Connected Neighborhood

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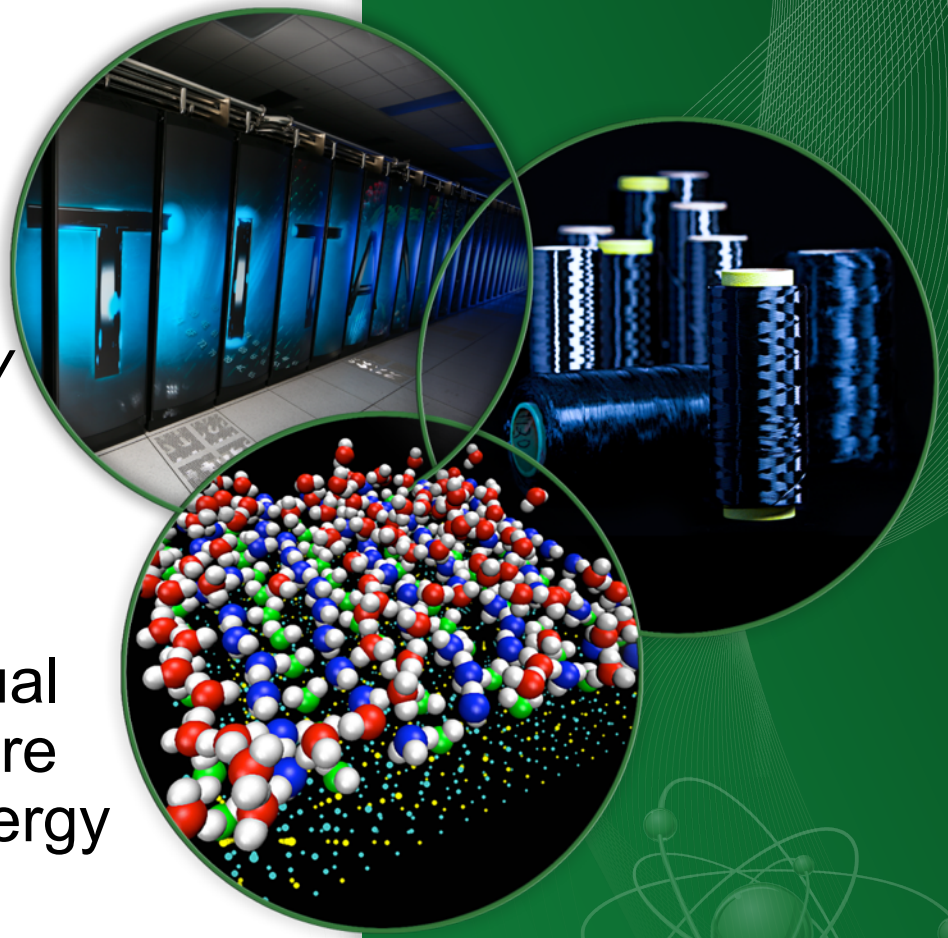

Presented to:

VOLTTRON™ 2017 - 4th Annual Technical Meeting on a Software Framework for Transactive Energy

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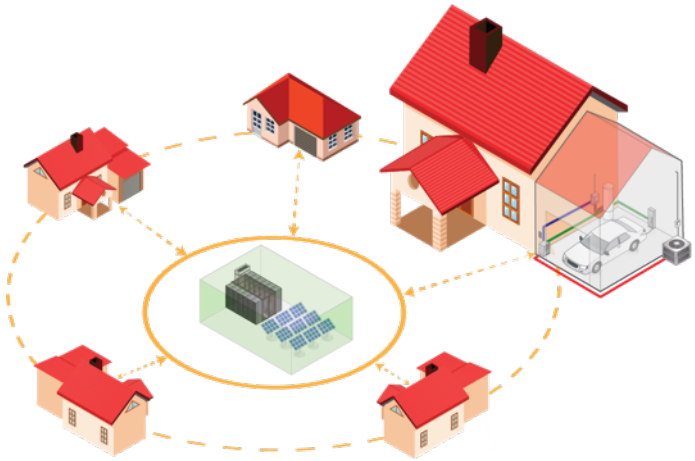
Connected and Transactive Neighborhoods

- An exploration with Southern Company on a possible future encompassing microgrids and customer side controls.
- Develop and demonstrate a neighborhood-level transactive energy and controls research platform to investigate grid integration, scalable distributed control and end-use energy management.
- Co-optimization of cost, comfort, environment, and reliability by controlling grid generation assets and home owner end devices through transactive control.



First-of-its-kind, **transactive** residential microgrid in the Southeast

Project Partners and Roles

With **Southern Company**, deploy two transactive **microgrid** approaches to distributed power generation and storage with **building level energy management** through **VOLTTRON**-based **transactive controls.**

- One neighborhood (~60 new homes) will aggregate renewable generation and distributed energy storage at the neighborhood level through **community scale** storage, solar photovoltaic (PV), and emergency distributed generation. (**Alabama Power**)
- Second neighborhood (~50 homes) will utilize a fully distributed approach with rooftop solar PV and home energy storage. (**Georgia Power**)

Southern Company

Alabama Power

Georgia Power

Develop and implement a VOLTTRON platform-based neighborhood-level transactive control system **that demonstrates grid integration, scalable distributed control, and residential energy management.**

Exploring Two Scenarios

Alabama Power
Subdivision-level microgrid

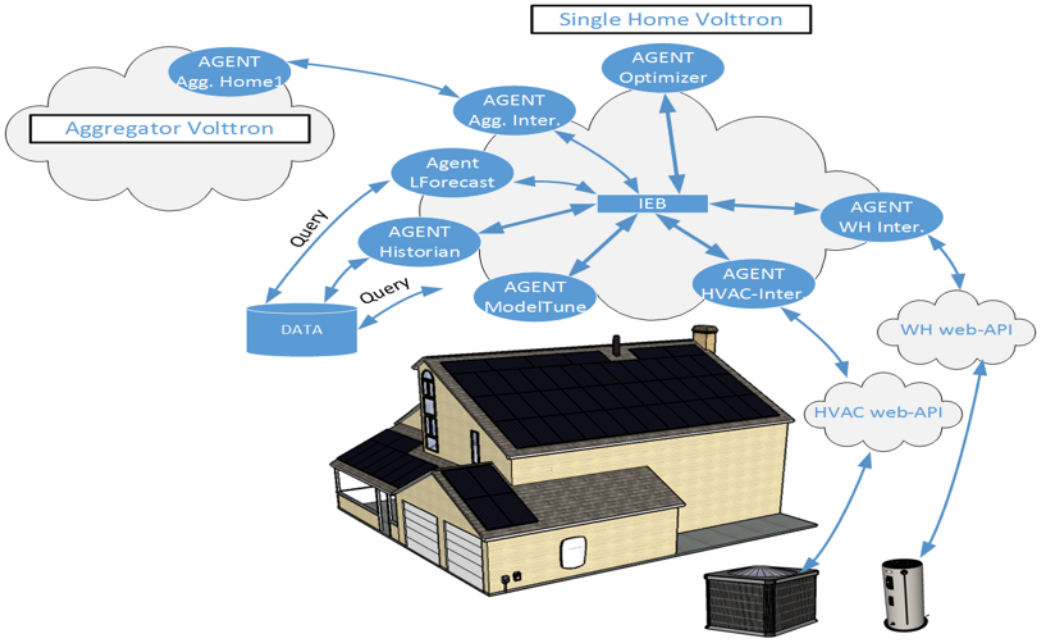
- VOLTTRON will be used in the server/cloud to control Carrier and Rheem equipment.
- VOLTTRON will interact with a microgrid controller located in the community
- VOLTTRON innovations needed include:
  - Model based optimization and control of residential buildings
  - Transactive integration with a microgrid controller

Georgia power
Home level micro/nano grid

- VOLTTRON instance on SBC in each home that will interact with HVAC and WH equipment
- VOLTTRON will interact with a simple micro/nano-grid controller in each home
- VOLTTRON innovations needed include:
  - Interaction with DER controls at home
  - Transactive integration with other homes in neighborhood

R&D Platform for Transactive Control and Market Experiments

- Virtual storage
- Cost optimization of energy consumed by home owners
- Maximize use of local generation and storage
- Maximize subdivisions' flexibility to assist in utility-level operations



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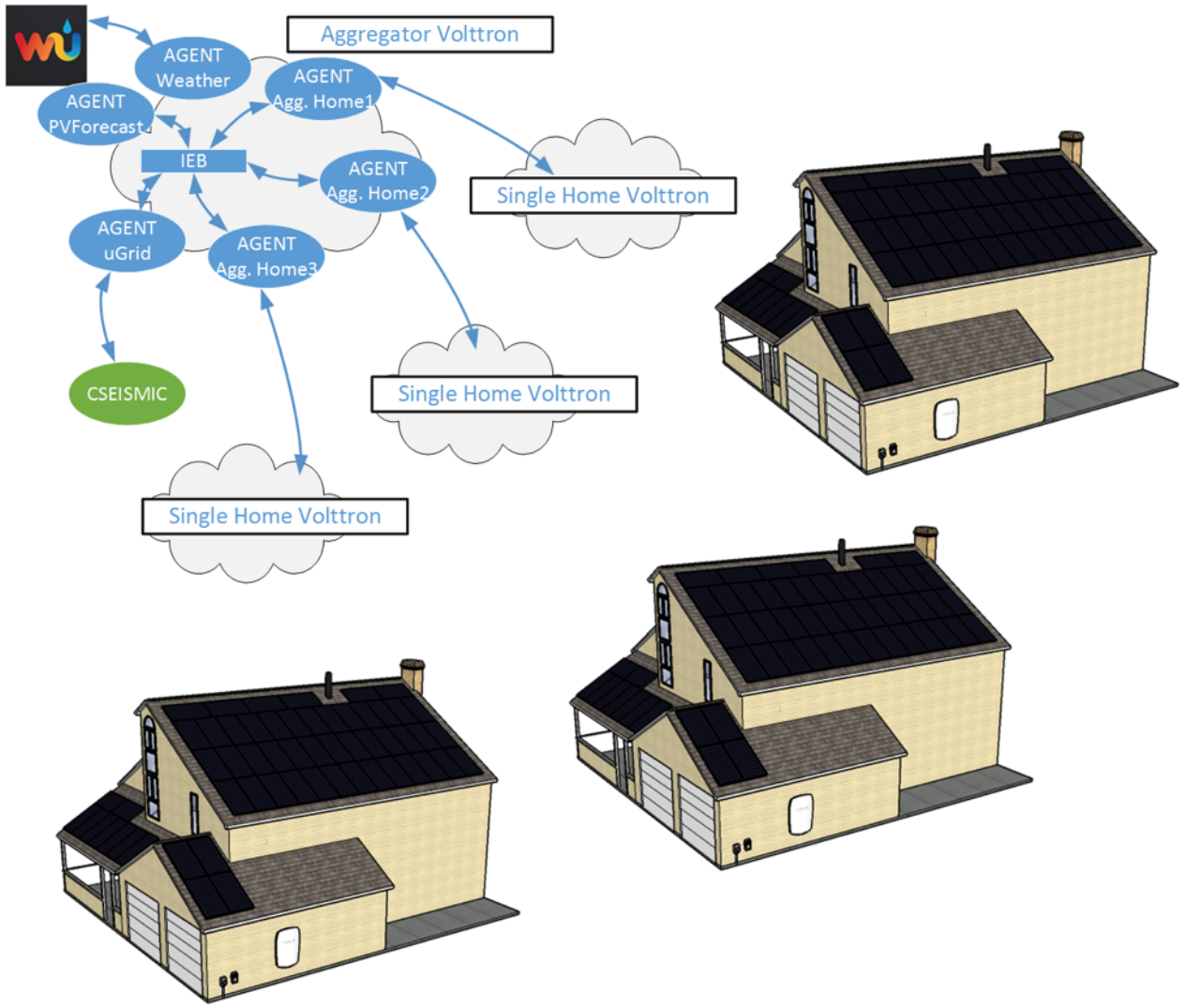
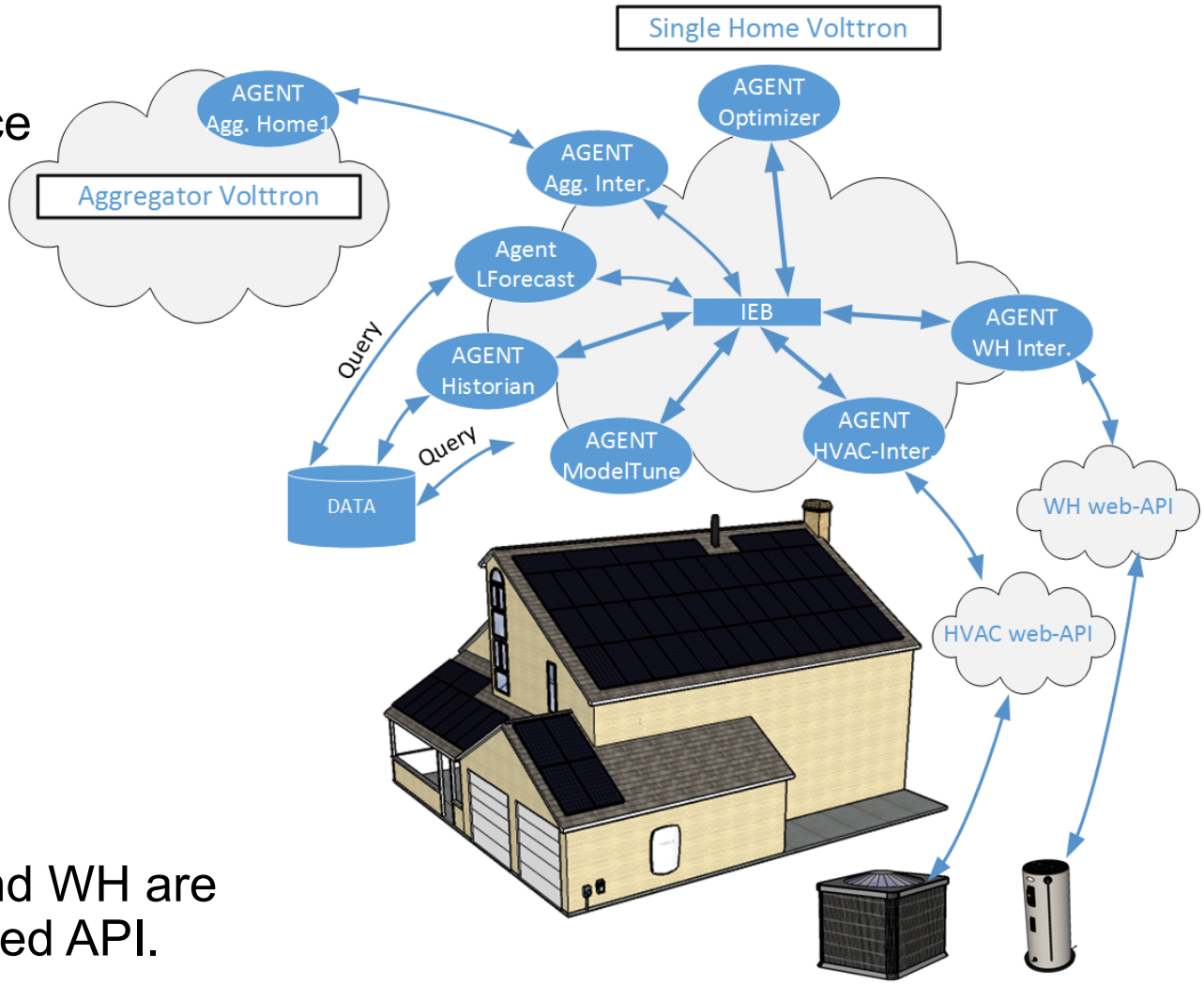
VOLTTRON Framework

- Each home within the community will have a single VOLTTRON™ instance.
- The communication to Microgrid Controller will go through an aggregation VOLTTRON™ instance that compiles data and transacts with Microgrid.



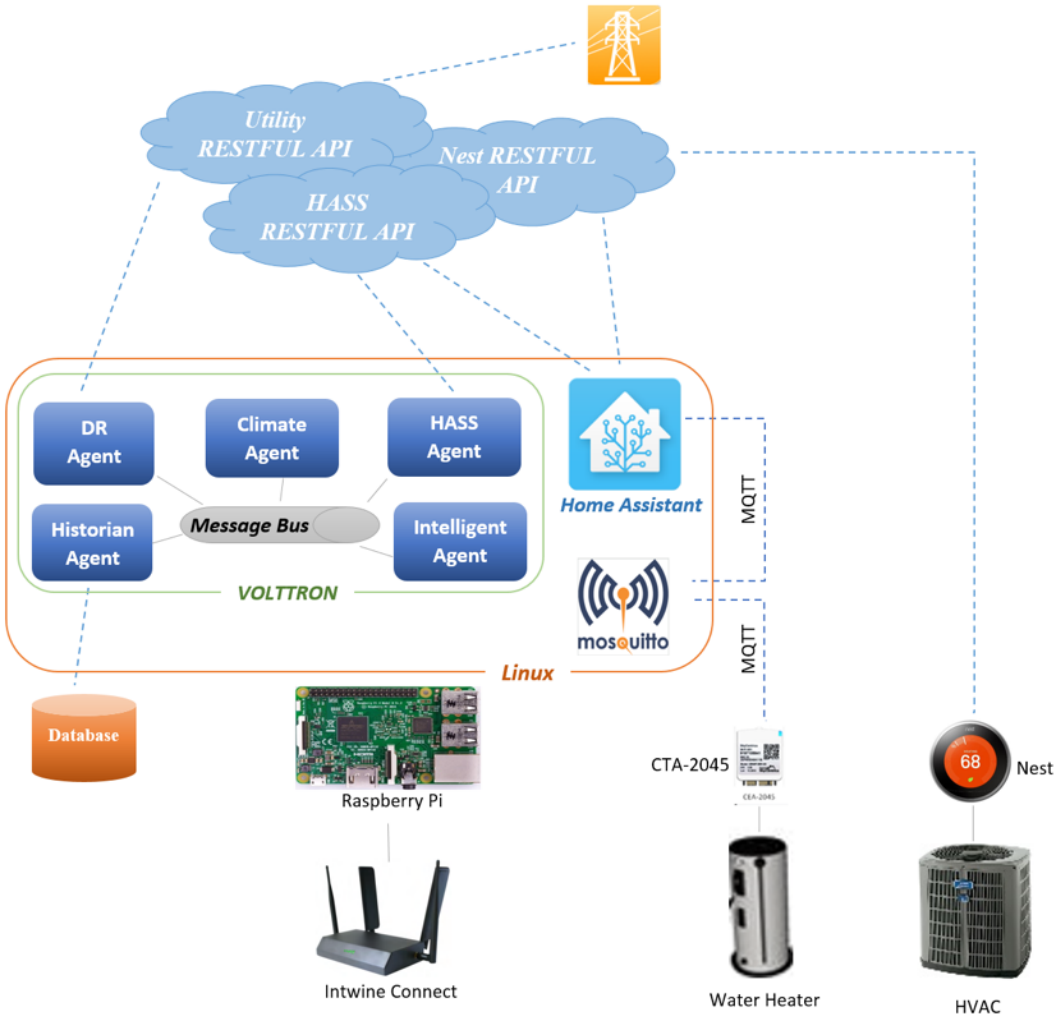
VOLTTRON Home Instance

- Each home VOLTTRON™ instance will support a number of different agents:
  - Optimizer
  - HVAC Interface
  - WH Interface
  - Learning Algorithms
  - Historians
  - Forecasting Algorithms
- Interfaces to HVAC and WH are through vendor provided API.



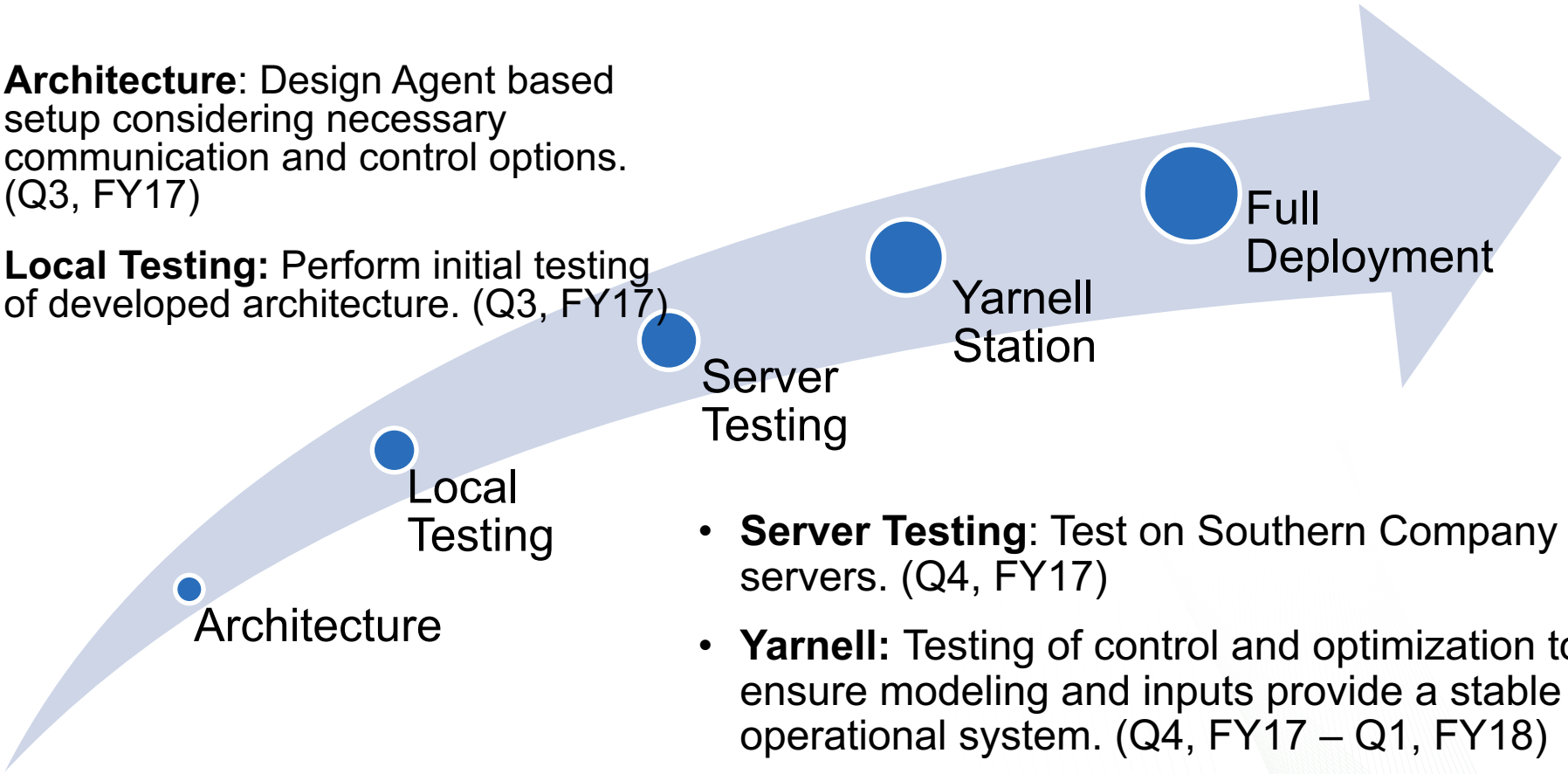
Home Assistant- VOLTTRON Integration

- Use existing code for developing a new HEMS
- Add necessary/missing functionalities to it
- Develop and introduce a new HEMS which is easy to deploy and satisfy HEMS goals
- Draft a user guide that vendors/developer can use to integrate their code with VOLTTRON
- Help vendors/ developers to leverage VOLTTRON as the control and interoperability engine for their software



Path Forward

- **Architecture**: Design Agent based setup considering necessary communication and control options. (Q3, FY17)
- **Local Testing:** Perform initial testing of developed architecture. (Q3, FY17)



- **Server Testing**: Test on Southern Company servers. (Q4, FY17)
- **Yarnell:** Testing of control and optimization to ensure modeling and inputs provide a stable operational system. (Q4, FY17 – Q1, FY18)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