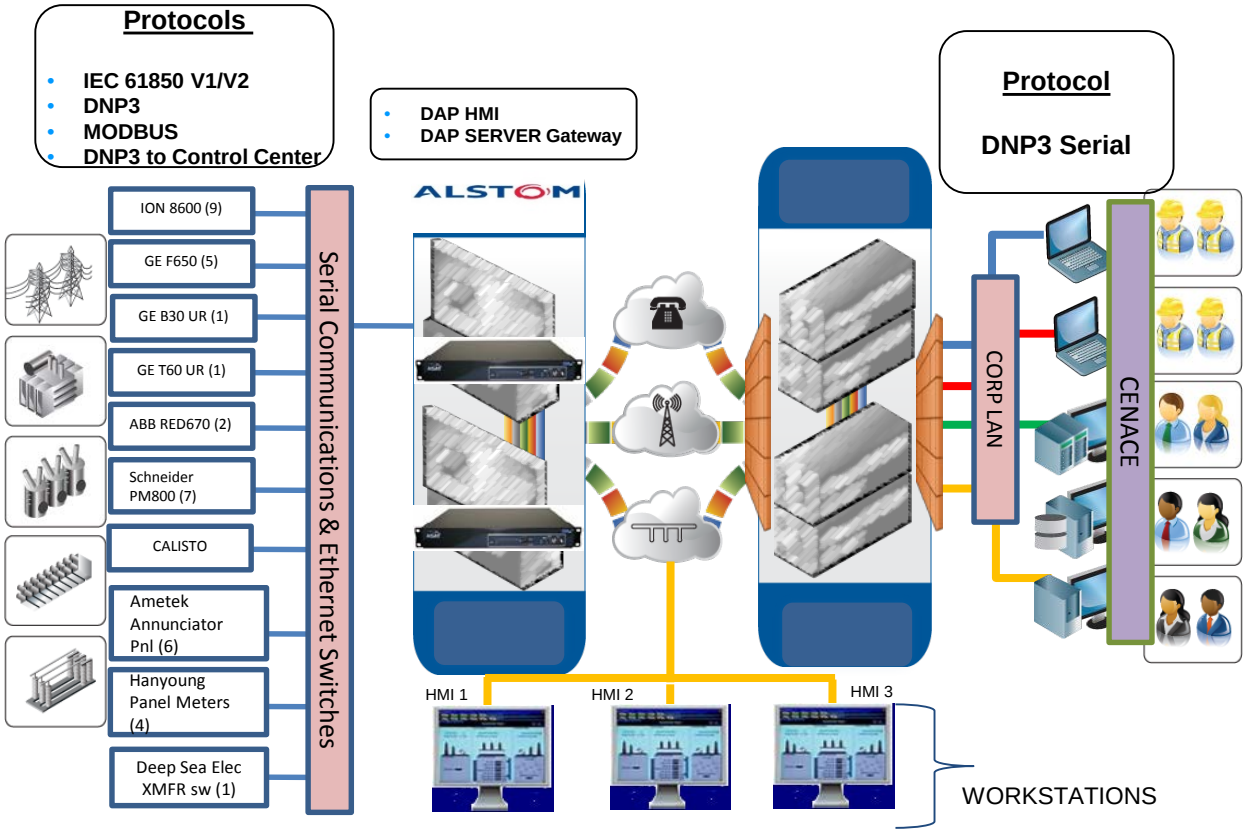
- PROPOSED -



AZOGUES DEVICE LIST

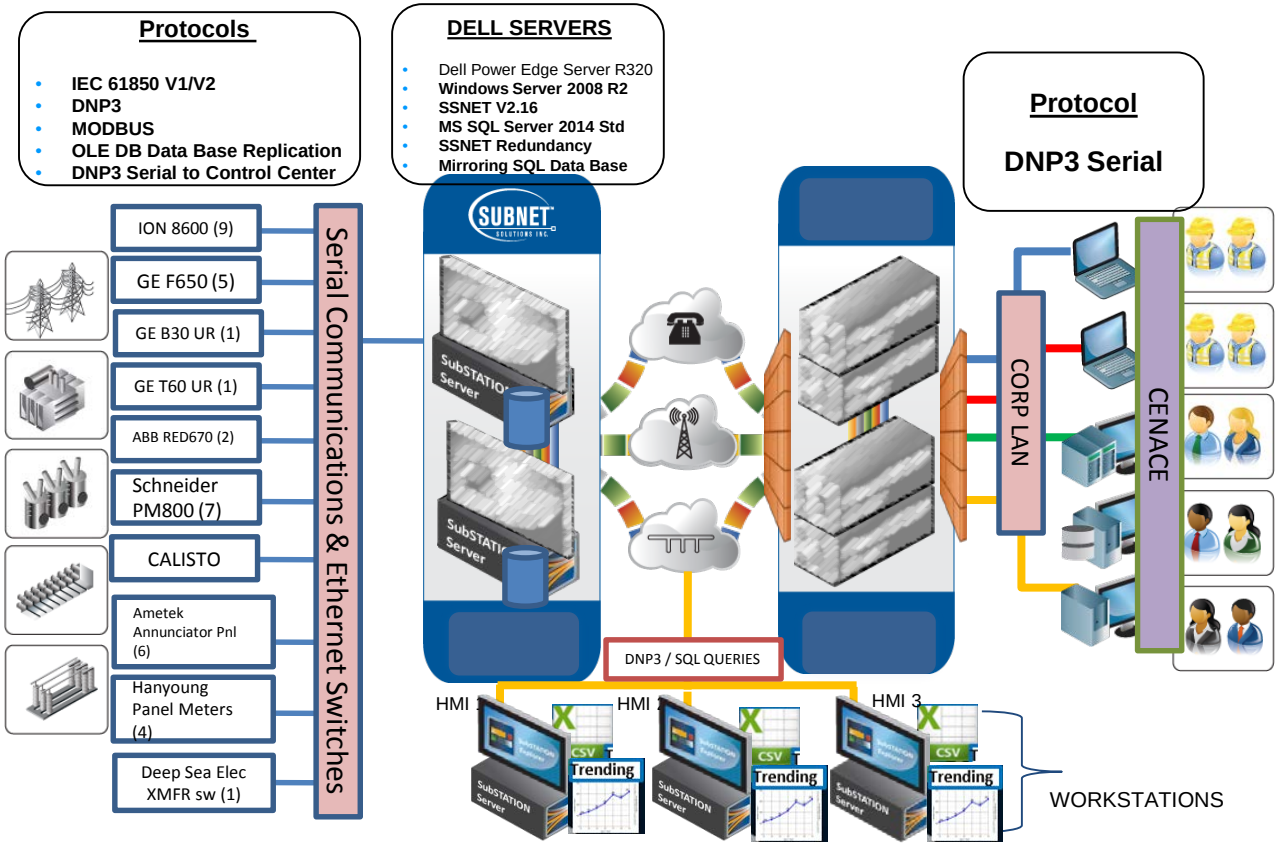
Device	Protocol
Schneider ION 8600 (9)	DNP3
GE F650 Bay Controller (5)	IEC 61850
GE T60 UR (1)	IEC 61850
GE B30 UR (1)	IEC 61850
ABB RED 670 (2)	IEC 61850
Schneider Power Meter PM800 (7)	Modbus TCP
Schneider PLC (8)	Modbus TCP
Ametek Annunciator panel (6)	Modbus TCP
Hanyoung panel mounted meter (4)	Modbus TCP
Deep Sea Electronics Generator Ctrl (1)	Modbus TCP
Zigor surge protectors (2)	Modbus TCP

AZOGUES Substation Architecture - Before *July 2015*

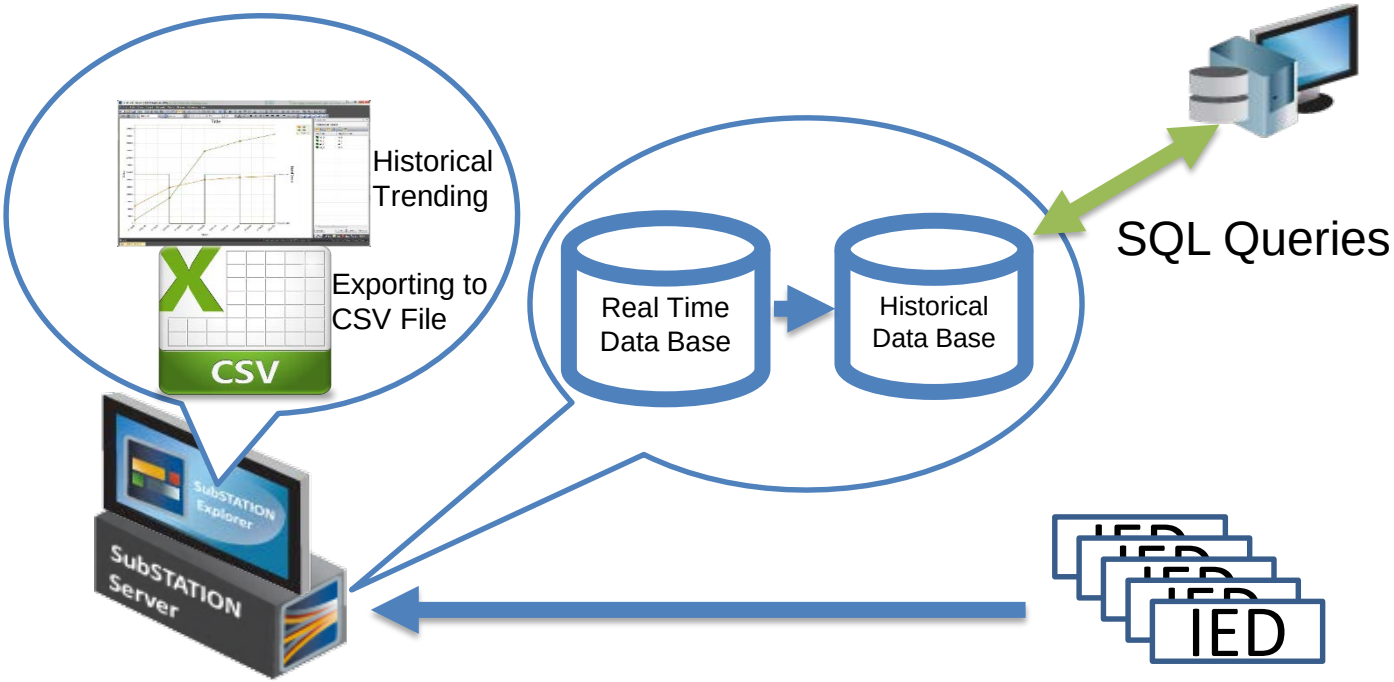


AZOGUES Substation Architecture – After *June 2016*

- Redundancy + Relational DB + Historical Trending -



Real Time and Historical Data Base



HMI DISPLAYS

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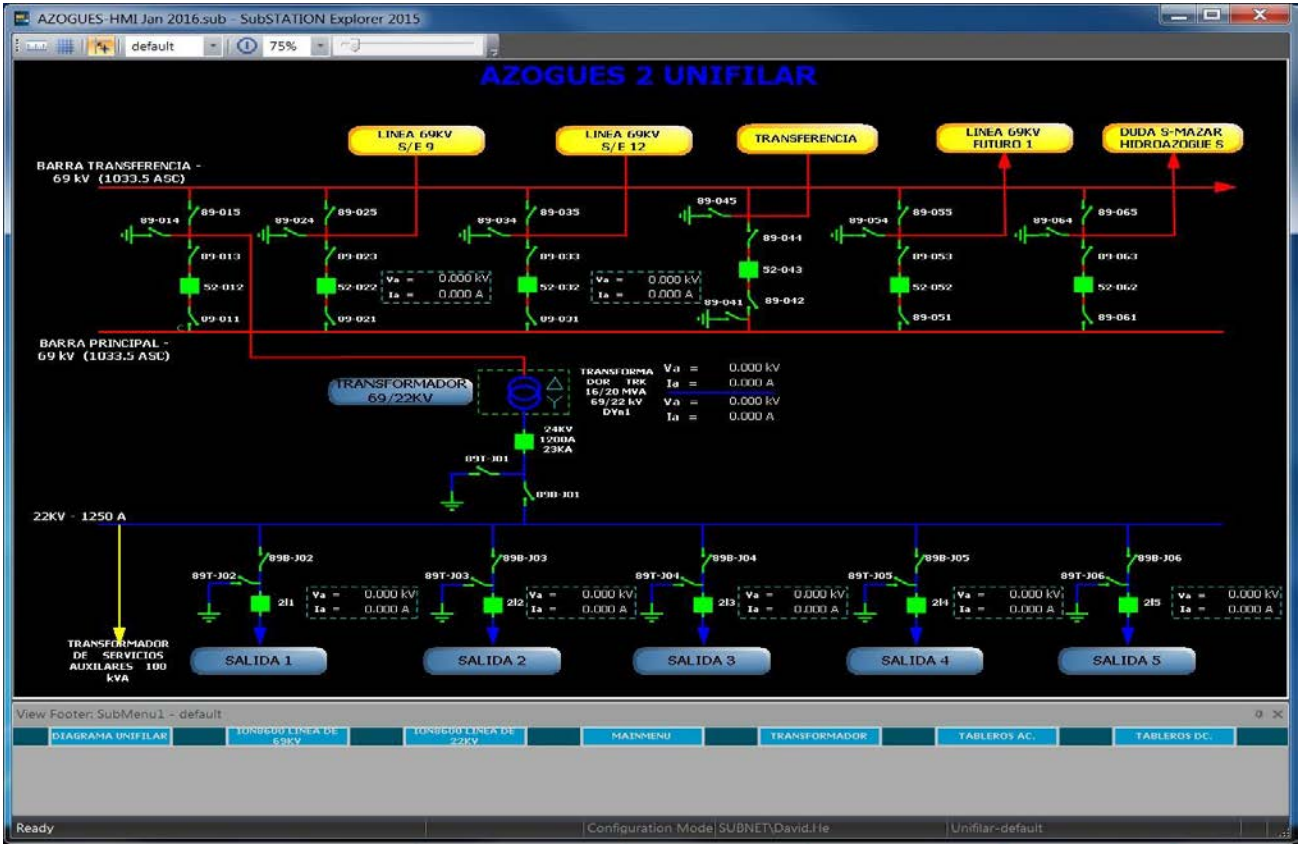

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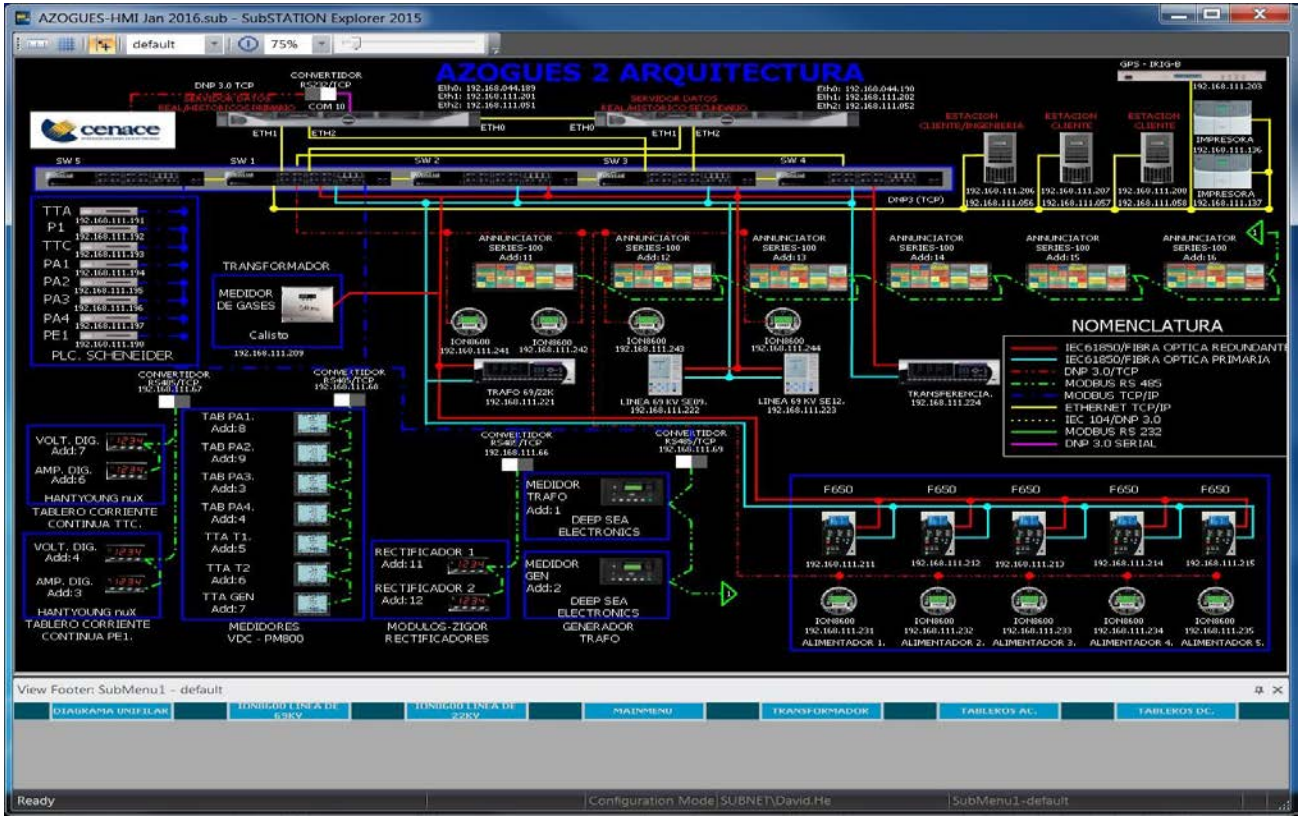

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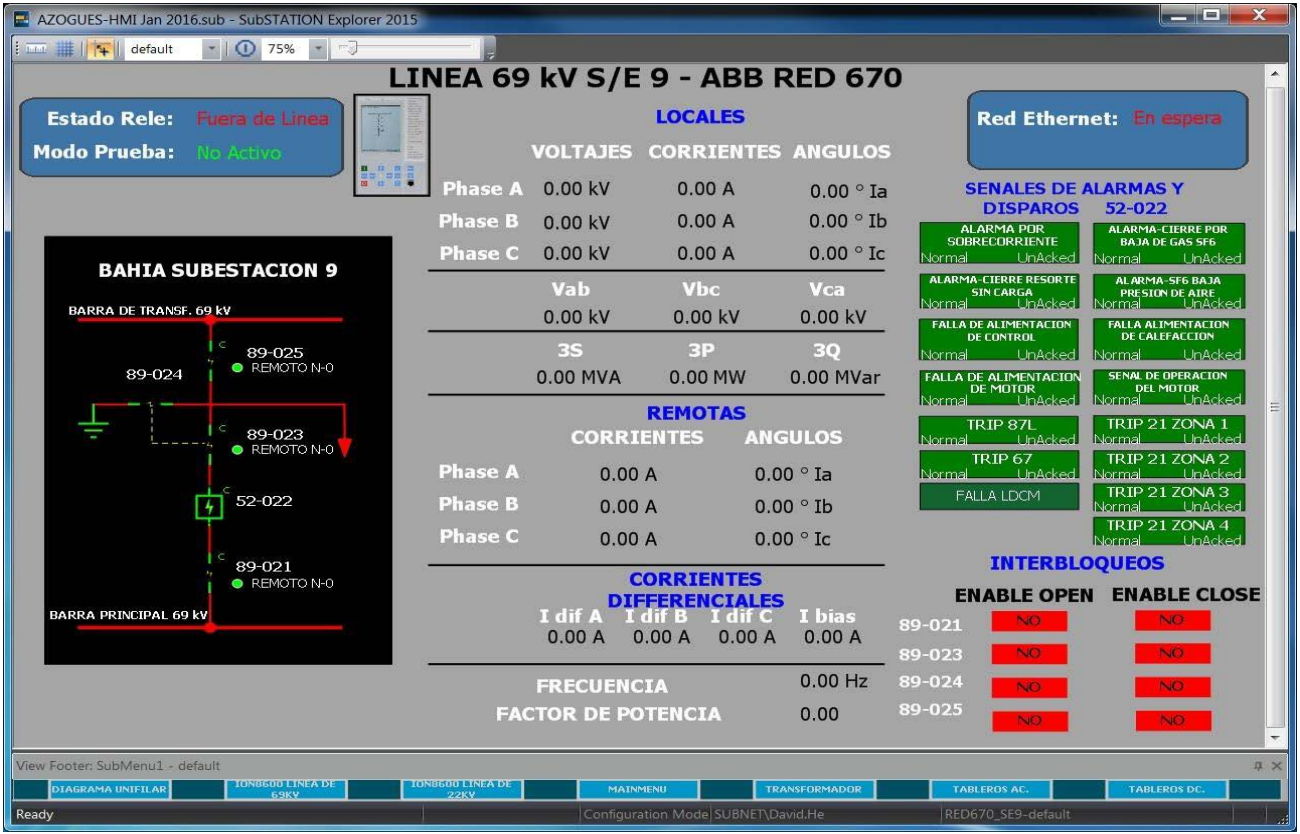

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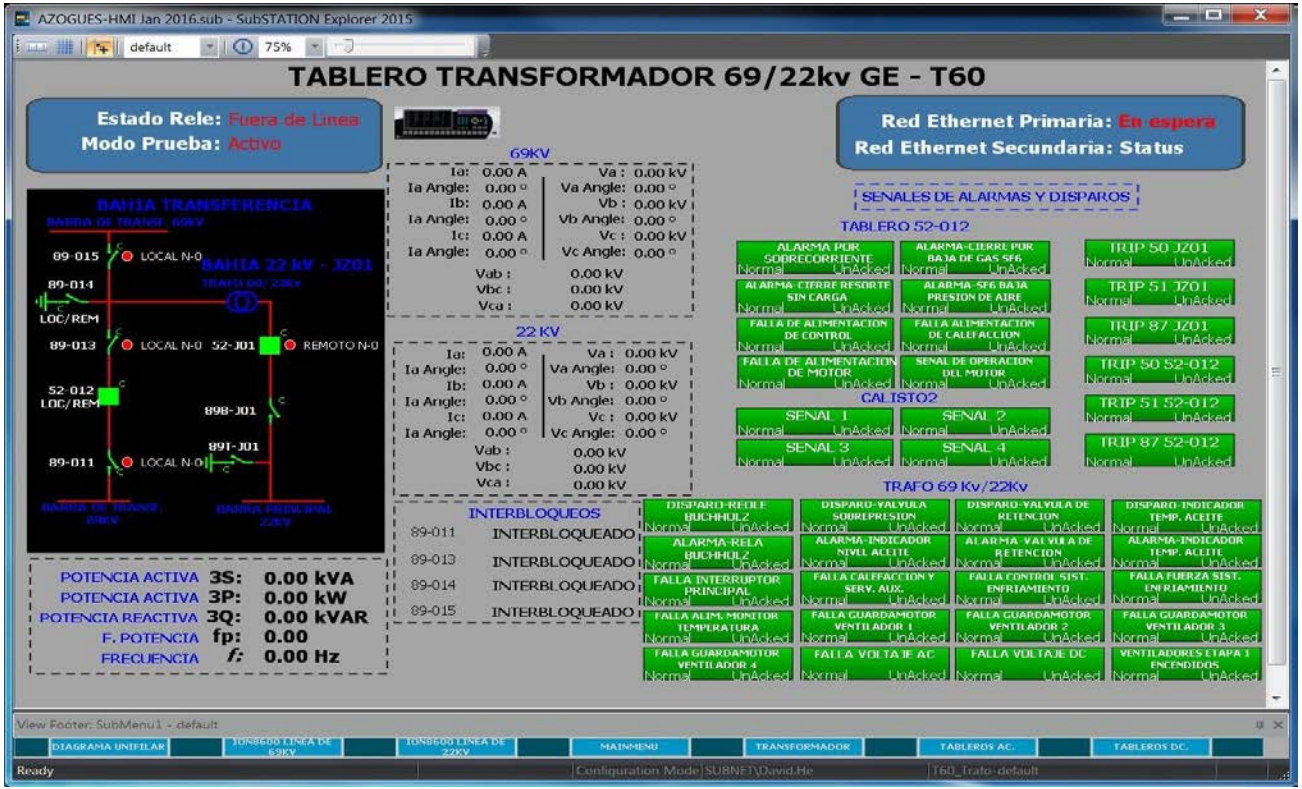

HMI DISPLAYS

Achievements

- Various devices (GE, ABB, ION, Calisto, Hanyoung, etc.) were successfully integrated to the redundant gateway solution using three different protocols: IEC 61850 MMS, DNP3, and Modbus
- HMI Screens were recreated and successfully mapped
- Redundancy was achieved with the new redundant solution
- A SQL Based historian solution was installed which included historical data trending and CSV export
- Gateway switchover time was consistent using the new redundancy solution
- The Azogues II substation was completed working with an experienced IEC 61850 company

Lessons Learnt

- IEC 61850 MMS Interoperability between IEDs and Gateway is possible with the right multi-vendor tool
- Wireshark was required to troubleshoot GOOSE interoperability between different vendor's devices
  - Some attributes are optional in the IEC 61850 standard but considered mandatory by one vendor
- IEDs were properly configured on the protection side, but, the MMS portion was incomplete
  - Customer had no previous experience with IEC 61850 MMS
- It was the first IEC 61850 substation implementation for The Azogues Company, hence they decided to work with an experienced integrator to complete the commissioning

Q&A