ee392b
Industrial IoT: Applications
Overview

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Outline

• Why the IIoT?
• Class subject
• IIoT application examples
• Syllabus
WHAT IS INDUSTRIAL IOT?
IoP and IoT

Internet Revolution
• 10-15% of economy
• Internet of People (IoP)

New Digital Revolution
• 80% of the economy
• Internet of Things (IoT)
• Industrial IoT (IIoT)
IIoT and IoT

IIoT ≠ IoT

Connected Industrial High-cost Assets

Connected Low-cost End-point Devices
NEW DIGITAL REVOLUTION
New Digital Revolution

• IIoT investment: $0.7T in 2017, $1T in 2018
  – Forecasted impact: $10T/year by 2025
• New Industrial Revolution
• How did previous Industrial Revolution go?
  – 2\textsuperscript{nd} Industrial Revolution scenario
2nd Industrial Revolution

Technological Revolution

- Power integration
  - Power transmission and distribution

Westinghouse Project
Telluride, CO, 1891
3\textsuperscript{rd} Industrial Revolution
IIoT Digital Revolution

• Computing integration
  – Data transmission and distribution
IloT Class Overview

COMPUTING ARCHITECTURE
IT/OT Convergence in the IIoT

Information Technology

IT: Enterprise computing. Cloud.

Fog.

Operational Technology

OT: Industrial systems. Secure, closed networks.
Enterprise Architecture View

- **Applications**
  - Business processes
  - Data analytics

- **Platform**
  - Data management
  - Computing tech
  - Most action, so far
Analytics Domains

Domains
- Operations Research
- Data Science for IIoT
- Decision and Control
- Signal Processing

Tools
- Statistics & Machine Learning
- Modeling and Simulation

IIIoT Persistent Data

IT
OT
Embedded
IIoT Class Overview

IIOT APPLICATION EXAMPLES
Application Examples

• The future is already here — it's just not very evenly distributed
• Where is it concentrated?
  – High-value enterprise application
• Buildings
• Transportation
• Manufacturing processes
Airline Example

• Aircraft fleet monitoring

IT

• IT: Airline Data Center
  – Persistent aircraft fleet data

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OT

• OT: Aircraft on-board network – 1553 Bus
  – Avionics
  – Flight Data Recorder
Building Example

- Smart thermostats - Demand Response

- IT: Utility and OEM
  - Data and command aggregation

- OT: ZigBee Network
  - Thermostats and HVAC
MORE EXAMPLES, APPLICATION STACK
Refinery Example

1. Valve flow control
2. Distillation column unit
3. Gasoline production
4. Plant management and production planning
5. Scheduling, order management, and finance

Chevron Refinery in Richmond, CA

ISA-99 Levels
Levels in ISA-99 Purdue Model

- IT
- OT
- Embedded

Persistent Data

Cisco
Ground Vehicle Example

5. Fleet management
4. Telematics
3. Integrated info system (head unit)
2. CAN bus functions
1. ECU
0. Sensor/Actuator
Planned Lectures

April 3, Introductory Lecture
April 10, Precision Planet, Alchemist Accelerator
April 17, IoT Cloud Platform, Microsoft
April 24, IoT in Smart Buildings, Honeywell
May 1, Data Revolution, Amplify Venture Partners
May 8, IoT in the Refining Industry, Andeavor
May 15, IIoT in Digital Aviation Industry, GE Aviation
May 22, Apps at the Edge of the IIoT, Foghorn
May 29, Knowledge-based IoT Analytics, Maana
June 5, Internet of Trains, Siemens
IIoT Lecture Map

Startup

Vendor

Enterprise

IT

OT

Alchemist

Amplify Venture

Foghorn

Maana

Microsoft Azure IoT

GE Aviation Digital

Honeywell Buildings

Andeavor Refineries

Siemens Trains

Startup            Vendor           Enterprise

Startup            Vendor           Enterprise
IloT Class Overview

EVOLVING LANDSCAPE
State of the IIoT

• 2016 Seminar on IIoT
  – New Wave, IIoT is the future
  – Upcoming Industry Transformation

• 2017 Seminar on IIoT
  – Platform efforts
  – Some application projects
  – How do we get on the IIoT train?
IoT in 2018

• IoT
  – Venture investor hype cycle is cresting
  – IoT cloud platforms are emerging
    • Microsoft, Amazon, Google, Dell; Cisco, Intel

• IIoT
  – Just keeps rising. Tsunami, not a hype wave
    • Industrial Revolution