



IEC 61850 CONCEPTS FOR TESTING AND ISOLATION OF SIGNALS

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- Approach
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Possibilities

- Conformance Tests
- Factory Acceptance Tests (FAT)
- Interoperability Tests
- Site Acceptance Tests (SAT)
- Functional Tests
- Performance Tests.

FUNCTIONAL TESTING OF IEC 61850 BASED SYSTEMS

Work Group
B5.32

December 2009

Members:

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The Wish....



IEC 61850



But.....

- „There is a Testbit“
- „As it was with 103“

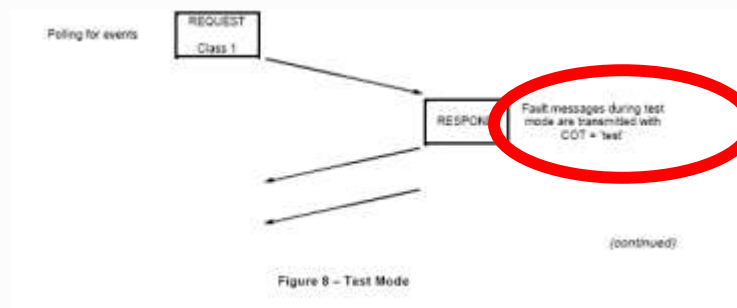


Table 5 – Semantics of CAUSE OF TRANSMISSION; Information in monitor direction

<1>	=	spontaneous
<2>	=	cyclic
<3>	=	reset frame count bit (FCB)
<4>	=	reset communication unit (CU)
<5>	=	start request
<6>	=	power on
<7>	=	test mode
<8>	=	time synchronization
<9>	=	general interrogation
<10>	=	termination of general interrogation
<11>	=	local operation
<12>	=	remote operation
<20>	=	positive acknowledgement of command
<21>	=	negative acknowledgement of command
<31>	=	transmission of disturbance data
<40>	=	positive acknowledgement of generic write command
<41>	=	negative acknowledgement of generic write command
<42>	=	valid data response to generic read command
<43>	=	invalid data response to generic read command
<44>	=	generic write confirmation

But.....IEC 61850 Edition 1

- Every LN Mode „Test“
- Logical Device Mode „Test“
- Resulting behaviour of a Logical Node
- Quality „Test“ (q= Test)
- Not just a „Test-Mode“ but:
 - On; Blocked; Test; Test/ Blocked; Off



Edition 2?

- As Edition 1
- „Blocked“ now „On/Blocked“
- „Simulate“-Indication for GOOSE/ SV
- Plus: Test Data Attribute (e.g.: tstEna)
- Plus Service Parameter „Test“ in control
- Plus Tracking of services
- Plus GOOSE/SV subscription diagram

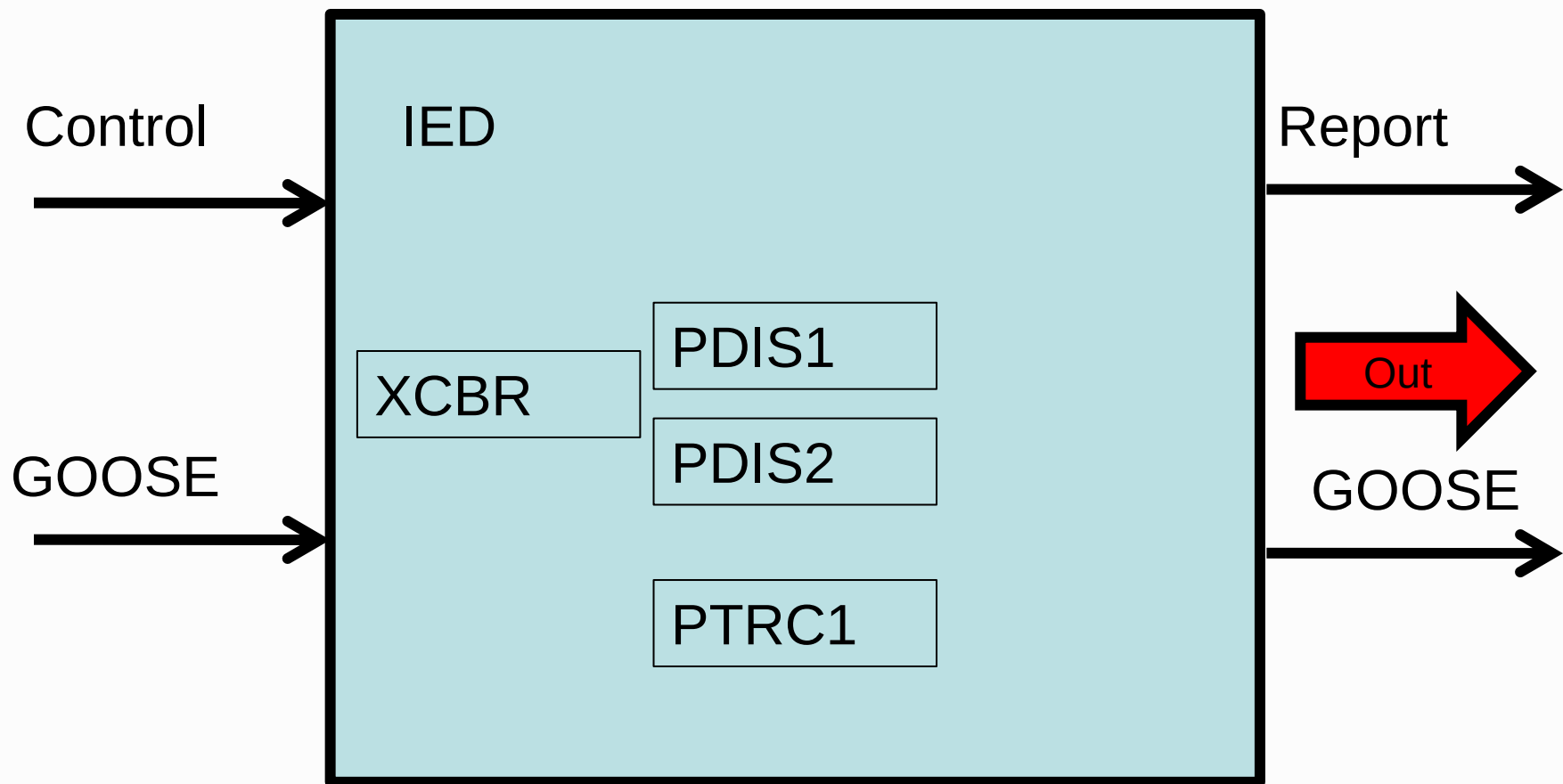


Table in 7-4

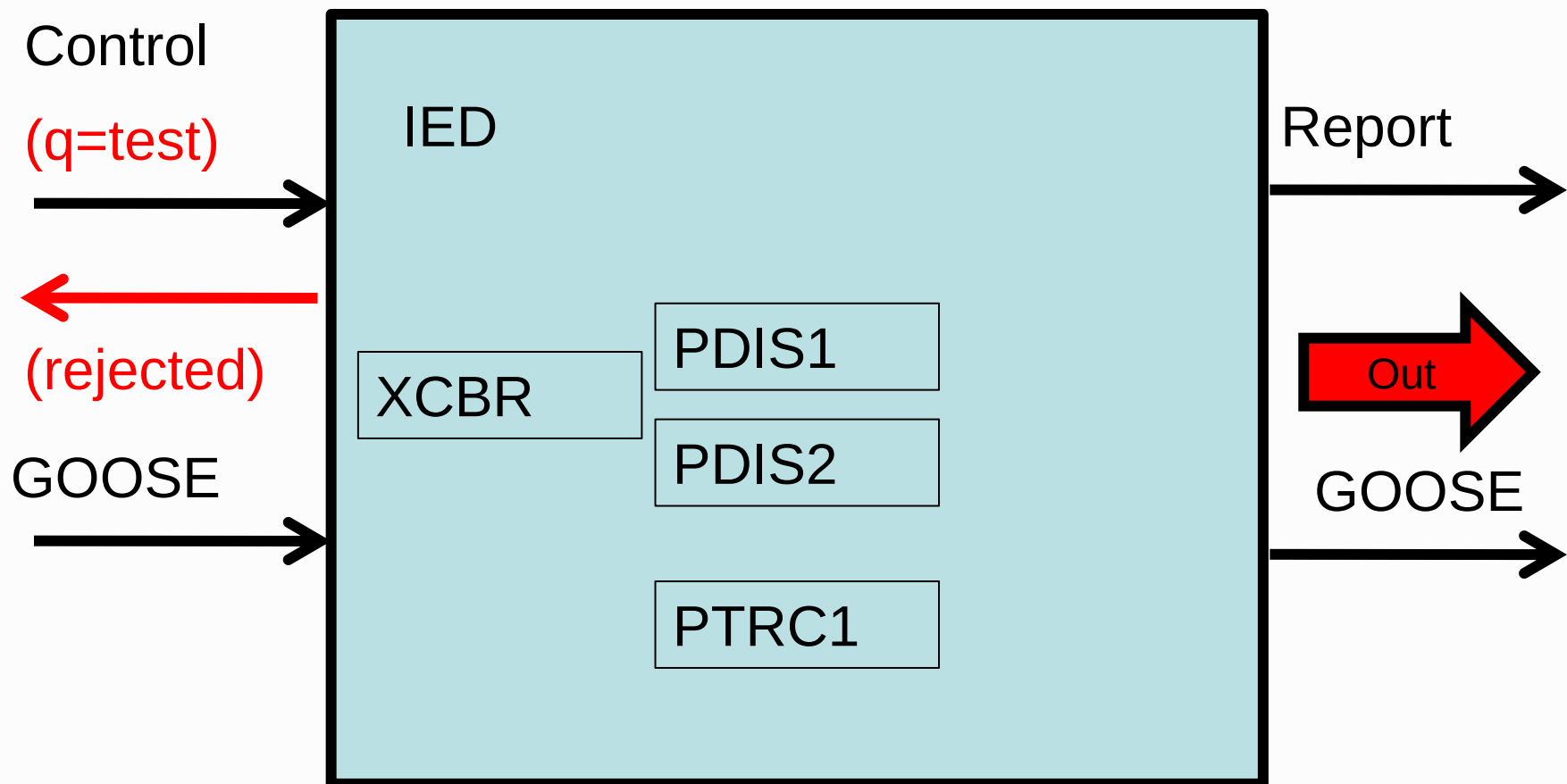
- ongoing discussion

MODE/BEHAVIOUR	on	on-blocked	test	test/blocked	off
Function behind LN	ON	ON	ON	ON	OFF
Output to the Process (Switchgear) via a non-IEC 61850 link for example wire (typical for X...,Y..., and GGIO LNs)	YES	NO	YES	NO	NO
Output of FC ST, MX (issued independently from Beh)	value is relevant q is relevant	value is relevant q is relevant	value is relevant q.test=true	value is relevant q.test=true	value is irrelevant q.validity=invalid
Response to (Normal) Command from Client (a+ / a- acknowledgement)	a+ pos. ack.	a- neg. ack.	a- neg. ack.	a- neg. ack.	a- neg. ack.
Response to TEST Command from Client (a+ / a- acknowledgement)	a- neg. ack.	a- neg. ack.	a+ pos. ack.	a+ pos. ack.	a- neg. ack.
Incoming data with q=normal	Processed as valid	Processed as valid	Processed as valid	Processed as valid	Not Processed
Incoming data with q=operatorBlocked	Processed as blocked	Processed as blocked	Processed as blocked	Processed as blocked	Not Processed
Incoming data with q=test	Processed as invalid	Processed as invalid	Processed as valid	Processed as valid	Not Processed
Incoming data with q=test+operatorBlocked	Processed as invalid	Processed as invalid	Processed as blocked	Processed as blocked	Not Processed
Incoming data with q=invalid	Processed as invalid	Processed as invalid	Processed as invalid	Processed as invalid	Not Processed
Non-IEC 61850 binary (relay, contact) inputs and analogue (instrument transformer) inputs	Processed	Processed	Processed	Processed	Not Processed

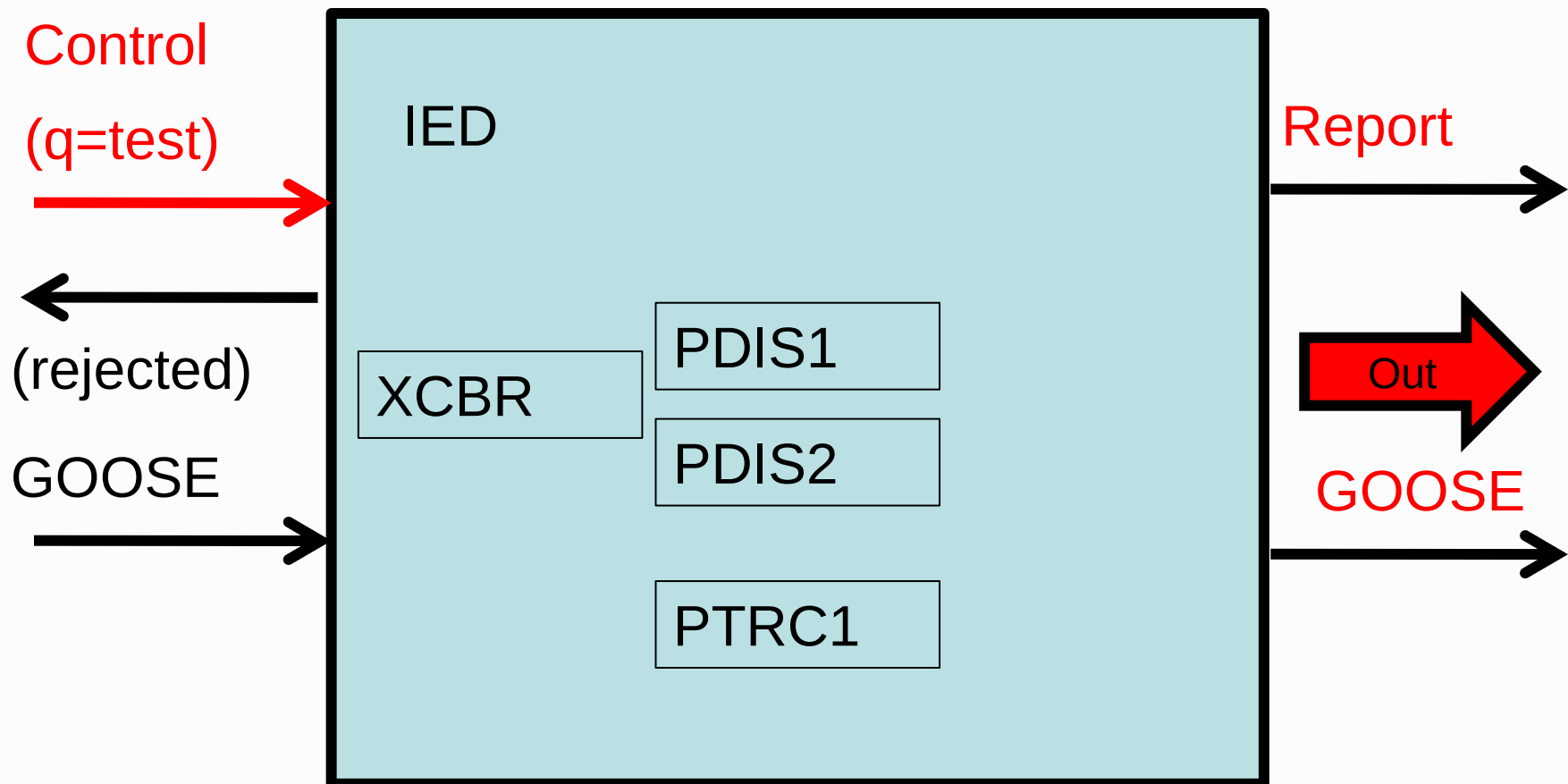
On, Test, Test/blocked - Example



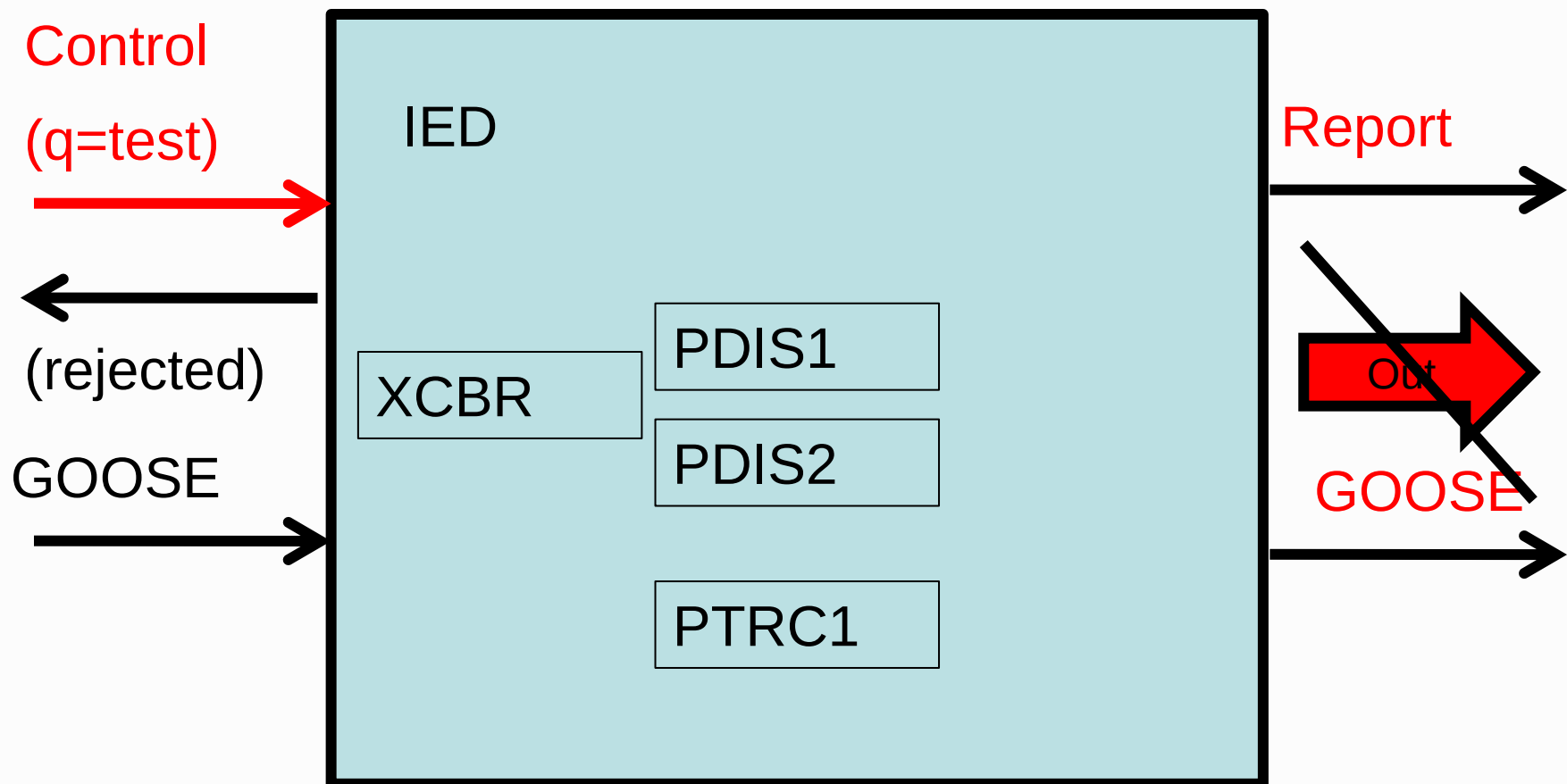
On



Test

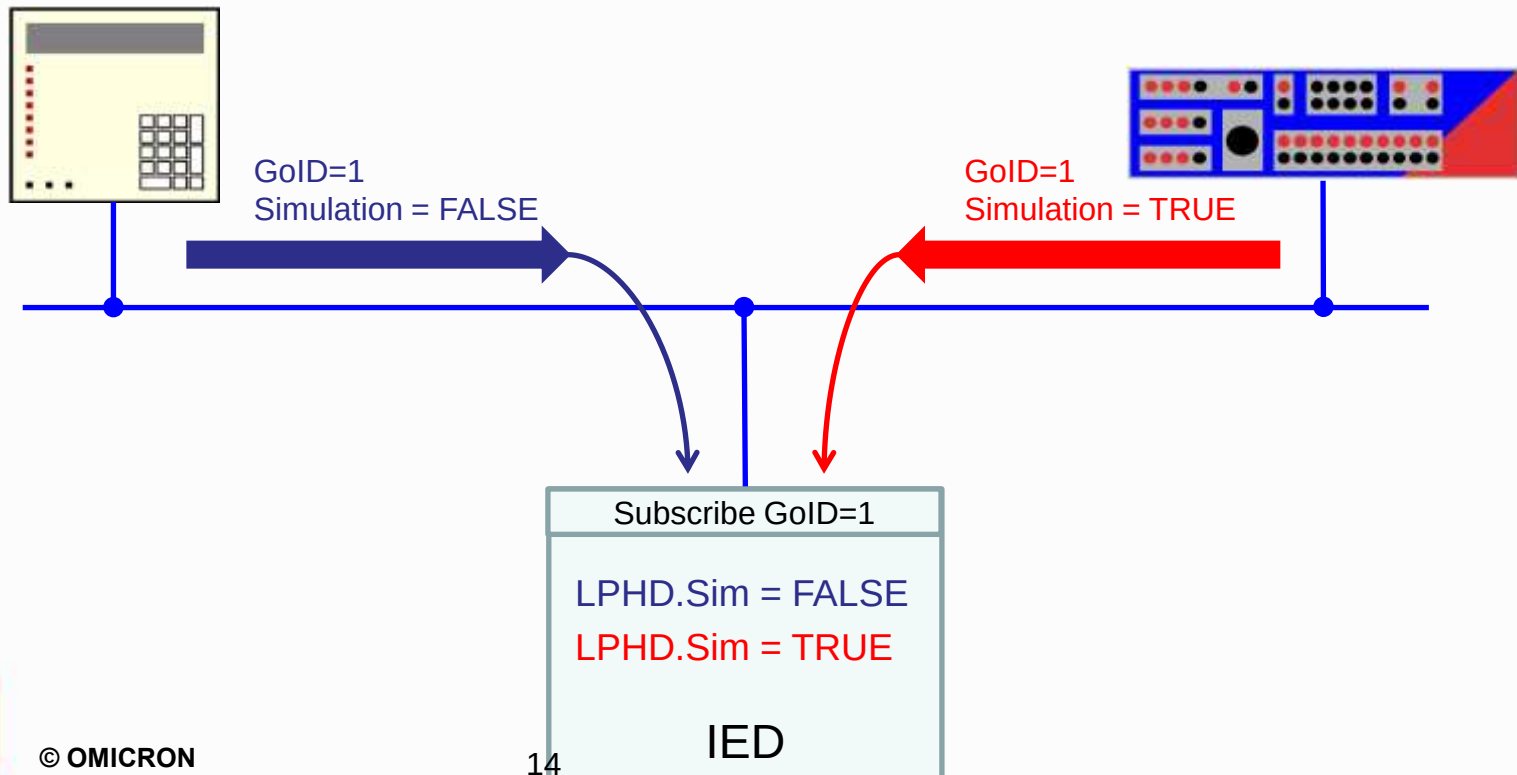


Test/Blocked

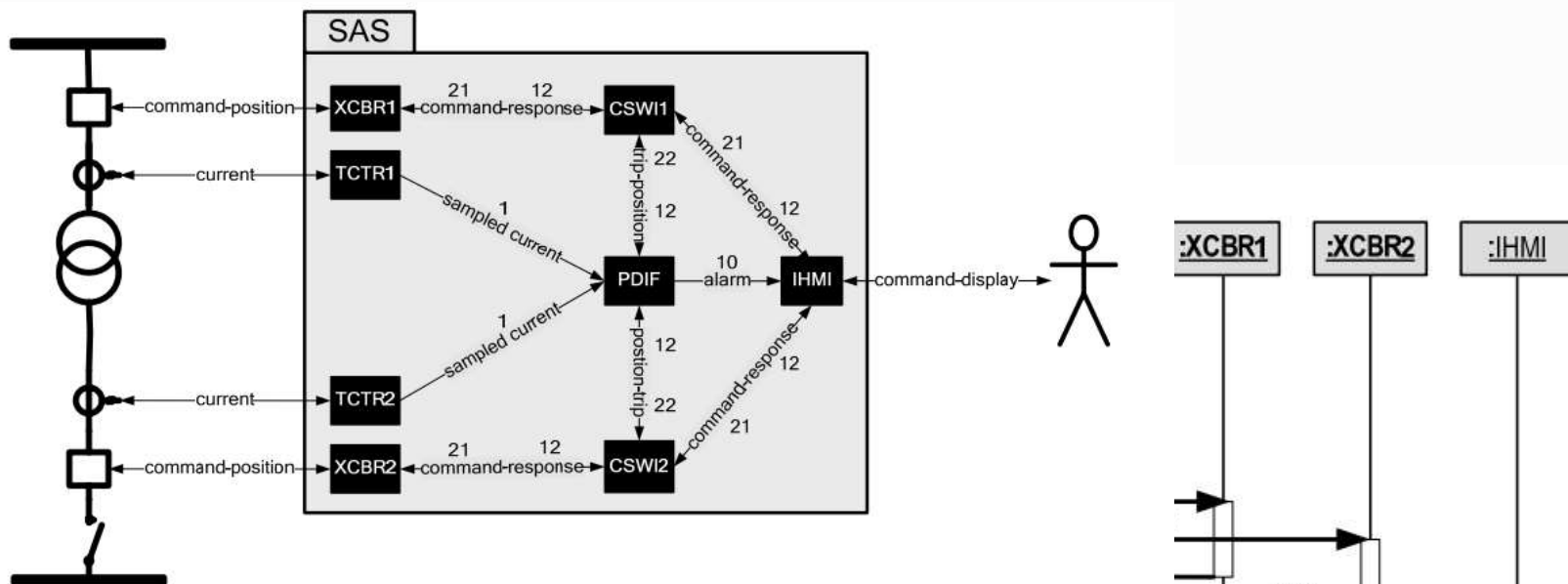


Simulation Feature (S-Bit)

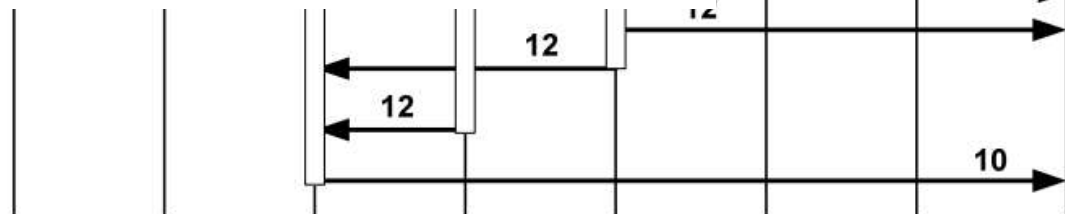
- not from the real process, bit in the Ethernet Frame
- IED in simulation mode LPHD.Sim = True



Functional Testing (CIGRE)



Picture 23 – Functional Specification by UML Communication Diagram



Picture 24 – Functional Specification by UML Sequence Diagram

The View from Germany

- WG 10 mirror
- Opinion: To continue work on testing document is essential and necessary
- Own very active „Testing Group“ in DKE with more than 10 members from utilities and vendors

Status- How to bring „test“ and „Sim“ together

TestSet

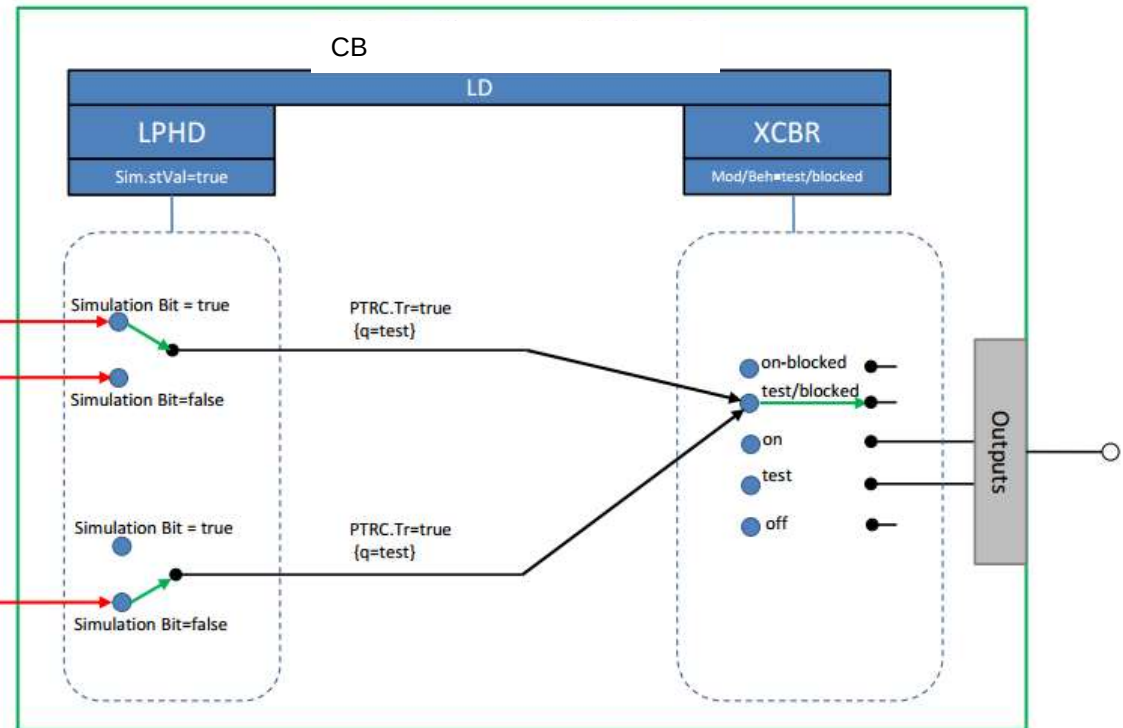
IED 1

IED 2

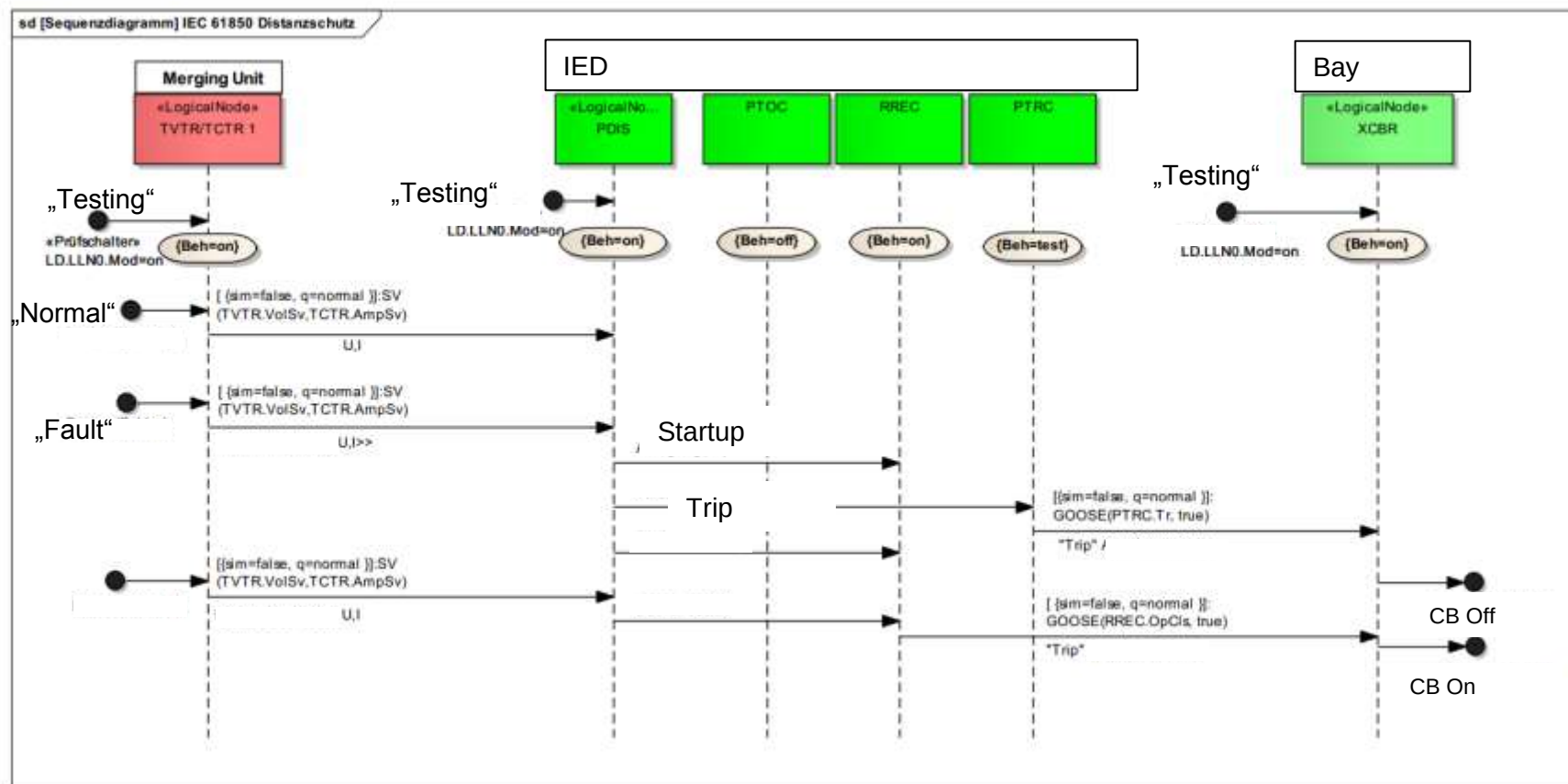
GOOSE (PTRC.Tr,true)
{sim=true, q=test}

GOOSE (PTRC.Tr,true)
{sim=false, q=normal}

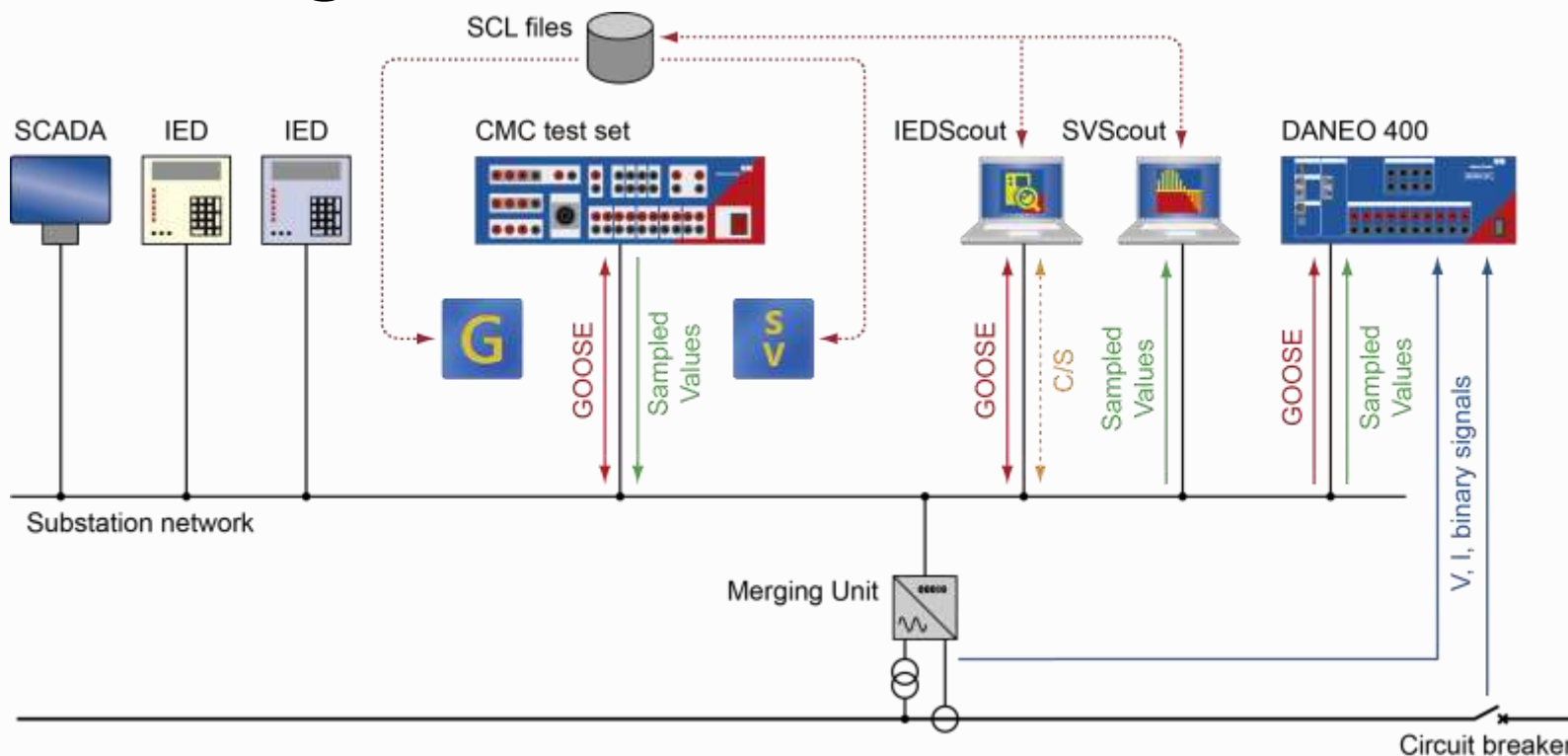
GOOSE (PTRC.Tr,true)
{sim=false, q=test}



Status: How to do routine testing

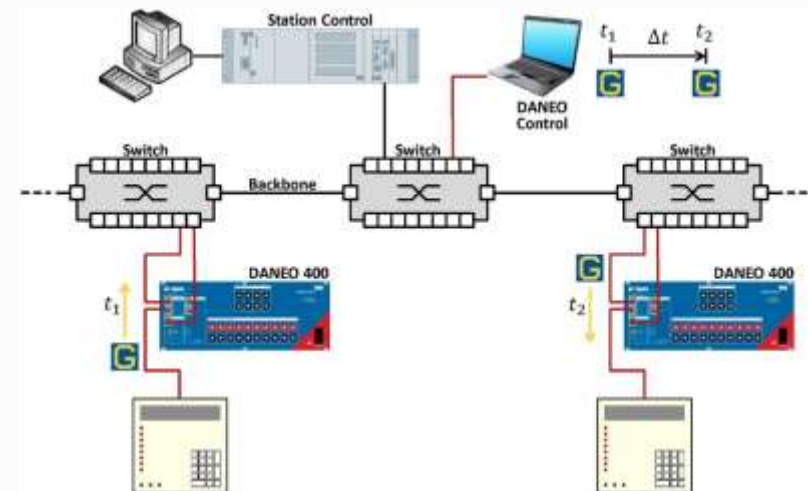


Testing Tools



Requirements

- Handling of scenarios
- Support of Edition 2
- Support of all testing features
- Client functionality
- Hybrid operation
- Distributed operation
- Time Synchronization (IEEE 1588/ PTP)



Conclusions

- New possibilities with Edition 2
- Ongoing work
- Contribution of users needed
- OMICRON provides solutions



Thank You!