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Substation to Control Centre (and more)

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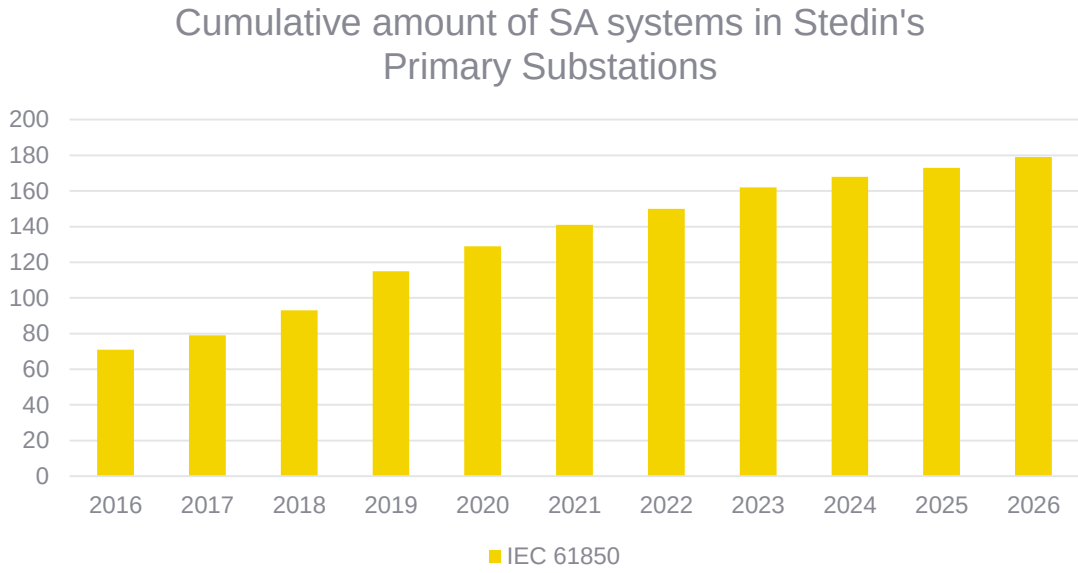
Stedin and IEC 61850

- Stedin adopted IEC 61850 in 2007 as its 3rd generation substation automation architecture
- All newly built primary substations are IEC 61850 based. Refurbishing 10-15 primary substations per year. Ambition to have vast majority on IEC 61850 in 2030.
- [Strong] international supporter of IEC 61850
- We standardize substations on:
  - Operating model
  - Functionality
  - Hardware and software components
  - Data model
  - Engineering



Why are we using IEC 61850?

Why are we using IEC 61850?

- No other choice?
- Engineering efficiency?
- Interoperability?
- From hardware to software?
- Phase out proprietary protocols?
- …?
- What about data modelling?!
- Integral testing?!

What are we doing?

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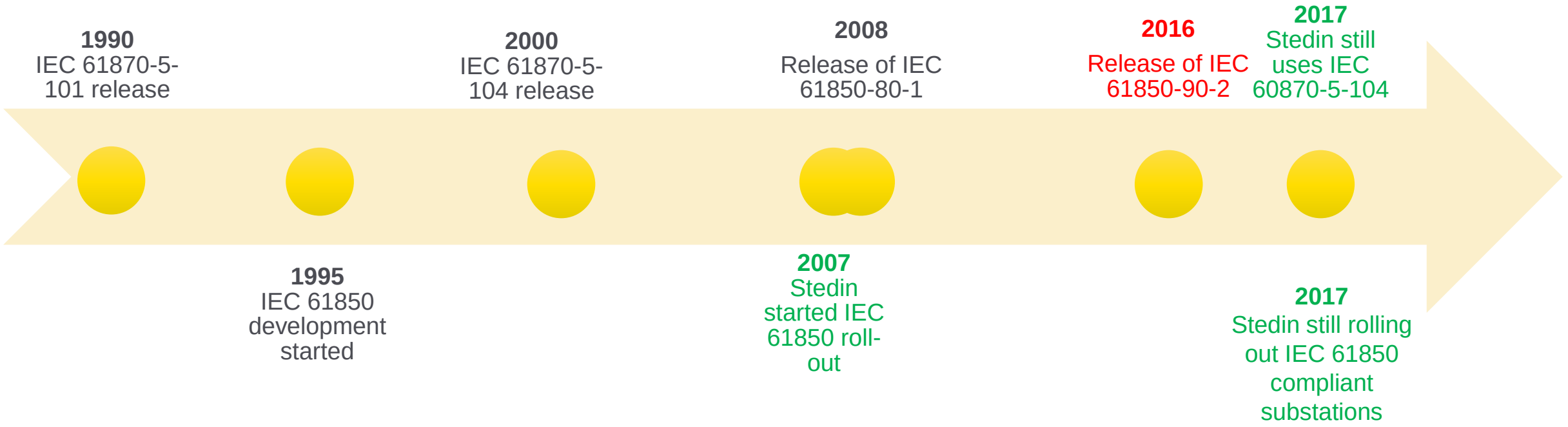
What are we doing?

…and still not using modelled IEC 61850 data…?

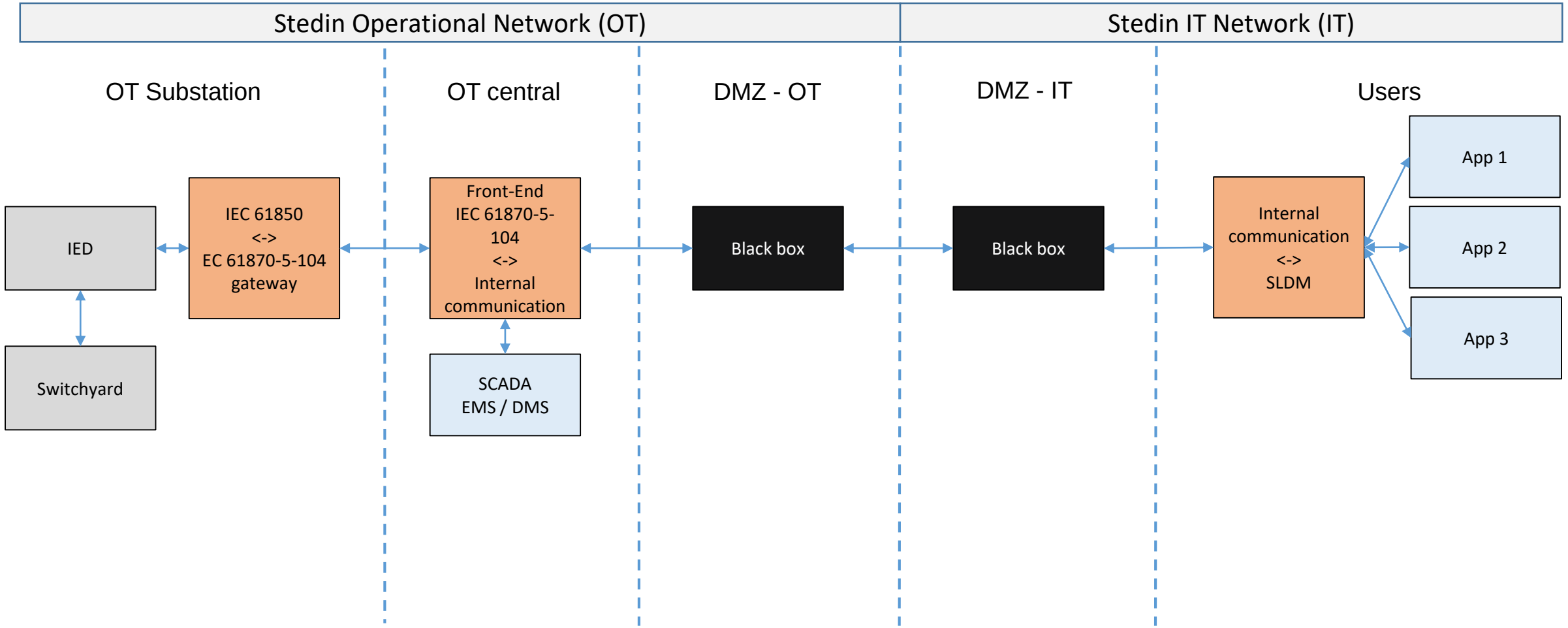
What’s the problem?

- Lack of OT modelled data (only inside the substation)
- Inefficient OT – IT work- and dataflow
- Gateway hardware and configuration costs
- HMI hardware and configuration costs

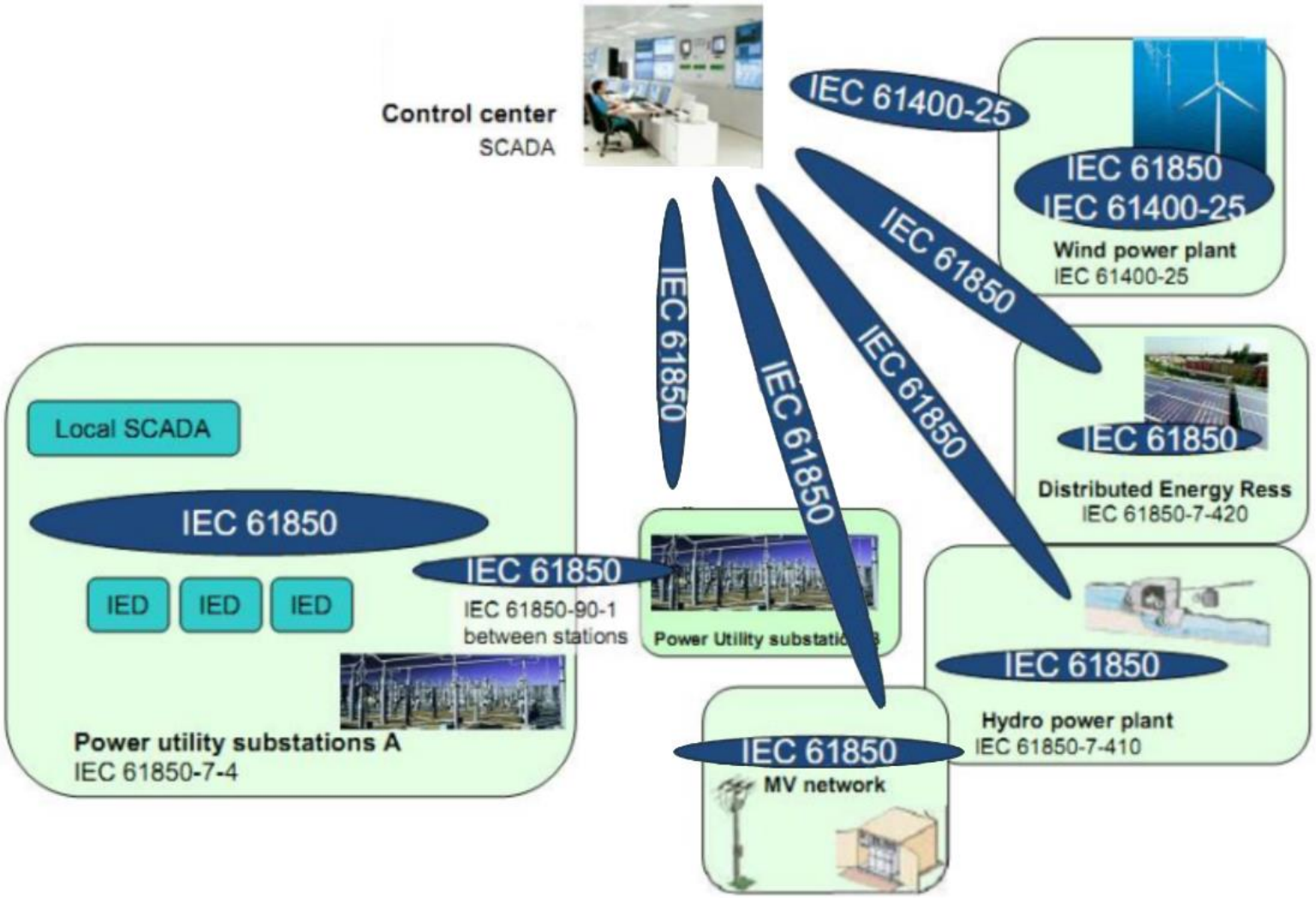
Important standards SS-CC – timeline



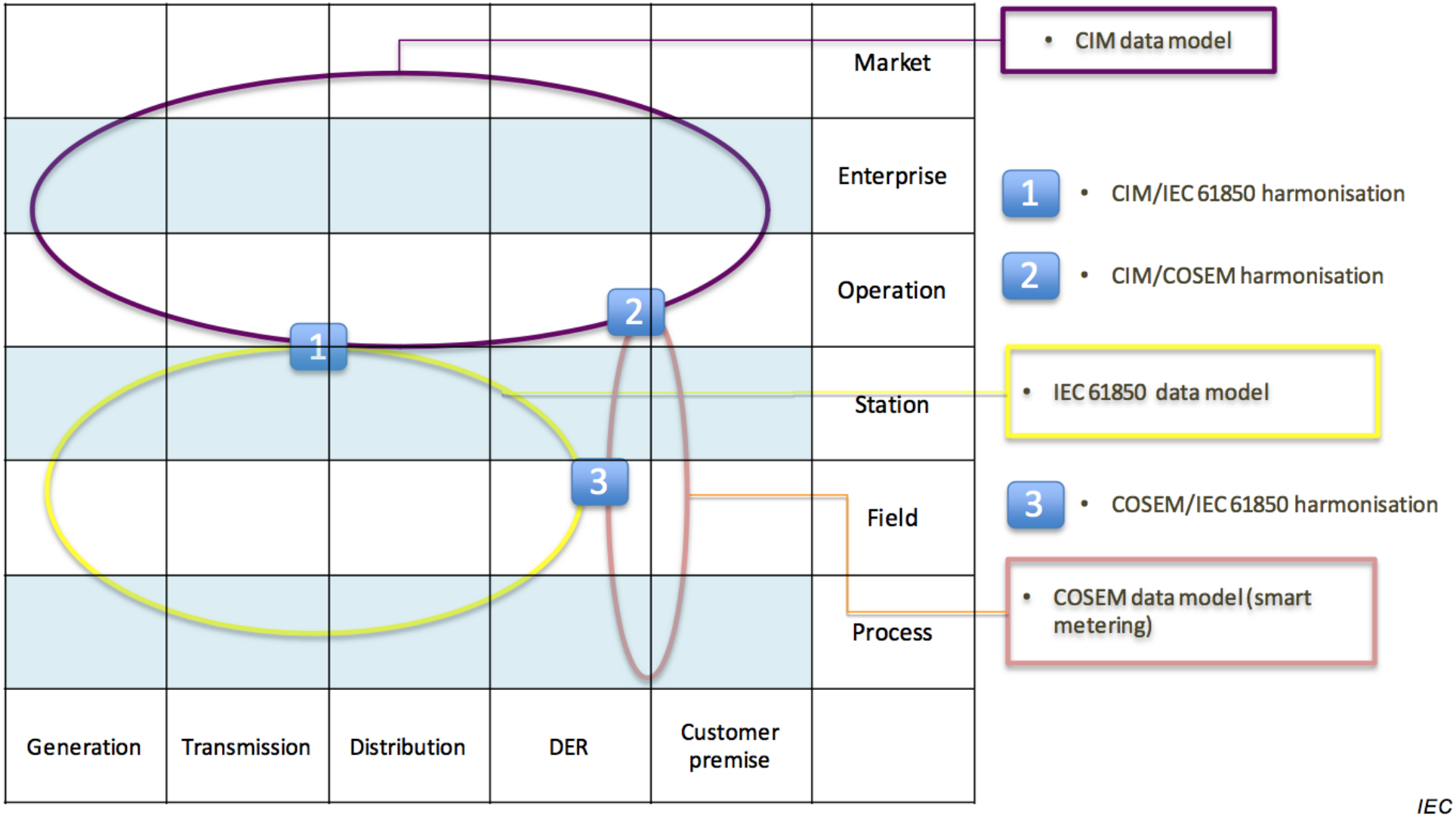
IT/OT simplified architecture – the big translator chain…



IEC landscape – availability of modelled data



TC57 reference architecture (IEC TR 62357-1)



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Quote

- *The object models and configuration language introduced by IEC 61850 provide new possibilities for the management of the automation system. A direct and seamless access from the control and maintenance centres to the IEDs of the substation automation system allows efficient data management of the overall control system.* (source: IEC 61850-90-2)

IEC 61850, get out of the substation!

- Improve existing use cases
  - Telecontrol, disturbance, counting, PQ, etc.
- Enable new use cases
  - Advanced device management and maintenance
  - Online configuration management
  - Looseless data connection due to the lack of a convertor
  - Sophisticated IT/OT integration
  - Multiple substations on virtualized HMI in substation
  - Etc.

There is a huge potential

- Huge savings in hardware, software and configuration costs
- Availability of modelled data, e.g.
  - Feed the GIS data an operational context
  - Enable operational analytics
  - Enable on-line configuration management
  - Etc…
- Efficient OT – IT workflow
- Improving existing use cases
- Enabling new use cases
- Improved reliability

IEC 61850-90-2 → a important key to success

- Think about your use cases
- Create an architecture and an IEC 61850-90-2 PID

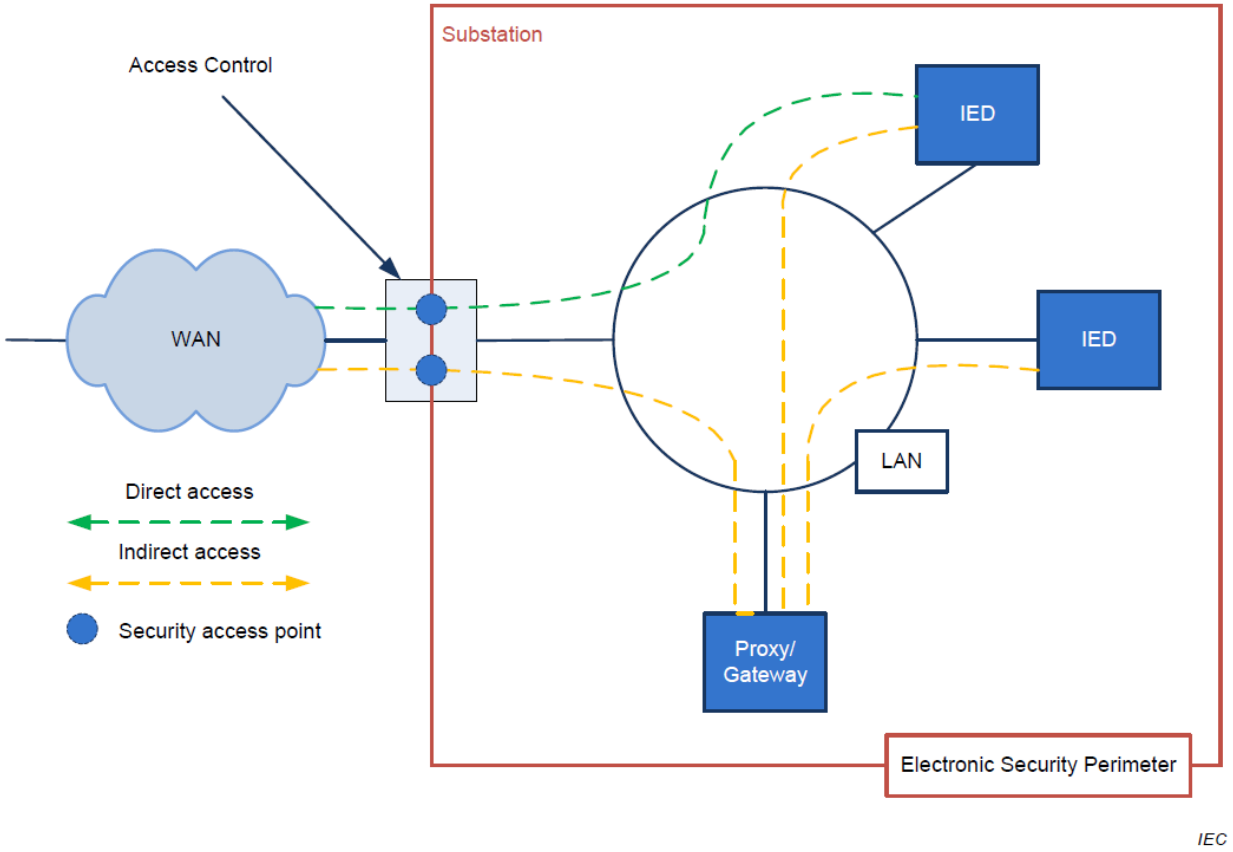
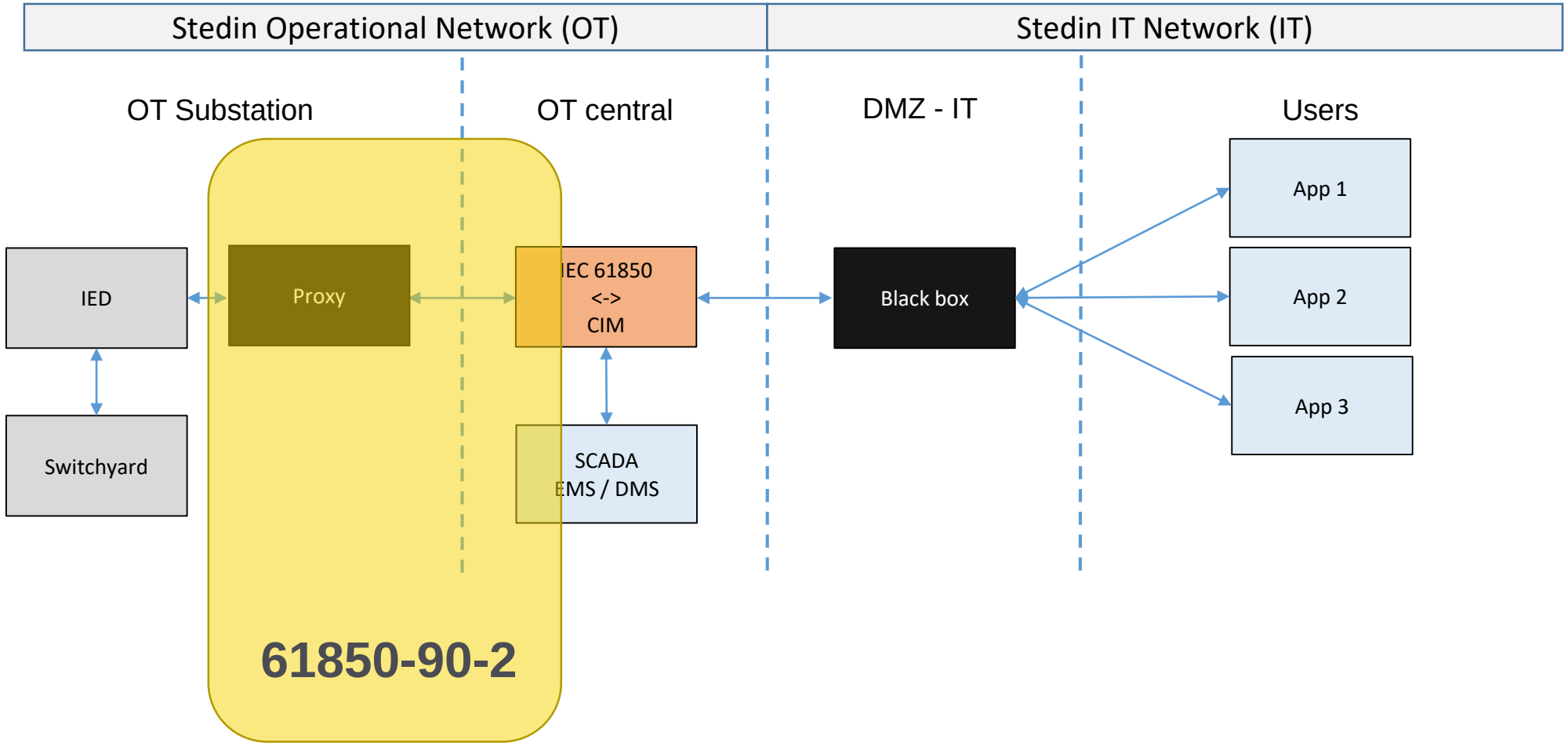


Figure 1 – Connectivity and communication paths of a substation

IT/OT simplified architecture – speaking the same language



Why is this not common?

- Grid operators; often different people and paradigms for central applications and Substation Automation guys

- Vendors; development roadmaps made from different point of views, quite similar to grid operators

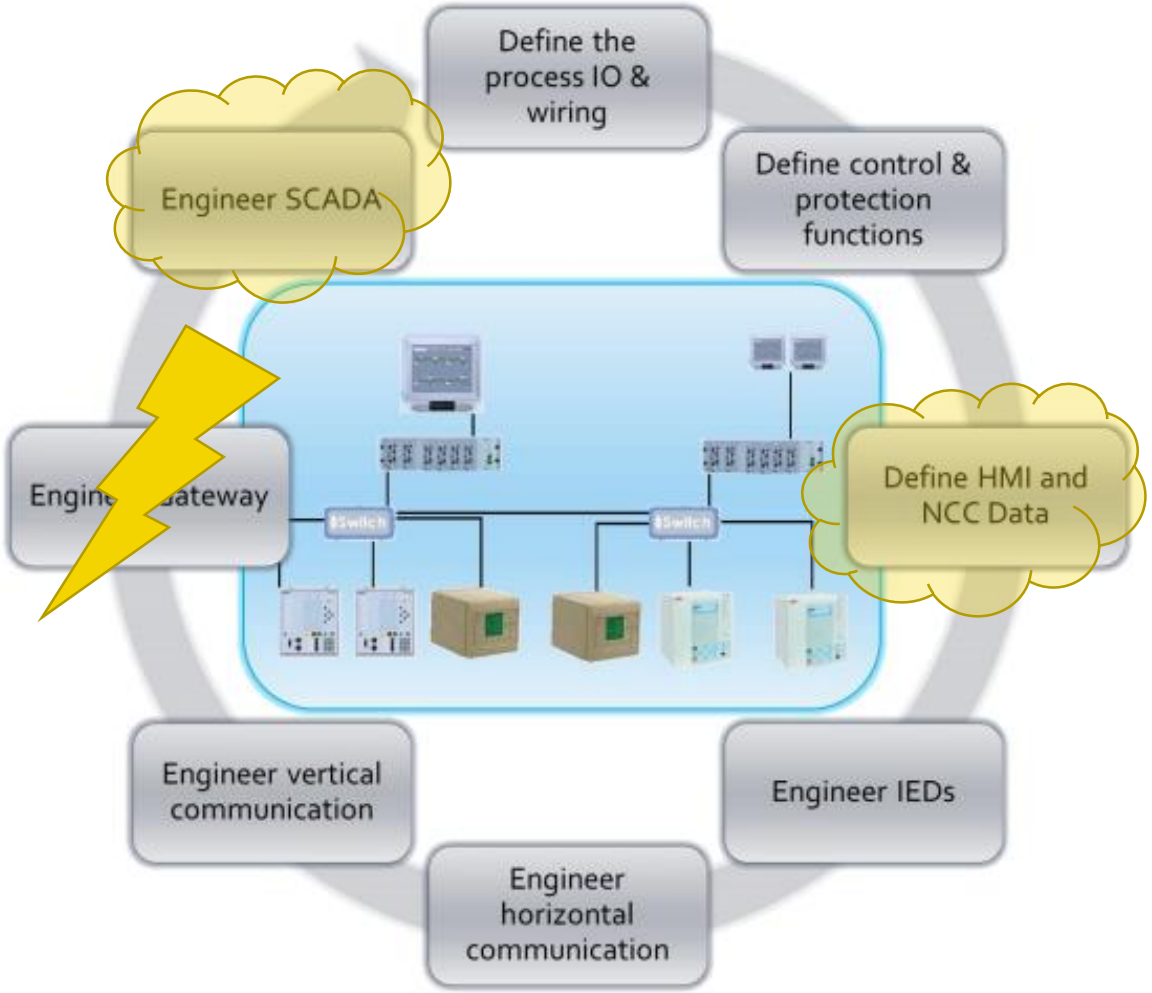
Connecting Distribution Automation and IoT devices

- Increasing need for structured data from thousands of devices
- CIM and IEC 61850 modelled data
- XMPP / MQTT via IPv6 networks

- DSOs struggle with diversity:
  - Many vendors and different views and approaches
  - Multiple communication and configuration standards
  - Many firmware updates and bug fixes
  - Microsoft Windows systems

Engineering

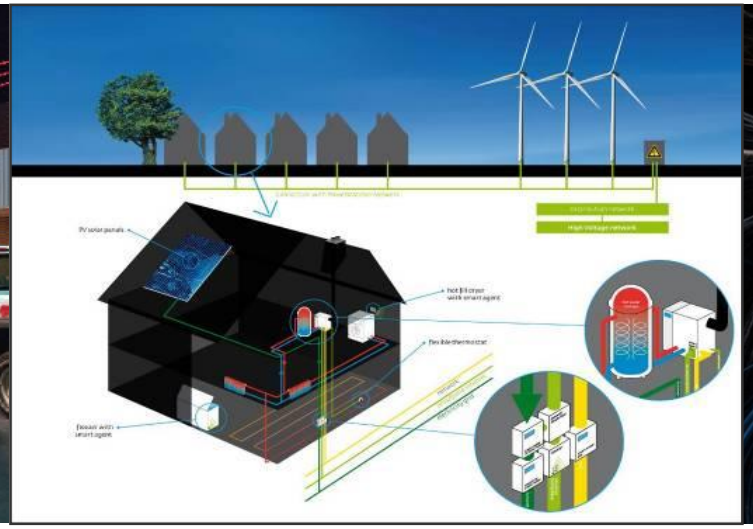
- Traditional cycle
- Digital substation means teamwork
- Digital substations breaks with existing paradigms



- Vendor selection based upon functions is key
- IEC 61850-6-2 plays an important role (in SS-CC integration)
- SCL engineering is function oriented including primary and secondary equipment, real-life is still signal oriented

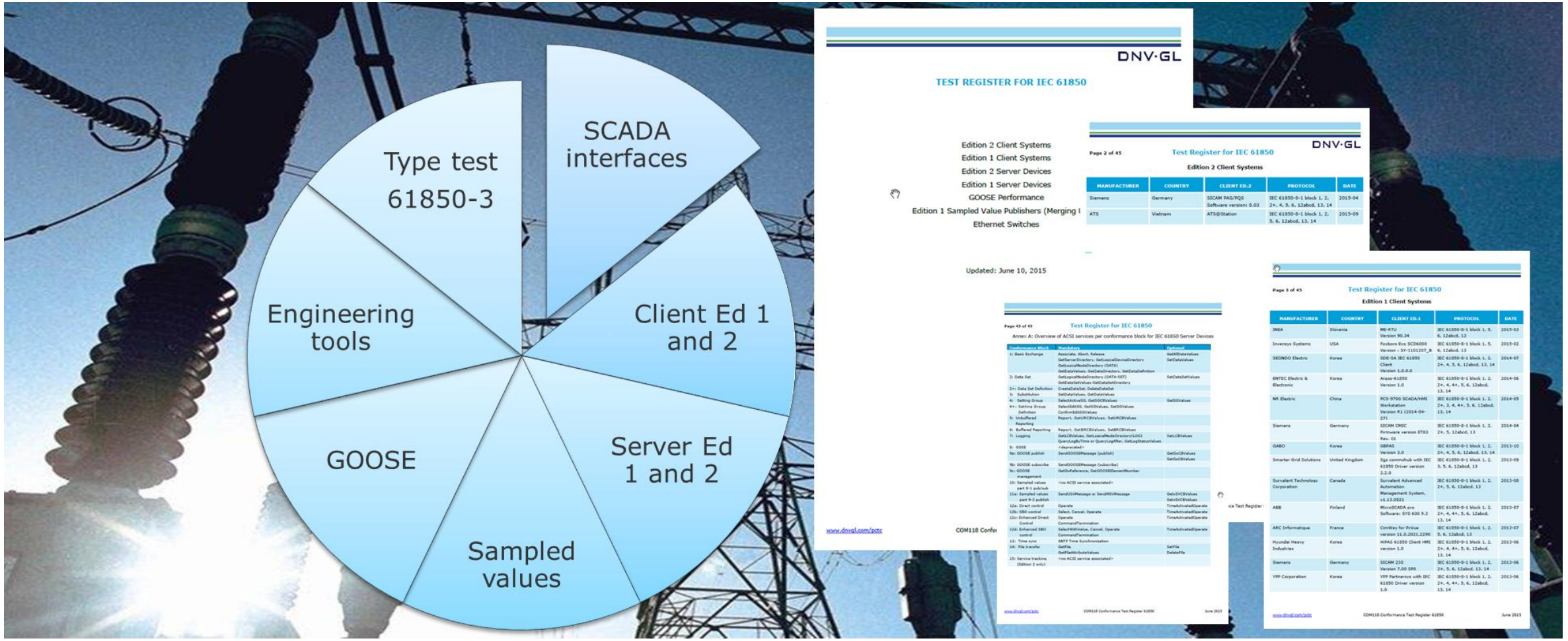
Picture provided by Joulz

Why more advanced testing?



- Smart Grids! Complex systems resulting in more data, need for integral testing
- Optimised use of the primary assets -> more data needed by operations
- Number of engineers is the same -> do more with less engineers
- Reduce the scheduled outage time
- IEC 61850 -> multi-vendor interoperability -> integral testing of the system

Testing of components



Lessons learned

- Conformance testing has improved IEC 61850 products
- Edition 2 fixed interoperability issues in tools and devices
- Int-op testing is done regularly

- SCADA vendors do not talk IEC 61850 (yet)
- Integration of IEC 61850 and SCADA asks more from telecom infra
- Training and education are repeating activities

- **Utilities** shall require tested and certified Engineering tools, IEDs and gateways/interfaces

- **Manufacturers** shall test during product development

Lessons learned – the way to success

Open standards

Use of open standards allows the end-user to select equipment based upon functionality and performance criteria, and not on supplier or technology. Open standards are key to ensure multiple suppliers.

Conformance & Interoperability

When having multiple suppliers conformance and interopability becomes crucial

Quality Assurance

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Detailed Specifications	Test procedures	Independent party

Conclusion

- IEC 61850 need to get out of the substation
- OT/IT integration in terms of data needed
- Enabling new use cases
- Teamwork and clear requirements needed

- Uniformity of substation automation design including SCADA interfaces
- Interoperability and Interchangeability are key aspects
- Using an IEC 61850 model increases data quality and reduces engineering efforts
- Future Proof, Protocol and device Agnostic

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