EPRI's Open-Source OpenADR 2.0b Software

OpenADR Alliance Member Meeting
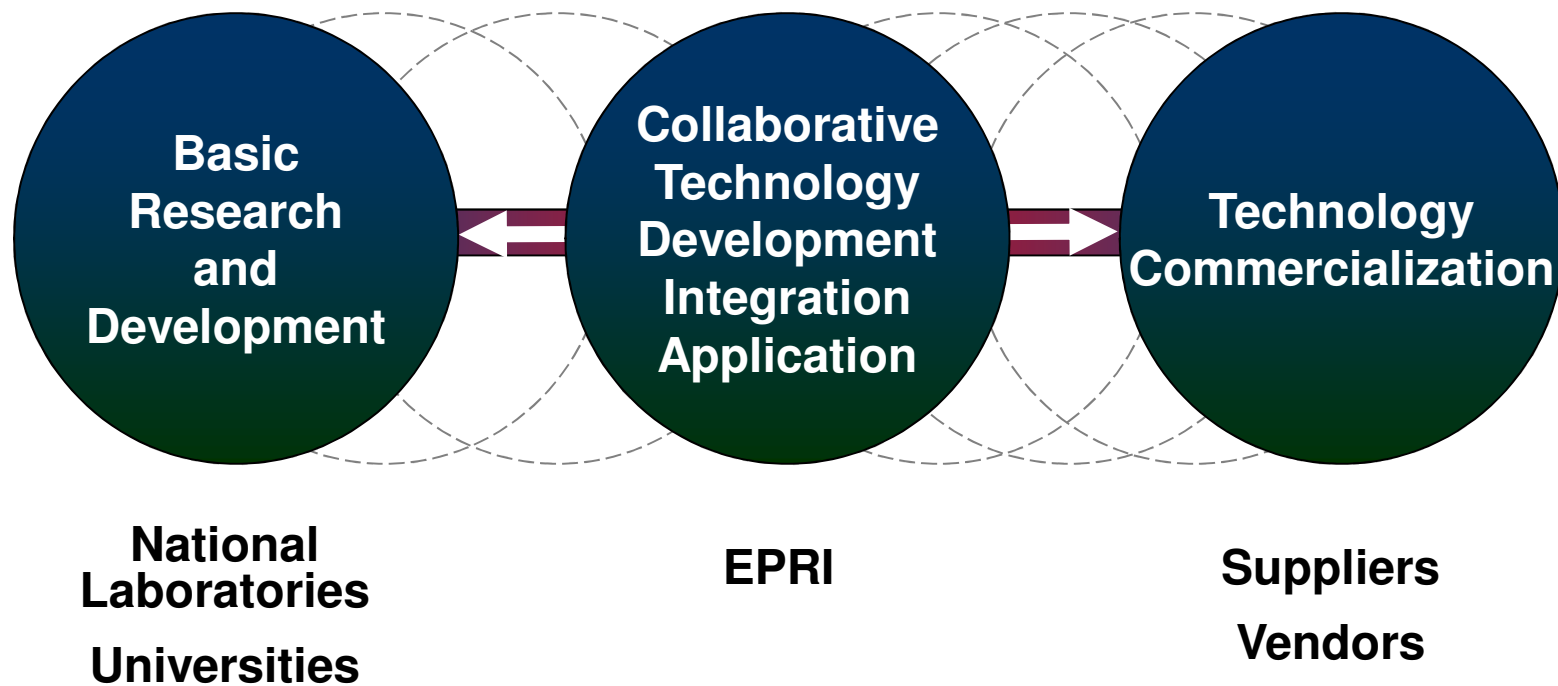
Walt Johnson
Technical Executive

May 14, 2015

EPRI's Role…

Help Move Technologies to the Commercialization Stage…

Basic Research and Development → Collaborative Technology Development Integration Application → Technology Commercialization

National Laboratories

Universities

EPRI

Suppliers

Vendors

"Technology Accelerator!"

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OpenADR 2.0b Open-Source Software

	VTN	VEN	VEN
Role	Virtual Top Node	Virtual End Node	Virtual End Node
Designed Use	DRMS	Desktop Client	Embedded Client
License	BSD 3-Clause	BSD 3-Clause	BSD 3-Clause
Profiles	2.0a and 2.0b	2.0b	2.0b
Data Models	Push/Pull (Poll)	Pull (Poll)	Pull (Poll)
Transports	HTTP, XMPP	HTTP	HTTP
Programming Language	JRuby, Java	C#	C++
Tested Operating Systems	Linux, Mac OS	Windows 7, 8	C++
Available on www.SourceForge.net	Yes	Yes	Yes

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WJ4 Chuck, do you have a better slide for this?

Walt Johnson, 12/3/2013

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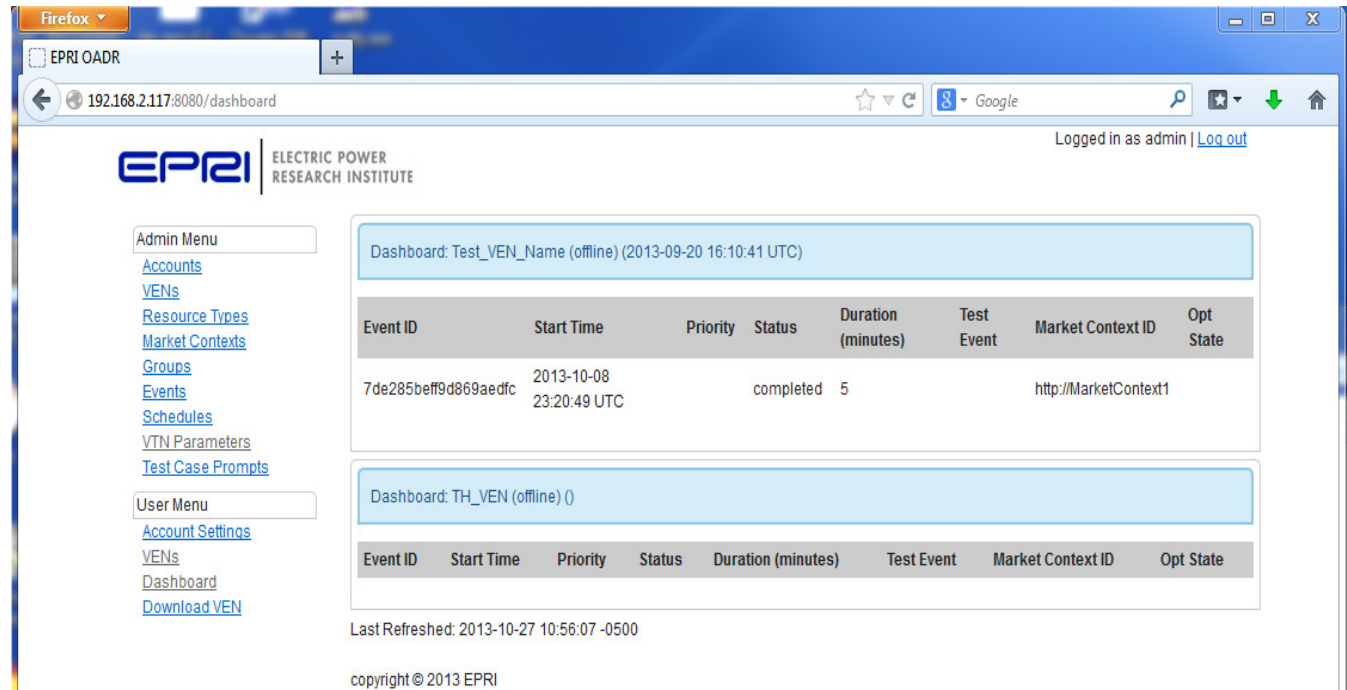
Virtual Top Node (VTN) and Virtual End Node (VEN)

- Complete OpenADR 2.0b-compliant server and standalone client

- Made available to the open source community in February 2014

- Received Alliance certification in October 2014

- Revised versions released in December 2014

- Overview DVD available

View of all XML Messages

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The EPRI OpenADR VTN User Interface (Current Release)

- The Admin menu consists of the following options: *Accounts, VENs, Resource Types, Market Contexts, Groups, Events, Schedules, VTN Parameters,* and *Test Case Prompts*.

- Non-admin users have limited access to the system. Their User Menu consists of five links*: Account Settings, VENs, Create Test Event, Dashboard,* and *Download VEN*.

More information about the EPRI OpenADR software is available in *Automated Demand Response and Ancillary Services Demonstration Project Update: Volume One* (Product ID 3002002782) and *OpenADR Technical Workshop DVD – 6.19.2013* (Product ID 3002001822).

The EPRI OpenADR VEN User Interface

1. Settings: This section has the following controls and actions: *Default Opt, URL, Client Certificate & Password, SSL/TLS, VEN Name, Password, Poll Interval,* and *Auto Scroll Log.*

2. OpenADR Services: This area has tabs that show the status and state of the four OpenADR services: Events, Reporting, Opt, and Registration.
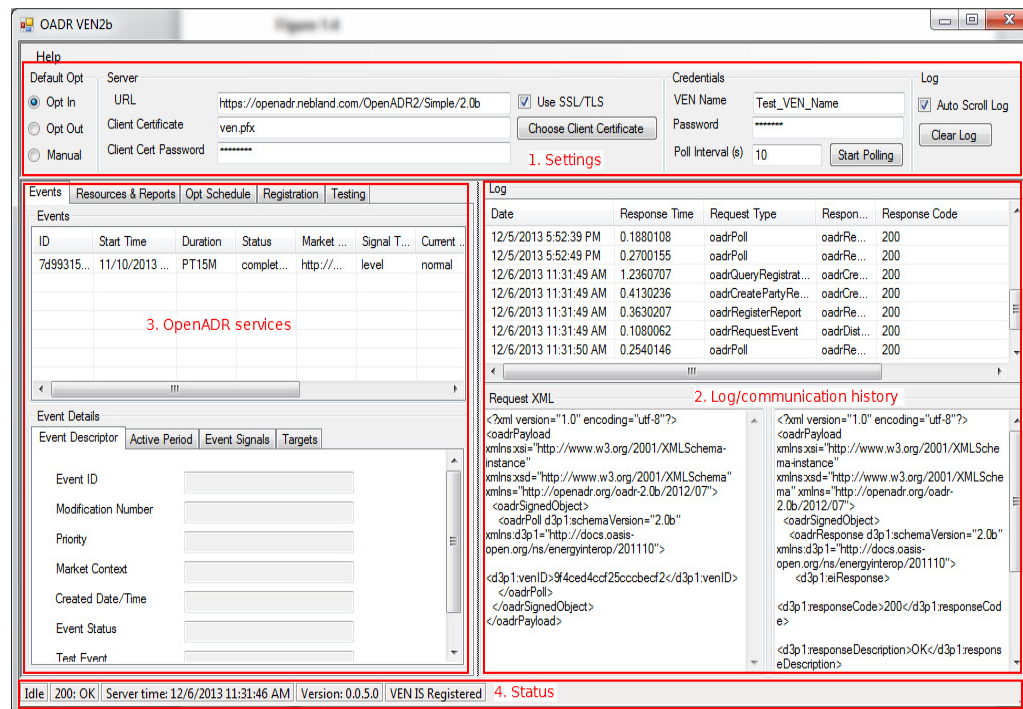
3. Log/Communication History: All OpenADR messages exchanged between the VEN and VTN are captured in the log list view. Selecting a message in the list view causes the associated request and reply messages to display in the request and reply XML areas.
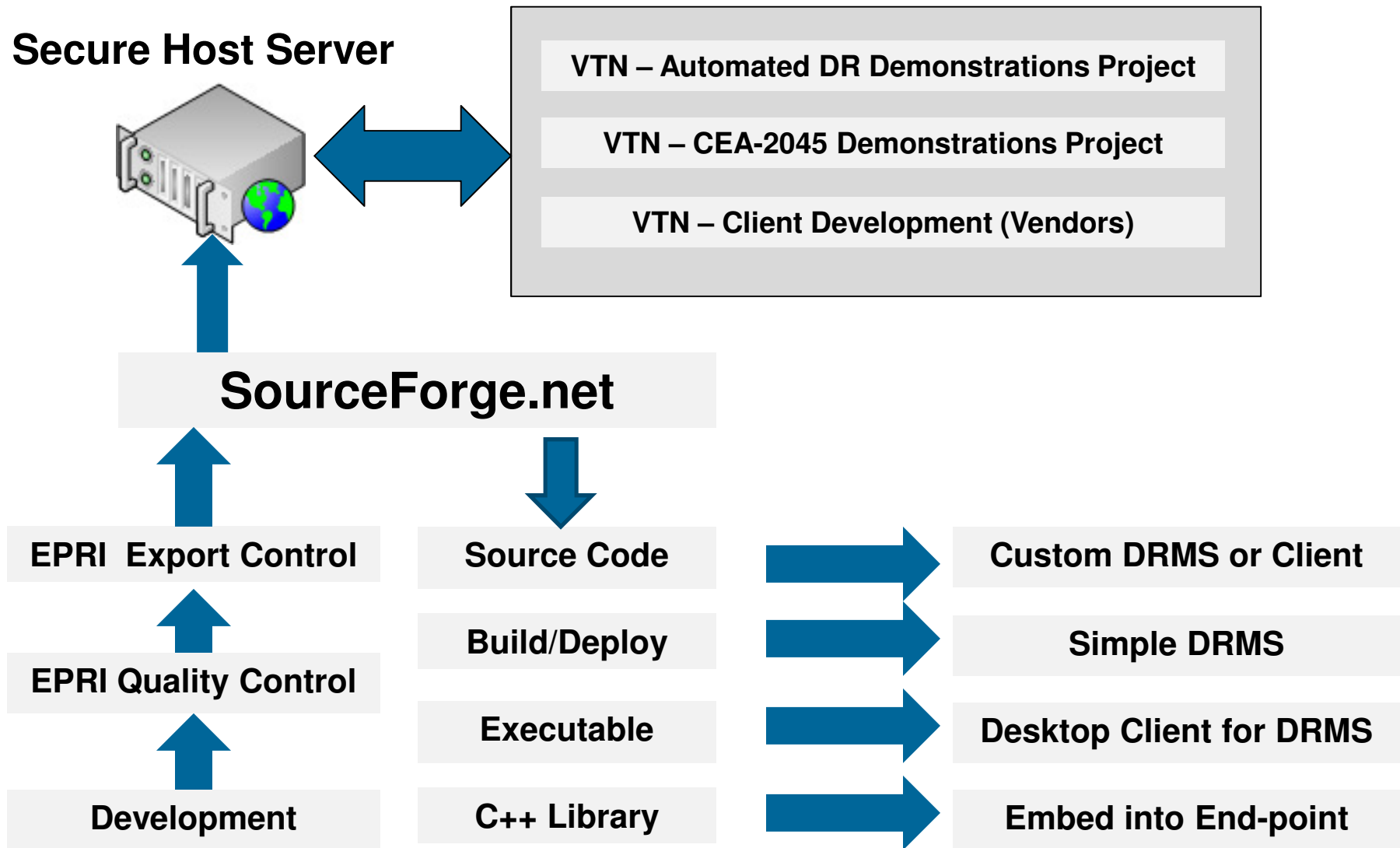
4. Status: The status bar, located at the bottom of the VEN's user's interface, displays information regarding the current state of VEN polling, the last message status, the VEN version, and the OpenADR registration state.

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C++ End-Node Library

- Released in December 2014

- Implements components of an OpenADR 2.0b pull VEN

- Intended for embedded applications

- Generates compliant messages for all four 2.0b services

- Manages HTTP/s connection with cURL and OpenSSL libraries

- Can be used to create a compliant VEN

> **Note:** Use of EPRI's Alliance-certified software to create a new application does *not* confer certification on the resulting application. All applications are individually certified by the OpenADR Alliance.

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OpenADR 2.0b Open-Source Opportunities

Secure Host Server

VTN – Automated DR Demonstrations Project

VTN – CEA-2045 Demonstrations Project

VTN – Client Development (Vendors)

SourceForge.net

EPRI Export Control	Source Code → Custom DRMS or Client
EPRI Quality Control	Build/Deploy → Simple DRMS
	Executable → Desktop Client for DRMS
Development	C++ Library → Embed into End-point

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What's Next: EPRI OpenADR Development

Integratability

Usability

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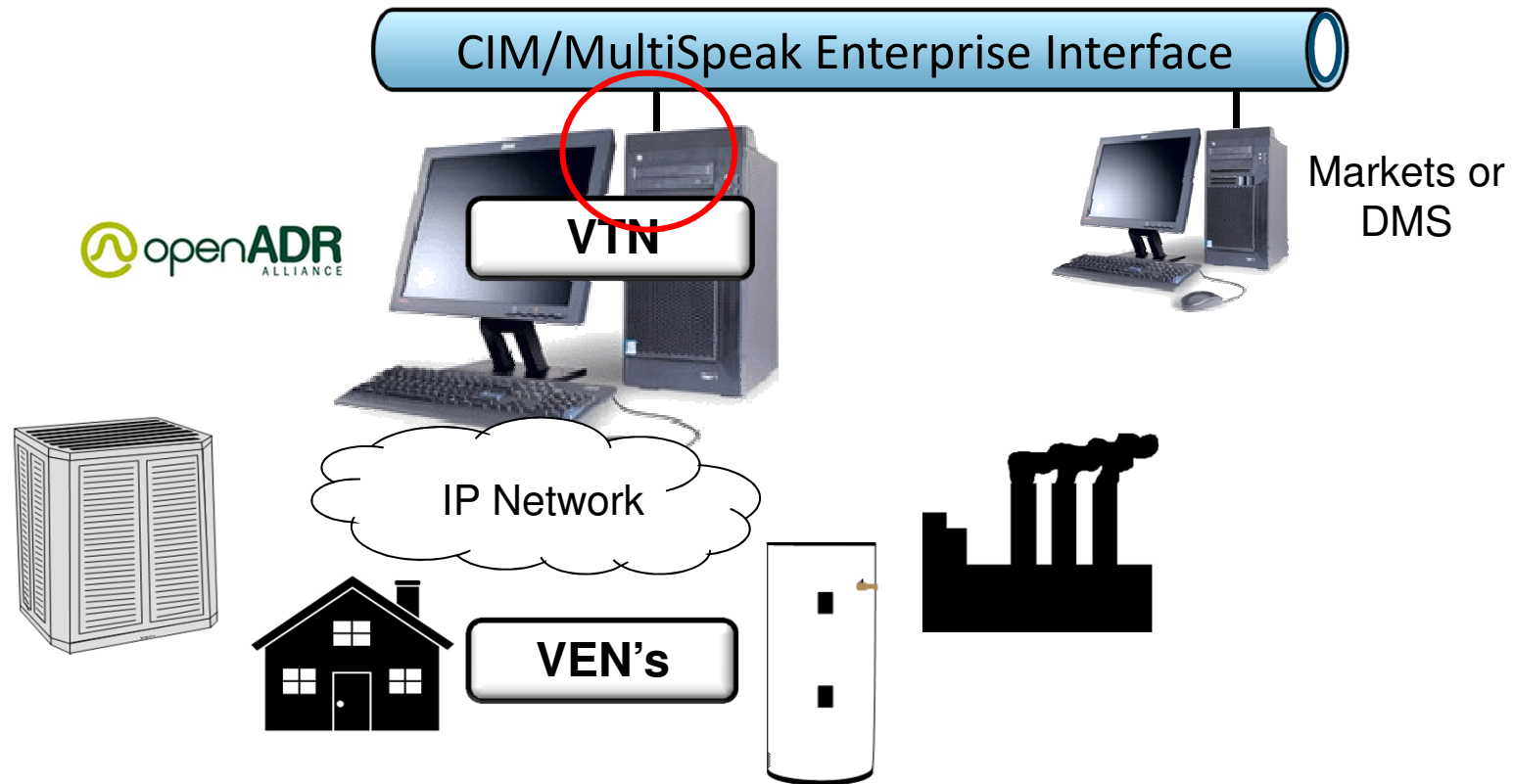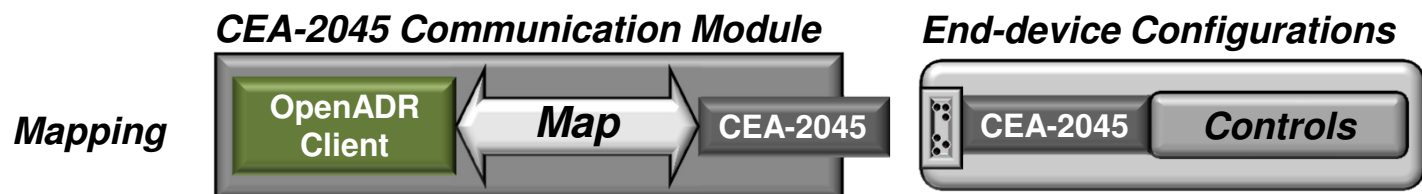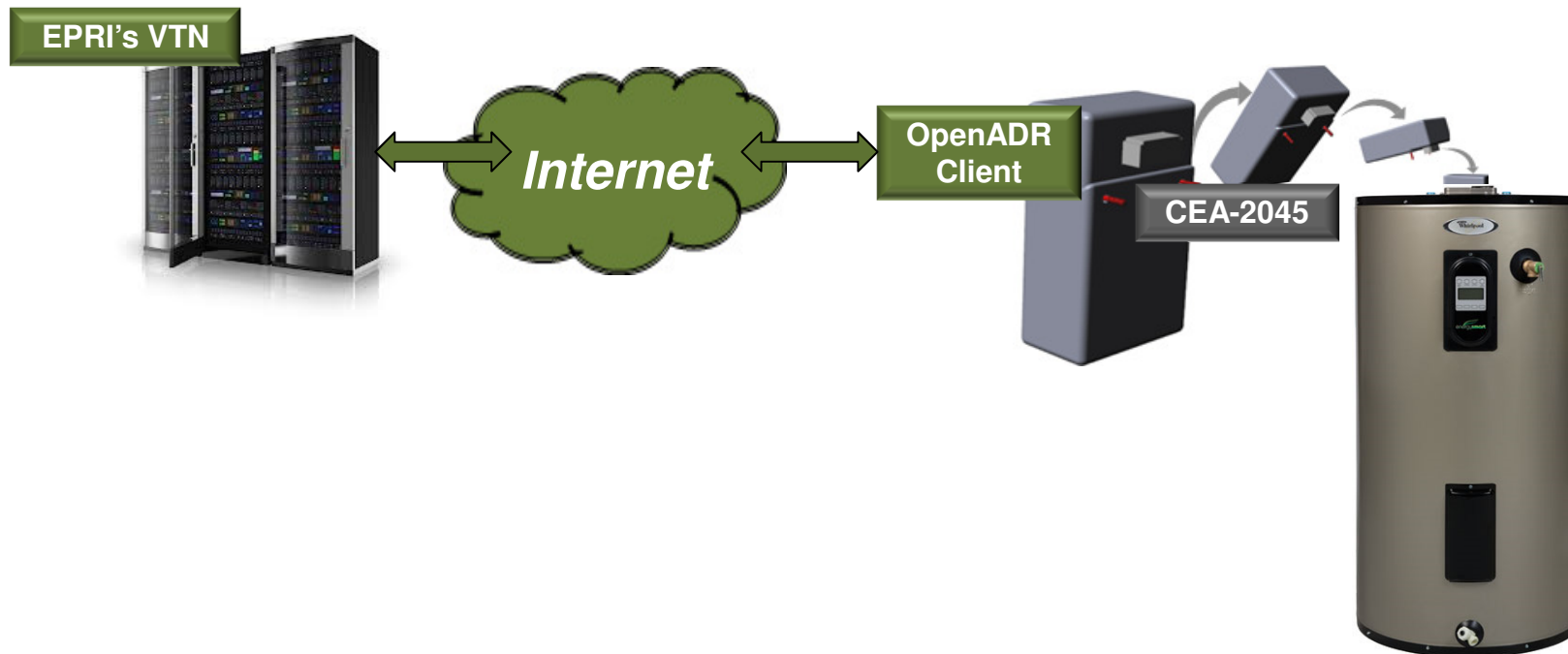
VTN Enhancements

- CEA-2045 Project

- Other usability enhancements

- Create a more utility-friendly OpenADR server
  - Hide complex details of OpenADR

- Use utility terminology
  - Add a utility-specific layer on top of "bare" OpenADR

- Add new features useful to the base OpenADR system

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CIM Message Interface

- Building on prior success – over 5,000 downloads worldwide of the EPRI VTN and VEN software
- Scope and use cases were taken from the PAP19 work, coding is in process

CIM/MultiSpeak Enterprise Interface

openADR ALLIANCE

VTN

Markets or DMS

IP Network

VEN's

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CEA-2045 Demonstration

CEA-2045 Communication Module

End-device Configurations

Mapping

OpenADR Client — *Map* → CEA-2045

CEA-2045 — *Controls*

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What's Changing?

- **New Features**
  - Many UI enhancements
    - Simplify
    - Hide OpenADR terminology
    - Allow utility-specific terminology
  - Non-admin account features
  - Time zone added to users, VENs, and events
  - Targeting
  - Status pages
  - Search
- **Make the base system generic**
  - To make this process repeatable
- **Major bug fixes**
  - 91 tickets closed (bugs and features)

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Updated UI

Slimmed down menu
w/simplified Utility menu

Utility Name

Log out
ben

About

Utility

Accounts

VENs

Events

VTN Config

Devices

Search

Devices

[   ] Search
...

Create Device

---

green bay wi

UCM ID: 1234
Equipment: Water Heater (Resistive)
Location: Circuit (Substation)
Program: Load Up

Status

Edit

Destroy

Connection: offline

Howard WI

UCM ID: 456
Equipment: HVAC Thermostat
Location: Section
Program: Grid Emergency

Status

Edit

Destroy

Connection: offline

Data "Card" views

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Targeting Enhancements

- Previous version supported four target types
- All types now supported
- VEN ID and PartyID not list – managed by system

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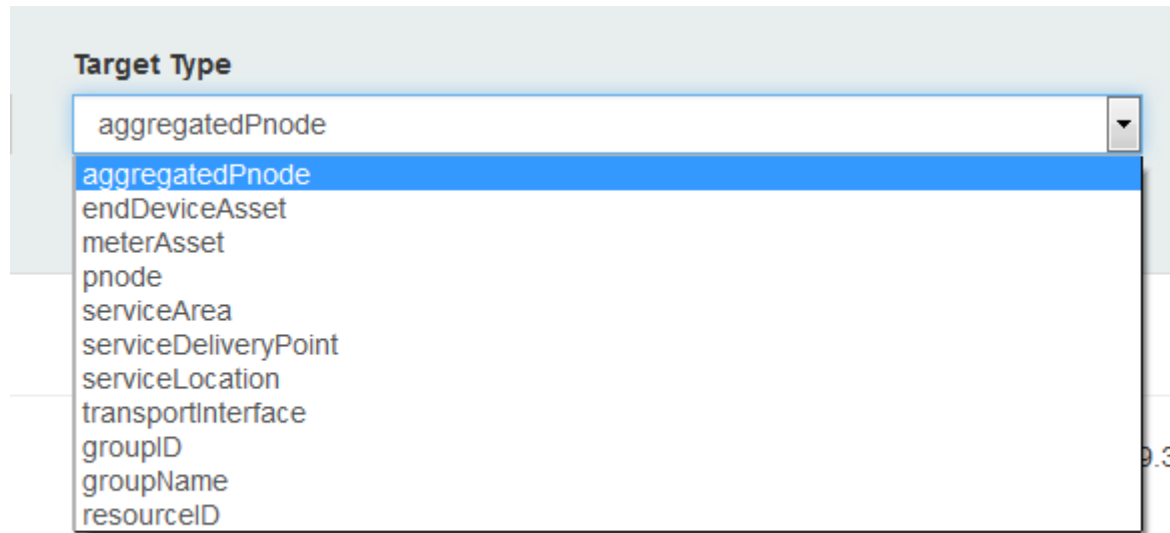
New Non-Admin Account Features

- Non-admin users can create **and** edit test events
- Can only target their own VENs
- Useful for multi-user system for testing VENs
- In the current system, non-admin users can create an event, but can't modify it and can't select targets (all VENs in the account are targeted)

Utility Terminology: Programs

- "Program" instead of "Market Context"

Market Context ID

LoadUp

Program

LoadUp

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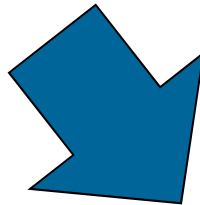
Utility Terminology: Devices

- "Device" instead of "VEN"

Identification

VEN Name

Common Name

Create VEN

Device

UCM

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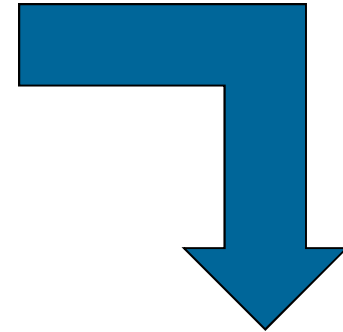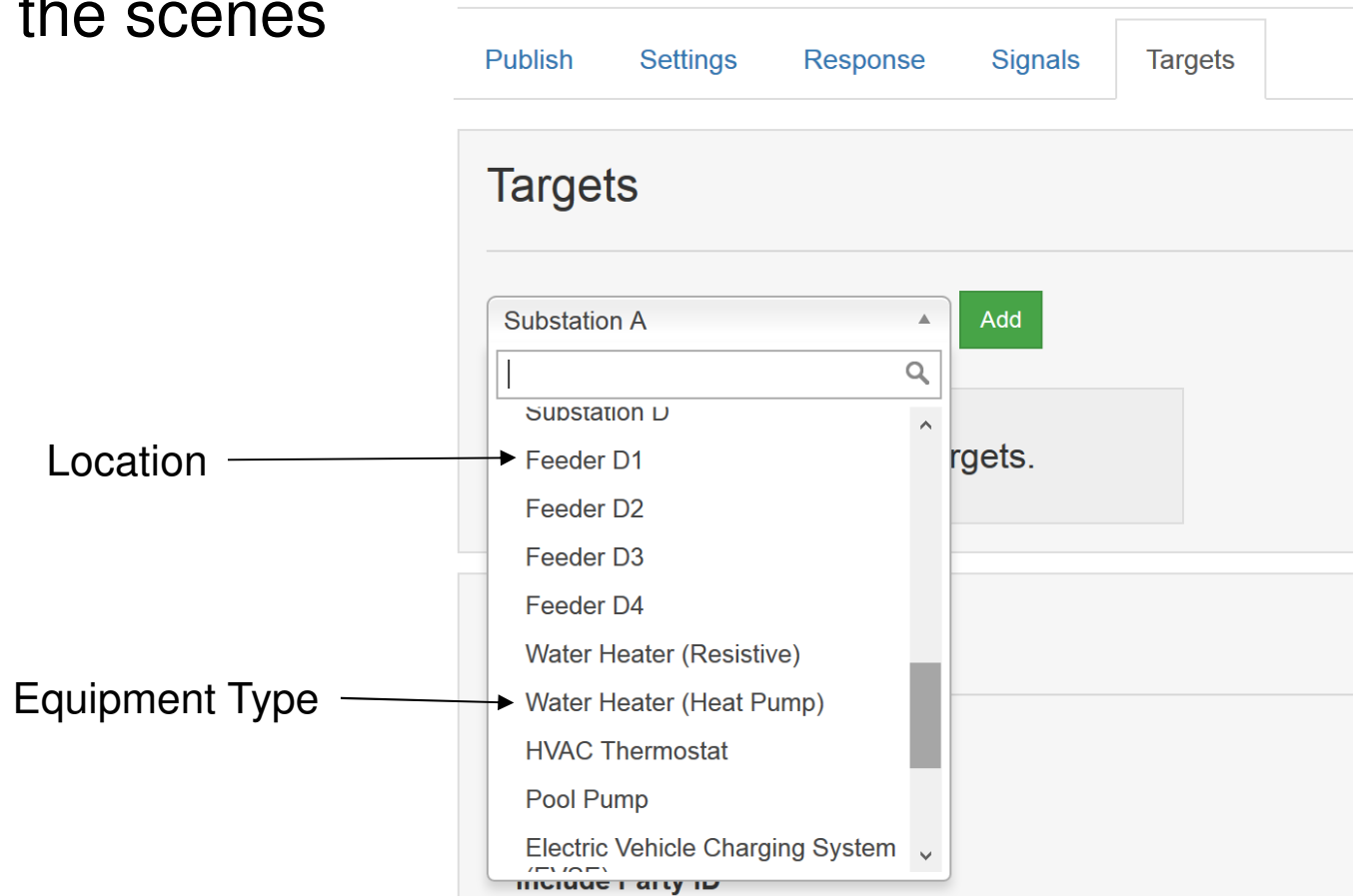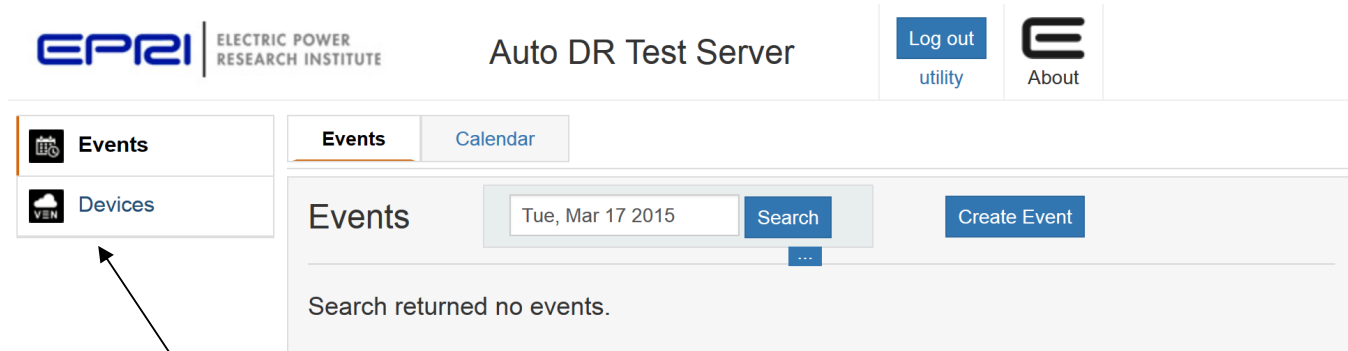
Utility Terminology: Locations and Equipment Types

"Locations" and "Equipment Type" are OpenADR EiTargets behind the scenes

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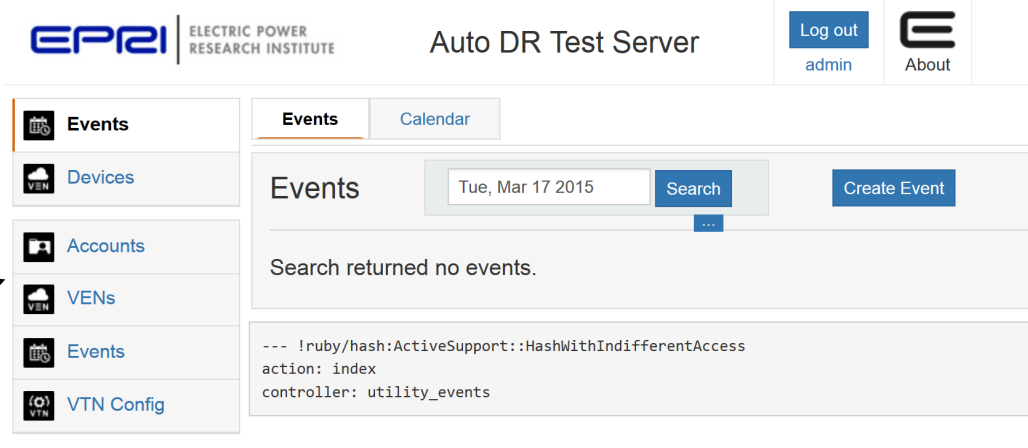# Utility Accounts

Only see Events and Devices

Utility Accounts see only
Events and Devices

Admin accounts see
everything

"Events" vs "Utility Events"

- **OpenADR Events are very complex**
  - Active Period
  - Event Descriptor
  - Signals
  - Signal Intervals
  - Targets

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Events vs Utility Events (continued)

- **Utility Events are more manageable**
  - Program → Market Context
  - Location → Target
  - Equipment Type → Target

VEN vs (Utility) Device

- VEN setup requires multiple screens

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VEN vs (Utility) Device (continued)

- Utility Devices need minimal information
  - Enter device info
  - Subscriptions, groups, etc., handled automatically

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Location Targeting

- Built on OpenADR Targeting
- Location types
  - Circuit (Substation)
  - Feeder
  - Section
  - Distribution Transformer
  - Customer (Service Delivery Point)
  - Load (Physical Location of UCM)
- Hierarchy of Locations

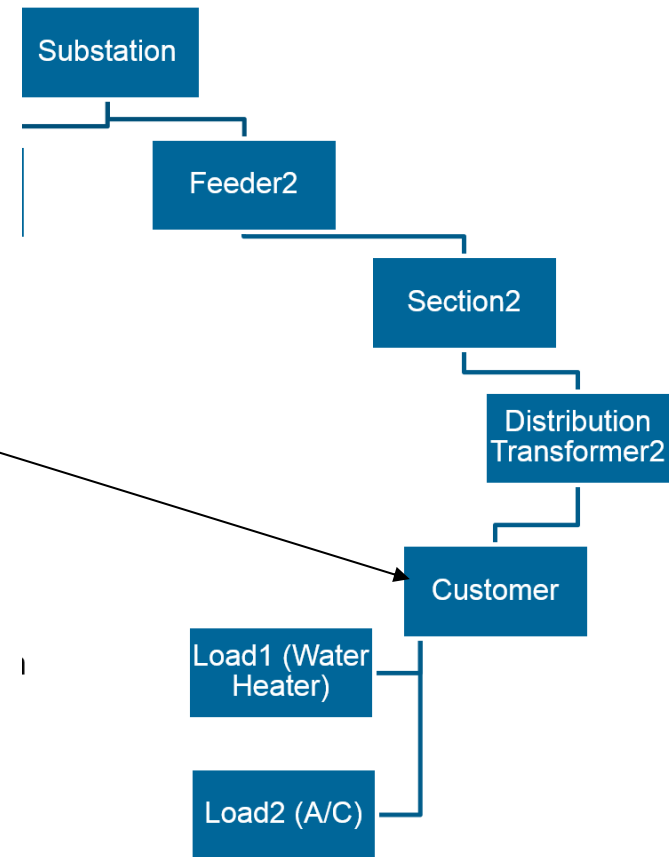EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Location Targeting

- OpenADR targets don't have a notion of hierarchy
  - They are arbitrary groups of VENs
- Solution: create a Location object that maps to an OpenADR target, and has a parent Location object
  - Allows arbitrary hierarchy of Locations

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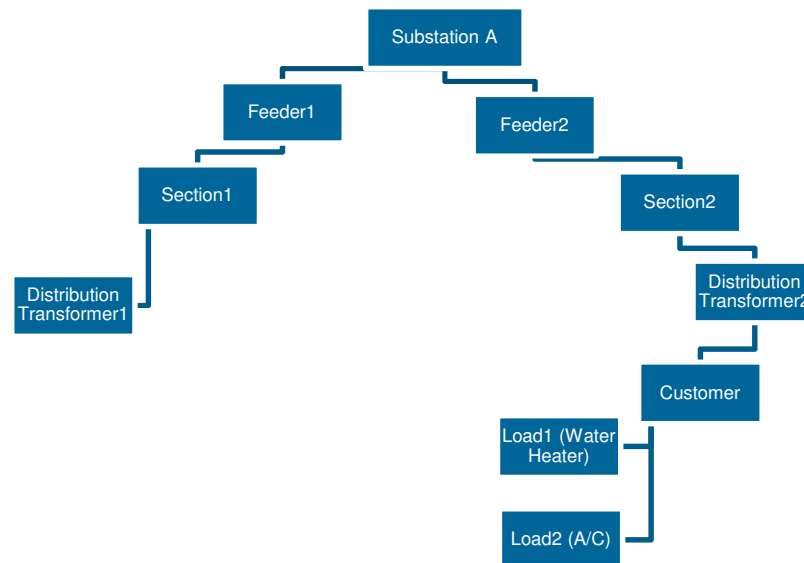
Location Targeting (continued)

- **Each location has**
  - OpenADR Target
  - Parent Location
- **Assign device to the Location object at the bottom of the hierarchy**
- **Automatically added to each parent**
- **Result: selecting Substation as a location for an event will target ALL devices below the substation**

Substation

Feeder2

Section2

Distribution Transformer2

Customer

Load1 (Water Heater)

Load2 (A/C)

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Together…Shaping the Future of Electricity

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