



Managing Energy Systems with VOLTTRON™

Our energy system is rapidly changing. Across buildings and the power grid, digital technology now produces data that offers in-depth understanding of demand and supply across the energy system. At the same time, the integration of renewable energy, energy storage, and electric vehicles adds new challenges. To solve this problem, Pacific Northwest National Laboratory (PNNL) has partnered with DOE to develop a real-time, scalable reference platform that supports the needs of the changing energy system – VOLTTRON™.



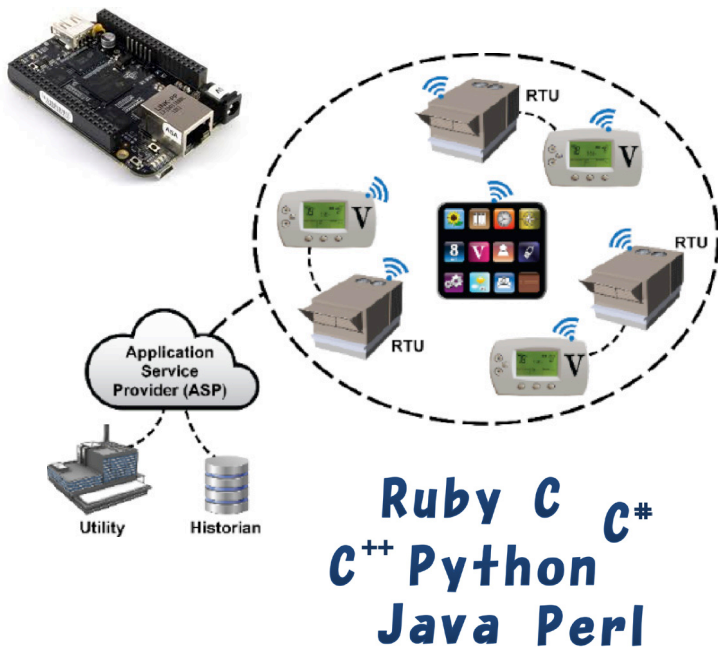
WHAT IS VOLTTRON?

VOLTTRON is a distributed control and sensing software platform that allows agents to easily communicate with physical devices and other resources. This means that VOLTTRON can independently manage a wide range of energy systems, such as HVAC systems, electric vehicles, distributed energy, or entire building loads.

Mobile and stationary software agents perform information gathering, processing, and control actions.

VOLTTRON ATTRIBUTES

- » Open, flexible, and modular software platform
- » Easy application development
- » Object oriented, modern software development environment
- » Supports an open source flexible messaging system - ZeroMQ (publish/subscribe)
- » Language agnostic – does not tie applications to a specific language
- » Supports a commonly used device and control systems protocols, such as MODBUS and BACnet (Building Automation and Control network)
- » Supports collection and sharing of energy performance and non-energy (comfort, operational, financial, etc.) related data with applications and other networked devices
- » Low CPU, memory, and storage footprint requirements
- » Supports non-Intel CPUs
- » Supports platform services such as messaging, mobility, and application support
- » Includes built-in weather service that can retrieve weather information for any location
- » Supports open source sMAP (simple measurement and actuation profile) historian
- » Supports OpenADR (open automated demand response) protocol



SECURITY

To address concerns regarding unauthorized access to or attacks on smart technologies for buildings and the power grid, VOLTTRON was designed with cybersecurity in mind. It includes security features such as memory protection, resource constraints and guarantees, authentication, authorization, and trust. For advanced diagnostic and control applications that require software to “move” between platforms, VOLTTRON supports secure application transport, including code, configuration, and collected data.

APPLICATIONS

VOLTTRON has been extensively simulated and tested under ongoing projects with the DOE Office of Energy Efficiency and Renewable Energy (EERE). At PNNL’s Lab Home facilities, VOLTTRON successfully scheduled water heater and electric vehicle recharging operations. It is also currently used by Lawrence Berkeley and Oak Ridge National Laboratories, in EERE’s Buildings Technologies Office-funded Transactive Network project. This project examined the role transactive networks could play in improving the operations of rooftop units (RTU) on commercial buildings, while also enabling the RTUs to participate in building-grid transactions. A number of other organizations are also using VOLTTRON to demonstrate energy efficiency and grid services.

WHERE TO GET VOLTTRON

The source code for VOLTTRON has been released to the public and is available at [github.com](https://github.com/VOLTTRON/volttron) (<https://github.com/VOLTTRON/volttron>), along with a quick start page, documentation, and the VOLTTRON user guide. With VOLTTRON’s non-proprietary nature, researchers and software developers can use this tool to build applications that more efficiently manage energy use among appliances and devices.

PLANNED ENHANCEMENTS

VOLTTRON 2.0 was released in September 2014 and introduced agent mobility, secure agent packaging, and resource monitoring. VOLTTRON 3.0 is under active development with planned features such as:

- » Enhanced security based on the results of penetration testing
- » Supervisory agent able to detect issues with agents and devices and take corrective action
- » Management utilities for easier administration of a distributed VOLTTRON deployment
- » Increased modularization of key components such as device communication and data storage making it simpler to swap in alternative technologies

For more information, contact

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To download VOLTTRON, visit

<https://github.com/VOLTTRON/volttron>


Pacific Northwest
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