VGI Communications Protocols Working Group

November 29, 2017 CPUC, CARB, CAISO, and GO-Biz Proposal for Next Steps

Background:

The Working Group has completed substantial portions of Deliverable 1 in the Work Plan. Based on the work to date, the CPUC, CARB, CAISO, and GO-Biz have made the following observations:

1. Based on Working Group results as of November 2017, we cannot designate a single existing protocol that would be able to support all of the VGI use cases. The market is still developing, and combinations of protocols are necessary to provide end-to-end (i.e. grid to vehicle) communications to meet the majority of use case requirements.
2. IOU Investments should minimize the probability of stranded assets that cannot participate in current and future VGI opportunities:
   a. Level 2 AC EVSE should be designed to be field upgradeable using software (e.g over the air flashing).
   b. Level 2 AC EVSE should be physically capable of handling all protocols that the Working Group has determined provide VGI-enabling functionalities, should the project host choose to implement them.
3. VGI-enabling hardware investments should be cost-effective and ensure long-term ratepayer benefits. Investments should:
   a. Minimize up-front investment.
   b. Maximize potential for grid benefits.
4. One of the goals of the Working Group is to gather data and document analysis that will help support State Agency decision making regarding what policies we need to adopt to support VGI. The agencies have considered every standard and non-standard option during the working group period.

Proposal

Given our finding that we cannot select a single protocol at this time, our suggested approach is to develop recommendations on hardware performance requirements that allow EVSEs to accommodate the multiple communications protocols that may be used to enable VGI. This approach combines the flexibility to ensure future usability with the certainty that manufacturers of charging stations and vehicles need to invest in producing products. Based on Working Group discussions and data EVSE providers shared with the Working Group, we expect the incremental costs of meeting the hardware performance requirements to be small.

Based on the Working Group results to date, CPUC, CARB, CAISO, and GO-Biz have developed the following proposal to guide future Working Group discussions necessary to develop recommendations to the CPUC on the IOUs' infrastructure investments. The goal of this proposal is to identify the necessary EVSE hardware performance requirements that will enable the VGI use cases that stakeholders identified through the working group process. We acknowledge that hardware alone is not

sufficient to enable VGI and that communications protocols will also be necessary; however, we do not think it is appropriate to mandate specific communications protocols at this time due to the interdependency of existing protocols, and the nascent state of protocol development for EVs. Instead, we document the recommended communications protocols for different domains of communication (Appendix A).

- The scope of this proposal is for Level 2 conductive AC EVSEs.
    - For the current large IOU SB 350 TE proposals before the CPUC, we suggest that this proposal could apply directly to SDG&E's Residential Charging Infrastructure Standard Review Project.
    - Note: State Agencies seek working group feedback on whether all of the hardware performance requirements should be applied to both multi-user EVSE (public, workplace, and MUD common areas) and single-family, residential EVSE, or if, for example, only a subset of the requirements should be applicable to the single-family residential setting.
- This proposal does not intend to apply to the design of an electric vehicle; therefore it does not restrict, limit, or determine the use of vehicle-based technologies (e.g. telematics) in providing grid integration functions between the Utility and EV.
- This proposal does not prohibit investments in DC charging technologies that can be designed or controlled to provide grid-integration functions.
    - Note: State Agencies seek working group feedback on whether there are hardware performance requirements that should apply to the DC fast chargers PG&E proposes to support through its Fast Charge DCFC Make-Ready Standard Review Project.
- The Working Group found that Level 1 EVSEs are unlikely to have a duty cycle that justifies the expense of enabling VGI in the EVSE hardware.

Table 1. Hardware Performance Requirements

Domain of Communication	Hardware Functionality /Physical Layer	Description	Documentation to Show Compliance
Utility to EVSE	IEEE 802.11n compliant hardware, IEEE 802.3 compliant hardware	Wifi and ethernet connection	
EVSE to Third Party (Distributed Energy Resource Provider, Aggregator, or Charging Network Service Provider)	Field upgradable, Sufficient processor power to perform real time protocol translation and encryption/decryption, supporting IP stack, interface that provides hardware extensibility, form factor that supports extensibility, via Internet Protocol version 6	Use of IPv6 will allow for third party management of EVSE. Each EVSE need not directly communicate to the third party. Rather, the EVSE may be part of a mesh architecture that communicates an individual EVSE's use to a "master" within an array of chargers.	
	Measurement of electricity dispensed to vehicle	Each EVSE must use an accurate electricity meter to permit "revenue grade" uses of its electricity consumption.	
EVSE to EV	HomePlug Green PHY for conductive EVSE	The physical layers that support the protocols the working group identified	

We have identified hardware requirements between the EVSE and the utility, EVSE and third parties, and between the EVSE and EV. There is still opportunity for growth in each area and we understand that standards specialized in each segment are necessary to enable a broader set of VGI controls by working in concert with the others. Utility to EVSE requirements are important because the agencies would like to avoid stranded assets and enable load management functionalities immediately, and the above protocols are commercialized for Demand Response and Distributed Energy Resource use. EVSE to third party communications should use Internet Protocol to enable remote management and flash capabilities that allow over-the-air software updates to be sent remotely to each of the networked stations. The EVSE to EV requirement allows for immediate VGI service functionality to accept vehicles implementing such protocols onboard and while allowing for charging to also occur for vehicles not capable of high-level communications.

The Working Group should determine what kind of documentation is necessary to show that an EVSE meets the required hardware functionality. This could include a certificate from a relevant standards organization, a parts list, or item data sheet. Each EVSE vendor or manufacturer shall self-certify each EVSE and maintain documentation of conformance from the applicable standardization body, subject to regulatory audit. This will allow the IOUs a clear and streamlined process for ensuring that any EVSE they support with ratepayer funding contains this functionality.

Next Steps:

During the December 1 Webex, the sponsoring State Agencies will review this proposal with the Working Group for their feedback.

The State Agencies anticipate continuing discussion of VGI communications protocols in the future, specifically as part of the state's VGI Roadmap.

Appendix A: Working Group-identified protocols that can help enable VGI in various communication domains

Domain of Communication	Protocols Currently Available
Utility to EVSE	One or a combination of the following: 1. OpenADR 2.0b for Demand Response functions 2. IEEE 2030.5/SEP 2.0 for Smart Inverter functions pursuant to Rule 21
EVSE to Third Party (Distributed Energy Resource Provider, Aggregator, or Charging Network Service Provider)	One or a combination of the following: 1. OCPP 1.6 2. IEC 63110 3. SEP 2.0 Metering and Cybersecurity requirements*
EVSE to EV	One or a combination of the following: 1. ISO 15118 v1 2. SEP 2.0 3. SAE J1772/ IEC 61851-1 4. IEEE 2030.1.1 5. SAE J2836 v1/ J2847 v1
Vehicle OEM to EV	Telematics

*In addition to the above identified protocols, the Working Group recommends every EVSE have a meter that complies with the requirements of ANSI C-12 and cybersecurity measures such as UL 2900 and compliance with the NISTIR 7624 Guidelines that define cybersecurity measures for the Smart Grid. The Working Group is asked to identify any other specific metering and cybersecurity measures it would recommend the CPUC consider.

Based on Working Group discussions with communications protocols subject matter experts, the CPUC, CARB, CAISO, and GO-Biz identified the leading communications protocols that are currently available to support various communications domains. To enable VGI in the near term, we recommend implementation of these protocols as appropriate for participation in various applications, programs, and markets in addition to the EVSE hardware performance requirements.