OpenADR/EPRI DER Workshop: Requirements and Communications Protocols for DER Integration

A Collaboration between the OpenADR Alliance and EPRI

Hosted by EPRI April 18-19, 2017
Palo Alto, CA

Workshop Goals

- Goal: Develop a landscape of DER requirements and protocols and identify prioritized options for OpenADR participation
  - Present and refine framework for DER Communications Landscape
    - Scope
    - Architectures
    - Communication Layer
  - Present and refine DER Use Cases and Requirements
    - DR, PV, Storage, EV Use Case/Requirements Framework
    - Overlaps and unique Requirements
  - Present and refine analysis of Communications Protocols for DER
    - Assessment against DER Use Cases/Requirements
    - Gaps in protocols for DER communications
  - Develop and prioritize a set of options for OpenADR participation in DER (OpenADR Alliance goal for the workshop)
  - Goal is NOT to pick a protocol or protocols for DER communications

Protocol Team

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C&C, Protocols, Information Model?

What is the current state 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?

Raymond Kaiser, Amzur

DER Communications Protocols Framework

- **Communications Protocols Framework**
  - Identification of Protocols
    - Considerations used to evaluate protocol applicability (rating criteria)
    - Short list of protocols and rationale for selection
    - Other considerations for deployment selection
  - Assessments of Protocols versus Requirements
    - Example of analysis the standards on 1 requirement area
    - Preview of overlaps and gaps in comparison with use cases/requirements
- **For this workshop, intent is NOT to pick a winner**
- **OpenADR Alliance goal is to understand how best to improve OpenADR for DER purposes**

Caveats

- Use cases, requirements and protocols are evolving. This work a snapshot of today.
- Key protocols are undergoing updates to address emerging DER communications requirements
- Protocols and requirements come from differing architectural context – best guesses as to integrated DER messaging requirements
- Requirements not detailed: room for differing interpretations
- Not clear if one protocol can meet the consolidated requirements for DER: probably requires multiple protocols and multiple layers of communications

Identifying Relevant Protocols

Criteria for Selection

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Protocol Selection Criteria

- Messaging domain between utilities (DERMS) and facility EMS and/or aggregated DER and/or DER
- Message exchange protocols – not transport (Wifi, Cellular, PLC, etc)
- International standard based
- Addresses at least PV, storage, EV or DR messaging requirements
- US and International interest and support
- Maturity of the standard – alliance, certification, adoption
- Ease of integration of technology based on the standard
- Flexibility in DER integration
- Security
- Future evolution

Standards Considered

Protocol	Protocol	Protocol
OpenADR 2.0	OCHP (EV)	Open SG Protocol
IEEE 2030.5	OCPI (EV)	TeMIX
IEC 61850-8-2	OCPP (EV)	CTA 2045
DNP3	OICP (EV)	ETSI TS 104.001
SunSpec	OSCP (EV)	FAN USEF
MESA	Green Button	ASHRAE 201/2030.5
IEC 61850-90-8	Orange Button	PowerMatcher
ISO/IEC 15118	OpenFMB	
eMIP (EV)	IEC 61850-4-720	

Of most interest

Also of interest

Other Considerations when Choosing a Protocol

- ***Openness -*** non-discriminatory availability of the standard to all interested parties.
- ***Interoperability -*** clarity (lack of ambiguity) in the specification, optionality permitted, "interop" events, test and certification.
- ***Market Adoption*** - current number of users, developers and countries adopting the protocol. Formal regulatory adoption/rulings "grid codes".
- ***Maturity -*** active community/alliance evolving and developing products using the standard; improving/evolving the standard itself.
  - Compliance/certification testing and insuring interoperability of implementations.
  - Standardized testing and certification tools.

Assessment Process and Example

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Standards Assessment Questions

- Does the protocol meet these requirements out-of-the box today?
- Is there a standard mechanism in the protocol that can be used to meet the requirements in a specific deployment (not part of certification profile)?
- Would fully addressing the requirements in this area require a change to the standard such as defining new functions and attributes or new services?

Example: DER Registration Requirements

- The general use cases for registering resources or devices:
  - A resource requesting the initiation of a registration process
  - A resource requesting that its registration ***information*** be updated
  - A resource requesting that it be removed from the registration database.
- The goals of a communication protocol in supporting a registration process are to:
  - Standardize and automate the process of registering a resource or device
  - Standardize a large collection of optional registration attributes, such as
    - Device type or resource type
    - Resource or device capabilities in terms of load reduction, power output, voltage support, etc
    - Ownership, location, URL, unique ID

Example: DER Registration Assessments

- ***OpenADR Registration Capabilities***
  - Does the protocol meet these requirements out-of-the box today? ***No***
  - Is there a standard mechanism in the protocol that can be used to meet the requirements in a specific deployment (not part of certification profile)? ***Yes***
  - Would fully addressing the requirements in this area require a change to the standard such as defining new functions and attributes or new services? ***No***
- The OpenADR protocol is well designed to automate a registration of a single resource or device operating as a VEN, but is not well suited to handle multiple resources/devices controlled by a single VEN…
- ***IEEE 2030.5 Registration Capabilities***
  - Does the protocol meet these requirements out-of-the box today? ***Yes***
  - Is there a standard mechanism in the protocol that can be used to meet the requirements in a specific deployment (not part of certification profile)? ***Not required??***
  - Would fully addressing the requirements in this area require a change to the standard such as defining new functions and attributes or new services? ***No***
- ***Registration*** can be done in-band using a specific ID mechanism and End Device list...

Example: DER Registration Assessments

- ***DNP3 Registration Capabilities***
  - Does the protocol meet these requirements out-of-the box today? ***No***
  - Is there a standard mechanism in the protocol that can be used to meet the requirements in a specific deployment (not part of certification profile)? ***Yes***
  - Would fully addressing the requirements in this area require a change to the standard such as defining new functions and attributes or new services? ***No***
- The DNP3 protocol does not support registration, but DNP3 data sets could be used to report the registration information.
- ***SunSpec Registration Capabilities***
  - Does the protocol meet these requirements out-of-the box today? ***No***
  - Is there a standard mechanism in the protocol that can be used to meet the requirements in a specific deployment (not part of certification profile)? ***No***
  - Would fully addressing the requirements in this area require a change to the standard such as defining new functions and attributes or new services? ***Yes***
- The Sunspec protocol does not support registration.

Protocol Assessment Summaries

In process

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Summary of OpenADR Assessment

Requirements Area	Comments	Level of effort
Registration	OpenADR 2.0 Registration and Report services can be extended within the standard to address requirements. Out-of-box support lacks detailed registration attributes and message payloads. Associating a VEN with each device can address device level registration information. To support interoperability, the Profile and Schemas would need to be updated and conformance tests added to the certification process.	Profile and Schema update
Identification/Group Management	OpenADR out-of-the box does not support a discovery mechanism in the protocol and managing groups of DER would require a new deployment strategy and additional generation and storage attributes to be defined. The attribute and deployment changes could be accomplished with a Profile update and Schema changes while Discovery would require significant effort and a new service to be defined.	Profile and Schema update except Discovery - new service
Device SW Update	Supporting software updates in the protocol would require defining a new service in OpenADR.	New Service
Transactive Energy	Energy Interop Services could be added to OpenADR to address TE requirements. Peer-peer would require a new service to be defined.	New services

OpenADR Opportunities

- ***Enhanced device knowledge and identification.*** Associating a VEN with each device can address device level registration information. Profile and Schemas would need to be updated.
- ***A DER deployment strategy*** that associates a VEN with each end device and adds detailed DER attributes to the current Registration services as alternative to adding a discovery mechanism.
- ***Transactive Energy*** support is a technical differentiation opportunity for OpenADR if the market requires it.
- To support ***inverter control messages natively***, a new signal type would be required and additional information model specifications adopted in OpenADR. Schedules for advanced DER would require enhancement to the current EiEvent schedule service.
- To support more ***Direct Dispatch of DER***, new event messages would be required for connect/disconnect, etc. Prioritization of overlapping behaviors would require a new service in OpenADR.
- To better support ***EV V2G communications***, new OptSchedule and EiReport attributes required to support power quantity and battery status would be required.
- To support most of the ***alarms and notification*** requirements, new OpenADR signal types would be required.

Opportunity Perspective

- Opportunities identified are focused on the current state-of-the-art requirements for DER identified in this project.
  - There may be other opportunities not in the scope of this project.
- Enhancements to a communications protocol for DER communications should be in the context of the expected applications for the protocol.
- An opportunity identified in this workshop does not mean it is the best enhancement for a given protocol.

Wednesday Morning Sessions

Panel of Protocol Experts and Breakout Session

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Protocol Panel of Experts

- OpenADR - Rolf Bienert, OpenADR Alliance; Bill Cox, Cox SW Architects; Pierre Mullin, Seimens
- IEEE 2030.5 – Mike Bourton, Kitu Systems
- SunSpec/DNP3 – Raymond Kaiser, Amzur; Ben DuPont, Nebland Software

Protocols Breakout Session

- Goal: Identify incorrect assessments and missing protocols
- Breakout session questions:
  - What do you think of the Protocol Assessment Framework and resulting assessments?
  - What improvements would you make to the assessments – individual protocol or in general?
  - What would be the most important next step for this project if it were to continue?
  - What does the group want to report out?
  - Who will do the report out?