

Intro to IEC 61850

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Implementada por
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BICENTENARIO
DEL PERÚ
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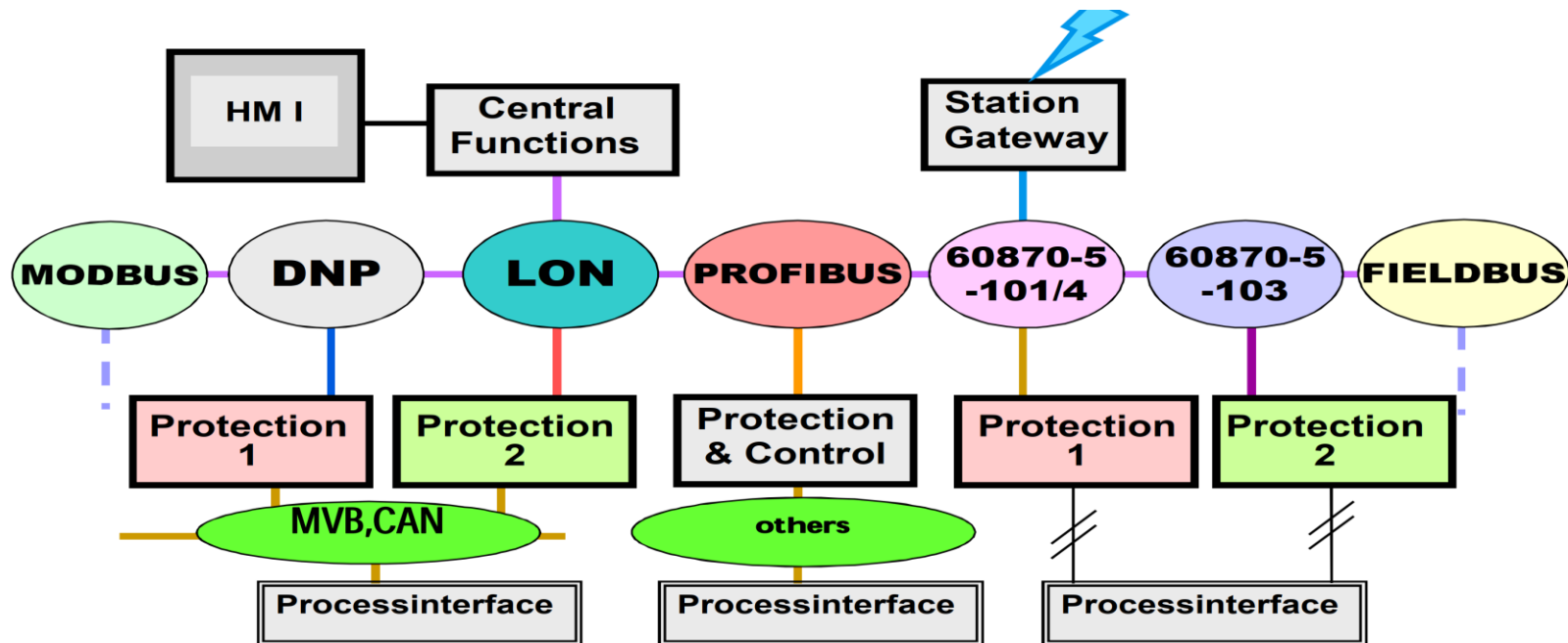
In view words=> What is IEC61850?

IEC 61850 is much more than a new protocol. The standard describes an engineering process and architecture with many new advantages that will influence design, specification, engineering, operation, and maintenance. It can be said to be both the language and the infrastructure for the power system.

IEC 61850 was developed by the International Electrotechnical Commission, Geneva by a group of manufacturers (ABB, Alstom, Schneider, SEL, Siemens, Toshiba,..) and electrical utilities (Electricité de France, Iberdrola, Hydro-Quebec,...)

State before IEC 61850

Substation Automation Systems with IED's (intelligent electronic devices) incl. a serial communication well accepted on the worldwide market



Why IEC61850

The global market

- needs a global standard
- A standard supporting all design & operation philosophies

Mixing IED's from different Vendor

- Interoperability between Vendor
- For need of equipment exchange , through end of availability

Cost reduction

- By competition for investments
- By engineering and commissioning
- For operation and maintenance

A Open and future-proof standard

- For staying up to date with cyber security standards
- For future extensions by bays or functions
- Long term stability (the standard allows to follow the progress in communication technology as well as evolving system requirements)

Avoid massive cable pulling



Non-Digital Substation



Conventional 132kV Control & Protection
incl. Metering for 3 Bays



Conventional Control & Protection Cubicle

Digital Substation

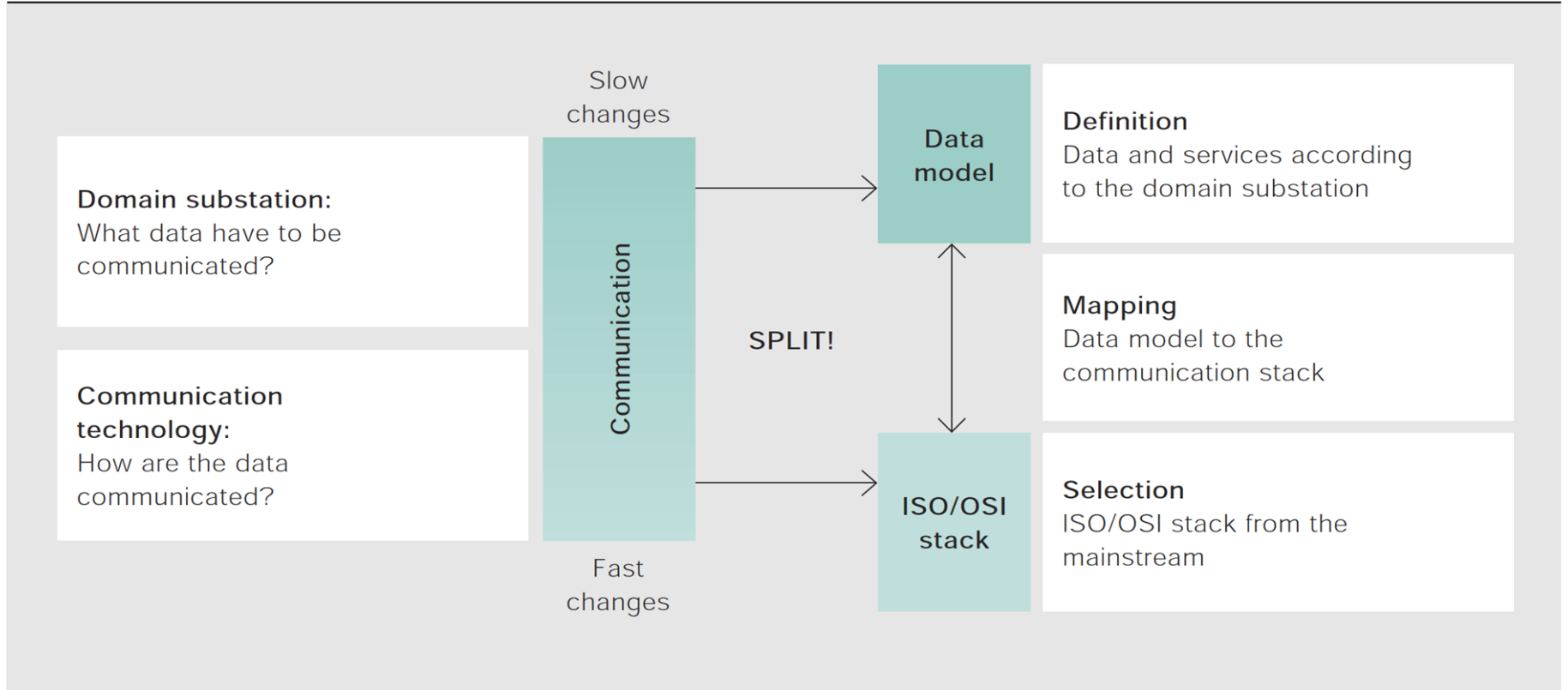


Frontview 132kV Control & Protection incl. Metering for 3 Bays



Backview 132kV Control & Protection incl. Metering for 3 Bays

Long term stability (future proof)



Overview of the standard

IEC 61850

Communication
Networks and
Systems for
Power Utility
Automation

System-Aspekte

- 1 Introduction and Overview
- 2 Glossary
- 3 General Requirements
- 4 System and Project Management
- 5 Communication Requirements for Functions and Device Models

Konfiguration

- 6 Configuration Language for electrical substation IEDs (SCL)

Datenmodelle

- 7-4 Compatible Logical Node Classes and Data Classes
- 7-3 Common Data Classes

Abstrakte Kommunikationsdienste (ACSI)

- 7-2 Abstract Communication Services
- 7-1 Principles and Models
- 7-500 Basic information and communication structure – Use of logical nodes for modeling application functions and related concepts and guidelines for substations

Mapping der Kommunikation (SCSM)

- 8-1 Mapping to MMS and ISO/IEC 8802-03
- 9-2 Sampled Values over ISO/IEC 8802-3

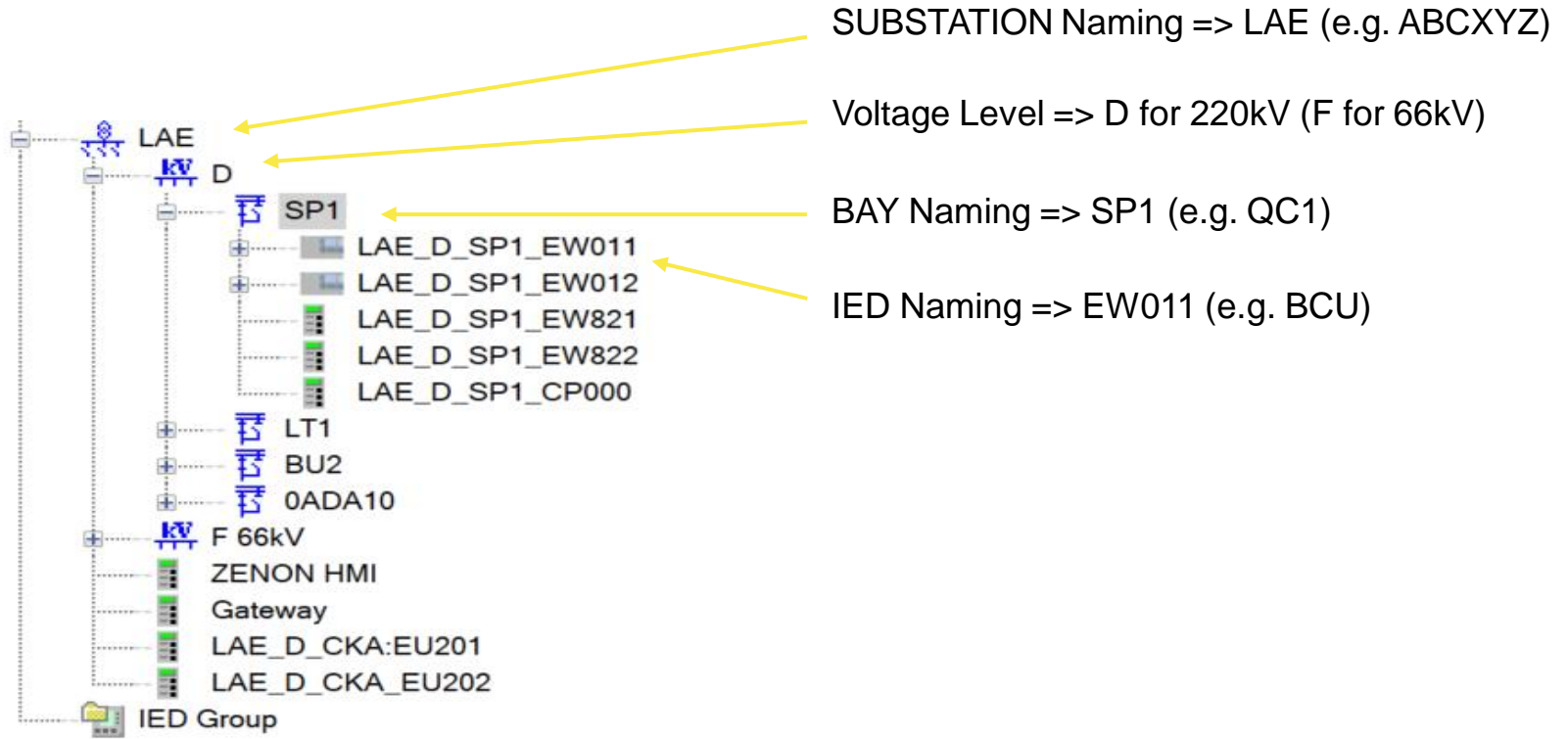
Testen

- 10 Conformance Testing

IEC 61850-6 = SCL Example

```
1 <?xml version="1.0" encoding="UTF-8"?>
2 <SCL xmlns="http://www.iec.ch/61850/2003/SCL" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:IEC_60870_5_104="http://www.iec.ch/61850-80-1/2007/SCL"
3 <Private type="Siemens-ScLib-V5-Version">V09.20.02.000</Private>
4 <Private type="Siemens-ScLib-V5-EditTime">27.10.2023 14:53:39</Private>
5 <Private type="Siemens-Configurator-Version">7.50.15</Private>
6 <Private type="Siemens SiedigGooseApplicationStorage">
52 <Private type="Siemens SiedigSMVApplicationStorage">
66 <Private type="eIEC61850-6-100">
67 <eIEC61850-6-100:ServiceSpecifications>
68 <eIEC61850-6-100:SMVParameters id="6MU85_OS_SV"/>
69 <eIEC61850-6-100:SMVParameters id="6MU85_US_SV"/>
70 </eIEC61850-6-100:ServiceSpecifications>
71 </Private>
72 <Header id="IEC station 1" version="1" revision="24" toolID="IEC 61850 System Configurator, Version: 7.50.15" nameStructure="IEDName">
101 <Substation name="EEA_" desc="61850_Multi-Vender">
102 <VoltageLevel name="J_0">
103 <Voltage unit="V" multiplier="k">20</Voltage>
104 <Bay name="J03" desc="Eigenbedarf">
105 <LNNode iedName="EEA_J_Q03_BFU" ldInst="LD0" prefix="" lnClass="LLNO" lnInst=""/>
106 <ConductingEquipment name="QA1" virtual="false" type="CBR">
107 <SubEquipment name="A" phase="A" virtual="false"/>
108 </ConductingEquipment>
109 <ConductingEquipment name="CT" virtual="false" type="CTR">
110 <SubEquipment name="A" phase="A" virtual="false">
111 <EqFunction name="ProxyLNs">
112 <EqSubFunction name="ProxyLN1">
113 </EqSubFunction>
114 </EqFunction>
115 </SubEquipment>
116 <SubEquipment name="B" phase="B" virtual="false">
117 <EqFunction name="ProxyLNs">
118 <EqSubFunction name="ProxyLN1">
119 </EqSubFunction>
120 </EqFunction>
121 </SubEquipment>
122 <SubEquipment name="C" phase="C" virtual="false">
123 <EqFunction name="ProxyLNs">
124 <EqSubFunction name="ProxyLN1">
125 </EqSubFunction>
126 </EqFunction>
127 </SubEquipment>
128 <SubEquipment name="N" phase="N" virtual="false">
129 <EqFunction name="ProxyLNs">
130 <EqSubFunction name="ProxyLN1">
131 </EqSubFunction>
132 </EqFunction>
133 </SubEquipment>
134 </ConductingEquipment>
135 </Bay>
136 <Bay name="J02" desc="NAP">
137 <LNNode iedName="EEA_J_Q02_BFU" ldInst="Control" prefix="" lnClass="LLNO" lnInst=""/>
138 <ConductingEquipment name="QA1" virtual="false" type="CBR">
139 <SubEquipment name="A" phase="A" virtual="false"/>
140 </ConductingEquipment>
141 <ConductingEquipment name="CT" virtual="false" type="CTR">
142 <SubEquipment name="A" phase="A" virtual="false">
143 <EqFunction name="ProxyLNs">
```

Substation Structure (IED Naming)



!!!All Equipment needs to be unique naming in the entire system!!!

IED Data model Overview

Physical Device (max.64 digits, start with a letter)

IED mit Netzwerkschnittstelle (IP)

e.g. BCU , BPU , MU,...

Logical Device LD

Functional Group within a Phy. IED (max. 64 digits)

e.g. PROT, CTRL, LD0,...

1xPhy. Device can contain multiple Logical Devices

Logical Note LN (max.4 digits)

Logical function within a Logical Device

e.g. DIFF, PTOC, PTRC, XCBR, CSWI,...

For more detailed it can modified with

Praefix and Instance Number

e.g. PTRDIFF1 (Powertransformer Diff.1)

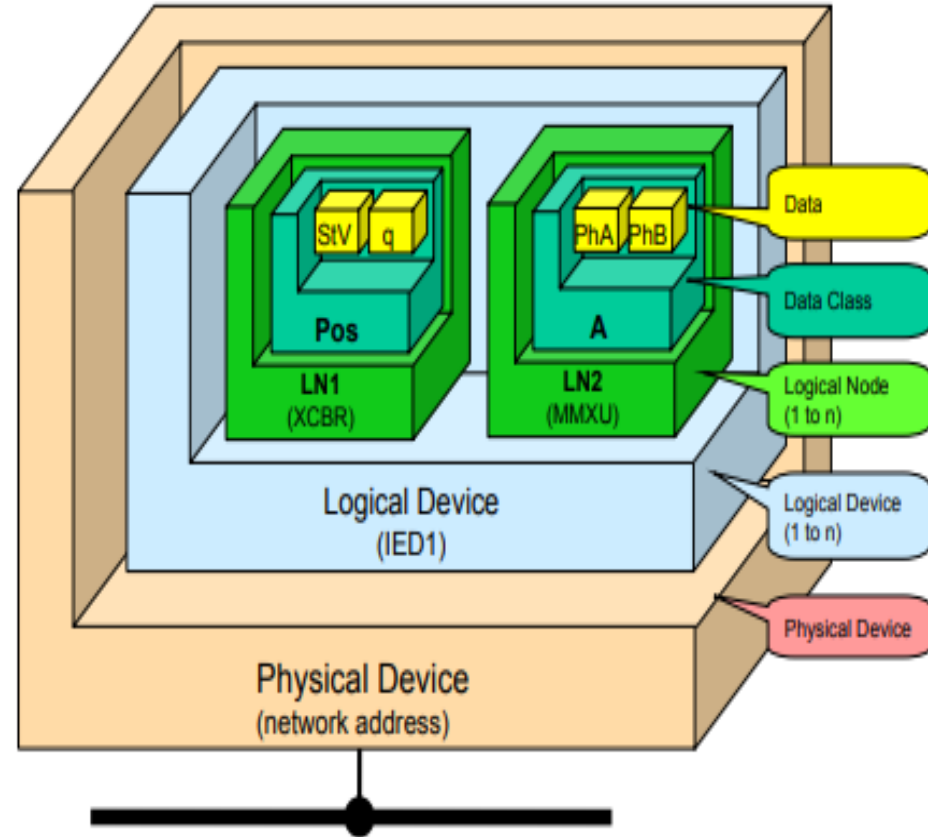
Data Object DO

Detailed Information Class within a Logical Note

e.g. Pos, A, Op, St,

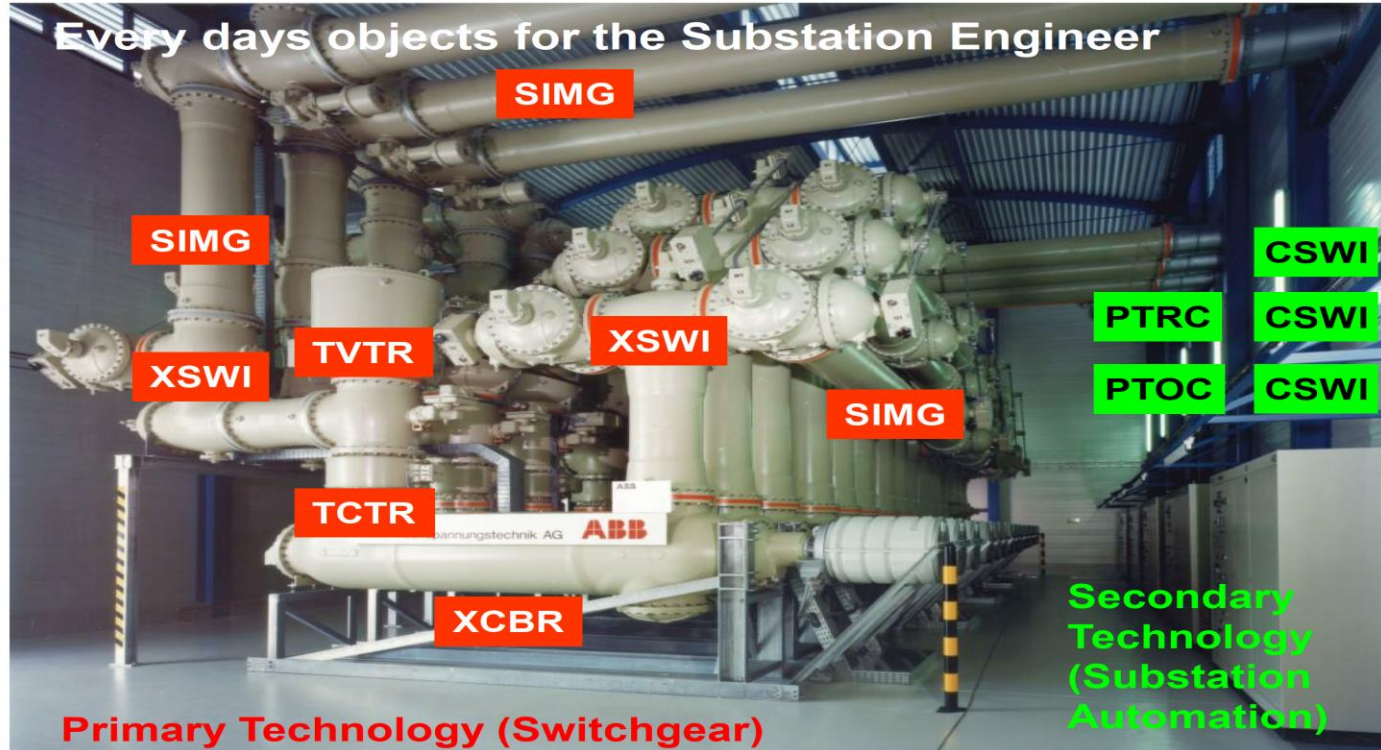
Data Attribute DA

e.g. StVal, q, CtVal, instmag



IED Data model Overview

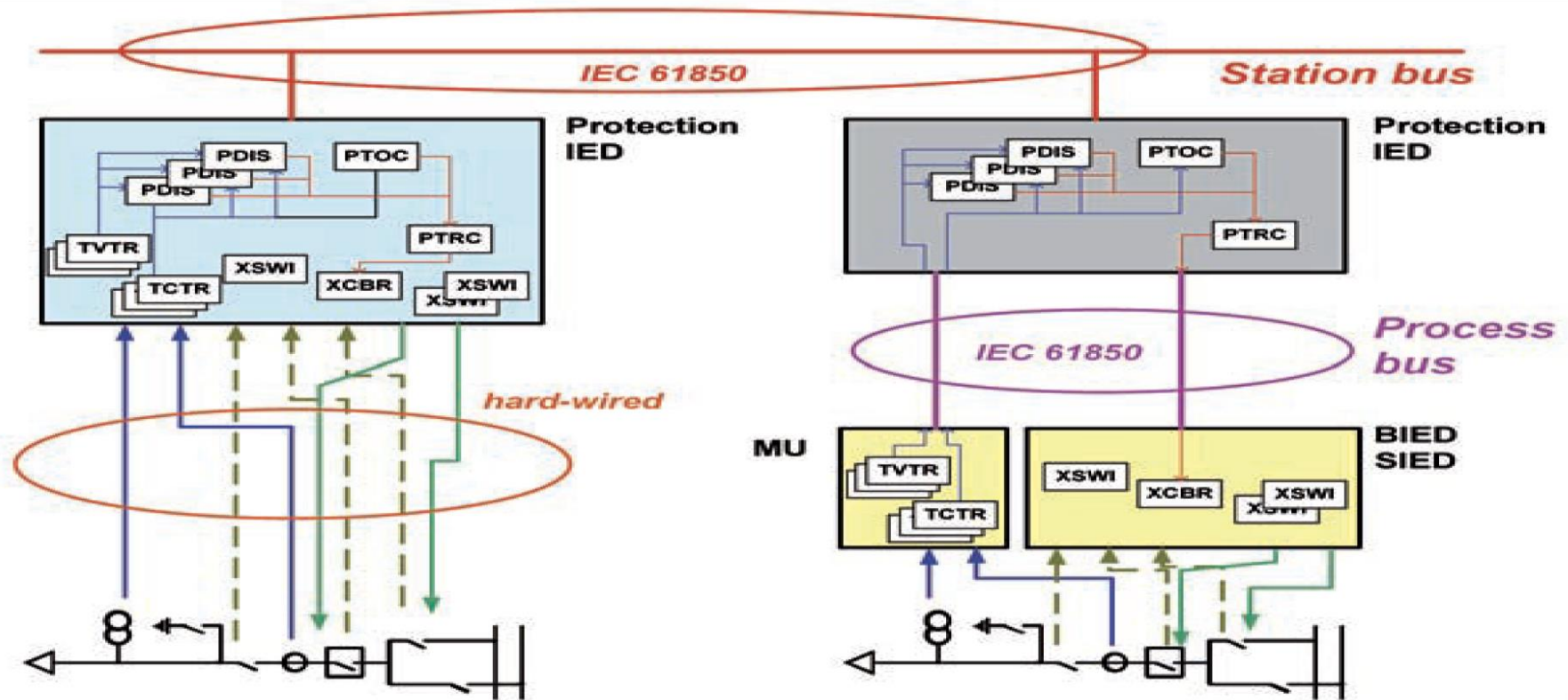
User-near object oriented Data model



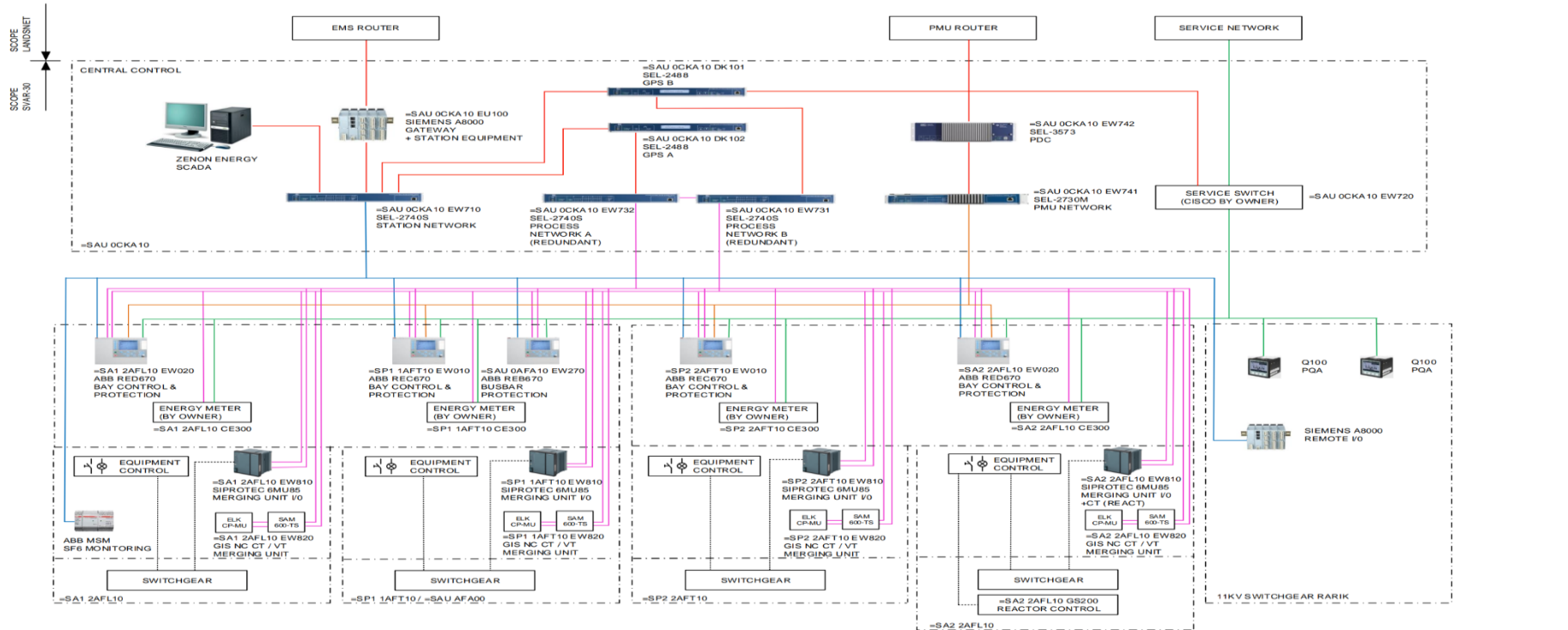
Example :
Object
Circuit
Breaker
XCBR
What
data
belong to
this object ?

These
Objects
are called
**Logical
Nodes**

61850 Station With and without Process-bus



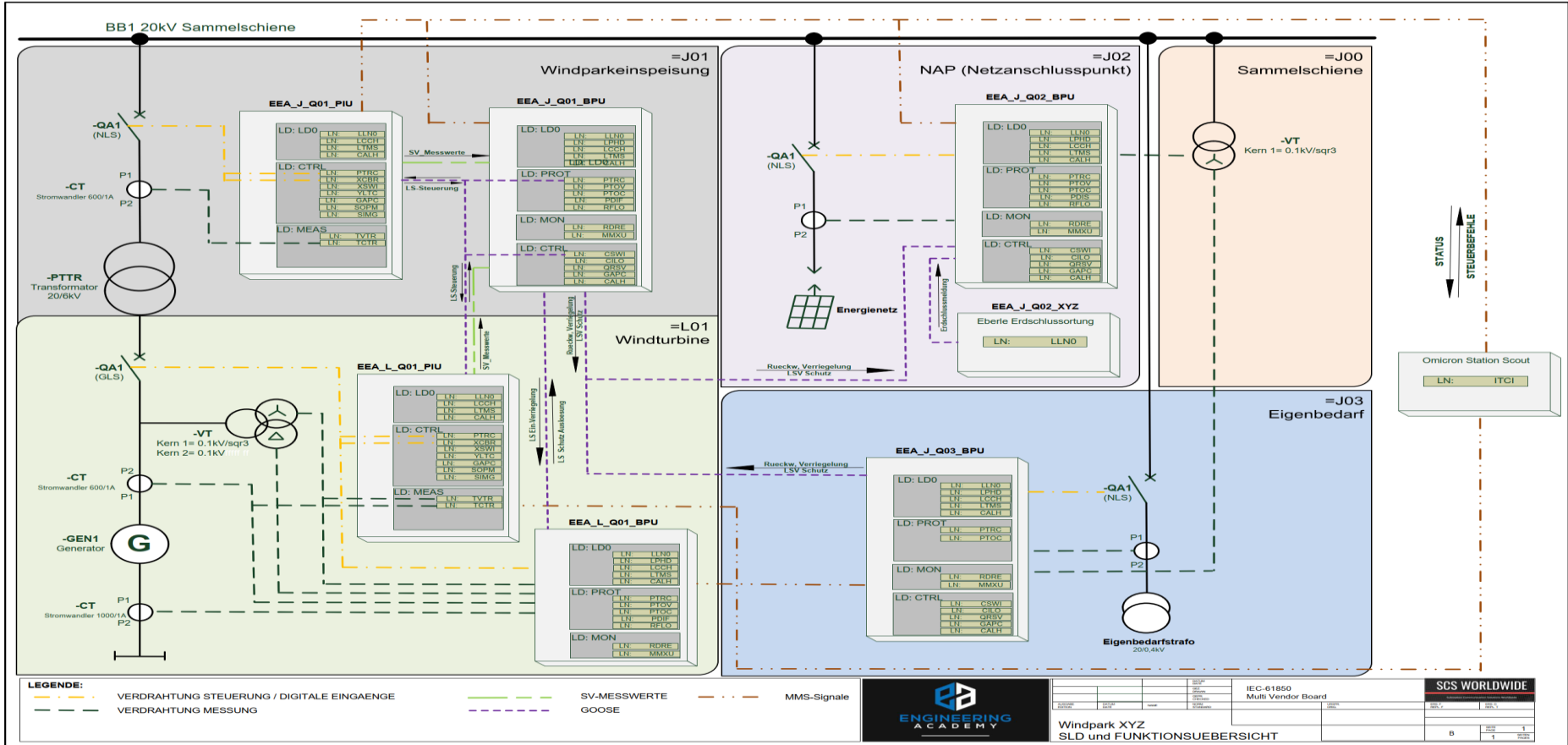
61850 Station Overview Exampe Iceland



LEGEND:
— ETHERNET RJ45 (C4)
— STATION NETWORK (FO)

A	2401.30	KNIS	21P	04.12.2015	LANDSNET SAUDARKKROKUR CONTRACT SVAR-30	
B	18.02.20	KNIS	21P	C. VON KÄNEL		
C	16.03.20	VKCH	21P	M. KNÖBEL		
66kV S/S SAUDARKKROKUR CONTROL & PROTECTION SYSTEM CONFIGURATION						19651P030001 B

61850 Station Overview Function Config.



Test Overview SCL via Station Scout

The screenshot displays the Station Scout interface for a power station named "KOR - Landsnet". The main window shows a "System diagram" with a "Devices" section at the top containing several circuit breakers (e.g., KOR_EW100, KOR_EW101, KOR_EW200). Below this, a detailed diagram shows various busbars (e.g., =E - 132kV, =H - 33kV, =K - 11kV) and their associated equipment (EDs, Equipment, GS210, GS220, GS270, GS310, GS330, GS100, GS110, GS130, GS150, GS170, GS108, GS109, GS100A, GS100B, GS100C, GS100D, GS100E, GS100F, GS100G, GS100H, GS100I, GS100J, GS100K, GS100L, GS100M, GS100N, GS100O, GS100P, GS100Q, GS100R, GS100S, GS100T, GS100U, GS100V, GS100W, GS100X, GS100Y, GS100Z). A specific circuit breaker, GS100, is highlighted in blue.

On the right side, the "Overview" panel is visible, showing a "Watchlist" for the selected device, GS100. The watchlist includes several signals with their current status and timestamps:

- GS100: Interlocking per apparatus
 - True: GS100: Close operation at open or i... 18:14:43
 - True: GS100: Open operation at closed or... 18:14:43
- GS100: Switch Controller
 - GS100: Position indication 18:14:43
 - Closed: execute command for close ... 18:14:43
 - Open: execute command for open ... 18:14:43
 - Intermediate: synchrocheck and energizin... 18:14:43
 - Bad state: automatic release 18:14:43
 - 0 deg: GS100: Phase angle difference calcul... 18:14:43
 - 0: GS100: Frequency difference calcula... 18:14:43
 - GS100: Voltage magnitude differenc...

The bottom status bar shows "Live status On", the time "18:21", and the user "CB213N".

Digital Substation FAT for 220kV Station



Factory acceptance test in Iceland /Landsnet

Digital Substation FAT for 220kV Station



Retrofit geothermal power plant



Site Acceptance Test with Omicron Station Scout

Gracias por su atención



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