Transmission Substation Automation Using SYNC 3000 And SYNC 2100

Application Note

Application Description

A Substation Automation (SA) system enables an electric utility to remotely monitor, control and coordinate the distribution components installed in the substation. The data communication between the control center and IEDs in remote locations and among the IEDs, thus becomes an important issue to realize these substation automation functions. The complexity arises due to the numerous protocols that are used for tele-control, but where none completely support interoperability among IEDs supplied by different vendors, in the substation.

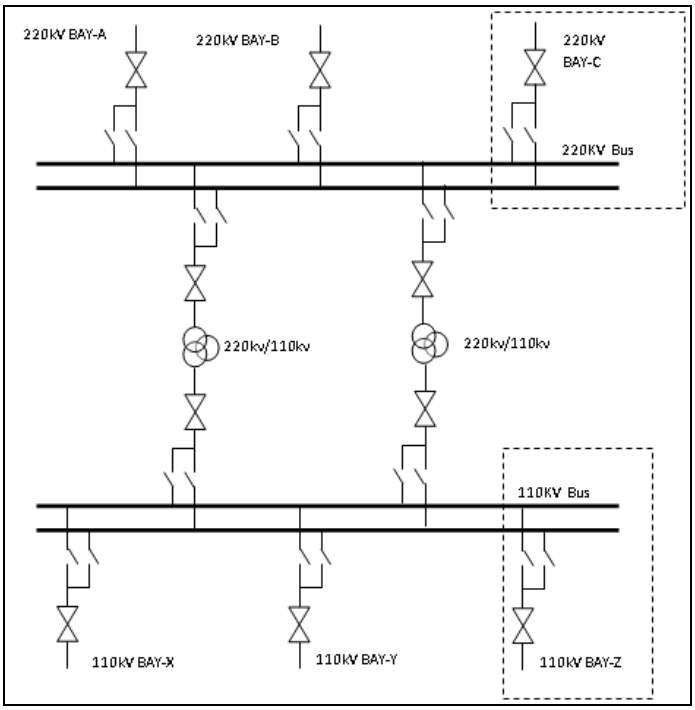

Figure 1:

The emergence of IEC61850 standard has now made it practical to have an interoperable solution for existing multi-vendor substations. Many countries have mandated to meet this at station level for existing substations and at station / bay / process level for new substations.

Typical transmission substation considered in this application note has two 220kV incomer and two 110 kV outgoing feeder. Automation of the new bays that will come up as part of Utility's planned network at both 110KV side and 66KV side is a general requirement, that calls for implementation on IEC61850. The requirement is generally expanded to the station level, where IEC61850 has to be used but without replacing existing IEDs.

The new and existing bays also have power meters, with the data required to be integrated with the SCADA system on IEC61850 bus. The station information also needs to be sent to the transmission company control center for remote monitoring and control.

Application Solution

A general representation of a SCADA and Control Center Data Reporting System comprises of Data Concentrating Units (DCUs), SCADA/HMI software, communication networks and Remote Terminal Units (RTUs). The figure shown below depicts the solution architecture for collecting data from legacy protection and control devices in legacy standard protocol as well as proprietary protocol.

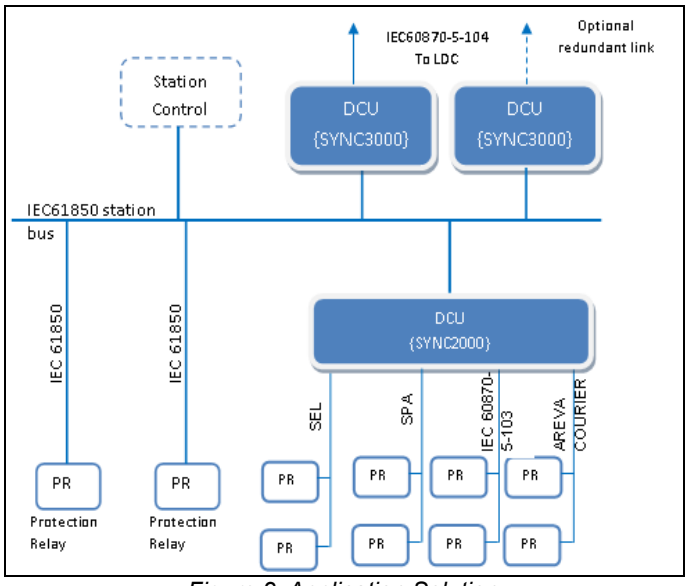

Figure 2: Application Solution

Data acquisition equipments are provided to acquire data from the substation bus for transmitting to the Load Dispatch Center (LDC), in addition to local display requirements. Local SCADA/HMI system provides for monitoring of the 110kV bus, 66kV buses as well as facilitates exchange of critical data with LDC in real time. The entire communication is based on open IEC

standards to ensure future scalability and also to make the system vendor independent.

The solution is designed in a decentralized architecture to optimize communication, cabling and to achieve better management of data. DCUs are categorically mapped to different functional and logical points in IEC61850.

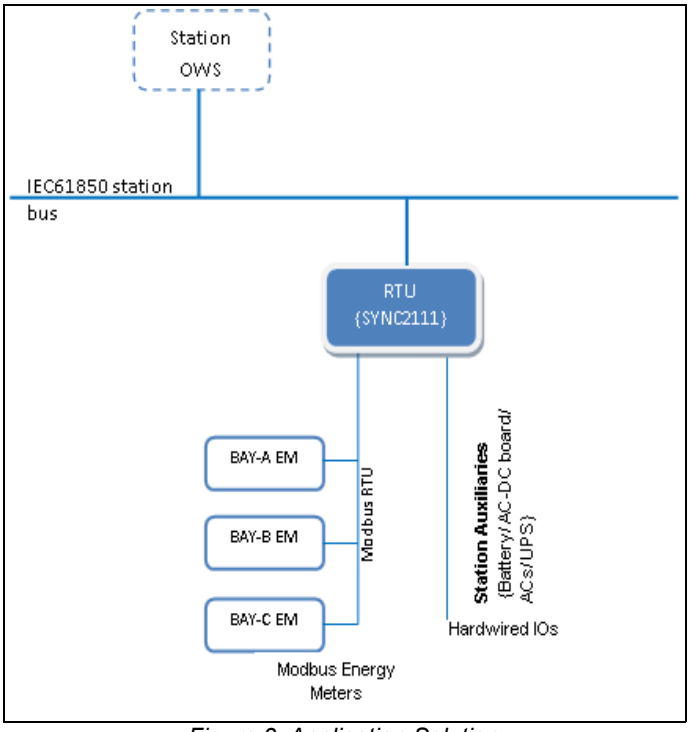

Figure 3: Application Solution

HV feeder protection equipment monitoring and data exchange with remote control center:

Data from existing protection devices at HV feeders (generally communicable over IEC60870-5-103, or proprietary protocols like SPA, SEL, Courier) can be converted into IEC61850 using a protocol converter , mounted in the control and protection panel. This interface device shall also meet IEC61850-3 requirements for substation-level EMI/EMC ruggedness.

The protocol converter acting as a proxy IEC61850 IED models each existing IEDs in different logical devices. Status of each device is also monitored in addition to the real time data server by each IED.

Connectivity with remote control center:

An optical link connects the transmission substation to control center. As shown in the figure, a high-end DCU is provided at the substation to establish communication with the RTU/Station Controller and provide an interface to the control center network. Hence, the DCU should be capable of communicating on IEC 60870-5-104, IEC 60870-5-101 as well as IEC 61850.

Note that the Station RTU / Controller can also take hard-wired inputs from switchgear status and provide this information on the IEC61850 bus to local SCADA and further upstream to the LDC.

Monitoring of Feeder Meters and Station Auxiliaries:

Feeder meters are present at each feeder bay for measuring voltage, current, frequency and power. These meters will be communicable on Modbus protocol. The meter data also need to be monitored on SCADA through IEC61850 station bus and can be achieved using an RTU (e.g., SYNC2111), that communicates via the Modbus master driver installed in the RTU, converting it into IEC61850 standard format.

As SYNC2111 acting as a Station RTU can also take hardwired input from station auxiliaries and provide these information on IEC61850 bus to local SCADA as well as to LDC. Hardwired input include battery sources, AC–DC board, ACs, Uninterrupted power supply.

Features

- High end security over VPN and CIP enabled devices
- Parallel connectivity to the end devices for parameterization and disturbance upload

Products Used

Products used for Transmission Substation Automation are:

- SYNC3000 are station DCU for interfacing with control center
- SYNC2111 as RTU for feeder meter and station auxiliary monitoring
- SYNC2000 as protocol converter for converting protection equipment protocol to IEC61850

Advantages

- Multi master communication capability
- Time synchronization is done on SNTP protocol
- Modular and expandable RTU for future expansion
- Secured IE62351-3/ SSL VPN based security for control center communication
- NERC/CIP Compliant DCU as a peripheral communication access point