



Pacific Northwest
NATIONAL LABORATORY

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Integrating with NodeRed, DDS, Etc.

VOLTRON™ External Tools Integration

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VOLTRON™ 2016

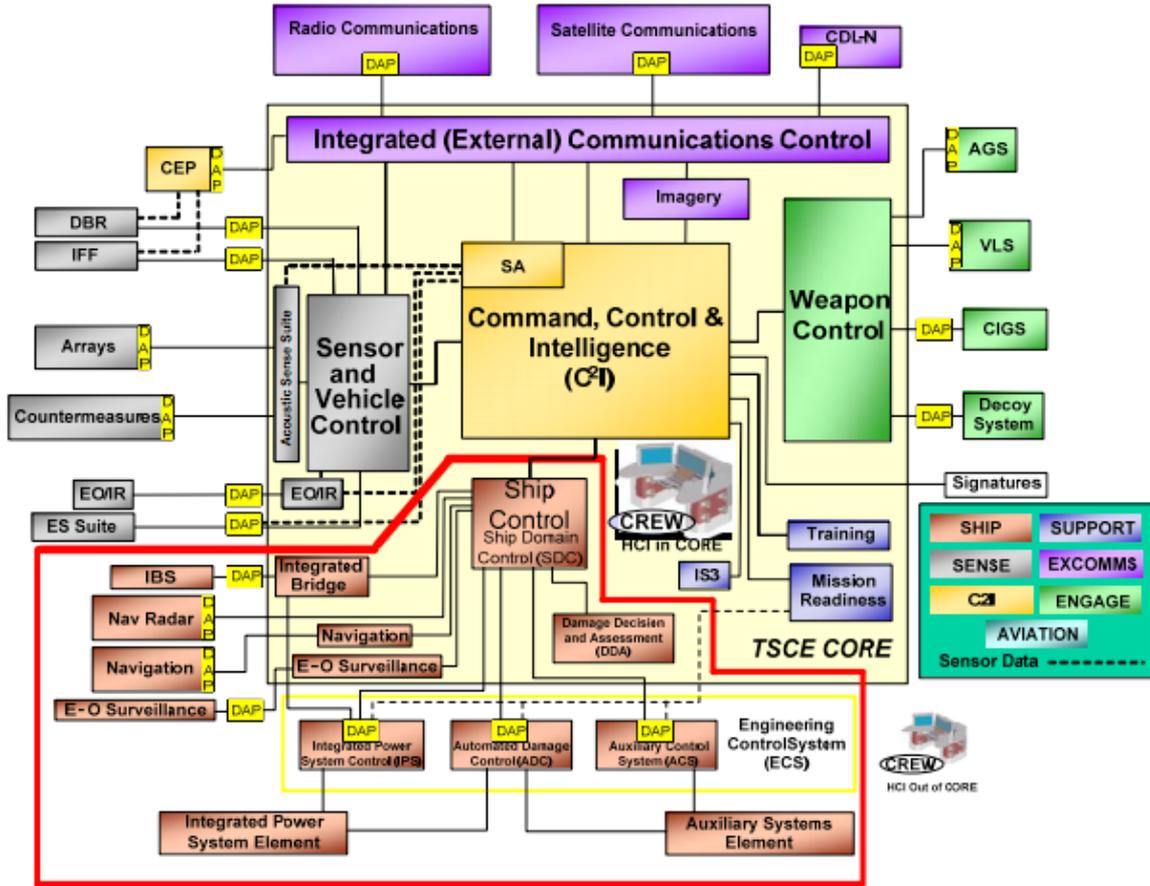


Data Distribution Service (DDS)

- ▶ Object Management Group (OMG) standard with multiple implementations
- ▶ “Data centric” middleware – data model required
- ▶ Publish / Subscribe messaging
- ▶ Automatic Discovery
- ▶ Fine-grain control at each stage of data transport
 - Configurable Quality of Service options



Total Ship Compute Environment





PubSub Topics

DDS

- ▶ Matched exactly
- ▶ Associated with a data type i.e. a struct
- ▶ Explicitly attached to pubsub nodes
- ▶ Lots of work to add new topics

ZMQ

- ▶ Matched by prefix
 - Very useful for hierarchical topics
 - i.e. campus/building/device
- ▶ No work to add new topics



DDS Type Configuration

```
<types>
  <struct name="ShapeType" extensibility="extensible">
    <member name="color" stringMaxLength="128" id="0" type="string" key="true"/>
    <member name="x" id="1" type="long"/>
    <member name="y" id="2" type="long"/>
    <member name="shapessize" id="3" type="long"/>
  </struct>
  <enum name="ShapeFillKind" extensibility="extensible">
    <enumerator name="SOLID_FILL" value="0"/>
    <enumerator name="TRANSPARENT_FILL" value="1"/>
    <enumerator name="HORIZONTAL_HATCH_FILL" value="2"/>
    <enumerator name="VERTICAL_HATCH_FILL" value="3"/>
  </enum>
  <struct name="ShapeTypeExtended" baseType="ShapeType" extensibility="extensible">
    <member name="fillKind" id="4" type="nonBasic" nonBasicTypeName="ShapeFillKind"/>
    <member name="angle" id="5" type="float"/>
  </struct>
</types>
```



Making DDS Available to VOLTRON

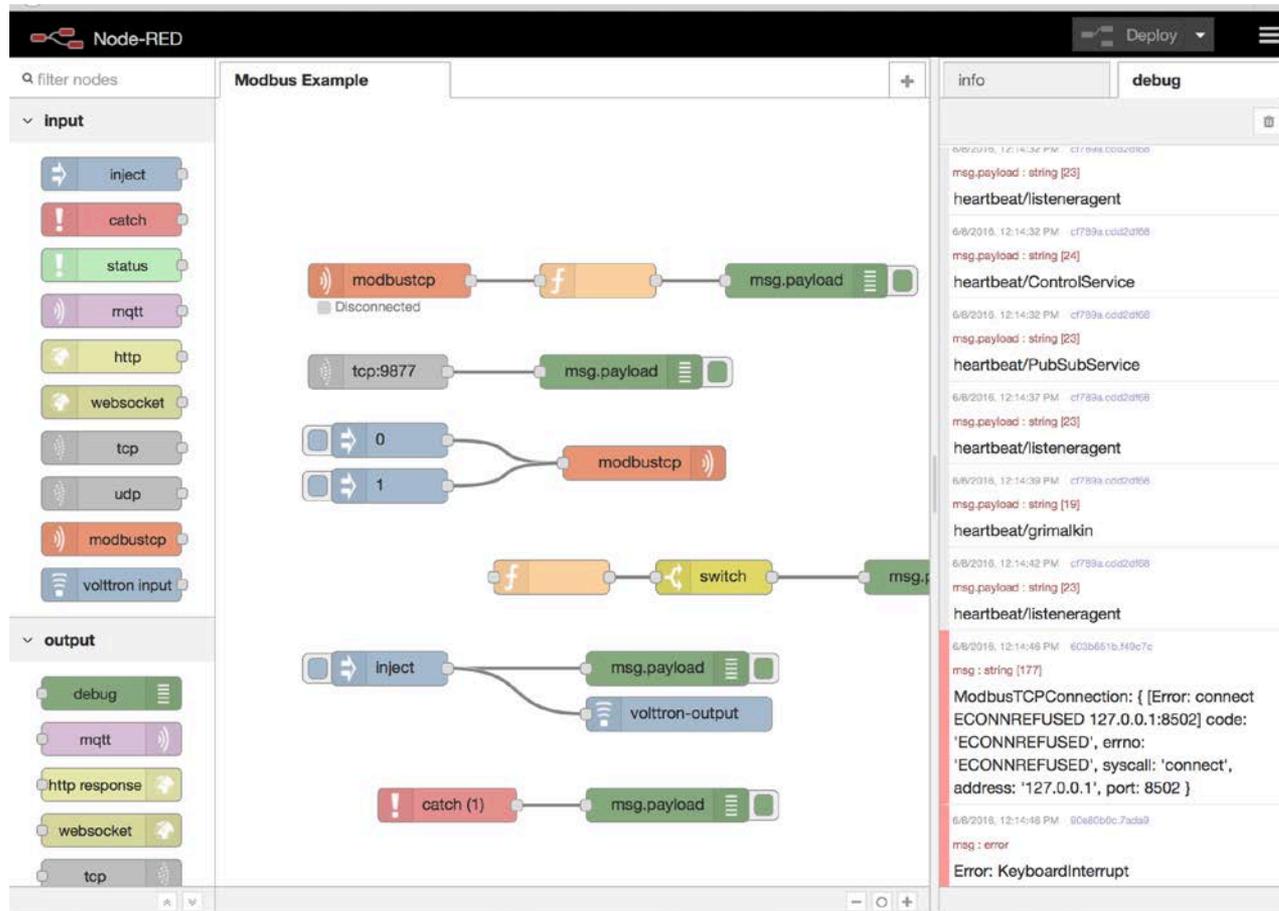
- ▶ rticonnextdds-connector adds python support for DDS
 - unofficial 'community' package
- ▶ Wrap library as an agent
- ▶ Expose needed functionality as RPC methods
- ▶ Other agents can now retrieve and publish to DDS topics



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Demo



The screenshot displays the Node-RED web interface. The main workspace shows a flow titled "Modbus Example". The flow starts with an "inject" node, which branches into two paths. One path goes through a "msg.payload" node to a "volttron-output" node. The other path goes through a "catch (1)" node to a "msg.payload" node. The flow then splits into two parallel paths. The top path consists of a "modbustcp" node (disconnected), followed by a function node "f", and then a "msg.payload" node. The bottom path consists of a "tcp:9877" node, followed by a "msg.payload" node. The flow then splits into two parallel paths. The top path consists of a function node "f", followed by a "switch" node, and then a "msg.payload" node. The bottom path consists of an "inject" node, which branches into two paths: one through a "msg.payload" node to a "volttron-output" node, and another through a "catch (1)" node to a "msg.payload" node. The right-hand side of the interface shows a "debug" console with a list of messages and an error message: "ModbusTCPConnection: { [Error: connect ECONNREFUSED 127.0.0.1:8502] code: 'ECONNREFUSED', errno: 'ECONNREFUSED', syscall: 'connect', address: '127.0.0.1', port: 8502 }".

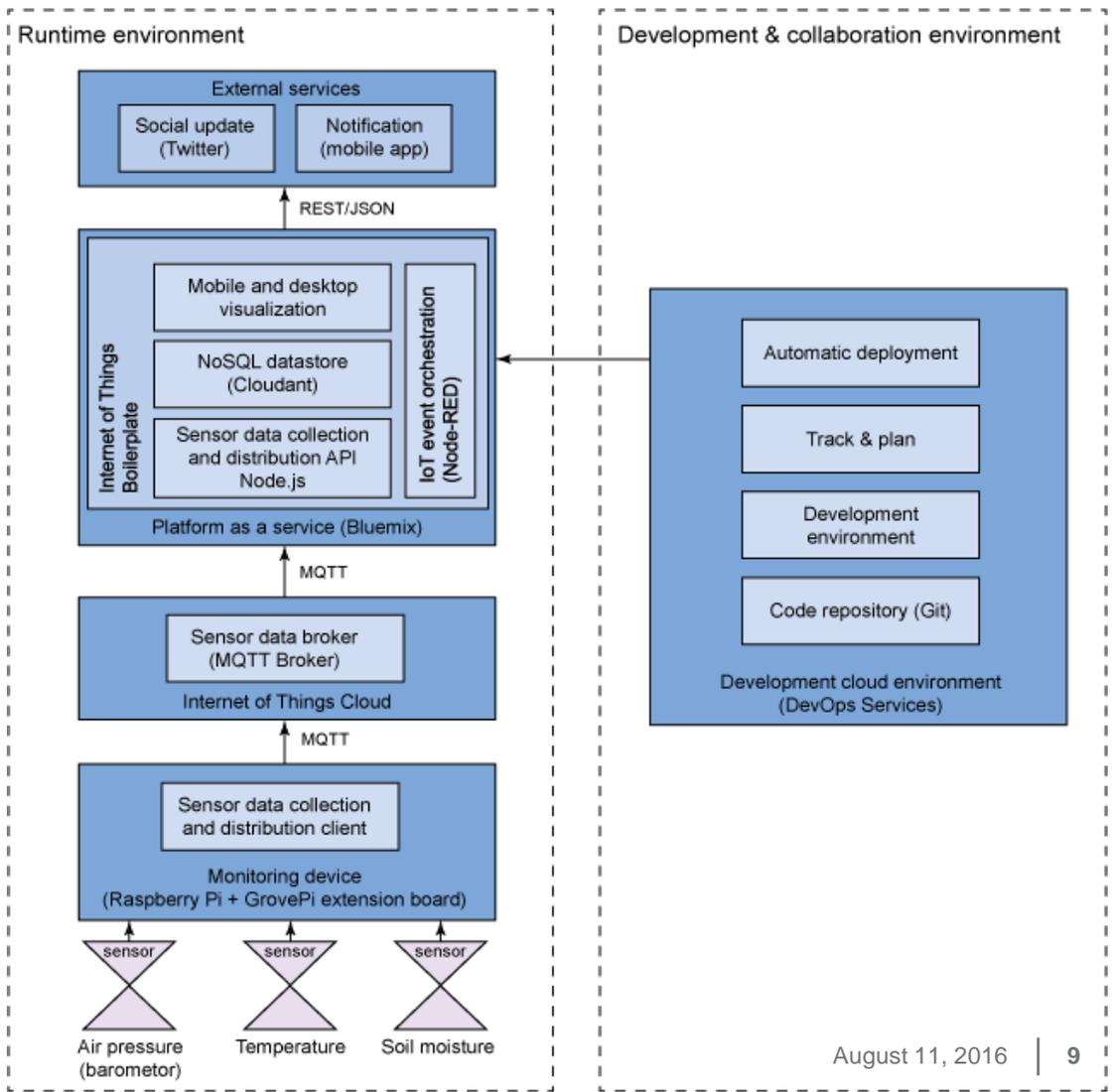
- ▶ Visual wiring tool for the Internet of Things
- ▶ Built on node.js
- ▶ Over 800 nodes and flows available for download
- ▶ Embeddable



Node-RED: Watering Plants with Bluemix



<http://www.ibm.com/developerworks/cloud/library/cl-poseidon1-app/>



Node-RED

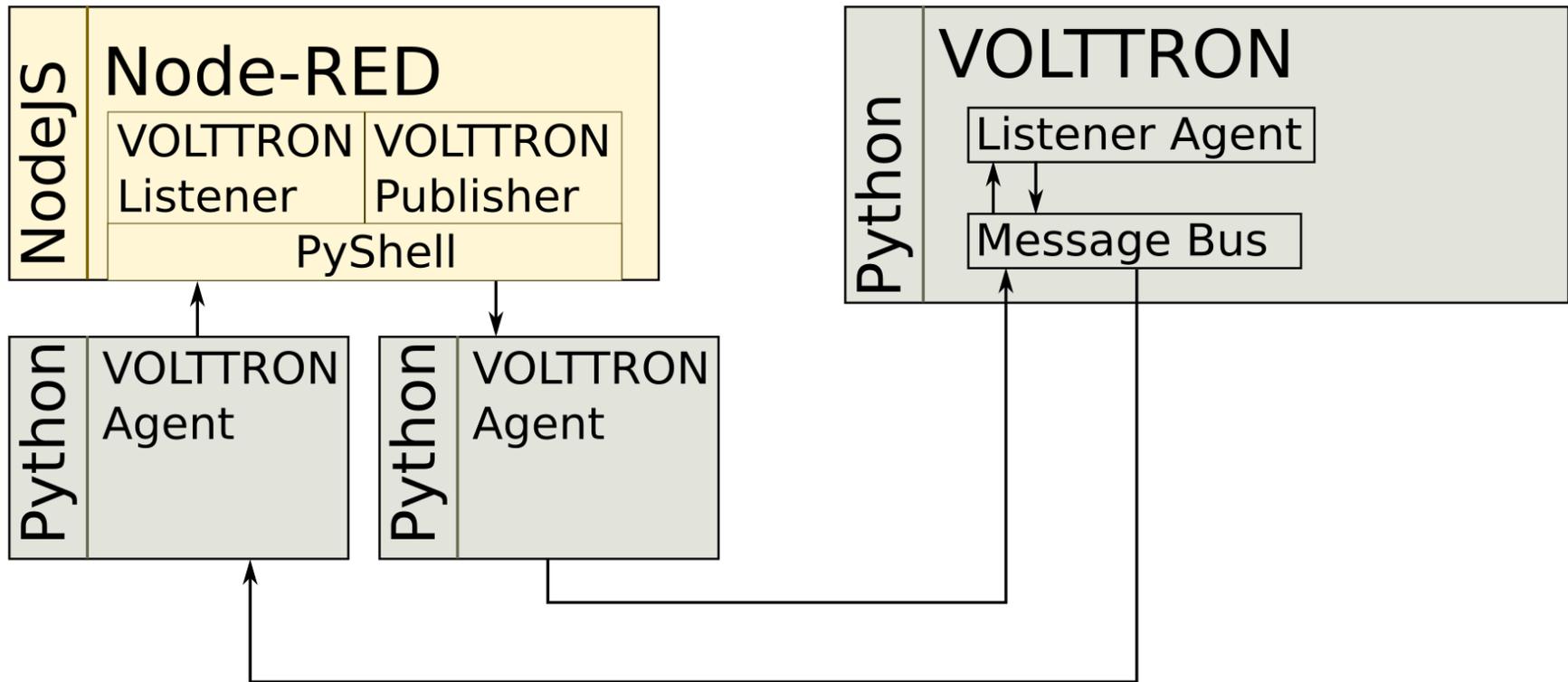
- ▶ General-purpose event processing
- ▶ Can talk Modbus
- ▶ Embed as UI in other tools

VOLTTRON™

- ▶ Applied to Smart Buildings
- ▶ Works with Modbus and BACnet
- ▶ Use UI for monitoring, control, feedback
- ▶ Includes security infrastructure, historian, etc.



Connecting Node-RED to VOLTTRON™





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Demo



Future Extensions

- ▶ MQTT – Machine to machine protocol with a focus on maintaining a small footprint
- ▶ Alljoyn – Framework for automatic device discovery and communication
- ▶ Azure IoT – Microsoft’s IoT cloud
- ▶ AWS IoT – Amazon’s IoT cloud