2015 TECHNOLOGY exchange

INTERNET2

OCTOBER 4-7
CLEVELAND OH

BUILDING AND TESTING IOT SOLUTIONS BOF

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
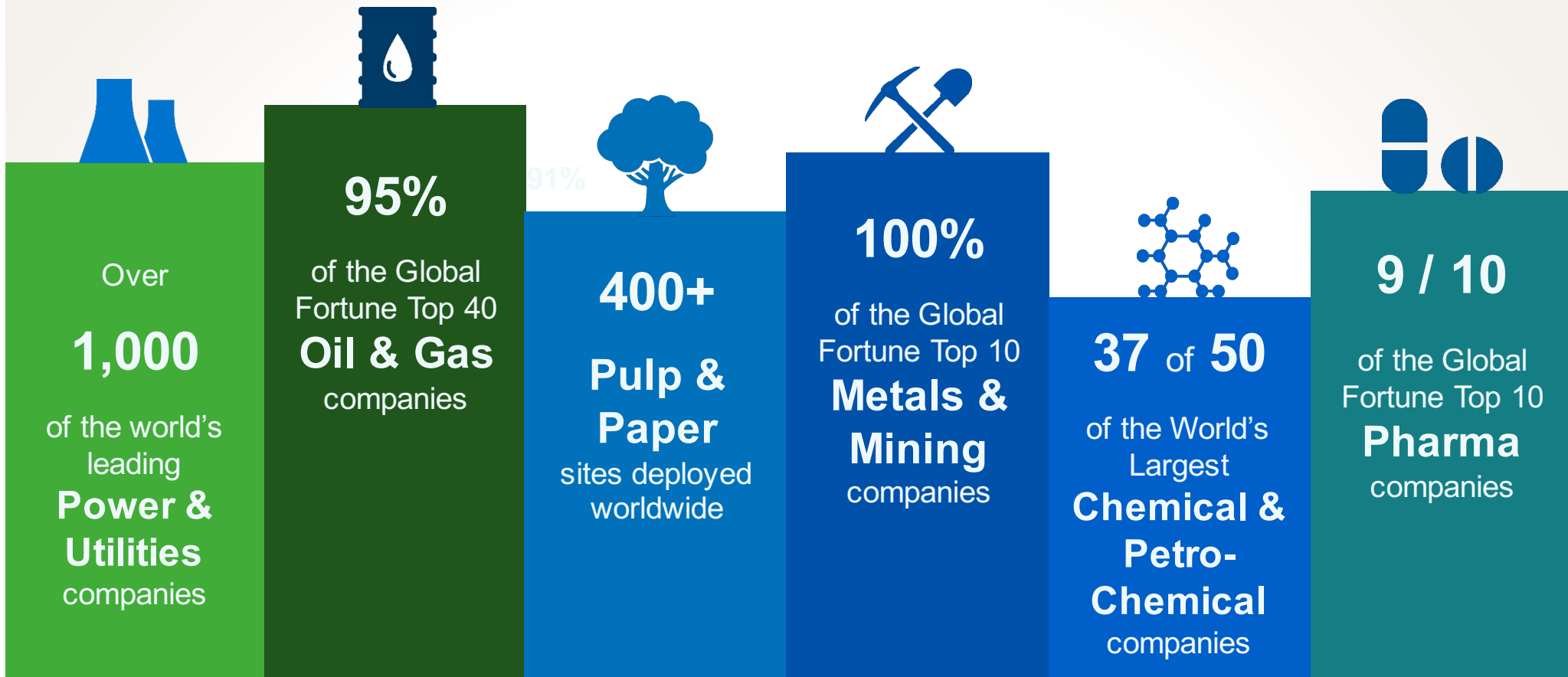- Microsoft Azure IoT and OSIsoft PI System 2015

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
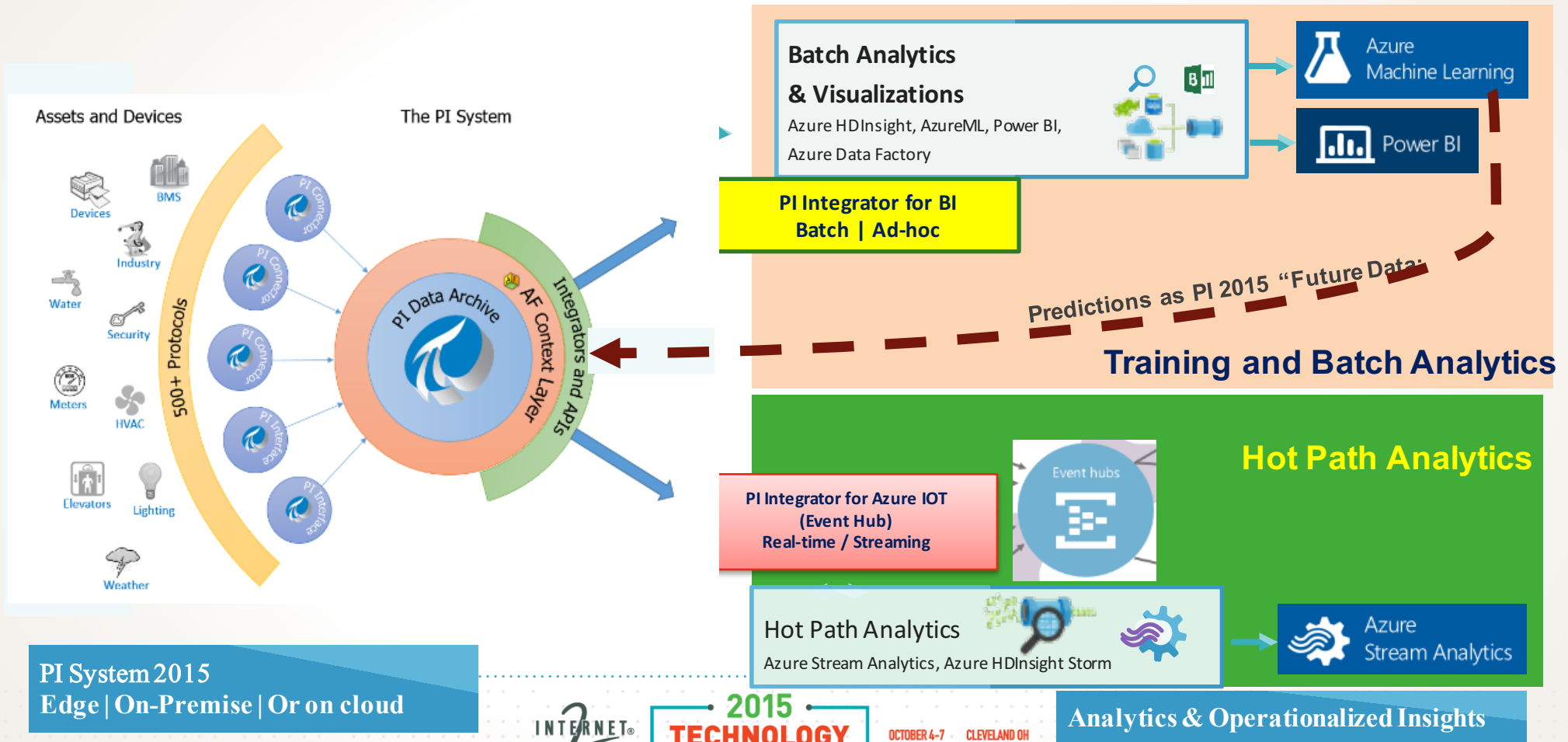- Grant Partnering

How

- Collaborative Innovation – Joint Vison OSIsoft/Academic Institution
- The Triple Helix – Academic, Government & Industry Drive Innovation

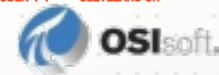# Microsoft Azure IoT and OSIsoft PI System 2015`

Carnegie Mellon University

"With OSIsoft and Microsoft data, cloud technologies and IOT, we can integrate almost any device interface and data type."

Bertrand Lasternas, Researcher
Carnegie Mellon

INTERNET2® 2015 TECHNOLOGY exchange OCTOBER 4–7 CLEVELAND OH OSIsoft.

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	Our Company	Manu., Retail, Energy	Partnerships	Our Focus
Drive customer value with Predictive Analytics on the Microsoft platform, and use Azure Machine Learning to drive IT & business partnership in our clients.	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.	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.	We are a Microsoft partner that develops solutions on using Azure ML, Azure marketplace, HDInsight, Stream Analytics, Azure Data Factory, and Event Hubs.	Demand forecasting, decision modelling, resource forecasting, predictive maintenance, systems integration and creating more profitable customers.

OUR PROCESS
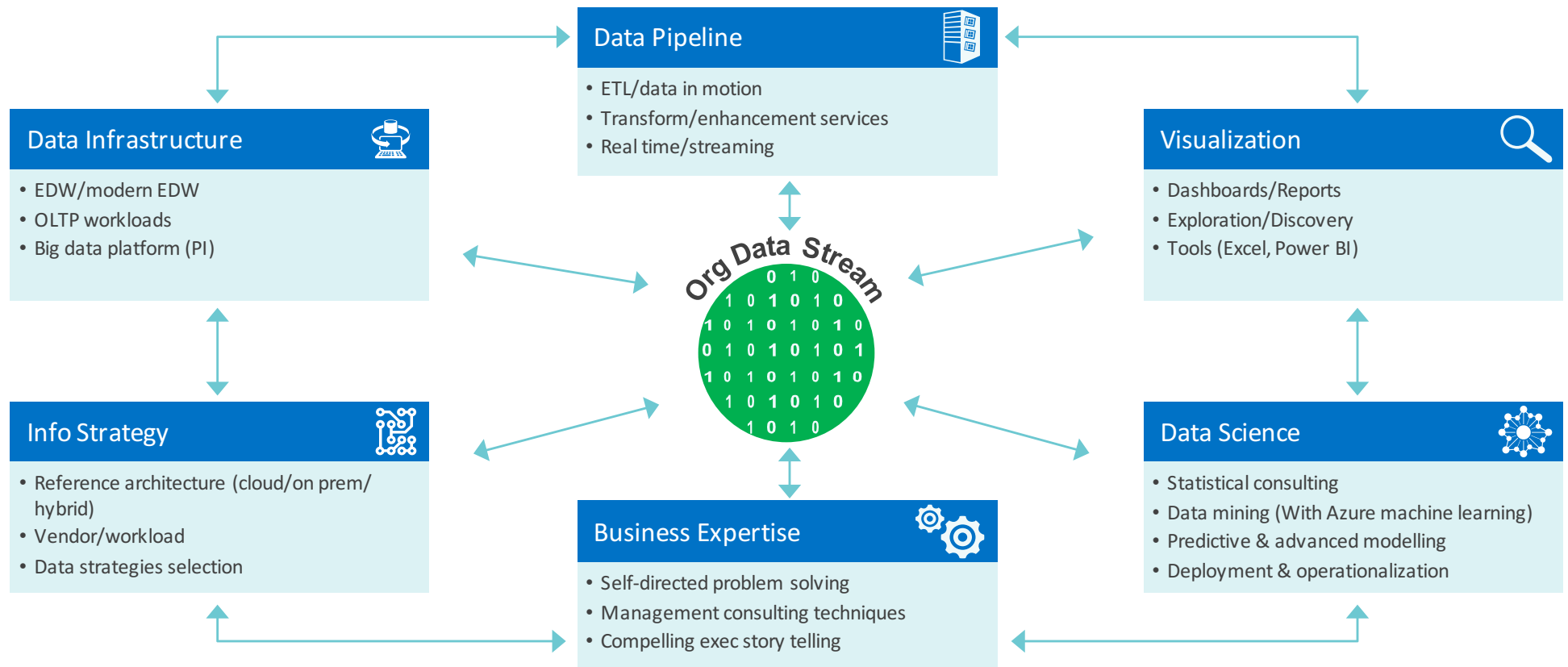
Prove ROI	Broadly Engage Leaders	Production

Neal Analytics Services

Creating the fabric of an enlightened organization

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

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

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

Org Data Stream

0 1 0
1 0 1 0 1 0
1 0 1 0 1 0 1 0
0 1 0 1 0 1 0 1
1 0 1 0 1 0 1 0
1 0 1 0 1 0
1 0 1 0

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

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

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

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

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IT

- Managed by central IT authority

- Deep Microsoft recognition & engagement
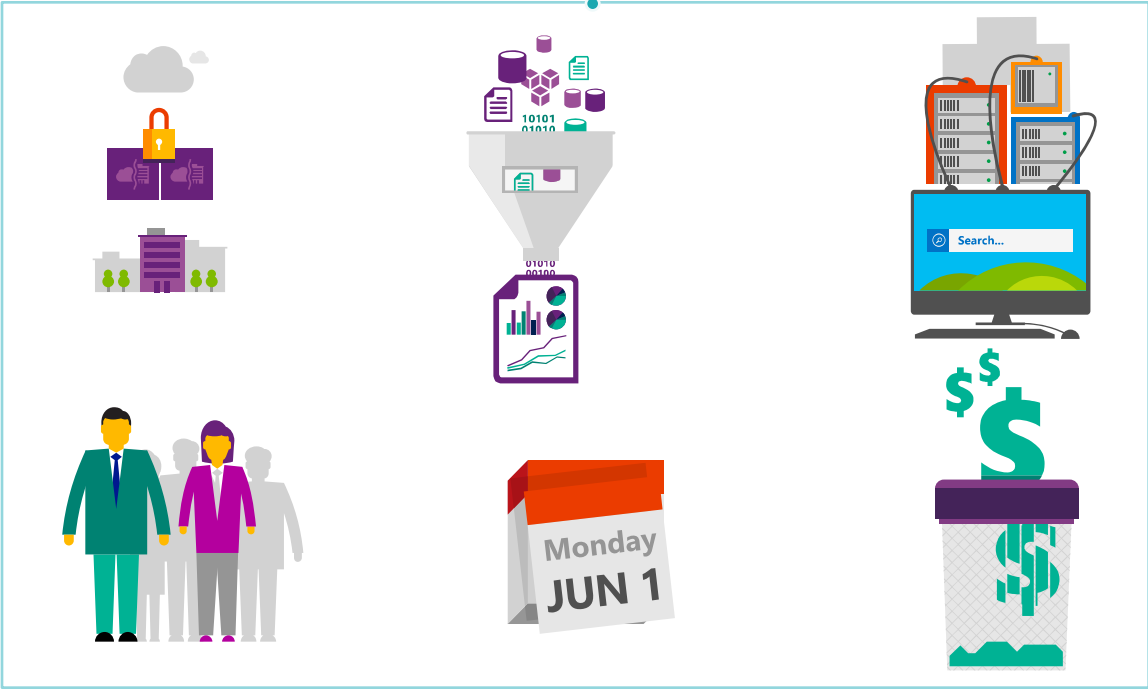
- Focus on cost reduction

OT

- Managed by operational & financial authorities

- Limited Microsoft recognition & engagement

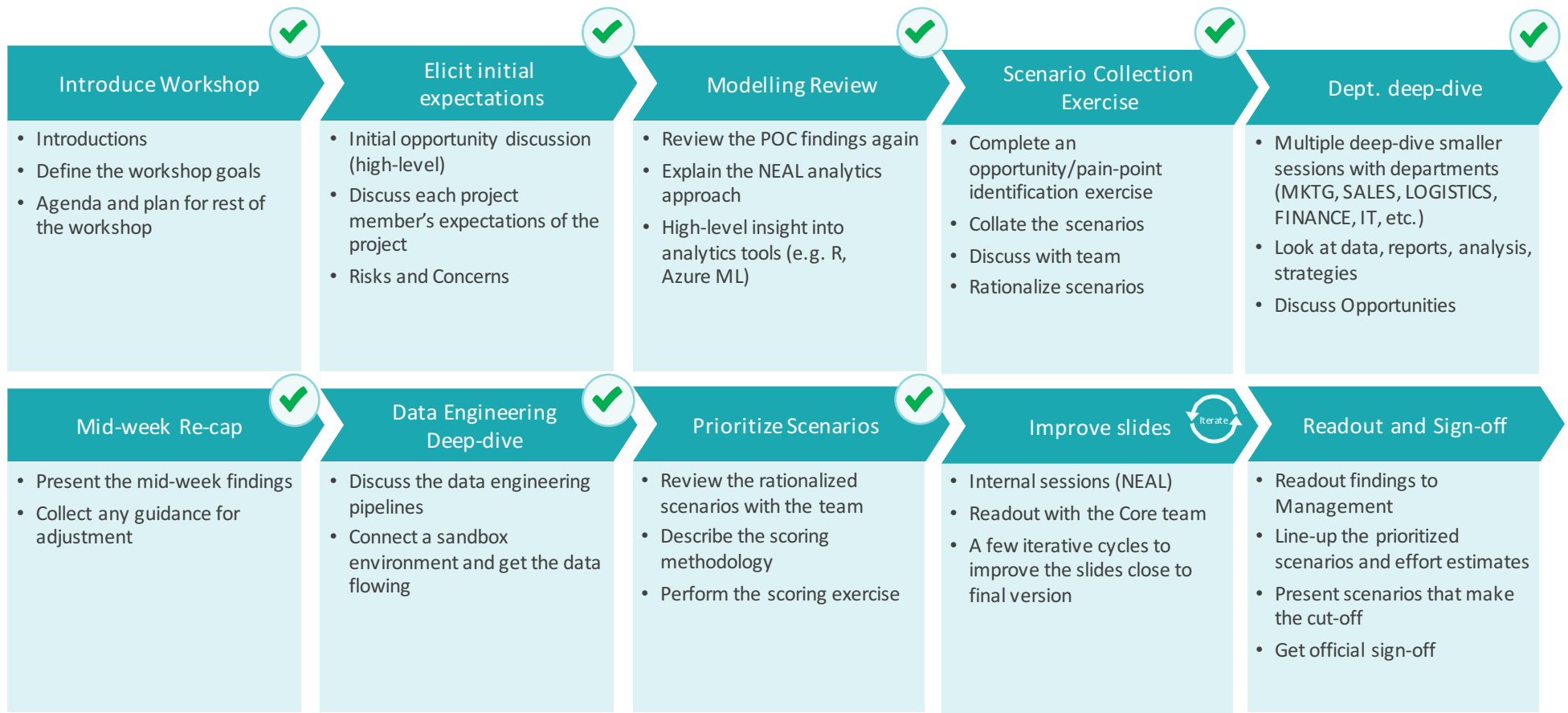- Focus on profitability improvement

Cortana Workshops: Make IT a Hero

Emerging Challenges

Desire

Cortana Deployment Workshop Methodology & Progress

Introduce Workshop

- Introductions
- Define the workshop goals
- Agenda and plan for rest of the workshop

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

Mid-week Re-cap

- Present the mid-week findings
- Collect any guidance for adjustment

Data Engineering Deep-dive

- Discuss the data engineering pipelines
- Connect a sandbox environment and get the data flowing

Prioritize Scenarios

- Review the rationalized scenarios with the team
- Describe the scoring methodology
- Perform the scoring exercise

Improve slides

- Internal sessions (NEAL)
- Readout with the Core team
- A few iterative cycles to improve the slides close to final version

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

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

INTERCONNECTED

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

INSTRUMENTED

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

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eWeek: IBM as #1 leader in companies investing in IoT

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.
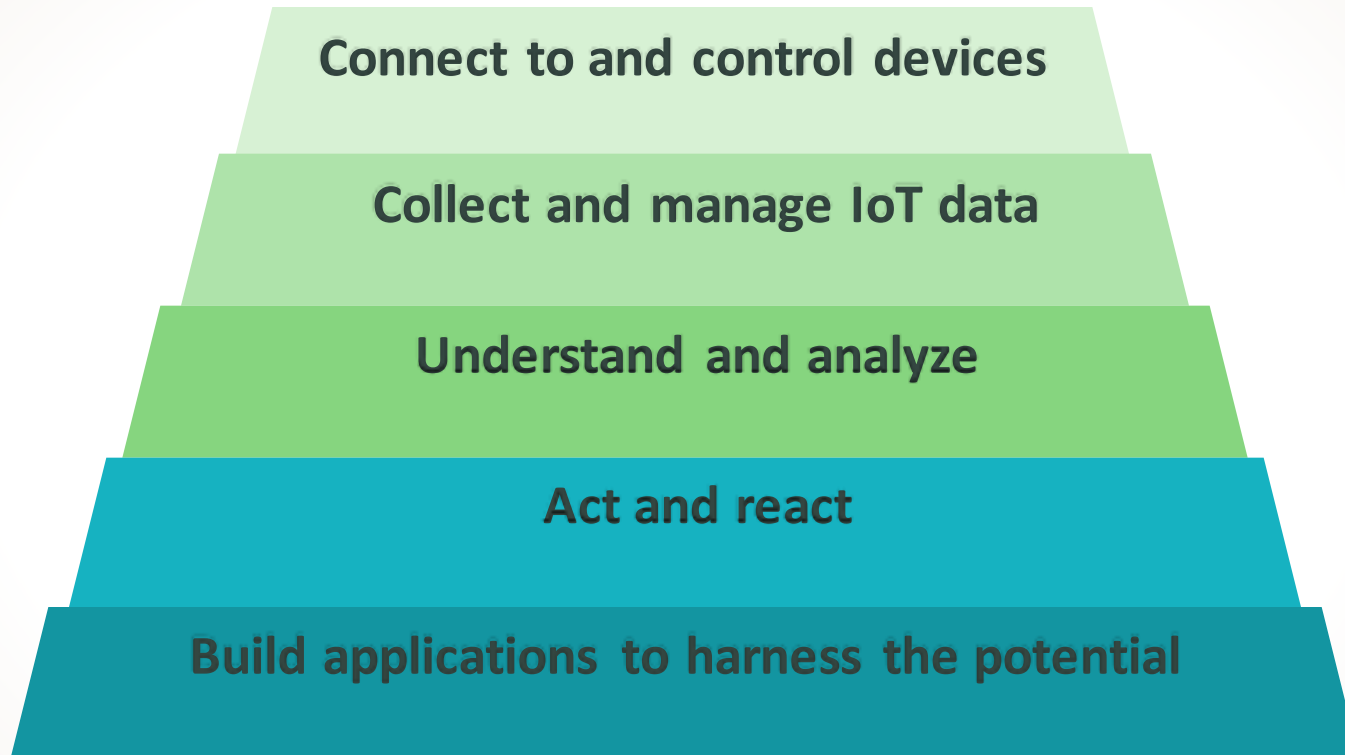
Mission

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

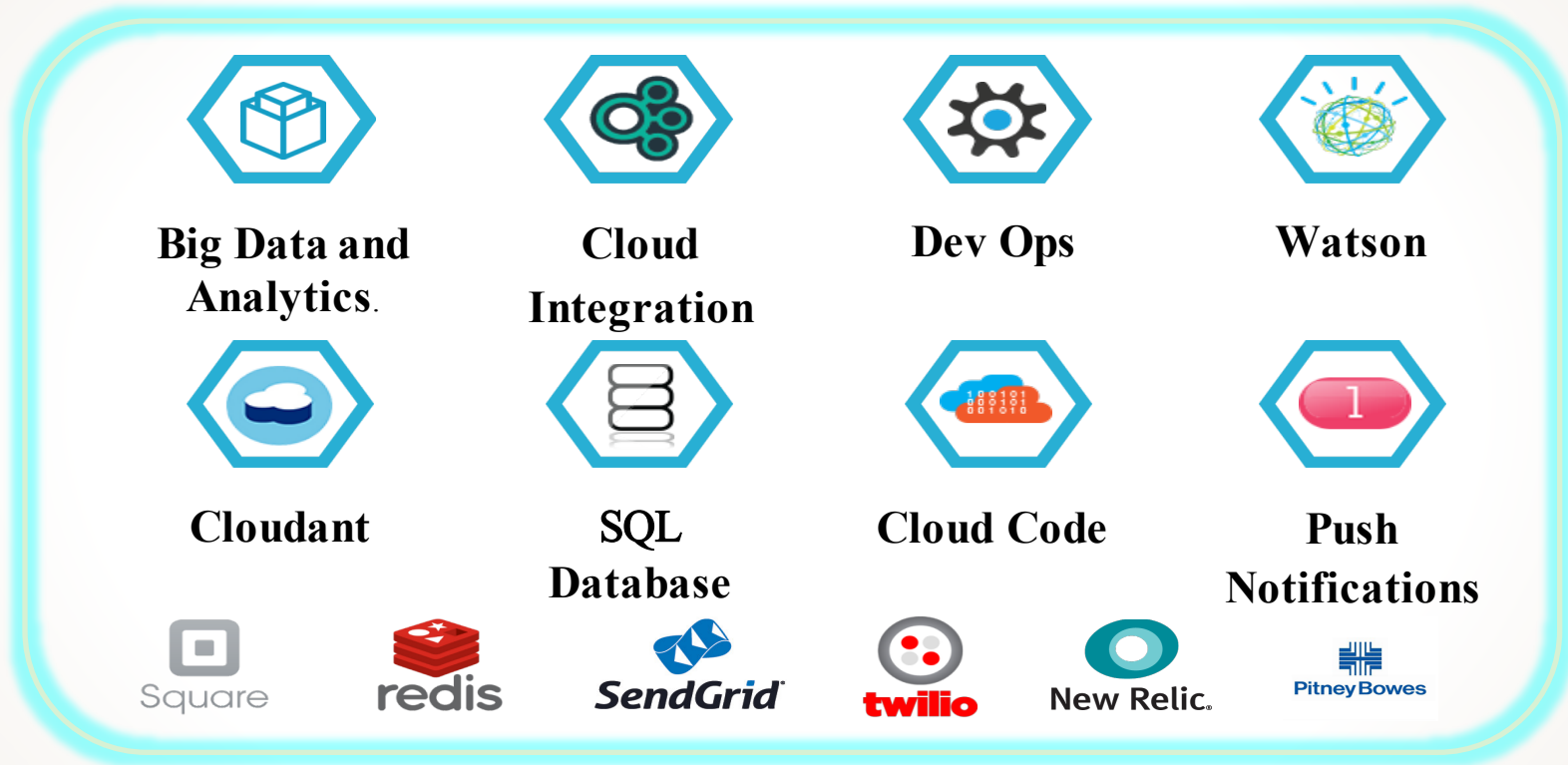- Leverage **faculty events** to create awareness, train and enable
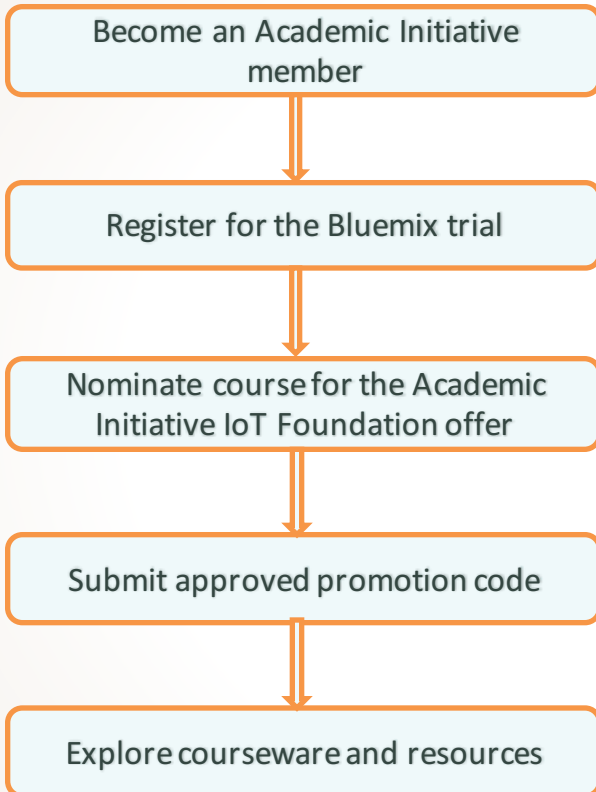
Five keys to tap into IoT Value

Connect to and control devices

Collect and manage IoT data

Understand and analyze

Act and react

Build applications to harness the potential

Building an IoT PaaS on the power of BlueMix

IBM

Big Data and Analytics.

Cloud Integration

Dev Ops

Watson

Cloudant

SQL Database

Cloud Code

Push Notifications

Square

redis

SendGrid

twilio

New Relic.

Pitney Bowes

Getting started with IBM Academic Initiative for IoT

```
┌─────────────────────────────────┐
│  Become an Academic Initiative   │
│            member                │
└─────────────────────────────────┘
                │
                ▼
┌─────────────────────────────────┐
│  Register for the Bluemix trial  │
└─────────────────────────────────┘
                │
                ▼
┌─────────────────────────────────┐
│  Nominate course for the Academic│
│  Initiative IoT Foundation offer │
└─────────────────────────────────┘
                │
                ▼
┌─────────────────────────────────┐
│  Submit approved promotion code  │
└─────────────────────────────────┘
                │
                ▼
┌─────────────────────────────────┐
│  Explore courseware and resources│
└─────────────────────────────────┘
```

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: sogetiibm)
- 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
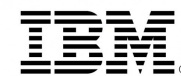
Customers capturing results with IBM IoT solutions

IBM

40% *Reduction in operating costs* — TPVISION

99% *Reduction of time for software error correction* — JAGUAR LAND ROVER

100% *Prediction of ground events for high risk engines* — Pratt & Whitney

20% *Improvement in steering decisions due to quality insight* — BOSCH Invented for life

Shorten customer service call time by **70%** — Whirlpool Corporation

$700M *In cost and performance benefits* — UNDERGROUND

95% *Elimination of manual operations* — VW

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

   Experiment with Node-Red

   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**

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

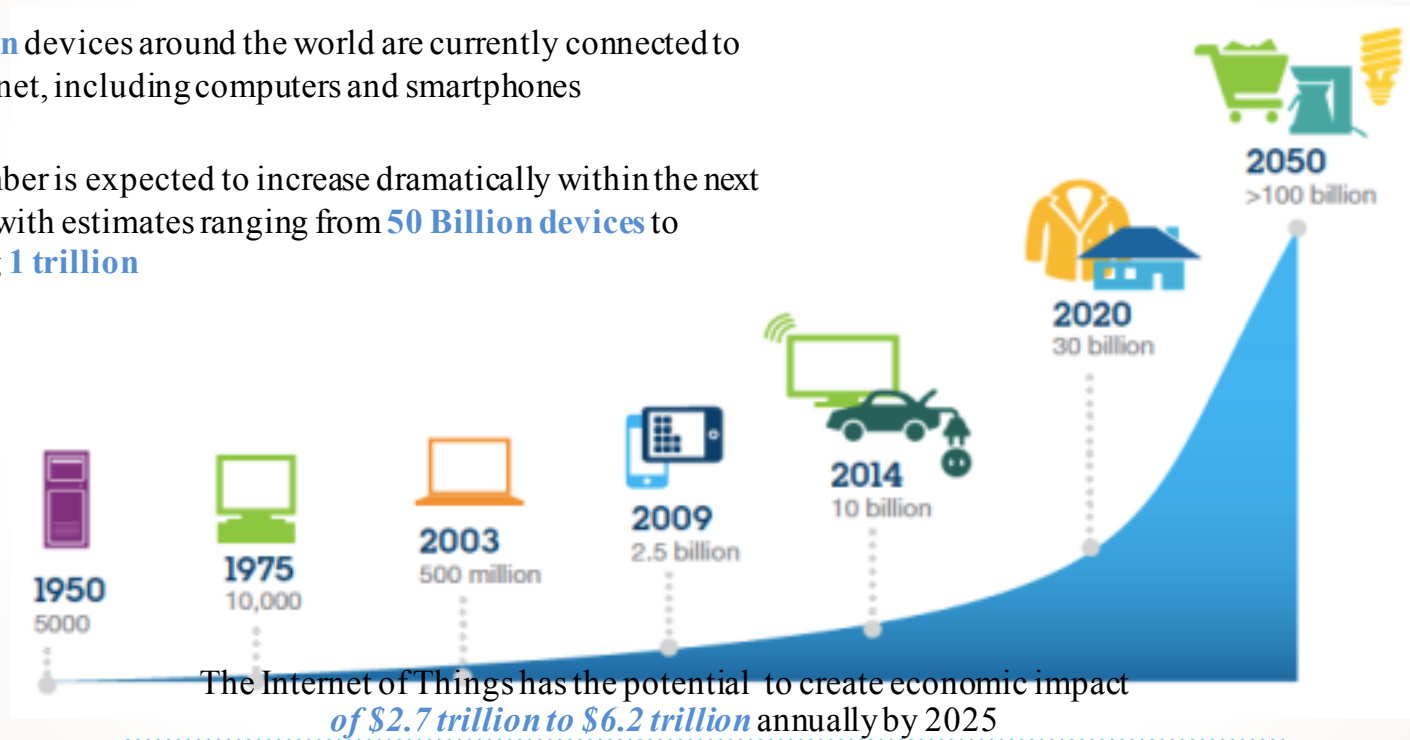- Ecosystem

- 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**

2050
>100 billion

2020
30 billion

2014
10 billion

2009
2.5 billion

2003
500 million

1975
10,000

1950
5000

The Internet of Things has the potential to create economic impact *of $2.7 trillion to $6.2 trillion* annually by 2025

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IoT is revolutionizing the market and a tremendous growth opportunity

IBM

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

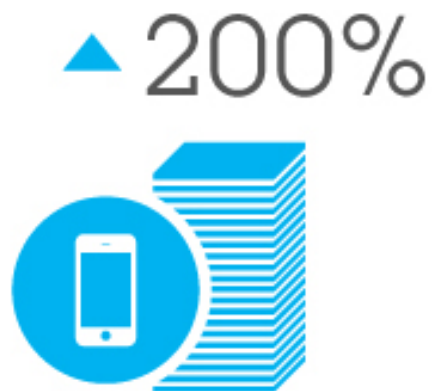**62%** Of C-suite execs believe failure to adopt IoT will mean getting left behind

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[3]

▲ **200%**
Increase in Mobile Network connections speeds from 2013 to 2018[2]
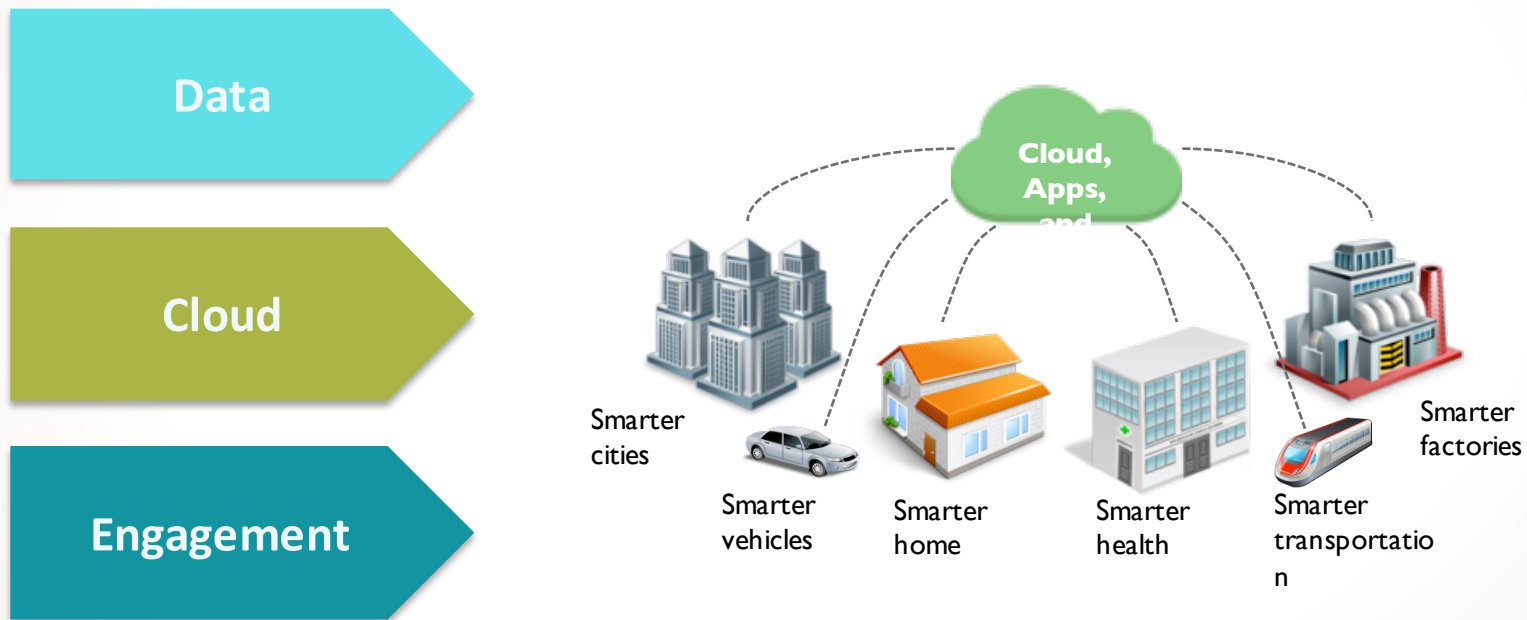
▼ **80%**
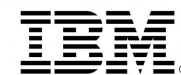Price decline in MEMs (microelectromechanical systems) sensors in last 5 years[3]

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

Data

Cloud

Engagement

Cloud, Apps, and

Smarter cities

Smarter vehicles

Smarter home

Smarter health

Smarter transportation

Smarter factories

IoT value is realized in four foundational areas

		Representative IBM Products
Industry Transformation	Evolving new business models	IoT for Automotive, IoT for Electronics, IoT for Insurance
Applications & Solutions	Optimizing operations and enhancing performance	Maximo, Tririga, PMQ,
Platform	Building and managing IoT solutions	Continuous Engineering IoT Foundation (IBM IoT Platform)
Devices & Networks	Connecting what matters	IBM Ecosystem partners

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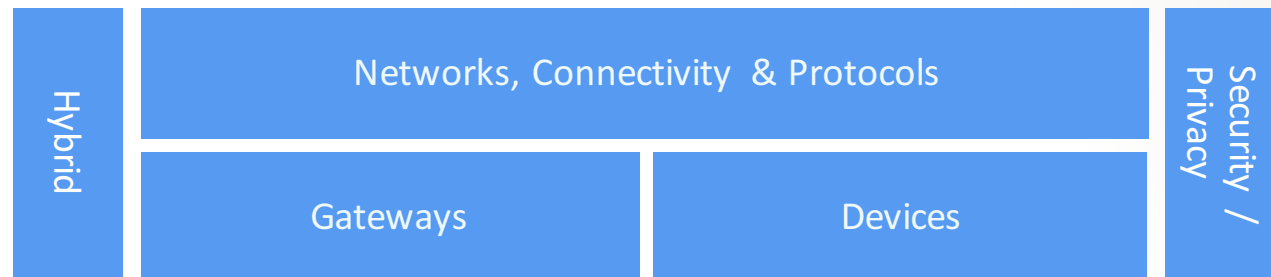
IBM

Four Foundations

Industry Transformations

Applications & Solutions

Platforms

Devices & Networks >

Hybrid	Networks, Connectivity & Protocols		Security / Privacy
	Gateways	Devices	

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

IBM

Devices & Networks

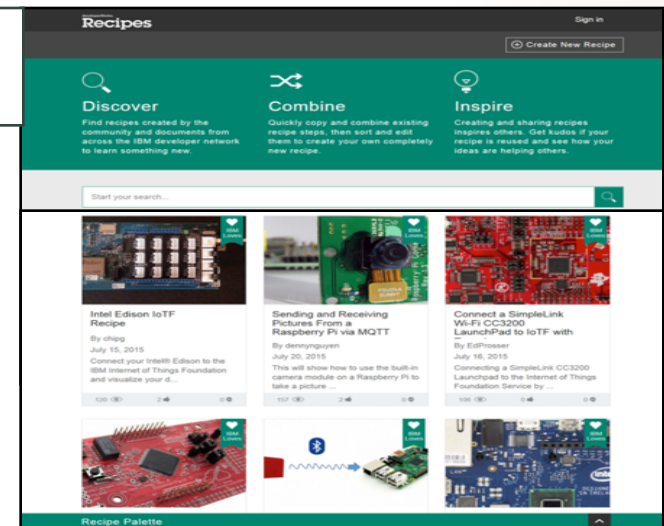**Derive IoT insight from data through strong industry partnerships and open ecosystem**

Examples:

ARM® (intel) TEXAS INSTRUMENTS at&t Sprint

Connecting Devices to the IBM IoT Foundation platform:

developerWorks.
Recipes

Wide variety of supported devices

✓ Self Service

✓ Open ecosystem

✓ Simple tutorials

✓ Connect in moments

Device recipe examples

Devices & Networks

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
Hardware Requirements

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

Containing
- Temperat
- Acceleron
- Potention
- Joystick

If you have completed the simple visualized your device data then j

Prepare
Get your device ready

1. Plug your boards together as
2. Connect to a network with in
3. Connect to your computer us board, as shown on the quick start g
4. The microcontroller appears

Network Gateway & Wzzard™ Edge Node

B+B SMARTWORX

This recipe has been provided by an IBM Business Partner

Use the Spectre router and Wzzard device(s) to connect to the IBM Internet of Thing Cloud. Then you can visualise the data generated by any Wzzard connected sensor the Quickstart page. This demo uses a thermocoil sensor attached to a Wzzard Edge to generate the temperature data to be sent to the cloud.

Ingredients
Hardware Requirements

- Spectre Network Gateway
- IBM Module for Spectre Network Gateway
- Wzzard Intelligent Edge Nodes
- Sensors
- Wizzard Android App

Prepare
Get your device ready

1. Connect the Spectre router to the internet. Refer to the Gateway Quickstart Guide as the first step for instruction on how to commission your network gateway

TEXAS INSTRUMENTS CC2650 SensorTag

This recipe has been provided by an IBM Business Partner

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
Hardware Requirements

The SensorTag is packed with low power sensors a connectivity to allow wireless, battery powered appli years of battery life. To learn more about the Senso your own go to www.ti.com/sensortag

Prepare
Get your device ready

1. Download the SensorTag app from the Apple Store or Google Play.

2. Pull the tab on the SensorTag battery to power on.

NATIONAL INSTRUMENTS National Instruments LabVIEW

This recipe has been provided by an IBM Business Partner: Espotel
Use LabView to transfer measurement data from PC or RT-Target to IBM Internet of Things Foundation and visualize the data available.

Ingredients
Hardware Requirements

National Instrument's myRIO, CompactRIO, FlexRIO, SingleBoardRIO, SOM RIO

Prepare
Get your device ready

1. Download and install LabVIEW (2013 or newer) on your host PC
2. Download IoT Foundation library for LabVIEW from: https://github.com/Espotel /LabVIEW-IOTFoundation
3. Extract the library zip package

Connect (Quickstart)
Internet of Things Foundation Quickstart connection

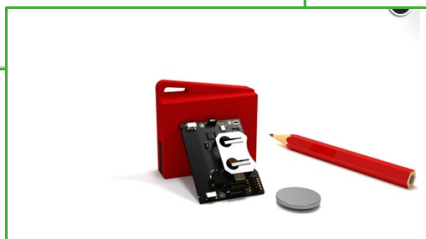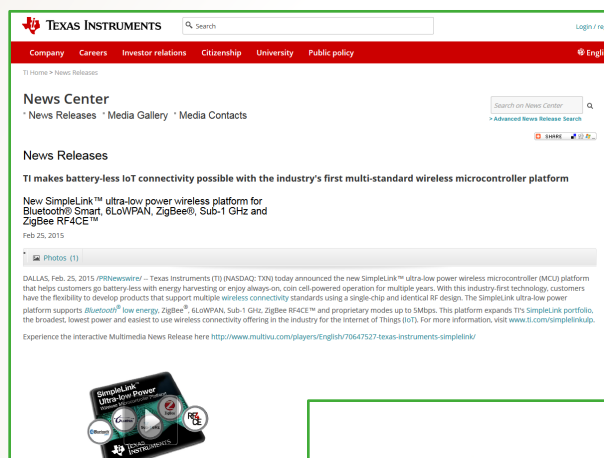1. Launch IOTFoundation\examples\quickstart.vi

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*
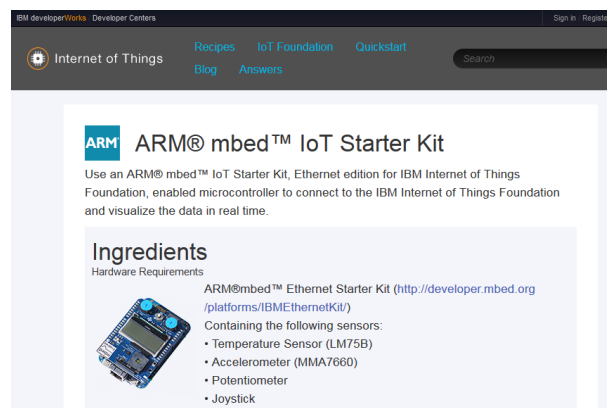*I downloaded the app, pulled the plastic tab and lo and behold I was connected to the cloud. Simply AWESOME"*   (IBM User)

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

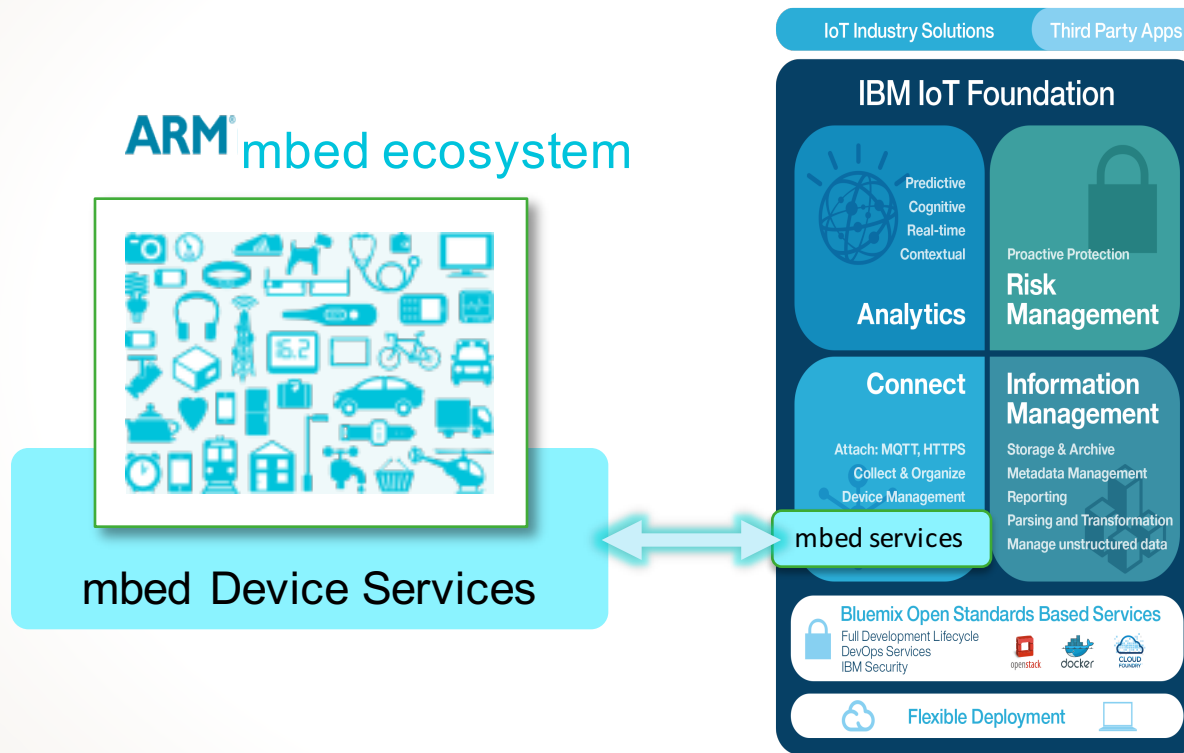# IBM teams with ARM – the first unified chip-to-cloud enterprise class IoT platform

ARM mbed ecosystem

mbed Device Services

IoT Industry Solutions | Third Party Apps

IBM IoT Foundation

Predictive
Cognitive
Real-time
Contextual

Analytics

Proactive Protection
Risk Management

Connect

Attach: MQTT, HTTPS
Collect & Organize
Device Management

Information Management

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

mbed services

Bluemix Open Standards Based Services
Full Development Lifecycle
DevOps Services
IBM Security

openstack docker CLOUD FOUNDRY

Flexible Deployment

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Platforms provide a foundation for building and managing IoT solutions and bridge between device manufacturers higher value outcomes
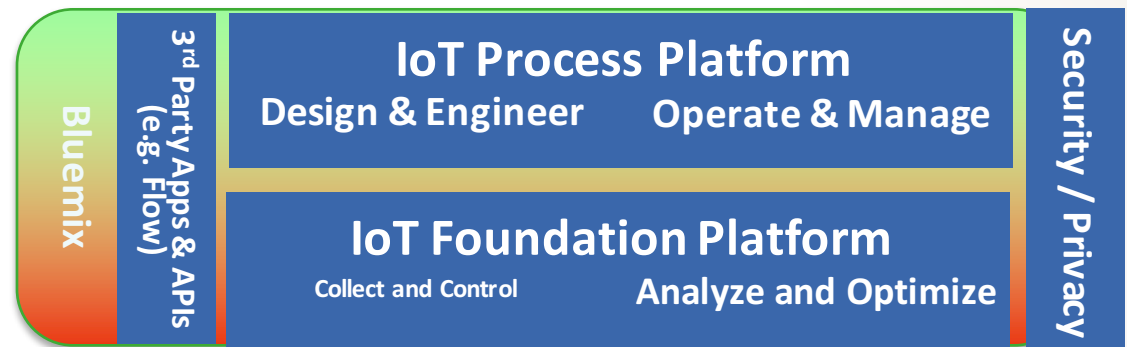
Four Foundations
Industry Transformations
Applications & Solutions
Platforms >
Devices & Networks

Product Family

Continuous Engineering

IoT Foundation
Connect, Information Management, Analytics, Risk Management

Bluemix

3rd Party Apps & APIs (e.g. Flow)

IoT Process Platform
Design & Engineer   Operate & Manage

IoT Foundation Platform
Collect and Control   Analyze and Optimize

Security / Privacy

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

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.
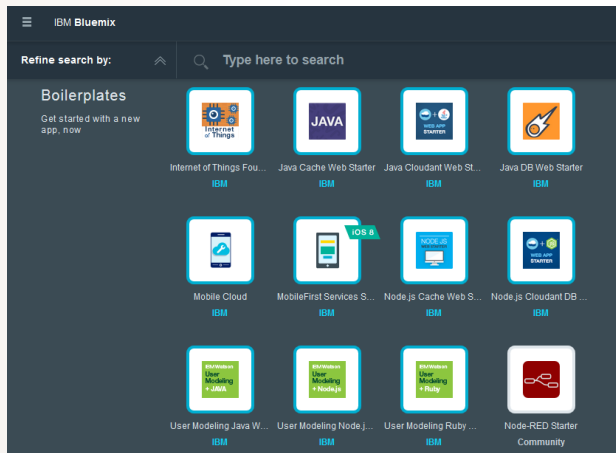
APIs and Services

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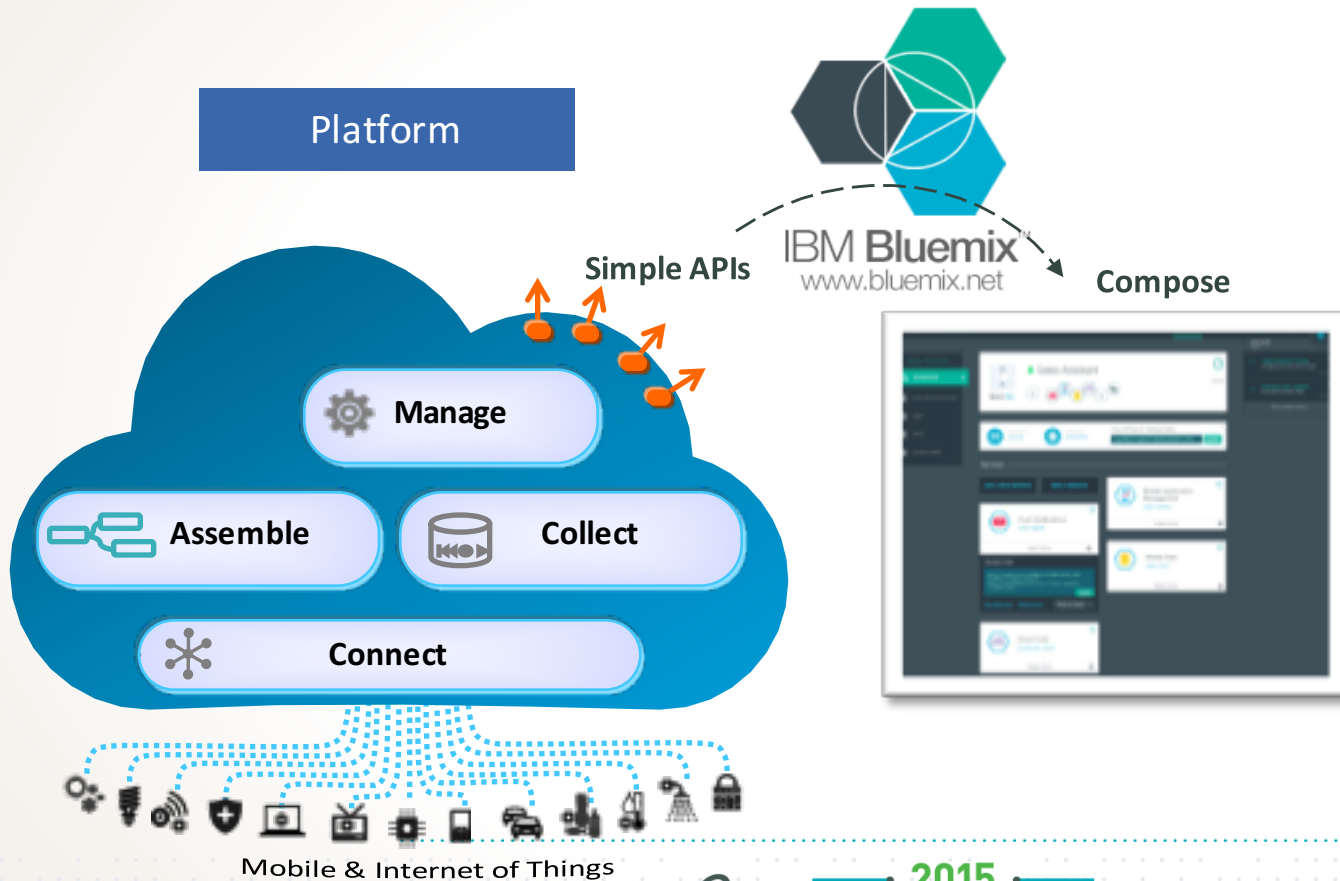
Cloud Integration

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

Platform

Simple APIs

IBM Bluemix
www.bluemix.net

Compose

Manage

Assemble

Collect

Connect

Mobile & Internet of Things

- **Secure Device Registration**
- **Scalable Device Connectivity**
- **Device Management new!**
- **PAYG SaaS pricing**
- **Powered by IBM MessageSight technology**

IoT Foundation Service Pricing structure

Platform

Pick a plan

Monthly prices shown are for country or region: United States

Plan	Features	Price
✓ 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 (with 30 day expiry) Maximum of 10 application bindings	Free

(i) 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.

Plan	Features	Price
Bronze	Includes up to 100 active devices, 100 MB of data traffic and 1 GB of storage Charge per device thereafter Charge per MB data exchanged thereafter Charge per GB data stored online thereafter	$20.00 USD/Instance $0.20 USD/Active Device $0.01 USD/Megabytes Exchanged $1.00 USD/Gigabyte Month
Silver	Includes up to 3,000 active devices, 100 MB of data traffic and 1 GB of storage Charge per device thereafter Charge per MB data exchanged thereafter Charge per GB data stored online thereafter	$120.00 USD/Instance $0.04 USD/Active Device $0.01 USD/Megabytes Exchanged $1.00 USD/Gigabyte Month
Gold	Includes up to 15,000 active devices, 100 MB of data traffic and 1 GB of storage Charge per device thereafter Charge per MB data exchanged thereafter Charge per GB data stored online thereafter	$450.00 USD/Instance $0.03 USD/Active Device $0.01 USD/Megabytes Exchanged $1.00 USD/Gigabyte Month

- **Monthly PAYG pricing**

- **SUBSCRIPTION pricing**

IBM delivers IoT connectivity across deployment options

Virtual appliances in datacenter

physical appliances withdrawn from market from July2015, focusing on virtual appliance form factor

Virtual appliances, Public or private cloud deployed

Fully managed as-a-service, PAYG Public Cloud

IBM **MessageSight**

IBM **MessageSight**

IoT Foundation Connect

Powered by IBM MessageSight technology

SOFTLAYER®

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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 down time
- **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

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Example usage

Maker

Operator

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.

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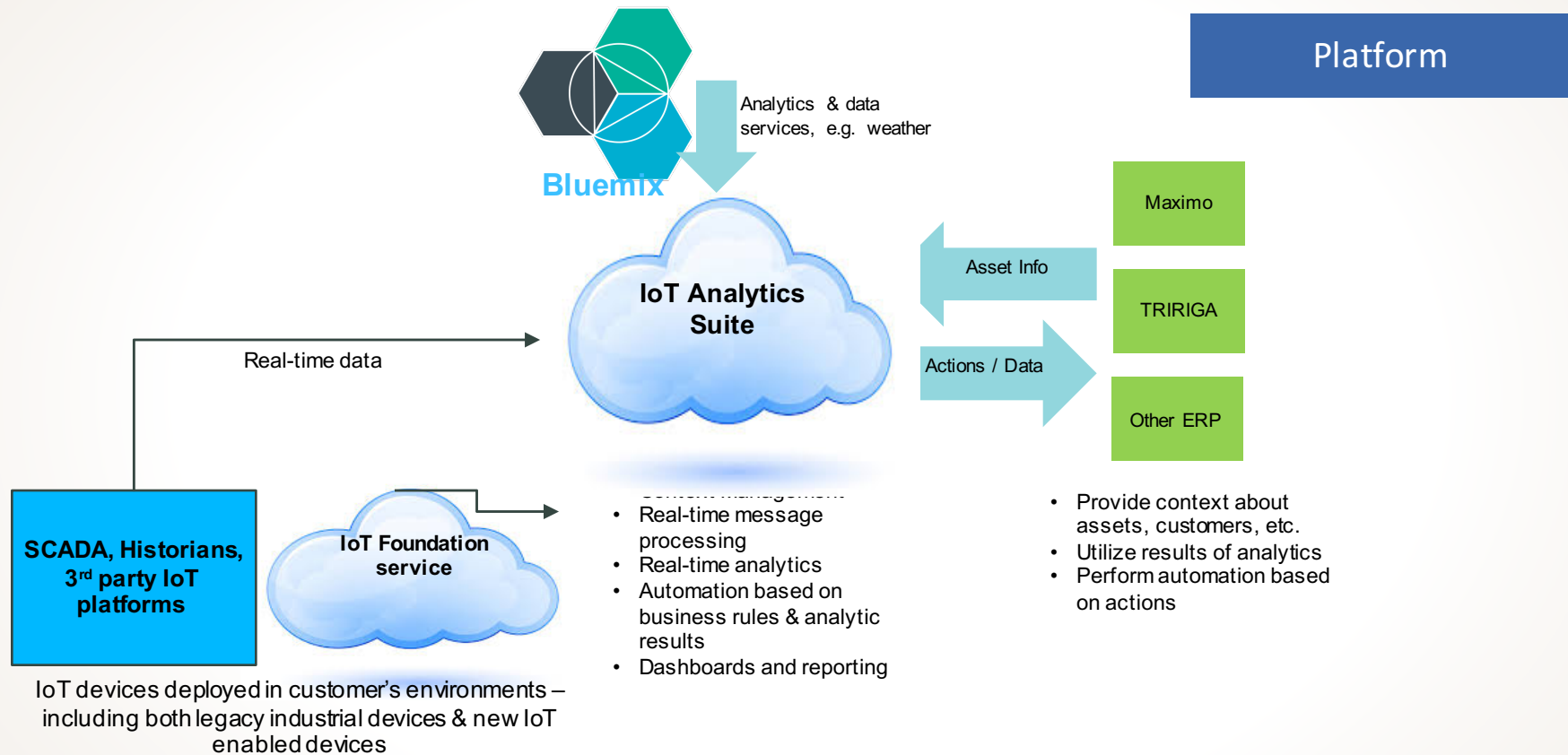
How IoT Analytics helps: Leveraging data from the remote SCADA systems, IoT analytics provides analytical tools to enable condition based maintenance, helping them understand what is happening or what might happen and automatically dispatch a technician to avoid failures and down time.

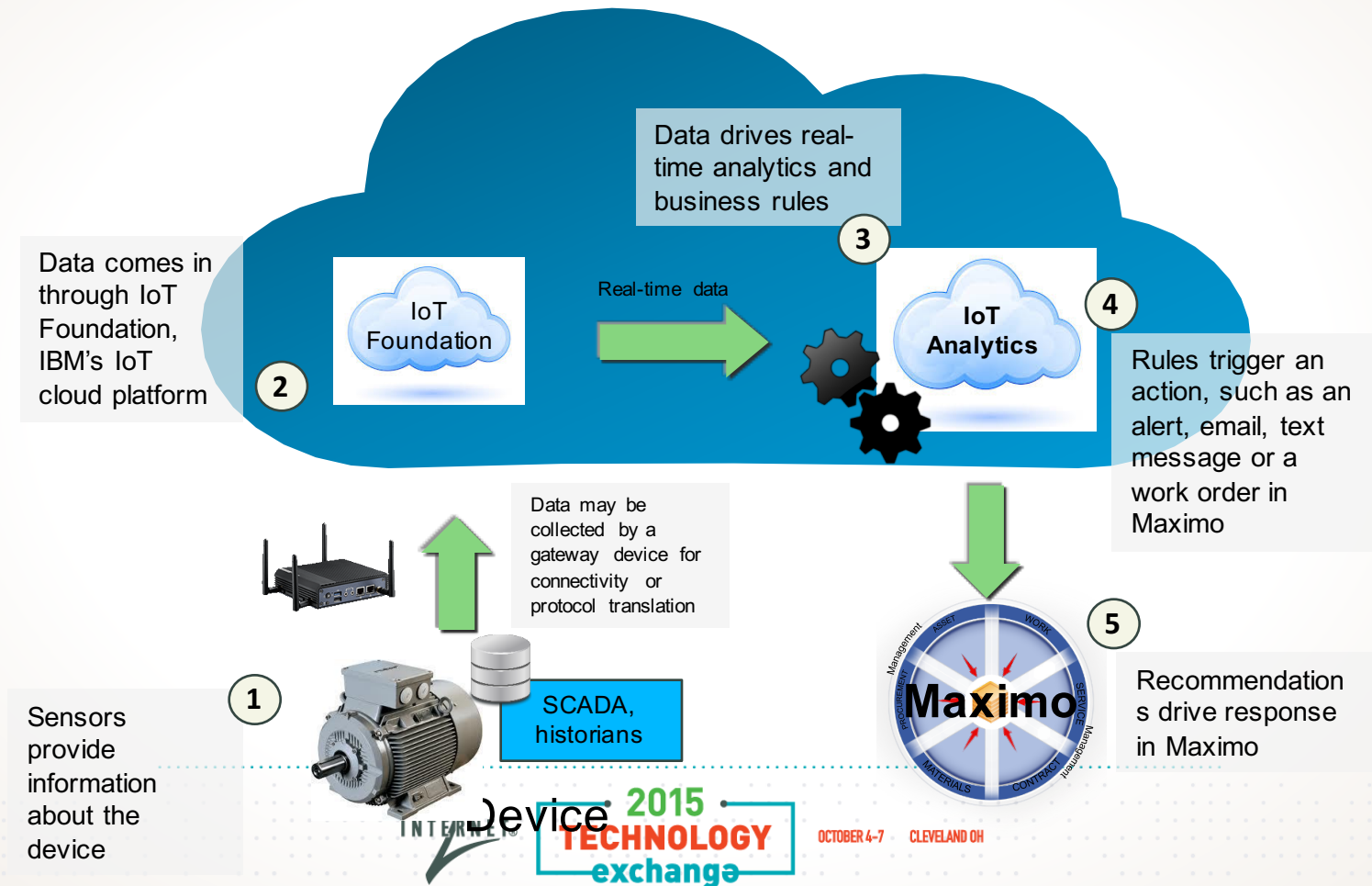# IBM IoT Real-time Insights - Architecture Overview

Platform

Analytics & data services, e.g. weather

Bluemix

IoT Analytics Suite

Asset Info

Actions / Data

Real-time data

Maximo

TRIRIGA

Other ERP

SCADA, Historians, 3rd party IoT platforms

IoT Foundation service

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

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

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

How "IoT Real-Time Insights" works

Platform

Data drives real-time analytics and business rules

3

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

IoT Foundation

Real-time data

IoT Analytics

4

2

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

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

1

SCADA, historians

Maximo

5

Sensors provide information about the device

Recommendations drive response in Maximo

Device

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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

Platform

IoT Industry Solutions   Third Party Apps

IBM IoT Foundation

Predictive
Cognitive
Real-time
Contextual

Analytics

Proactive Protection
Risk Management

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
openstack   docker   CLOUD FOUNDRY

Flexible Deployment

INTERNET2®

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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

Buyer Aligned

Operations

Engineering

Risk

Maintenance

Product

Industry Specific

Cross Industry

Life Cycle Aware

| Design | Build | Deploy | Operate/Maintain | Refurb/Retire |

Insight Driven

Prescribe

Predict

Condition
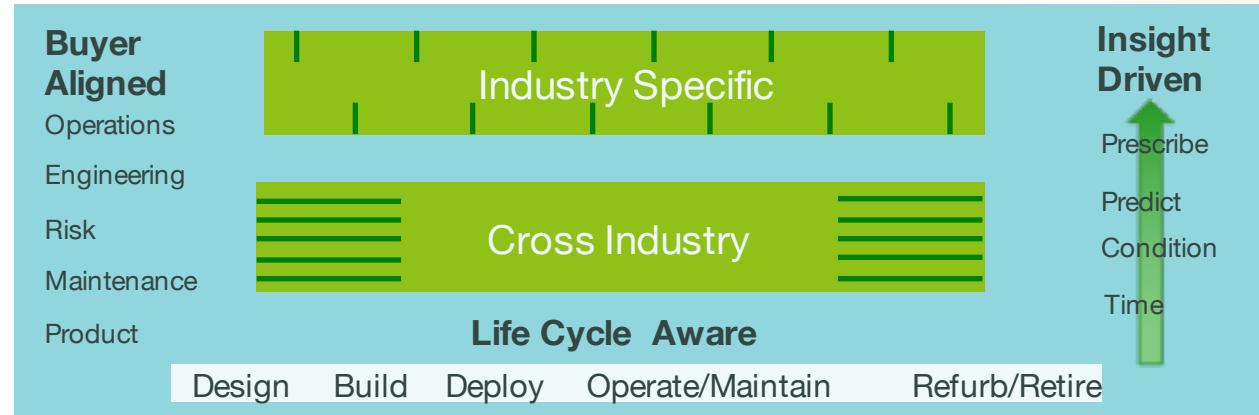
Time

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
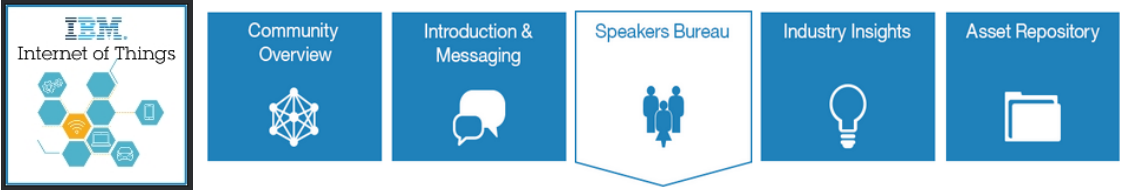
Our favourite use case !

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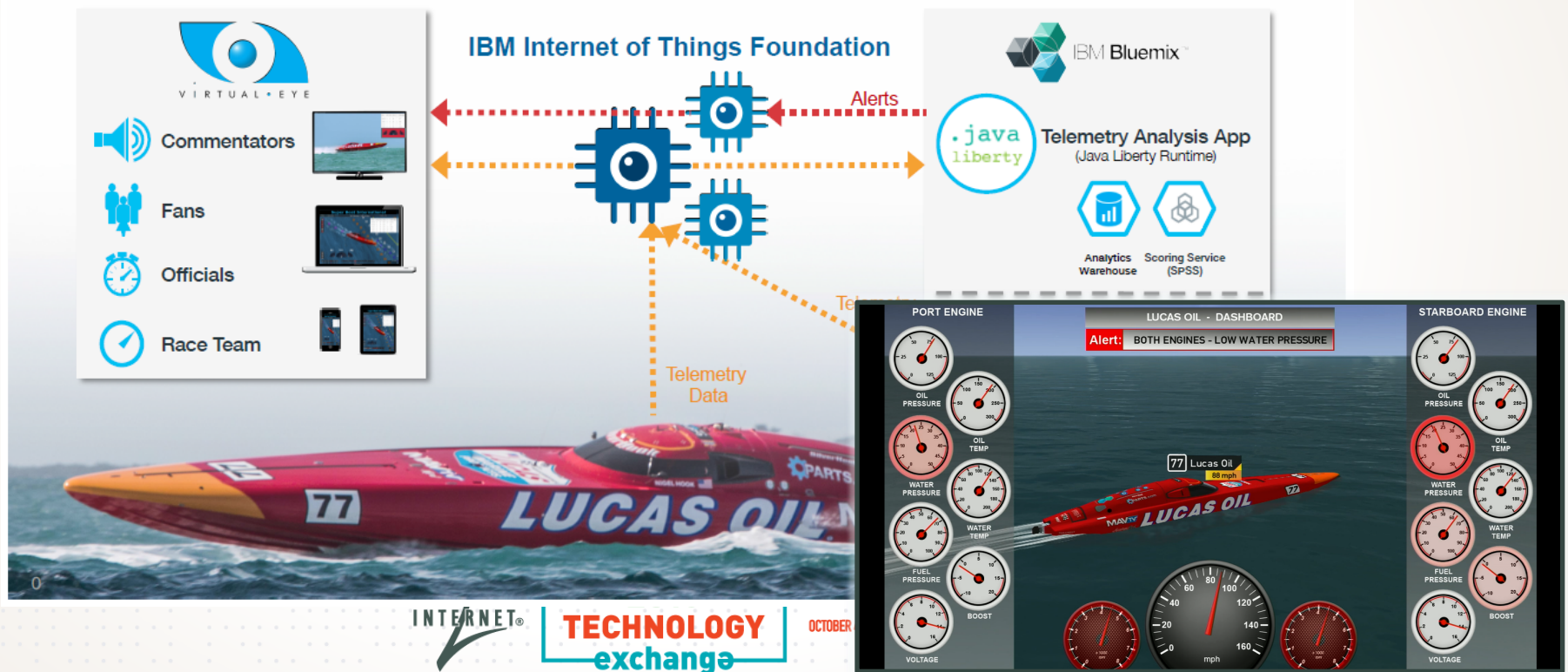
Internal resources

Internal one stop shop for IoT
ibm.biz/IoTWiki

THINKACADEMY

https://w3.ibm.com/ibm/thinkacademy/index.html#/internet-of-things/learning-for-a-new-era
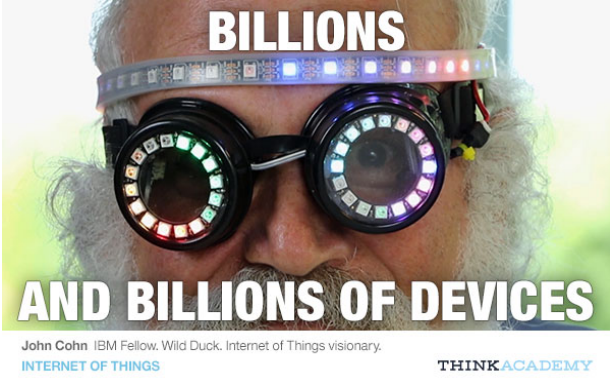
World Wide Sales Team

- WW Sales Team
- Michael Riley, WW IoT Business Unit Executive, mariley@us.ibm.com
- Ted Connell, NA and Japan, ted.connell@us.ibm.com
- Tim Henrion, Europe and MEA, tjhenrio@us.ibm.com
- Lu Lanier, Asia Pacific and GCG, llanier@us.ibm.com
- Bernadine Stephens, NA IMTs as well as the Latin America market, bernadine.stephens@us.ibm.com
- WW Technical Sales
- David Dougherty, WW Tech Sales Lead, ddougher@us.ibm.com
- Peter Jenkins, WW Tech Sales Lead, Peter.Rhys.Jenkins@us.ibm.com
- Jim MacNair , WW Tech Sales Lead , macnair@us.ibm.com
- 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
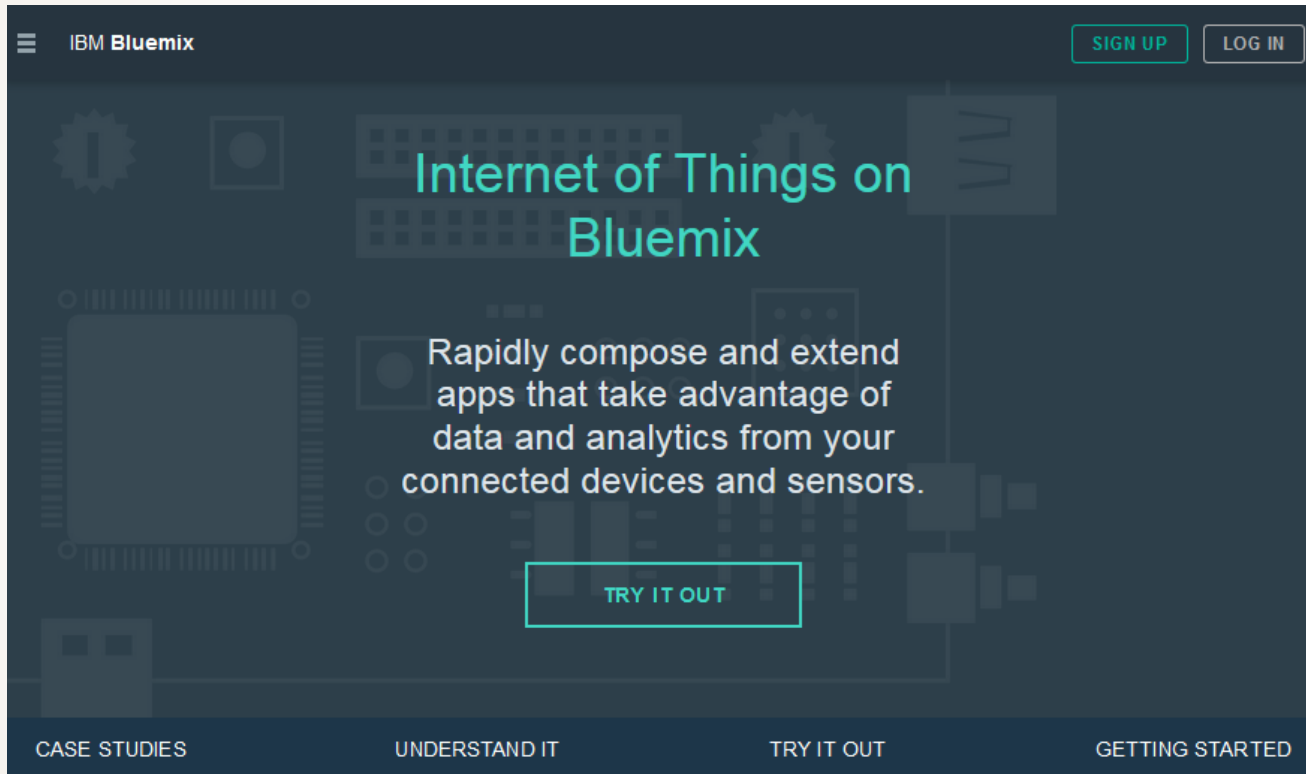
https://bluemix.net/solutions/iot

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
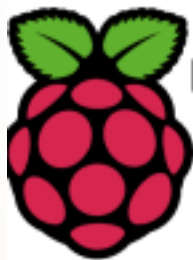
Islands or Webs?
IoTs should be loney.

- 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 sytem.
- 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.

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 surprising well

- Low power (1.4 watts while running wireshark)
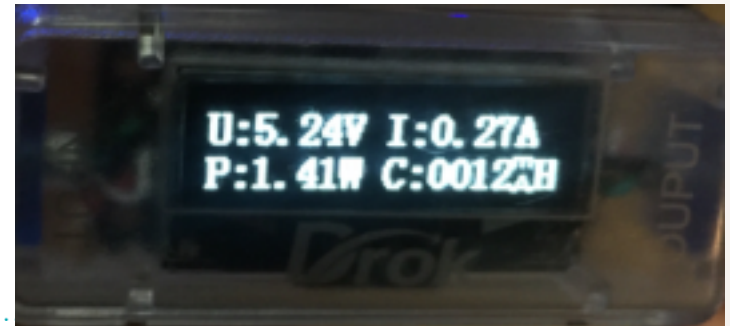
Jumpstarting a Bluemix IoT application...

https://developer.ibm.com/recipes/tutorials/raspberry-pi-4/

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

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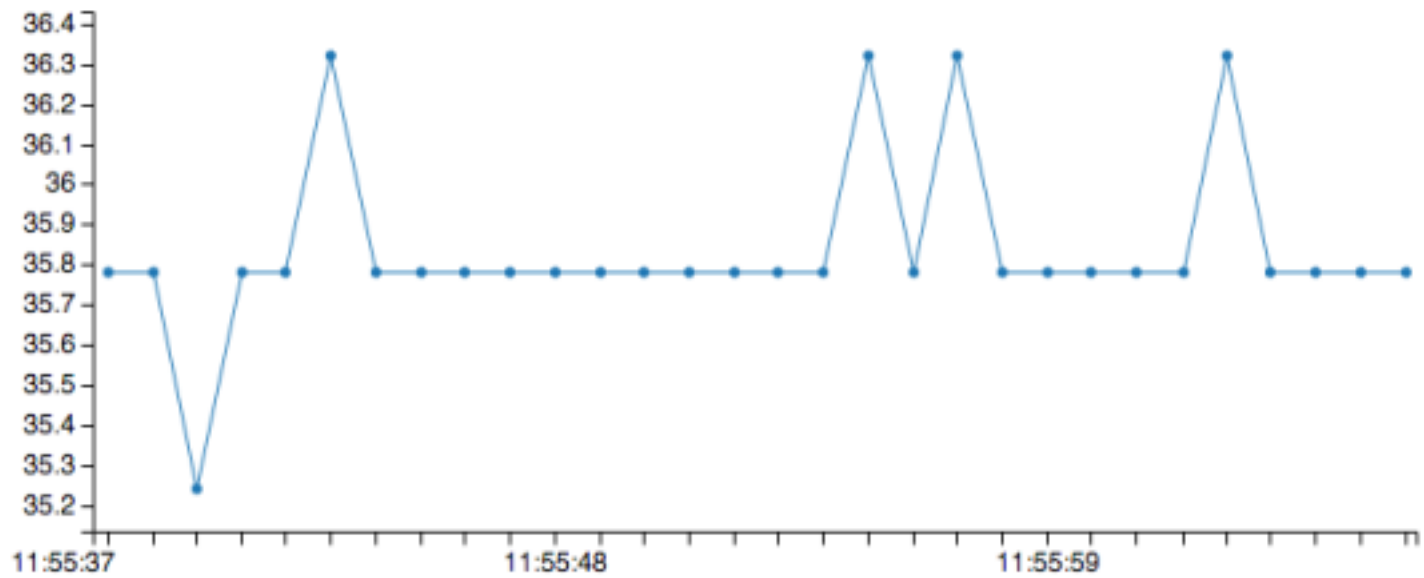

service iot getdeviceid   b827eb4db983

https://quickstart.internetofthings.ibmcloud.com/#/device/b827eb4db983

Selecting a Protocol

MQTT.org

- 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,"cpuloa
d":0.13,"sine":0.38}}0]..iot-
2/evt/status/fmt/json{"d":{"myName":"myPi","cputemp":36.86,"cpuloa
d":0.13,"sine":0.71}}0]..iot-
2/evt/status/fmt/json{"d":{"myName":"myPi","cputemp":36.86,"cpuloa
d":0.13,"sine":0.92}}0]..iot-
2/evt/status/fmt/json{"d":{"myName":"myPi","cputemp":36.86,"cpuloa
d":0.13,"sine":1.00}}0]..iot-2/evt/status/fmt/json{"d"

MQTT.org
Security Concerns
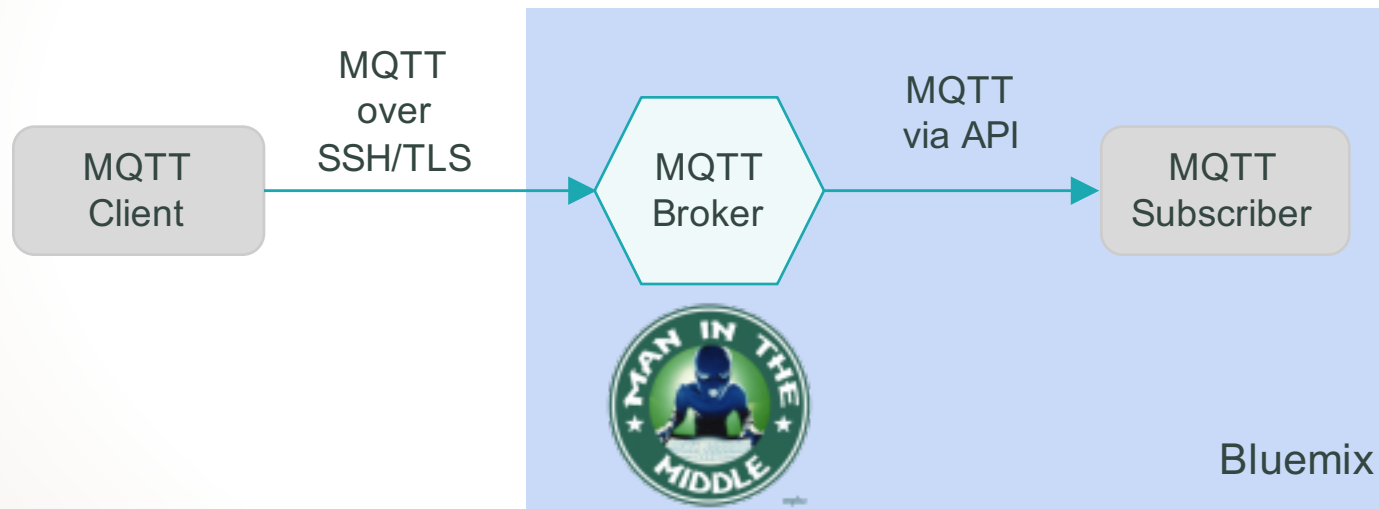
Suggestion for Bluemix IoT

- 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 implmement 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

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BUILDING AND TESTING IOT SOLUTIONS BOF