

B3 – SUBSTATION & ELECTRICAL INSTALLATIONS

Substations and Electrical Installations

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IMPLEMENTATION OF POWERGRID'S FIRST 400kV PROCESS BUS BASED FULL DIGITAL SUBSTATION

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Motivation

- IEC 61850 Station based Digital Substations, have been implemented world over with Generic Object Oriented Substation Events (GOOSE) being used for non time critical applications such as interlocking, voltage selection etc.
- To harness the full potential of IEC 61850, the Process Bus based system, utilizing both GOOSE & Sampled Values was implemented at one of the 400kV substations in POWERGRID.

Approach

- The conventional control & Protection system (typical shown in Figure 1), at one of the old substations (around 30 years old) of POWERGRID was upgraded with IEC 61850 Process Bus based System (typical shown in Figure 2).
- The Instrument Transformers & Switchgear data was digitized using Intelligent Electronic Devices (IEDs) called as Merging Units (MU) and Switchgear Controllers (SGC) respectively. This data was sent over the Ethernet LAN called as Process Bus. The Bay level Control & Protection IEDs were also connected to the Process Bus and they utilized the Digital values present in the network to perform the control & protection functions. The picture of Marshalling Box housing MUs and SGCs is shown in Figure 3.
- The protection and control schemes were tested completely with integrated system during Factory Acceptance Test.
- At site, as the substation was already in operation, feeder wise system upgrade was performed and eventually, the entire conventional system of control & protection was upgraded with IEC 61850 Process Bus based Protection Automation & Control system.

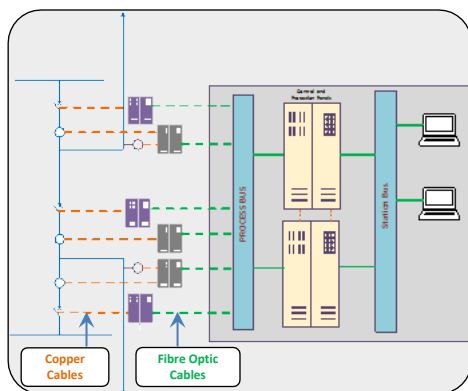


Figure 2-Process Bus based Substation

Discussion

1. Control Cable Requirement reduced by about 80%.
2. Downtime for Retrofit or Upgrade reduced by about 75% as compared to upgrade with conventional system as the major work of system integration & Validations were completed before availing the system shutdown.

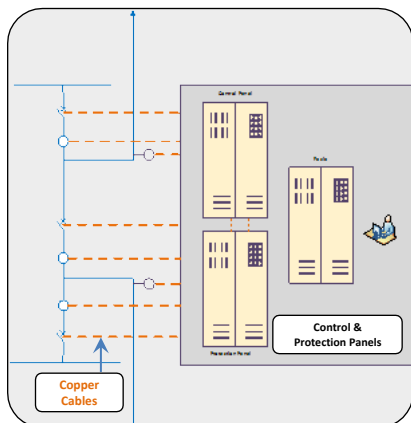


Figure 1-Conventional Substation



Figure 3-Marshalling Boxes housing MUs & SGCs

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continued

Discussion (continued)

3. The Process Bus based implementation offers :

- Improved Engineering Process & FAT experience.
- Enhanced Centralized Testing setup (Figure 4) for local and remote testing experience (remote testing via dedicated fibre optic connection).
- Green Technology- Reduced cables (Figure 5) and concrete, overall reduced environmental footprint.

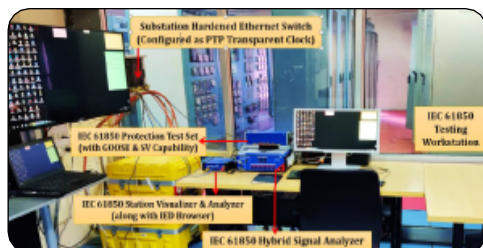


Figure 4-Centralized Test Setup

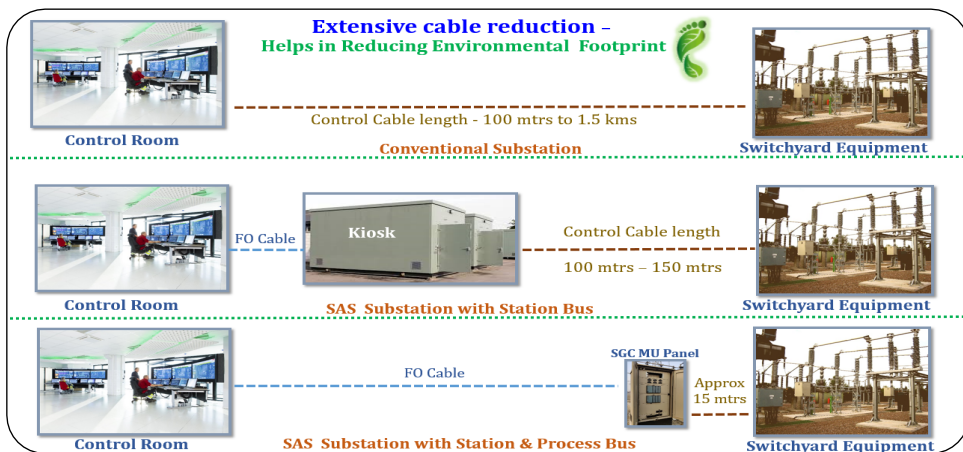


Figure 5-Illustration indicating typical savings in Copper cabling

Conclusion

The IEC 61850 Process Bus based substation implementation has enabled POWERGRID to implement all the features of IEC 61850 standard.

The implementation of IEC 61850 Process Bus based substation has resulted in extensive savings: about 80% reduction in control cables; about 75% reduction of downtime for retrofit/upgrade work.

The performance evaluation of system is underway and an assessment of overall benefits and challenges is being done. Nevertheless, the commercial implementation of Process Bus Technology has been an important milestone in POWERGRID's endeavor to make the Grid smarter and more efficient