



Seamless communication from the electricity socket
up to the control centre and the further tasks in the
standardization bodies of IEC

EU-PROJECT WEB2ENERGY

www.Web2Energy.com

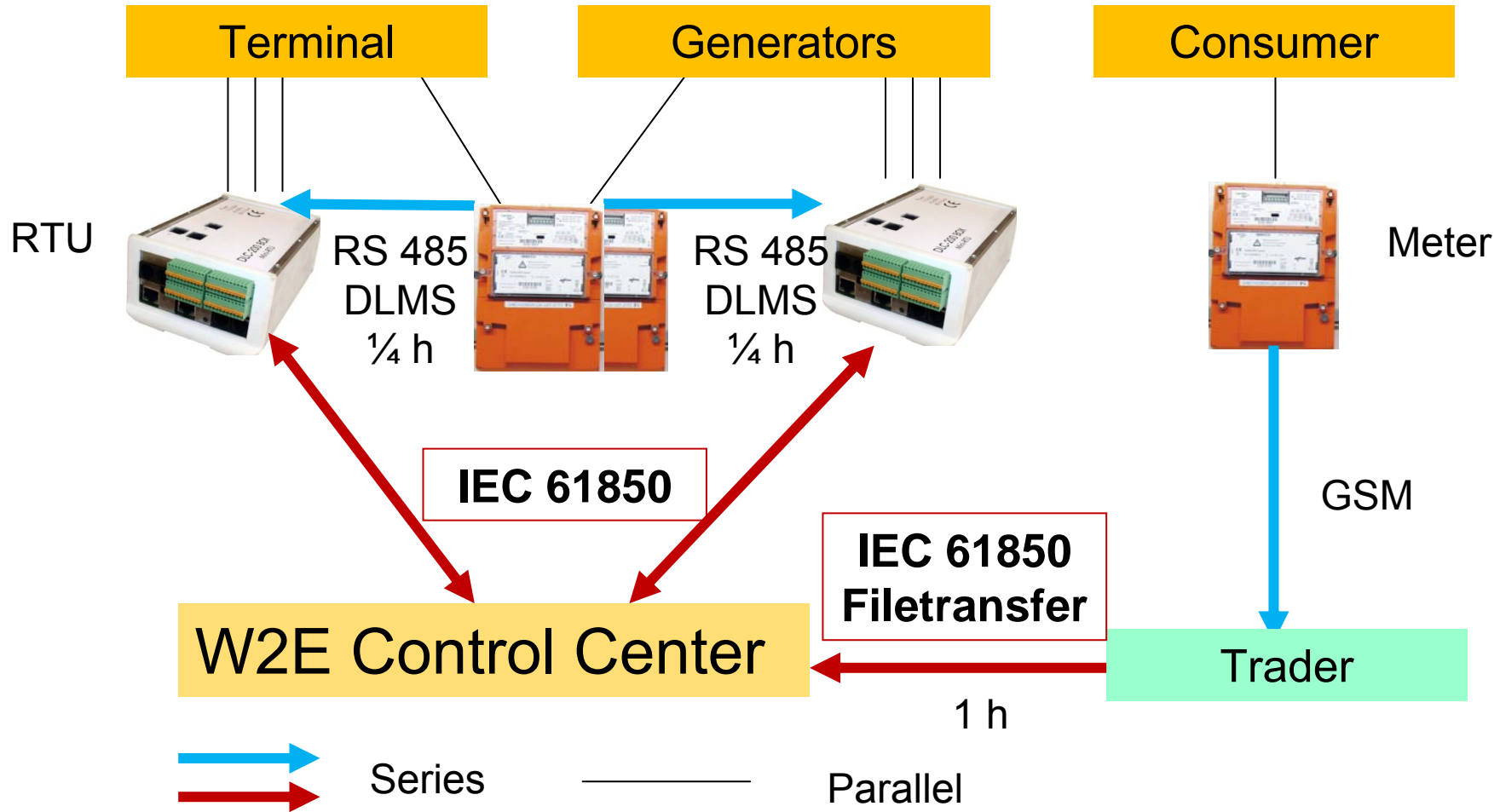
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Web2Energy Communication Architecture

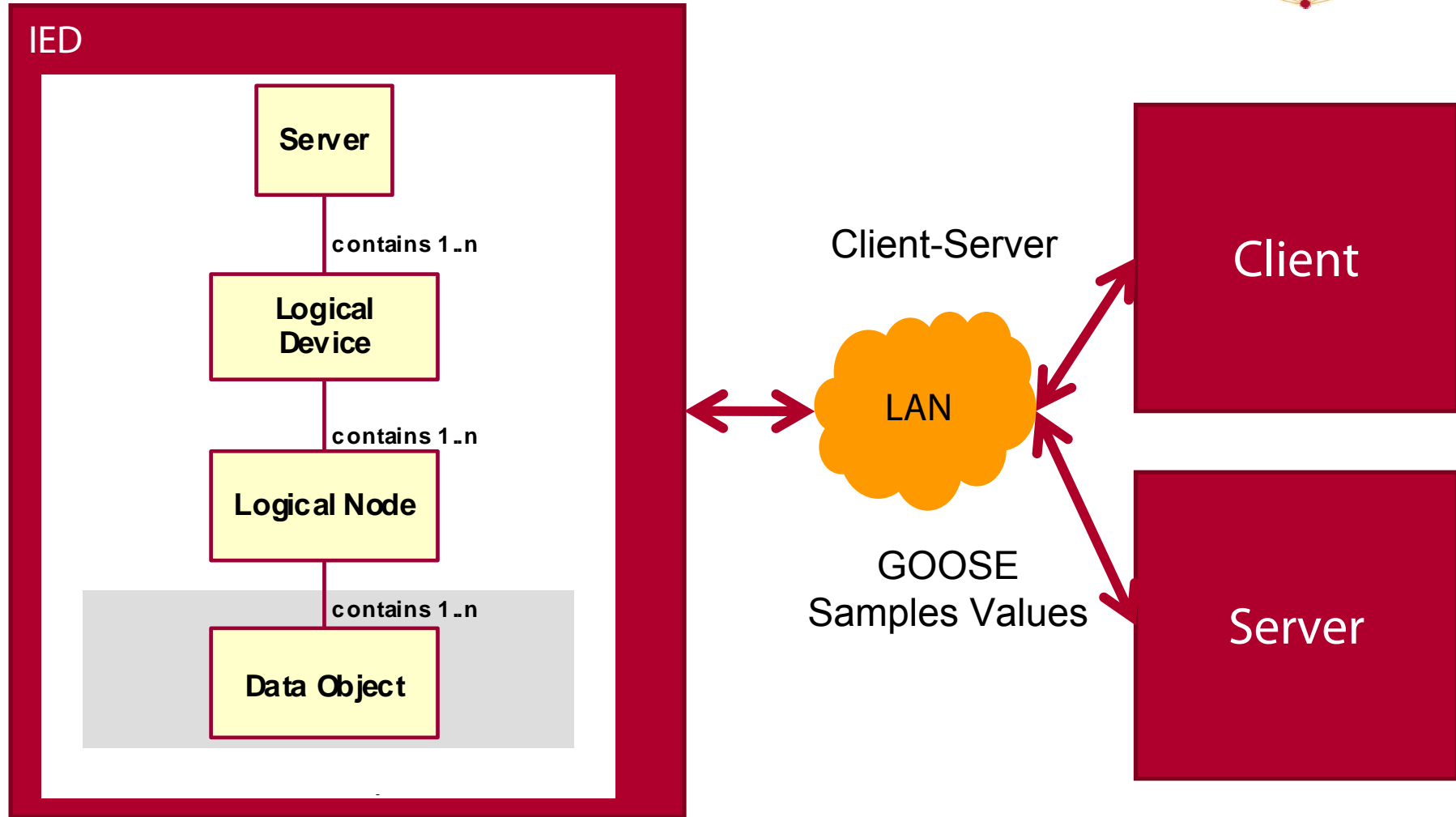


IEC 61850 as a SmartGrid solution

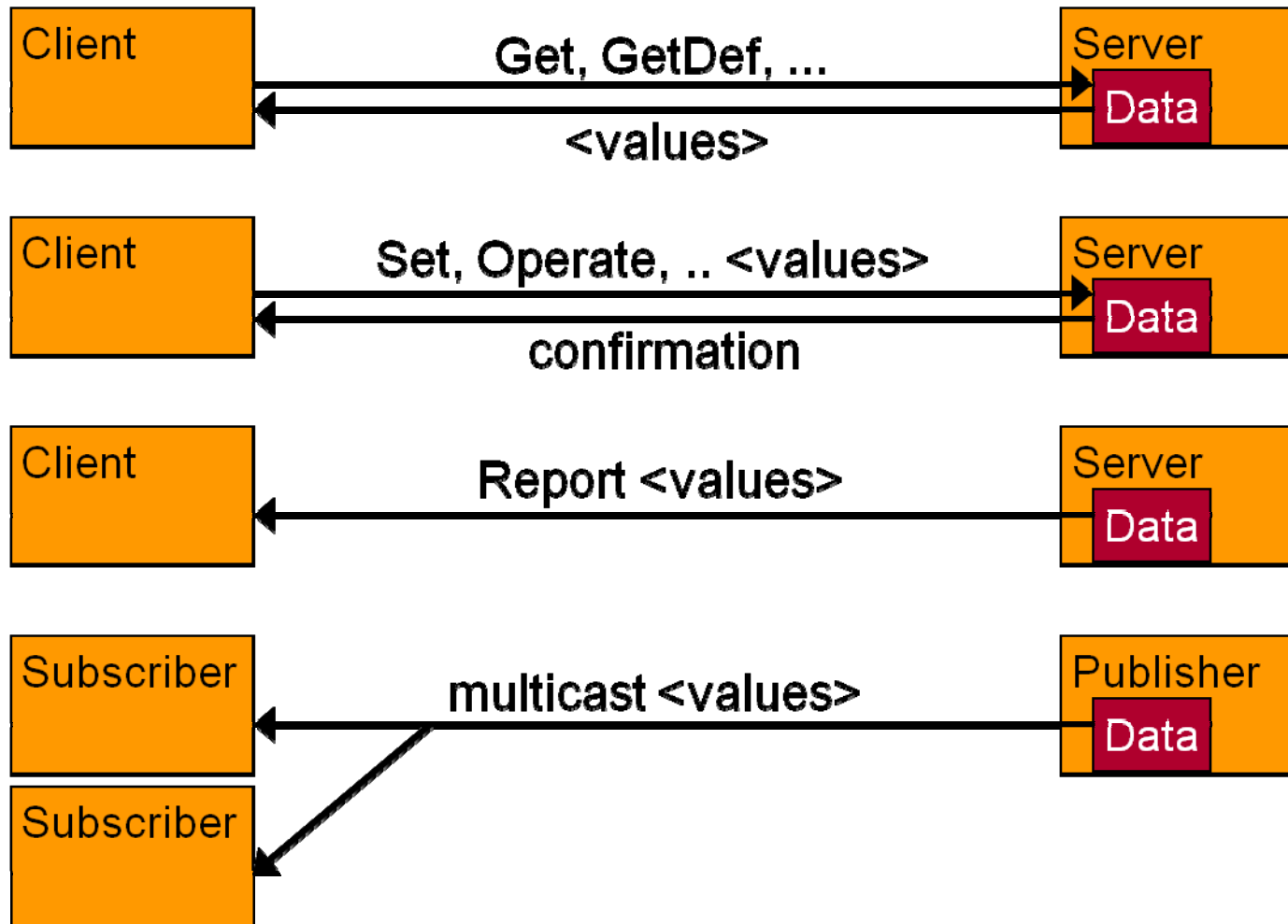


- Global standard for power utility automation
 - Generic, Object Oriented data models
 - Extensible data model
 - Flexible mapping on communication technology
 - Advanced Services – configurable and reliable
 - Realtime communication services
 - IEC ensures continuity in new standards for extended applications
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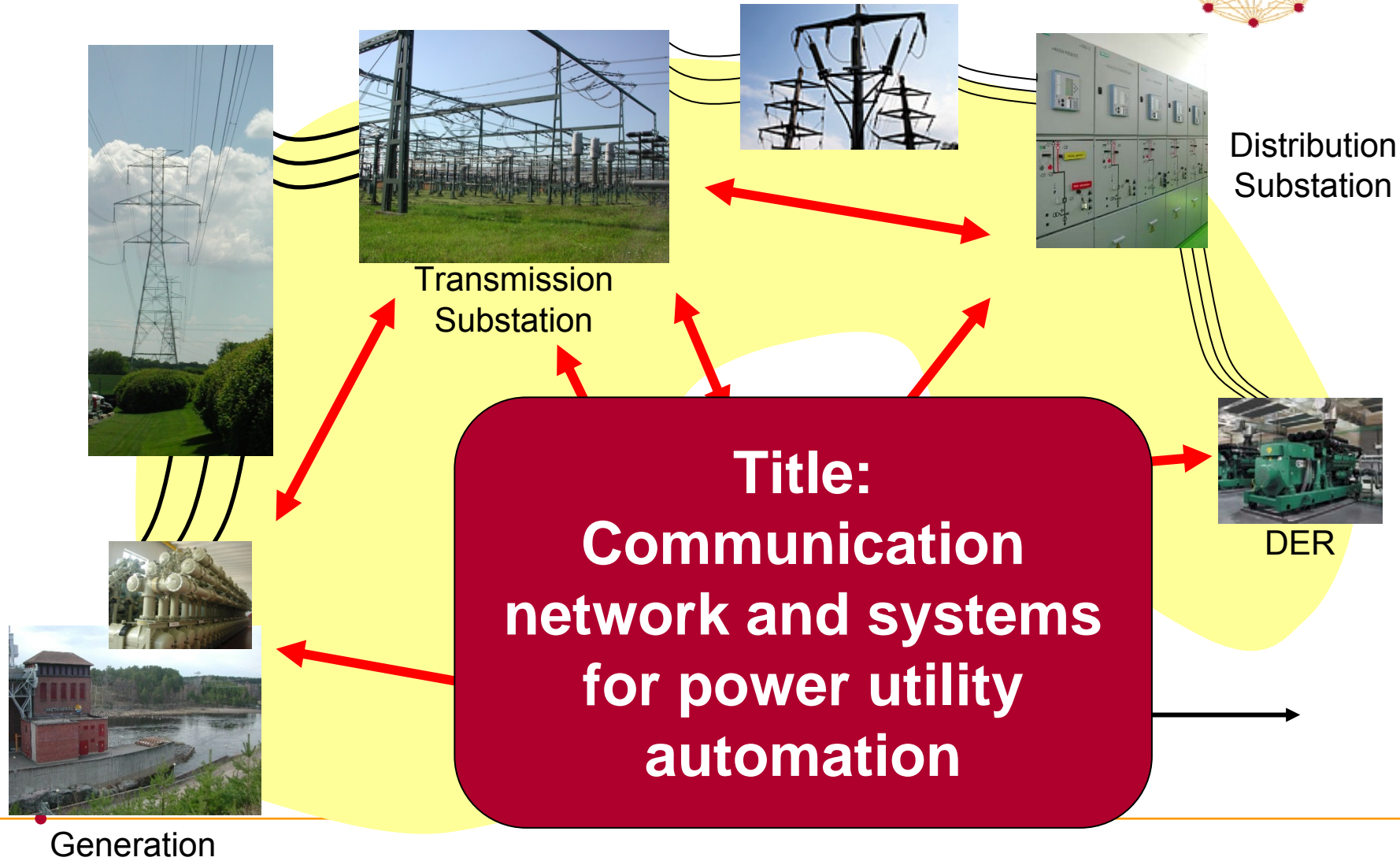
IEC 61850 Principles



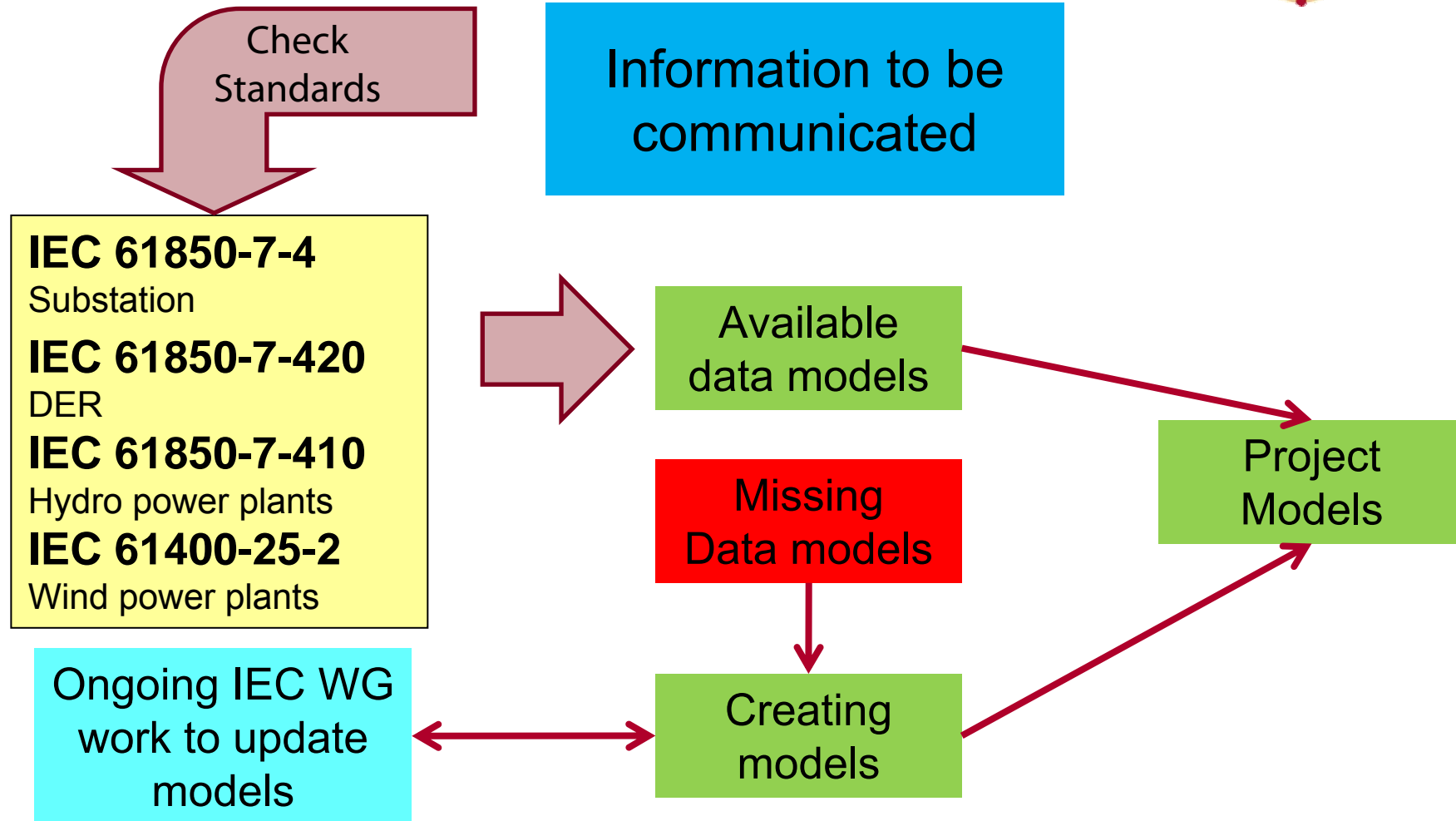
IEC 61850 Principles



Scope of IEC 61850



Process of the standardization



IEC 61850 using various physics

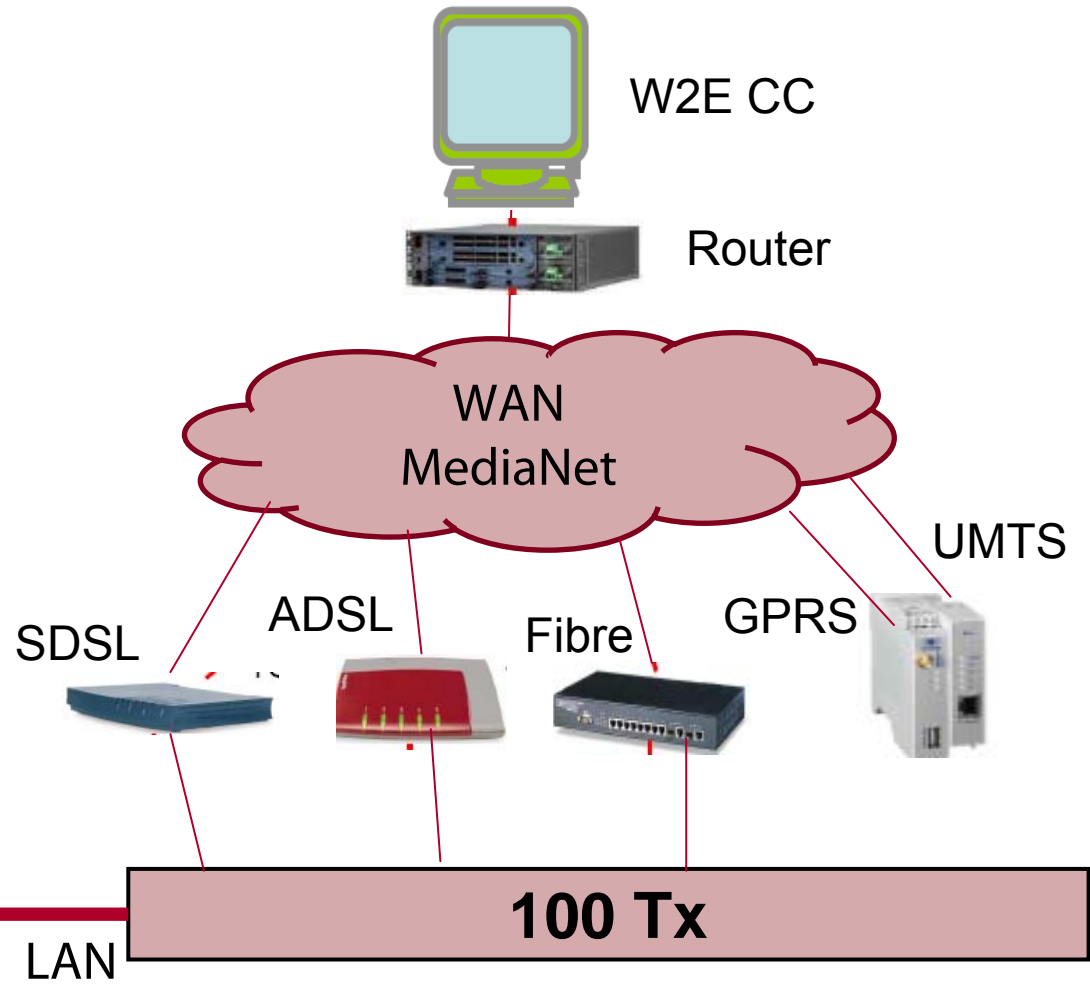


RTU

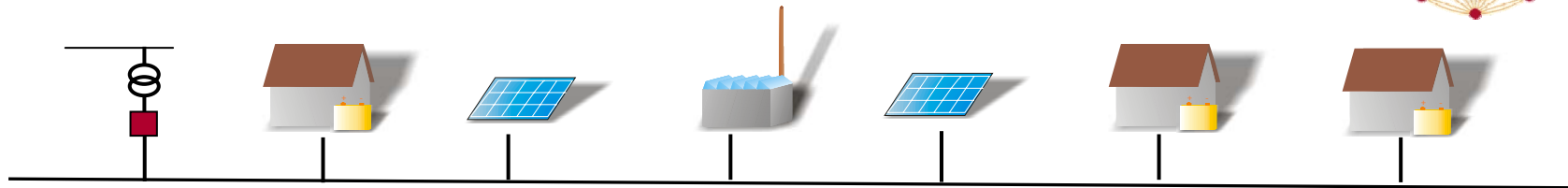


Protocol stack

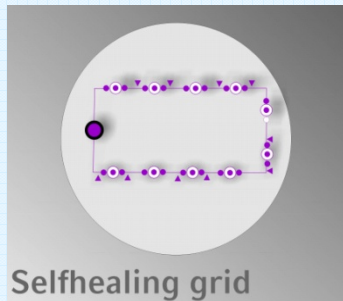
IEC 61850 ACSI
ISO 9506 (MMS)
ASN.1
Session
RFC 1006 (Port 102)
TCP
IP
Ethernet
100Tx



Data exchange for Smart Distribution



Distribution automation



Selfhealing grid

Metered values $\frac{1}{4}$ h
 Measurements I, V, P, Q
 Switch status/ control
 Short circuit indication
 S.C. reset

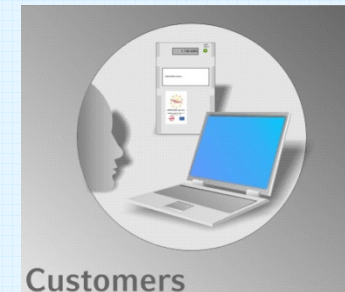
Smart Aggregation



Virtual power plant

Metered values $\frac{1}{4}$ h
 Measurements I, V, P, Q, P_{th}, T_{st}
 Target values P, Q
 Schedules (P,Q 96 $\frac{1}{4}$ h)
 Switch commands,
 Plant Status

Smart Metering



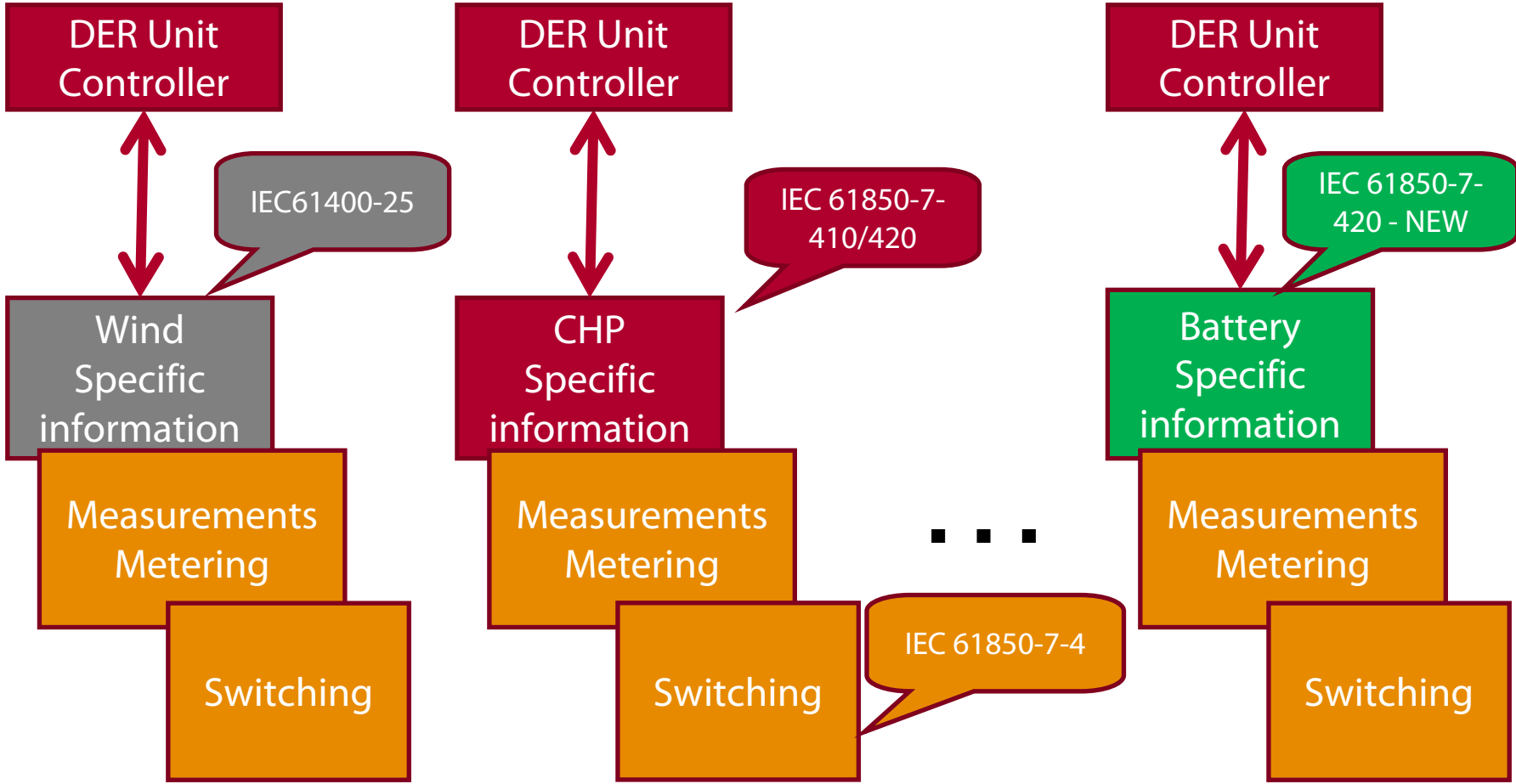
Customers

Metered values 1h
 Tariff signals (tariff tables)
 Tariff forecasts
 Current demand/ costs
 Interface „smart home“

V- Voltage, I- current

P - Power, Q – reactive Power, T – temperature, th – thermal , st - storage

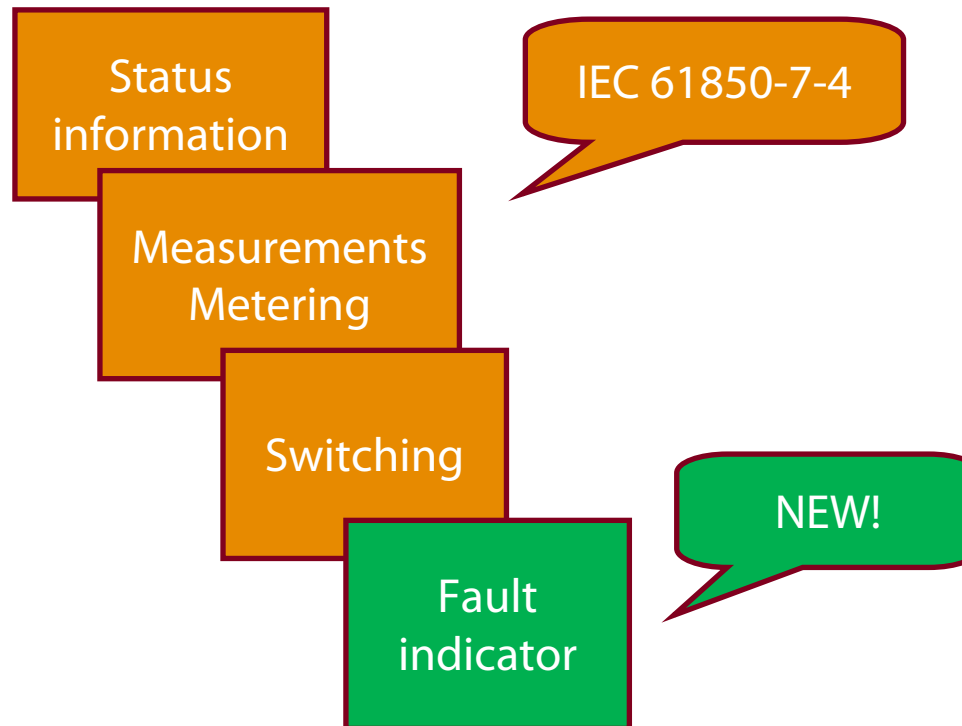
Modeling the Smart Generation in W2E



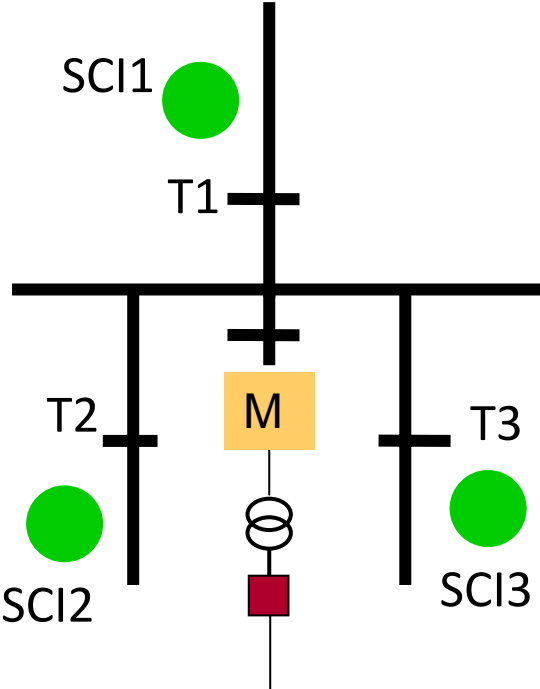
Modeling the Smart Terminal in W2E



RTU terminal
model



RTU - 20 kV terminal



M- Measurement



60 V DC

W2E CC

Ethernet
IEC 61850



1/4 h:
Wh, VARh
W, VAR

IA	VA
IB	VB
IC	VC

3 Currents
3 Phase to Earth
voltages

S1	S2
S3	S4
S5	S6
S7	

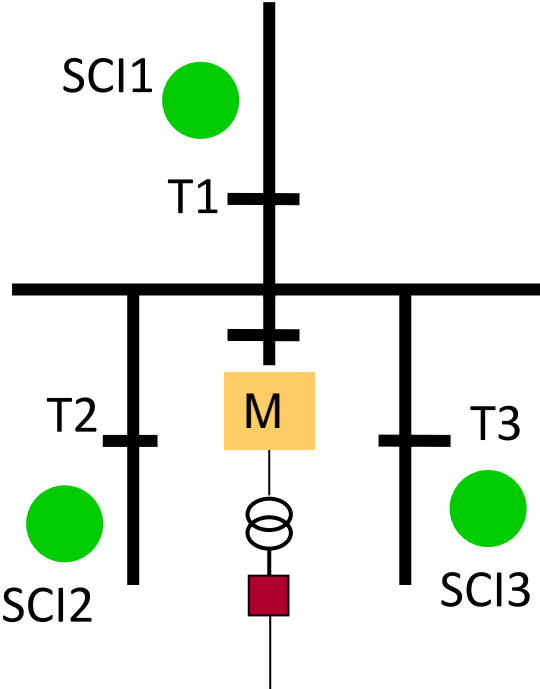
DPC T1
DPC T2
DPC T3
SPC All SCI Reset

- M1
- M2
- M3
- M4
- M5
- M6
- M7
- M8

StatusT1
StatusT2
StatusT3
Status SCI 1
Status SCI 2
Status SCI 3

Door contact

RTU - 20 kV terminal



M- Measurement



60 V DC

W2E CC

Ethernet IEC 61850



MMTR

MMXU

3 Currents
3 Phase to Earth voltages

CSWI

DPC T1
DPC T2
DPC T3
SPC All SCI Reset

SFPI

XSWI

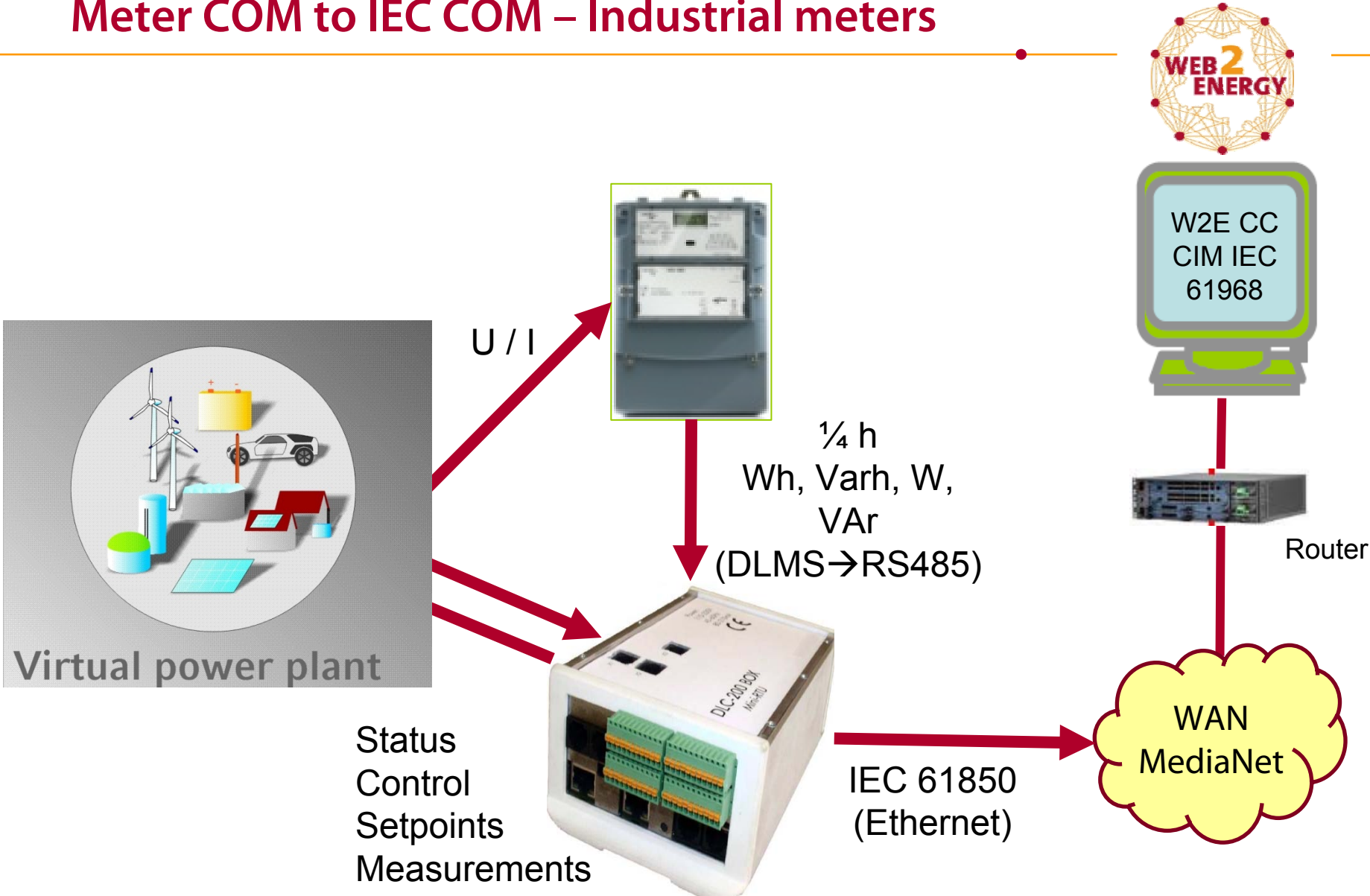
StatusT1
StatusT2
StatusT3
Status SCI 1
Status SCI 2
Status SCI 3

SFPI

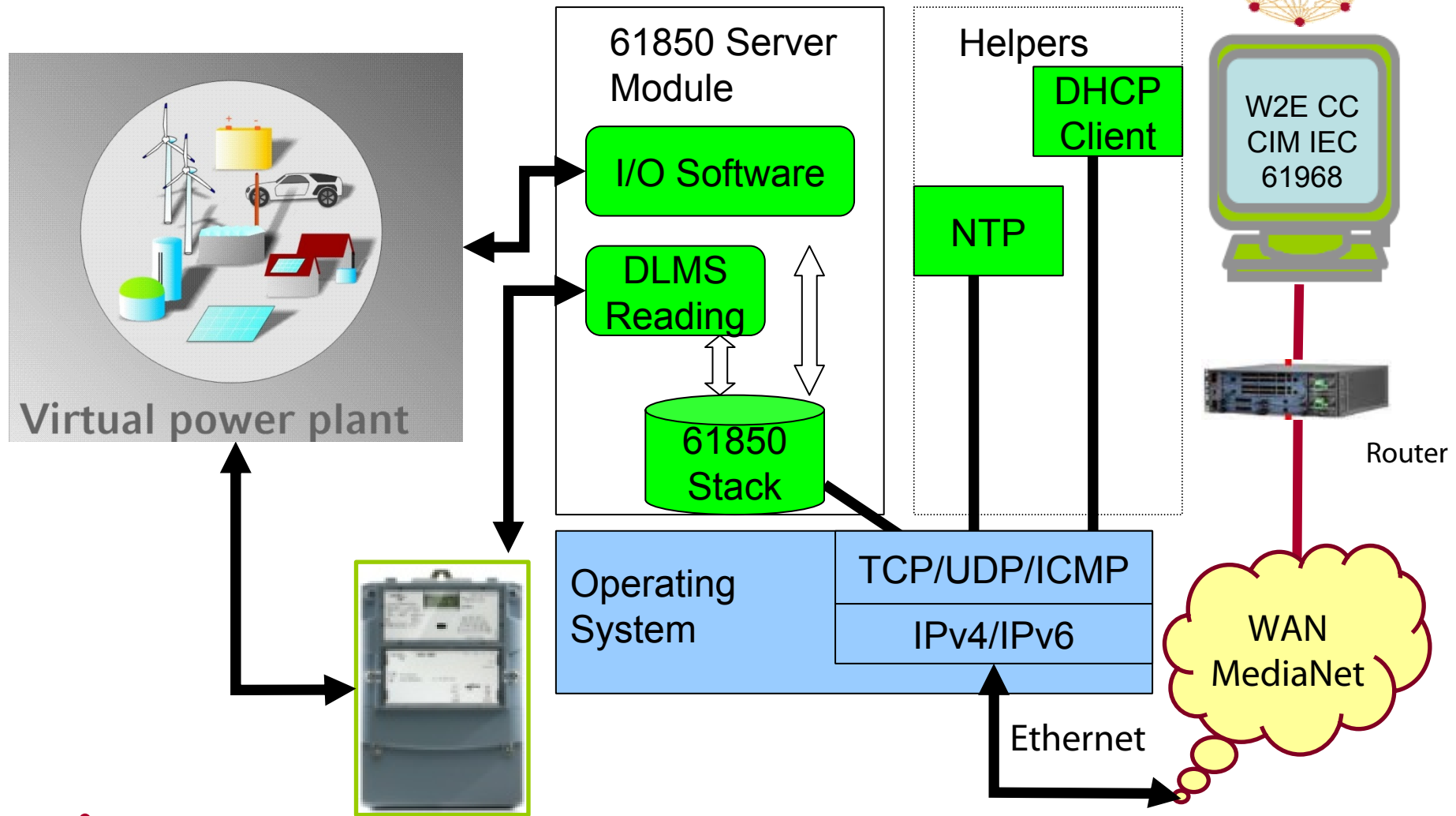
M7
CSWI

Door contact

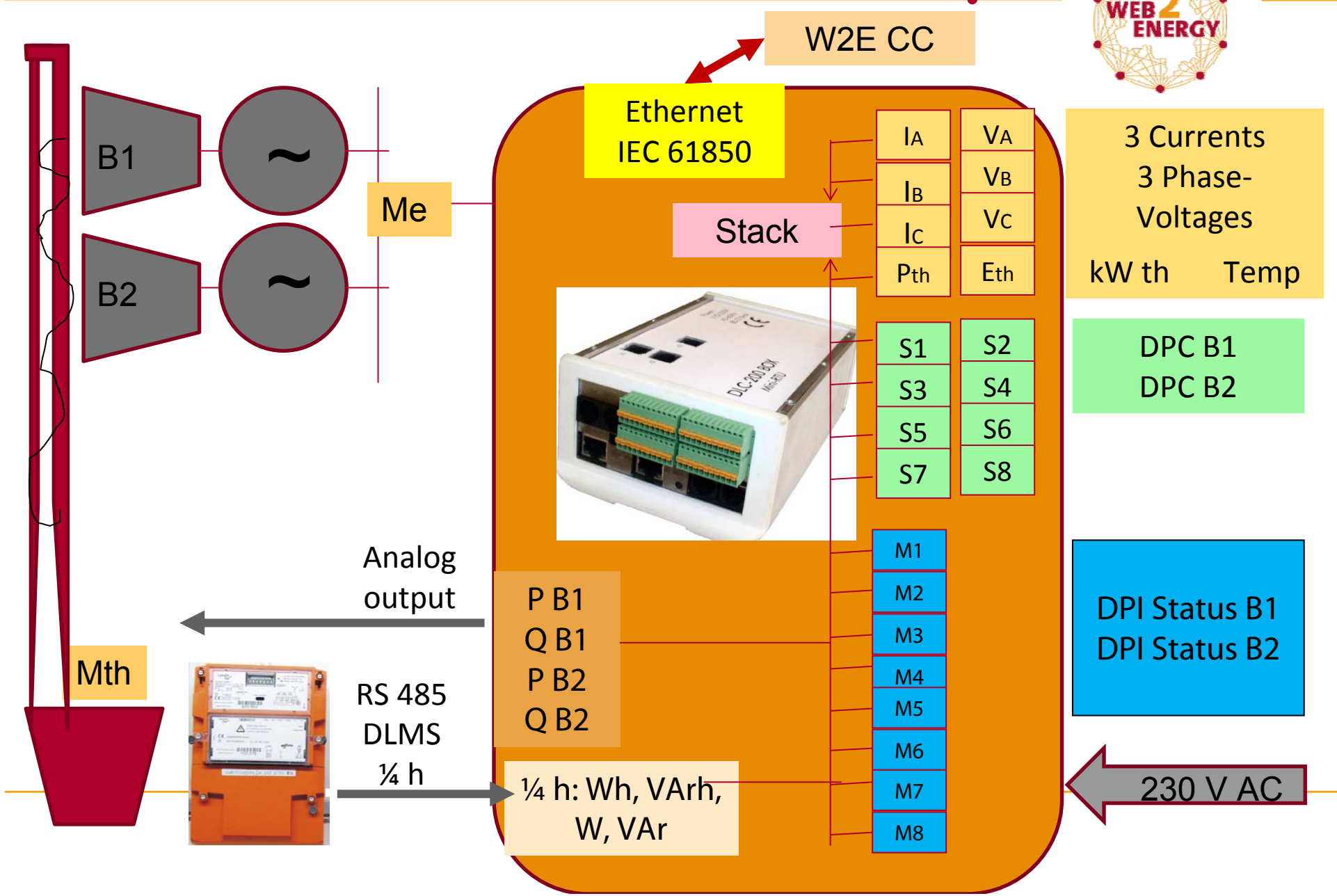
Meter COM to IEC COM – Industrial meters



Software Modules of the RTU



CHP – Installation Eberstadt (maximum configuration)



Conclusions (1) - Realization



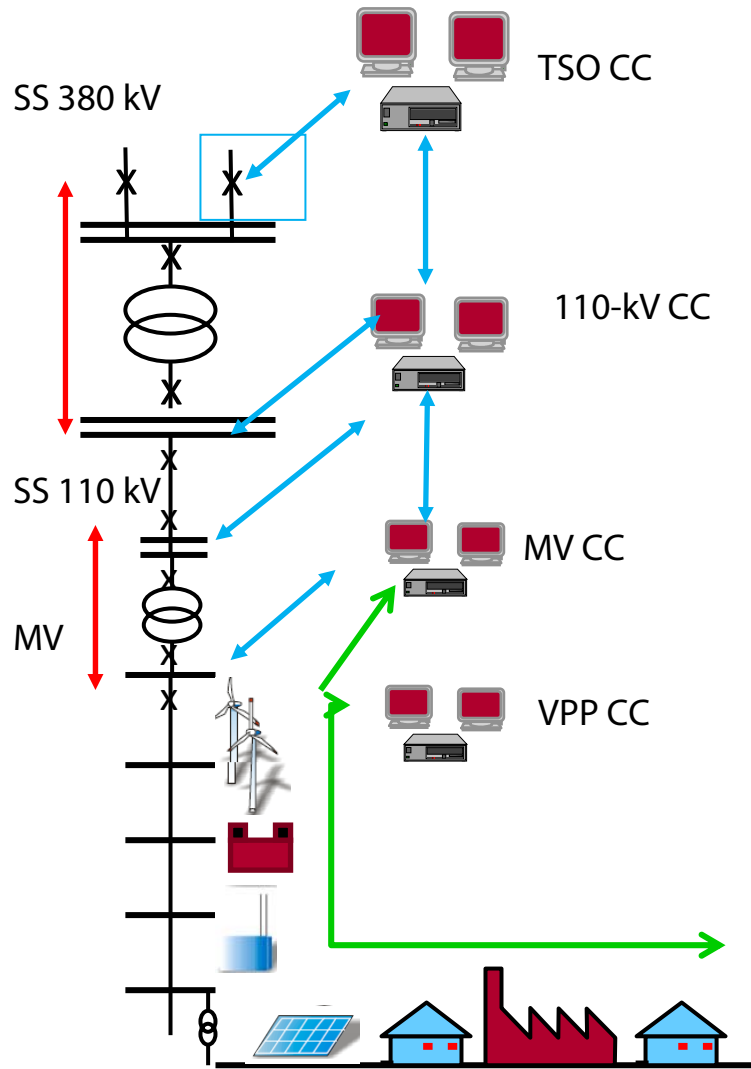
- The IEC 61850 communication stack as defined for substation automation can as well be applied for wide area communication using Ethernet based communication interfaces
 - The W2E project will assess the bandwidth and performance requirements for typical SmartGrid applications and will therefore evaluate, if the standard stack can be used or if optimised mapping is required
 - Implementation of the IEC 61850 communication in small RTUs is feasible. A stack that offers an environment, where the data model can be described by an SCL file allows efficient implementations
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Conclusions (2) - Models



- Information models for SmartGrid applications are defined in principle in IEC 61850
 - Extensions are required to fully address the requirements of a virtual power plant – the W2E project will supply this as input to the standardization process
- ***Applying IEC 61850 in the distribution level - a common “communication language” is achieved from the sockets of the consumers up to the network control center. The loop is finally closed!***
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Common Language on all Levels



- IEC 60870-5-101/4
with generic data models of IEC 61850: IEC 61850-80-1 mapping to IEC 60870-5-101/4
- IEC 61850-8.1 in all substations (SS)
- IEC 61850-7-4 Switchgear
IEC 61850-7-410 Hydro power plants
IEC 61850-7-420 Dispersed generation
IEC 61400-25 Wind power plants
IEC 61850-7-x New data models e.g. Smart Meter, Smart Terminal

TSO – Transmission system operator, CC – control center, SS – Substation, VPP – virtual power plant, MV – Medium voltage