

許雲欽/ Charlie Hsu, Sales, PSAC, Power System Division, TWABB, June.2013

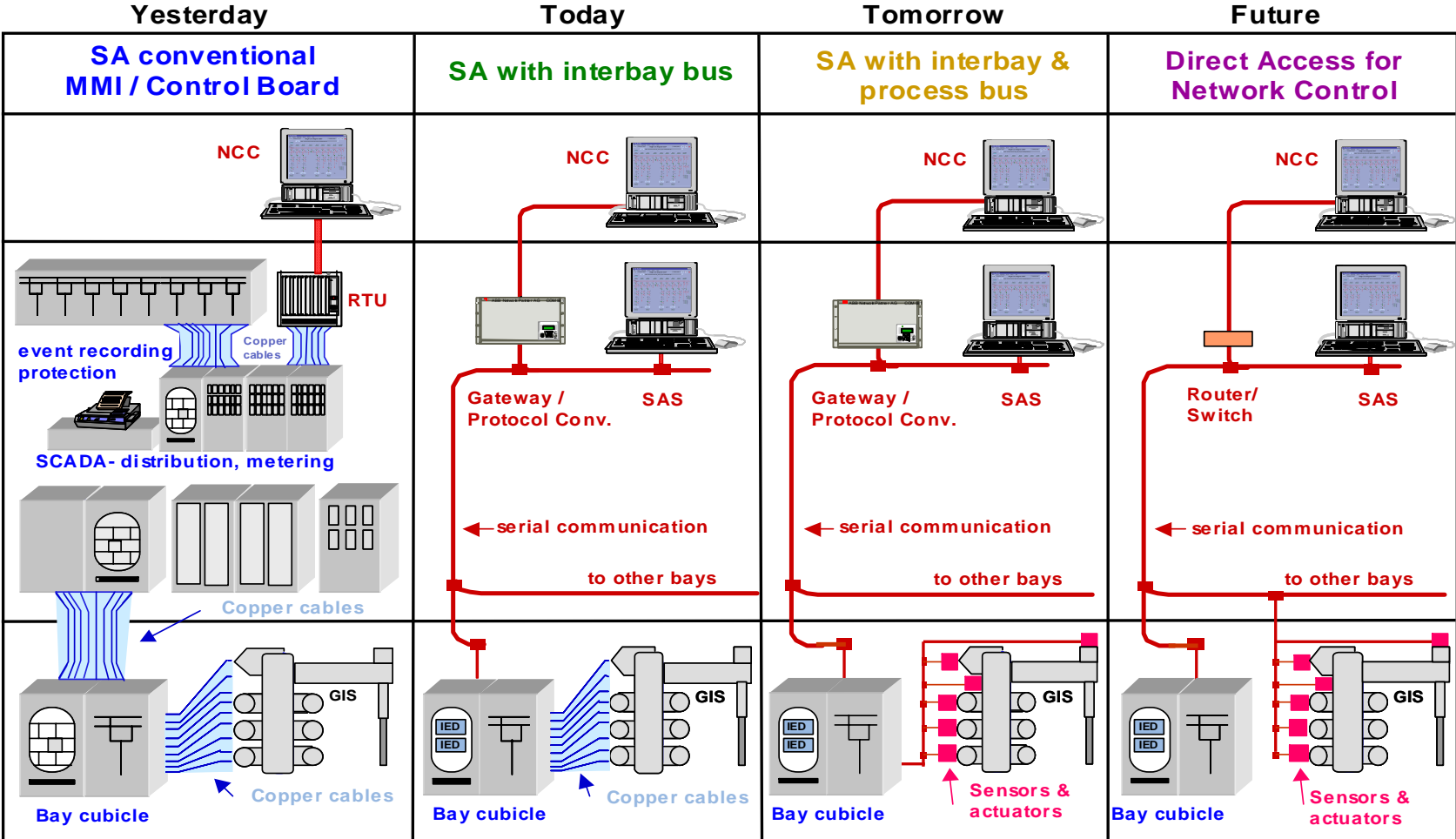
IEC 61850

The Approach and the Standard

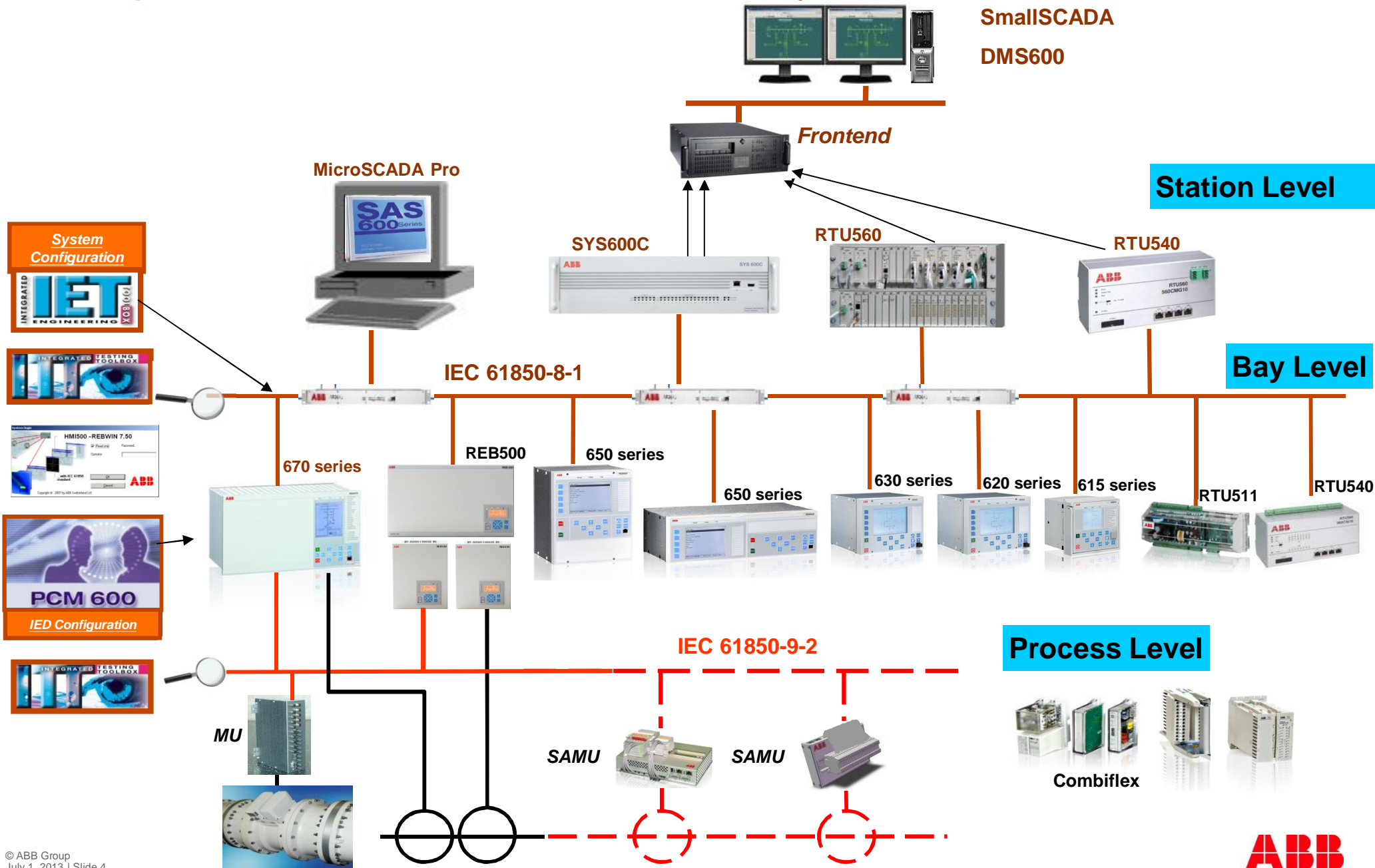
Agenda

- Introduction & revolution
- The key issues for IEC 61850
 - Logical Nodes
 - Communication Services
 - GOOSE applications
 - Process bus for digital substation
 - The integration in Engineering & Testing Process
- Summary

The IEC 61850 standard Revolution of Substation Automation



Example of IEC 61850 substation system structure



Requirements for Standard in SA

Interoperability



The ability for IED's from one or several manufacturer to *exchange* information and *use* the information for the their own functions.

Free configuration



The standard shall support different *philosophies* and allow a free allocation of functions e.g. it must work equally well for centralized (RTU like) or decentralized (IED base) systems.

Long term stability

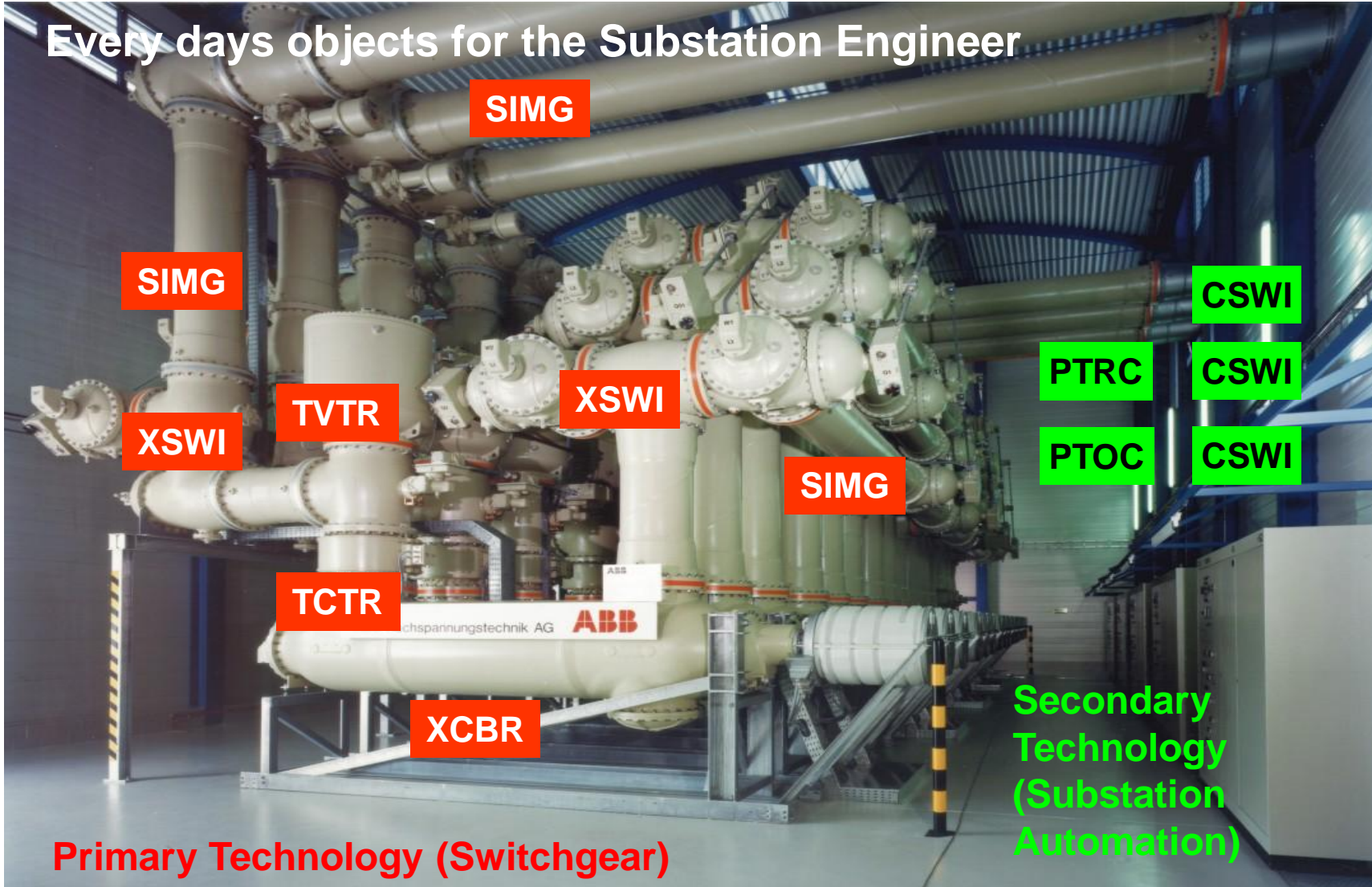


The standard shall be *future proof*, i.e. it must be able to follow the progress in *communication technology* as well as evolving *system requirements*.



Key issues for IEC 61850

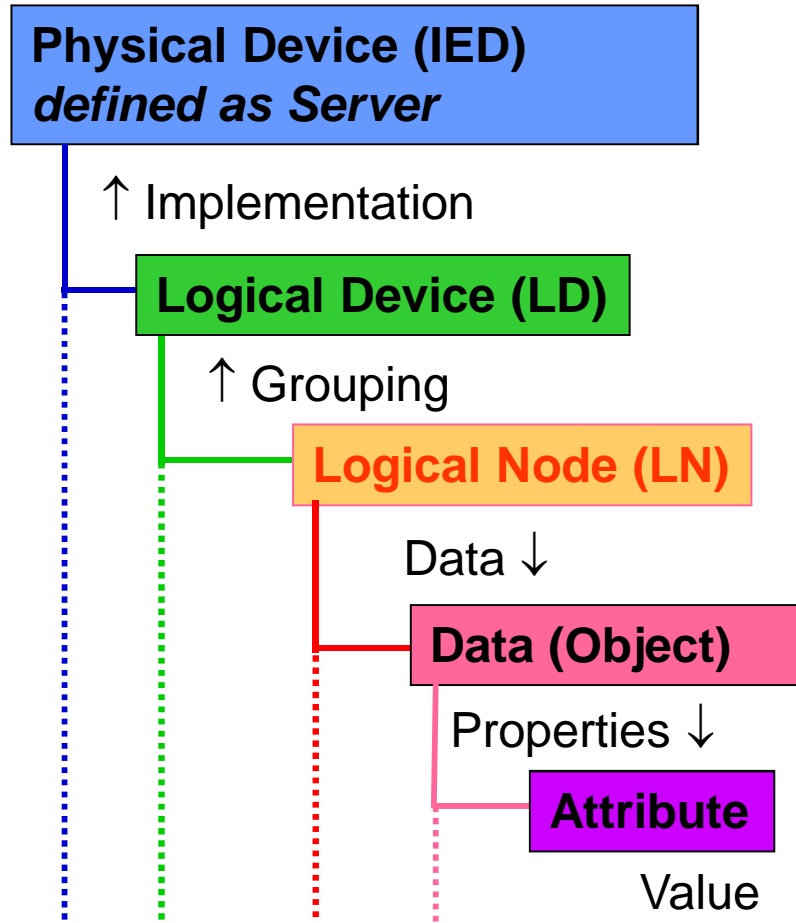
User-near, object oriented Data model



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

These
Objects
are called
**Logical
Nodes**

Data Hierarchy



Bay Unit

Bay Controller

XCBR *Circuit breaker*

Position

Control Value

ON/OFF

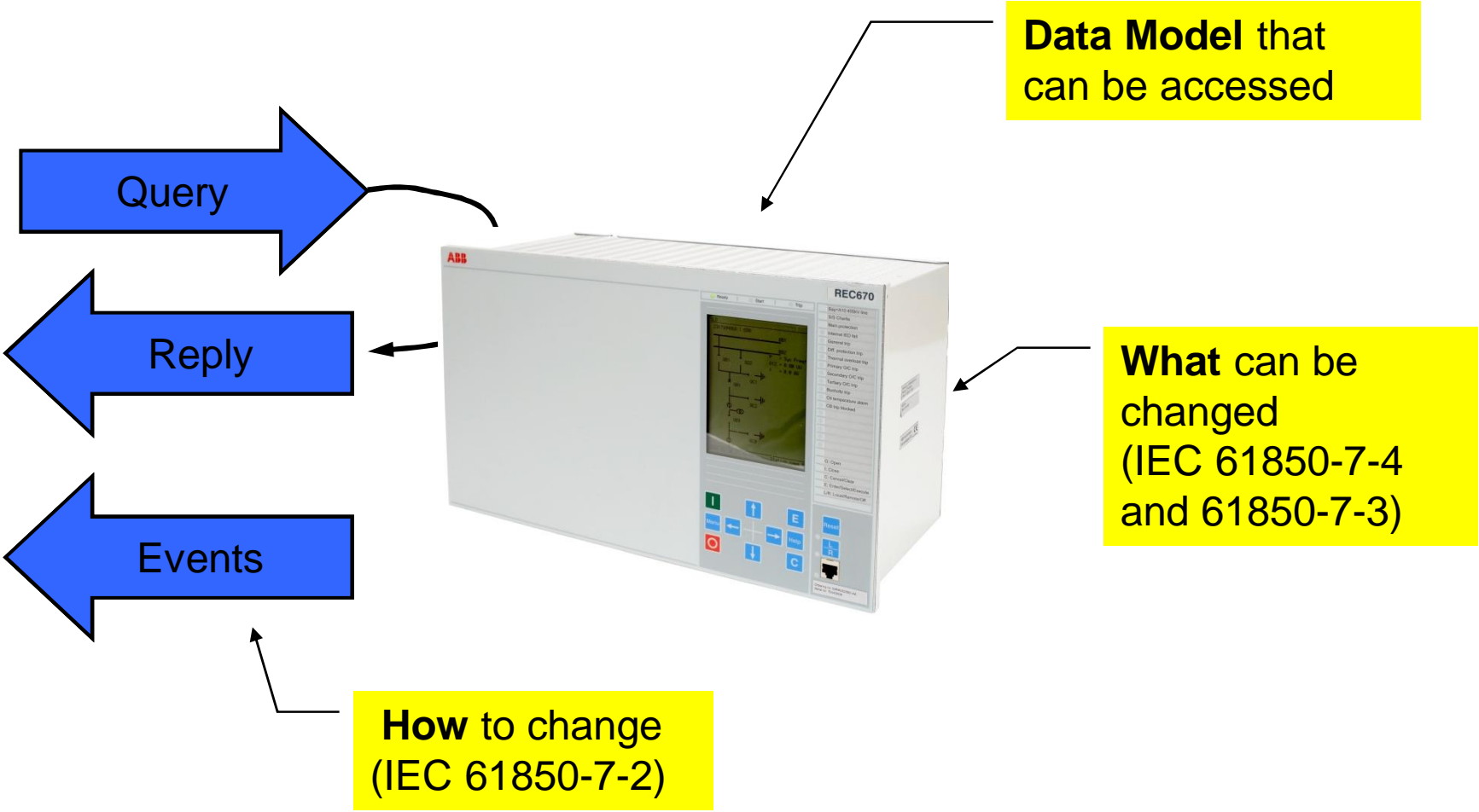
Status Value

INTERM./OFF/ON/BAD

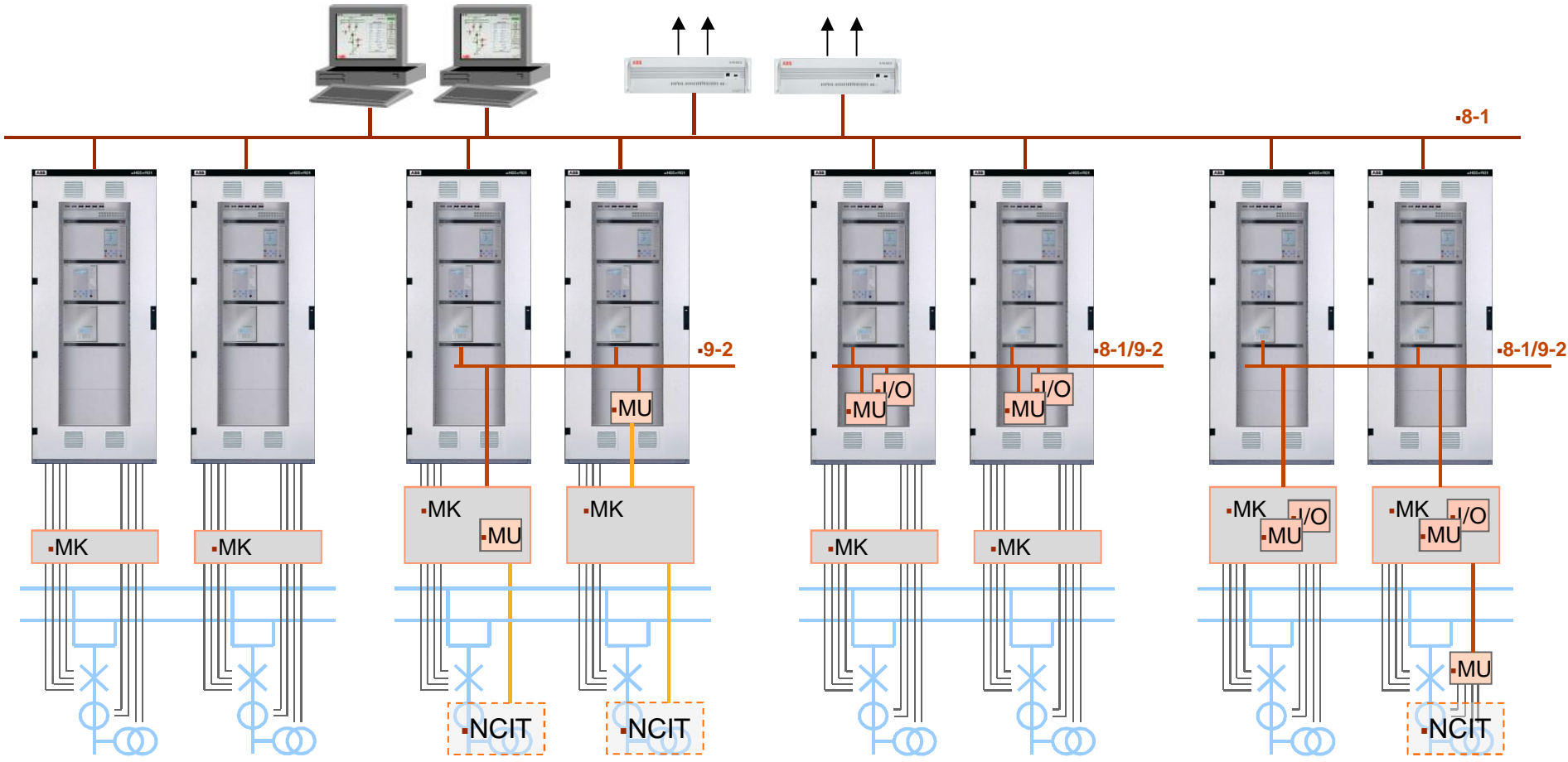
Example for Logical Node

| XCBR class | | | | |
|---|------------|---|---|-----|
| Attribute Name | Attr. Type | Explanation | T | M/O |
| LNNName | | Shall be inherited from Logical-Node Class (see IEC 61850-7-2) | | |
| Data | | | | |
| <i>Common Logical Node Information</i> see Example for Logical Node (1) | | | | |
| | | LN shall inherit all Mandatory Data from Common Logical Node Class | | M |
| Loc | SPS | Local operation (local means without substation automation communication, hardwired direct control) | | M |
| EEHealth | INS | External equipment health | | O |
| EEName | DPL | External equipment name plate | | O |
| OpCnt | INS | Operation counter | | M |
| <i>Controls</i> | | | | |
| Pos | DPC | Switch position | | M |
| BlkOpn | SPC | Block opening | | M |
| BlkCls | SPC | Block closing | | M |
| ChaMotEna | SPC | Charger motor enabled | | O |
| <i>Metered Values</i> | | | | |
| SumSwARs | BCR | Sum of Switched Amperes, resetable | | O |
| <i>Status Information</i> | | | | |
| CBOpCap | INS | Circuit breaker operating capability | | M |
| POWCap | INS | Point On Wave switching capability | | O |
| MaxOpCap | INS | Circuit breaker operating capability when fully charged | | O |

Communication services - Data access and transfer



Communication for Station & Process bus IEC 61850-8-1 & 9-2



Vertical communication

Control Station

Station Level



Vertical Serial Communication



Bay Level



Examples:
Samples
Trips
Positions

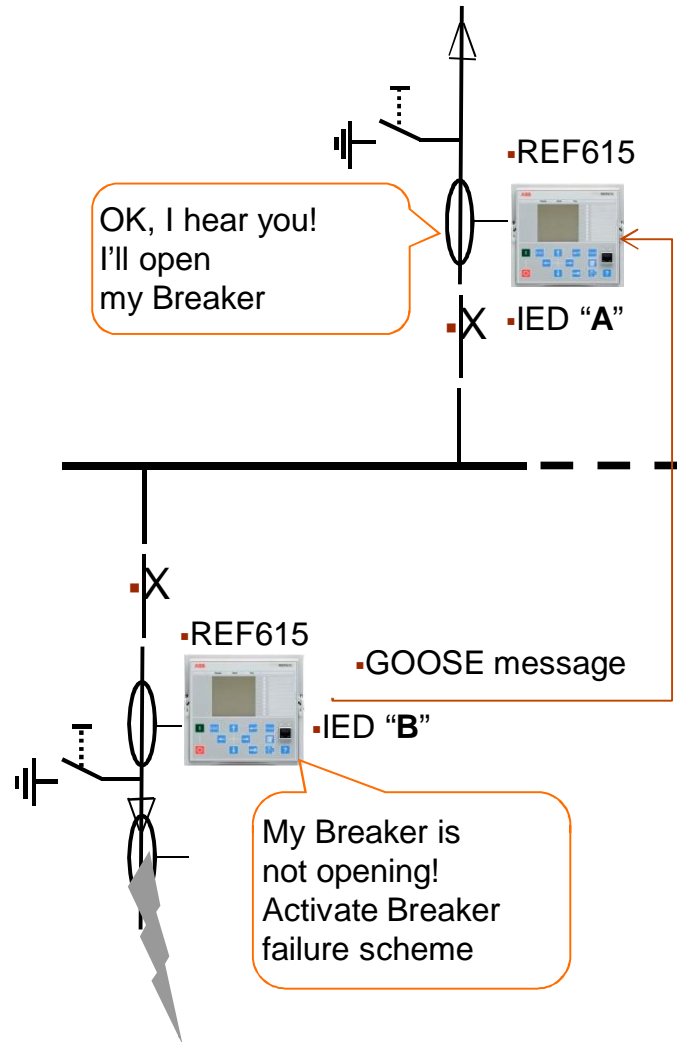


(Equipments, processes)

Process Level

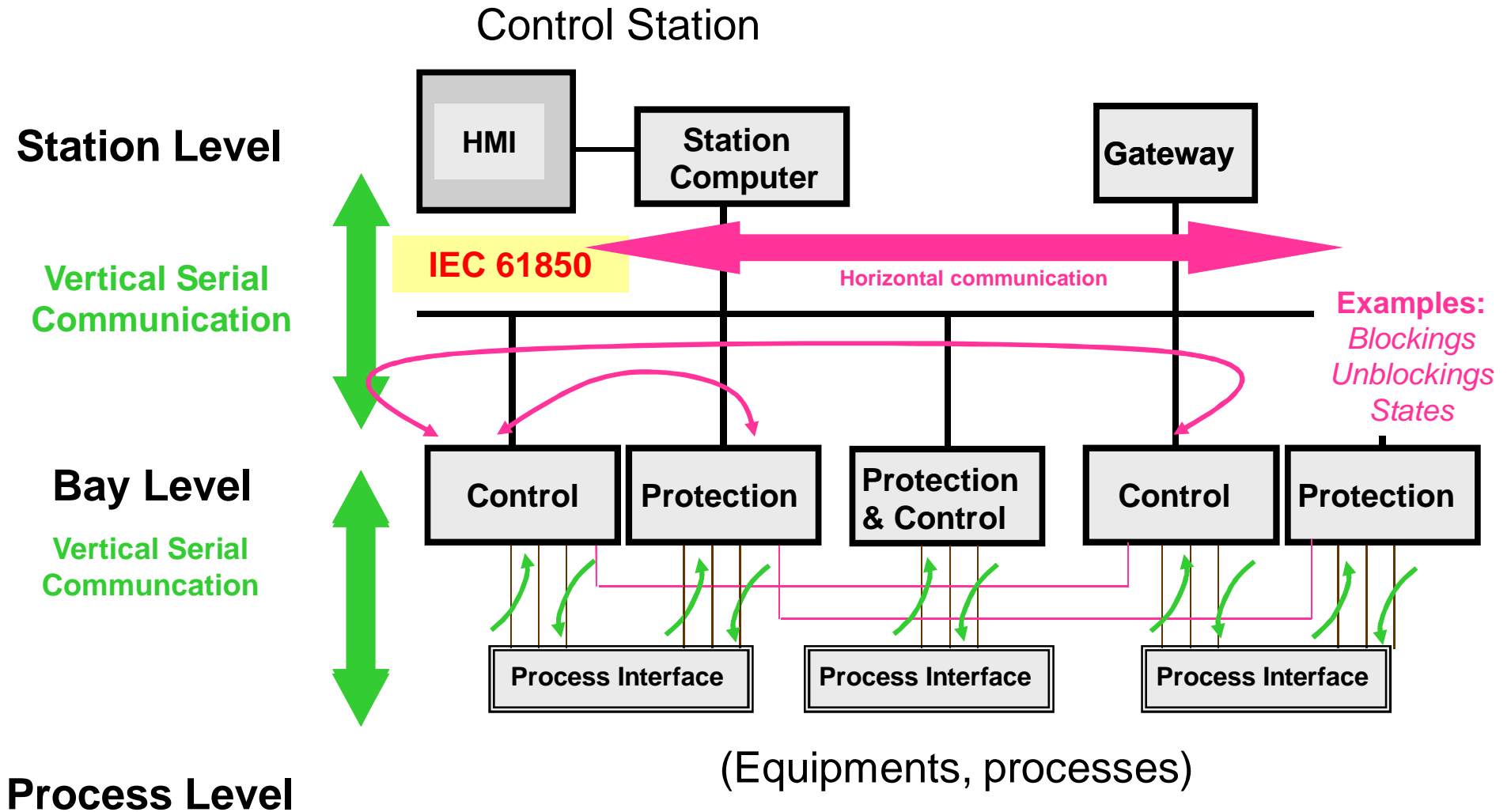
Application examples

Circuit-breaker failure protection

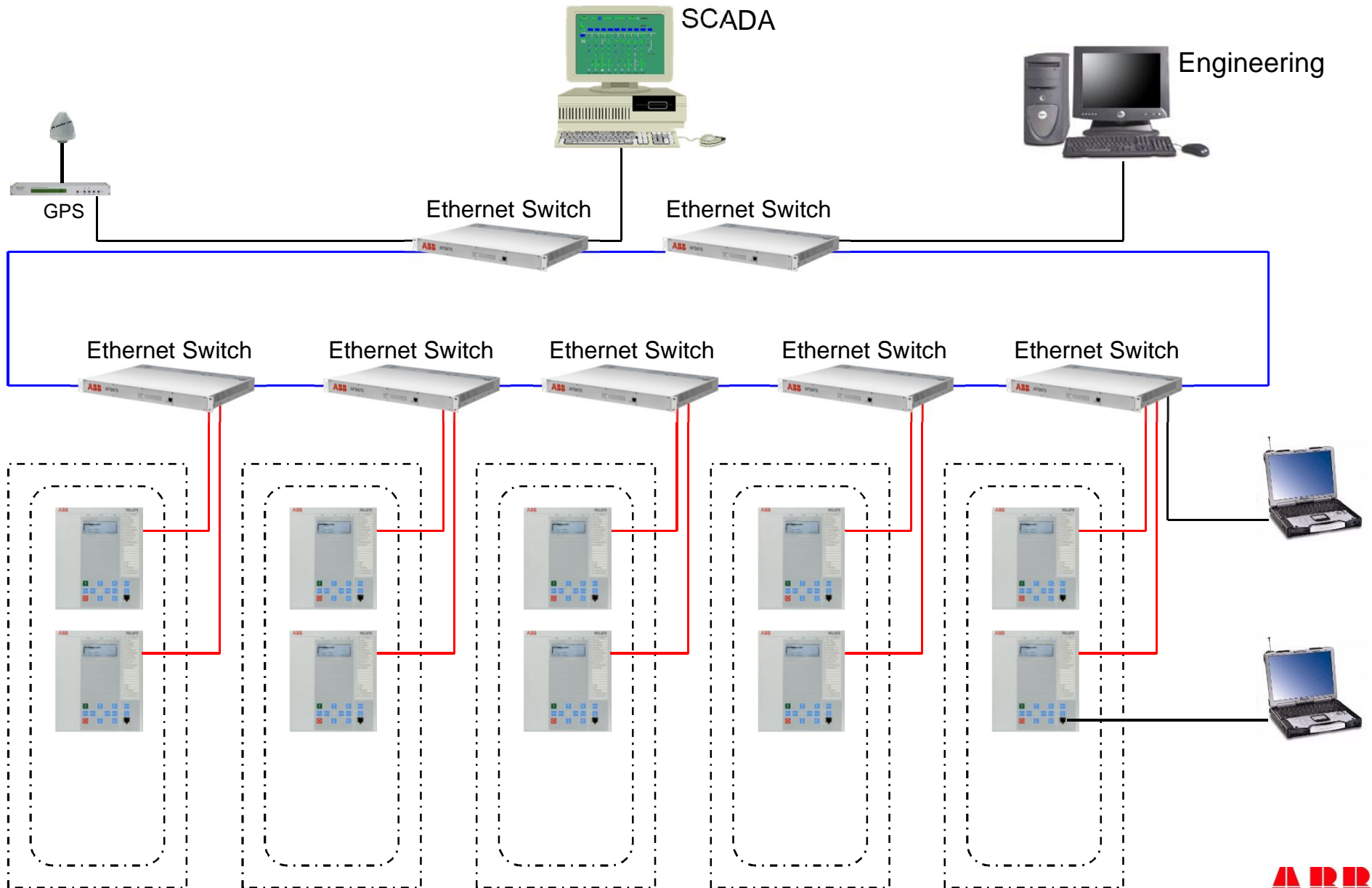


- IED B (outgoing feeder) detects a fault, issues an opening command to its breaker and starts the breaker failure protection
- The breaker of the outgoing feeder fails to open and after a set time delay the breaker-failure protection in IED B sends a BFP trip command to IED A as a GOOSE message
- After receiving the GOOSE message IED A issues an opening command to the incoming feeder breaker and the fault is cleared

Horizontal communication

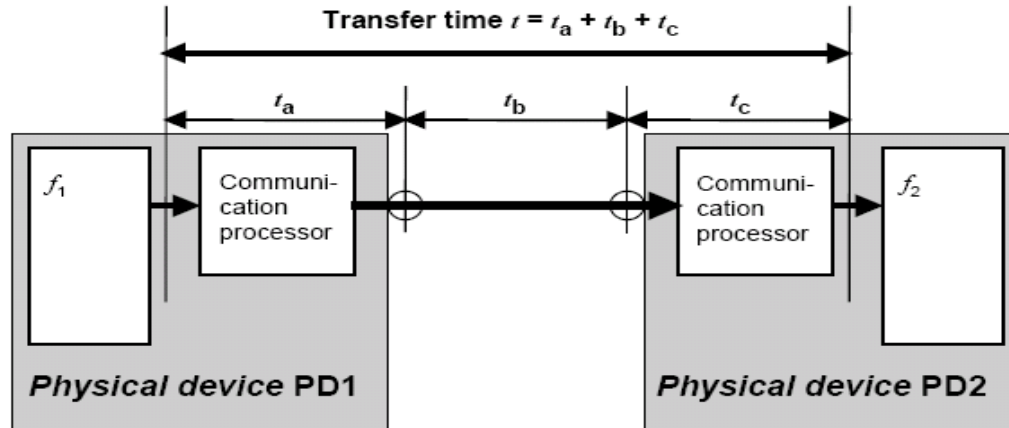


Horizontal communication: GOOSE



Horizontal GOOSE communication

GOOSE performance

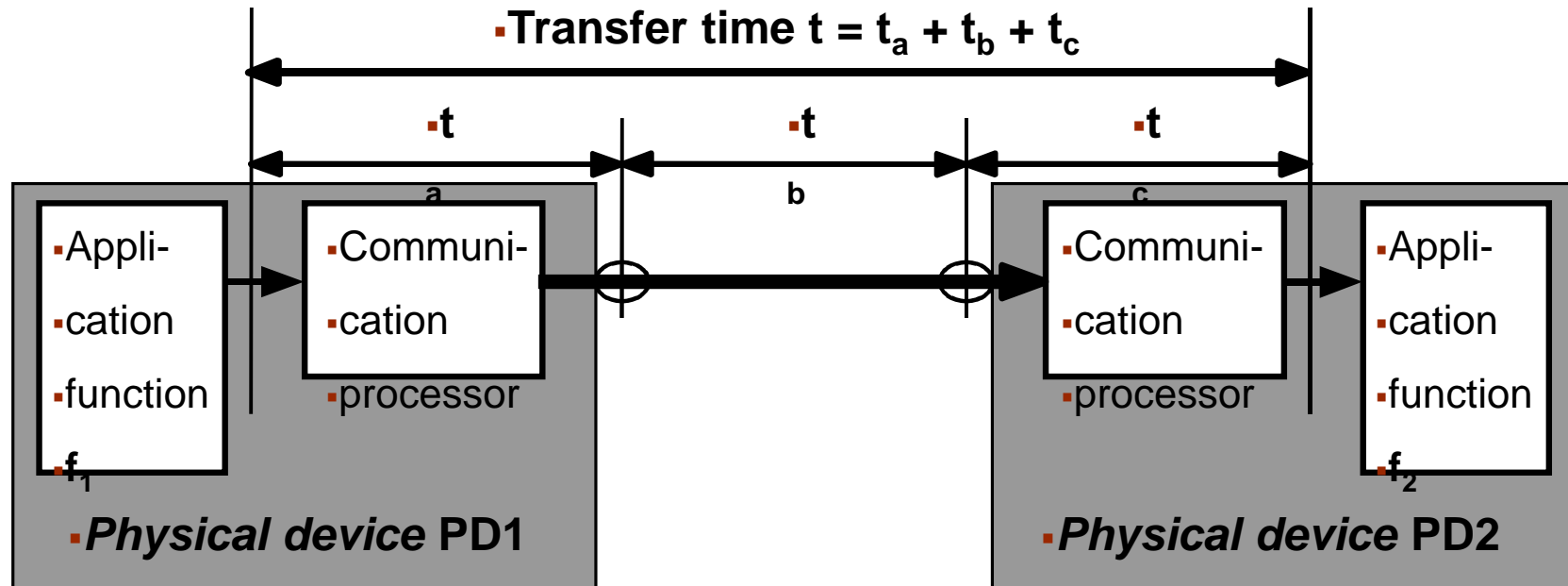


IEC 1918/03

- GOOSE speed requirements from IED to IED as defined by the standard
 - Type 1 (fast messages)
 - Type 1A (tripping)
 - Class P2/3: <3 ms (transmission)
 - Class P1: <10 ms (distribution)
 - Type 1B (others)
 - Class P2/3: <20 ms
 - Class P1: <100 ms
- Following the IEC 61850 standard means that peer-to-peer signalling is faster than traditional hard-wiring
 - Reduced wiring and faster response times

Aspects of IEC 61850 System Integration

IEC61850 Performance requirements Services



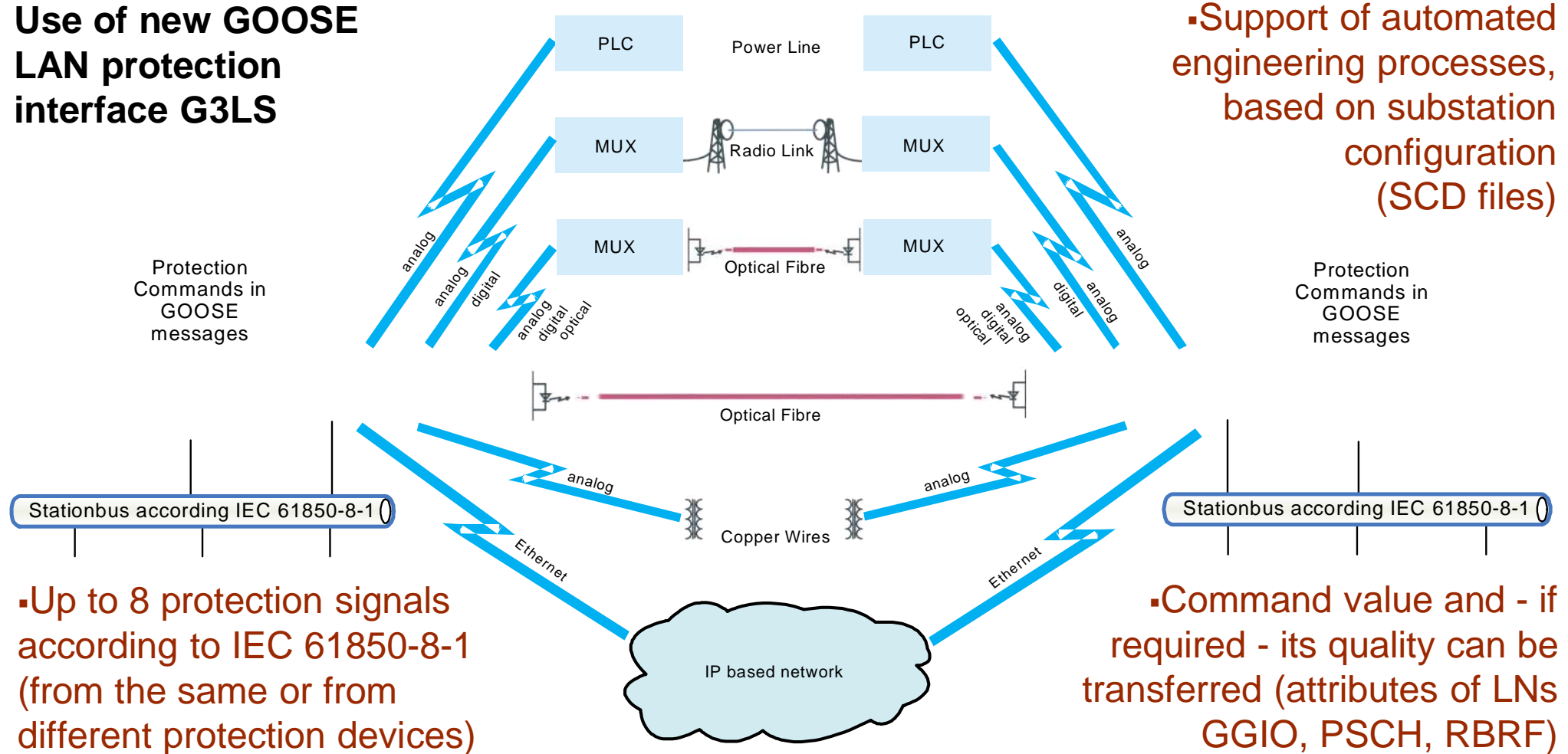
| Transfer time class* | Transfer time [ms] | Application examples: Transfer of |
|----------------------|--------------------|-----------------------------------|
| TT0 | >1000 | Files, events, log contents |
| TT1 | 1000 | Events, alarms |
| TT2 | 500 | Operator commands |
| TT3 | 100 | Slow automatic interactions |
| TT4 | 20 | Fast automatic interactions |
| TT5 | 10 | Releases, Status changes |
| TT6 | 3 | Trips, Blockings |

*) Classes according to IEC 61850-5 Ed2

Between substations / GOOSE application

Connection to IEC 61850 protection devices (for 61850-90-1)

Use of new GOOSE LAN protection interface G3LS



- Support of automated engineering processes, based on substation configuration (SCD files)

- Up to 8 protection signals according to IEC 61850-8-1 (from the same or from different protection devices)

- Command value and - if required - its quality can be transferred (attributes of LNs GGIO, PSCH, RBRF)

▪ LN = Logical Node

▪ GGIO = Generic Process I/O

▪ PSCH = Protection Scheme (blocking, permissive, direct)

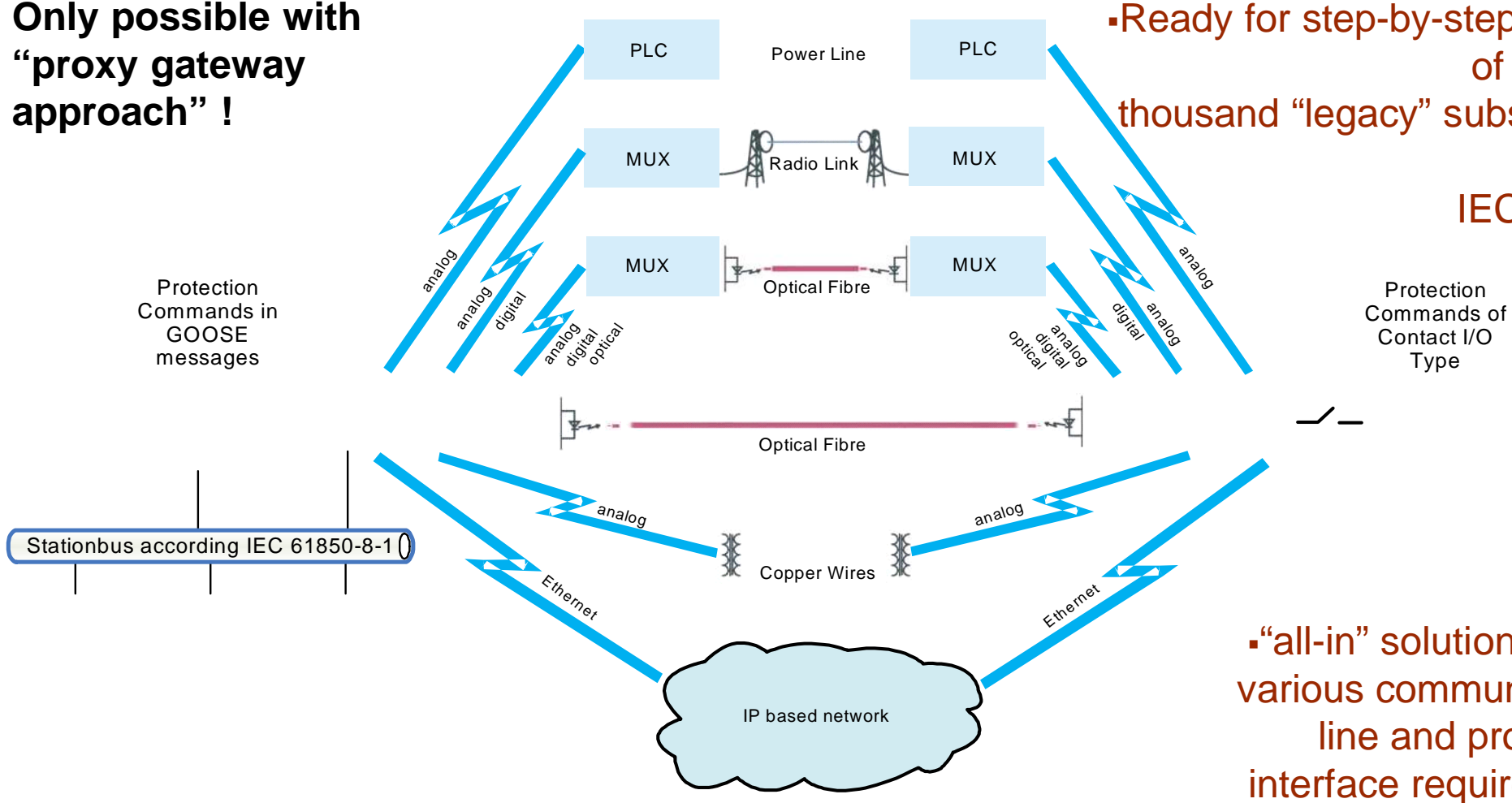
▪ RBRF = Breaker Failure

Evolution for future

Interconnection of IEC 61850 substation with “legacy” substation

Only possible with
“proxy gateway
approach” !

▪ Ready for step-by-step retrofit
of several
thousand “legacy” substations
with
IEC 61850



▪ “all-in” solution for the
various communication
line and protection
interface requirements

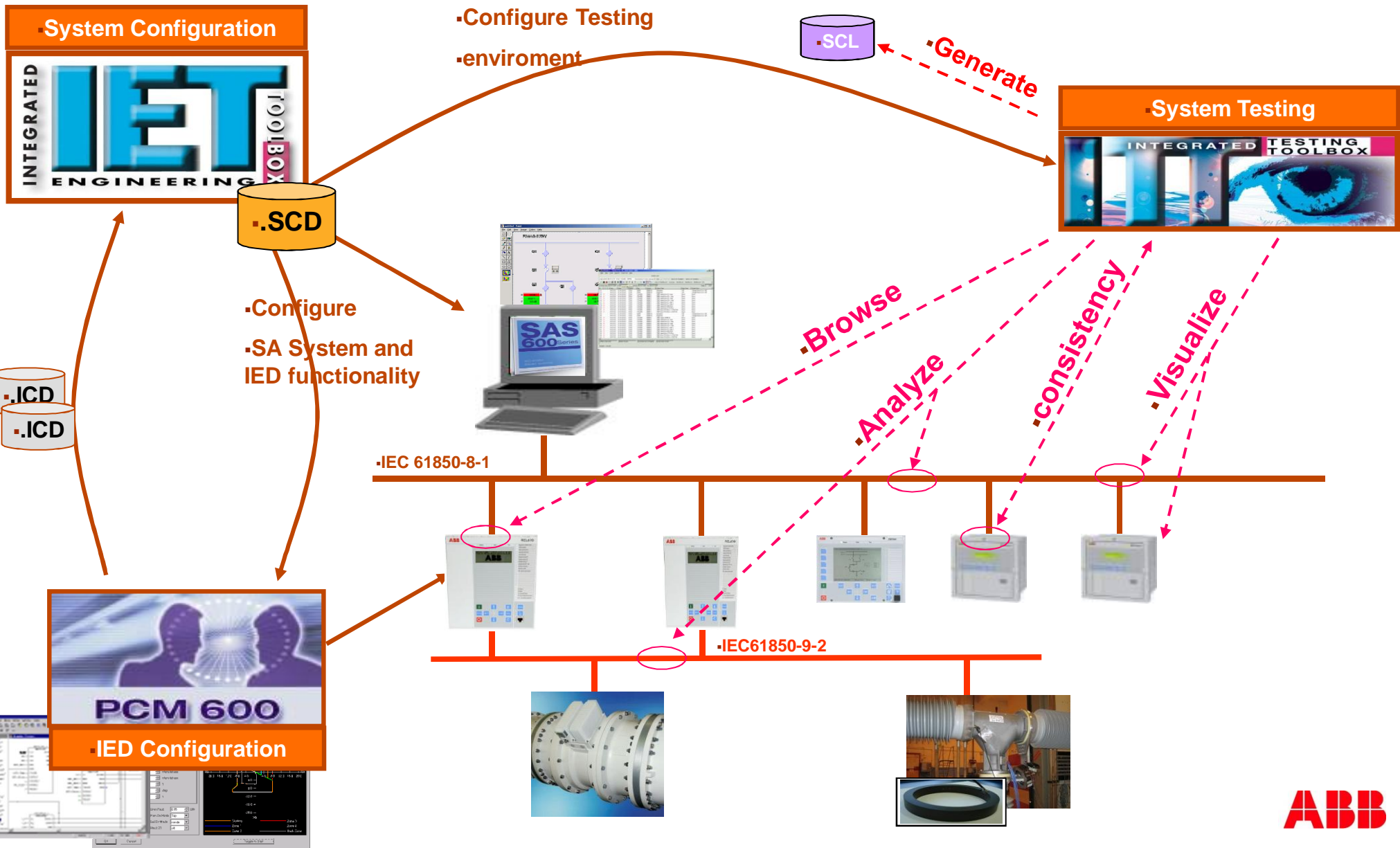
Evolution of Process bus

The next step to digital substation

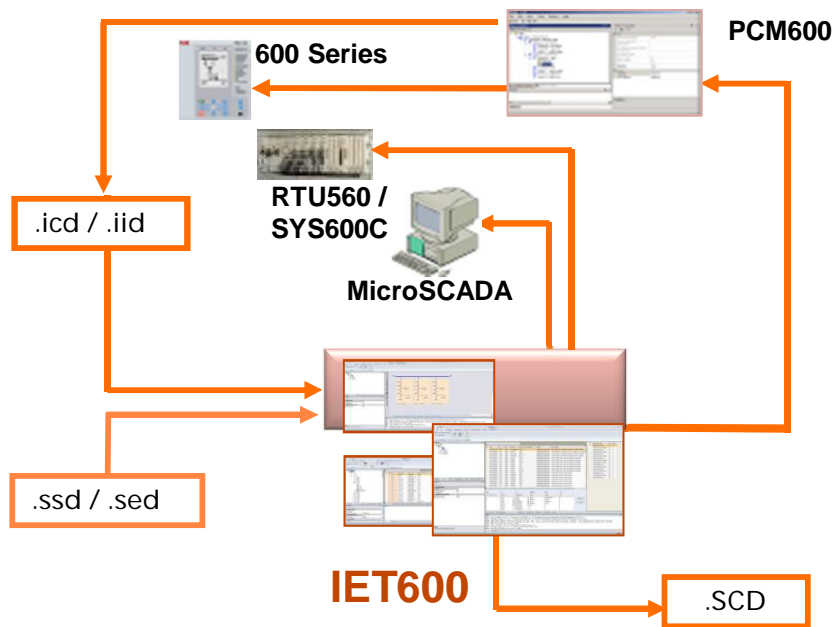


- Make process bus available for any convention instrument transformer
- Combine newest NCIT technology with Conventional Instrument Transformer
- Scalable and modular I/O platform for process level installations
- Process bus systems can reduce the need for preventive maintenance
 - Moving electronics closer to the primary system increases the supervised area between station and bay level
 - Detailed health information from IEDs and MUs allow for fast remedial actions
 - Advanced tools for comprehensive testing

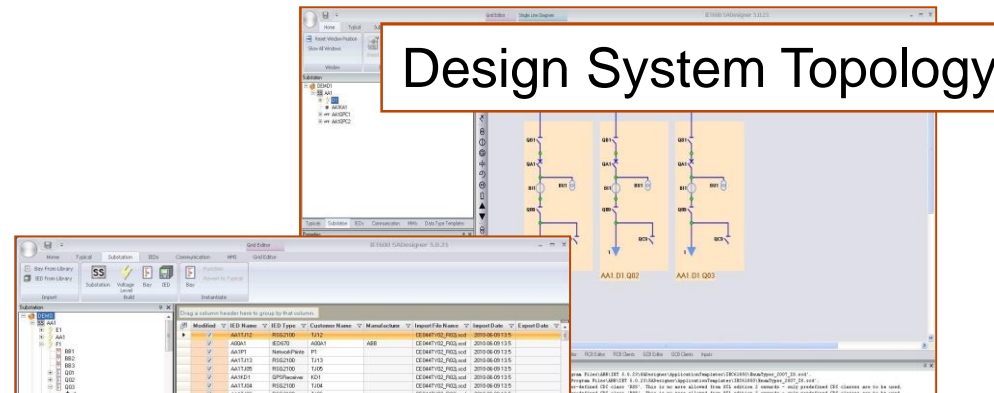
Integration in Engineering & Testing Process



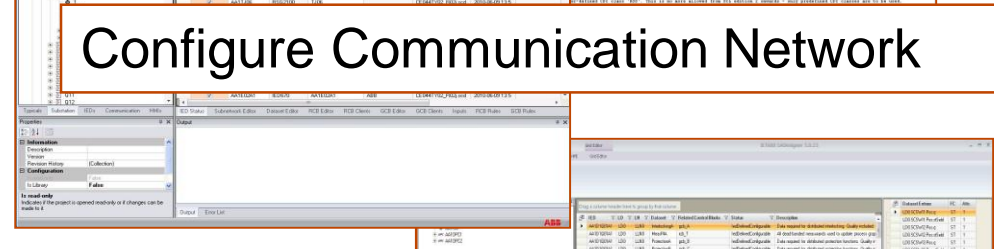
IET600 – Integrated Engineering Tool



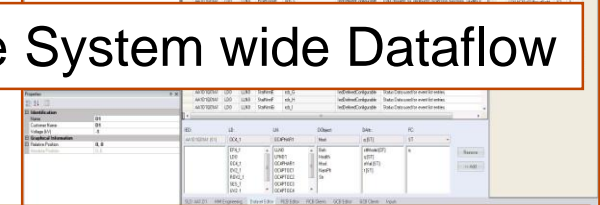
Design System Topology



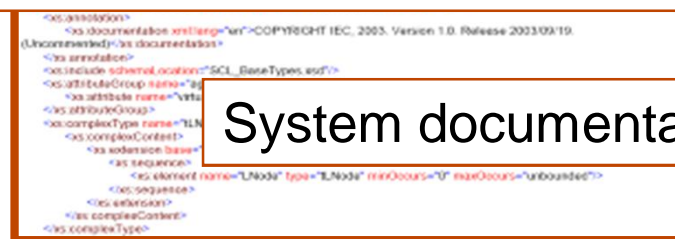
Configure Communication Network



Configure System wide Dataflow

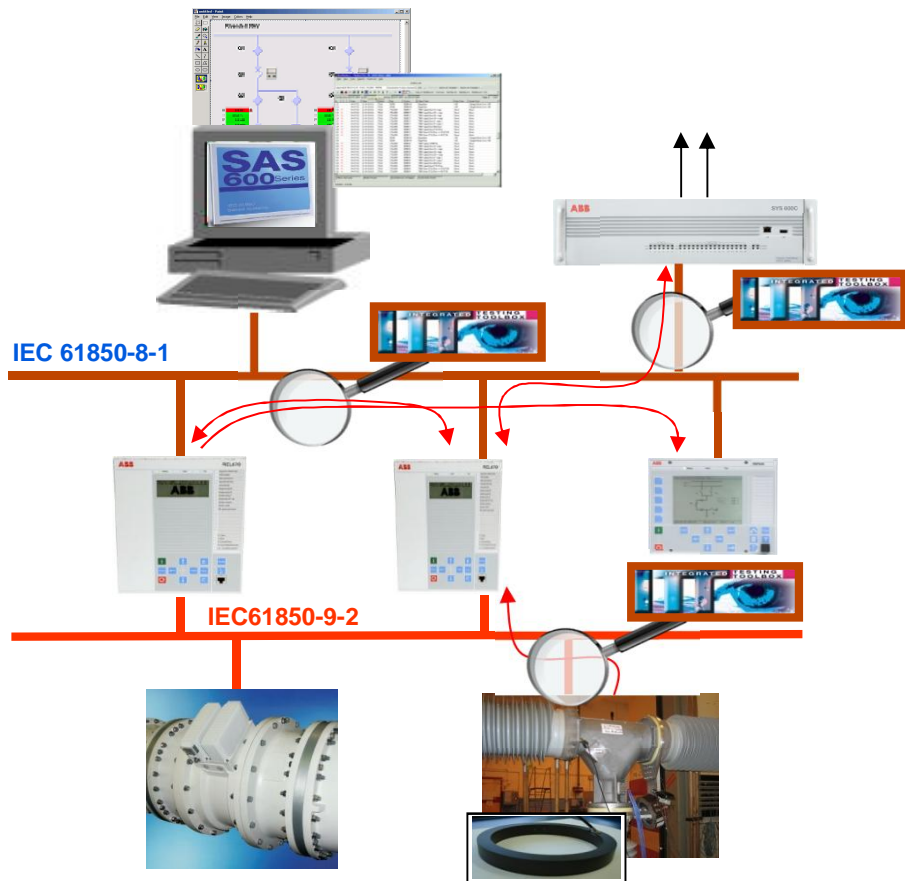


Signal engineering for System & Gateway



System documentation

ITT600 SA Explorer – Analysis & Debug Tool



```

MMS PDU: MMSpdu CHOICE{
  MMS Write entries
  Invoke ID : 2062
  Domain ID : AA1D1Q10A1C1
  Item ID : QA1_1CSW11.CO.Pos.SB0w
  Command Type : Select with value
  ctfVal : True
  Originator: orCat : 2 = station_control
  Originator: ordent : ABB
  ctfNum : 7
  Control Time Stamp: T : 2005-10-20 16:05:05.071000
  Test : False
  Check : 11 = synchrocheck, interlock_check
    
```

```

MMS PDU: MMSpdu CHOICE{
  confirmed-RequestPDU Confirmed-RequestPDU{
    invokeID = 2062
    service ConfirmedServiceRequest{
      write Write-Request{
        variableAccessSpecification VariableAccessSpecification{
          listOfVariable SEQUENCE_OF{
            ...
          }
        }
      }
    }
  }
}
    
```

Decode protocols

Visualize configurations

Assess and monitor Applications

| IEDName | Status | Description | Check | Configuration/Matches |
|-------------|--------|-------------------|-------|-----------------------|
| AA1OPC3 | ✖ | OPC Server | ✔ | Offline |
| AA1D1Q08A1 | ✖ | REx67010 | ✔ | Offline |
| AA1D1Q05A1 | ✖ | REx67010 | ✔ | Offline |
| AA1OPC1 | ✖ | OPC Server | ✔ | Offline |
| AA1Sntp1 | ✖ | GPS Receiver Sntp | ✔ | Offline |
| AA1D1Q01A1 | ✖ | REx67010 | ✔ | Offline |
| AA1Sntp2 | ✖ | GPS Receiver Sntp | ✔ | Offline |
| AA1TH1 | ✖ | | | |
| AA1D1Q10FP2 | ✖ | | | |
| AA1D1Q10FP1 | ✖ | | | |
| REB500 | ✖ | | | |
| AA1D1Q09A1 | ✔ | Bay Control Unit | ✔ | 0 |
| AA1D1Q10A1 | ✔ | Bay Control Unit | ✔ | 0 |

Check Consistency





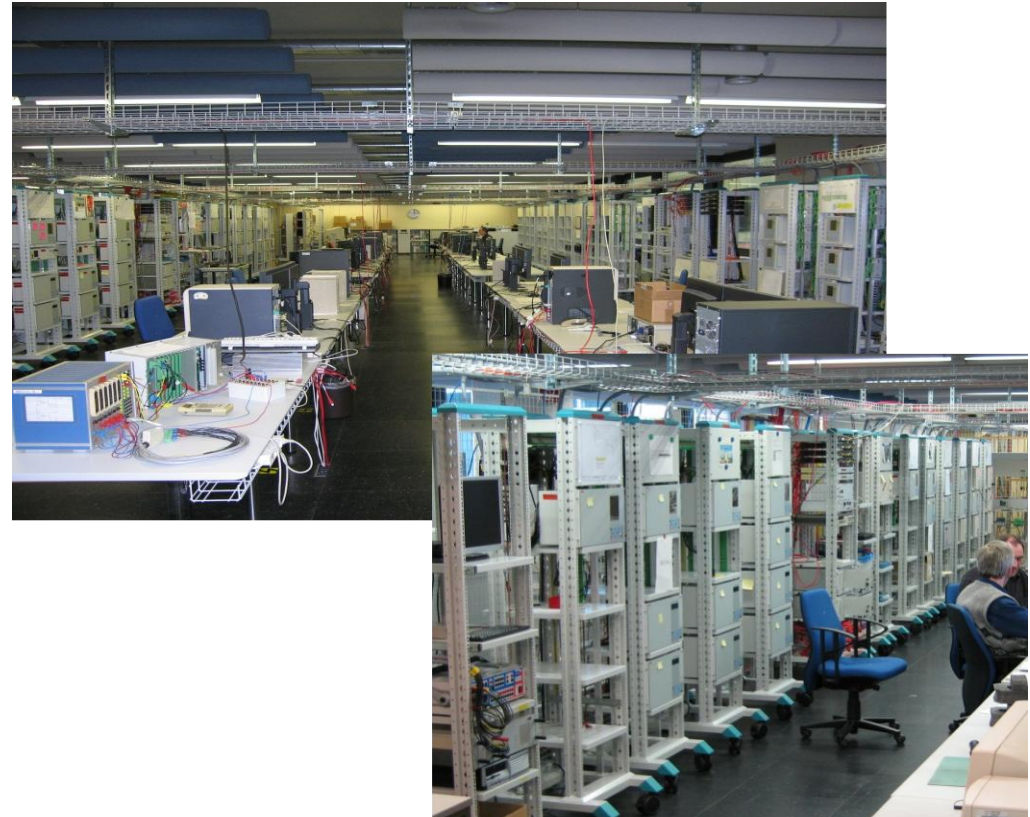
Summary

ABB Quality Assurance for IEC 61850 Technology System Verification Center, qualified by UCA



We are pleased to announce that the UCA International Users Group has qualified ABB Switzerland, Ltd to perform IEC 61850 conformance testing in accordance with the Users Group Testing Quality Assurance Program.

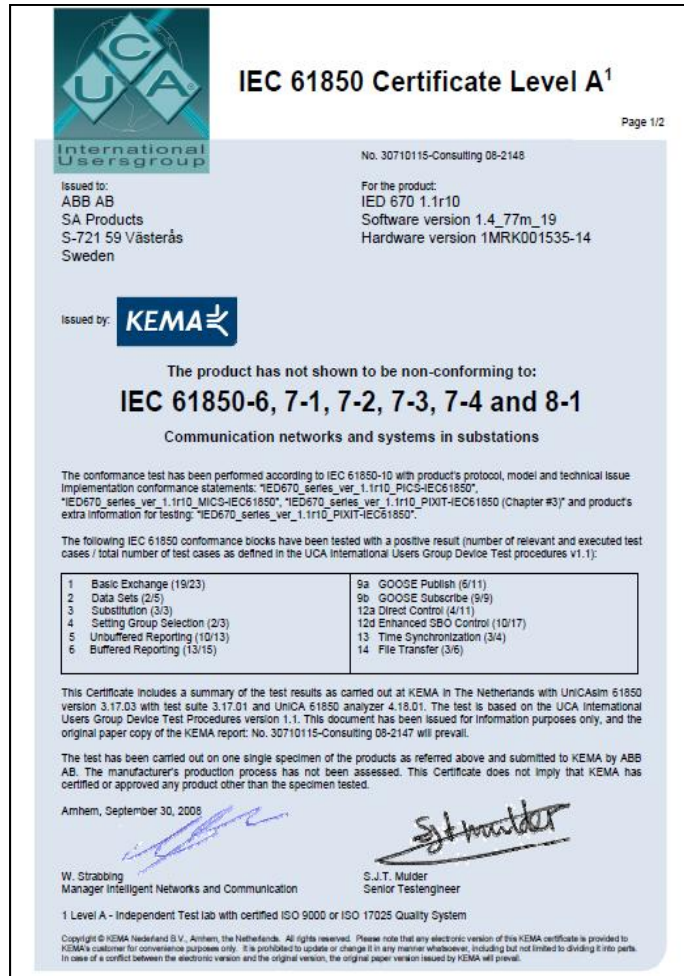
Our thanks to ABB Switzerland for preparing their Test Center and agreeing to participate in the UCA International Users Group Test Quality Assurance Program.



ABB's System Verification Center is officially entitled by the UCA International Users Group to **certify the IEC 61850 conformity of products** and attach the Users Group Label to them

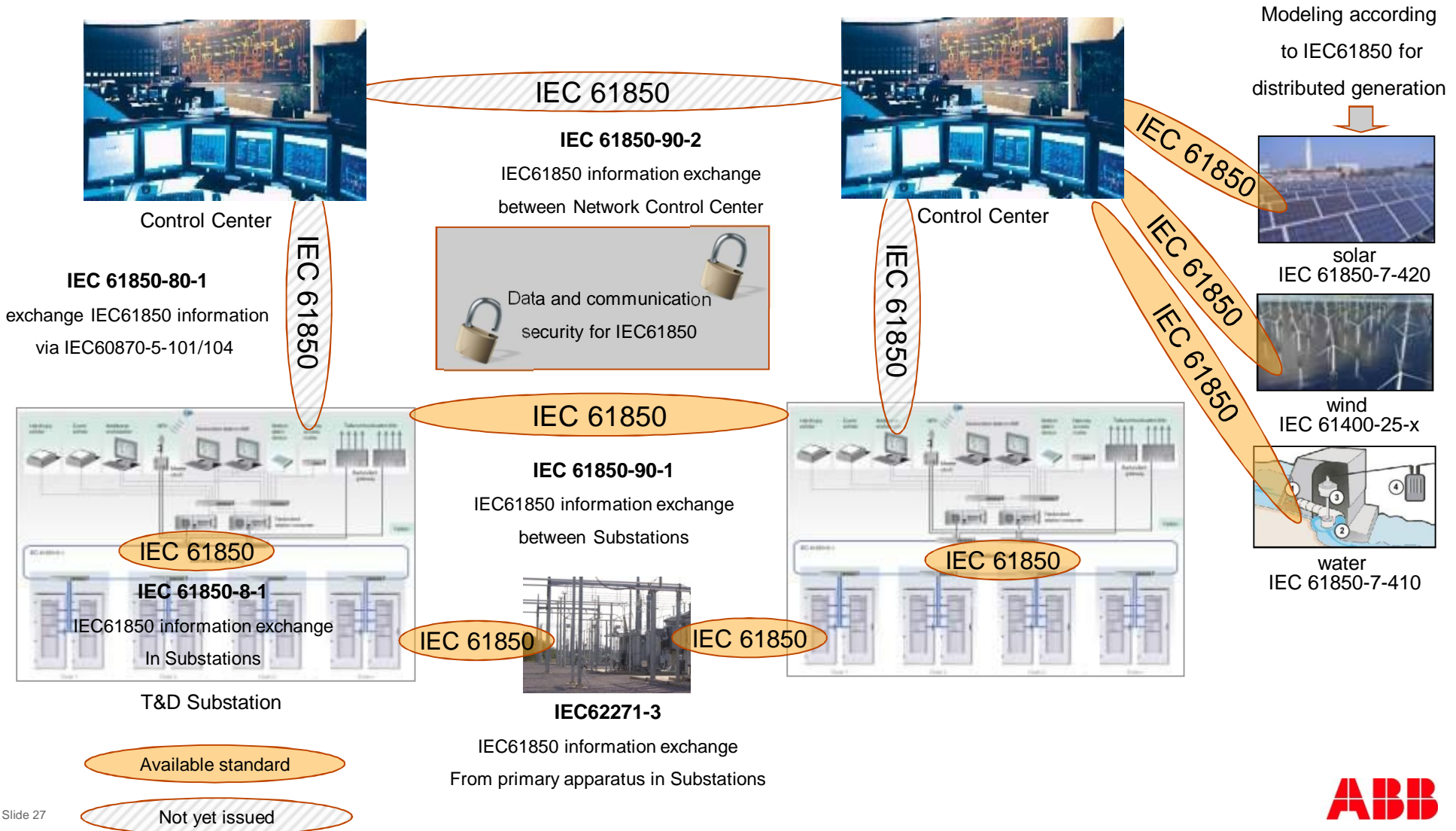
Certification from KEMA

Ensure Integration and Interoperability for customer



- IEC61850 device certification
 - 302 devices (IEC61850-8-1)
 - 3 Merging Units (IEC61850-9-2LE)

Future: IEC 61850 Network Extending from LAN into the WAN



Power and productivity
for a better world™



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