OCPP 2.1 and Grid Code Requirements
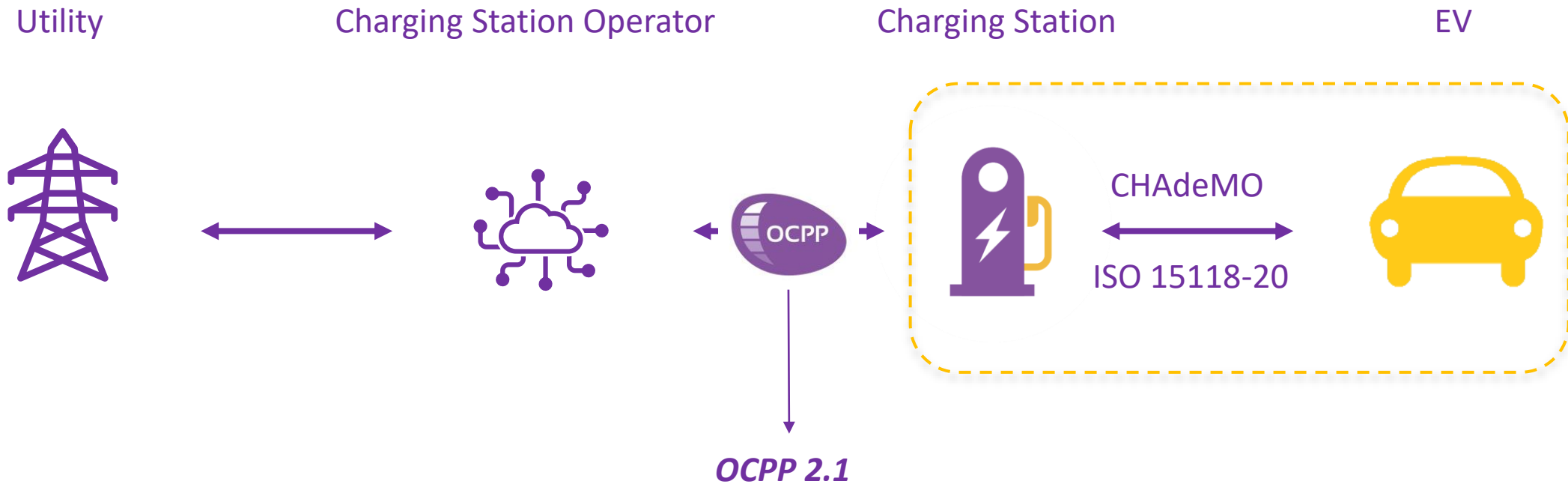
(06-03-2024)
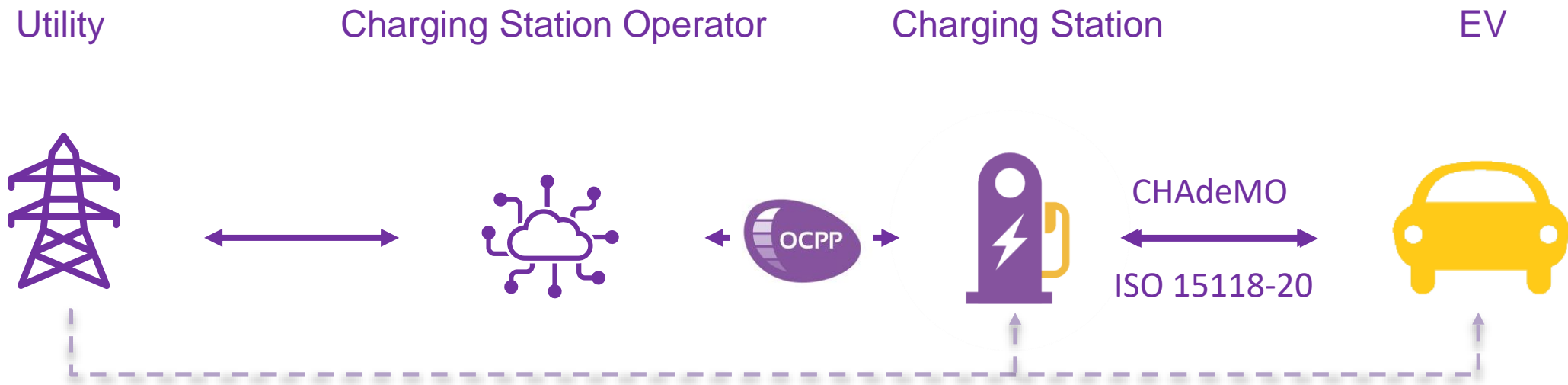www.OpenChargeAlliance.org

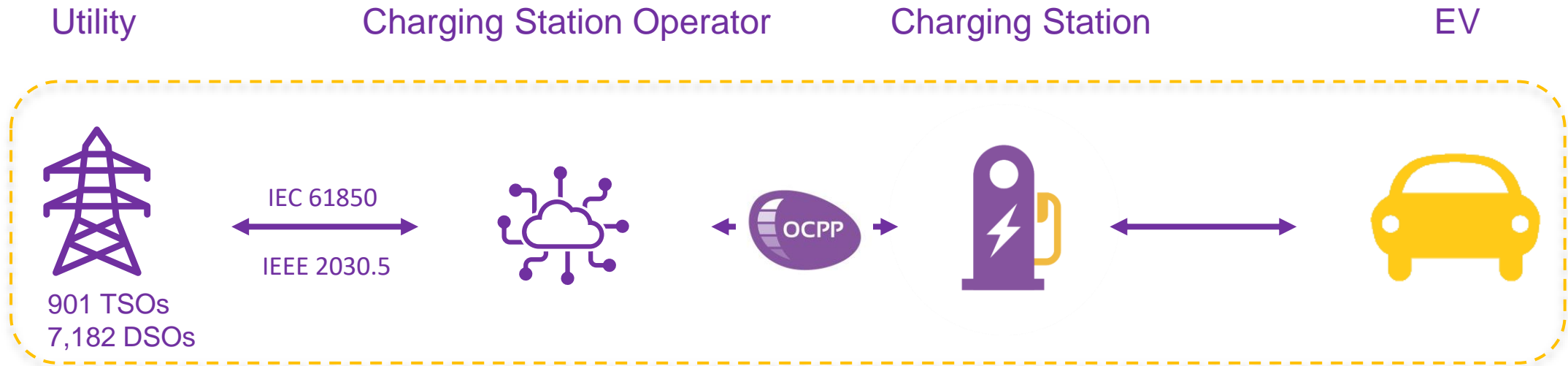# OCPP and bidirectional power flow

Utility

Charging Station Operator

Charging Station

EV

CHAdeMO

ISO 15118-20

OCPP

OCPP 2.1

OPEN CHARGE ALLIANCE

V2G: when EVs become distributed energy resources

Utility   Charging Station Operator   Charging Station   EV

CHAdeMO

OCPP

ISO 15118-20

Requirements, Grid Codes, OCPP and V2G

Utility | **Charging Station Operator** | **Charging Station** | **EV**

IEC 61850

IEEE 2030.5

OCPP

901 TSOs
7,182 DSOs

IEEE 1547 - Standard for Interconnection and Interoperability of Distributed Energy Resources with associated Electric Power Systems Interfaces
EN 50549 - Requirements for generating plants to be connected in parallel with distribution networks

Grid codes France
Grid code Netherlands
Grid code Germany
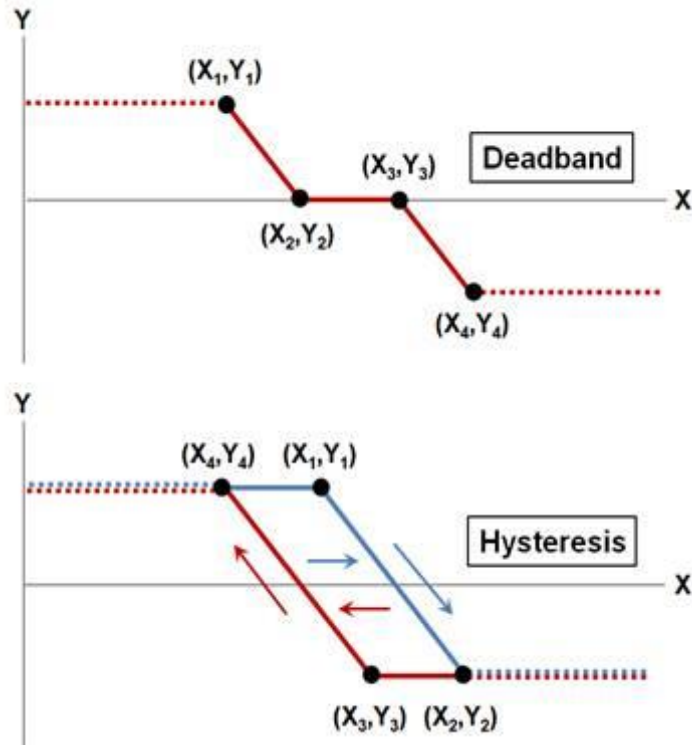
What all Grid Codes have in common

Grid codes across the world cover the same 4 aspects: a 'Distributed energy resource' (i.e., a bidirectional vehicle) must:

A. Adjust behavior according to the grid frequency and voltage

B. Continue operation despite grid 'hick-ups'

C. Listen to a direct 'STOP!' signal

D. Detect if the grid is down: do not feed into the grid when it is down and when the grid comes back up, reconnect with care
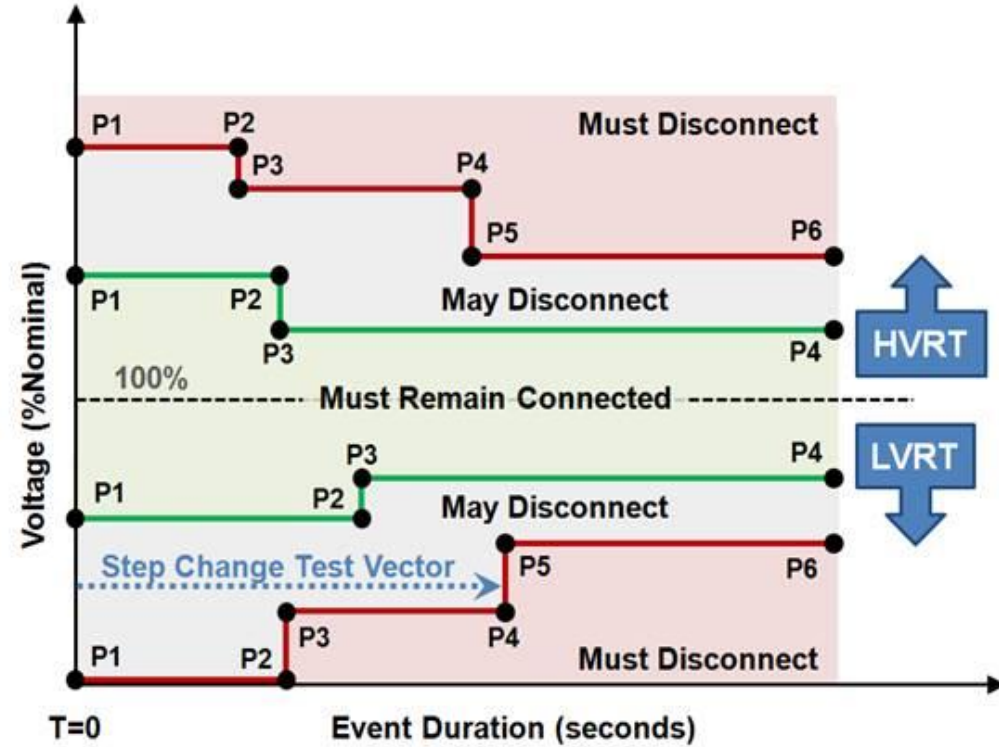
DER Curves

DER Curves
Voltage - Reactive Power
Voltage - Active Power
Active Power - Reactive Power
Active Power – Power Factor
Frequency – Watt
High Voltage Trip Curve
Low Voltage Trip Curve
High Frequency Trip Curve
Low Frequency Trip Curve

Frequency-Watt

Voltage Ride-Through

Example IEC 61850

DWMX	Attribute
WMaxSptPct	ctlModel (CtlModelKind)
	dbRef (FLOAT32)
WMaxSpt	ctlModel (CtlModelKind)
	dbRef (FLOAT32)
RmpRteUse	setVal (Boolean)
InEcpRef	setSrcRef (ObjectReference)

DVVR	Attribute
CurveVVar	CSG
DepRef	ReactivePowerReferenceKind
VArAvl	MV

- 61850 defines "logical nodes" for certain functions
  - (1) Utility sets attribute WMaxSpt of logical node DWMX to limit active power to 10 kW for a certain station in field InEcpRef.
  - (2) Utility sets attribute CurveVVar of logical node DVVR to set a VoltVar curve
- CSMS sends settings to EVSE as:

> 1. SetChargingProfileRequest(purpose="ChargingStationMaxProfile", limit=10.000, stackLevel=1)
> 2. SetDERControlRequest("VoltVar", <Volt-Var curve 1>)

Example IEEE 2030.5

2030.5 is a RESTfull interface with XML content

```xml
<DERProgram href="/sep2/A1/derp/1">
  <mRID>B01000000</mRID>
  <description>SYS-A1</description>
  <ActiveDERControlListLink
  <DefaultDERControlLink
  <DERControlListLink href=
  <DERCurveListLink href="/
  <primacy>89</primacy>
</DERProgram>
```

```xml
<DefaultDERControl href="/sep2/A1/derp/1/dderc" xmlns="urn:ieee:std:2030.5:ns">
  <mRID>E0000001</mRID>
  <description>Default DERC</description>
  <DERControlBase>
1.  <opModMaxLimW>10000</opModMaxLimW>
2.  <opModVoltVar href="/sep2/dc/1"/>
3.  <setGradW>0</setGradW>
    <setSoftGradW>0</setSoftGradW>
  </DERControlBase>
</DefaultDERControl>
```

Limit power to 10 kW (charging profile)
Use default DER curve VoltVar 1
No ramp-up rates

OCPP:
1. SetChargingProfileRequest(purpose="ChargingStationMaxProfile", limit=10.000, stackLevel=1)
2. SetDERControlRequest("VoltVar", <Volt-Var curve 1>)
3. SetDERControlRequest("RampRates", 0)

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Charging station executing DER curve

DSO CSMS CS AC EV

Updated P(F) curve

SetDERCurve(...)

When bidirectional charging in progress
and a frequency anonamaly occurs.

EVSE detects anomaly
and start following P(F) curve

SignalDEREvent(P(F), started)

ISO15118-20 ChargeLoop instructions

SignalDEREvent(P(F), ended)