



## OpenADR and Internet of Things

### An Overview

Presentation By:

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### ➤ IoT is Here

- Ubiquity of connected and off-the-shelf communicating devices

### ➤ DR Programs Target Large Loads

- No low cost and non-proprietary solution that extends DR and M&V to IoT

### ➤ Automating IoT Is Cool But Benefits Are Not Tangible

- Customers cannot reap the benefits of energy conservation programs and rebates
- How about those billions of IoT devices out there which can participate in DR programs but are left out?



### ➤ The Marriage!

- Why don't we marry IoT Automation with Energy Management?
- They are definitely compatible: Energy Management and Automation are pretty much two sides of the same coin
- But: the marriage would be short-lived without a common language!

### ➤ The Language: OpenADR

- Standards based and Device Agnostic (common)
- Communicates DR and Price events to the VENs
- Measurement and Verification reports sent to the VTNs

### ➤ The Rest is History!

- And they are still married ... but ...



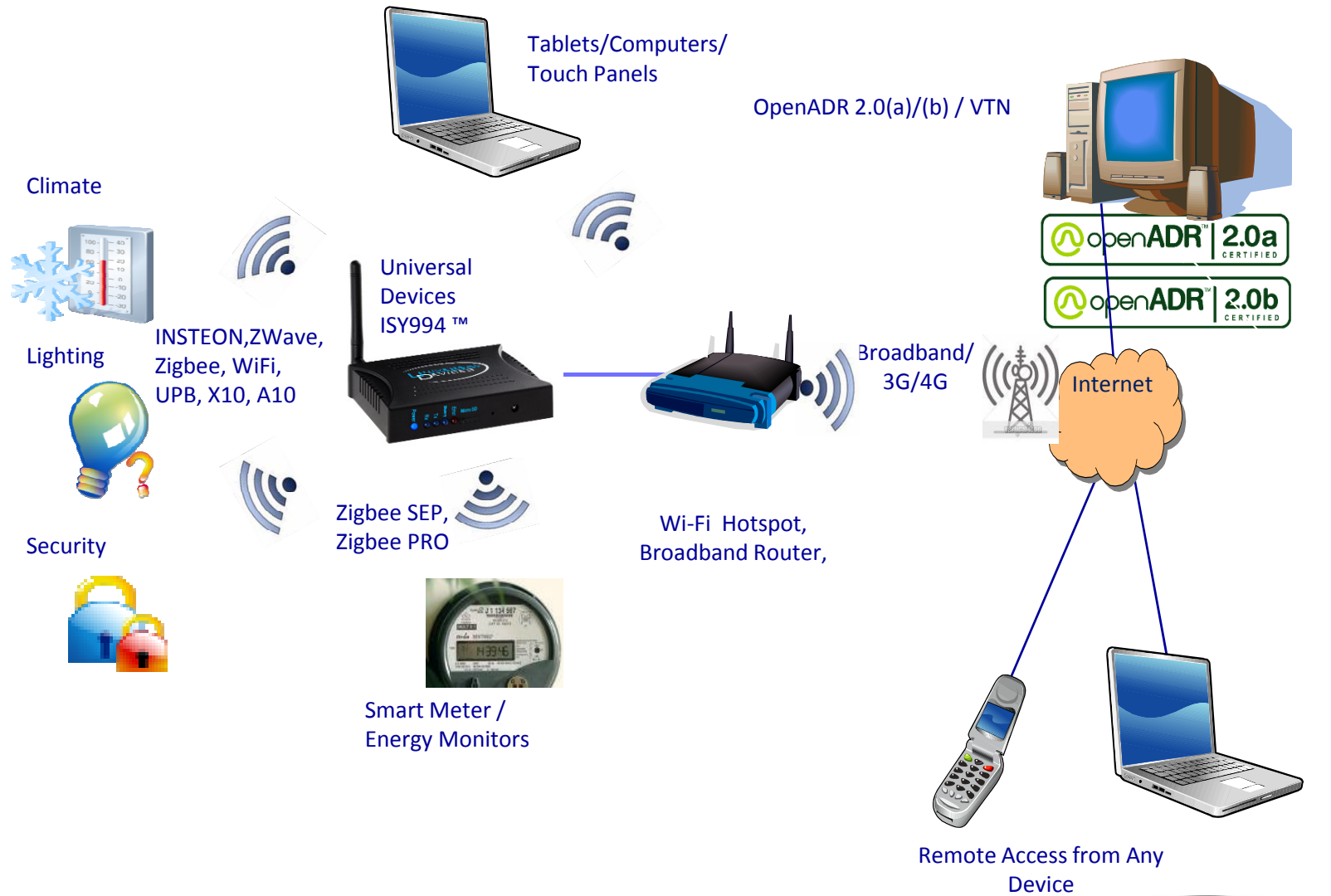
### ➤ Interoperability

- Currently ISY figures out device classes and capabilities based on some heuristics
- In the brave new world of IoT, device classes and capabilities must be automatically discoverable
- Many disjoint and competing IoT standards: IPSO, AllJoyn, OIC/UPnP, Lightweight M2M, Thread, etc.

### ➤ Cooperation

- OpenADR and IoT standards bodies must cooperate otherwise every minor change may cause major interoperability issues





# SAMPLE - CONFIGURATION

ISY Dashboard
Online Mon 2016/03/21 02:41:11 PM

### My Devices

**Office Lamp**

Office **Z-Wave Dimmer**

Off On Off

**Table Lamp**

Table **Z-Wave Load Controller**

Off On Off

**ZW 004 Thermostat**

74° 65° (H) 80° (C)

Down Up Mode

**Z-Wave Thermostat**

### My Electricity

**Status**

EUID 0021ED0000062A5F Install Code 9ED74423C50F3582

Network Joined Securely | 84CA | 001D2301000085AB | 12

Time Synchronized

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**Summary**

Inst. Demand **1.688 kW** Cost **\$ 0.244 / Hour**

Price Tier DDDDDDD \$ 0.144444 / kWh

Next Price Tier AAAAAAA \$ 0.111111 / kWh 2016/03/21 14:44:22 PM

Today 24.662 kWh \$ 2.880550

Yesterday 81.103 kWh \$ 4.928021

Month 785.673 kWh \$ 94.789215 Billing Cycle

All Time 13725.154 kWh Cycle Ends 2016/04/01 11:59:59 PM

List Prices Normal Polling

Smart Meter Information

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**Load Control**

Status Start Time Criticality Duration

List All Opt In Opt Out

---

**Messages**

Status Start Time Priority Duration

Message

List All Confirm

### My OpenADR

56730E43-AAE8-43A6-BA5E-CBEC1D9158F9 / 1

Status ✔ Completed Disposition Opted In

Current Value N/A Priority 1 Mod. # 0

Start Time 2016/03/18 8:10:00 AM End Time 2016/03/18 8:14:00 AM

Opt Out Details

### OpenADR Settings

Profile 2.0 b

Server URL

User ID  Password

**OpenADR 2.0 Settings**

VTN Interaction Mode Pull  XML Signature

Evaluation Interval (sec) 5  Auto Registration

Push URL Base

VTN ID dev

VEN ID universal\_ven1

Party ID

Resource ID

Group ID

Market Context

Registration ID b3eaccbd-f6b8-4bc4-b2c3-b50776a351e1

**Normal Mode Settings** Simple Mode Based Settings

Setpoint Offset ° 0 Duty Cycle % 100 Load Adj % 0

**Moderate Mode Settings**

Setpoint Offset ° 2 Duty Cycle % 50 Load Adj % 0

**High Mode Settings**

Setpoint Offset ° 4 Duty Cycle % 25 Load Adj % 0

### My Weather

Snow 23.00° F

Tue Wed Thu

Hi 21.00° Hi 25.00° Hi 23.00°

Lo 18.00° Lo 16.00° Lo 5.00°

Feels 16.00° F Rain 0.00 inches

Hi 26.00° F Wind 6 mph NNE

Lo 17.00° F Gust 10 mph 0

Humidity 28.00 % Dew Point -5.00° F



# SAMPLE – RULES

The screenshot shows the 'Administrative Console' interface. At the top, there is a menu bar with 'File', 'Z-Wave', 'Tools', and 'Help'. Below the menu bar is a toolbar with various icons. The main area displays the date and time 'Mon 03/21/2016 03:06:41 PM, [USA, CA, Los Angeles]' along with sunrise and sunset times: '06:55:36 AM [Sunrise]' and '07:06:08 PM [Sunset]'. The interface has several tabs: 'Main', 'Programs', and 'Configuration'. Under 'Programs', there are sub-tabs for 'Summary', 'Details', and 'Variables'. The left sidebar shows a tree view of programs, with 'Precool' selected. The main content area displays the 'Program Content for 'Precool'' with the following logic:

```
Program Content for 'Precool'
If
  Module 'Climate' Temperature >= 95 °F
  And Module 'OpenADR' Mode is High
  And (
    Module 'OpenADR' Status is Pending Near
    Or Module 'OpenADR' Status is Pending Far
  )
  And On Mon, Tue, Wed, Thu, Fri
  From 12:00:00PM
  To Sunset - 1 hour and 15 minutes (same day)
Then
  Set 'ZW 004 Thermostat' 70° F (Heat Setpoint)
  Send Notification to 'michel@universal-devices.com' content 'pending'
  Wait 1 hour
  Run Program 'Normal Operations' (Then Path)
Else
  - No Actions - (To add one, press 'Action')
```



- **Smart Meter, Thermostats, and Load Controllers in Residential (2.0b)**
  - Off-the-shelf Z-Wave
  - Off-the-shelf INSTEON
  - Zigbee SEP 1.1
- **Thermostats in SMB (2.0b)**
  - Off-the-shelf Z-Wave and Zigbee
- **Thermostats in College Campus (2.0b)**
  - Off-the-shelf Zigbee
- **Load Controllers on RTUs (2.0a)**
  - Off-the-shelf Zigbee
- **DR + Measurement & Verification (2.0b)**
  - Off-the-shelf wired relays
  - EM3 Energy Monitor + Pulse counter





# Thank you!

## Contact Information

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### ➤ ISY994 Series

- A fully autonomous and low cost Automation and Energy Management system:
  - Utilizes off-the-shelf devices for command/control
    - Z-Wave, Zigbee, INSTEON, A10, X10 and Network
  - OpenADR 2.0a/2.0b Certified
  - Simple configuration for how devices respond to OpenADR Events
  - Opt Schedules automate when to Opt-in or Opt-out of OpenADR Events
  - Measurements are automatically sent to the VTN/DRAS utilizing OpenADR 2.0b Report Service
  - Not cloud based
  - Supports up to 1024 devices and therefore applicable to both residential as well as SMB



### ➤ ISY994zw ZS

- Ideal For SMB and Residential Venues
- Direct Communications with Smart Meters
  - SEP 1.1 Certified
  - PG&E, SCE, NVE, and Oncor Certified
  - Near real-time energy readings from the Smart Meter are automatically sent to the VTN using OpenADR 2.0b Report Service
- Z-Wave Support
  - Support for any off-the-shelf Z-Wave device, including – but not limited to – thermostats and heavy duty load controllers
  - Energy readings from Z-Wave devices that report energy information is automatically sent to the VTN
  - Our OEM Z-Wave thermostats show OpenADR Events on their displays



### ➤ ISY994R ZS

- Ideal for Venues with Existing Building Management Systems
- Direct Communications with Smart Meters
  - SEP 1.1 Certified
  - PG&E, SCE, NVE, and Oncor Certified
  - Near real-time energy readings from the Smart Meter are automatically sent to the VTN using OpenADR 2.0b Report Service
- Relays
  - Two relays to send signals to building management systems



### ➤ EM3 Series

- Ideal for Venues without Smart Meters
- A fully autonomous and low cost Energy Monitoring and Relay Control System
  - OpenADR 2.0a/2.0b Certified
  - Energy Monitor – 3 Phase / Billing grade
    - Up to 480 volts balanced
    - 5 Channels of energy monitoring
    - 2 Temperature sensors
    - 2 Pulse counters or 1 KZY Simple configuration
    - Up to 16GB of storage
  - 4 x Relays
    - Communicate with Building Management Systems or
    - Turn on/off devices directly
  - Opt Schedules automate when to Opt-in or Opt-out of OpenADR Events
  - Measurements, for all channels – and including Pulse Counts – are automatically sent to the VTN/DRAS utilizing OpenADR 2.0b Report Service
  - Not cloud based



### ➤ EM3 ZW

- Ideal for Venues without Smart Meters and Building Management Systems (SMB)
- Extends EM3 with Z-Wave Capabilities
  - Support for any off-the-shelf Z-Wave device, including – but not limited to – thermostats and heavy duty load controllers
  - Energy readings from Z-Wave devices that report energy information is automatically sent to the VTN
  - Our OEM Z-Wave thermostats show OpenADR Events on their displays





## ➤ EM3 ZB

- Ideal for Larger Venues without Smart Meters and Building Management Systems such as SMB and Rooftops
- Extends EM3 with Zigbee Capabilities
  - Support for our OEM Zigbee Thermostats and Heavy Duty Load Controllers
  - Our OEM Z-Wave thermostats show OpenADR Events on their displays



### ➤ Hardware

- Freescale CPU
- 2MB Flash/8MB RAM
- Up to 16GB SD Card storage
- 10/100 Ethernet
- Real Time Clock on board
- 2 Serial Ports
- 4 digital I/O

### ➤ Firmware

- HTTP
- HTTPS
  - Up to TLS 1.2
  - Client Authentication/Digital Certificates
- Open ADR, SEP, Flex Your Power
- Abstraction layer for support of other devices/protocols



### ➤ EM3™

- 3 Phase Energy Monitor
  - Automatic configuration
  - Up to 480 volts balanced
  - 5 Channels of energy monitoring
  - 2 Temperature sensors
  - 2 Pulse counters or 1 KZY
  - Zigbee communications to ISY

### ➤ EM3-RTU™

- 3 Phase Energy Monitor and RTU Diagnostics (SMDS)
  - Same features as EM3
  - Up to 16GB data storage
  - Real time clock on board
  - Network accessible

