Agenda

• Welcome and Introductions
• Technologies available to support university research in IoT
  – Researcher Support through Microsoft, OsiSoft and Neal Analytics
  – Early IoT experiences with IBM BlueMix and IoT Foundations
• Some campus perspectives on developing and deploying IoT Solutions
• Q&A and Open Discussion
The Researcher Support through Microsoft, OsiSoft and Neal Analytics

Microsoft and Partner Support for IoT Development and Deployment

- Cameron Evans, National Technology Officer, US Education

OSISoft and Academia: The Experience from Carnegie Mellon University

- Mike Mihuc, Academic Principal, OSISoft
- Bertrand Lasternas, Senior Researcher, Carnegie Mellon University

Cortana and the IoT Suite

- David Brown, Neal Analytics
Industry View on IoT

Cameron Evans
National Technology Officer, US Education
Microsoft

• Introduction
• What is Microsoft doing?
• Role of Partners
OSIsoft & Academic

Mike Mihuc
Academic Principal

- Introduction to OSIsoft
- OSIsoft Academic Program Goals
- Microsoft Azure IoT and OSIsoft PI System 2015
OSIsoft is trusted by the world’s leading companies

- Over 1,000 of the world’s leading Power & Utilities companies
- 95% of the Global Fortune Top 40 Oil & Gas companies
- 400+ Pulp & Paper sites deployed worldwide
- 100% of the Global Fortune Top 10 Metals & Mining companies
- 37 of 50 of the World’s Largest Chemical & Petro-Chemical companies
- 9 / 10 of the Global Fortune Top 10 Pharma companies
OSIsoft Academic Program Goals

Why

- Changing Academic Market to One of Industry Collaboration and Data Analytics
- Paying Back To Universities >> Paying Forward To Students
- Enhancing Customer Value via a Deeper Partnership

What

- Providing Complementary Software, Jumpstart Services, Coaching & Learning
- YOUtube Learning – About 2,000 lessons each 2-10 min long
- Grant Partnering

How

- Collaborative Innovation – Joint Vision OSIsoft/Academic Institution
- The Triple Helix – Academic, Government & Industry Drive Innovation
With OSIsoft and Microsoft data, cloud technologies and IOT, we can integrate almost any device interface and data type.

Bertrand Lasternas, Researcher
Carnegie Mellon
University Use Case

Bertrand Lasternas
Senior Researcher
Carnegie Mellon University

• Data in buildings
  • Collection of data
  • CMU results
• Data Analytics
• How does IoT Support Research
Partnership: Cortana & IOT Suite

David Brown
Sales Director
Neal Analytics

• A Brief Introduction to Neal Analytics
• Creating an “Enlighted Organization”
• Some Industry Use Cases of IoT and Analytics
• Cortana Deployment
Neal Analytics: Microsoft Partner

Our Mission
Drive customer value with Predictive Analytics on the Microsoft platform, and use Azure Machine Learning to drive IT & business partnership in our clients.

Our Company
We are Seattle-based company with 25 data engineers and scientists that have helped dozens of customers improve their businesses. We were founded in 2011.

Manu., Retail, Energy
Our objective is to make analytics accessible to companies of all sizes across our verticals. Our team specializes in creation of analytical practices to help companies grow and scale.

Partnerships
We are a Microsoft partner that develops solutions on using Azure ML, Azure marketplace, HDInsight, Stream Analytics, Azure Data Factory, and Event Hubs.

Our Focus
Demand forecasting, decision modelling, resource forecasting, predictive maintenance, systems integration and creating more profitable customers.

Solution Sales Director: David Brown, 425-283-6842, davidb@nealanalytics.com
http://www.nealanalytics.com
Neal Analytics Services
Creating the fabric of an enlightened organization

Data Infrastructure
- EDW/modern EDW
- OLTP workloads
- Big data platform (PI)

Info Strategy
- Reference architecture (cloud/on prem/hybrid)
- Vendor/workload
- Data strategies selection

Data Pipeline
- ETL/data in motion
- Transform/enhancement services
- Real time/streaming

Visualization
- Dashboards/Reports
- Exploration/Discovery
- Tools (Excel, Power BI)

Data Science
- Statistical consulting
- Data mining (With Azure machine learning)
- Predictive & advanced modelling
- Deployment & operationalization

Business Expertise
- Self-directed problem solving
- Management consulting techniques
- Compelling exec story telling

Data Integration
- ETL/data in motion
- Transform/services
- Real time/streaming
## Industry Use Cases of IoT & Analytics

### Financial Services
- New account risk screens
- Fraud prevention
- Trading risk
- Facial & Biometric Recognition
- Insurance underwriting
- Accelerate loan processing

### Retail
- 360° view of the customer
- Analyze brand sentiment
- Localized, personalized promotions
- Website optimization
- Optimal store layout
- Beacons & kiosk

### Telecom
- Call detail records (CDRs)
- Infrastructure investment
- Next product to buy (NPTB)
- Real-time bandwidth allocation
- New product development

### Manufacturing
- Supplier consolidation
- Supply chain and logistics
- Assembly line quality assurance
- Proactive maintenance
- Crowd source quality assurance

### Healthcare
- Genomic data for medical trials
- Monitor patient vitals
- Reduce re-admittance rates
- Store medical research data
- Recruit cohorts for pharmaceutical trials

### Utilities & Energy
- Smart meter stream analysis
- Slow oil well decline curves
- Optimize lease bidding
- Compliance reporting
- Proactive equipment repair
- Seismic mage processing

### Public Sector
- Analyze public sentiment
- Protect critical networks
- Prevent fraud and waste
- Crowd source reporting for repairs to infrastructure
- Fulfill open records requests

### Goods and Manufacturing
- Identify hidden revenue opportunities
- See and predict changes in supply or demand
- Market price volatility and production planning
- Promotional demand
- Purchase Engine
IT

• Managed by central IT authority
• Deep Microsoft recognition & engagement
• Focus on cost reduction

OT

• Managed by operational & financial authorities
• Limited Microsoft recognition & engagement
• Focus on profitability improvement
Cortana Workshops: Make IT a Hero

Emerging Challenges

Desire
# Cortana Deployment Workshop Methodology & Progress

<table>
<thead>
<tr>
<th>Introduce Workshop</th>
<th>Elicit initial expectations</th>
<th>Modelling Review</th>
<th>Scenario Collection Exercise</th>
<th>Dept. deep-dive</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Introductions</td>
<td>• Initial opportunity discussion (high-level)</td>
<td>• Review the POC findings again</td>
<td>• Complete an opportunity/pain-point identification exercise</td>
<td>• Multiple deep-dive smaller sessions with departments (MKTG, SALES, LOGISTICS, FINANCE, IT, etc.)</td>
</tr>
<tr>
<td>• Define the workshop goals</td>
<td>• Discuss each project member’s expectations of the project</td>
<td>• Explain the NEAL analytics approach</td>
<td>• Collate the scenarios</td>
<td>• Look at data, reports, analysis, strategies</td>
</tr>
<tr>
<td>• Agenda and plan for rest of the workshop</td>
<td>• Risks and Concerns</td>
<td>• High-level insight into analytics tools (e.g. R, Azure ML)</td>
<td>• Discuss with team</td>
<td>• Discuss Opportunities</td>
</tr>
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</table>

<table>
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<tr>
<th>Mid-week Re-cap</th>
<th>Data Engineering Deep-dive</th>
<th>Prioritize Scenarios</th>
<th>Improve slides</th>
<th>Readout and Sign-off</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Present the mid-week findings</td>
<td>• Discuss the data engineering pipelines</td>
<td>• Review the rationalized scenarios with the team</td>
<td>• Internal sessions (NEAL)</td>
<td>• Readout findings to Management</td>
</tr>
<tr>
<td>• Collect any guidance for adjustment</td>
<td>• Connect a sandbox environment and get the data flowing</td>
<td>• Describe the scoring methodology</td>
<td>• Readout with the Core team</td>
<td>• Line-up the prioritized scenarios and effort estimates</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Perform the scoring exercise</td>
<td>• A few iterative cycles to improve the slides close to final version</td>
<td>• Present scenarios that make the cut-off</td>
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<tr>
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<td></td>
<td>• Get official sign-off</td>
</tr>
</tbody>
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- Elicit initial expectations
  - Initial opportunity discussion (high-level)
  - Discuss each project member’s expectations of the project
  - Risks and Concerns

- Modelling Review
  - Review the POC findings again
  - Explain the NEAL analytics approach
  - High-level insight into analytics tools (e.g. R, Azure ML)

- Scenario Collection Exercise
  - Complete an opportunity/pain-point identification exercise
  - Collate the scenarios
  - Discuss with team
  - Rationalize scenarios

- Dept. deep-dive
  - Multiple deep-dive smaller sessions with departments (MKTG, SALES, LOGISTICS, FINANCE, IT, etc.)
  - Look at data, reports, analysis, strategies
  - Discuss Opportunities

- Readout and Sign-off
  - Readout findings to Management
  - Line-up the prioritized scenarios and effort estimates
  - Present scenarios that make the cut-off
  - Get official sign-off
Use of IBM BlueMix and IoT Foundations to Support Campus IoT Initiatives

IBM IoT solutions for a Smarter Planet
  • Gaya Srinivasan, Business Development Executive, Internet of Things, IBM Analytics

IBM IoT Foundation Platform and BlueMix
  • Jay Venenga, Internet of Things Solution Architect

Enterprise IoT
  • Steven Wallace, Network Engineer, Indiana University
IBM delivering IoT solutions for a Smarter Planet
even pre-IoT campaign launch in 2008

Gaya Srinivasan
IBM

INSTRUMENTED

Digital technologies (sensors and other monitoring devices) are being embedded into many objects, systems and processes

INTERCONNECTED

In the globalized, networked world, people, systems, objects and processes are connected, and they are communicating with one another in entirely new ways

INTELLIGENT

Leveraging the data generated by digital technology provides intelligence to help us do things better, improving our responsiveness and ability to predict and optimize for future events
IBM’s $3 billion investment places it No. 1 in the world on the list of companies that are betting a whole lot on this market, which is already quite active.

IBM isn’t often mentioned in the media as being a leader in the rapidly growing Internet of things market, but it is quietly putting out a substantial corporate investment in it.

Back in March, the venerable all-purpose IT provider announced that it was investing a cool $3 billion and hiring 1,400 workers into a new business unit that would create, develop and market products and services that would fit into the Internet of things bucket. That investment places it No. 1 in the world on the list of companies that are betting a whole lot on this market, which is already quite active.

According to a listing compiled by the research firm IoT Analytics, IBM—with that huge $3 billion commitment—is now No. 1 in the world in IoT investment, followed by Google, Intel, Microsoft and Cisco Systems. Apple, SAP, Oracle, Samsung and Hewlett-Packard round out the top 10.

The second 10 are ranked in this order: Ericsson, Amazon, GE, Qualcomm, AT&T, Orange, BlackBerry, Facebook, Dell and Verizon.
Mission

Mission Statement:

- Provide **a no-charge program** to educators to teach IBM IoT Foundation that
  - includes required training material, curriculum guides, software & the cloud environment
  - gives students hands-on, real-world IoT and IBM IoT foundation experience
  - makes students able to use the learned technology & skills in their future careers
- **Get feedback** from faculty/students on the ease of use, technology barriers etc. & feed it to the product teams for product/process improvements
- Leverage IBM and partners to **scale** extensively
- Leverage **faculty events** to create awareness, train and enable
Five keys to tap into IoT Value

1. Connect to and control devices
2. Collect and manage IoT data
3. Understand and analyze
4. Act and react
5. Build applications to harness the potential
Building an IoT PaaS on the power of BlueMix

- Big Data and Analytics
- Cloud Integration
- Dev Ops
- Watson
- Cloudant
- SQL Database
- Cloud Code
- Push Notifications

Equipment:
- Square
- redis
- SendGrid
- twilio
- New Relic
- Pitney Bowes
Getting started with IBM Academic Initiative for IoT

**STEP 1:** Join the Academic Initiative
You will be prompted to create an IBM ID.

**STEP 2:** Sign up for the Bluemix trial
Already have a trial account? Proceed to step 3.

**STEP 3:** Nominate course
Click on 'Sign in to Academic Initiative' button in Faculty section; Sign in with your IBM ID created in Step 1.

**STEP 4:** Sign in to Bluemix
Enter promo code by signing into your Bluemix trial account ID used in Step 2.

**STEP 5:** Use resources
Explore the courseware assets and faculty guides
Resources

- Faculty Guide: IBM Academic Initiatives IoT Faculty Guide
- Redbook: The Interconnecting of Everything
- Whitepaper:
  - Is your business ready for the Internet of Things
  - Four ways to drive service innovation with the Internet of Things
  - Deriving business value from the Internet of Things
  - The rise of the machine data - Are you prepared?
  - IBM MessageSight in the Automotive Industry
  - IBM Point of View: Internet of Things Security
- Demo:
  - Intro to Bluemix and Internet of Things Foundation - Part 1
- Intro to Bluemix and Internet of Things Foundation - Part 2
- Connected Car
- IBM IoT overview and Connected Car demo
- Smart Buildings with Sogeti (Recorded)
- Smart Buildings with Sogeti (Manual; password: sogetibm)
- Bluemix and Internet of Things
- IBM Python app with a Raspberry Pi and Bluemix
- Tutorial:
  - IoT Python app with a Raspberry Pi and Bluemix
  - Build a connected-car IoT app with Geospatial Analytics
Customers capturing results with IBM IoT solutions

- **40%** Reduction in operating costs
- **99%** Reduction of time for software error correction
- **100%** Prediction of ground events for high risk engines
- **20%** Improvement in steering decisions due to quality insight
- **70%** Shorten customer service call time by
- **95%** Elimination of manual operations
- **$700M** In cost and performance benefits

**Reduction in manual operations:** 95%
Case Studies

- **SilverHook Powerboats** lead with IBM IoT Solutions
- **Technicolor** solution on the cloud
- **Lafarge S.A.** advanced asset management solution
- **Kiwi Weareables** fast time to market
- **Hildebrand** revolutionary new IoT services
- **University of Alberta** understanding climate and environment change
- **Dubai Airport** is a smarter airport
- **Ireland Electricity Board** minimize cost of electric vehicle charging
- **Lysi Energy** saves energy costs in smarter homes
- **Bangalore Water Supply and Seward Board** reduce waste and supply equitable water
- **E. & J. Gallo Winery** conserve water and increase fertilizer efficiency
- **Waratahs Rugby** prevent player injuries
- **Dublin City Council** reduce traffic congestion
- **Miami-Dade Police Department** break cold cases
- **Sun Life Stadium** running sports complex like a smart city
- **City of Dubuque** smart city solution
- **Yarra Valley Water** keeping water service flowing to millions of customers
- **Chaotic Labor** reduces labor cost
- **Florida State University** speeds investigation
- **Palava by Lodha Group** sets benchmark for 21st century urban living
- **US Federal Agency** manages full lifecycle of assets
- **Staples** provides better online experience to customers
- **City of Madrid** cuts costs
- **Sao Paolo State Transportation Agency** promotes driver safety
Next Steps

1. **Learn more**
   Start using [Bluemix](http://ibm.biz/try_iot)
   Experiment with [Node-Red](http://node-red.org)
   Try out Internet of Things on Bluemix [ibm.biz/try_iot]

2. **Get Involved**
   Use the Internet of Things Foundation

3. **Learn more about IBM’s point of view on the Internet of Things**

4. **Join us in our IoT conversations @IBMIoT**

5. **Join the IBM Academic Initiatives and offer the course**

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We’re here to help

Gayathri Magie
IBM IoT
Academic Initiative
gayathri@us.ibm.com
IBM IoT Foundation Platform and BlueMix

Jay Venenga
IBM

- IoT Strategy
- IBM IoT Foundation platform
- Ecosystem
- What’s coming next
- Where to go for more information
We are on the threshold of massive explosion of connected things

10 billion devices around the world are currently connected to the Internet, including computers and smartphones.

The number is expected to increase dramatically within the next decade, with estimates ranging from 50 Billion devices to reaching 1 trillion.

The Internet of Things has the potential to create economic impact of $2.7 trillion to $6.2 trillion annually by 2025.
IoT is revolutionizing the market and a tremendous growth opportunity

Top 3 ways IoT will change how business operates

1. Unlock new revenue from existing products/service
2. Inspire new working practices or processes
3. Change or create new business model or strategy

75% of Companies are exploring IoT
62% Of C-suite execs believe failure to adopt IoT will mean getting left behind
36% Growth in sensing, communicating devices
400% Growth in Google search interest
The barriers have been broken

▲ 300%
Increase in connected machine-to-machine devices over past 5 years

▲ 200%
Increase in Mobile Network connections speeds from 2013 to 2018

▼ 80%
Price decline in MEMs (microelectromechanical systems) sensors in last 5 years
Internet of Things digitizes our world, providing us with prolific amounts of data and new delivery models that allow business to engage in new value creation.
IoT value is realized in four foundational areas

- **Industry Transformation**: Evolving new business models
- **Applications & Solutions**: Optimizing operations and enhancing performance
- **Platform**: Building and managing IoT solutions
- **Devices & Networks**: Connecting what matters

**Representative IBM Products**
- IoT for Automotive, IoT for Electronics, IoT for Insurance
- Maximo, Tririga, PMQ,
- Continuous Engineering
- IoT Foundation (IBM IoT Platform)

**IBM Ecosystem partners**
Devices and Networks include the hardware, gateways and operating infrastructure that serve as the foundation of IoT solutions.

**Expansive, scalable and secure ecosystem** that drives interoperability via open source and standards bodies:

- Driving convergence in IoT industry standards
- Connect devices into platforms and vendor specific IoT centric solutions seamlessly and securely
Ecosystem and partnership strategy extends the IBM IoT capabilities to include Devices and Networks

Derive IoT insight from data through strong industry partnerships and open ecosystem

Examples:
- ARM
- Intel
- Texas Instruments
- AT&T
- Sprint

Connecting Devices to the IBM IoT Foundation platform:

Wide variety of supported devices
- Self Service
- Open ecosystem
- Simple tutorials
- Connect in moments

Examples:
- Derive IoT insight from data through strong industry partnerships and open ecosystem
Device recipe examples

**ARM® mbed™ IoT Starter Kit**

Use an ARM® mbed™ IoT Starter Kit, Ethernet edition for IBM Internet of Things Foundation, enabled microcontroller to connect to the IBM Internet of Things Foundation and visualize the data in real time.

**Ingredients**

- ARM® mbed™ Ethernet Starter Kit (http://developer.mbed.org)

**Prepare**

- Download the mbed software development kit
- Connect to your computer or board, as shown in the quick start guide
- The microcontroller appears

**Network Gateway & Wizard™ Edge Node**

This recipe has been provided by an IBM Business Partner

Use the Spectra router and Wizard device(s) to connect to the IBM Internet of Things Cloud. Then you can visualize the data generated by any Wizard connected sensor through the Quickstart page. This demo uses a thermal sensor attached to a Wizard Edge to generate temperature data to be sent to the cloud.

**Ingredients**

- Spectra Network Gateway
- IBM Module for Spectra Network Gateway
- Wizard Intelligent Edge Nodes
- Sensors
- Wizard Android App

**Prepare**

- Connect the Spectra router to the internet
- Refer to the Gateway Quickstart Guide as the first step for instructions on how to commission your network gateway

**CC2650 SensorTag**

Connecting the TI SimpleLink SensorTag to the IBM IoT Foundation service is beautifully simple. Follow these steps to connect your SensorTag to the IBM quickstart cloud service in less than 3 minutes.

**Ingredients**

- The SensorTag is packed with low-power sensors in connectivity to allow wireless, battery powered applications.

**Prepare**

- Download the SensorTag app from the Apple Store or Google Play
- Pull the tab on the SensorTag battery to power on

**National Instruments LabVIEW**

This recipe has been provided by an IBM Business Partner: Espelet

Use LabVIEW to transfer measurement data from PC or RT target to IBM Internet of Things Foundation and visualize the data available.

**Ingredients**

- National Instruments myRIO, CompactRIO, FlexRIO, SingleBoardRIO, SOM RIO

**Prepare**

- Download and install LabVIEW (2015 or newer) on your host PC
- Download IoT Foundation library for LabVIEW from: https://github.com/Espelet
- Extract the library zip package

**Connect (Quickstart)**

- Launch IoTFoundationexamples/quickstart.xli
Texas Instruments new SimpleLink MCUs and SensorTags

- And what’s really exciting, is the SensorTags auto home to IBM IoT Foundation using the TI phone app as a gateway...

- “OKAY - this is cool. So I actually ordered the new SensorTag from ti.com I downloaded the app, pulled the plastic tab and lo and behold I was connected to the cloud. Simply AWESOME” (IBM User)
ARM mbed IoT Starter kit

ARM mbed IoT Starter Kit for IBM Internet of Things
... makes it incredibly quick and easy to get started with IoT
IBM teams with ARM – the first unified chip-to-cloud enterprise class IoT platform

**ARM** mbed ecosystem

mbed Device Services

mbed services
Platforms provide a foundation for building and managing IoT solutions and bridge between device manufacturers higher value outcomes.

**Global, innovative platforms** to deliver high performance at cost-effective scale:
- Reduce the cost while supporting innovation
- Utilize a flexible platform that provides best practices and better processes

---

**Four Foundations**
- Industry Transformations
- Applications & Solutions
- Platforms > Devices & Networks

**Product Family**
- Continuous Engineering
- IoT Foundation
  - Connect, Information Management, Analytics, Risk Management

**IoT Process Platform**
- Design & Engineer
- Operate & Manage

**IoT Foundation Platform**
- Collect and Control
- Analyze and Optimize

**Security / Privacy**
IBM Bluemix

Composable services development, runtime and operations for your IoT apps

Run Your Apps
The developer can chose any language runtime or bring their own.

DevOps
Development, monitoring, deployment and logging tools allow the developer to run the entire application.

APIs and Services
Broad catalog of IBM, 3rd party, and open source, APIs and services to compose an application in minutes.

Cloud Integration
Build hybrid environments. Connect to on-premises systems of record plus other public and private clouds. Expose your own APIs to your developers.

Built on IBM SoftLayer
No need to worry about provisioning or managing infrastructure.
IBM Internet of Things Foundation Service

- Secure Device Registration
- Scalable Device Connectivity
- Device Management new!
- PAYG SaaS pricing
- Powered by IBM MessageSight technology
IoT Foundation Service Pricing structure

### Monthly PAYG pricing

- **Free**
  - Includes up to 20 active devices, 100 MB of data traffic, and 1 GB of storage
  - Maximum of 20 active devices
  - Maximum of 100 MB data exchanged
  - Maximum of 1 GB data storage
  - Maximum of 10 application bindings
  - Price: Free

- **Bronze**
  - Includes up to 100 active devices, 100 MB of data traffic, and 1 GB of storage
  - Charge per device thereafter: $0.20 USD/Active Device
  - Charge per MB data exchanged thereafter: $0.01 USD/Megabytes Exchanged
  - Charge per GB data stored online thereafter: $1.00 USD/Gigabyte Month
  - Price: $20.00 USD/Instance

- **Silver**
  - Includes up to 5,000 active devices, 100 MB of data traffic, and 1 GB of storage
  - Charge per device thereafter: $0.04 USD/Active Device
  - Charge per MB data exchanged thereafter: $0.01 USD/Megabytes Exchanged
  - Charge per GB data stored online thereafter: $1.00 USD/Gigabyte Month
  - Price: $120.00 USD/Instance

- **Gold**
  - Includes up to 15,000 active devices, 100 MB of data traffic, and 1 GB of storage
  - Charge per device thereafter: $0.03 USD/Active Device
  - Charge per MB data exchanged thereafter: $0.01 USD/Megabytes Exchanged
  - Charge per GB data stored online thereafter: $1.00 USD/Gigabyte Month
  - Price: $450.00 USD/Instance

### SUBSCRIPTION pricing

- The Free service plan for Internet of Things Foundation includes up to 20 active devices, 100 MB of data traffic, and 1 GB of online data storage per month.
IBM delivers IoT connectivity across deployment options

Virtual appliances in datacenter

*physical appliances withdrawn from market from July 2015, focusing on virtual appliance form factor

Virtual appliances, Public or private cloud deployed

Fully managed as-a-service, PAYG
Public Cloud

Platform

IoT Foundation Connect
Powered by IBM MessageSight technology
IoT Analytics - meaningful insights from devices in the field

- **What is going on with all the ‘things’ I am responsible for?**
  - I need to monitor device behaviors to understand anything that isn’t working as expected – in real-time
- **If I have an issue with one of my ‘things’, how can I get it fixed faster?**
  - I need to detect that something is wrong and drive automation to rectify the situation using appropriate, prescribed actions
- **Can I avoid problems before they occur?**
  - I need to forecast problems or situations and initiate appropriate response(s) to avoid unplanned downtime
- **How can I design and build better things?**
  - I need insights from devices in the field to adjust designs and manufacturing processes based on actual operating conditions and performance
- **How do I become smarter?**
  - Everything in my world behaves differently under different operating conditions, I need to understand my world so I can determine if/when/how I might want to change it
**Example usage**

**Maker**

**Appliance Manufacturer**

**Role:** Asset Analyst

**Pain points:** I need to understand product performance in the field under different operating conditions and identify product defects or failure patterns under real-world conditions.

**How IoT Analytics helps:** IoT Analytics integrates IoT data from the appliances and augments it with additional context including master data, anonymized owner information, location, and manufacturing details. The Asset Analyst can then use a variety of analytical tools to gain insight about performance, usage patterns, and failures.

**Operator**

**Energy Production**

**Role:** Maintenance Manager / Reliability Engineer

**Pain points:** I have dozens of remote power plants, and I can’t afford to have people on site. In addition, my equipment is processing a variable quality source gas source which causes a high degree of variability in wear patterns in the equipment, so it’s difficult to plan my maintenance.

**How IoT Analytics helps:** Leveraging data from the remote SCADA systems, IoT analytics provides analytical tools to enable condition based maintenance, helping them understand what is happening or what might happen and automatically dispatch a technician to avoid failures and down time.
IBM IoT Real-time Insights - Architecture Overview

IoT devices deployed in customer's environments – including both legacy industrial devices & new IoT enabled devices

- SCADA, Historians, 3rd party IoT platforms
- IoT Foundation service

Real-time data

IoT Analytics Suite

- Real-time message processing
- Real-time analytics
- Automation based on business rules & analytic results
- Dashboards and reporting

Bluemix

Analytics & data services, e.g. weather

Platform

- Maximo
- TRIRIGA
- Other ERP

Actions / Data

Asset Info

- Provide context about assets, customers, etc.
- Utilize results of analytics
- Perform automation based on actions

2015 TECHNOLOGY exchange
Sensors provide information about the device.

Data comes in through IoT Foundation, IBM's IoT cloud platform.

Real-time data drives real-time analytics and business rules.

Data may be collected by a gateway device for connectivity or protocol translation.

Rules trigger an action, such as an alert, email, text message or a work order in Maximo.

Recommendations drive response in Maximo.
The IBM IoT Foundation - our next generation IoT platform

**IBM IoT Foundation Offerings**

**IBM IoT Foundation Connect**
Attach, Collect & Organize, Device Management, Secure Connectivity, Visualization

**IBM IoT Foundation Information Management**
Storage & Archive, Metadata Management, Reporting, Streaming data, Parsing and Transformation, Manage unstructured data

**IBM IoT Foundation Analytics**
Predictive, Cognitive, Real-time, and Contextual

**IBM IoT Foundation Risk Management**
Security Analytics, Data Protection, Auditing/Logging, Firmware Updates, Key/Cert Mgmt, Org Specific Security

---

**IBM IoT Foundation**

- **Analytics**
  - Predictive
  - Cognitive
  - Real-time
  - Contextual

- **Risk Management**
  - Proactive Protection

- **Connect**
  - Attach: MQTT, HTTPS
  - Collect & Organize
  - Device Management
  - Secure Connectivity
  - Visualization

- **Information Management**
  - Storage & Archive
  - Metadata Management
  - Reporting
  - Parsing and Transformation
  - Manage unstructured data

---

**Bluemix Open Standards Based Services**
- Full Development Lifecycle
- DevOps Services
- IBM Security
- OpenShift
- Docker
- Cloud Foundry

**Flexible Deployment**

---

**2015 Technology Exchange**

OCTOBER 4-7 - CLEVELAND OH
IBM IoT Foundation Connect & Information Management expand capabilities

**Today ...**
- Composable services
- Rapid innovation with Bluemix
- Dashboard/console for each service
- Pricing per service
- Integrate at the application level
- Focused on device connectivity & data storage
- Device Management

**Tomorrow ...**
- Pre-integrated services
- Single console
- Simple predictable pricing
- Support for consuming other IoT platform data
- Integrate at the business services level
- Focused on device connectivity, management & data storage, caching & transformation
Extend insight with IBM IoT Foundation Analytics

**Today ...**
- ✔ IoT Real-Time Insights (individual service)
- ✔ Real-time dashboards
- ✔ Other services from IBM, e.g. Hadoop Big Insights, Streams
- ✔ Maximo integration

**Tomorrow ...**
Pre bundled set of Analytics capabilities by use case
- ✔ Real-Time
- ✔ Descriptive analytics – reporting, BI, and discovery
- ✔ Predictive analytics, trending, & machine learning
- ✔ TRIRIGA Integration
- ✔ Multiple deployment options – local/dedicated/public
Enhanced security with IBM IoT Foundation Risk Management

**Today ...**
- ✓ Device-Cloud communication security
- ✓ Device-Cloud authentication
- ✓ App authentication
- ✓ Underlying cloud infrastructure security
- ✓ Different across each IoT related service

**Tomorrow ...**
- ✓ Base level security in the IoT Foundation with consistent approach across all elements
- ✓ Extra level of proactive security purchasable
Applications and solutions provide further differentiated value through unique capabilities, products and industry specific expertise.

**Four Foundations**
- Industry Transformations
- Applications & Solutions
- Platforms
- Devices & Networks

**Product Family**
- Maximo
- Tririga
- PMQ

**Breadth and depth of applications** to uncover opportunities in all types of sources:

- Maximize the value of your existing assets and investment
- Optimize your existing operations with real-time analytics and insight
Industry Specific Transformations combine service, expertise, ecosystem and scale to evolve the enterprises to create and deliver new revenue with new models.

**Four Foundations**

- Industry Transformation
- Applications & Solutions
- Platforms
- Devices & Networks

**Product Family**

- **IoT for Electronics**: Ann 3rd Sept 15
- **IoT for Auto**: Ann 14th Sept 15
- **IoT for Insurance**: Coming in 2H
- **IoT for Aviation**: Coming in 2H

**Transforming Business**

- **Accelerating Innovation**
- **Enhancing Operations**
- **Improving Engagement**

**Vertical integration and industry focus** to accelerate transformation with industry specificity:

- ✓ Get you to your business objectives faster
- ✓ Apply the right technologies with the right expertise to expedite adoption
Our favourite use case!

**SilverHook and Virtual Eye:** Driving the Powerboat Experience with IBM Bluemix
Internal resources

Internal one stop shop for IoT
ibm.biz/IoTWiki

THINK ACADEMY
World Wide Sales Team

- WW Sales Team
  - Michael Riley, WW IoT Business Unit Executive, mariley@us.ibm.com
  - Ted Connell, NA and Japan, ted.connell@us.ibm.com
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  - Daniel Tabuenca, WW Tech Sales Lead, daniel.tabuenca@es.ibm.com
IBM IoT – Get started today

Learn more about IBM’s point of view on the Internet of Things
ibm.com/IoT

Try out Internet of Things on Bluemix
ibm.biz/try_iot

Join us in our IoT conversations
@IBMIoT
Demo our IoT Zone in Bluemix

https://bluemix.net/solutions/iot

Internet of Things on Bluemix

Rapidly compose and extend apps that take advantage of data and analytics from your connected devices and sensors.

TRY IT OUT
Use of IBM BlueMix and IoT Foundations to Support Campus IoT Initiatives

IBM IoT solutions for a Smarter Planet

• Gaya Srinivasan, Business Development Executive, Internet of Things, IBM Analytics

IBM IoT Foundation Platform and BlueMix

• Jay Venenga, Internet of Things Solution Architect

Enterprise IoT

• Steven Wallace, Indiana University
Enterprise IoT

Steven Wallace
Indiana University
Islands or Webs?
IoTs should be loney.

• There once was a temperature sensor in room 101. It reported directly to the building’s HVAC system.
• Along comes another temperature sensor in room 101. It reports to the university's electrical load predictions system.
• Alongs comes a fancy sensor to room 101. It knows the temperature, humidity, and pollen count. It reports to the university’s health surveillance system.
• Room 101 has a happy family of duplicate sensors.

• IoTs should be loney
Enterprise IoT Principles
IoTs should serve one master. Chain of command is everything!

• IoTs are either secret agents infesting your enterprise, or trusted soldiers allied to your mission.
• To keep IoTs lonely, secure (e.g. patches applied, etc.), and compliant (e.g., conforms to university privacy policies), require a consistent architecture, implementation, and operations.
• Deploying IoTs in an enterprise requires coordination of stakeholders, and the authority to ensure a good overall system.
• Let’s call a university's IoT system its IoT cloud. This cloud is not locked in the data center, rather is engulfs the entire university.
• Potential need for “University office of IoT”?
Exceptions
an exception requires a policy from which you deviate

• Universities are made of fine people; staff, faculty, and students. These fine people are the core of the university. They’re also infested with IoTs.
• The “I” in “IoT” means that their IoTs become part of the university's network.
• Their range of IoTs is broad, from insulin pumps to writing pens.
• This arena will be shaped largely by policy and education. Much potential for the Internet2 community, as well as others such as Educause, to collaborate.
• Universities were light years ahead of the popular BYOD movement. We’re well positioned to provide BYO-IoT leadership.
A taste of IoT with Bluemix
Raspberry Pi 2

- Linux raspberrypi 4.1.6-v7+
- 1 GB of RAM
- Built-in 10/100 Ethernet
- USB WiFi
- Pretty powerful, runs wireshark over X-windows surprisingly well
- Low power (1.4 watts while running wireshark)
Jumpstarting a Bluemix IoT application...

curl -LO https://github.com/ibm-messaging/iot-raspberry-pi/releases/download/1.0.2/iot_1.0-1_armhf.deb

sudo dpkg -i iot_1.0-1_armhf.deb

service iot getdeviceid b827eb4db983

https://quickstart.internetofthings.ibmcloud.com/#/device/b827eb4db983
Selecting a Protocol
MQTT.org
(MQ Telemetry Transport)

- Light weight (no security included)
- Open Standard
- Library implementations for most languages
- Publish/Subscribe
- Broker based, clients publish to broker, broker is responsible for satisfying subscribe requests
- Can carry any type of data, no support for data typing (e.g., No ASN.1, CORBA, JSON, etc.)
- MQTT relies on TLS/SSL for security (this can be an issue as there’s no end-to-end security, due to the “broker” model)
- Requires persistent TCP session per IoT (scale issues)
MQTT on the wire

..MQIsdp...../d:quickstart:iotsample-raspberrypi:b827eb4db983
...0]..iot-
2/evt/status/fmt/json{"d":{"myName":"myPi","cputemp":37.93,"cpuoloa
d":0.13,"sine":0.38}}0]..iot-
2/evt/status/fmt/json{"d":{"myName":"myPi","cputemp":36.86,"cpuoloa
d":0.13,"sine":0.71}}0]..iot-
2/evt/status/fmt/json{"d":{"myName":"myPi","cputemp":36.86,"cpuoloa
d":0.13,"sine":0.92}}0]..iot-
2/evt/status/fmt/json{"d":{"myName":"myPi","cputemp":36.86,"cpuoloa
d":0.13,"sine":1.00}}0]..iot-2/evt/status/fmt/json{"d"}
MQTT.org
Security Concerns

MQTT Client → MQTT Broker
MQTT over SSH/TLS → MQTT via API

MQTT Subscriber

Bluemix
Suggestion for Bluemix IoT

- Native IPv6 support
- Direct support for two-factor authentication (development environment)
- Option for MQTT broker to operate inside of user application space
  - allows control over CA, also can implement bi-directional TLS trust
  - provides for end-to-end TLS
- Additional IoT Foundation that supports protocols other than MQTT
- All recipes implement TLS
- Default broker require TLS by default
Moving Forward
Explore Technology and Develop a Shared Base of Knowledge

- Protocols
- Development environments (e.g., Bluemix)
- Privacy Policy
- Proof-of-Concept deployments
- Best Common Practices
- Legal...

Collaborate and Coordinate to Establish Leadership

- Develop community-wide standards
- Engage industry leaders (help them "normalize" their services to better fit our needs)
- Develop IoT workshops
- Establish/Define the governance model for enterprise IoT (e.g., office of IoT)
Thank you
ssw@iu.edu
Campus experience with engaging researchers in the use of IoT Solutions

Edward Aractingi,
Assistant Vice President of Information Technology and Deputy CIO, Marshal University

Brian Stengel,
Information Technology – CSSD, University of Pittsburgh
BUILDING AND TESTING IOT SOLUTIONS BOF