

Protocols, Data Models and DER C&C



Two nerds

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What is the future of DER Communications & Control (C&C)?

1. The current utility C&C model
2. What is a protocol and why is it important?
3. What is a data model?
4. How do the pieces fit together?





DER C&C
Confusing
and overlapping mix
of services,
standards,
and protocols.

transactive
energy

SunSpec

IEEE 61850-7-420

Orange
Button

Common
Information
Model

UL 1741-SA

IEEE1815.1

web
services

Modbus

SEP 2

TCP/IP

CIM

RESTful API

ASHRAE
201

CSIP

oSDX

OpenADR

DNP3

IEEE 2030.5

Protocols

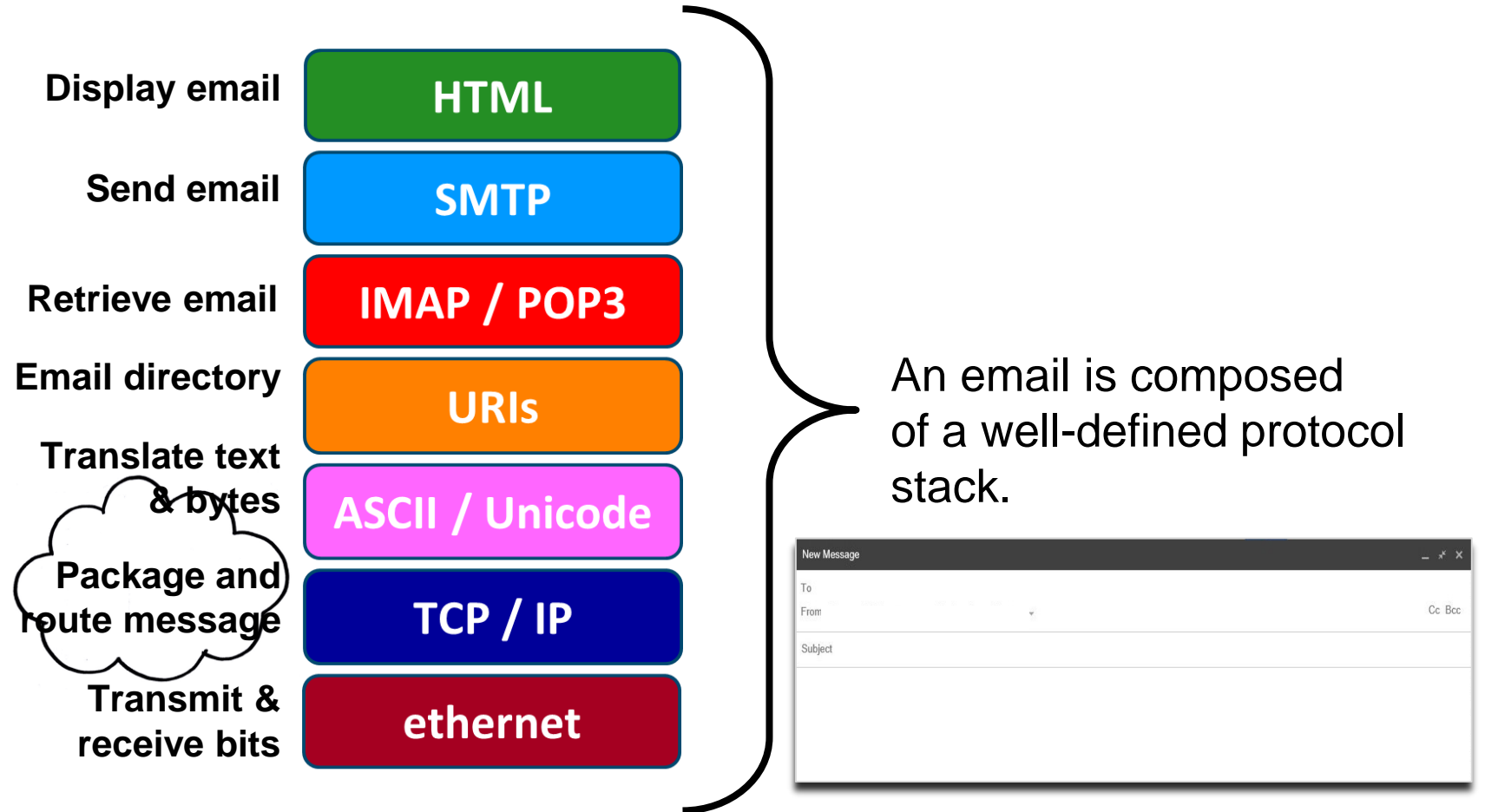
Special set of rules that specify interactions between communicating devices, systems or services.

Hardware protocols

Modbus, ethernet, Wifi

Software protocols

HTML and TCP/IP





Information Model

Describes a system/data in a an abstract way and not tied to a specific implementation.



IEC 61850-7-420 DER
61850-90-7 Advanced
Inverters

Common data models



Data Models

Concrete representation of an information model tied to a specific representation.



Inverter
models

Battery
models

Logger
models

Module
models

protocols

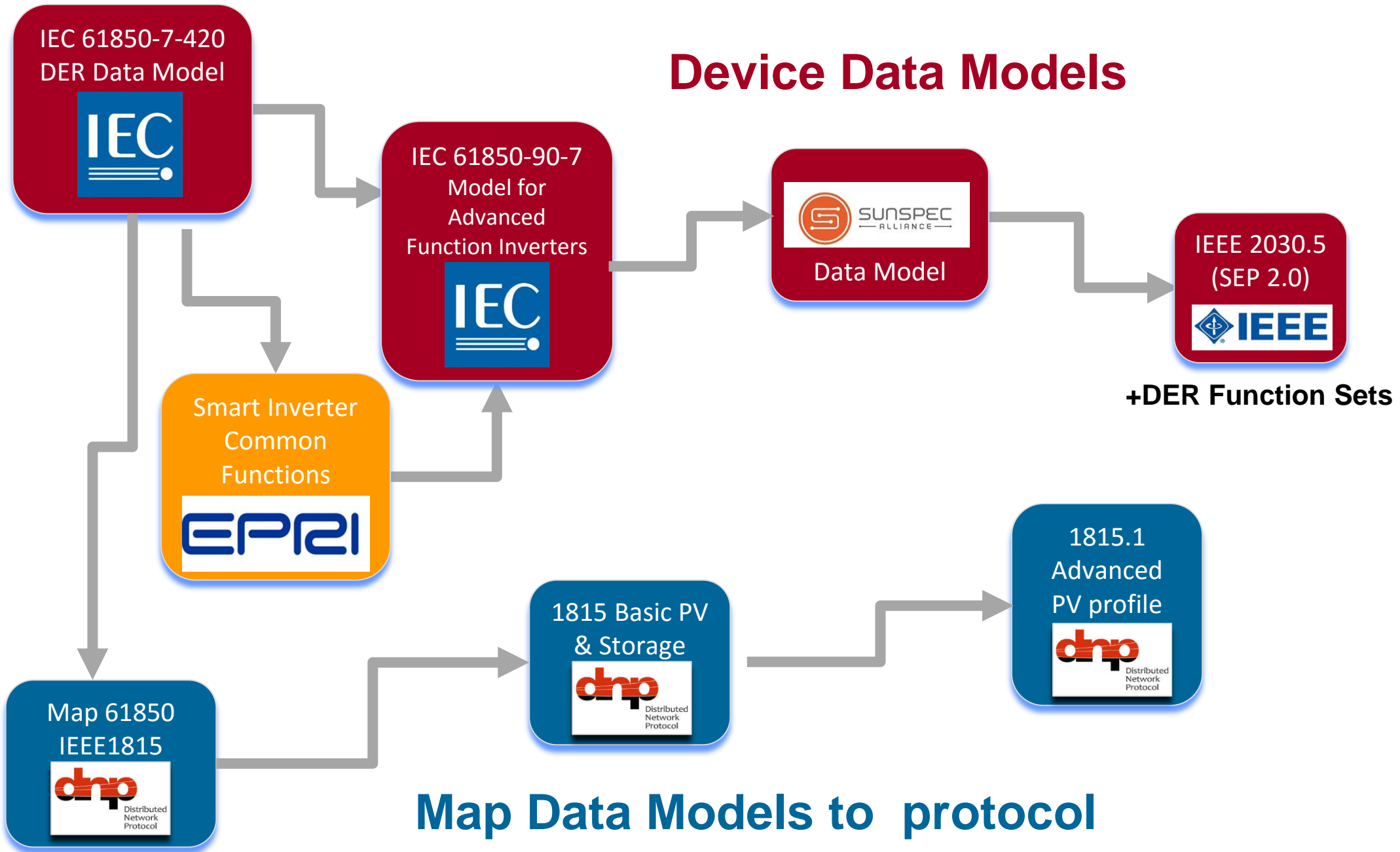


RS-485

Modbus registers Structured Data a la 61850

Address Offset	Block Offset	Size	Name	Label	Description
0		1	ID	Inverter (Single Phase)	Include this model for single phase inverter monitoring
1		1	L		Model Length
2	0	1	A	Amps	AC Current
3	1	1	AphA	Amps PhaseA	Phase A Current
4	2	1	AphB	Amps PhaseB	Phase B Current
5	3	1	AphC	Amps PhaseC	Phase C Current
6	4	1	A_SF		
7	5	1	PPVphAB	Phase Voltage AB	Phase Voltage AB
8	6	1	PPVphBC	Phase Voltage BC	Phase Voltage BC
9	7	1	PPVphCA	Phase Voltage CA	Phase Voltage CA
10	8	1	PhVphA	Phase Voltage AN	Phase Voltage AN
11	9	1	PhVphB	Phase Voltage BN	Phase Voltage BN
12	10	1	PhVphC	Phase Voltage CN	Phase Voltage CN
13	11	1	V_SF		
14	12	1	W	Watts	AC Power
15	13	1	W_SF		
16	14	1	Hz	Hz	Line Frequency
17	15	1	Hz_SF		
18	16	1	VA	VA	AC Apparent Power
19	17	1	VA_SF		
20	18	1	VAr	VAr	AC Reactive Power
21	19	1	VAr_SF		
22	20	1	PF	PF	AC Power Factor
23	21	1	PF_SF		
24	22	2	WH	WattHours	AC Energy
26	24	1	WH_SF		
27	25	1	DCA	DC Amps	DC Current
28	26	1	DCA_SF		
29	27	1	DCV	DC Voltage	DC Voltage
30	28	1	DCV_SF		
31	29	1	DCW	DC Watts	DC Power
32	30	1	DCW_SF		

Device Data Models



Device functional requirements.

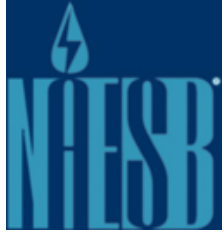


UL1741SA



IEEE1547.1



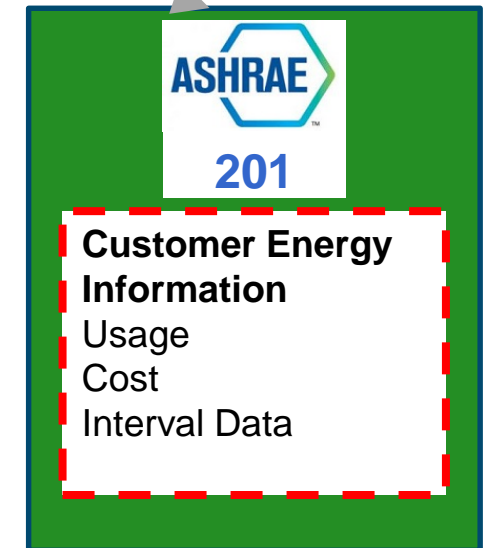
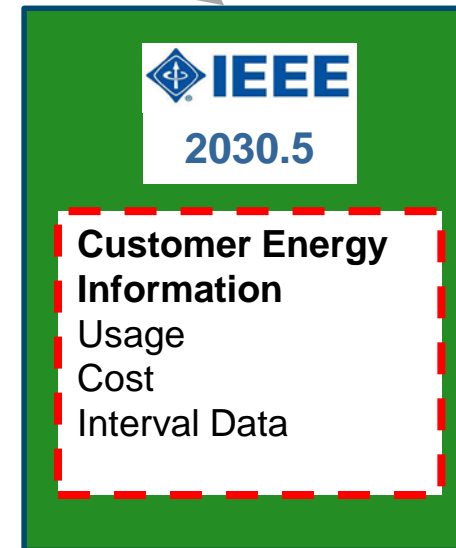
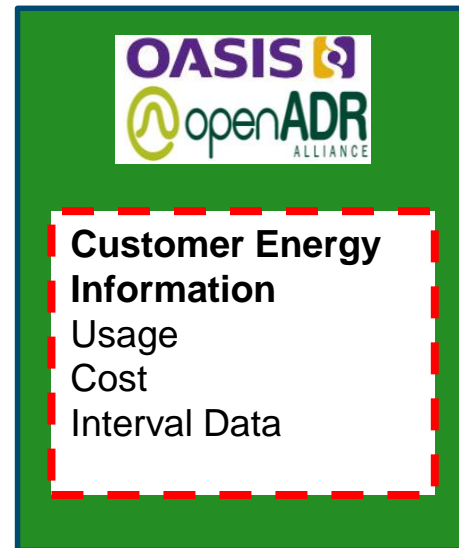
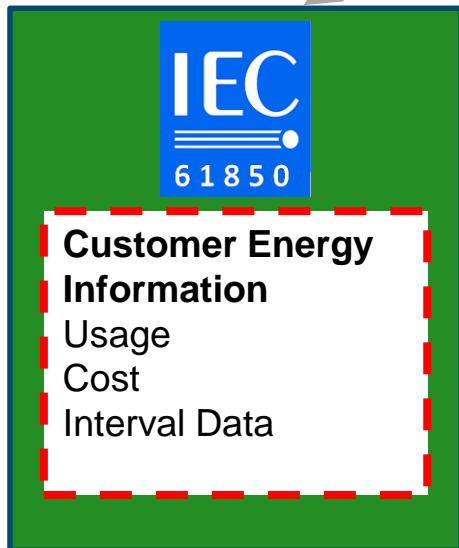
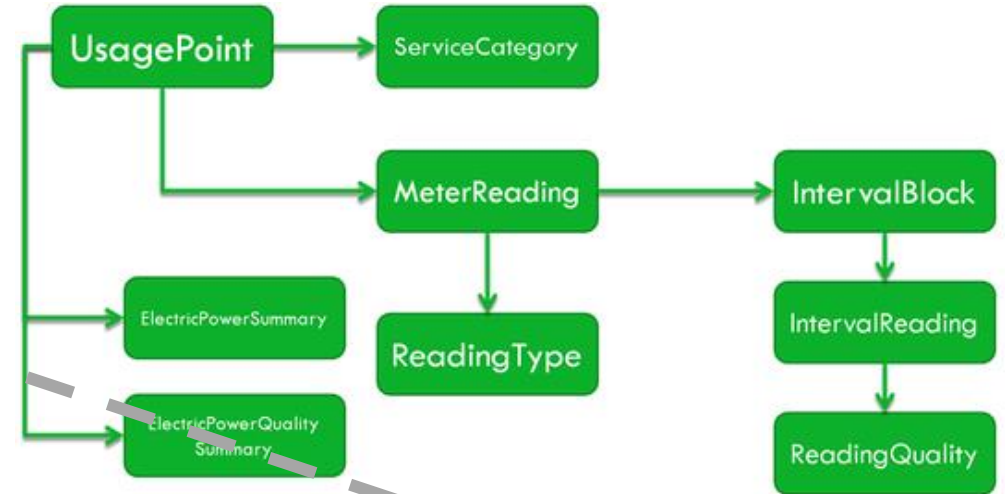


A Service Data Model

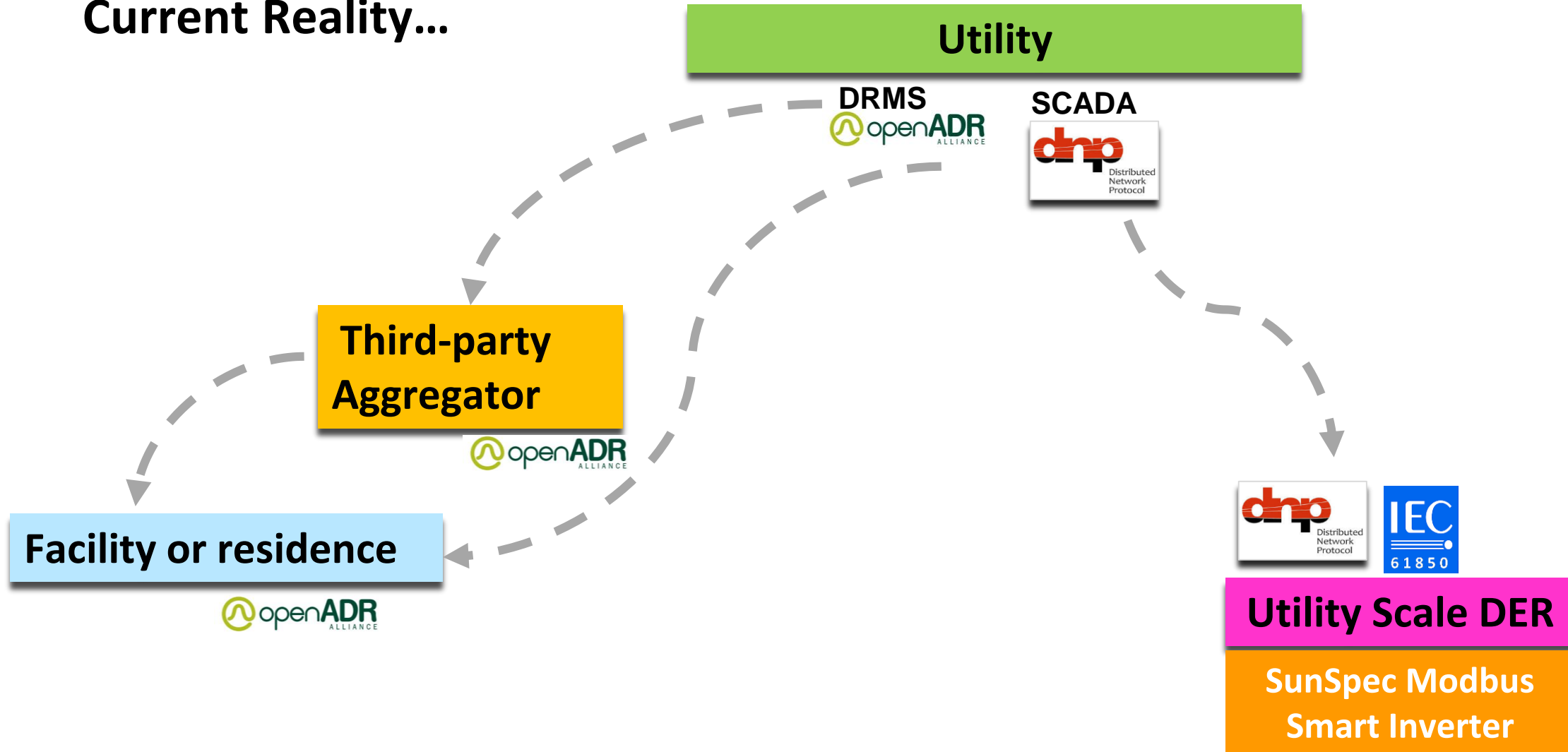
Customer Energy Information
Usage
Cost
Interval Data

eMIX
WS-Calendar

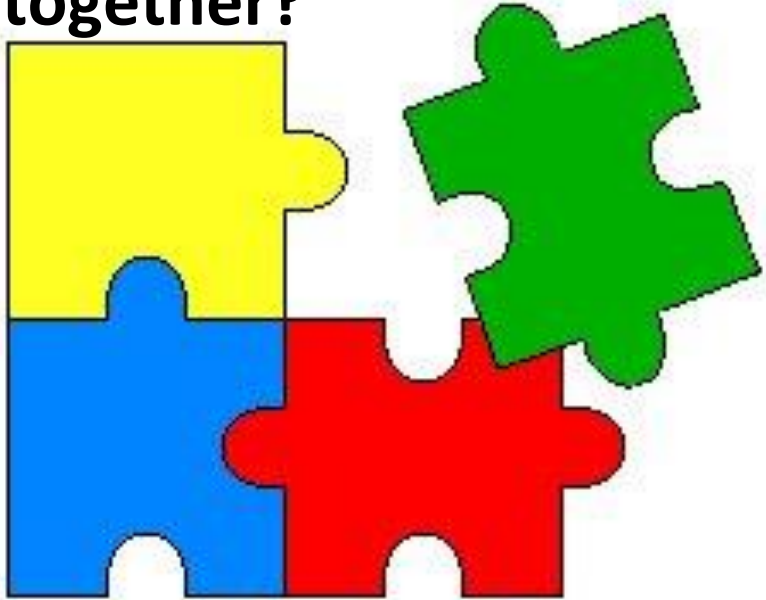
OASIS



Current Reality...

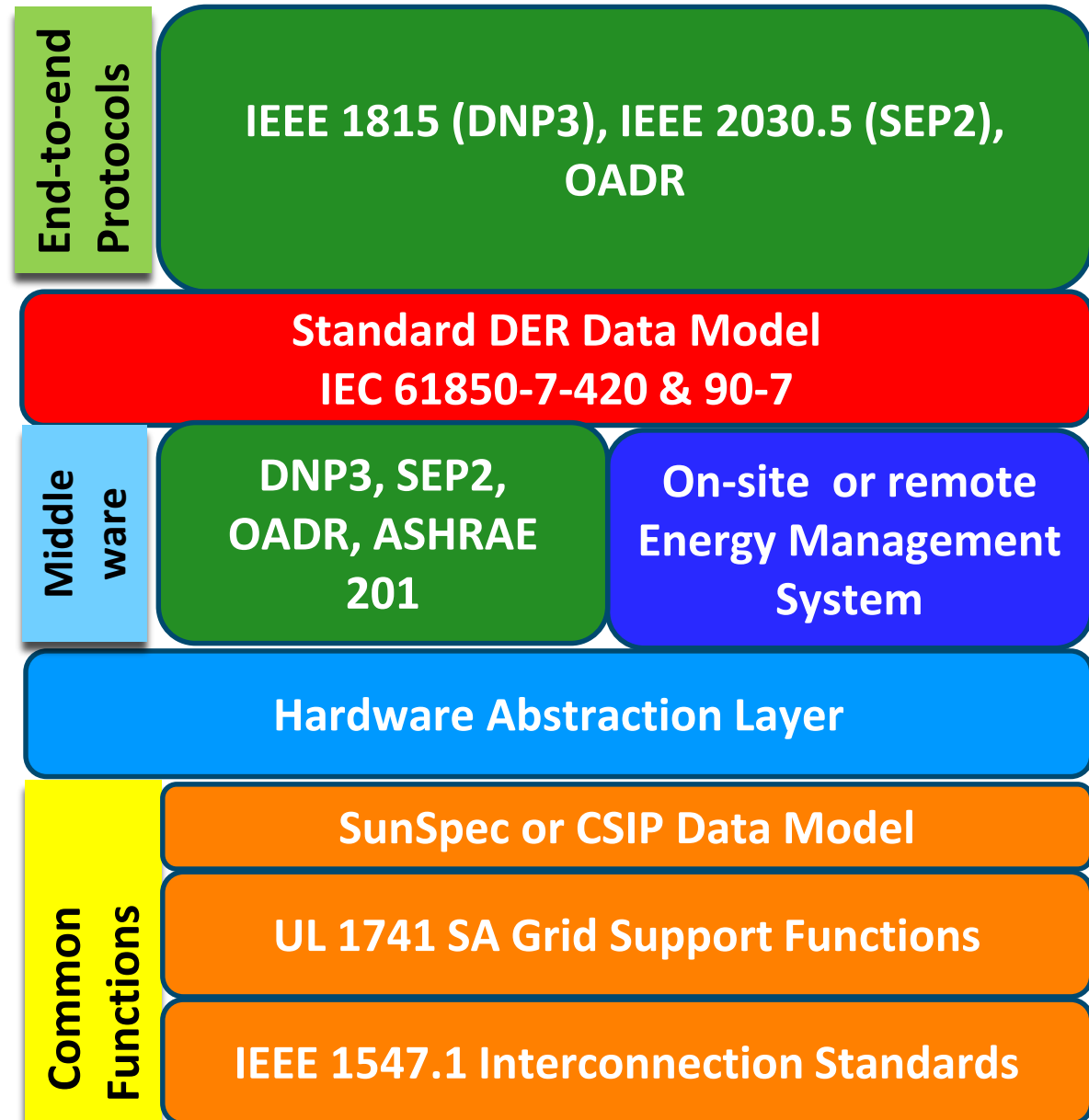


How do the DER/DR C&C pieces fit together?



Key to the puzzle

Well-defined **services** and a **shared data model**.



Looking ahead...



ORANGE BUTTON

**Third-party
Aggregator**



Facility or residence



Smart Inverter

Utility



SCADA



Utility Scale DER

Smart Inverter



Together...Shaping the Future of Electricity