VOLTTRON: Development Primer

BRANDON CARPENTER
JEREME HAACK
Pacific Northwest National Laboratory
DOE Building Technologies Office: Technical Meeting on Software Framework for Transactive Energy
July 23-24, 2014
Installing the Platform

- Clone project from Git: https://github.com/VOLTTRON/volttron.git
- Run: ./bootstrap
  - Can take some time
- Launch platform
- Build and deploy ListenerAgent
  - volttron/scripts/build-agent.sh ListenerAgent
  - chmod +x Agents/listeneragent-0.1-py2.7.egg
  - bin/volttron-ctrl install-executable Agents/listeneragent-0.1-py2.7.egg
  - bin/volttron-ctrl load-agent Agents/ListenerAgent/listeneragent.launch.json
  - bin/volttron-ctrl start-agent listeneragent.launch.json
  - To see that it's running: bin/volttron-ctrl list-agents
  - Publishes a heartbeat message
  - Subscribes to all messages

https://github.com/VOLTTRON/volttron/wiki/BuildingTheProject
Drivers

Modbus and BACnet drivers use a CSV file to specify points and names.
Initial BACnet driver can be created using a configuration grabbing utility.
No additional code needed for devices using these protocols.

https://github.com/VOLTTRON/volttron/wiki/BacnetDriver
https://github.com/VOLTTRON/volttron/wiki/ModbusDriver
sMAP Driver

- sMAP Driver to push collected data to historian
- Specifies topics data will be published to on Message Bus

https://github.com/VOLTTRON/volttron/wiki/BacnetDriver
https://github.com/VOLTTRON/volttron/wiki/ModbusDriver
ListenerAgent Walkthrough

- **ListenerAgent** – Simple agent which publishes a heartbeat and listens to all messages. Useful for testing install and listening to agents being developed.
  - **BaseAgent**
    - Init
    - Setup
    - Loop
    - Etc.
  - **PublishMixin**
  - **Topic Matching**
    - **Matching.py**

[https://github.com/VOLTTRON/volttron/wiki/ListenerAgent](https://github.com/VOLTTRON/volttron/wiki/ListenerAgent)
Steps for using Scheduler

- Publish schedule request
- Get success/error
- If success, wait for schedule announce and then take action via Actuator

Priorities

- High, Low, Low_Preempt

https://github.com/VOLTTRON/volttron/wiki/ActuatorAgent
Actuator

```python
def command_equipment(self, point_name, value, timeout=None):
    _log.debug('set_point({}, {}, {})'.format(point_name, value, timeout))
    headers = {
        'Content-Type': 'text/plain',
        'requesterID': agent_id,
    }
    self.publish(topics.ACTUATOR_SET(point=point_name, **rtu_path),
                 headers, str(value))
    try:
        return self.value_queue.wait(timeout)
    except green.Timeout:
        return True
```

- Listen for schedule announce
- Send command
- Listen for error
- Check that value changed

[https://github.com/VOLTTRON/volttron/wiki/ActuatorAgent](https://github.com/VOLTTRON/volttron/wiki/ActuatorAgent)
Weather

- Obtain WeatherUnderground key
- Edit settings.py to use that key
- Agent publishes all weather data from the site for a given zipcode
- Serves as an example for a proxy agent

https://github.com/VOLTTRON/volttron/wiki/WeatherAgent
Logging

```python
headers = {}
headers['mod.FROM'] = self.agent_id
headers['mod.CONTENT_TYPE'] = headers_mod.CONTENT_TYPE.JSON

mytime = int(time.time())

content = {
    "Listener": {
        "Readings": [[mytime, 1.0]],
        "Units": "TU",
        "data_type": "double"
    },
    "heartbeat": {
        "Readings": [[mytime, 1.0]],
        "Units": "TU",
        "data_type": "double"
    }
}

self.publish('datalogger/log/', headers, json.dumps(content))
```

- Publish message to the logging topic
  - Topic after /log/ used in point or defaults to /datalogger
- Dynamically creates topics as needed

[https://github.com/VOLTTRON/volttron/wiki/Logging](https://github.com/VOLTTRON/volttron/wiki/Logging)
Archiver

► Publish request to archiver topic
  - Point
  - Timerange
  - Note: best to chunk large requests
  - publish('archiver/request/campus1/building1/realcatalyst1/CoolCall1',{},'(now - 1h, now)')
    publish('archiver/request/campus1/building1/realcatalyst1/CoolCall1',{},'(1374192541000.0, 1374193541000.0)')

► Receive answer on response topic in a list of time/value pairs
  - [[1371851254000.0, 1.0], [1371851314000.0, 1.0], [1371851374000.0, 1.0]]

https://github.com/VOLTTRON/volttron/wiki/ArchiverAgent
Multi-Node

MultiBuildingAgent provides multi-node communication

- Listens on its own pub/sub channels and passes messages between platforms
- Can be encrypted

https://github.com/VOLTTRON/volttron/wiki/MultiBuildingMessaging
VOLTTRON 2.0 Changes

- Optional Features:
  - Resource Management
  - Agent signature validation
- Packing format changed to Wheel
- New configuration file and options
- New command structure
FY15 Plans

- Centralized Management Console
- Enhanced modularization to easily swap out different component implementations
- Supervisory Agent
  - Monitor other platforms
  - Return appliances to a known state in case of abnormal agent condition
- Scalability Study
  - Investigate large scale deployment of platform
- Penetration Testing and Security Enhancements
Resources

- VOLTTRON Resources
  - Wiki: https://github.com/VOLTTRON/volttron/wiki
  - Email: volttron@pnnl.gov

- If you are interested please contact us to be added to:
  - Mailing list: volttron-dev@lyris.pnnl.gov
  - Office hours
    - Twice monthly telecon with VOLTTRON development team