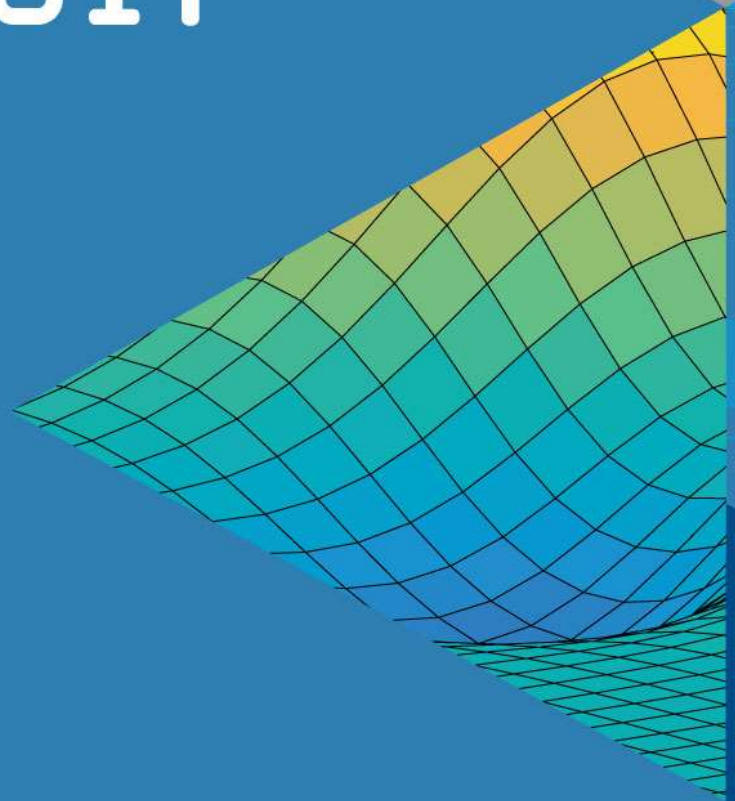
MATLAB EXPO 2017 KOREA

4월 27일, 서울

등록 하기 matlabexpo.co.kr

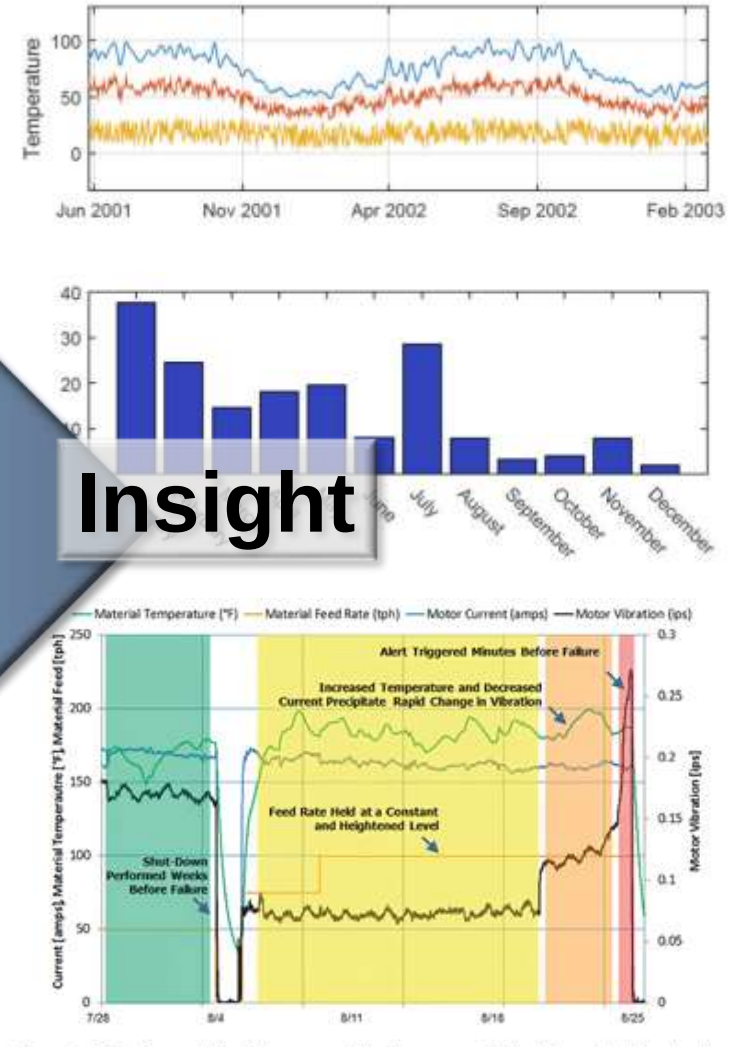


Internet of Things (IoT)를 위한 애널리틱 개발 및 적용

성 호 현 차장
Senior Application Engineer
The MathWorks Korea

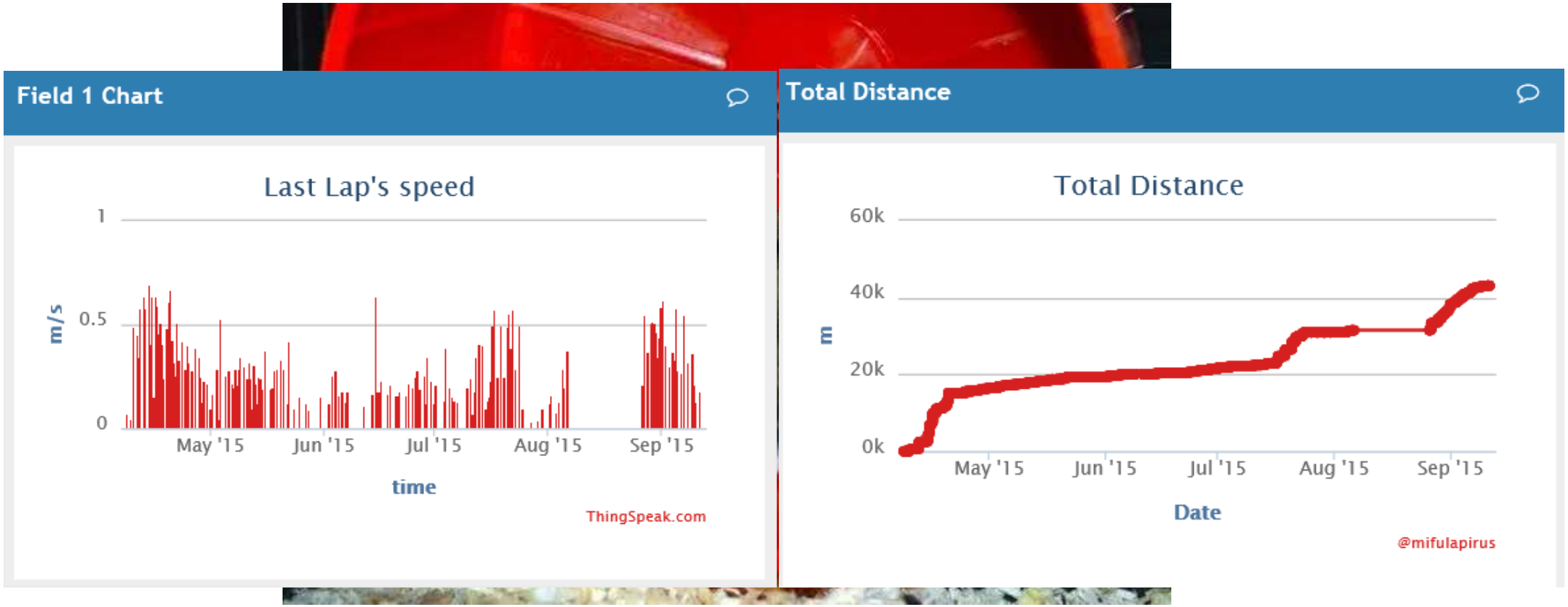
What is IoT?

Analytics



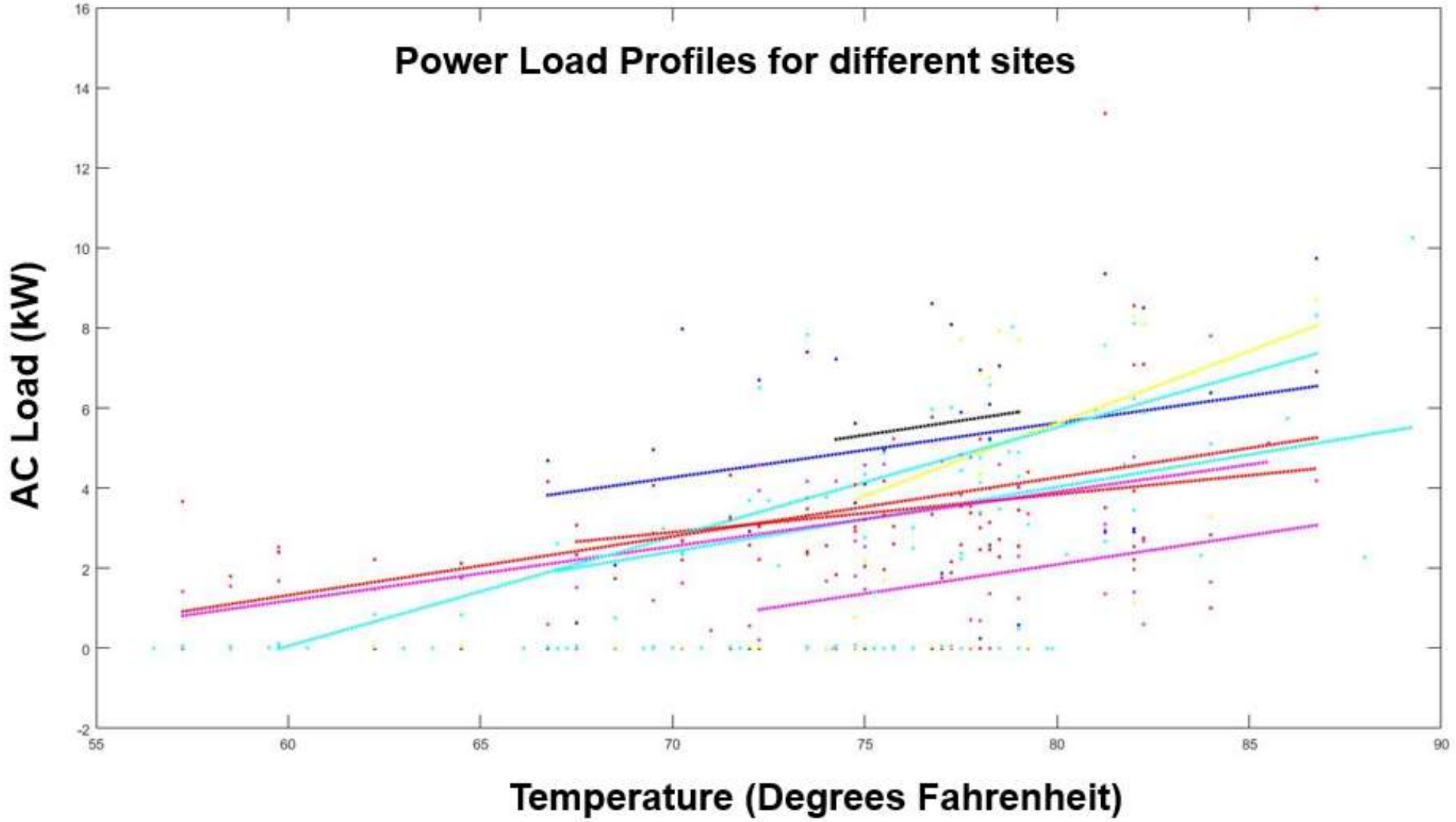
Insight

Fun Example from Michelle Leonhart



Do hamsters run a marathon every day?

Commercial Example from Cadmus



IoT Analytics

Devices

Analytics

Access and Explore Data

Business Data

Sensor Data

Preprocess Data

Data Reduction/ Transformation

Feature Extraction

Develop Predictive Models

Model Creation

Model Validation

Insight

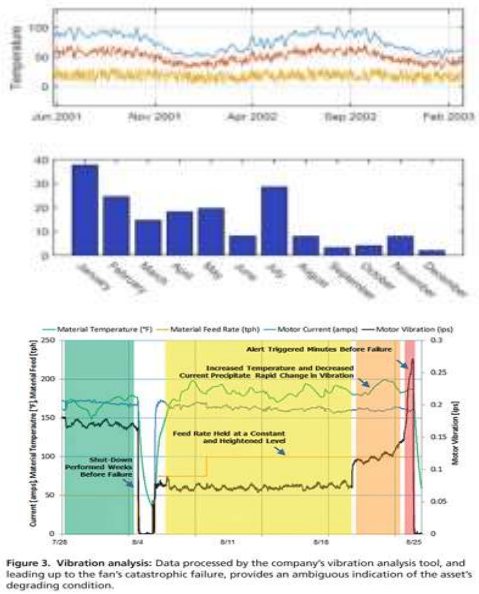
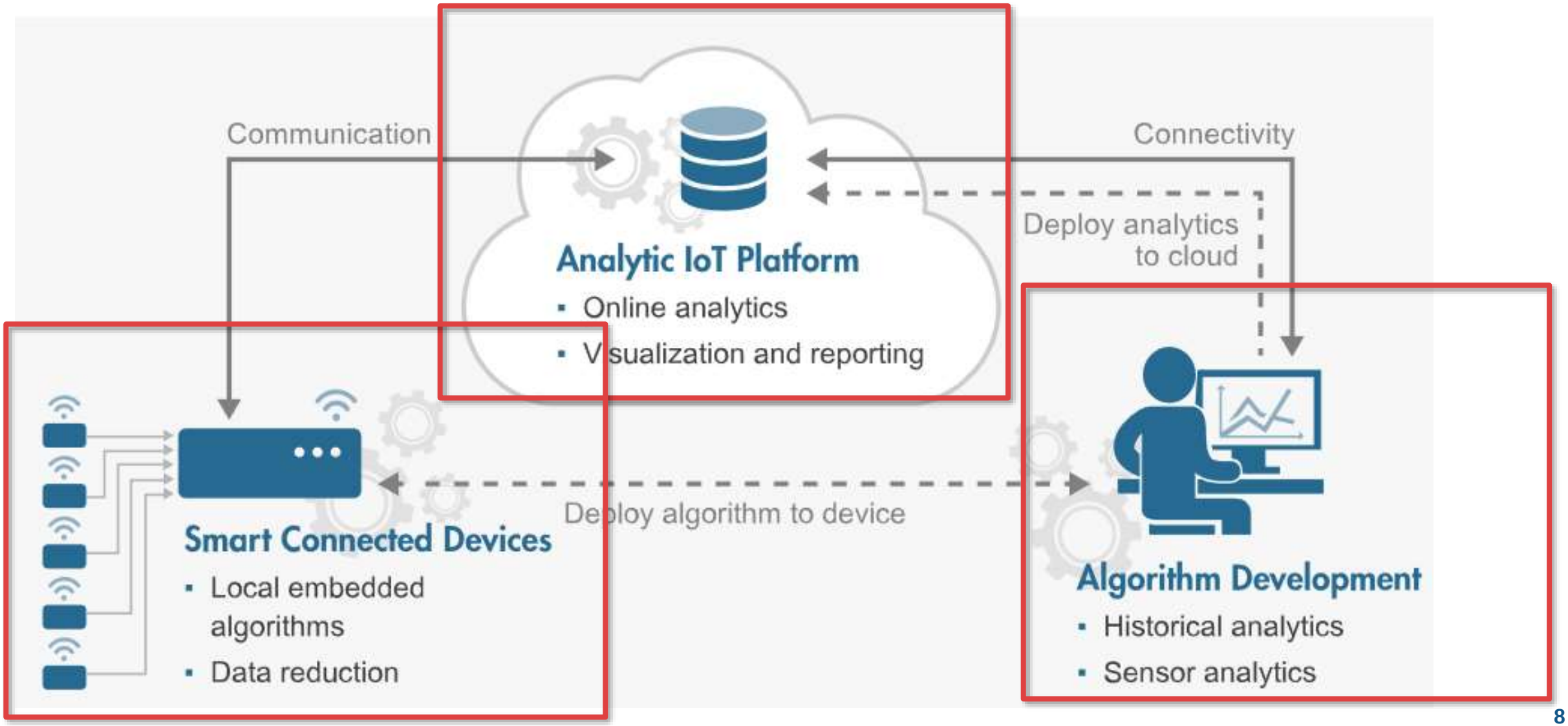


Figure 3. **Vibration analysis:** Data processed by the company's vibration analysis tool, and leading up to the fan's catastrophic failure, provides an ambiguous indication of the asset's degrading condition.

Algorithms are Key to IoT Systems and MATLAB Can Help

- Real data is messy and needs to be cleaned up.
- Features need to be detected and classified
- Missing data points need to be handled
- Predictions need to be made

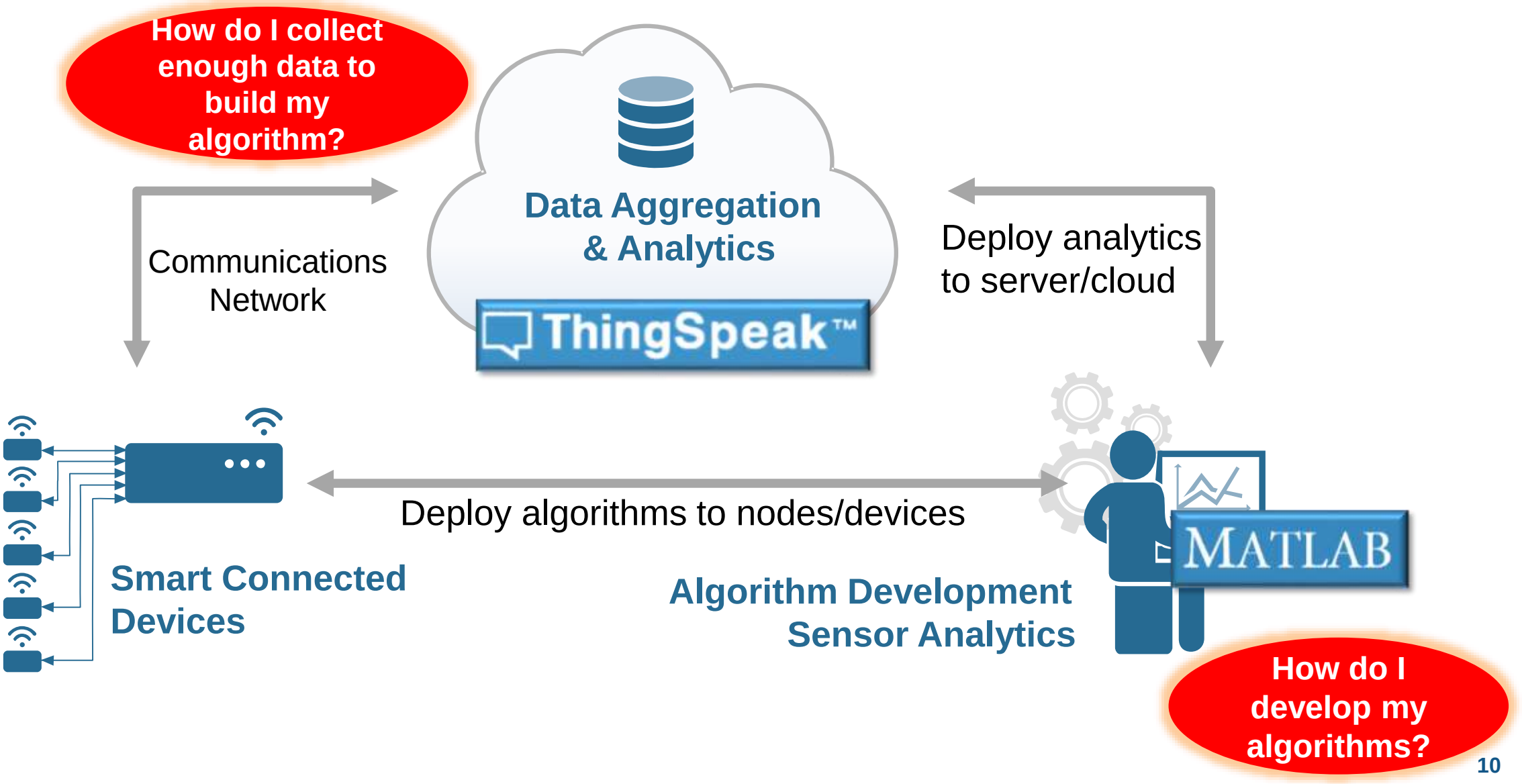
IoT Analytics Framework



IoT Analytics Challenges

- **How do I collect enough data to build my algorithm?**
- **How do I develop my algorithms?**
- **How do I deploy my algorithms on a smart device?**
- **How do I deploy my algorithms to the cloud?**

IoT Analytics Challenges



What Is ThingSpeak?

Web Site For People

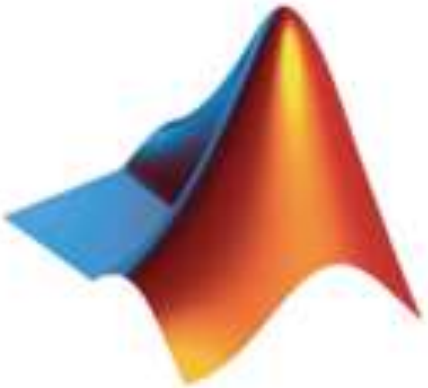
Web Service for Devices


```
{
  - 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"
        },
      - {
            created_at: "2016-05-19T10:36:35Z",
            entry_id: 1477231,
            field1: "18.000000",
            field2: "14.000000"
        }
    ]
}
```

ThingSpeak

- New MathWorks web service hosted on AWS
- Lets you 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

https://thingspeak.com



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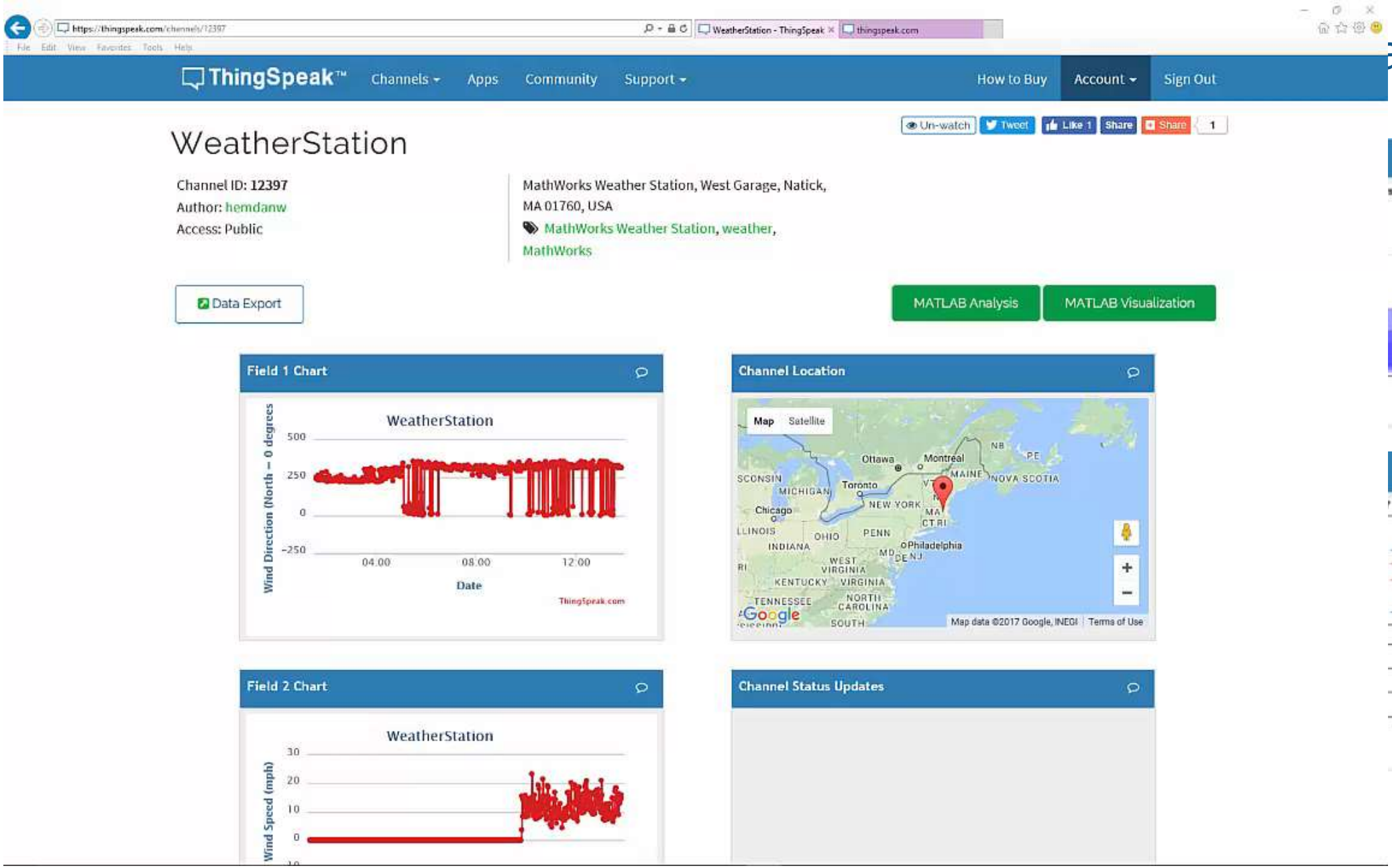
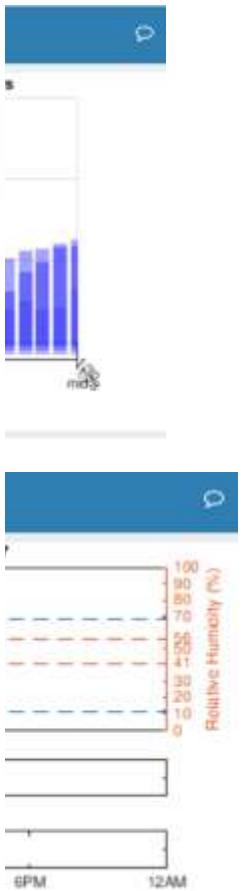

https://thingspeak.com/channels/12397
WeatherStation - ThingSpeak
thingspeak.com
ThingSpeak™
Channels
Apps
Community
Support
How to Buy
Account
Sign Out
Un-watch
Tweet
Like 1
Share
Share
1
WeatherStation
Channel ID: 12397
Author: hemdanw
Access: Public
MathWorks Weather Station, West Garage, Natick, MA 01760, USA
MathWorks Weather Station, weather, MathWorks
Data Export
MATLAB Analysis
MATLAB Visualization
Field 1 Chart
WeatherStation
Wind Direction (North = 0 degrees)
500
250
0
-250
04:00
08:00
12:00
Date
ThingSpeak.com
Channel Location
Map
Satellite
Ottawa
Montreal
Toronto
Chicago
NEW YORK
MAINE
NOVA SCOTIA
NB
PE
MICHIGAN
OHIO
PENN
INDIANA
Philadelphia
WEST VIRGINIA
KENTUCKY
VIRGINIA
TENNESSEE
NORTH CAROLINA
SOUTH
Google
Map data ©2017 Google, INEGI
Terms of Use
Field 2 Chart
WeatherStation
Wind Speed (mph)
30
20
10
0
Channel Status Updates


Relative Humidity (%)
6PM
12AM

Predictive Analytics Example with ThingSpeak

ThingSpeak™ Channels Apps Community Support How to Buy Account

Un-watch Tweet Like 0 Shar

Predicted and Measured Ockway Bay Tide Chart

Channel ID: **137305**
Author: mawrey
Access: Public

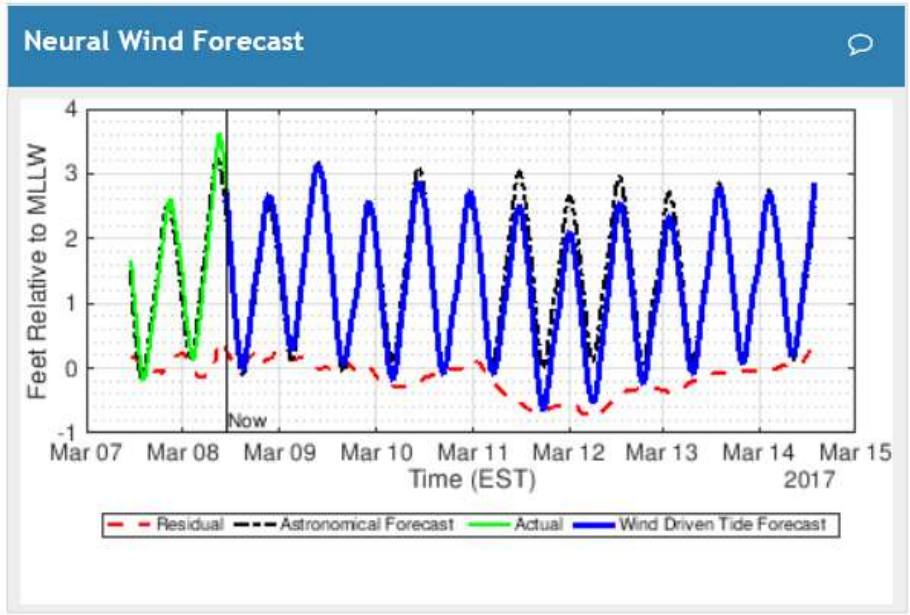
Tide measurement and forecasting with the effect of wind predicted using neural networks.

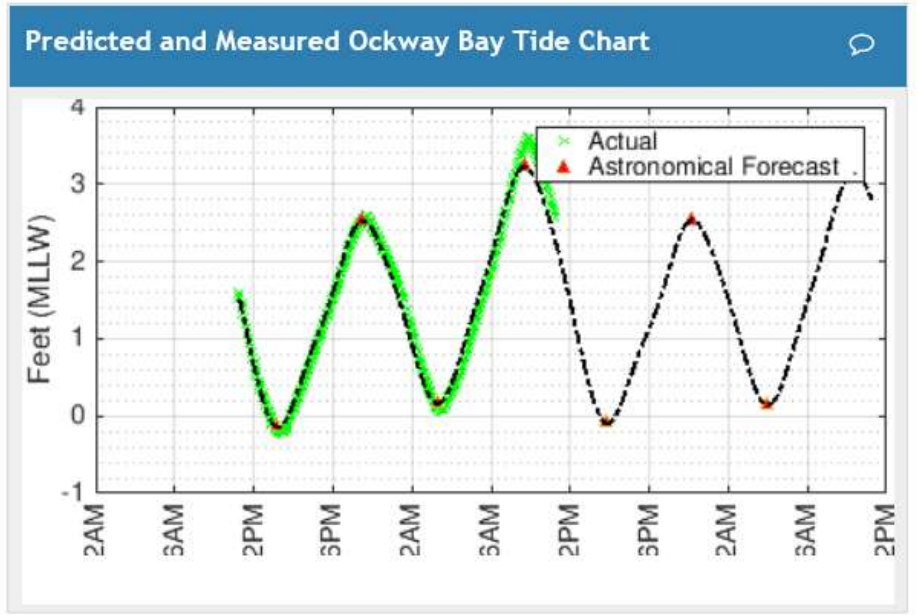
tide, wind surge, neural network

Data Export | More Information

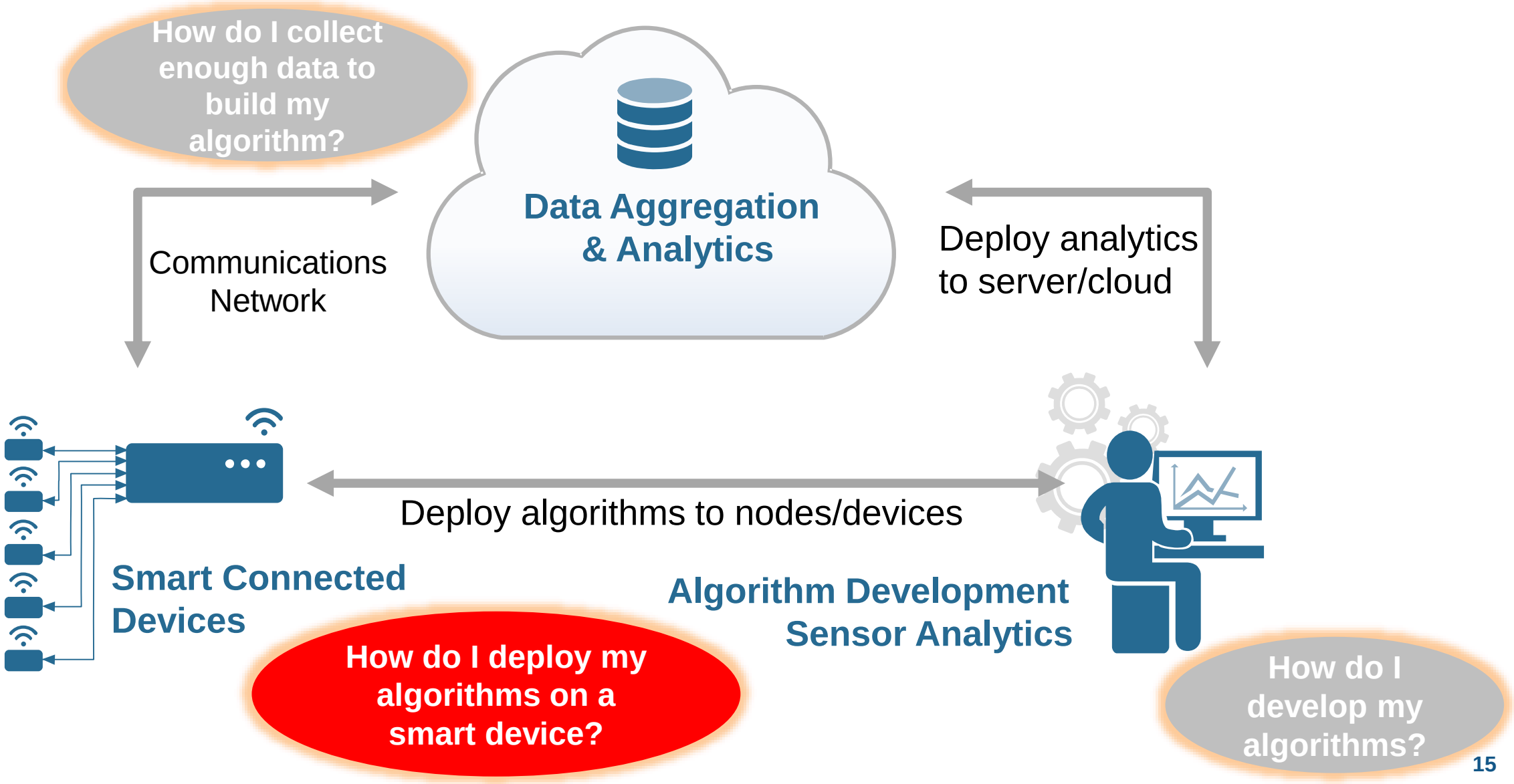
MATLAB Analysis | MATLAB Visualiz

Historical Wind and Tide Data

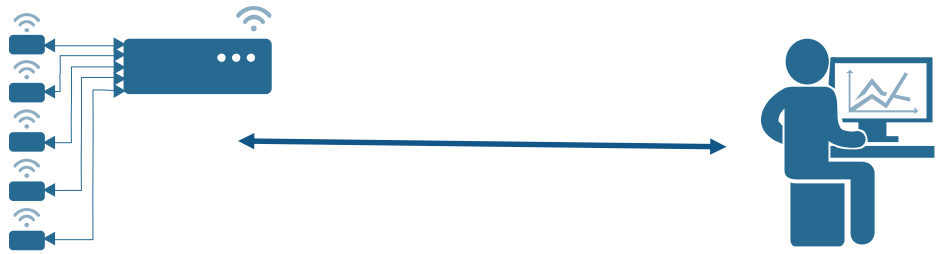


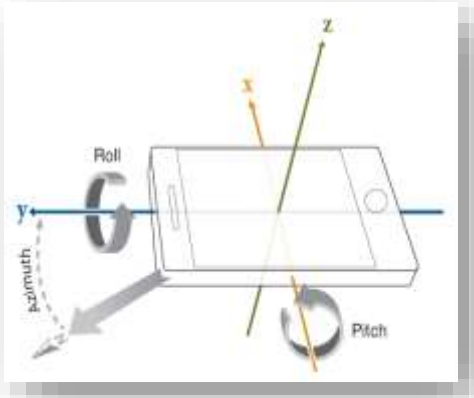


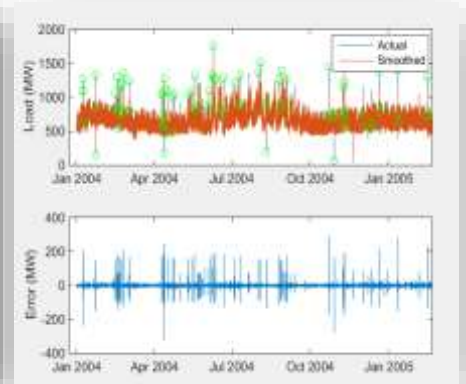
IoT Analytics Challenges



Sensor Analytics and Development of Smart Connected Devices

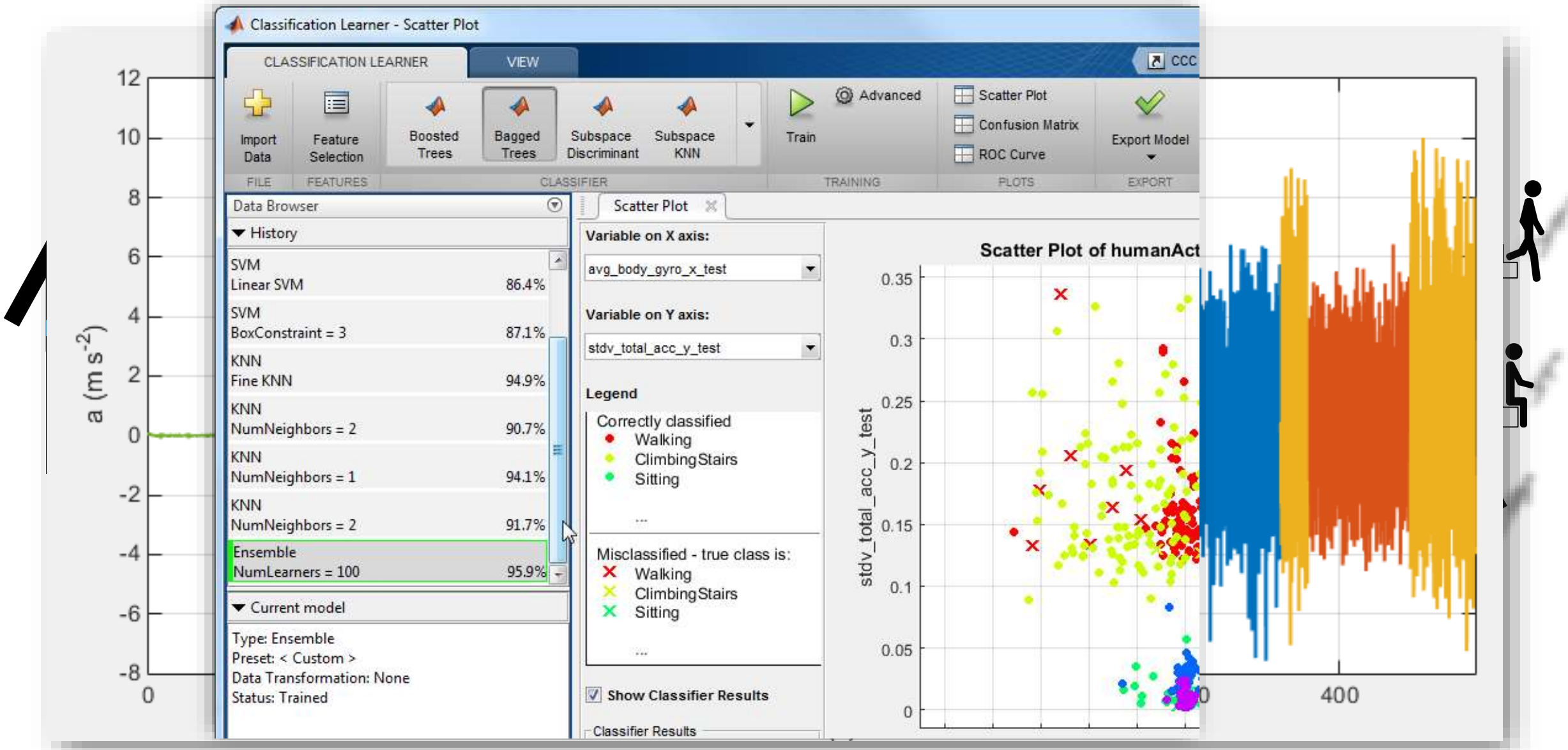




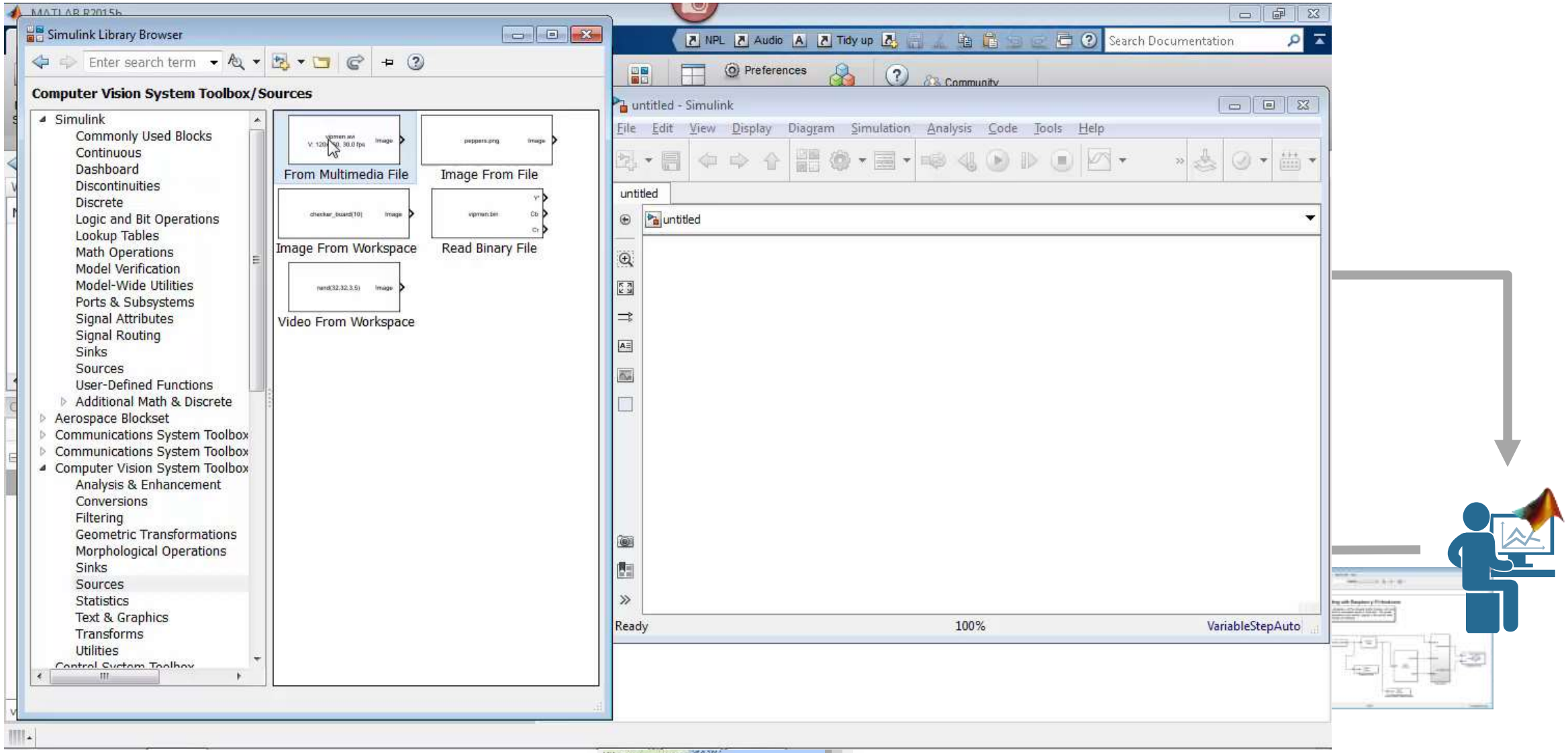


Connect and Acquire → **Signal Processing** → **Machine Learning** → **Embedded Implementation**

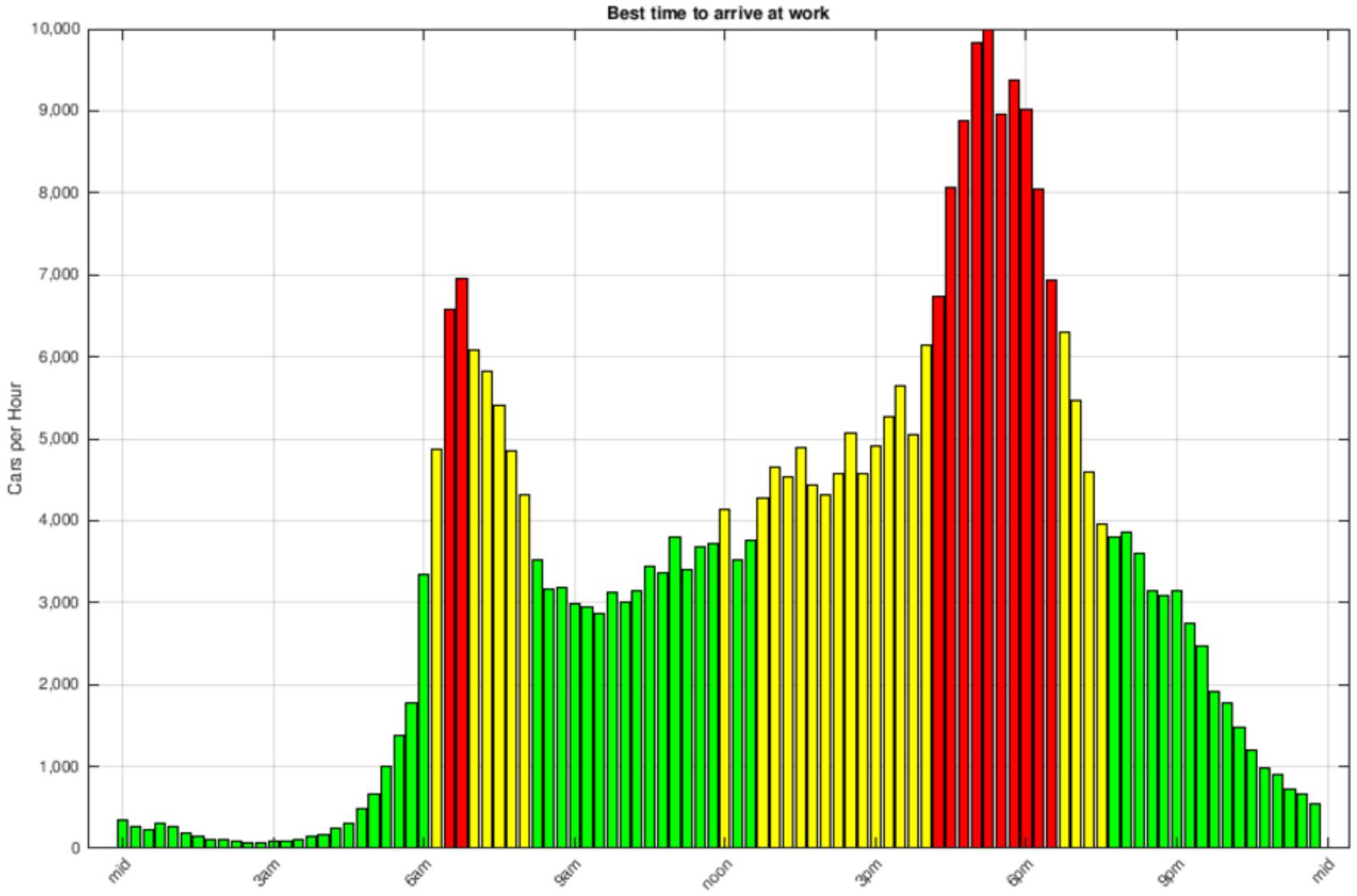
Example: Human Activity Analysis and Classification



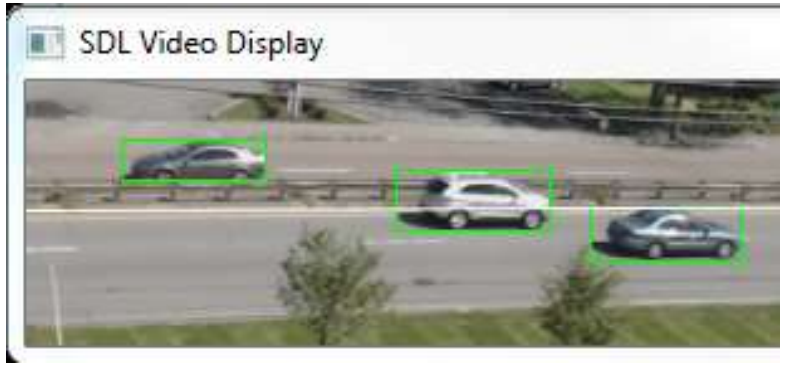
Example: Partitioning Algorithms Between Device and Cloud



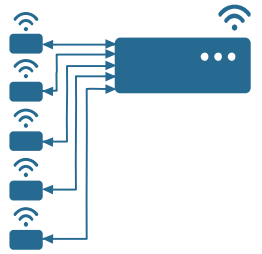
From Data to Insight



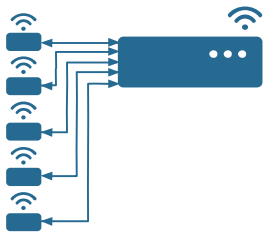
When should I go t
o work?



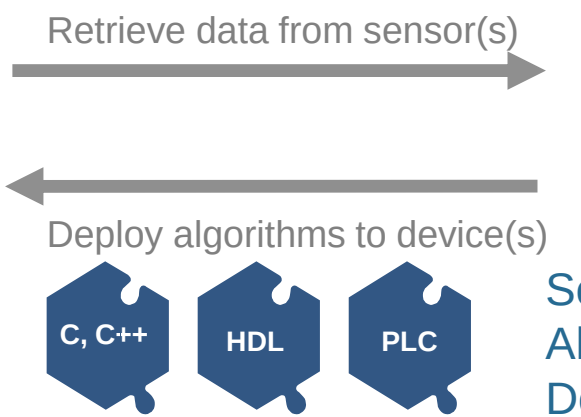
Designing Smart Connected Devices



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

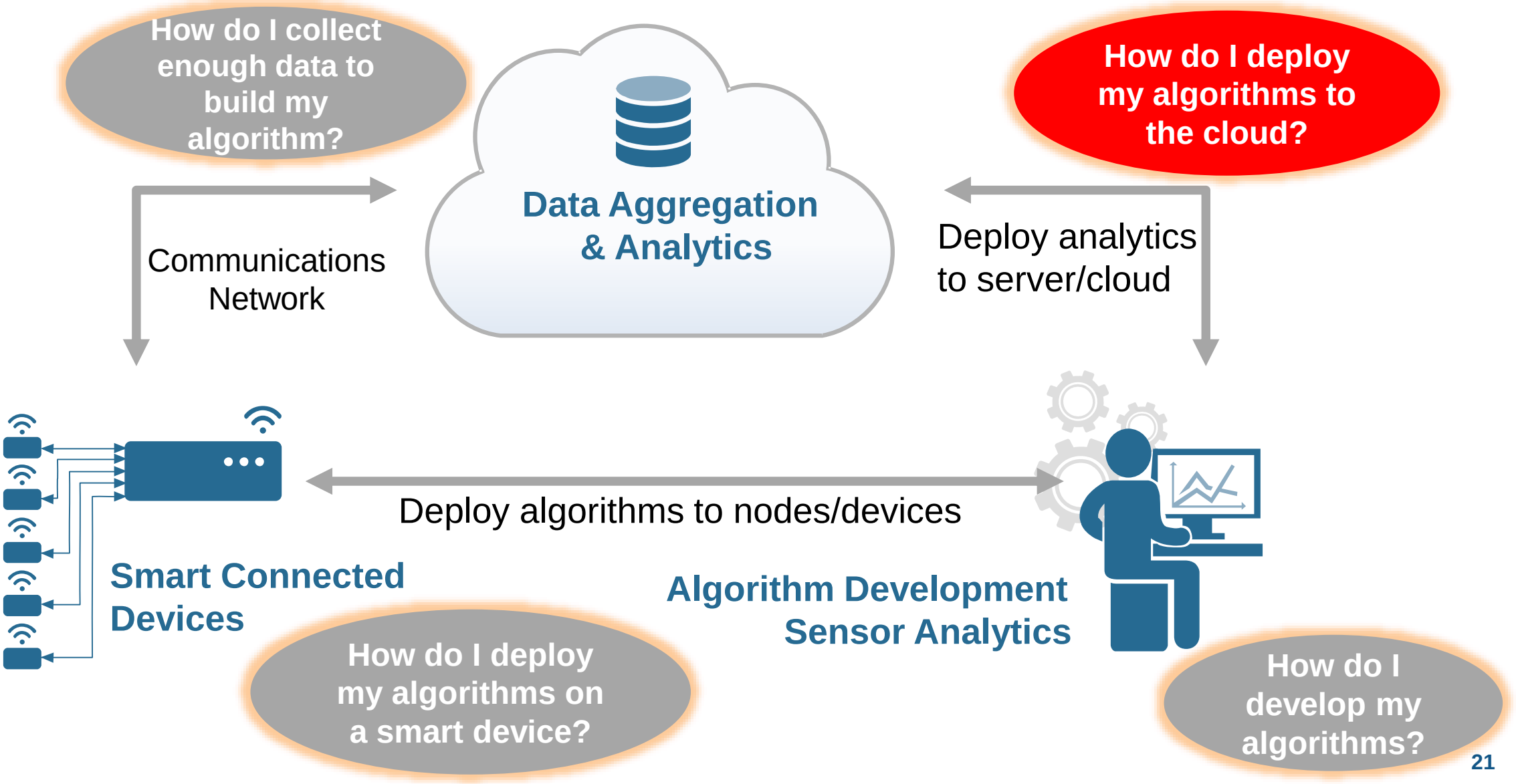


Smart Connected Devices

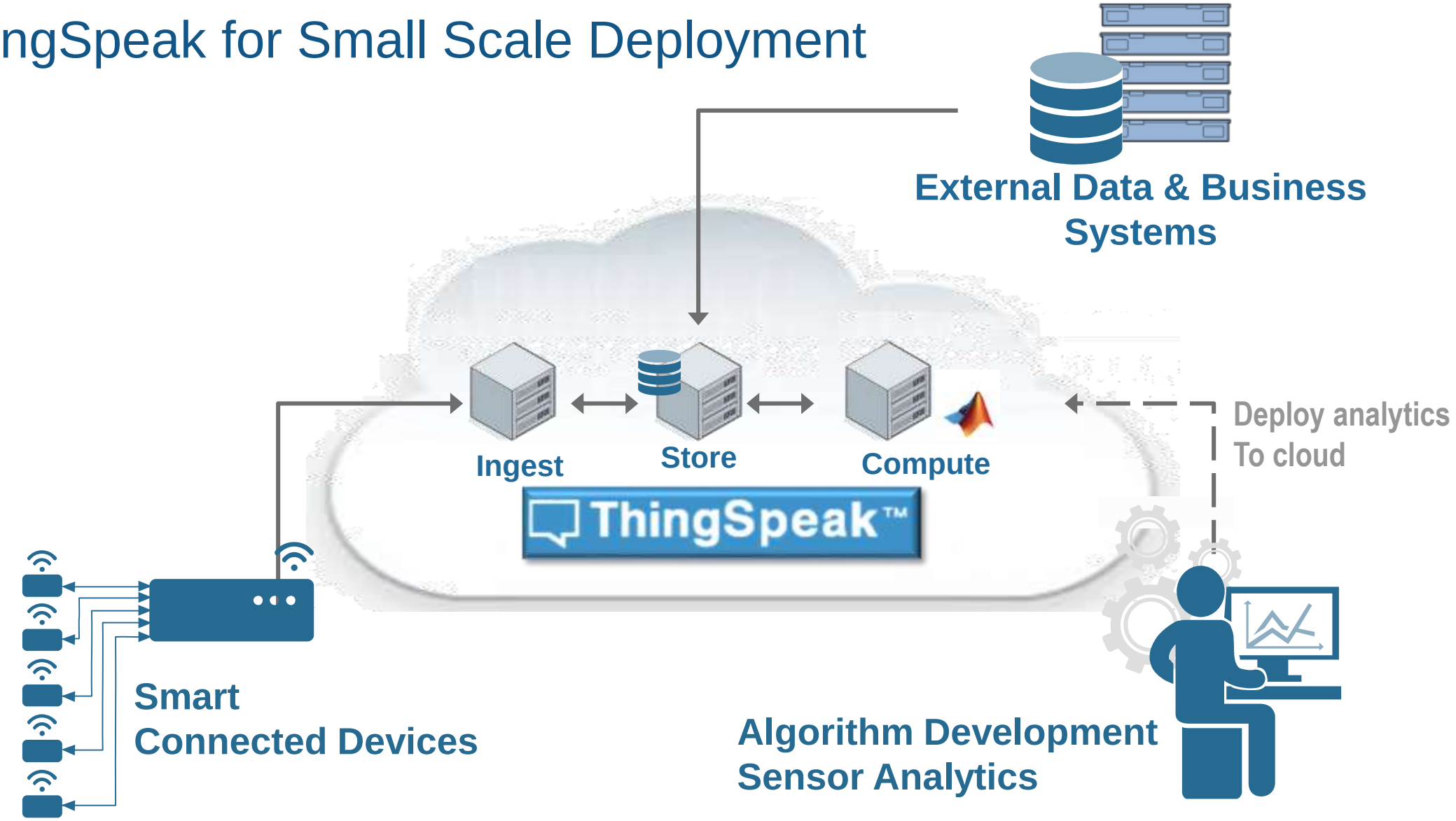


Sensor Analytics Algorithm Development

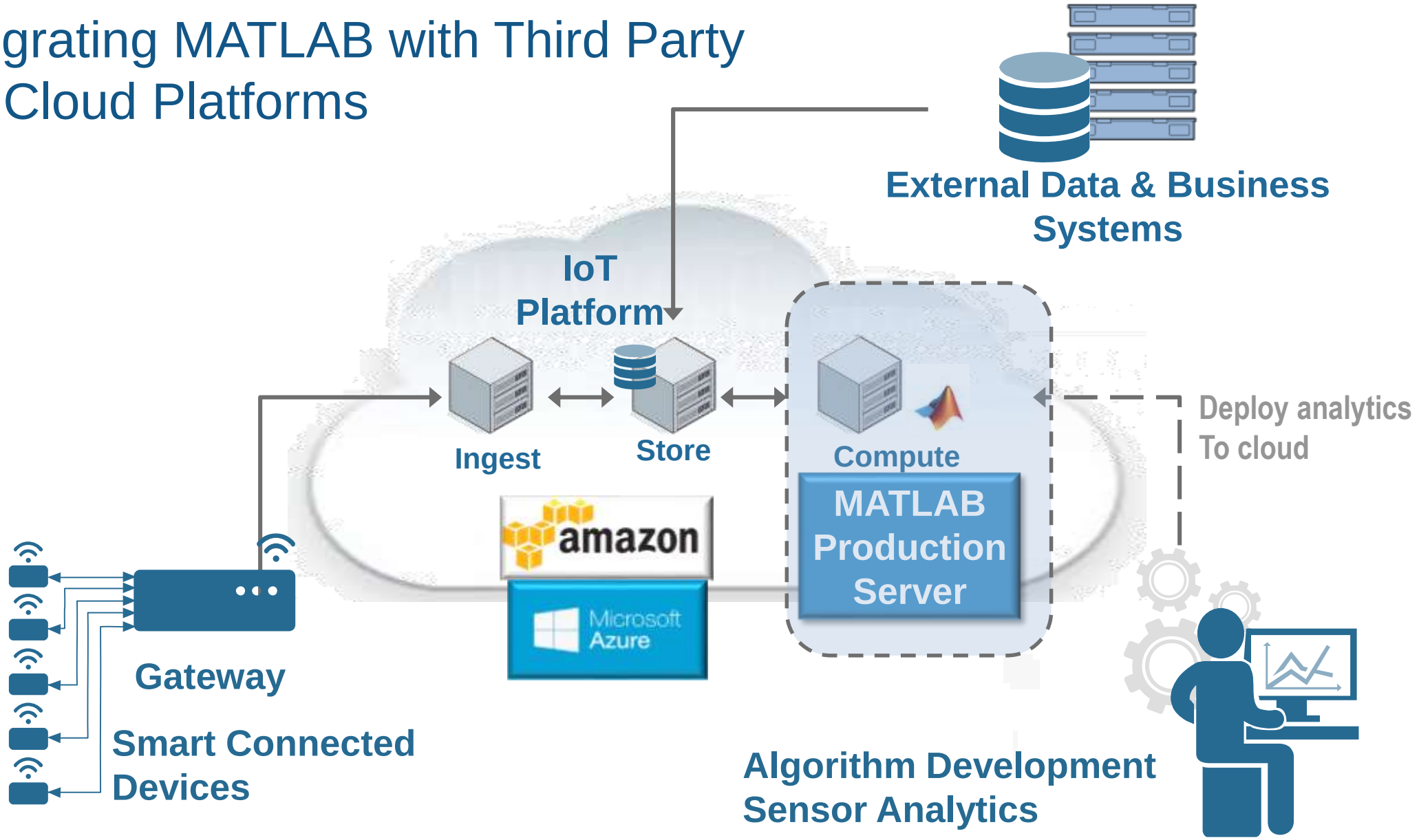
IoT Analytics Challenges



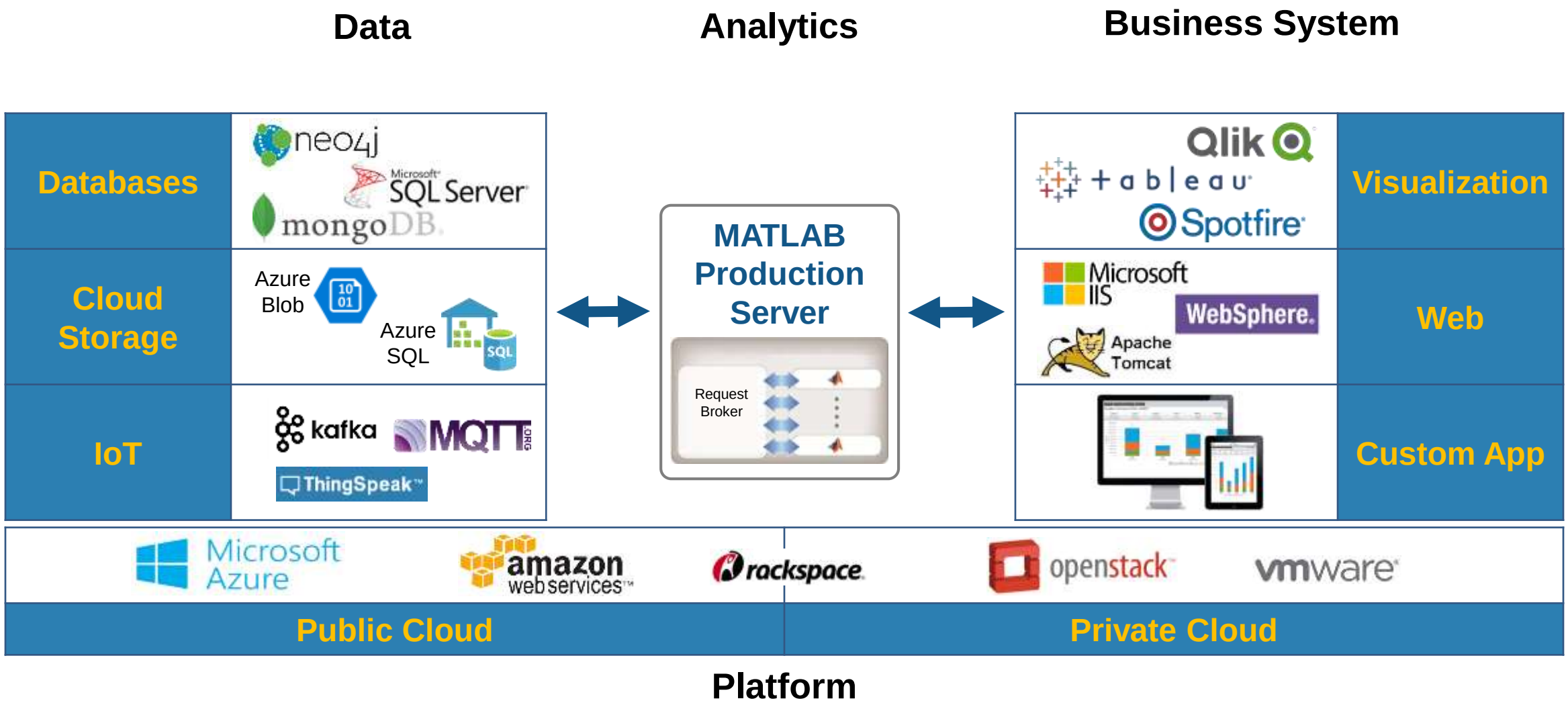
ThingSpeak for Small Scale Deployment



Integrating MATLAB with Third Party IoT Cloud Platforms

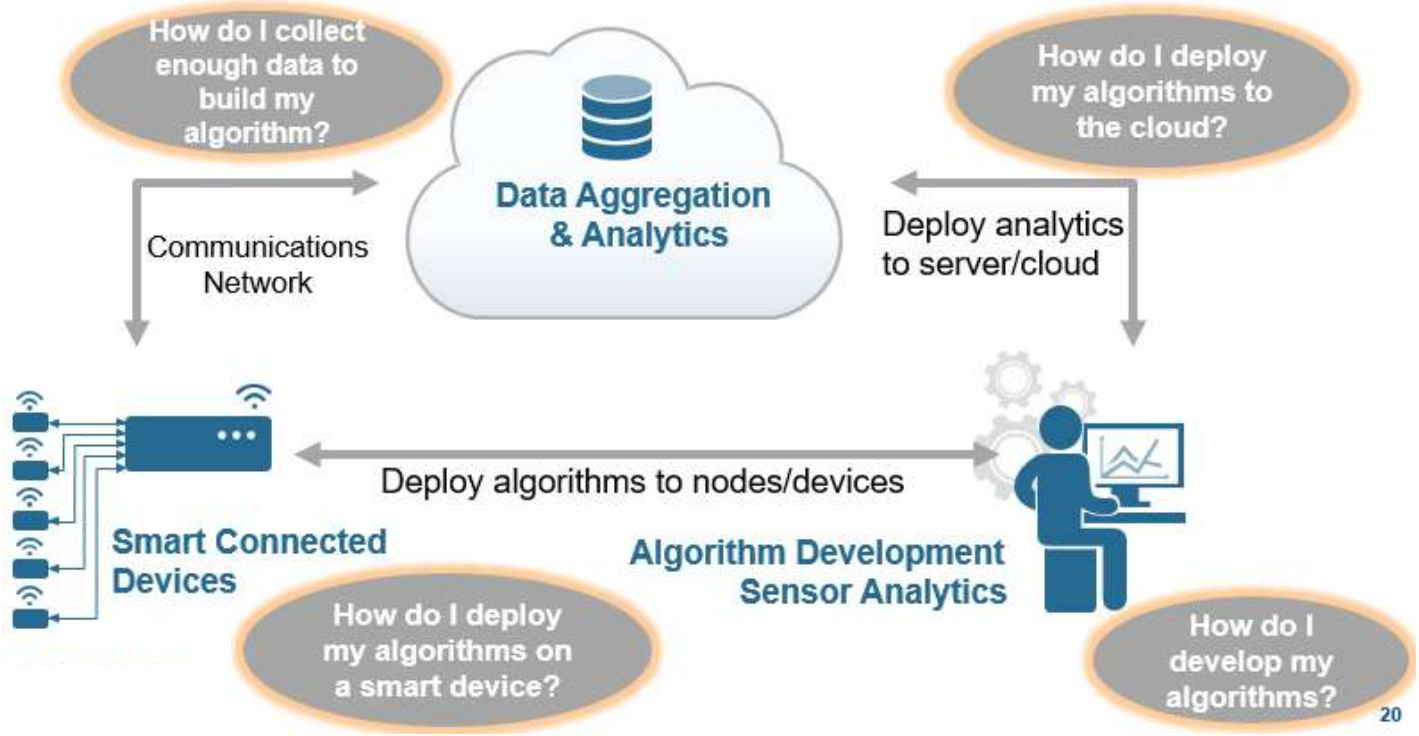


Integrating MATLAB in Large Scale Production Systems



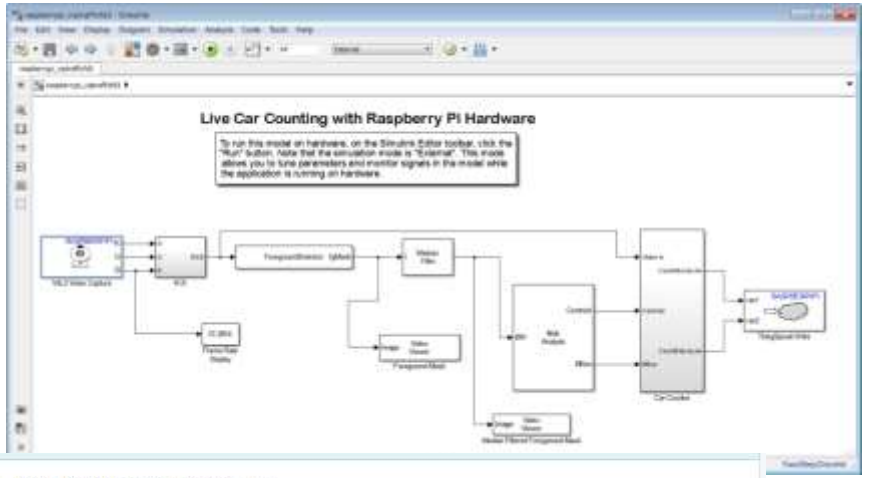
MathWorks Addresses IoT Analytics Challenges

- Quickly 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



What You Can Do to Learn More

- Log-in to ThingSpeak with you 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



Using the Corporate Template

- Avoid manually formatting whenever possible. Instead, use built-in styles, templates, layouts, and col ors.
- When creating new presentations, select the slide layout that best suits your needs from the built-in t heme, then add content.
- When creating custom shapes, text boxes, and other elements, start from scratch rather than reforma tting template shapes.
- When applying the new template to existing presentations, review your presentation carefully and ma nually adjust any formatting issues that have occurred. For additional help, contact Creative Services.

V17.0 *Delete this slide before finalizing your presentation.*

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