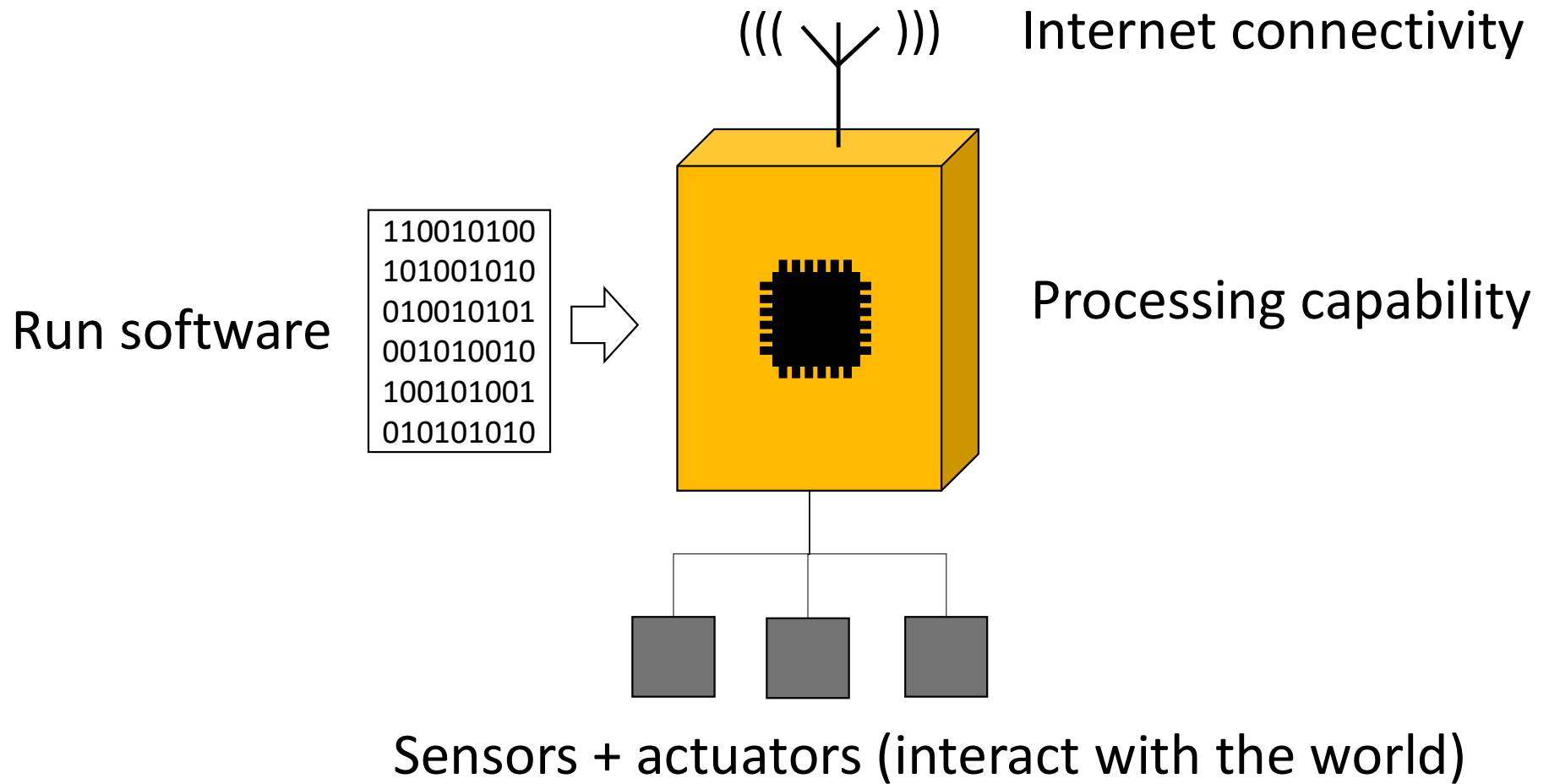




IoT 101

A thing:

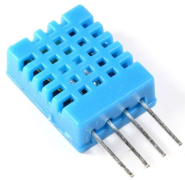


Sensors

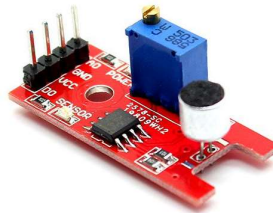
Button/Keypad



Temperature & Humidity



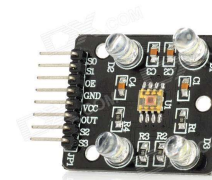
Sound



Light



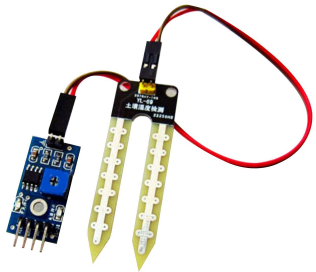
Color



Motion



Soil Moisture



Distance



Smoke



GPS



Water Level

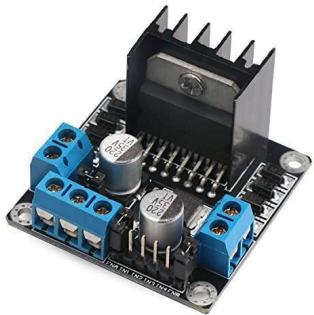


Accelerometer



Actuators

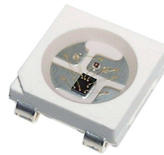
Motor Driver



OLED Screens



NeoPixels



LCD Screens



Buzzer



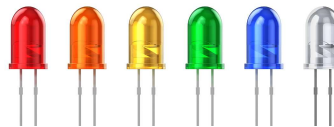
Water Valve



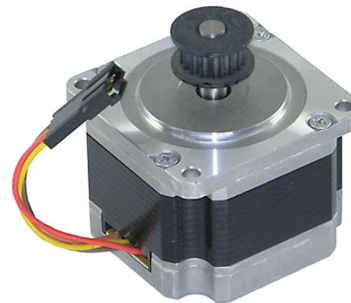
Water Pump



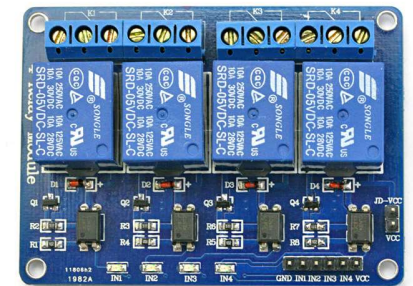
LEDs



Motors



Relays



Smart things....



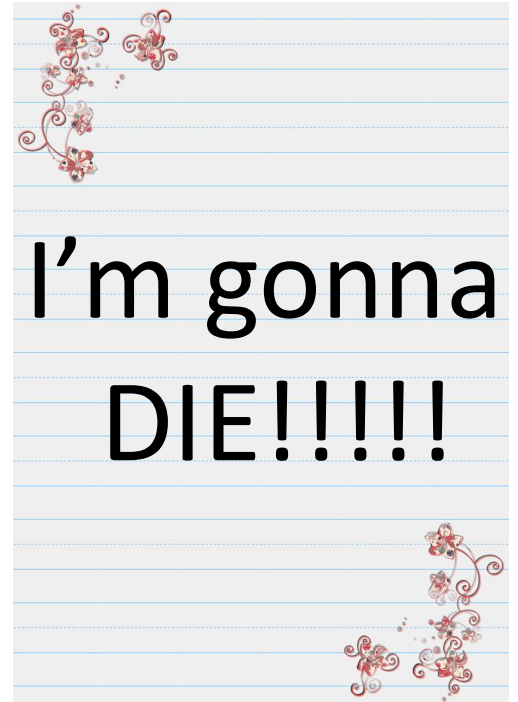
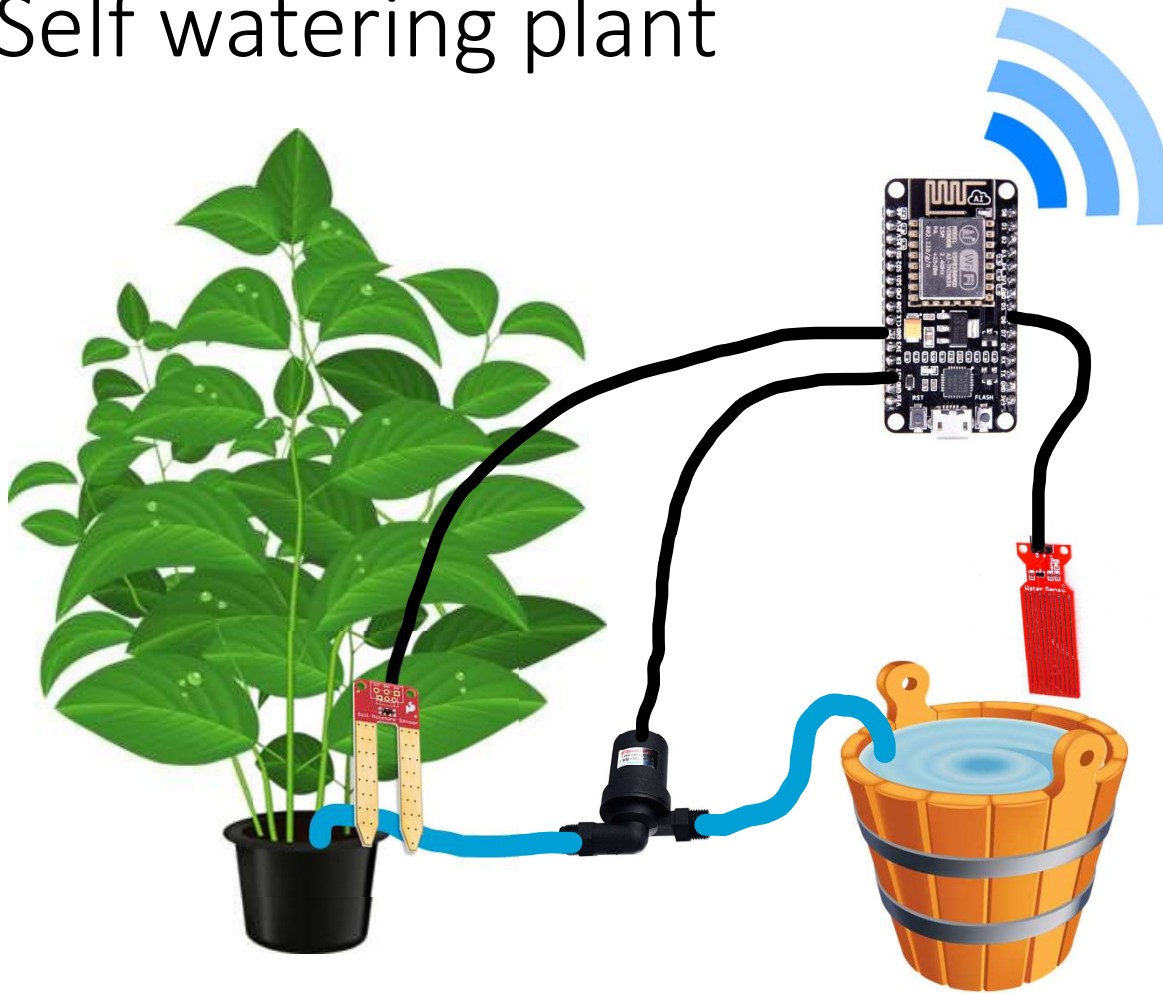
Enable business scenarios
Save lives
Optimize costs
Minimize environment impact
Support your health



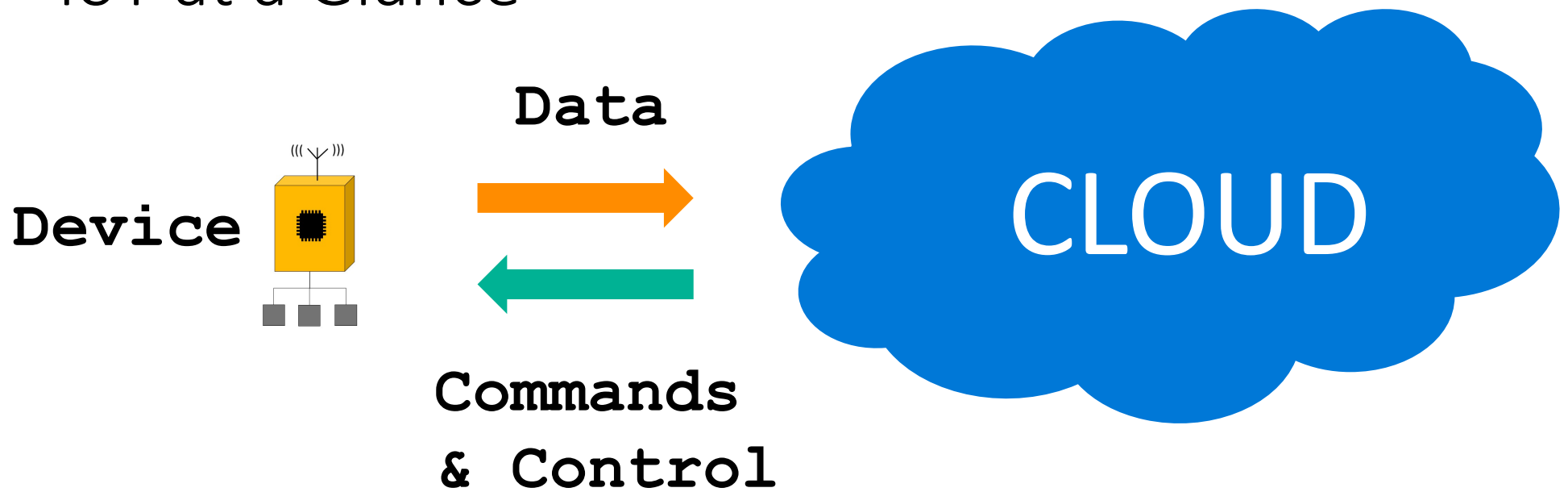
Save your living room plant!!!



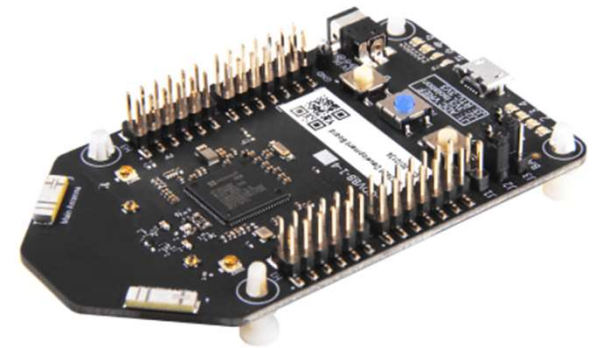
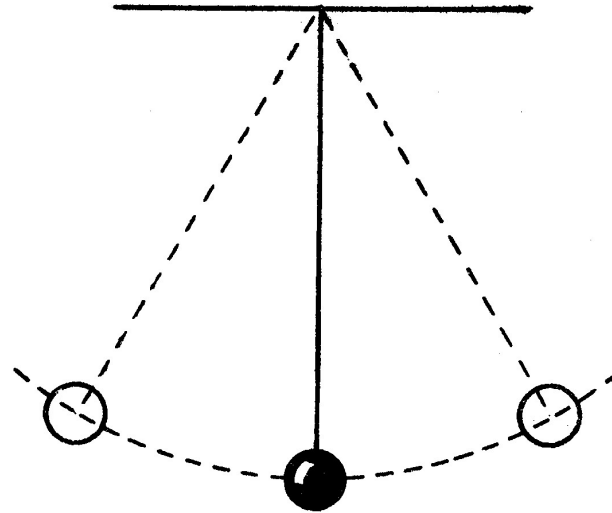
Self watering plant



IoT at a Glance



What to expect from this workshop?










- Free online message broker
- Cheap MCU board
- Hacker / Learning

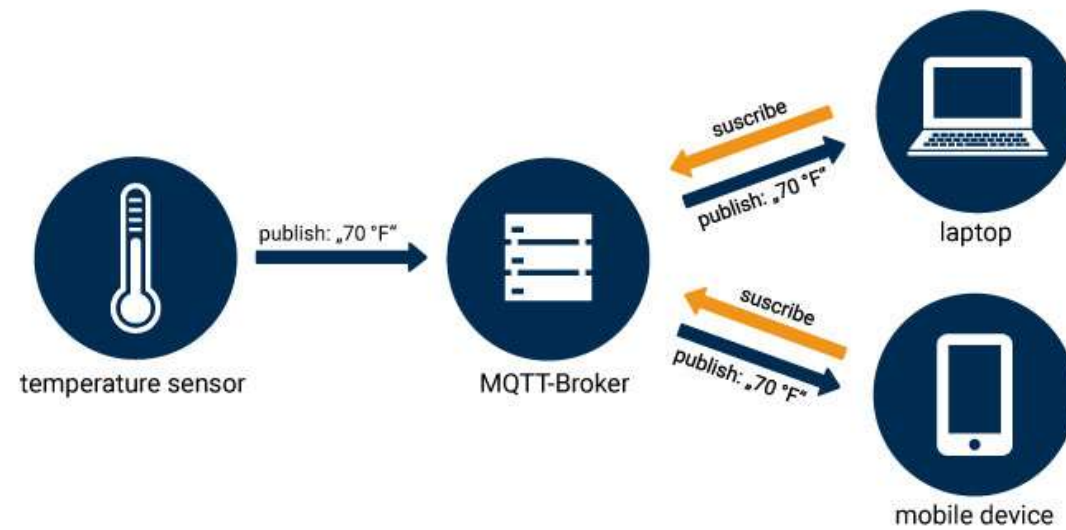
- Industry grade solutions
- Implements all 7 properties of highly secure devices

PROPERTIES OF HIGHLY SECURE DEVICES

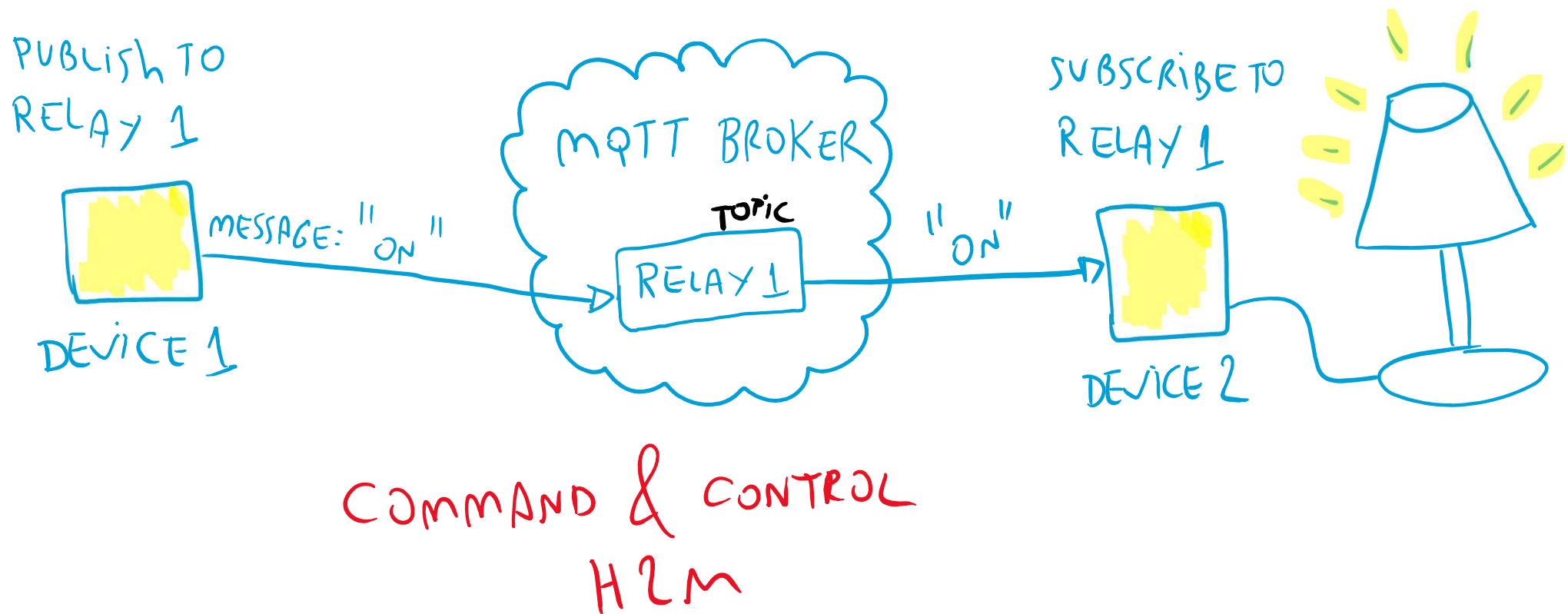
Galen Hunt, George Letey, and
Edmund B. Nightingale
Microsoft Research NExT Operating Systems
Technologies Group

Property	Examples and Questions to Prove the Property
 Hardware-based Root of Trust	Unforgeable cryptographic keys generated and protected by hardware. Physical countermeasures resist side-channel attacks.
	<i>Does the device have a unique, unforgeable identity that is inseparable from the hardware?</i>
 Small Trusted Computing Base	Private keys stored in a hardware-protected vault, inaccessible to software. Division of software into self-protecting layers.
	<i>Is most of the device's software outside the device's trusted computing base?</i>
 Defense in Depth	Multiple mitigations applied against each threat. Countermeasures mitigate the consequences of a successful attack on any one vector.
	<i>Is the device still protected if the security of one layer of device software is breached?</i>
 Compartmentalization	Hardware-enforced barriers between software components prevent a breach in one from propagating to others.
	<i>Does a failure in one component of the device require a reboot of the entire device to return to operation?</i>
 Certificate-based Authentication	Signed certificate, proven by unforgeable cryptographic key, proves the device identity and authenticity.
	<i>Does the device use certificates instead of passwords for authentication?</i>
 Renewable Security	Renewal brings the device forward to a secure state and revokes compromised assets for known vulnerabilities or security breaches.
	<i>Is the device's software updated automatically?</i>
 Failure Reporting	A software failure, such as a buffer overrun induced by an attacker probing security, is reported to cloud-based failure analysis system.
	<i>Does the device report failures to its manufacturer?</i>

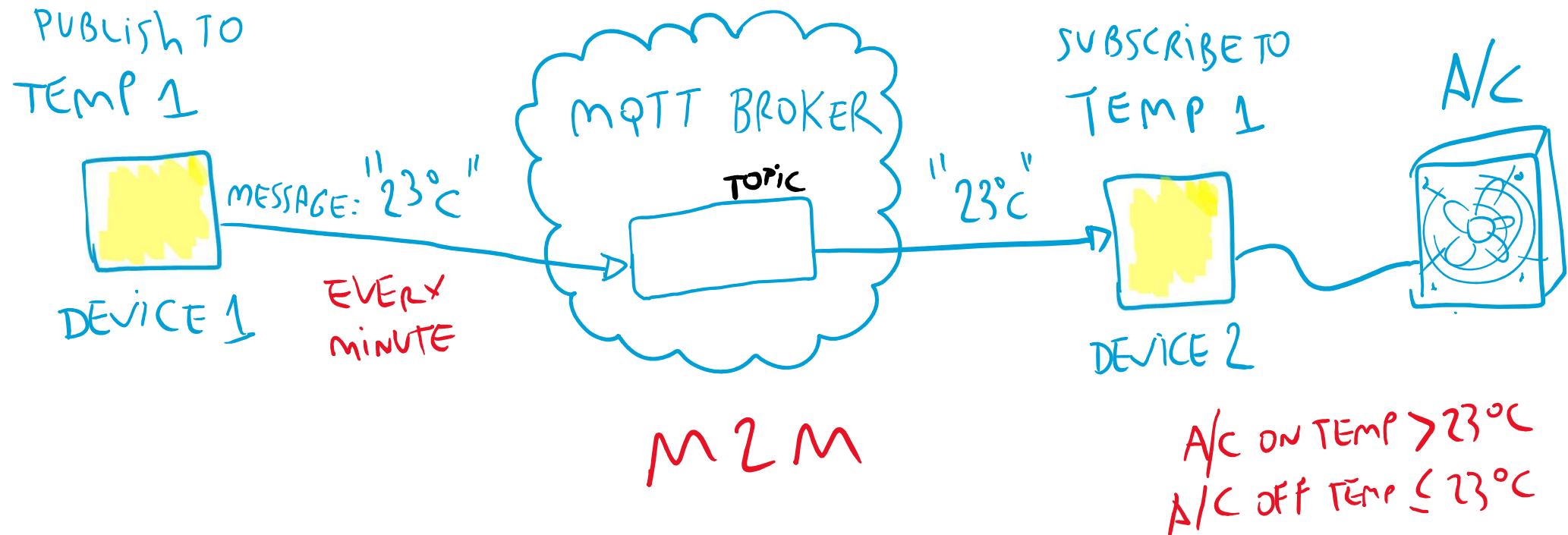
MQTT Broker



Making it real:

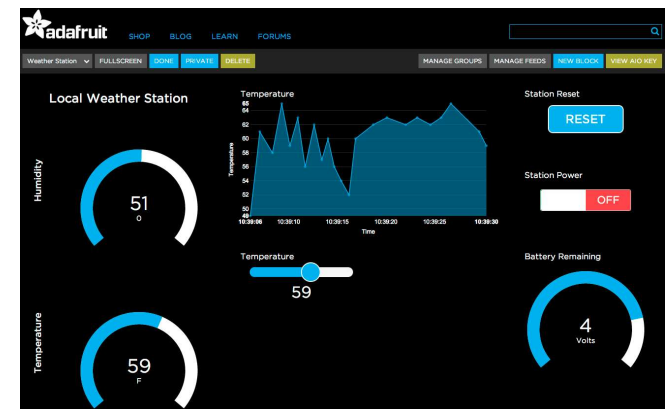


Making it real:



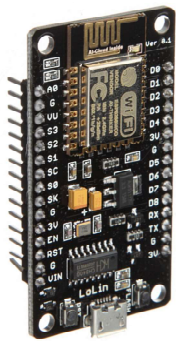
MQTT Broker:

- MQTT Broker: [IO.adafruit.com](https://io.adafruit.com)
- Free service
- 30 data points per minute
- 30 days of storage
- Up to 5 feeds
- Up to 5 dashboards



Hands-on time!!!

IoT Device



Publishes to:

- Temperature
- Humidity

Subscribes to:

- Led

MQTT Broker

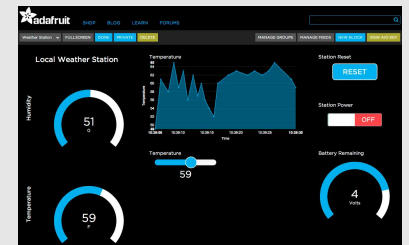
Feeds

Temperature

Humidity

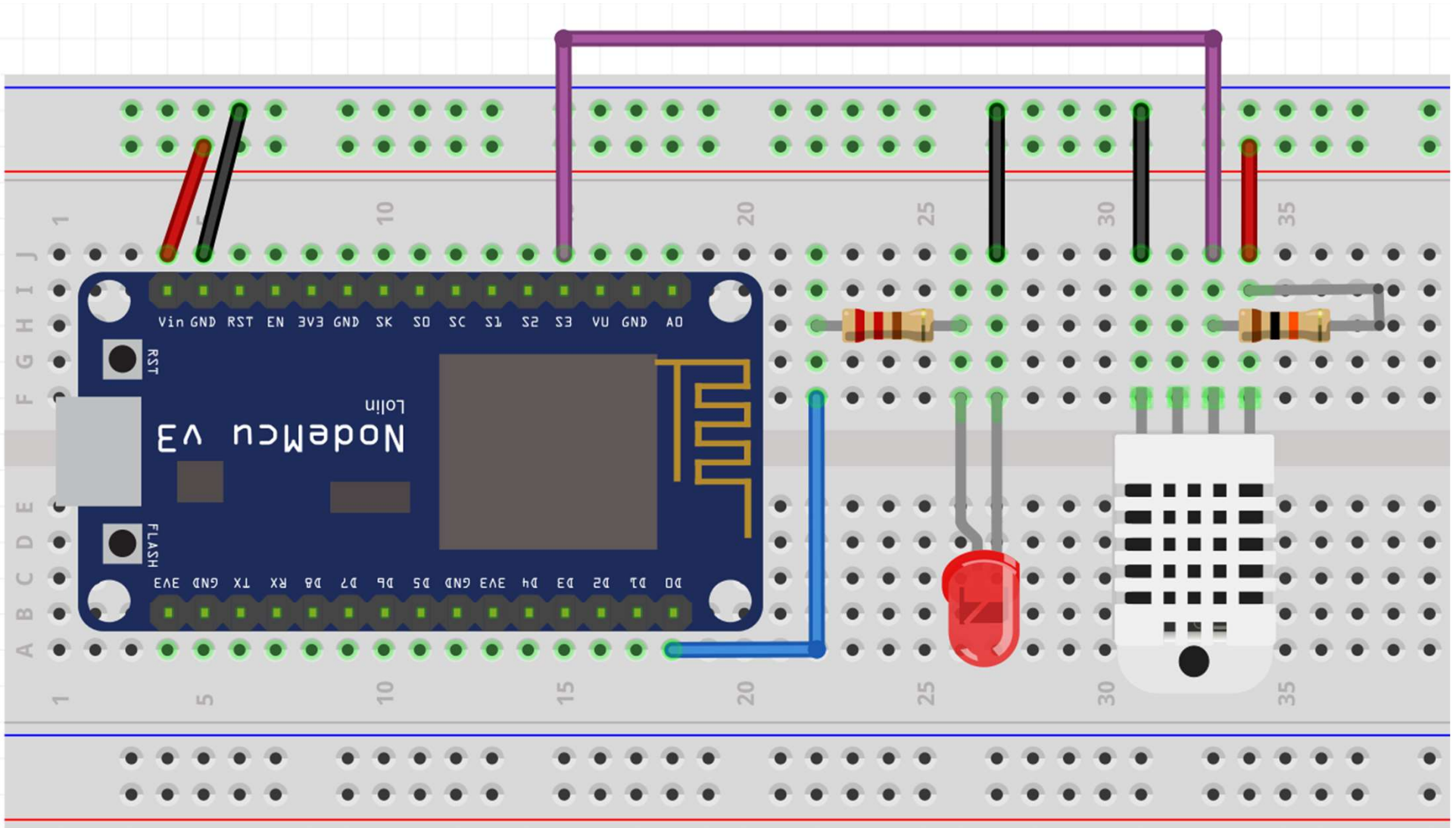
Led

Dashboard



Database





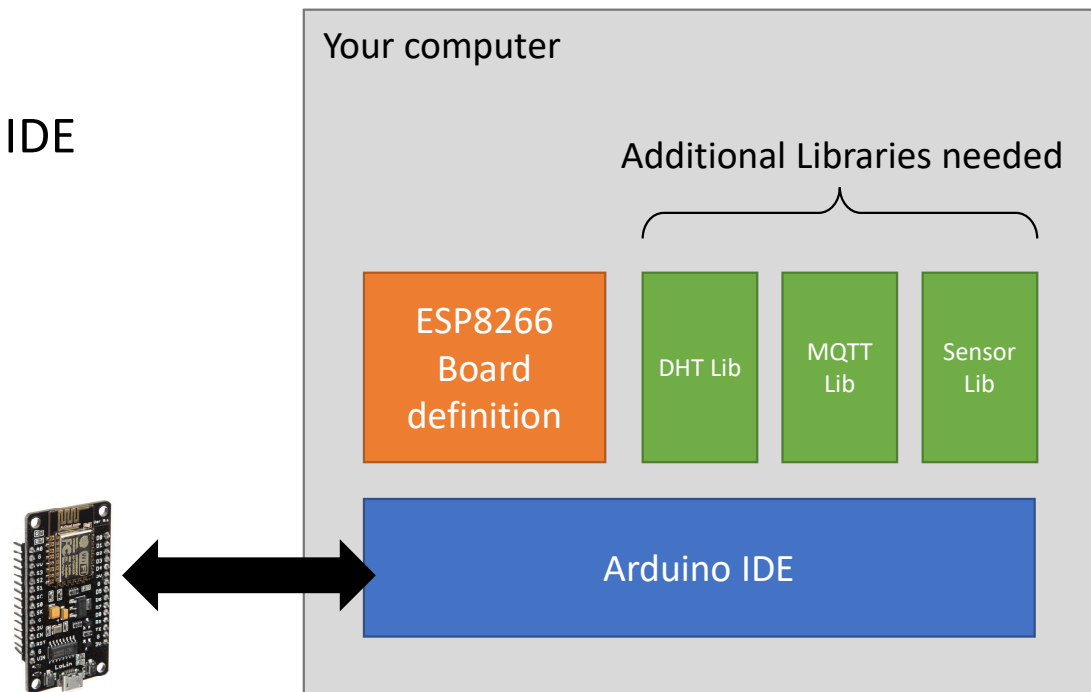
IoT end to end: Hands-on (DEVICE)

Setup the toolchain needed for IoT Projects (these steps need to be performed only once)

Step 1 – Install Arduino IDE

Step 2 – Install Board support on Arduino IDE

Step 3 – Install Libraries



ESP8266 Board Support

1. Open Arduino IDE → File/Preferences
2. Find a text box called “Additional board manager URLs” and type:

`http://arduino.esp8266.com/stable/package_esp8266com_index.json`

3. Under the “Show verbose output during” configuration mark the checkboxes “compilation” and “upload”.
This is important as this will give us clear error messages, we can use to identify future problems
4. Click OK
5. Now go to menu Tools/Board/Boards Manager
6. Type **ESP8266** in the search box and wait until the board manager finds “esp8266 by ESP8266 Community”
7. Select the latest version
8. Click “Install”
9. Be patient, this process can take several minutes under slower connections

Libraries

1. On the Arduino IDE go to menu Sketch/Include Library/Manage Libraries
2. Type **DHT11**, wait to see the results, click on **DHT Sensor Library by Adafruit**, select the highest version in the “Select Version” dropdown list, and then click Install.
3. Follow the same procedure to install 2 additional libraries:

What to type	Library name
MQTT	Adafruit MQTT Library by Adafruit
Adafruit unified sensor	Adafruit unified sensor by Adafruit

IoT end to end: Hands-on (CLOUD + Device)

Step 1 – Create an IO.Adafruit.com account (free)

Step 2 – Create the necessary feeds / topics

Step 3 – get your credentials

Step 4 – download the sample code from GitHub

Step 5 – find and replace the credentials in the code

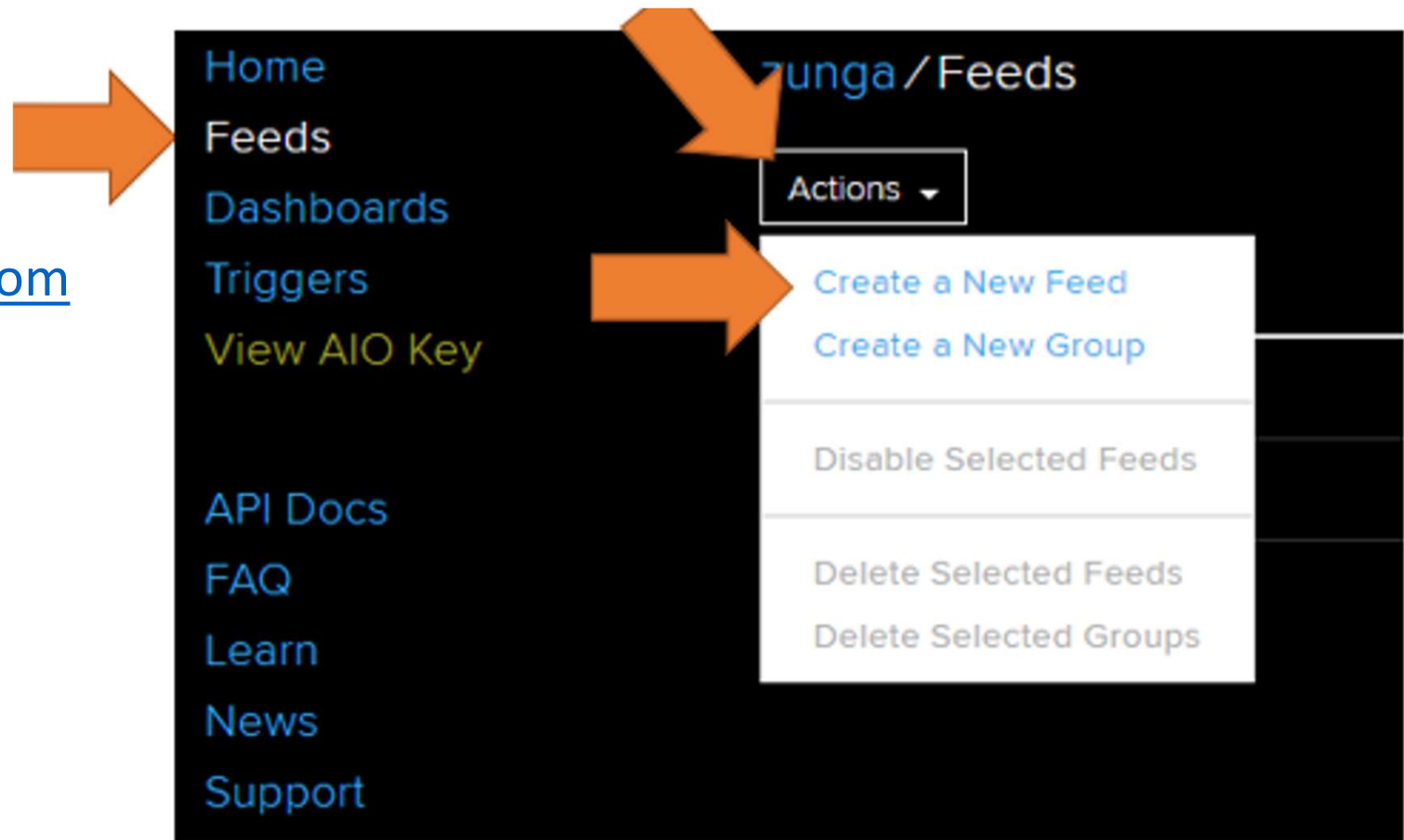
Step 6 – Load the code into the device and open the serial Monitor

Create Account and Feeds

<http://io.adafruit.com>

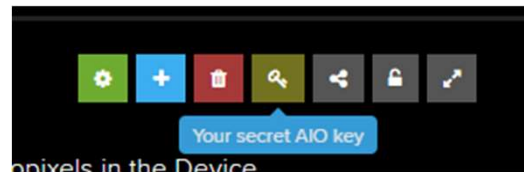
Create 3 new Feeds:

- Temperature
- Humidity
- LED



Get your credentials

Top Right menu: Key icon



YOUR AIO KEY



Your Adafruit IO key should be kept in a safe place and treated with the same care as your Adafruit username and password. People who have access to your AIO key can view all of your data, create new feeds for your account, and manipulate your active feeds.

If you need to regenerate a new AIO key, all of your existing programs and scripts will need to be manually changed to the new key.



Username

Active Key

REGENERATE AIO KEY

Get sample code

<https://github.com/wduraes/Workshops>
IoT 101 for Makers/ IoT_101_Online

Copy / Paste that code into Arduino IDE, find and replace the credentials

#define WLAN_SSID "WIFI NAME"	"YOUR WIFI NAME"
#define WLAN_PASS "WIFI PASSWORD"	"YOUR WIFI Password"
#define AIO_SERVER "io.adafruit.com"	
#define AIO_USERNAME	"YOUR ADAFRUIT USERNAME"
#define AIO_KEY	"YOUR ADAFRUIT ID"

TEST!!!

Serial Monitor information OK?

Sending data?

Go back to [IO.Adafruit.com](https://io.adafruit.com) and open the feeds to see data flowing to:

1. Temperature
2. Humidity
3. Light

IoT end to end: Hands-on (CLOUD – refining)

Step 1 – Go to [IO.Adafruit.com](https://io.adafruit.com)

Step 2 – Create a Dashboard

Step 3 – add Blocks

Block Type	Feed	Block title	Obs
Stream	Temperature	Temperature	
Stream	Humidity	Humidity	
Toggle	Led	Led	
Line Chart	Temperature + Humidity	Temperature + Humidity	Select 2 feeds for this block

Thank you!!!

