



 OCTOBER 8 & 9  DOWNEY, CA

ET Summit Fall 2018

COMMERCIAL + RESIDENTIAL BUILDINGS

Connected Homes

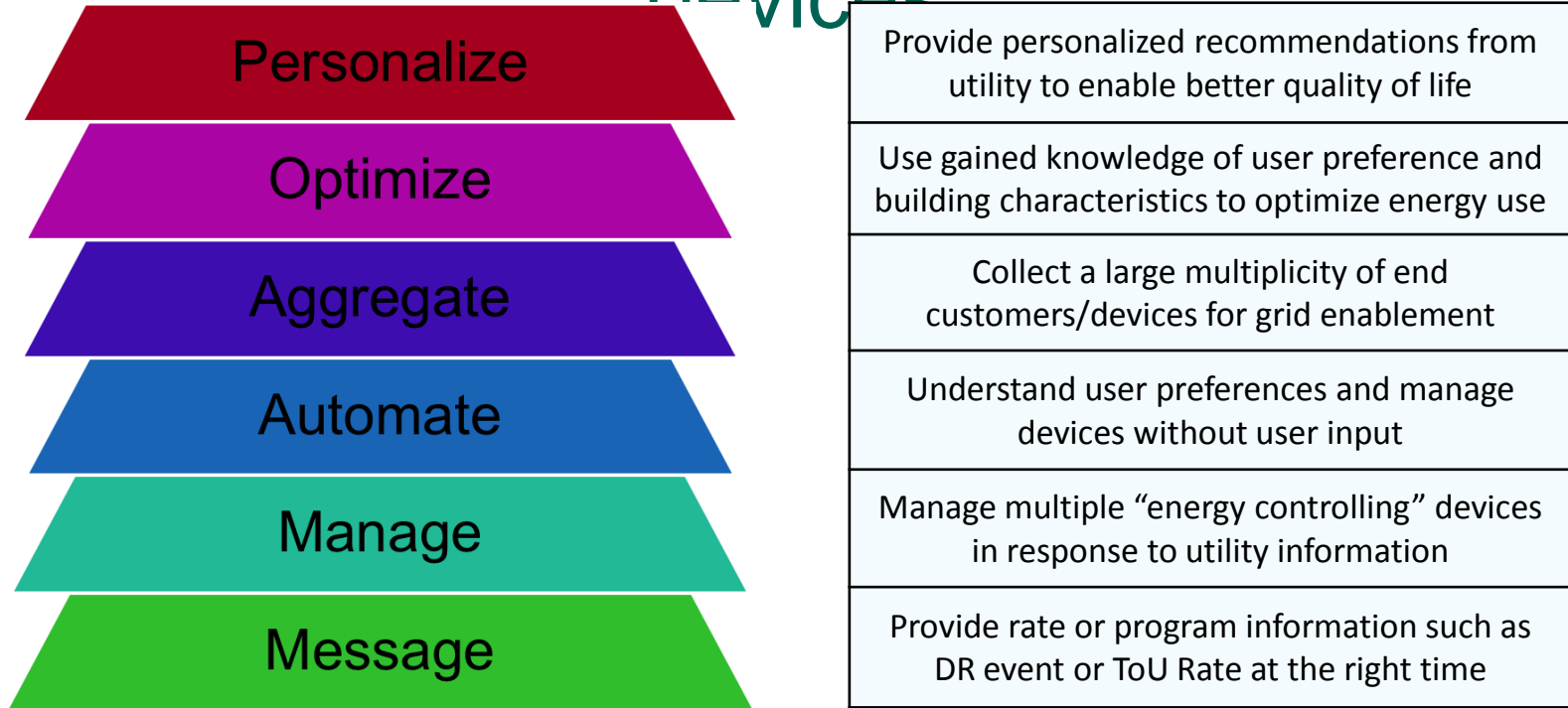
How emerging technologies can lead to customer engagement and grid flexibility

Ram Narayanamurthy

Team Acknowledgement: Ben Clarin, Martin Prado
Electric Power Research Institute (EPRI)



The Value Stack – Evolution of connected devices



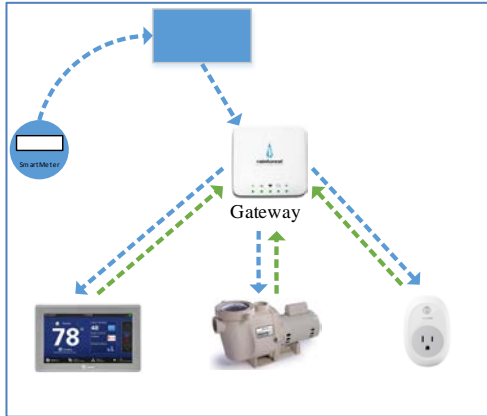
Whole Home Demand Response

Research Goal

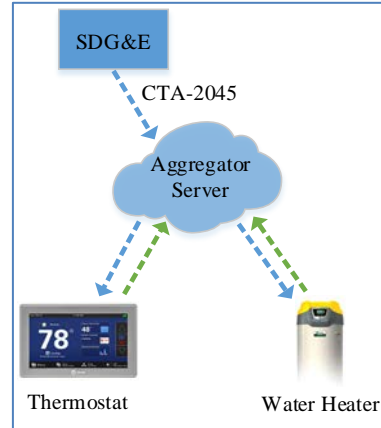
- Evaluate feasibility and DR capacity for whole home DR ecosystems with off the shelf technologies

Scope

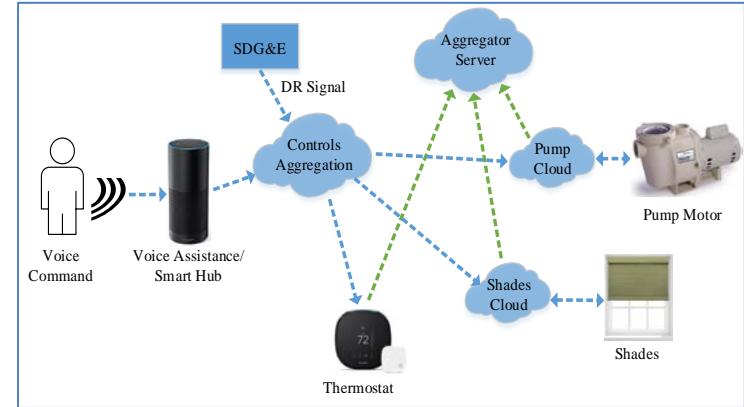
- Field demonstrations of 3 unique Whole Home ecosystems within SDG&E territory
- Analysis of available capacity and effectiveness of DR events called in Summer 2018



AMI meter connected network

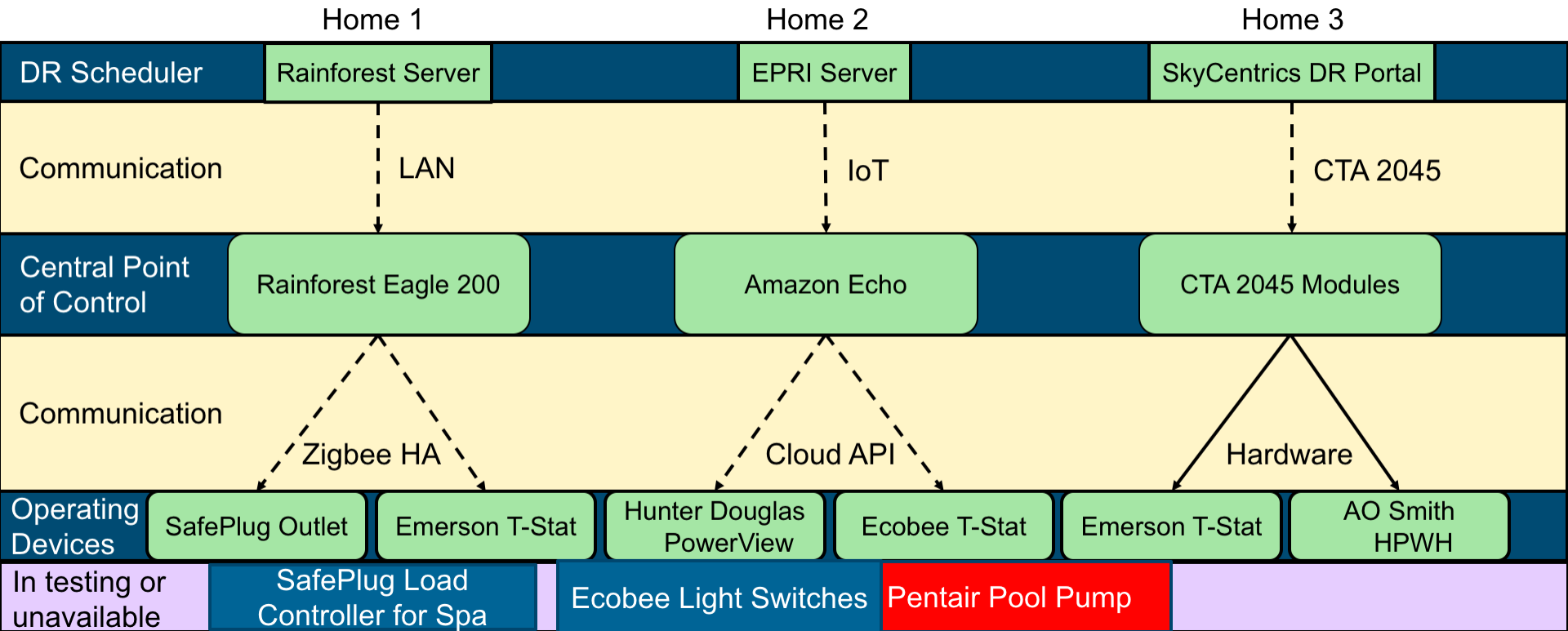


CTA 2045 Modular Connector



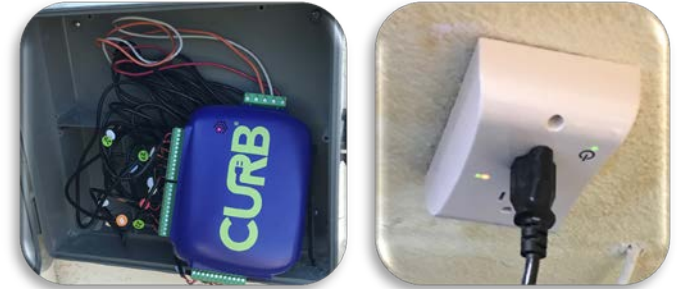
IoT API Integration (Voice Assistants)

In Field Ecosystems



DR Capacity Evaluation

- **Available Capacity**
 - From pilot, typically 2-4kWh reduction over 2 hours
- **M&V using CURB Circuit metering and API data models**
- **Lessons Learned**
 - **Heat Pump Water Heater**
 - DR not significant if operated efficiently
 - **Spa/pool pumps**
 - Already off during peak load
 - **Outlet and light switch control**
 - Doable but worth it?
 - Do customers want lights turning off?
 - High variety of possible loads for outlets
 - **Blinds**
 - Pre-programmed to lower in the afternoon and raise in the evening
 - No DR capacity if already down...
 - Complicated integration with few participants



Measure	Control	Peak Load Reduction
HVAC	Setpoint, On/Off	3-4kW
Heat Pump Water Heater	Setpoint, On/Off	350W
Pool Pump	On/Off	600W
Spa	On/Off	500W – 5kW
Light Switches	On/Off, Dimmable	~100W per switch
Outlet	On/Off	50-75W per outlet
Blinds	Up/Down	Leads to longer HVAC DR duration

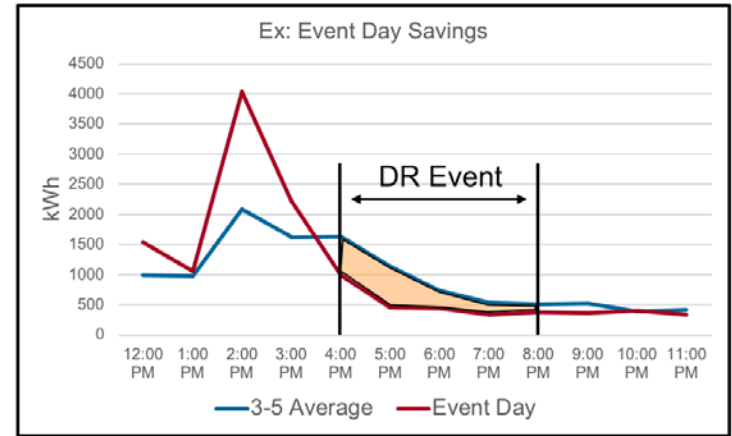
Results Summary

Implementation

- Successful deployment of 3 ecosystems
- Successful DR events throughout the summer saw up to 63% reduction during 4 hour event
 - Up to 5.5kWh reduction
- High rate of opt out caused by technology “misinterpretation” (see lessons learned)

Lessons Learned

- Responses differ among thermostat manufacturers
 - Ex: Emerson “Hold” set prior to the event will act as an “Opt out”
 - Ex: Ecobee “Smart Recovery” mode automatically opts out and turns on when it detects both occupancy and high temperatures (~80 degrees F)
- Need for accurate two way communication for response data to verify successful events
- Where does the utility fit in with Voice Assistants?

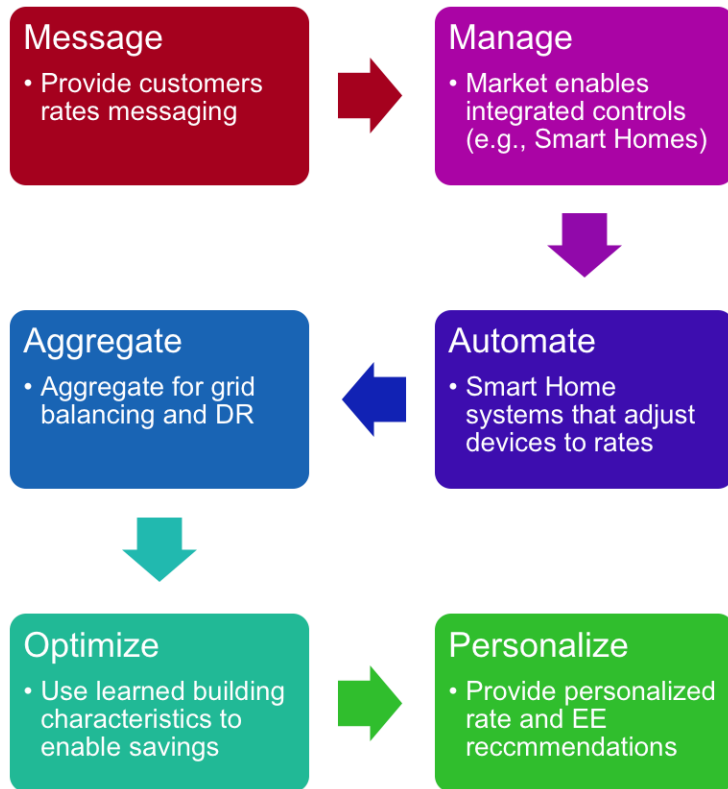


■ Example event

- ~40% reduction in total kWh consumption during 4 hour event
 - 2-4kWh reduction
- Atypical load shape due to ~600W pool pump shutting off at 4:00pm (event start)
 - 600W missed DR potential

Leveraging Short Term for the Long Term

- Short Term Impact – Customer Centric Use Cases – Roll into Voice Assistants
- Long Term Use Cases – Grid Flexibility needs mass adoption – Mass adoption required for aggregation – utility use cases are centered around aggregators
- We mapped the customer journey in the CCDWC – Voice Assistants are an opportunity to realize it



Together...Shaping the Future of Electricity

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