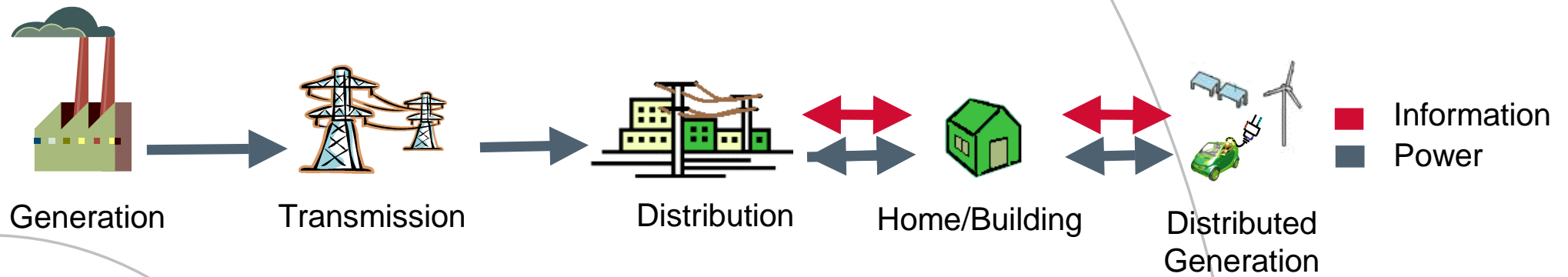


# ZigBee Application in Energy Space

Anthony Lai, Zigbee Alliance  
alai@ember.com

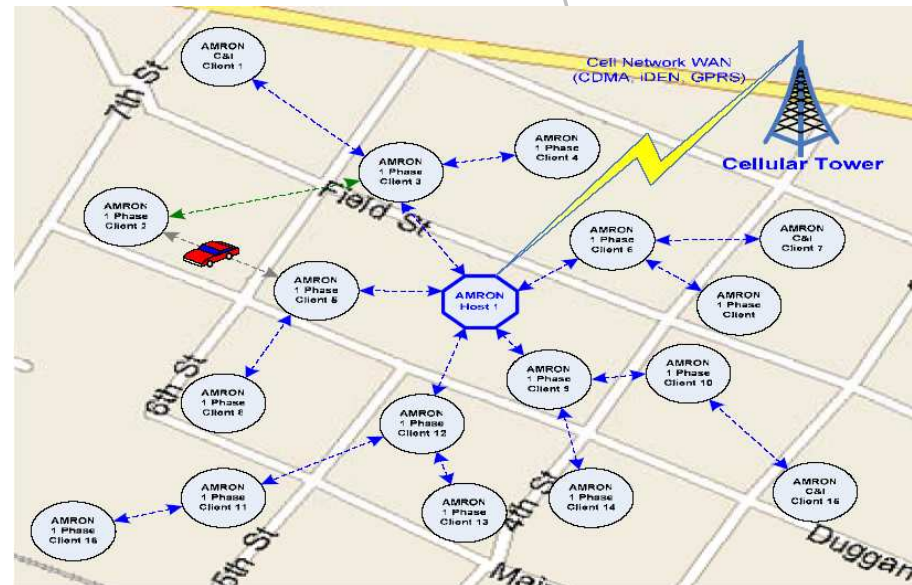
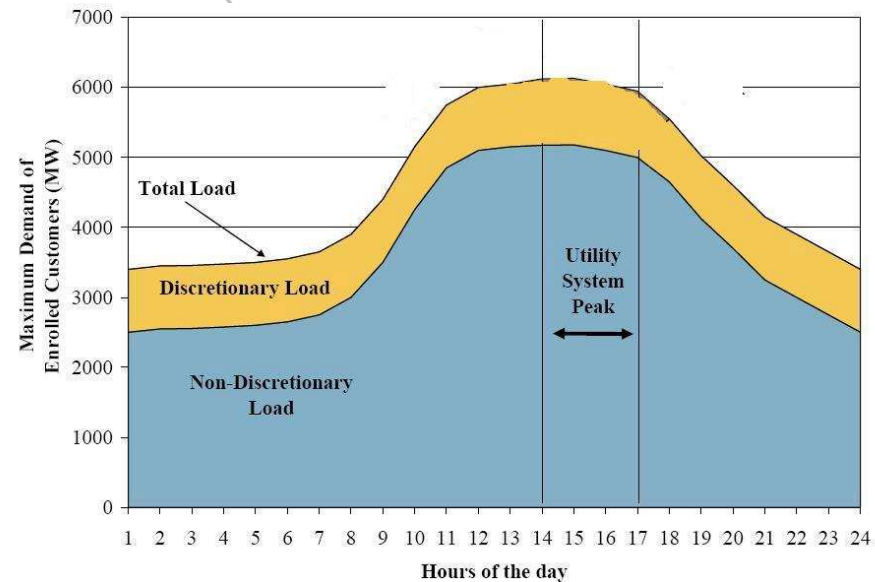


# The Power Grid



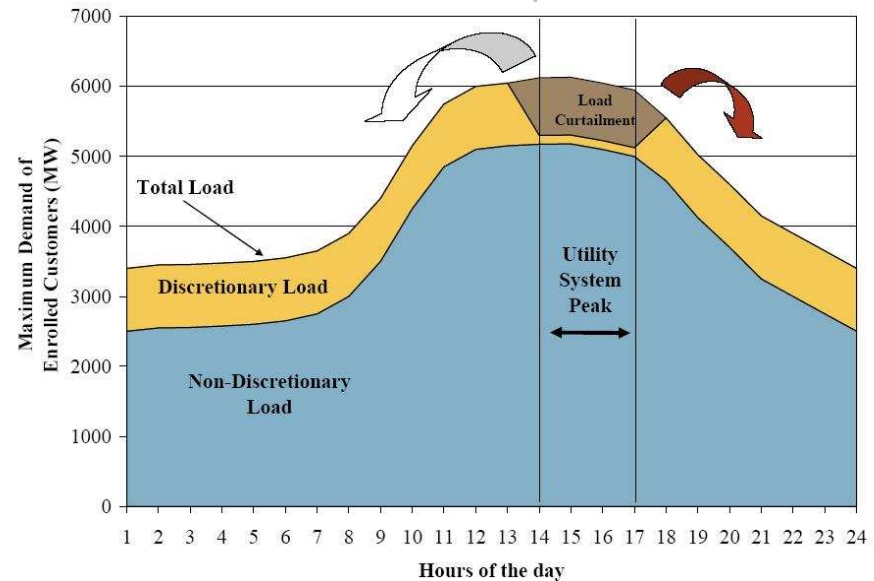
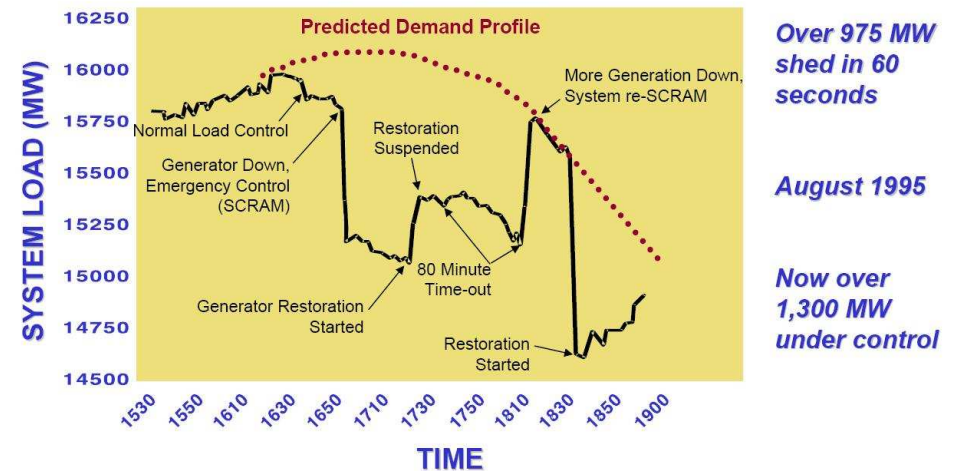
# 1. Power consumption forecasting

- Find out power usage pattern of a district
- Data can be used for power supply & infrastructure planning



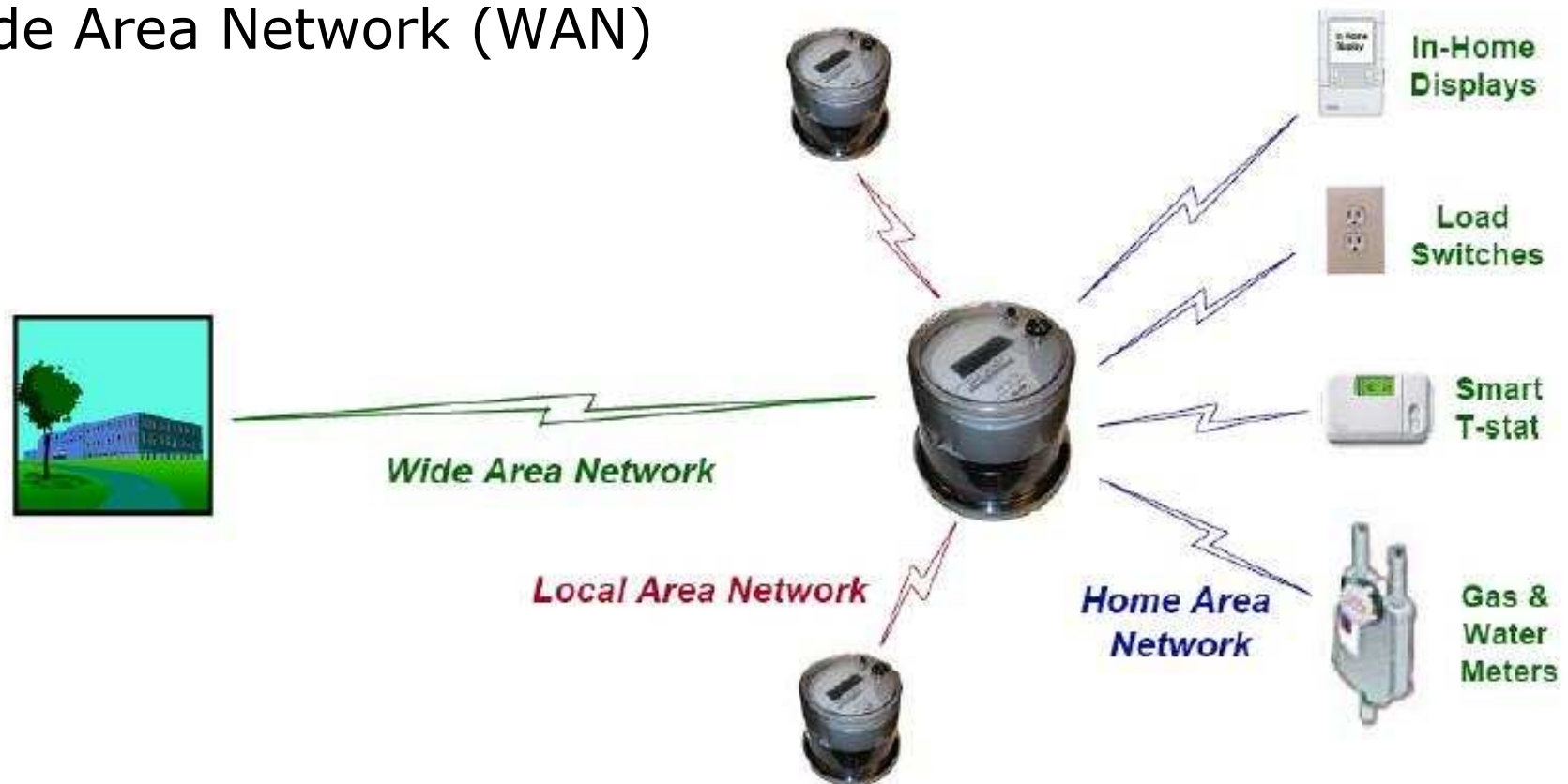
## 2. Demand Side Management

- Allow proactive prevention of potential problems
- Increase flexibility in business model
  - Prepayment systems
  - Time-based rates



# Components of AMI / AMR

- Home Area Network (HAN)
- Local Area Network (LAN)
- Wide Area Network (WAN)



# Requirement

- Secure
- Reliable
- Easy deployment and maintenance
- Open standards with multiple vendors
- Cost effective

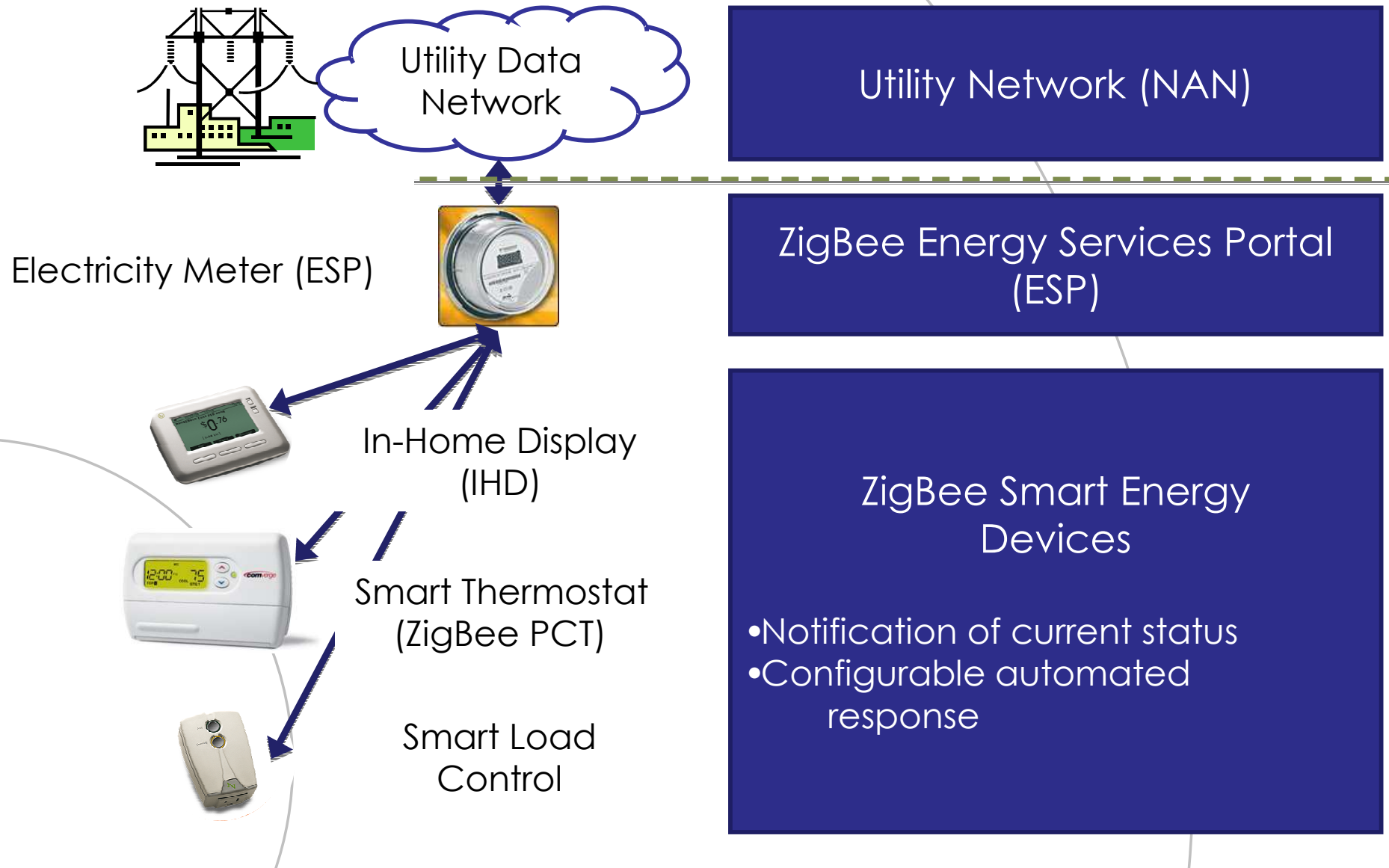
# ZigBee Smart Energy

Market Overview and Status

## Contents

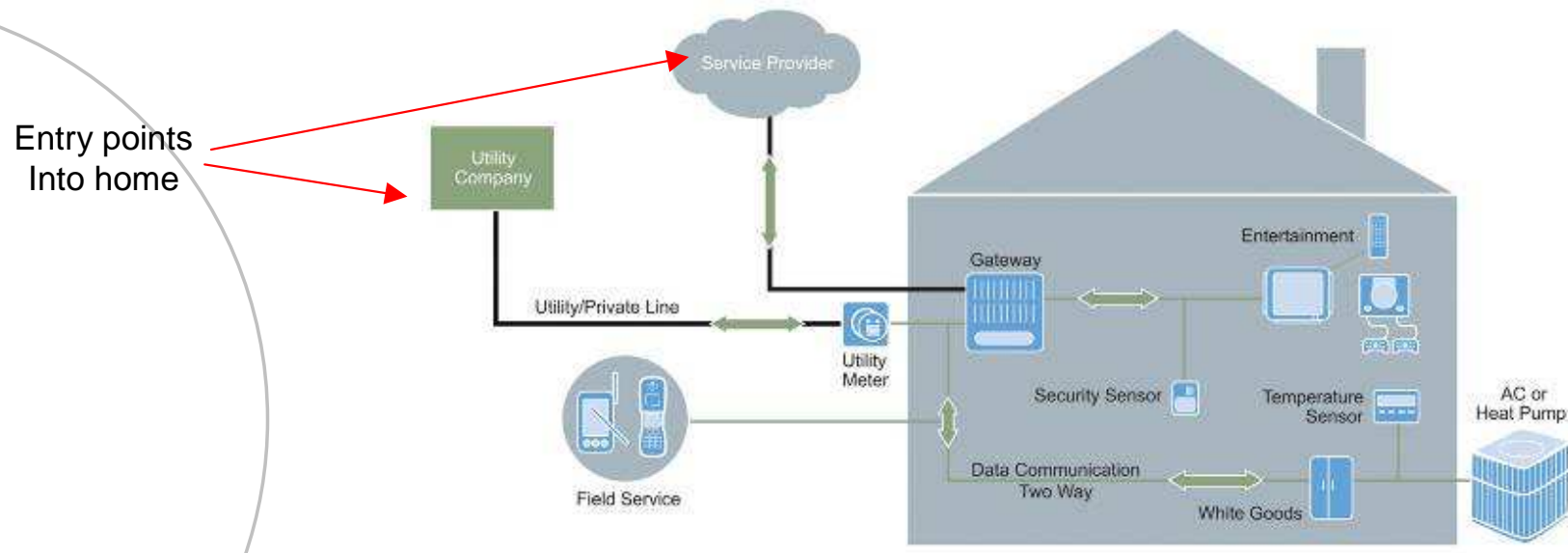
- Smart Energy Basics
- Current Status
- Future Plans

# ZigBee Smart Energy Architecture



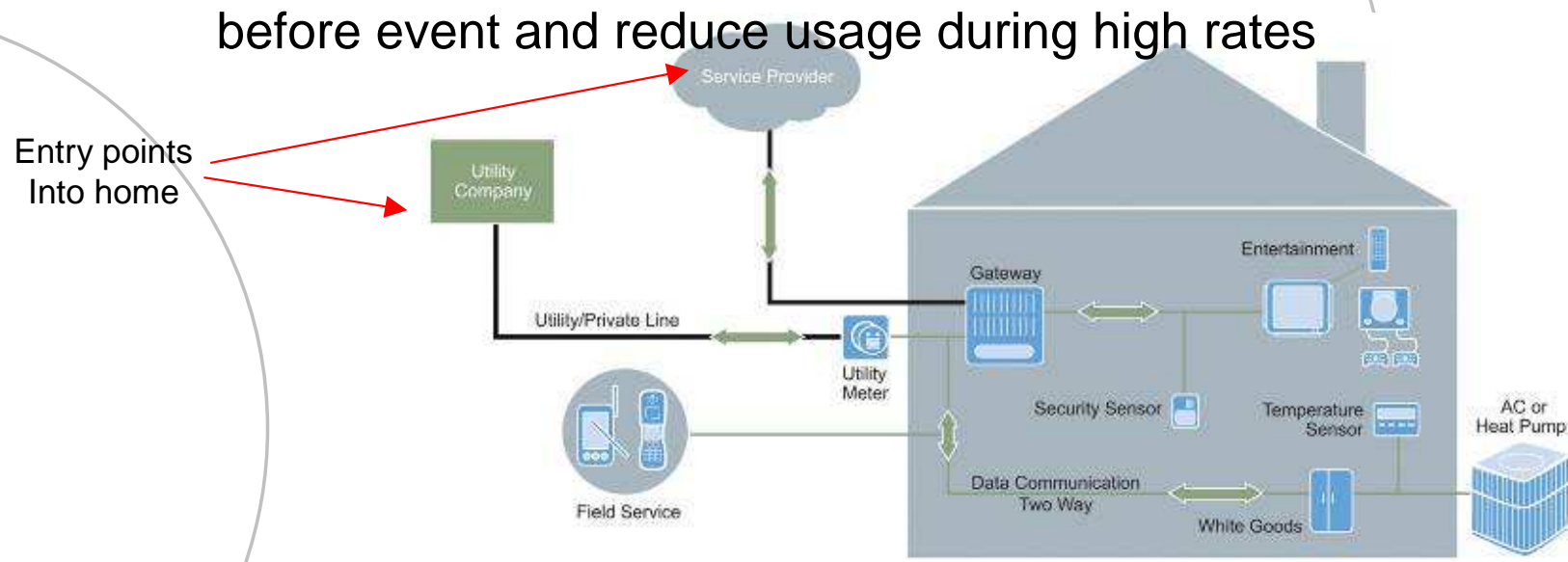
# ZigBee Smart Energy Use Cases

- **User gets instant read of consumption data**
  - User request meter read via a In-Home Display, Set Top Box or PC
  - Request is sent to the meter and responds with information requested
  - User turns on device and sees change in meter data
    - Results in association of cost of operation per device



# ZigBee Smart Energy Use Cases

- **User Programs devices to automatically respond to utility price signals or allows utility direct access**
  - Price signal is sent from utility over their network to the meter
  - Meter sends the message out over the ZigBee network
  - Devices receive the message and automatically react
    - Dishwasher schedules start to correspond with best rates
    - Pool pumps schedule filter cycle for best rates
    - Comfort points (heating, etc) change set point to pre-heat/cool before event and reduce usage during high rates



# SE Devices

## Infrastructure Devices

Energy Services Portal (ESP)

Range Extender Device

Metering Device

## User Interaction Devices

In-Premise Display

Prepayment Terminal Device

## Control Devices

Programmable Communicating  
Thermostat (PCT)

Load Control Device

Smart Appliance Device

- Example: Smart Thermostat can be PCT and IPD



# SE Current Status



## Google Map of Smart Metering Programs across the World as of January 2010

(Maintained by the Energy Retailers Association, UK)

Smart meters in the world will jump from 76 million [in 2009]  
to 212 million in 2014.

(estimated by ABI Research).

# USA

- Part of US Smart Grid Stimulus Package
  - 3.4B USD Government Grant for improving US Smart Grid
  - Zigbee SE Profile is chosen as standard in HAN
- 8.3 Million Zigbee Meters deployed in 2009
- 40 Million meters in committed programs
- Installing 20-25k Zigbee Meters / day

<b>California</b>	
PG&E	deploying 6ku per day, 5m by 2012
SDG&E	deploying 2ku per day, 2.4m by 2012
So. Cal Edison	deployment started in September 2009, 5.3m meters by 2012 (170k as of Jan 2010)
<b>Texas</b>	
Centerpoint	\$200m in stimulus funds for 2.2m smart meters
Oncor	deploying now, 3m by 2012

# UK Smart Metering

- EU Directive
- UK Government mandate
  - 95% of homes deployed by 2020
- Department of Energy and Climate Change (DECC)
  - Consultation process on WAN and HAN
    - GPRS WAN, ZigBee well placed for HAN
  - Official roll-out to start by 2012/2013
- Some are not going to wait

# British Gas Smart Meter Rollout

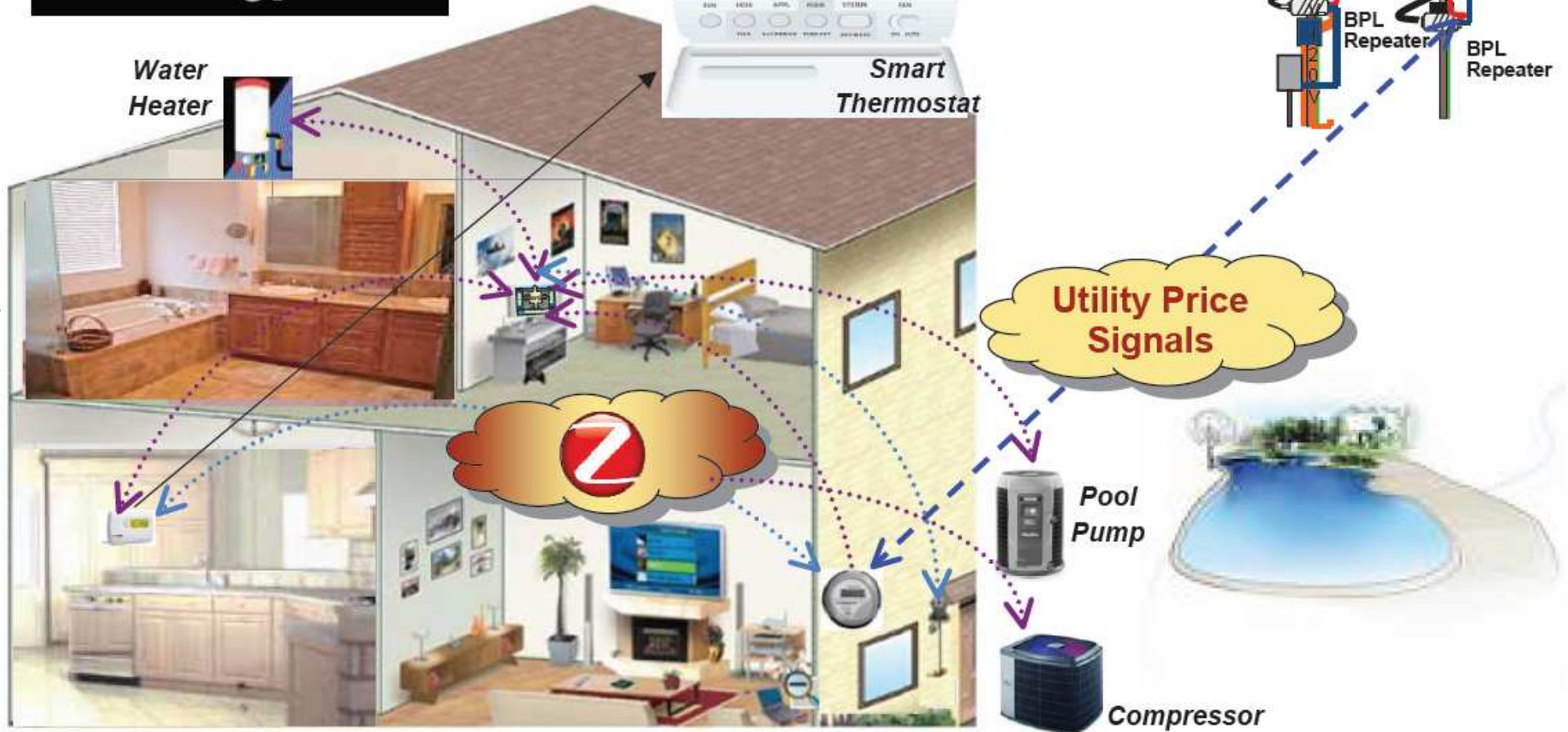
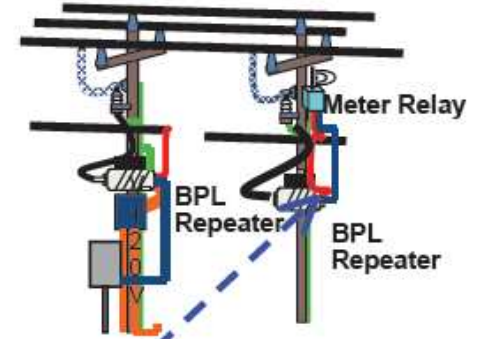
- Replace 47 Million gas and electric meters
  - 50k trial meters installed in 2009
  - Planned 2H 2010 start -> 2020 complete
  - Announced hiring 2,600 installation engineers
- Committed to ZigBee for HAN

# Australia

- Victoria
  - Mandatory rollout beginning Q1 2009;
  - ZigBee SE profile required for HAN, deployed 100k Meters
  - 3M Meters by 2012
- New South Wales
  - Pilot sites by Energy Australia & Integral Energy
- Queensland
  - Deploying pilot systems

# SE Case Studies

# Centerpoint Energy Vision



# Pepco Holdings Inc.

- Demand Response program expected to save 200MWs
- Uses VHF to ZigBee bridge compatible with their existing system with full AMI upgrade path using ZigBee



– Bridge relays VHF messages to ZigBee Programmable Communicating Thermostat (PCT)

– ZigBee In-Home Display Manages energy usage in near real time

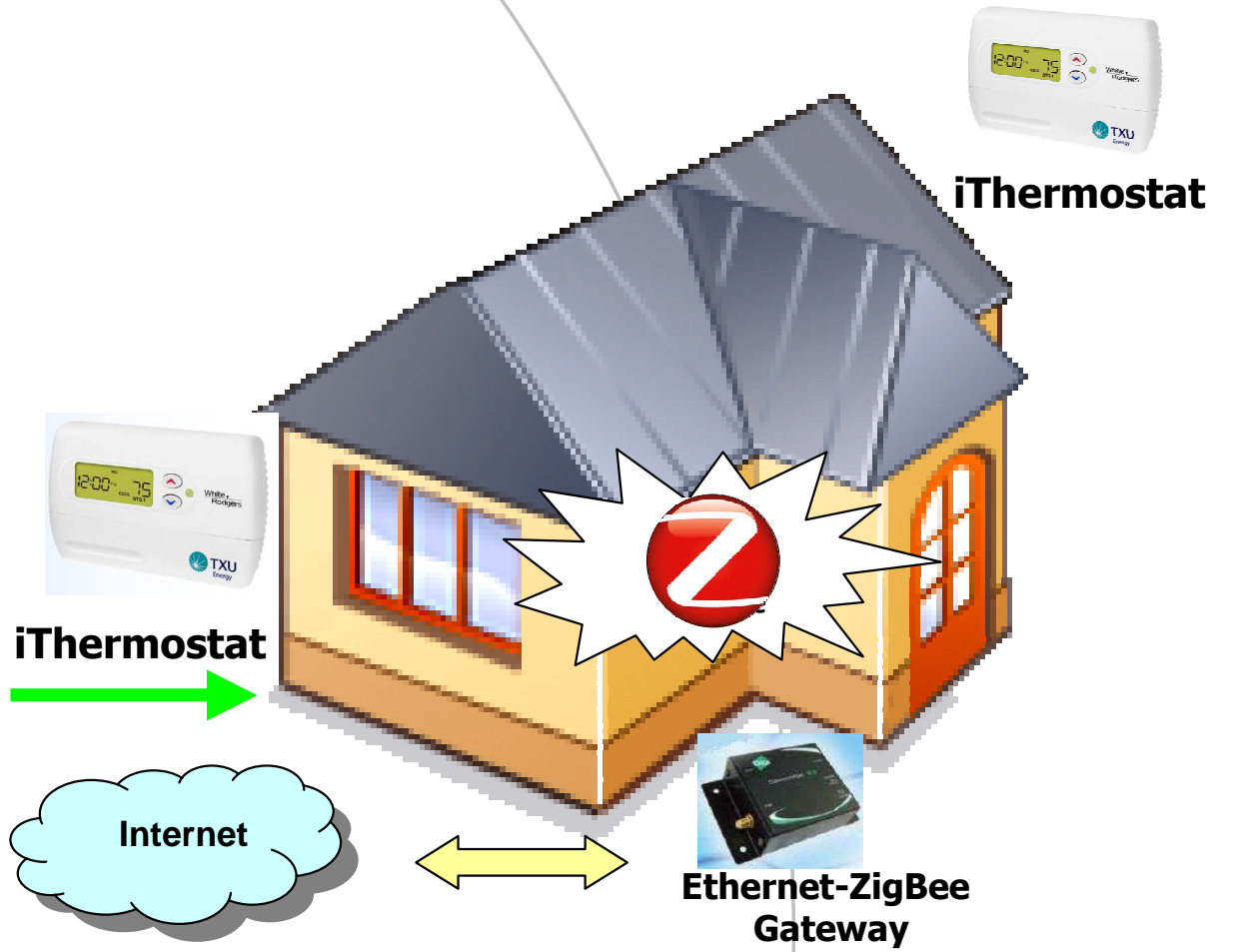
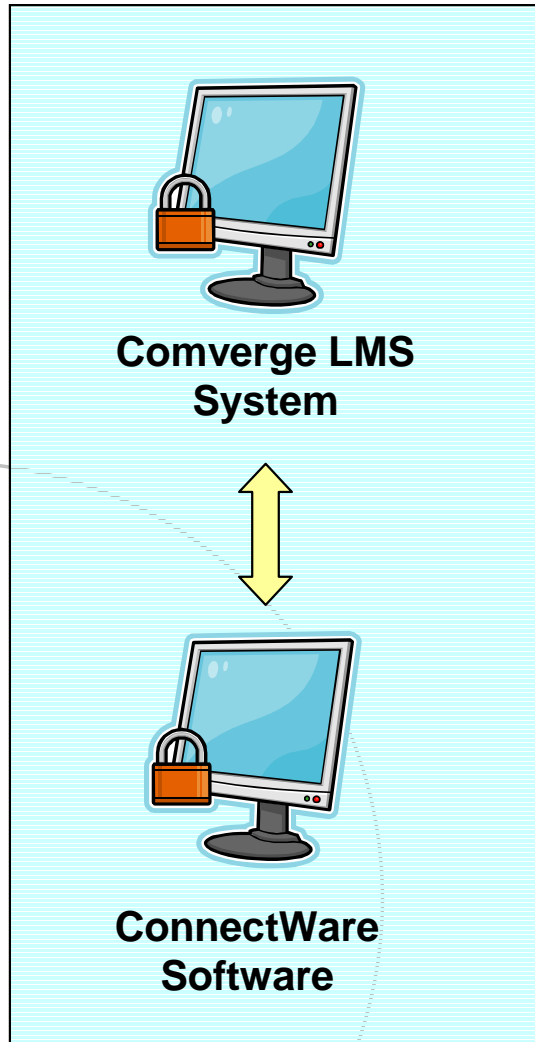


# TXU Energy Broadband Project

- ZigBee enabled thermostats and gateways
  - Active program launched in June 2008
  - Self installation by home owner
    - Plug and Play
- Integrates ZigBee technology into home area networks
- Internet based demand response program



# TXU System Architecture



# TXU Energy iThermostat Website



TXU Energy iThermostat™

Questions about iThermostat? Call us at 1-866-733-1807

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[Program Details](#)

[FAQs](#)

[Installation](#)

[Energy Tips](#)

[Enroll ▶](#)



At home, from the office, or on the road...  
manage your home's heating & cooling from virtually anywhere.

The new web-enabled TXU Energy iThermostat™ lets you manage your home's energy usage, save money and help the environment from virtually any computer.

[Learn More ▶](#)

## Features & Benefits

[Click here to Watch Video](#)



Home, work or on the road, manage your home's air conditioning use - anytime, anywhere - from any Internet-connected device.

[Learn more ▶](#)

## Installation

[Click here to Watch Video](#)



Learn how to install your iThermostat and gateway device.

[Learn more ▶](#)

## iThermostat Virtual Tour

[Take the Virtual Tour](#)



See a demonstration of the powerful capabilities of the TXU Energy iThermostat.

## iThermostat Log In

Already participating in the Energy Conservation Program at TXU Energy?

Login below to access your energy management console:

Email Address:

Password:

[Log In](#)



# SE Future plans

# Smart Energy Enhancements

- What is proposed:
  - Block Tariffs
  - Meter swap out/ InterPAN CBKE
  - Tunneling (for DLMS)
  - Price Ack
  - Device Diagnostics/Network Mgmt
  - Network Joining
  - Profile interop
  - OTA cluster
  - Prepayment (Europe and US)
- TRD completing letter ballot now
- Will hold schedule over features except for **OTA upgrade**

# Standardized OTA Upgrade

- Standard cluster for Application Bootloader
  - Standardize OTA messages and not image format
  - Agree on messages, attributes and over the air capabilities
  - Provide security of image through digital signature
  - Networks will need an upgrade manager to handle this functionality for devices in the network
- Utilities want this to ensure upgradeability of devices in the field
  - Concern is in home devices as meters are generally upgrades over backhaul network
  - Utilities want capability to upgrade SE 1.x devices to SE 2.0
- Bootloader requires in home devices to have external flash to hold images

# SE 2.0

- Upgrading for IP compatibility, compliance with US regulations being formed
- Requires review of stack, security and application
- Utilities also requiring SE 2.0 to fit within existing SE 1.0 devices
  - A consideration for the SE 2.0 design
  - Do not want to compromise design, however do not want to strand assets

# SE 2.0 Stack Efforts

- What is in it?
  - MAC – 15.4 2006 with MAC security
  - 6lowPAN packet format and fragmentation
  - 6lowPAN neighbor discovery and address assignment
  - ROLL routing
  - UDP messaging plus some ack mechanism
  - New App Interface (tokenized XML?)
- What is being worked on
  - Fragmentation above 6lowPAN for larger messages?
  - How ZCL runs over SE 2.0 (other profile support)
  - How to handle sleeping end devices?
  - Service discovery protocol