Impact of IEC 61850 Edition 2 on Functional Testing of Protection Systems

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Questions

- What are we doing?
- Why are we doing it?
- How are we doing it?

What are we doing?

- Improving the efficiency of testing of digital substations

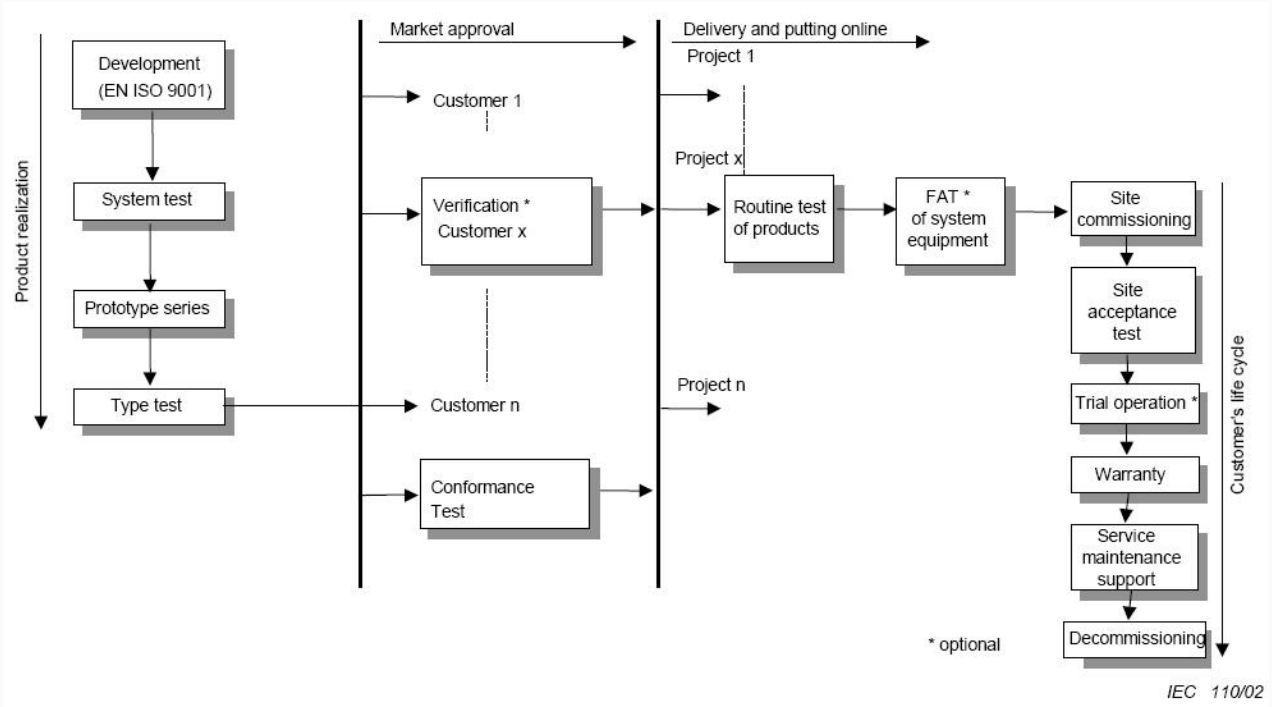
Why are we doing it?

- To improve the reliability of the electric power system
- To reduce the duration of outages
- To improve the efficiency of the use of the time of testing crews
- To improve safety

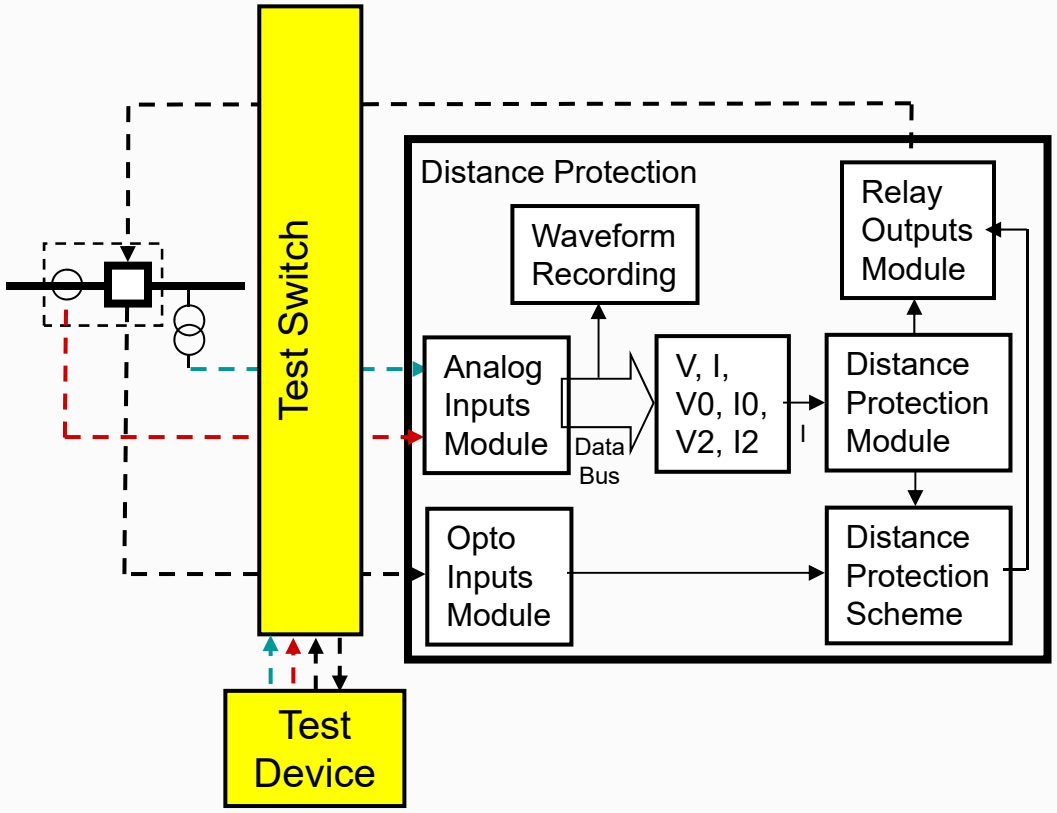
Improving Efficiency

- Efficiency: the extent to which a resource is used in order to effectively achieve an objective
- Minimize the resources being used to perform the testing
- Minimize the impact of the testing on the availability of the power system components and protection

Quality Assurance Process



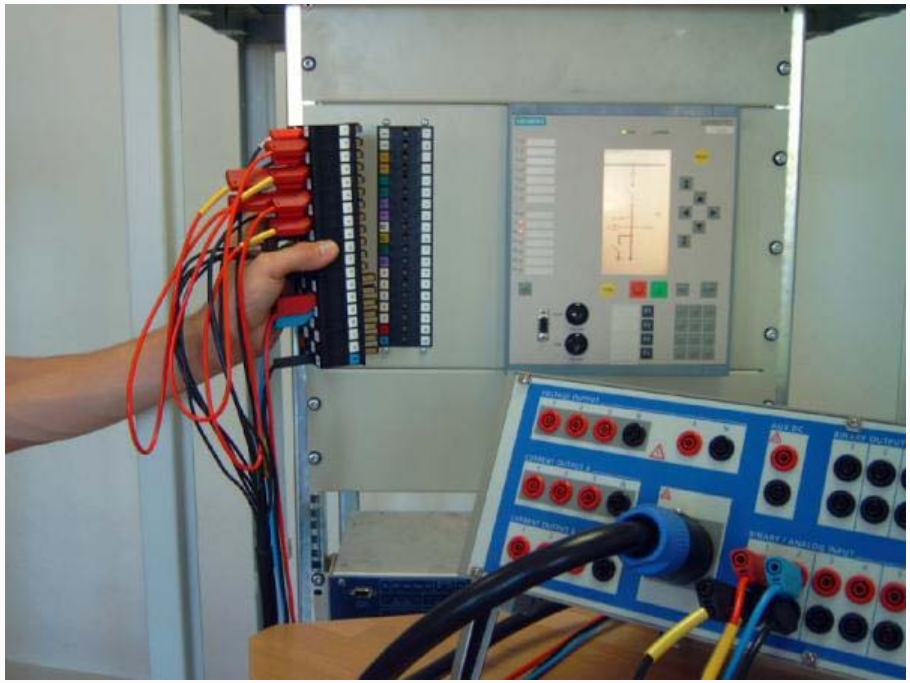
Conventional Protection Testing



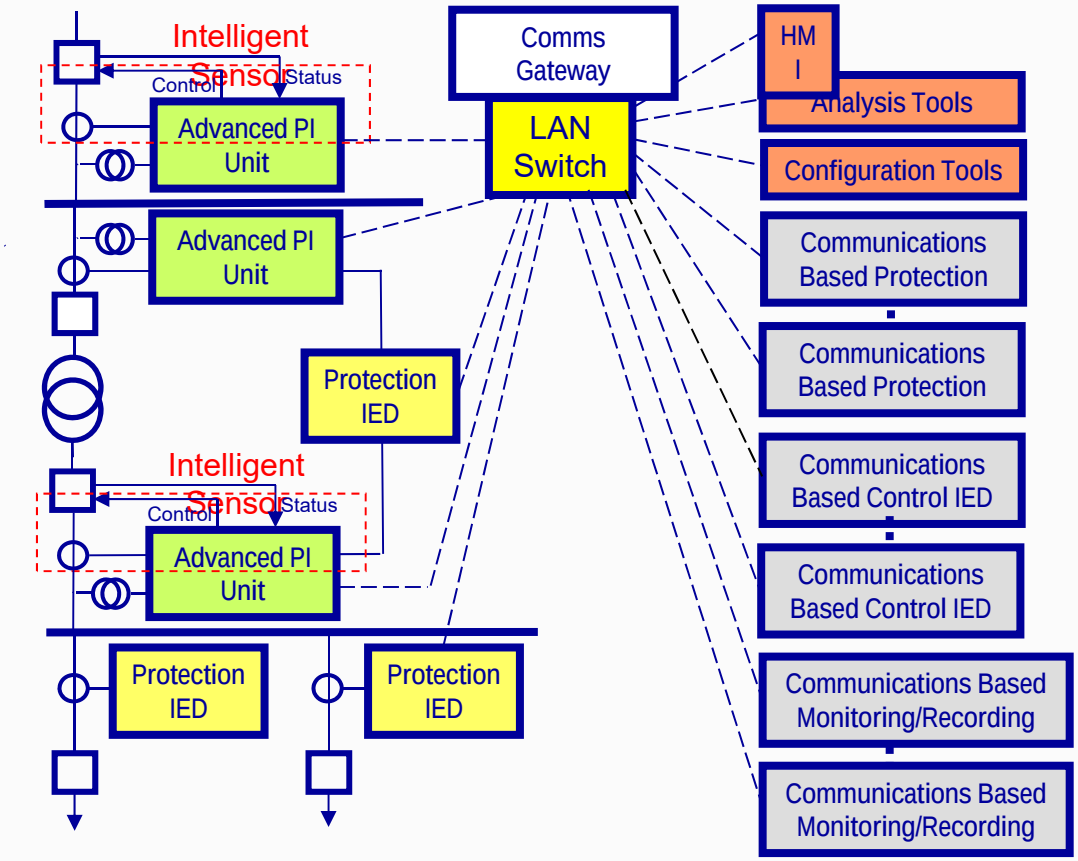
How are we doing it?

It depends!

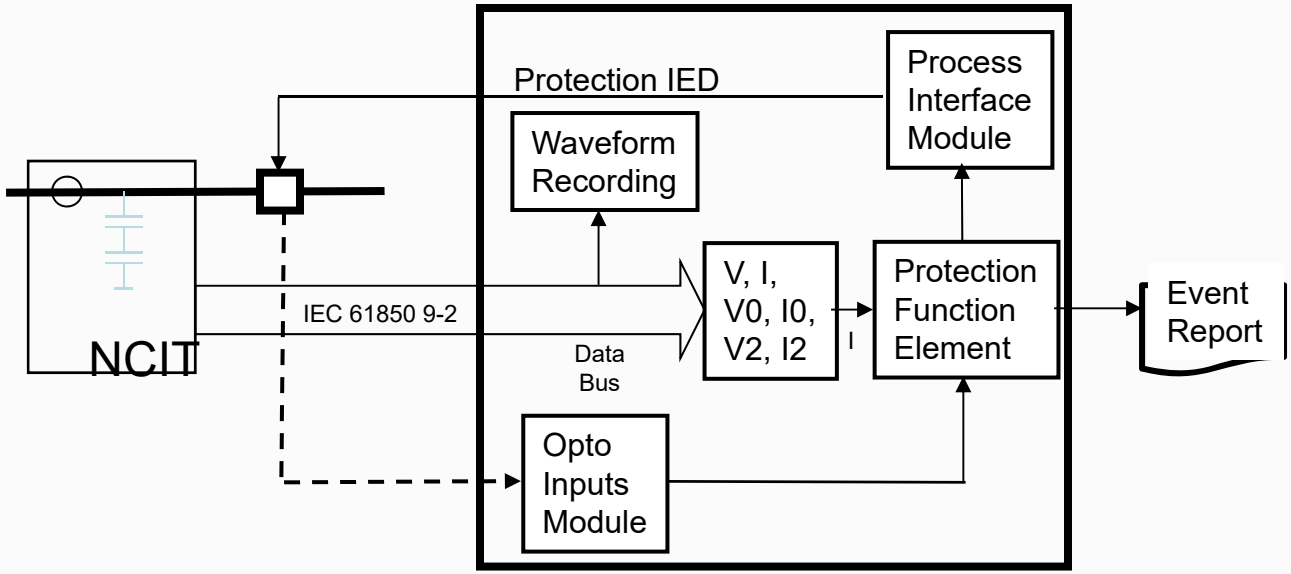
Conventional Isolation



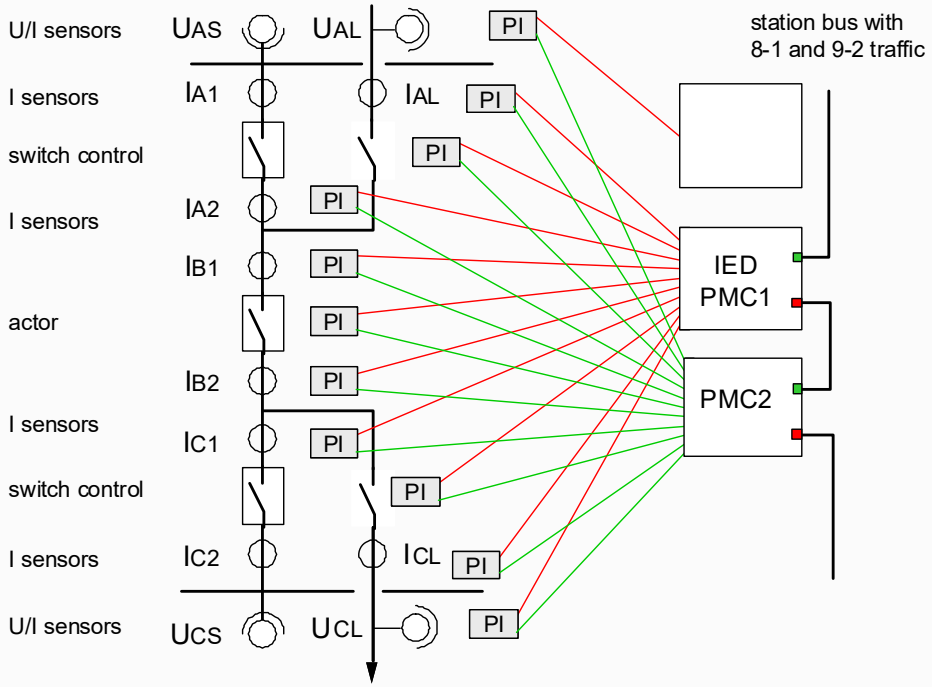
Digital substation



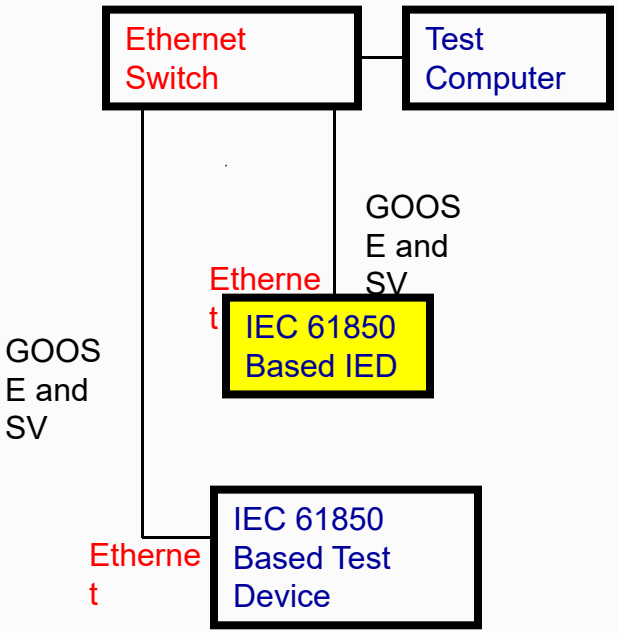
NCIT with embedded MU



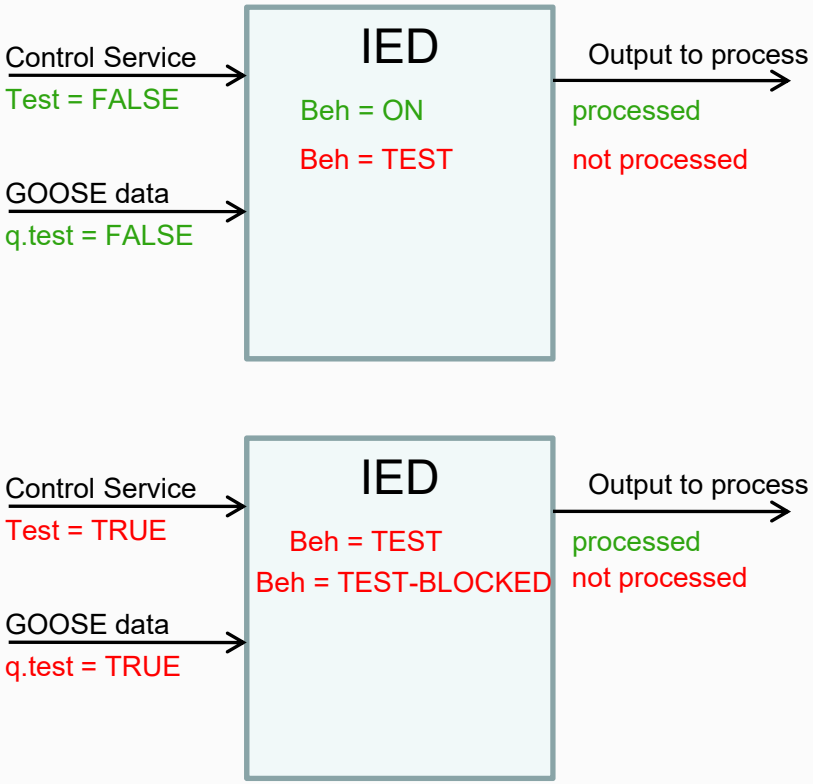
Process Bus interface



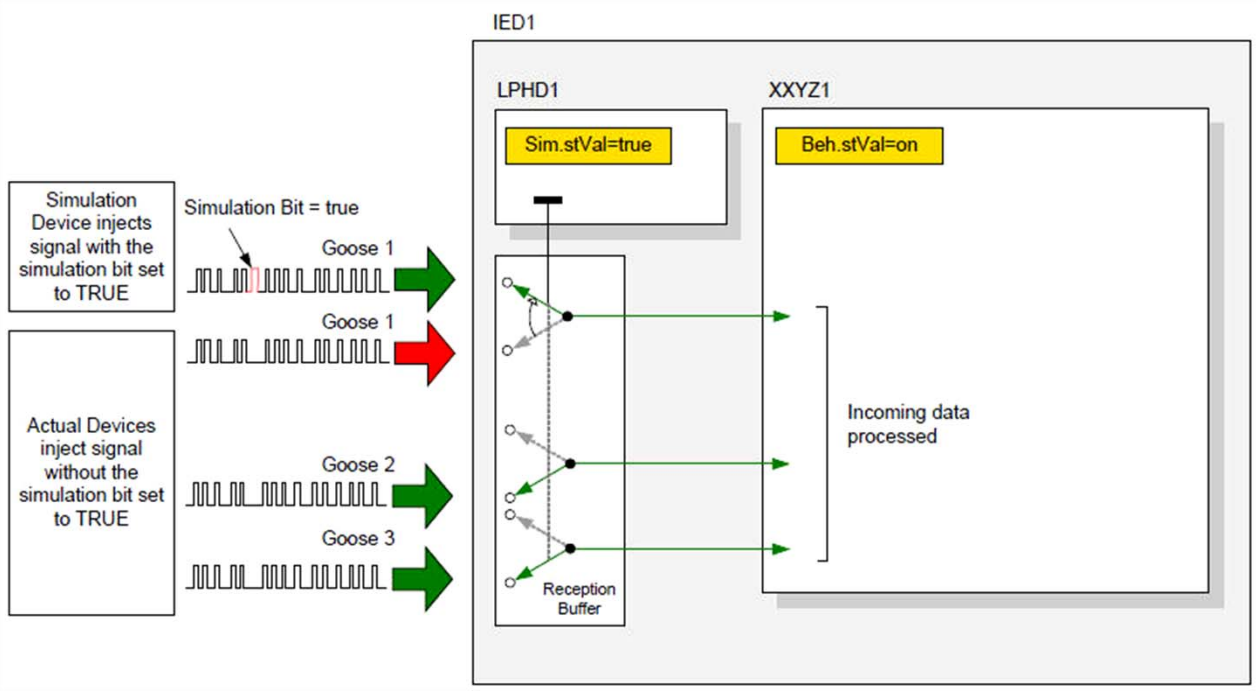
Digital Substation Test Setup



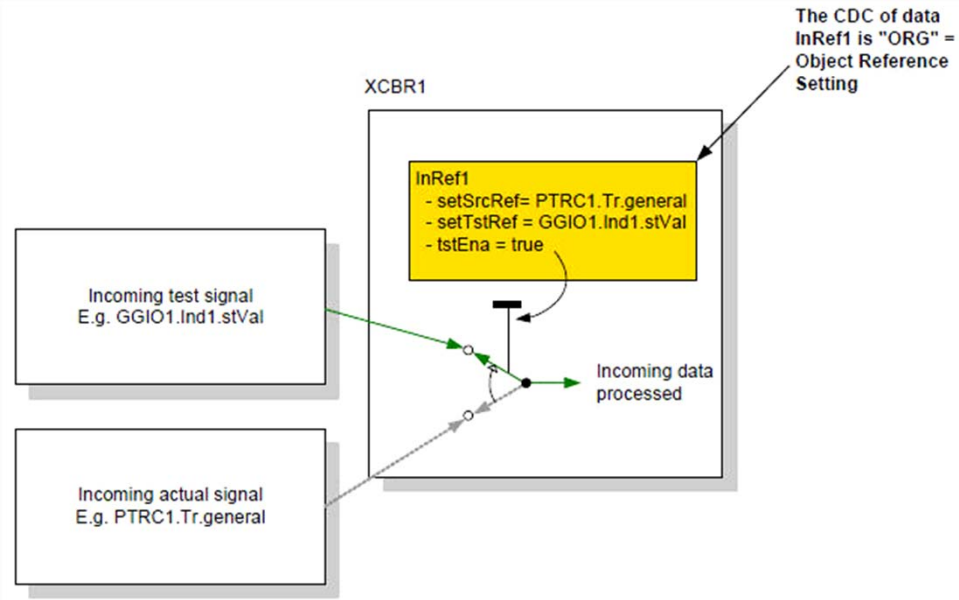
Separating Test and Normal information



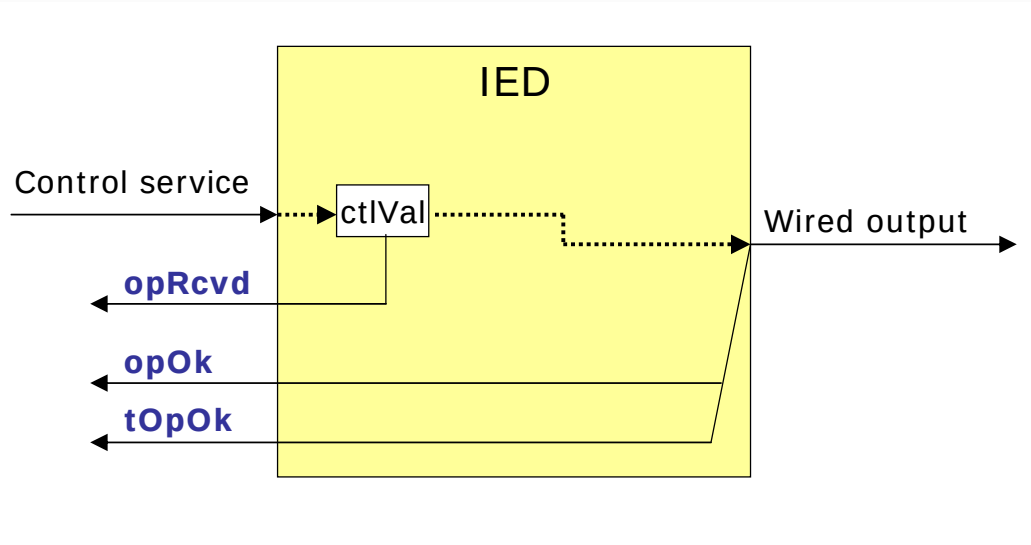
Simulation Bit



Input Reference

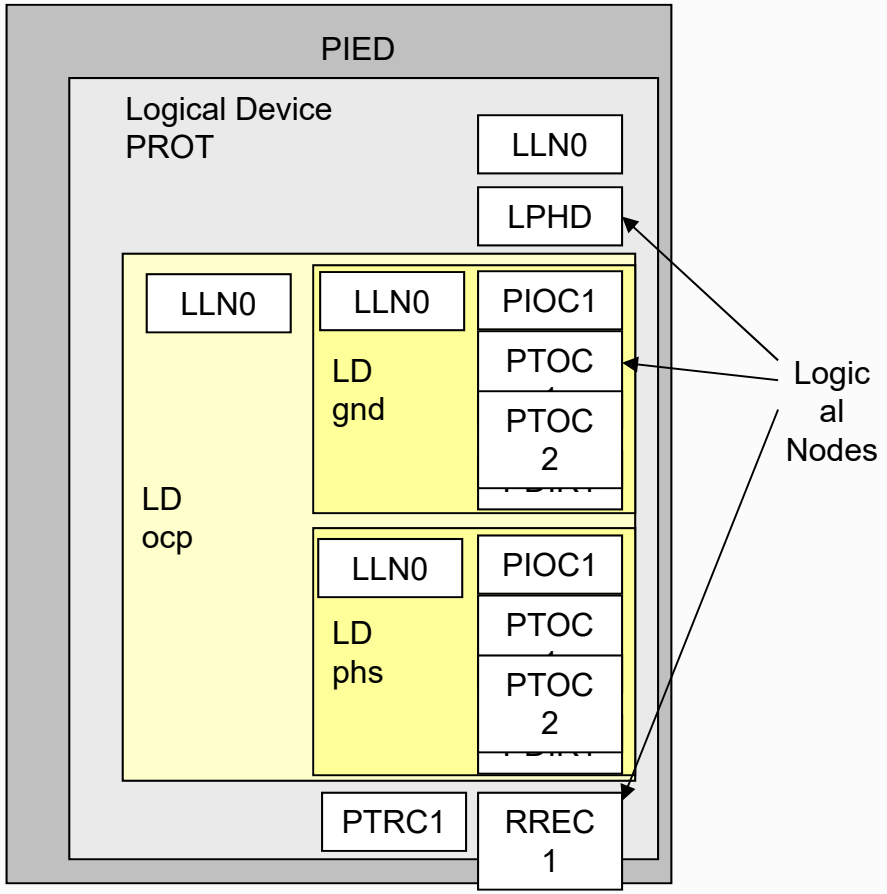


Ed. 2 Mirroring Control Info

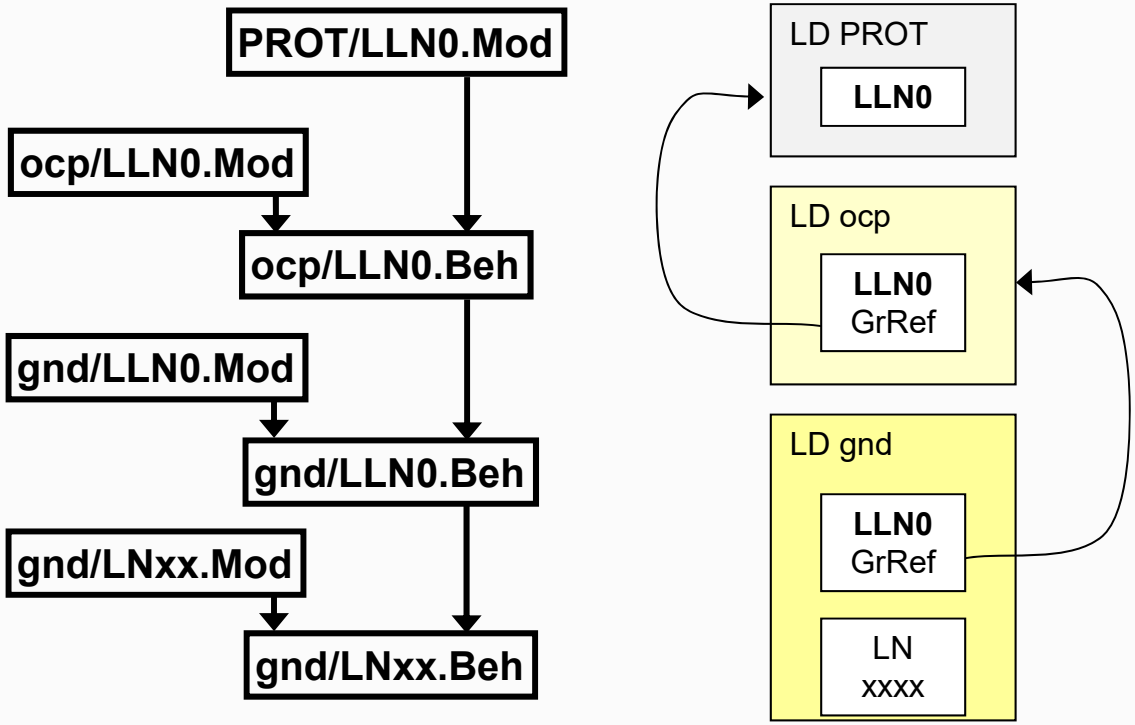


A. Command is sent to Data Object
B. Response is to set the Data Attribute "**opRcvd**"
C. "**opOk**" is set with same timing as wired output
D. "**tOpOk**" has same time stamp as wired output and "**opOk**".
E. The attributes are produced independent of the wired output
F. Wired Output is Not produced if **MOD**=TEST-BLOCKED.

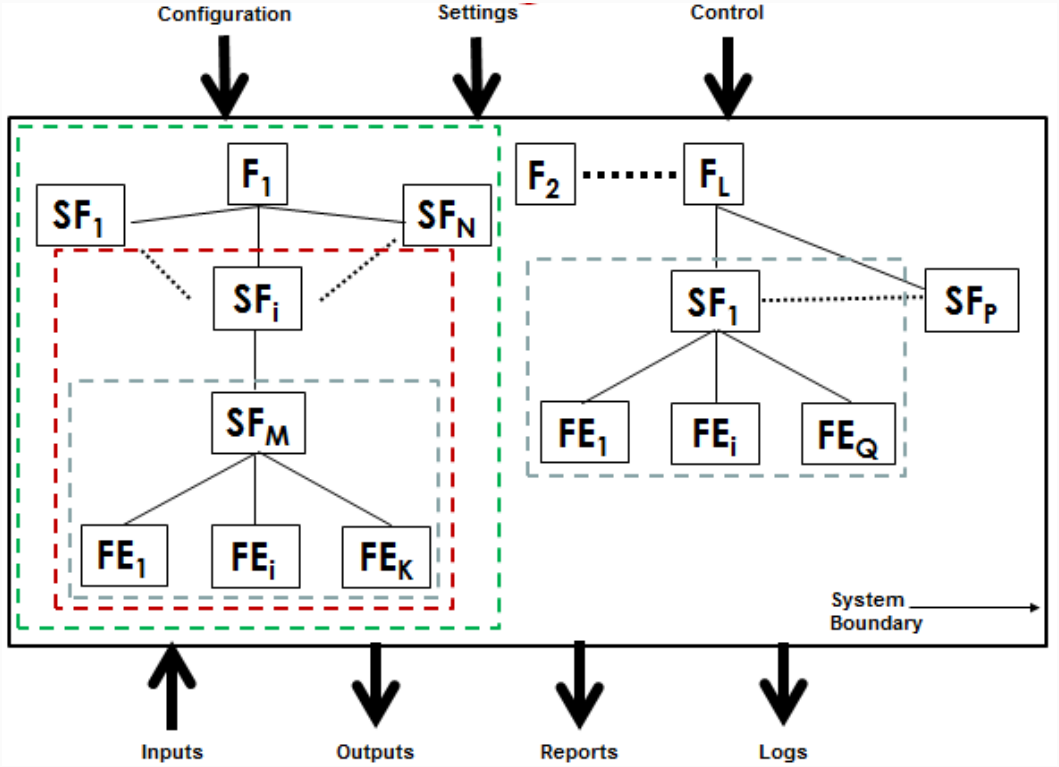
Edition 2 – hierarchy of LDs



Hierarchy of logical devices

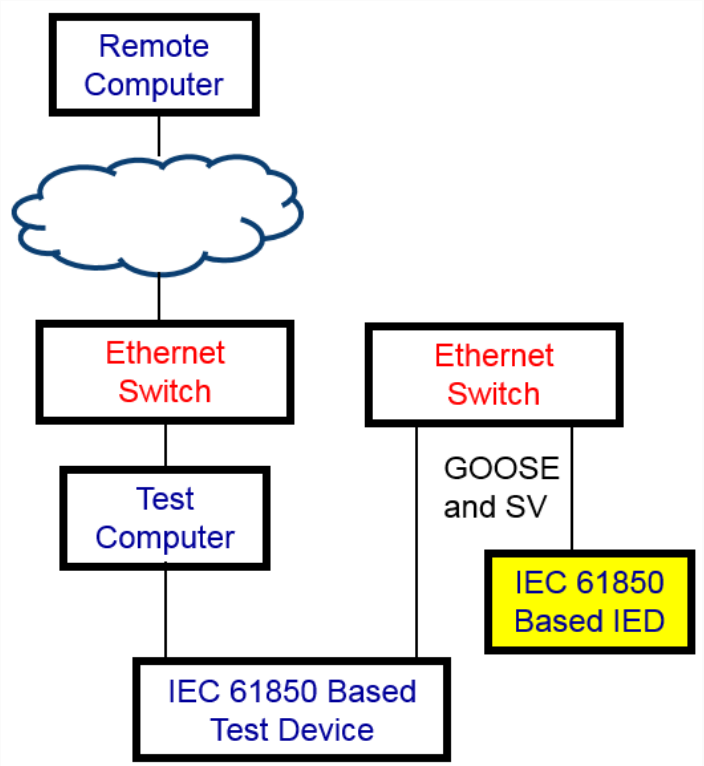


Bottom-up and Top-down testing



Why do we need remote testing?

Remote Testing



The benefits

- No travel time
- Minimum setup time
- Independent of weather conditions
- Improved PACS availability
- Reduced outage time

The challenges

- Changes in test philosophy
- Changes in test procedures
- Test object and test system isolation
- Test equipment availability in the substation
- Remote access capability
- Cyber security

Conclusions

- Edition 2 of IEC 61850 introduced many new features that further enhance the power of the standard.
- They are designed to support not only automated configuration and execution of test procedures, but also remote testing for some specific test cases.
- Using remote testing by controlling the test system in a remote substation from the convenience of the engineering office brings significant benefits by improving efficiency and safety, as well as reducing outage times.