

Appendix A

Communications Architectures of Protocols Considered by the VGI Working Group

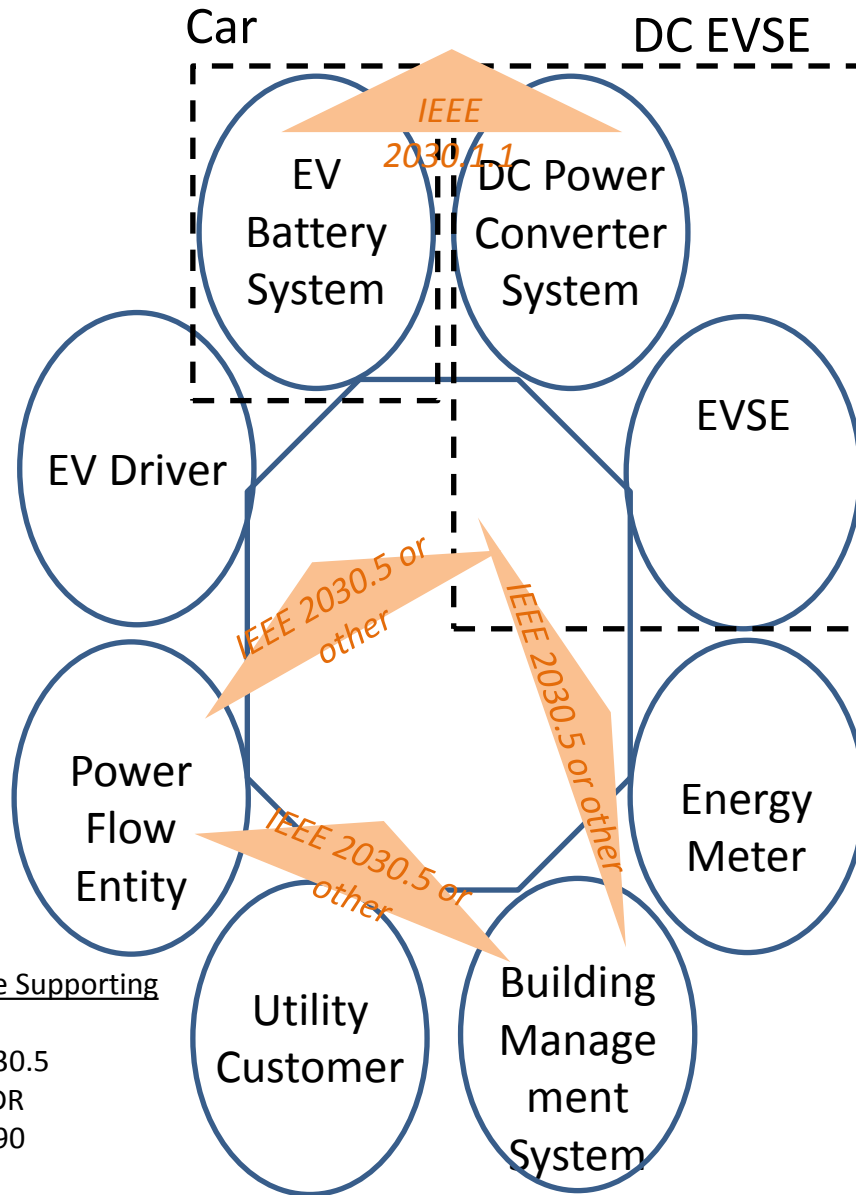
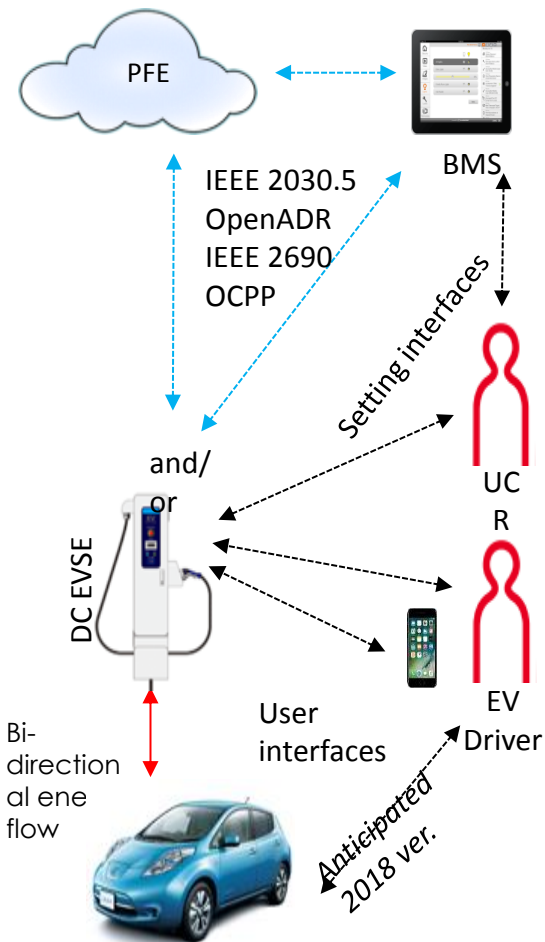
CHAdeMO (IEEE 2030.1.1)

- Developed for DC Fast Charging
- Most communications and settings occur at the DCPC
- Flexible protocol that can be used in conjunction with many others to communicate from PFE to EV

CHAdeMO, an abbreviation of Charge de Move, is the trade name for a protocol for fast charging EV batteries. Available at: <https://www.chademo.com/about-us/what-is-chademo/>

Likely End-to-End Architecture CHAdEMO (IEEE 2030.1.1)

Functional Block Diagram



Example Supporting

- Stds:
- IEEE 2030.5
 - OpenADR
 - IEEE 2690
 - OCPP
 - or other

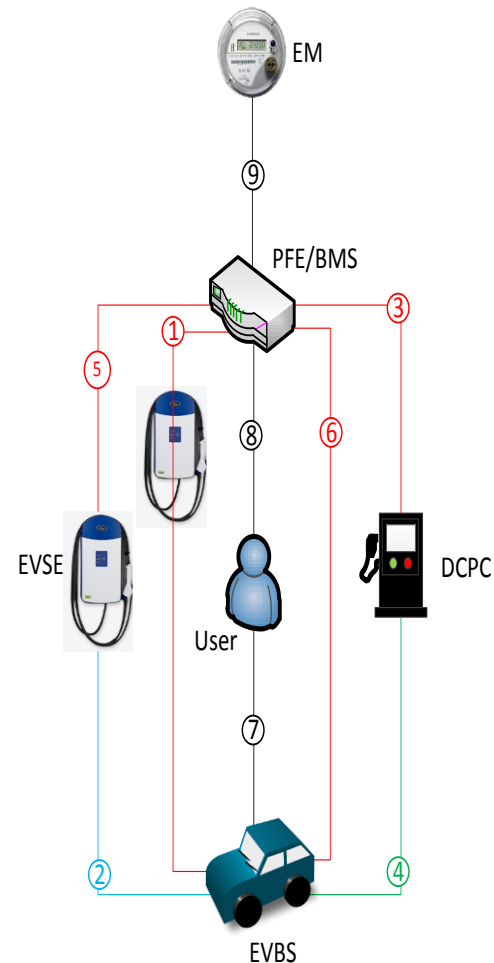
IEEE 2030.5

- Can be used in both AC and DC applications
- Current revision will add new capabilities that better allow EVs to serve as demand response resources
- Can be used in conjunction with EV telematics to communicate between PFE and EV

The Institute of Electrical and Electronic Engineers (IEEE) is an organization that develops standards through consensus building aimed at advancing technologies by identifying specific functionality, capability, and interoperability standards. More information is available at <http://standards.ieee.org/>

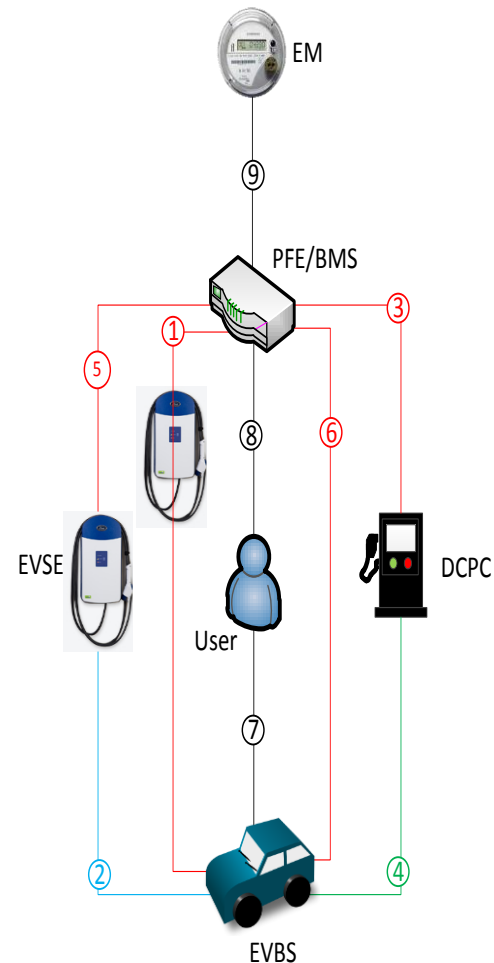
IEEE 2030.5 - AC Charging

- 1- PFE/BMS to EV (Bridged through EVSE)
- 2- Not Needed
- 3- Not Applicable
- 4- Not Applicable
- 5- May be used for DR to communicate between PFE/BMS and EVSE
- 6- Communications between PFE and EVBS possible if IEEE 2030.5 is run over Telematics
- 7- *BMS/EVSE to User (Secondary)*
- 8- *EV/Telematics to User (Secondary)*
- 9- *Energy Meter to PFE/BMS (Secondary)*



IEEE 2030.5 - DC Charging

- 1- Not Needed
- 2- Not Needed
- 3- IEEE 2030.5 communicates between PFE/BMS and DCPC
- 4- Not Applicable
- 5- Not Applicable
- 6- Not Applicable
- 7- *BMS/EVSE to User (Secondary)*
- 8- *EV/Telematics to User (Secondary)*
- 9- *Energy Meter to PFE/BMS (Secondary)*



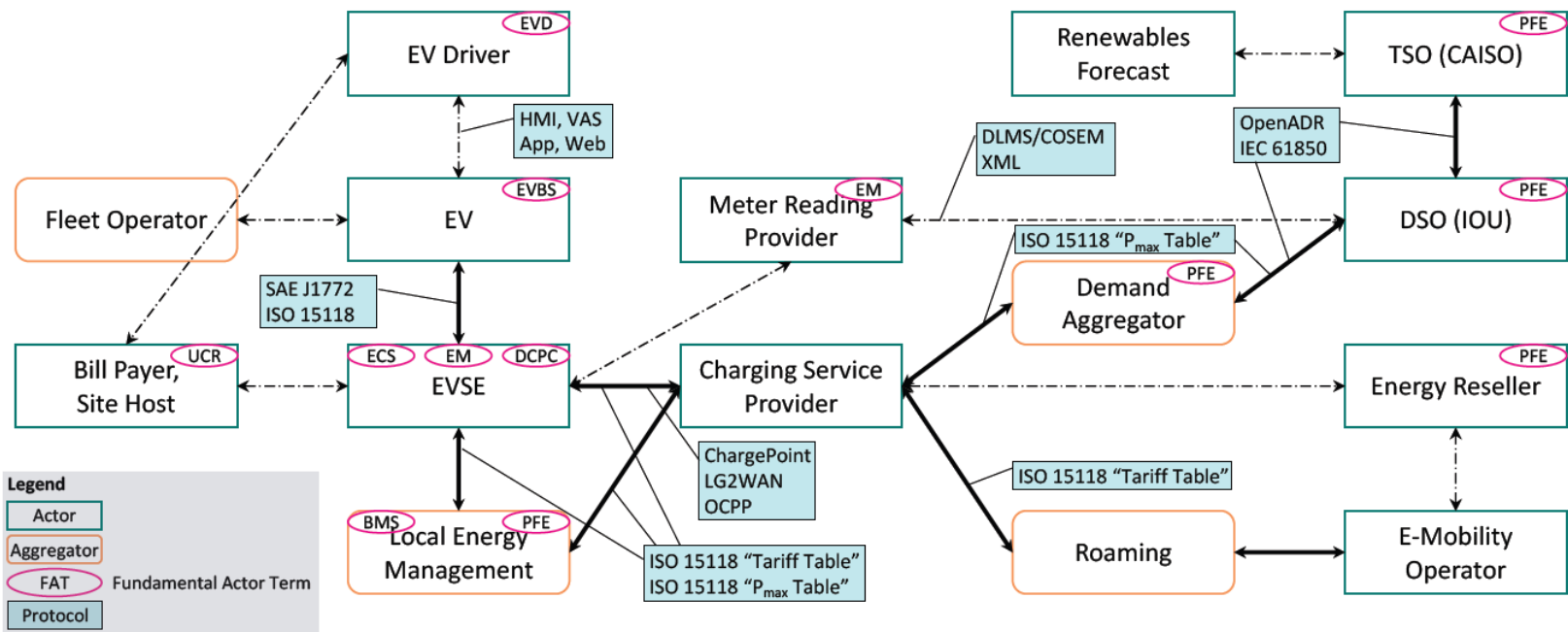
ISO 15118

- Communicates between the EV and the EVSE
- Signals between the PFE and EV can be transported using other protocols and translated by the EVSE

The ISO is a non-governmental organization made up of 162 national standards bodies that develops voluntary, consensus-based standards to support technology innovation. More information is available at <https://www.iso.org/home.html>

ISO 15118 relevant communication links

— with “Fundamental Actor Terms” & protocols

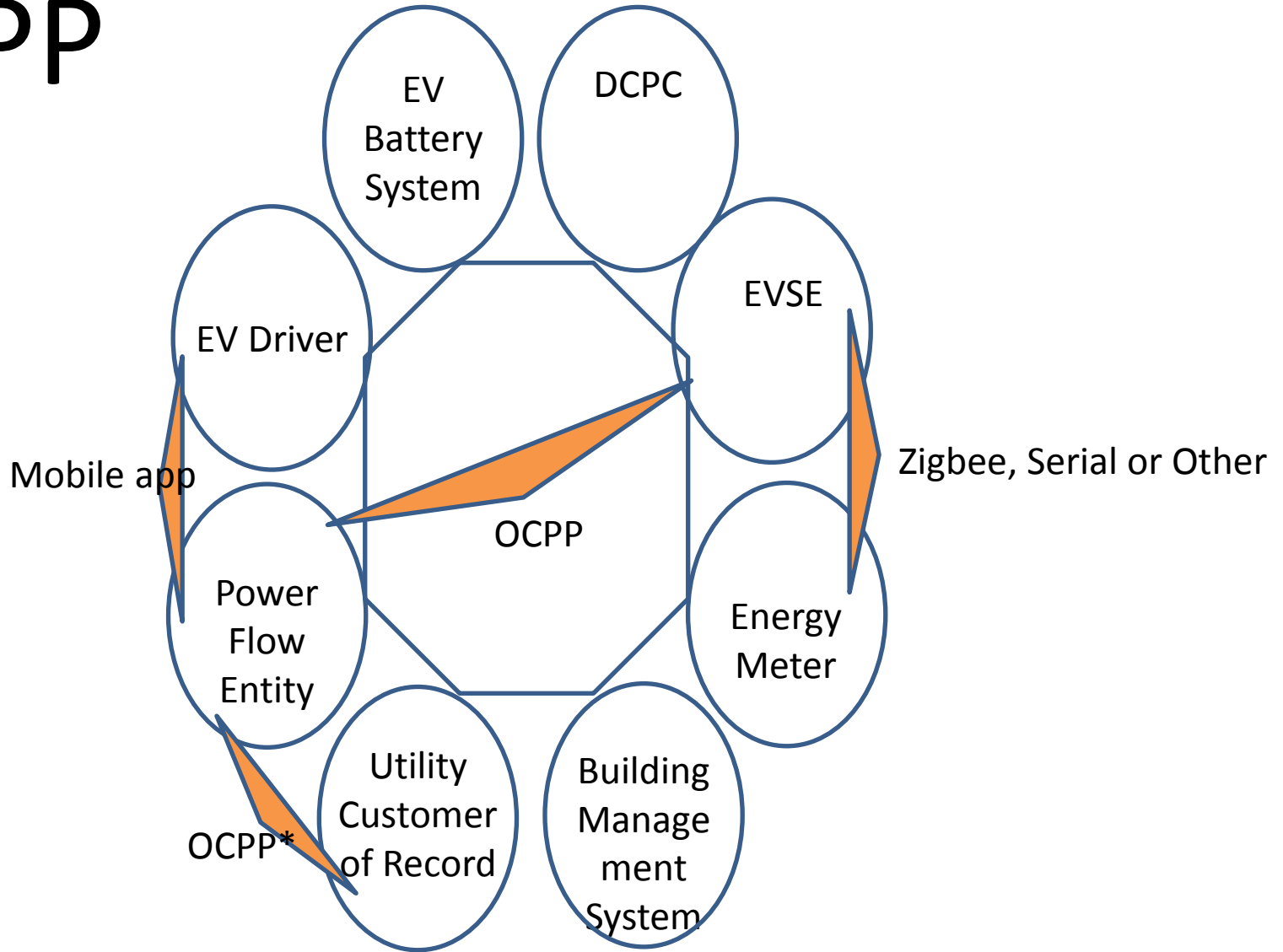


OCPP

- Enables communications between a central server/back office and the EVSE
- Communications forwarded to EV via a mobile app or other software
- Typically implemented with other open protocols, especially OpenADR

Open Charge Point Protocol (OCPP) is sponsored by the Open Charge Alliance, and offers a uniform method of communication between a charge point and a network operator or utility system. Version 2.0 is currently being finalized. More information is available at <http://www.openchargealliance.org/>

OCPP

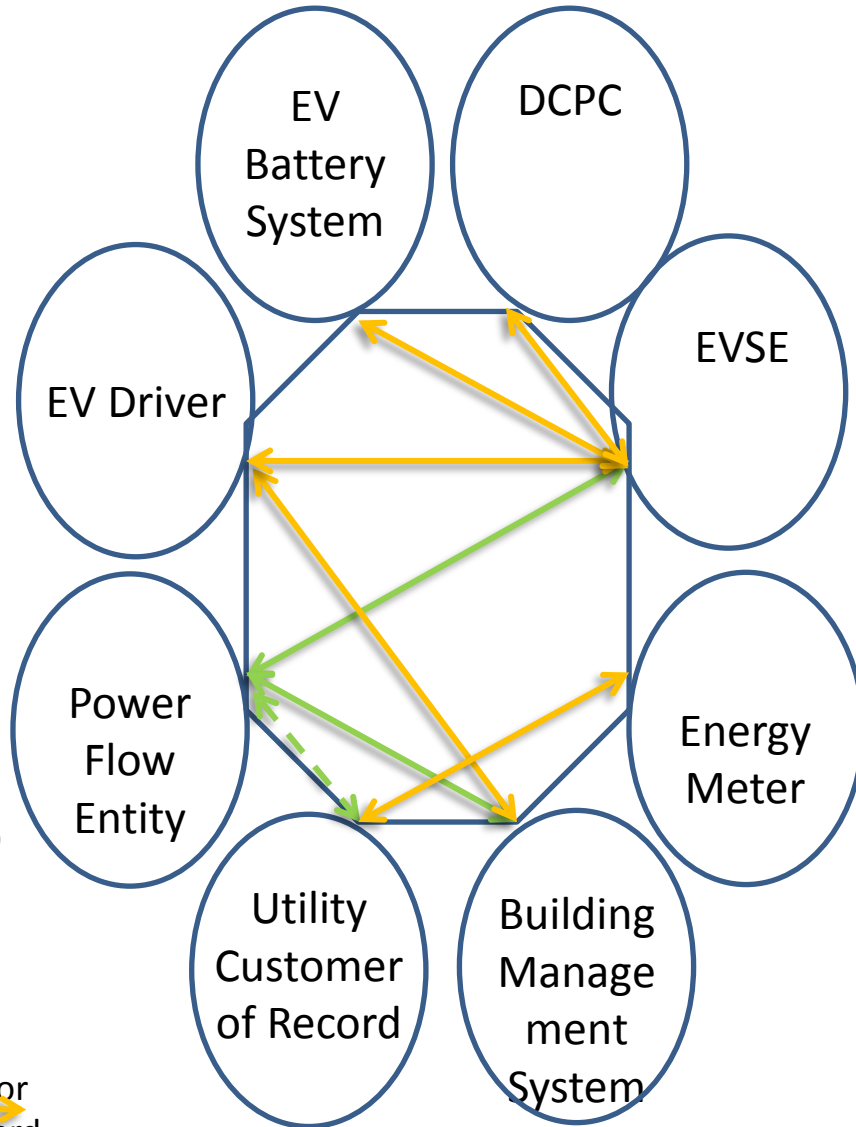
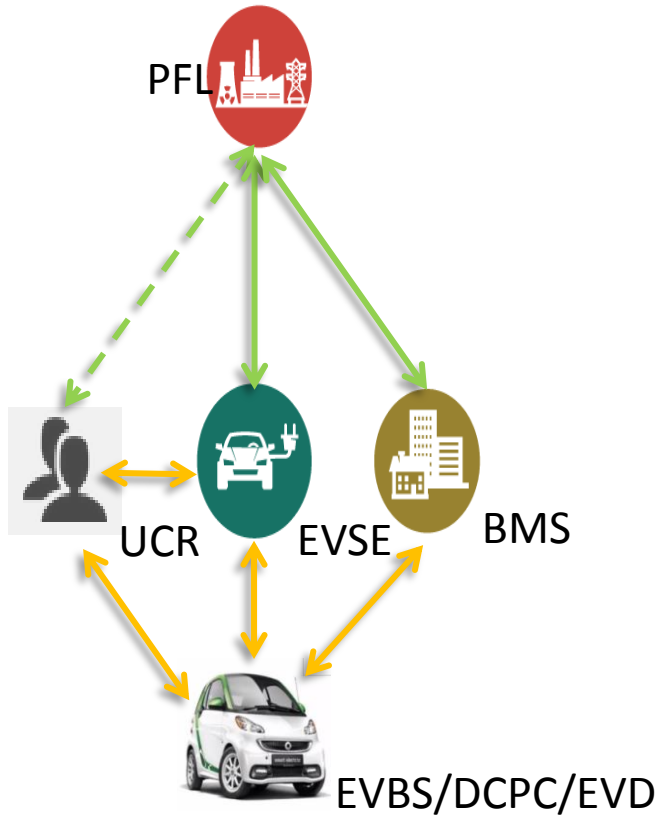


OpenADR 2.0b

- Sends information from the PFE about grid conditions to a BMS or EVSE
- Other protocols are needed to translate the OpenADR signal into an action/response
- BMS or EVSE can communicate the EV's action/response back to PFE

OpenADR is sponsored by the OpenADR Alliance, which was formed in 2010 by industry stakeholders to standardize and automate utility demand response programs using an open software platform. More information is available at <http://www.openadr.org/>

OpenADR 2.0b



OpenADR link

Proprietary or other standard

SAE Suite

- SAE's standards are designed for use with other protocols, largely IEEE 2030.5
- There are different SAE standards for AC and DC applications
- The communications functionality of ISO 15118 is expected to be added to the next version of SAE 2047.2, which sends direct messages between the DCPC and the EV

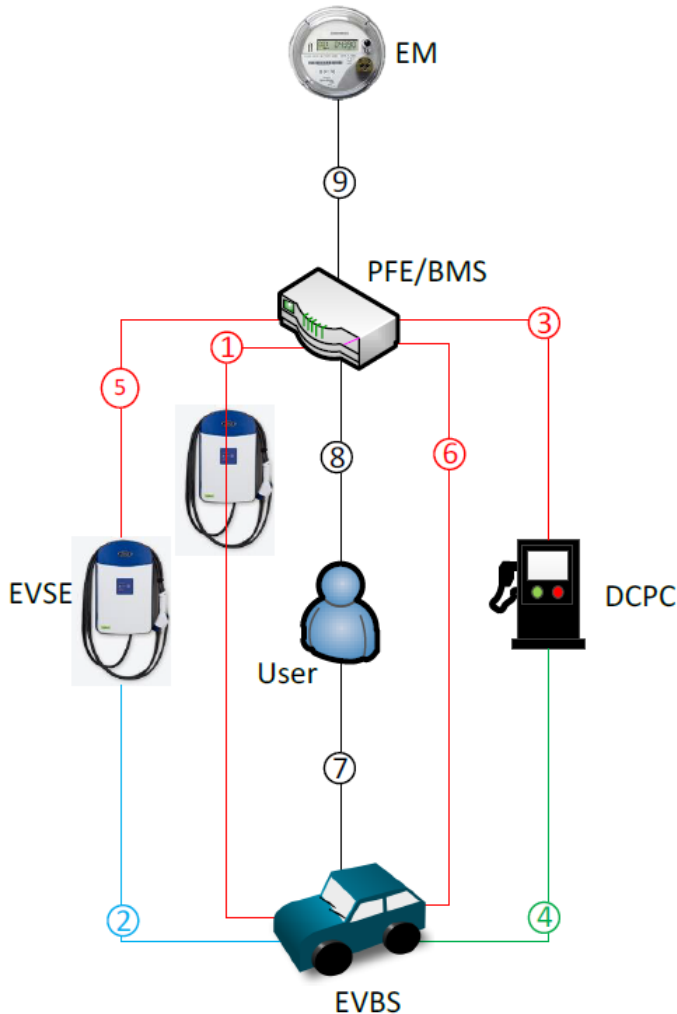
SAE Suite

AC Charging : J2836/1,
J2847/1, IEEE 2030.5

DC Charging (SAE/DIN)
J2836/2, J2847/2

Note: SAE is working to harmonize J2847/2 with ISO 15118 but it is not clear if it will incorporate the existing standard or develop its own that mirrors it

VGI end-to-end Application Interfaces



	Charging		DER	
	AC	DC	AC	DC
1- PFE/BMS to EV (Bridged through EVSE)	X		X	
2 (+5)- EVSE to EVBS (Needs 5 for end to end)			X	
3- PFE/BMS to DCPC				X
4 (+3)- EVBS to DCPC		X		X
5- Direct to EVSE (Interface 2 protocol or J1772 PWM to EV)	X		X	X
6- Telematics direct to EV	X		X	X
7- BMS/EVSE to User (Secondary)	X		X	X
8- EV/Telematics to User (Secondary)			X	X
9- Energy Meter to PFE/BMS (Secondary)				

Eight (8) Fundamental Actor Terms

3 entities

5 equipment items

Decision & Choice Entities			Acting Equipment & Hardware				
EV Driver (EVD)	Power Flow Entity (PFE)	Utility Customer of Record (UCR)	EV Battery System (EVBS)	DC Power Converter system (DCPC)	Energy Connection System (EVSE)	Energy Meter (EM)	Building Management System (BMS)

Examples of common names used in use-case descriptions:

<ul style="list-style-type: none"> • Driver • End User • Owner • Fleet transportation operator 	<ul style="list-style-type: none"> • Aggregator • Utility • EV Service Provider • Energy Service Co. • Alt. Energy Supplier • Energy Portal • Clearing House 	<ul style="list-style-type: none"> • Site Host • Ratepayer • Bill Payer • Home Owner 	<ul style="list-style-type: none"> • Electric Vehicle • EV • BEV • PHEV • PEV 	<ul style="list-style-type: none"> • Inverter • Rectifier • Bi-directional inverter 	<ul style="list-style-type: none"> • Electric Vehicle Supply Equipment • Charger • Level 2 EVSE • Level 1 EVSE 	<ul style="list-style-type: none"> • End-user meter device (EUMD) • Site meter • Sub meter 	<ul style="list-style-type: none"> • Site controller • Building site controller • Energy management system • Home Energy Management System (HEMS)
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