MATLAB EXPO 2017
Developing Analytics and Deploying IoT Systems
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What is IoT?

Devices → Analytics → Insight
**Example from Cadmus**

**Challenge:** Measure and evaluate energy efficiency of buildings based on onsite sensor data

**Solution:** **ThingSpeak**: collect data (temperature, humidity, power usage), **MATLAB**: analyze and visualize data

**Results**
- Market opportunity seized
- Development effort cut by two-thirds
- Sensor networks quickly deployed
Algorithms are Key to IoT Systems: MATLAB Can Help

- Signal processing
  - Real data is messy and needs to be cleaned up
  - Missing data points need to be handled

- Image processing
  - Objects need to be detected

- Statistics/Machine Learning
  - Objects need to be classified
  - Predictions need to be made
IoT Analytics Framework

- **Communication**
- **Connectivity**
- **Deploy analytics to cloud**
- **Deploy algorithm to device**

**Smart Connected Devices**
- Local embedded algorithms
- Data reduction

**Analytic IoT Platform**
- Online analytics
- Visualization and reporting

**Algorithm Development**
- Historical analytics
- Sensor analytics
IoT Analytics Challenges

How do I collect enough data to build my algorithm?

Communications Network

How do I deploy my algorithms to the cloud?

Deploy analytics to server/cloud

How do I deploy my algorithms on a smart device?

Deploy algorithms to nodes/devices

How do I develop my algorithms?

Algorithm Development Sensor Analytics

Smart Connected Devices

Data Aggregation & Analytics

How do I develop my algorithms?
What Is ThingSpeak?

- Web Site For People
- Web Service for Devices

- https://thingspeak.com
- New MathWorks web service hosted on AWS: collect, analyze and act on data from “things”
- Over 130,000 users worldwide
- It has MATLAB for IoT Analytics
- It’s free to get started

Collect  Analyze  Act
Example: ThingSpeak Weather Station Data Visualizations

Collect

Analyze

Act
IoT Analytics Challenges

- How do I collect enough data to build my algorithm?
- How do I deploy my algorithms to the cloud?
- How do I deploy my algorithms to nodes/devices?
- How do I develop my algorithms?
- How do I deploy my algorithms on a smart device?
Sensor Analytics and Development of Smart Connected Devices

- Gather data from sensors using I2C/SPI and other interfaces
- Use pre-built libraries for signal processing, computer vision, machine learning and more
- Automatically generate C / C++ and HDL code
- Embedded targeting packages for a wide variety of hardware
IoT Analytics Challenges

- How do I collect enough data to build my algorithm?
- Communications
  Network

Data Aggregation & Analytics

- How do I deploy my algorithms to the cloud?
  Deploy analytics to server/cloud
- Deploy algorithms to nodes/devices

Smart Connected Devices

- How do I deploy my algorithms on a smart device?

Algorithm Development
Sensor Analytics

- How do I develop my algorithms?
ThingSpeak for Small Scale Deployment

External Data & Business Systems

Deploy analytics To cloud

Ingest
Store
Compute

Smart Connected Devices
Algorithm Development Sensor Analytics
Integrating MATLAB with Third Party IoT Cloud Platforms

External Data & Business Systems

Ingest

Store

IoT Platform

MATLAB Production Server

Deploy analytics To cloud

Gateway

Smart Connected Devices

Algorithm Development Sensor Analytics
MathWorks Solutions to IoT Challenges

Summary

- Collect and analyze IoT data with ThingSpeak and MATLAB
- Develop analytics algorithms using MATLAB and toolboxes
- Deploy on smart devices using code generation and embedded target support
- Deploy on cloud using ThingSpeak and MATLAB

Production Server

Your Next Steps

- Log-in to ThingSpeak with your MathWorks account and explore
- View a webinar on Machine Learning with MATLAB
- Read a Technical Article on Forecasting Tides with MATLAB
- Read a tutorial on how to send data to ThingSpeak over MQTT
Developing Analytics and Deploying IoT Systems

Thank you for your attention!