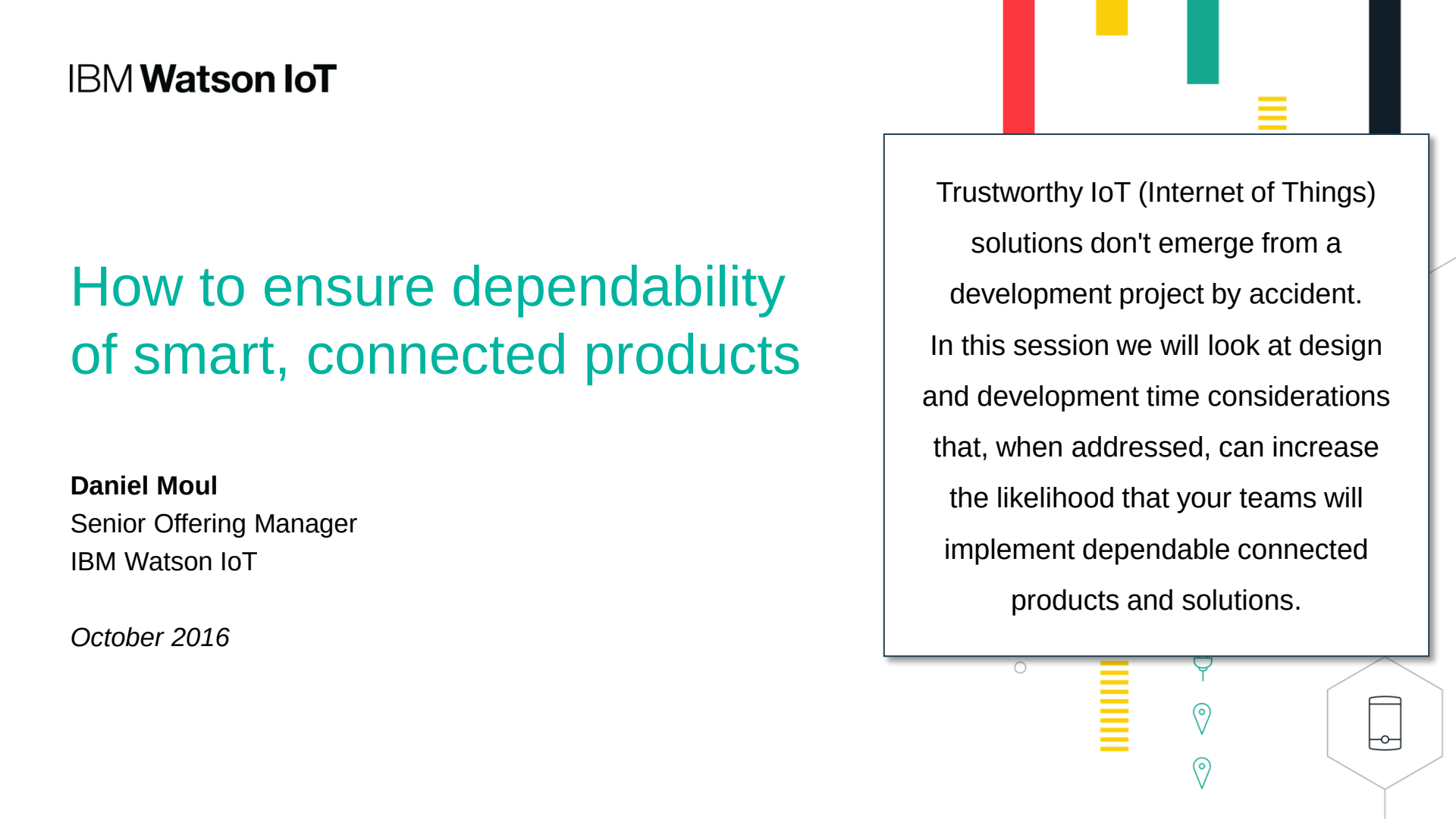
IBM Watson IoT

# How to ensure dependability of smart, connected products

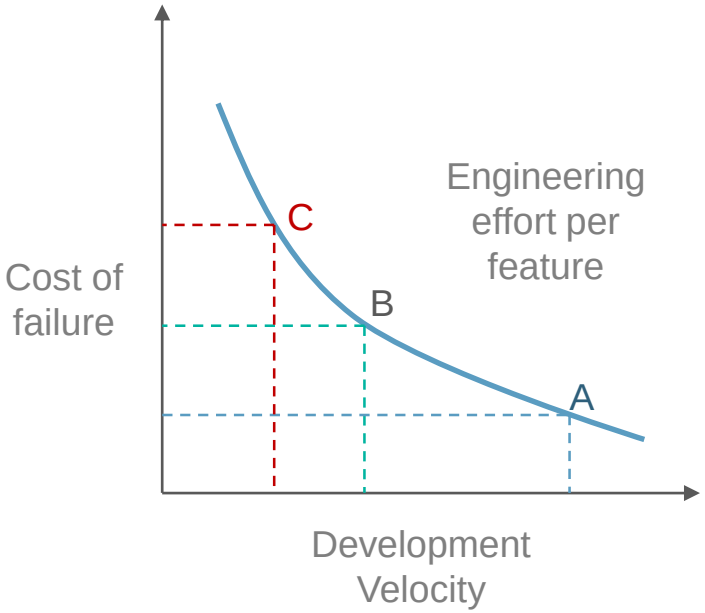
**Daniel Moul**
Senior Offering Manager
IBM Watson IoT

*October 2016*

Trustworthy IoT (Internet of Things) solutions don't emerge from a development project by accident. In this session we will look at design and development time considerations that, when addressed, can increase the likelihood that your teams will implement dependable connected products and solutions.



# How much dependability do you really need?




# What kinds of dependability do you really need?

- Availability
- Reliability
- Safety
- Security

# Some costs of failure

- Harm to person
- Harm to environment
- Harm to property
- Financial penalties
- Information disclosure
- Loss of customers or revenue
- Harm to reputation
- Cost of clean-up

# Some IoT devices emit data (sensors → telemetry)

## Lawsuit claims FitBit devices dangerously underestimate heart rate

Three plaintiffs say FitBits fail during exercise, worthless as heart monitors.
*-ARS Technica Jan 6, 2016*

TECH MAY 23 2016, 9:42 AM ET

## Fitbit Trackers Are 'Highly Inaccurate,' Study Finds

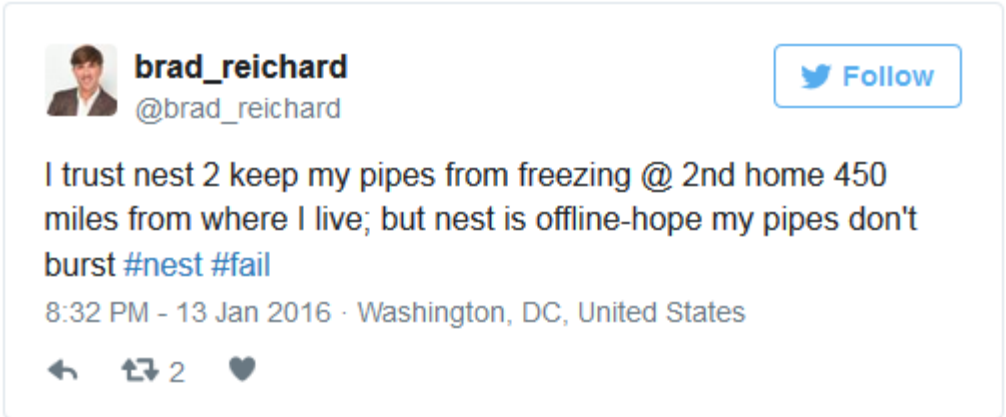
BY KALYEENA MAKORTOFF, CNBC

"… Fitbit devices miscalculated heart rates by up to 20 beats per minute on average during more intensive workouts."

# Some IoT devices do something (actuators → behavior)


**Nest thermostat bug leaves owners without heating**

*-The Stack Jan 14, 2016*



# What could go wrong with a simple IoT pet feeder?

## Dogs and cats left without food for an ENTIRE DAY as remote smart feeder PetNet fails to dispense meals after suffering 'server issues'

- Dogs and cats left hungry for 10 hours after app feeding devices failed
- The PetNet feeder devices, controlled with smartphones, broke down
- It was blamed on a malfunction in the company's computer program
- But customers took to Twitter to express their frustration at the situation

By SAM TONKIN FOR MAILONLINE
**PUBLISHED:** 03:04 EST, 29 July 2016 | **UPDATED:** 06:32 EST, 29 July 2016

http://www.dailymail.co.uk/news/article-3714186/Dogs-cats-left-without-food-remote-smart-feeder-PetNet-fails-dispense-meals-suffering-server-issues.html

**Petnet(io)** @Petnetio · Aug 1
An update to our customers regarding the recent server outage: bit.ly/2auzfhe.

1 1

To our loyal Petnet family,

As you may know, our third-party servers suffered an outage late Wednesday evening, which temporarily disabled the ability to remote feed and edit feeding schedules for about 10 percent of our users. We immediately became aware of the issue and were back up and running in about eight hours. We sincerely apologize for any issues this may have caused.

As pet parents ourselves, we recognize that when it comes to our pets, even one hour is too long to wait when it's time for a feeding. That's why we were already working on a solution to prevent this issue from happening. The fix was ready, but still needed to be tested when this outage occurred. Our engineers were prepared to implement the solution and get your SmartFeeders back online as quickly as possible. Now that this update has been made, our platform is stronger and more reliable than ever. We have two fail-safes in place, making it virtually impossible for this to happen again and ensuring your pets will always be fed…

http://bit.ly/2auzfhe

# There are many causes of failures, for example …

Poor design or implementation

Insufficient validation and verification

Software bugs

Security exposures

Hardware or operating environment

Changes implemented incompletely

Poor operational procedures

Bad assumptions

Misunderstandings

Human error

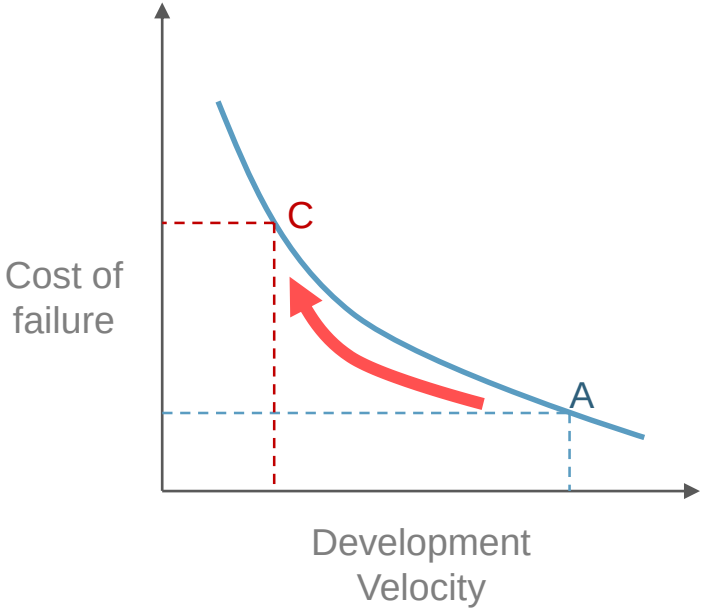
Shortage of experts

Cutting corners

Negligence

Bad actors

# How much dependability do you really need?
## Perhaps more than you think




# Recommended reading

ACM Forum on Risks to the Public in Computers and Related Systems (comp.risks)

Peter G. Neumann, moderator, chairman ACM Committee on Computers and Public Policy

http://www.risks.org

# Understand your problem domain

Isolated products are a
product engineering challenge

Connected products are a
system-of-systems engineering challenge

- Many systems in a bigger system
- Many parts and interactions
- Emergent system behavior
- New uncertainties, risks, hazards, and failure modes

# Recommended practices and community

Most systems engineers accept the following basic core concepts:

- Understand the whole problem before you try to solve it
- Translate the problem into measurable requirements
- Examine all feasible alternatives before selecting a solution
- Make sure you consider the total system life cycle. The birth to death concept extends to maintenance, replacement and decommission…
- Make sure to test the total system before delivering it.
- …

-- Brian Marr

http://www.incose.org/AboutSE/WhatIsSE

**The International Council on Systems Engineering (INCOSE)**

INCOSE champions the art, science, discipline, and practice of systems engineering. It provides its individual and corporate members with a wealth of knowledge opportunities:

- An evolving Systems Engineering Body of Knowledge (BKCASE);
- Journals and a practitioner's magazine;
- A library of INCOSE-developed products, best practices, and resources;
- An annual international symposium; regional conferences in the US and in Europe, Africa, and Asia; local chapter programs;
- A Systems Engineering Professional (SEP) Certification program.
- Each of these knowledge opportunities enables our members to meet and network in this dynamic, global community of practitioners, stakeholders, and academicians.

Join Now

http://www.incose.org/

# Highly recommended

## What the Internet of Things Needs: Systems Engineering

Fri, 04/22/2016 - 9:04am 9 Comments

by Barclay R. Brown, Ph. D., ESEP, Global Solution Executive, IBM Watson Internet of Things, and former Director for the Americas, International Council on Systems Engineering

http://www.ecnmag.com/blog/2016/04/what-internet-things-needs-systems-engineering

Some top-down design

Systems engineering for the IoT

Some bottoms-up evolution

# Good business design is the foundation for success

Create a favorable, durable business context

- Business model
- Partners and suppliers
- Organizational capacity

# Do good technical design: Take potential failures seriously

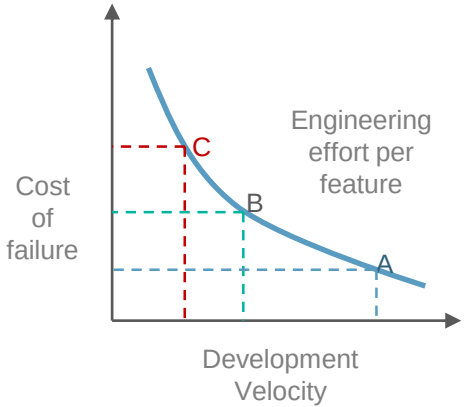
Think through what could go wrong

Prioritize and manage your risk

- Technical
- Legal
- Business

# Identify and manage risk with failure mode and effects analysis (FMEA)

- What could go wrong?
- How you would know?
- What effects?
- How significant?
- How can you reduce the risk?
- How can you minimize the impact?



# Example: part of a solar power system FMEA

*In IBM Rational DOORS Next Generation*

| Item | Failure Mode | KPI | Failure Effects | Severity (FMEA) | Pot |
|---|---|---|---|---|---|
| 2673:The system shall send an alert if a low battery voltage (< 2%) is detected. (Solar Battery System Requirements) | Dead Battery | 2707:Battery Voltage (Key Performance Indicators) | Excess solar energy not stored | Minor (3) | Bat Ma Mir col env |

System requirement

Failure mode

Key performance indicator

# Do good technical design: Invent only where necessary

Use frameworks, patterns and other proven building blocks

- In design and construction
- Operational components
- Development practices/processes

# Frameworks help with thinking

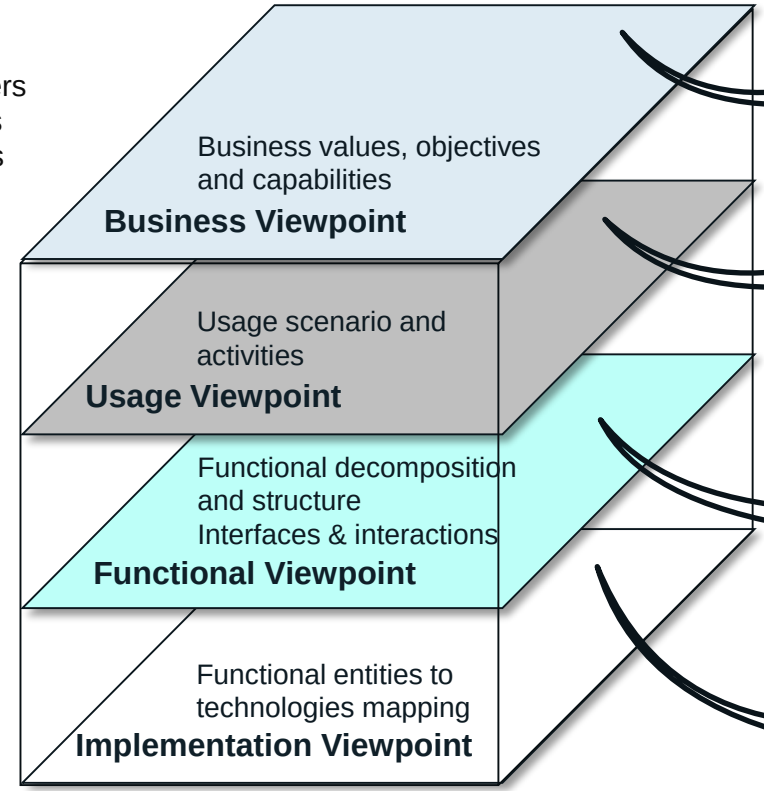
*Industrial Internet Consortium (IIC) Framework*

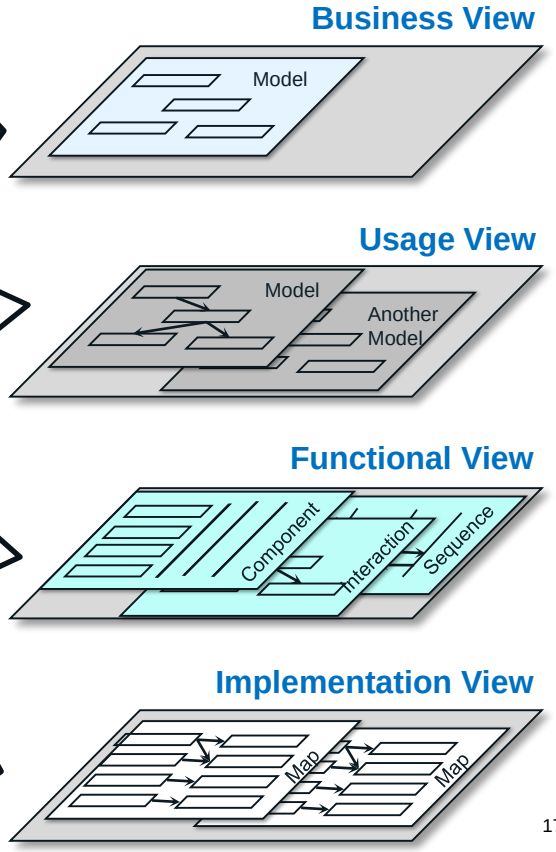
Biz decision makers
System Engineers
Product Managers

System Engineers
Product Managers
System Architects

Architects
Engineers
Developers

Integrators
Deployment
Operations



# Do good technical design: “design in” essential qualities

- Security
- Resilience
- Performance
- Extensibility

# Security risks in a system of Internet of Things

1. Large number of new network endpoints (devices)
2. Mobility and Vulnerability of devices
3. Privacy and Security of data generated (by devices)
4. Compromised devices used to launch attack on IT
5. Compromised IT used to launch attack on devices
6. Compromised Network access points

# IBM IoT Security

| IoT Security | | |
|---|---|---|
| DESIGN securely | DEPLOY securely | MANAGE securely |
| ▪ Design and manufacture securely<br>▪ Harden the devices<br>▪ Ensure integrity in manufacturing and delivery<br>▪ Continuous delivery model *(for post deployment updates)*<br>▪ Create a trusted maintenance ecosystem | ▪ Operate securely<br>− Application authentication and security<br>− Device authentication<br>− Network security<br>− Communication security<br>▪ Strong encryption and integrity protection for data | ▪ Audit and analyze usage patterns<br>▪ Detect and Defend with advanced threat detection<br>▪ Strong Intrusion detection systems<br>▪ Create a trusted maintenance ecosystem<br>▪ Maintain an up-to-date security environment |
| *IoT threat models, control points and response processes* | | |

# The IBM Watson IoT Platform

*Employ a highly secure, scalable,*
*and open platform. Start small and grow quickly.*

## Security and Risk Management

Security Analytics

- Dashboard
- Threat detection

Data Protection

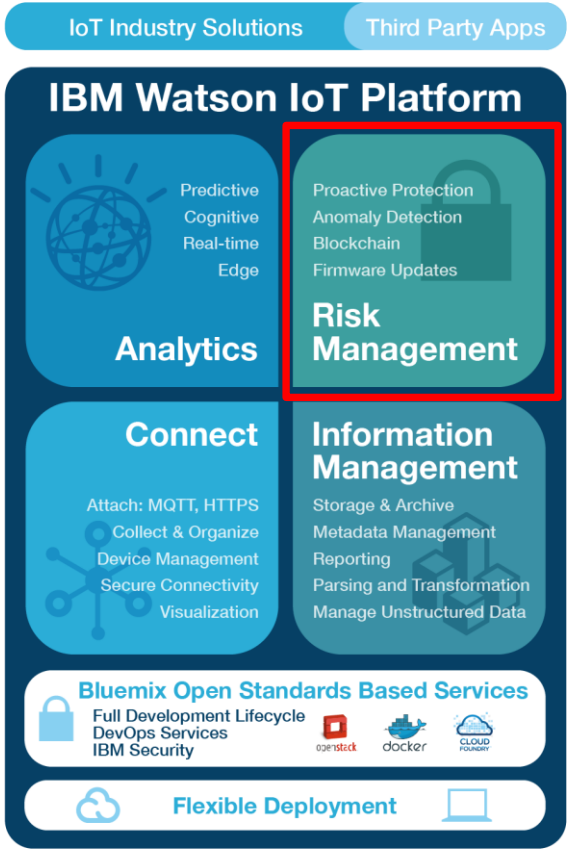
Device Registration

Key/Certificate Management

Firmware Updates

Process Compliance

Testing and Evaluation




www.ibm.com/iot

# Development practices/processes


Agile principles

★★★★☆ (6 Ratings)

Just enough architecture

☆☆☆☆☆ (0 Ratings)

Kanban and Scaled Agile Framework (SAFe)

★★★★★ (3 Ratings)

Continuous delivery and iterative development for Internet of Things projects

Test-driven development

★★★★☆ (4 Ratings)

https://ibm.com/devops/method/

# IBM Watson IoT solutions for continuous engineering

## Systems engineering

Architect, design and deliver complex, software-intensive connected products and systems.

## Application software development

Adopt a DevOps approach to become more agile and accelerate time to value in software delivery while reducing operational costs.

## Embedded software development

Agile methods to meet customer requirements, model and test software architectures and designs and deliver high quality code.

https://www.ibm.com/internet-of-things/iot-solutions/product-development/

# Where are you on the journey?


- Discover
- Explore
- Learn

- Propose
- Prove
- Learn

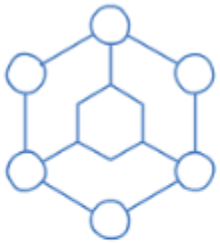
- Plan / Design
- Develop / Deliver
- Prove
- Learn
- Improve

# Less talking, More doing

*Get started today*

www.ibm.com/iot

Collaborate with IBM experts



Take advantage of our hands-on industry labs

Partner with your colleagues for innovation

See IoT in action in our Client Experience Center

Explore Watson IoT Platform with easy demos and free trial ibm.biz/try_iot

Sit in on a weekly IoT Webinar
ibm.com/internet-of-things/iot-news.html

Learn more about continuous engineering
www.ibm.com/continuousengineering

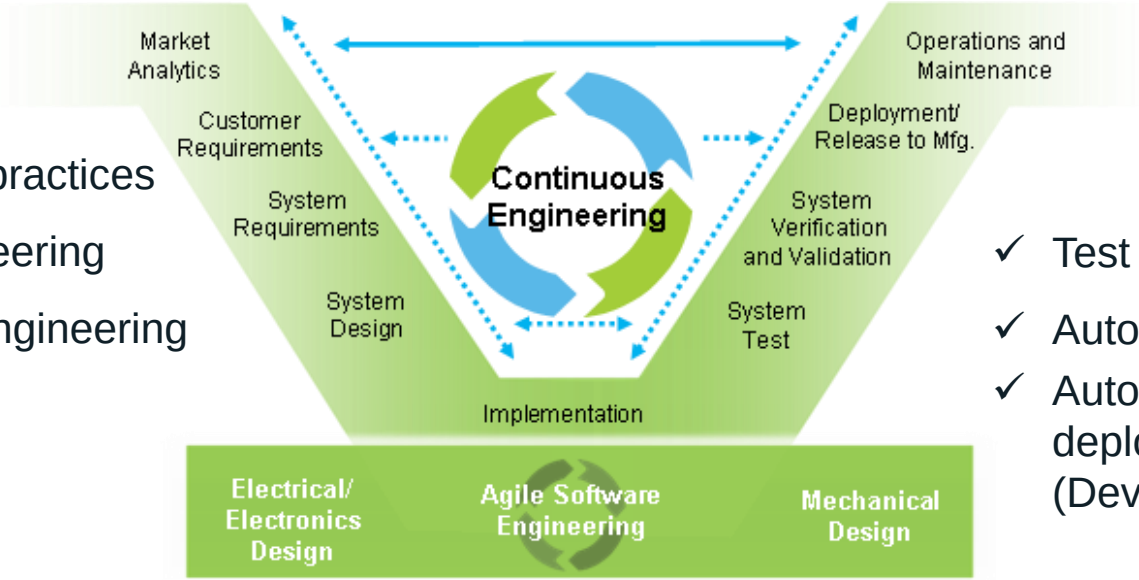
# Thank You

# Useful Links

- **IBM Watson IoT Platform**
  - https://www.ibm.com/iot
- **IBM IoT Security Point of View**
  - http://ibm.co/IoTSecurity
  - http://ibm.co/1KZRglR
- **IBM Bluemix**
  - https://www.bluemix.net/
- **IBM SoftLayer**
  - http://www.softlayer.com/
- **IBM Cloud Technologies**
  - http://www.ibm.com/cloud-computing/us/en/
- **IBM Analytics**
  - http://www.ibm.com/analytics/us/en/
- **IBM MobileFirst**
  - http://www.ibm.com/mobilefirst/us/en/
- **IBM Social Business**
  - http://www.ibm.com/social-business/us/en/
- **IBM Security**
  - http://www.ibm.com/security/
- **IBM Asset Management**
  - https://www.ibmserviceengage.com/asset-management/learn
- **IBM Continuous Engineering**
  - https://www.ibm.com/internet-of-things/iot-solutions/product-development/
- **IBM DevOps Services**
  - http://hub.jazz.net
- **IBM IoT on Twitter**
  - http://twitter.com/IBMIoT
  - @IBMIoT
- **IBM IoT Blog**
  - http://ibminternetofthings.tumblr.com
- **IBM Big Data Hub Blog**
  - http://ibmbigdatahub.com
- **IBM developerWorks Recipes**
  - http://developer.ibm.com/recipes

# IBM IoT Continuous Engineering

- ✓ Requirements practices
- ✓ Systems engineering
- ✓ Model-based engineering
- ✓ Simulation




- ✓ Test Management
- ✓ Automated testing
- ✓ Automated build and deployment pipeline (DevOps)

- ✓ Change management
- ✓ Version and configuration management

- ✓ Iterative / agile / lean practices
- ✓ Automated reporting and doc generation
- ✓ Regulatory compliance

https://www.ibm.com/internet-of-things/iot-solutions/product-development/

# IoT security whitepaper

IBM Analytics

Thought Leadership White Paper

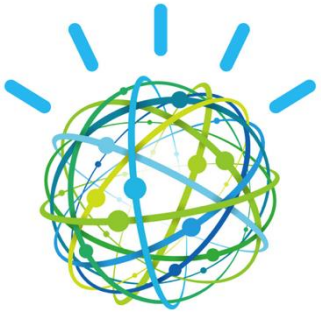
# IBM POINT OF VIEW: INTERNET OF THINGS SECURITY

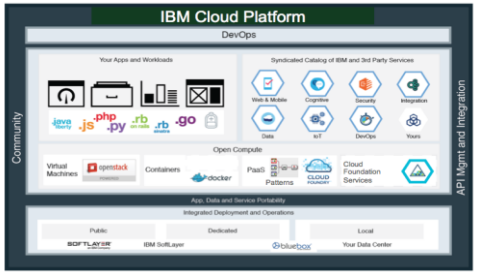
The connectivity of “things” presents an exciting environment for innovation and opportunity, but also a broad set of security challenges and threats.

Get the whitepaper

# Uniquely IBM

The Weather Company






## Integrate enterprise, device, and 3rd party data

*Combining weather data with traditional business data and rich data from an unprecedented number of Internet of Things (IoT) enabled systems and devices will fundamentally transform enterprise decision-making.*

## Out think the competition with Watson

*Gain competitive advantage with Cognitive and Advanced Analytics services, such as natural language processing, machine learning, textual analytics, and video/image analytics.*

## IBM Bluemix environment for IoT development

*Composable services development, runtime and operations for your IoT apps, running on IBM SoftLayer global cloud*

www.ibm.com/iot


IBM