Pacific Northwest
NATIONAL LABORATORY

Eclipse VOLTTRON Development Update

September 25, 2019

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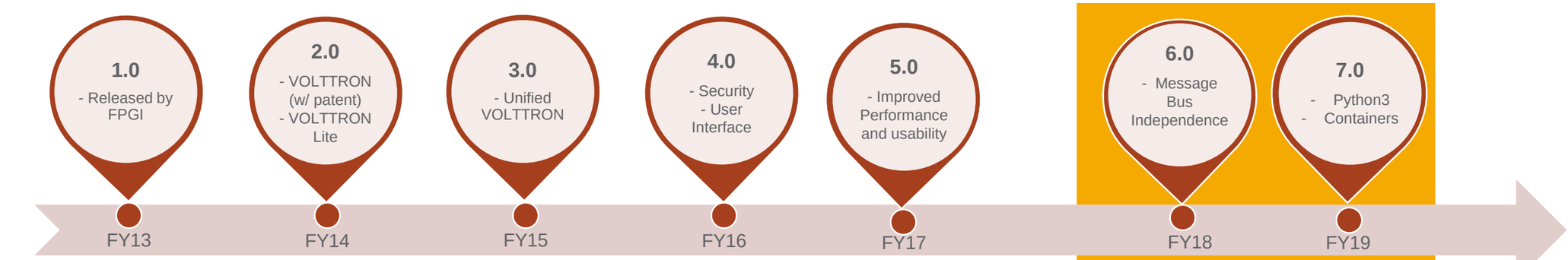
VOLTTRON™

PNNL-SA-146939

VOLTTRON™ Releases



PNNL EV Demo

BEMOSS
RTU Network
First User Forum

NREL ESIF
2nd User Forum
Quality Logic Implements Transactive Node

3nd User Forum
Transactive Campus
BIRD-IP
GMLC Usage
Buildings Challenge
TWT Deployment
Intellimation deploying 100 instances

NW Tech Meeting
4th User Forum
VOLTTRON ™ Foundation

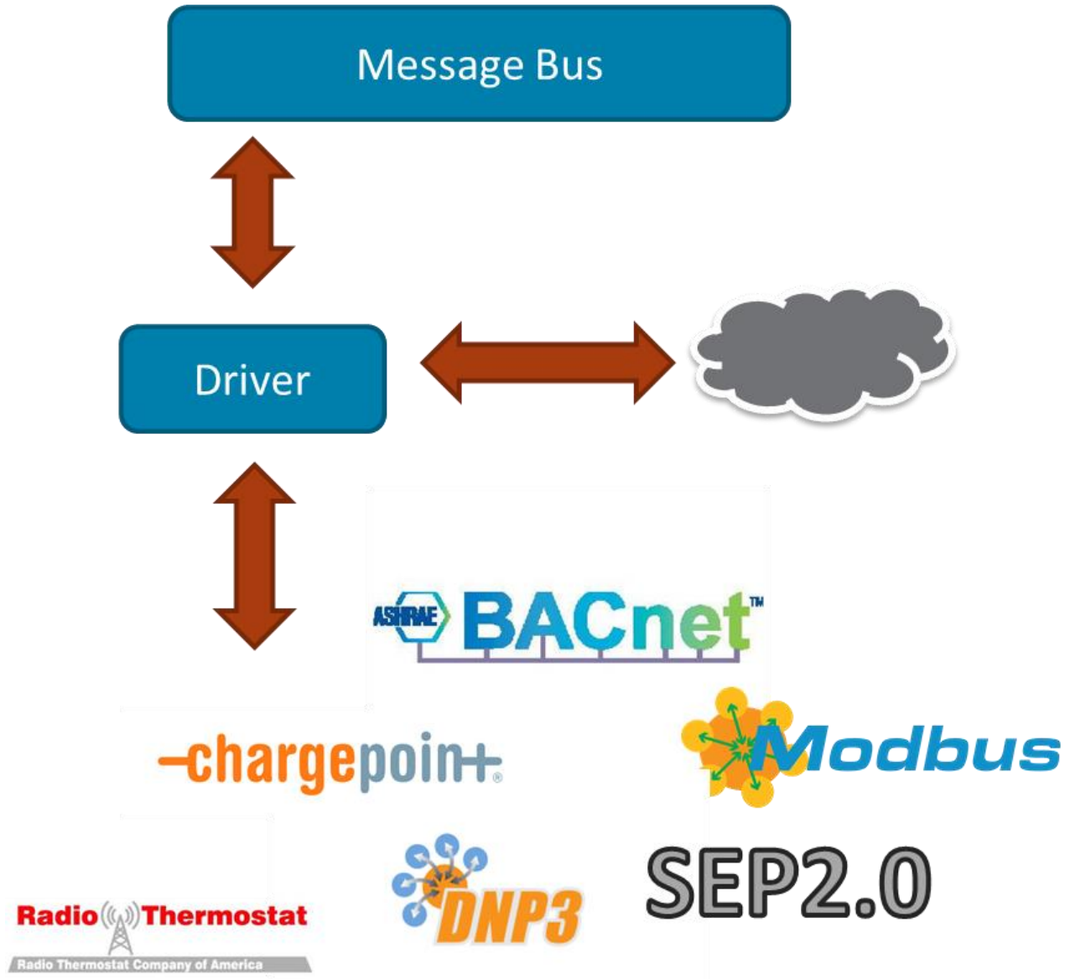
5th User Meeting
Chargepoint training session
ACEIoT Announcement

Pillars of VOLTTRON

- Flexibility - The platform should be flexible to meet requirements for a varied set of solution spaces
  - Deployment – Can be installed on a variety of hardware with differing capabilities
  - Topology – Can be arranged in differing topologies to meet the needs of specific implementations
  - Services – Components of the platform can be easily added to/replaced
- Usability – The platform should be both easy to use and straightforward to develop
  - Development – It should be clear how to develop agents and services for the platform. Developers should have the insight and feedback to ease development
  - End User – The platform should provide services that enable the development of high quality user interfaces to simplify deployment, installation, and management of the end solution.
- Scalability – The platform should enable deployments at scale through proper deployment and division of resources
  - Number of platforms
  - Number of agents
  - Number of devices
- Security – The platform must be secure to protect the devices being controlled and not provide a “backdoor”
  - Platform integrity – The platform must protect itself from subversion
  - Infrastructure integrity – Recommendations for securing the underlying resources used by the platform
- Interoperability – The platform must work across vendors and protocols and provide capabilities to simplify these interactions
  - Data standard – A standard data format and naming convention would allow applications written by different organizations to easily talk with each other and the devices being controlled.
  - Interface library – A library of interfaces allowing the platform to communicate with a variety of devices through standard (Modbus, BACnet, etc.) or custom protocols.

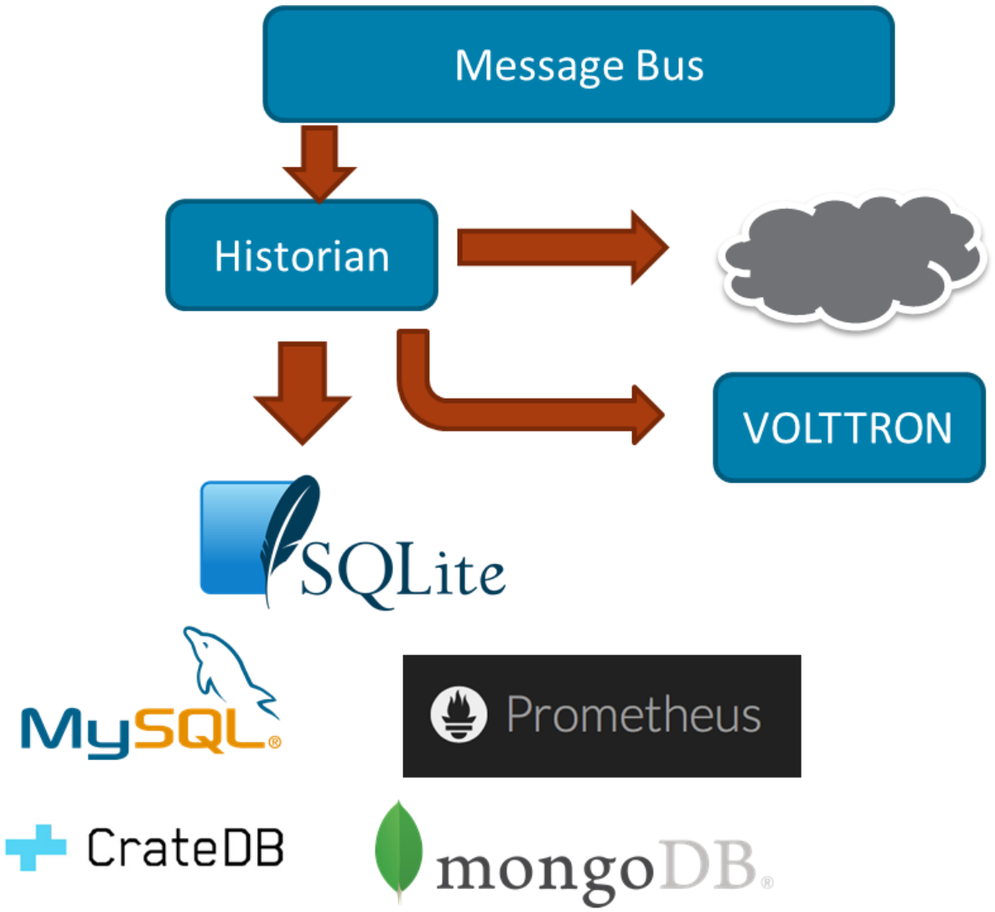
Driver Framework

- 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
- Deployer edits configuration files, no need to code for different devices



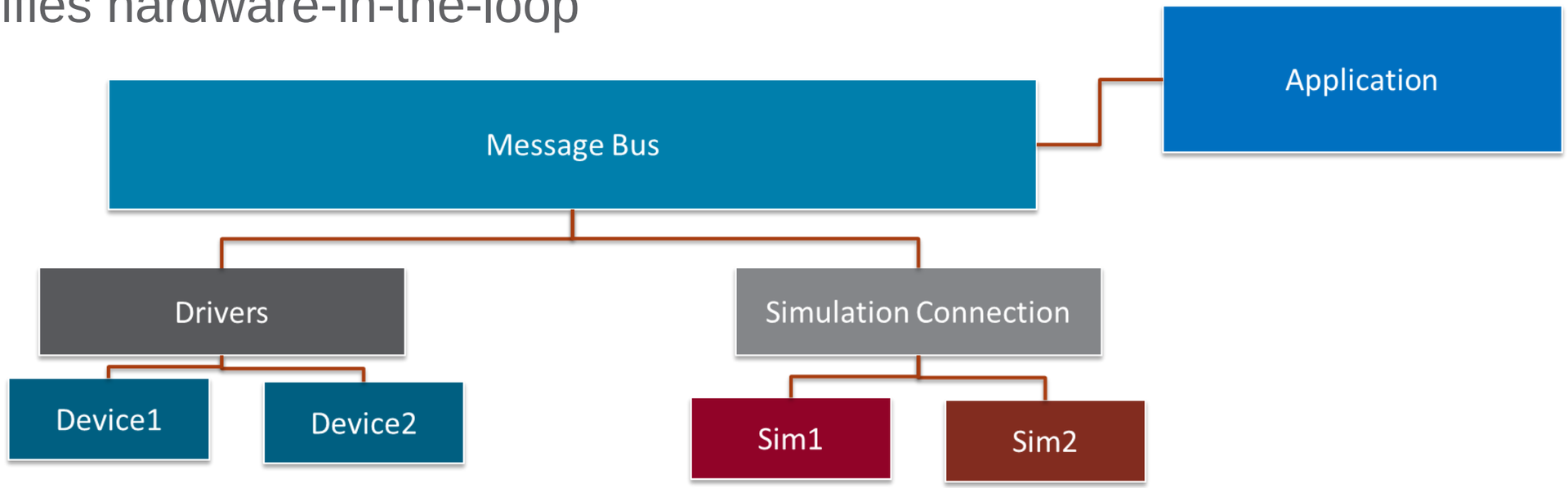
Historian Framework

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



Simulation and Hardware in the Loop

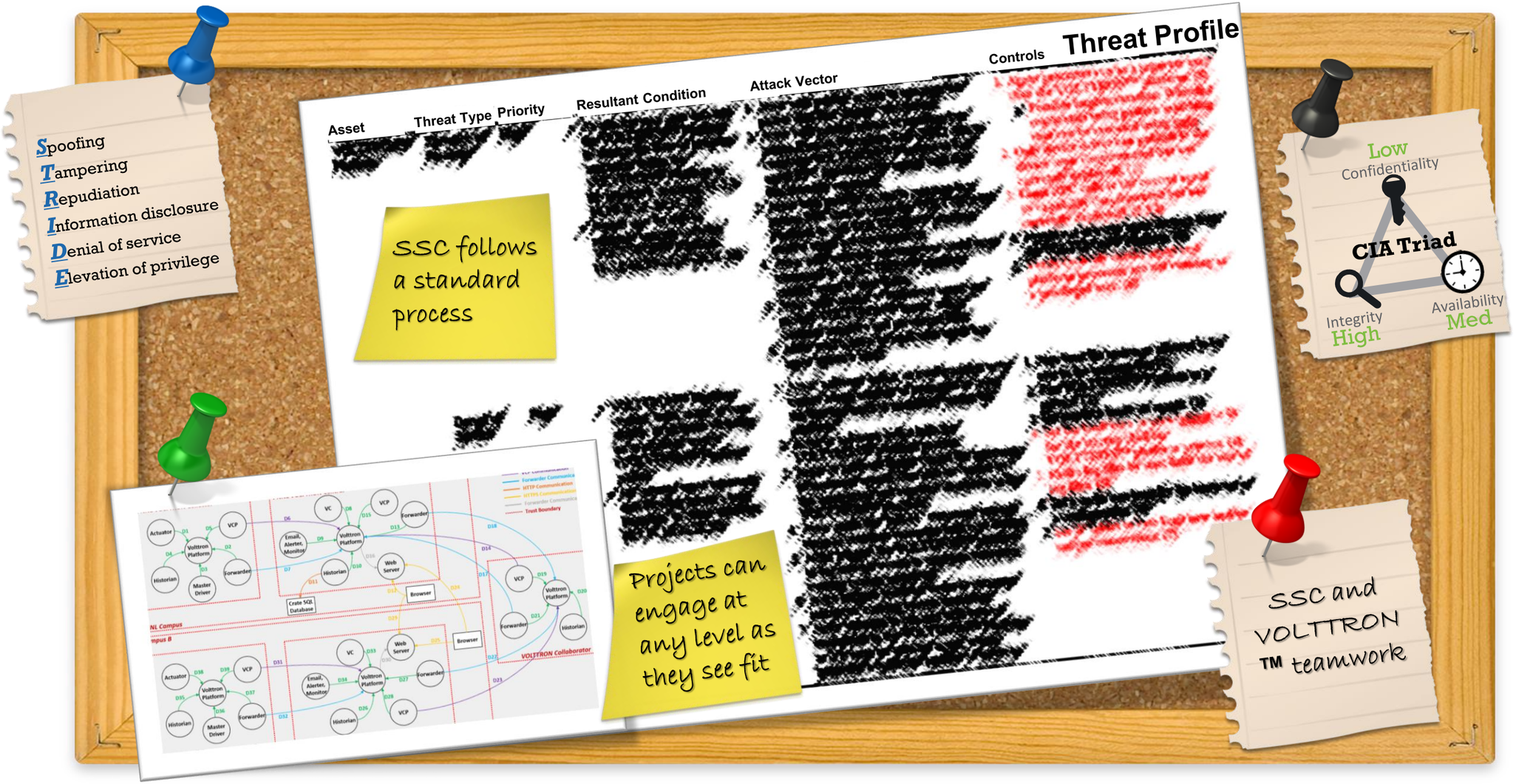
- Simulation connection module allows applications to interact with simulations and models as if they were real buildings.
- Applications tested against simulation need no modification to run against target buildings/devices
- Simplifies hardware-in-the-loop



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



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Platform Updates

Message Bus

- Message Bus
  - Message bus refactoring to support both ZMQ and RabbitMQ message bus
    - ✓ Command line wizard (vcfg) supports installing both options
  - Multiplatform communication with federation and shovel plugins
  - Management plugin integrated with volttron-ctl
  - Backward compatibility with ZeroMQ
  - Added CSR support for multiplatform and multi-bus communication
  - Added SSL support to the platform for secure communication
    - ✓ In ZMQ, this is for https not Elliptic curve
  - Integrating 3rd party tools
    - ✓ MQTT
    - ✓ Elastic Search
    - ✓ Non-VOLTTRON clients

Services

- Drivers
  - Driver support for DNP3 based MESA-ESS outstation communication
  - BACNet proxy and driver now support Change of Value Subscriptions
- Market Service
  - Added a base MarketAgent and Market Service agent to allow simulation of market based pricing model.
- Weather Agent
  - WeatherUnderground no longer has free keys
  - New WeatherAgent based on a framework similar to historians
  - Implemented for DarkSky and weather.gov
- Historian
  - Redshift Historian
  - Base historian now uses health subsystem and can report backlogged, cache_count, publishing and cache_full status keys.

Agents

- Agents
  - Agent configurations can be written in yaml (no tabs in yaml) or json.
  - Secure ConfigStore
- Agent Template
  - Updated template generation
  - Historian template
- Simulation Support
  - Added fncs subsystem (Allows co-simulation FNCS https://github.com/FNCS/fncs/tree/develop)
  - New MATLab integration agent

Automated Testing

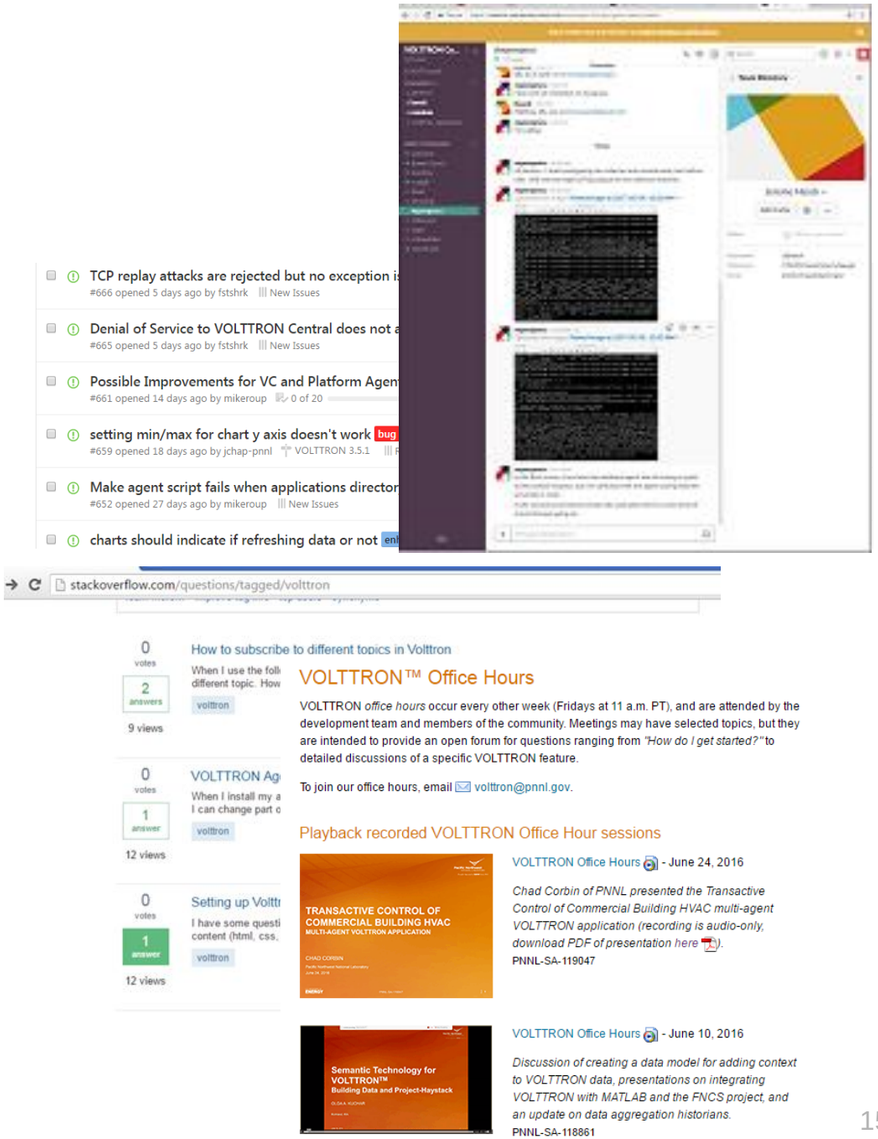
- Testing
  - Added docker support to the test environment for easier RabbitMQ testing.
  - Added test support for RabbitMQ installations of all core agents.
  - Added multiplatform (zmq and rmq based platform) testing.
  - Review of tests both for RMQ upgrade as well as Python3 work

Upcoming

- VOLTTRON 7.0
  - **Python 3**
    - ✓ Python2 approaching end of life
  - Deployment “recipes”
  - Addressing Security Assessment
    - ✓ Agents launched with a different user from that of the platform
    - ✓ CSR framework for RMQ
  - Simulation integration streamlined
- Future
  - Integration possibilities with other platforms
  - Data curation during collection
  - Simulation specific version of VOLTTRON
  - Video tutorial series
  - User interfaces to simplify manual processes (tell us your pain points)

VOLTTRON Community

- Feedback is essential
- Make use of support channels
  - Suggest topics for office hours
  - Present research
- Project participation
  - Interest/ability to try out experimental branches and release candidates
  - Trying out/contributing documentation and example agents
- What equipment do you have access to?
- Which agents in the applications repo are of interest?
  - Preferences on ‘abandoned” agents?
- Additional drivers, historians, weather services, message buses, etc.
  - What are the needs?
  - What can be contributed back?
- Interest in a hands-on focused meeting/training session?



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Thank you