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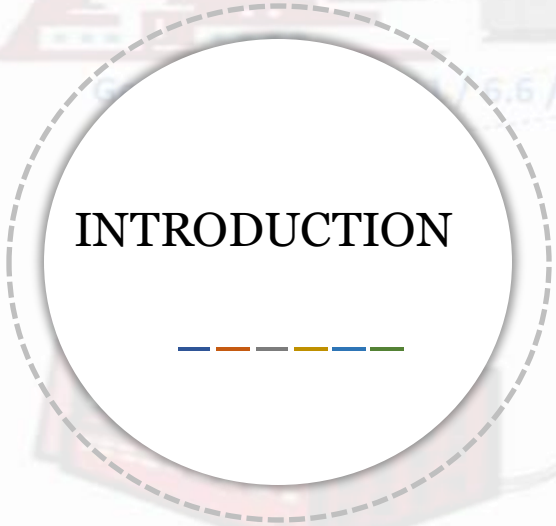
Session : Disruptive Innovations for Utilities: Evolution of Substation Automation System

Presented By

Tushar Kanti Bag, HoG, TP Central Odisha Distribution Ltd.

INTRODUCTION



Key Task of the Grid

The Key task of the electrical grid is to provide connectivity between Power Generation and consumer.

Reconfiguration of Network

The power system requires reconfiguration of the power network time to time to provide reliable power and maintain voltage & frequency

Connection of Equipments

Typical changes in system configurations include connection and disconnection of electrical equipment of the grid.

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Role of Substation

Electrical substation plays a pivotal role to achieve the reconfiguration. Hence Automation of the electrical substation was started long days back in 1950s

Substation Automation

Substation Automation System is an artifact of Software and hardware which is used for controlling and monitoring of electrical system of the Substation.

CONTEXT OF SUBSTATION AUTOMATION SYSTEM

01 The history of Substation Automation System is closely linked with the development of RTU/Substation controller cum Gateway System.

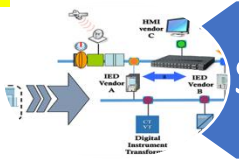
02 The early RTUs were telemetry applications that helped collect data from different subsystem and send it to the main control room in the 1950s. We find its first application in Power Generation plant.

03 With the advancement of electronic system the first electronics-based RTU was introduced in 1960s and 1970s.

04 The first modern Microprocessor based RTU was developed in mid of 1980s which can perform advanced logic, can collect data through communication and Input output modules.

05 However Communication protocols were mainly point to point serial protocol and many protocols were proprietary.

RELEVANCE OF SUBSTATION AUTOMATION



Substation Automation System uses technology to monitor and control electrical systems

Increase operational efficiency by adopting Substation Automation System

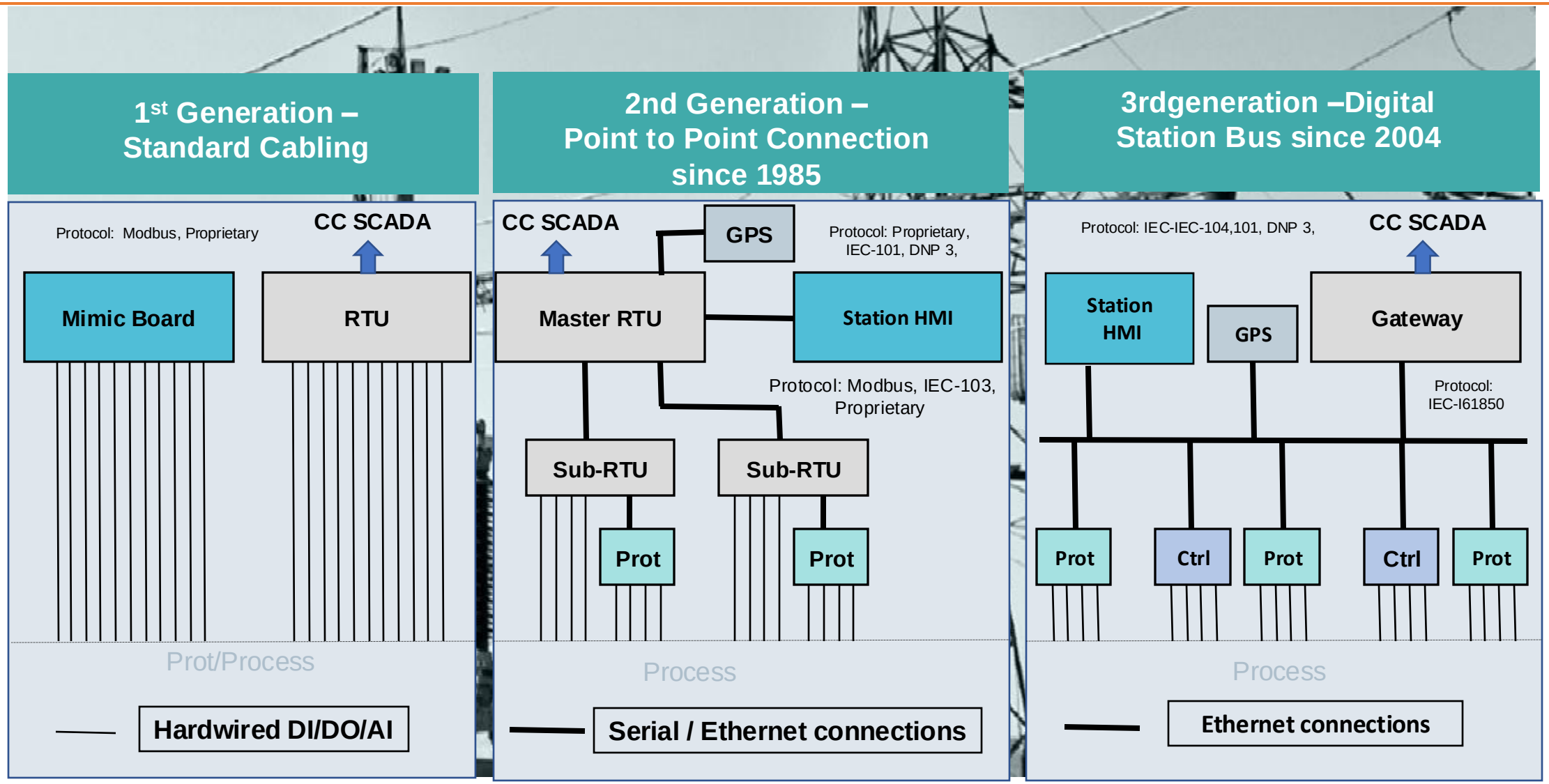
Enhanced Safety: Terminating CT/PT cable in the Marshalling Kiosk contributes to enhanced safety in substation operations & maintenance

Reduced Environmental Footprint: Reduced number of Panel and less use of copper control cables, contributing to a smaller environmental footprint.

Easier interface to IoT open the door for value adding central application, Big data analytics & predictive maintenance

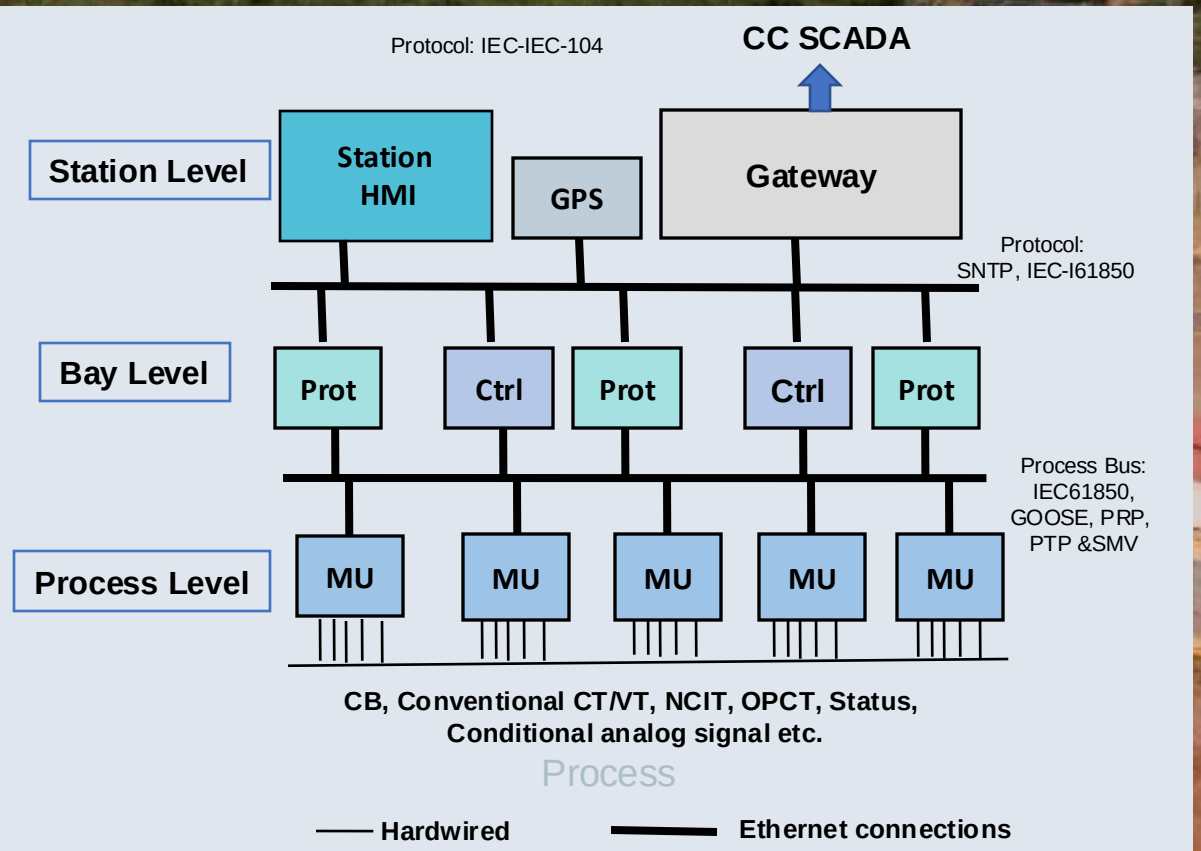
Improved reliability and flexible adaptation to future requirements, Easy incorporation of next generation sensors, Integrated engineering; Easier installation and commissioning

EVOLUTION OF SUBSTATION AUTOMATION SYSTEM

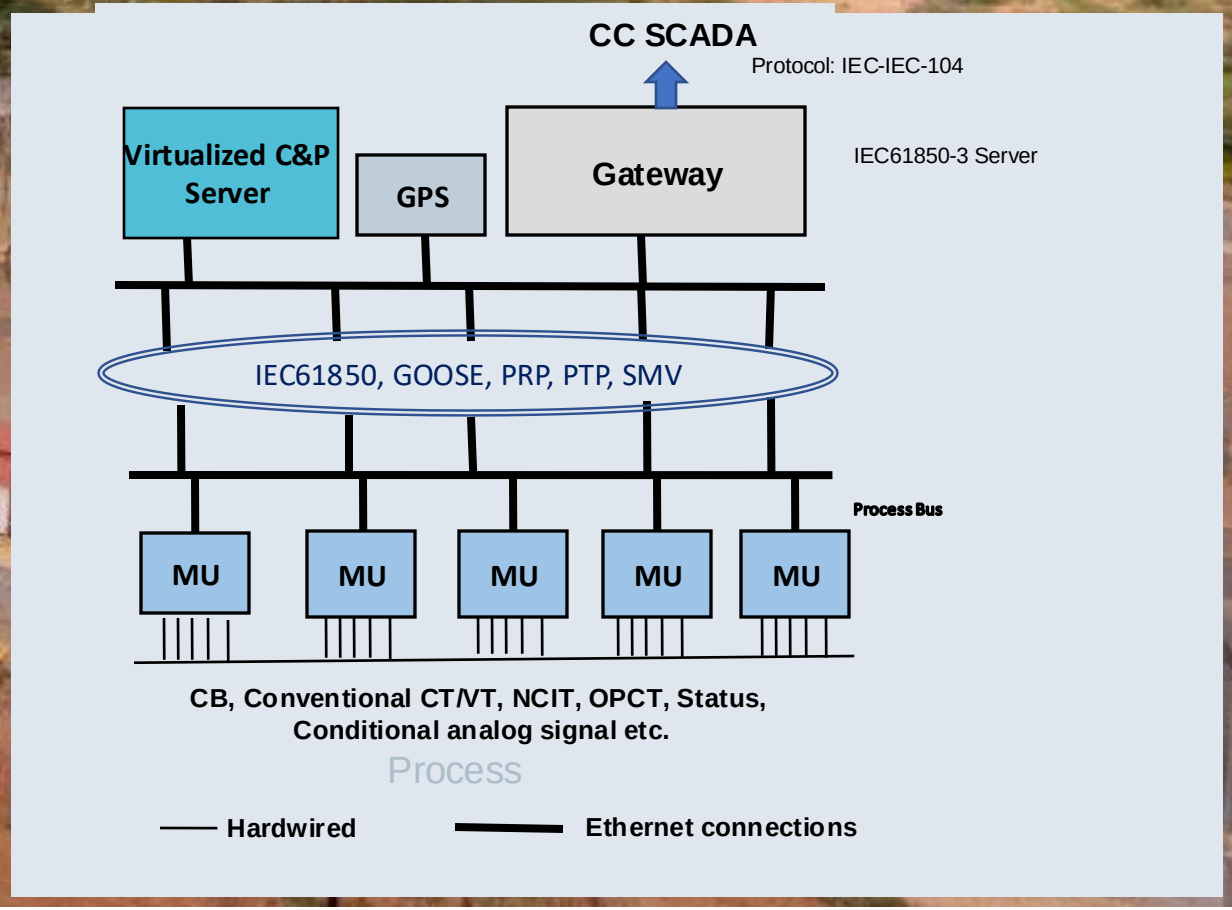


EVOLUTION OF SUBSTATION AUTOMATION SYSTEM

4th Generation – Digital Substation 4.0 - Processbus since 2016



5th Generation –Virtual Digital Station



Remote Control & Monitoring & DR Data Collection of Conventional PSS (350 Nos. PSS) in TPCODL

- Challenge: Manual Operation, Longer power restoration time
- Solution: RTU based Automation integrates BCPU, Relays, DC System, Fire Detection System, TMU, NIFPS and MFM for real time data monitoring. Integration with Control Centre SCADA

Benefit:

- Remote Control & Realtime Monitoring of the PSS
- Unmanning of PSS
- Cost Saving in operation
- Improved operation Efficiency
- Faster Restoration
- Improvement in A&C Losses
- Improvement in Reliability Indices (SAIDI, SAIFI & CAIDI)
- Remote Maintenance and Configuration
- Customer delights

KEY TAKEAWAYS / RECOMMENDATIONS

PRP/HSR

PRP/HSR both the network protocol is recommended : zero-recovery-time redundancy for mission-critical networks.

DR DC

Substation gateway should support additional DR Data DC Function for Centralized DR Data Analysis

SCADA Communication

Currently Mobile Communication with LTE Modem is good enough for SCADA Communication. OFC infra may be avoided

PTP TIME SERVER

Strategic planning is a crucial process for organizations to set goals, define strategies

Networking

Process bus network is required to be very reliable and hence special care is required to implement the network

Cyber Security

VLANing & Network segmentation is required to avoid data congestion and to support enhanced Cyber Security in PB Network.

KEY TAKEAWAYS / RECOMMENDATIONS

WHAT'S NEXT ?

Switchgears could be equipped with all necessary Sensors & Accuators that too with a wireless communication port which could support the bandwidth required for communication with upper level devices.

In the future smart switchgear with wireless communication capability could reduce cost for substation communication infrastructure and at the same time commissioning and maintenance efforts will be reduced to a great extent

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THANK YOU

For discussions/suggestions/queries email: ***isuw@isuw.in***

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Links/References (If any)