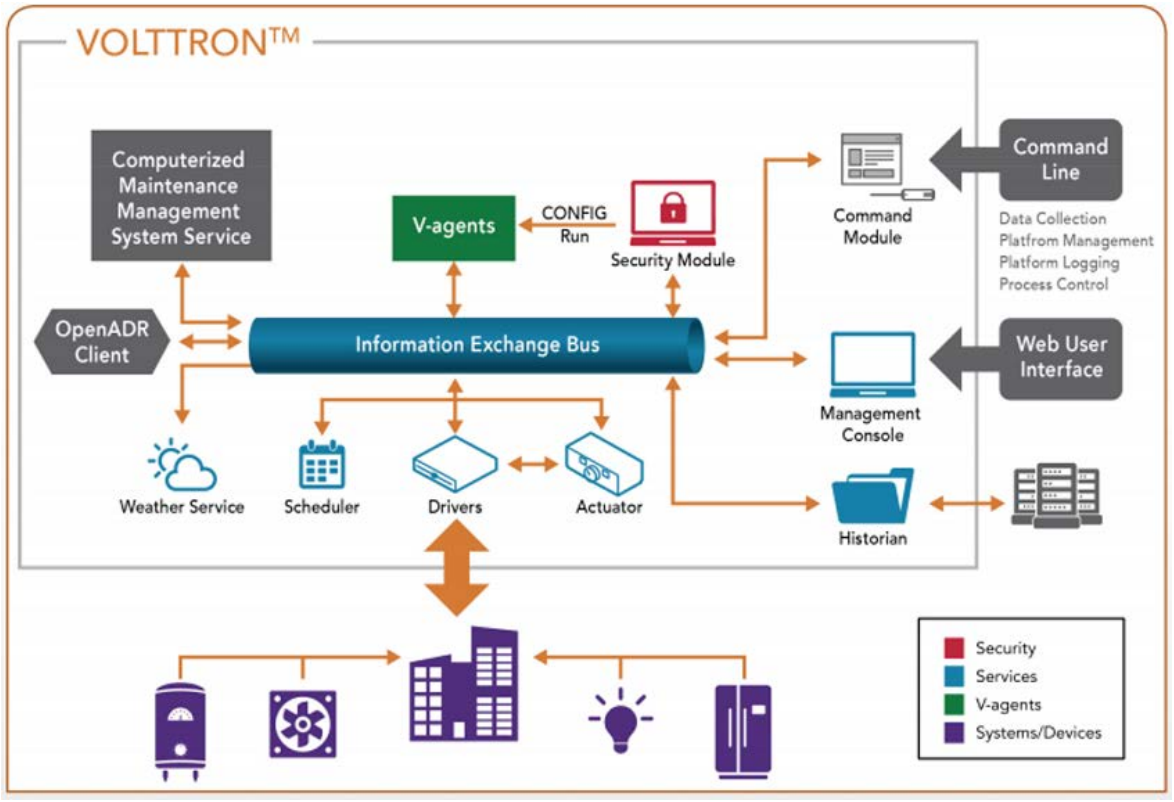
U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

VOLTTRON Message Bus Protocol Adapter



Performing Organization(s): SLAC National Accelerator Laboratory & Kisensum

PI Name and Title: Sila Kiliccote, Staff Scientist and Dept. Head

(Presented by Bob Barcklay, Kisensum)

PI Tel and/or Email: 510.384.1635 | silak@slac.stanford.edu

Project Summary

Timeline:

Start date: October 2016

Planned end date: September 2018

Key Milestones

1. Communications with EVs achieved; Nov 2016
2. Communication with in-home devices; Jun 2017
3. Common Data Model Whitepaper; Sep 2017
4. Communication with storage devices; Dec 2017
5. Communication with bulk system operators; Apr 2018

Budget:

Total Project $ to Date:

- DOE: $409,311
- Cost Share: $0

Total Project $:

- DOE: $620,000
- Cost Share: $0

Key Partners:

SLAC
Kisensum
NREL

Project Outcome:

Enable VOLTTRON for DER Management by adding common DER protocol support to the platform.

Team

Sila Kiliccote
(PI)

Anupama Kumar
Software Engineer

Nani Sarosa
Financial Analyst

Bob Barcklay
CTO

Rob Calvert
Principal Engineer

Anh Nguyen
Software Engineer

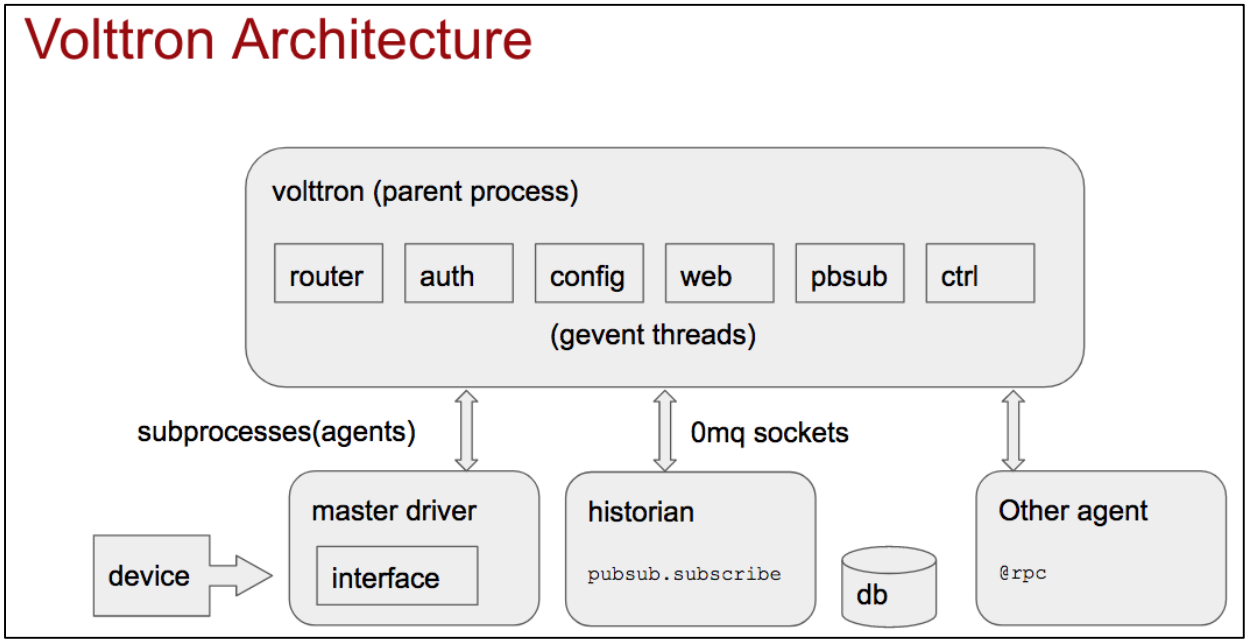
James Sheridan
Software Engineer

Challenge

The wider adoption of VOLTTRON for grid interactions requires appropriate adapters for existing protocols in this space.

The goal of this project is to create a protocol adapter layer on top of the VOLTTRON Message Bus that will enable the re-use of existing, widely used protocols between VOLTTRON agents and services.

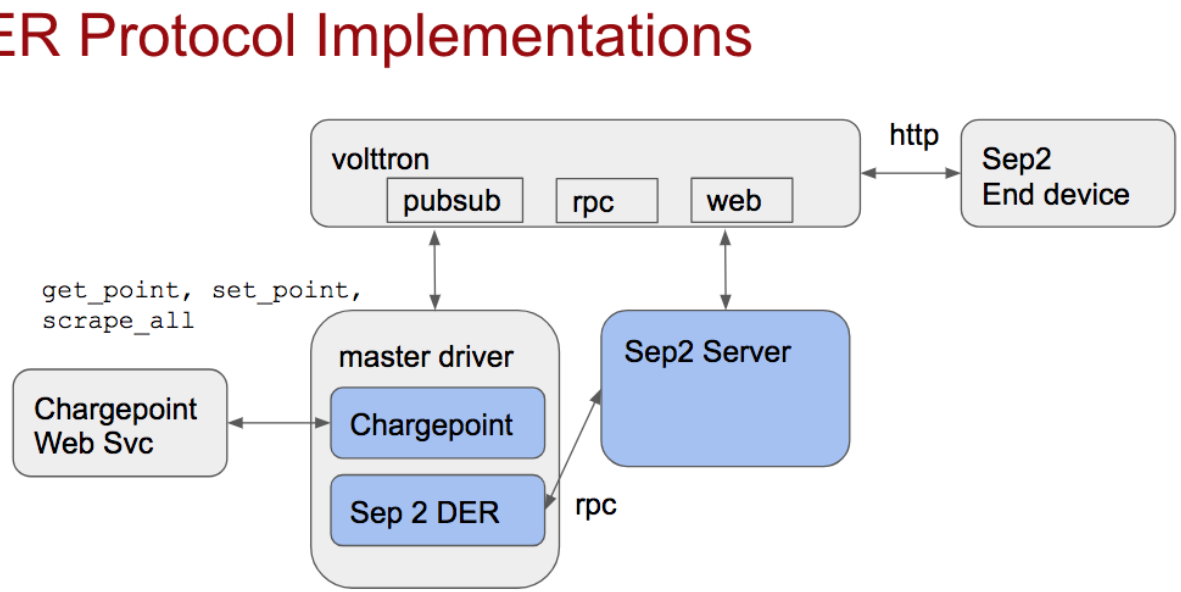
The message bus will provide a common transport for the message content of protocols such as SEP2, DNP3, OCPP and information models based on IEC61850, MESA/SunSpec Inverter, Storage and Meter Data Models.



Approach

- Leverage existing platform services: Master Driver & topics
- Map supported protocols to widely used SunSpec data dictionary
- Develop and contribute (as open source), common protocol implementations:

- 2030.5 (SEP2)
- ChargePoint Web Services
- DNP3 (MESA)
- Modbus (adds RTU)
- OpenADR (as separate project)



Impact

- Out of the box support for commonly used protocols will allow for DER resources to be integrated with VOLTTRON and leverage all other VOLTTRON services, historians, control agents, etc.
- An open, inexpensive building management platform with the right analytics will encourage adoption of distributed generation, storage and renewables behind-the-meter and support resilience.
- Kisensum has commercial projects underway to use VOLTTRON as a DER management platform for large scale DER deployments.

Progress – Year 1

- ChargePoint Implementation (communication with EVs)
- DER use cases for IEEE 2030.5 (communication with loads)
- Common Data Model (SunSpec Mapping)

Progress – Year 2

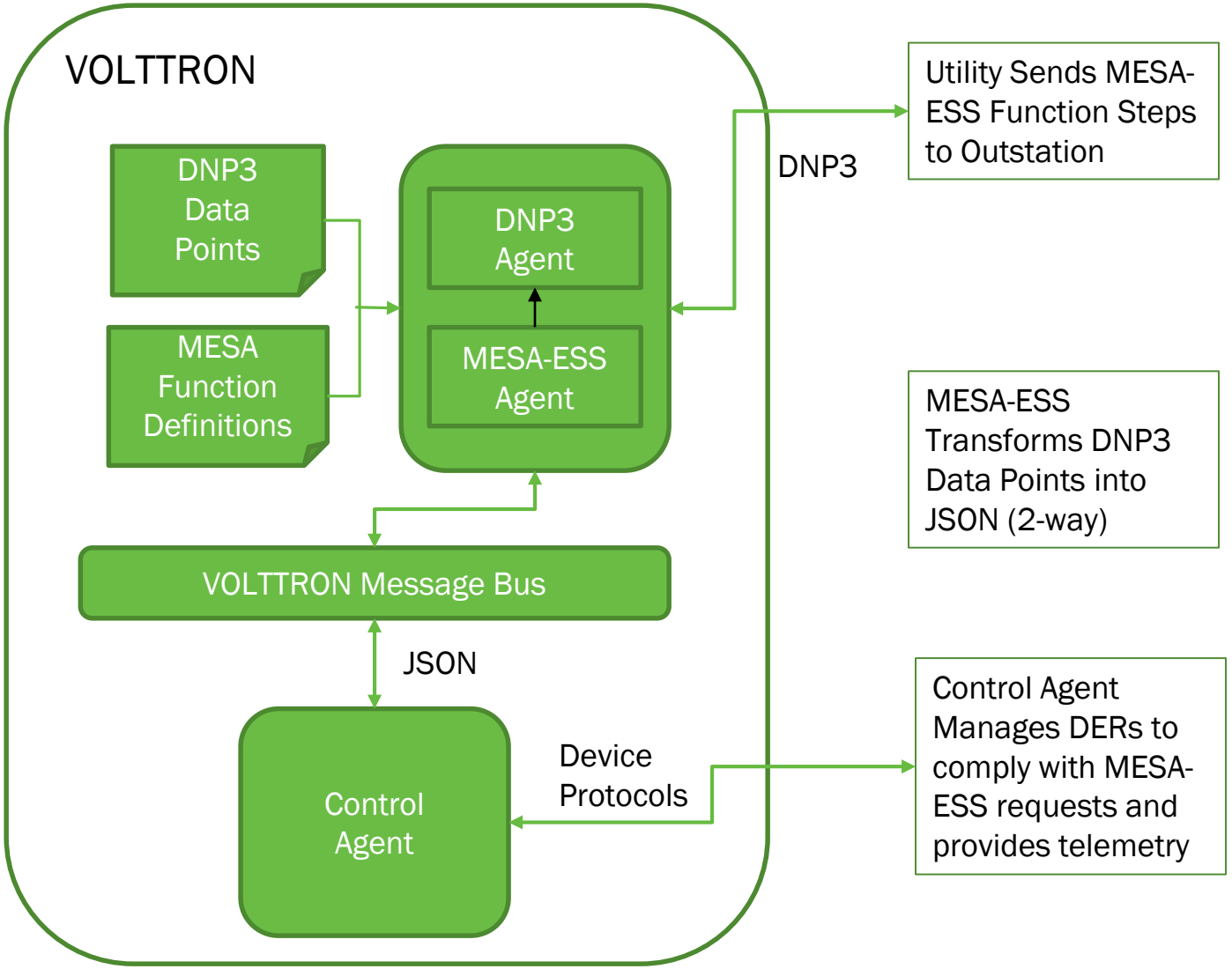
- Modbus Implementation (communication with storage)
- DNP3 Implementation (communication with bulk power system)
- Testing VOLTTRON on RabbitMQ
- Evaluate & customize monitoring/admin tools for new message broker

Distributed Network Protocol

Stakeholder Engagement

- This is a core development effort. We support other labs in their development and actively participate in office hours.
- Publish code and documentation to Github for interested developers and users.
- ModBus and DNP3 agent development will be integrated in two commercial projects
  - 8minutenergy is building an open source DNP3-based MESA-ESS Agent to be used in production solar/storage projects
  - Avistacorp is working on a decentralized SCADA architecture and evaluating how it can leverage VOLTTRON to serve some of the underlying platform components (i.e. security management, software framework, configuration management, endpoint and service integration, message bus, etc.).

DNP3 MESA-ESS AGENT



Remaining Project Work

The last two deliverables have been changed from demonstrations to development work supporting the RabittMQ migration.

The remaining work includes:

- Contribute to RabbitMQ port through early evaluation of RabbitMQ fork and detailed feedback to core team
- Build unit tests and automated regression tests for VOLTTRON on RabbitMQ
- Evaluate, customize and document admin & monitoring tools for VOLTTRON on RabbitMQ

Thank You

SLAC & Kisensum
Sila Kiliccote, Staff Scientist, SilaK@slac.stanford.edu
Bob Barkclay, CTO, bob@kisensum.com

REFERENCE SLIDES

Project Budget

Project Budget: $620,000 (220K in FY16, 135K in FY17, 265K in FY18)
Variances: None, we are on target and on budget.
Cost to Date: $409,311
Additional Funding: None

August 2017 – FY 2017 (past)		FY 2018 (current)		FY 2018 (planned)	
DOE	Cost-share	DOE	Cost-share	DOE	Cost-share
$312,421	$0	$96,889	$0	$307,579	$0

Project Plan and Schedule

Milestone	Description	Due Date	Comp. Date
M1.T0	Kick-off Meeting	Aug 16	Sept 16
M1.T2	ChargePoint Driver (as requested by PNNL and approved by program manager)	Apr 17	Dec 16
M1.T3	Common Data Model Version	Aug 17	Sept 17
M1.T1	SEP2 DRLC	Oct 17	Jun 17
M2.T1	Modbus serial and TCP implementation	Nov 17	Dec 17

Project Plan and Schedule

Milestone	Description	Due Date	Comp. Date
M2.T2	DNP3 Agent	May 18	Mar 18
M2.T3	Microgrid Control and Analytics	Aug 18	
M3.T1	VCDM white paper refined	Jan 18	Jan 18
M4.T1	~~Demo at SLAC~~ Prototype Meassage broker API	April 18	
M5.T1	~~Demo at NREL~~ Implement Message Broker on 3rd Party Broker	May 18	
M6.T3	~~Demo at LBNL~~ (LBNL never received their funding)	July 18	