PSI3542 2023
SISTEMAS EMBARCADOS PARA IOT

AULA07 – clients MQTT

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Alguns Brokers MQTT de código aberto

Mosquitto	https://github.com/eclipse/mosquitto
Aedes	https://github.com/moscajs/aedes
EMQ (emqttd)	https://github.com/emqx/emqx
VerneMQ	https://github.com/vernemq/vernemq
Apache ActiveMQ	
RabbitMQ	
HiveMQ	https://github.com/HiveMQ
MQTTnet	
Wave	

https://mqtt.org/software/

Clientes MQTT

- Versão
  - 3.1.1
  - 5.0
- Sistema Operacional
  - Linux
  - Windows
  - Embarcado
    - RTOS
    - Bare metal
- Linguagem
  - C
  - Python
  - MicroPython

Clientes MQTT

- Mosquitto.
  - C
  - https://github.com/eclipse/mosquitto
- Eclipse Paho.
  - C, C++, Phython, Java, JavaScript, Lua, Go etc.
  - https://eclipse.dev/paho/index.php?page=clients/python/index.php

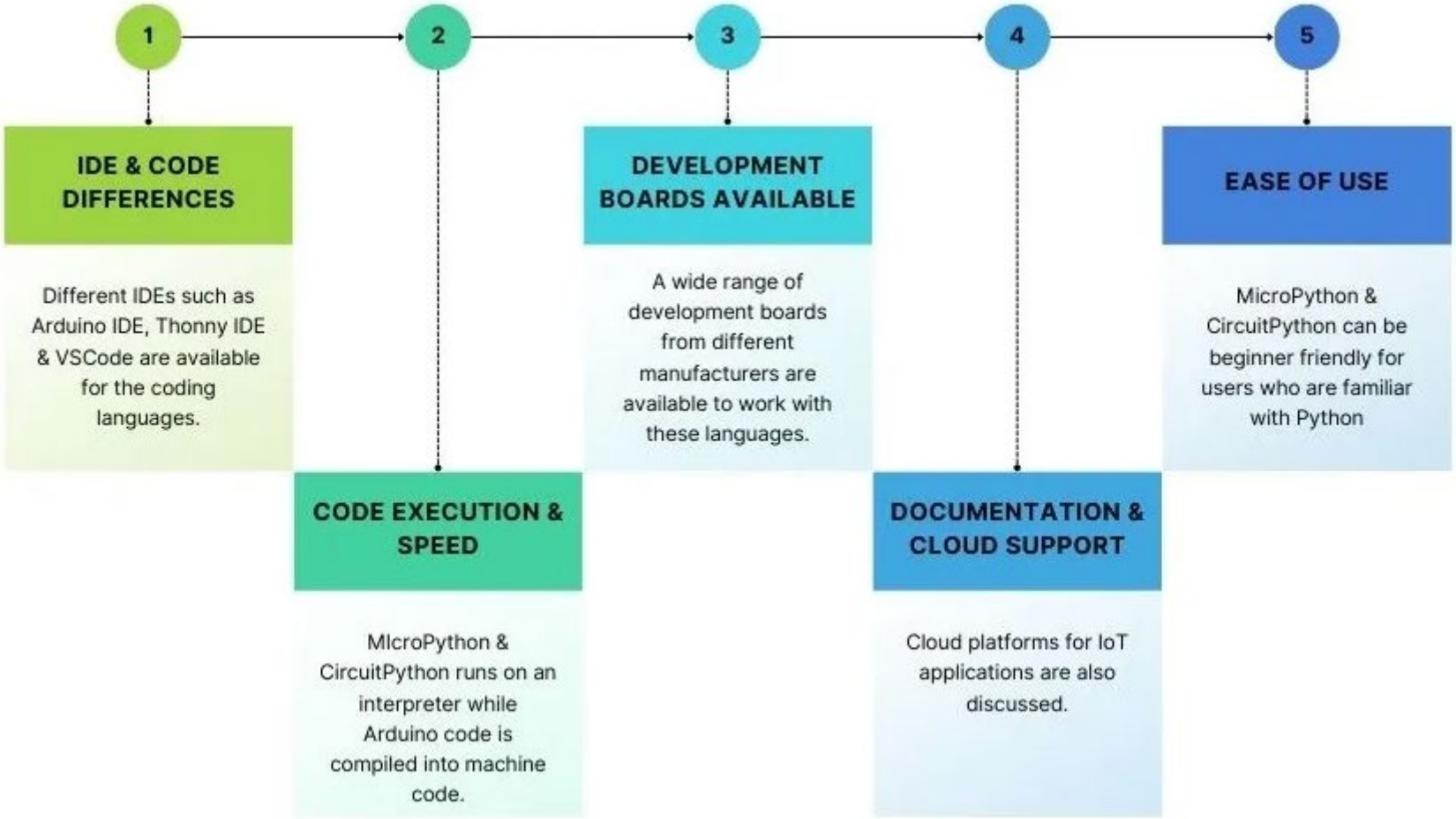
Clientes Eclipse Paho

Client	MQTT 3.1	MQTT 3.1.1	MQTT 5.0	LWT	SSL / TLS	Automatic Reconnect	Offline Buffering	Message Persistence	WebSocket Support	Standard MQTT Support	Blocking API	Non-Blocking API	High Availability
Java	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Python	✔	✔	✔	✔	✔	✔	✔	✖	✔	✔	✔	✔	✖
JavaScript	✔	✔	✖	✔	✔	✔	✔	✔	✔	✖	✖	✔	✔
GoLang	✔	✔	✖	✔	✔	✔	✔	✔	✔	✔	✖	✔	✔
C	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
C++	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Rust	✔	✔	✖	✔	✔	✔	✔	✔	✖	✔	✔	✔	✔
.Net (C#)	✔	✔	✖	✔	✔	✖	✖	✖	✖	✔	✖	✔	✖
Android Service	✔	✔	✖	✔	✔	✔	✔	✔	✔	✔	✖	✔	✔
Embedded C/C++	✔	✔	✖	✔	✔	✖	✖	✖	✖	✔	✔	✔	✖

Clientes MQTT MicroPython

- Umqtt.simple.
  - MicroPython
  - https://github.com/micropython/micropython-lib/tree/master/micropython/umqtt.simple

Arduino, MicroPython, CircuitPython



Arduino code vs MicroPython code

```ino
void setup() {

  pinMode(LED_BUILTIN, OUTPUT);      // initialize digital pin LED_BUILTIN as an output.
}



void loop() {
  digitalWrite(LED_BUILTIN, HIGH);   // turn the LED on (HIGH is the voltage level)
  delay(1000);                       // wait for a second
  digitalWrite(LED_BUILTIN, LOW);    // turn the LED off by making the voltage LOW
  delay(1000);                       // wait for a second
}
```

```micropython
from machine import Pin
import time

#initialize pin connected to onboard LED as output.
led = Pin("LED", Pin.OUT)

while True:
    led.low()
    time.sleep(1)
    led.high()
    time.sleep(1)
```

https://electrocredible.com/arduino-vs-micropython-vs-circuitpython/

Clientes MQTT Arduino

- knolleary/pubsubclient
  - https://github.com/knolleary/pubsubclient
  - https://pubsubclient.knolleary.net/
- ArduinoMqtt
  - https://www.arduino.cc/reference/en/libraries/arduinomqtt/
  - https://github.com/monstrenyatko/ArduinoMqtt
  - Baseado no Eclipse Paho
- ArduinoMqttClient Library for Arduino
  - https://www.arduino.cc/reference/en/libraries/arduinomqttclient/
  - https://github.com/arduino-libraries/ArduinoMqttClient

Clientes MQTT ESP32

- Comparação entre clientes MQTT para ESP32
  - https://cedalo.com/blog/enabling-esp32-mqtt/
- Espressif ESP-MQTT (sobre FreeRTOS)
  - https://docs.espressif.com/projects/esp-idf/en/latest/esp32/api-reference/protocols/mqtt.html
  - https://www.microprogramador.com.br/2022/09/mqtt-basico-com-esp32-e-mosquitto-broker.html
- PubSubClient Tutorial para ESP32 (Bare Metal Arduino code)
  - https://randomnerdtutorials.com/esp32-mqtt-publish-subscribe-arduino-ide/
  - https://www.emqx.com/en/blog/esp32-connects-to-the-free-public-mqtt-broker
  - https://www.newtoncbraga.com.br/index.php/microcontroladores/143-tecnologia/17117-comunicando-se-via-mqtt-com-o-esp32-mic404.html
  - https://medium.com/@flaviofagundes/primeiros-passos-esp32-e-broker-mqtt-b8b3e41297c

Projetos WOKWI MQTT ESP32 (Arduino,C++)

- PUBSUBCLIENT
  - https://wokwi.com/projects/322524997423727188
  - https://wokwi.com/projects/357700966220449793
  - https://wokwi.com/projects/323934403367535186
  - https://wokwi.com/projects/335981300939752020
  - https://wokwi.com/projects/374148034848049153
  - https://wokwi.com/projects/372596627753133057
  - https://wokwi.com/projects/374036089311655937
  - https://wokwi.com/projects/373333515024527361
- Sobre FREERTOS
  - https://wokwi.com/projects/349902937965724242

Projetos WOKWI MQTT ESP32 (microPython)

- umqtt.simple
  - https://wokwi.com/projects/322577683855704658
  - https://wokwi.com/projects/374335118460288001
  - https://wokwi.com/projects/315787266233467457
  - https://wokwi.com/projects/373403210006640641
  - https://wokwi.com/projects/373401376591341569
  - Video:
    - https://www.youtube.com/watch?v=lEXQ9w1z7Aw
    - https://www.youtube.com/watch?v=eZZCA-1s2wI

MQTT Thingspeak

MQTT API

- https://www.mathworks.com/help/thingspeak/mqtt-api.html?s_tid=CRUX_lftnav

- Publish Using WebSockets in Python on a Raspberry Pi (Paho)
  - https://www.mathworks.com/help/thingspeak/use-raspberry-pi-board-that-runs-python-websockets-to-publish-to-a-channel.html
- Remote Sensor Control Using Secure MQTT Publish and Subscribe
  - https://www.mathworks.com/help/thingspeak/mqtt-publish-and-subscribe-with-esp8266.html

Dúvidas?

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