



IEC 61850 communication and CIM data base management applied for Smart Distribution

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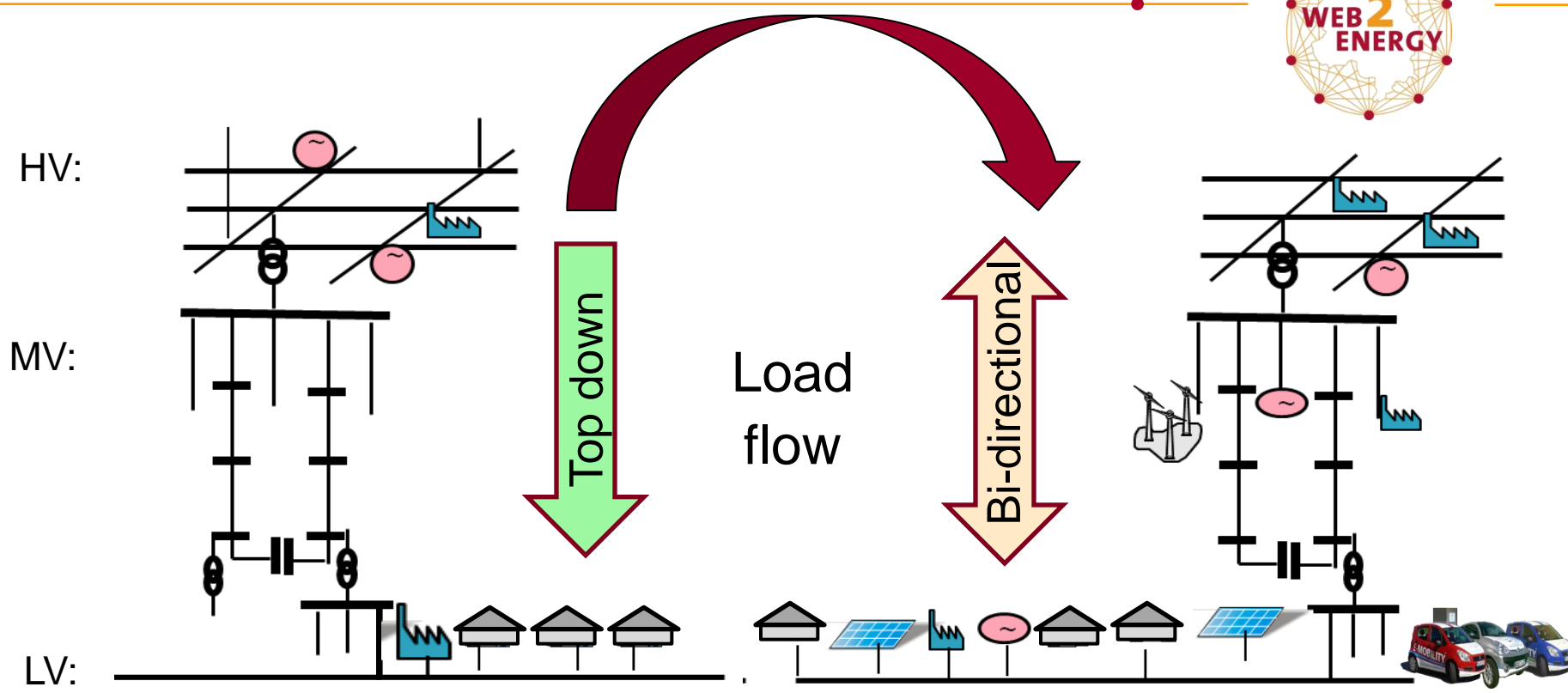
www.web2energy.com

<http://www.amazon.com/Smart-Grids-Fundamentals-Technologies-Electricity/dp/3642451195>




The proof of readiness of a standard for introduction into new areas requires pilot applications in practice


Distribution networks are becoming active





New challenges: volatile generation, high power loads

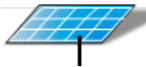
Need for advanced solutions: balancing load & generation, power and voltage control

 Generator

 Industry

 Household

 Transformer

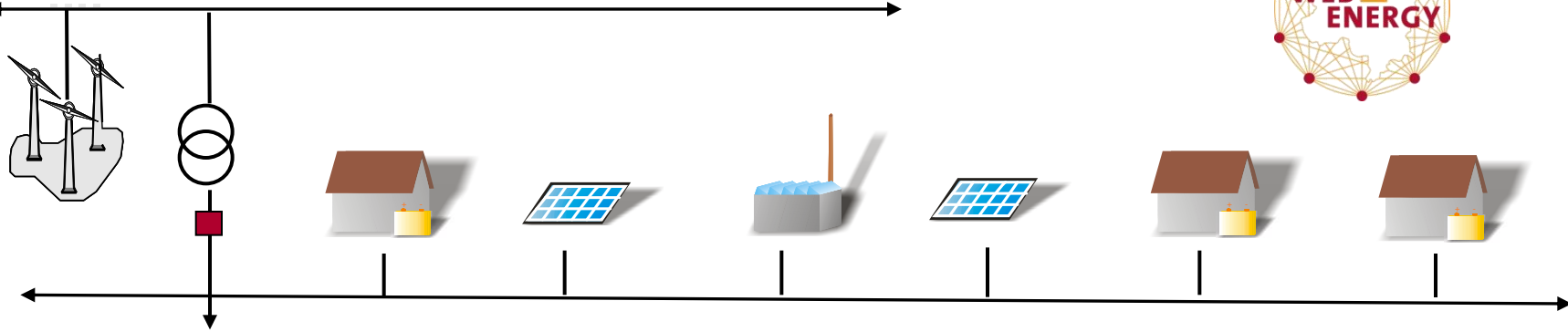
 PV plant

The 3 Pillars of Smart Distribution

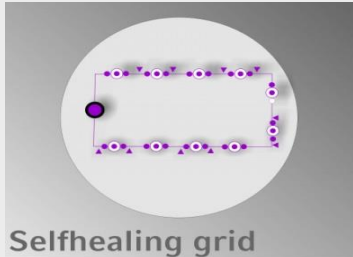


MV:

LV:

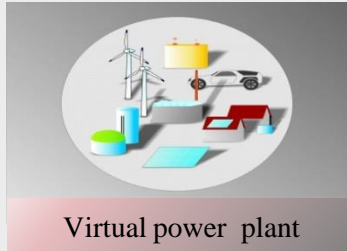


SCADA & Automation



Selfhealing grid

Smart Aggregation



Virtual power plant

Smart Metering



Consumers

Main Targets

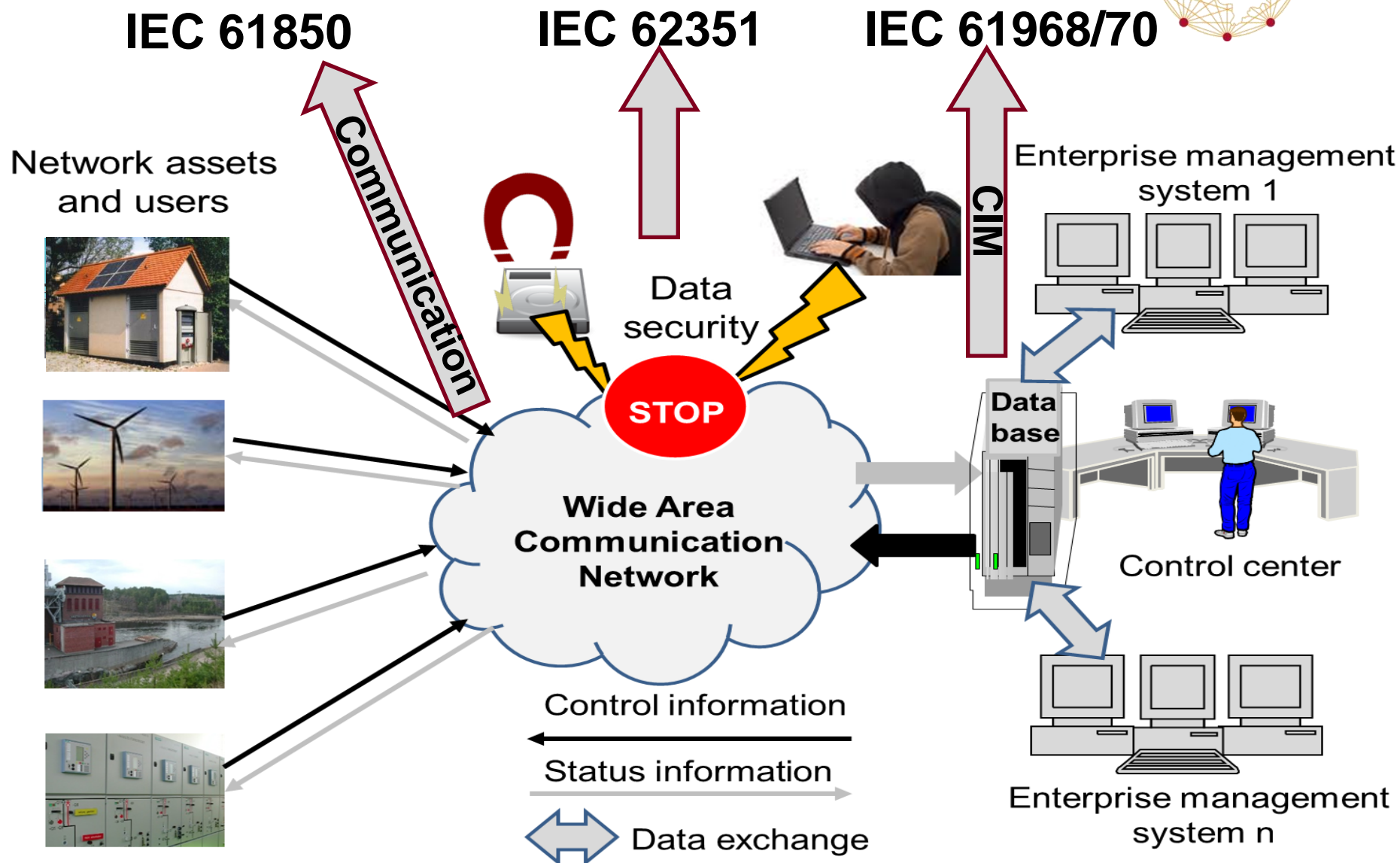
Keep high level of
voltage quality &
reliability of supply

Definitely
scheduled
generation

Adaptation of load
and available
energy / network
capacity

Information and communication penetrate distribution networks

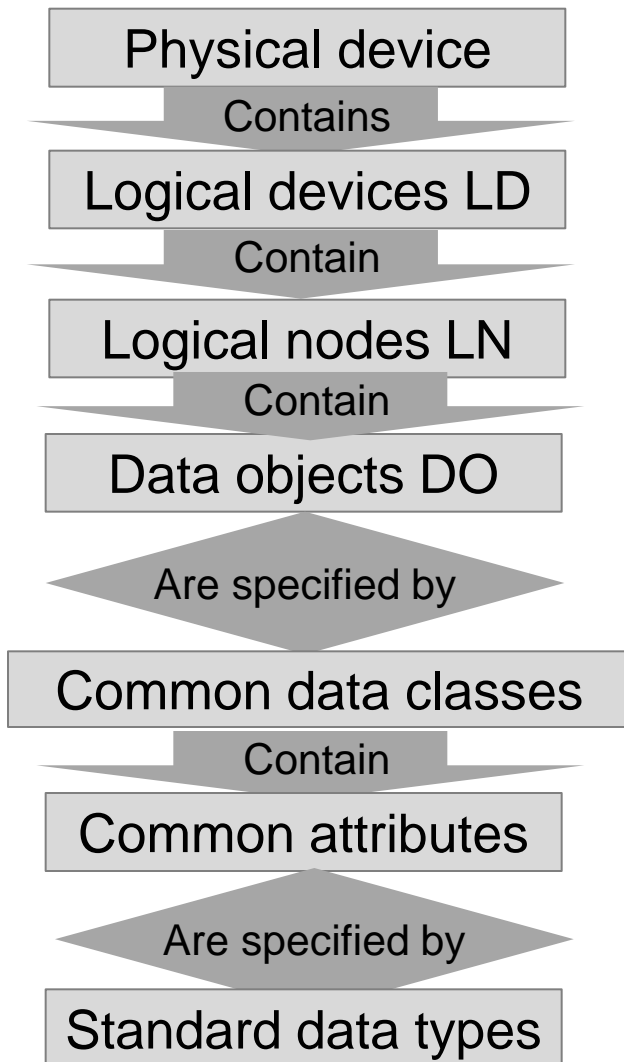
ICT for distribution networks and the related standards



IEC 61850 data models and Common Information Model CIM of IEC 61968/70

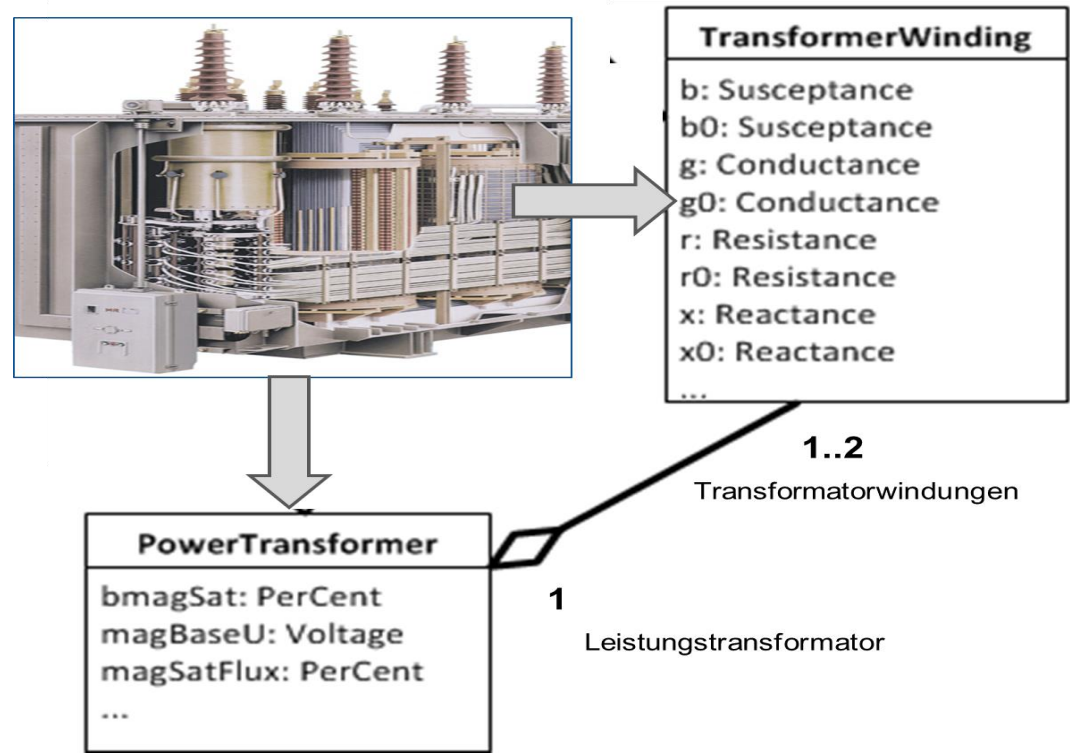


IEC 61850



CIM

- Objects are presented by classes
- Classes contain attributes
- Classes perform relations to other classes like association, aggregation, inheritance



The European Project Web2Energy



W2E Control Center



**CIM data
formats
IEC 61968**

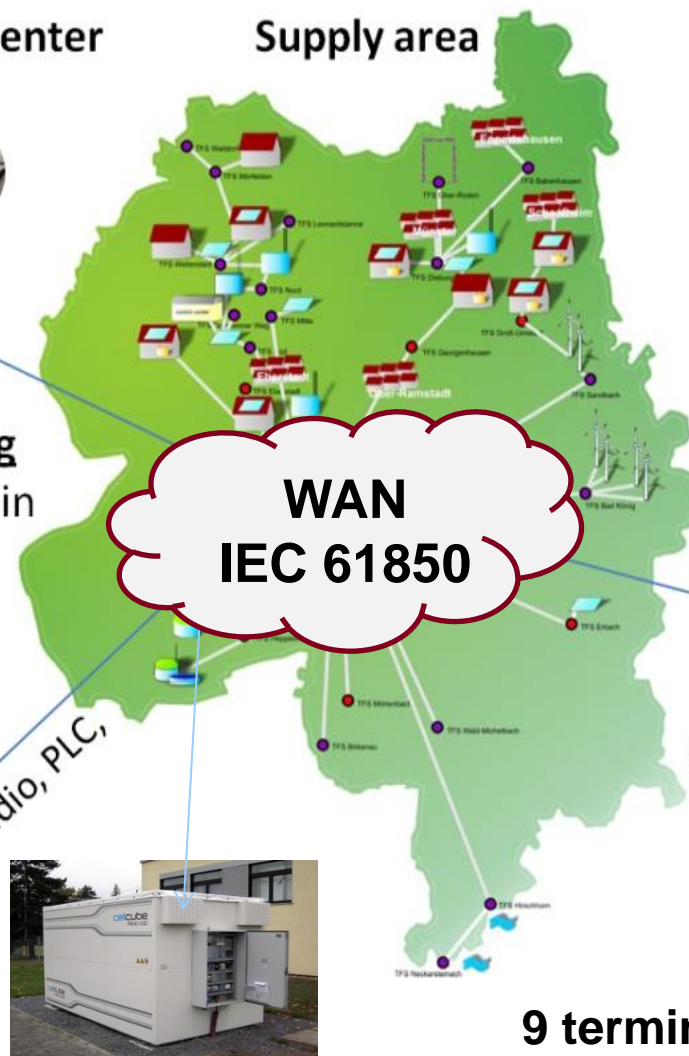
Smart Metering
200 households in
6 locations



Storage Batteries



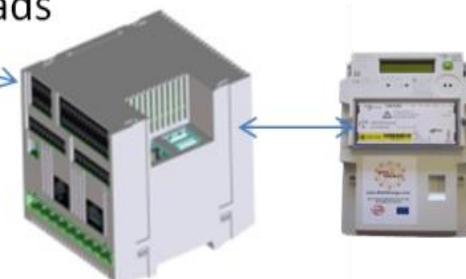
Supply area



Virtual Power Plant

5 CHP plants (cogeneration of
heat and power)
2 Batteries Redox 100 kWh
10 Batteries Li-Io 5 kWh
6 PV plants
3 Wind parks
2 Hydro stations
3 types of large controllable
loads

Radio,
Fibre
Copper

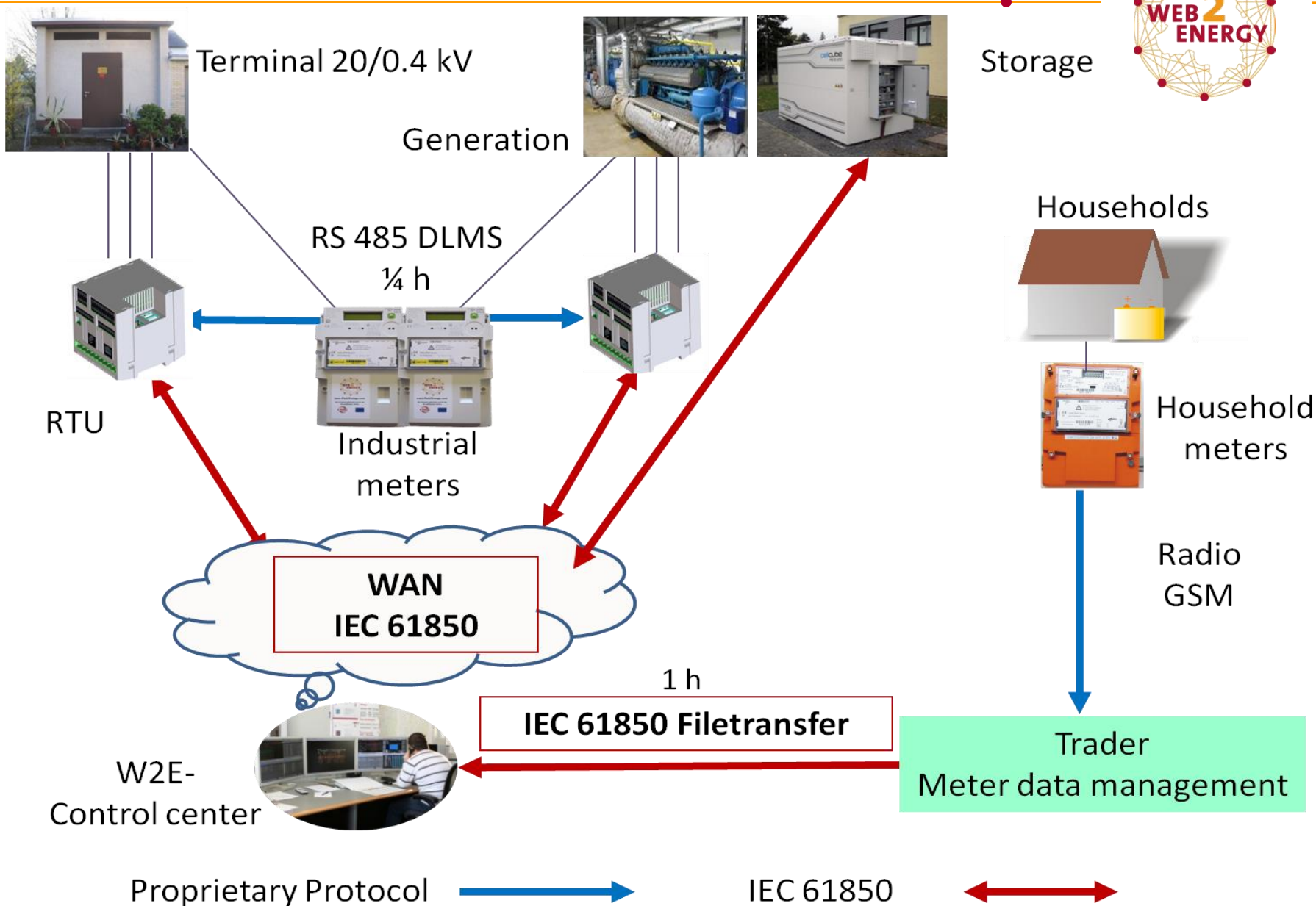
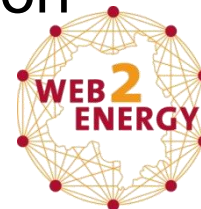


RTU IEC 61850 Meter

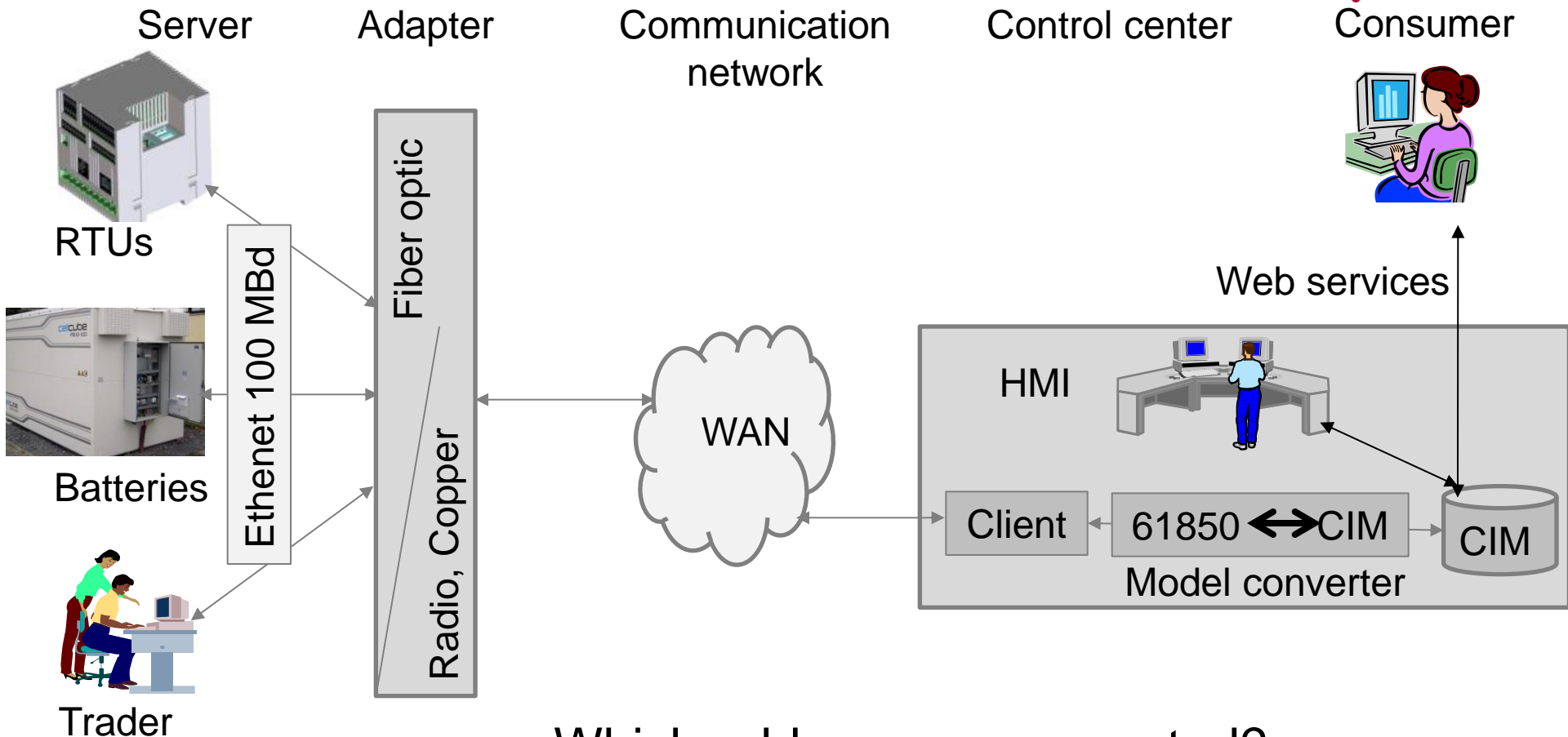
Network automation

9 terminals 20/0.4 kV in an open loop

IEC 61850 communication and meter data integration



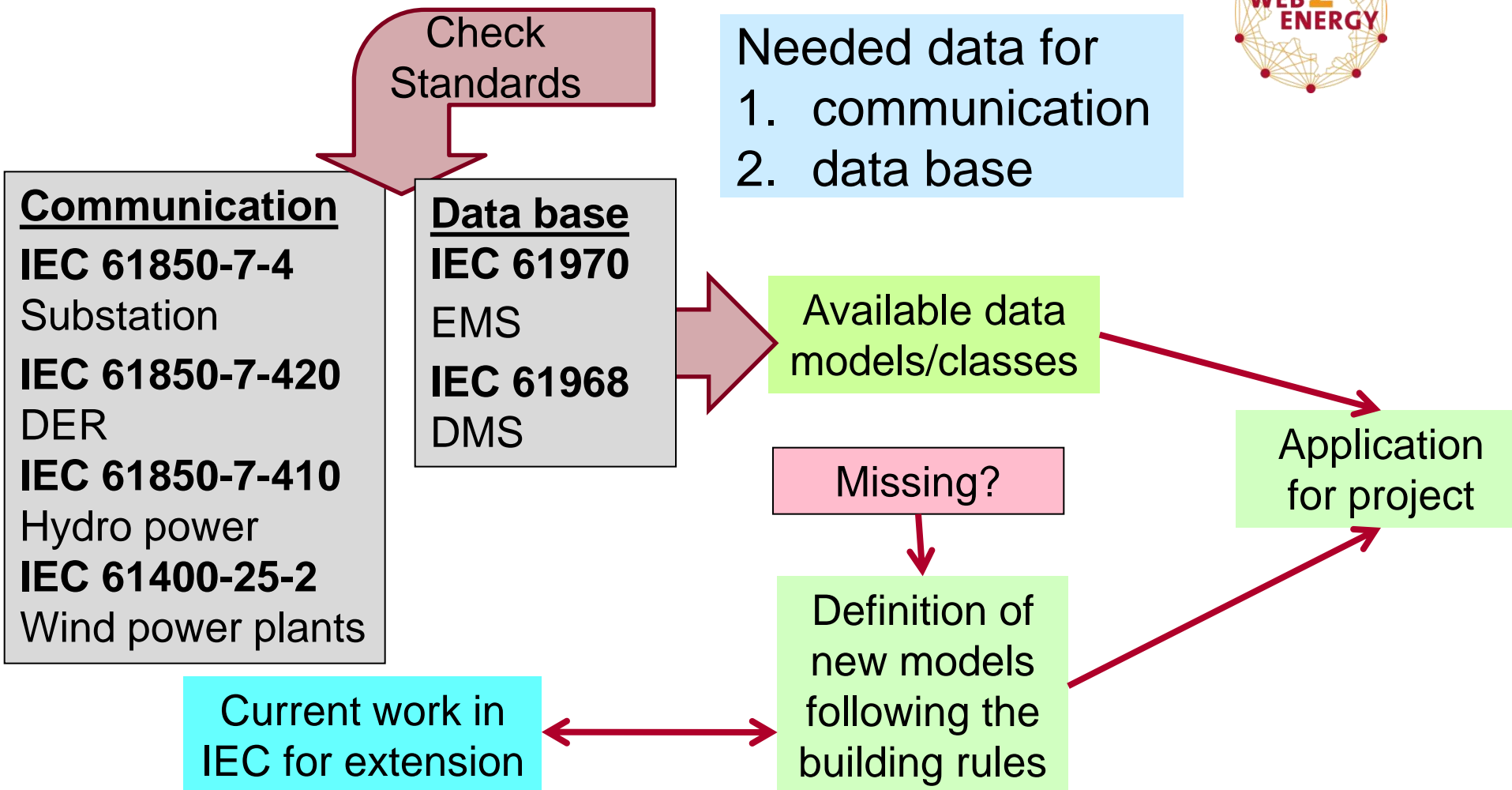
SCADA for Smart Distribution applying IEC 61850 & CIM



Which add-ons are requested?

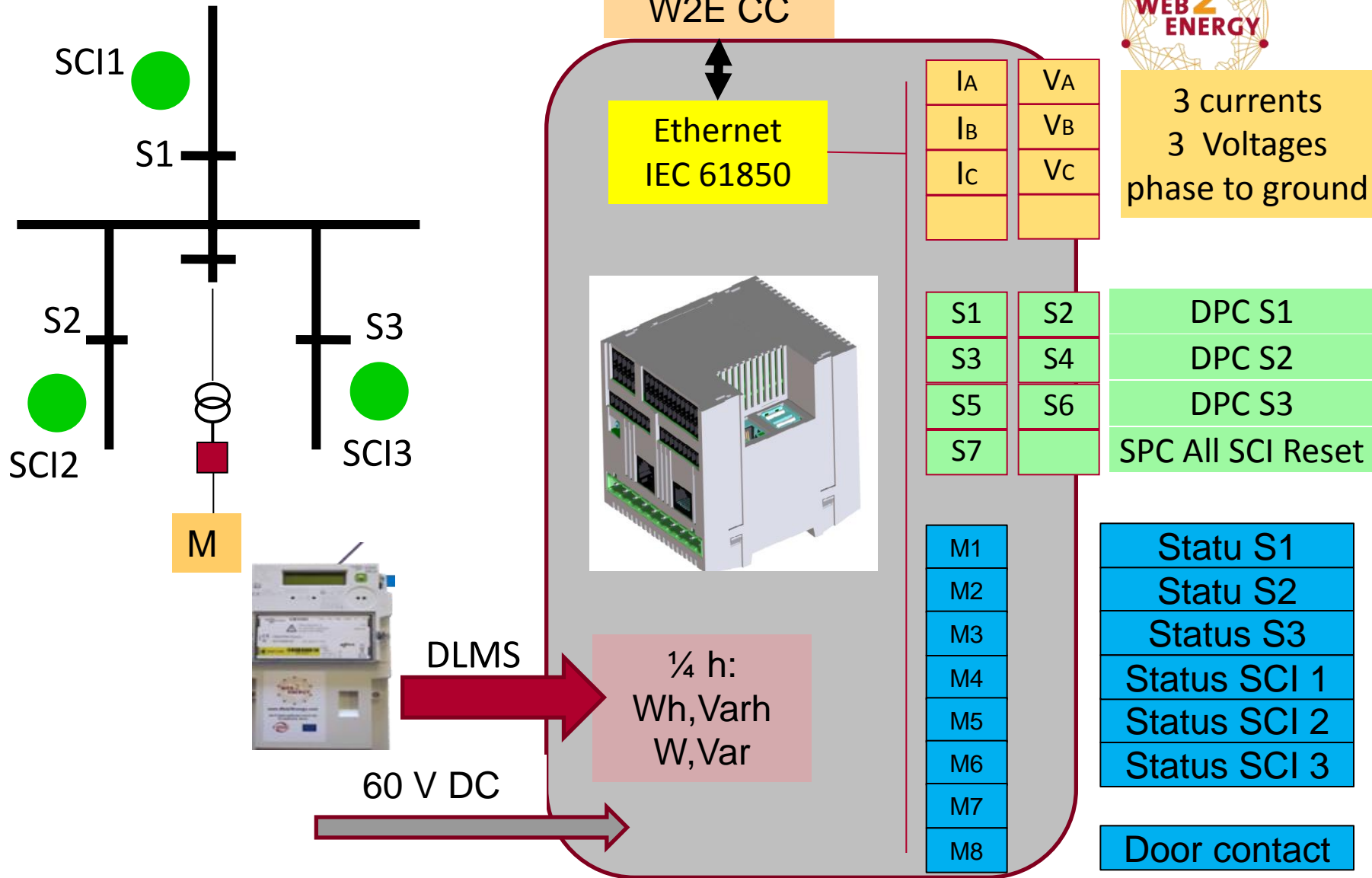
1. Extensions of both data models
2. Conversion of the data models

Data models and classes for ICT in distribution



New data models & classes for IEC 61850 & CIM are requested

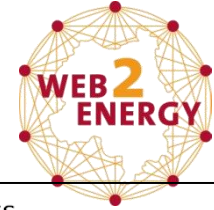
RTU Engineering for 20/0.4 kV -Terminals





M- measurement

SCI- Short circuit indicator, S- Load break switch

Data models for 20 kV terminal and CHP

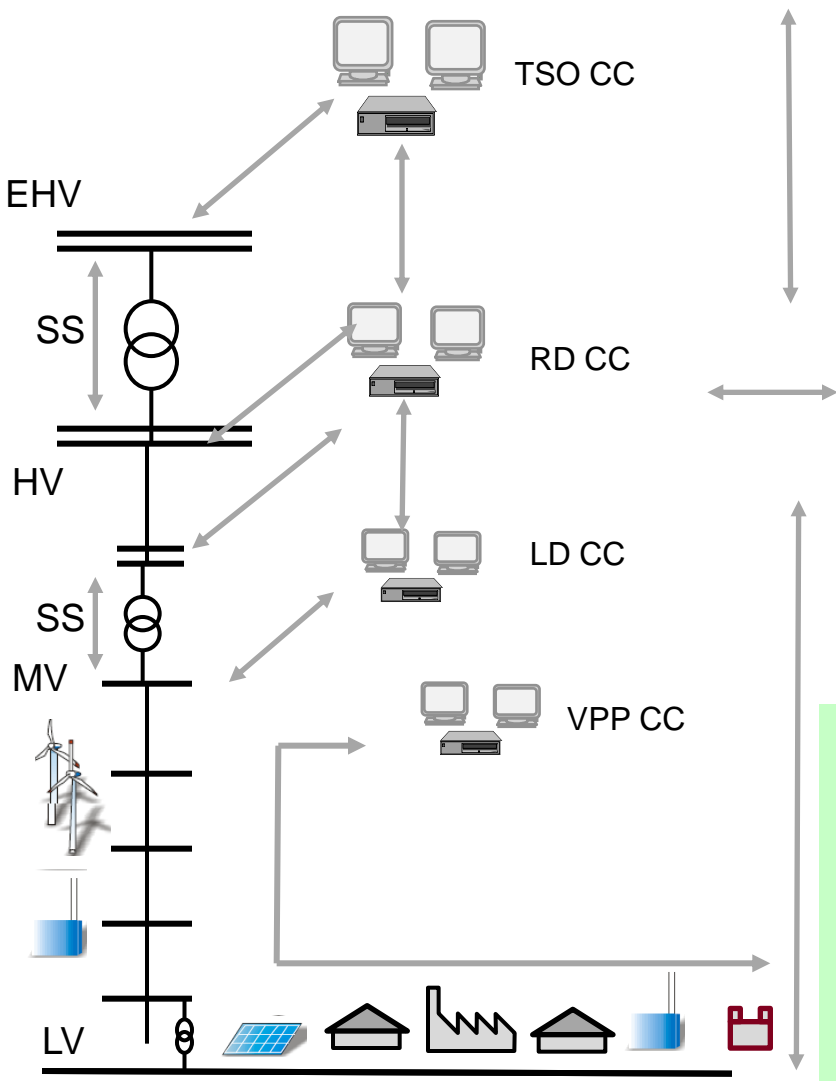


	Local Node	LN	Data	Class	Comments
<p>20/ 0,4 kV terminal</p> 	Measurement:	MMXU	PhV	WYE	Phase-ground Voltages
			A	WYE	Currents
			TotW	MV	Active Power
			TotVAr	MV	Reactive power
	Metering:	MMTR	TotWh	MV*	Energy
			TotVArh	MV*	Reactive Energy
			Pos.ctlVal	DPC	Switch command
	Control:	CSWI	SFPI	SPC	Reset S.C. indication
			Pos.stVal	ENUM	Switch position
			Str.general	BOOL	S.C. indication
<p>Co- generation of heat and power</p> 	Measurement:	MMXU	PhV	WYE	Ph. to ground Voltages
			A	WYE	Currents
			TotW	MV	Power
			TotVAr	MV	Reactive power
			TotWth	MV	Thermal power
			ThrCapTot	MV	Thermal storage
	Metering:	MMTR	TotWh	MV*	Energy
			TotVArh	MV*	Reactive Energy
			DERStr	SPC	Start Unit
	Control:	DRCC	DERStop	SPC	Stop Unit
			Pos.ctlVal	DPC	Switch command
			OutWSet	APC	Target power
	Setpoints	DRCC	OutVarSet	APC	Target reactive power
			OpModDERunit	ENUM	On, Off, Ready, Disturbed
			Pos.stVal	ENUM	Switch position

In IEC 61850 defined

Extensions needed * up to now only impulses are defined

IEC 61850 – seamless communication over all network levels



Control Center ↔ Control Center ✓

Substation ↔ Control Center ✓

Substation ↔ Substation ✓

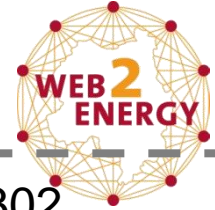
Inside Substation ✓

Data models: Smart Distribution:
DER, wind & hydro power plants ✓

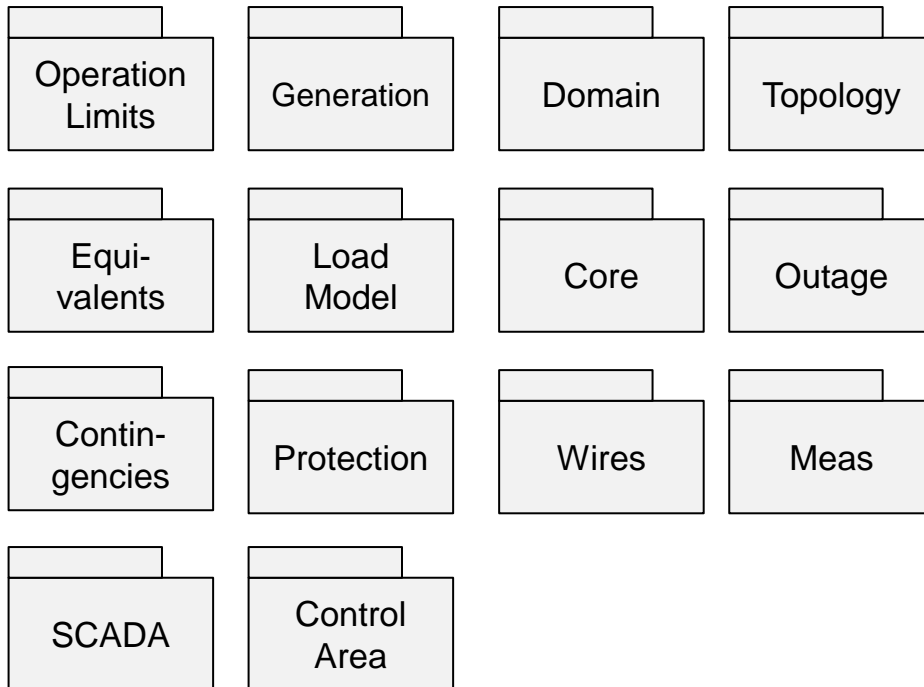
26 new data models are identified and recommended for: CHP plants, MV/ LV transformer terminals, battery & schedule management, Smart Metering

SS – Substation, EH – Extra High, H – High, M – Medium. L – Low, V – Voltage, CC – Control Center, TSO – Transmission System Operator,, R – Regional. L - Local, D – Distribution, VPP – Virtual Power Plant, ACSI – Abstract Communication Service Interface, SCSM – Specific Communication Service Mapping

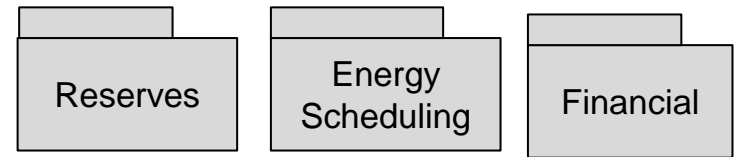
Extension needs for CIM class packages



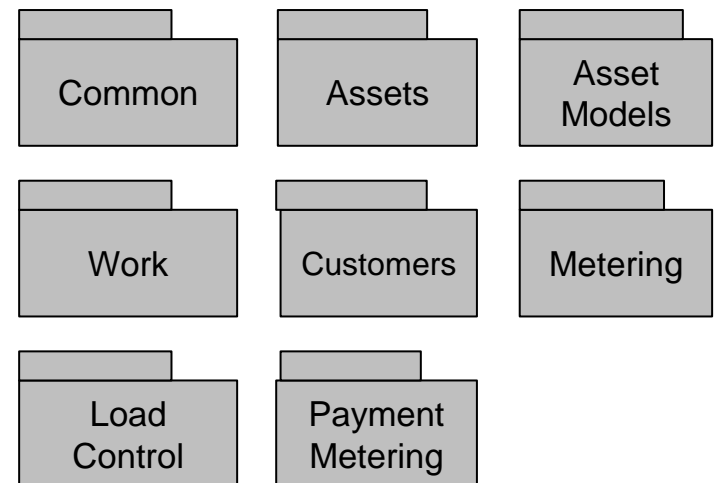
IEC 61970-301



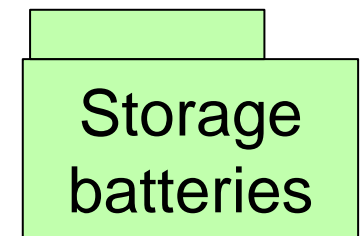
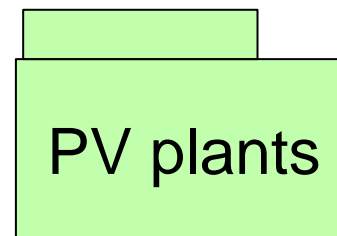
IEC 61970-302



IEC 61968-11



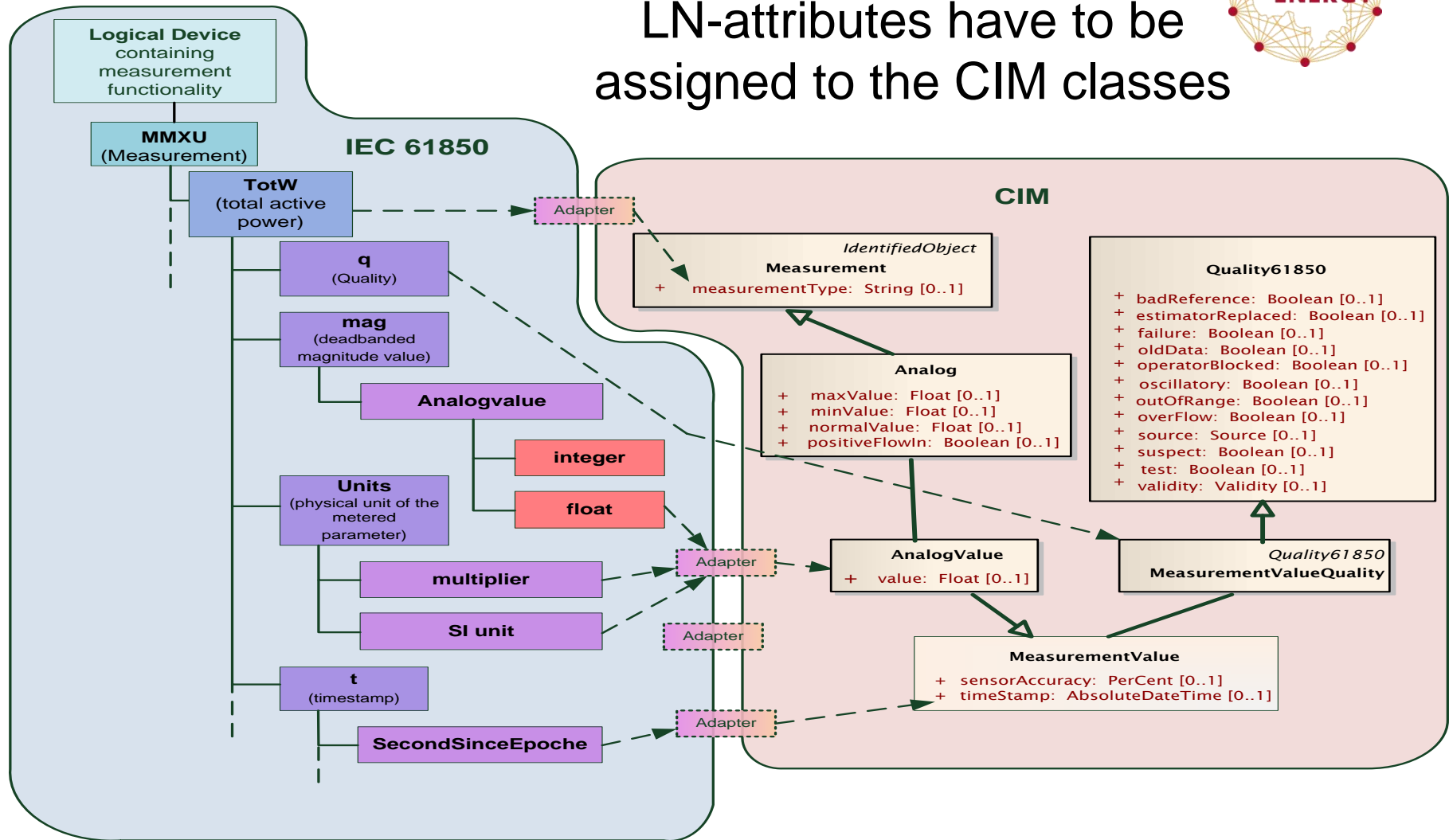
12 new classes are specified for



Example data conversion IEC 61850 ↔ IEC 61968/70



LN-attributes have to be assigned to the CIM classes



The converter is developed for the needs of Smart Distribution

Conclusions



Smart Distribution opens prospective markets for IEDs and information & communication technologies in distribution grids

In the framework of the European Project W2E the functions of Smart Distribution are applied using the standards IEC 61850 for communication and IEC 61968/70 for data management

The Smart Distribution communication architecture is developed and 3 ways are presented for embedding Smart Meters into the IEC 61850 communication environment

Today, IEC 61850 offers the seamless communication over all levels of the electric power system

New data models and classes for Smart Distribution should be integrated into the standard series IEC 61850 and IEC 61968

The harmonization and the standardized conversion of the data models for communication and data management is recommended