IoT Mashups with the WoTKit

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Motivation

- IoT *mashups are* simple, personal, situational, short lived applications
- Existing platforms often steep learning curve and complex tool chains
- Leveraging web protocols important step forward - *Web of Things*
- Web-centric IoT toolkits can increase pool of developers and applications.

Overview

- Other Toolkits
- Application Experience
- Requirements
- WoTKit
- Lessons Learned

Many Other Toolkits

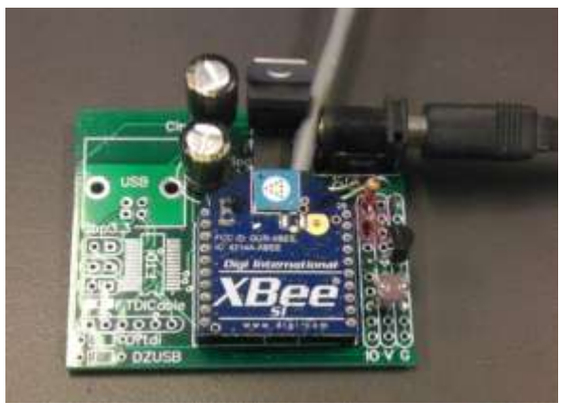
- High end M2M systems
  - Custom solutions
  - Not focused on web, sharing
    - Can be complex
- Similar web-centric toolkits
- Key differences
  - what is included
  - how services are delivered

Application Experience

- Health
  - Remote monitor of pulse oximeter
  - Connect heart rate monitor alerts when heart rate is high
- Environment
  - air quality data from web to display on mobile application

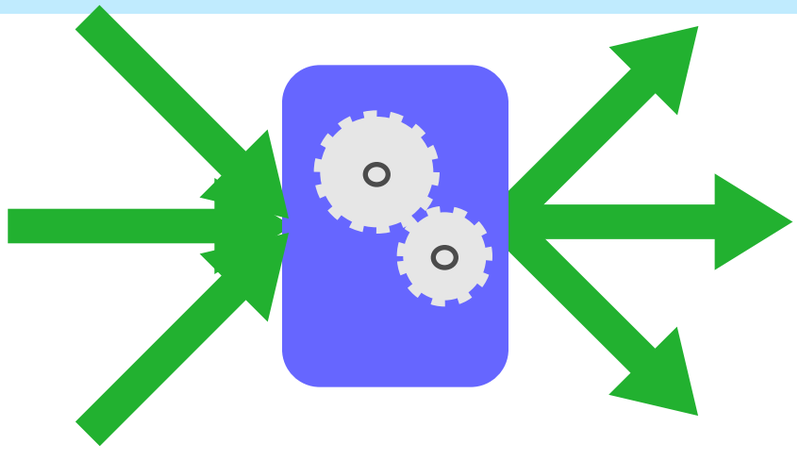
Application Experience

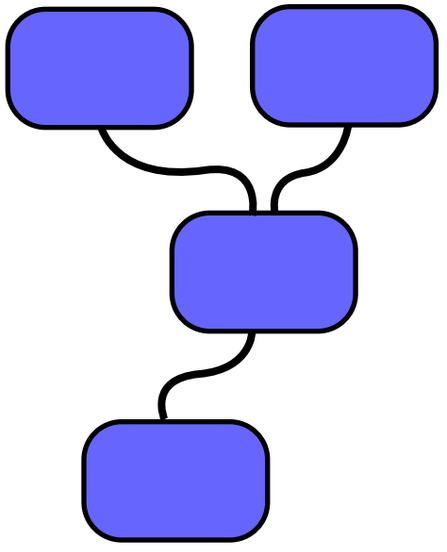
- Transport
  - vehicle location monitoring
  - location and transport mode
  - mobile traffic visualizations
  - ship locations
- IT, Social Networks, Home
  - Phidget, Arduino integration
  - Zigbee gateways
  - CPU monitors
  - Home and appliance power monitoring
  - Social network integration

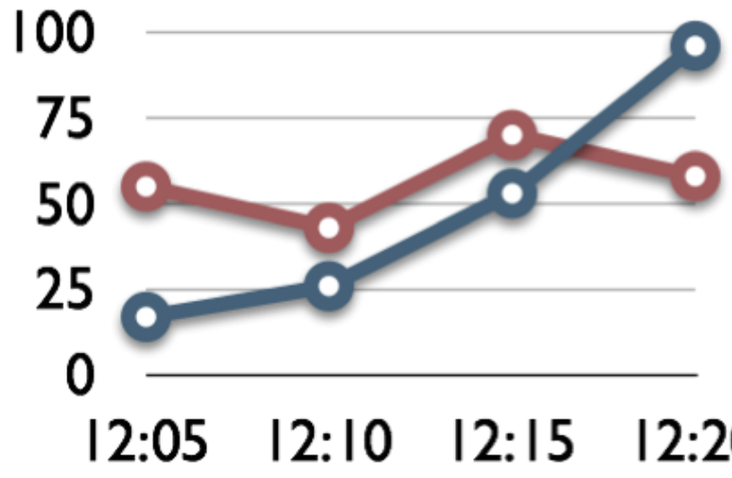


Toolkit Requirements

- Integration
- Meta-data and Storage
- Visualizations
- Control
- Sharing
- Processing and Alerts
- APIs

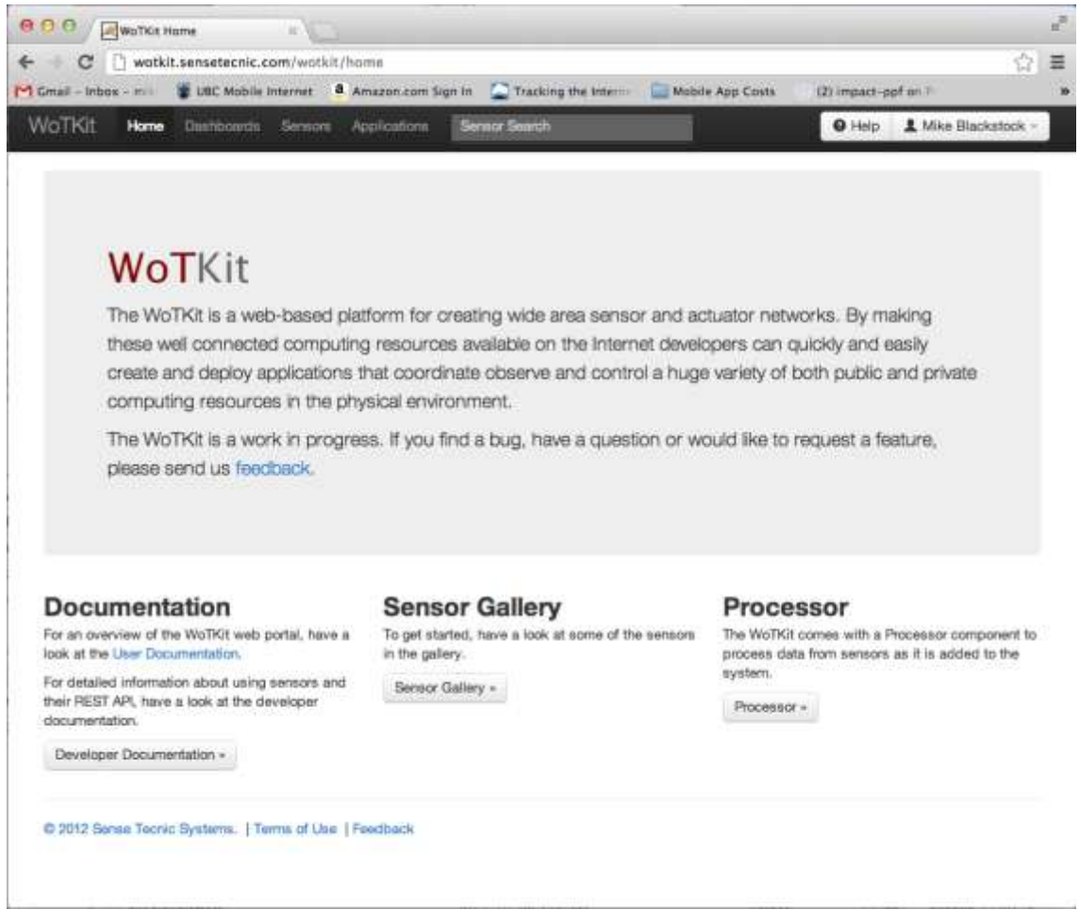






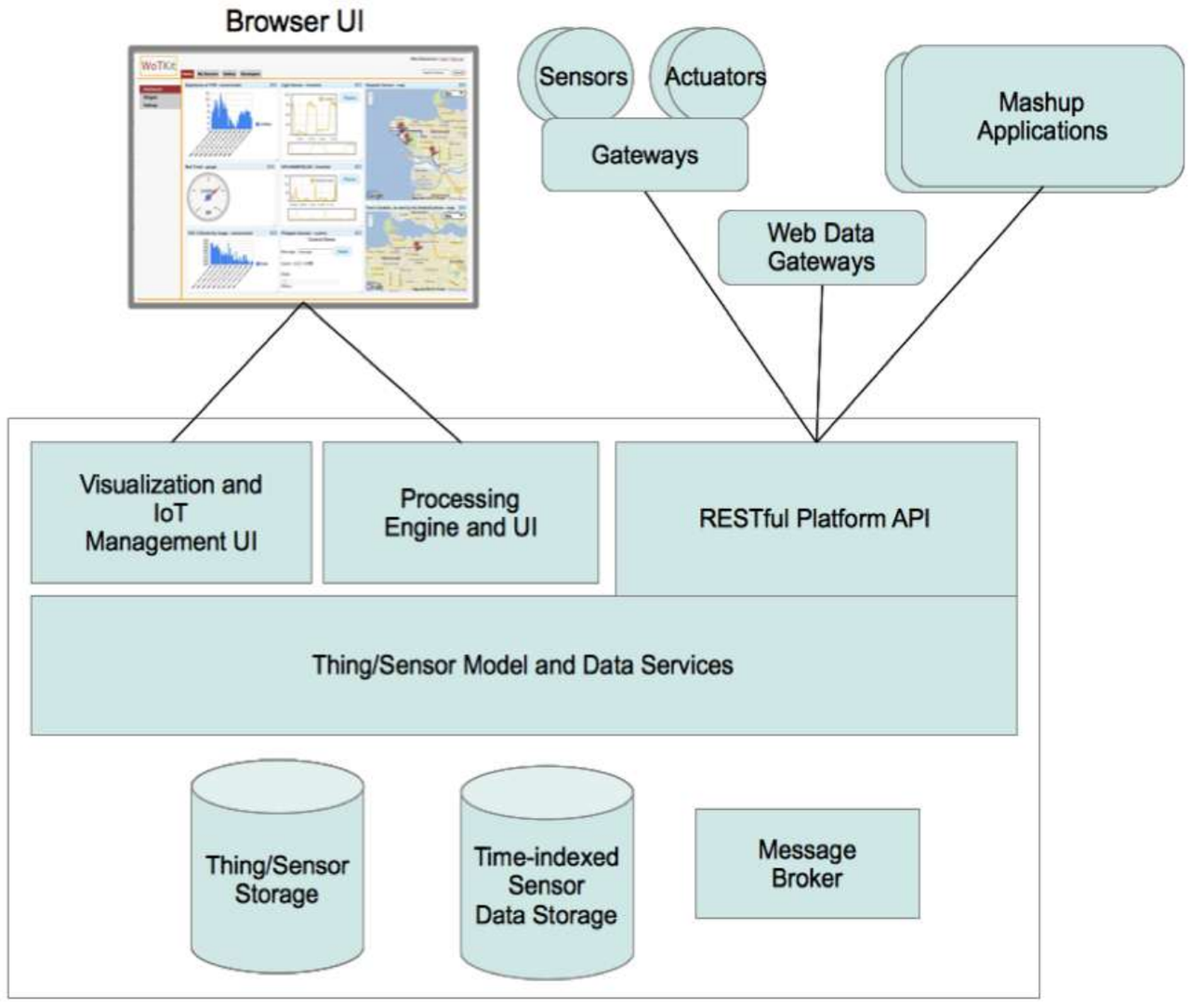
WoTKit

- Platform and Mashup Services
  - Sensor manager and aggregator
  - Visualizations
  - Finding & sharing sensors
  - Processing and alerts
- all are *core* system facilities, not plug ins or add ons.



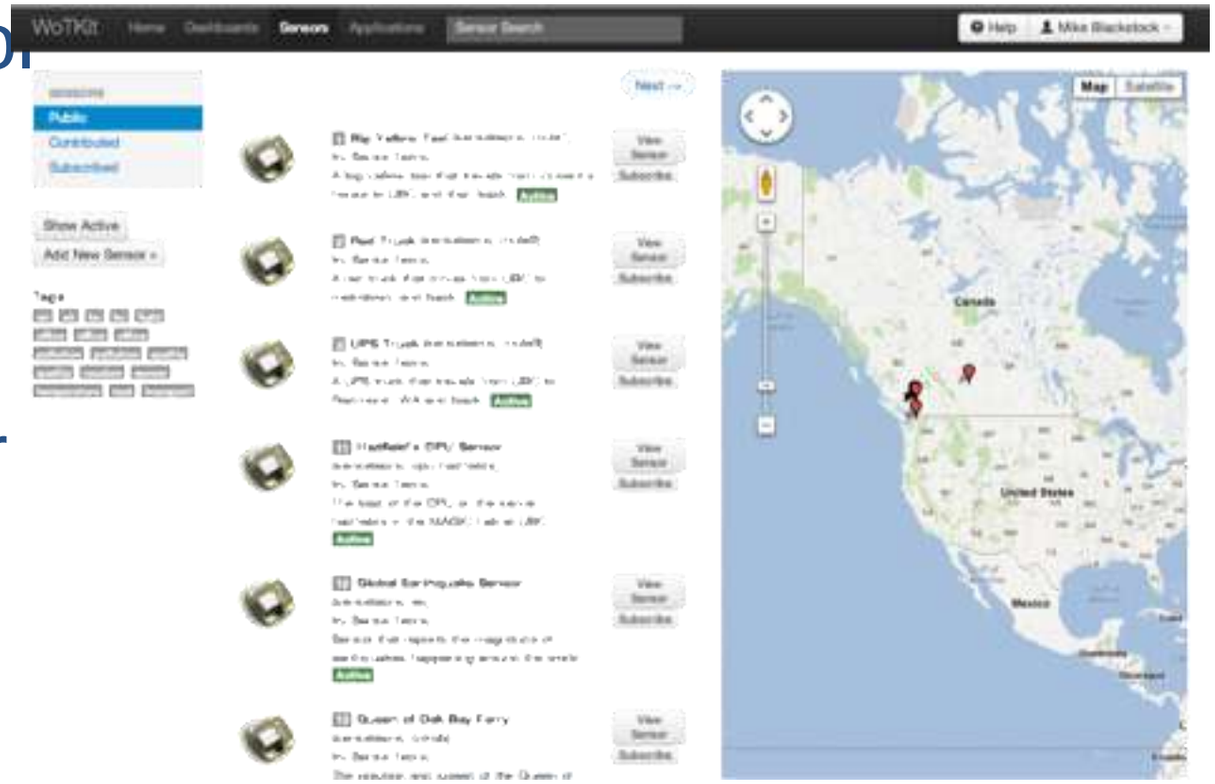
Architecture

- Management and visualization UI
- Processing engine
- RESTful API
- Shared data model
- Database and message broker



Integration and Sharing

- Easy integration using HTTP
- 2 way – sense and control
- Sharing meta data and sensor data
- Saves integration task for others
- Allows easy search and creation of mashups
- Provide services for connecting ‘islands of things’.

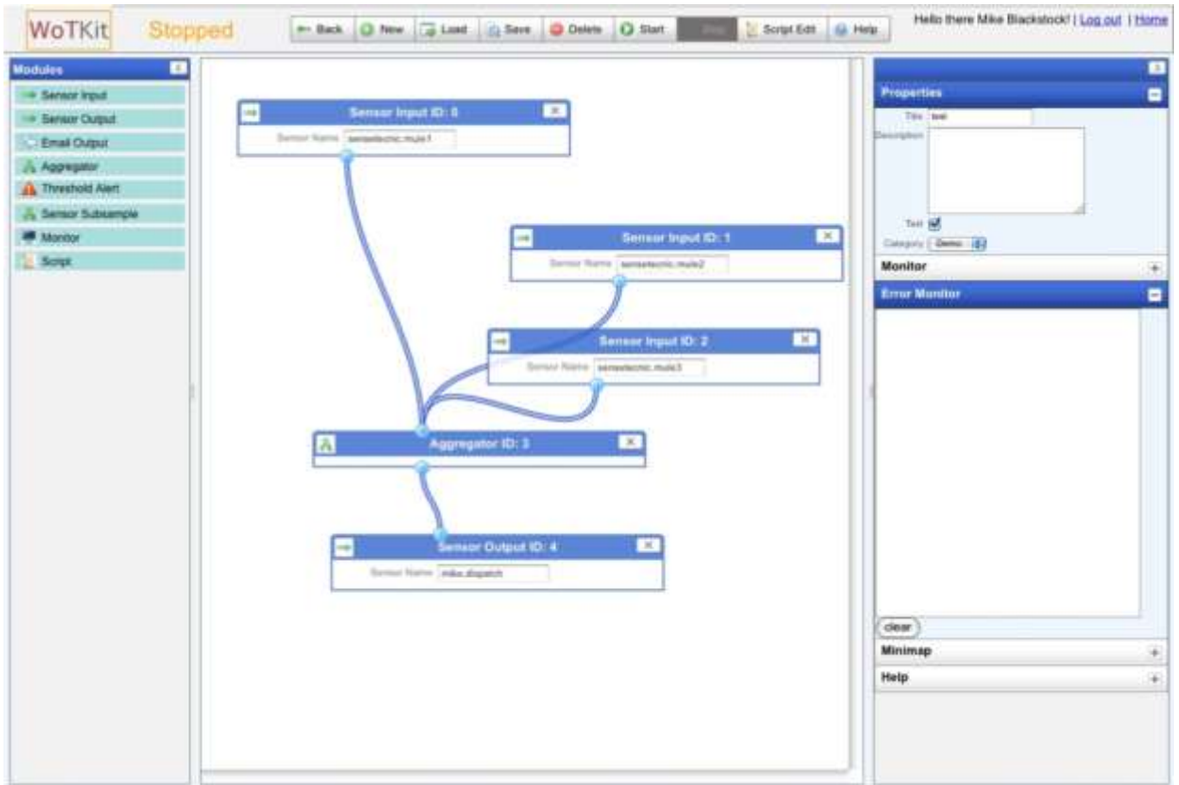


Visualizations

- First task after integration: *see your data*
- Widgets on dashboards
  - Google Charts
  - Maps
  - jQuery plugins

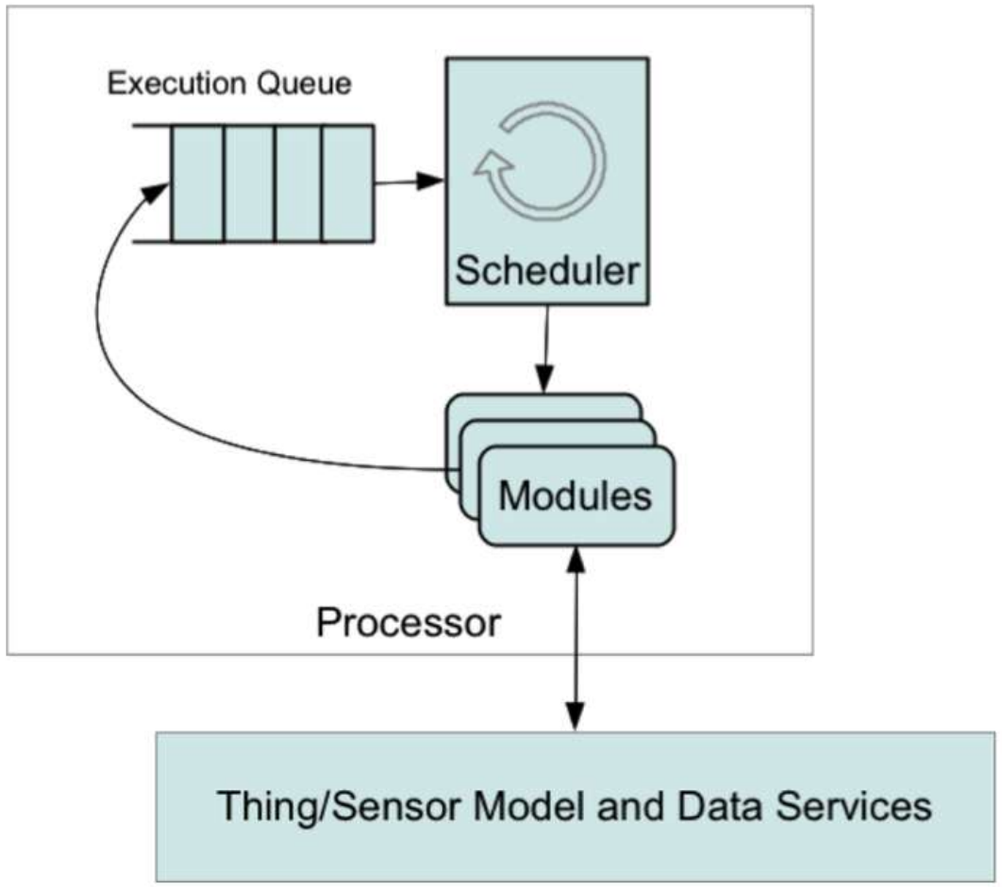
Processing and Alerts

- Inspired by Yahoo Pipes
- Users generate pipe descriptions by dragging and dropping modules and wires
- Input, output, processing, user scripting, debugging, testing, integration



Processing Engine

- Pipe descriptions are ‘compiled’
  - Instantiates pipe modules in the server (checking for scripting and configuration errors)
  - Routing table of module connections
- Messages from sensors, external systems are received by modules and added to queue.
- Modules may send output to downstream modules for processing, the WotKit, or to external systems



Lessons Learned

- Data Schema and Representations
- Sharing
- Component Model
- Sensor Updates and Processing Model
- Batteries included

Schema and Representations

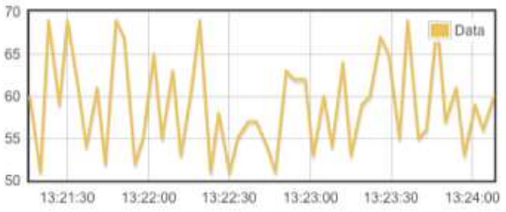
- Important to be simple and flexible
  - e.g. location can be meta data or sensor data
- Numeric sensor values are not enough
  - physical and virtual sensor feeds (tweets)
- Start with a very simple schema (timestamped value) that can be extended
- True for sensor data *and* meta data

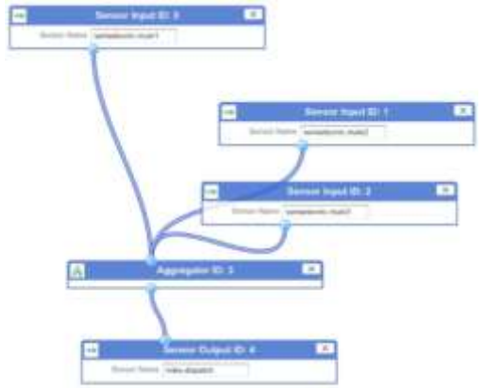
Sharing

- Important to create network effect; increasing value of platform
- Public things, private things, group things
- Subscribe to favourite sensors
- Tagging for easier search
- Share via social networks

Component Model

- Dashboard widgets
  - visuals + sensors
- Pipes and modules
  - modules - input, output and processing
- Sufficiently different to warrant separate integration points





Sensor Updates and Processing Models

- Push (Event): firewall friendly, but can store and process data no one is interested in
- Pull (Query): infrastructure polling for unnecessary updates, real time alerting not as timely
- Both current state *and* stream of historical values are needed by applications
- Both updates and processing models are required.

Batteries Included

- If users are able to easily capture and visualize data, they will invest time in exploring other toolkit capabilities
- From there, explore data processing, more visualizations, actuators, etc.
- Provide RESTful API and integration points for more complex applications and contributions to platform.

Conclusions

- IoT applications can be complex
  - Many IoT toolkits but can have a steep learning curve
  - require sophisticated middleware and development toolchains.
  - For mashups, rapid development environments are needed:
    - Use familiar web technologies and tools
    - Quick ability to find and visualize things
    - Mashup a variety of data from things and data sources
    - Provide path to more complex applications

Thank you

- Give it a try!
- http://wotkit.sensetecnic.com
- Academic version available
- Commercialized by Sense Tecnic Systems
- mblackst@magic.ubc.ca