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Update: CEA Standard Modular Communication Interface for Residential Demand Response

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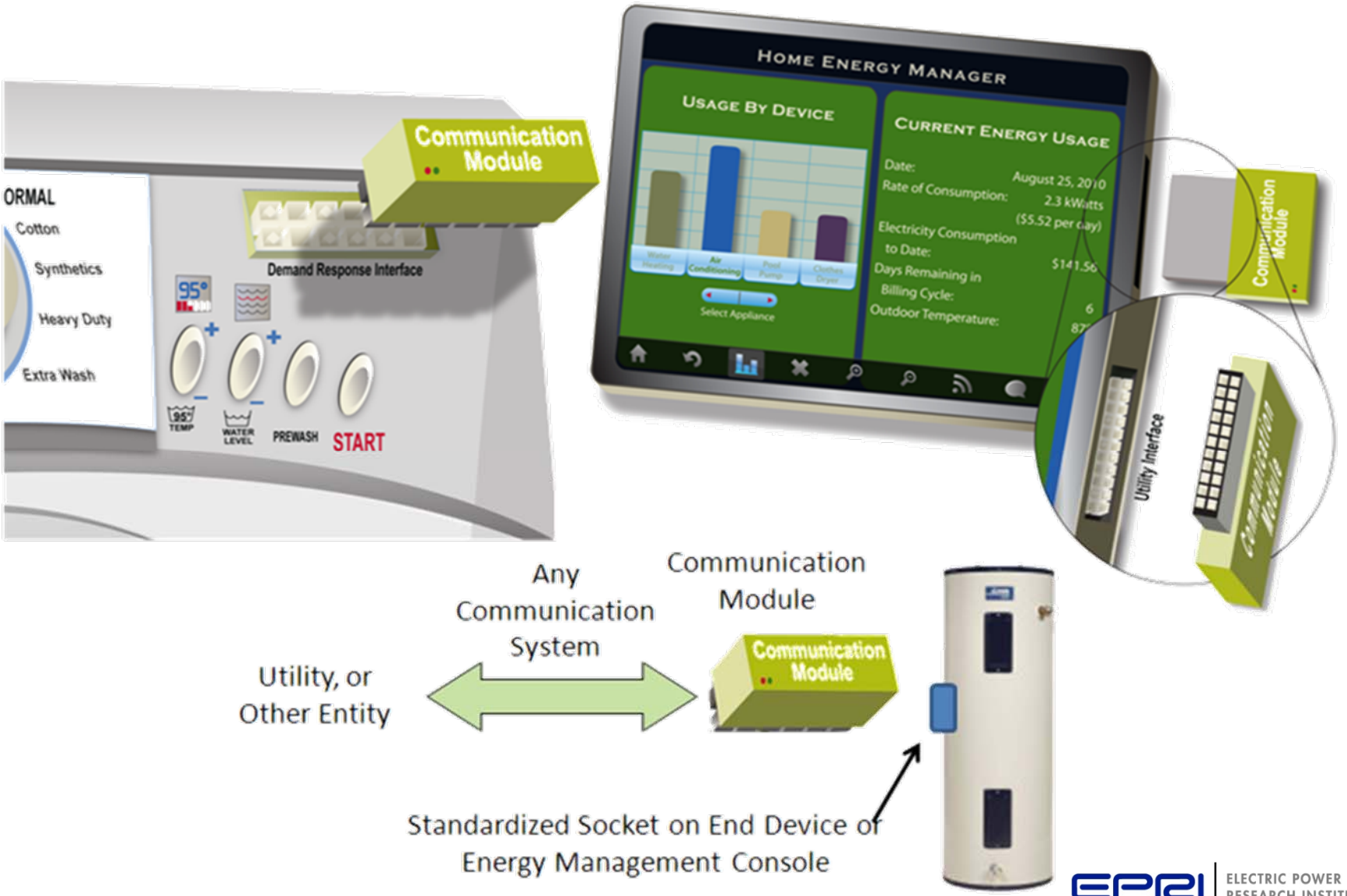
EPRI Smart Grid Information Sharing Call
March 27th , 2012

Agenda

- Concept Introduction and Rationale
- Timeline and Status
- Challenges
- USNAP Alliance
- Discussion

The Modular Communication Interface Concept



Limited Success with Load Switches

- Low market penetration, after 40 years <1%. Applicable only to certain load types.
- No intelligent responses, sub-optimal customer experience
- Diagnosing product failures (is the appliance bad? Did the DR program accelerate failure?)
- Control equipment removal cost 2, 5, even 15 years later
- Total cost (hardware, install, marketing, O&M) has limited the range of economical DR programs and target end devices

The Better Way – DR Ready Devices

- Off the shelf
- Included in basic models too
- No utility service call needed
- Works everywhere

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Challenges in Taking DR Mainstream

- General consumer energy interest / awareness is low. Little vendor confidence that the average product will ever be enrolled.
- DR program consideration and product purchases are out of sync - large power consuming devices are “crisis buys”
- Diverse and evolving demand response value & use cases
- Diverse and evolving communication technologies
- Uncertainties regarding consumer preferences
  - privacy (both the install process and ongoing operation)
  - control (inform & motivate vs. command & control)

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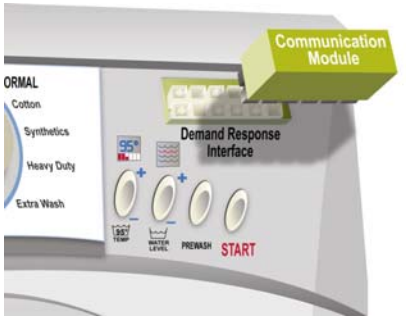
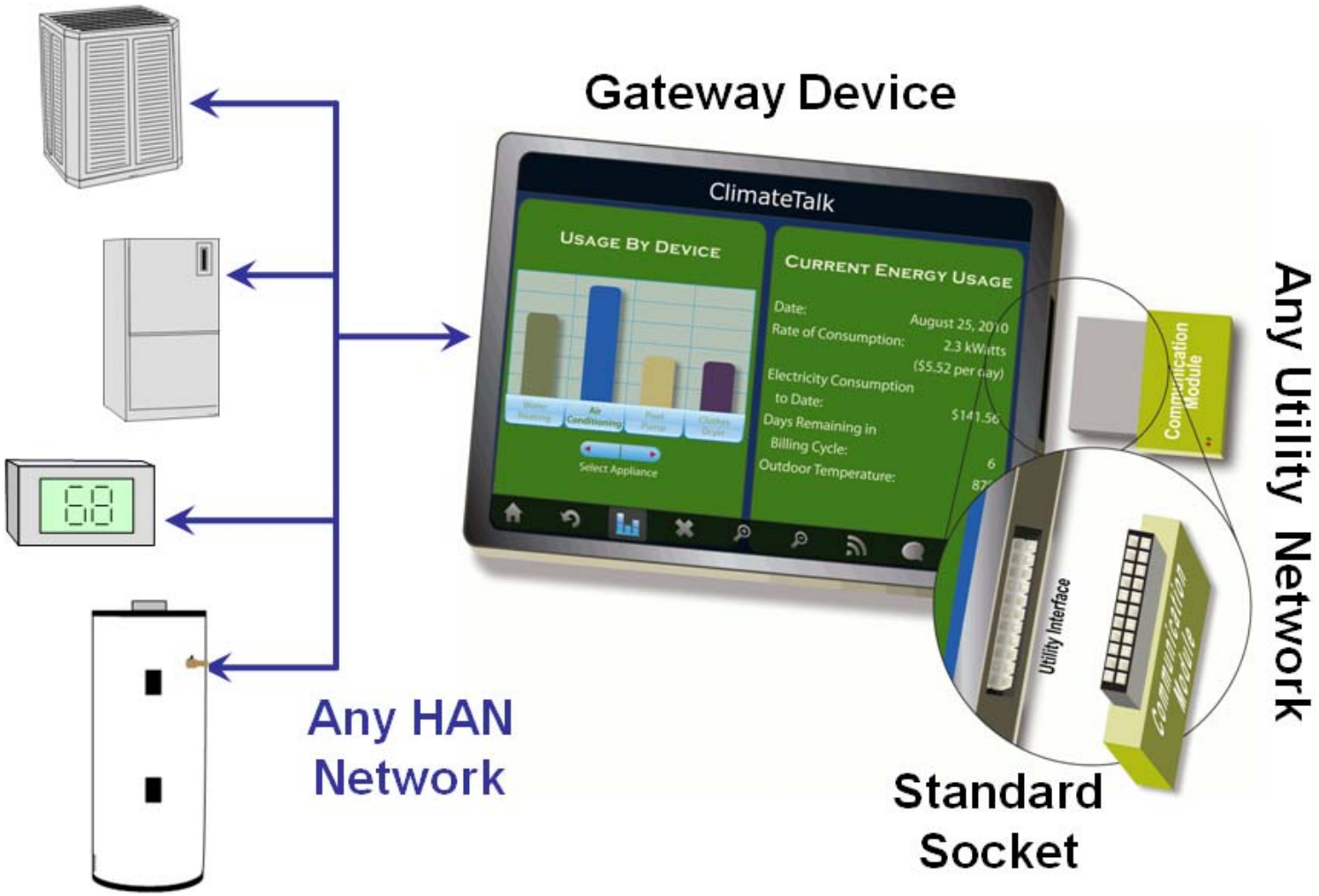
Indispensible Characteristics

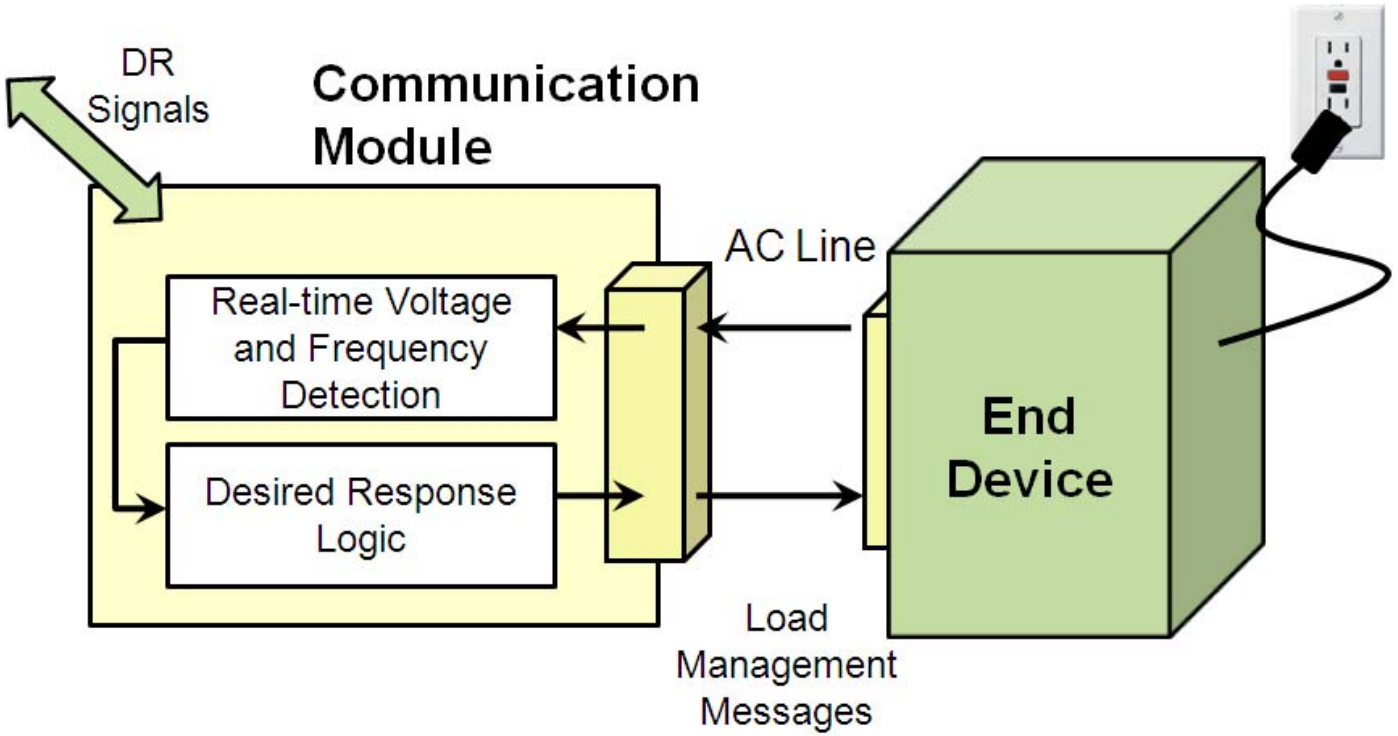
- A uniform open standard
  - An appliance works with any comm module
  - A comm module works with any appliance
- Modules are homeowner installable, removable and replaceable at any time
- Intelligently informs the appliance, does not cut off its power
- Low cost impact upfront, cost is incurred only when actually utilized
- Simple for the most limited of devices, yet extensible
- Communication systems can evolve without obsoleting the end device



Architectural Flexibility: Gateway Concept



Housing Additional Logic

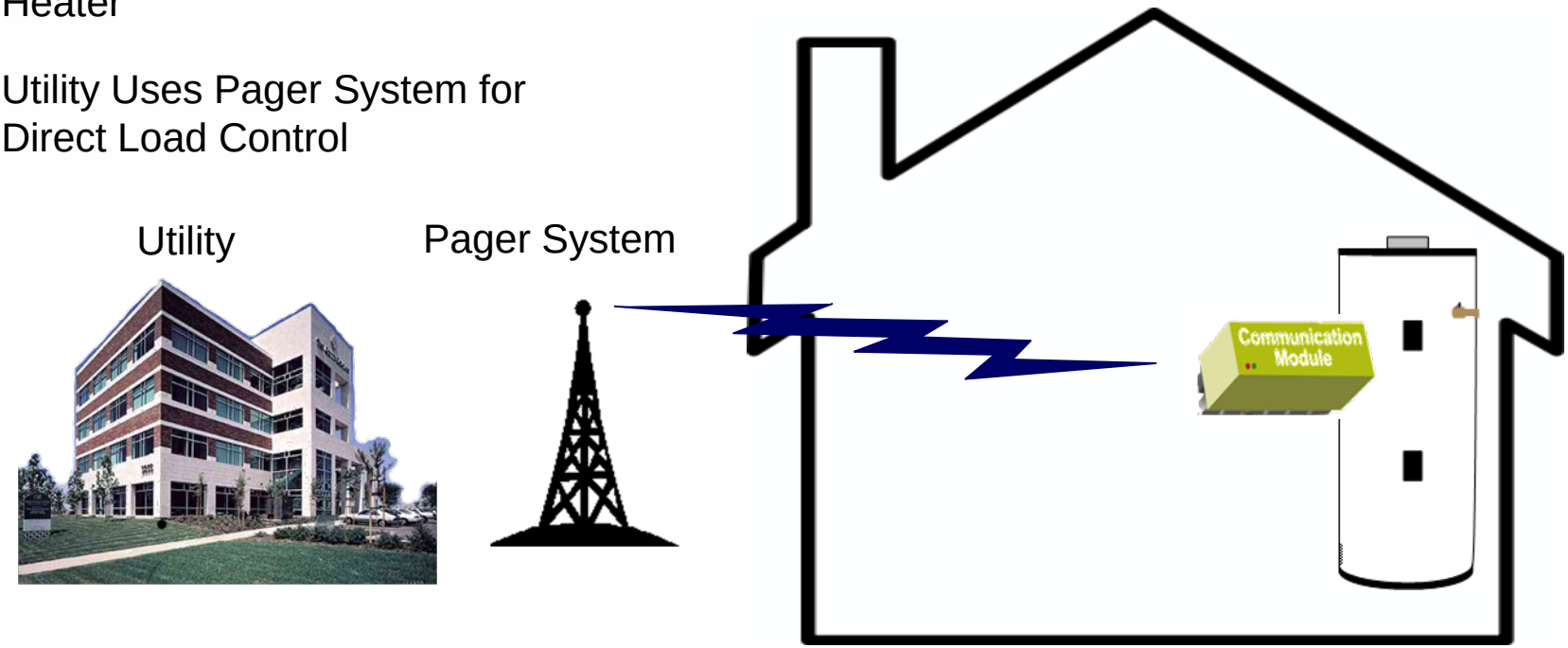


Modules Can House Regional / Utility-Specific Logic:

- Event Randomization
- Power Quality
- Target Cycling Reduction
- Etc.

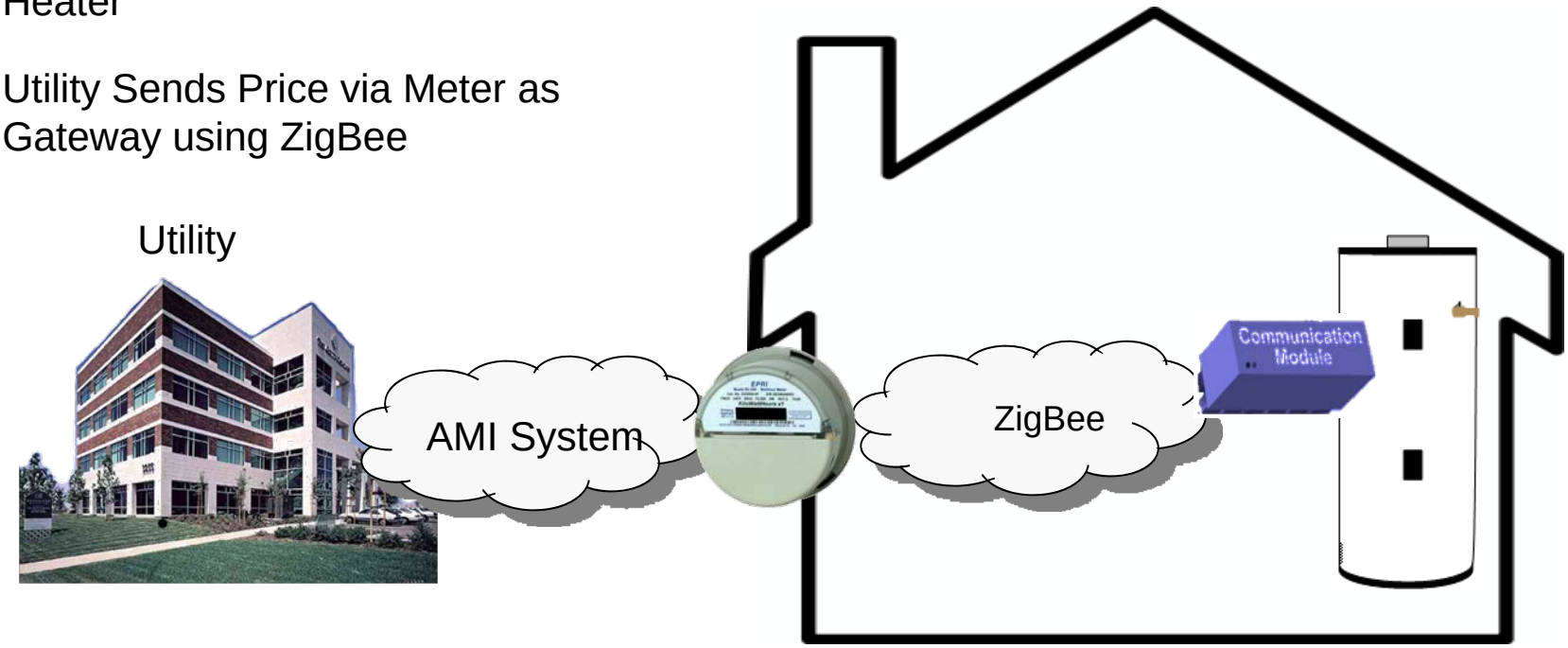
Application Example 1

- Homeowner Wants to Participate in a LC Program with a Water Heater
- Utility Uses Pager System for Direct Load Control



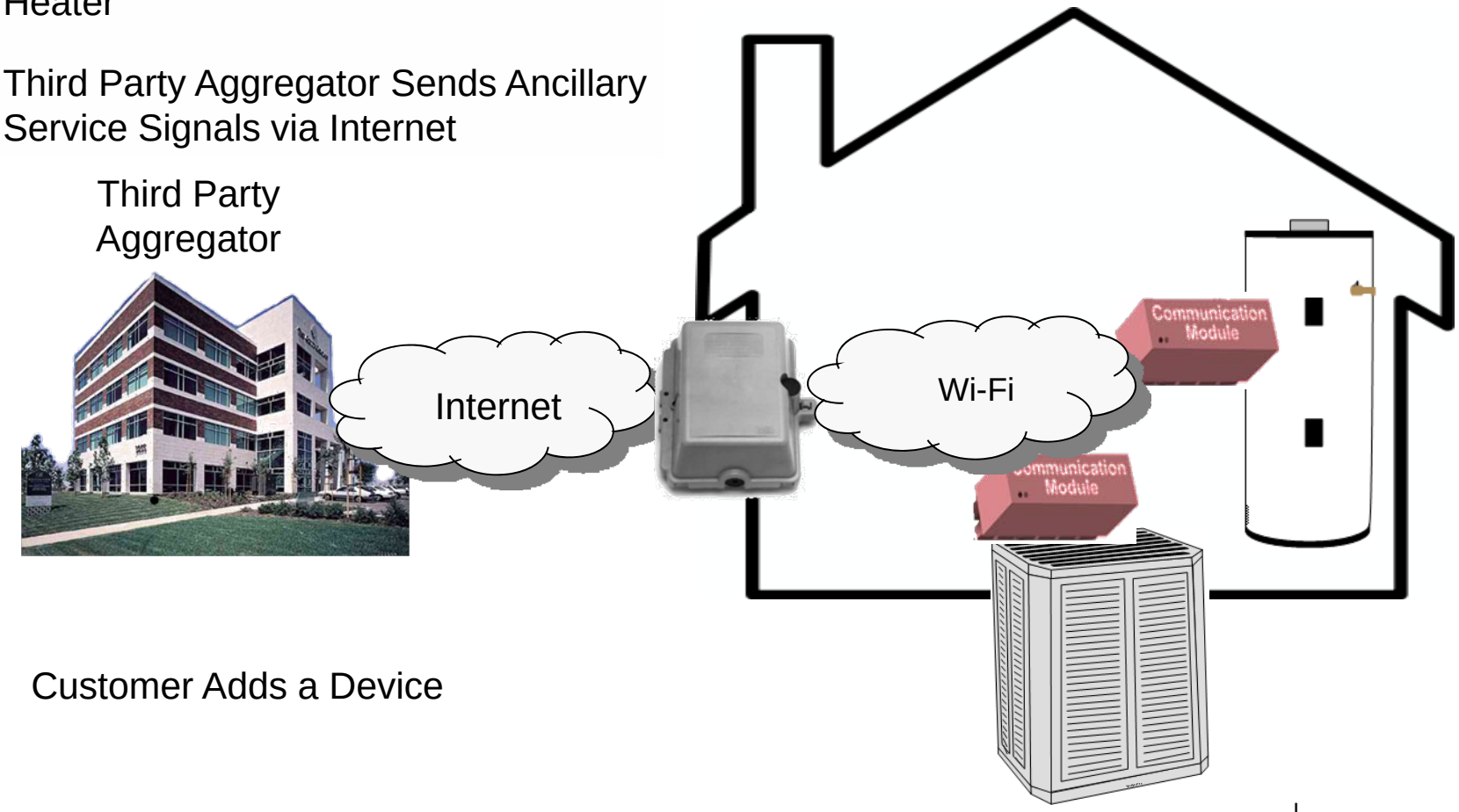
Application Example 2

- Homeowner Wants to Participate in a Rate Plan with a Water Heater
- Utility Sends Price via Meter as Gateway using ZigBee



Application Example 3

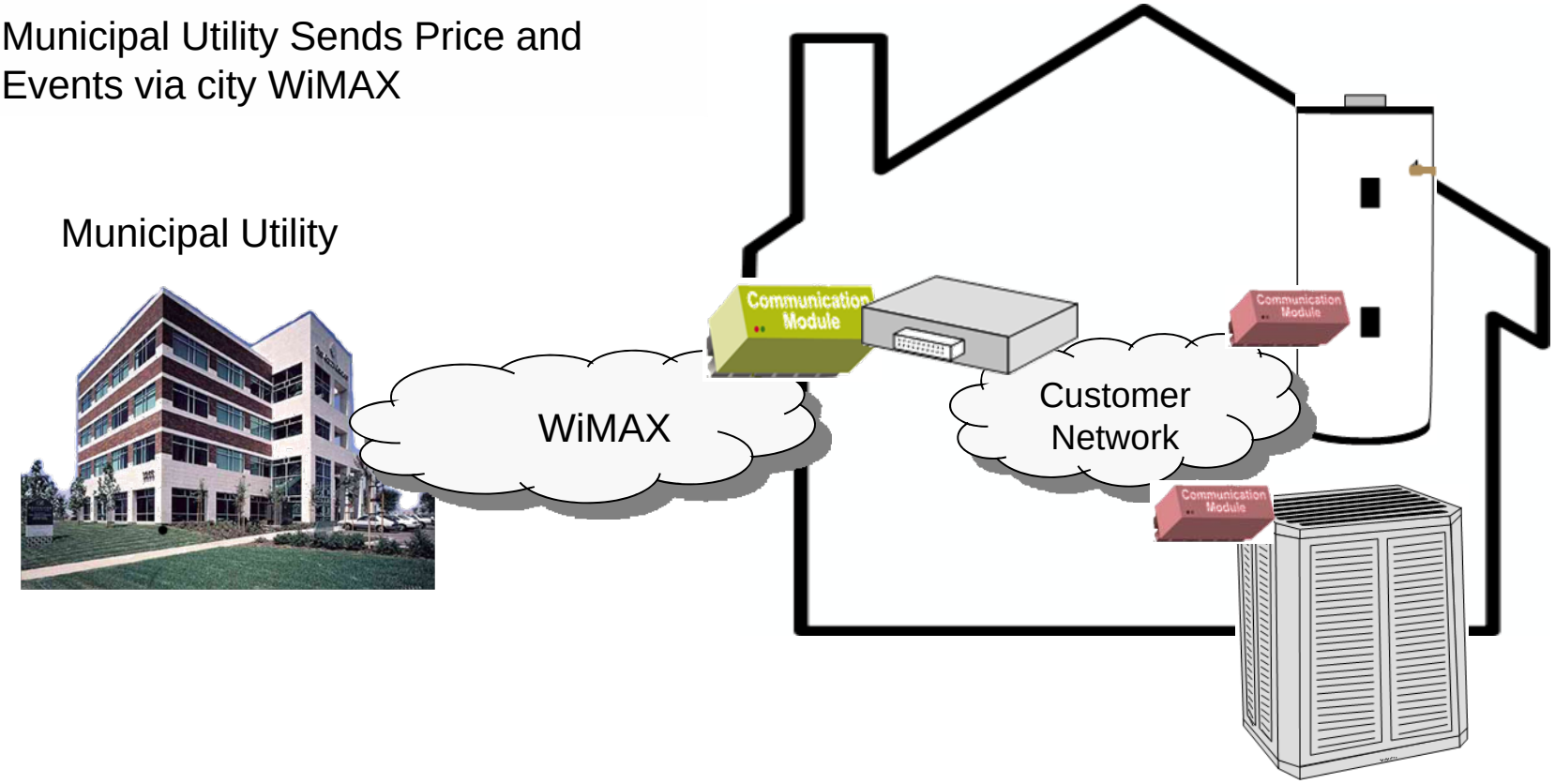
- Homeowner Wants to Participate in an Ancillary Service market with a Water Heater
- Third Party Aggregator Sends Ancillary Service Signals via Internet



- Customer Adds a Device

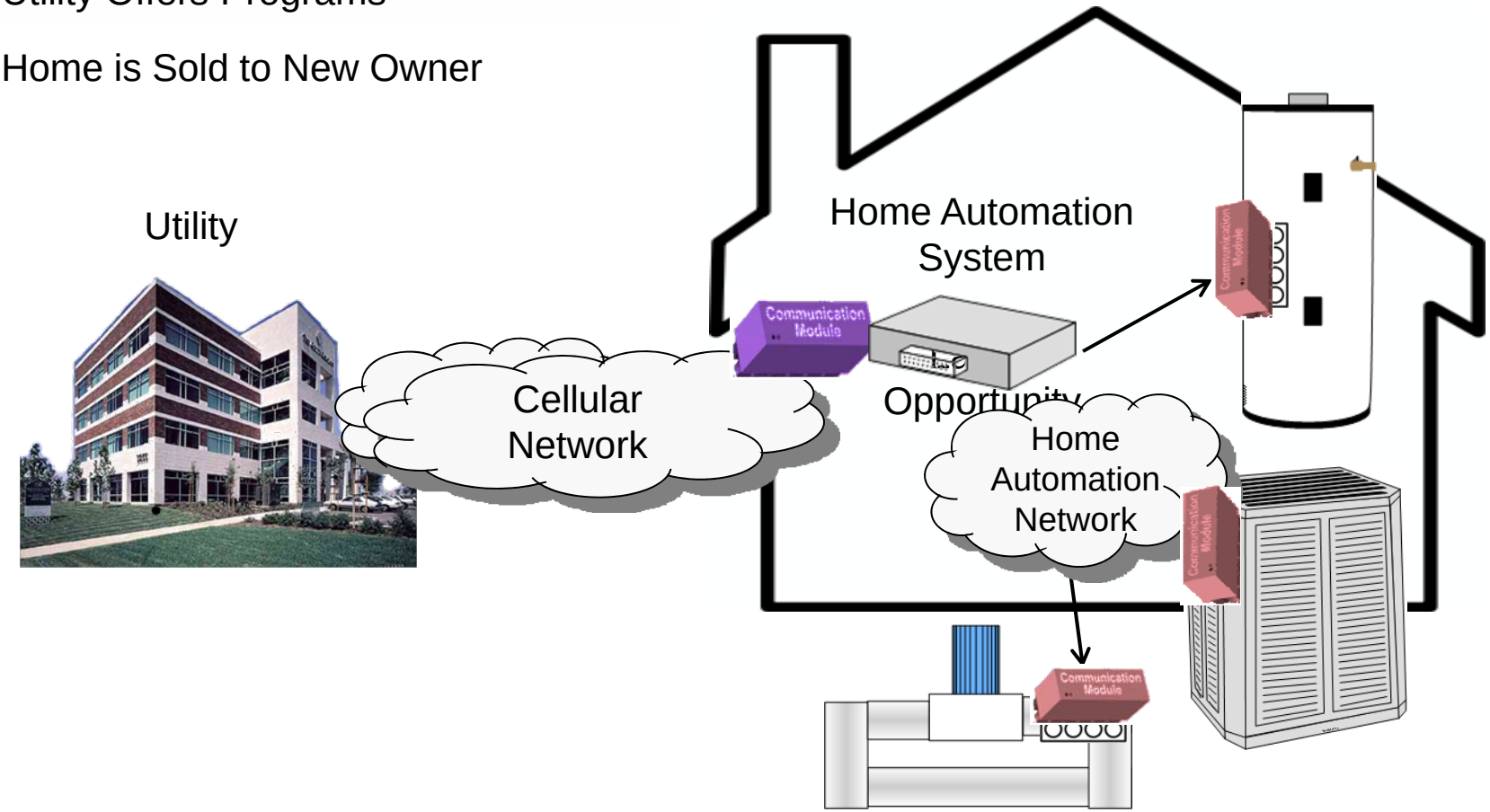
Application Example 4

- Customer Chooses to Use an Energy Management Console
- Municipal Utility Sends Price and Events via city WiMAX



Application Example 5

- Homeowner is Not Interested
- Utility Offers Programs
- Home is Sold to New Owner



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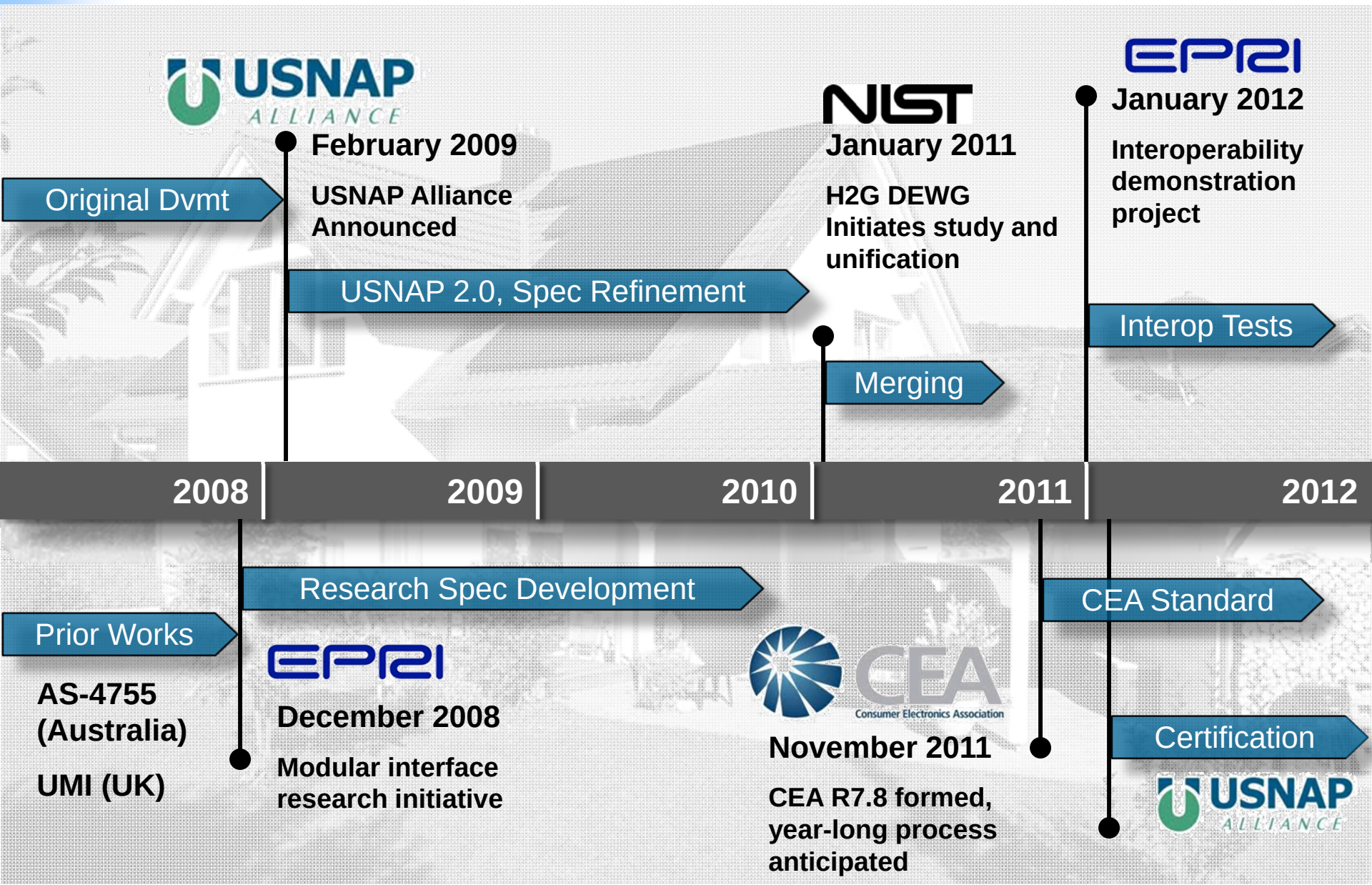
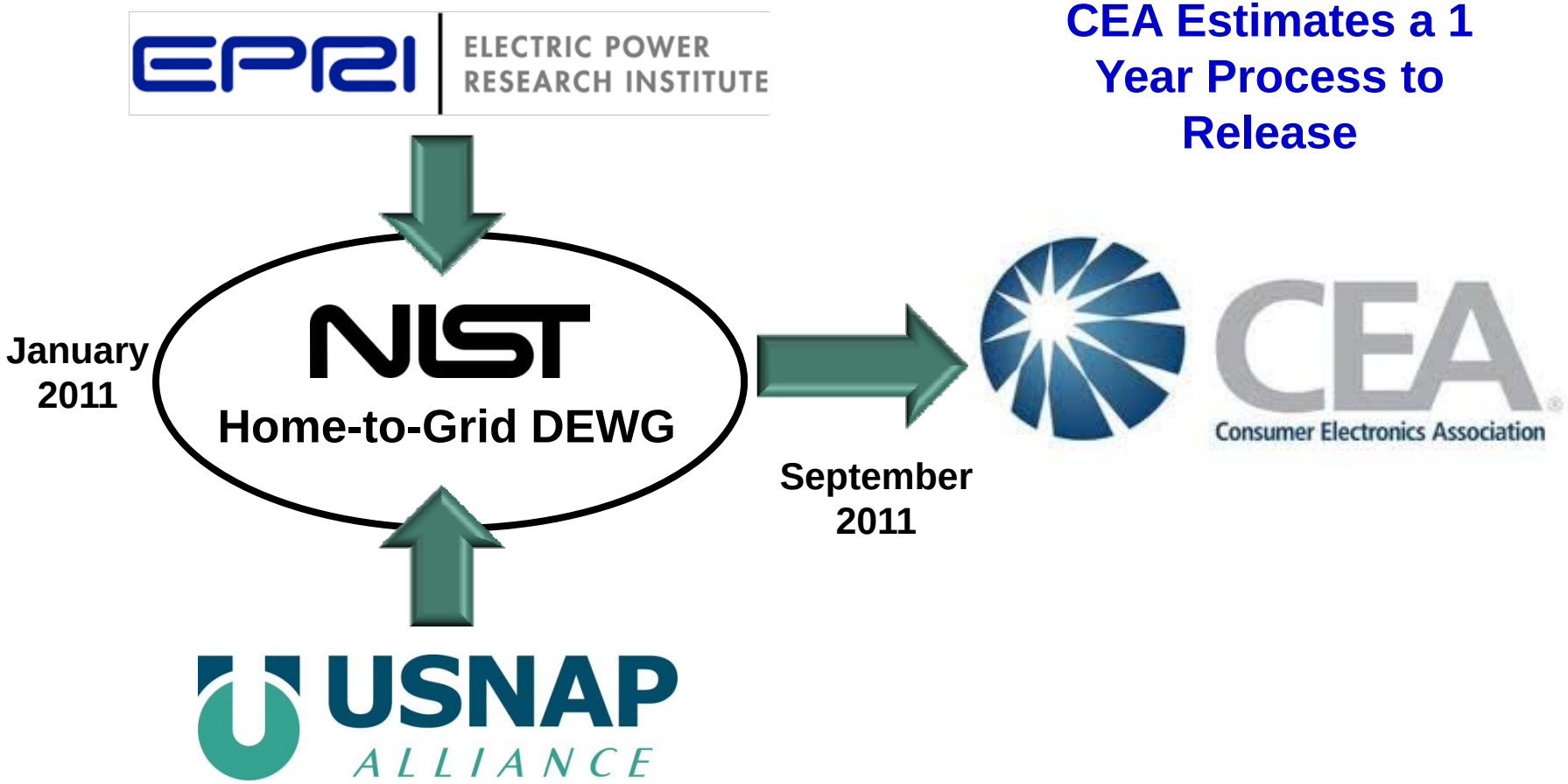
Modular Interface Development Timeline



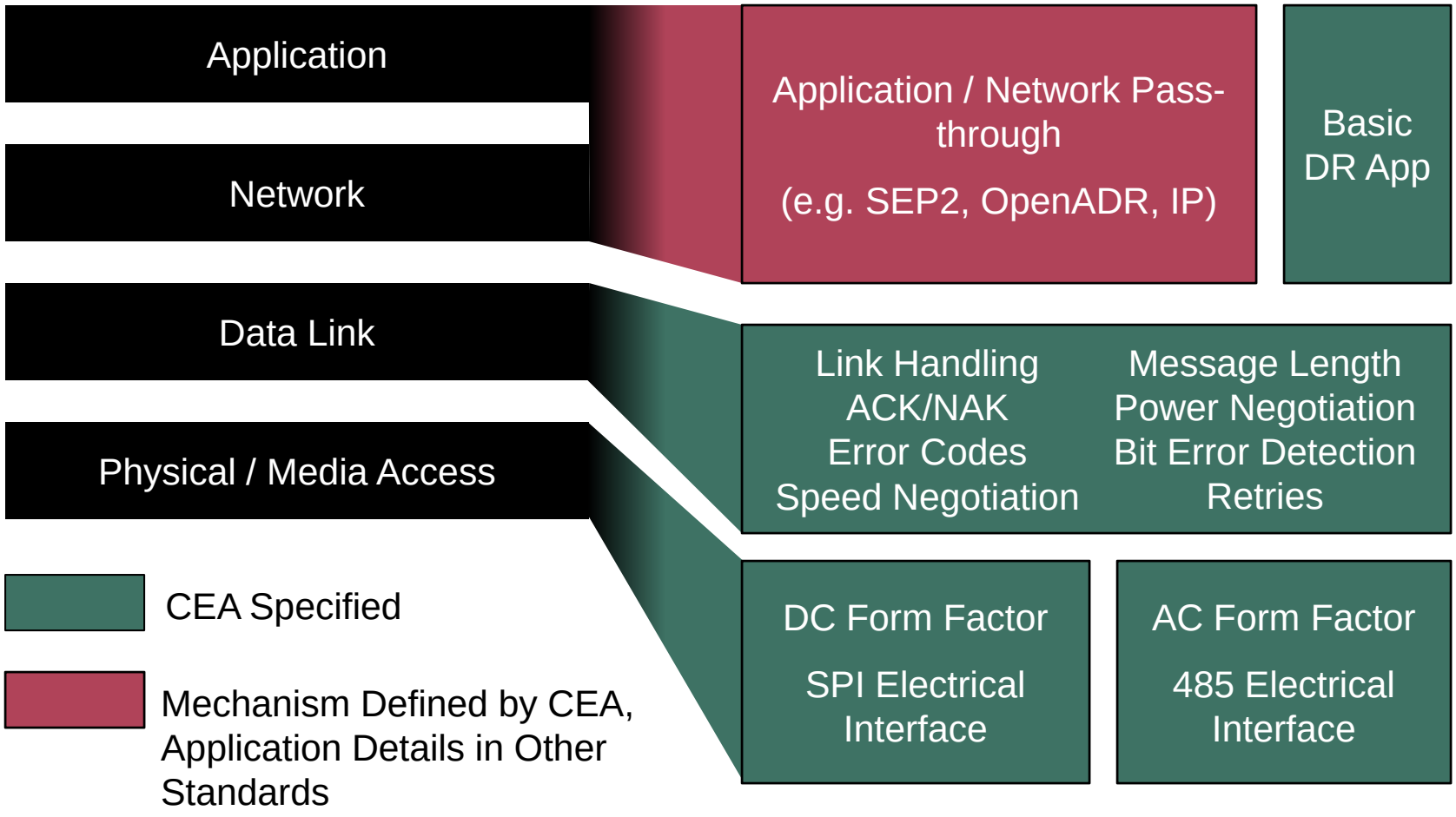
Consumer Electronics Association Standard ANSI/CEA-2045



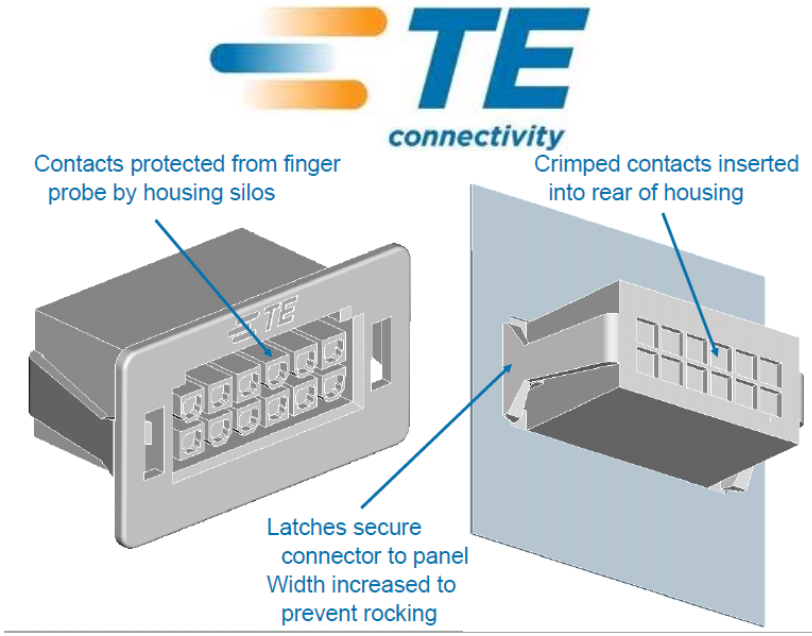
Specification Link

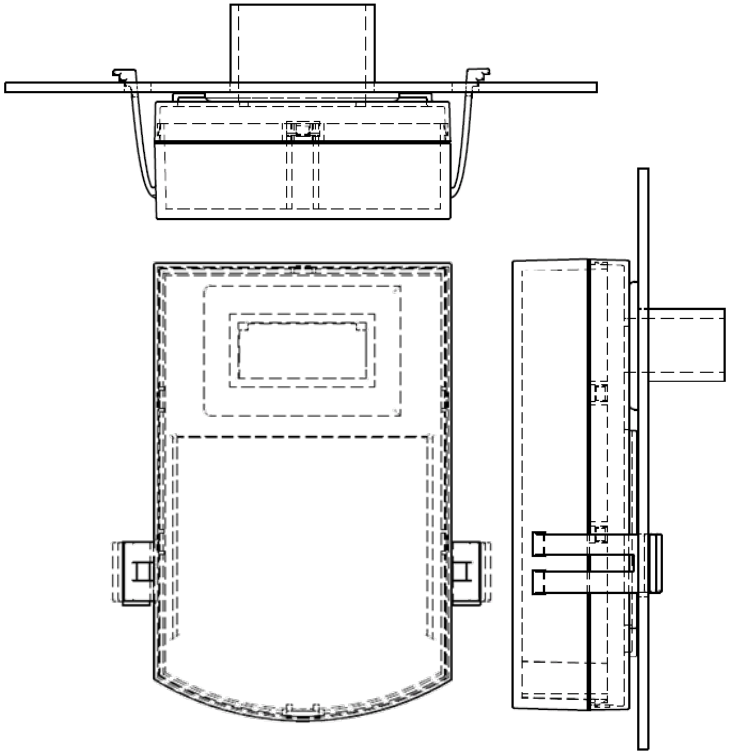
http://collaborate.nist.gov/twiki-sggrid/pub/SmartGrid/H2G/MCI-V2.pdf

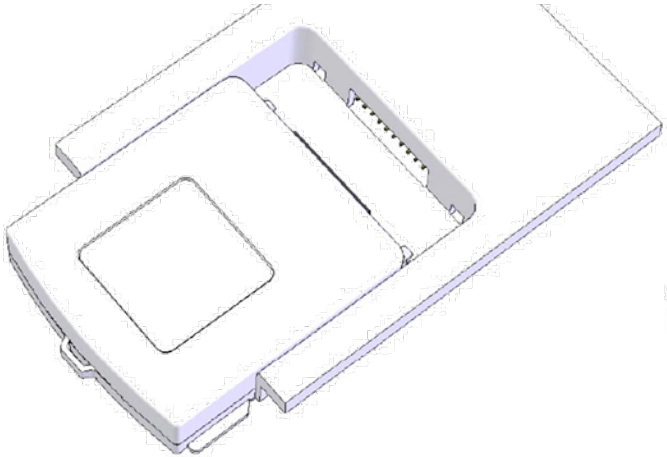
ANSI/CEA-2045 Interface Layers

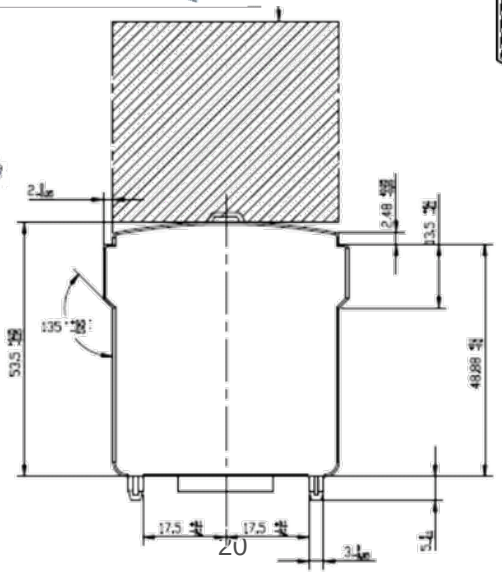


Physical Details









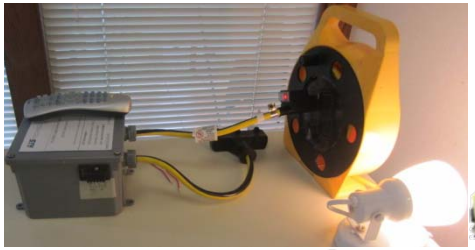
Challenges

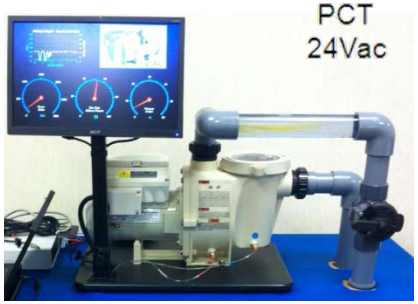
Incentive for Product Manufacturers: Upfront cost-adder is borne by the product manufacturer, and the benefits are realized by the consumer and the grid at a later time.

Chicken and Egg Dilemma: Build a socketed consumer device when there are no modules? Build a module when there are no consumer devices?

DR Program Redesign: Smart, communicating devices would notionally have variable responses (consumer preferences, override) and would honor consumer privacy. How then to value their contribution?

Ongoing Interoperability Workshops





Communication Module

VHF Wireless

Communication Module

FM Radio

Communication Module

900MHz Mesh AMI

Communication Module

900MHz Tower/Star AMI

Communication Module

Voltage Sense

Communication Module

Wi-Fi

Communications PC Simulator

End Device PC Simulator

All Communication Modules Work with All End Devices

HAN Gateway

Pool Pump

PCT 24Vac

30A Load Switch

EVSE

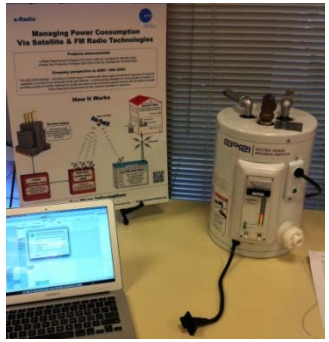
Water Heater

Water Heater

HVAC Unit

PCT

HVAC



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Continued Activity in the USNAP Alliance

- During standardization in CEA R7.8, USNAP continues the establishment of the certification program
- USNAP Alliance to be recognized by NIST as an Interoperability Certification & Testing Authority (ITCA)
- USNAP Alliance developing compliance and certification program including a harmonized test tool

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USNAP Moving Forward

- Non-profit mutual benefit corp (501(c)6)
- 40+ Members
- Member dues only – no license/royalty fees
- Focus:
  - Brand Awareness
  - Marketing
  - Conformance
- Product certification & branding

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How to Get Involved

Participate in the CEA Standards Process:

- Join the R7.8 (part of the Home Networks Committee)

Join the USNAP Alliance:

- The certification and testing organization per the CEA standard

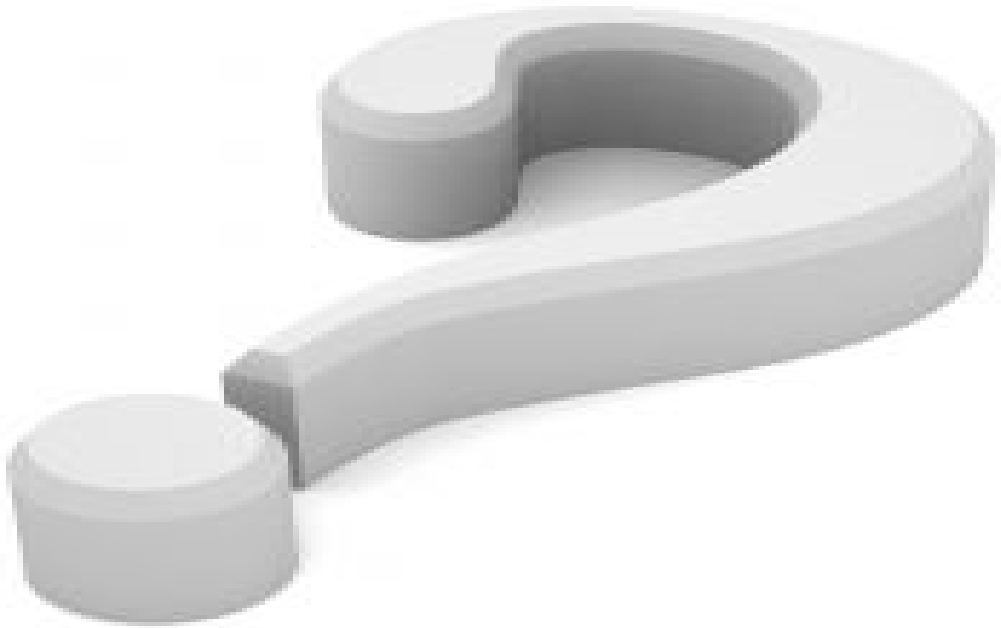
Participate in the EPRI Interoperability Workshops / Demonstration Project:

- Verify that the functional needs of your technology and DR programs are supported
- Have your technology involved early in interoperability workshops
- Provide the CEA with valuable input based on build/test findings

Project Description:

www.epri.com, search for: 1023136

Discussion



Reference Material:

Reflecting on a Modular Communication Interface Relative to National Smart Grid Goals

NSTC: "A Policy Framework for the 21st Century Grid: Enabling Our Secure Energy Future"

Calls on NIST and FERC to ensure that the following benefits are realized:

- **Today's investments in the Smart Grid remain valuable in the future**. Standards can ensure that smart grid investments made today will be compatible with advancing technology.

- **Innovation is catalyzed**. Shared standards and protocols help reduce investment uncertainty by assuring that new technologies can be used throughout the grid, lowering transaction costs and increasing compatibility. Standards also encourage entrepreneurs by enabling a significant market for their work

- **Consumer choice is supported**. Open standards.. can alleviate concerns that companies may attempt to "lock-in" consumers by using proprietary technologies that make their products (and, therefore, their consumers' assets) incompatible with other suppliers' products or services

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NSTC: "A Policy Framework for the 21st Century Grid: Enabling Our Secure Energy Future" (continued)

- **Costs are reduced**. Standards can.. create economies of scale, providing consumers greater choice and lower costs

- **Best practices are highlighted** as utilities face new and difficult choices. Standards can provide guidance to utilities as they face novel cybersecurity, interoperability, and privacy concerns; and

- **Global markets are opened**. Development of international Smart Grid interoperability standards can helps to open global markets, create export opportunities for U.S. companies, and achieve greater economies of scale and vendor competition that will result in lower costs for utilities and ultimately consumers.

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NIST Interoperability Framework 2.0
Architectural Goals of the Smart Grid

Options – Should support a broad range of technology options— both legacy and new. Architectures should be flexible enough to incorporate evolving technologies as well as to work with legacy applications…

Interoperability – Must support interfacing with other systems. This includes the integration of interoperable third-party products into the management and cybersecurity infrastructures.

Maintainability – Should support the ability of systems to be safely, securely, and reliably maintained throughout their lifecycle.

Upgradeability – Should support the ability of systems to be enhanced without difficulty and to remain operational during periods of partial system upgrades.

Innovation – Should enable and foster innovation...

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NIST Interoperability Framework 2.0
Architectural Goals of the Smart Grid

Scalability – Should include architectural elements that are appropriate for the applications that reside within the architecture…

Legacy – Should support legacy system integration and migration.

Security – Should support the capability to resist unwanted intrusion, both physical and cyber. This support must satisfy all security requirements of the system components. (This is covered in more detail in Chapter 6 of this document).

Flexibility – Should allow an implementer to choose the type and order of implementation and to choose which parts of the architecture to implement without incurring penalties for selecting a different implementation.

Governance – Should promote a well-managed system of systems that will operate for its entire life cycle with routine maintenance.

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Together…Shaping the Future of Electricity