



Functional Testing of Centralized IEC 61850 Based Protection and Control Systems



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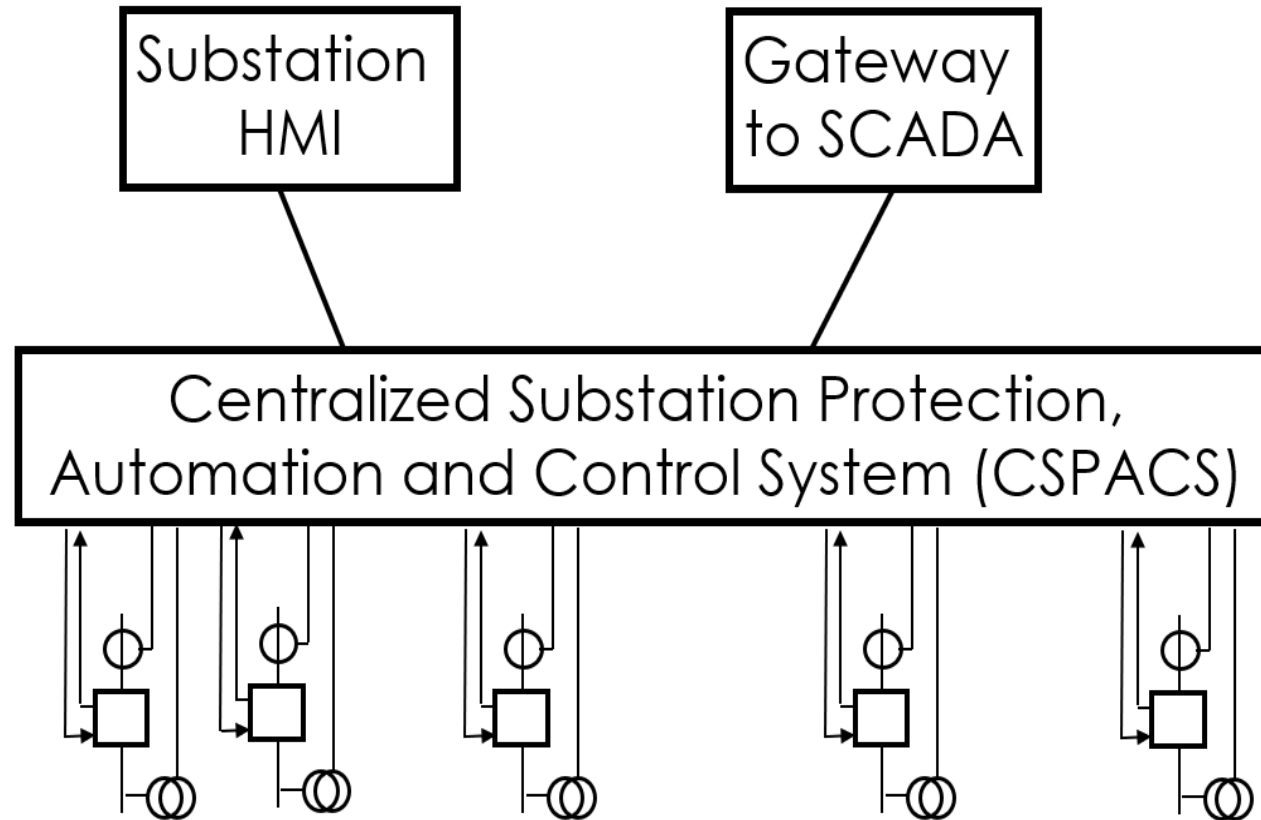
Texas A&M, March 2024

25 March 2024

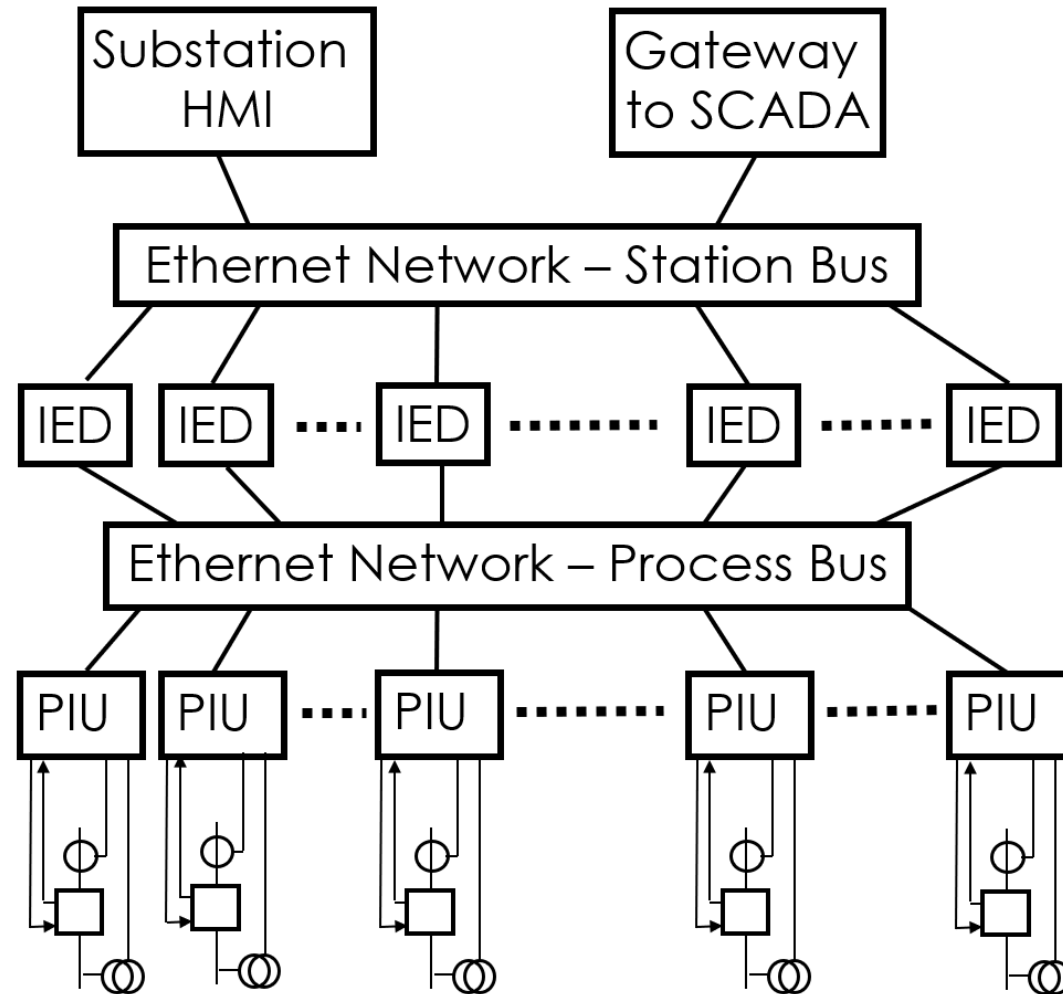
Questions

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

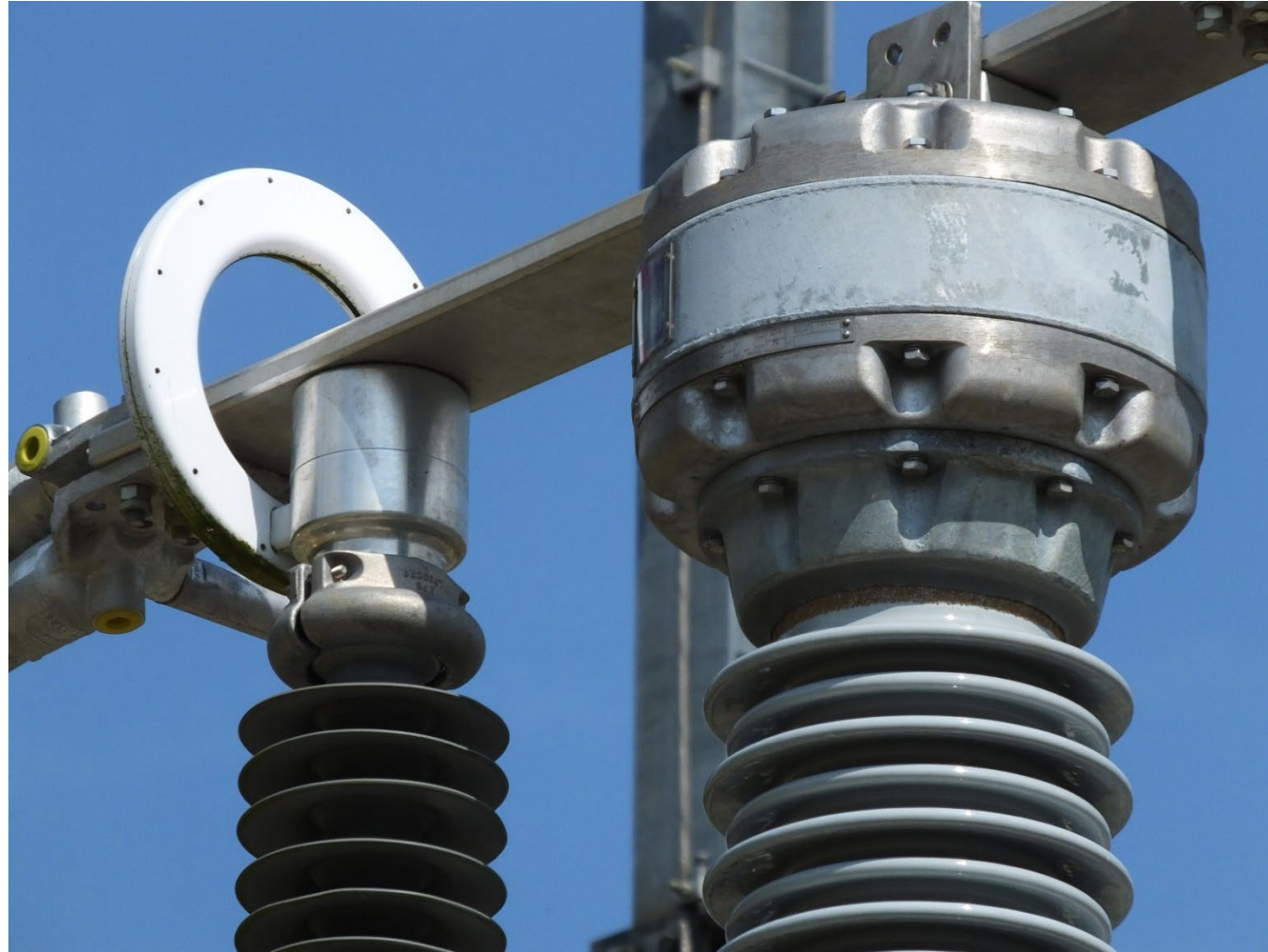
Hardwired CSPACS



IEC 61850 Based Digital Substations



Optical CT in France

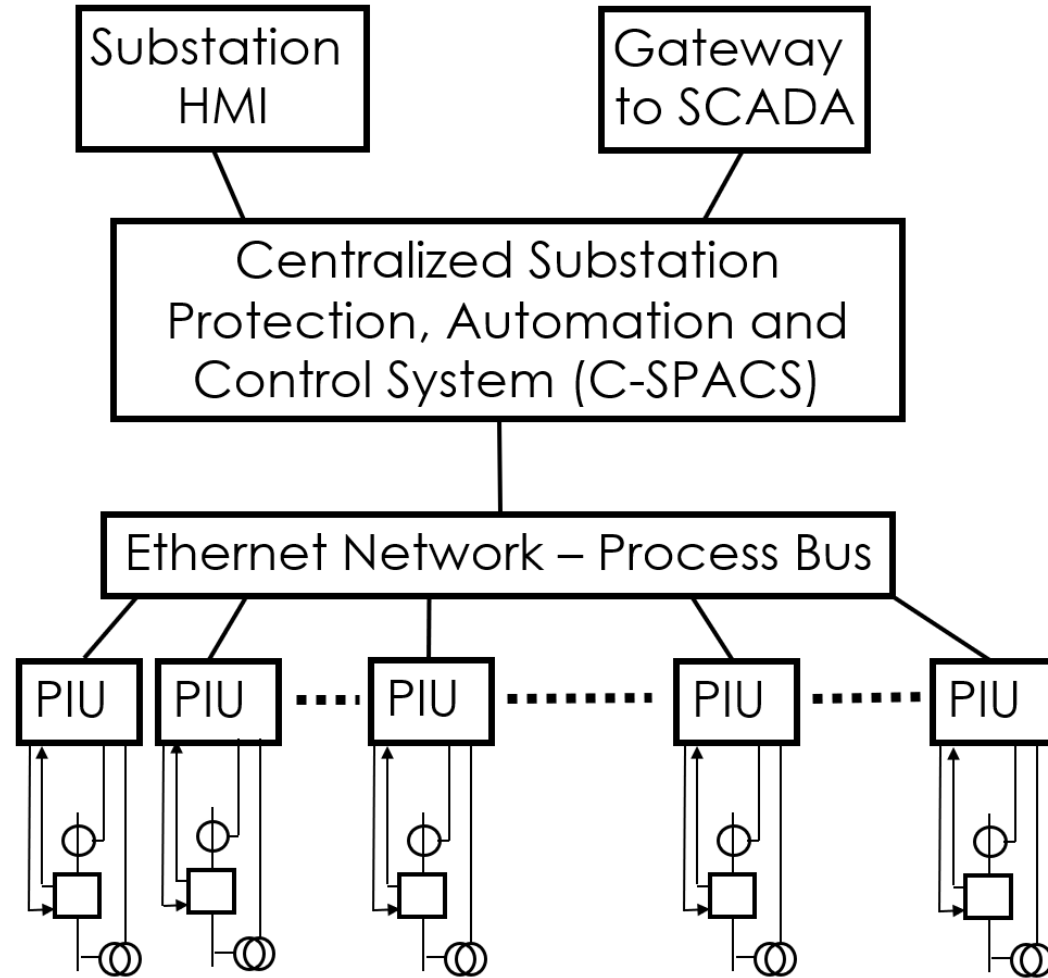


Protection panel in France

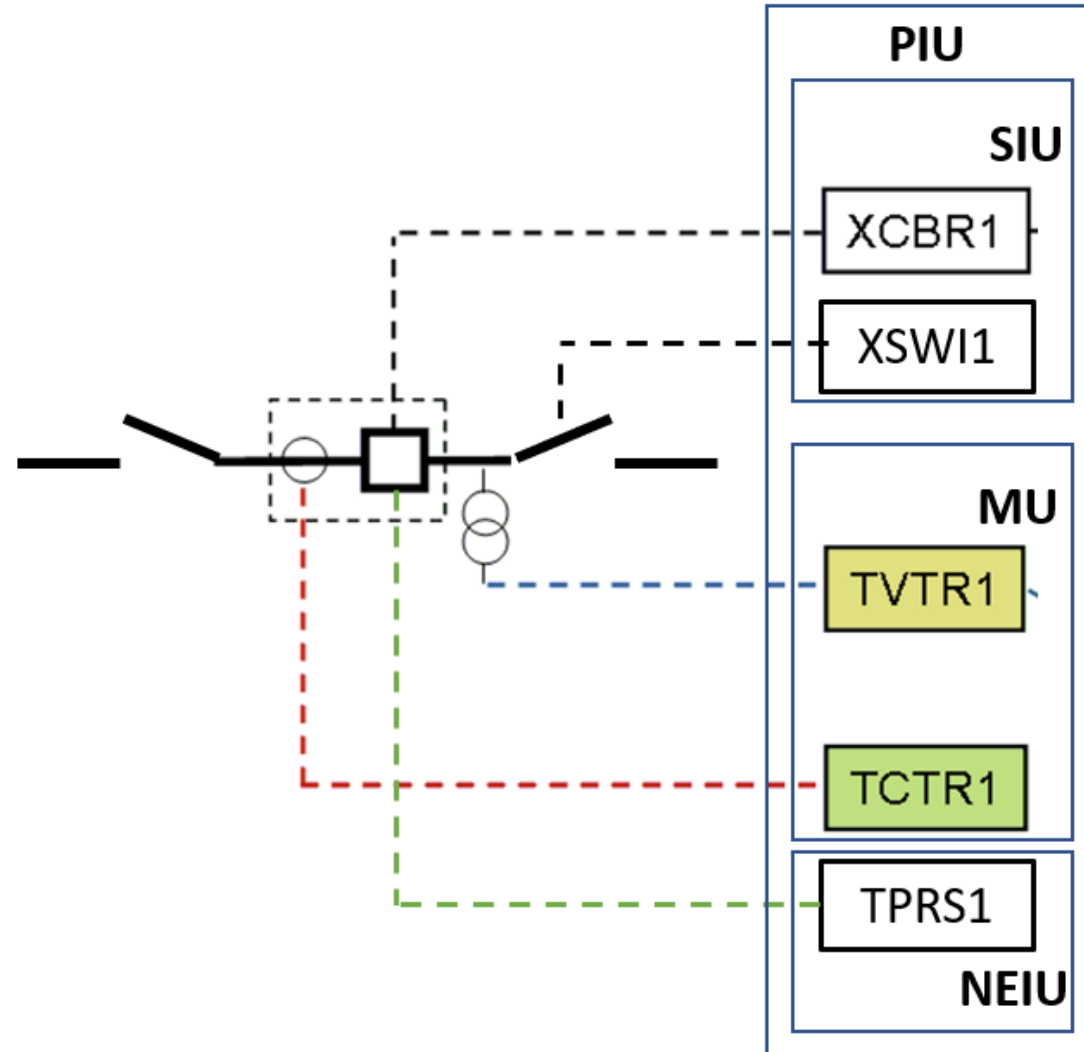


Disconnecting Circuit Breaker (DCB)

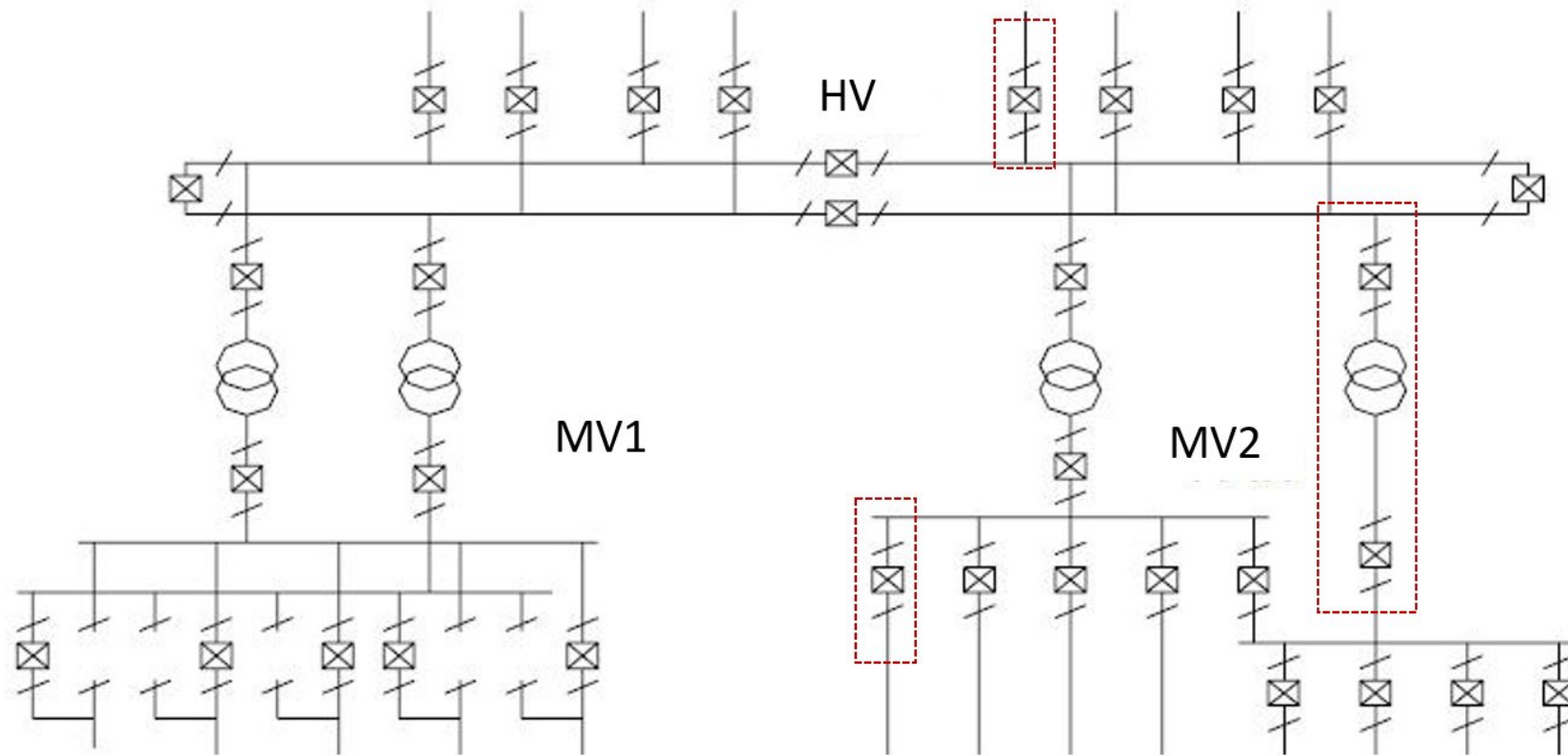




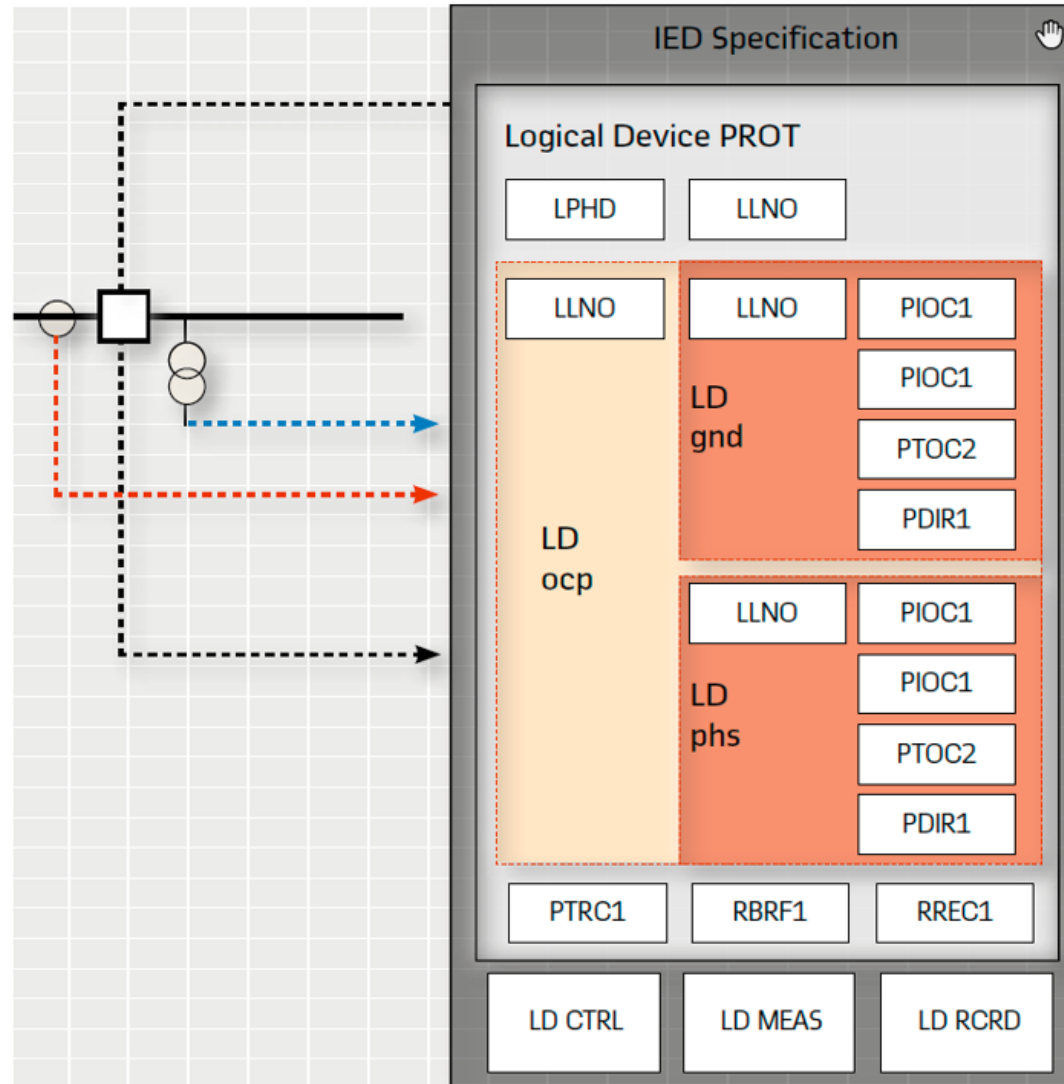
Process Interface Unit (PIU)



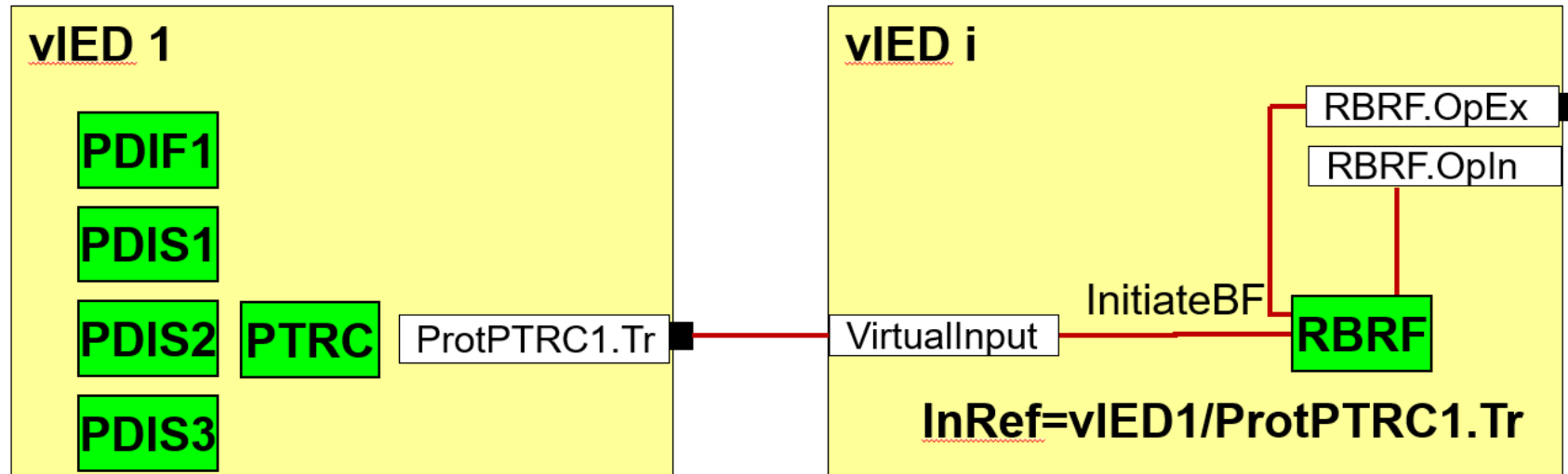
Engineering of SPACS



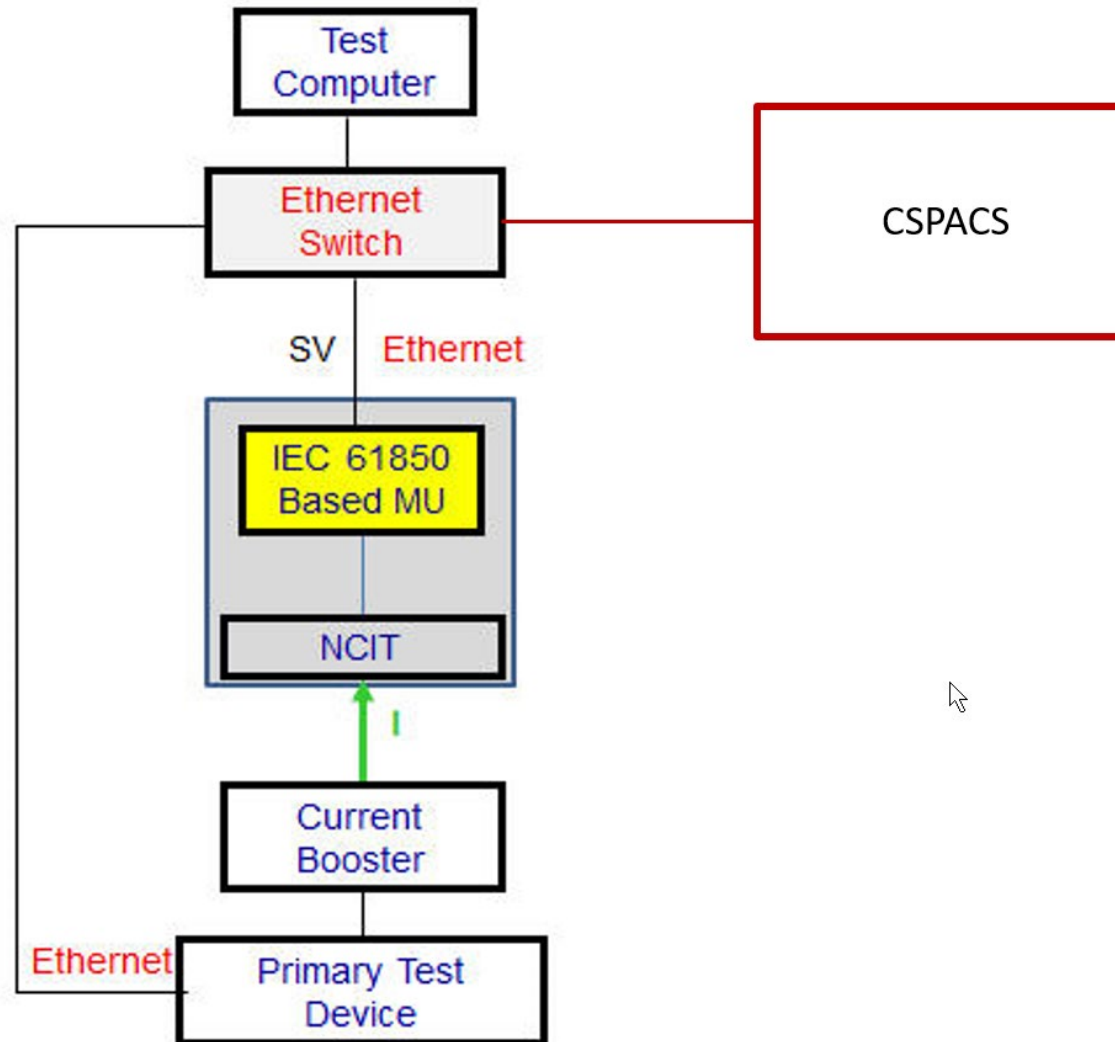
Virtual IED Model



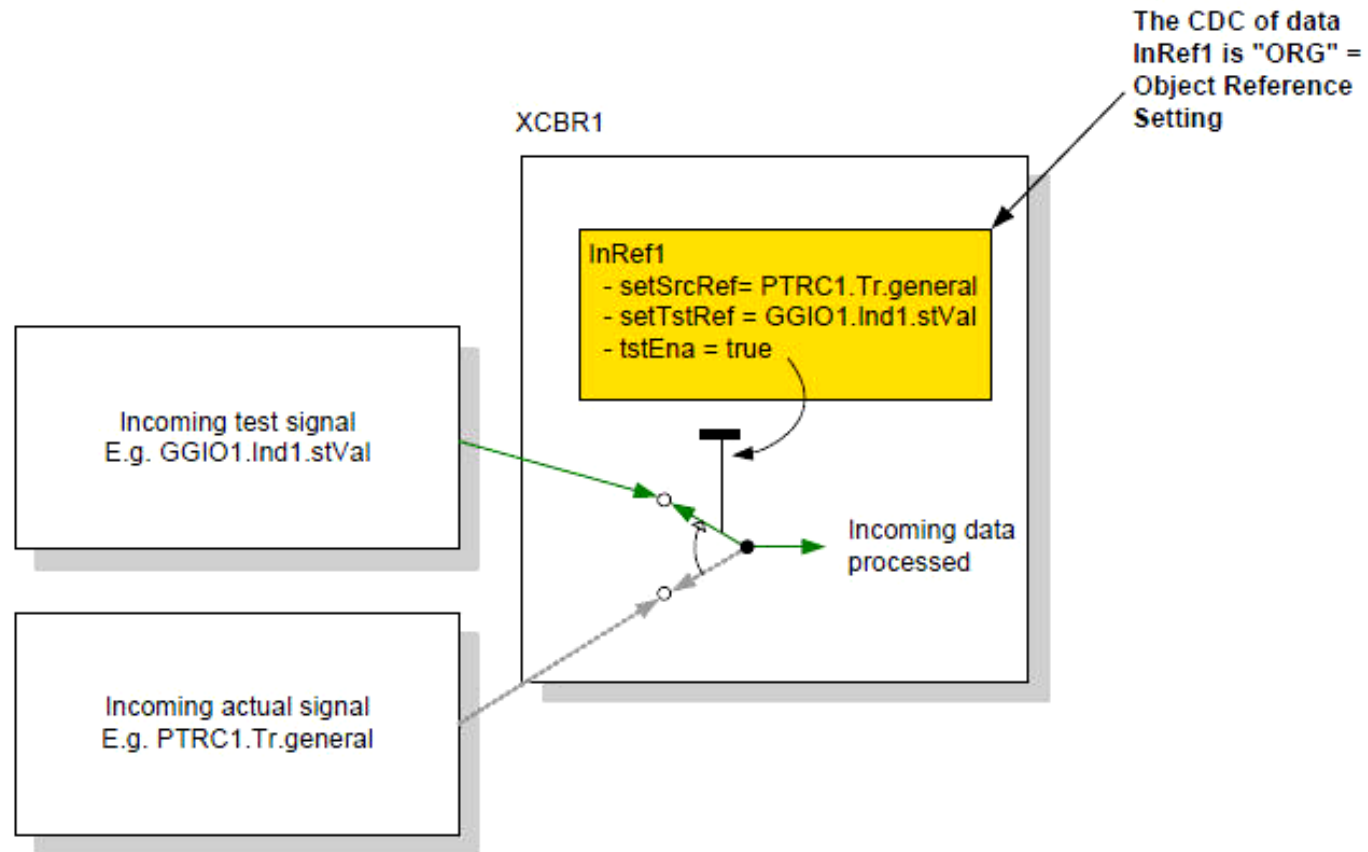
Signal flow definition



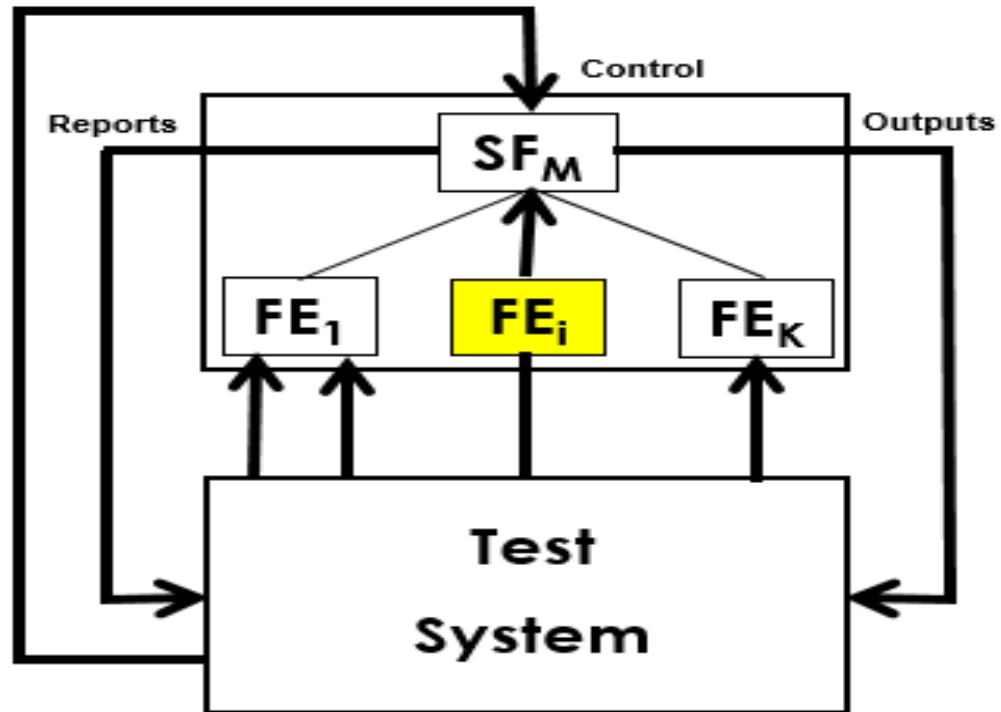
Commissioning testing



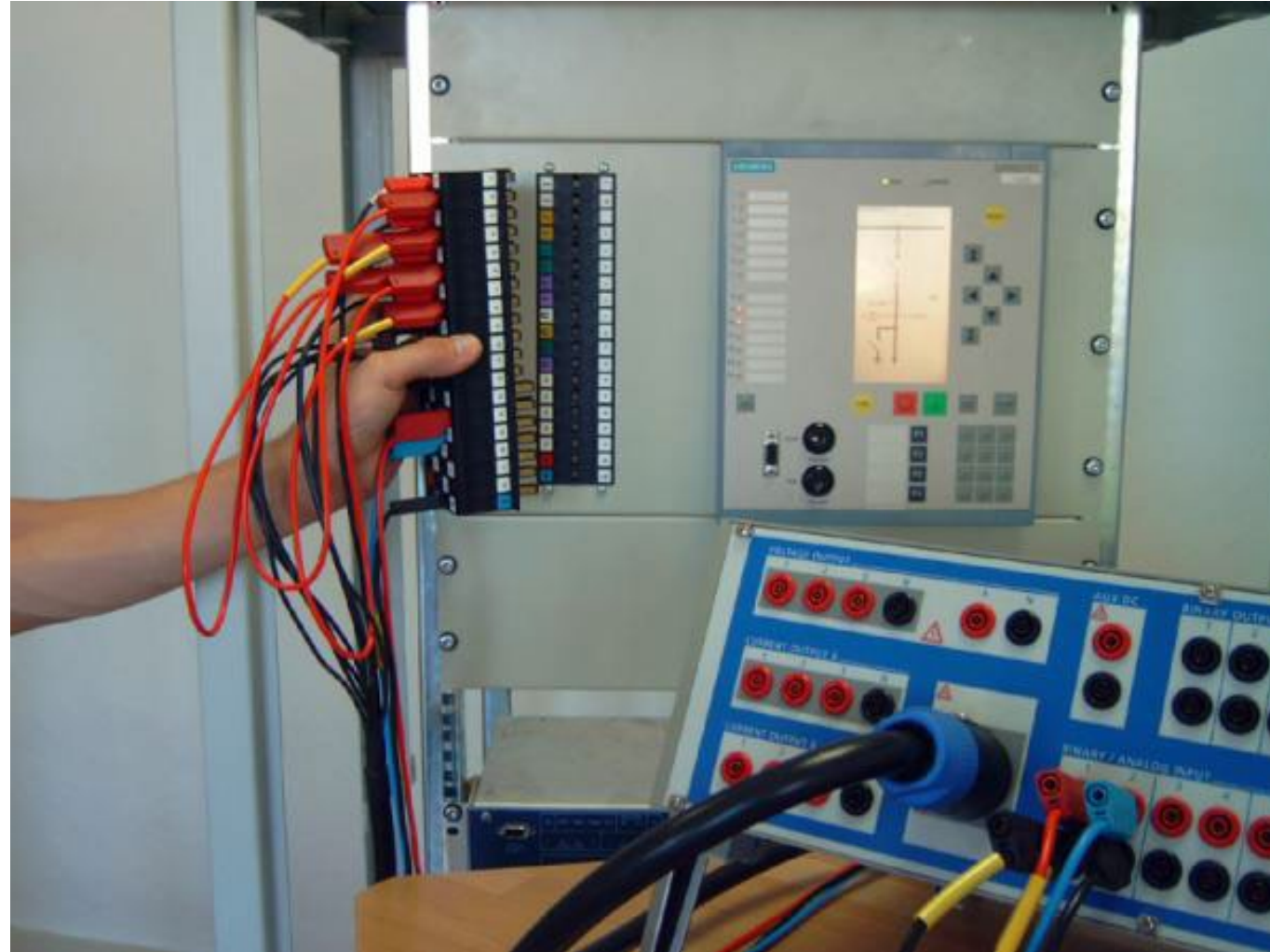
Using TstRef



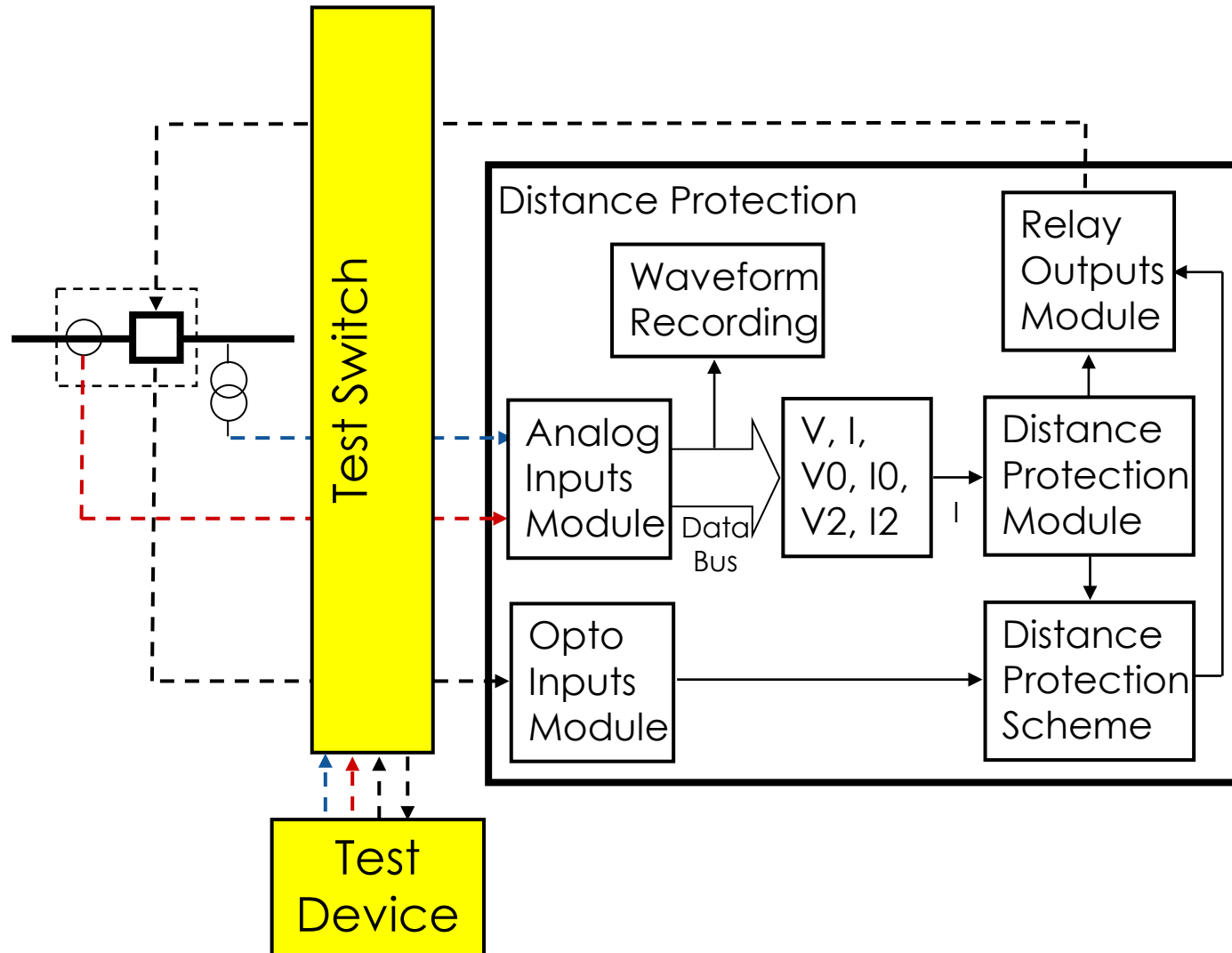
White-box testing



Conventional Isolation



Distance Protection Testing



Why do we need remote testing?



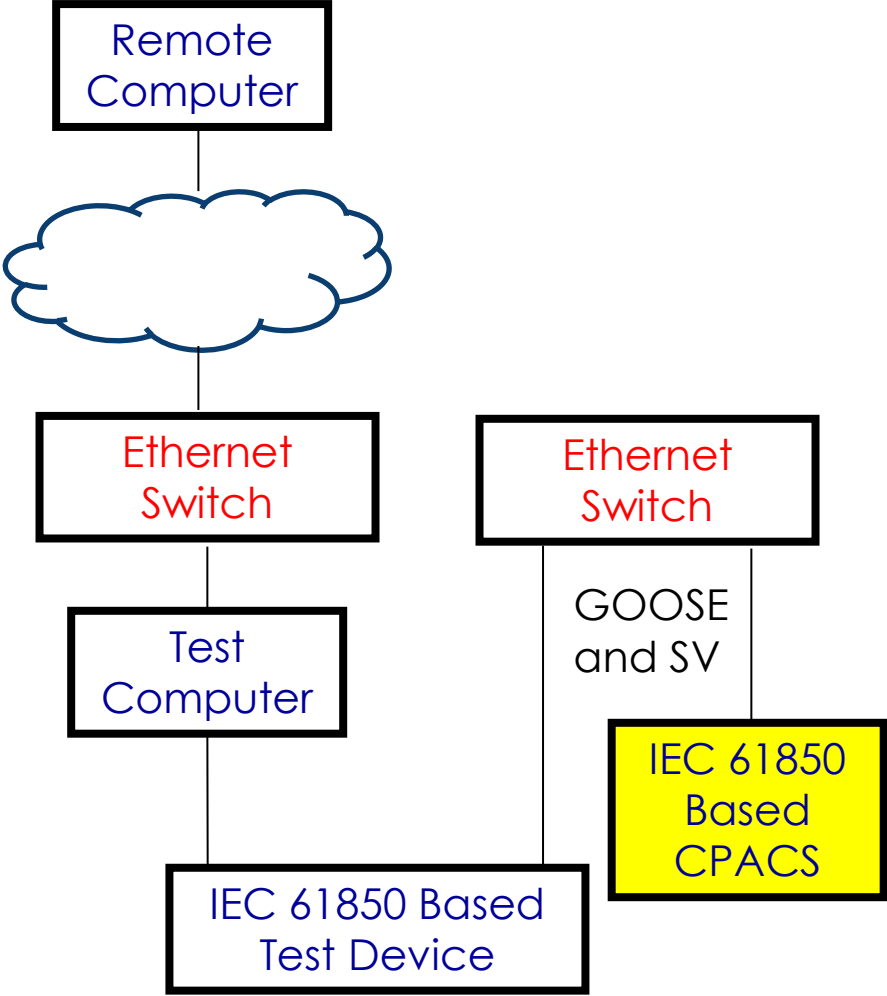
The benefits

- > 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

Remote Testing



Conclusions

- > The future is now
- > Digitization of the grid based on IEC 61850
- > Virtualization of PAC functions – apps vs. boxes
- > Extensive use of communications
- > It improves the efficiency of the engineering, maintenance and testing process
- > Remote testing can be implemented in IEC 61850 based digital substations



