Pacific Northwest
NATIONAL LABORATORY

Eclipse VOLTTRON Overview

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VOLTTRON™

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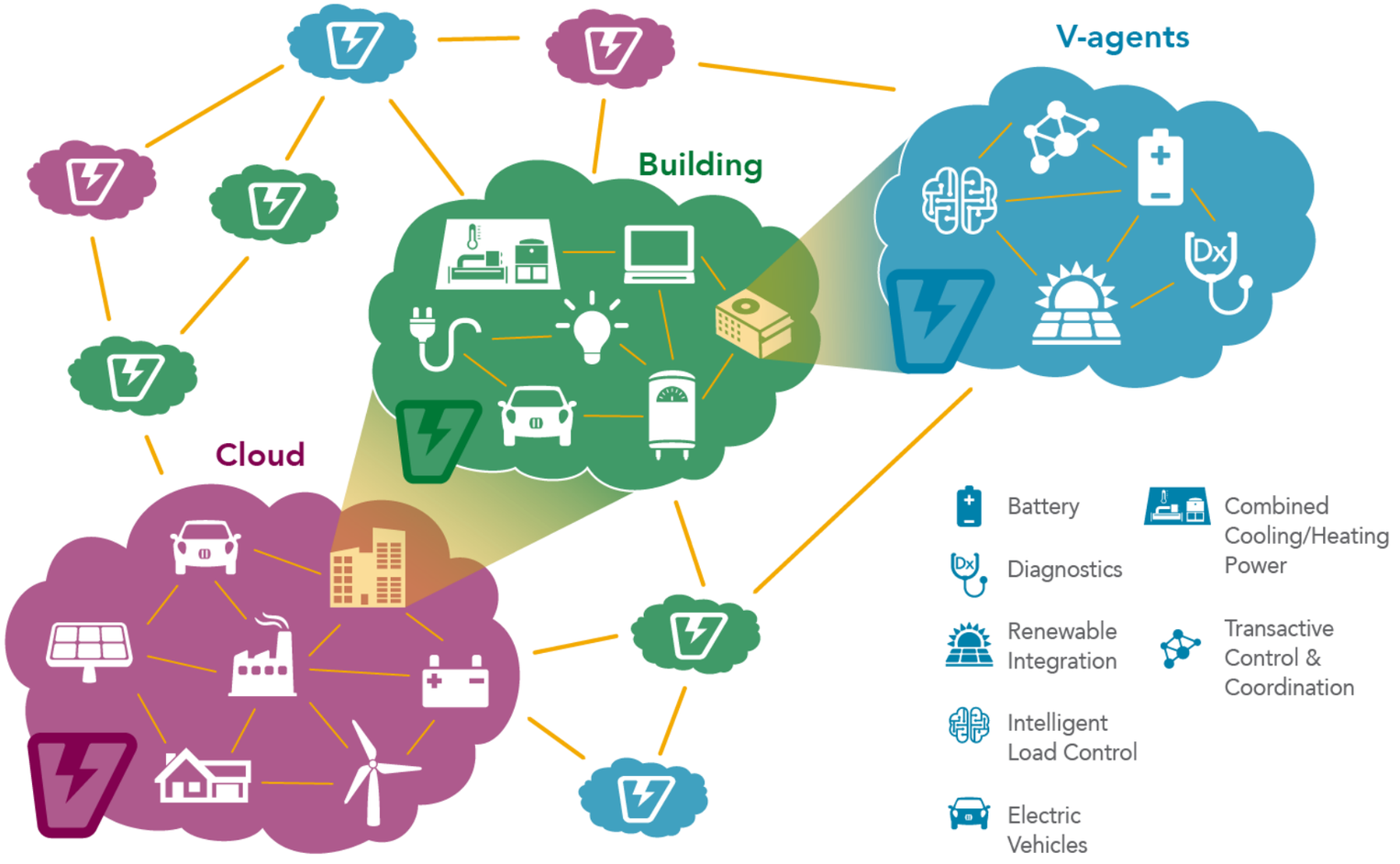
Eclipse VOLTTRON™ Definition

- VOLTTRON is an application platform (e.g. Android, iOS) for distributed sensing and control applications
  - Written in Python
  - Deployable on Linux
- VOLTTRON utilizes protocols to interact with devices
- VOLTTRON enables applications but is not an application itself
  - Demand response can be implemented as an application on top of VOLTTRON
- VOLTTRON is open, flexible, and grows stronger with the community

Eclipse VOLTTRON Eco-System

- Multiple standards and protocols in buildings space
- VOLTTRON™ can act as interoperability platform
- Capabilities expand along with community



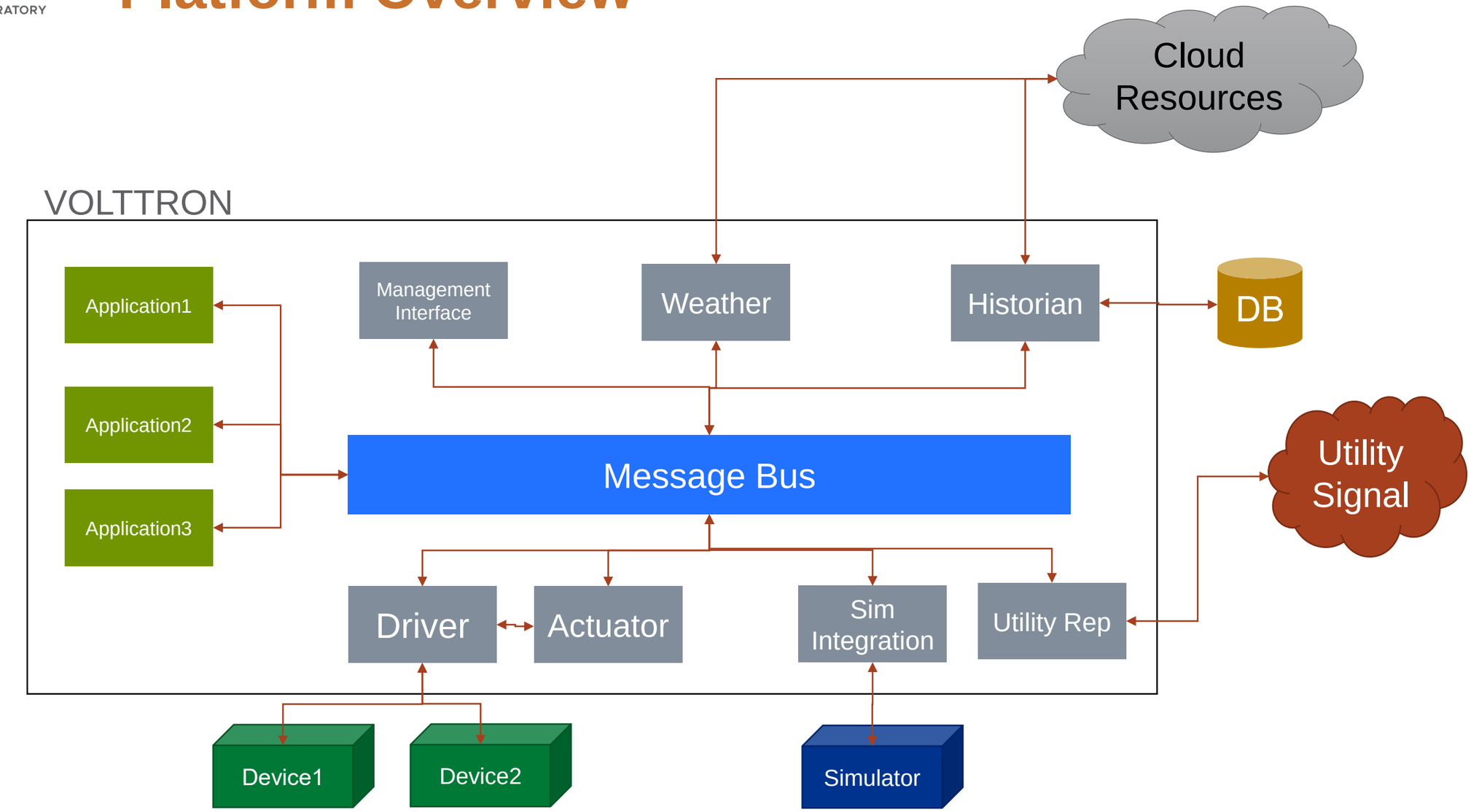
Key Benefits and Primary Uses

- 3 Key Benefits:
  - Cost-effective – Open source software (free to users) and can be hosted on inexpensive computing resources
  - Scalable – Can be used in one building or a fleet of buildings
  - Interoperable – Enable interaction/connection with various systems/subsystems, in and out of the energy sector
- 3 Primary Use Areas:
  - Building Efficiency – To help control building energy system performance
  - Building-Grid Integration – To support “beyond demand response” approach and integration of distributed energy resources into the grid
  - Transactive Control – To support a scalable, distributed control mechanism for transacting information about systems, loads and constraints to deliver user specified services.

Pillars of VOLTTRON

- Flexibility
  - The platform should be flexible to meet requirements for a varied set of solution spaces
- Usability
  - The platform should be both easy to use and straightforward to develop
- Scalability
  - The platform should enable deployments at scale through proper deployment and division of resources
- Security
  - The platform must be secure to protect the devices being controlled and not provide a “backdoor”
- Interoperability
  - The platform must work across vendors and protocols and provide capabilities to simplify these interactions

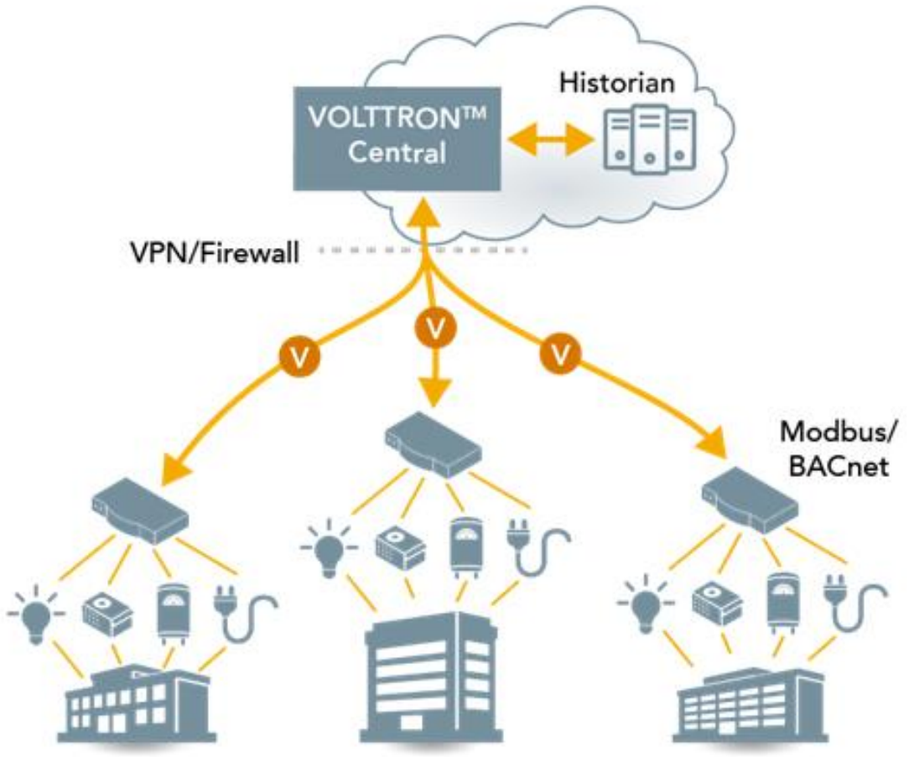
Platform Overview

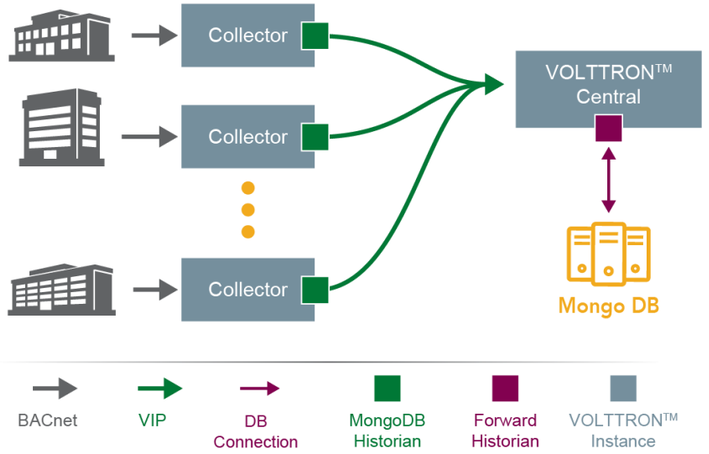


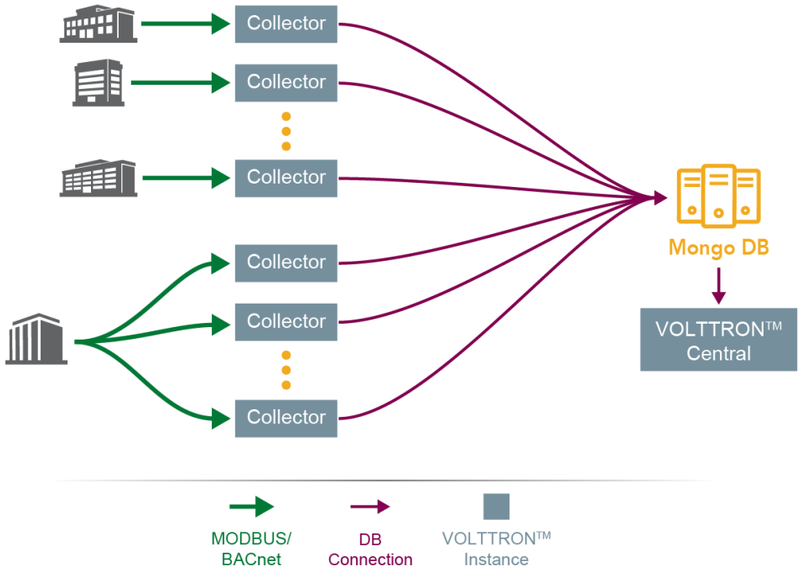
Interoperability Platform

- MessageBus
  - ZMQ
  - RabbitMQ
- Device interaction protocols
  - BACnet
  - Modbus
  - Chargepoint
  - DNP3
  - SEP2.0
  - Device specific
- Simulation
  - Energy+
  - MATLab
  - FNCS
- Data Storage options
  - SQLite
  - MySQL
  - Prometheus
  - CrateDB
  - MongoDB
  - Redshift
- Weather Data
  - DarkSky
  - Weather.gov
  - Weather Underground
- OpenADR Signal

Flexible Deployment Options



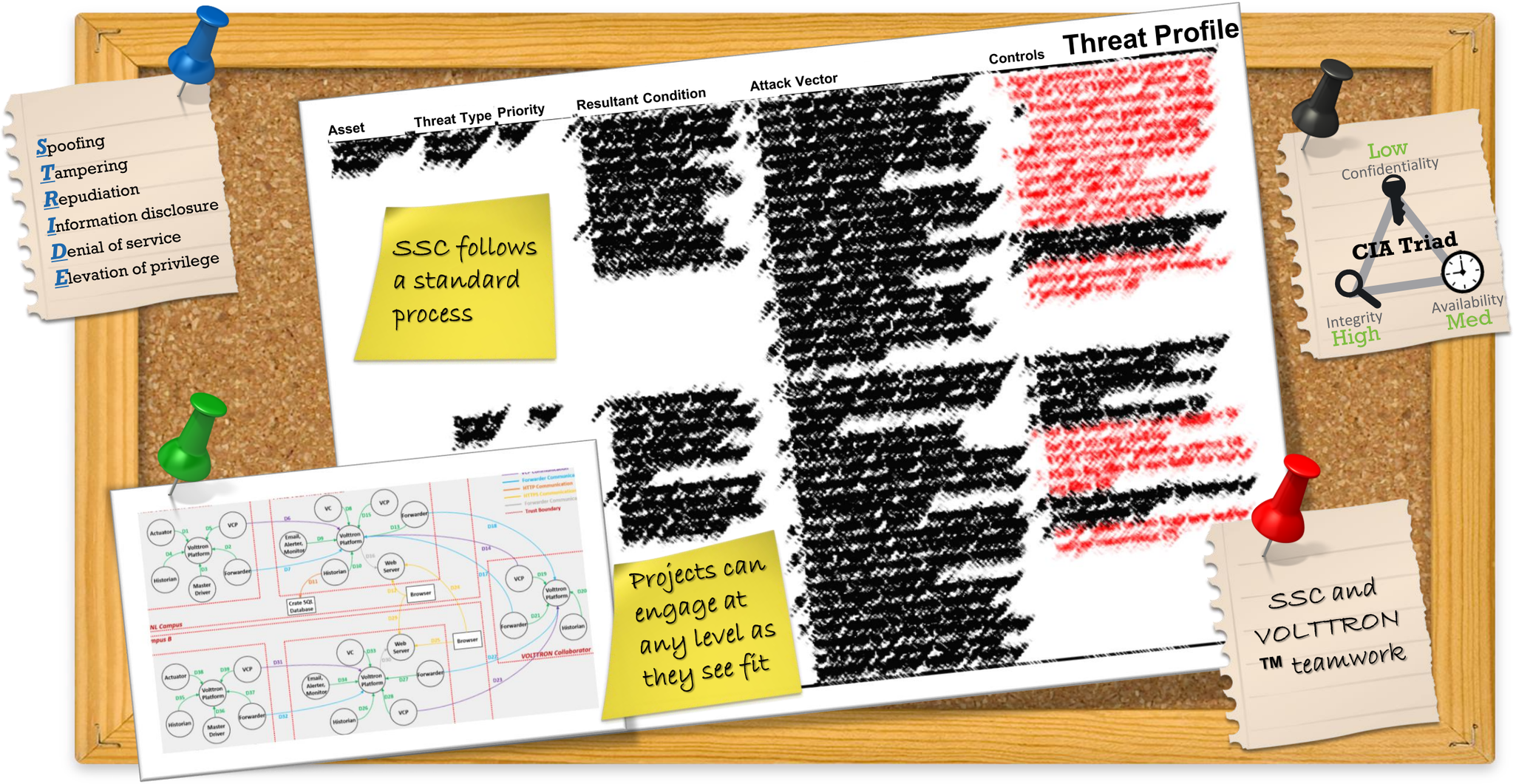




Platform Security

- 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

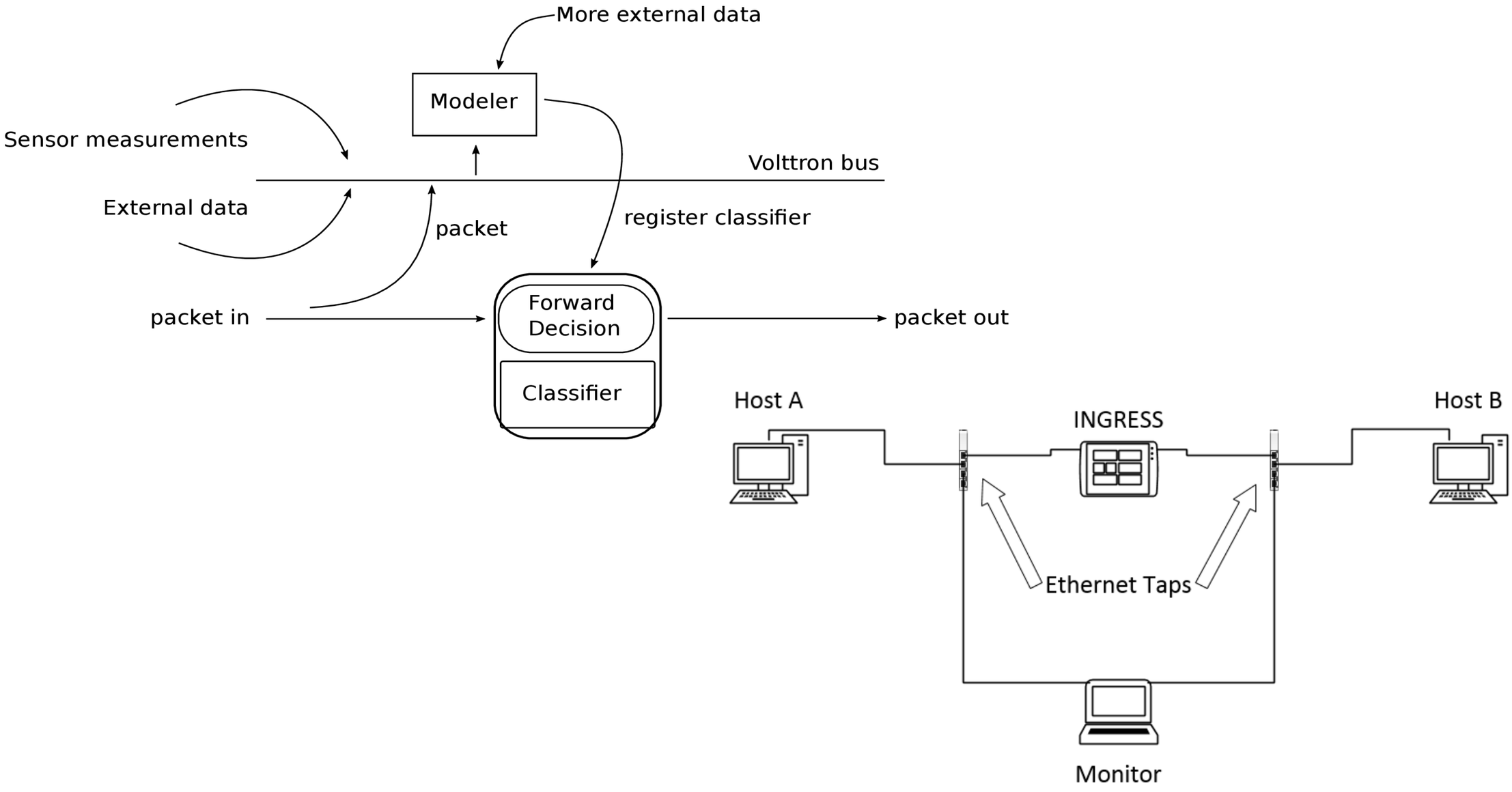
VOLTTRON Security Analysis



Applications

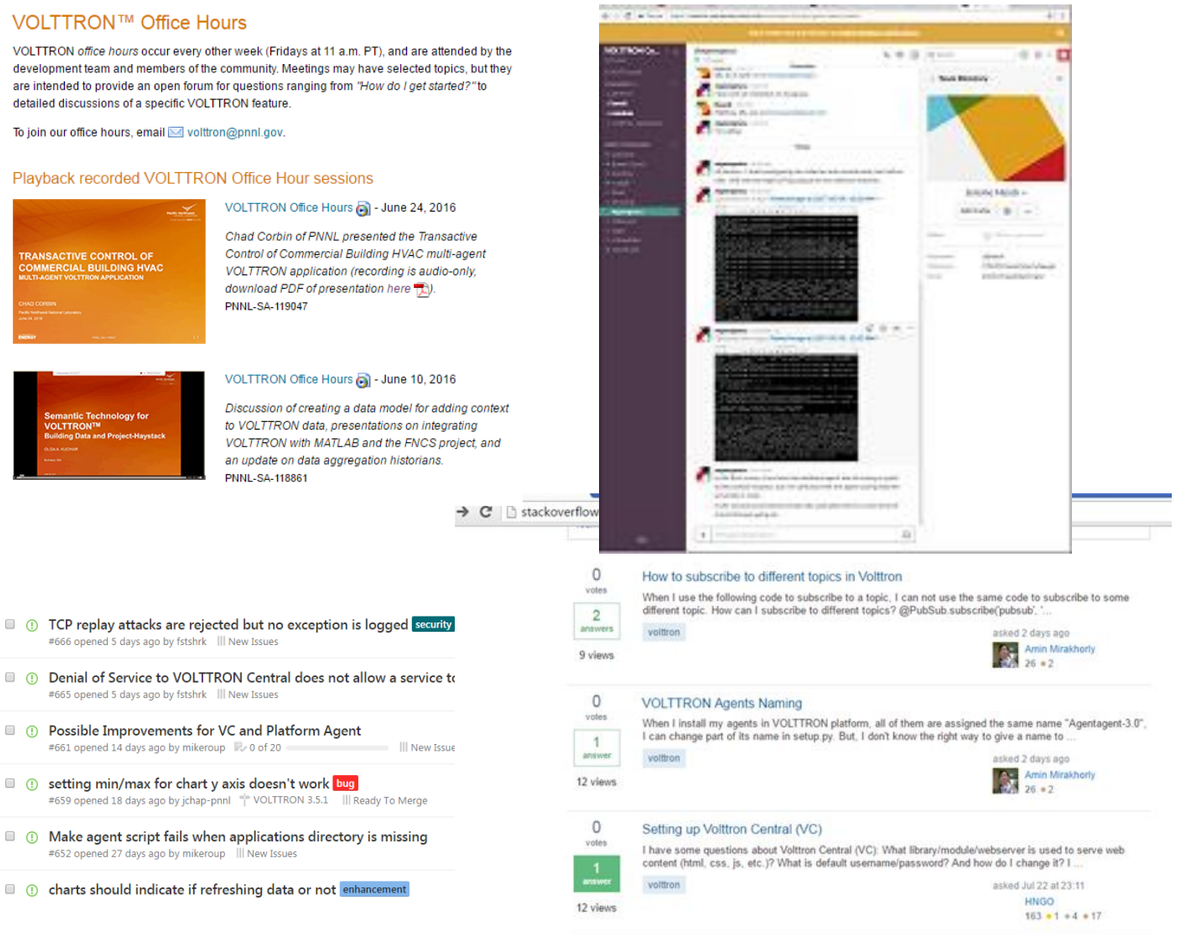
- AFDD – Automatic Fault Detection and Diagnostic
- AFDDVis – Visualization for AFDD results
- AirsideRCxAgent - Air-side HVAC Auto-Retuning Diagnostics
- DrivenMatlabAgent – Integrates MATLAB code with VOLTTRON platform
- EconomizerRCxAgent - Application to detect and correct operational problems for AHUs/RTUs.
- ILCAgent – Intelligent Load Control Agent
- TCM2Agent
- WBE – Whole Building Energy
- Economic Dispatch

Example Application – Inline Security Device



VOLTTRON Community

- Mailing list: 200
- Online Office Hours
  - Invite list: 60+ (recently pruned)
  - 20+ regular attendees
  - 3 years of recordings
- Slack: 86 members
- Github stats
  - 1200+ Views, 161 Unique visitors
  - 109 clones, 38 unique cloners
  - 42 contributors
  - 200 Watchers
  - 100+ forks
- Community
  - National Labs
  - Universities
  - Commercial Companies



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Thank you