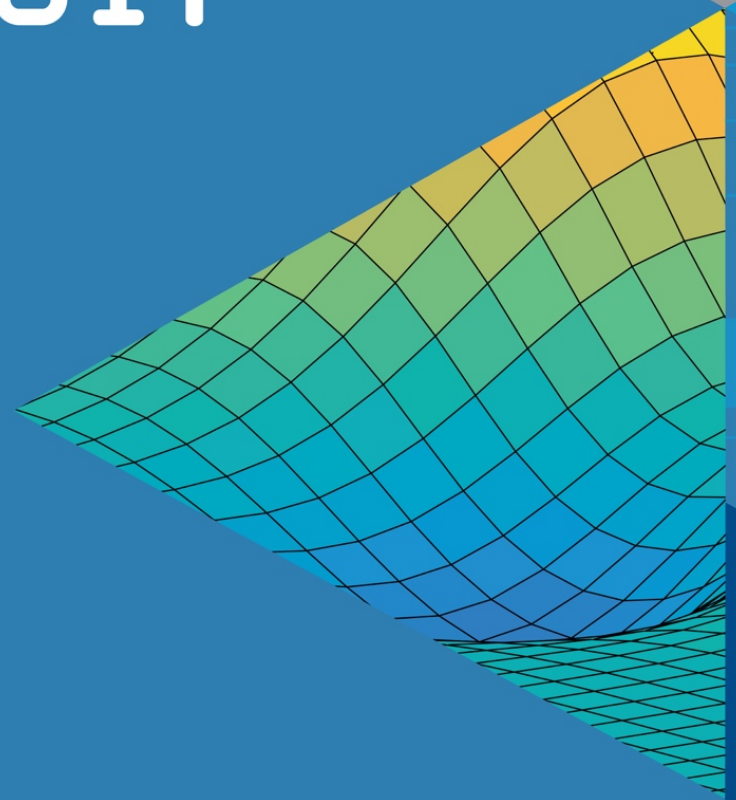
MATLAB EXPO 2017

Developing Analytics and Deploying IoT Systems



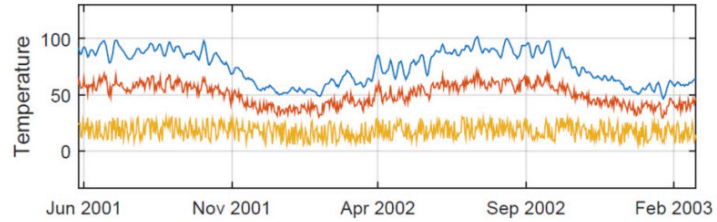
Antje Dittmer

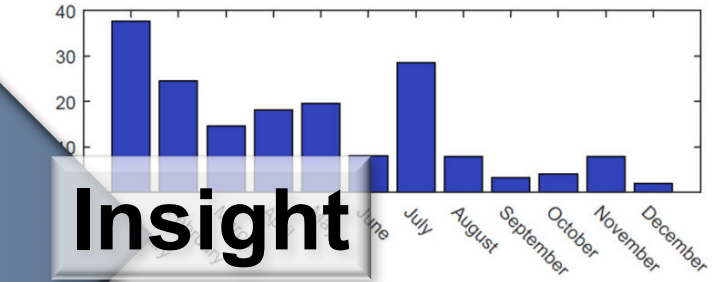
What is IoT?

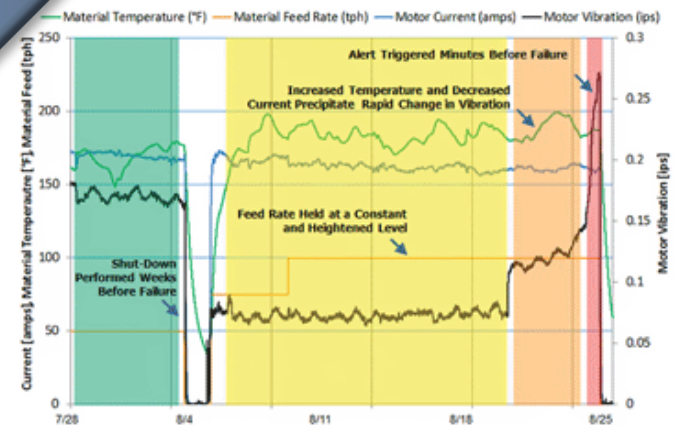
Devices

Analytics

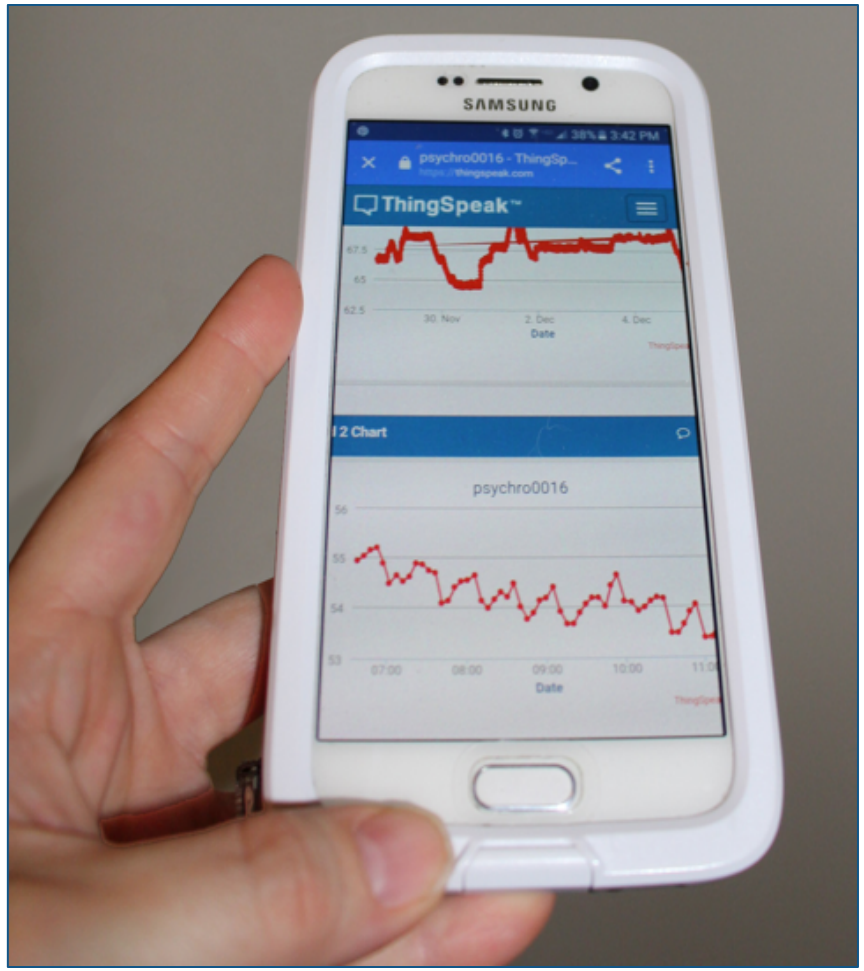
Insight







Example from Cadmus

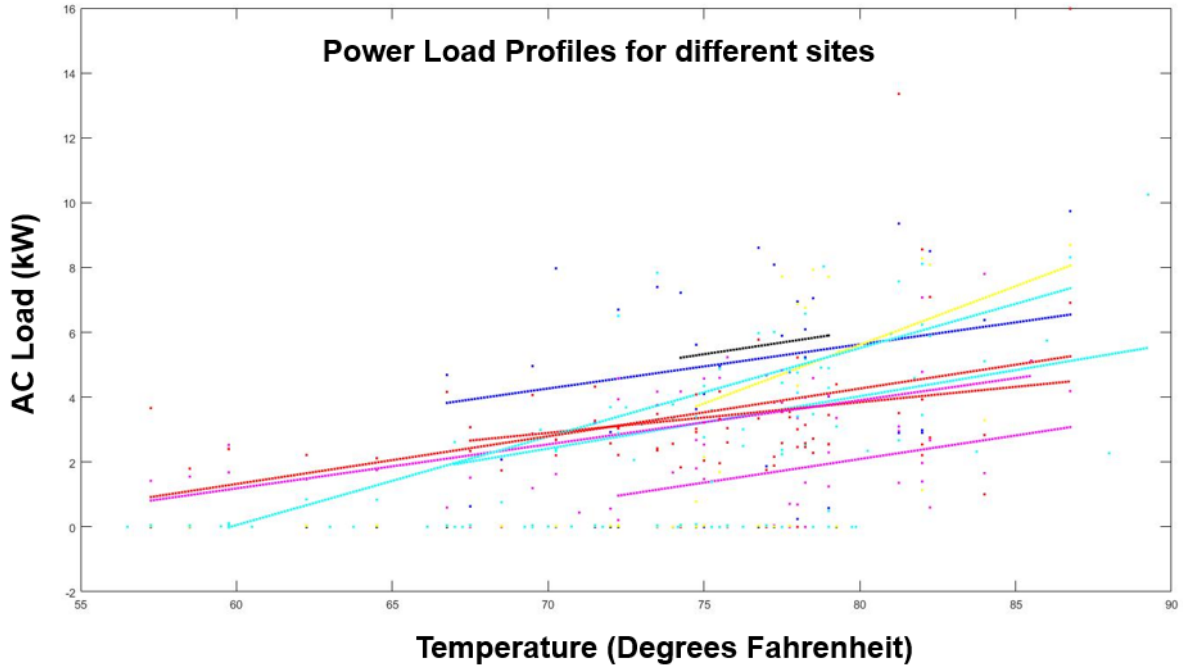


Challenge: Measure and evaluate energy efficiency of buildings based on onsite sensor data

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

Results

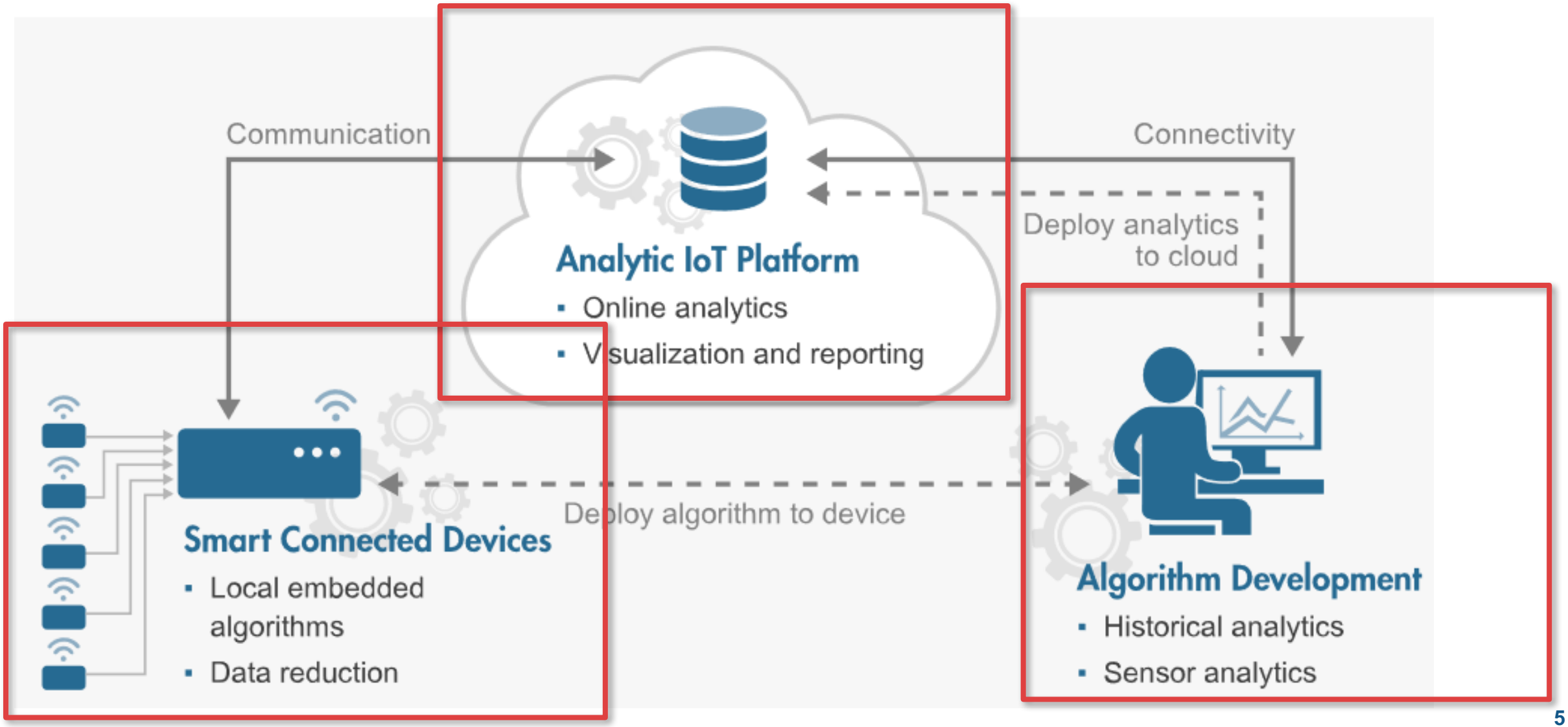
- Market opportunity seized
- Development effort cut by two-thirds
- Sensor networks quickly deployed



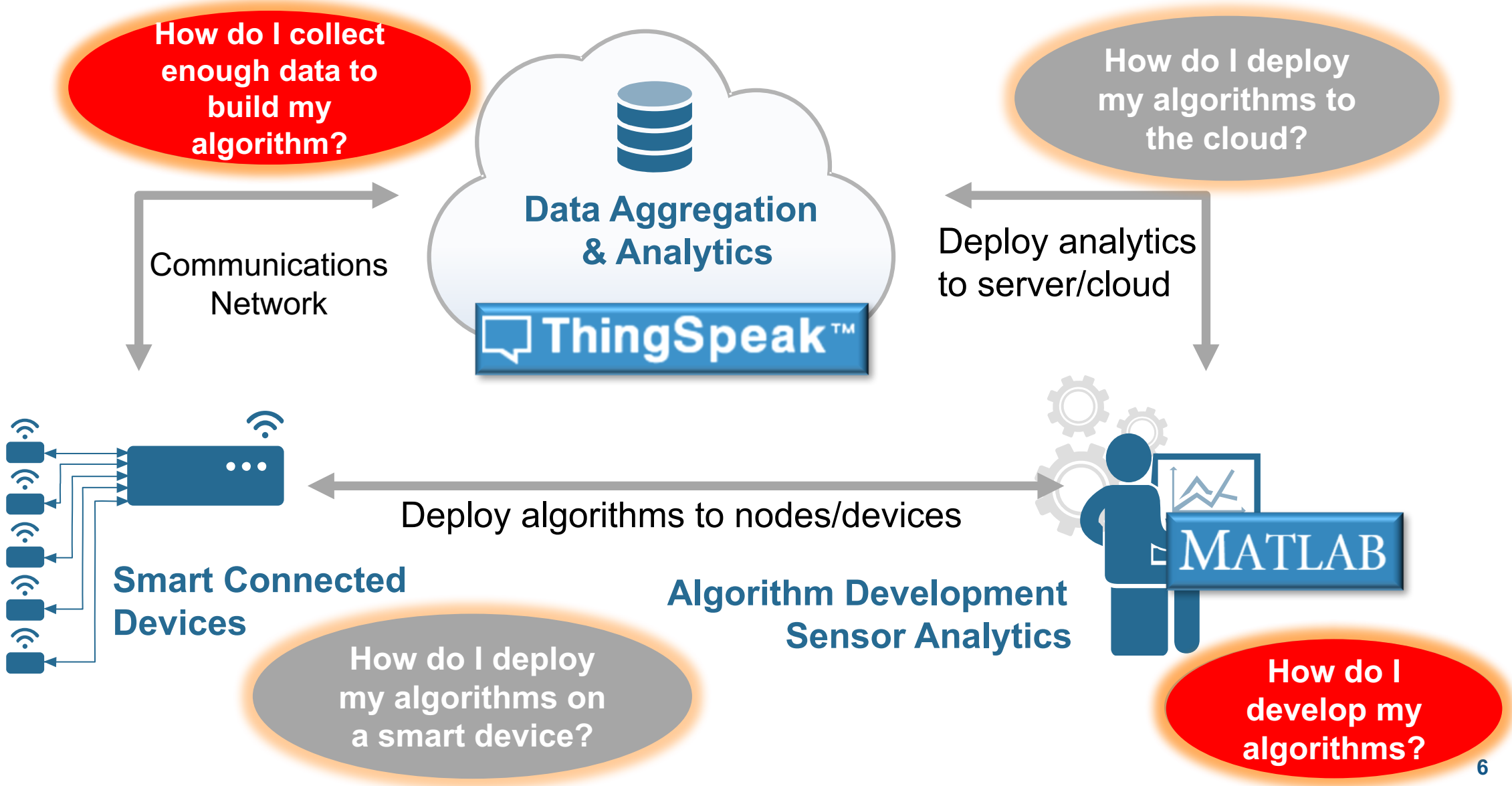
Algorithms are Key to IoT Systems: MATLAB Can Help

- 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

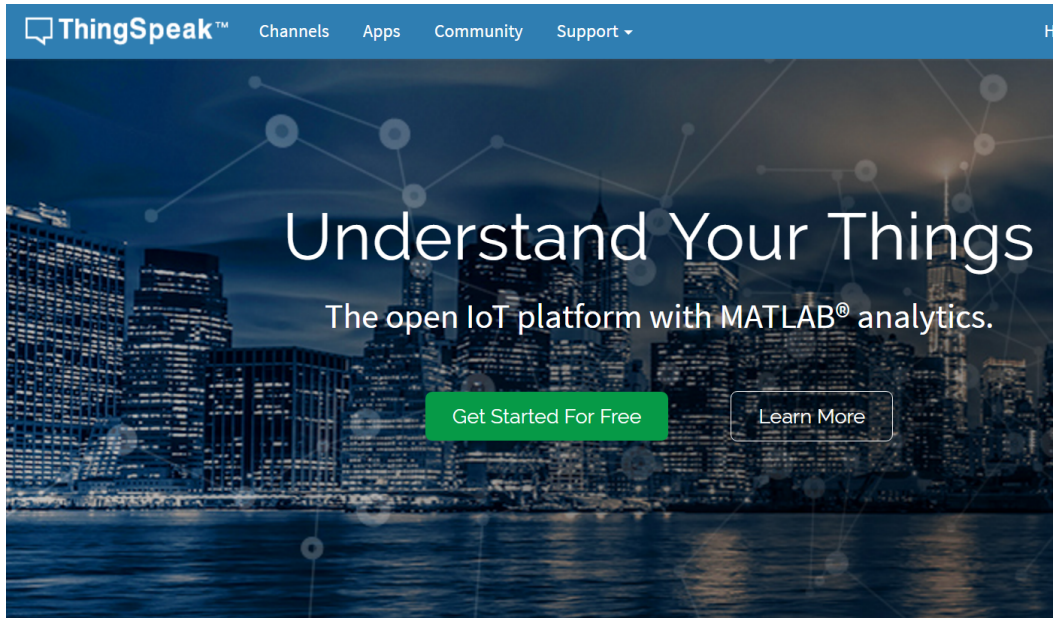


IoT Analytics Challenges



What Is ThingSpeak?

Web Site For People



Web Service for Devices

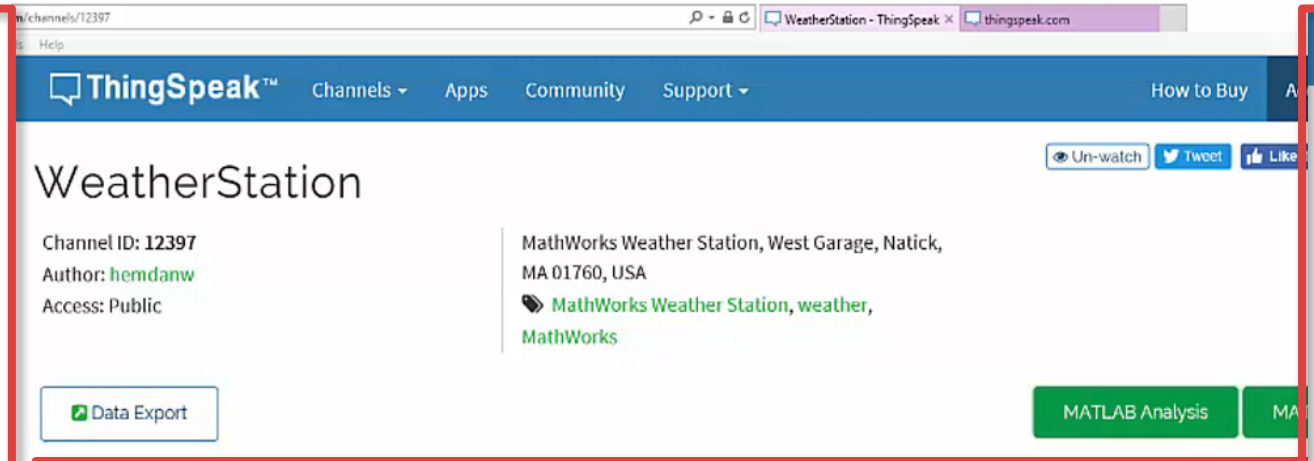

```
{
  - channel: {
        id: 38629,
        name: "Car Counter",
        description: "Counting number of cars passing a reference line in 15 sec interval",
        latitude: "42.28",
        longitude: "-71.35",
        field1: "Number of Westbound Cars",
        field2: "Number of Eastbound Cars",
        created_at: "2015-05-19T20:14:03Z",
        updated_at: "2016-05-19T10:36:35Z",
        last_entry_id: 1477231
    },
  - feeds: [
      - {
            created_at: "2016-05-19T10:36:20Z",
            entry_id: 1477230,
            field1: "18.000000",
            field2: "8.000000"
        },
```

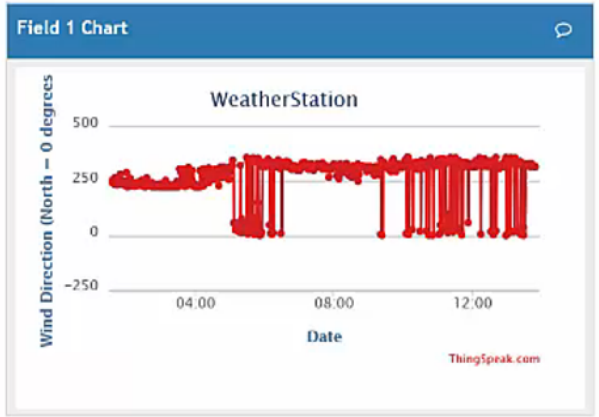

- **https://thingspeak.com**
- New MathWorks web service hosted on AWS: collect, analyze and act on data from “things”
- Over **130,000** users worldwide
- It has **MATLAB** for IoT Analytics
- It’s **free** to get started

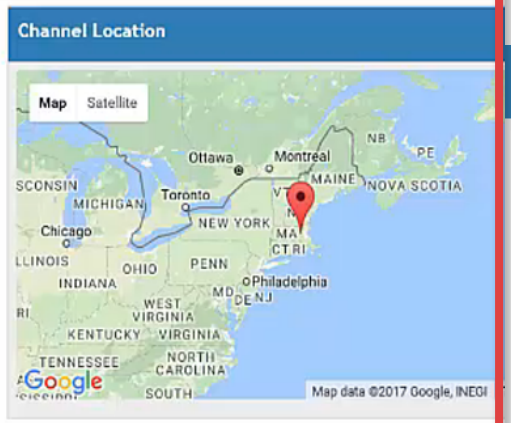
Collect Analyze Act

Example: ThingSpeak Weather Station Data Visualizations

Collect

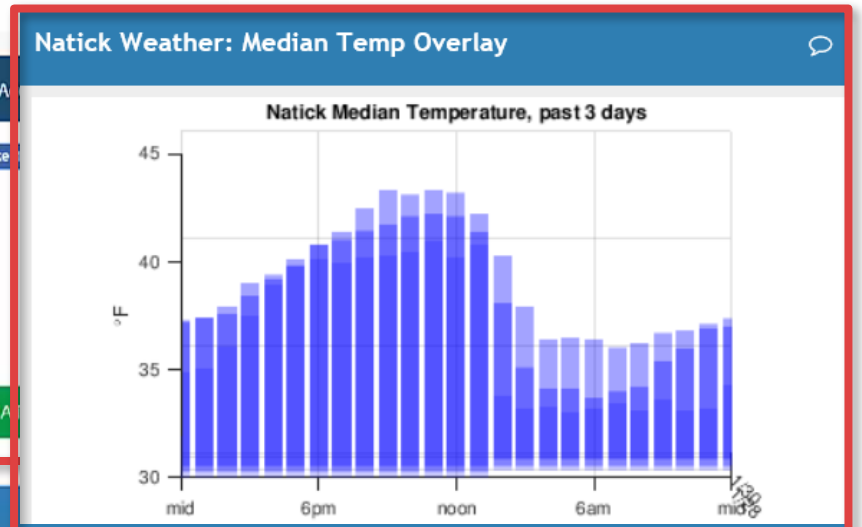


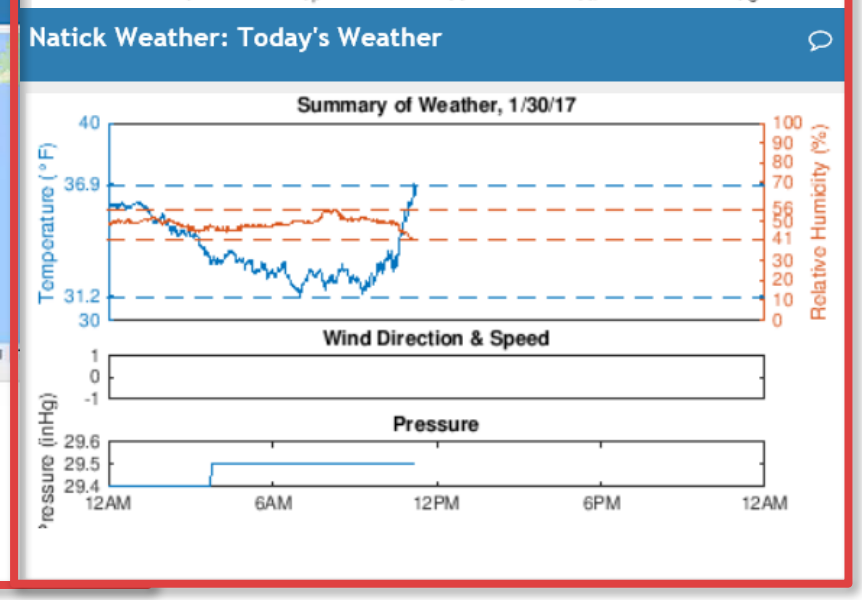




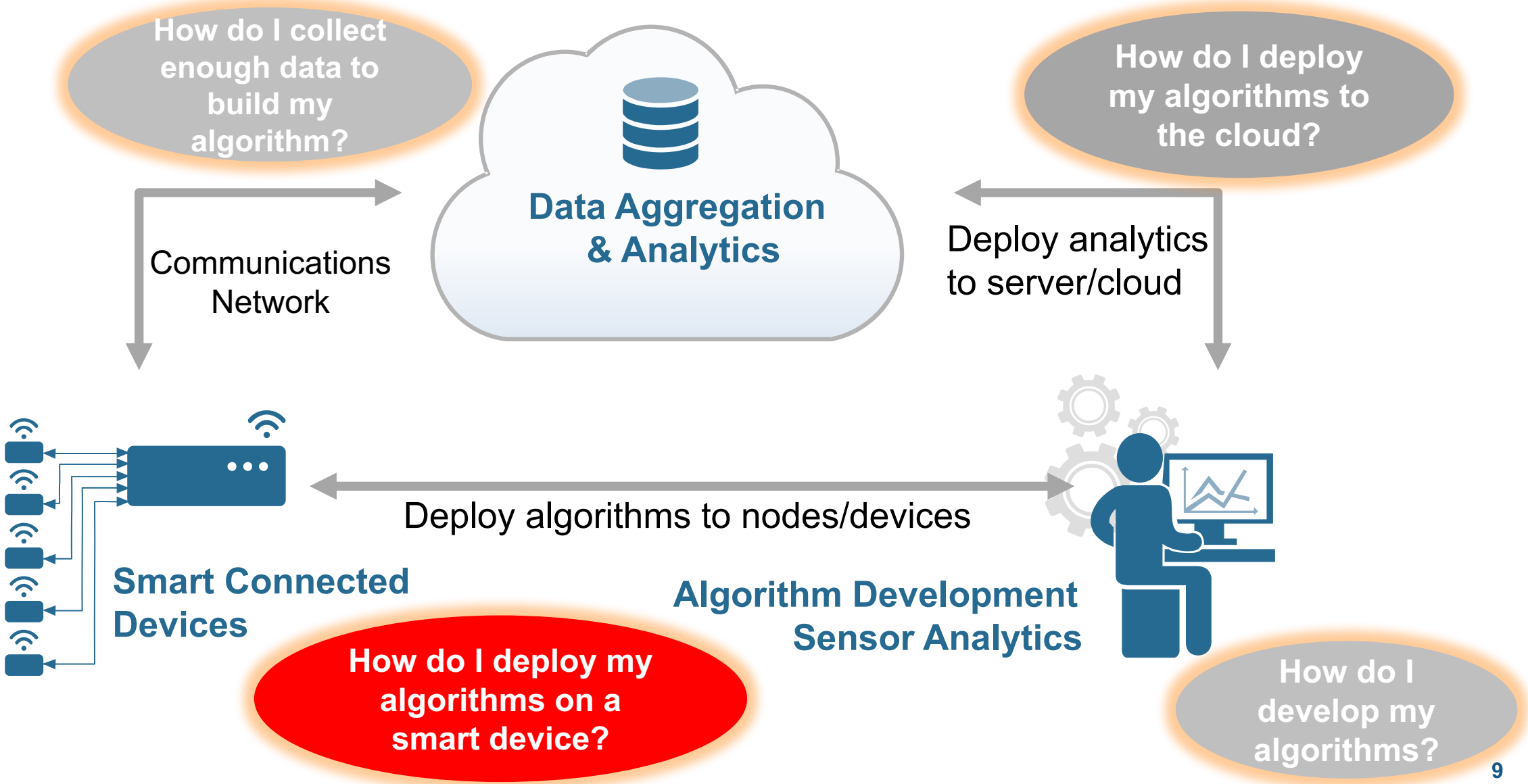
Analyze

Act

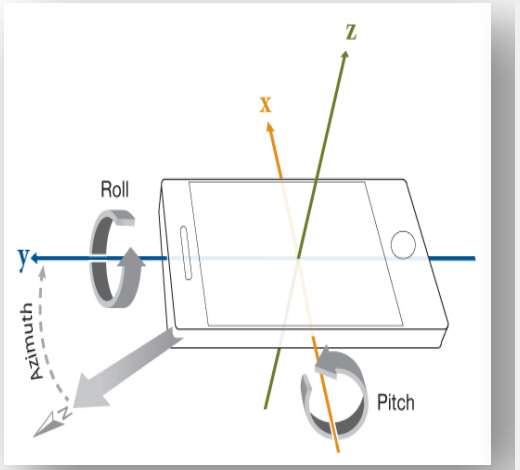


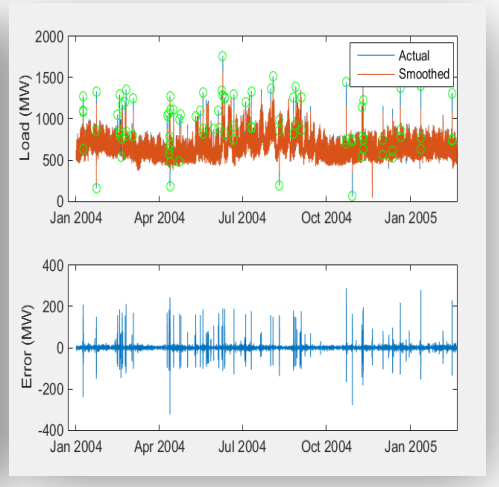


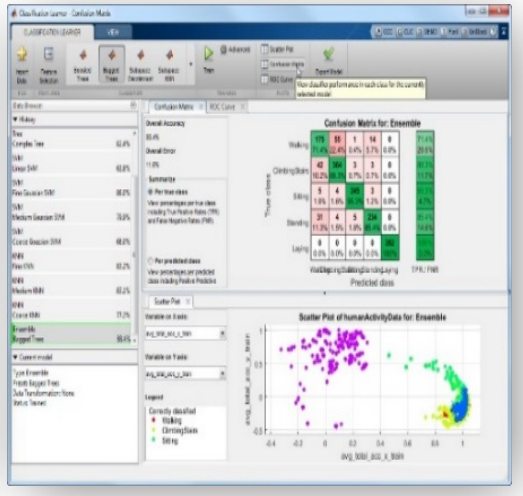
IoT Analytics Challenges



Sensor Analytics and Development of Smart Connected Devices



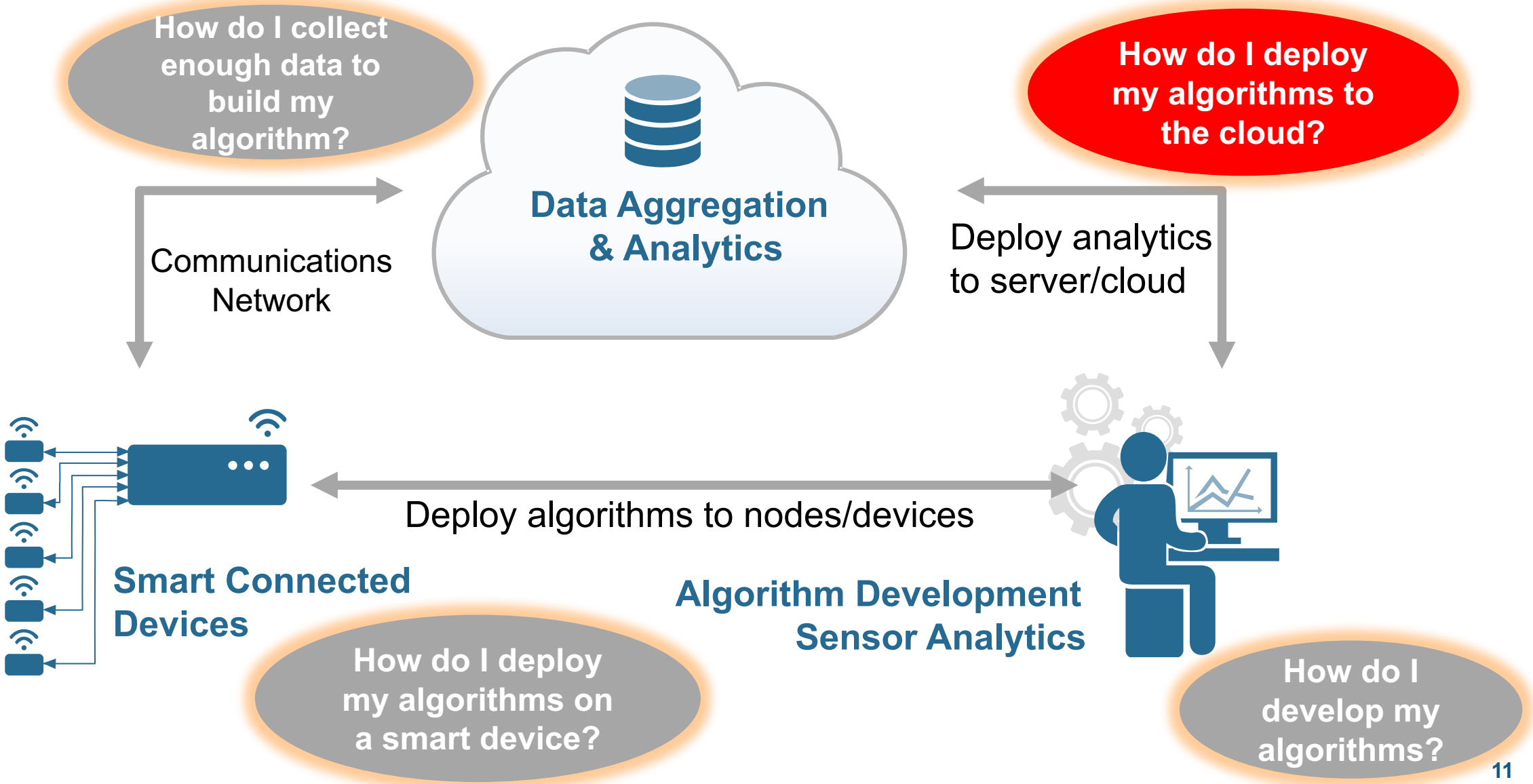




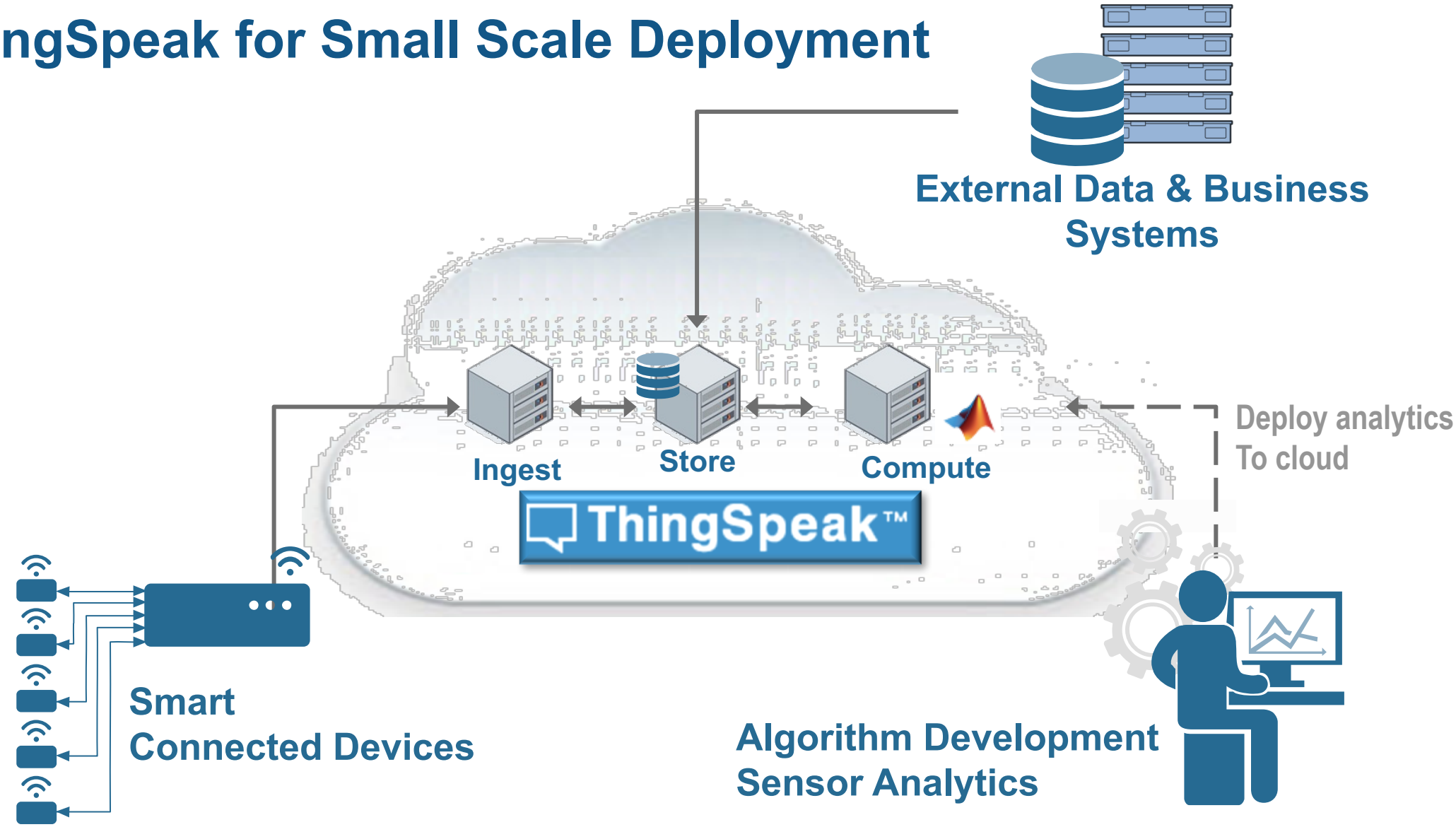
Connect and Acquire → **Signal Processing** → **Machine Learning** → **Embedded Implementation**

- 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

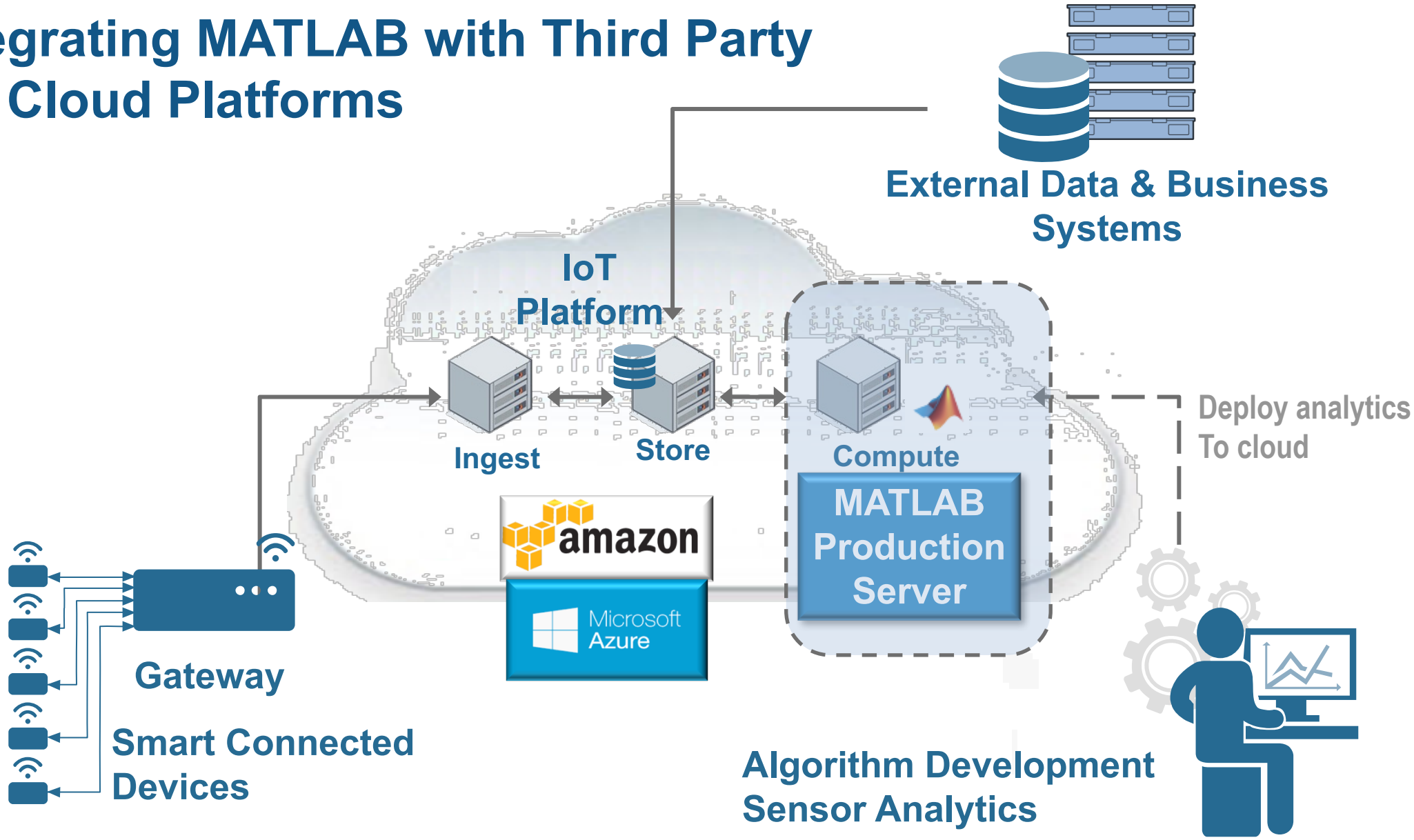
IoT Analytics Challenges



ThingSpeak for Small Scale Deployment



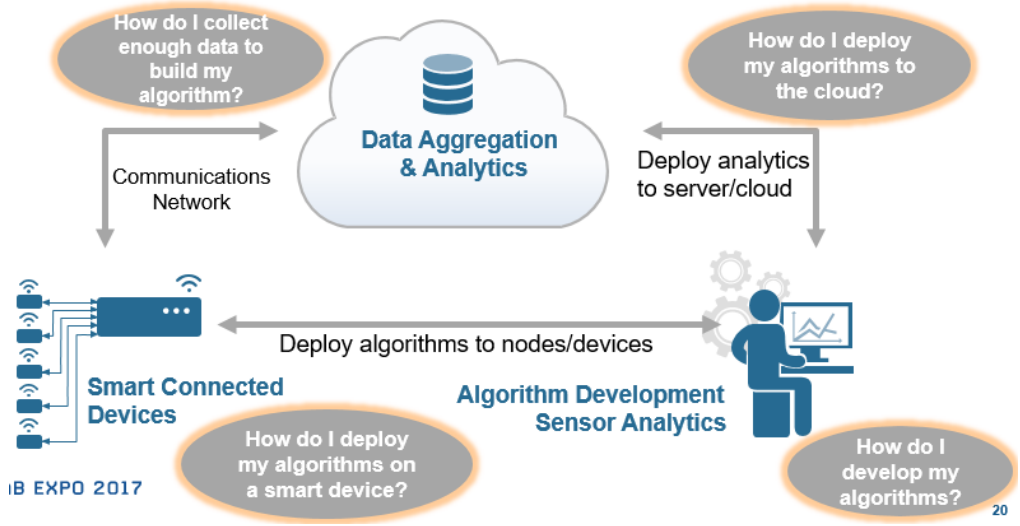
Integrating MATLAB with Third Party IoT Cloud Platforms



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!