Connected Neighborhood

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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)

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
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.
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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