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Smart Grid / Smart Market Communication based on IEC 61850-8-2 and XMPP

Smart Grid FORUM, Hannover Fair 2015

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IEC 61850 – Worldwide - standardized Communication in Smart Grids

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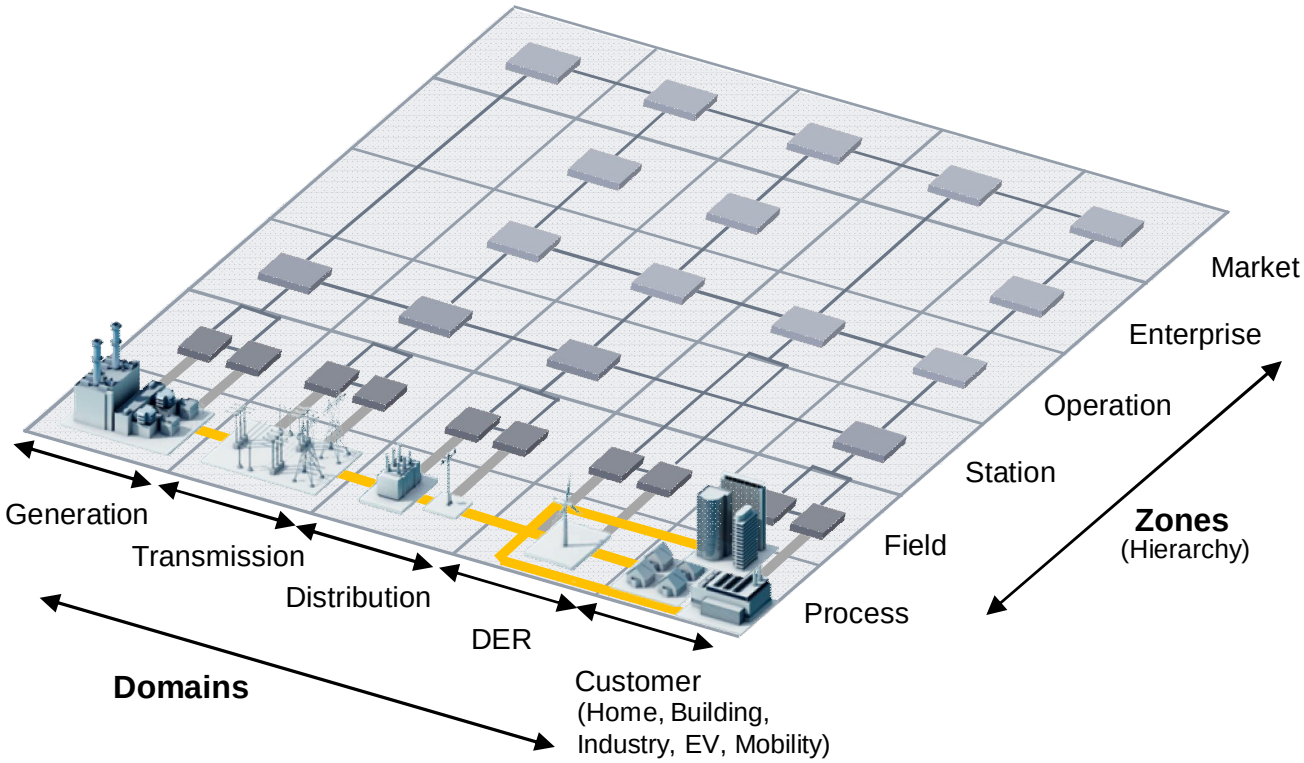
Smart Grid Architecture Model



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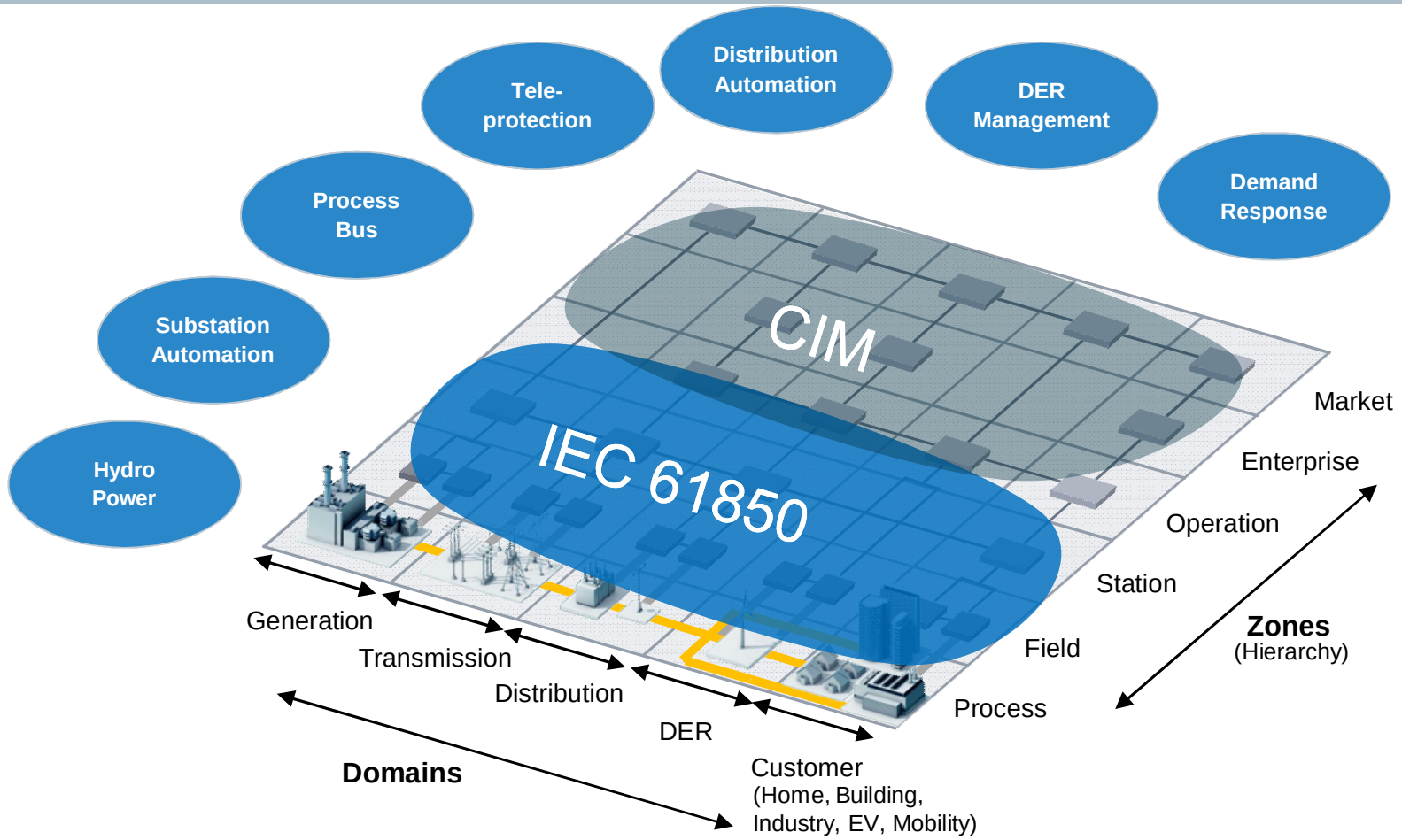

IEC 61850 – Worldwide - standardized Communication in Smart Grids

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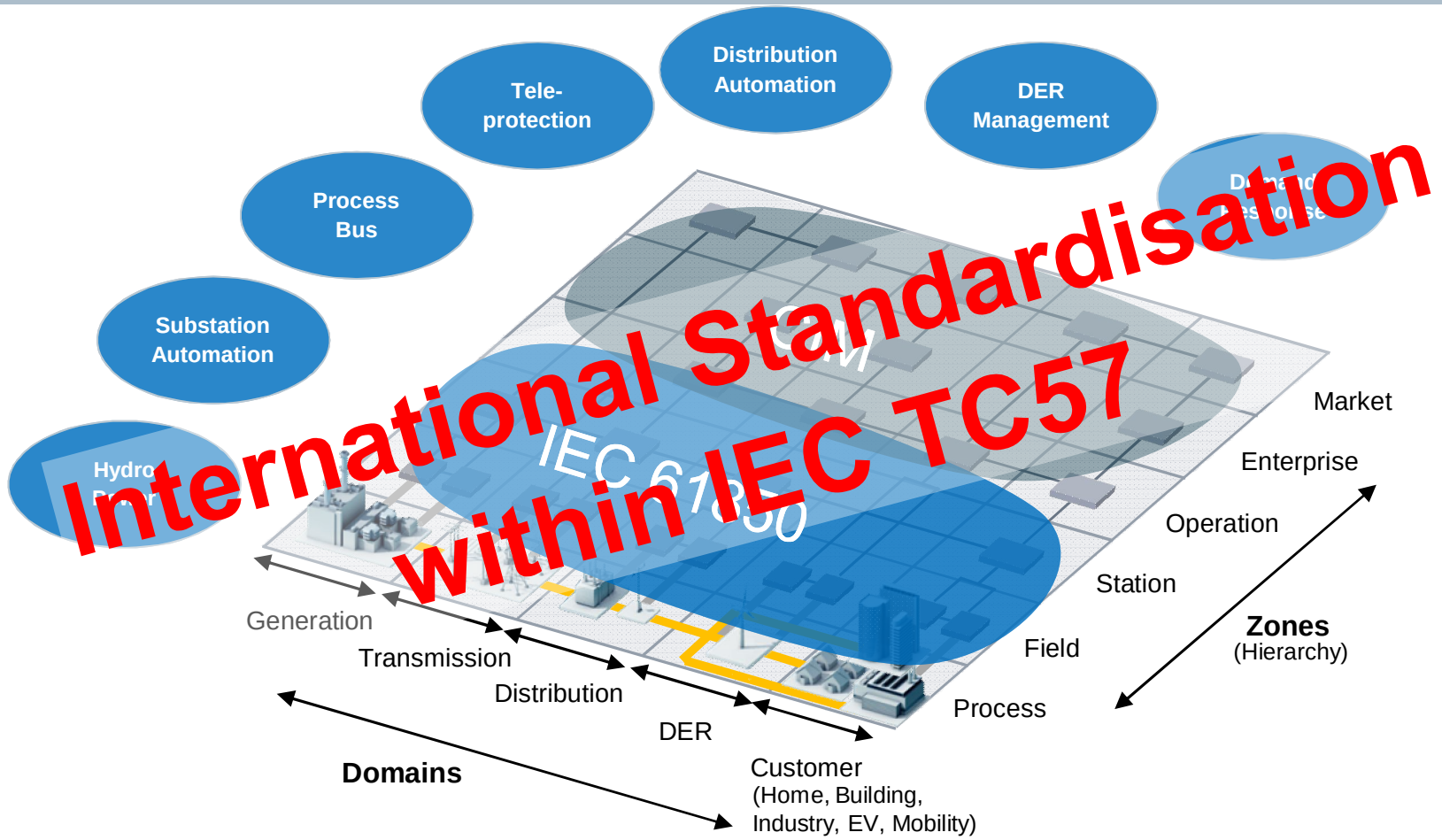

IEC 61850-8-2
Standardization Project of IEC TC 57 WG17

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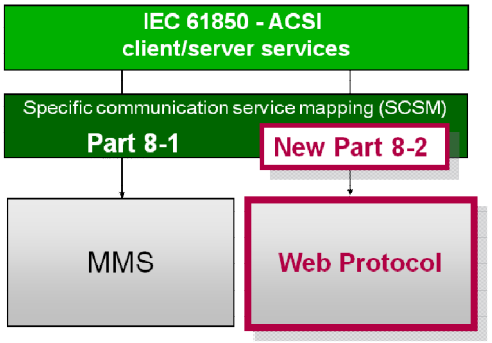
Goal:

IEC 61850-8-2 specifies a method of exchanging non-time-critical data through any kinds of network, including public networks.

Part 8-2 Specific communication service mapping (SCSM) – Mapping to Extensible Messaging Presence Protocol (XMPP)

- Comply with the edition 2 and future editions of IEC 61850-7-1, IEC 61850-7-2, IEC 61850-7-3 and IEC 61850-7-4
- Support the existing application data model defined in IEC 61850-7-410, 7-420 and 61400-25-2
- Consideration of cyber-security, in conjunction with IEC TC 57 WG 15 work
- **complementary to the existing SCSM (8-1), not competing**



Comparison of Requirements regarding Station Automation und Smart Grid/Smart Market

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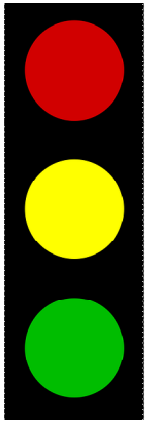
Requirements	Station Automation	Smart Grid / Market Use Cases
Number of devices	Up to 100 devices per substation	1.000 – 10.000.000 devices in systems
Number of data points	> 1000 DP per device	Ca. 10-100 DP per device
Engineering	Static, seldom changes	Dynamic system management
Real time Performance	In miliseconds	In seconds / minutes
Communication Structures	Local, homogeneous (LAN, Ethernet)	Heterogeneous (FAN, NAN, WAN)
Networks	Private communication networks	Private and public communication networks
Security	Role based access control (RBAC)	End-to-End Authentication and Confidentiality, RBAC, no open interface ports at device

Scenarios and Requirements

- Scenarios for smart market driven interactions, for smart grid driven and emergency interactions are covered.

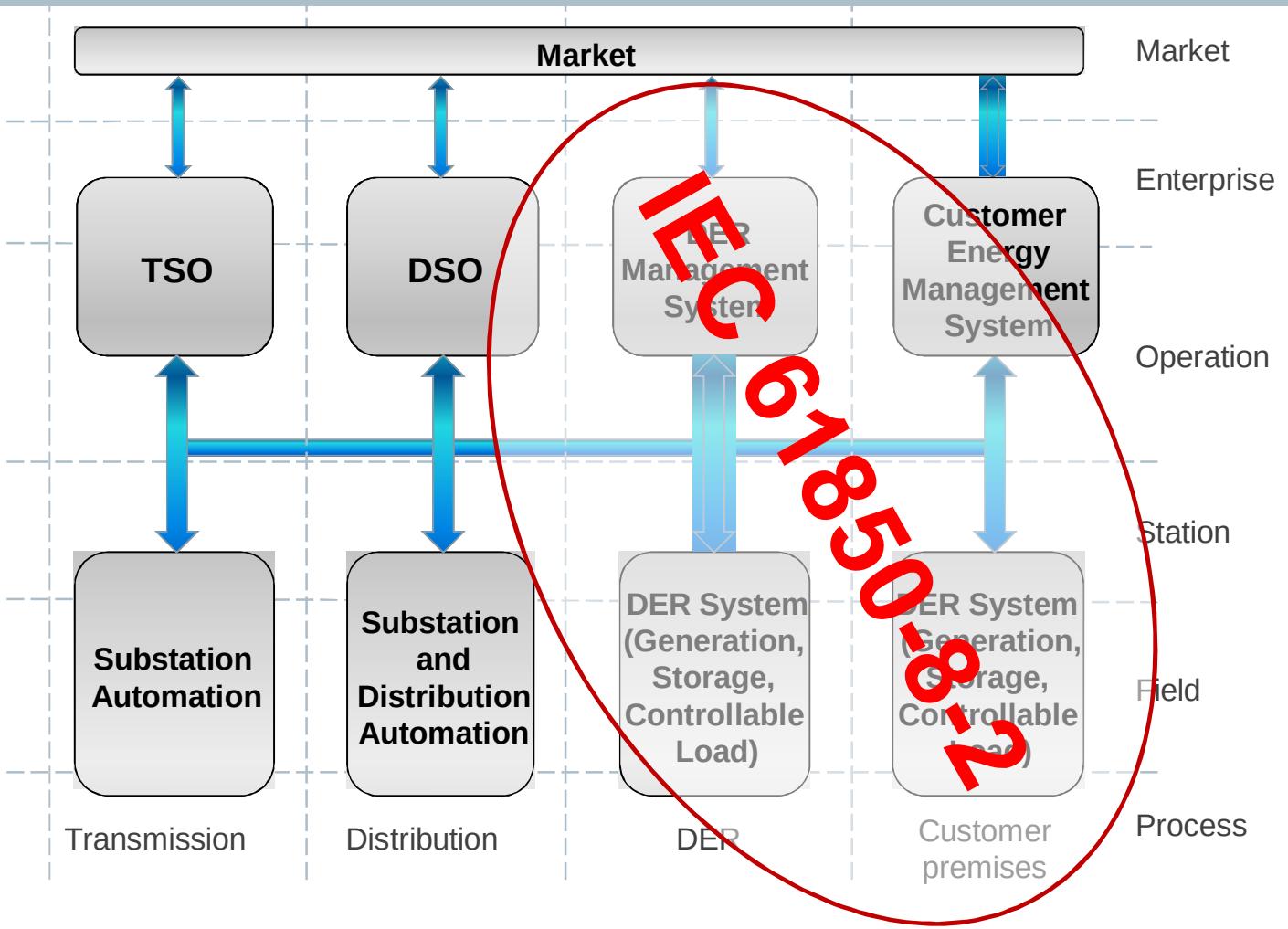


- Therefore closed coordination between several working groups specifying different applications (demand response, power management ..) is established for
  - Domain Distributed Energy Resources (DER) – IEC TC57 WG17
  - Domain Customer Premises – IEC TC57 WG21

- Usage in public networks requires data exchange with 100% End-to-End securtity

- Simple and hierachical configurations should be be supported , e.g autonomous working DER, Virtual Power Plants (VPP), Microgrid Control Center, Buildung/Facility and Industrial Energy Management Systems

Overview of the Configuration in the Smart Grid Architecture Model (SGAM)



DER Integration with IEC 61850 over XMPP
Extensible Messaging and Presence Protocol

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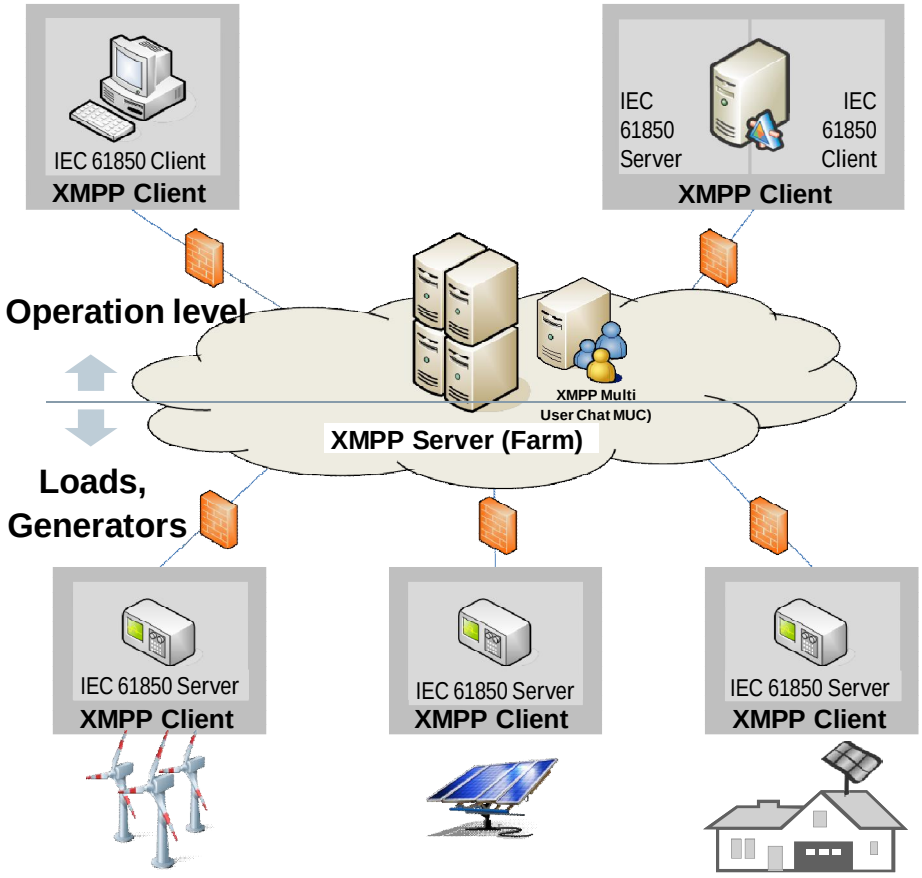
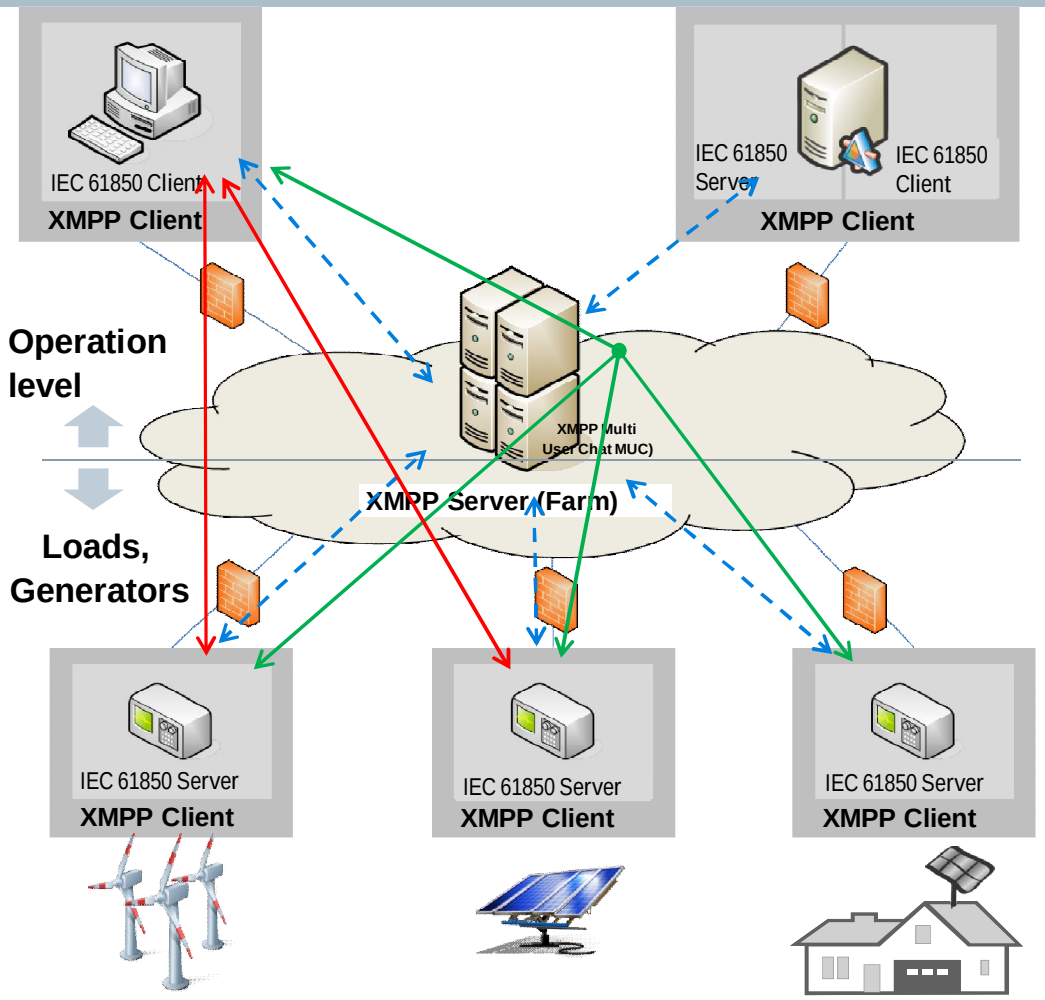
- XMPP is a XML based communications protocol
- Relay architecture (XMPP Server)
- XMPP Client has to start connection (No inbound connection)
- Server Federation for redundancy
- Presence service (presence announcement)
- Efficient group messaging
- Service Discovery



Security Relations of DER Integration



Trust relations

- DER resource (XMPP client on IEC61850 server) belongs to DER owner
- DER control (XMPP client on IEC 61850 client/server) incl. control center belongs to DNO
- XMPP server may belong to DNO or 3rd party service provider

Resulting requirements

- **Authentication**
  - End-to-middle between XMPP client and server or between XMPP servers
  - End-to-end authentication between IEC 61850 client and server instances
- **Integrity** protection between all instances
- **Confidentiality** protection between IEC 61850 client and server instances

Hop-to-Hop

End-to-End unicast

End-to-End multicast

Protocol Stack of IEC 61850-8-2
Specific Communication Service Mapping (SCSM)

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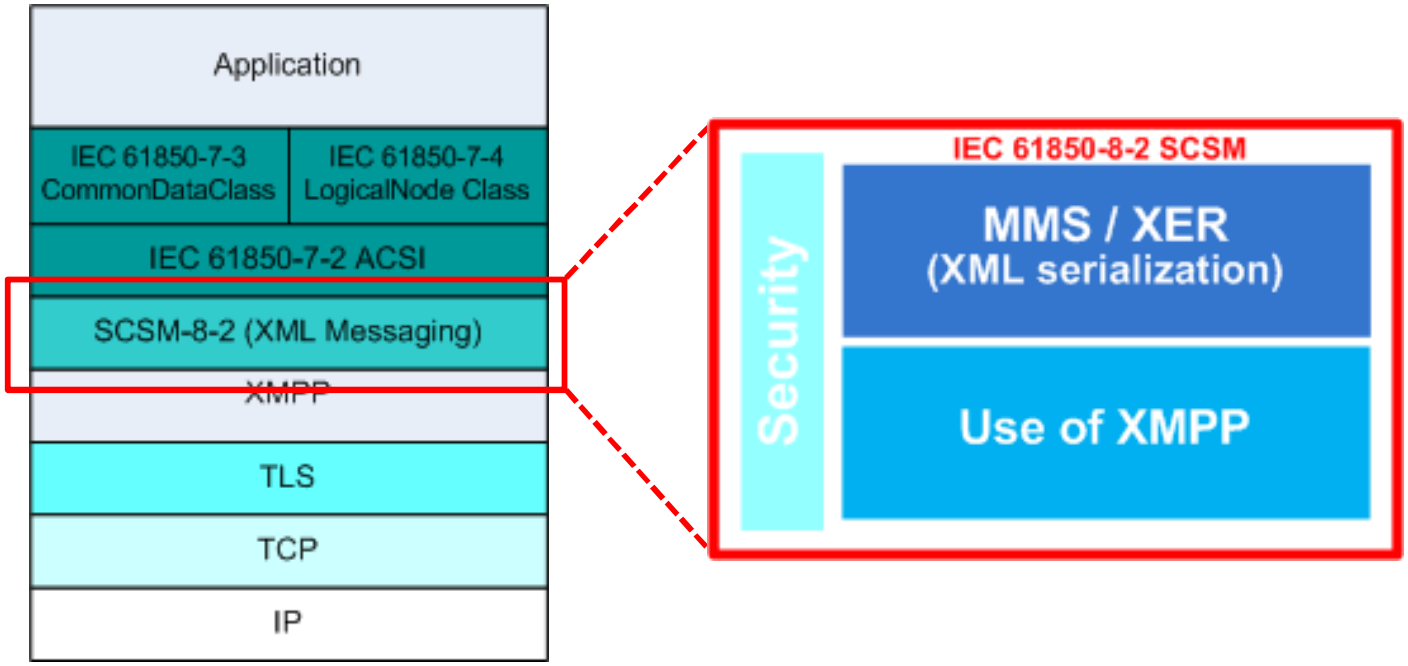
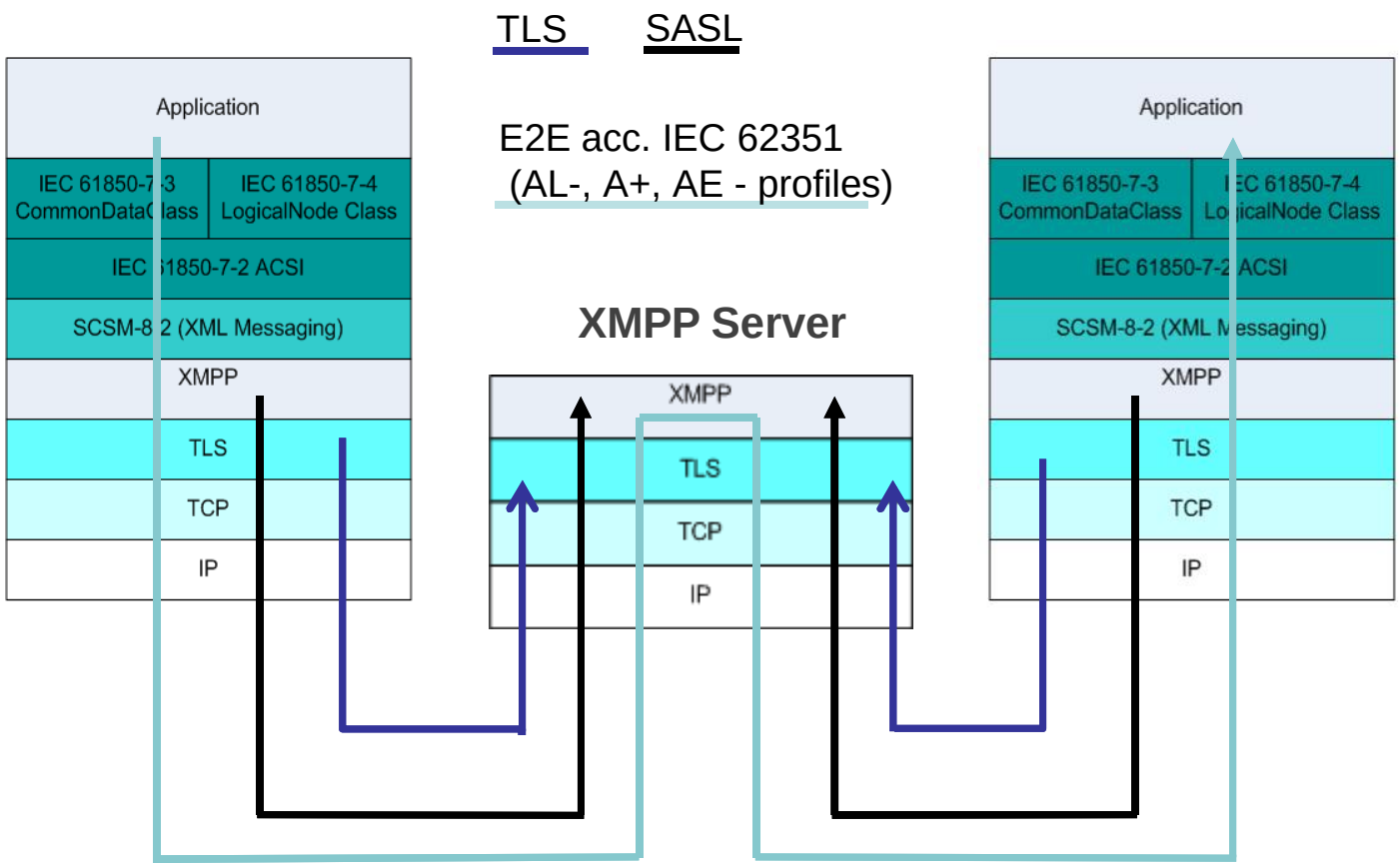
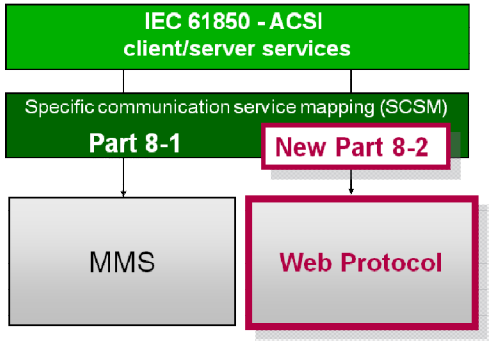


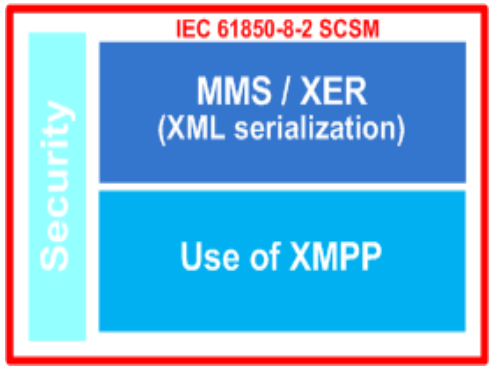
Approaches of Security



Conclusion

- IEC 61850-8-2 extents the IEC 61850 technology by a mapping based on XMPP
- It provides a secure and powerful communication for public networks considering end-to-middle and end-to-end security relations
- IEC 61850-8-2 is intended to use for power management and demand response of DER (distributed energy resources)
- In 2015 the IEC TC57 working group WG17 will finalize and publish this new specification





Contact

Henry Dawidczak
Standardization
Energy Management
Germany
EA PRO D

Humboldtstr. 59
90459 Nuremberg

E-mail:
henry.dawidczak@siemens.com

siemens.com/answers