IoT Platforms

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What are IoT platforms

- IoT applications combine sensors, devices, data, analytics and integrations in a seamless and unified way
  - e.g. your project!
- IoT Platforms provide software tools and components to:
  - connect sensors, devices, and data networks
  - Analyse and store data
  - Integrate with other apps
- So what? We know the tech for that now (I2C, SPI, BLE, MQTT, Python...)
- Main selling point of an IoT platform is software that it
  - accelerates the IoT development process
  - Focuses on IoT: brings in best of breed features
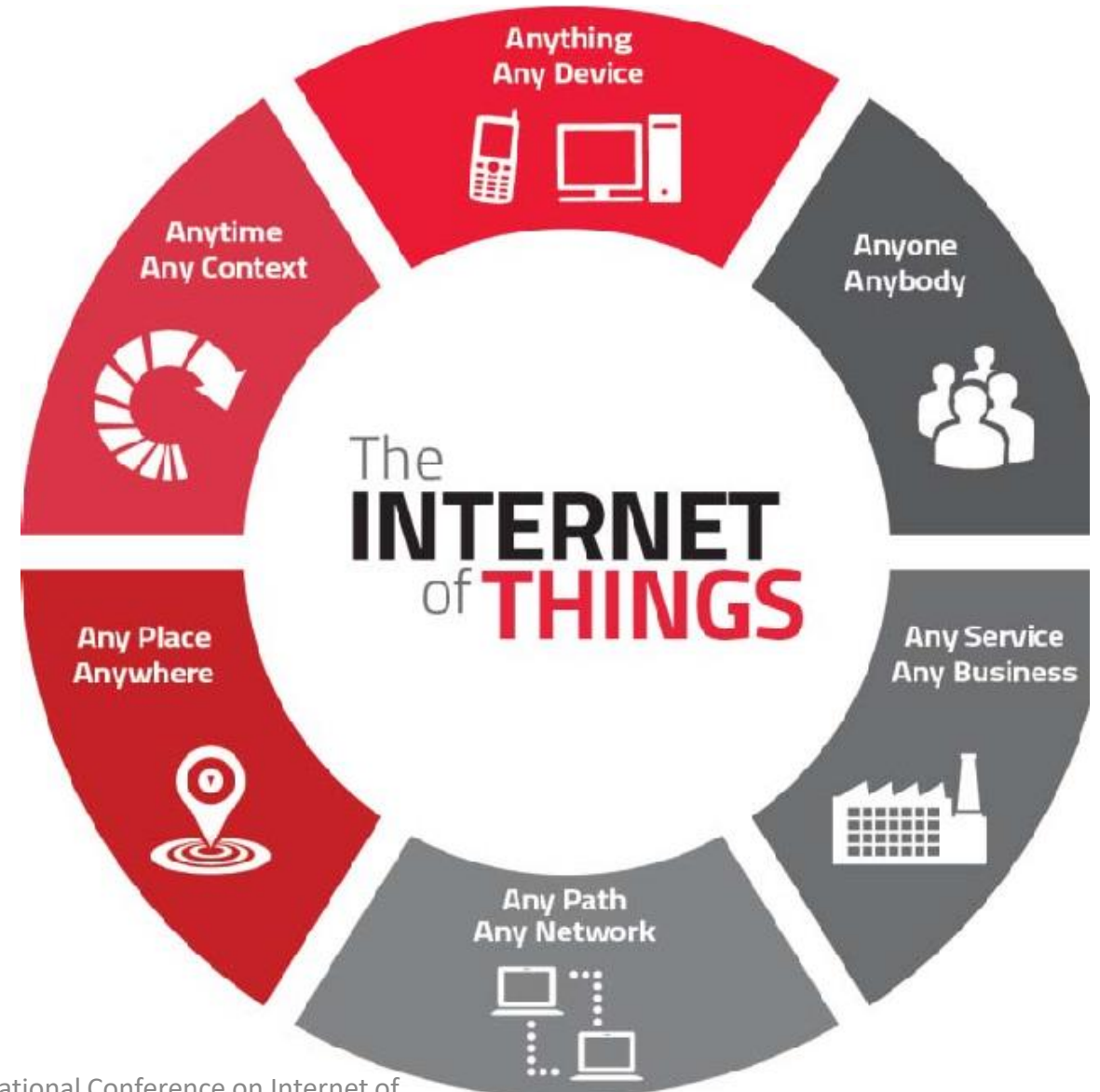 - Provides initial scaffolding for IoT projects

What are IoT Platform

- Many(not all) are cloud-based platforms that require subscription

- Provide device/language agnostic set of Software Development kits
  - Arduino/RPi/beagleboard

- IoT development is generally iterative:
  - Starts with initial simple use case
  - Once operational, data/insights result in new usecased

- IoT platforms should promote scalable, iterative development
  - Allow for quick app development
 - Ability to adapt/optimise apps quickly

IoT Platform Characteristics

- Manage many concurrent device connections
- Connectivity across several connection types
- "Off-the-peg" IoT protocol stack
- Manage/analyse/visualise data
- Integrations to other services/apps
- App Development

IoT Platform – generalised

Data/commands

IoT Platform

Configure
analytics/visuals/apps

Deploy program to devices
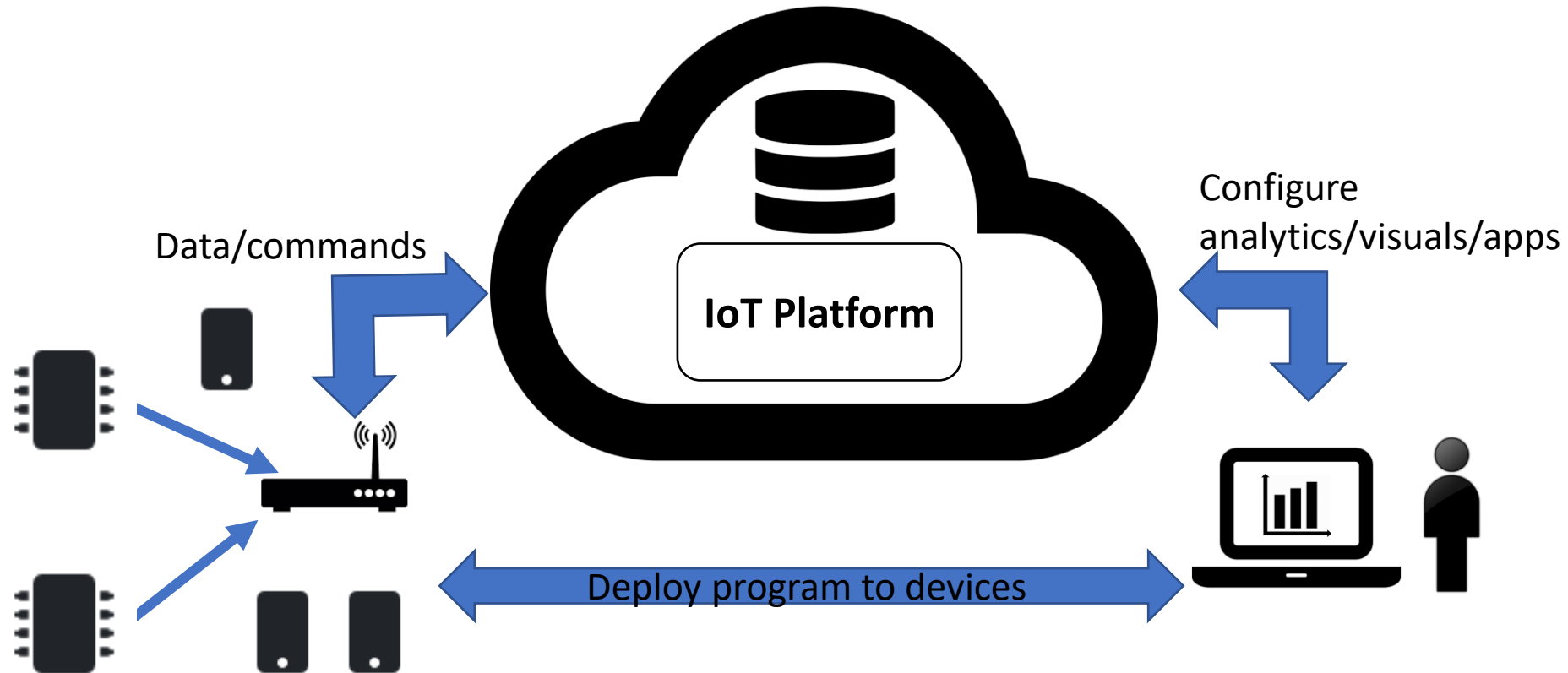
IoT Platform Advantages

- Use sofware component that has been pre-built and pre-tested. This increases the reliability of your application and reduces development effort.
- IoT frameworks constantly evolve, providing new features, integrations etc.
- Encourages better "design pattern" for your IoT app.
- Predefined APIs and docs
  - Great for collaboration
- "Baked-in" standards and features:
  - Security, authentication, scalability...

Which one?

- Connectivity
  - Does the platform provide suitable capability and integrations (WiFi/Cellular/LPWan-Sigfox)
- Maturity
  - In business for long? Critical mass in developer community?
- Free
  - Is there a free tier (handy for evaluation)?
- Service type
  - Platforms try to distinguish themselves – what specialisms/USP does it have?
- Security
  - What security model do they use? Is there security issues reported in past?
- Geographic area
  - Does it operate well at your location (can you select edges/data centres)
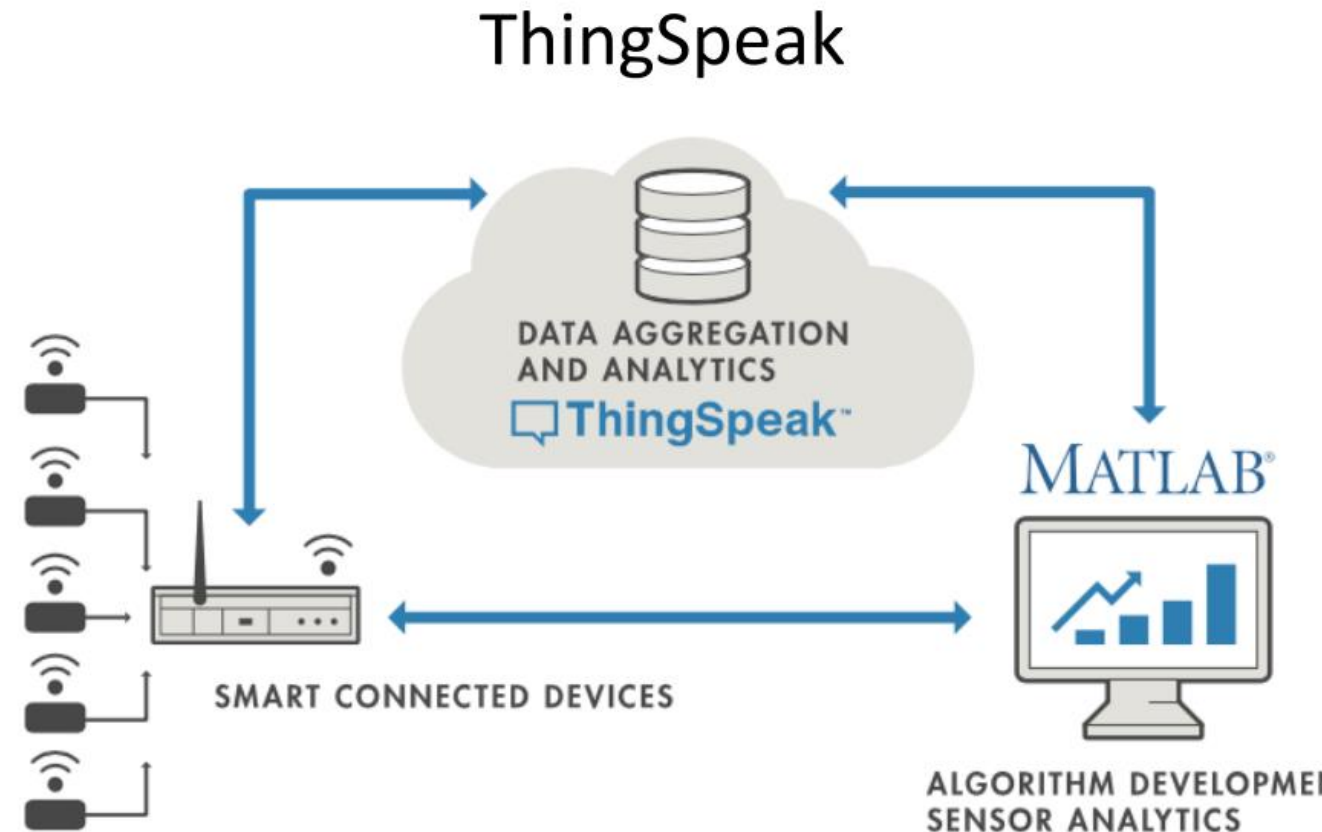
Thingspeak

Thingspeak Overview

- Account-based
  - Can create free account online
- Brought to you by the people who made Matlab
  - Uses Matlab features/toolboxs
- SDKs/librarys for popular languages/devices
- Should work with any connected device

Thingspeak – basic use

Create a new channel

- Channels collect data

Collect data in the channel

- Devices write data to channels

Analyse the data

- Run analytical algorithms/visualise your data

Act on the data

- Test for certain conditions and perform actions
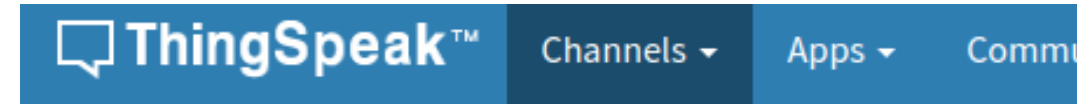
ThingSpeak – Create new channel

CREATE A NEW CHANNEL TO COLLECT DATA FROM DEVICES

DEFINE DATA FIELDS FOR THE CHANNEL(MAX 8)

CAN ALSO INPUT LOCATION(LAT/LONG) OF CHANNEL SOURCE)

ThingSpeak™   Channels ▾   Apps ▾   Commu

New Channel

Name	SensePi
Description	Environment data from senspi
Field 1	temperature	☑
Field 2	pressure	☑
Field 3	humidity	☑

Thingspeak - New channel

- Once saved you can access channel page:

SensePi

Channel ID: **625505**
Author: fxwalsh
Access: Private

Environment data from senspi

| Private View | Public View | Channel Settings | Sharing | API Keys | Data Import / Export |

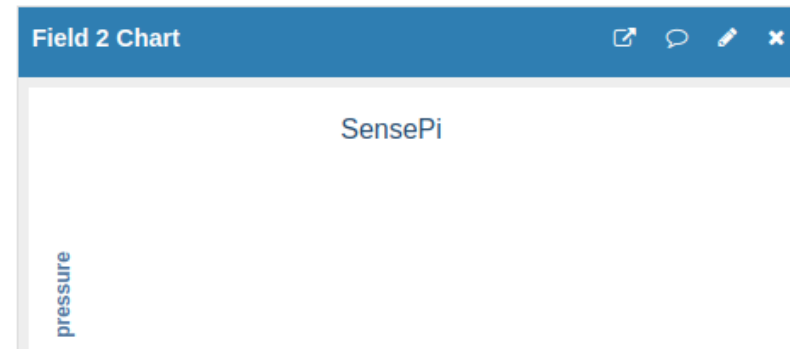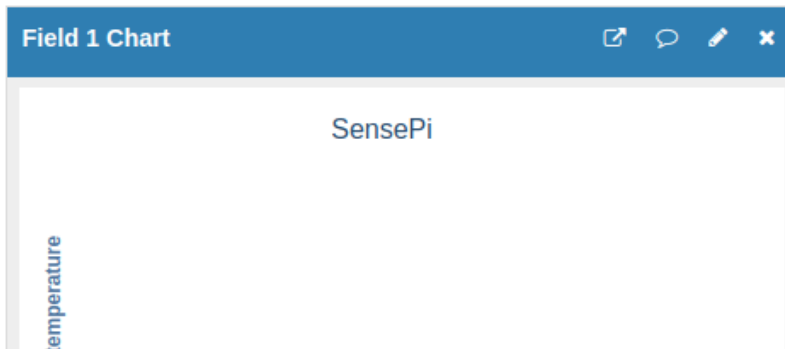[+] Add Visualizations   [+] Add Widgets   [↗] Export recent data

MATLAB Analysis   MATLAB Visualization

Channel Stats

Created: 4 minutes ago
Updated: 4 minutes ago
Entries: 0

Field 1 Chart

SensePi
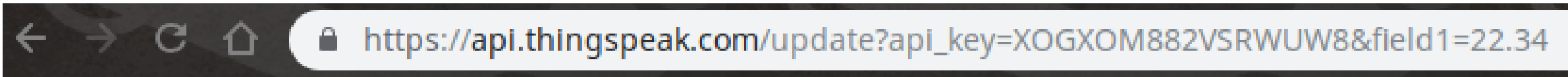
temperature

Field 2 Chart

SensePi

pressure

Thingspeak - Add data to channel

- Programmatically, many ways!
  - Construct HTTP GET request and include field values in query string

  GET https://api.thingspeak.com/update?api_key=<WRITE-KEY>&field1=12

- Because always HTTP GET request, can test from a browser:

https://api.thingspeak.com/update?api_key=XOGXOM882VSRWUW8&field1=22.34

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Thingspeak – Add data with python

- Make HTTP request from Python:

```python
def writeData(temp,press,hum):
    # Sending the data to thingspeak in the query string
    conn = urllib2.urlopen(baseURL + '&field1=%s&field2=%s&field3=%s' % (temp, hum,press))
    print(conn.read())
    # Closing the connection
    conn.close()

while True:
    temp=round(sense.get_temperature(),2)
    press=round(sense.get_pressure(),2)
    hum=round(sense.get_humidity(),2)
    writeData(temp,press,hum)
    time.sleep(60)
```

Think Speak – Analyse data

- Thingspeak will visualise each field by default in channel view

Thingspeak - Apps

- The Apps tab provides various mechanism to transform, analyse,visualise and act on data.

Analytics

MATLAB Analysis	MATLAB Visualizations	Plugins
Explore and transform data.	Visualize data in MATLAB plots.	Display data in gauges, charts, or custom plugins.

Actions

ThingTweet	TimeControl	React
Connect a device to Twitter® and send alerts.	Automatically perform actions at predetermined times with ThingSpeak apps.	React when channel data meets certain conditions.

ThingSpeak Example: ThingTweet

- Link Twitter account to Thingspeak

- Create a **React** to tweet when a certain condition is met.

- Also tweet from device using HTTP POST:

POST https://api.thingspeak.com/apps/thingtweet /1/statuses/update

api_key=<YOUR_API_KEY>
status=I just posted this from my thing!

Apps / React / Fermenting Beer Too Cold

Edit React

Name:	Fermenting Beer Too Cold
Condition Type:	Numeric
Test Frequency:	Every 30 minutes
Last Ran:	
Channel:	SensePi
Condition:	Field 1 (temperature) is less than 17
ThingTweet:	frankwalsh59: BEER TO COLD!!!
Run:	Only the first time the condition is met

ThingSpeak Example: Analysis

- Can write Matlab Code to analyse and transform data

- Possible uses:
  - Clean data (remove "outliers")
  - Statistical analysis
  - Transfomations
  - Data Fusion

- Generally write results to second channel for further analysis/visualisation.

Thinkspeak: Convert Celcius to Fahrenheit

Convert temperature units

MATLAB Code

```
1
2  readChannelID = 12397;
3  % Temperature Field ID
4  temperatureFieldID = 4;
5
6  readAPIKey = '';
7
8  tempC = thingSpeakRead(readChannelID,'Fields',temperatureFieldID,'ReadKey',readAPIKey);
9
10 % Convert to Fahrenheit
11 tempF = tempC*1.8+32;
12 display(tempC,'Temperature in Fahrenheit');
13
14 % Replace the [] with channel ID to write data to:
15 writeChannelID = 1234;
16 % Enter the Write API Key between the '' below:
17 writeAPIKey = 'abcd';
18
19 thingSpeakWrite(writeChannelID,[tempF,tempC],'Writekey',writeAPIKey);
```

Save and Run   Save*

Other Platforms

- Ubidots
- Amazon Web Services
- Microsoft Azure
- Evothings