



ENERGY

Digital substations

A broader view

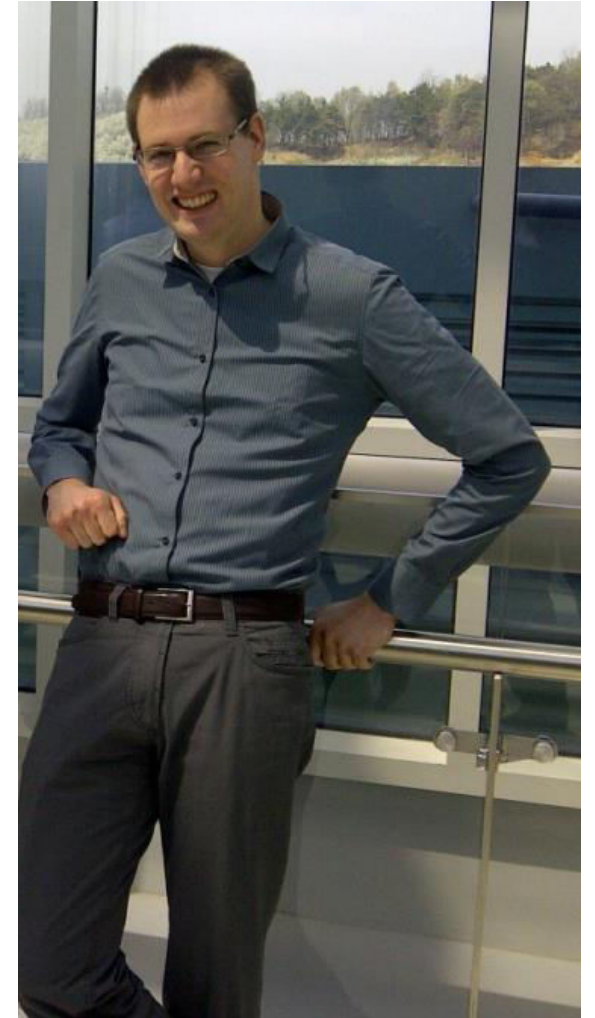
Bas Mulder

28 September 2017

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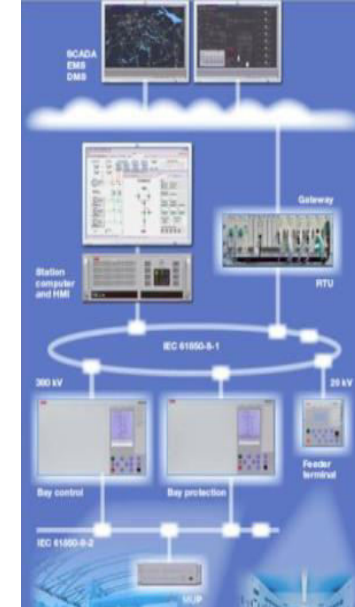
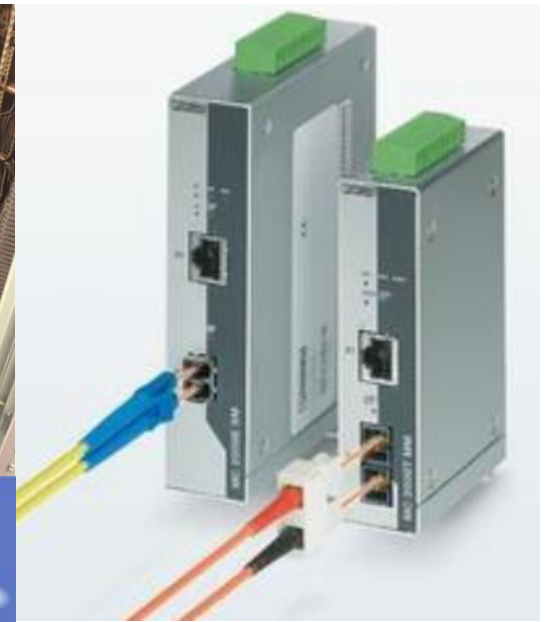
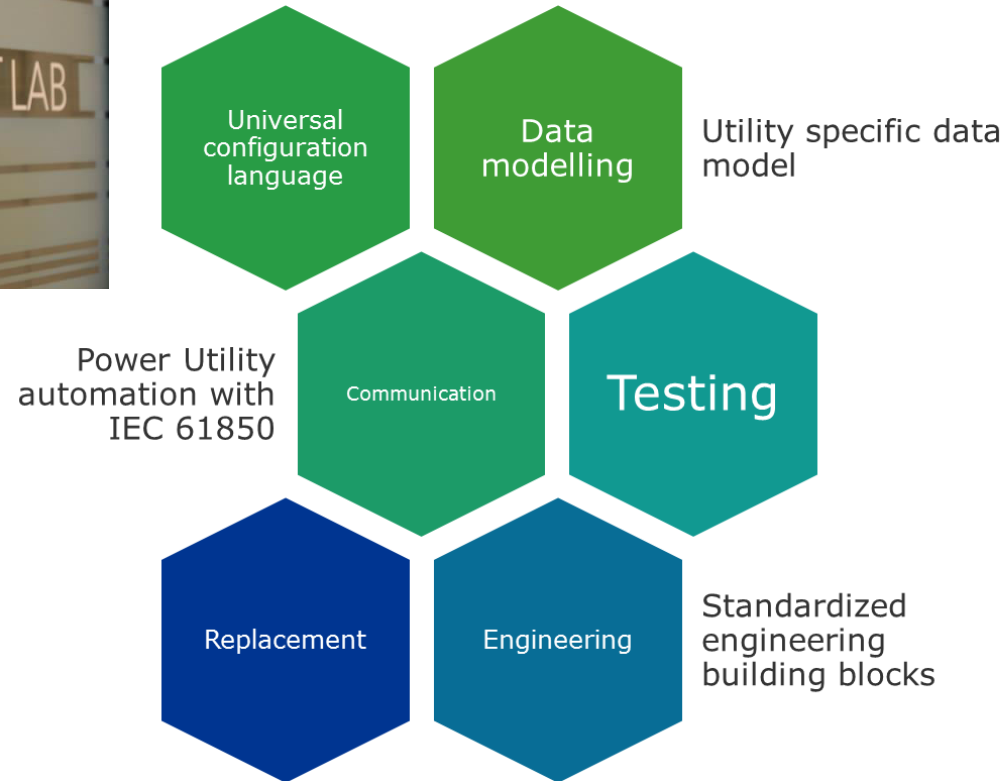
Bas Mulder

- Consultant for Telecommunication and IEC 61850
- KEMA – DNV KEMA – DNV GL
 - Since 2005 in the company
 - Does not like airports anymore
- Involved in
 - (Inter) National standardization committees
 - UCAIug & USE61400-25
 - Harmonization of CIM and IEC 61850
- Active contributor to several IEC 61850 documents
 - -90-4 / -90-12 / -80-1 / -80-4 / -10



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What are digital substations about?



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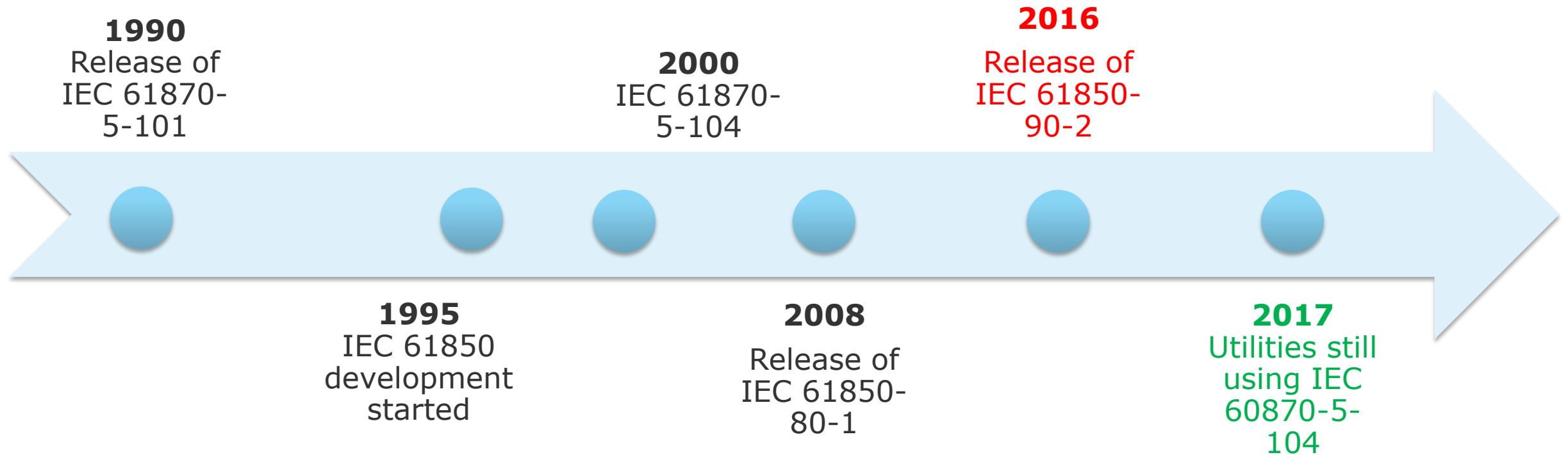
How IEC 61850 will help you!

- A **single standard** for communication inside and outside the substation
- A common and consistent method/format for storing complete substation data (**Virtualised Data Model**)
- Define complete testing methodology and procedure required for the equipment which conforms to the standard (**Conformance or Type Testing and Interoperability Testing**)



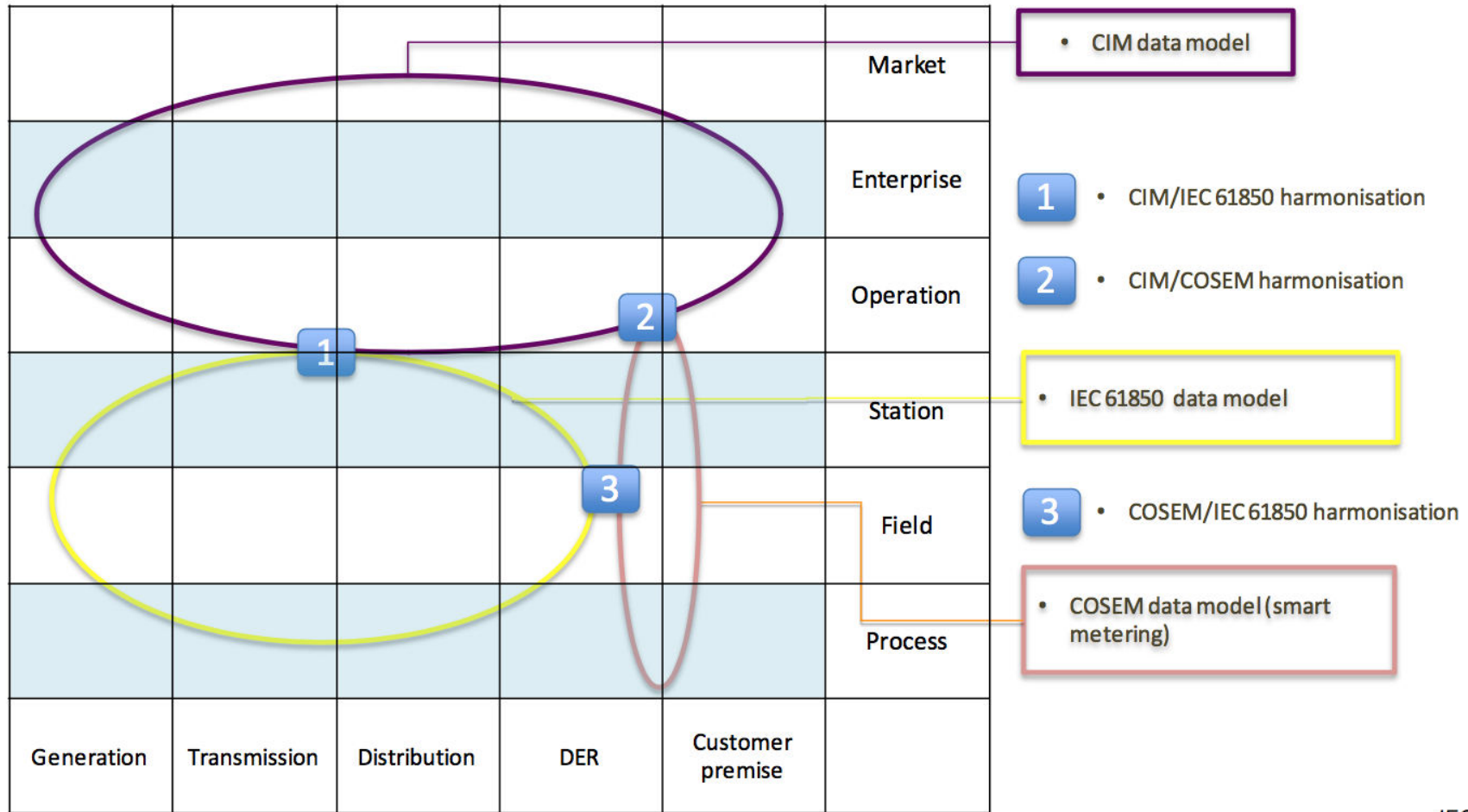
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Important milestones



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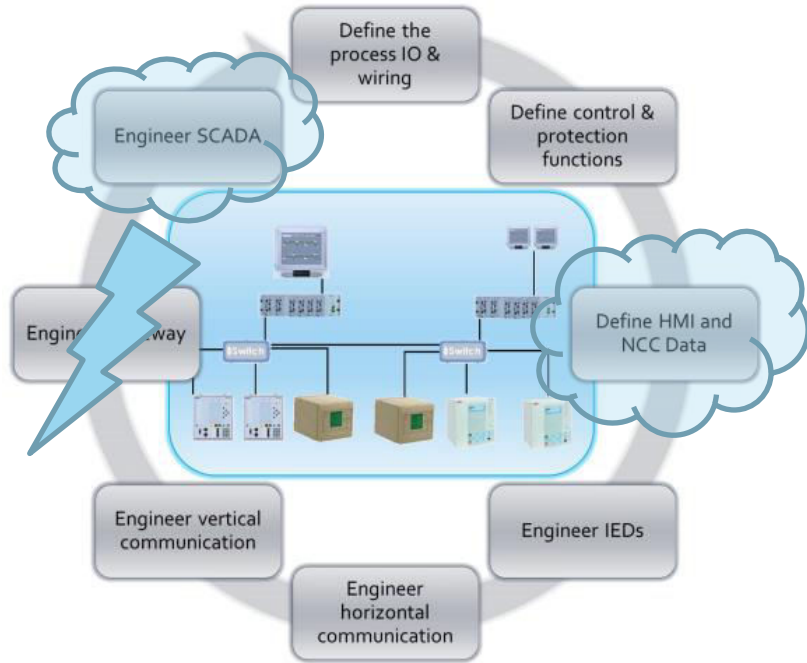
IEC TC57 reference architecture



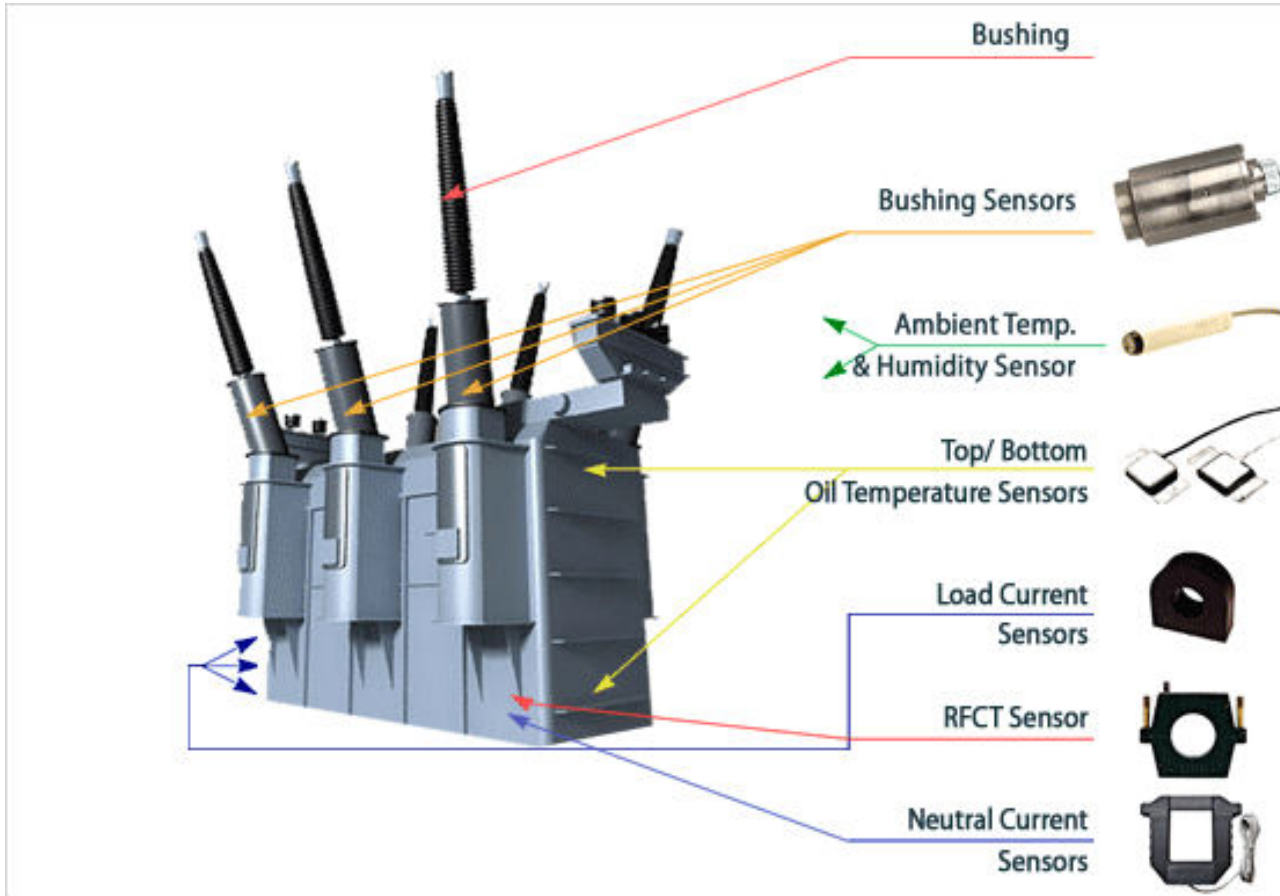
IEC

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Engineering and Asset Management



Digital substations breaks with existing paradigms
Vendor selection based upon functions is key
Function oriented engineering vs signal oriented



The utility world is changing

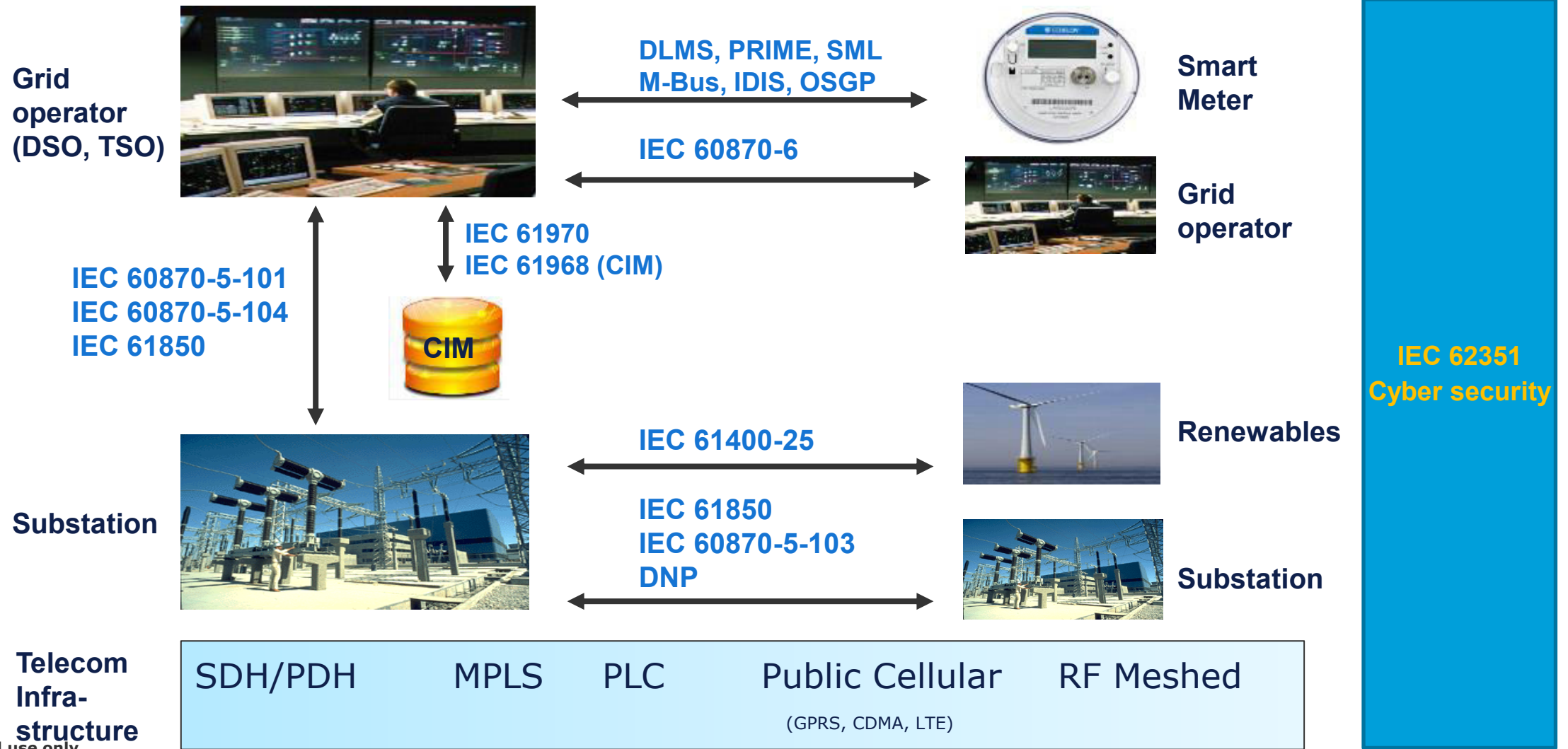


- Increasing need for structured data from thousands of devices
- CIM and IEC 61850 modelled data
- Utilities struggle with diversity:
 - Many vendors and different views and approaches
 - Multiple communication and configuration standards
 - Many firmware updates and bug fixes
 - Microsoft Windows systems



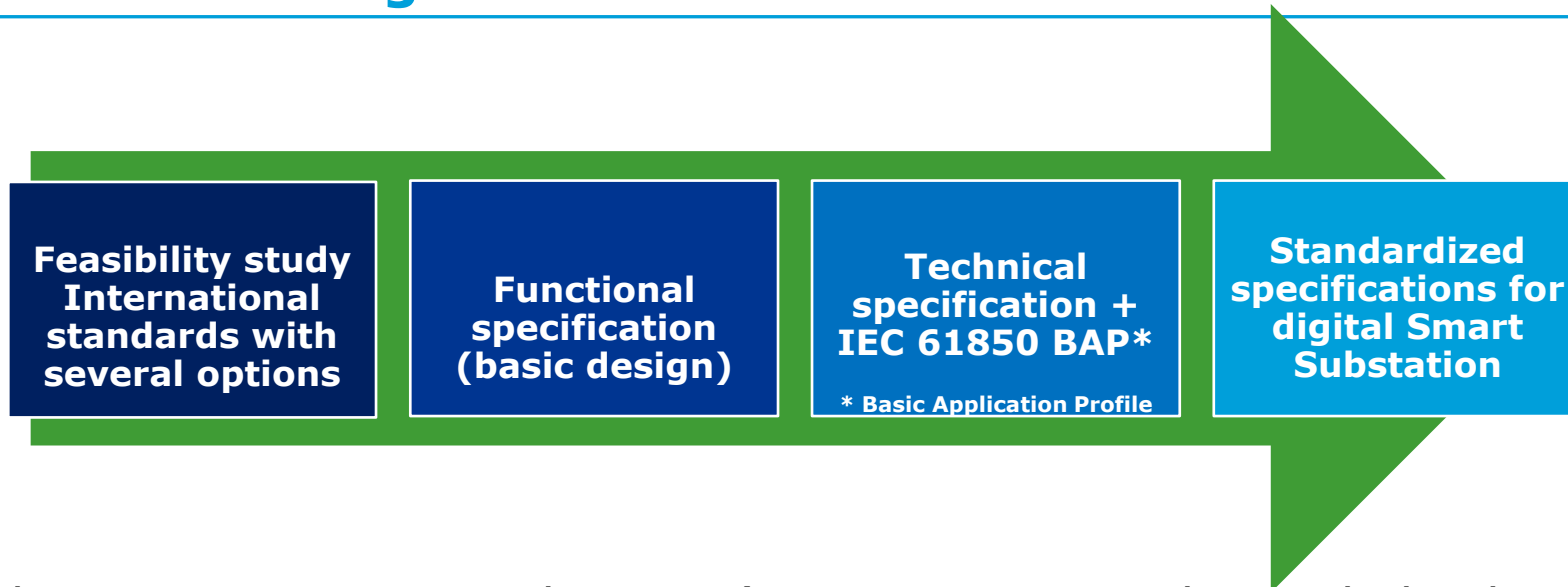
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Open standards are crucial for interoperability



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Our road to a digital substation

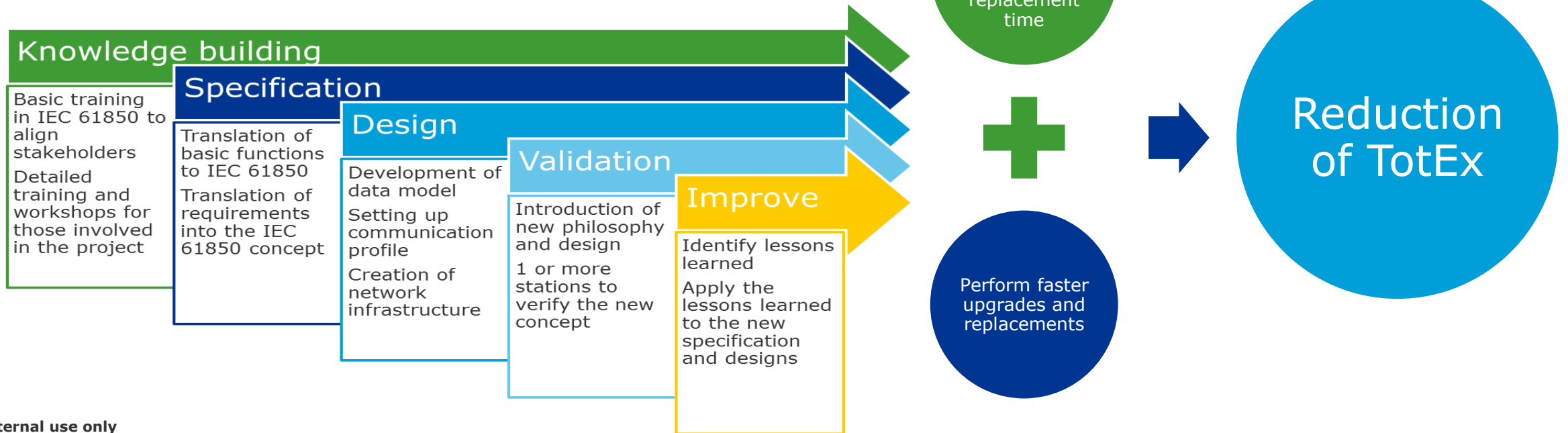


- Substation Automation changes (merging units and sampled values)
- Primary components (e.g. switchgear, circuit breaker)
- Protection relays impact
- Telecommunication architecture (real-time communication, network recovery)
- Security (physical and cyber)
- Remote operation of the substation

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Project experiences

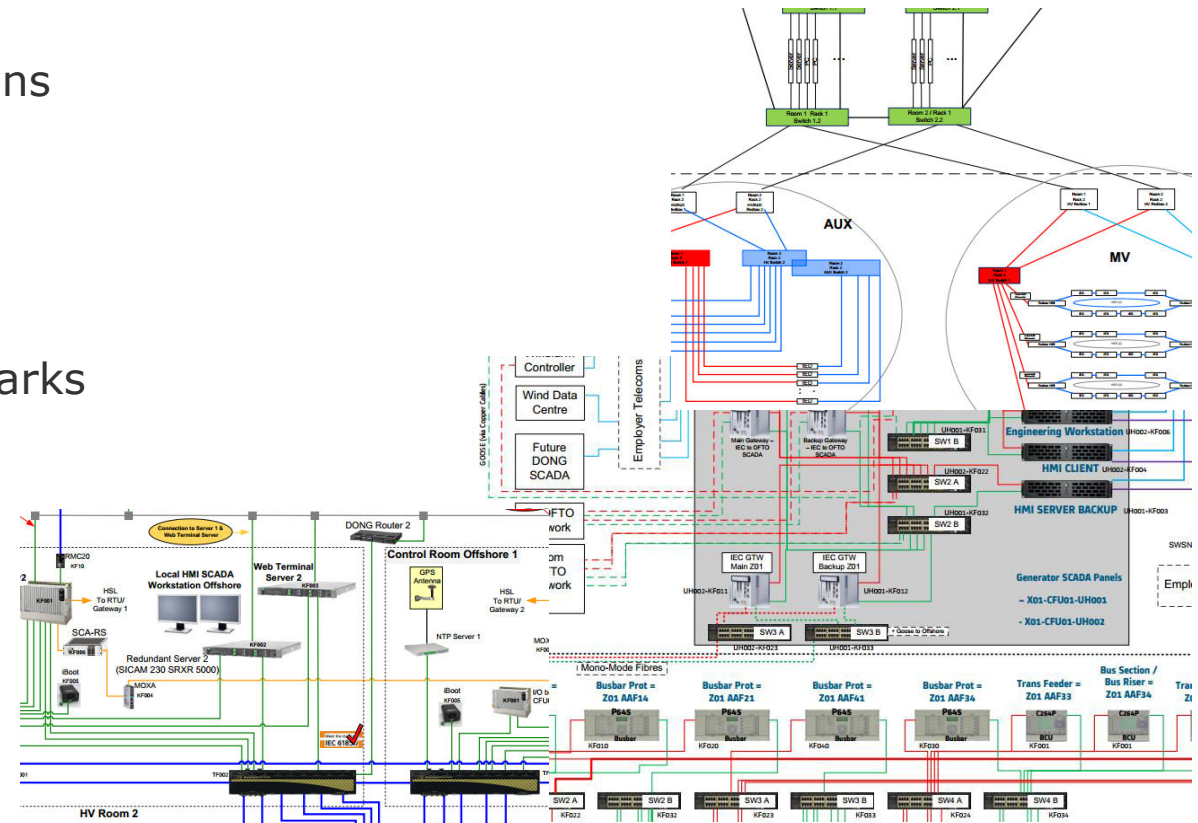
- First half of 2016 – study about concepts and potential solutions
- End of 2016 start of the PoC and to rebuild 110/150 kV substations
 - 3 substations from AIS to AIS
 - 2 substations from AIS to GIS
 - 1 substation from indoor AIS to GIS



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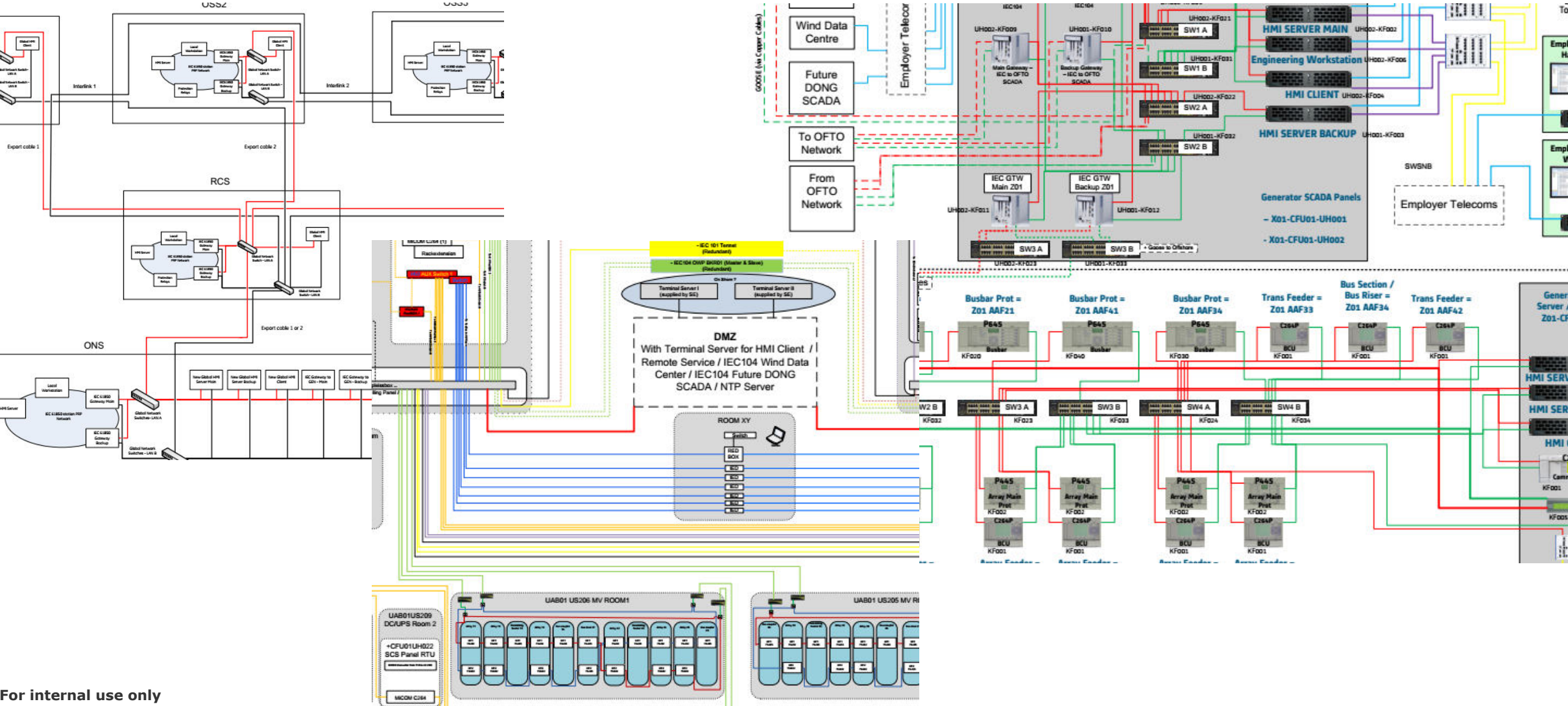
Project experiences

- Wind park owners work with many contractors to design/construct/maintain
- Over the years many architectures have been used:
 - Every contractor has it's own view
 - problems and adjusted philosophies and configurations
 - Technical lifetime is getting shorter
 - Proprietary versus open standards
- WPO is looking for a long-term specs for future wind parks
 - Alarms/HMI
 - IEC 61850 modelling and communication (PROFILE)
 - CS104 communication (PID)
 - Network (LAN) architecture



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Project experiences



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Testing of components

The diagram illustrates the testing components for IEC 61850, divided into seven segments:

- Type test 61850-3
- SCADA interfaces
- Client Ed 1 and 2
- Server Ed 1 and 2
- Sampled values
- GOOSE
- Engineering tools

Accompanying the diagram are three screenshots of the DNV-GL Test Register for IEC 61850:

Test Register for IEC 61850 - Edition 2 Client Systems

Updated: June 10, 2015

MANUFACTURER	COUNTRY	CLIENT ED.	PROTOCOL	DATE
Siemens	Germany	SICAM PAS/RGS Software version: 8.03	IEC 61850-9-1 block 1, 2, 2+, 4, 5, 6, 12abod, 13, 14	2013-04
ATS	Vietnam	ATS@Station	IEC 61850-9-1 block 1, 2, 5, 6, 12abod, 13, 14	2013-09

Test Register for IEC 61850 - Edition 1 Client Systems

MANUFACTURER	COUNTRY	CLIENT ED.	PROTOCOL	DATE
INEA	Slovenia	NE-RTU Version 90.24	IEC 61850-9-1 block 1, 5, 6, 12abod, 13	2015-03
Inventive Systems	USA	Pushover Bus SC2000 Version: 101-1101207_8	IEC 61850-9-1 block 1, 5, 6, 12abod, 13	2013-02
SEONDO Electric	Korea	SEB-SA IEC 61850 Client Version 1.0.0.0	IEC 61850-9-1 block 1, 2, 2+, 4, 4+, 5, 6, 12abod, 13, 14	2014-07
ENTEC Electric & Electronics	Korea	Avase-4.0300 Version 1.0	IEC 61850-9-1 block 1, 2, 2+, 4, 4+, 5, 6, 12abod, 13, 14	2014-06
NR Electric	China	PCS-9700 SCADA/HMI Workstation Version R1 (2014-04-27)	IEC 61850-9-1 block 1, 2, 2+, 4, 4+, 5, 6, 12abod, 13, 14	2014-03
Siemens	Germany	SICAM CMSC (Firmware version 8783 Rev. 01)	IEC 61850-9-1 block 1, 2, 2+, 5, 12abod, 13	2014-04
GARD	Korea	GRPAJ Version 3.0	IEC 61850-9-1 block 1, 2, 2+, 4, 4, 5, 6, 12abod, 13, 14	2013-10
Smarter Grid Solutions	United Kingdom	Spz commhub with IEC 61850 Driver version 2.2.0	IEC 61850-9-1 block 1, 2, 3, 5, 6, 12abod, 13	2013-09
Survallent Technologies Corporation	Canada	Survallent Advanced Automation Management System, v1.13.0021	IEC 61850-9-1 block 1, 2, 2+, 5, 6, 12abod, 13	2013-08
ABB	Finland	MicroSCADA core Software: SVS 650 9.3 v1.14	IEC 61850-9-1 block 1, 2, 2+, 4, 4+, 5, 6, 12abod, 13, 14	2013-07
ARC Informatique	France	Controler for PIVUE version 11.0.2021.2290	IEC 61850-9-1 block 1, 2, 5, 6, 12abod, 13	2013-07
Hyundai Heavy Industries	Korea	HNAS 41300 Client HW version 1.0	IEC 61850-9-1 block 1, 2, 2+, 4, 4+, 5, 6, 12abod, 13, 14	2013-06
Siemens	Germany	SICAM 220 Version 7.00 SR0	IEC 61850-9-1 block 1, 2, 2+, 5, 6, 12abod, 13, 14	2013-06
YPP Corporation	Korea	YPP Partners with IEC 61850 Driver version 1.0	IEC 61850-9-1 block 1, 2, 2+, 4, 4+, 5, 6, 12abod, 13, 14	2013-06

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Conclusions

- Digital substations require paradigm changes and teamwork
 - IEC 61850 need to get out of the substation
 - OT/IT integration in terms of data needed
 - Enabling new use cases
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- Conformance is based on testing of specific versions of the standard (IEC 61850, Edition 1 or 2)
 - Functional/application testing is based on profiles
 - Using an IEC 61850 model increases data quality and reduces engineering efforts
-
- Utilities should require conformance tested IEDs but also certified SCL Engineering tools

Let's digitalize together!

For more information, please get in touch !

Bas.Mulder@dnvgl.com

+31615063666

www.dnvgl.com

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