Leveraging the power of IoT with MATLAB

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“It’s not an Internet of Things, It’s an internet of People”

Neil Lawrence
inverseprobability.com
Internet of (every)Things (IoT), what it’s really about...

Mostly, though, the IoT is about collecting industrial data on an industrial scale. Tracking vibrations in buildings to measure their stability. Tracking smells via adsorption, ... Tracking noises, lights, moisture, toxins. And then making this data available despite the physical restrictions of battery power and radio networks.
Anatomy of an “IoT” ecosystem

1. Things sending DATA (embedded systems &/or sensors)
2. (Cloud) Infrastructure hosting both DATA & Application Servers
3. DATA Lake
   - Engineering, Scientific & Field
   - Business, Transactional, Social, Clinical...
4. Business Application
   Enable end-users to visualize & take decisions

Business/External Systems
(ERP, CRM, EHR, Weather, Market, Social data…)

PRODUCTION Environment
- Real-Time &/or
- On-Demand Analytics

Development Platform(s)
Enable Domain Experts to Access, Develop, Scale & Deploy analytics on both Things & Infrastructure
Anatomy of an “IoT” ecosystem & main challenges associated

1. Things sending DATA (embedded systems &/or sensors)
   - Power & Volume restrictions
   - Access & Deploy on sensors
   - Communication Stack

2. (Cloud) Infrastructure hosting both DATA & Application Servers

3. DATA Lake
   - Engineering, Scientific & Field
   - Business, Transactional, Social, Clinical...
   - Development Platform(s) Enable Domain Experts to Access, Develop, Scale & Deploy analytics on both Things & Infrastructure

4. Business Application Enable end-users to visualize & take decisions

Business/External Systems (ERP, CRM, EHR, Weather, Market, Social data...)

Integration & Scaling into Production

PRODUCTION Environment
- Real-Time &/or
- On-Demand Analytics

Enable Domain Experts to Access, Develop, Scale & Deploy analytics on both Things & Infrastructure

Multiple development software
How can you leverage & address the challenges of IoT?

Accessing Aggregators/Data

- **Aggregators**
  - RDBMS/SQL
  - SQLite/No-SQL Databases
  - Google Cloud/Big Query
  - AWS
  - Homegrown
  - **ThingSpeak**

- **Web services**
  - `webread/websave`
  - RESTful, SOAP

- **Protocols** (e.g., Xively, SDMX)

- **API for social interaction data**
  - Indico/Twitter
How can you leverage & address the challenges of IoT?
Accessing & Deploying at the Edge nodes

- **Hardware Connectivity & Support Packages**
  - DAQ/Instruments Control/Low-Cost HW/iOS/Android…

- **Communication**
  - M2M (e.g., DDS)
  - Device to aggregator (e.g., ThingSpeak)
  - Device to analyst (e.g., XBee®)
  - 2-4G/RF/WLAN

- **Automatic Code Generation**
  - Embedded processors and FPGAs
  - Popular IoT devices (RaspberryPi, Arduino, ARM,STM…)

- **Verification/Validation & Process Support***
  - Model & Code proving
  - IEC Certification /DO Qualification kits
How can you leverage & address the challenges of IoT?

Deploying Analytics into Production environments

- Desktop/Mobile Application
- Dashboards & Webpages
- Hadoop servers
- Databases
- Custom environments (e.g., Google Earth, TIBCO Spotfire, Qlik…)
Anatomy of an “IoT” ecosystem & main challenges associated

1. Things sending DATA (embedded systems &/or sensors)
   - Power & Volume restrictions
   - Access & Deploy on sensors
   - Communication Stack

2. (Cloud) Infrastructure hosting both DATA & Application Servers
   - DATA Lake:
     - Engineering, Scientific & Field
     - Business, Transactional, Social, Clinical...

3. Development Platform(s)
   - Enable Domain Experts to Access, Develop, Scale & Deploy analytics on both Things & Infrastructure

4. Business Application Enable end-users to visualize & take decisions
   - Integration & Scaling into Production

- Real-Time &/or On-Demand Analytics
- Enable Domain Experts to Access, Develop, Scale & Deploy analytics on both Things & Infrastructure
- Multiple development software
Anatomy of an “IoT” ecosystem & main strengths of MATLAB

1. Things sending DATA (embedded systems &/or sensors)
   - Communication Stack
   - Power & Volume restrictions
   - Access & Deploy on sensors

2. (Cloud) Infrastructure hosting both DATA & Application Servers
   - Security

3. DATA Lake
   - Engineering, Scientific & Field
   - Business, Transactional, Social, Clinical…
   - Development Platform(s) Enable Domain Experts to Access, Develop, Scale & Deploy analytics on both Things & Infrastructure
   - Integrate & Scale into Production

4. Business Application
   - Enable end-users to visualize & take decisions
   - Single development software
Thanking You with examples of MATLAB saving lives (& money) *(running as we speak)*

Opportunity

- Crash detection

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Working with MathWorks has enabled:

- Rapid data analysis during development of ACD1 solution
- A toolset for developing ACD2 which *within a unified environment* for:
  - **signal processing**
  - **machine learning** algorithms
  - **Easy deployment** of these tools into existing AWS / .NET based environment

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RAC Telematics

A system of innovation

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Link to Story
Thanking You with examples of MATLAB saving lives (& money) *(running as we speak)*

**Opportunity**
- Asthma crisis detection

**Analytics in cloud & embedded**
- Captures windpipe sound & **clean/processes the data locally**
- **Spectral processing & Pattern-detection** (NN & KNN) on the cloud

**Benefit (Provides feedback to patient & alert doctors)**
- Eliminates error-prone self-reporting & visits to the doctor
- Quick hospitalization in case of emergency alarm

**Results with Mathworks**
- Manual coding effort reduced
- Algorithm development iterations faster
- Code maintenance overhead reduced