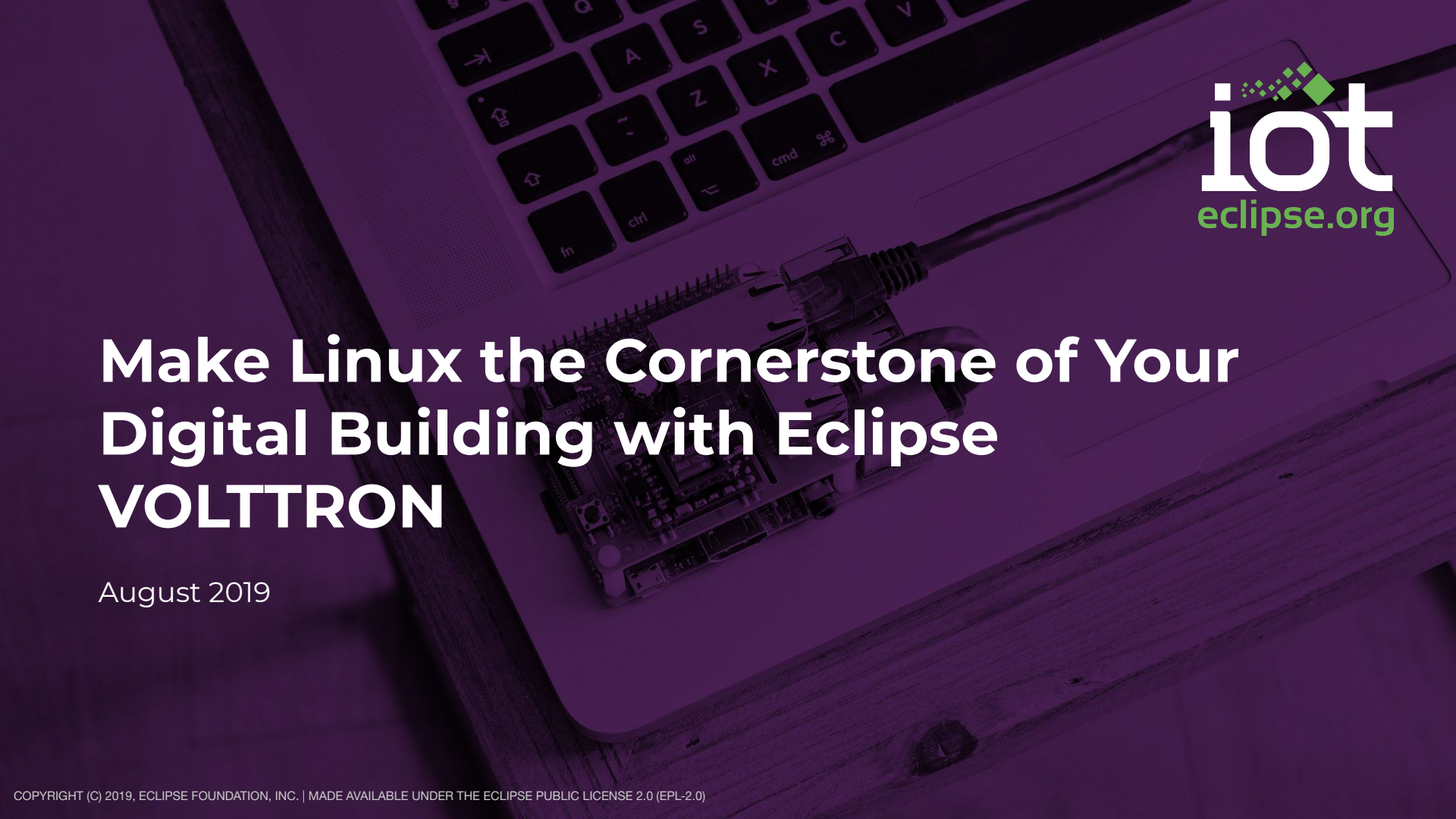


Make Linux the Cornerstone of Your Digital Building with Eclipse VOLTTRON

August 2019

Characteristics of an IoT Solution

Long lifespan

Spans multiple years, if not decades

Heterogenous

Nobody can deliver an end-to-end solution alone

Constraints

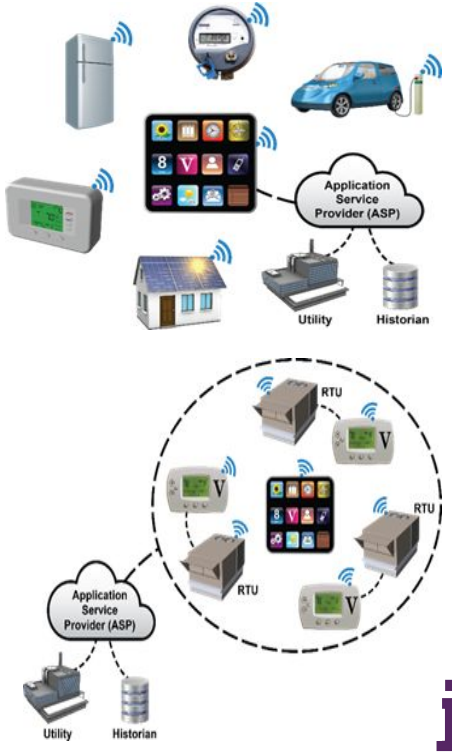
Power, compute, environmental and many others

Connectivity

Connectivity is a given, but stability and reliability are not

Eclipse VOLTTRON

- VOLTTRON is a software platform for distributed sensing and control applications
- VOLTTRON is not a protocol
  - A protocol, such as SEP2.0, DNP3, can be built into the platform for use by applications
  - VOLTTRON supports industry standard protocols
- VOLTTRON is an open source project at the Eclipse Foundation, with an active community for support and development
- VOLTTRON runs on Linux!



The Eclipse Foundation - By the Numbers

370+
Projects

275+
Members

1550+
Committers

195M+
Lines of Code

30
Staff Members

10+
Working Groups

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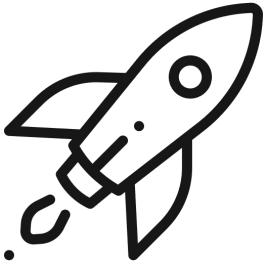
eclipse.org

Strategic Focus Areas

Cloud Native Java



We provide a collaborative environment for the world's leading Java ecosystem players to advance open source enterprise Java technologies for the cloud.

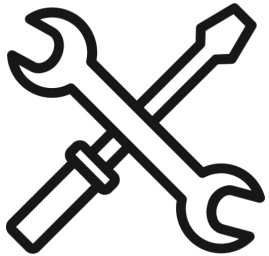
IoT & Edge

We enable industry leaders to collaborate on an end-to-end IoT architecture that is secure, flexible, and fully based on open source and open standards.

Automotive

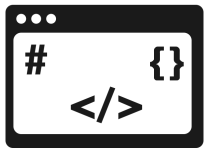
We provide leading automotive OEMs, their suppliers, and partners with a sustainable, transparent, and vendor-neutral platform to collaborate on open technologies and standards.

Tools



The Eclipse IDE is the critical development environment for more than 4 million active users. Our community is innovating on the next generation of cloud native developer tools.

Eclipse IoT Community



3.9M

lines of code

38

projects

350+

contributors

40

member companies

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Protocols & Standards

Protocol or standard	Projects
MQTT	Paho, Mosquitto
Sparkplug	Tahu
CoAP	Californium
LWM2M	Wakaama, Leshan
DDS	Cyclone
DTLS	TinyDTLS
PPMP	Unide
W3C Web of Things	ThingWeb
oneM2M	OM2M
OPC-UA	Milo

IoT Working Group Member Organizations

Strategic members

BOSCH Invented for life

EUROTECH Imagine. Build. Succeed.

Red Hat

ADLINK Leading EDGE COMPUTING

AZUL SYSTEMS

BREDEX

ca technologies

Calypso Networks Association

CANONICAL

list CEA tech

Cirrus Link SOLUTIONS

cloudera

COMPEX

CONTACT Software

DB

DC square

edgeworx

ENGINEERING proud sponsor of KNOWAGE

FONDAZIONE BRUNO KESSLER

fortiss

GENERATIVE SOFTWARE

HUAWEI

IBM

IncQueryLabs Ltd

inductive automation

influxdata

Innoopract

intel

itemis

kichwa coders

kynetics enjoy the art of coding

LAAS-CNRS

THE LINUX FOUNDATION

m2m alliance

MICROEJ

NOKIA

openHAB FOUNDATION

orange

SAP

SIEMENS

SIERRA WIRELESS

V2COM

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Eclipse VOLTTRON: Key Benefits and Primary Use Areas

- 3 Key Benefits:
  - Cost-effective - Open source software and can be hosted on inexpensive Linux-based computing resources
  - Scalable - Can be used in one building or fleet of buildings
  - Interoperable
- 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 to grid
  - Transactive Control

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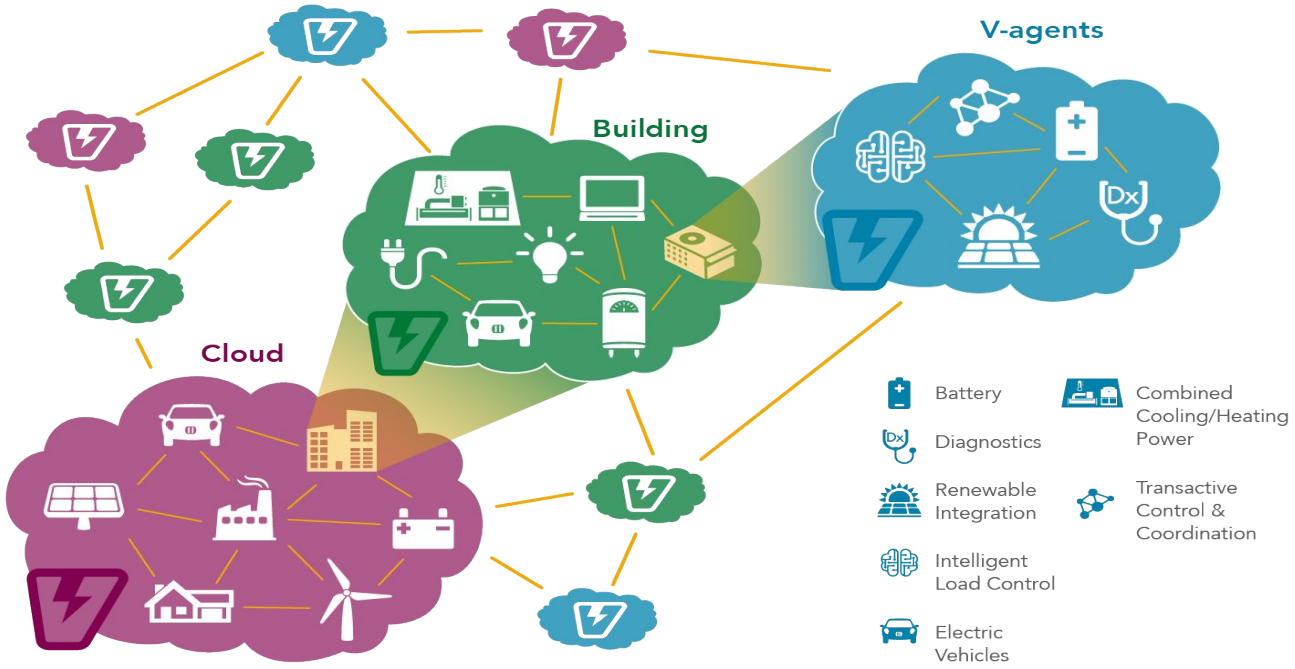
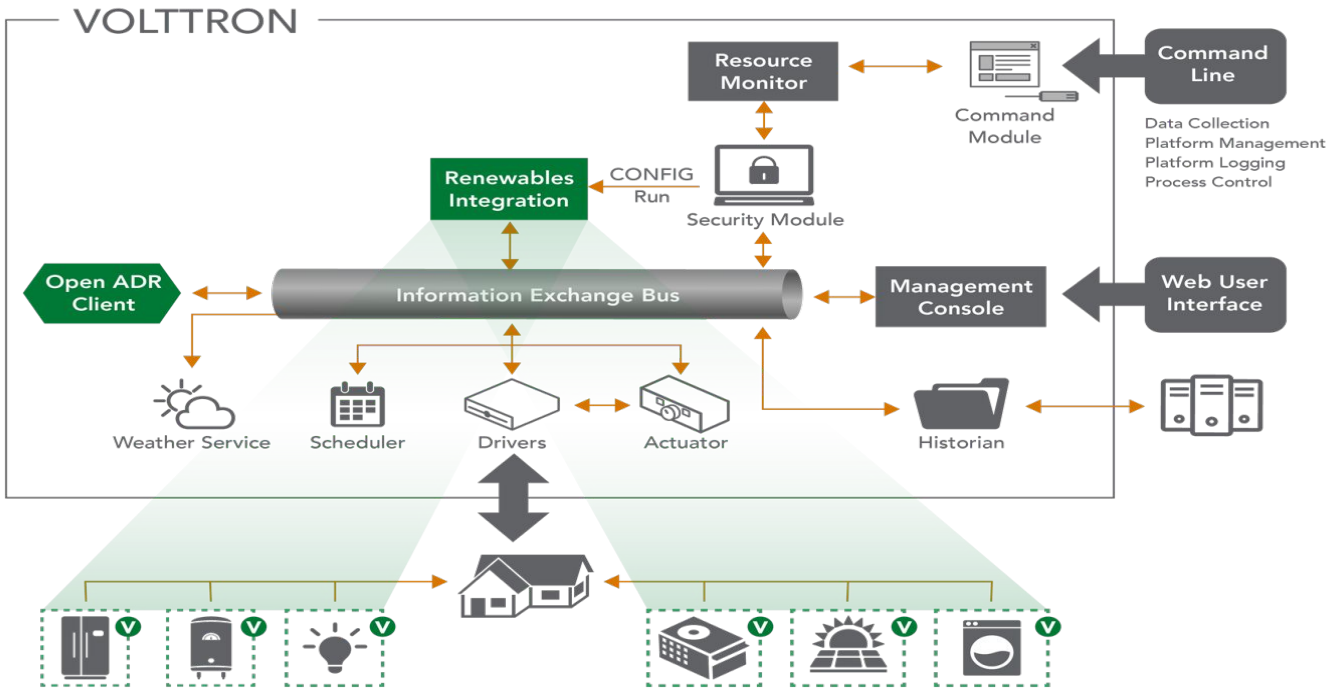
Eclipse VOLTTRON Ecosystem



Platform Overview



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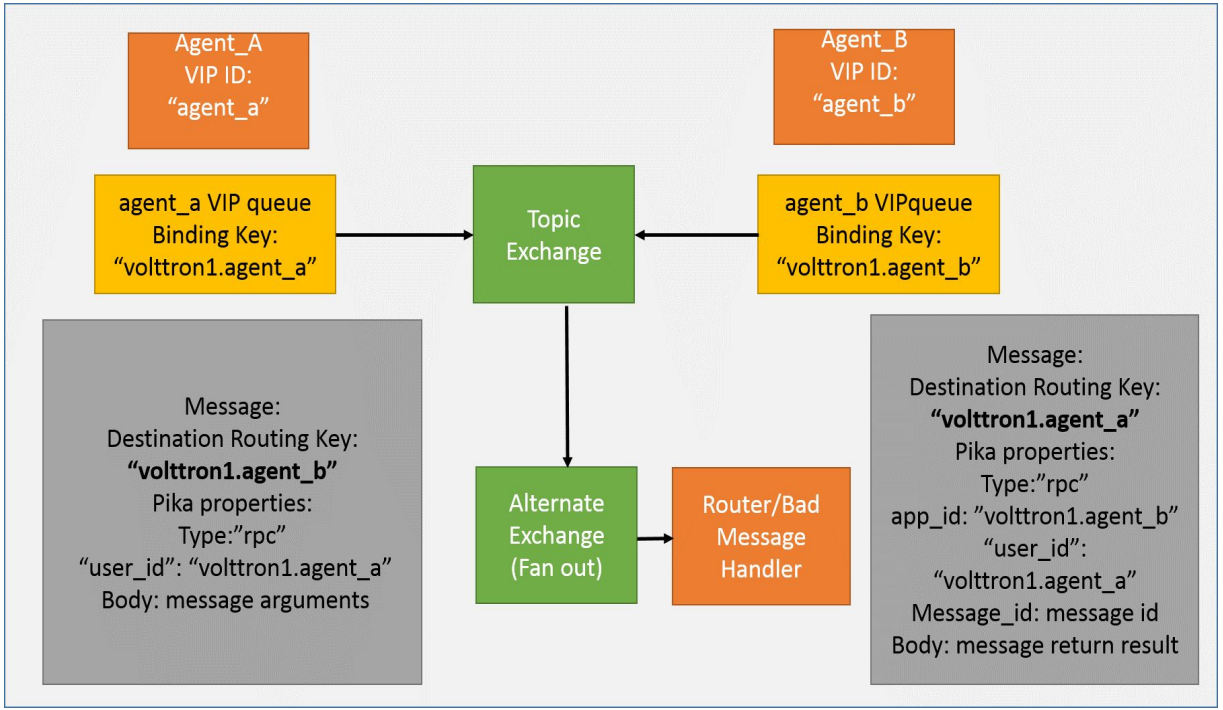
Message Bus Framework

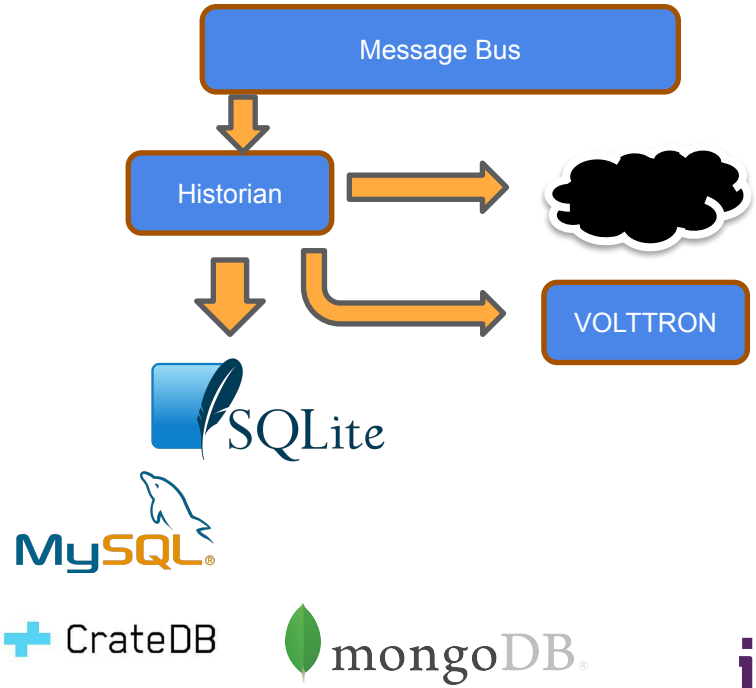
- Message bus is responsible for moving data from one endpoint to another. It allows agents to communicate with each other using
  - Publish/Subscribe mechanism
  - Remote Procedure Call mechanism
- Message bus framework supports ZeroMQ and RabbitMQ message queue libraries. Can support other message queue libraries in the future
  - Actual application code is decoupled from message bus
  - Easy switch between different type of message bus. Application/agent code remains unaffected.
  - Allows VOLTTRON instances running on different types of message bus to communicate with each other
  - Proxy agent acts as bridge between local and remote message bus

RabbitMQ based VOLTTRON



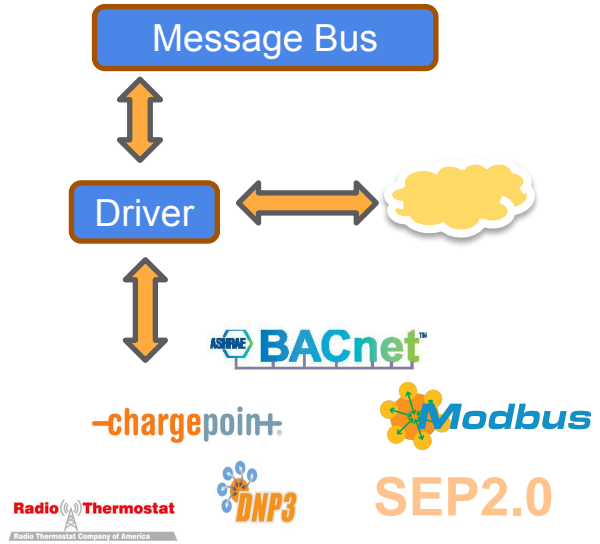
Historian Framework

- Framework handles collecting data from the message bus for storage
- Simplifies creating specific instance
  - Setup
  - How to store data
  - How to retrieve data
- Maintains a cache until data stored
- Numerous supported databases with more being contributed
- Data can also be sent to cloud services or another VOLTTRON instance



Driver Framework

- Framework simplifies process. Fill out methods for:
  - Setup
  - Reading values
  - Sending commands
- Growing list of existing interfaces
- Flexible options for collection rate and organization of sensor points
- User edits configuration files, no need to code for different devices



Eclipse VOLTTRON 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
  - 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. Restricted access to configuration store
  - Agents execute in separate process from platform

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
- WBE – Whole Building Energy
- Transactive Market Service
- Economic Dispatch

Application demo

Link to VAV-Thermostat

Call to action

- Learn about our projects by visiting iot.eclipse.org/projects
- Try Eclipse VOLTTRON! https://volttron.org/
- Subscribe to the Eclipse IoT newsletter
- Follow and engage with us on social media: @EclipseIoT
- Attend an Eclipse community event or join our Virtual IoT Meetup
  - **Eclipse Con Europe 2019**
    Ludwigsburg, Germany - October 21 - 24, 2019