Systems Integration
4-day Course

1. Review of Essentials
2. Conceptual Design
i. Modelling, ACSI and communication summary
ii. Design and explore the use case of operating switchgear
- HTML version of the standard
- Data models
- Issuing commands through GOOSE and control services
- Reporting – configuration
- Control – services
- GOOSE – configuration
i. Access Points in SCL

3. ACSI details
i. Input and output model
ii. Abstract model defined in ACSI
iii. Formatting of messages
iv. Configure control blocks
v. Perform information exchange
vi. List the services needed each time
vii. Analyse the details of the messages

4. Advanced Functionality
i. LD Hierarchy
ii. Control Hierarchy
iii. Provisions in Ed2 for Testing
iv. Extensions
v. Analytics
vi. Routable GOOSE and SMV
vii. Function allocation example
viii. Datasets
- fixed
- configurable
- dynamic

5. Advanced Applications
i. Substation to substation communications
ii. Substation to Control Centre communications
- SCADA Gateway
- Mapping IEC 61870-5-101/-104
- Mapping IEEE 1815 (DNP3)
- Harmonisation
iii. Condition Monitoring
iv. Substation HMI
v. Synchrophasor communication (IEC 61850-90-5)
vi. Windfarm
vii. Hydro
viii. Smart Grids and IEC 61850
- Distributed Energy Resources (Diesel Generators, Batteries, Electric Vehicles ....)

6. Advanced Networks
i. Time Synchronisation
- IEEE1588
i. HSR
ii. PRP
iii. IEC 62439 High security networks
iv. Fundamentals of ISO 9506 (MMS)
v. ASN.1 and BER
vi. IEC 61850-90-4
vii. IEC 62350 Security

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7. Systems Specification
  i.   Single Line Diagram
  ii. Functions
  iii. Use of ICD
  iv. Virtual IEDS
  v. Bay Libraries
  vi. IEC 62271 HV interfaces
  vii. IEEE 1686 IED Cyber Security Capabilities

8. Systems Integration
  i.   XML introduction
  ii. Object model and content of SCL files
  iii. Network
  iv. IED Instantiation
  v. Control Blocks
  vi. Messaging
  vii. Functional Constraints
  viii. Relationship to wire engineering
  ix. Naming objects in an IEC 61850 system
      • IEC 61346
  i.   Logic
      • IEC 61131
      • IEC 61499

9. Advanced LN and Common Data Classes
  i.   Statistic and historic calculation
  ii. Input Reference
  iii. Blocking Reference
  iv. Namespace and Model extensions
  v. L-Nodes
  vi. Power Quality Nodes
  vii. LNs from IEC 61850-7-410