Beyond the Blink: Add Drupal to Your IoT Playground

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Hi. I'm Amber.

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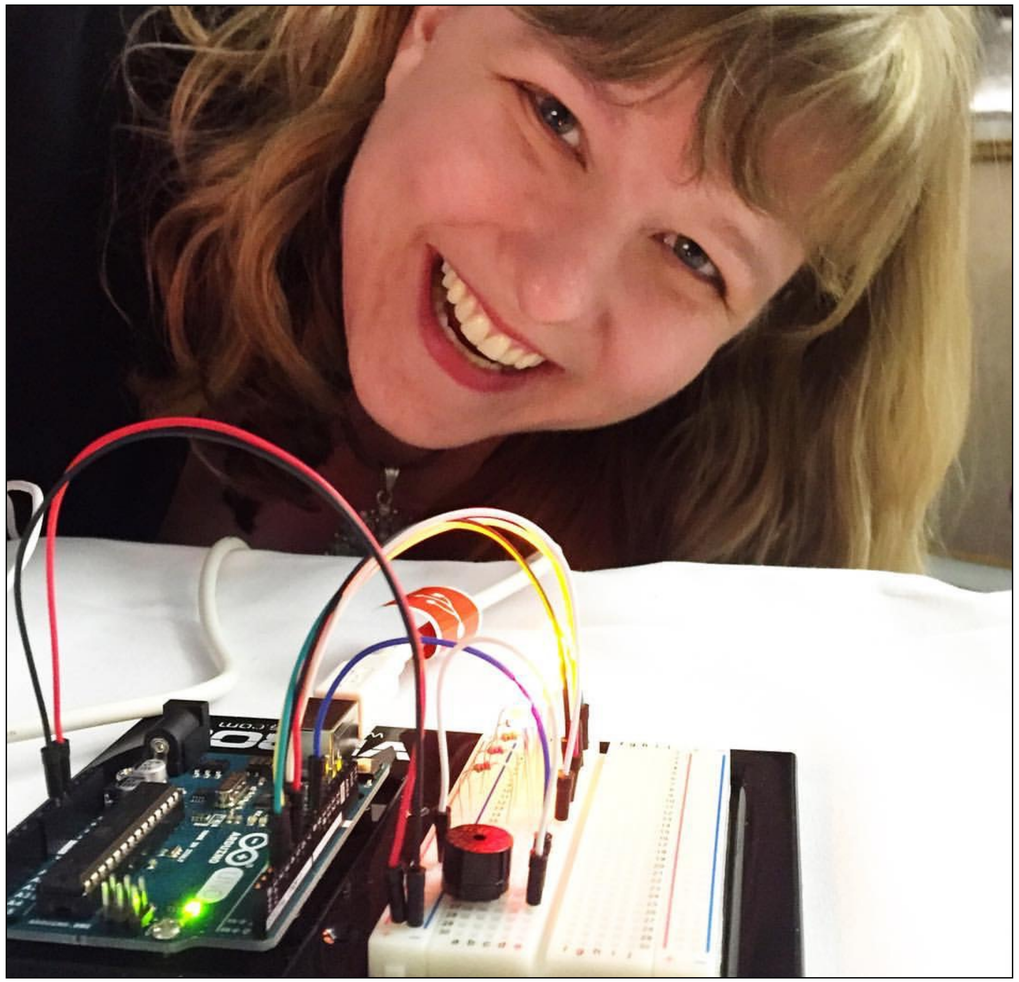


Today's Takeaways

- An introduction to microcontrollers
- What is the Internet of Things (IoT)?
- How can a thing connect to the Internet and why would you want to do that?
- How can machines and devices pass messages to each other?
- What Drupal has now for IoT applications
- What Drupal needs to better serve IoT applications

What is IoT?

IoT = Internet of Things

1. Take a thing

2. Add computational intelligence to it

3. Connect it to the Internet

4. Profit?

It begins with a blink

- Arduino Uno (or compatible)
- Breadboard
- LED (Light Emitting Diode)
- (1) 330 Ohm Resistor
- Jumper wires
- “Blink” example sketch
- Arduino IDE
- USB “printer-type” cable for power and programming the Arduino

Add an analog input

Potentiometer

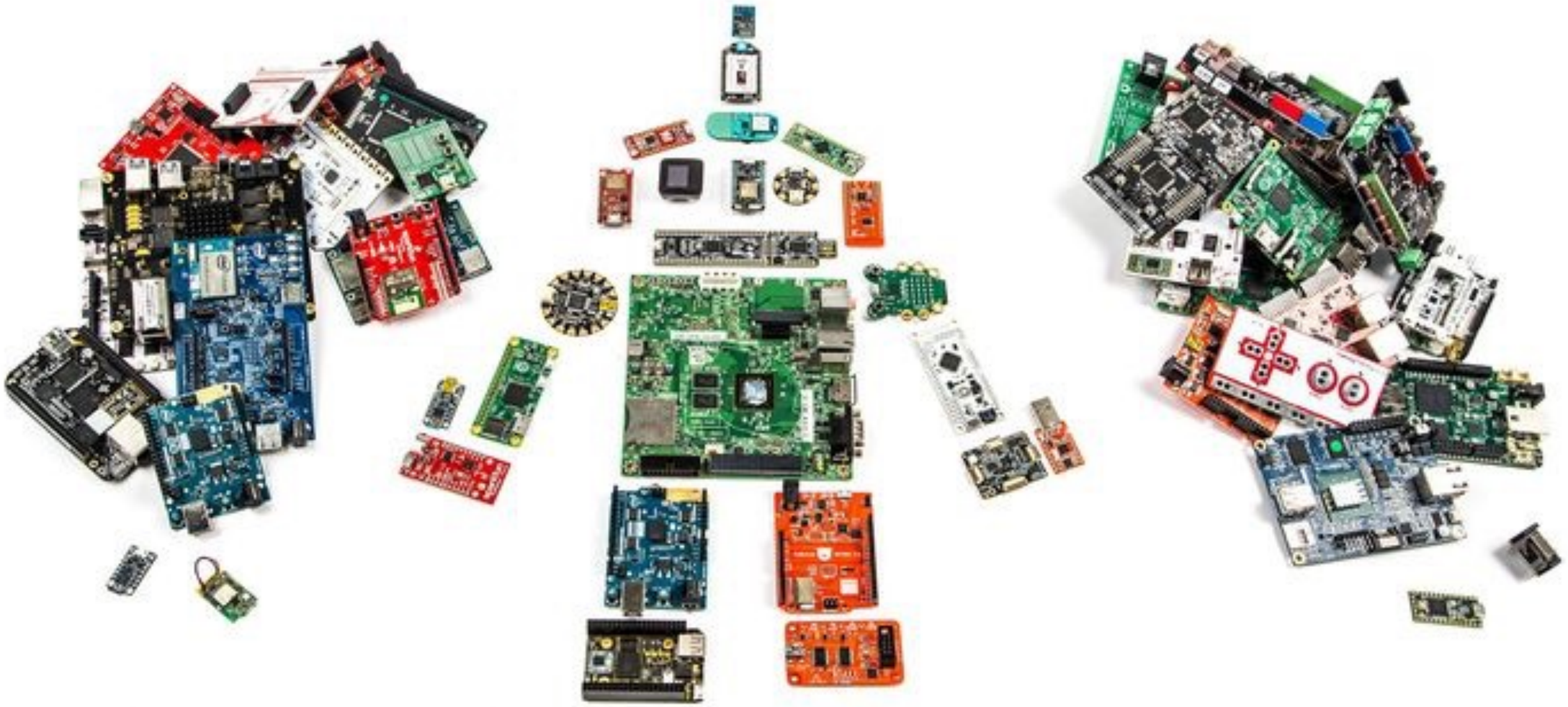
Arduino + Trim Pot to control the blink

Gemma Soft Pot

NeoPixel Hoodie

What is a microcontroller?

Microcontrollers



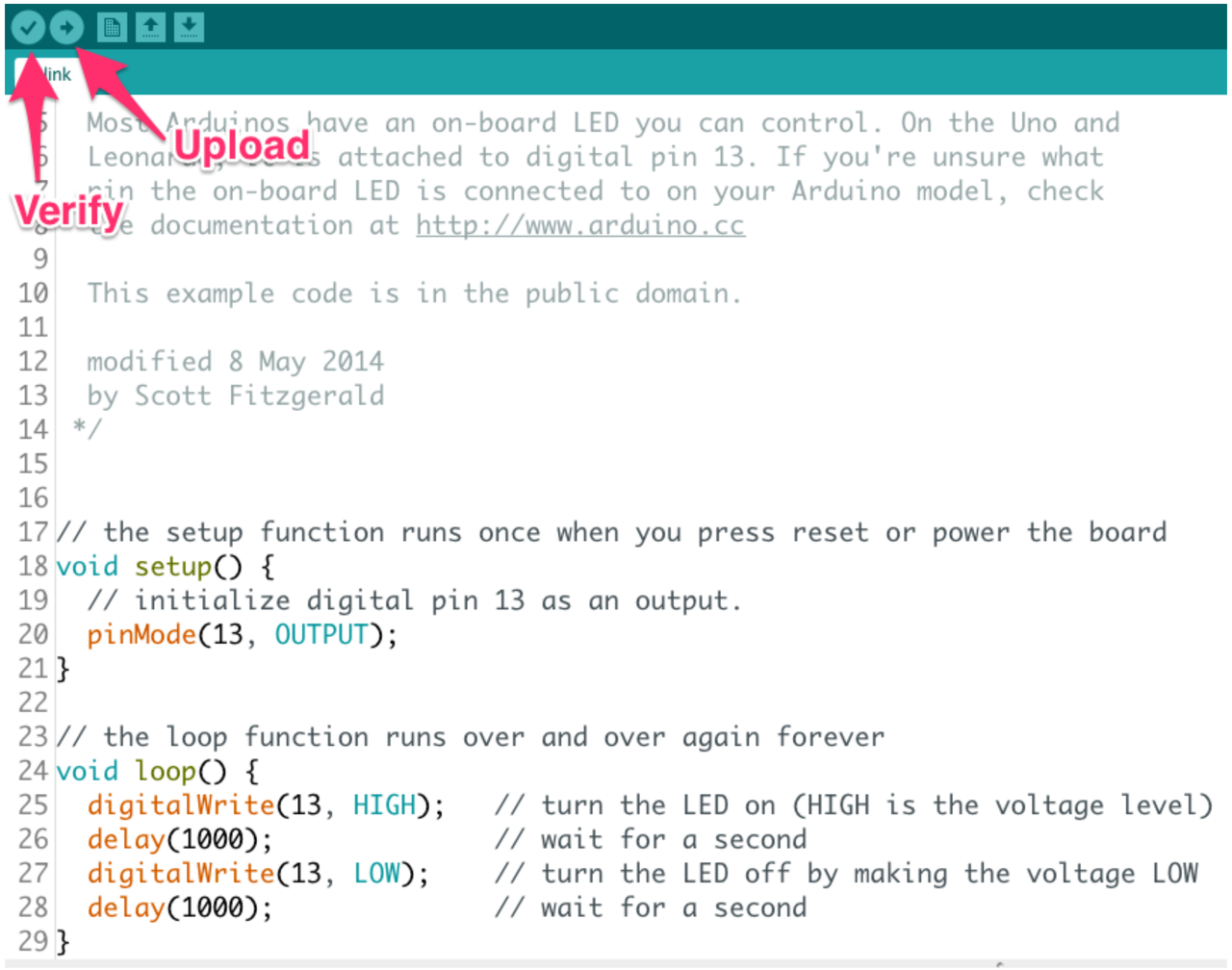
http://makezine.com/comparison/boards/

What is Arduino?

- Arduino IDE
- Arduino boards
- Arduino code
- Arduino community
- Open hardware + source
- Great for automated systems

- setup() runs code once
  loop() runs code in a loop
- Attach sensors to digital or analog inputs
- Extensible with add-ons called “Shields”
- Internet-enabled thru shields

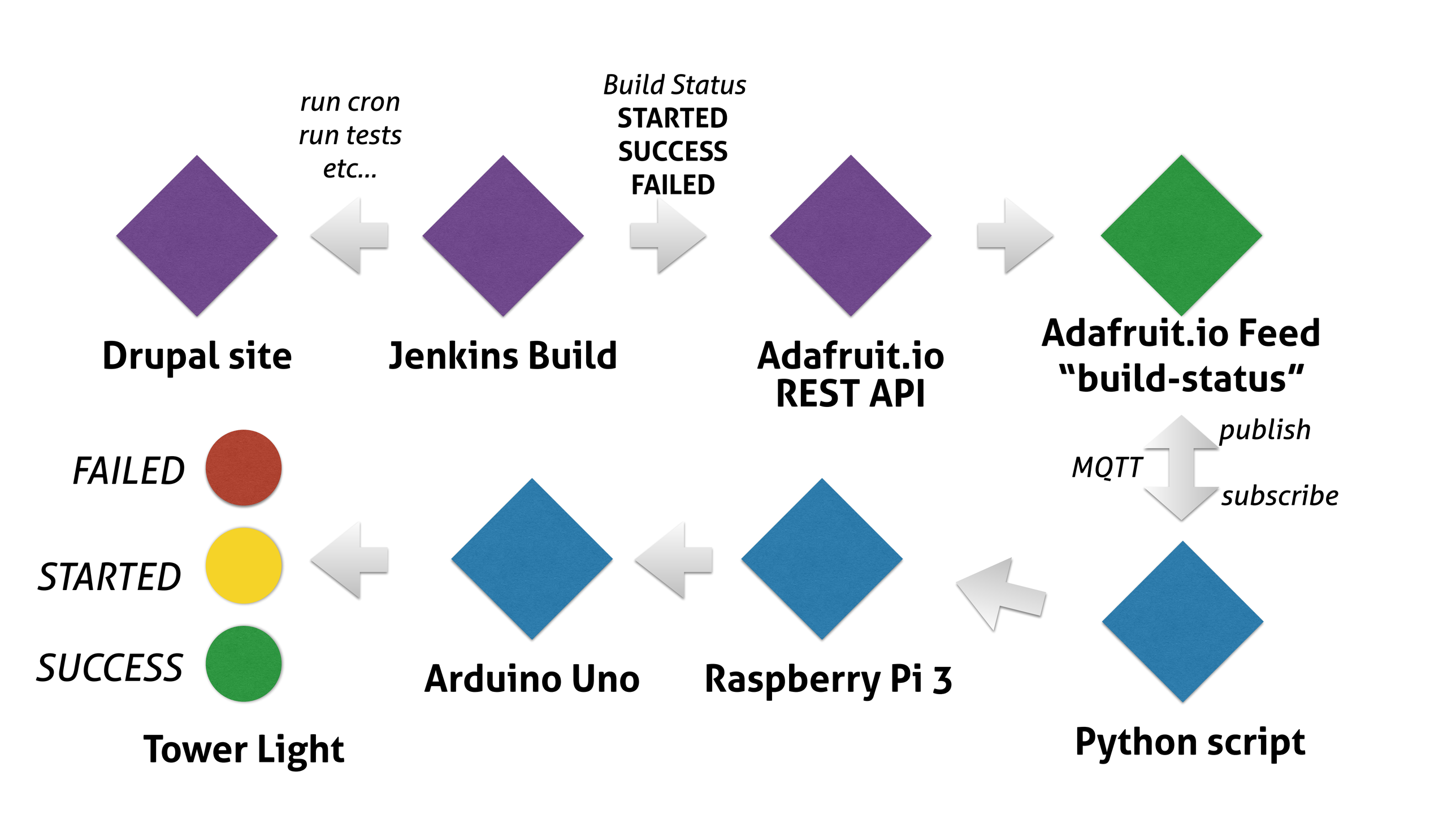
Arduino IDE


Upload
Verify
Most Arduinos have an on-board LED you can control. On the Uno and
Leonardo, it is attached to digital pin 13. If you're unsure what
pin the on-board LED is connected to on your Arduino model, check
the documentation at http://www.arduino.cc
This example code is in the public domain.
modified 8 May 2014
by Scott Fitzgerald
*/
// the setup function runs once when you press reset or power the board
void setup() {
// initialize digital pin 13 as an output.
pinMode(13, OUTPUT);
}
// the loop function runs over and over again forever
void loop() {
digitalWrite(13, HIGH); // turn the LED on (HIGH is the voltage level)
delay(1000); // wait for a second
digitalWrite(13, LOW); // turn the LED off by making the voltage LOW
delay(1000); // wait for a second
}

Raspberry Pi

- Single board Linux computer
- USB, HDMI interfaces
- GPIO pins (similar to Arduino)
- Easy to connect to network and Internet

Tower Light Build Notifier


run cron
run tests
etc...
Build Status
STARTED
SUCCESS
FAILED
Drupal site
Jenkins Build
Adafruit.io
REST API
Adafruit.io Feed
"build-status"
publish
MQTT
subscribe
FAILED
STARTED
SUCCESS
Tower Light
Arduino Uno
Raspberry Pi 3
Python script

So you want an Internet Thing, huh?


WHY?

Reasons to connect

- Your device has data and you want it
- Your device is far away or inaccessible to you and you want its data
- Your device needs data from elsewhere to do its thing
- You have two or more devices that need to exchange data or messages
- You want to trigger some action on your device remotely

Reasons not to....

- You think it will be so easy
- You loathe code
- You hate learning new things

IoT Data Needs

- ***Storage***
- ***Visualization***
- ***Monitors and triggers***
- ***Calculations***
- ***Updatability***

Ways to connect

- ***WiFi***
- ***Cellular***
- ***Ethernet***
- ***Bluetooth LE***
- ***Radio***

Consider this....

- How accessible does your data need to be?
- Will other things need your device’s data to trigger actions?
- How will other machines access your data?
- How will humans access your data?

IoT Cloud APIs

- Store sensor data in feeds/channels
- Hosted REST API endpoints to create, update, delete your data or feeds/channels
- Use message broker protocols like MQTT to distribute data as you require

ThingSpeak

- Store data in channels
- REST API
- ThingSpeak Analytics
  - MATLAB analysis
  - MATLAB visualizations
  - Plugins (gauges, charts, custom)
- Actions/Triggers

Adafruit.io

- Store data in feeds
- Data visualization widgets
- Feed data manipulation tools
- Device control
- Integrates with IFTTT
- Code libraries with helper functions to connect

Context: On-the-go

- Is Thing 1 **on the move** or **away** from a controlled Access Point?
- Can it connect over **Cellular**? Right hardware? SIM? Network access?
- Is it **close** to something else with Internet access?
  - Are they both **Bluetooth LE enabled**?
  - What about using **Radio**?
  - You'll need a **gateway** that can pass data back and forth
- How will the device be **powered**, and for how long?

Temp Sensor Data over Bluetooth LE

Context: WiFi Range

- How often does the “thing” need to refresh its data?
- Does it need to give/receive realtime updates?

WiFi-enabled OLED displays temp

Monitor + Trigger

- Autonomous systems can take action when:
  - User input is received
  - Sensor data reaches a certain value
  - Time-based conditions are met

Action brokers

- Web services and APIs provide web-based interfaces for setting up data triggers and actions
  - ThingSpeak
  - IFTTT
  - MQTT brokers
  - Custom solutions

Every day at 07:00 AM

Send data to hightemp feed

Recipe Title

If every day at 07:00 AM, then send data to hightemp feed

Actions

ThingTweet

Connect a device to Twitter® and send alerts.

TweetControl

Listen to the Twitterverse and react in real time.

TimeControl

Automatically perform actions at predetermined times with ThingSpeak apps.

React

React when channel data meets certain conditions.

TalkBack

Queue up commands for your device.

ThingHTTP

Simplify device communication with web services and APIs.

Component-based

- One Thing does not rule them all (in the maker/hacker space)
- Use as “component-based” approach to add functionality and connectivity
- Leverage services that your thing has access to, like cloud-based APIs design for IoT data needs

What about Drupal?

What Drupal has now

- Guzzle (code wrapper for HTTP Requests/Responses)
- A vendor directory (ability to add external PHP dependencies)
- Ability to utilize/integrate JavaScript, Node.js, etc.

Drupal with a map of points from ThingSpeak

Drupal example

- Uses Guzzle to get latitude/longitude data from a ThingSpeak channel that tracks the location of the Mary Maersk container ship
- Has a simple form that will get data from ThingSpeak and create a bunch of location nodes
- Uses Views to create a REST endpoint with a GeoJSON formatter
- Uses Leaflet to display the map using the GeoJSON object at a local endpoint

Improvements

- Automated updates (if channel has new data, get it)
- Only get new data
- Only create nodes if data is new (don’t duplicate)

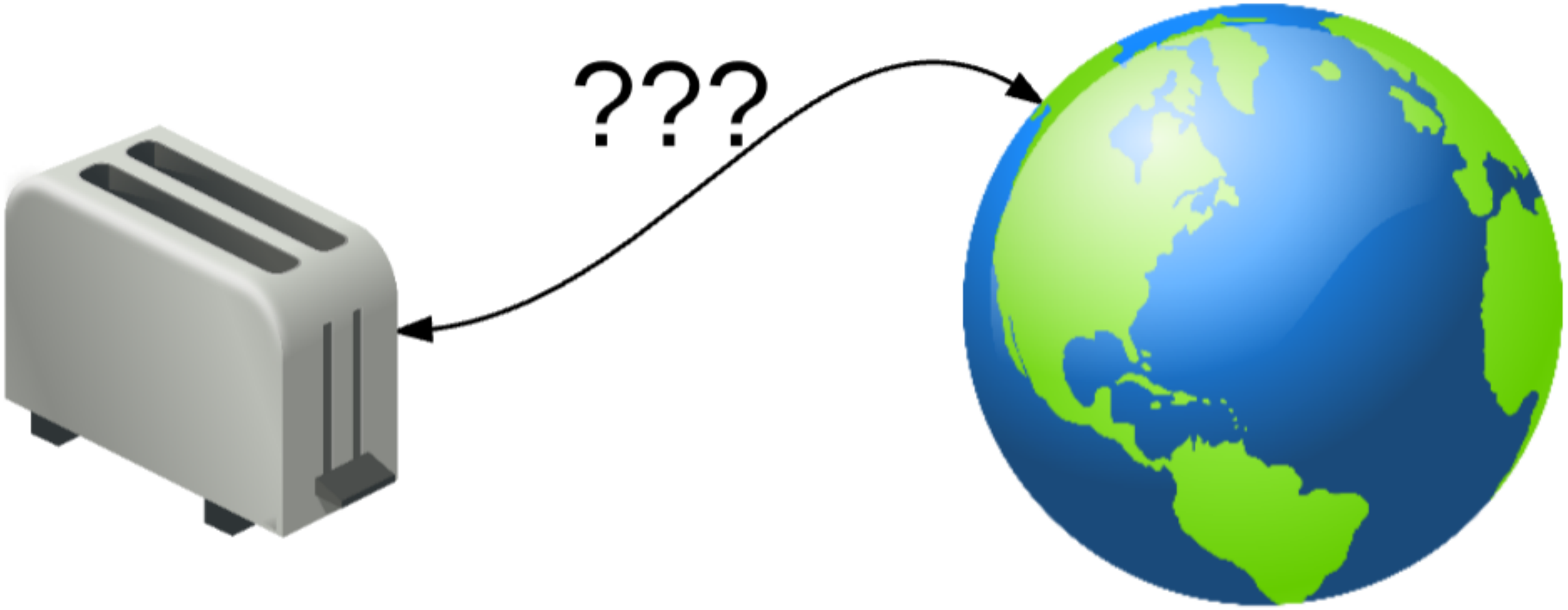
In my opinion....

- Drupal needs better ways to consume data from endpoints
- Drupal needs both code-based and UI-based tools to accommodate IoT data stored or communicated in the cloud
- Drupal needs modules that can handle frequent data updates over HTTP that go beyond “polling”

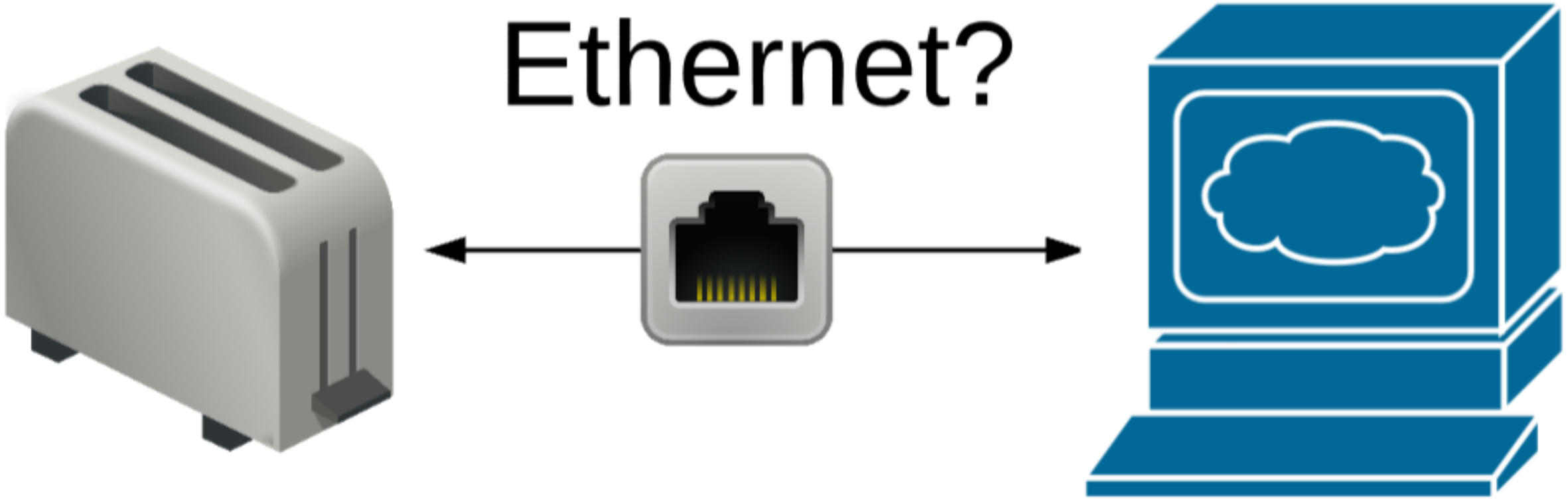
What Drupal needs

- Integration with popular IoT APIs
- MQTT
- Something like Feeds where you can create or update nodes
- Data visualization Views display plugins
- Create Views from JSON objects at an endpoint (not local)


MQTT



https://learn.adafruit.com/mqtt-adafruit-io-and-you/why-mqtt



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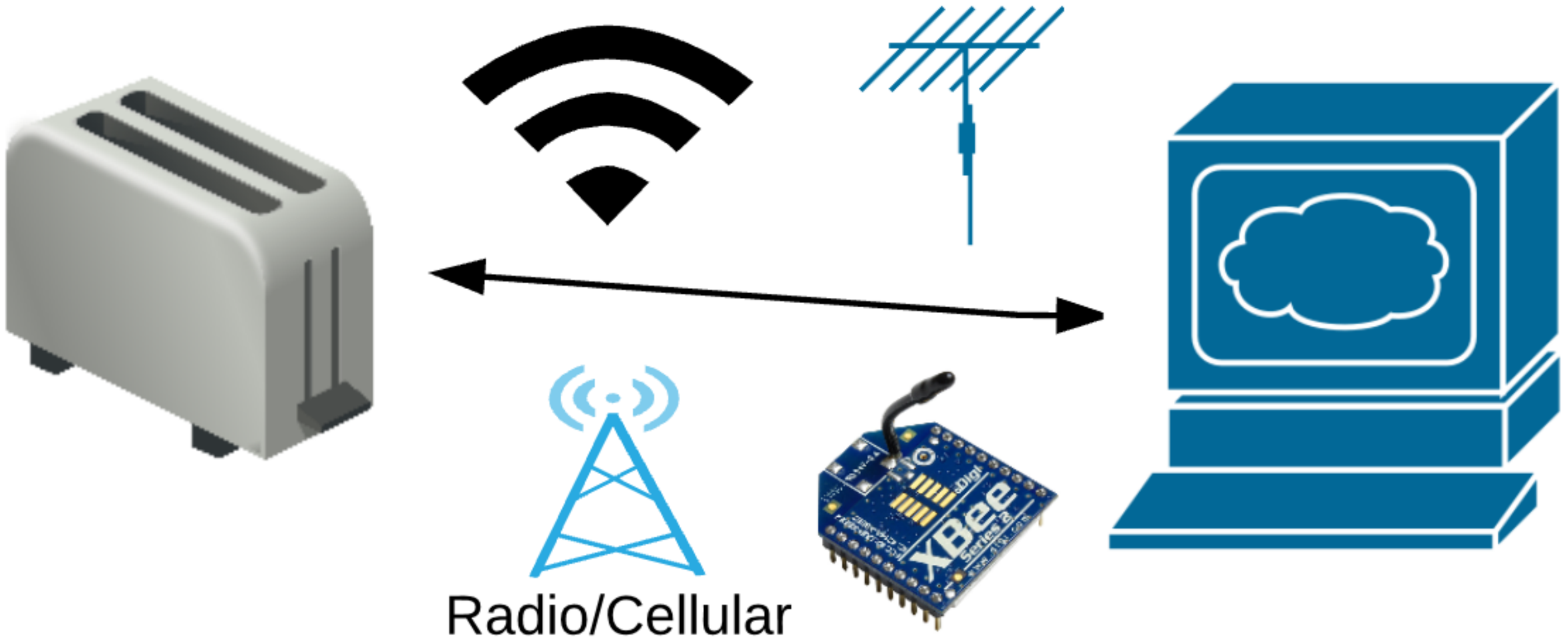

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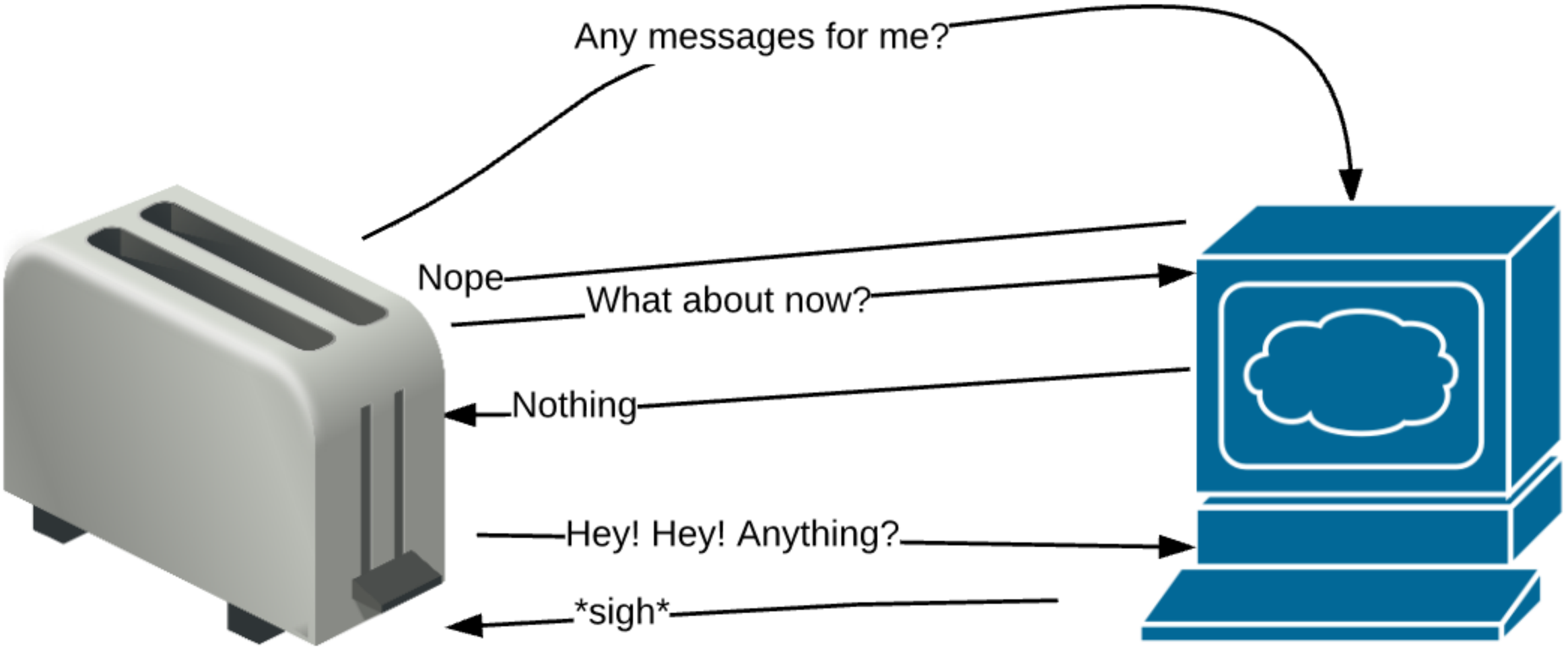
Portability = Power

- If you’re using wireless, you’ll need to consider how you will power the device.
- Low power = good

What about HTTP (REST)?



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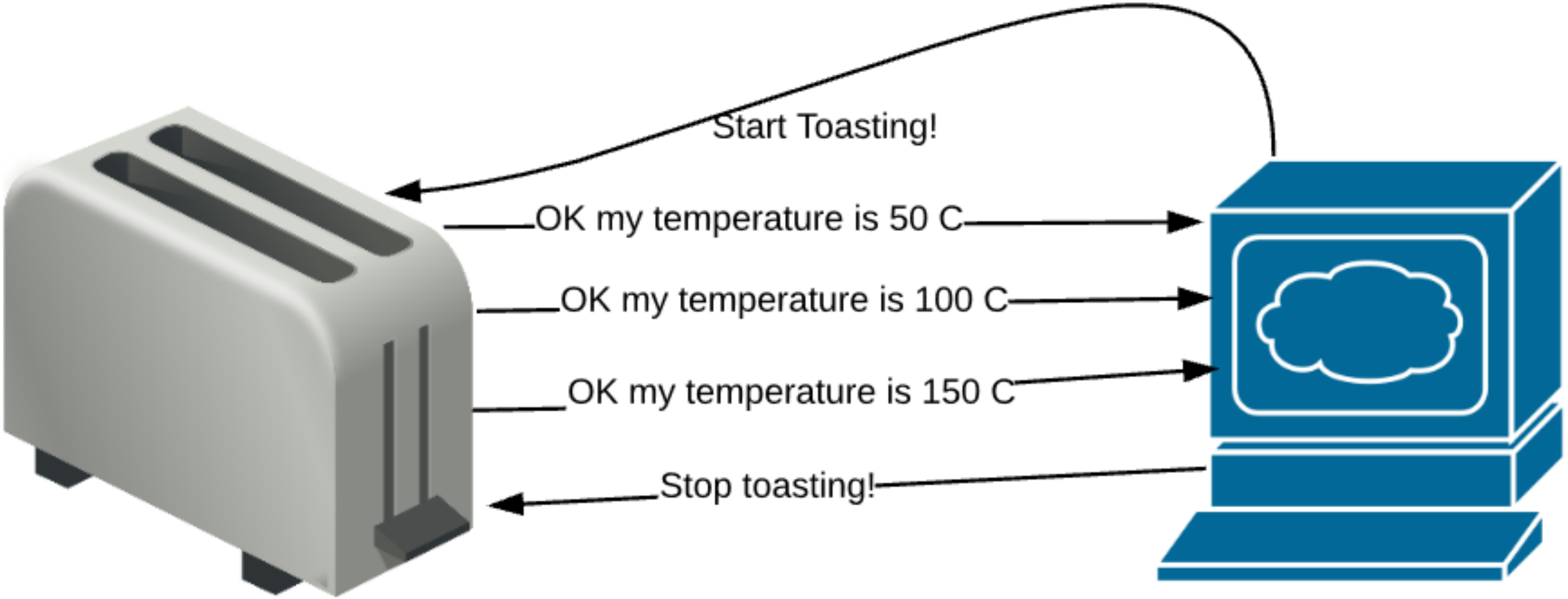
Enter....MQTT!



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MQTT to the rescue!

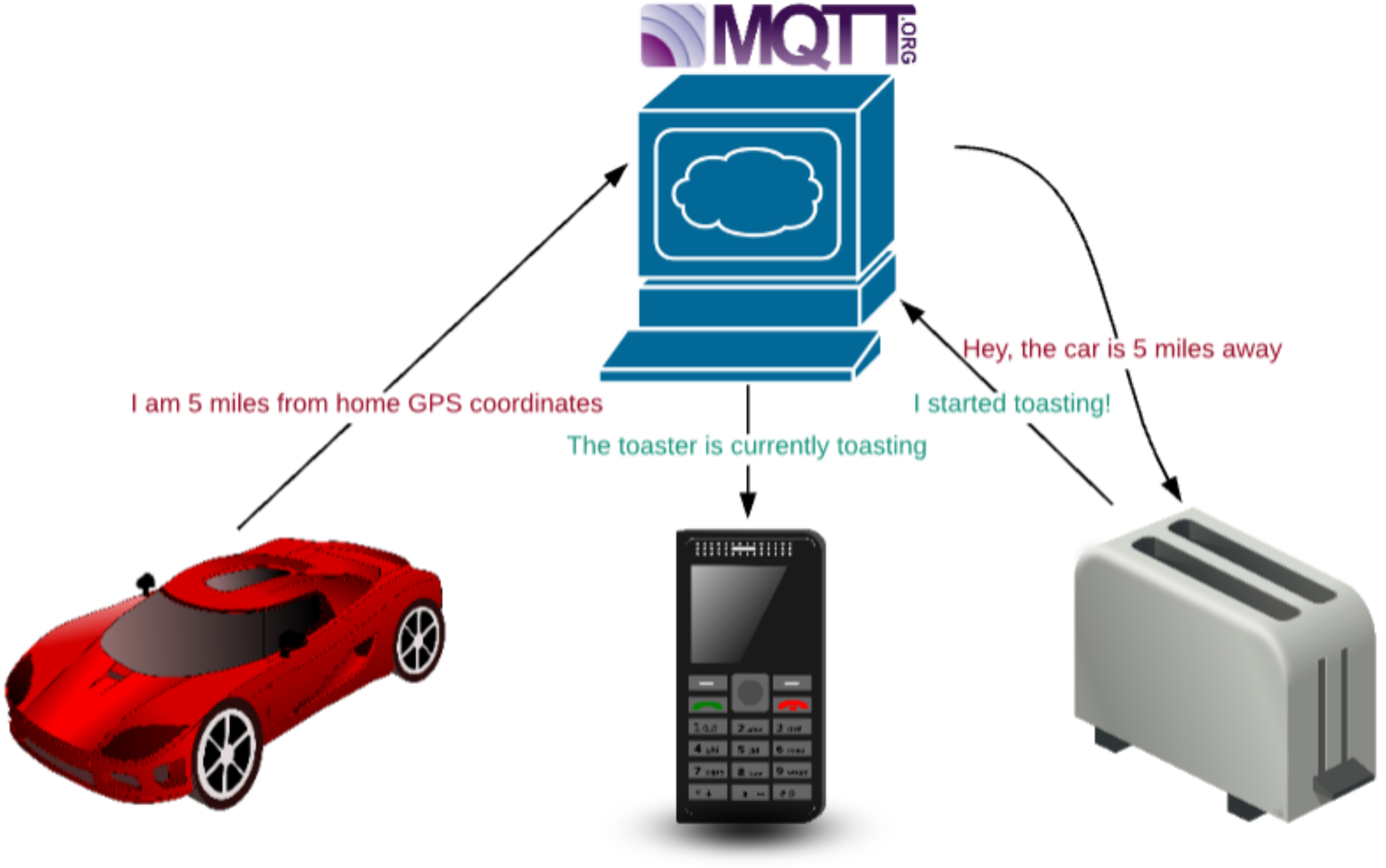
- Publish (push data from device to server)
- Subscribe (pull data from server to device)
- Connection stays open
- Can connect over various types of networks (TCP/IP, Bluetooth)

IoT Data is special

- IoT uses sensor data a LOT.
- Why monitor sensor data if you're not going to trigger some action?
- Why trigger an action if it's too late?
- "The house was full of smoke…3 hours ago, when cron was run."

MQTT Brokers

- A server that both (or all) your devices can talk to or retrieve messages from
- No need for Thing 1 to talk directly to Thing 2 (know its IP address, wait for a connection, etc.)
- The 3rd party broker is a neutral party that your Things can connect to and send and receive messages


MQTT.ORG
I am 5 miles from home GPS coordinates
The toaster is currently toasting
Hey, the car is 5 miles away
I started toasting!

Resources

- https://learn.adafruit.com/mqtt-adafruit-io-and-you/why-mqtt
- http://www.hivemq.com/blog/mqtt-essentials-part-1-introducing-mqtt

Gotchas, "Oh-No's" and other sad tales

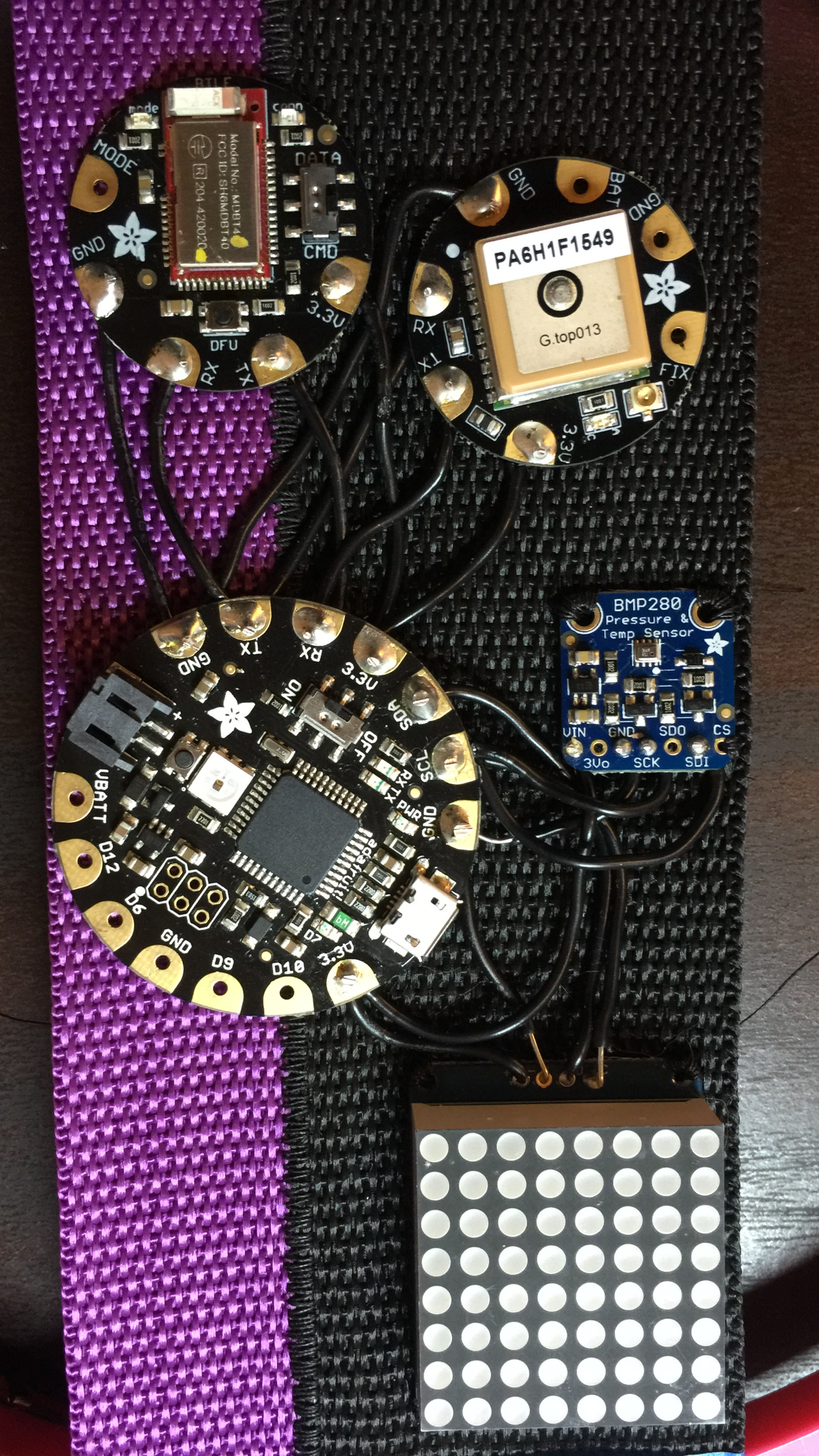
Hardware limits

- What can your microcontroller or single-board computer do?
- What is required to get it connected in the way that you need it to get connected?
- Can it run the code in your program?
- Are there libraries that can help you with your code?
- Is the documentation up-to-date?

Storage limits

- Is there enough program storage space for all of the code you need to run on this microcontroller?
- Each component requires a library
- If you're "adding-on" internet, you'll be adding a library
- Do you have space for that?

RIP Thing 2


MODE
GND
DATA
CMD
3.3V
DFU
RX
TX
Model No.: MDBT40
FCC ID: SH6MDBT40
GND
BAT
GND
PA6H1F1549
G.top013
RX
TX
FIX
3.3V
BMP280
Pressure &
Temp Sensor
VIN
GND
SDO
CS
3Vo
SCK
SDI
GND
TX
RX
3.3V
SDA
SCL
ON
OFF
PWR
RX
TX
GND
VBATT
D12
D6
GND
D9
D10
D7
3.3V

Takeaways

- Before you add Internet to a Thing, consider the following:
  - How will you connect?
  - What kind of microcontroller or computer do you need?
  - Can you actually get it? (Is it in stock?)
  - What will you do with the data and how?

For Drupal....

- Drupal has good ways of exposing an API, but needs better ways to consume APIs and handle real-time updates
- Contributions that help Drupal sites utilize IoT APIs is a good place to start
- Contributions that can talk to MQTT brokers and/or enable other pubsub protocols for message passing is critical if Drupal is to be a beneficial tool in the IoT space

So How Was It? Tell Us What You Think

Evaluate this session:
https://events.drupal.org/neworleans2016/sessions/beyond-blink-add-drupal-your-iot-playground

Thanks!