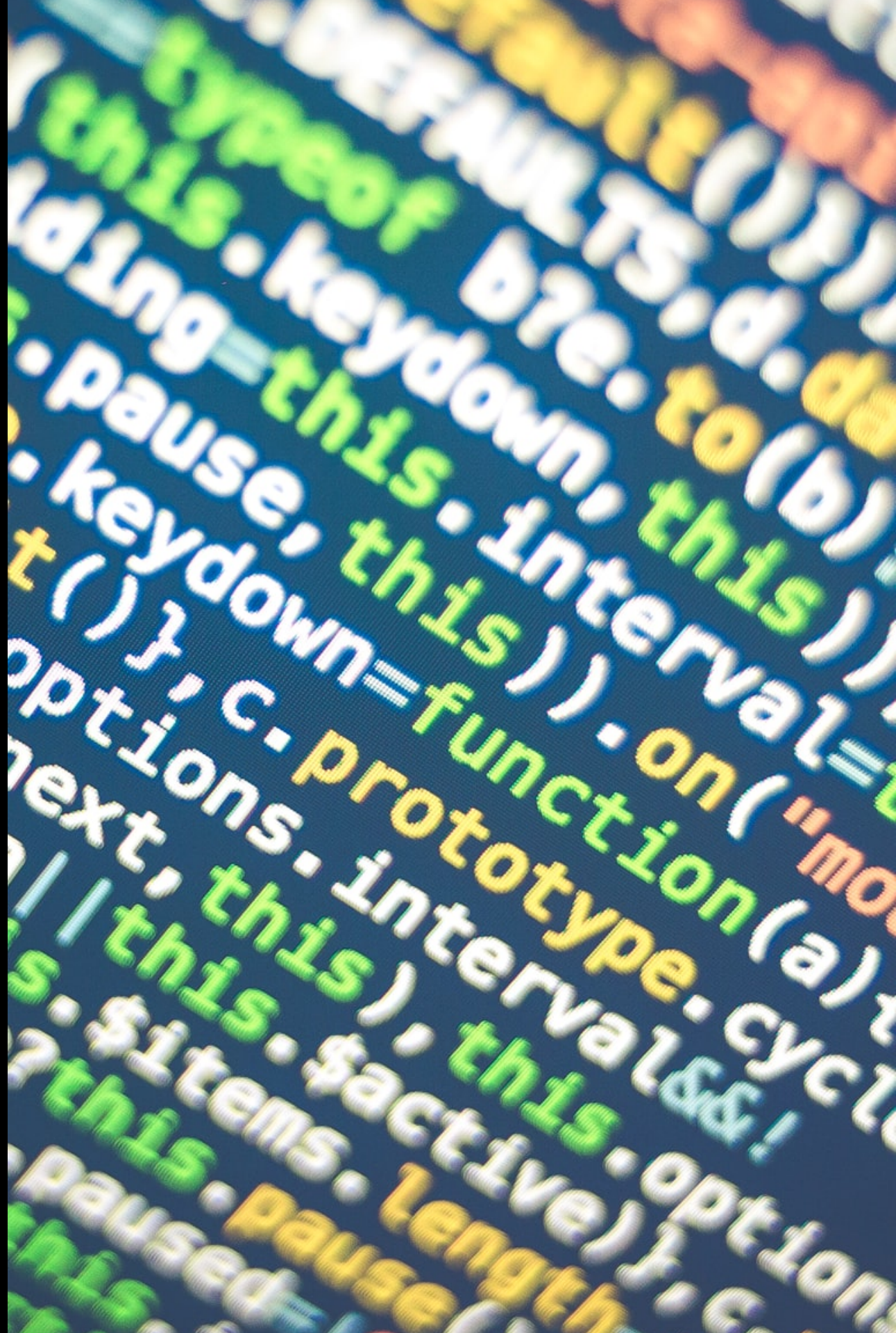
Introduktion till Internet of Things

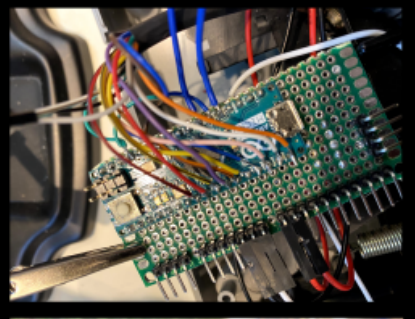
Sensorer, Mjukvara och Plattformar

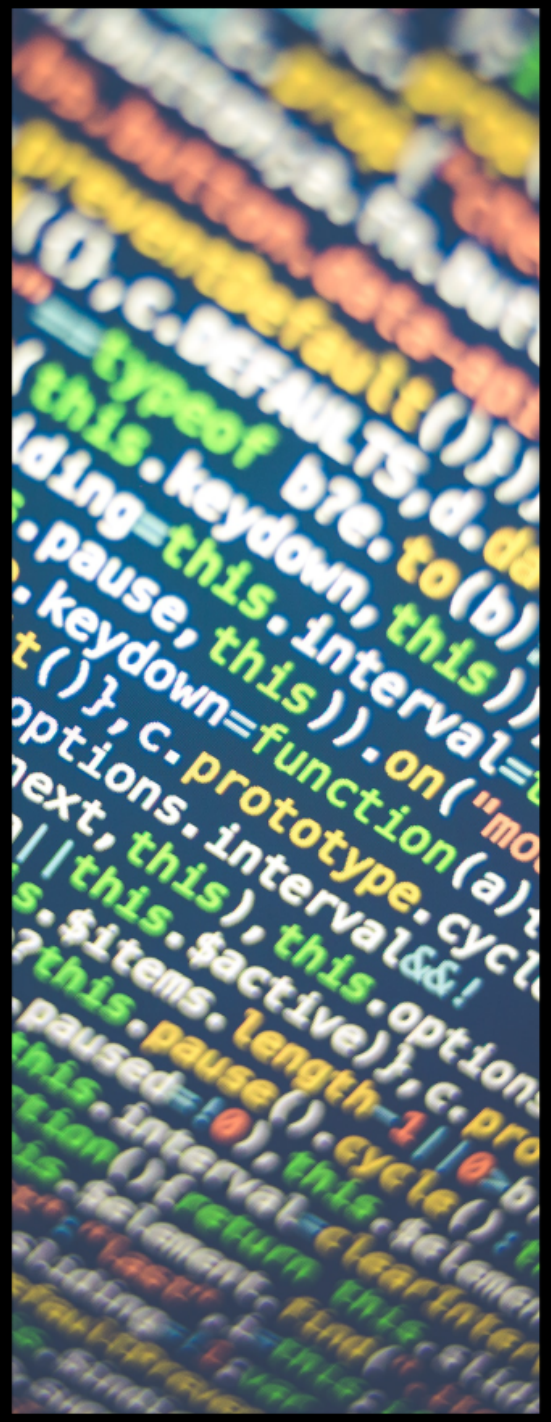
Agenda

- Intro
- Hårdvara
- Mjukvara
- Verktyg
- Plattform
  - Home Assistant
- Lab01-1
- Lab01-2
- Lab01-3
- Plattform
  - ThingsBoard
- Lab02
- Uppgift

Intro





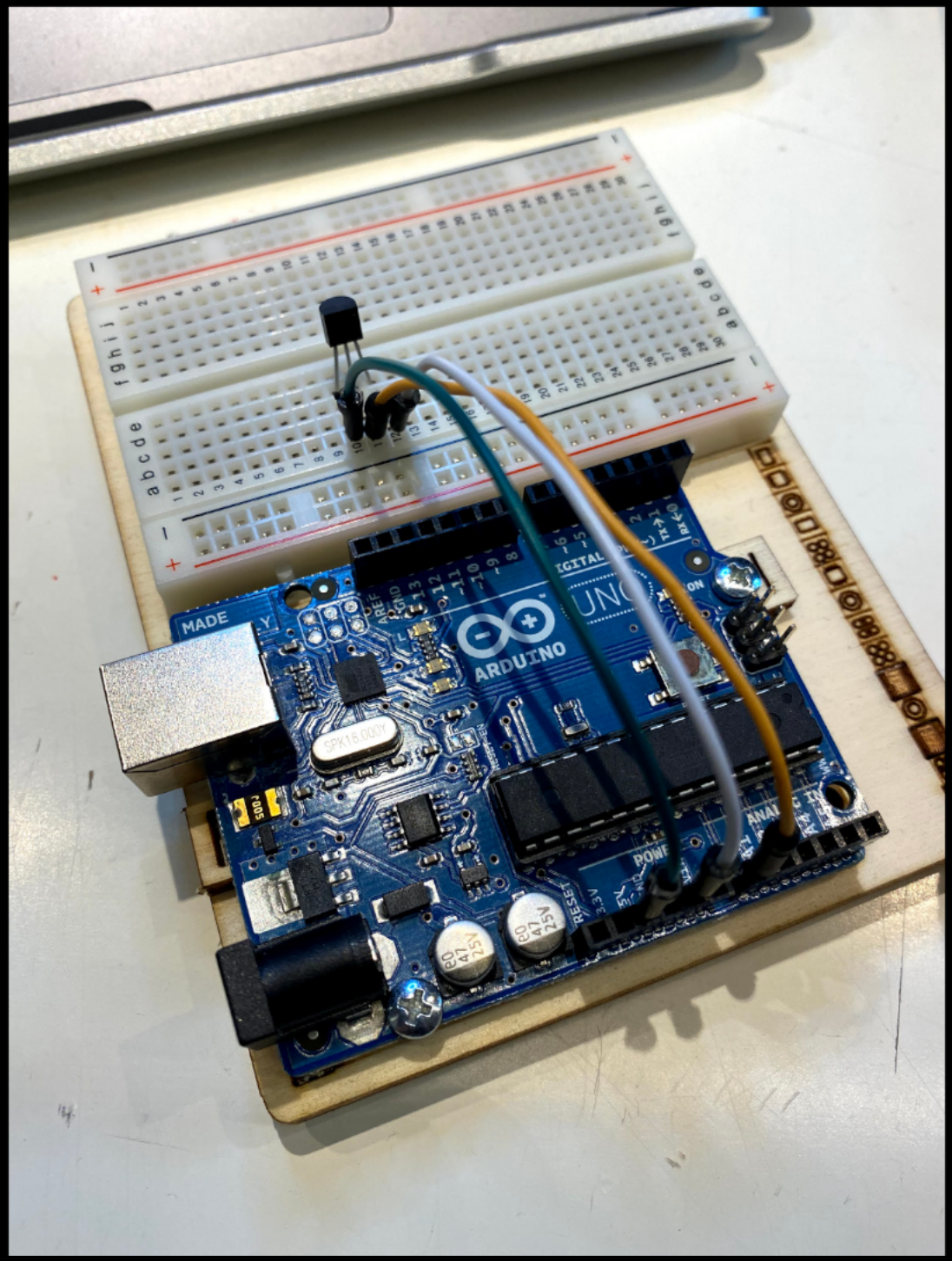


Emil Nildersen

Tinkerer, Coder, Father, Husband, Flyer

Hårdvara

Sensorer, Microkontroller, Gateways, osv.


ARDUINO
MADE


CENTRAK

Fråga:

Vilken erfarenhet har ni av olika sensorer/chip/datorer?

Poll: Hårdvara

Diskussion:

IoT i vardagen

- Exempel
- Användningsområden

Mjukvara

Firmware, Converters, API, SDK, Protokoll, Programmering

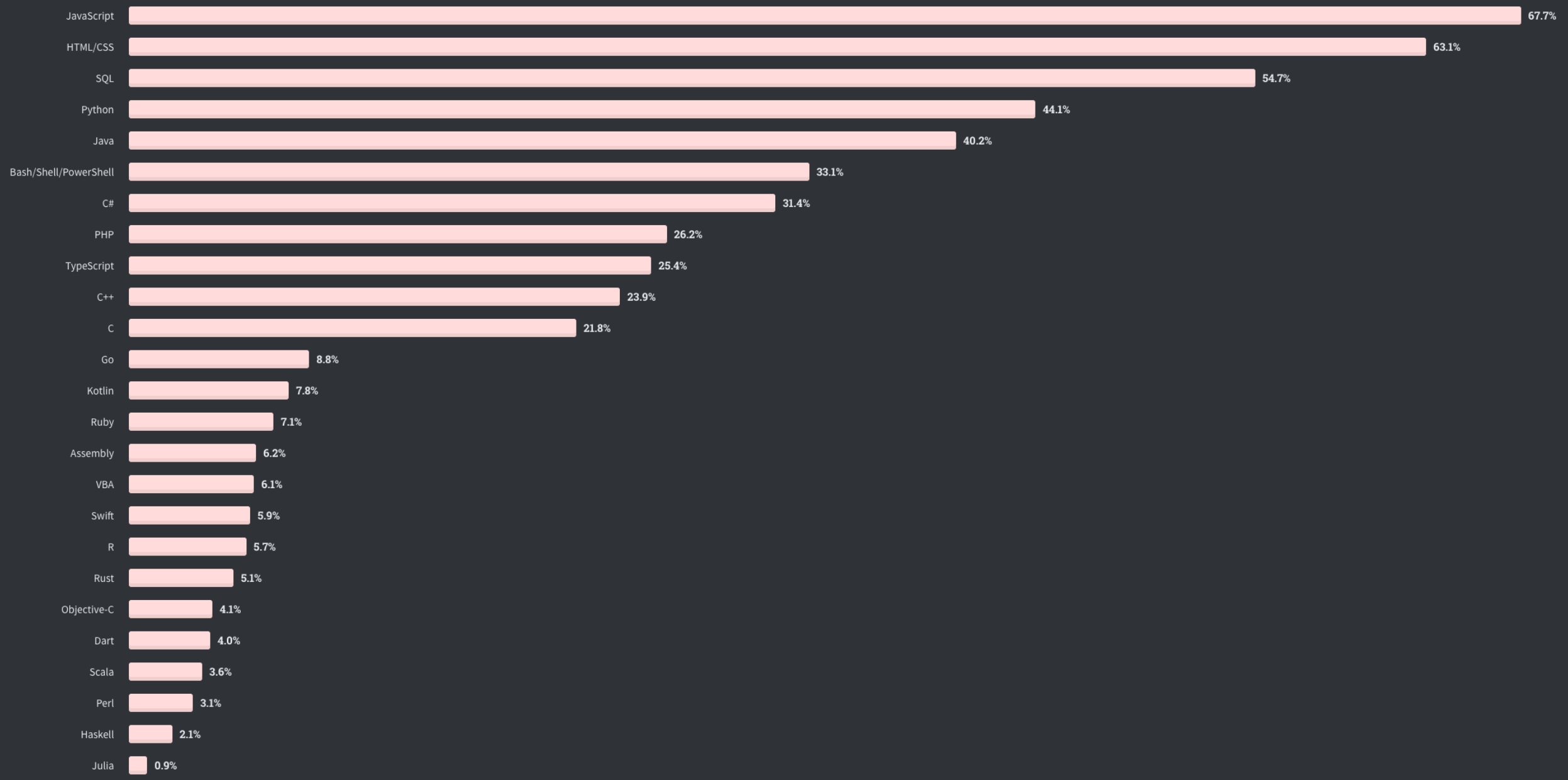
Fråga:

Hur många har programmerat tidigare?

Poll: Programmering

Fråga:

Vilka programmeringsspråk känner ni till?



source: https://insights.stackoverflow.com/survey/2020#technology

Programmering inom IoT

- Firmware
- Converters
- Bryggor
- Filter
- API Anrop

- Python
- JavaScript
- Java
- C

Exempel

https://github.com/voxic/thingsboardTrafikverket/blob/master/trafikverketBridgeMQTT.py

Diskussion:

Vad är Firmware?

- Användningsområden
- Miljö/Runtime
- Programmeringsspråk
- Skillnad mellan sketch och firmware?

```
#include "Joystick.h"

Joystick_ Joystick;

  int xAxis_ = 0;
  int RxAxis_ = 0;
  int yAxis_ = 0;
  int RyAxis_ = 0;
  int throttle=0;
  void setup()
{
  //Setup all buttons as inputs with PULLUP
  for(int i = 3;i < 13;i++){
    pinMode(i, INPUT_PULLUP);
  }

  Joystick.begin();
  //Serial.begin(9600); //Start serial monitoring
}
void loop()
```

Sketch: Arduino Joystick, C

Sketch implementerar funktionen

Firmware är bryggan mellan hårdvaran och sketch

Introduktion: Python

Note

la behöver en Kod-editor. Välj vad ni vill. Jag kör Visual Studio Code <-- Bra val

Learn Python The Hard Way

https://learnpythonthehardway.org/python3/

Exercise 00

```
"The Setup"
```

Exercise 01

Input:

```
print("Hello World!")
print("Hello Again")
print("I like typing this.")
print("This is fun.")
```

Output:

```
python3.6 ex1.py
Hello World!
Hello Again
I like typing this.
This is fun.
```

Exercise 02

```
# A comment, this is so you can read your program later.
# Anything after the # is ignored by python.

print("I could have code like this.") # and the comment after is ignored

# You can also use a comment to "disable" or comment out code:
# print("This won't run.")

print("This will run.")
```

Exercise 03

```
print("I will now count my chickens:")

print("Hens", 25 + 30 / 6)
print("Roosters", 100 - 25 * 3 % 4)

print("Now I will count the eggs:")

print(3 + 2 + 1 - 5 + 4 % 2 - 1 / 4 + 6)

print("Is it true that 3 + 2 < 5 - 7?")

print(3 + 2 < 5 - 7)

print("What is 3 + 2?", 3 + 2)
print("What is 5 - 7?", 5 - 7)

print("Oh, that's why it's False.")
```

Exercise 04

```
cars = 100
space_in_a_car = 4.0
drivers = 30
passengers = 90
cars_not_driven = cars - drivers
cars_driven = drivers
carpool_capacity = cars_driven * space_in_a_car
average_passengers_per_car = passengers / cars_driven


print("There are", cars, "cars available.")
print("There are only", drivers, "drivers available.")
print("There will be", cars_not_driven, "empty cars today.")
print("We can transport", carpool_capacity, "people today.")
print("We have", passengers, "to carpool today.")
print("We need to put about", average_passengers_per_car,
      "in each car.")
```

Moduler

Där python hämtar sin styrka

```
import json # <--- Modul

# Mitt program kan nu hantera JSON
print(json.loads(jsonDataFromServer))
```

```
import paho.mqtt # <--- Modul

# Mitt program kan nu hantera MQTT
client = paho.Client(cfg['clientID'], True, None, paho.MQTTv31)
```

Protokoll

Fråga:

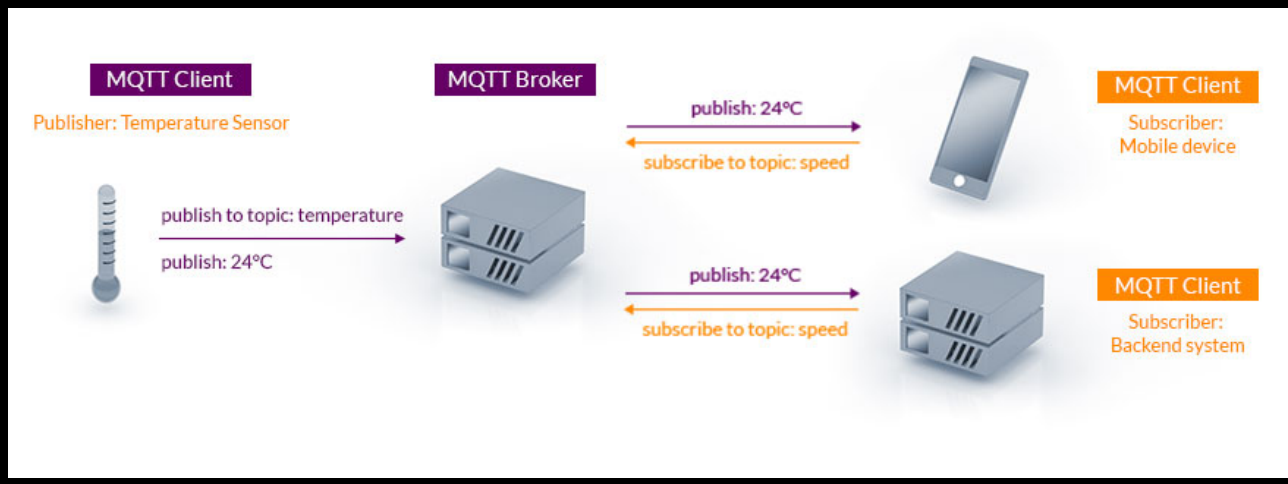
Vad är ett protokoll?

Protokoll

Vanliga protokoll inom IoT:

- MQTT
- REST
- CoAP
- SOAP

MQTT


MQTT Client
Publisher: Temperature Sensor
MQTT Broker
publish: 24°C
subscribe to topic: speed
MQTT Client
Subscriber:
Mobile device
publish to topic: temperature
publish: 24°C
publish: 24°C
subscribe to topic: speed
MQTT Client
Subscriber:
Backend system

MQTT forts.

Broker: Mosquitto
https://mosquitto.org/

Client: MQTTExplorer
http://mqtt-explorer.com/

MQTT Övning

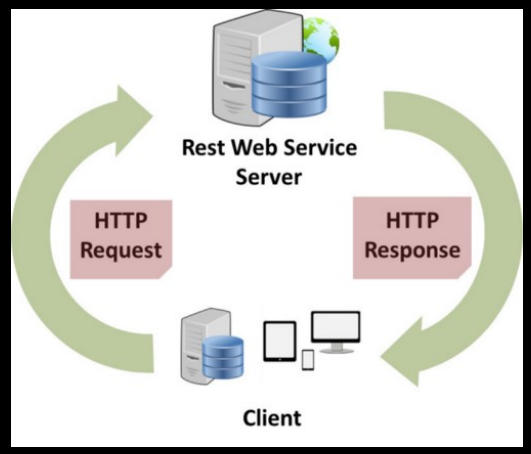
Chatta med MQTT

1. Dela in er två och två
2. Installera MQTT Explorer
3. Anslut till mqtt.eclipse.org
4. Kom överrens om en topic
5. Börja chatta

REST

Representational state transfer (REST)

- En bas URI, exempel: http://api.example.com/collection/
- Standard HTTP metoder (e.g., GET, POST, PUT, PATCH and DELETE)
- Vanligt med svar i JSON-format



Vanligt protokoll för att interagera med API:er


```
{
  "name": "pikachu",
  "order": 35,
  "species": {
      "name": "pikachu",
      "url": "https://pokeapi.co/api/v2/pokemon-species/25/"
  },
  "stats": [
      {
          "base_stat": 35,
          "effort": 0,
          "stat": {
              "name": "hp",
              "url": "https://pokeapi.co/api/v2/stat/1/"
          }
      }
    ]
}
```

Verktyg

Postman

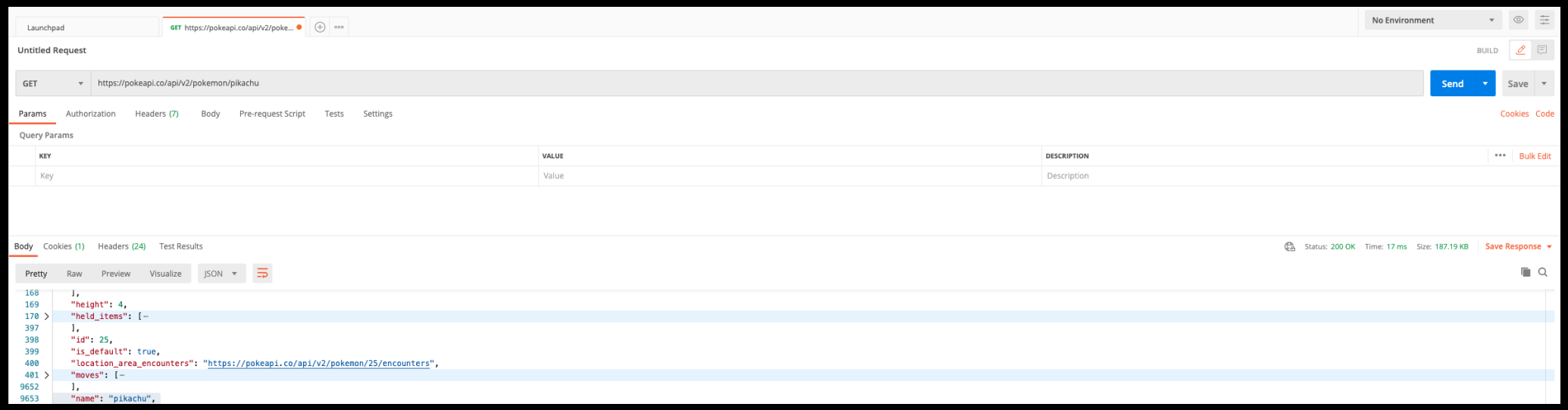
https://www.postman.com/

cURL

https://en.wikipedia.org/wiki/CURL

Övning:

Använd postman för att göra ett API anrop


Launchpad
GET https://pokeapi.co/api/v2/poke...
No Environment
Untitled Request
BUILD
GET
https://pokeapi.co/api/v2/pokemon/pikachu
Send
Save
Params
Authorization
Headers (7)
Body
Pre-request Script
Tests
Settings
Cookies
Code
Query Params
KEY
VALUE
DESCRIPTION
Bulk Edit
Key
Value
Description
Body
Cookies (1)
Headers (24)
Test Results
Status: 200 OK
Time: 17 ms
Size: 187.19 KB
Save Response
Pretty
Raw
Preview
Visualize
JSON
168],
169 "height": 4,
170 "held_items": […
397],
398 "id": 25,
399 "is_default": true,
400 "location_area_encounters": "https://pokeapi.co/api/v2/pokemon/25/encounters",
401 "moves": […
9652],
9653 "name": "pikachu",

API

Application **P**rogramming **I**nterface

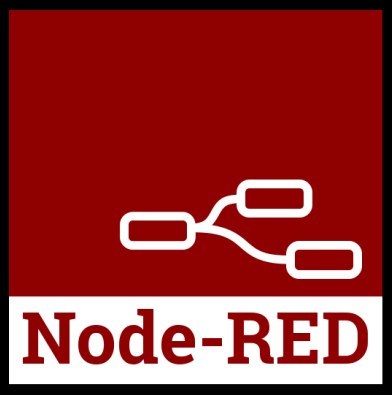
SDK

Software **D**evelopment **K**it

Diskussion:

Användningsområden för API:er/SDK

- Exempel på API:er
- Exempel på där ett API avänds
- Skillnader mellan SDK och API



Verktyg

- Node-red
- Grafana
- Postman
- MQTTExplorer
- Git/Github

Poll: Git

Plattformar

"A platform to rule them all"

Diskussion:

Plattformar och Ekosystem

- Vilka känner ni till?
- Skillnader?

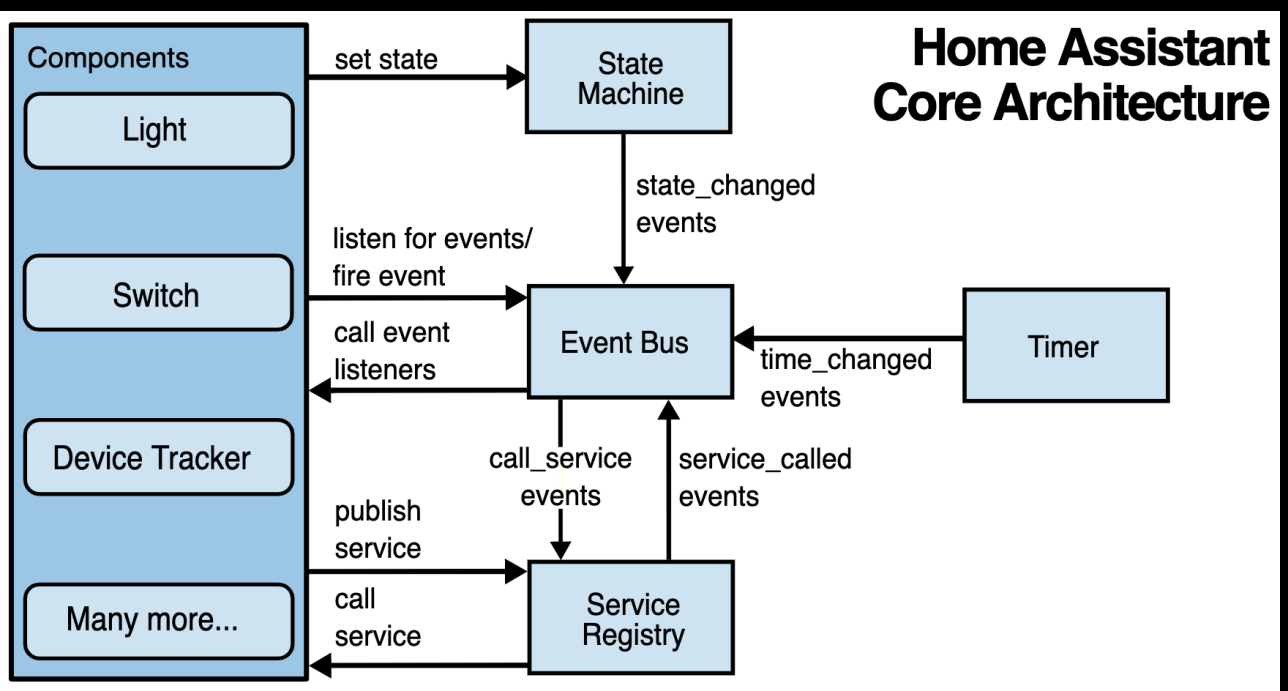
Home Assistant

Home Assistant

"Open source home automation that puts local control and privacy first.
Powered by a worldwide community of tinkerers and DIY enthusiasts.
Perfect to run on a Raspberry Pi or a local server."

https://homeassistant.io

Arkitektur



Bra exempel på en modern event-driven arkitektur

- Abstraktionslager
- Integration
- Automation
- Loggning
- NAV

Lab01-1

Installation Home Assistant

uide:
tps://github.com/voxic/Nackademin/blob/master/Dag1/Installation%20Home%20Assistant.m

Lab01-2

Uppsättning Arduino Sensor

Guide:
https://github.com/voxic/Nackademin/blob/master/Dag1/Upps%C3%A4ttning%20Arduino.m

Lab01-3

Arduino sensor till Home Assistant

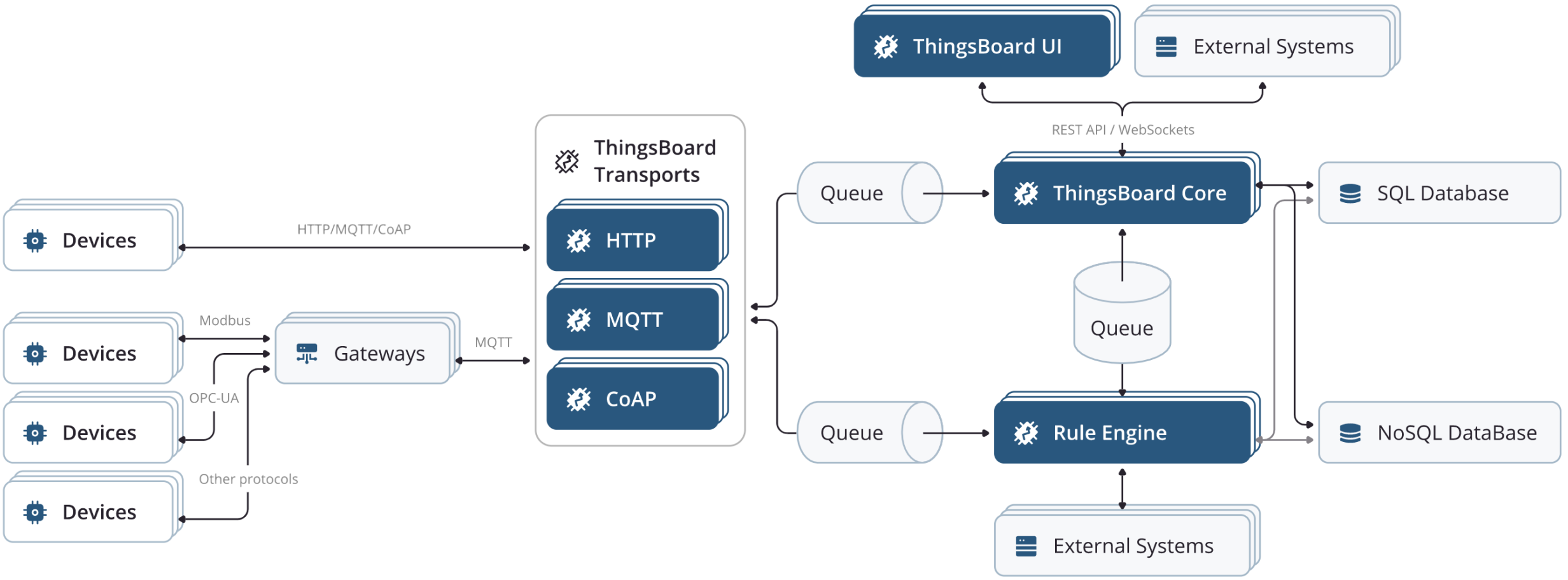
le:
s://github.com/voxic/Nackademin/blob/master/Dag1/Arduino%20till%20Home%20Assistan

Thingsboard

sBoard is an open-source IoT platform that enables rapid development,
ment and scaling of IoT projects. The goal is to provide the out-of-the-box IoT clo
mises solution that will enable server-side infrastructure for your IoT applicatio

https://thingsboard.io

Arkitektur



"Enterprise-grade Event architecture"

- Provision devices, assets and customers and define relations between them.
- Collect and visualize data from devices and assets.
- Analyze incoming telemetry and trigger alarms with complex event processing.
- Control your devices using remote procedure calls (RPC).
- Build work-flows based on device life-cycle event, REST API event, RPC request, etc
- Design dynamic and responsive dashboards and present device or asset telemetry and insights to your customers
- Enable use-case specific features using customizable rule chains.
- Push device data to other systems.