



IEC 61850 standard update

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IEC 61850 Europe Conference
Amsterdam

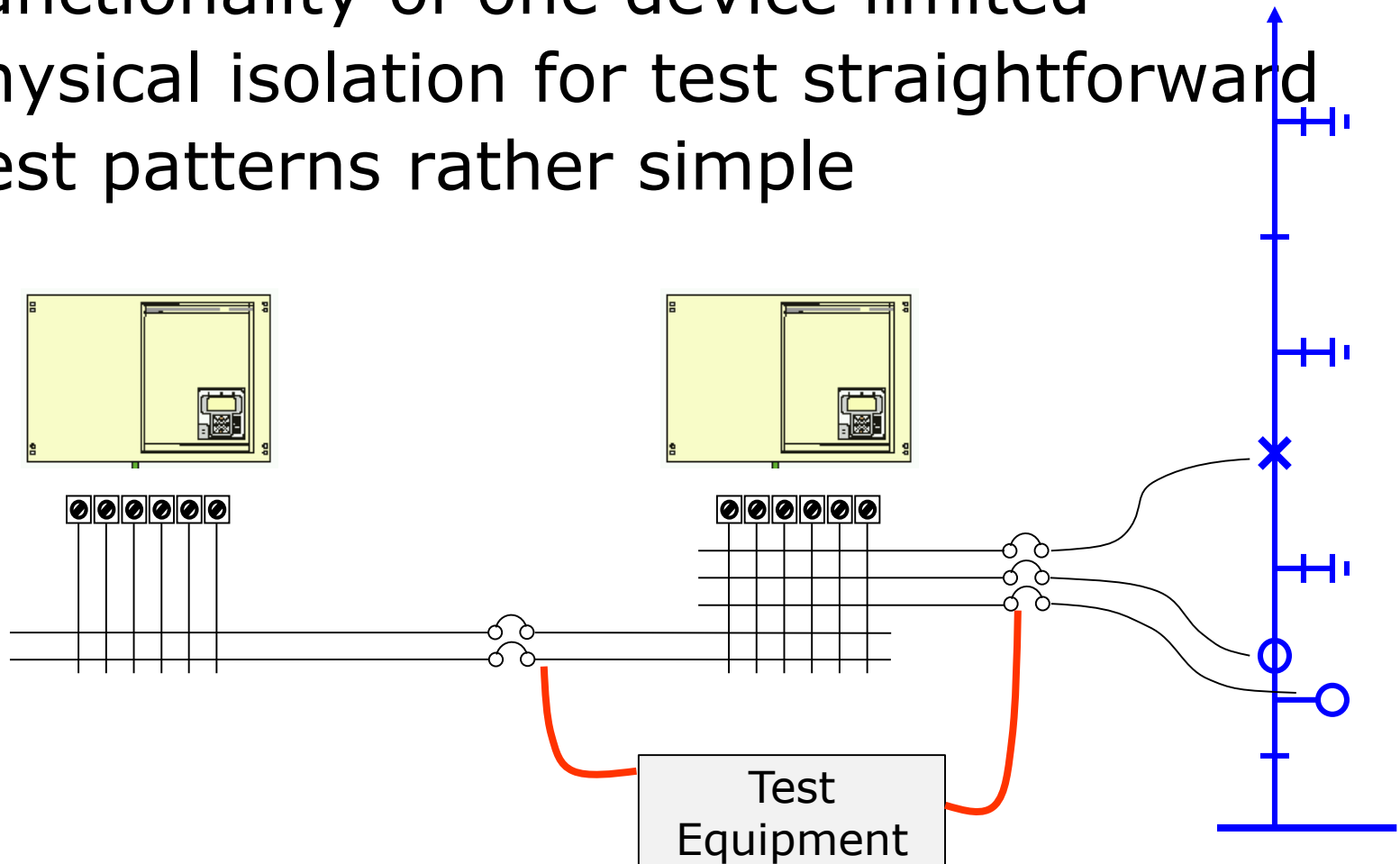
October 18 – 20, 2016

Content

- Improvements helping the implementation
- Status of Edition 2.1
- Systems using mixed configurations
- Updates on new domains

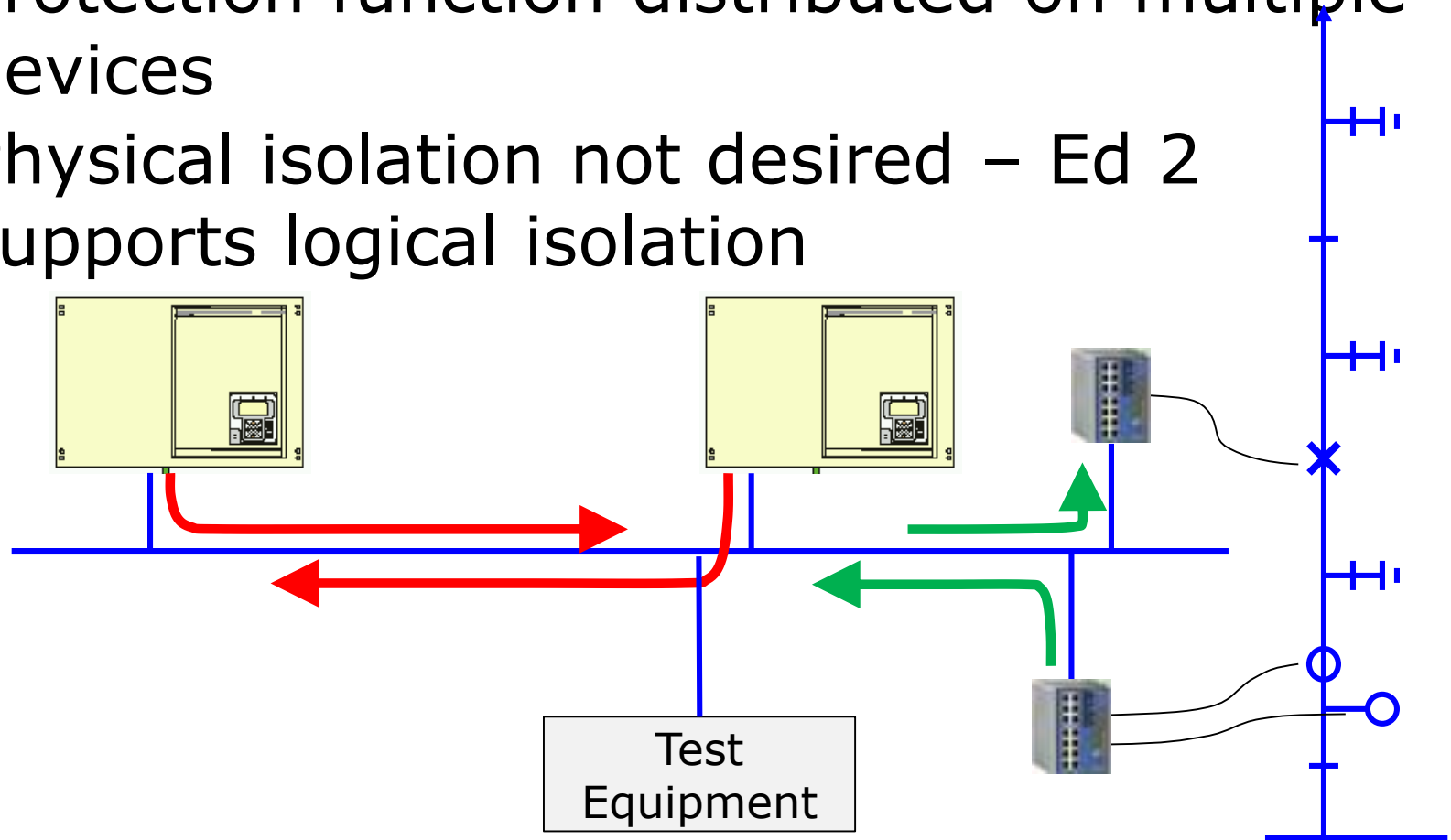
Testing in a life scenario

- IEDs are stand alone devices
- Functionality of one device limited
- Physical isolation for test straightforward
- Test patterns rather simple



Testing with IEC 61850 process bus

- No wired outputs from relay
- Protection function distributed on multiple devices
- Physical isolation not desired – Ed 2 supports logical isolation



Support for isolation and test

Separating test and normal information flow

- LN Mode **test** and test/blocked
- Control service parameter **Test**
- Quality attribute **q.test**

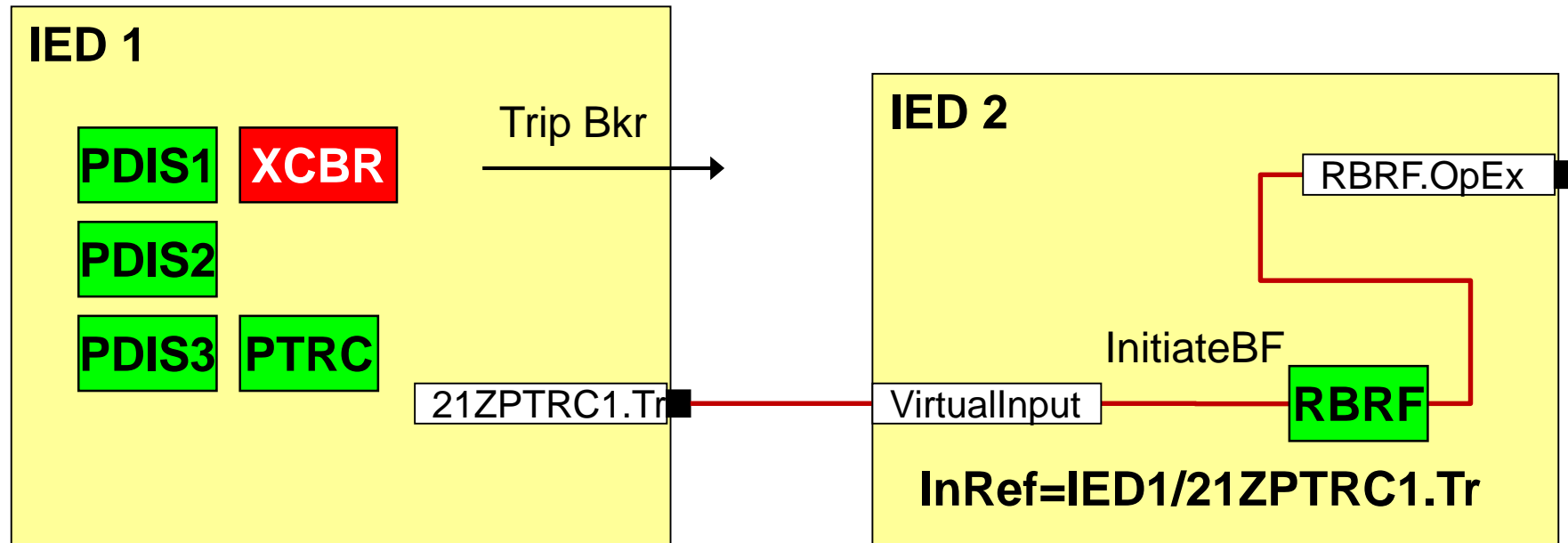
Separating simulated and normal messages

- Parameter **Simulation** in GOOSE and SV message
- DO **Sim** in LN LPHD

Support observation

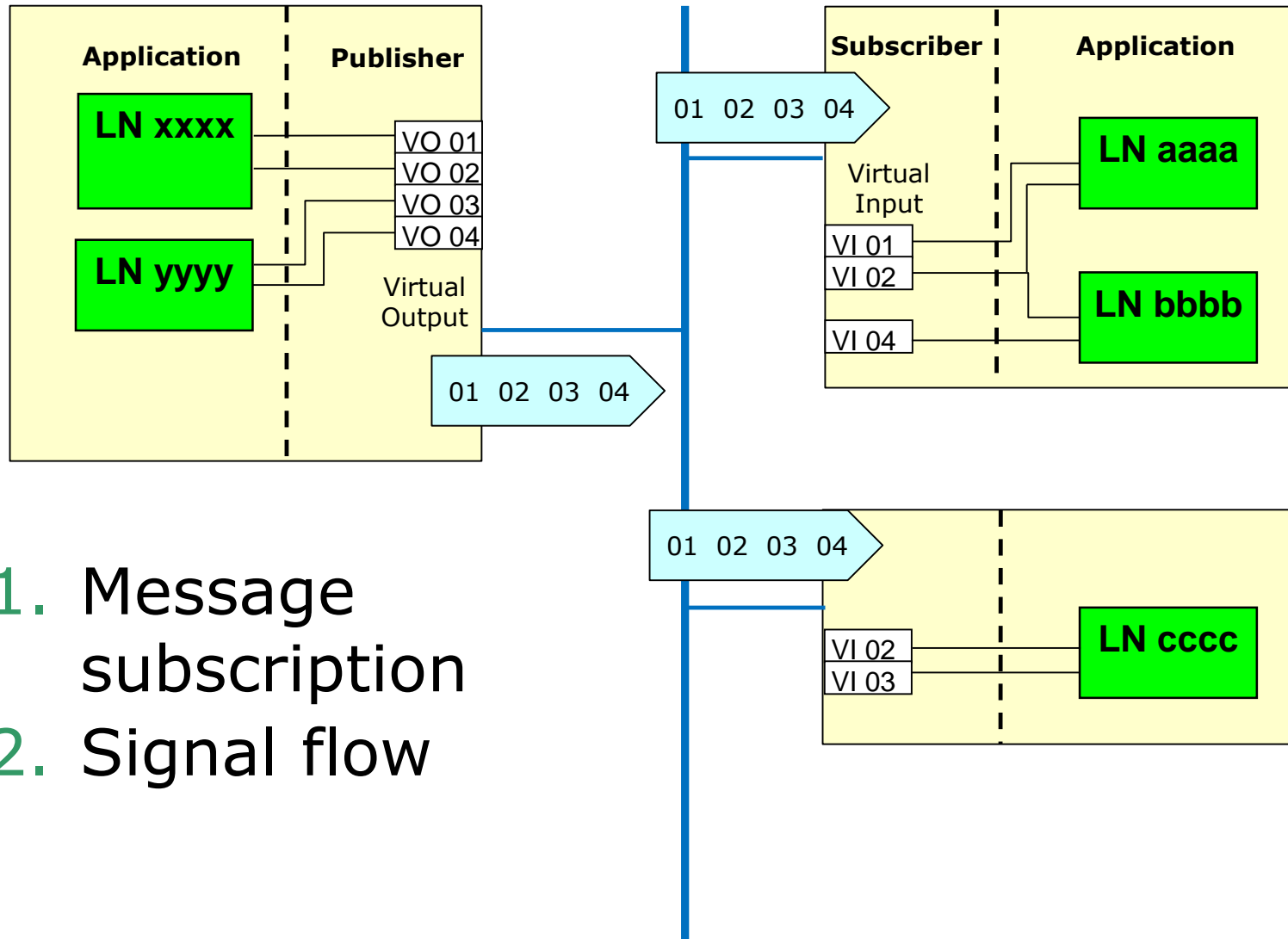
- **Mirroring** of control service requests

Engineering of distributed applications



- GOOSE – wires become virtualized
- Signal flow
 - engineered in SCL (**ExtRef**)
 - described in online data model (**InRef** / Ed2)

Two configuration steps



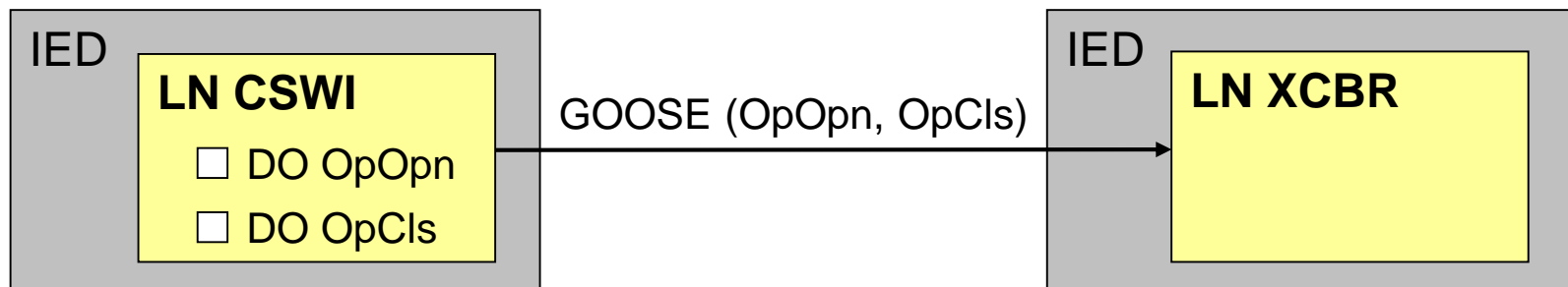
1. Message subscription
2. Signal flow

Declaration of ExtRef

- If an IED accepts inputs anywhere in the model, no declarations are made
- If an IED has limitations, where to receive inputs, the icd/iid file has to declare the inputs (“**later binding**”)

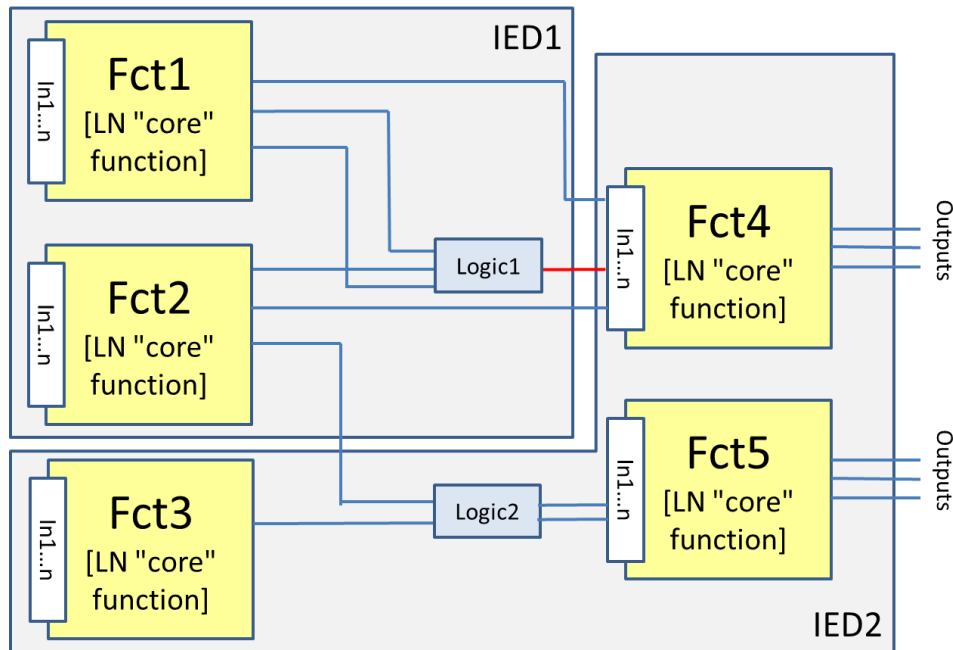
Principle of later binding

- IED declares required inputs by
 - Indicating expected type with a DO name at pDO
 - Indicating semantic of the input in the description



```
<LN lnType="BayControllerQ.QA1XCBR1" prefix="QA1" lnClass="XCBR" inst="1">
  <Inputs>
    <ExtRef intAddr="OpOpn" desc="Breaker Open" pDO="OpOpn" pServT="GOOSE" />
    <ExtRef intAddr="OpCls" desc="Breaker Close" pDO="OpCls" pServT="GOOSE" />
    <ExtRef intAddr="Tr" desc="Trip" pDO="Tr" pServT="GOOSE" />
  </Inputs>
</LN>
```

System design with IEC 61850



- Routing of signals between functional elements
- Apply **logic functions** on signals
- IEC 61850-90-11 will describe methods to expose logic functions in a standardized way

Profile for accurate time synchronization

- **IEC 61850-9-3** has been released in 2016
- Is a joint standard with IEEE replacing former IEEE C37.238
- Is a key technology for process bus / sampled value transmission based on IEC 61850-9-2
 - Allows **accurate (+/- 1 μsec) synchronization** over the Ethernet network
 - Will be referred by IEC 61850-9-2

Summarizing enhancements of Ed 2

- Consistent and clarified definitions of data objects in part 7-4
- Basic support for Smart Grid Application
- Addresses challenges for efficient engineering raised by major utilities
- Introduces a section in each part of the standard to address backwards compatibility
- Clarifications and corrections by integration of TISSUES

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- **Status of Edition 2.1**
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Status of Ed 2.1

- Standard parts published as Ed 2.1 will be published as amendment
 - A informative document will be published as well reflecting the consolidated version
- Parts 6, 7-2, 7-3, 7-4 and 9-2 have been circulated as CDV
- Parts 4, 5, 7-1 and 10 are as well planned to be revised
- Target release date as IS: Mid/End 2017

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How to handle mixed configurations?

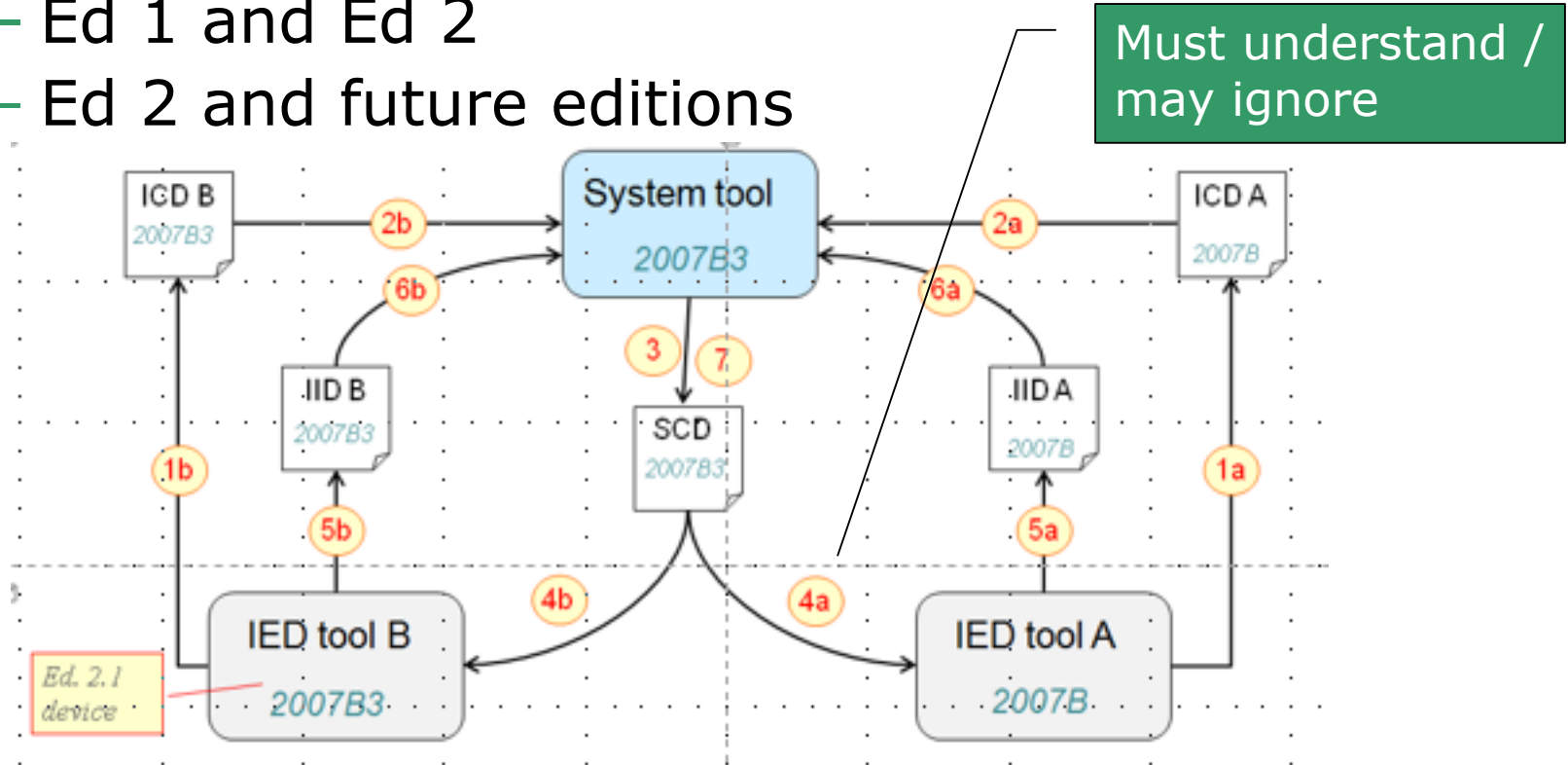
- Systems considered as mixed configurations are those systems where
 - IEDs communicate based on different version of the standard
 - Engineering needs to be done with tools supporting different versions of the standard
- Basic approach
 - Clients need to support the highest version
 - System configuration tool needs to support the highest version

SCL compatibility between versions

- With Ed 2 the concept of **may ignore** / **must understand** was introduced to support forward compatibility
 - If an element marked as “must understand” is not known to the tool, it can not use the parent element
 - Example: With routable GOOSE introduced by IEC 61850-90-5 additional configuration parameters have been added; a tool that does not understand these parameters, may not use that control block
- Between Ed 1 and Ed 2 some specific care needs to be taken – system tool may need to be able to export in downgraded format

Engineering of mixed configurations

- Annex is planned to be added to IEC 61850-6 discussing how to handle configuration of mixed systems
 - Ed 1 and Ed 2
 - Ed 2 and future editions

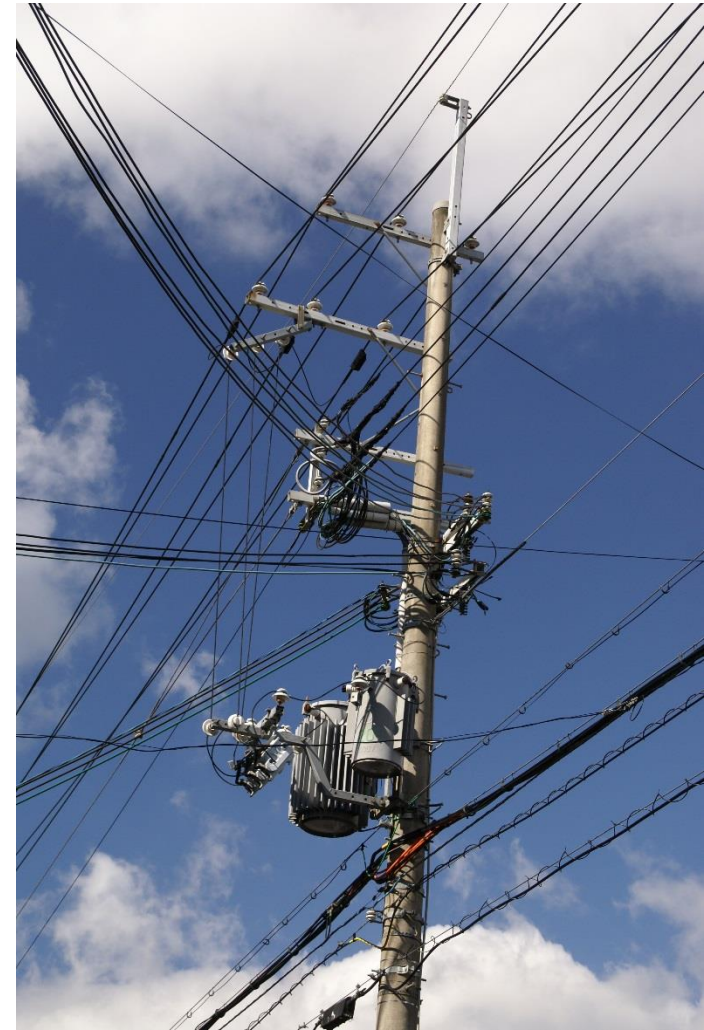


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Distribution Automation

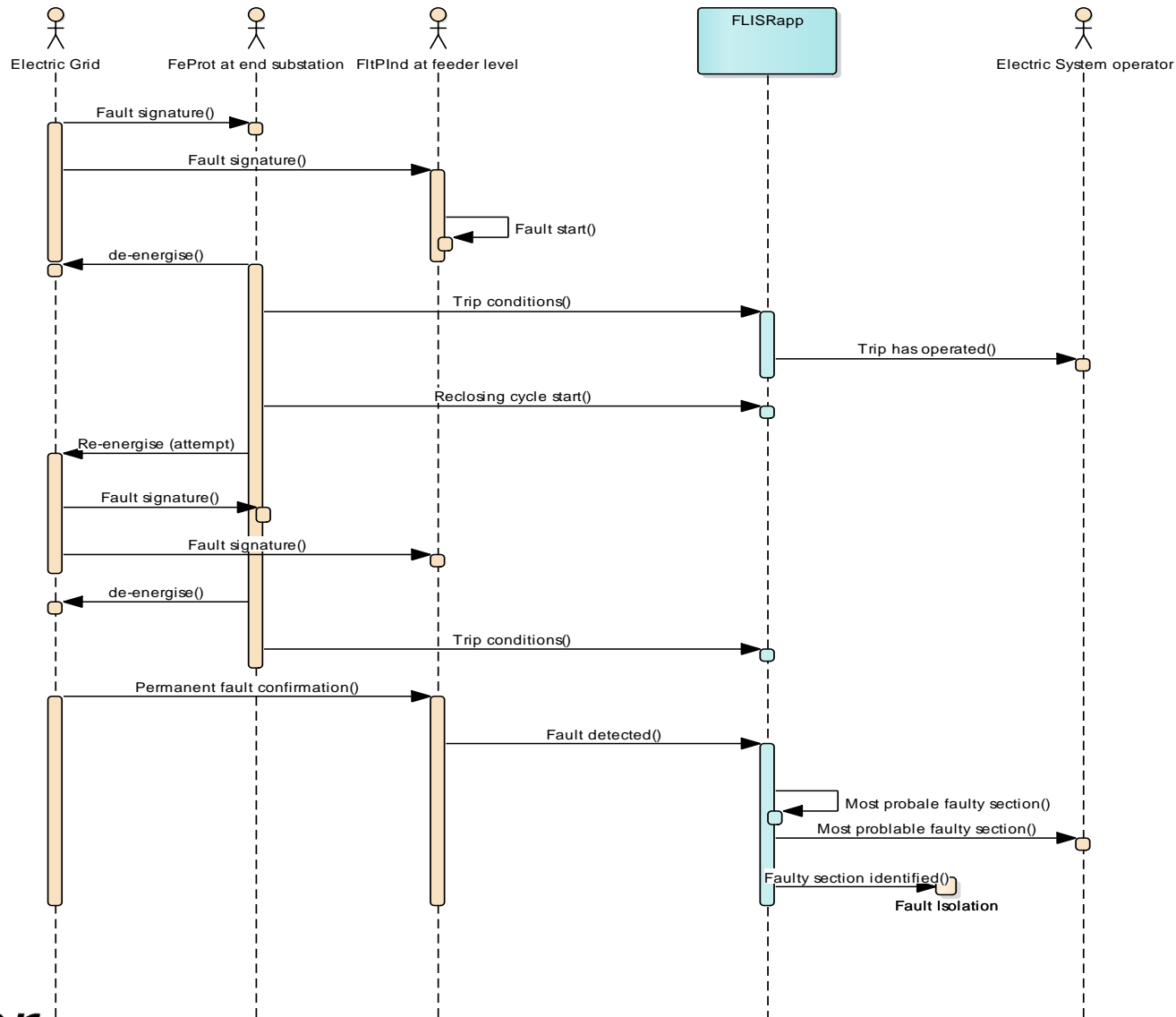
- IEC 61850-90-6: Using IEC 61850 for Distribution Automation
 - Requirements and use cases
 - IEC 61850 information models
 - Communication requirements and services
 - Configuration



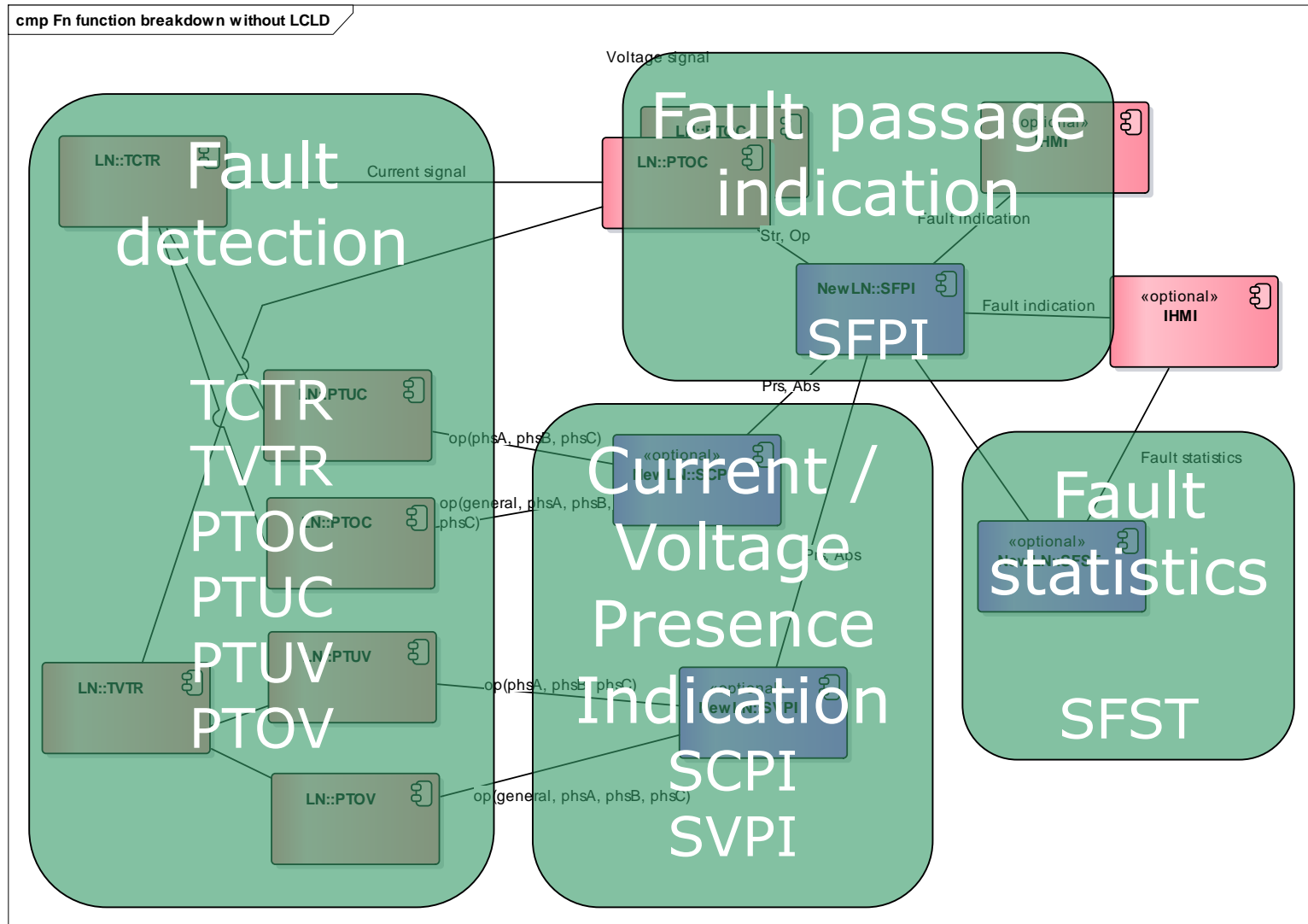
Use cases considered

- Fault location, isolation and restoration (FLISR)
 - Using local control
 - Using centralized control
 - Distributed control
- Voltage and Var control
- Anti-islanding protection based on communication
- Automatic transfer switch
- Fault indication and report
- Monitoring energy flow
- Environment situation awareness

FLISR – Fault identification and location



LN for fault passage indication

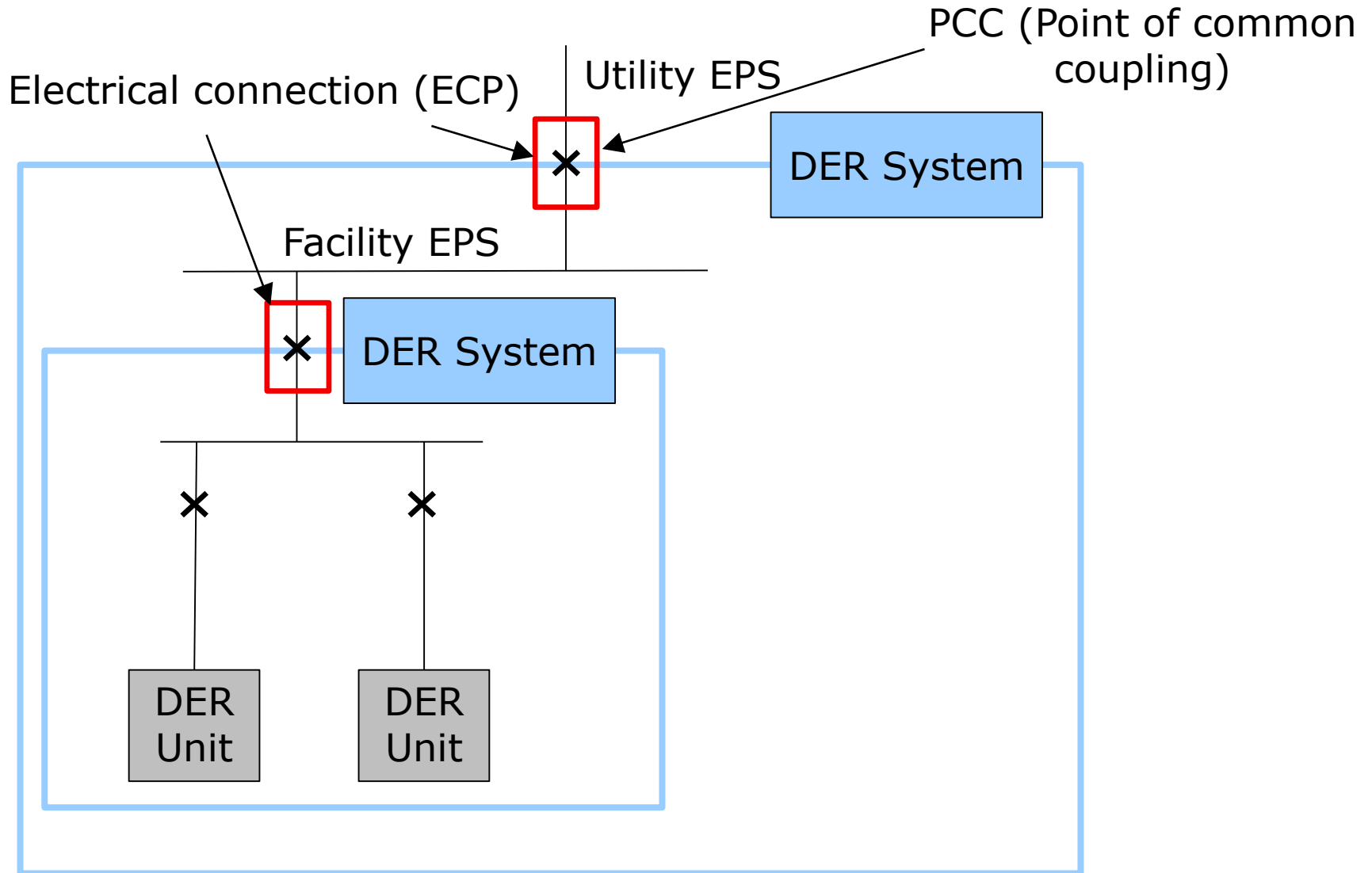


Integrating DER

- IEC 61850-90-15: IEC 61850 based DER Grid Integration
 - Basic concepts
 - Functional requirements
 - IEC 61850 data models



Integration of DER system



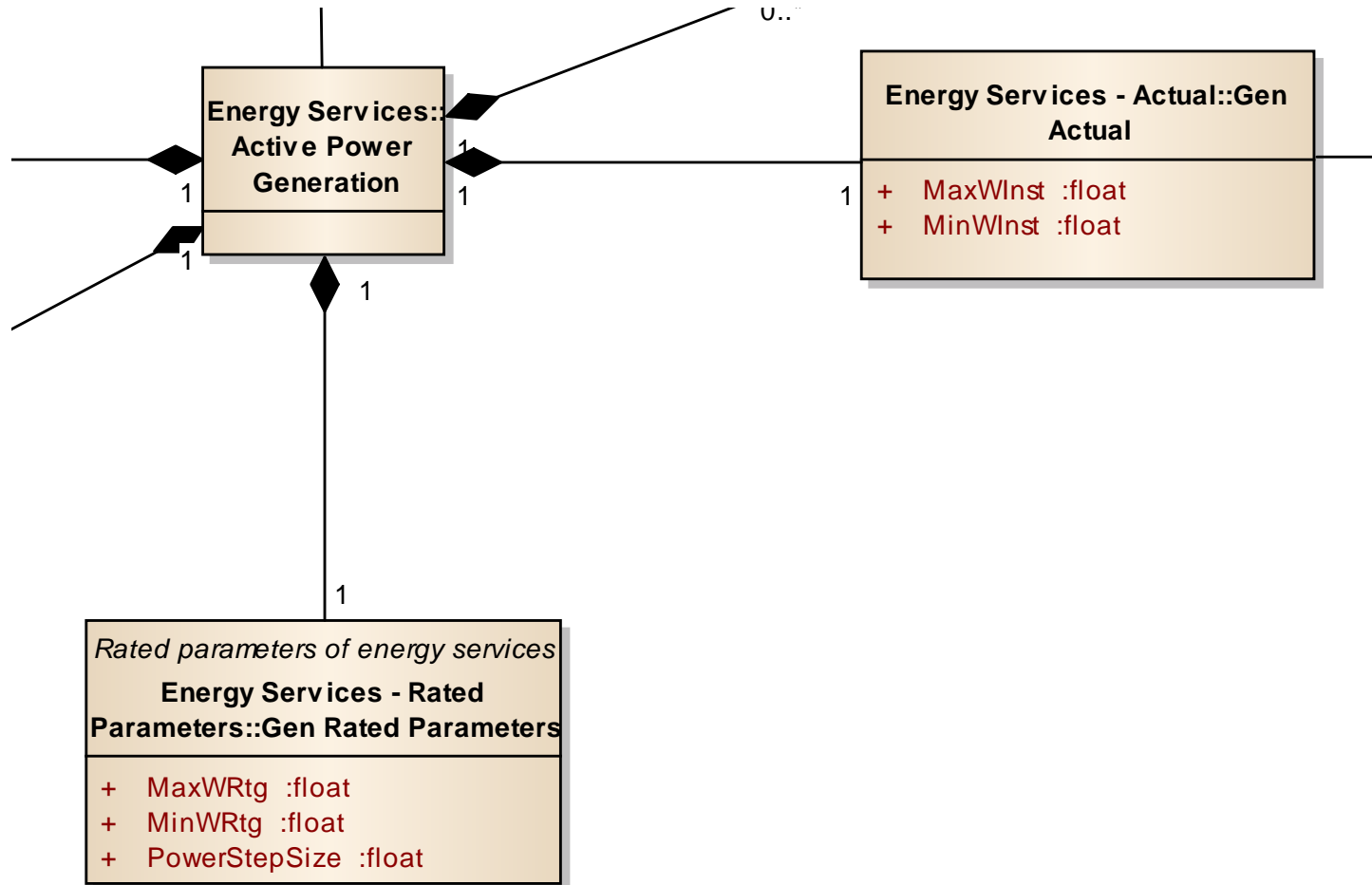
Open System for Energy Services OS4ES

Collaborative project funded by the European Commission

- Aim to provide a solution that closes the current gap between DERs and DSOs, and instead make them cooperate dynamically so that the aggregated DER flexibility provides added value to active electricity network management.
- Based on international standards (IEC 61850, CIM)
- Plug and play using a registry

Example – Active power

... actual and rated values



LN DSPG

```
▲ <LNNodeType id="dspg" InClass="DSPG" iedType="" desc="">  
  <DO name="Beh" type="ENS_Beh" transient= Actual values  
  <DO name="MaxWInst" type="MV" transient="false" desc="">  
  <DO name="MinWInst" type="MV" transient="false" desc="">  
  <DO name="Disp" type="SPG" transient="false" desc="">  
  <DO name="DetTyp" type="ENS_DetTyp" transient="false" desc="">  
  <DO name="WSpt" type="APC" transient="false" desc="">  
  <DO name="MaxWRtg" type="ASG" transient="false" desc="">  
  <DO name="MinWRtg" type="ASG" transient="false" desc="">
```

Rated values

Conclusions

- As a living standard shaping the future of utility automation, IEC 61850 is moving in several directions
 - Improving the efficiency to design and commission substation automation systems
 - ...while still supporting backwards and forwards compatibility to the level required by user of the standard
 - Supporting new areas to implement the smart grid



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