ANSI/CEA-2045 Modular Communication Interface Standard Update

Chuck Thomas, Brian Seal, EPRI

ICT Informational Webcast
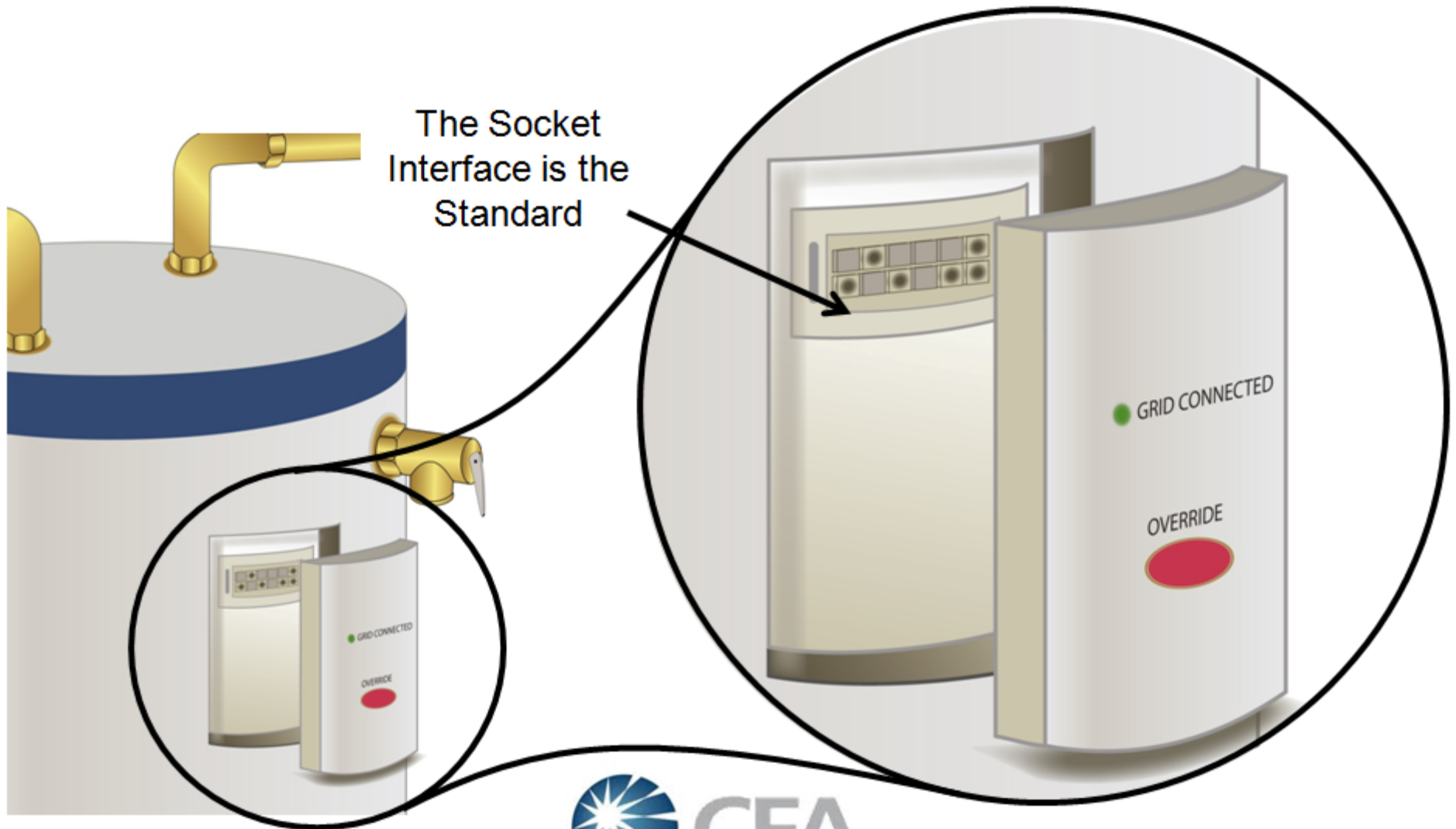
Date

June 9th, 2015

OUTLINE

➢ Overview of the CEA-2045 Standard

➢ Rationale and Potential Benefits of a Modular Approach

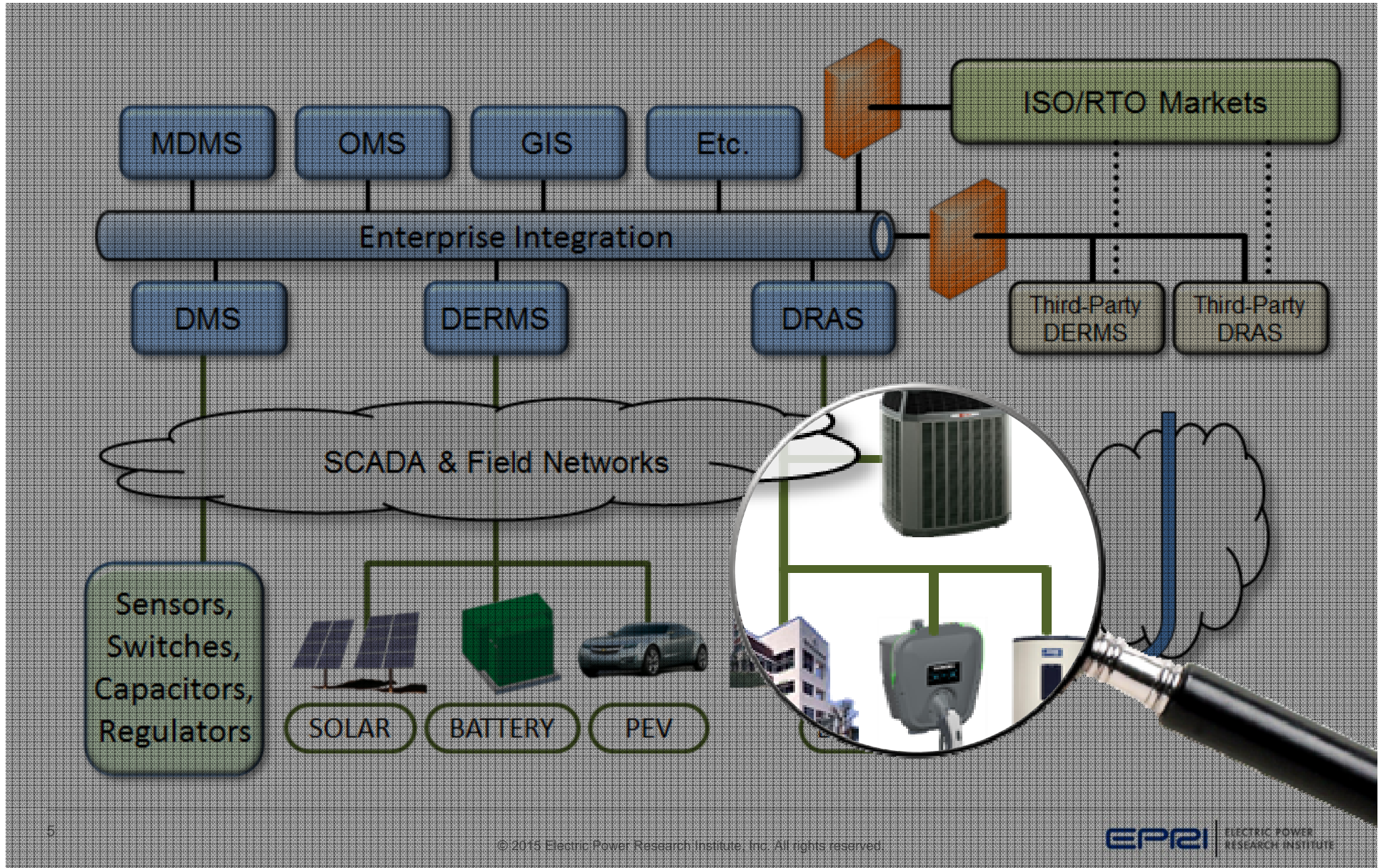➢ EPRI Field Demonstration Project

➢ Related Industry Activities

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Overview of the ANSI/CEA-2045 Standard

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ANSI/CEA-2045 Modular Communication Interface
Standard for the Integration of End-use Devices

The Socket Interface is the Standard

GRID CONNECTED

OVERRIDE

CEA
Consumer Electronics Association

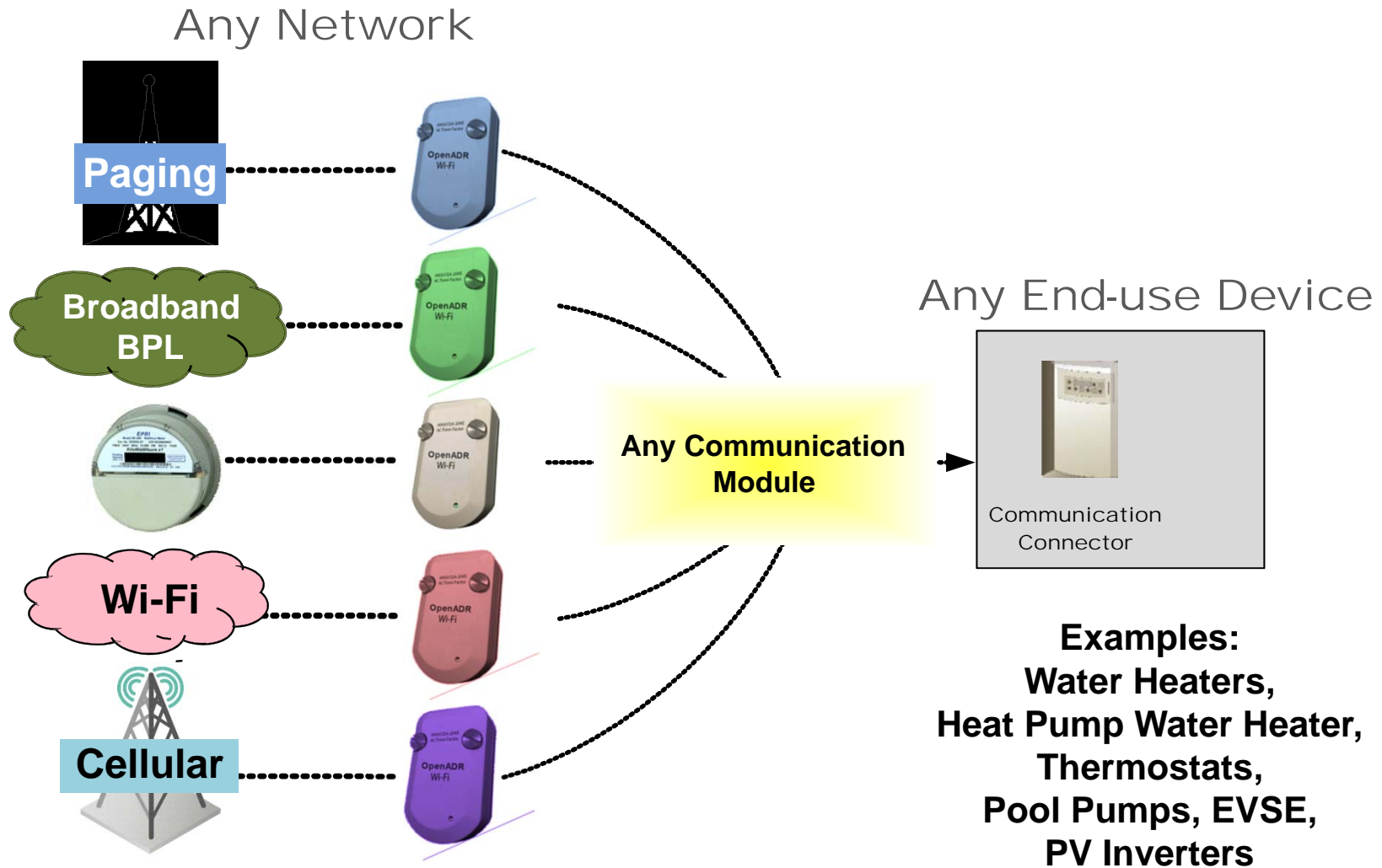RESEARCH INSTITUTE

Place in the Overall Architecture

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ANSI/CEA-2045 Modular Communication Interface Standard
Interoperability between ANY Network + ANY End-Use Device

Any Network

Paging

Broadband BPL

Wi-Fi

Cellular

Any Communication Module

Any End-use Device

Communication Connector

Examples:
Water Heaters,
Heat Pump Water Heater,
Thermostats,
Pool Pumps, EVSE,
PV Inverters

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Two Form Factors are Specified

AC Form Factor

DC Form Factor

- Compact
- Powered by 3Vdc
- Low power RF networks
- Friction mount

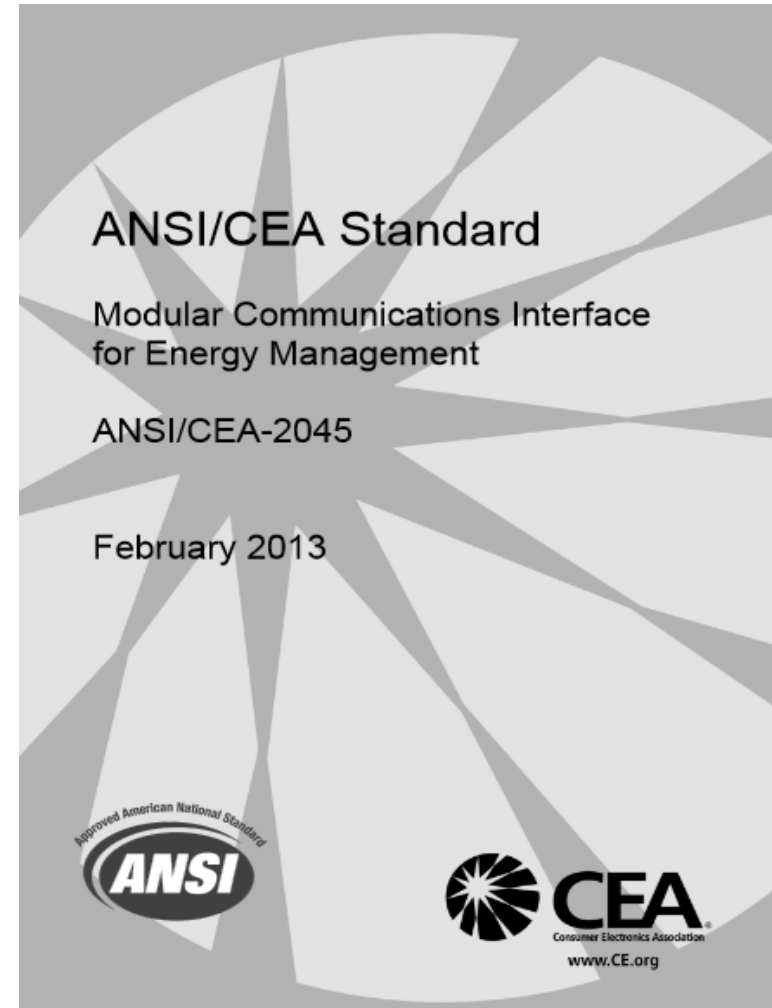- Larger components/circuits
- Powered by line voltage
- Supports PLC and other higher power networks
- Screw mount

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Published by the Consumer Electronics Association
February 2013 (Version A)

- NIST SGIP Effort Began in 2010
  - Utilities
  - Service Providers
  - OEMs (End-use and Communications)
  - Standard Organizations
  - Researchers
- Standard Released , Feb 2013
- Available from the Consumer Electronics Association
  - www.ce.org
- Early Adopter Stage
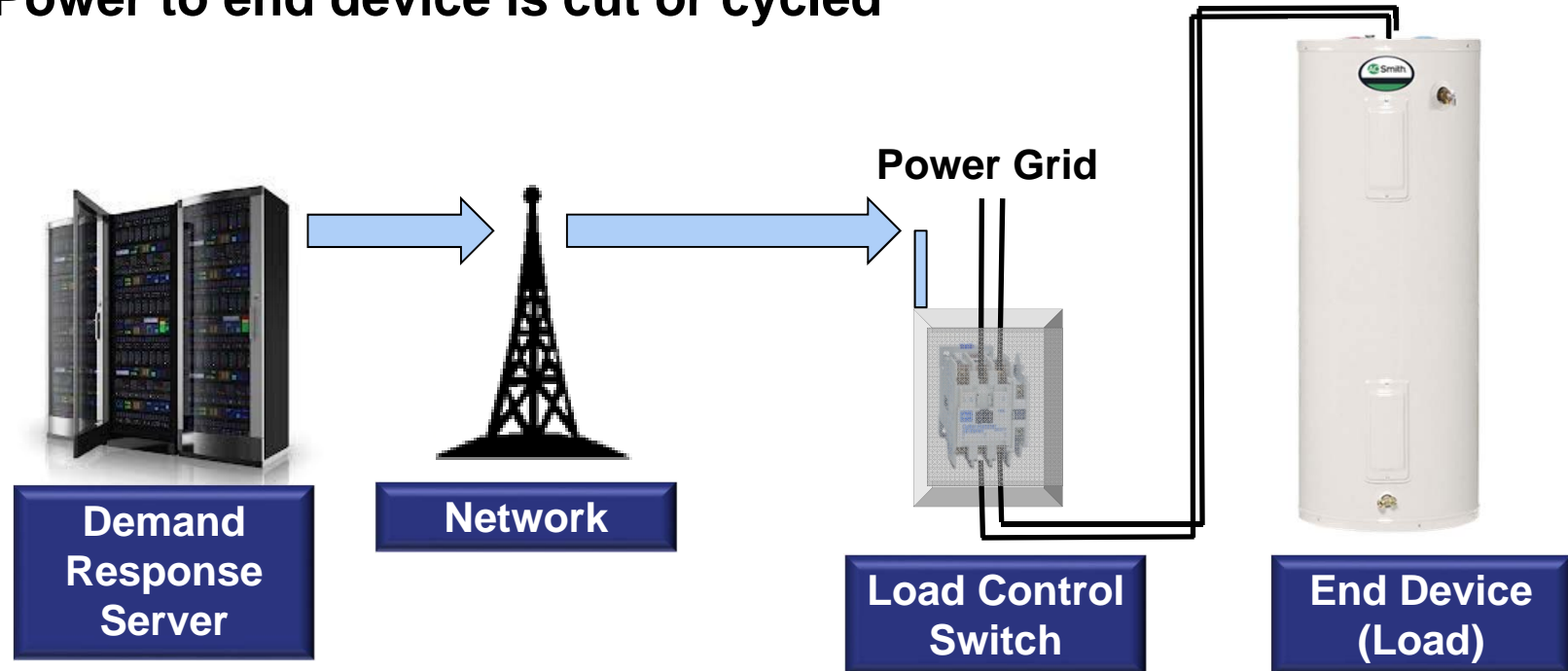- First Deployments Underway

ANSI/CEA Standard

Modular Communications Interface for Energy Management

ANSI/CEA-2045

February 2013

ANSI

CEA
Consumer Electronics Association
www.CE.org

Additional Information about the CEA-2045 Standard: Report # 3002004020

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Rationale and Potential Benefits of a Modular Approach

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Migration from Traditional to Intelligent DR
Most DR is Under the Control of Load Switches

- **One-way communications, no visibility into equipment status**

- **Professional Installation of Load Control Switch**
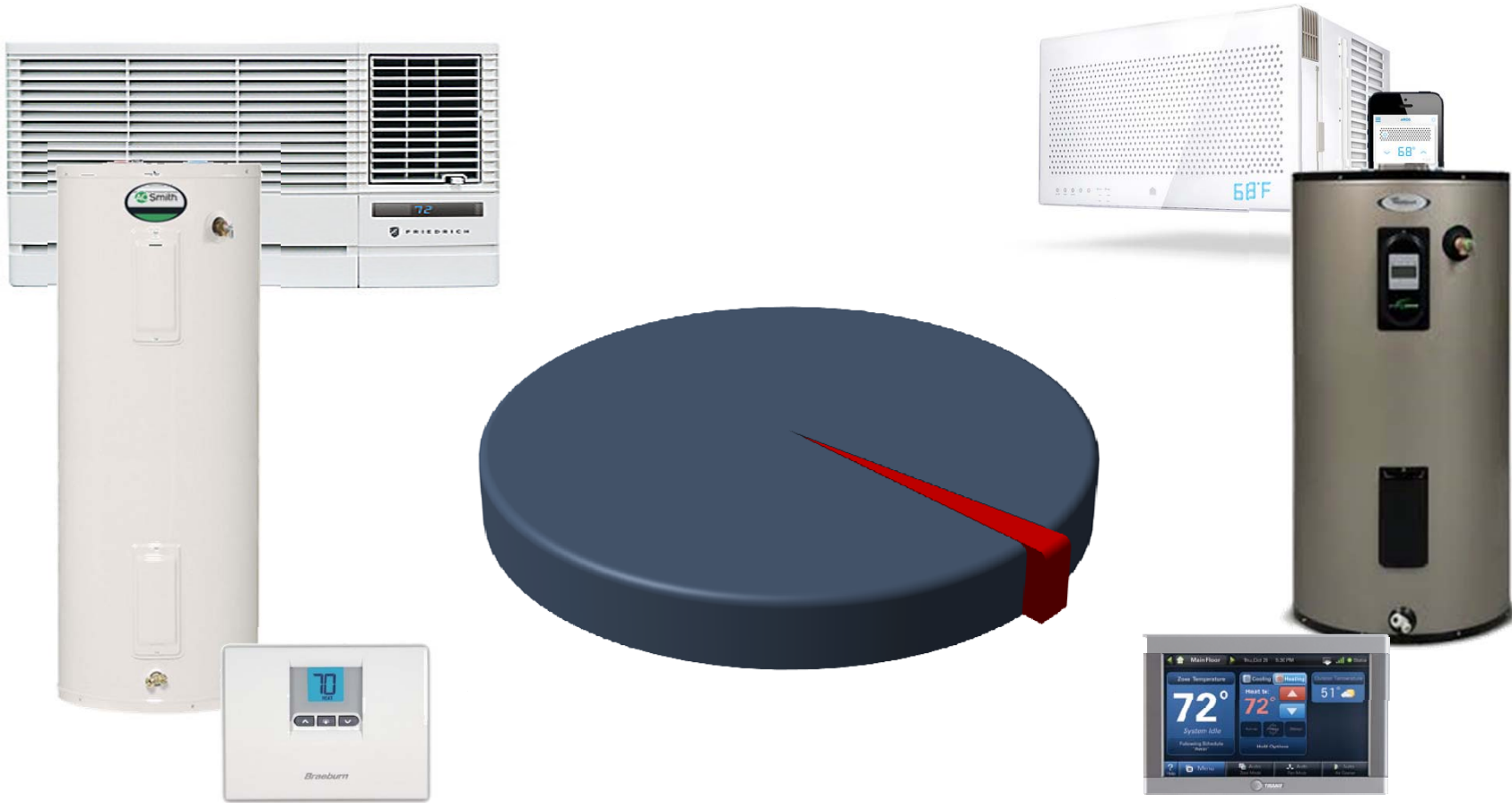
- **Power to end device is cut or cycled**

Power Grid

Demand Response Server

Network

Load Control Switch

End Device (Load)

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Vision of Mainstream DR-Ready

- Nationwide distribution, mass production
- On common models, not just high end

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Practical for Mainstream Retail Products

Basic Commodity Models

Advanced Models

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Vision of Mainstream DR-Ready

- Nationwide distribution, mass production
- On common models, not just high end
- Typical retail channels
- Easy to connect/enroll, no truck roll
- Smart responses

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Challenges in Taking DR-Ready Mainstream

✓ • Upfront cost addition must be minimized

✓ • Need to work with **diverse** communication technologies

✓ • Allow communication technologies to **evolve** over the long service life of products

✓ • Diverse and evolving demand response use cases

✓ • Ensures open access, encourages competition and innovation

Open Modular Port

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Example Modular Interfaces

VGA

DB-9/ RS-232 Interface

PCMCIA Interface

PCI Interface

PCI interface
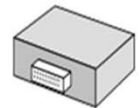
RJ-45 slot

USB Interface

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EPRI Field Demonstration Project

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ANSI/CEA-2045 Field Demonstration Project

End-Use Devices / Communication Technologies matrix showing: Thermostat / HVAC, Resistive Water Heater, Electric Vehicle Service Equipment, Window AC, Pool Pump, Solar Inverters, Heat Pump Water Heaters, Load Relay.

Communication Technologies: Aclara TWACS, Comverge, Cooper (Eaton), Corporate Systems Engineering, eRadio (FM-RDS), Echelon, Elster, G3-PLC, Hunt, Itron, Intwine, Landis+Gyr, NexGrid, OATI, Sensus, SilverSpring Networks, SkyCentrics, Tantalus, Trilliant, Verizon Cellular, Wi-Fi / OpenADR, ZigBee / SEP1.1, Wi-Fi/SEP 2.0.

Field Testing for Interoperability

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ANSI/CEA-2045 Field Demonstration Project
Participants

Ameren
Tri-State G&T
Bonneville Power Administration
Portland General Electric
Sacramento Municipal Utility District
Southern California Edison
Salt River Project
Southern Company
Hawaiian Electric Co

Hydro One
National Grid
NYSERDA
New York Power Authority
Electricité de France
American Electric Power
Duke Energy
Tennessee Valley Authority
Jackson EMC
McMinnville Electric System
North Georgia EMC
Oglethorpe Power

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Project Objectives

- Evaluate the ANSI/CEA-2045 in actual field environments

- Accelerate adoption of open standards and product availability

- Provide consensus guidance to manufacturers

- Provide a forum to share utility learnings & activities

- Investigate business models for mainstream retail introduction

- Provide feedback to the CEA

- Contributions to the USNAP Alliance (certification)

Additional Information about the Field Demonstration Project: Report # 3002004009

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Technical Support – Tools and Software

Software: CEA-2045 Simulator

Hardware: Test Cables
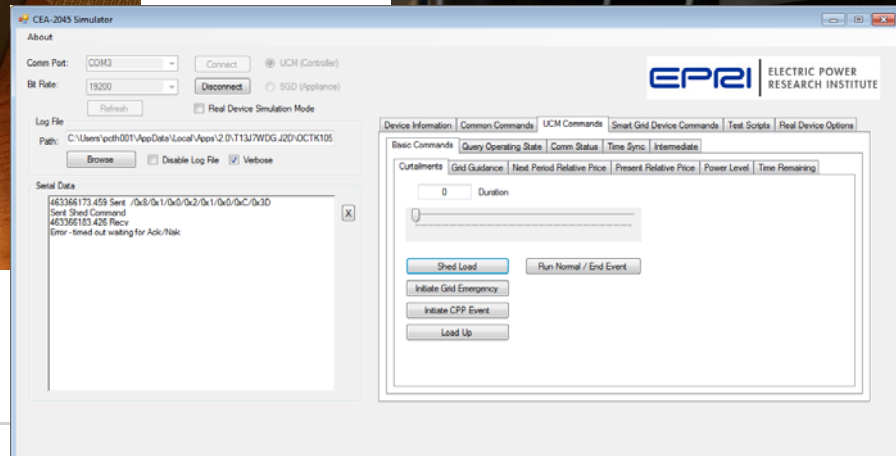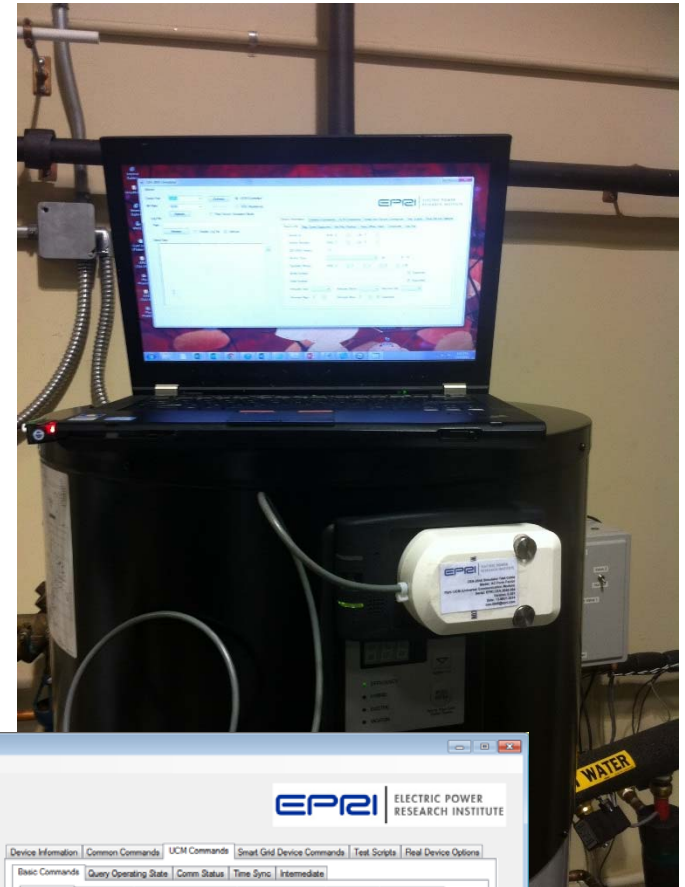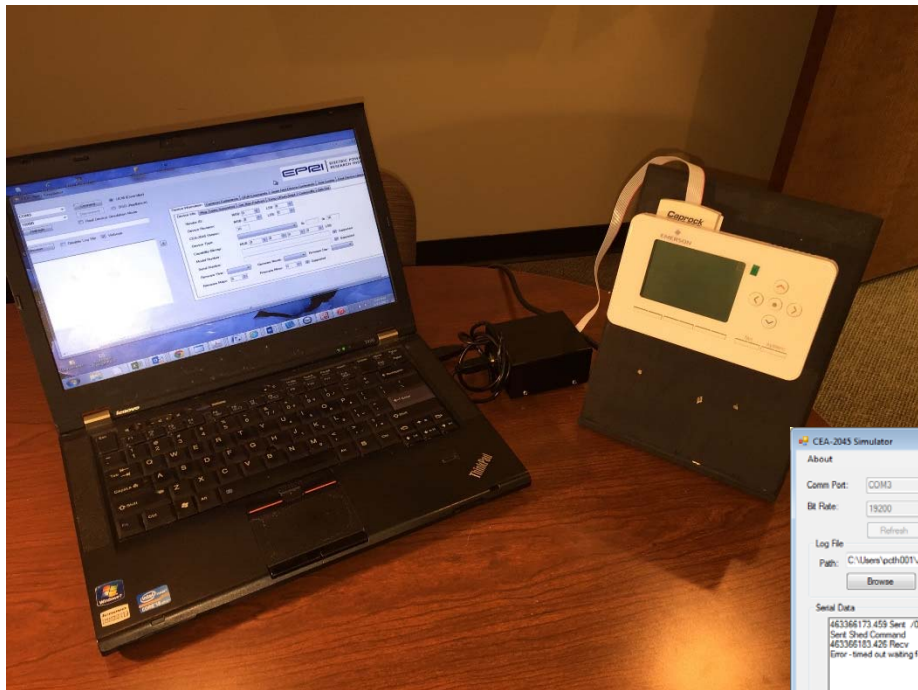
Supporting Member Labs and Testing

> "The EPRI Simulator is our baseline/standard. Any UCM or end device functionality will be measured against it. Scripting allows unattended, repeatable testing and has allowed us to develop confidence in test procedures and eliminate communications to the UCM from head end systems as being a potential cause of test failure. "
>
> *- Tom Fenimore, Duke Energy*

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Prototype Products
Domestic Water Heaters (Resistive and Heat Pump)

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Prototype Products
Thermostat, EVSE and PTAC

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ANSI/CEA-2045 Field Demonstration Project
Example Application

OpenADR 2.0b Server

OpenADR 2.0b Client / Wi-Fi Module

| OpenADR Client | Map | CEA-2045 Interface |

Any CEA-2045 End-Use Device

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Related Industry Activities

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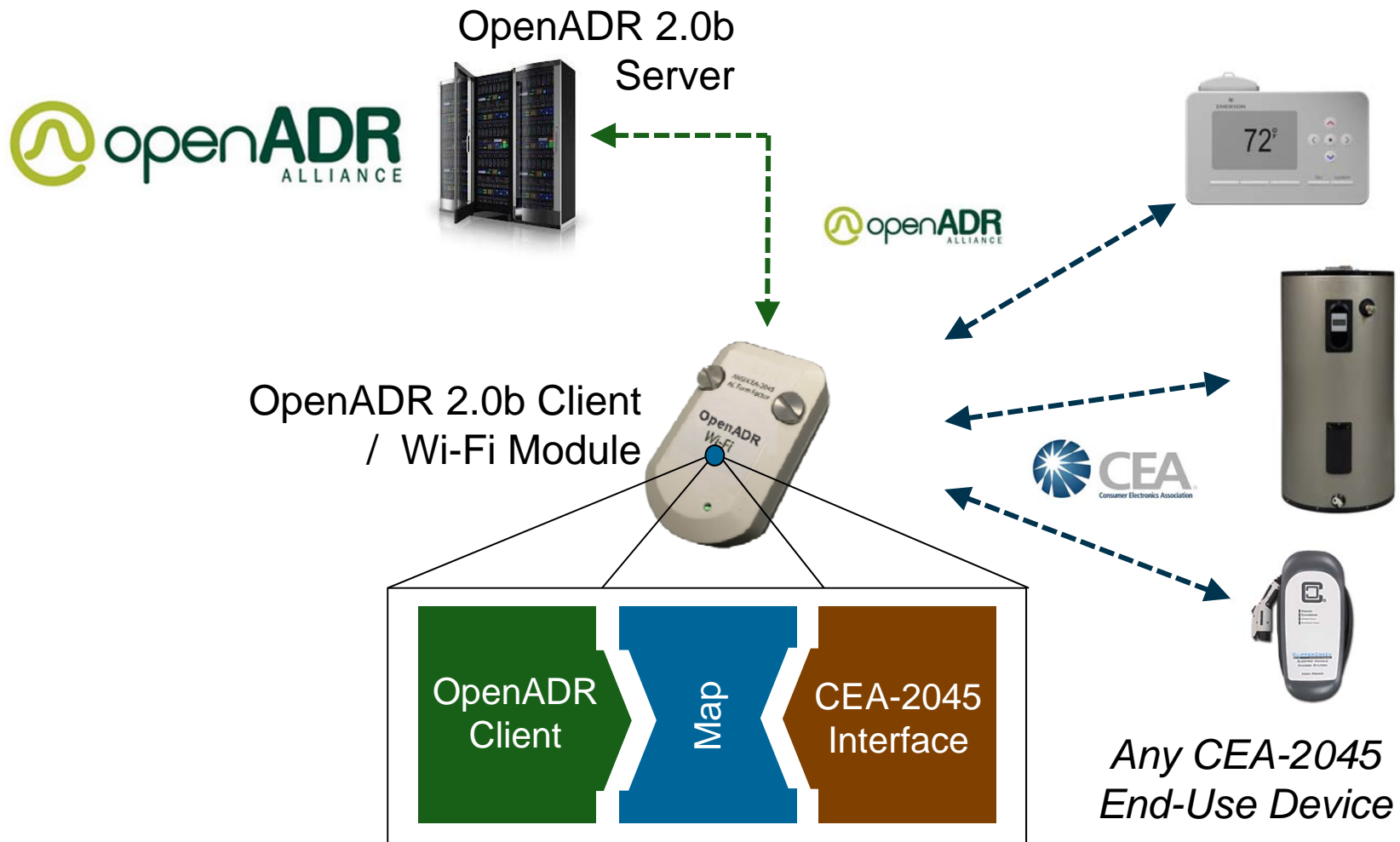
Related Industry Activities
International Standardization

ANSI/CEA-2045
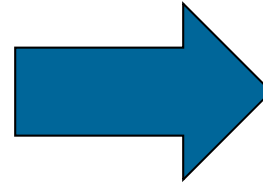
Approved as a new work item by ISO/IEC JTC1, SC25, WG1.

- JTC1 = Information Technology Standards
- SC25 = Interconnection of Information Technology
- WG1 = Home Electronic Systems

Status: Under review

Approval required a majority of the 37 countries to approve of the activity and 5 or more to commit to work on it

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Related Industry Activities
ECHONET Lite Pass-through

- Objective: International standardization of an open interface

- Host: Feb 2015, Waseda University, Tokyo

- ECHONET Lite (Home Automation Protocol)

- Successfully demonstrated Interoperability between ECHONET Lite over CEA-2045 port

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Related Industry Activities
EPA Energy Star, AHRI

- Energy Star "Connected" Designation

"Communication device(s), link(s) and/or processing that enables open standards-based communication between the Connected R/F System and Energy Management Device/Application(s). These elements could be within the base appliance, and/or an external communication module, a hub/gateway, or in the Internet/cloud."
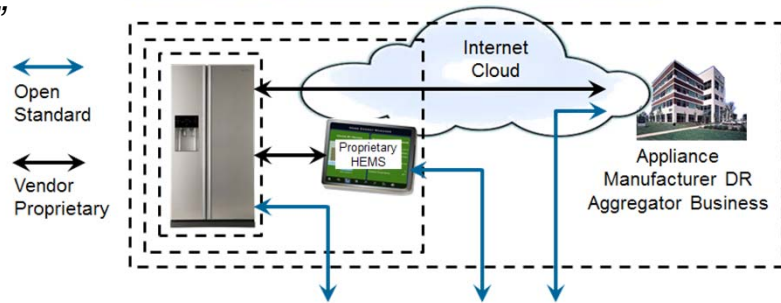
- AHRI Smart or Connected Equipment Ad Hoc Committee is developing a scope and definition for "smart" systems

"The DR-Ready HVAC system may also be pre-programed and capable of receiving, processing and responding to signals from a CEA2045, or other commercially available hardware ports and translation modules attached to the HVAC system."

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Related Industry Activities
California Solar Initiative

OVER

Related Industry Activities
Energy Efficiency Improvement Act of 2015

- Signed into law May, 2015

- Title II, Section 201 of this act is titled "Grid-Enabled Water Heaters"

- Allows the manufacture, distribution and use of resistive water heaters >75gal given that:

  - Manufactured in a limited state of operation

  - Full rated capabilities can only be unlocked in a demand response program

- CEA-2045 Field Demonstration project participants are exploring how a smart, communicating water heater can support this law
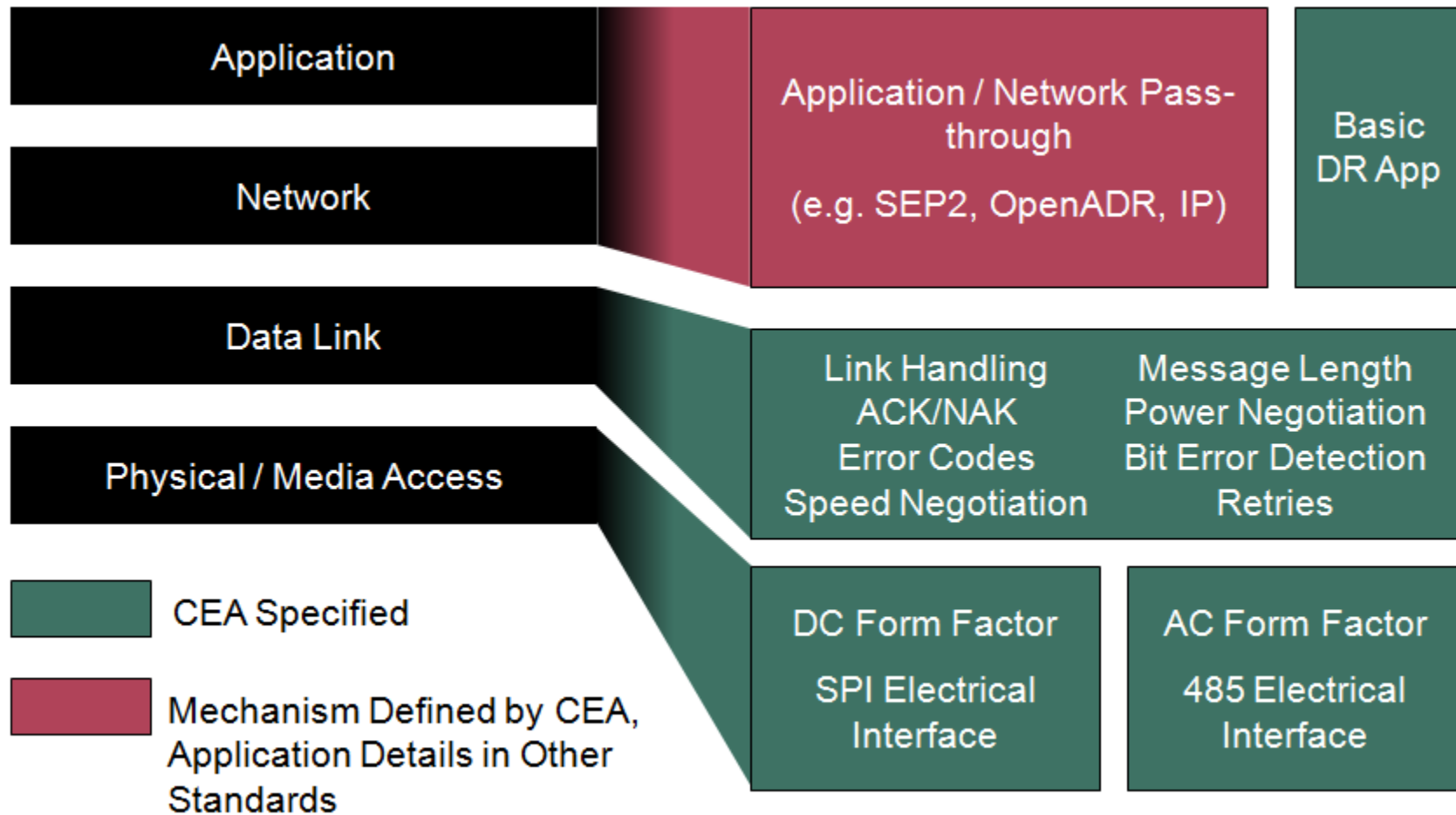
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Discussion

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Together…Shaping the Future of Electricity

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ANSI/CEA-2045 Standard
Interface Layers Specified

Application	Application / Network Pass-through (e.g. SEP2, OpenADR, IP)	Basic DR App
Network		

Data Link	Link Handling, ACK/NAK, Error Codes, Speed Negotiation — Message Length, Power Negotiation, Bit Error Detection, Retries
Physical / Media Access	

| | DC Form Factor — SPI Electrical Interface | AC Form Factor — 485 Electrical Interface |

Legend:
- CEA Specified
- Mechanism Defined by CEA, Application Details in Other Standards

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Decoupling the Network
A Modular Approach

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