Eclipse VOLTTRON™ Definition

• VOLTTRON is an application platform (e.g. Android, iOS) for distributed sensing and control applications
  ▪ Written in Python
  ▪ Deployable on Linux

• VOLTTRON utilizes protocols to interact with devices

• VOLTTRON enables applications but is not an application itself
  ▪ Demand response can be implemented as an application on top of VOLTTRON

• VOLTTRON is open, flexible, and grows stronger with the community
Eclipse VOLTTRON Eco-System

• Multiple standards and protocols in buildings space
• VOLTTRON™ can act as interoperability platform
• Capabilities expand along with community
Key Benefits and Primary Uses

• 3 Key Benefits:
  ▪ Cost-effective – Open source software (free to users) and can be hosted on inexpensive computing resources
  ▪ Scalable – Can be used in one building or a fleet of buildings
  ▪ Interoperable – Enable interaction/connection with various systems/subsystems, in and out of the energy sector

• 3 Primary Use Areas:
  ▪ Building Efficiency – To help control building energy system performance
  ▪ Building-Grid Integration – To support “beyond demand response” approach and integration of distributed energy resources into the grid
  ▪ Transactive Control – To support a scalable, distributed control mechanism for transacting information about systems, loads and constraints to deliver user specified services.
Pillars of VOLTTRON

• Flexibility
  ▪ The platform should be flexible to meet requirements for a varied set of solution spaces

• Usability
  ▪ The platform should be both easy to use and straightforward to develop

• Scalability
  ▪ The platform should enable deployments at scale through proper deployment and division of resources

• Security
  ▪ The platform must be secure to protect the devices being controlled and not provide a “backdoor”

• Interoperability
  ▪ The platform must work across vendors and protocols and provide capabilities to simplify these interactions
Platform Overview

VOLTTRON

Application1
Application2
Application3

Management Interface
Weather
Historian

Message Bus

Driver
Actuator
Sim Integration
Utility Rep

Device1
Device2
Simulator

Cloud Resources

DB

Utility Signal
Interoperability Platform

• MessageBus
  ▪ ZMQ
  ▪ RabbitMQ

• Device interaction protocols
  ▪ BACnet
  ▪ Modbus
  ▪ Chargepoint
  ▪ DNP3
  ▪ SEP2.0
  ▪ Device specific

• Simulation
  ▪ Energy+
  ▪ MATLAB
  ▪ FNCS

• Data Storage options
  ▪ SQLite
  ▪ MySQL
  ▪ Prometheus
  ▪ CrateDB
  ▪ MongoDB
  ▪ Redshift

• Weather Data
  ▪ DarkSky
  ▪ Weather.gov
  ▪ Weather Underground

• OpenADR Signal
Flexible Deployment Options
Platform Security

• Platform hardening guidelines for securing underlying Linux system

• Multi-platform Message Bus
  ▪ Encrypted communication between VOLTTRON instances
  ▪ Authorization required for agents to communicate with the VOLTTRON message bus
  ▪ Pub/sub topics can be restricted to authorized agents

• Platform Security and Monitoring
  ▪ Access to VOLTTRON instances restricted to approved hosts
  ▪ System for forwarding crucial log files for analysis
  ▪ Alerts can trigger emails to administrators
  ▪ Monitor and alert on pub/sub topics for interruptions and unexpected values

• Agent Security
  ▪ Role based access to agent capabilities
  ▪ Agents execute in separate process from platform
VOLTTRON Security Analysis

- Spoofing
- Tampering
- Repudiation
- Information disclosure
- Denial of service
- Deviation of privilege

SSC follows a standard process

Projects can engage at any level as they see fit

SSC and VOLTTRON™ teamwork
Applications

• AFDD – Automatic Fault Detection and Diagnostic
• AFDDVis – Visualization for AFDD results
• AirsideRCxAgent - Air-side HVAC Auto-Retuning Diagnostics
• DrivenMatlabAgent – Integrates MATLAB code with VOLTTRON platform
• EconomizerRCxAgent - Application to detect and correct operational problems for AHUs/RTUs.
• ILCAgent – Intelligent Load Control Agent
• TCM2Agent
• WBE – Whole Building Energy
• Economic Dispatch
Example Application – Inline Security Device
VOLTTRON Community

• Mailing list: 200
• Online Office Hours
  • Invite list: 60+ (recently pruned)
  • 20+ regular attendees
  • 3 years of recordings
• Slack: 86 members
• Github stats
  • 1200+ Views, 161 Unique visitors
  • 109 clones, 38 unique cloners
  • 42 contributors
  • 200 Watchers
  • 100+ forks
• Community
  • National Labs
  • Universities
  • Commercial Companies
Thank you