Internet of Things

Internet2 CINO Initiative Working Group Meeting #2

July 7, 2015

Chairs:
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Steve Walllace, Indiana U.

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Introduction and Meeting Objectives

- Comments on initiative objectives and status

- Discussion of eight candidate use cases and projects

- Possible funding sources – government and corporate
  - Why is Internet2 the right organization for this work?

- Formation of sub-groups to develop approaches to selected use cases/projects

- Next steps and major milestones

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Eight Candidate Use Cases and Projects

- Power over Ethernet – Steve Wallace (IU)

- University Electric Vehicle Project – Brian Stengel (Pitt)

- Wireless Waterways IOT Testbed -- Brian Stengel (Pitt)

- Large Campus Building IOT Testbed -- Brian Stengel (Pitt)

- IoT Stack -- Brian Stengel (Pitt)

- Internet2 and the Smart Grid – Bob Brammer (Internet2)

- Internet of Medical Things – Florence Hudson (Internet2)

- Open End to End IOT Security Architecture – Florence Hudson (Internet2)

Power over Ethernet

- Power over ethernet (PoE) is a key enabler of many IOT applications

- The goal of this project is to produce a white paper that provides campuses with insights into the drivers and implications of PoE, including:
  - Survey selected examples of campus uses of PoE (e.g., data center operations, video networks for campus safety)
  - Survey of emerging PoE devices (e.g, lighting, sensor platforms, displays, etc.)
  - Description of current PoE capabilities and what is on the horizon
  - Discussion of PoE implications for network design, including edge devices (e.g., switches), power and HVAC requirements, etc.
  - Identify typical campus units that should be included in the PoE planning process (physical plant services, architectes, safety, etc.)
  - Examples of possbile project funding sources

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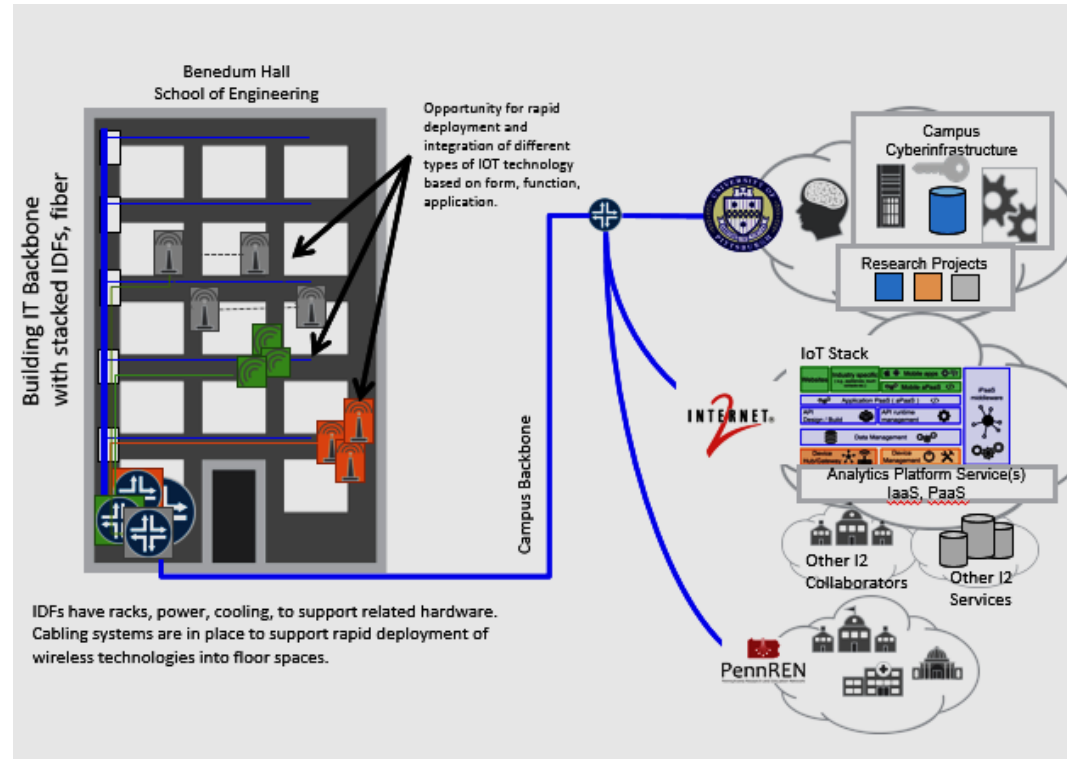# Internet2 of Things University Electric Vehicle Project
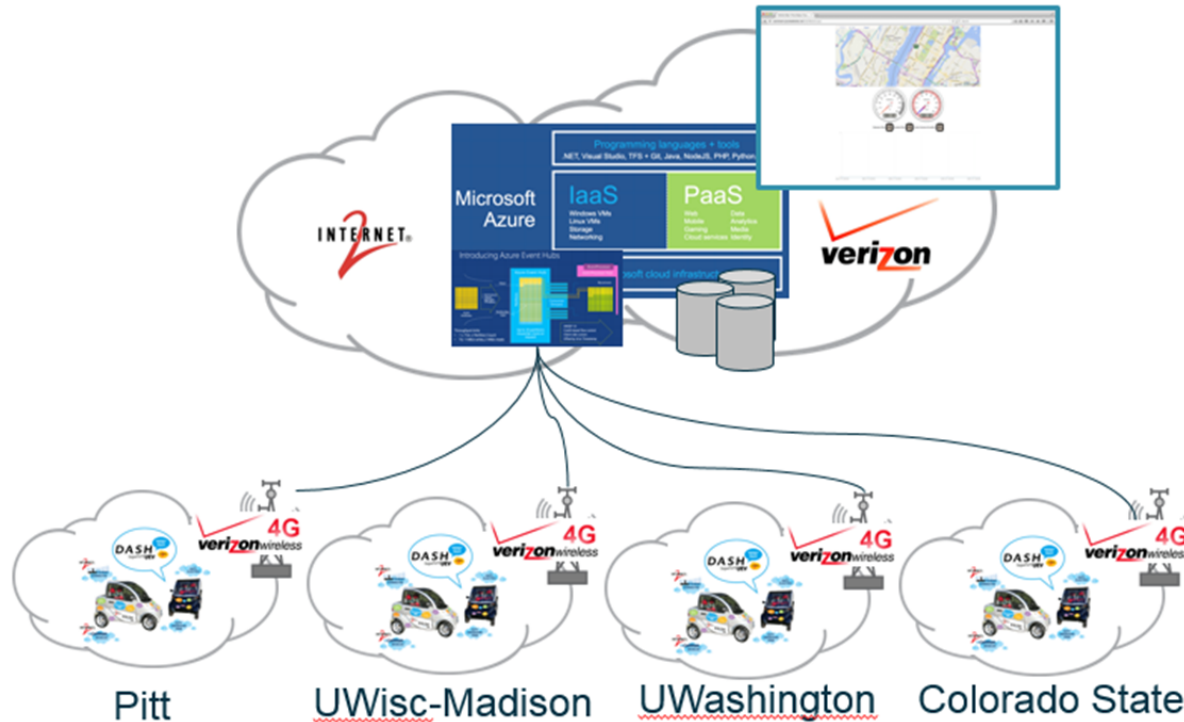
Wireless Waterways Network – IOT Testbed
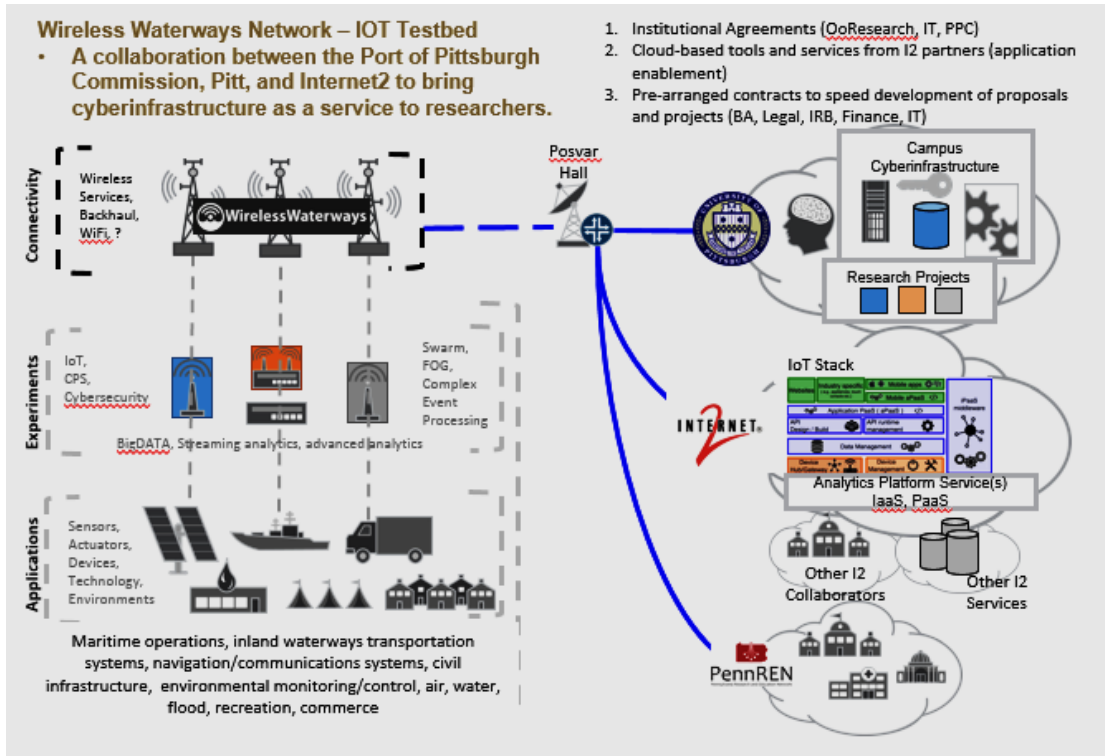
Benedum Hall IOT Test Bed – Large, campus building

The first three floors are a microcosm of campus life (classrooms, labs, library, retail, student, staff, etc.)
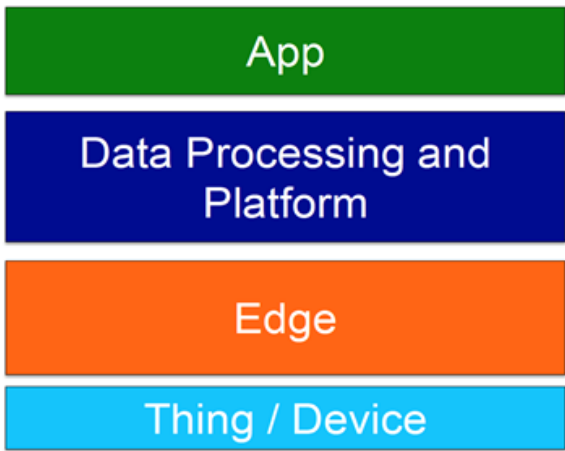
IOT Stack

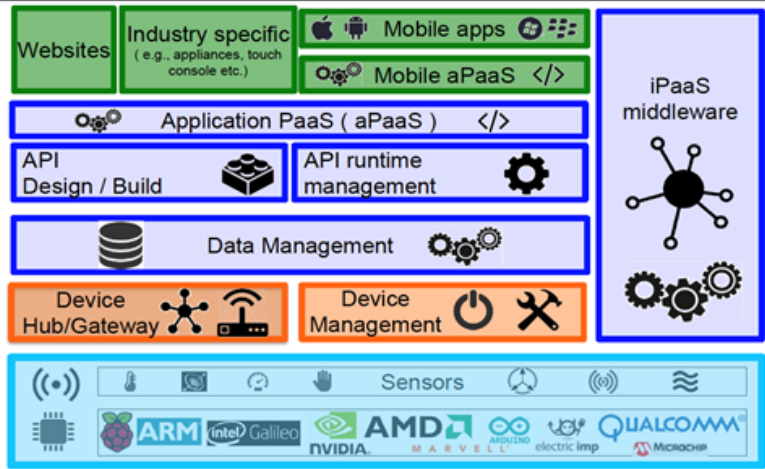At a high level this is the general IoT stack

- App
- Data Processing and Platform
- Edge
- Thing / Device

IoT Stack

Websites | Industry specific (e.g., appliances, touch console etc.) | Mobile apps | Mobile aPaaS

Application PaaS (aPaaS)

API Design / Build | API runtime management

Data Management

Device Hub/Gateway | Device Management

Sensors

ARM | intel Galileo | NVIDIA | AMD MARVELL | ARDUINO | electric imp | QUALCOMM | Microchip

iPaaS middleware

Architectural Patterns in an IOT Stack
q
(Source: Sharma 2014 MuleSoft Inc.)

SeeControl | PTC | xively by LogMeIn | TUTK ThroughTek Co., Ltd.
aeris | MuleSoft | Predixion Predict Everything | greenWAVE systems
SOFTLAYER an IBM Company

Internet2 and the Smart Grid

- Many large research campuses have already begun to build smart grids under DOE/NREL sponsorship
  - http://www.nrel.gov/tech_deployment/climate_neutral/smart_grid.html

- Some Internet2 corporate members are developing technology to address the large communication requirements for Smart Grid management and operation
  - E.g., Ciena, Cisco

- Can we create a proposal for the use of the Internet2 network to enable research on regional smart grid communication and collaboration?

Internet of Medical Things

- The Internet2 community has a long history of research in uses of advanced networking for medical applications
  - Many research demonstrations of our network for teleradiology, telesurgery, telepathology, etc.

- However, there are still many factors limiting scalable applications for widespread use
  - Need to mitigate risks in TIPS – Trust, Identity, Privacy, and Security
  - In particular, risks associated with devices and cloud services
  - Need to improve energy efficiency for sensors, networking, IT operations, etc.
  - Need to address "standards wars" in order to increase interoperability and reduce costs

- Are there use cases and pilot projects in your institutions that we should consider as part of our IOT Working Group activities?

Open End to End IOT Security Architecture

- Some of our members (e.g., Stanford, Berkeley, Michigan, NIST, Cisco) have current projects to address IOT security

- Our members need a flexible architecture that can be adapted to a broad range of applications (e.g., all preceding use cases)

- Can we build on previous work, including our other CINO Working Groups to create an effective archecture?

Stanford Secure Internet of Things Project

Stanford, Berkeley, Michigan

NIST Cybersecurity Framework

CISCO

Securing the Internet of Things: A Proposed Framework

Next Steps

Call to Action for IOT Working Group

Send a note to the IOT Working Group leadership team **iotchairs@internet2.edu** with your interests in working to develop concepts in one or more of these candidate use cases

- Need to create subgroup teams
- Need to develop specific project definitions and approaches
- Need to identify required resources and potential funding sources

Monthly team meeting – next one late July

Joint Collaborative Innovation Community call with all 3 working groups bi-monthly

Preparation for TechEx meeting in October

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Thank You

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