Publish/Subscribe and IFTTT

44-440/640-IoT

Objectives

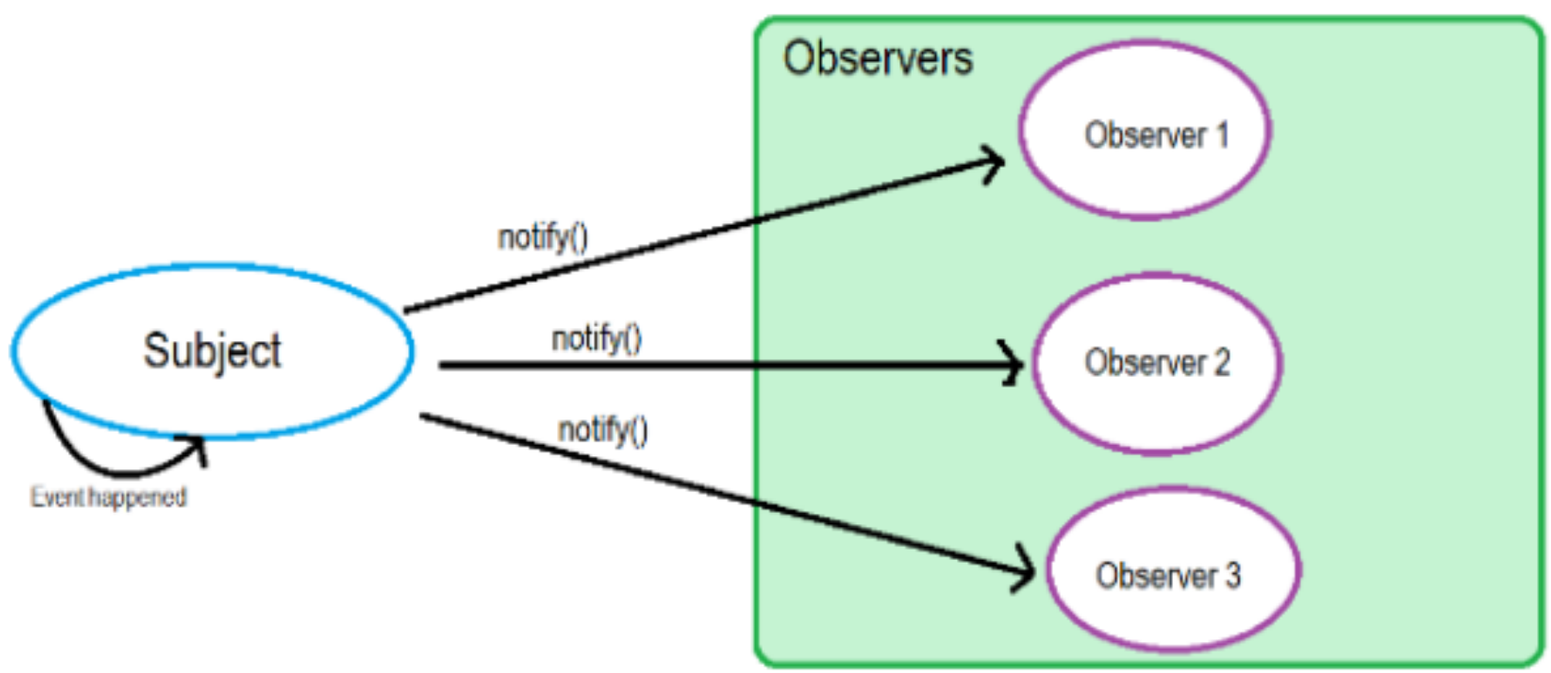
- Students will be able to:
  - describe the publish and subscribe design pattern and how it is implemented in Particle
  - describe the purpose and function of IFTTT
  - understand how to access variables and invoke functions using IFTTT
  - create novel applets using IFTTT
  - use IFTTT with events

Executive Summary:

IoT allows devices to talk to one another. In this keynote we take our first tentative steps to make that happen.

The Observer Pattern

- In an observer pattern, the subject keeps track of its observers, and notifies them when any state changes, by invoking an appropriate method



Observer design pattern (A bird's eye view :P)

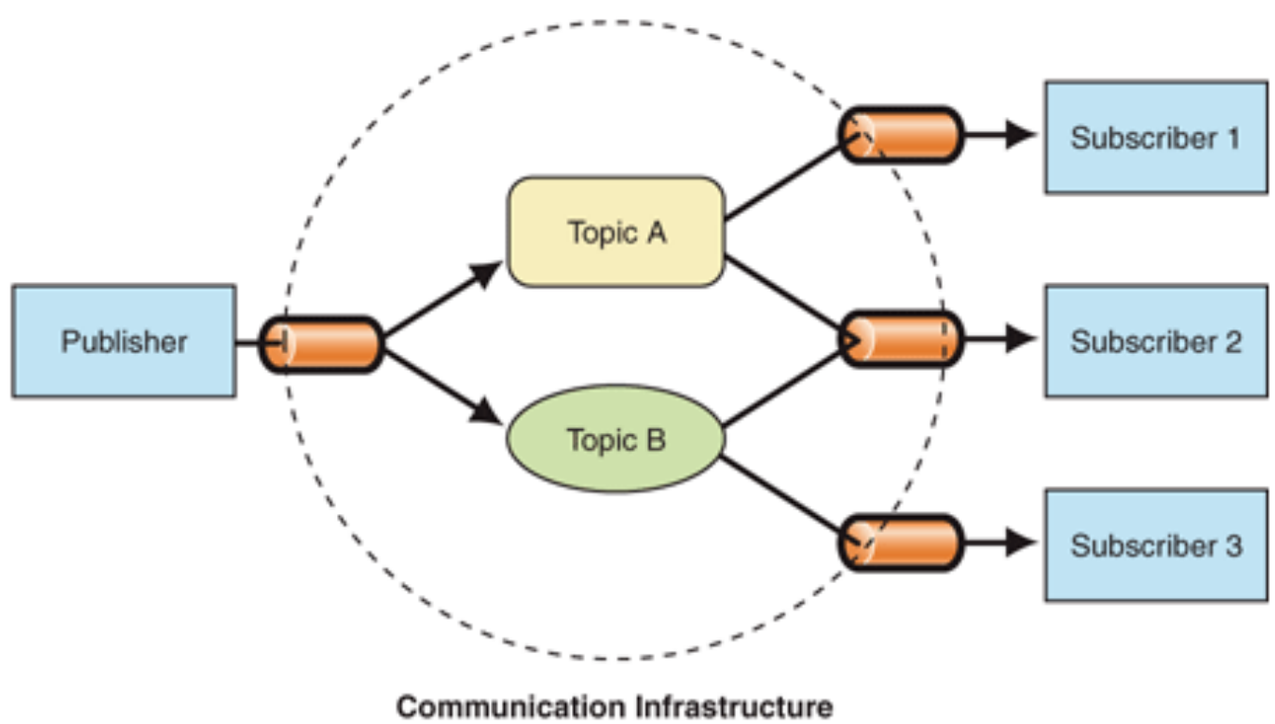
Publish/Subscribe Pattern

- In this pattern, there is an intermediary between the subject (now called a publisher) and the observer (now called a subscriber)

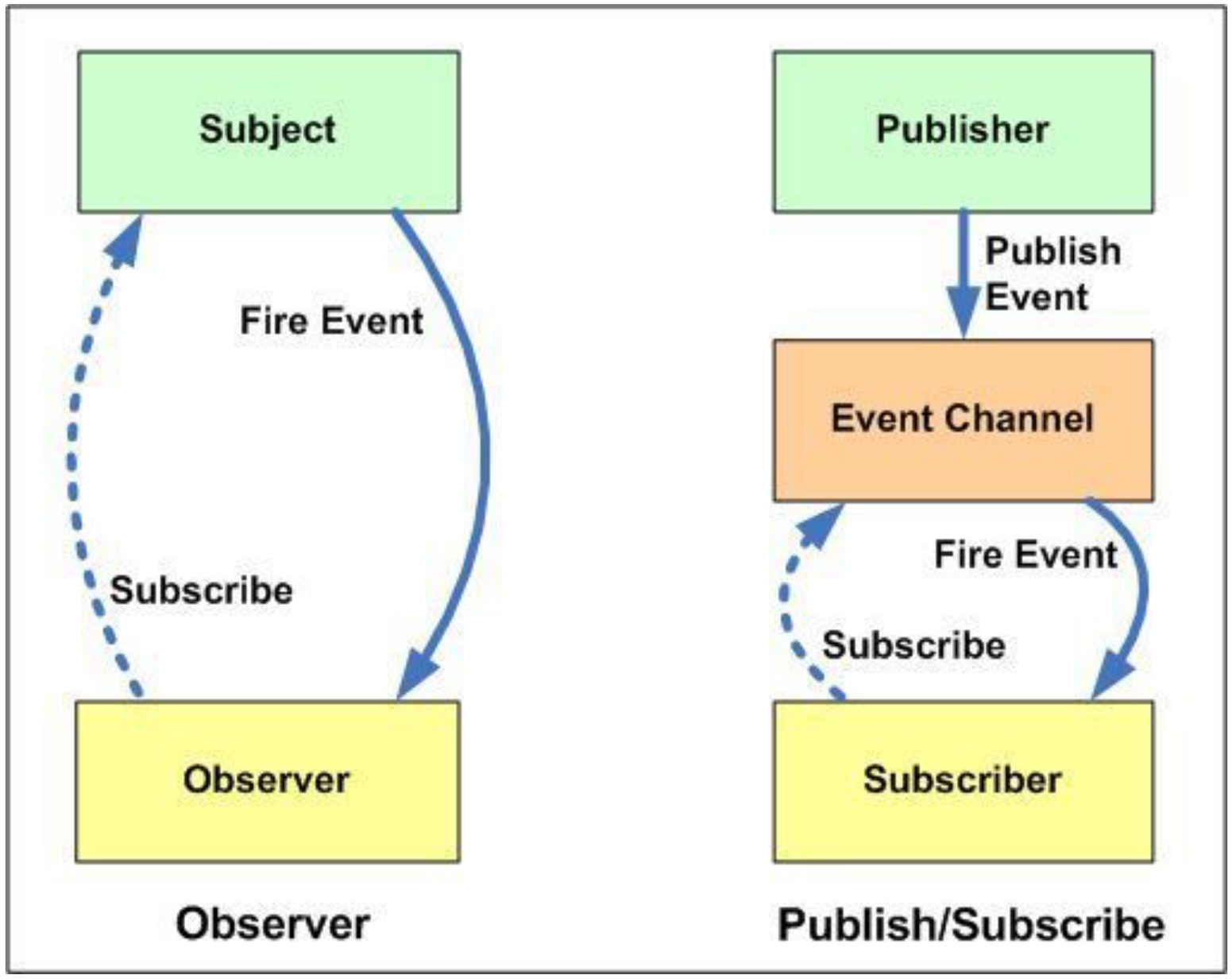
- The publisher publishes an event; the subscribers learn about it; but the publisher doesn't know who its subscribers are, and vice-versa

- It is affectionately known as **pub/sub**

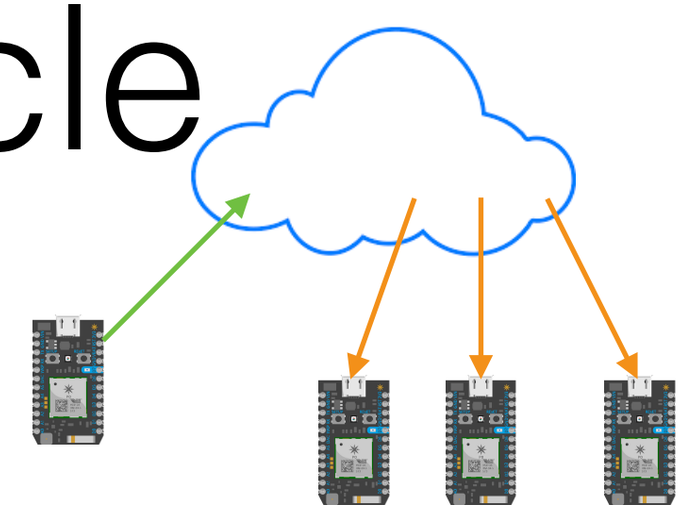
- The intermediary is known as a broker, message broker or event bus



To Summarize ...



Events in Particle

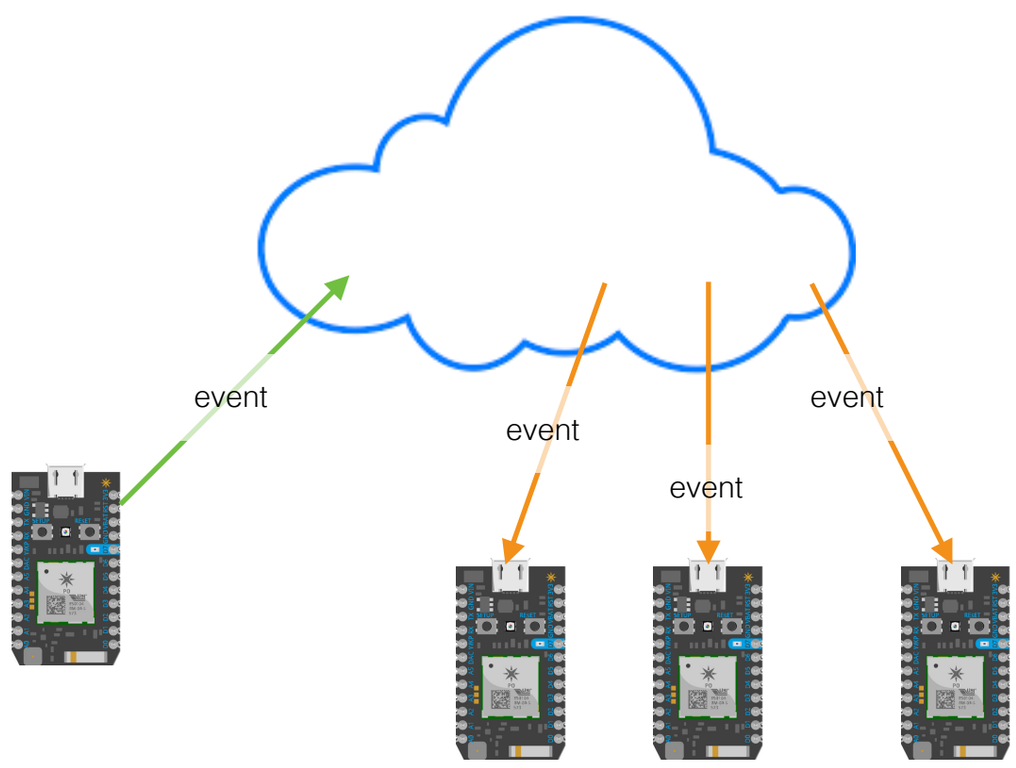


- In Particle, an event has 4 properties:
  - **name** (1-63 characters)
  - **data** (≤ 255 bytes)
  - **time to live** (0-16777215, but 60 is the *immutable* default time)
  - **access level** (public: *anyone* can subscribe. private: only the device owner can subscribe)

The data is entirely implementation/context dependent.

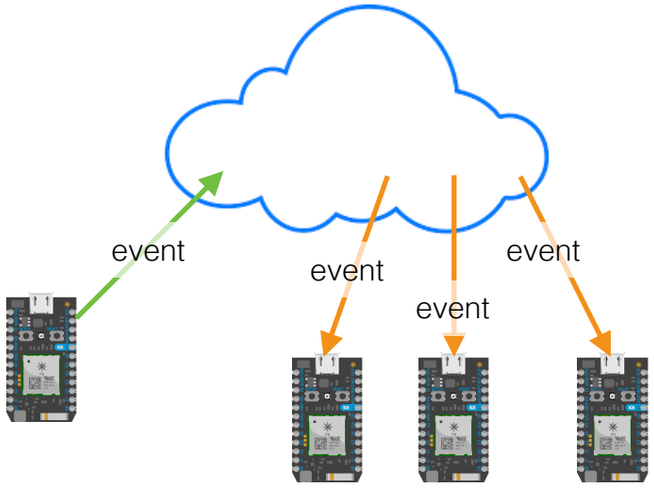
Events in Particle

- Events can be
  - published to the cloud, via **Particle.publish()**
  - subscribed to by other devices, via **Particle.subscribe()**



Events in Particle

- The ability for multiple Photons to receive events raises all *sorts* of interesting possibilities ...



- Events can be published at about the rate of 1 event / second. Don't flood the system!!!

- Use the Particle console, under devices, to see events: (click on a log entry for raw data)

Particle.publish()

API:

- Particle.publish(const char * eventName, PublishFlags flags);
- Particle.publish(const char * eventName, const char * data, PublishFlags flags);
- Particle.publish(const char * eventName, const char * data, int ttl, PublishFlags flags);

Examples:

- Particle.publish("Low On Fuel", PRIVATE);
- Particle.publish("Garage Door Event", "Closed", PRIVATE);
- Particle.publish("Battery Charge", "2.8 V", 60, PUBLIC);

Anywhere const char * appears, you can also use String, it gets converted: see this discussion.

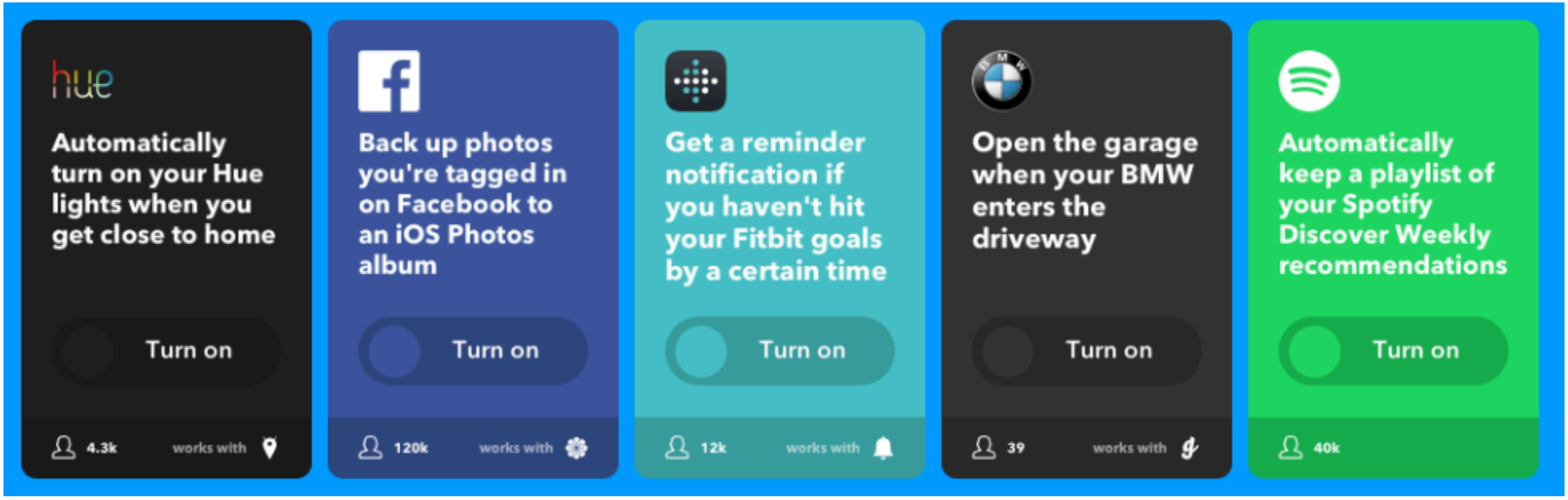
Particle.subscribe() Details

- Particle.subscribe(const char * eventName, EventHandler handler)
- Particle.subscribe(const char * eventName, EventHandler handler, Spark_Subscription_Scope_TypeDef scope=ALL_DEVICES)
  - This will subscribe you to any event that **starts** with eventName, e.g., if you subscribe to, say "gro", you will be notified when any event that starts with "gro" ("grok", "groan", "grocer", etc.)
  - The **<u>event handler</u>** is any void function with two C Strings (this is *different* than a Particle function: an int function with 1 C String). This function will be triggered when the event is published
  - You can subscribe to up to 4 event handlers

```
typedef void (*EventHandler)(const char* name, const char* data);

typedef enum
{
  MY_DEVICES,
  ALL_DEVICES
} Spark_Subscription_Scope_TypeDef;
```

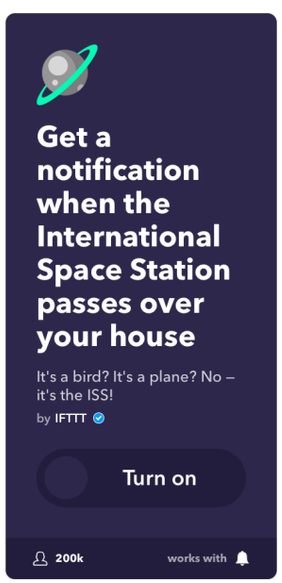
IFTTT Concepts

- IFTTT (pronounced like "Gift" without the G) stands for If This Then That. It connects web services together to create new functionality.

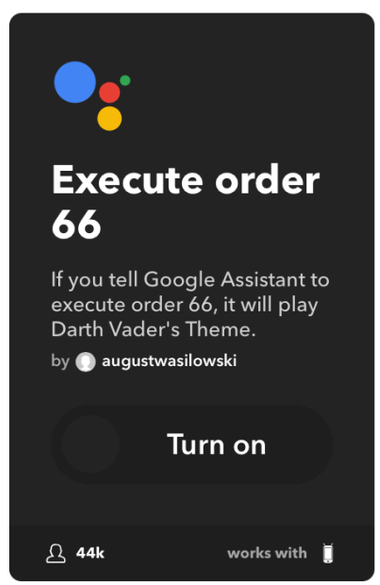


IFTTT Concepts

- IFTTT is based on **applets**. An applet consists of a **trigger** and **action**.
- When the trigger is fired, the action takes place
- Data, or **ingredients**, available in the trigger, can be passed to the action.
- Here are some possibilities: take a few moments to <u>find others</u> ...

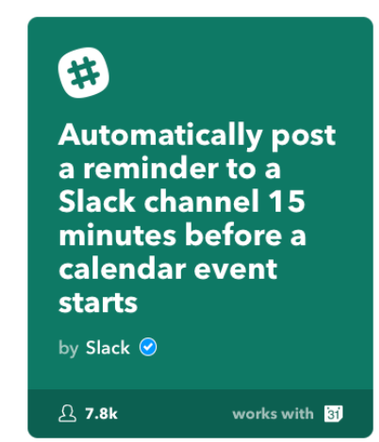


Trigger: The ISS is over your house
Action: Get a text message



Trigger: OK, Google, execute order 66
Action: Google plays Darth Vader's Theme

Trigger: Push a button
Action: Get a phone call



Trigger: 5 minutes until a Google Cal event
Action: Post a reminder to a Slack channel

Particle Triggers and Actions

New event published

This Trigger fires when an interesting event comes from a particular device. Send events using Particle.publish.

Monitor a variable

This Trigger fires when a value on your Particle device changes to something interesting. Include particle.variable in your Particle code.

Monitor a function result

This Trigger checks a function on your device to see if something interesting is happening.

Monitor your device status

This Trigger fires when your device changes states (i.e. when it goes online or offline.) Useful for detecting the power is out, when the internet is down, or when your Particle device sleeps much of the time.

Triggers

Publish an event

This Action publishes an event back to your Device(s), which you can catch with particle.subscribe.

Call a function

This Action will call a function on one of your Devices, triggering an action in the physical world.

Actions

In constructing an Applet, you will likely use a Particle Trigger or Action, but not both together.

IFTTT ICE: Preliminaries

1. Bring to class a completed circuit that contains:
    1. a TMP 36
    2. a button
    3. an LED
2. Flash firmware that has the following capabilities:
    1. when the button is pressed, it stores the temperature in a Particle variable, **temperature**, and writes it out to the console
    2. Particle functions, **turnOn()** and **turnOff()** that turn the LED on and off, respectively.
3. Get an account on IFTTT.com (enable Particle, Phone, Email and Twitter integration)

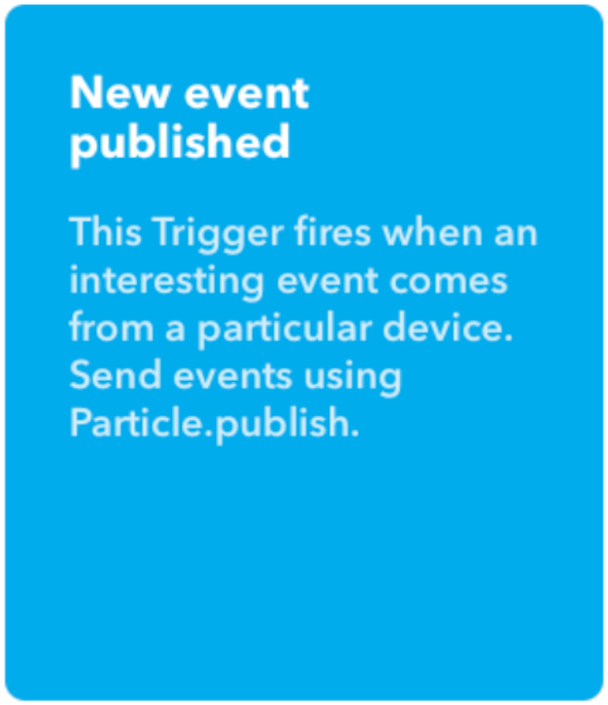
IFTTT ICE: New Event Published

1. Modify your firmware so that when the button is pushed, it publishes an event with two arguments:

    1. "pushed" -- the event name

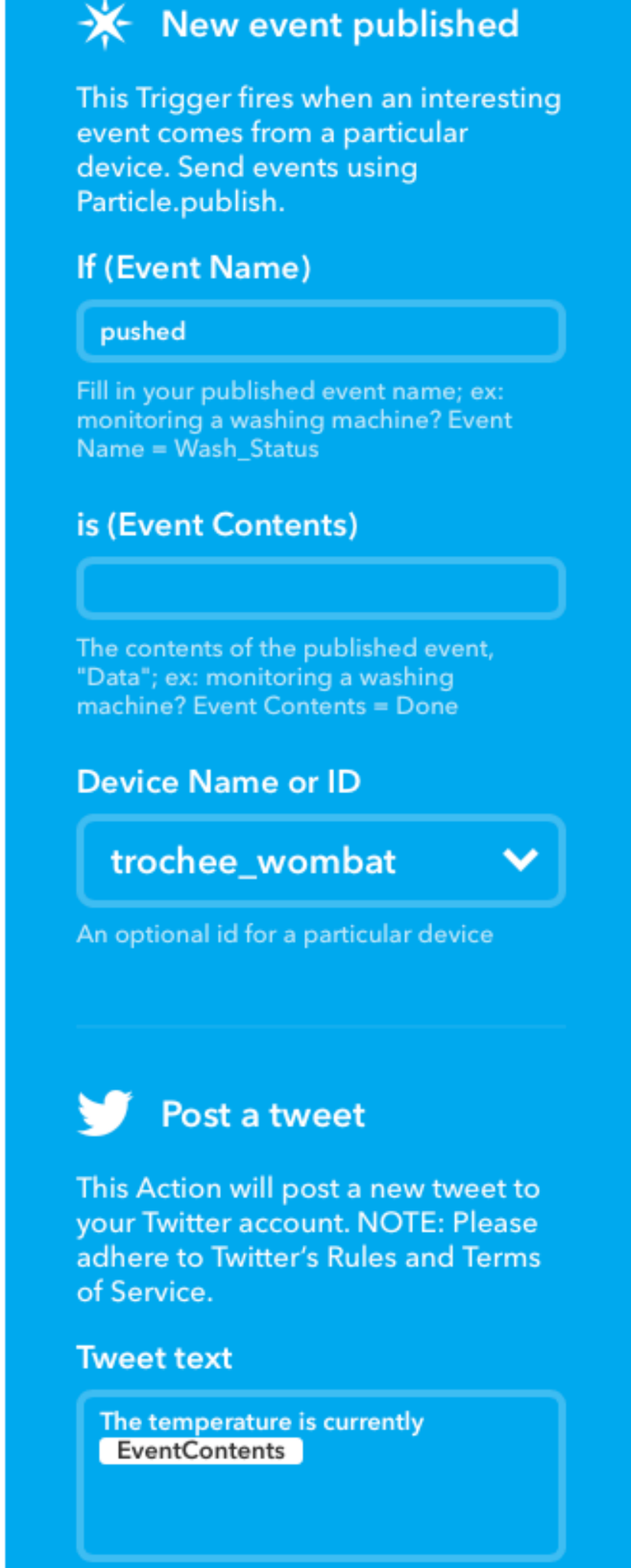
    2. String(temperature) -- the data

2. Create an applet in IFTTT that will, when pushed is received, post a tweet that indicates the temperature



IFTTT ICE: New Event Published - Solution

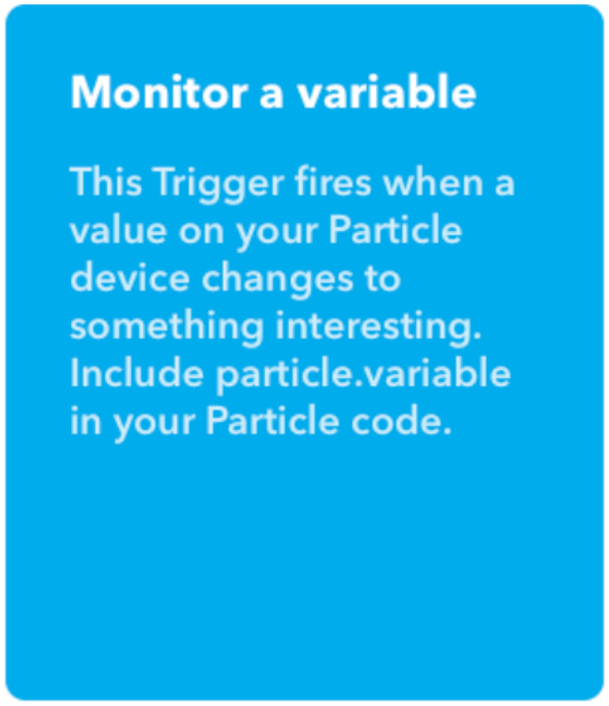
```
double temperature = 0.0;
const int yellowLED = D0;
const int switchy = A0;
const int temperaturePin = A1;

void setup() {
    pinMode(yellowLED,OUTPUT);
    pinMode(switchy,INPUT_PULLUP);
    pinMode(temperaturePin, AN_INPUT);

    Particle.variable("temperature",temperature);
    Particle.function("turnOn",turnOn);
    Particle.function("turnOff",turnOff);
}

void loop() {
  if(digitalRead(switchy)==LOW){
     double voltage = analogRead(temperaturePin)/4095.0 * 3.3;
     temperature = 104.7*voltage - 53.1;
     Particle.publish("pushed", String(temperature,2));
     delay(250);
  }
}

int turnOn(String data){
  digitalWrite(yellowLED,HIGH);
}

int turnOff(String data){
  digitalWrite(yellowLED,LOW);
}
```



IFTTT ICE: Monitor a Variable

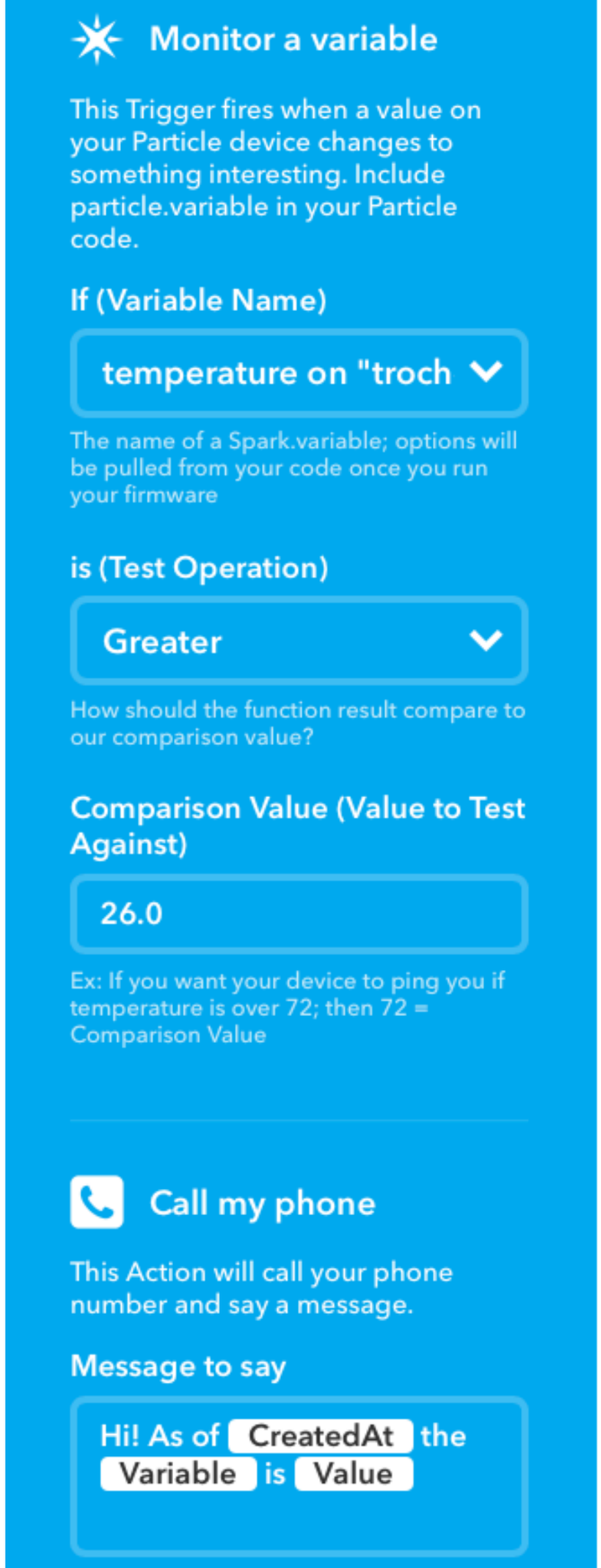
- Create an applet such that when the temperature exceeds current temperature + 0.5°, it calls your phone (from 415-969-2754)

- Test it by breathing on your TMP36



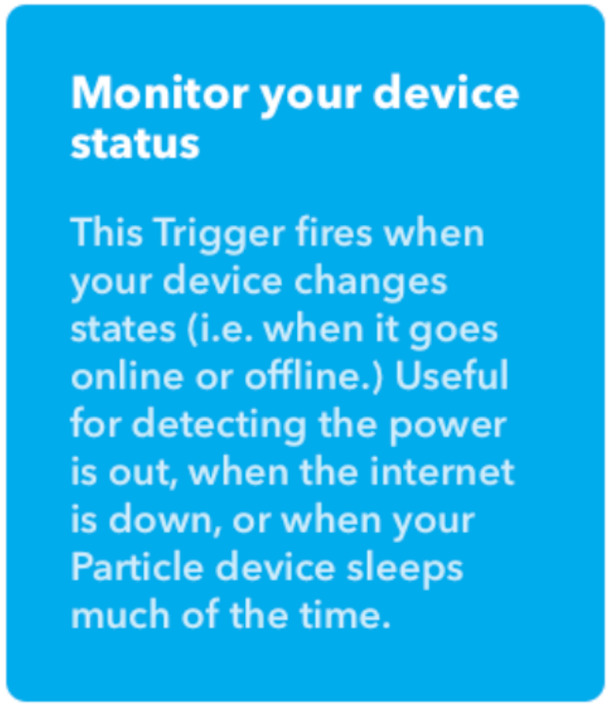
IFTTT - ICE: Monitor a Variable - Solution

- No extra code is required, since temperature is a Particle variable



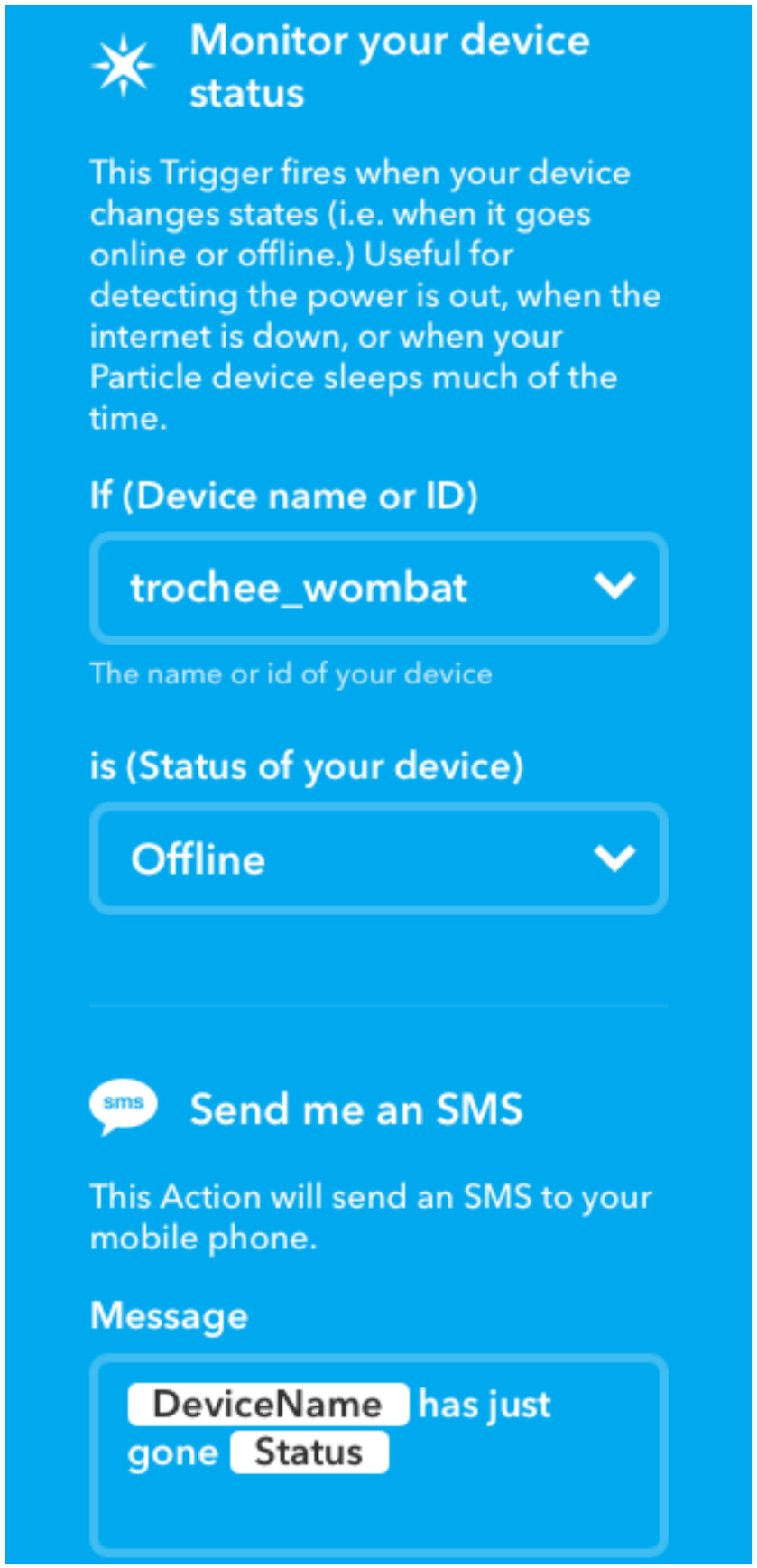
IFTTT ICE: Monitor Your Device Status

- Create an applet so that if your device goes offline, you get a text



IFTTT ICE: Monitor Your Device Status - Solution

- It took a 1.5 minutes for this to get triggered
- Starting with DeviceOS 0.8.0, some of this functionality is <u>available natively in Photon</u>



IFTTT ICE: Call a Function

- Call a Function is an **action**, which means any trigger available through IFTTT can invoke a function on your Particle

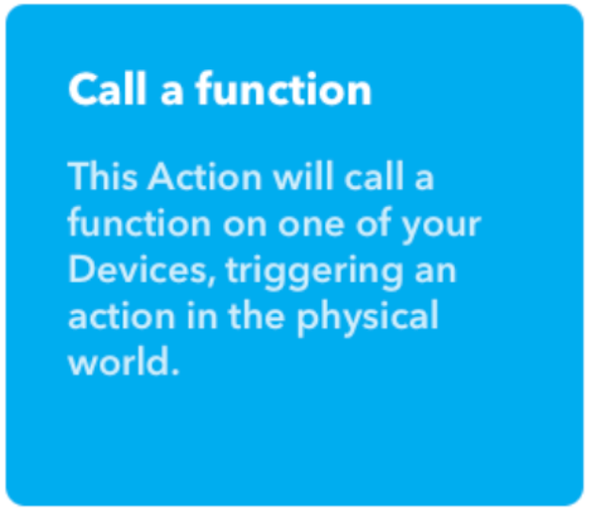
- Write an applet so that when you send either

  a) a Tweet with a hashtag #ILikePhoton,

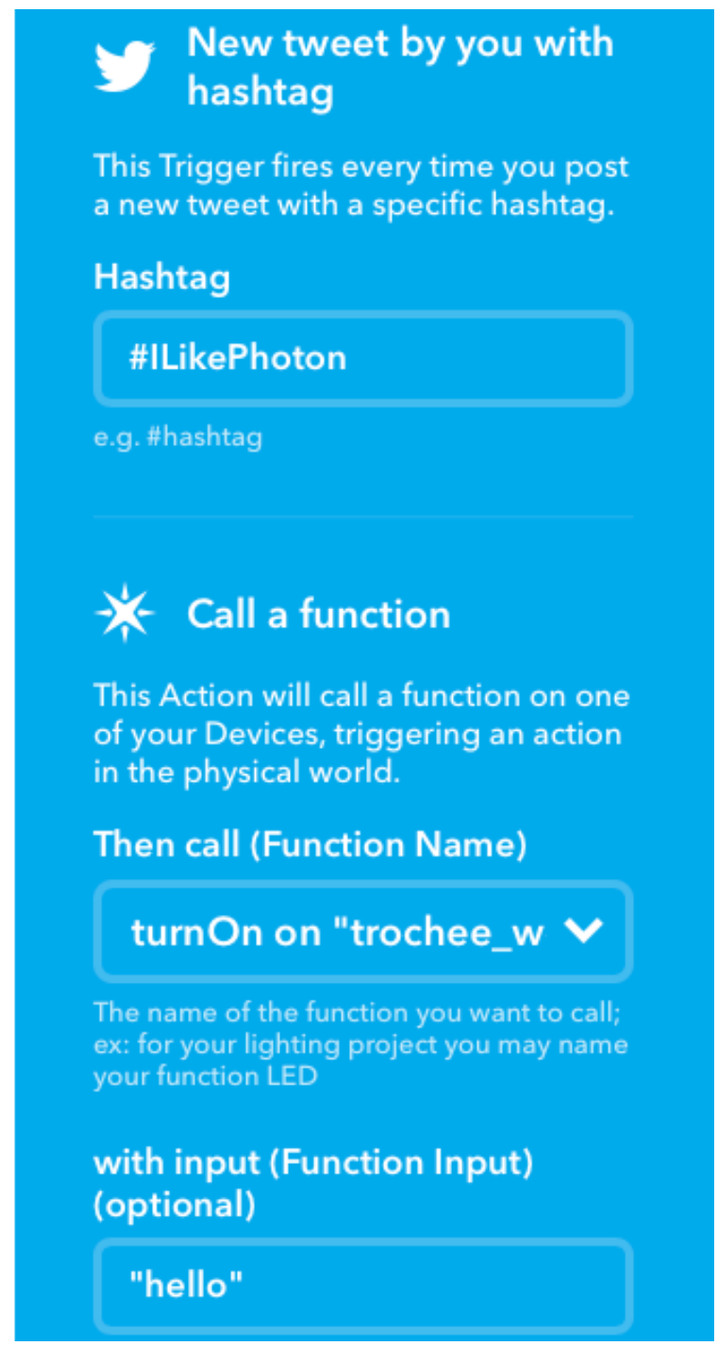
  b) an email with a subject #ILikePhoton

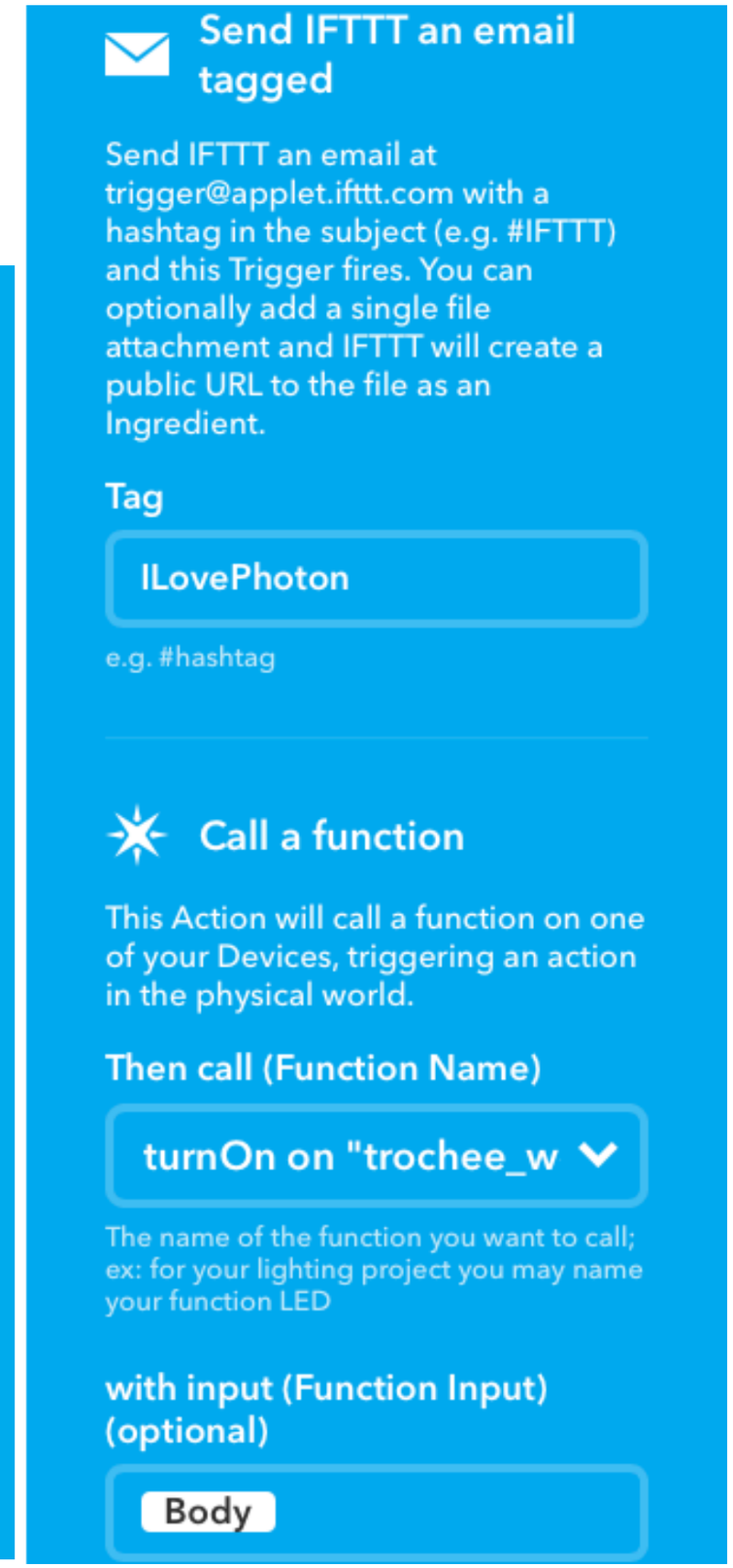
- turnOn() will be invoked

- Unsurprisingly, b) is much faster



IFTTT ICE: Call a Function - Solution





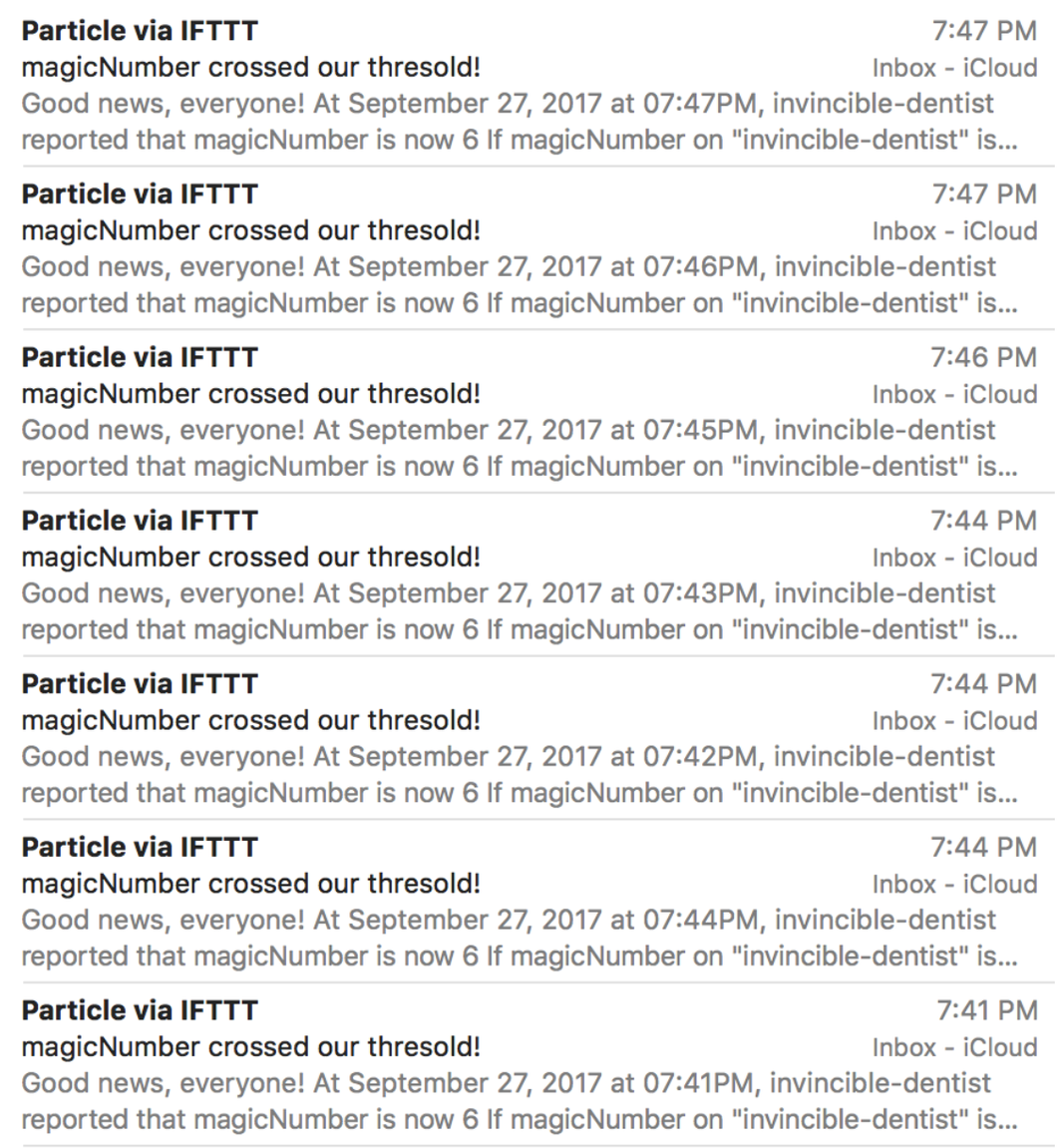
IFTTT ICE: Publish an Event

- Pending

IFTTT Polling Frequency

- IFTTT is not instantaneous. The **<u>documentation states that</u>** "Some applets run within seconds, while others run every 60 minutes. On average, most applets run within 15 minutes of being triggered."

- In your instructor's experience, <u>IFTTT.com</u> under promises/over delivers: applets run *much* faster, about once a minute.



Exercises

- Write a function to flash the morse code equivalent of a String (e.g., HELP ==> .... . .-.. .--.) on an LED, then invoke the function through IFTTT if an email is received with the subject line "HELP"

Resources

- IFTTT.com
- Monk, Simon. Make: Getting Started with the Photon.
- firmware/wiring/inc/spark_wiring_cloud.h
- https://hackernoon.com/observer-vs-pub-sub-pattern-50d3b27f838c