

# OpenADR 2.0

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# QualityLogic Intro

- Test products & services for the smart grid, CE, telecom, and software technologies
- Smart Grid Projects Sampler:



*Smart Energy  
Profile 2.0*



# Topics

- Demand Response Overview
- OpenADR 1.0 Background
- OpenADR 2.0 Message Exchange
- OpenADR 2.0 “A” Profile
- OpenADR 2.0 “B” profile
- Additional Resources

# Demand Response (DR)

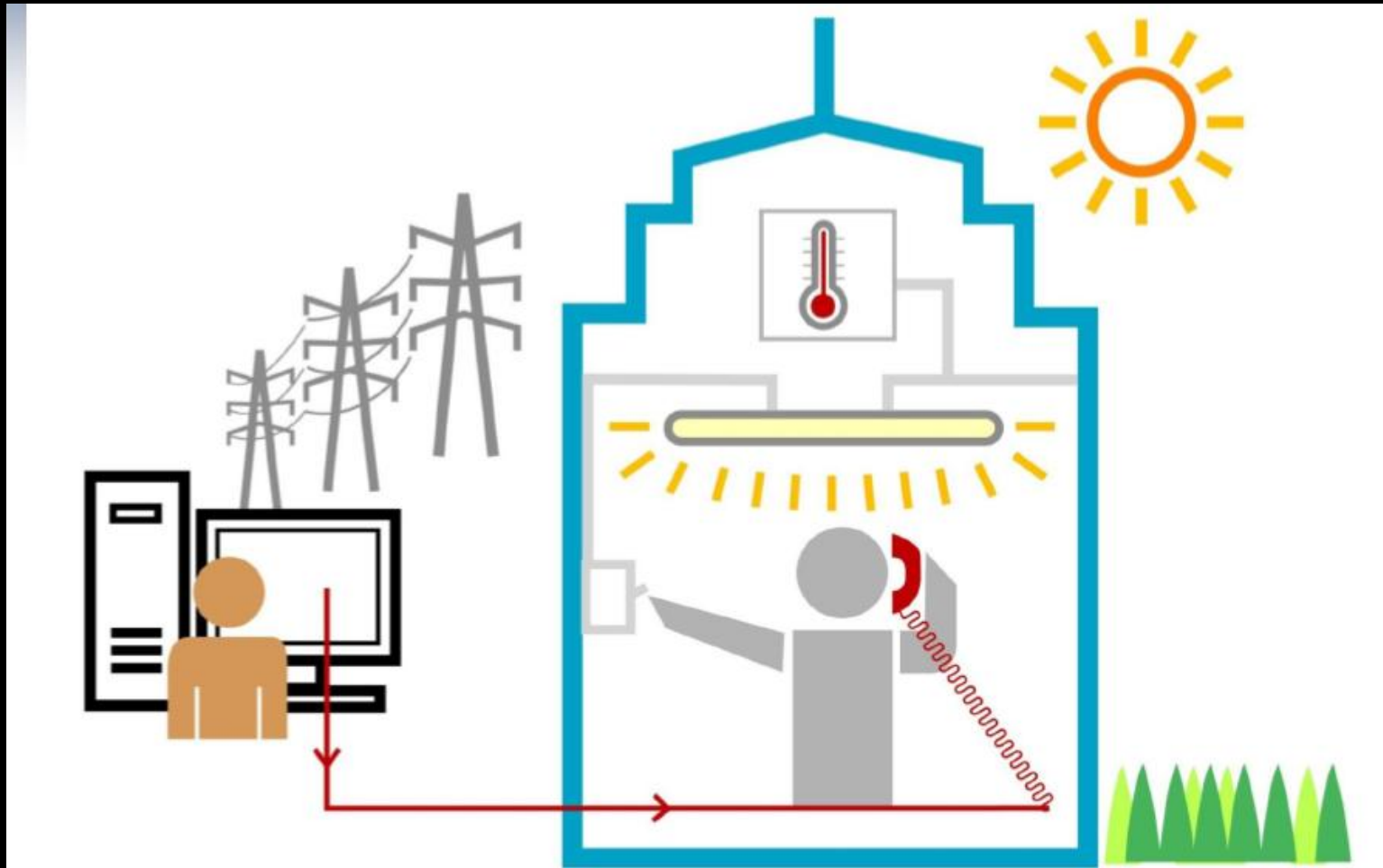
**Demand Response:** *Changes in electric use by demand-side resources from their normal consumption patterns in response to changes in the price of electricity, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized.*

# DR Programs

2010 FERC Survey Program Classifications <sup>1</sup>		Description
1	<b>Direct Load Control</b>	Sponsor remotely shuts down or cycles equipment
2	<b>Interruptible Load</b>	Load subject to curtailment under tariff or contract
3	<b>Emergency Demand Response</b>	Load reductions during an emergency event Combines direct load control with specified high price
4	<b>Load as Capacity Resource</b>	Pre-specified load reductions during system contingency
5	<b>Spinning Reserves</b>	Load reductions synchronized and responsive within the first few minutes of an emergency event
6	<b>Critical Peak Pricing w/Control</b>	Combines direct load control with specified high price
7	<b>Non-Spinning Reserves</b>	Demand side resources available within 10 minutes
8	<b>Regulation Service</b>	Increase or decrease load in response to real-time signal
9	<b>Demand Bidding and Buyback</b>	Customer offers load reductions at a price
10	<b>Time-of-Use Pricing</b>	Average unit prices that vary by time period.
11	<b>Critical Peak Pricing</b>	Rate/price to encourage reduced usage during high wholesale prices or system contingencies
12	<b>Real-Time Pricing</b>	Retail price fluctuates hourly or more often to reflect changes in wholesale prices on day or hour ahead
13	<b>Peak Time Rebate</b>	Rebates paid on critical peak hours for reductions against a baseline
14	<b>System Peak Response Transmission Tariff</b>	Rates / prices to reduce peaks and transmission charges

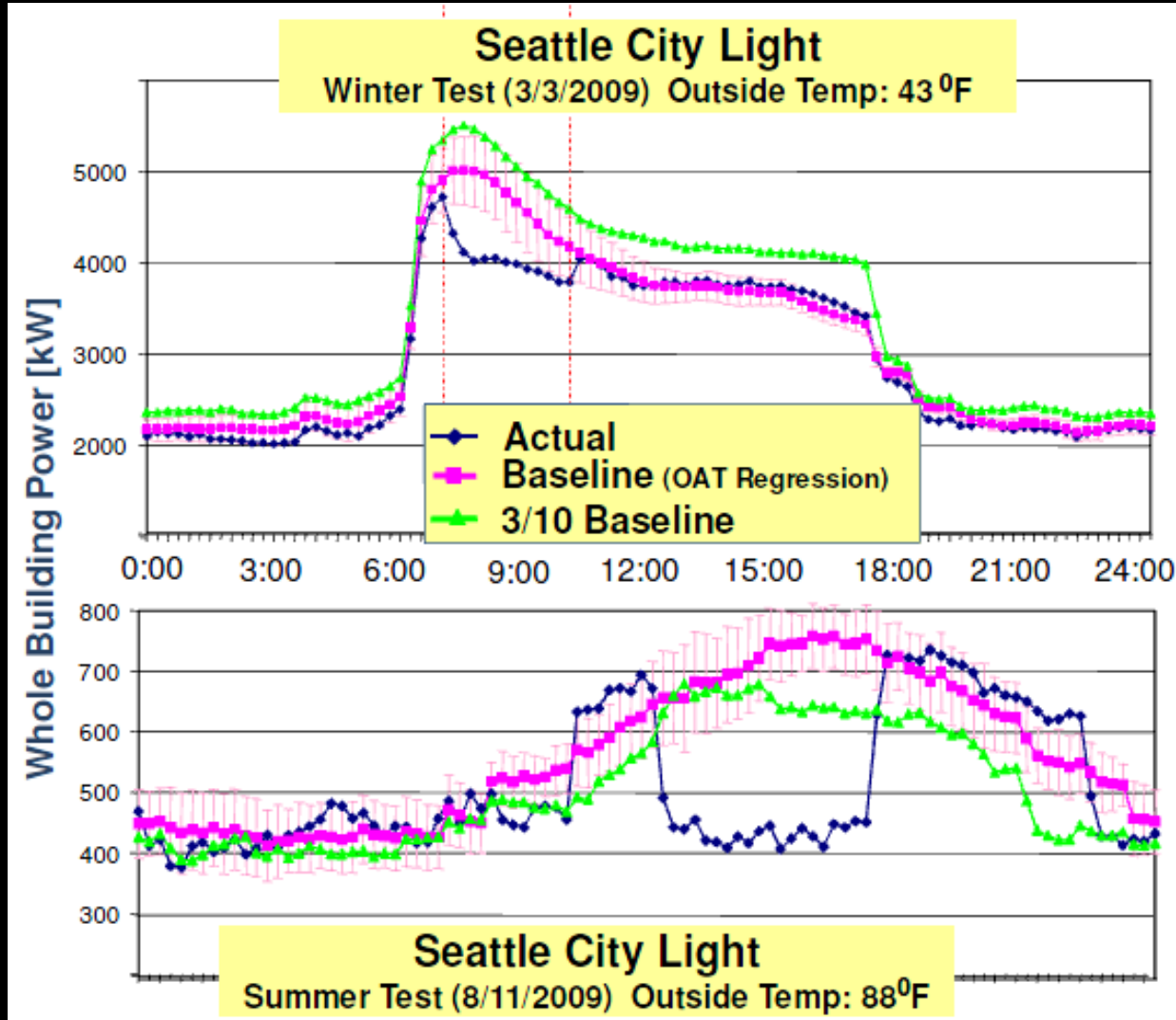
<sup>1</sup>Source: Lawrence Berkeley National Laboratory , Demand Response Research Center, LBNL-Webinar5-DRWeb.pdf

# Traditional DR



Source: Lawrence Berkeley National Laboratory, Demand Response Research Center, PEC\_training\_S1f.pdf

# DR Results



# Automated DR

- An information exchange model to facilitate communication of price and reliability signals




# Auto DR Components




## ISO or Utility

- Manage generation
- Monitor consumption
- Create DR strategy



-Schedule  
-Price  
-Amount



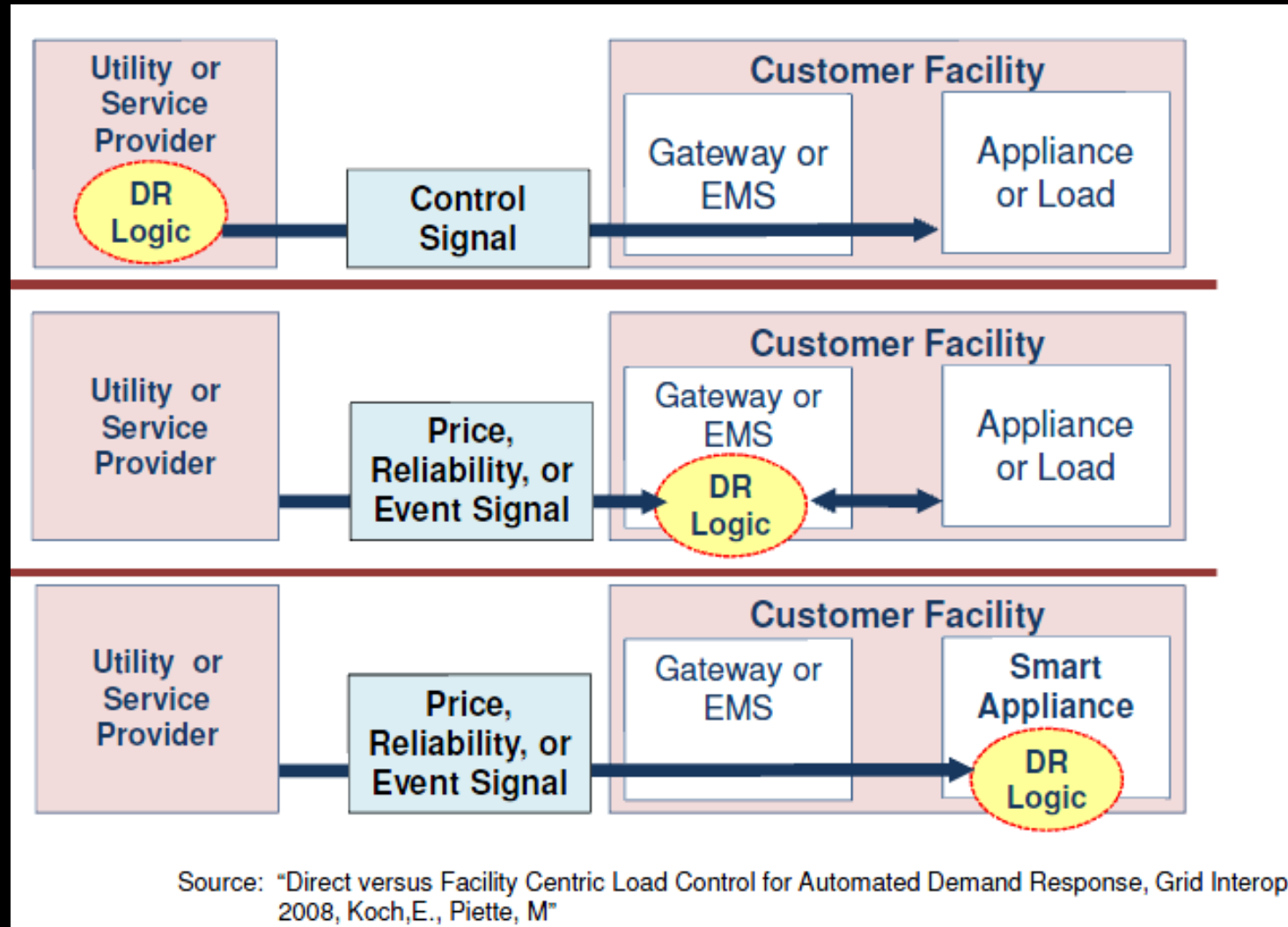
-Acknowledgement  
-Telemetry/Reports  
-Opt in/out



## Utility Customer

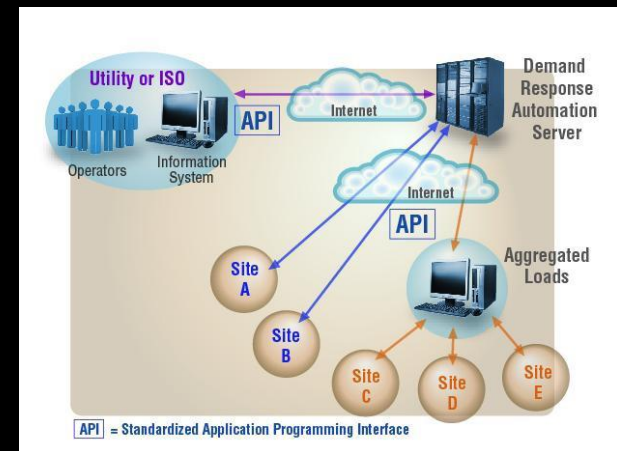
- Conservation strategies
- Automates Processes
- Manages manual cuts

# Auto DR Logic

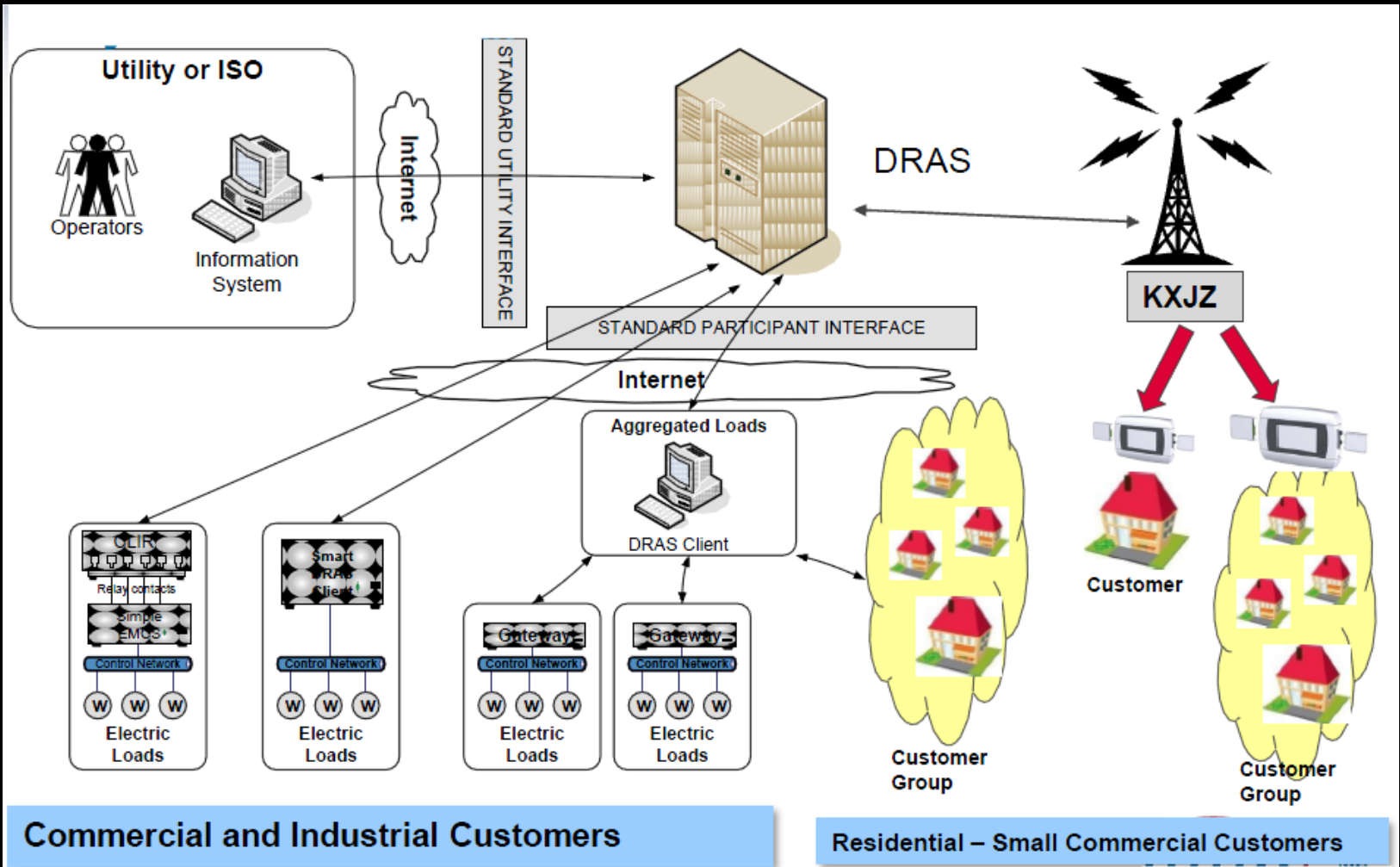


# OpenADR 1.0

- Developed by Lawrence Berkeley National Labs, DR Research Center
- California state funded effort
- PG&E, SCE, and SG&E collaboration
- Specification released April 2009
- Modest ecosystem of vendors
- Many successful deployments
- Viewed as a regional DR solution



# OpenADR 1.0 Architecture



# OpenADR 2.0 Origins

- NIST Smart Grid harmonization project initiated in 2009
- Priority Action Plans (PAPs) to work on common standards for price models, schedule representation, and standard DR Signals
- OpenADR Alliance formed in 2010 to evolve work done on OpenADR 1.0 into an recognized national and international standard

# OpenADR Alliance Members

## Sponsors



## Contributors

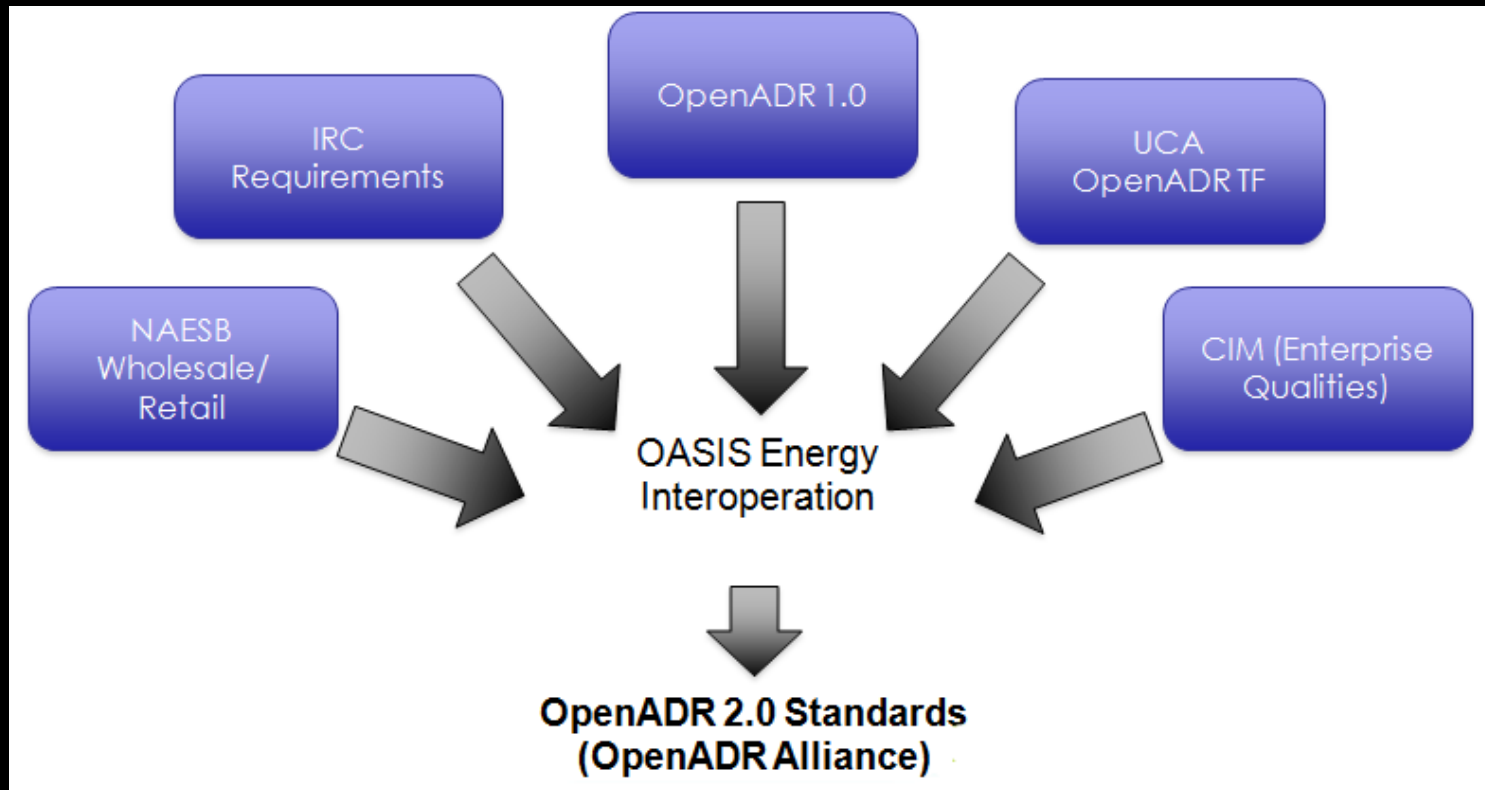


## Adopters



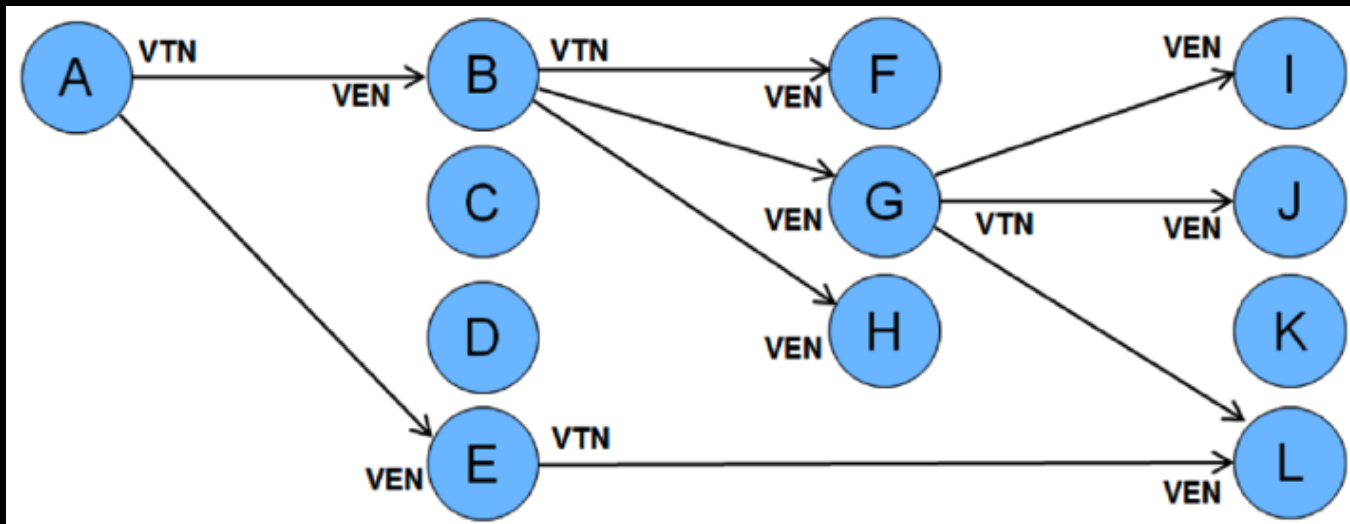
# OpenADR 2.0 Energy Interoperation 1.0

OpenADR 2.0 is derived from OASIS  
Energy Interoperation 1.0 standard

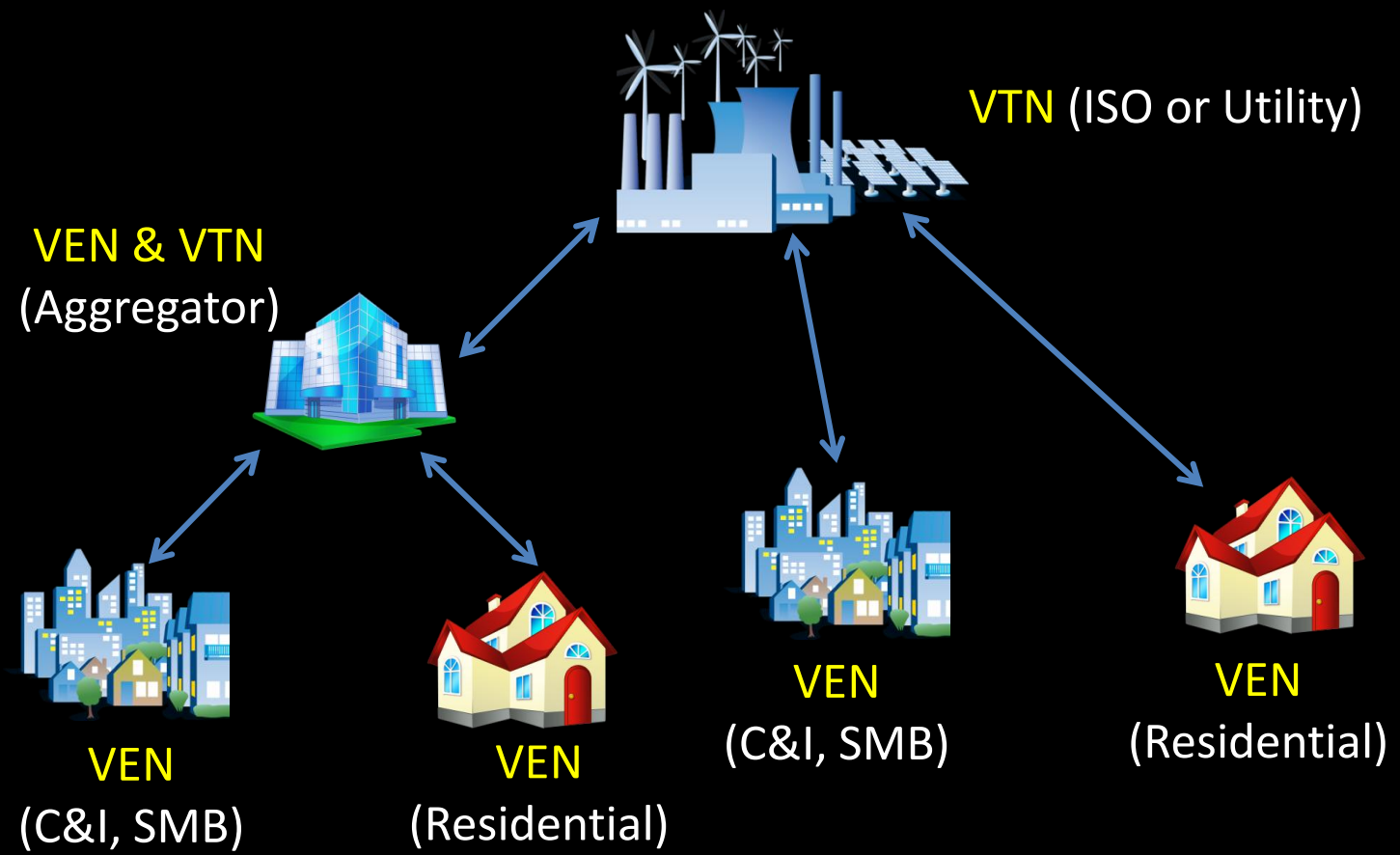


# OpenADR 2.0 Logical Interfaces

- Two types of logical interfaces
  - Virtual Top Nodes (VTN)
  - Virtual End Nodes (VEN)
- One to many relationship between a VTN and VEN
- Devices may be a VTN, VEN, or Both



# OpenADR 2.0 VEN & VTN



# OpenADR 2.0 Message Exchange



- Web Service–like logical Request Response Services
  - EiEvent Service – Send and Acknowledge DR Events
  - EiOpt Service – Define temporary availability schedules
  - EiReport Service – Request and deliver reports
  - EiRegisterParty Service – VEN Registration, device information exchange
- XML Payloads – Root element defines service operation

# OpenADR 2.0 Message Exchange

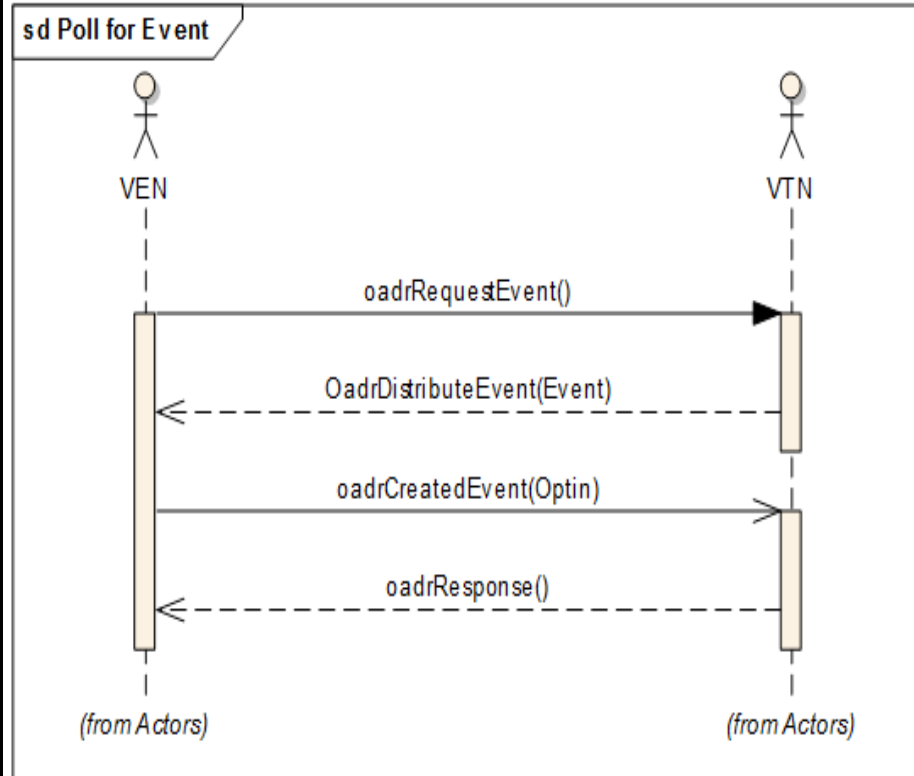


- **Transports**
  - HTTP
  - XMPP – Extensible Messaging and Presence Protocol
- **Exchange Patterns**
  - Push – VTN pushes Events to VTN
  - Pull – VEN polls VTN for Events
- **Security**
  - TLS 1.0, RSA and ECC Ciphers
  - Client and Server x509 certificates
  - Optional TLS 1.2 and XML Signatures

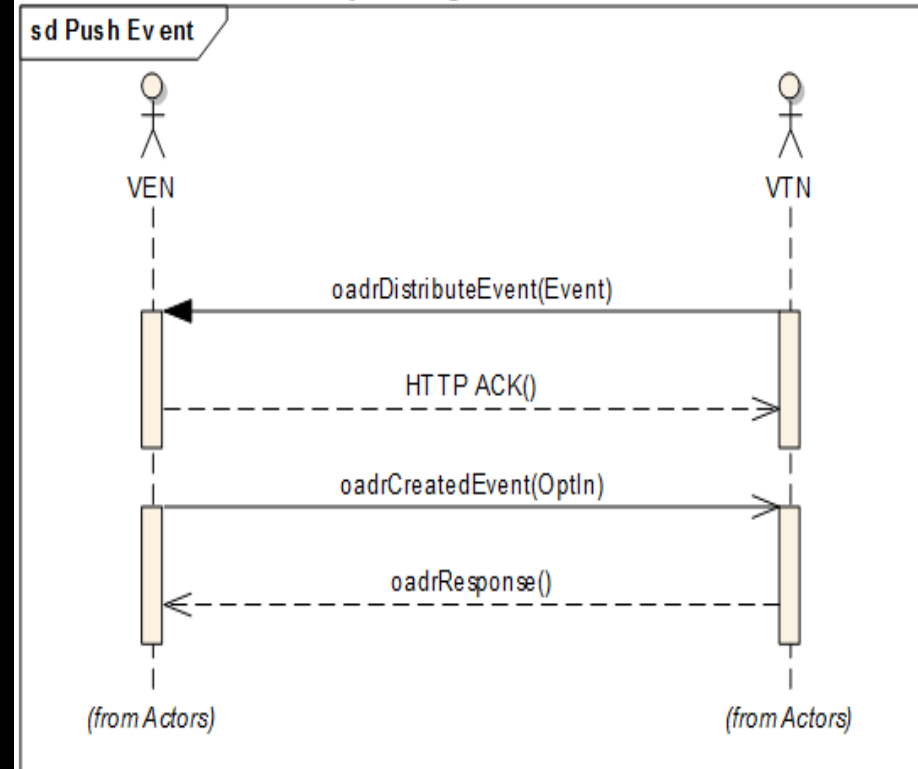
# OpenADR 2.0 EiEvent Sequence Diagrams



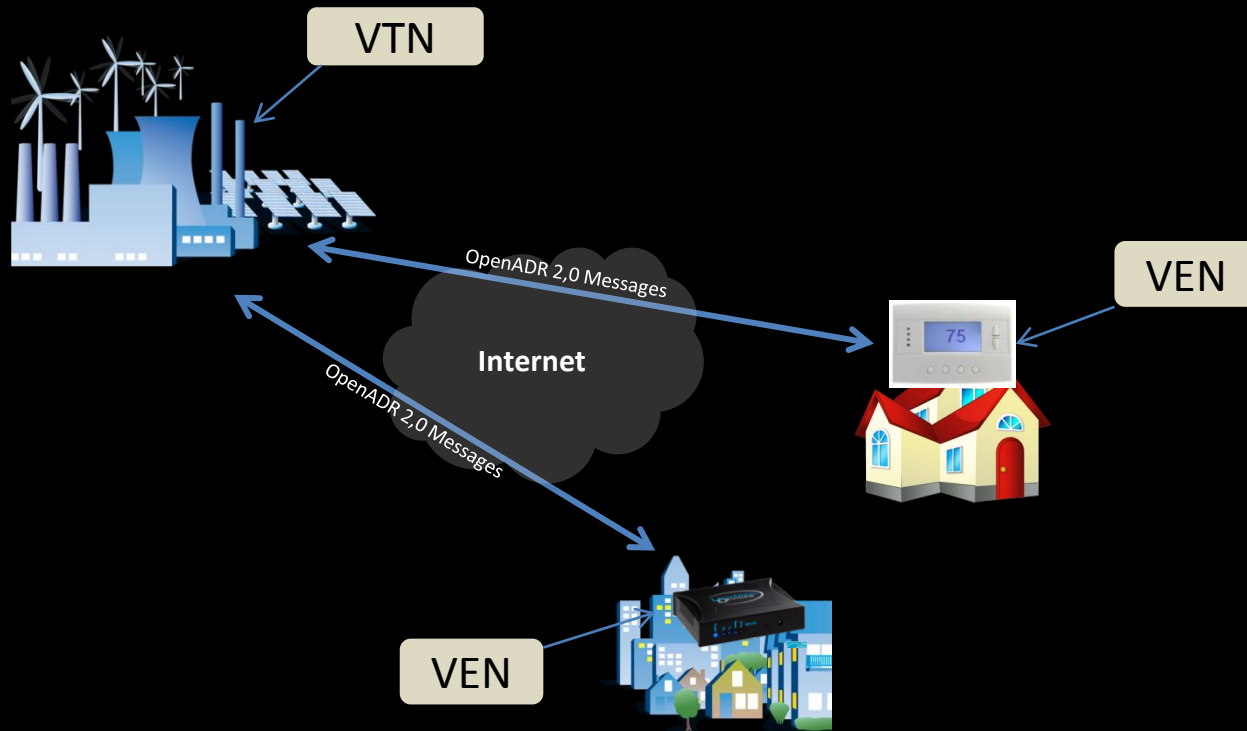
Sequence diagram: Poll for Event



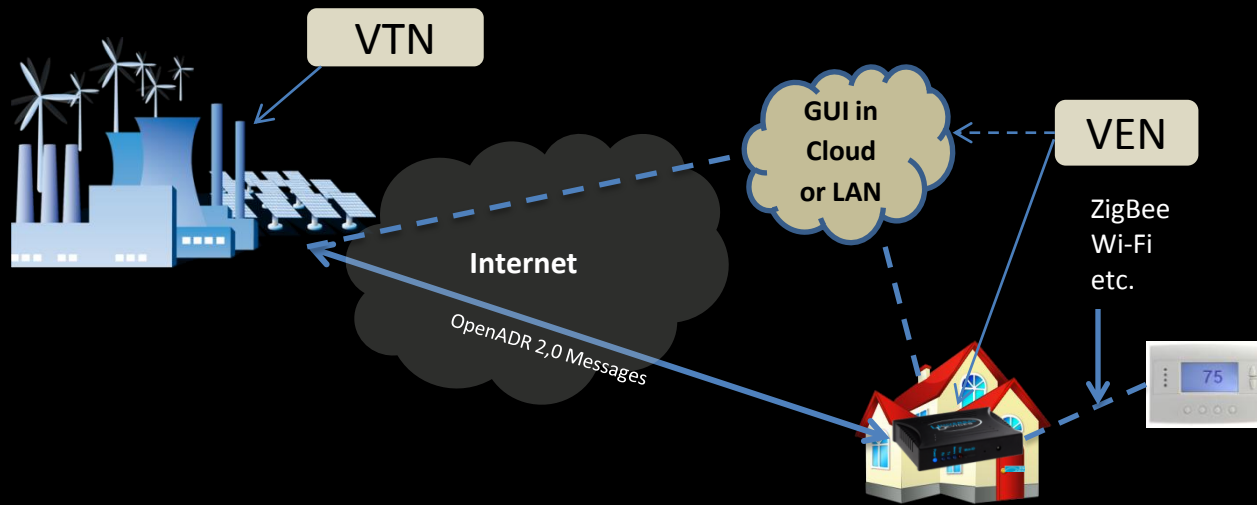
Sequence diagram: Push Event



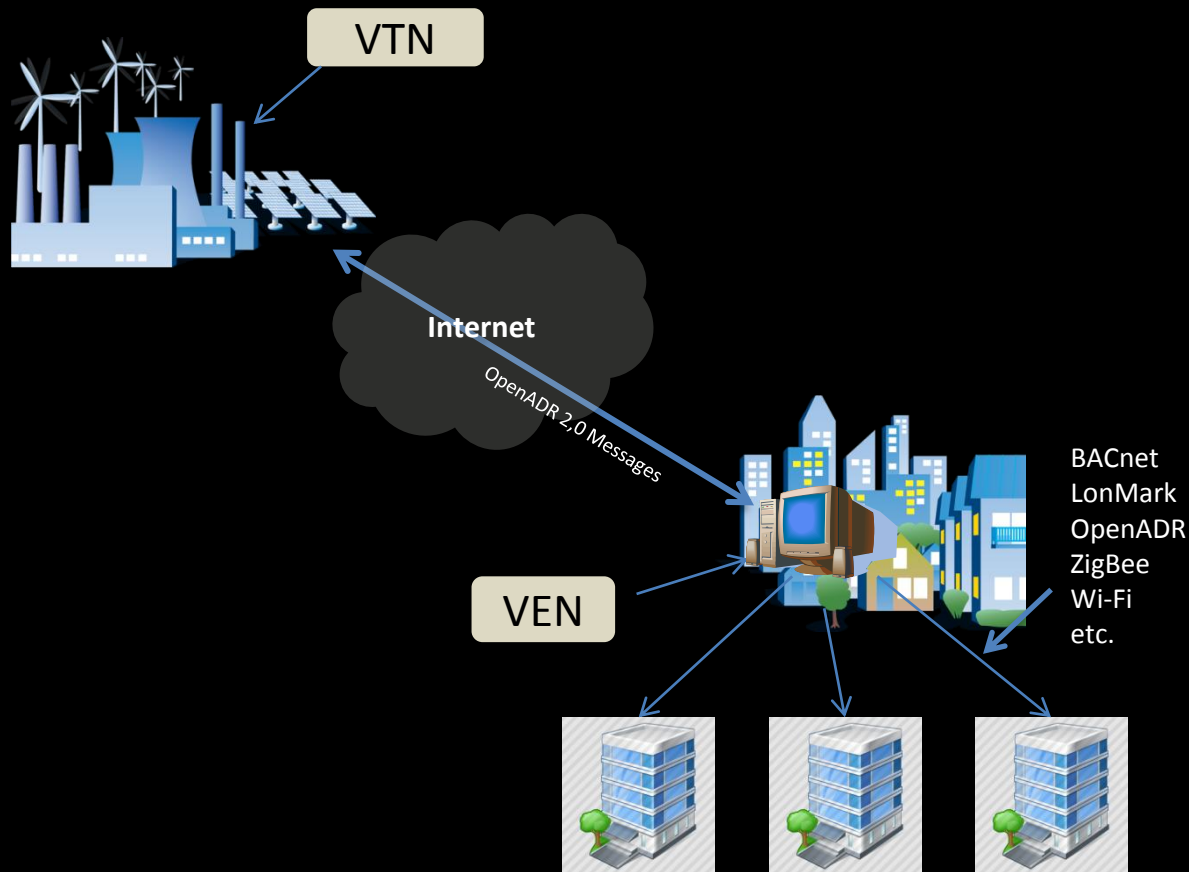
# OpenADR 2.0 Direct Connect Messaging



# OpenADR 2.0 Residential Cloud Interface

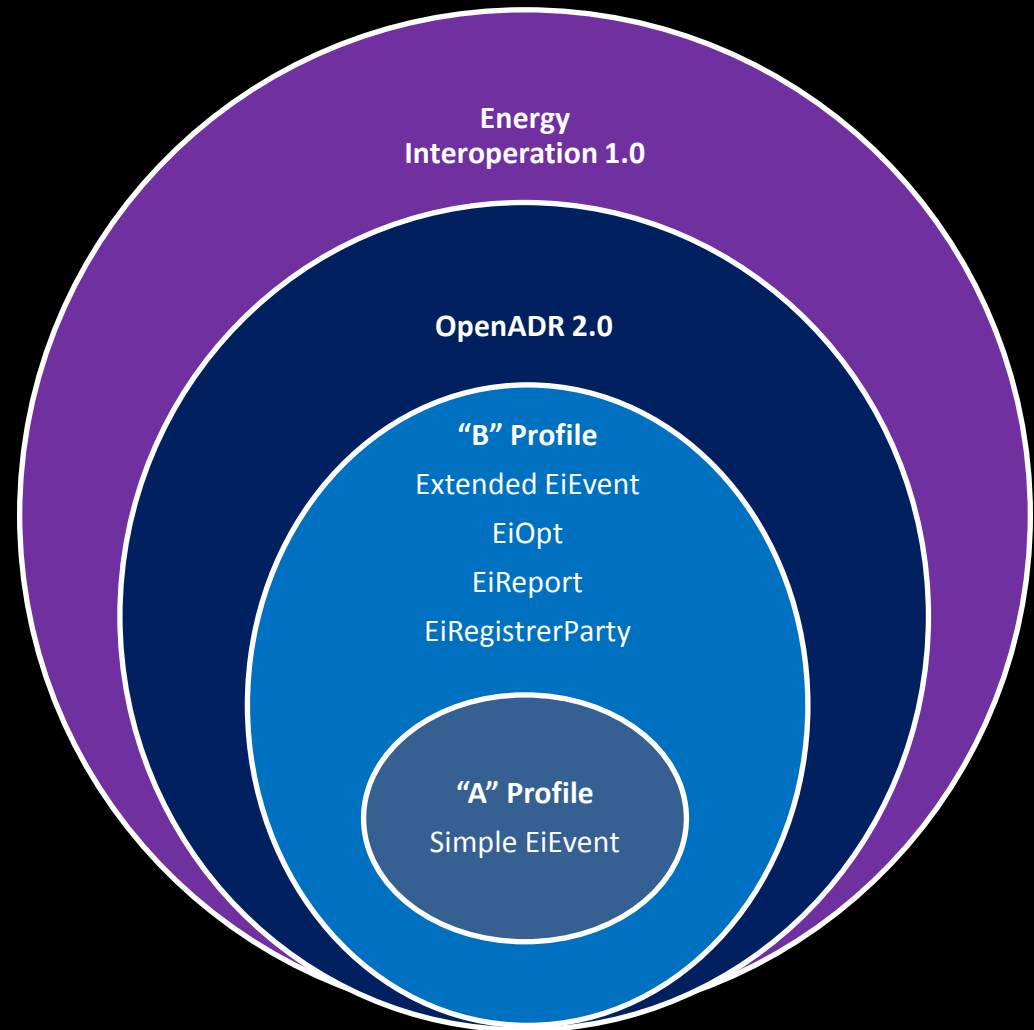


# OpenADR 2.0 Commercial & Industrial

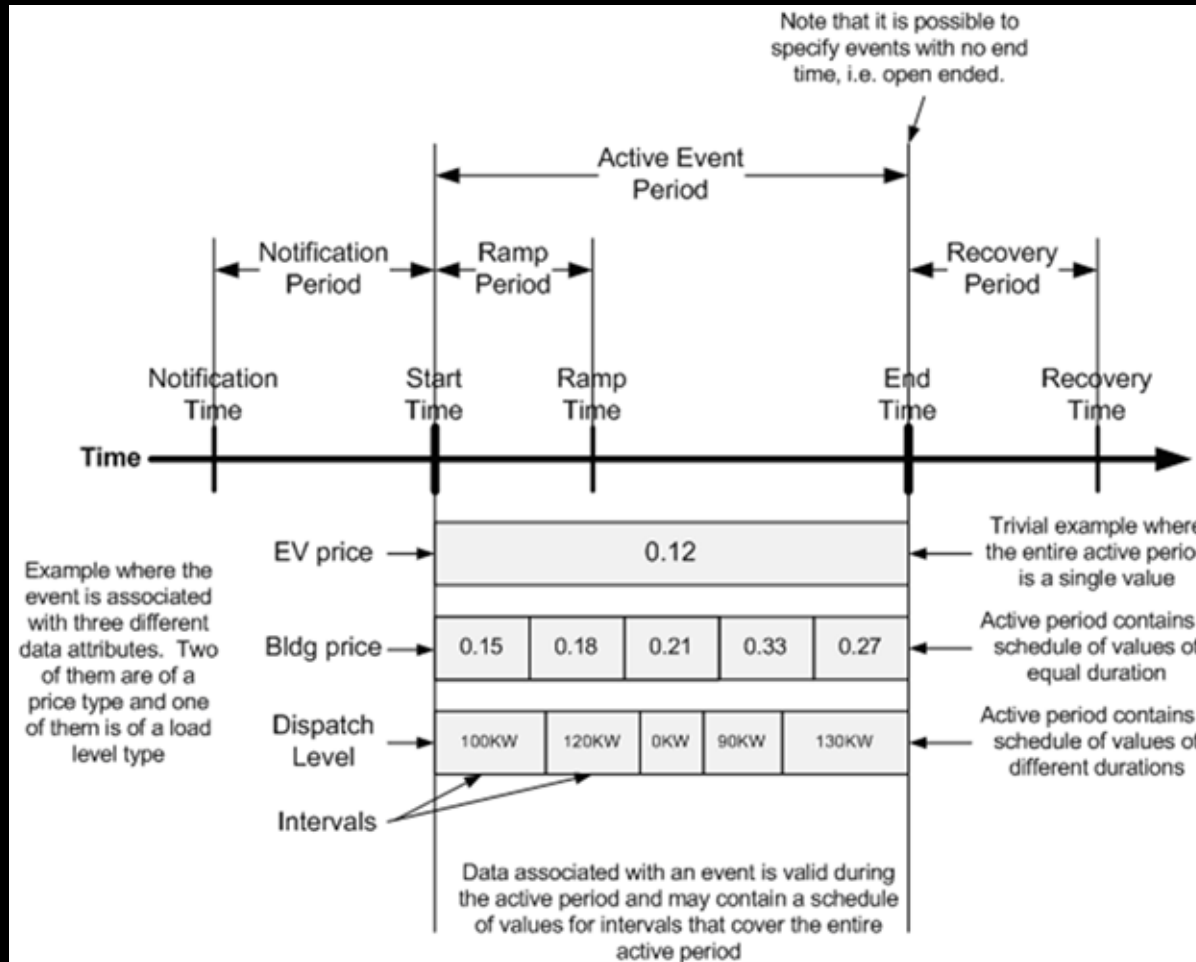


# OpenADR 2.0 Profiles

- “A” profile is targeted at limited resource devices and simple DR applications
- “B” profile is targeted at robust devices and sophisticated DR applications



# OpenADR 2.0 Event Characteristics



# “A” Profile EiEvent Service Operations



- **oadrDistributeEvent Payload**
  - VTN sends one or more events to VEN
  - Each Event can have one “simple” signal
  - Signal can have multiple intervals
  - Interval data limited to 4 levels (0,1,2,3)
  - Can target physical devices behind VEN
- **oadrCreatedEvent Payload**
  - Sent by the VEN to the VTN
  - Opt in or out of Event
- Other payloads include **oadrRequestEvent** and **oadrResponse**

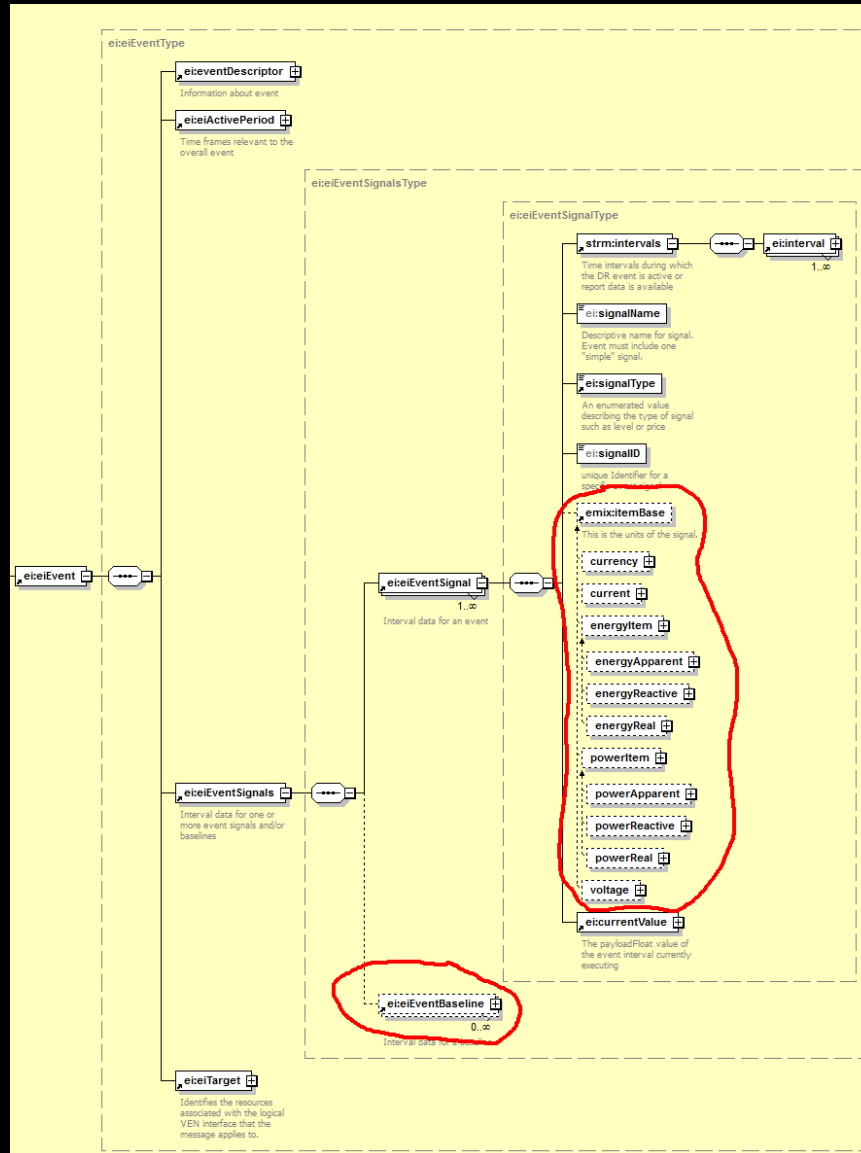


# “B” Profile EiEvent Service Operations



- oadrDistributeEvent Payload
  - Extends “A” profile Event functionality
  - Multiple signals per event allowed
  - Interval data now any float value associated with a defined unit type (currency, real energy, etc.)
  - Baselines supported using same signal, interval, interval data structure as Events
  - More robust ways of specifying target resources behind VEN including geographic service location
- Other payloads include oadrCreateEvent, oadrRequestEvent, and oadrResponse

# "B" Profile Event Schema

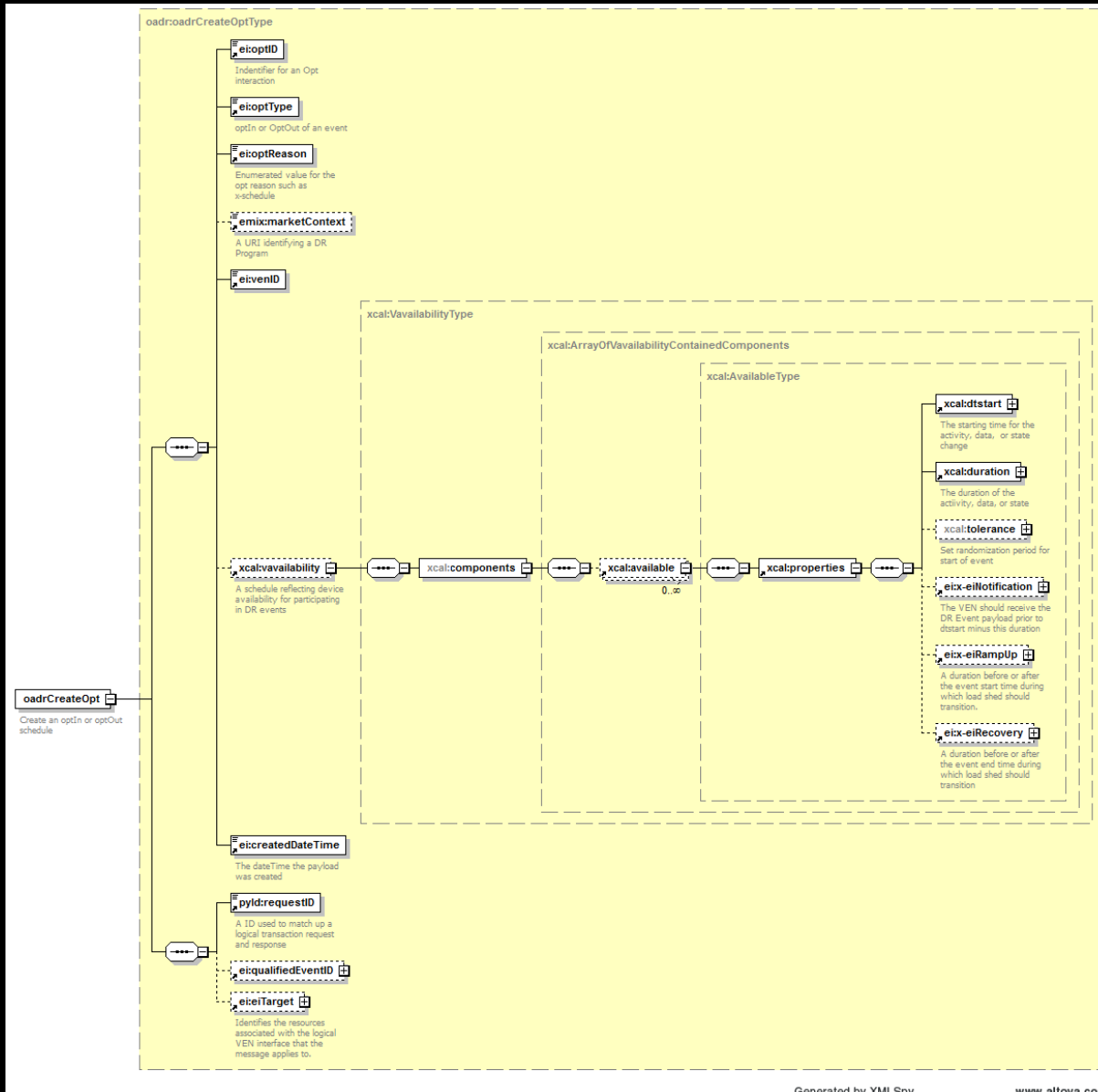


# “B” Profile EiOpt Service Operations



- oadrCreateOpt Payload
  - Used by VEN to set temporary availability schedules that differ from the default
  - Can set opt in or opt out schedule
  - Can set different availability schedules for subsets of resources behind VEN
  - Can use with active event to opt in or opt out a subset of resources behind VEN
- Other payloads include oadrCreatedOpt, oadrCancelOpt, oadrCanceledOpt

# "B" Profile oadrCreateOpt Schema



# “B” Profile EiReport Service Operations



- oadrRegisterReport Payload
  - Used by VEN or VTN to define a set of reports and associated data points it is capable of reporting (called a Metadata report)
  - Reports must be a subset of well defined OpenADR Alliance Report Profiles
    - Data Reports – History, Telemetry, Forecasts
    - Performance Reports – Baseline, DR Availability
  - Report Profiles define logical sets of oadrReport schema elements to use for a particular type of report

# “B” Profile EiReport Service Operations



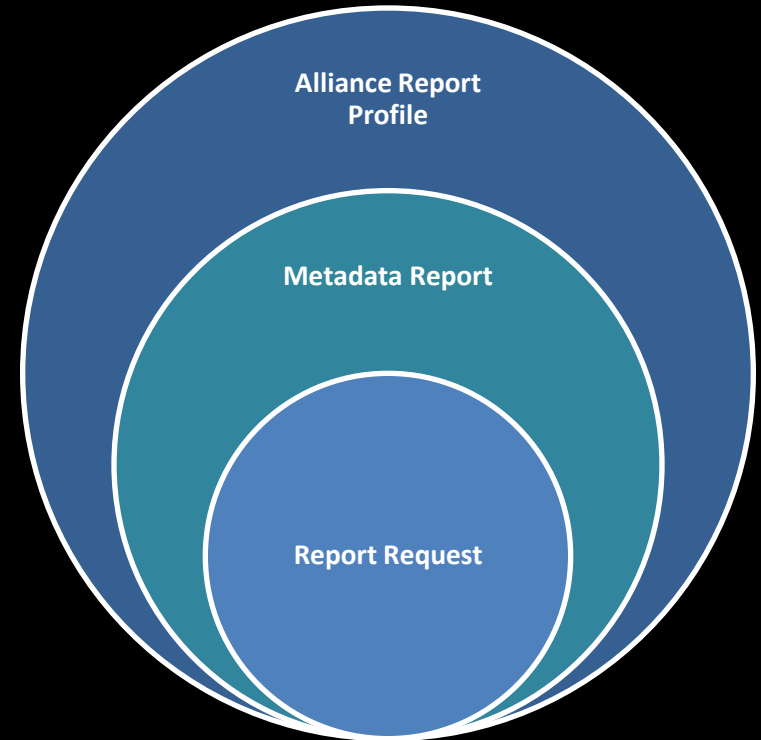
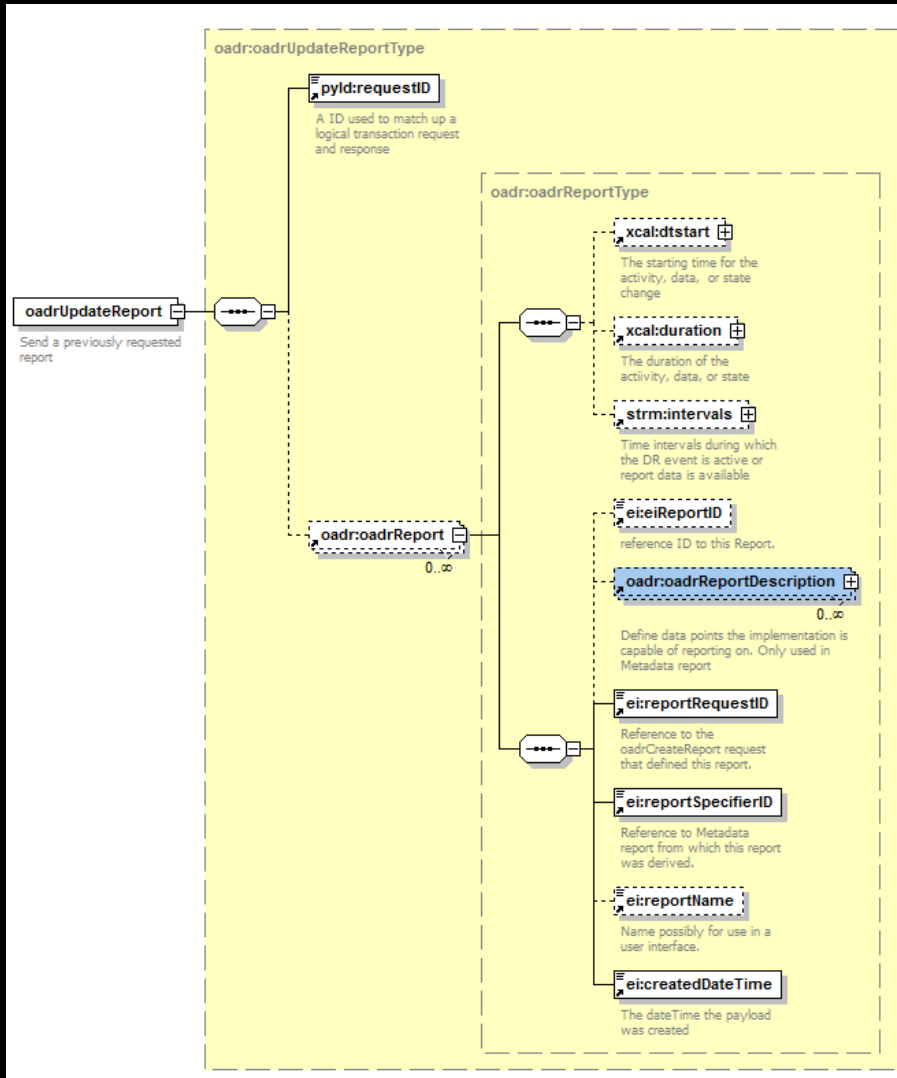
- oadrRequestReport Payload
  - Used by VEN or VTN to request a report from the other party
  - Requested report can be for a subset of data points supported by other party
  - Request can also specify
    - Data point sampling frequency
    - How frequently to deliver the report
    - When to start and stop the periodic delivery of reports

# “B” Profile EiReport Service Operations



- **oadrUpdateReport Payload**
  - Used to deliver the report to the requestor
  - One or more reports may be contained in this payload
  - Each report may include one or more time based intervals of data
  - Each Interval may contain one or more data points.
- Other Payloads include oadrRegisteredReport, oadrCancelReport, oadrCanceledReport, oadrUpdatedReport, oadrCreatedReport

# “B” Profile oadrUpdateReport Schema

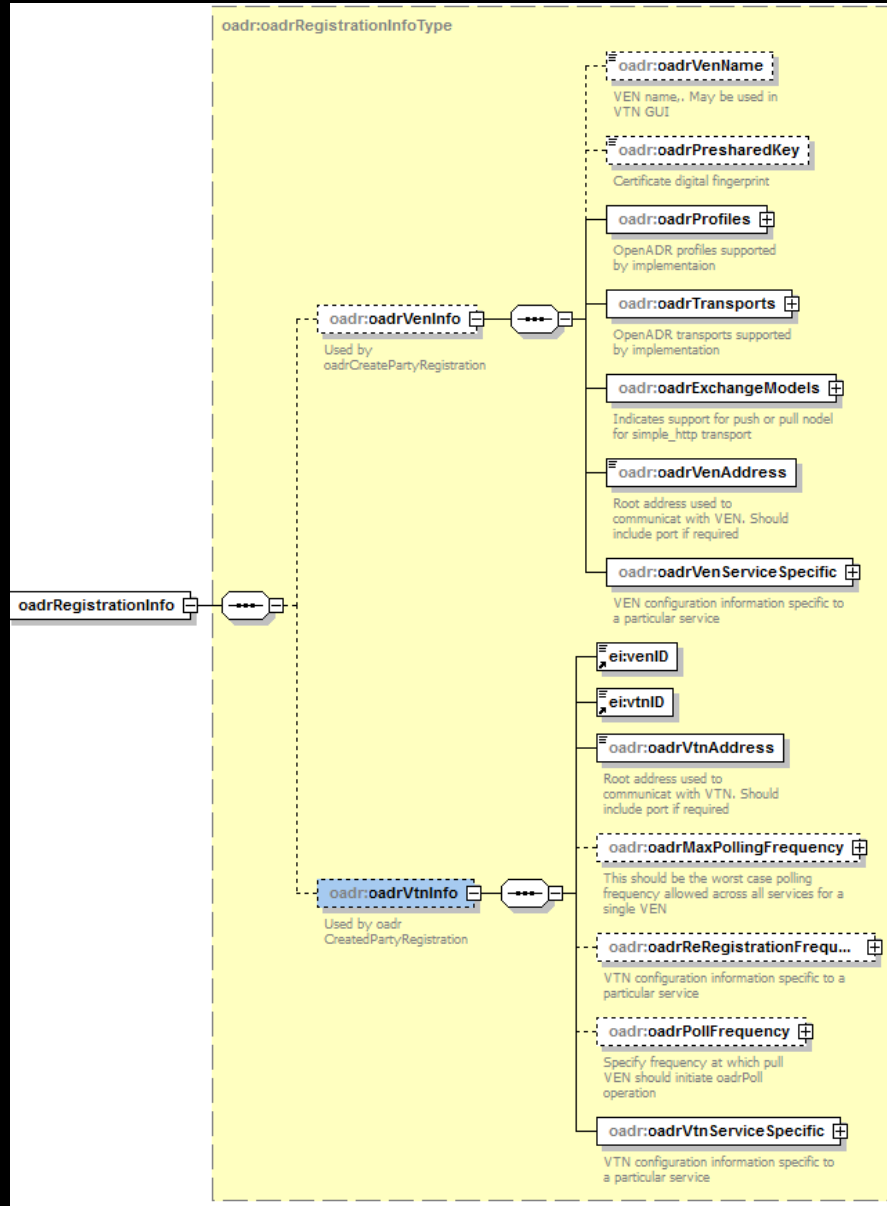


# “B” Profile oadrRegisterParty Operations



- oadrCreatePartyRegistration Payload
  - Used by VEN to register with VTN
  - Payload contains VEN specific configuration information
- oadrCreatedPartyRegistration Payload
  - Used by VTN to acknowledge VEN registration request
  - Contains VTN information required by VEN for interoperation with VTN
- Other payloads include oadrCancelPartyRegistration and oadrCanceledPartyRegistration

# “B” Profile oadrRegistrationInfo Schema



# OpenADR 2.0 Status

- “A” profile specification completed
- Certification program in place
- Certified “A” profile VTN and VEN devices are commercially available
- “B” profile specification in development by OpenADR Alliance members, with a completion target by the end of 2012

# Additional Resources

- OpenADR Alliance
  - <http://www.openadr.org>
- LBNL Demand Response Research Center
  - <http://drrc.lbl.gov/>
- QualityLogic, Inc.
  - <http://www.qualitylogic.com>