

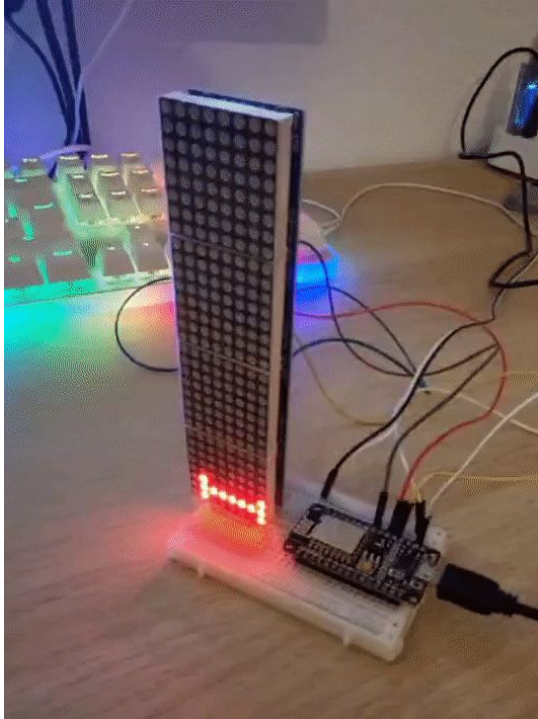
Building Simple & Low-cost IoT Display

29.08.2023 - Birkan Kolcu

Overview

- What does Simple IoT Display Look Like?
- Is it Really Cheap?
- Why?
- How?

What does Simple IoT Display Look Like?

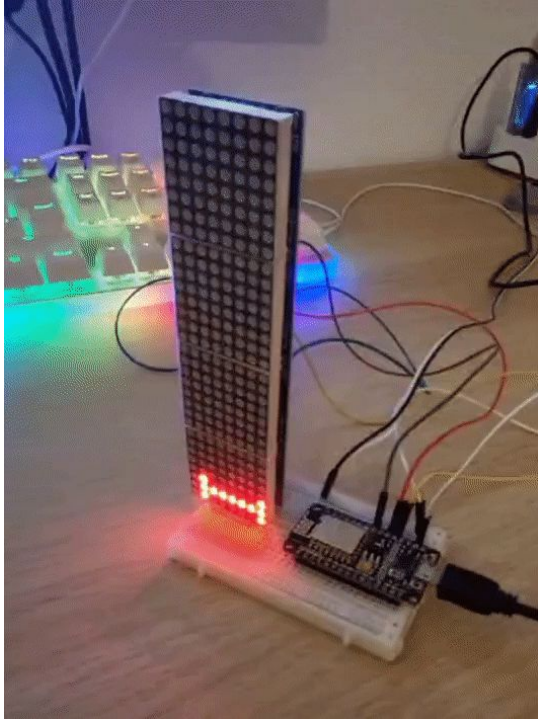


HTTP POST

<http://myFakeAPI.birkankolcu.com>

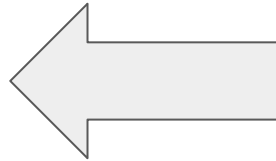
{
 "message": "I am alive!"
}

What does Simple IoT Display Look Like?



Example Curl Command

```
curl --location --request POST  
'https://yoev9tai04.execute-api.eu-central-1.amazonaws.com/prod' \  
--header 'Content-Type: application/json' \  
--data-raw '{  
  "message": "I am alive!"  
}'
```



Is it *Really* Cheap?



MAX7219 dot matrix modul mikrocontroller modul 4 in einem display
★★★★★ 4.9 132 Bewertungen 500+ verkauft

3,40€

Preis inkl. MwSt.

👉 **Zusätzlicher 2 % Rabatt**

83,40€ günstiger
Shop-Coupon

Farbe: RED

RED Blue GREEN

Weitere Preisinformationen ⓘ



400 löcher Punkte Solderless 8.5 CM x 5.5 CM PCB Breadboard Mini
Universal Test Protoboard DIY Bord Bus Test platine

★★★★★ 4.9 52 Bewertungen 262 verkauft

1,02€

Preis inkl. MwSt.

👉 **Zusätzlicher 2 % Rabatt**

83,40€ günstiger
Shop-Coupon

Farbe: White



- Display: 3.4€
- Nodemcu: 2.7€
- Breadboard: 1€
- Cable: 0.85€
- Shipping: 1.2€



Wireless modul CH340/CP2102/CH9102X NodeMcu V3 V2 V 2,1 Lua WIFI
Internet der Dinge entwicklung board basierend ESP8266 ESP-12E/F

★★★★★ 4.9 95 Bewertungen 500+ verkauft

2,68€

Preis inkl. MwSt.

👉 **Zusätzlicher 2 % Rabatt**

83,40€ günstiger
Shop-Coupon

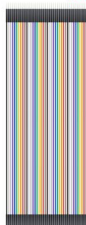
Farbe: Nodemcu-CP2102



Weitere Preisinformationen ⓘ



20CM
Male to Male



Dupont Linie 20Cm Männlich zu Männlich + Männlich zu Weiblich und
Buchse auf Buchse Jumper Wire Dupont Kabel für arduino

★★★★★ 5.0 45 Bewertungen 289 verkauft

0,84€

Preis inkl. MwSt.

👉 **Zusätzlicher 2 % Rabatt**

83,40€ günstiger
Shop-Coupon

Farbe: 20cm M-M



Liefert nach

📍 Köln, Köln, Germany

Versand: 1,18€

Kostenloser Versand für Bestellungen über
36,01€ auf eine ausgewählte
Versandmethode

Voraussichtliche Lieferung am Okt 29

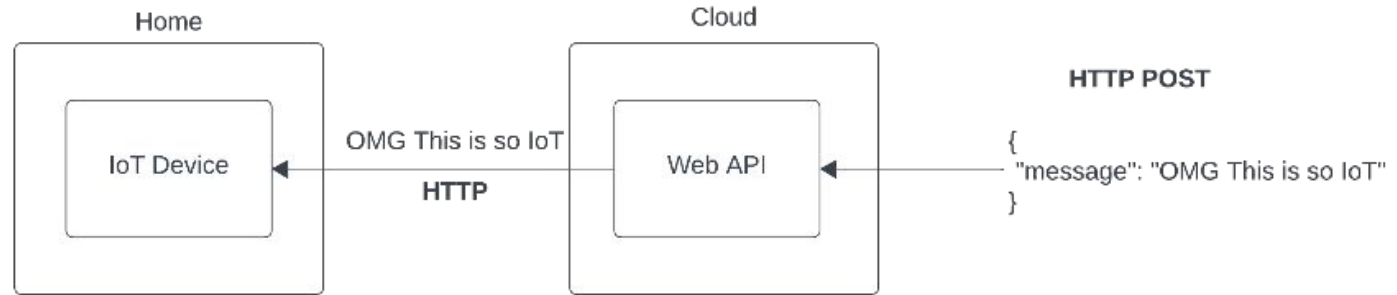
📦 **12-Tage Lieferung** auf Bestellungen
über 10,00€

Total cost: 8€

Why?

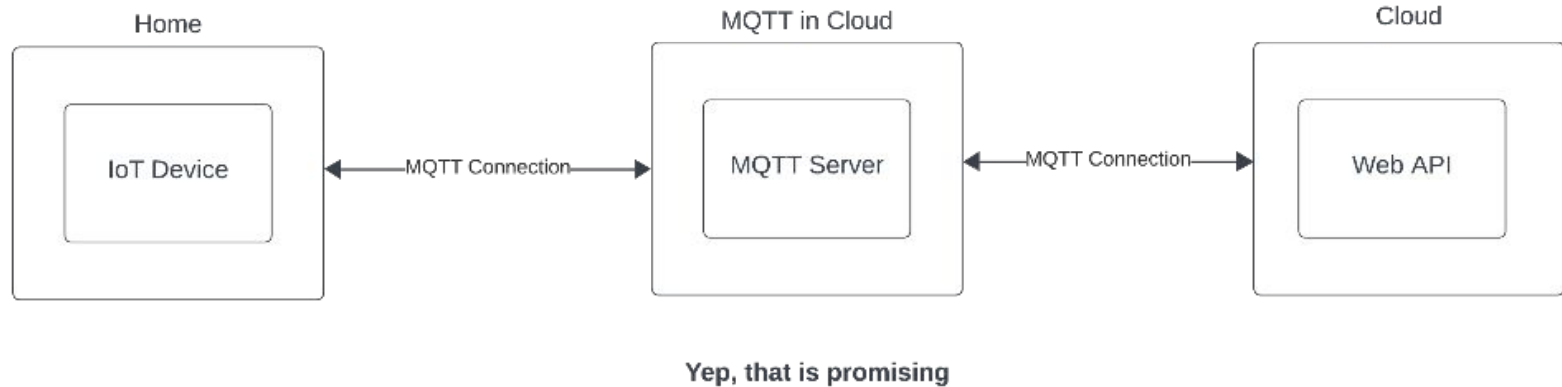
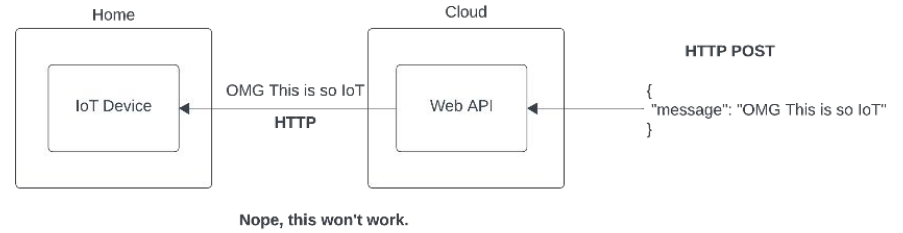
- WHY NOT!?!?!?!?!?
- A lot of different technologies to experiment with. It is interesting learning experience.
- Possible interesting use cases if you think hard enough :D
 - Display number of active users on your website.
 - Display estimated end of month infrastructure cost.
 - Display (non critical) alerts.
 - Display any live info you can fetch over the internet.
 - Your suggestions?

How? - Architecture (not)

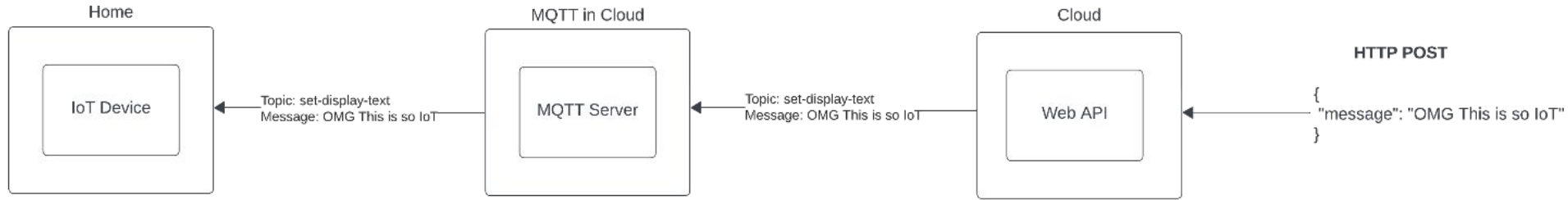


Nope, this won't work.

How? - Architecture

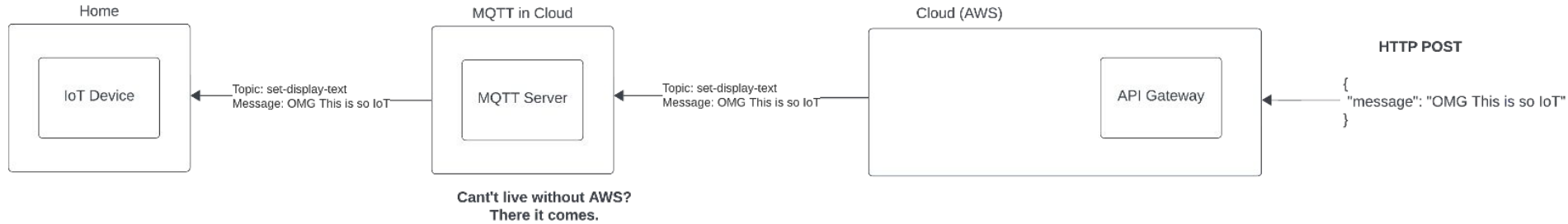


How? - Architecture

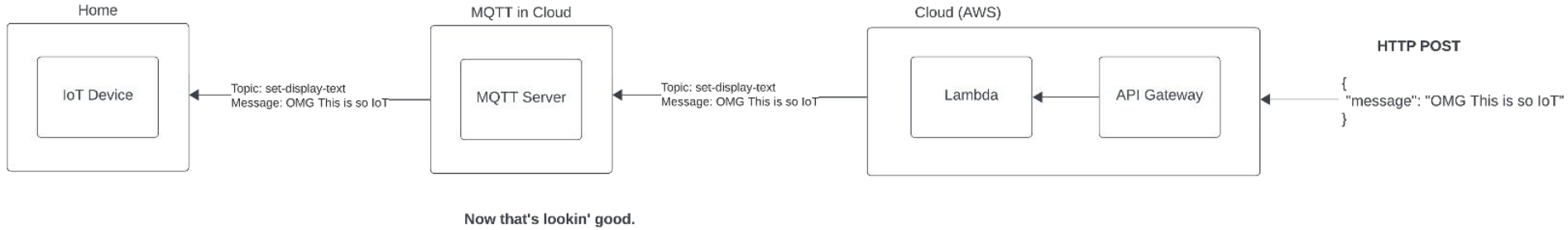


MQTT? It is all about topics.

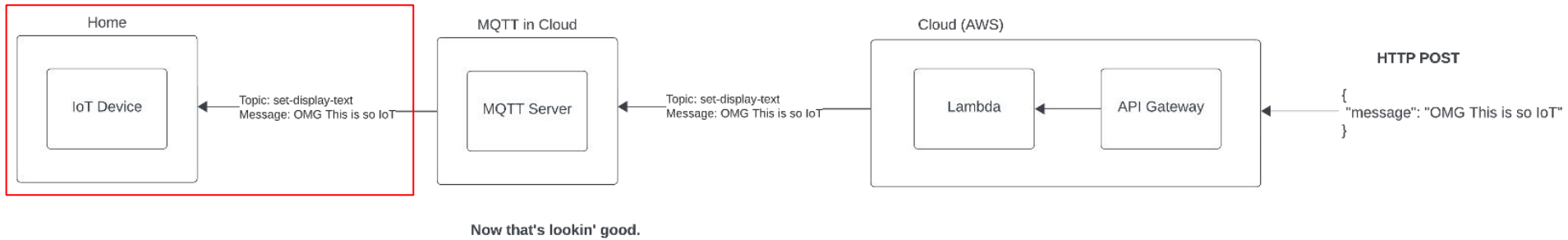
How? - Architecture



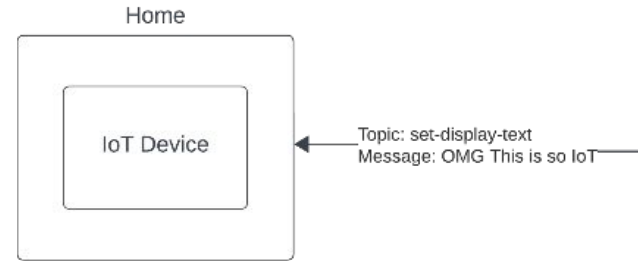
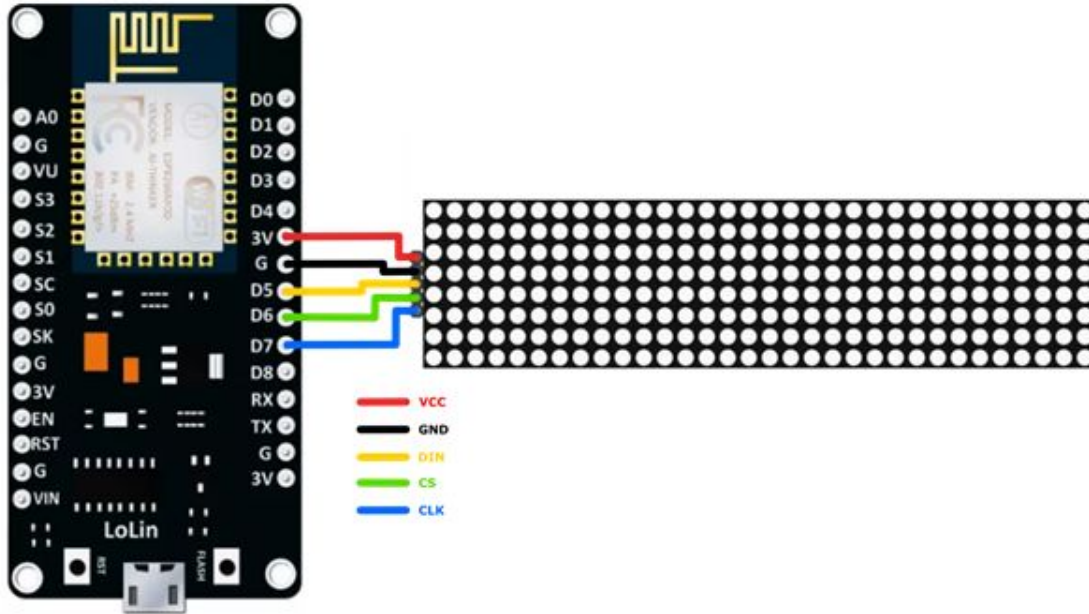
How? - Architecture



How? - Zooming into IoT Device

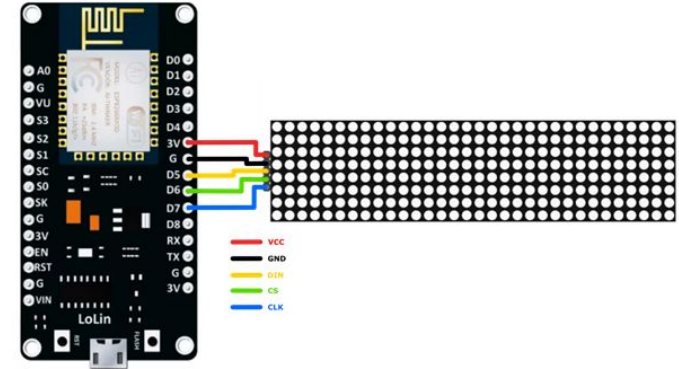
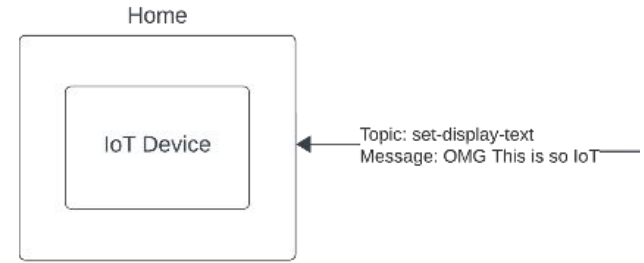


How? - IoT Device -> Nodemcu + LED



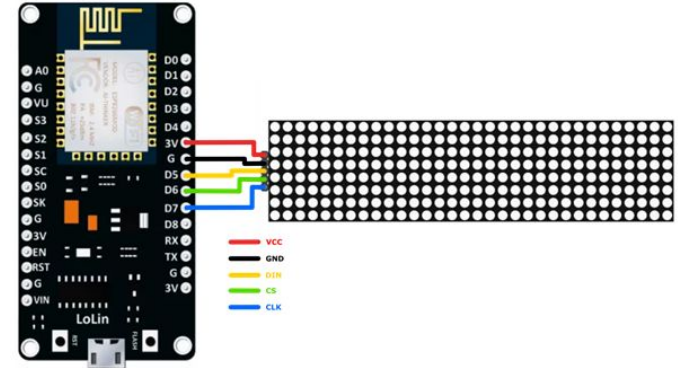
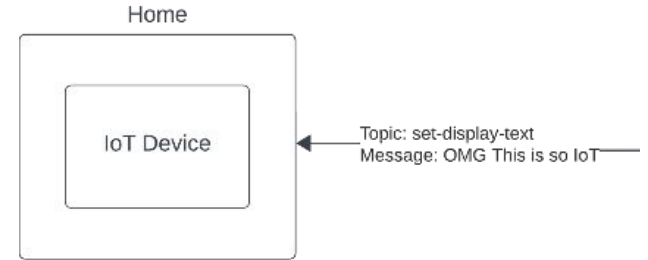
How? - Gathering Examples to Build It

- How to use “Dot Matrix Display” with Nodemcu
- How to connect Nodemcu to MQTT (HiveMQ)
- Tiny modification to combine two examples together.



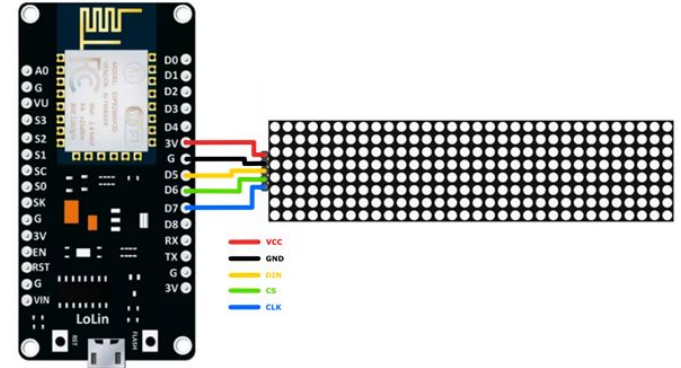
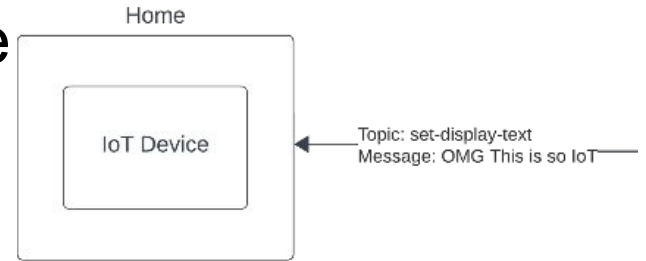
How? - Subscribe to MQTT Topic

```
99  /***** Connect to MQTT Broker *****/
100 void reconnect() {
101     // Loop until we're reconnected
102     while (!client.connected()) {
103         Serial.print("Attempting MQTT connection...");
104         String clientId = "ESP8266Client-"; // Create a random client ID
105         clientId += String(random(0xffff), HEX);
106         // Attempt to connect
107         if (client.connect(clientId.c_str(), mqtt_username, mqtt_password)) {
108             Serial.println("connected");
109
110             client.subscribe("set_led_display"); // subscribe the topics here
111
112             DynamicJsonDocument doc(1024);
113             doc["deviceId"] = "NodeMCU";
114             doc["status"] = "connected";
115             char mqtt_message[128];
116             serializeJson(doc, mqtt_message);
117             publishMessage("esp8266_data", mqtt_message, true);
118
119         } else {
120             Serial.print("failed, rc=");
121             Serial.print(client.state());
122             Serial.println(" try again in 5 seconds"); // Wait 5 seconds before retrying
123             delay(5000);
124         }
125     }
126 }
```

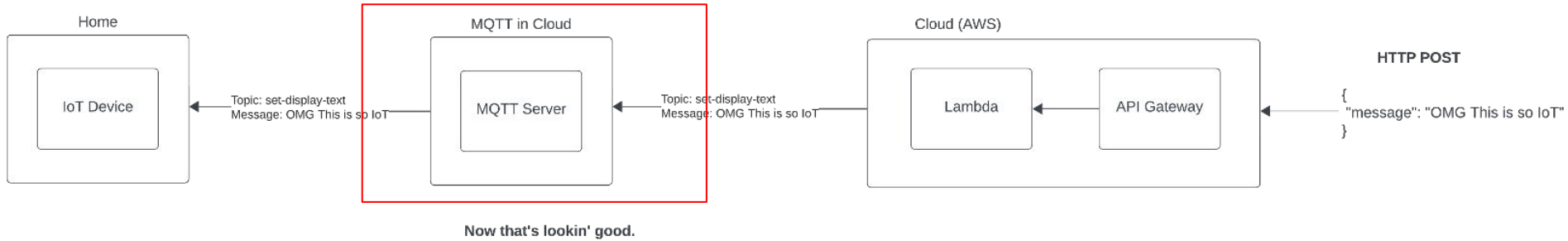


How? - Update Display Upon Message

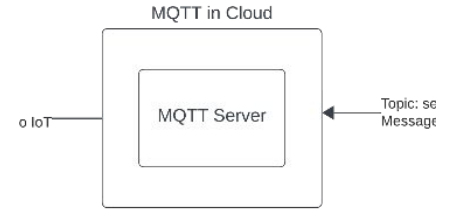
```
128  /**** Call back Method for Receiving MQTT messages and Switching LED ****/  
129  String dotmatrixText = "";  
130  
131  void callback(char* topic, byte* payload, unsigned int length) {  
132      String incomingMessage = "";  
133      for (int i = 0; i < length; i++) incomingMessage+=(char)payload[i];  
134  
135      Serial.println("Message arrived ["+String(topic)+"]"+incomingMessage);  
136  
137      /--- check the incoming message  
138      if( strcmp(topic,"set_led_display") == 0){  
139          dotmatrixText = incomingMessage;  
140          const char* myCharArray = dotmatrixText.c_str();  
141          Serial.println(myCharArray);  
142          myDisplay.displayClear();  
143          myDisplay.displayScroll(myCharArray, PA_CENTER, PA_SCROLL_LEFT, 200);  
144      }  
145  }  
146  
147
```



How? - Zooming into MQTT Server



How? - MQTT Server: HiveMQ, FREE!



Cluster Details

Clusters

FREE #1 Serverless

Billing

Billing & Payment

What's new

Cluster Information

Current Plan

Serverless

Current Tier

FREE

Name

[REDACTED]

Cloud Provider

Azure

CHANGE PLAN TO PAY AS YOU GO

► What is included in my plan?

Connection Settings

Cluster URL

EDIT

[REDACTED].s2.eu.hivemq.cloud

Port

8883

Websocket Port

8884

Current Usage

MQTT Client Sessions

2 / 100

Data Traffic

28.5 kB / 10 GB

Last update

2 minutes ago

Price per session

FREE

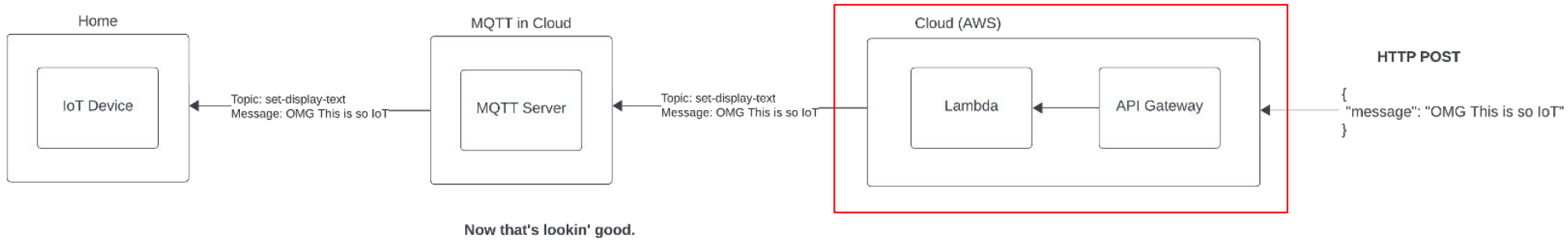
Last update

2 minutes ago

Price per GB

FREE

How? - Zooming into AWS



How? - Lambda

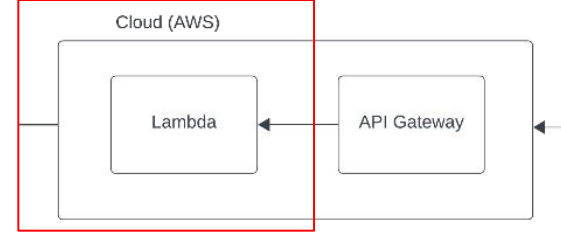
```
import * as mqtt from "mqtt";

export const handler = async (event) => {
  console.log("PRINTIN EVENT")
  console.log(event)

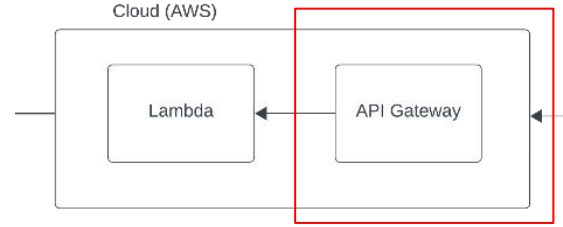
  const mqttClient = mqtt.connect('mqtt://[REDACTED].s2.eu.hivemq.cloud', {
    username: 'backend-mqtt',
    password: '[REDACTED]',
    port: 8883,
    protocol: 'mqtts'
  });


  return new Promise((resolve, reject) => {
    mqttClient.on('connect', () => {
      mqttClient.publish('set_led_display', event.message, (err) => {
        if (err) {
          reject(err);
        } else {
          const response = {
            statusCode: 200,
            body: JSON.stringify('Message sent to MQTT broker!'),
          };
          resolve(response);
        }
      });
      mqttClient.end(); // Close the connection
    });
  });

  mqttClient.on('error', (err) => {
    reject(err);
  });
});
```



How? - API Gateway



Resources Actions ▾ / - GET - Setup 

▾ /

GET
POST

Choose the integration point for your new method.

Integration type ☒ Lambda Function ⓘ
☐ HTTP ⓘ
☐ Mock ⓘ
☐ AWS Service ⓘ
☐ VPC Link ⓘ

Use Lambda Proxy integration ☐ ⓘ

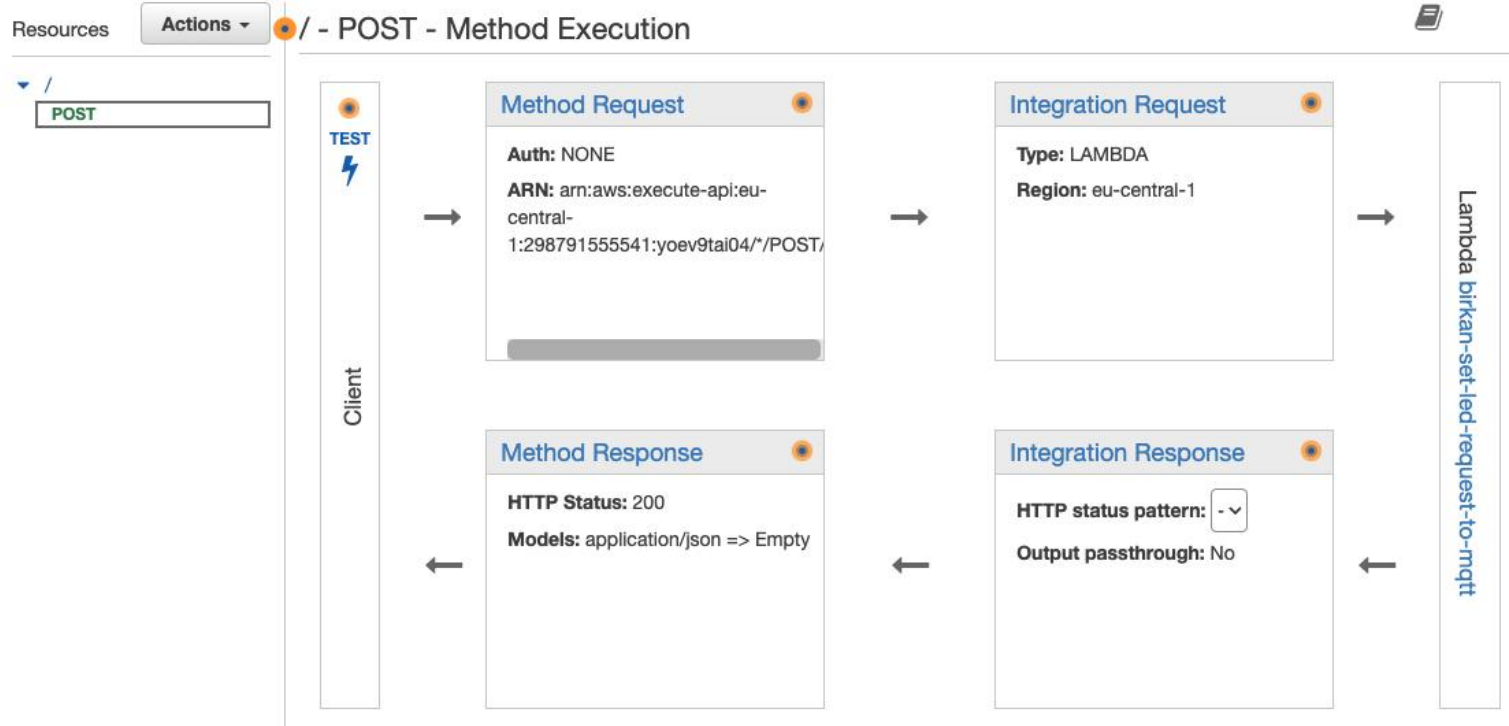
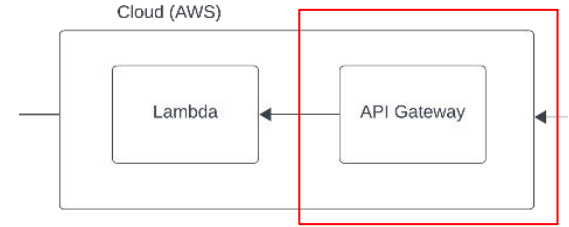
Lambda Region ▾

Lambda Function ⓘ

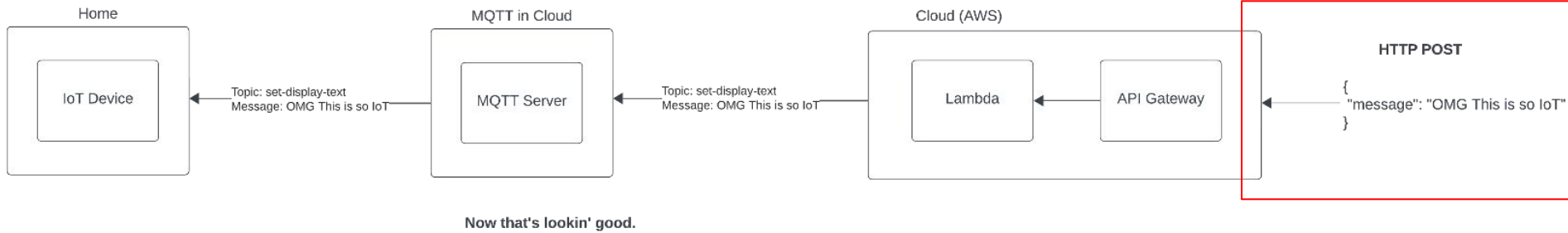
Use Default Timeout ☒ ⓘ

Save

How? - API Gateway



How? - Zooming into API



How? - API Gateway Expose our API to World



HTTP POST

`https://yoev9tai04.execute-api.eu-central-1.amazonaws.com/prod'`

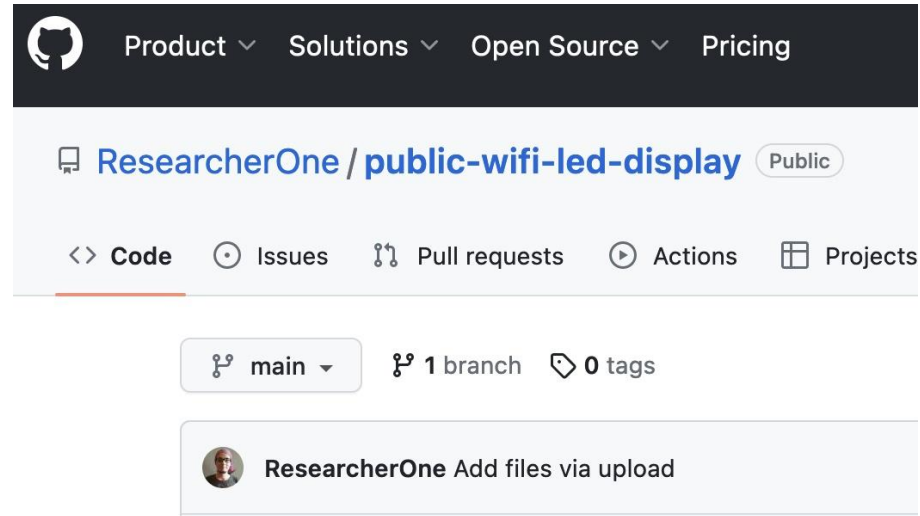
```
{  
  "message": "OMG this is so IoT"  
}
```

Example Curl Command

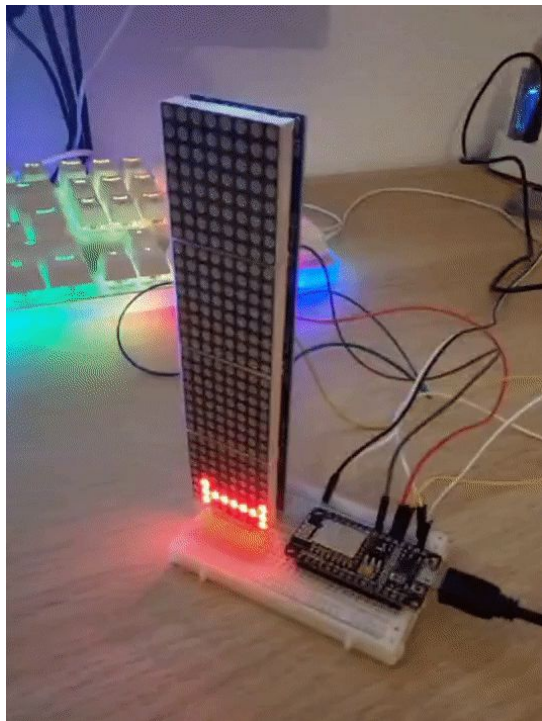
```
curl --location --request POST  
'https://yoev9tai04.execute-api.eu-central-1.amazonaws.com/prod' \  
--header 'Content-Type: application/json' \  
--data-raw '{  
  "message": "OMG this is so IoT"  
}'
```


Talk is Cheap Show Me The Code

[https://github.com/ResearcherOne/
public-wifi-led-display](https://github.com/ResearcherOne/public-wifi-led-display)



The End (?)



THX FOR LISTENING!

