https://www.halvorsen.blog

MQTT with Python

A Communication Protocol popular in Internet of Things Applications

Hans-Petter Halvorsen

Contents

- MQTT Overview
- MQTT Brokers
  - HiveMQ Cloud
- MQTT Clients
  - MQTT X
- Python
  - MQTT Python Library
  - HiveMQ Cloud and Python Examples
- ThingSpeak
  - ThingSpeak and MQTT X Client
  - ThingSpeak and Python

MQTT

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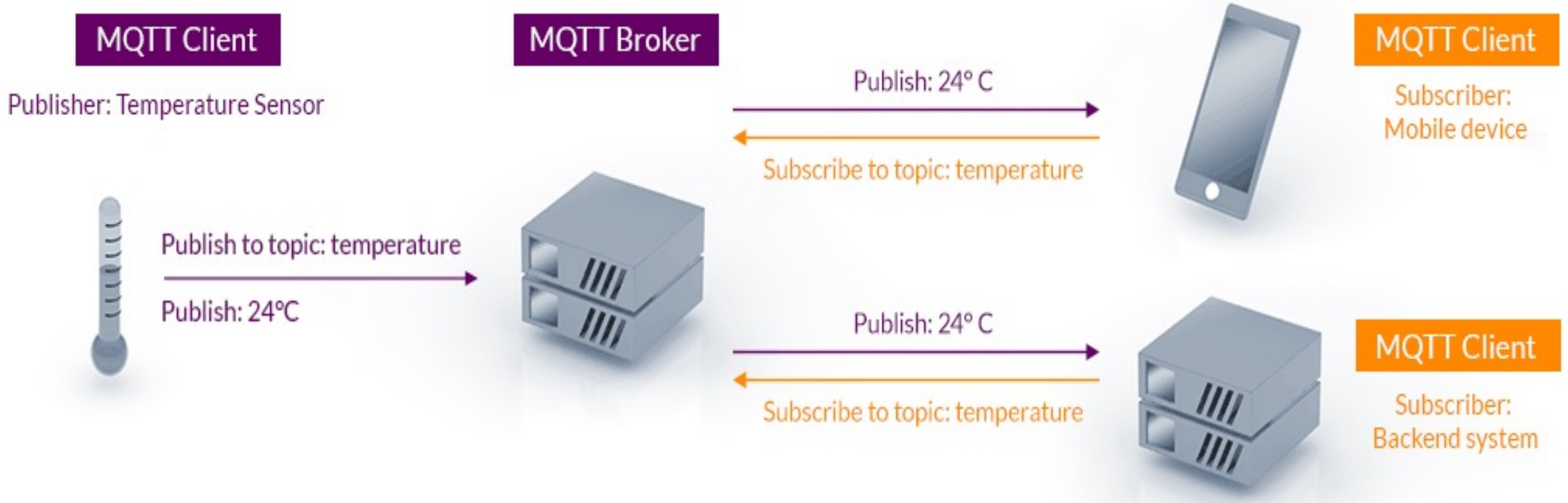
Table of Contents

MQTT

- MQTT is a Communication Protocol popular in Internet of Things (IoT) Applications
- https://mqtt.org
- You can use or implement MQTT in all the most popular Programming environments
- MQTT can be used on all the popular platforms like Windows, macOS, Linux, Arduino, Raspberry Pi
- You can use an existing API, or you can implement and use the MQTT protocol from scratch
- We will Python in this Tutorial

MQTT



MQTT Client

Publisher: Temperature Sensor

Publish to topic: temperature

Publish: 24°C

MQTT Broker

Publish: 24° C

Subscribe to topic: temperature

MQTT Client

Subscriber: Mobile device

Publish: 24° C

Subscribe to topic: temperature

MQTT Client

Subscriber: Backend system

https://mqtt.org

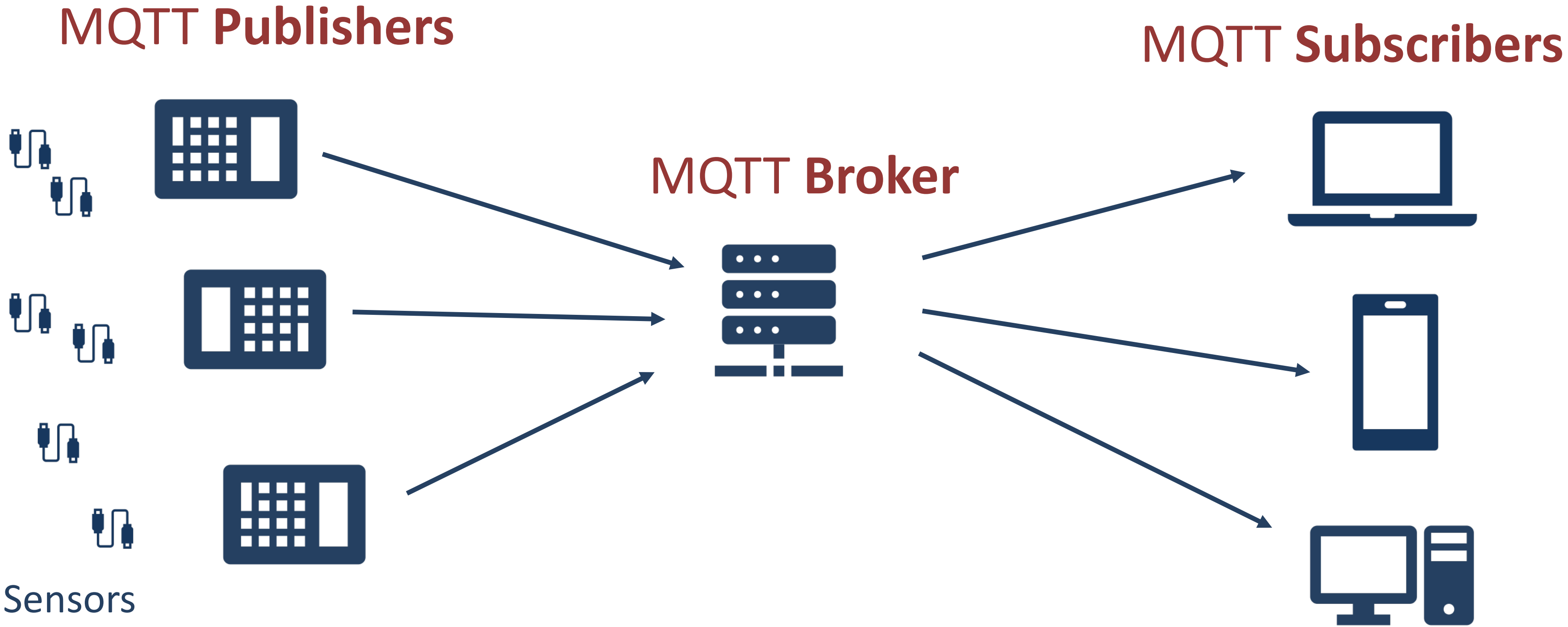
MQTT

- Message Queueing Telemetry Transport (MQTT) is an IoT connectivity protocol
- MQTT is used in applications with thousands of sensors
- MQTT is efficient in terms of bandwidth, battery, and resources
- **MQTT uses a publish/subscribe model**
- MQTT can be implemented using standard HTTP calls
- M2M (machine to machine) Communication

Internet of Things (IoT) and MQTT

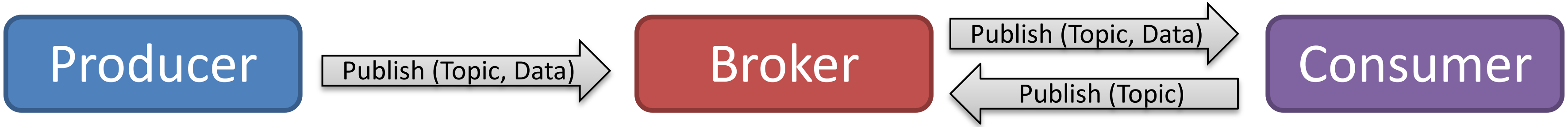
- Internet of Things (IoT): To get data to and from devices on a network.
- MQTT is a lightweight protocol that makes this easier

MQTT Scenario



Publish/Subscribe Model

Typically, we have what we call **Producers** (Publishers), and we have **Consumers**, which can be both Publishers and Subscribers.



Producer

Publish (Topic, Data)

Broker

Publish (Topic, Data)

Publish (Topic)

Consumer

Client

Server

Client

Client that Writes Data

Client that Reads Data

MQTT Terms

- MQTT Broker
  - Server
- MQTT Publishers
  - Clients that Write/Publish Data
- MQTT Subscribers
  - Clients that Read/Subscribe to Data

MQTT Topics

- Data in MQTT are Published to Topics
- Topics are made up of one or more topic levels, separated by a forward slash

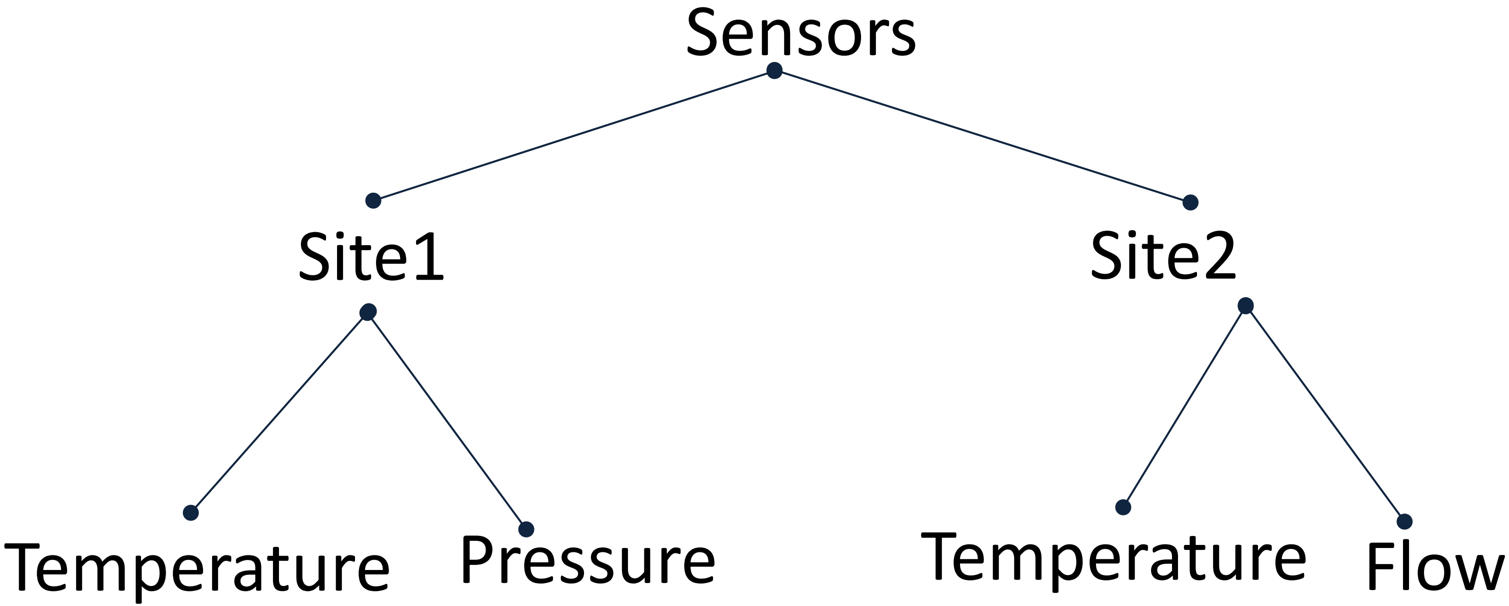
Example:

Sensor/Temperature/TMP36

- Topics are used to organize the data
- Topics are case sensitive
- Topics don’t have to be pre-registered at the broker

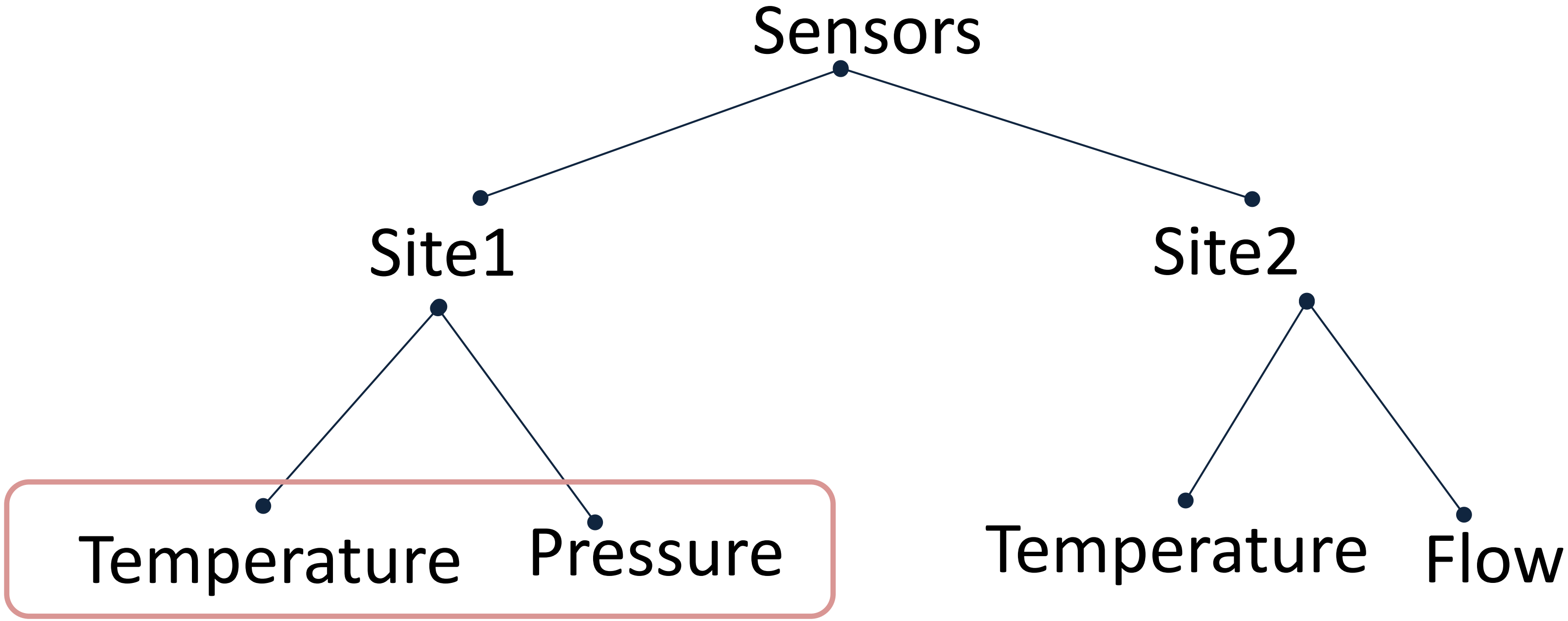
MQTT Topics

Topics are used to organize the data



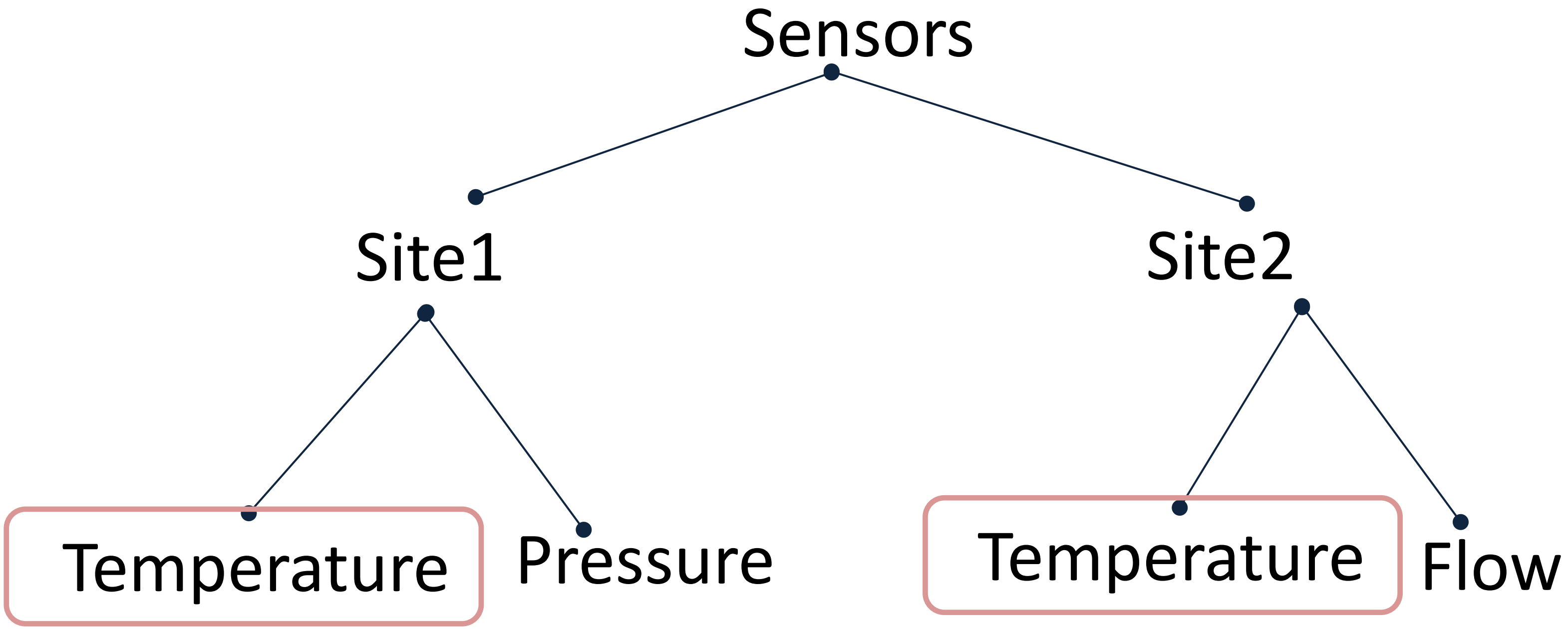
Subscribe on Topics - Wildcards

Wildcards: Sensors/Site1/#



Subscribe on Topics - Wildcards

Wildcards: Sensors/**+**/Temperature



Quality of Service (QoS)

MQTT offers 3 Quality of Service levels:

- QoS **0** - Delivery at most once (“fire and forget“)
  - In QoS 0 there is no guarantee of delivery
- QoS **1** - Delivery at least once
  - QoS 1 guarantees that a message is delivered at least one time to the receiver
- QoS **2** - Delivery exactly once
  - QoS 2 is the highest level of service in MQTT. This level guarantees that each message is received only once by the intended recipients

MQTT Brokers

Free MQTT Brokers

- Eclipse Mosquitto
  https://mosquitto.org
- HiveMQ Community Edition (HiveMQ CE)
  https://www.hivemq.com
- **HiveMQ Cloud**
  https://www.hivemq.com
- EMQ X MQTT IoT Cloud
  https://www.emqx.com/en/mqtt/public-mqtt5-broker
- **ThingSpeak** (IoT Cloud Platform that offers an MQTT Broker among others)
  https://thingspeak.com

HiveMQ Cloud

MQTT Broker in the Cloud

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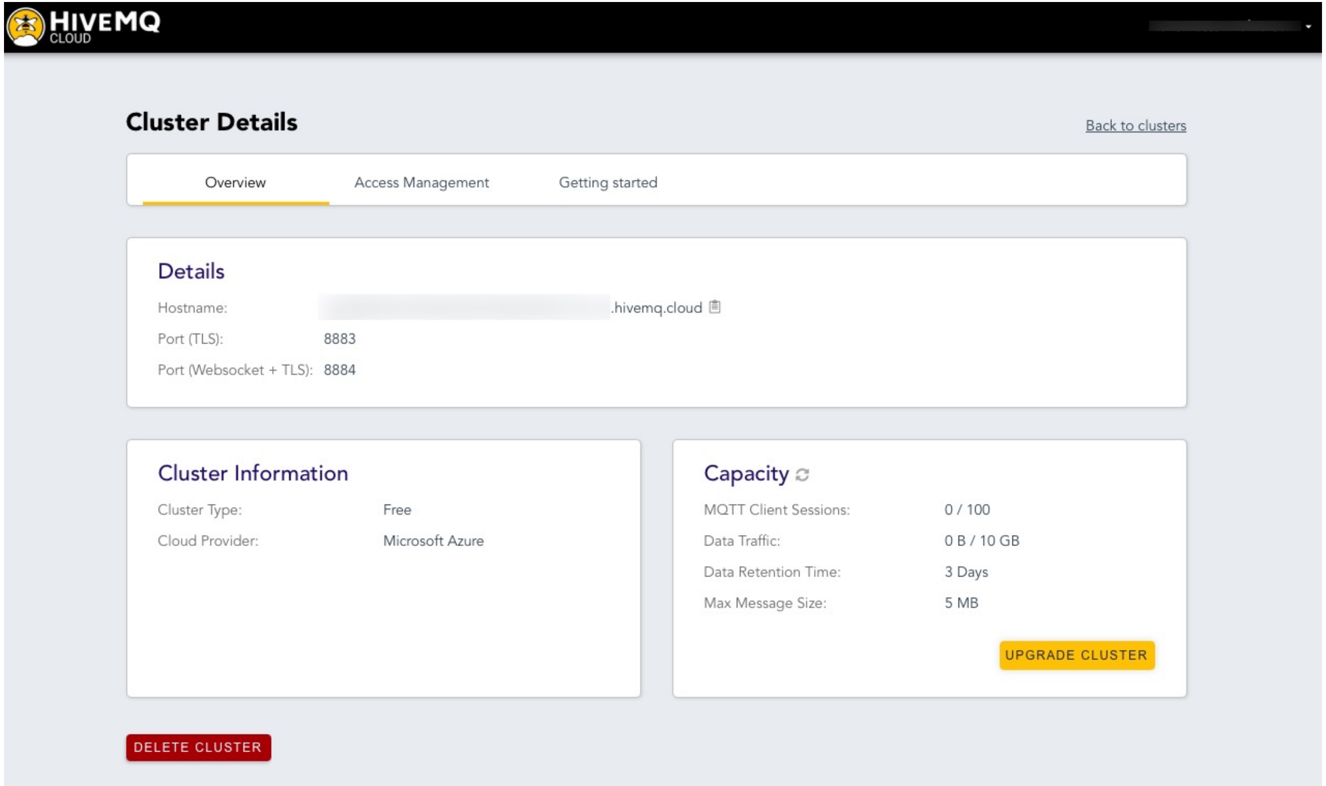
Table of Contents

HiveMQ Cloud

https://www.hivemq.com



Cluster Details

Details

Hostname: [redacted].hivemq.cloud

Port (TLS): 8883

Port (Websocket + TLS): 8884

Cluster Information

Cluster Type: Free

Cloud Provider: Microsoft Azure

Capacity

MQTT Client Sessions: 0 / 100

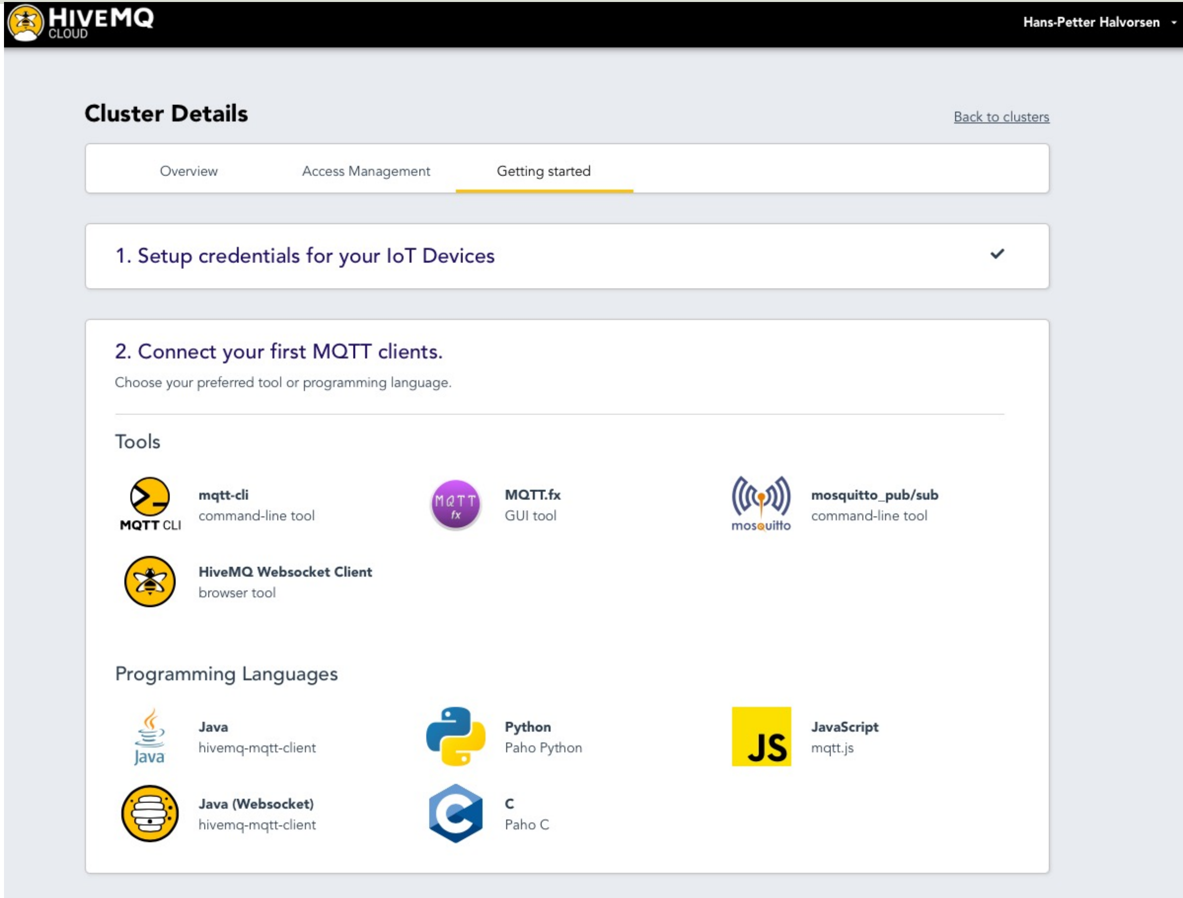
Data Traffic: 0 B / 10 GB

Data Retention Time: 3 Days

Max Message Size: 5 MB

HiveMQ Cloud

https://www.hivemq.com



Cluster Details

Back to clusters

1. Setup credentials for your IoT Devices ✓

2. Connect your first MQTT clients.

Choose your preferred tool or programming language.

Tools

- mqtt-cli – command-line tool
- MQTT.fx – GUI tool
- mosquitto_pub/sub – command-line tool
- HiveMQ Websocket Client – browser tool

Programming Languages

- Java – hivemq-mqtt-client
- Python – Paho Python
- JavaScript – mqtt.js
- Java (Websocket) – hivemq-mqtt-client
- C – Paho C

Here you can find a basic Python example

MQTT Clients

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Table of Contents

Free MQTT Clients

- **MQTT X** is an MQTT 5.0 Open-source Desktop Client
  https://mqttx.app
- **HiveMQ** Community Edition (HiveMQ CE)
  - Both Broker and MQTT Client
    https://www.hivemq.com

MQTT X

Open-source MQTT Desktop Client

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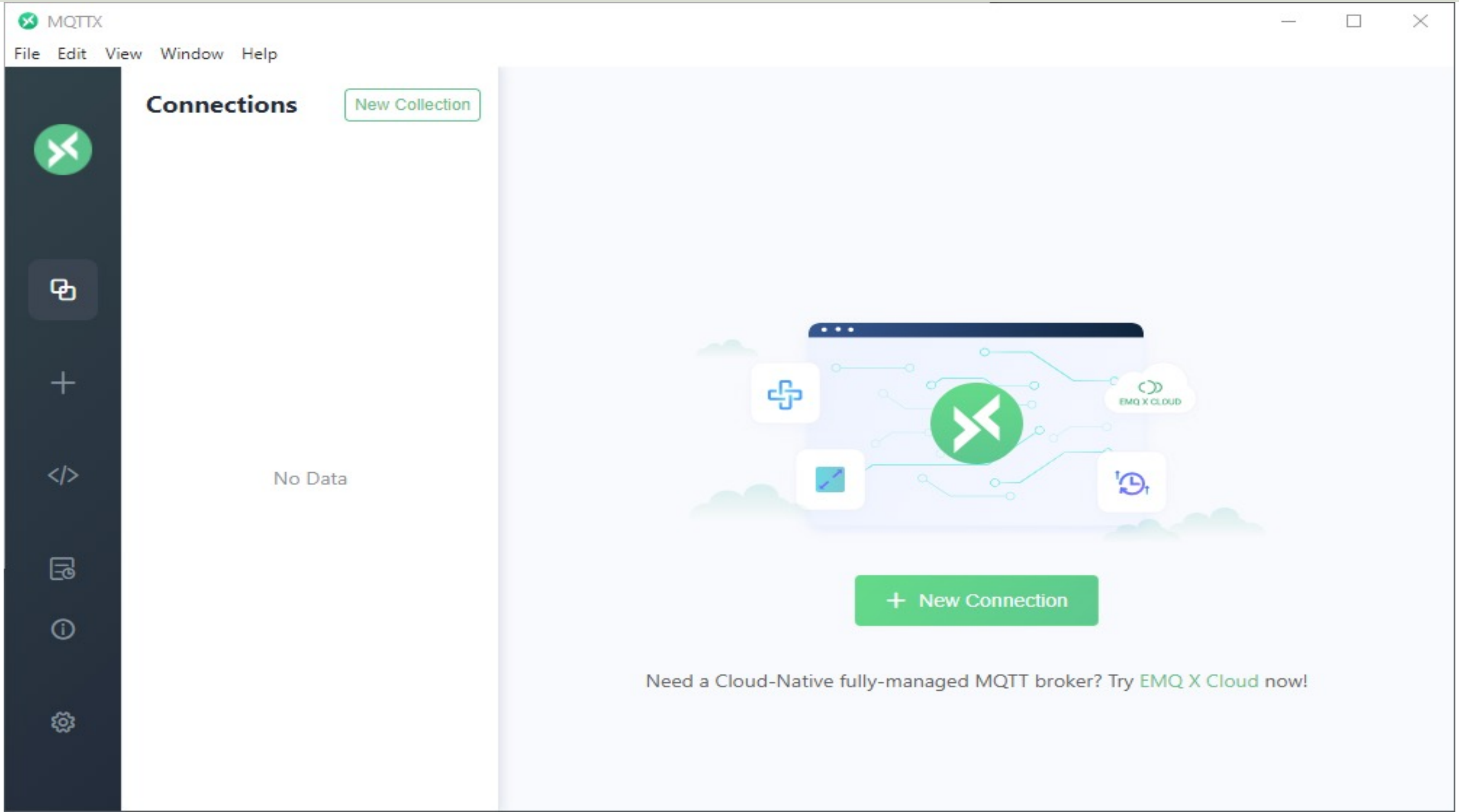
Table of Contents

MQTT X

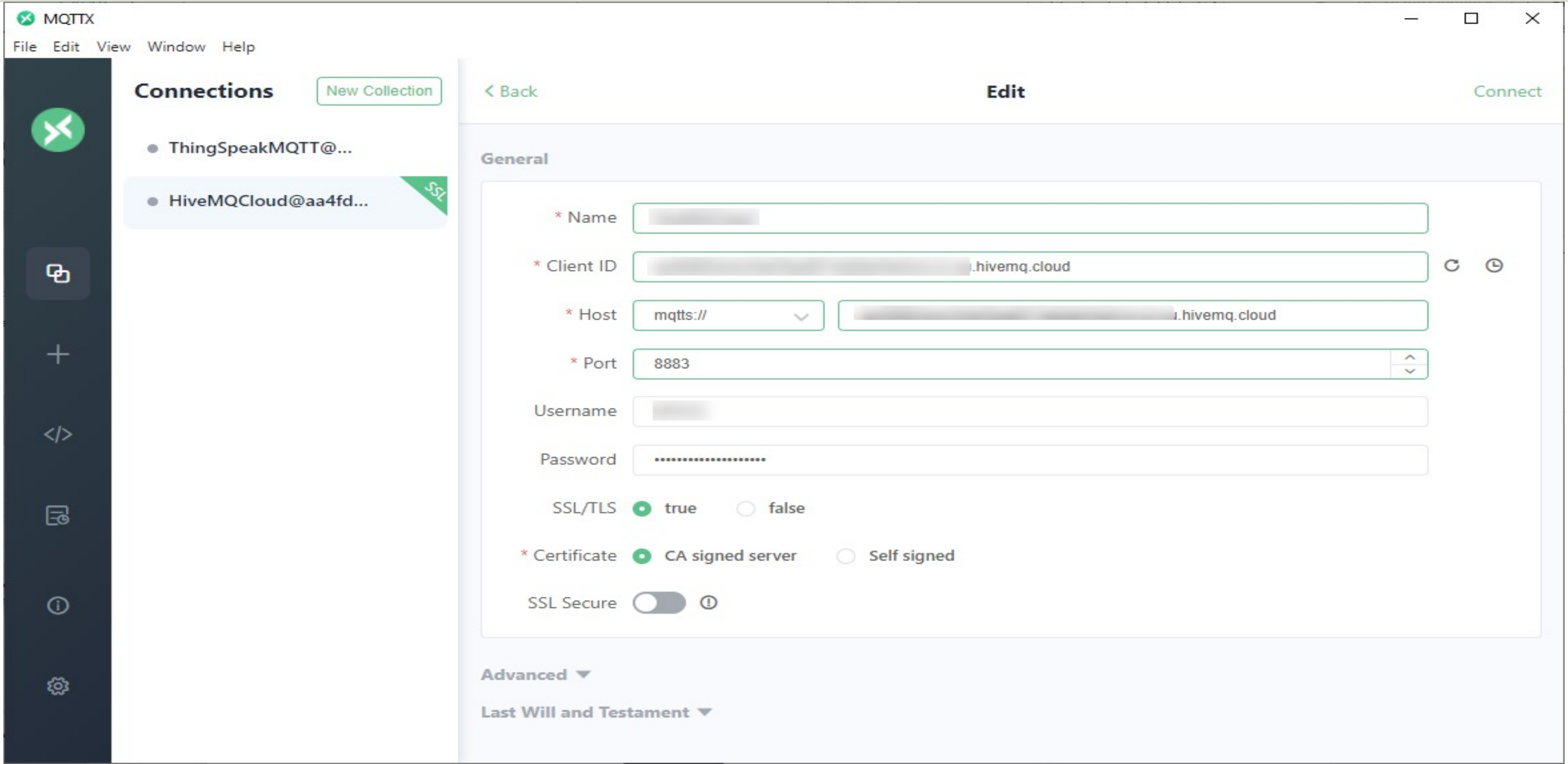
- MQTT X is an MQTT 5.0 Open-source MQTT Desktop Client
- It work with and Windows, macOS and Linux
- https://mqttx.app

MQTTX



Need a Cloud-Native fully-managed MQTT broker? Try EMQ X Cloud now!

Connect to Broker HiveMQ Cloud using MQTTX Client



General

* Name: [redacted]

* Client ID: [redacted].hivemq.cloud

* Host: mqtts:// [redacted].hivemq.cloud

* Port: 8883

Username: [redacted]

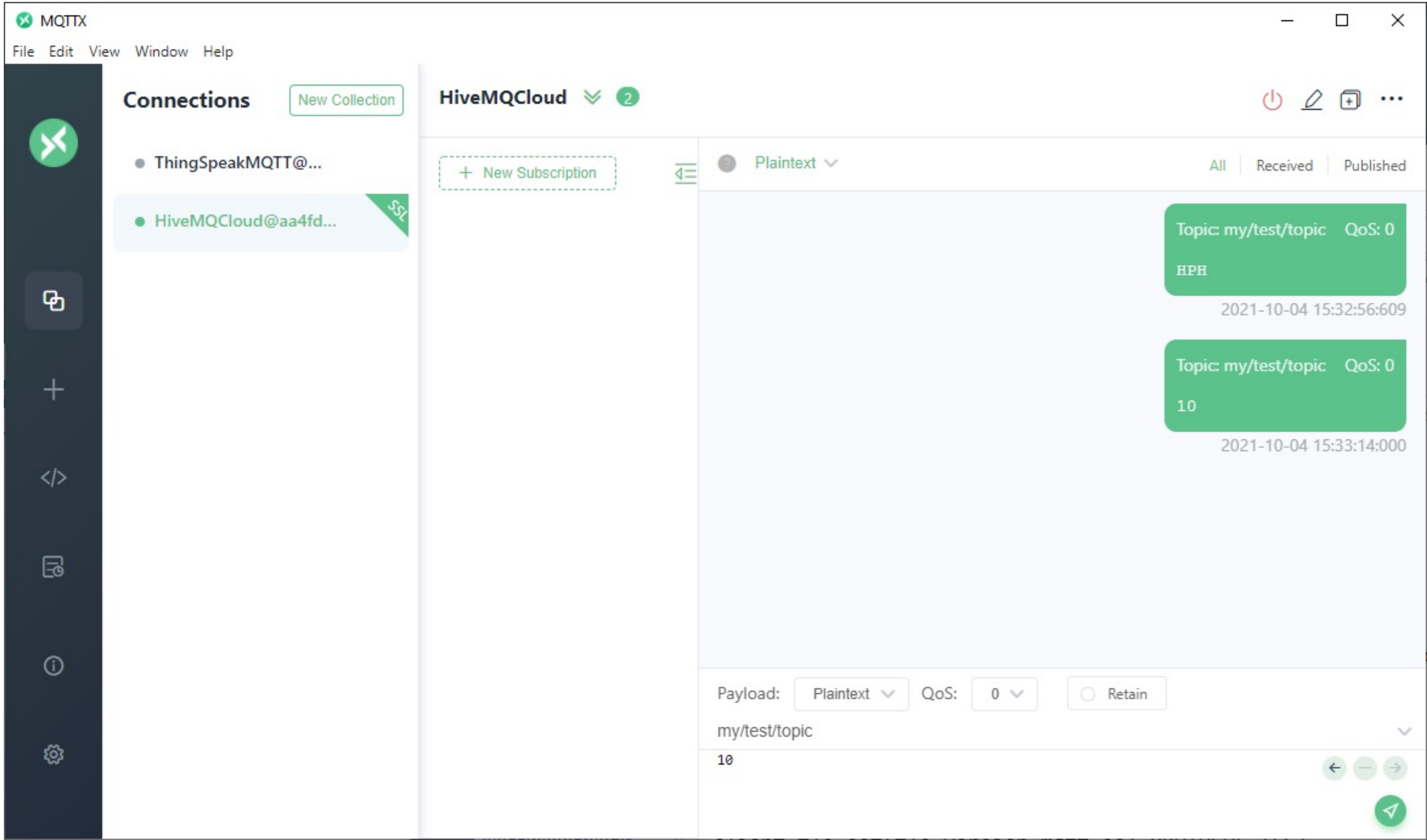
Password: ••••••••••••••••••••••

SSL/TLS: ● true ○ false

* Certificate: ● CA signed server ○ Self signed

SSL Secure: off

Publish to Broker HiveMQ Cloud using MQTTX Client



Topic: my/test/topic QoS: 0

HPH

2021-10-04 15:32:56:609

Topic: my/test/topic QoS: 0

10

2021-10-04 15:33:14:000

Payload: Plaintext QoS: 0

my/test/topic

10

Python

Using MQTT with Python

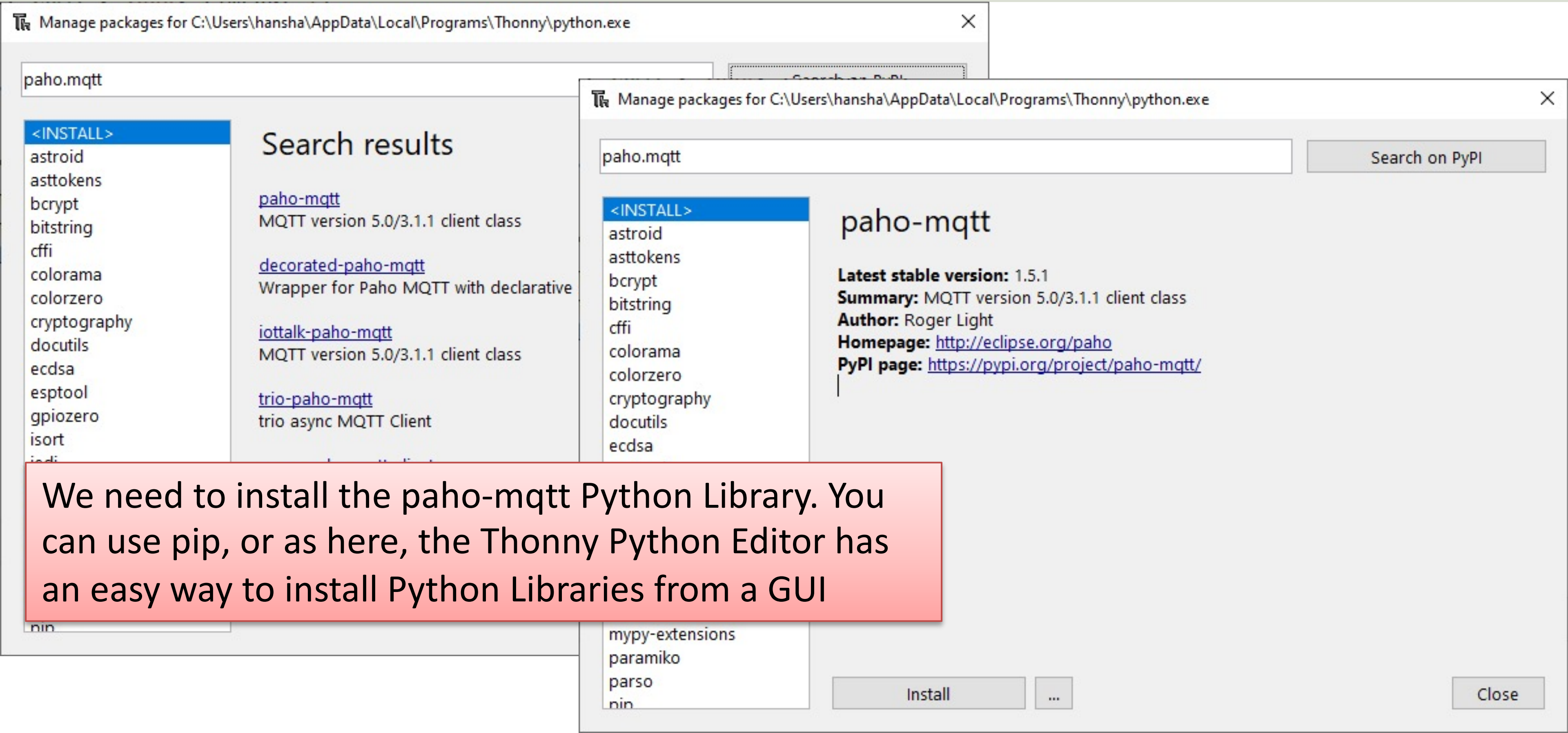
Hans-Petter Halvorsen

Table of Contents

Using MQTT in Python

- The most used MQTT Python Library is paho-mqtt
- We need to install the paho-mqtt Python Library using pip

paho-mqtt



Manage packages for C:\Users\hansha\AppData\Local\Programs\Thonny\python.exe

paho.mqtt

Search results

paho-mqtt
MQTT version 5.0/3.1.1 client class

decorated-paho-mqtt
Wrapper for Paho MQTT with declarative

iottalk-paho-mqtt
MQTT version 5.0/3.1.1 client class

trio-paho-mqtt
trio async MQTT Client

Manage packages for C:\Users\hansha\AppData\Local\Programs\Thonny\python.exe

paho.mqtt

paho-mqtt

Latest stable version: 1.5.1
Summary: MQTT version 5.0/3.1.1 client class
Author: Roger Light
Homepage: http://eclipse.org/paho
PyPI page: https://pypi.org/project/paho-mqtt/

We need to install the paho-mqtt Python Library. You can use pip, or as here, the Thonny Python Editor has an easy way to install Python Libraries from a GUI

HiveMQ Cloud and Python

Hans-Petter Halvorsen

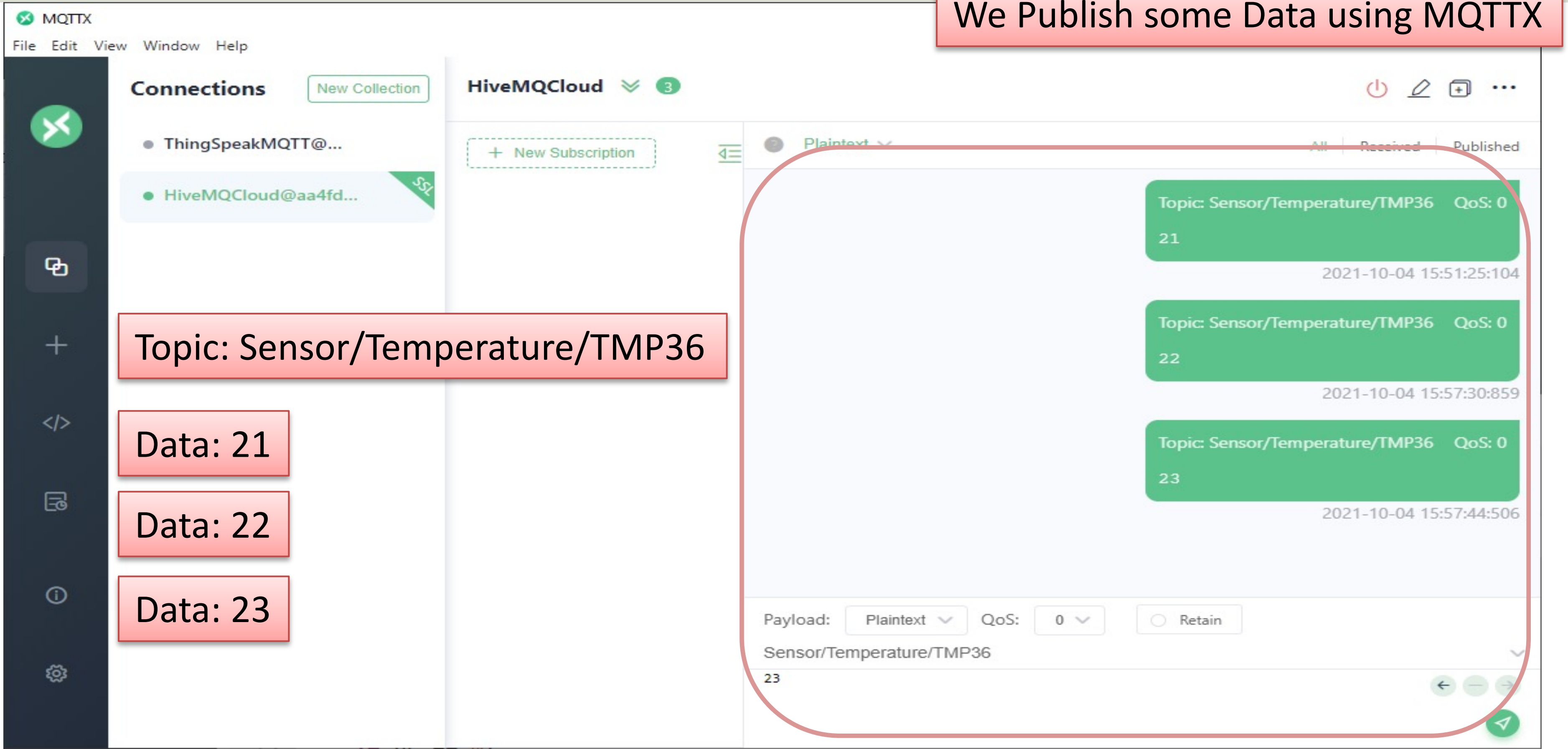
Table of Contents

HiveMQ Cloud Python Example

```python
import paho.mqtt.client as mqtt

brokerAddress = "xxxxx"
userName = "xxxxx"
passWord = "xxxxx"
topic = "my/test/topic"
data = "Hello"

def on_connect(client, userdata, flags, rc):
    if rc == 0:
        print("Connected successfully")
    else:
        print("Connect returned result code: " + str(rc))

def on_message(client, userdata, msg):
    print("Received message: " + msg.topic + " -> " + msg.payload.decode("utf-8"))

client = mqtt.Client()
client.on_connect = on_connect
client.on_message = on_message
client.tls_set(tls_version=mqtt.ssl.PROTOCOL_TLS)
client.username_pw_set(userName, passWord)
client.connect(brokerAddress, 8883)


client.subscribe(topic)
client.publish(topic, data)

client.loop_forever()
```

Example

We Publish some Data using MQTTX



Topic: Sensor/Temperature/TMP36 QoS: 0

21

2021-10-04 15:51:25:104

Topic: Sensor/Temperature/TMP36 QoS: 0

22

2021-10-04 15:57:30:859

Topic: Sensor/Temperature/TMP36 QoS: 0

23

2021-10-04 15:57:44:506

Payload: Plaintext QoS: 0 ○ Retain

Sensor/Temperature/TMP36

23

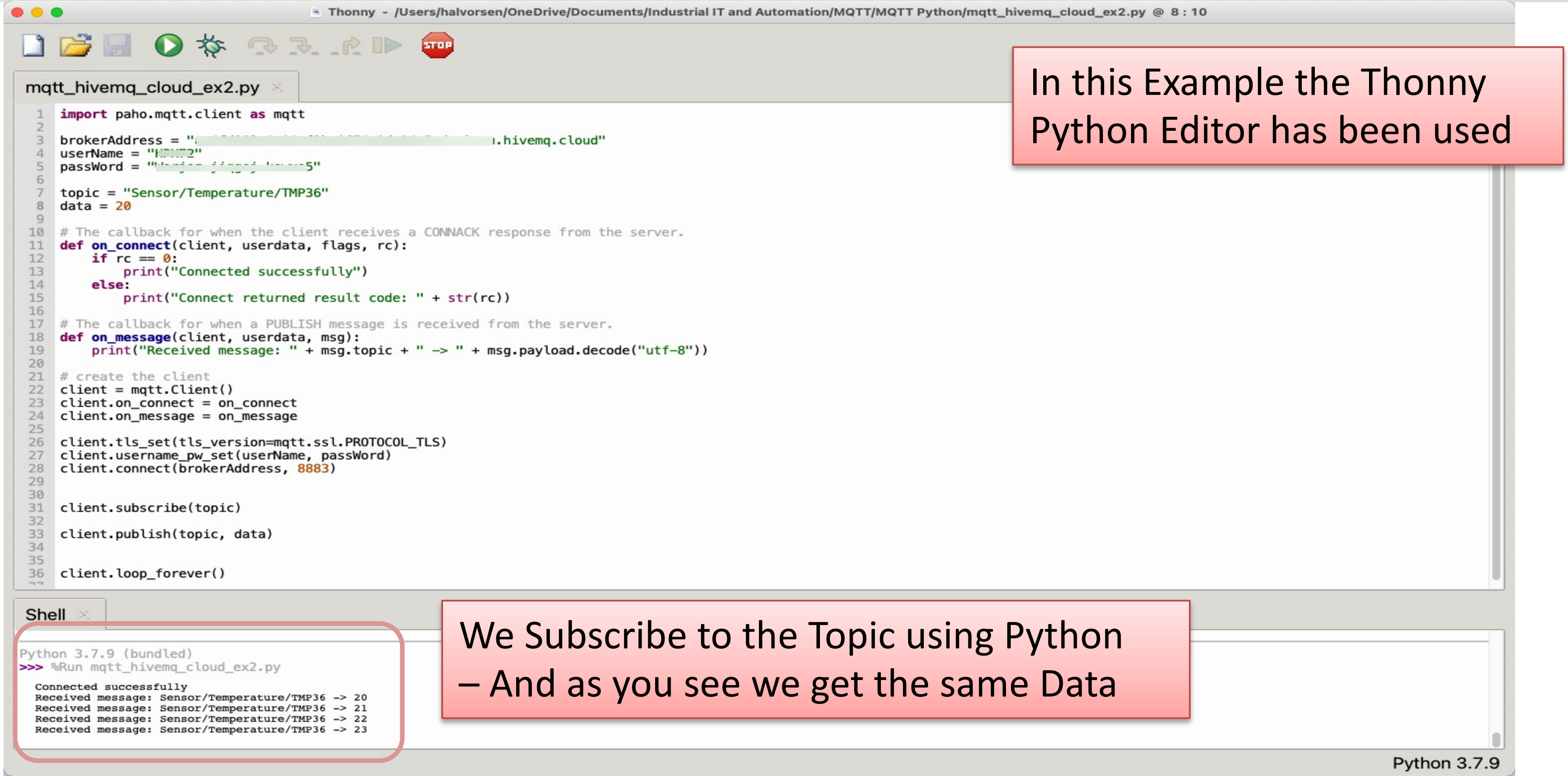
Topic: Sensor/Temperature/TMP36

Data: 21

Data: 22

Data: 23

Python Example



Thonny - /Users/halvorsen/OneDrive/Documents/Industrial IT and Automation/MQTT/MQTT Python/mqtt_hivemq_cloud_ex2.py @ 8 : 10

mqtt_hivemq_cloud_ex2.py

```python
import paho.mqtt.client as mqtt

brokerAddress = "[redacted].hivemq.cloud"
userName = "[redacted]2"
passWord = "[redacted]5"

topic = "Sensor/Temperature/TMP36"
data = 20

# The callback for when the client receives a CONNACK response from the server.
def on_connect(client, userdata, flags, rc):
    if rc == 0:
        print("Connected successfully")
    else:
        print("Connect returned result code: " + str(rc))

# The callback for when a PUBLISH message is received from the server.
def on_message(client, userdata, msg):
    print("Received message: " + msg.topic + " -> " + msg.payload.decode("utf-8"))

# create the client
client = mqtt.Client()
client.on_connect = on_connect
client.on_message = on_message

client.tls_set(tls_version=mqtt.ssl.PROTOCOL_TLS)
client.username_pw_set(userName, passWord)
client.connect(brokerAddress, 8883)


client.subscribe(topic)

client.publish(topic, data)


client.loop_forever()
```

Shell

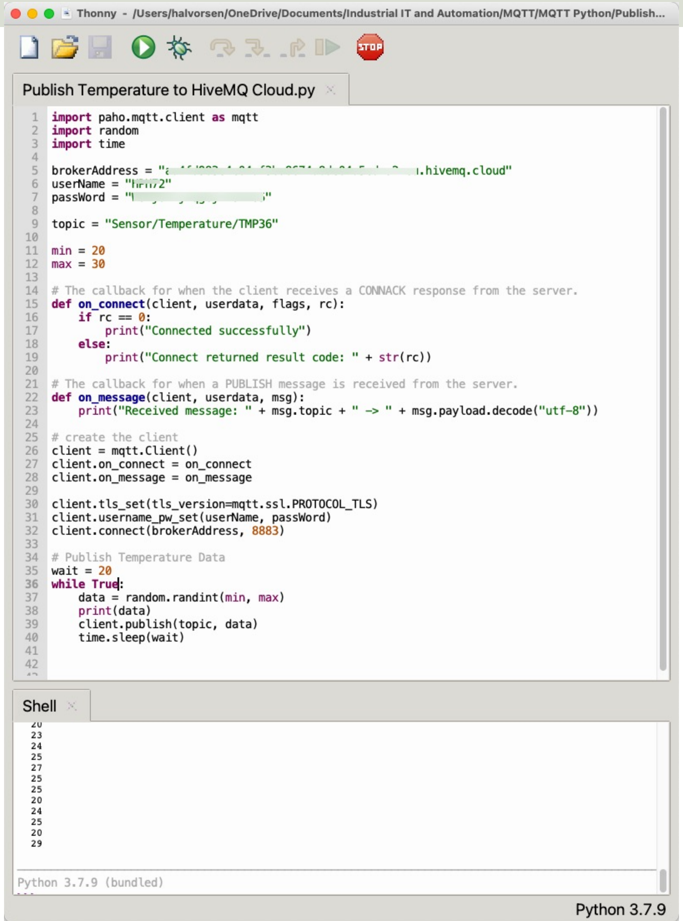
```
Python 3.7.9 (bundled)
>>> %Run mqtt_hivemq_cloud_ex2.py

  Connected successfully
  Received message: Sensor/Temperature/TMP36 -> 20
  Received message: Sensor/Temperature/TMP36 -> 21
  Received message: Sensor/Temperature/TMP36 -> 22
  Received message: Sensor/Temperature/TMP36 -> 23
```

Python 3.7.9

In this Example the Thonny Python Editor has been used

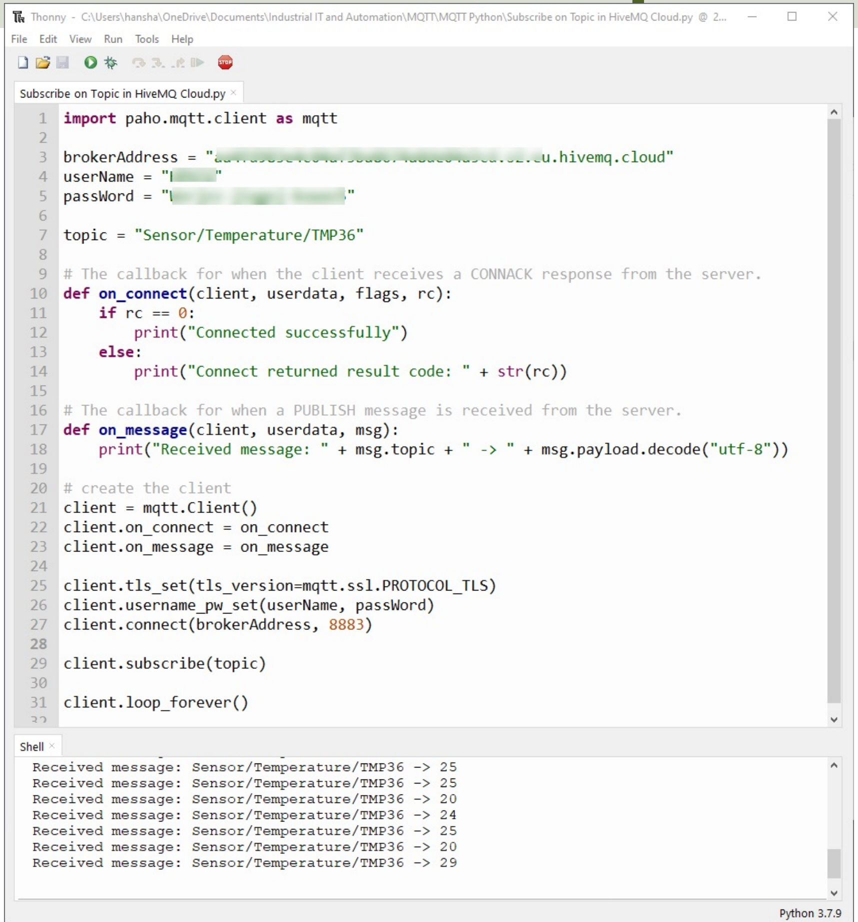
We Subscribe to the Topic using Python – And as you see we get the same Data

Publish – Subscribe Examples


Thonny - /Users/halvorsen/OneDrive/Documents/Industrial IT and Automation/MQTT/MQTT Python/Publish...
STOP
Publish Temperature to HiveMQ Cloud.py
Shell
Python 3.7.9

```python
import paho.mqtt.client as mqtt
import random
import time

brokerAddress = "[redacted].hivemq.cloud"
userName = "[redacted]"
passWord = "[redacted]"

topic = "Sensor/Temperature/TMP36"

min = 20
max = 30

# The callback for when the client receives a CONNACK response from the server.
def on_connect(client, userdata, flags, rc):
    if rc == 0:
        print("Connected successfully")
    else:
        print("Connect returned result code: " + str(rc))

# The callback for when a PUBLISH message is received from the server.
def on_message(client, userdata, msg):
    print("Received message: " + msg.topic + " -> " + msg.payload.decode("utf-8"))

# create the client
client = mqtt.Client()
client.on_connect = on_connect
client.on_message = on_message

client.tls_set(tls_version=mqtt.ssl.PROTOCOL_TLS)
client.username_pw_set(userName, passWord)
client.connect(brokerAddress, 8883)

# Publish Temperature Data
wait = 20
while True:
    data = random.randint(min, max)
    print(data)
    client.publish(topic, data)
    time.sleep(wait)
```

```
20
23
24
25
27
25
25
20
24
25
20
29

Python 3.7.9 (bundled)
```


Thonny - C:\Users\hansha\OneDrive\Documents\Industrial IT and Automation\MQTT\MQTT Python\Subscribe on Topic in HiveMQ Cloud.py @ 2...
File
Edit
View
Run
Tools
Help
STOP
Subscribe on Topic in HiveMQ Cloud.py
Shell
Python 3.7.9

```python
import paho.mqtt.client as mqtt

brokerAddress = "[redacted]u.hivemq.cloud"
userName = "[redacted]"
passWord = "[redacted]"

topic = "Sensor/Temperature/TMP36"

# The callback for when the client receives a CONNACK response from the server.
def on_connect(client, userdata, flags, rc):
    if rc == 0:
        print("Connected successfully")
    else:
        print("Connect returned result code: " + str(rc))

# The callback for when a PUBLISH message is received from the server.
def on_message(client, userdata, msg):
    print("Received message: " + msg.topic + " -> " + msg.payload.decode("utf-8"))

# create the client
client = mqtt.Client()
client.on_connect = on_connect
client.on_message = on_message

client.tls_set(tls_version=mqtt.ssl.PROTOCOL_TLS)
client.username_pw_set(userName, passWord)
client.connect(brokerAddress, 8883)

client.subscribe(topic)

client.loop_forever()
```

```
Received message: Sensor/Temperature/TMP36 -> 25
Received message: Sensor/Temperature/TMP36 -> 25
Received message: Sensor/Temperature/TMP36 -> 20
Received message: Sensor/Temperature/TMP36 -> 24
Received message: Sensor/Temperature/TMP36 -> 25
Received message: Sensor/Temperature/TMP36 -> 20
Received message: Sensor/Temperature/TMP36 -> 29
```

Publish

```
import paho.mqtt.client as mqtt
import random
import time

brokerAddress = "xxxxxx"
userName = "xxxxxx"
passWord = "xxxxxxx"

topic = "Sensor/Temperature/TMP36"

min = 20
max = 30

def on_connect(client, userdata, flags, rc):
    if rc == 0:
        print("Connected successfully")
    else:
        print("Connect returned result code: " + str(rc))

# create the client
client = mqtt.Client()
client.on_connect = on_connect

client.tls_set(tls_version=mqtt.ssl.PROTOCOL_TLS)
client.username_pw_set(userName, passWord)
client.connect(brokerAddress, 8883)

# Publish Temperature Data
wait = 20
while True:
    data = random.randint(min, max)
    print(data)
    client.publish(topic, data)
    time.sleep(wait)
```

Subscribe

```python
import paho.mqtt.client as mqtt

brokerAddress = "xxxxxx"
userName = "xxxxxx"
passWord = "xxxxxxx"

topic = "Sensor/Temperature/TMP36"

def on_connect(client, userdata, flags, rc):
    if rc == 0:
        print("Connected successfully")
    else:
        print("Connect returned result code: " + str(rc))

def on_message(client, userdata, msg):
    print("Received message: " + msg.topic + " -> " + msg.payload.decode("utf-8"))

# create the client
client = mqtt.Client()
client.on_connect = on_connect
client.on_message = on_message

client.tls_set(tls_version=mqtt.ssl.PROTOCOL_TLS)
client.username_pw_set(userName, passWord)
client.connect(brokerAddress, 8883)

client.subscribe(topic)

client.loop_forever()
```

Summary

- Example 1
  - Python Publish Data to a Topic
  - MQTT X Client Subscribing on the same Topic
- Example 2
  - MQTT X Client Publish Data to a Topic
  - Python Subscribing on the same Topic
- Example 3
  - Python Publish Data to a Topic
  - Python Subscribing on the same Topic

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ThingSpeak

Internet of Things Cloud Service

Hans-Petter Halvorsen

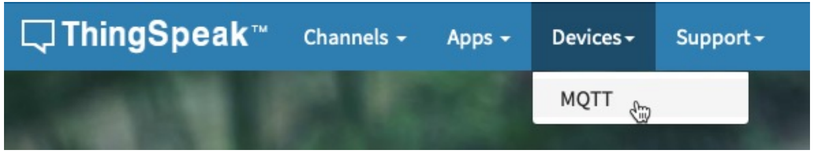
Table of Contents

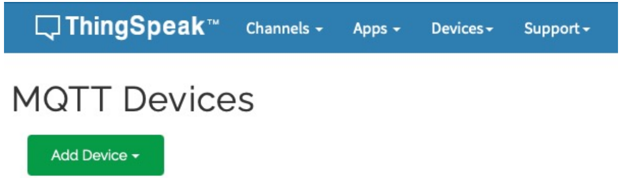
MQTT ThingSpeak

- https://mathworks.com/help/thingspeak/use-desktop-mqtt-client-to-publish-to-a-channel.html

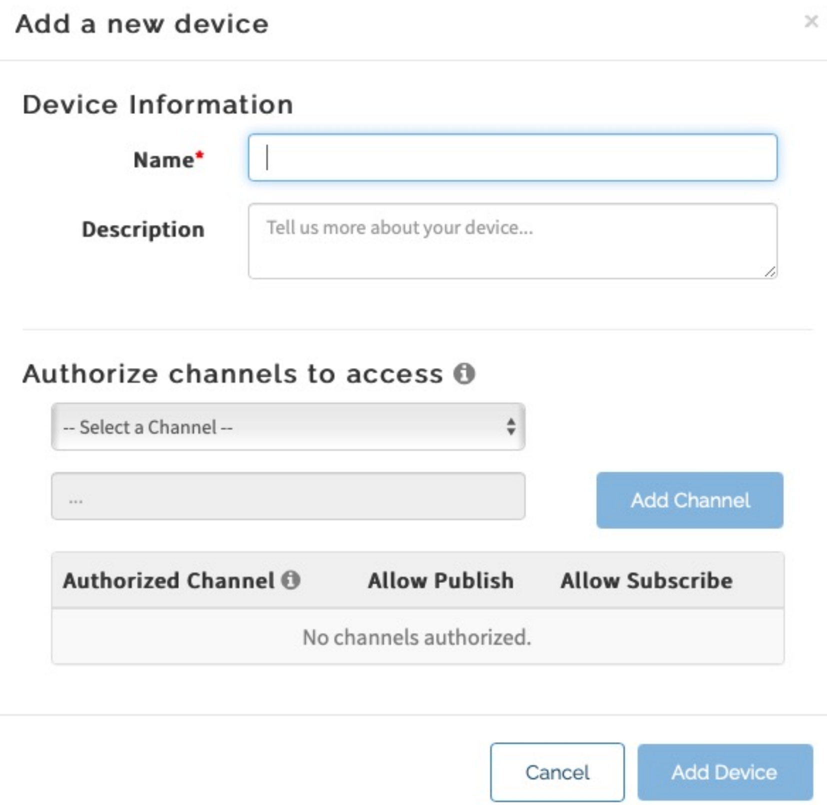
Configure MQTT in ThingSpeak

https://thingspeak.com





MQTT Devices



Add a new device

Device Information

Name*

Description: Tell us more about your device...

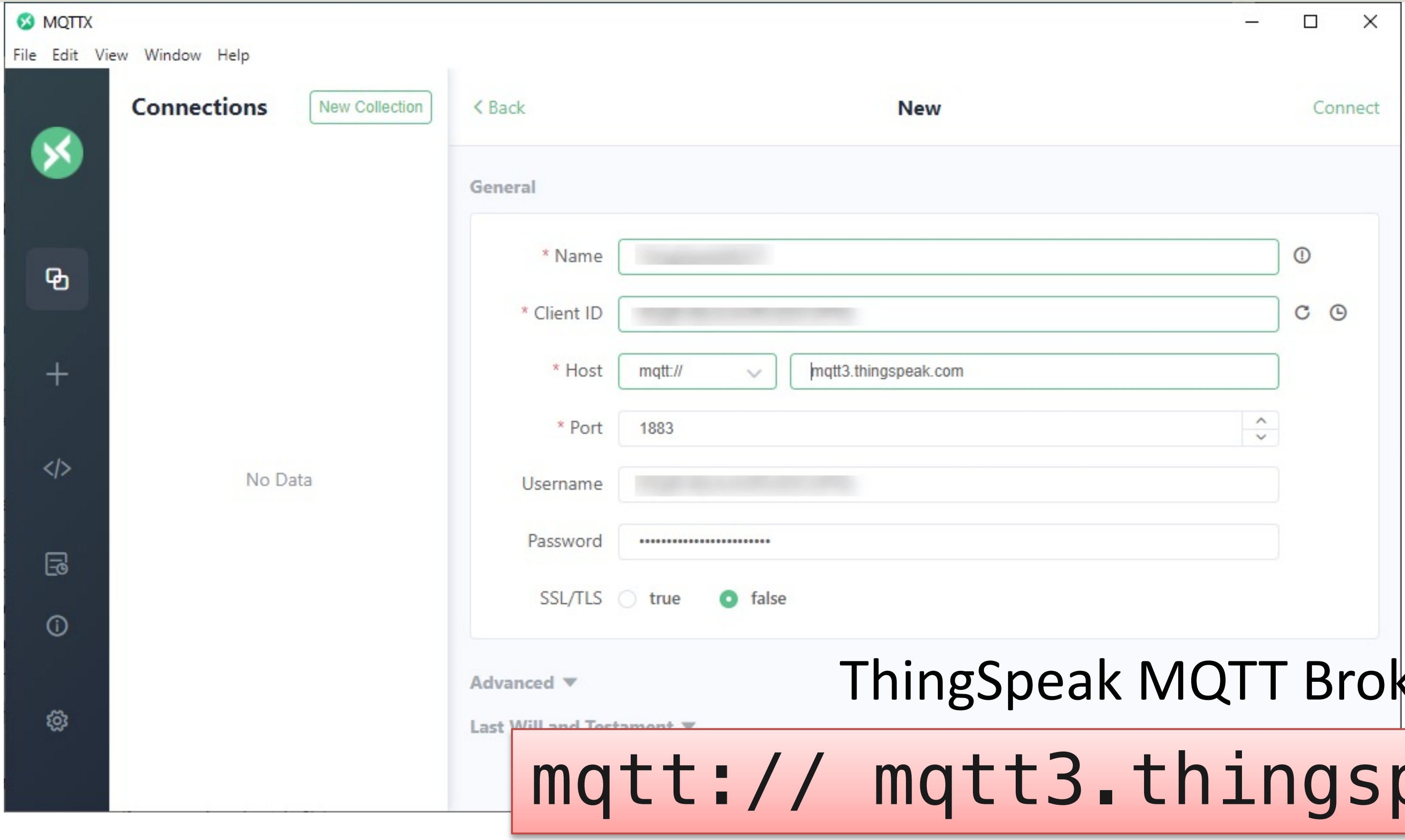
Authorize channels to access

-- Select a Channel --

...

Authorized Channel	Allow Publish	Allow Subscribe
No channels authorized.		

ThingSpeak and MQTTX



* Name: [redacted]

* Client ID: [redacted]

* Host: mqtt:// mqtt3.thingspeak.com

* Port: 1883

Username: [redacted]

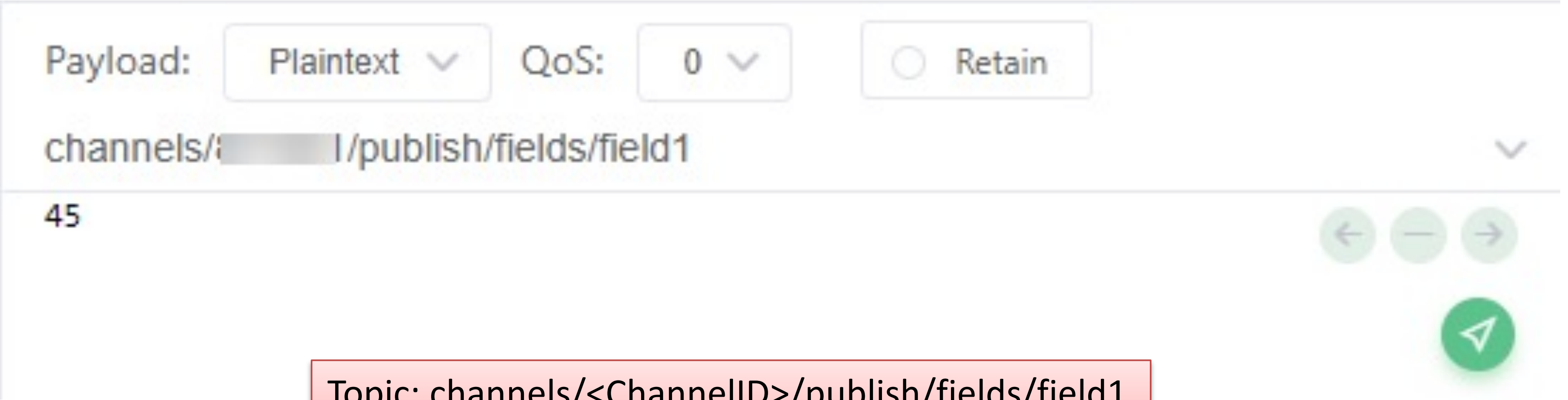
Password: ••••••••••••••••••••••••

SSL/TLS: ○ true ● false

ThingSpeak MQTT Broker:

```
mqtt:// mqtt3.thingspeak.com
```

Publish to Channel **Field**



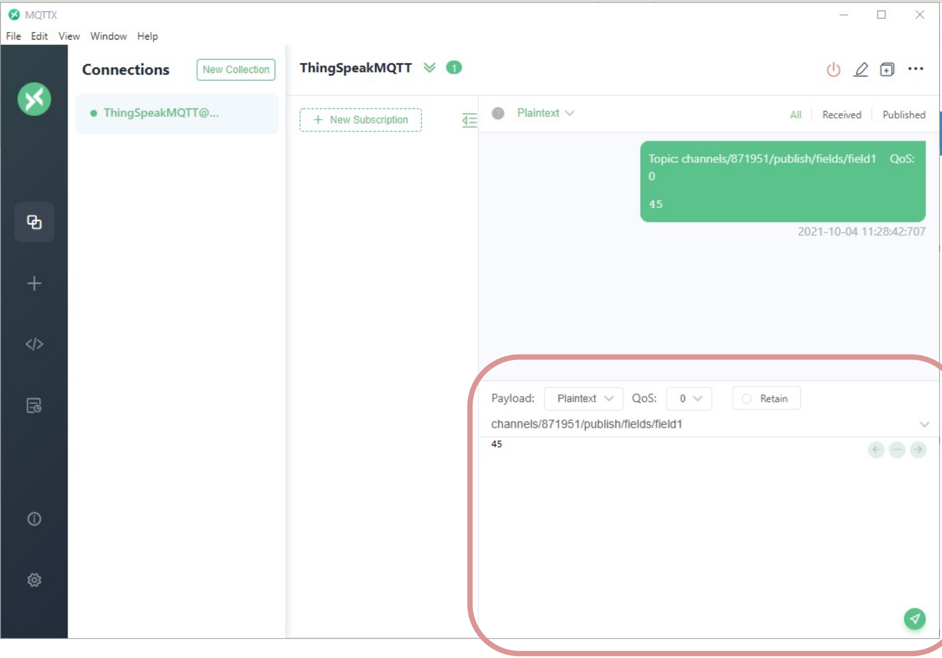
Payload: Plaintext QoS: 0 ○ Retain

channels/[redacted]/publish/fields/field1

45

Topic: channels/<ChannelID>/publish/fields/field1
Data: 45

Publish to Channel Field



Topic: channels/871951/publish/fields/field1 QoS: 0

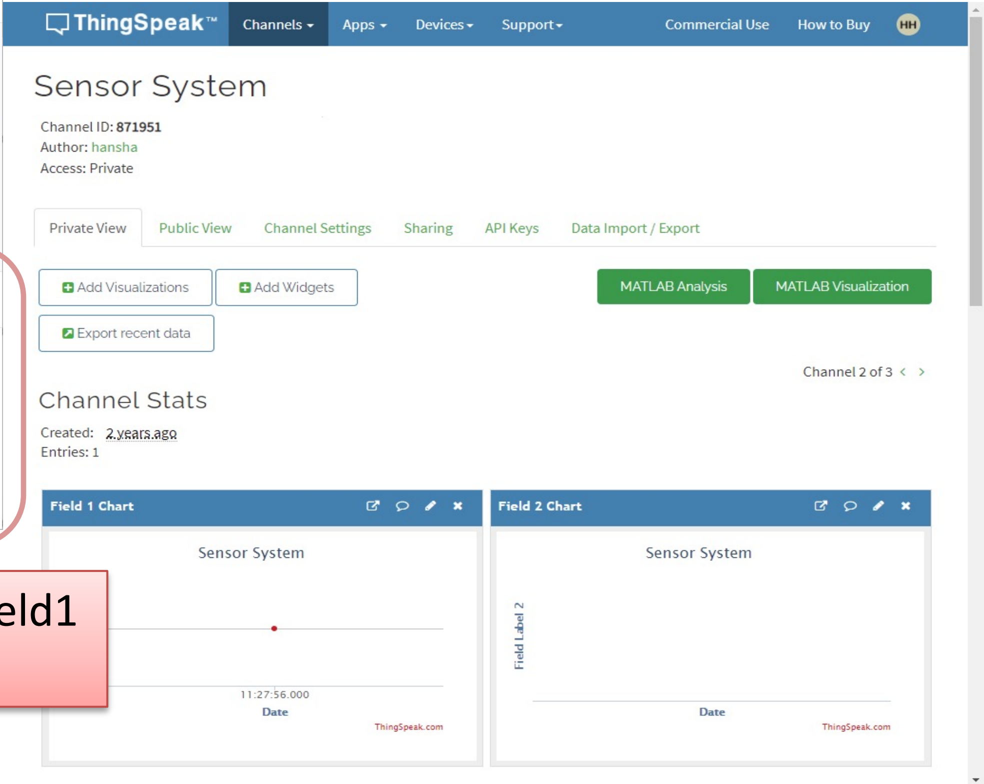
45

2021-10-04 11:28:42:707

Payload: Plaintext QoS: 0 ○ Retain

channels/871951/publish/fields/field1

45



Sensor System

Channel ID: **871951**
Author: hansha
Access: Private

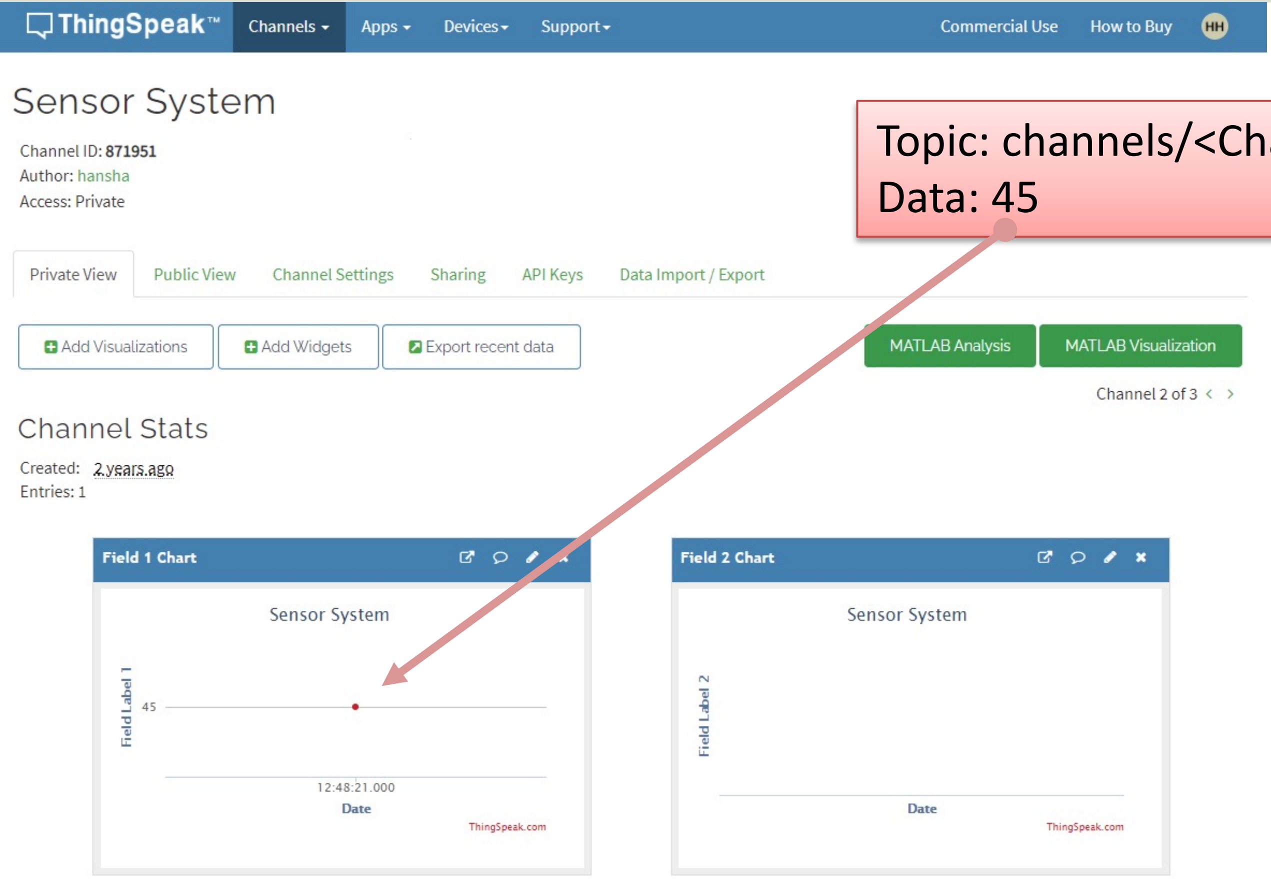
Channel 2 of 3

Channel Stats

Created: 2 years ago
Entries: 1

Topic: channels/<ChannelID>/publish/fields/field1
Data: 45

Publish to Channel Field



Sensor System

Channel ID: 871951
Author: hansha
Access: Private

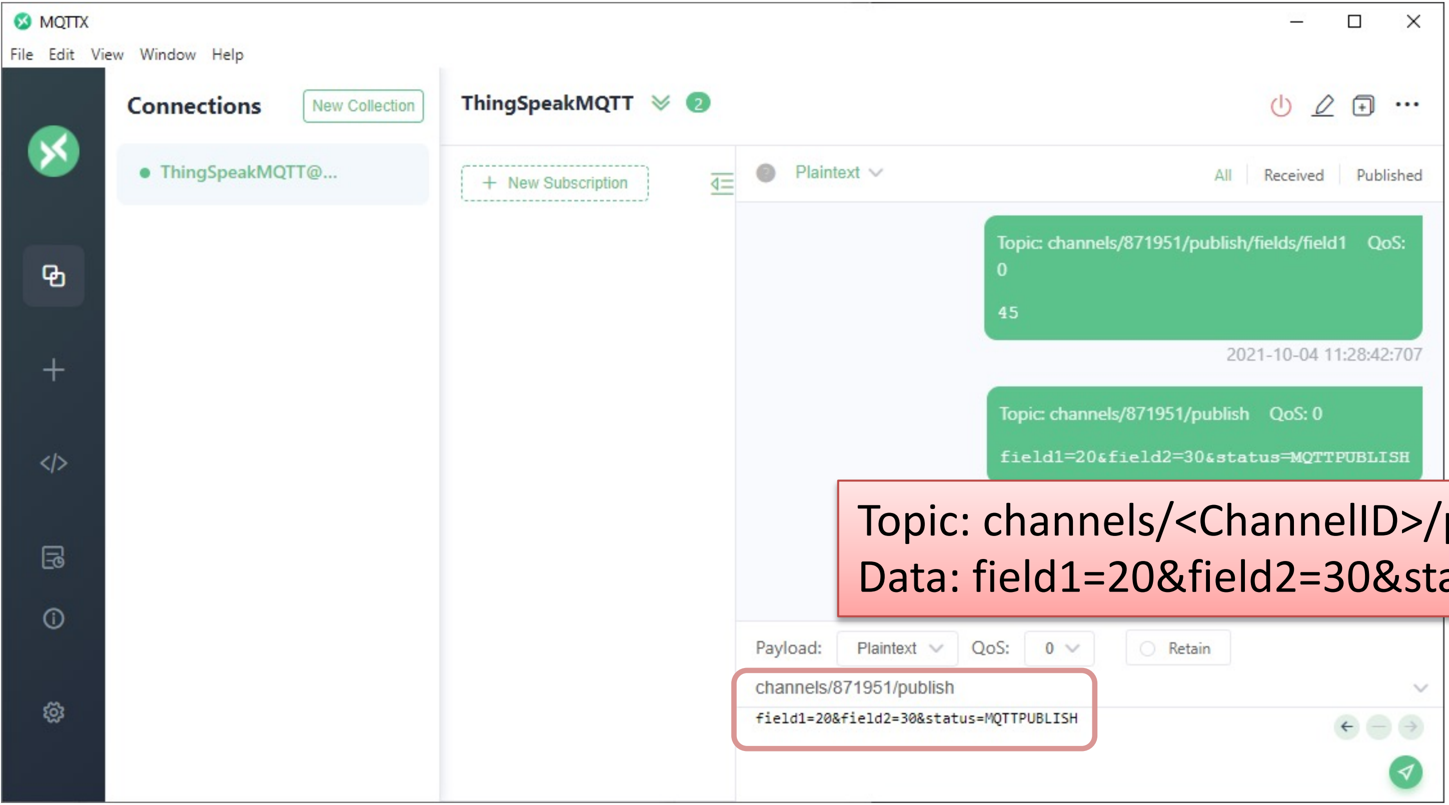
Channel Stats

Created: 2 years ago
Entries: 1

Topic: channels/<ChannelID>/publish/fields/field1
Data: 45

Publish to Channel **Feed**

Here we will Publish to **multiple** Fields within a Channel



Topic: channels/871951/publish/fields/field1 QoS: 0

45

2021-10-04 11:28:42:707

Topic: channels/871951/publish QoS: 0

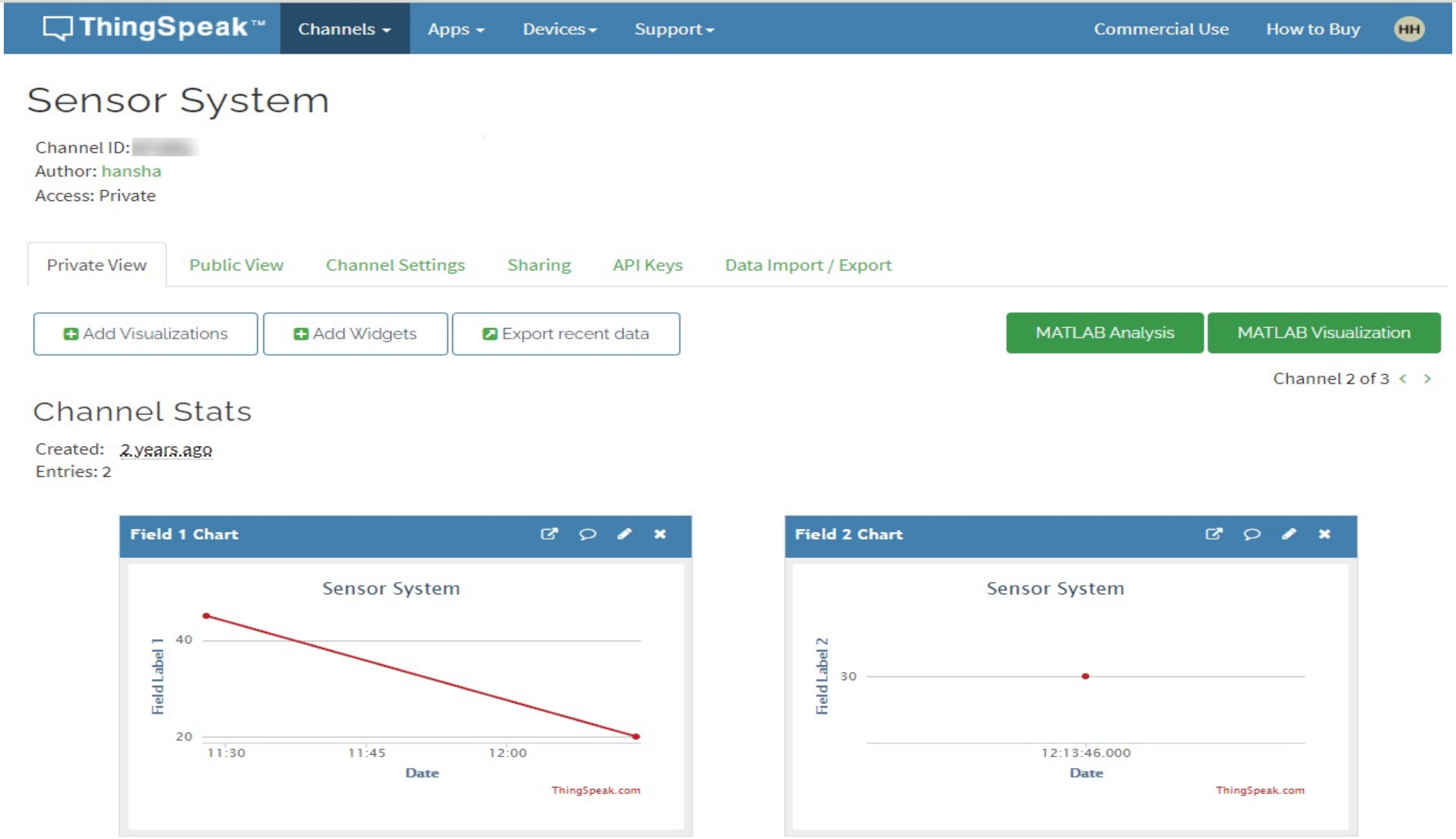
field1=20&field2=30&status=MQTTPUBLISH

channels/871951/publish

field1=20&field2=30&status=MQTTPUBLISH

Topic: channels/<ChannelID>/publish
Data: field1=20&field2=30&status=MQTTPUBLISH

Publish to Channel **Feed**



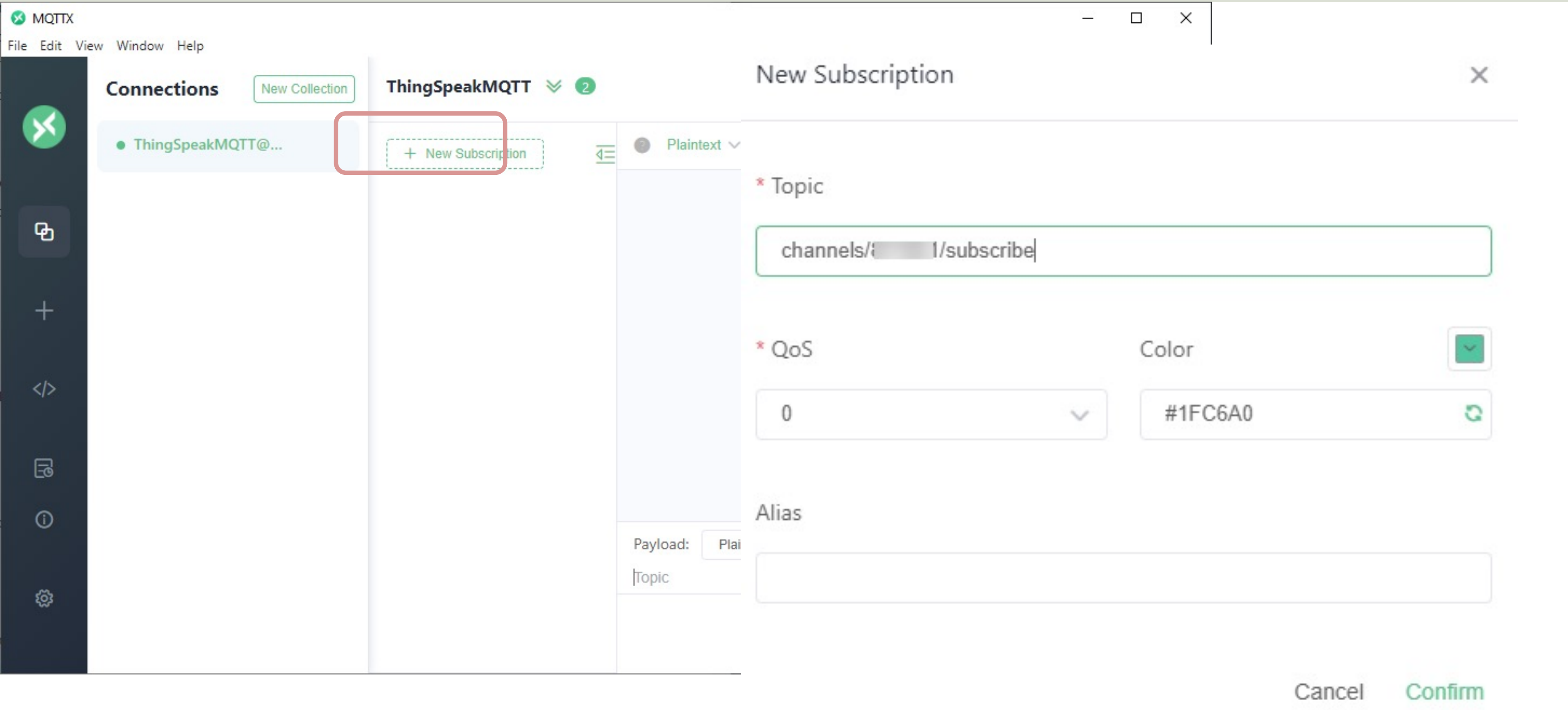
Sensor System

Channel ID: [redacted]
Author: hansha
Access: Private

Channel Stats

Created: 2 years ago
Entries: 2

Subscribe to a Channel Feed



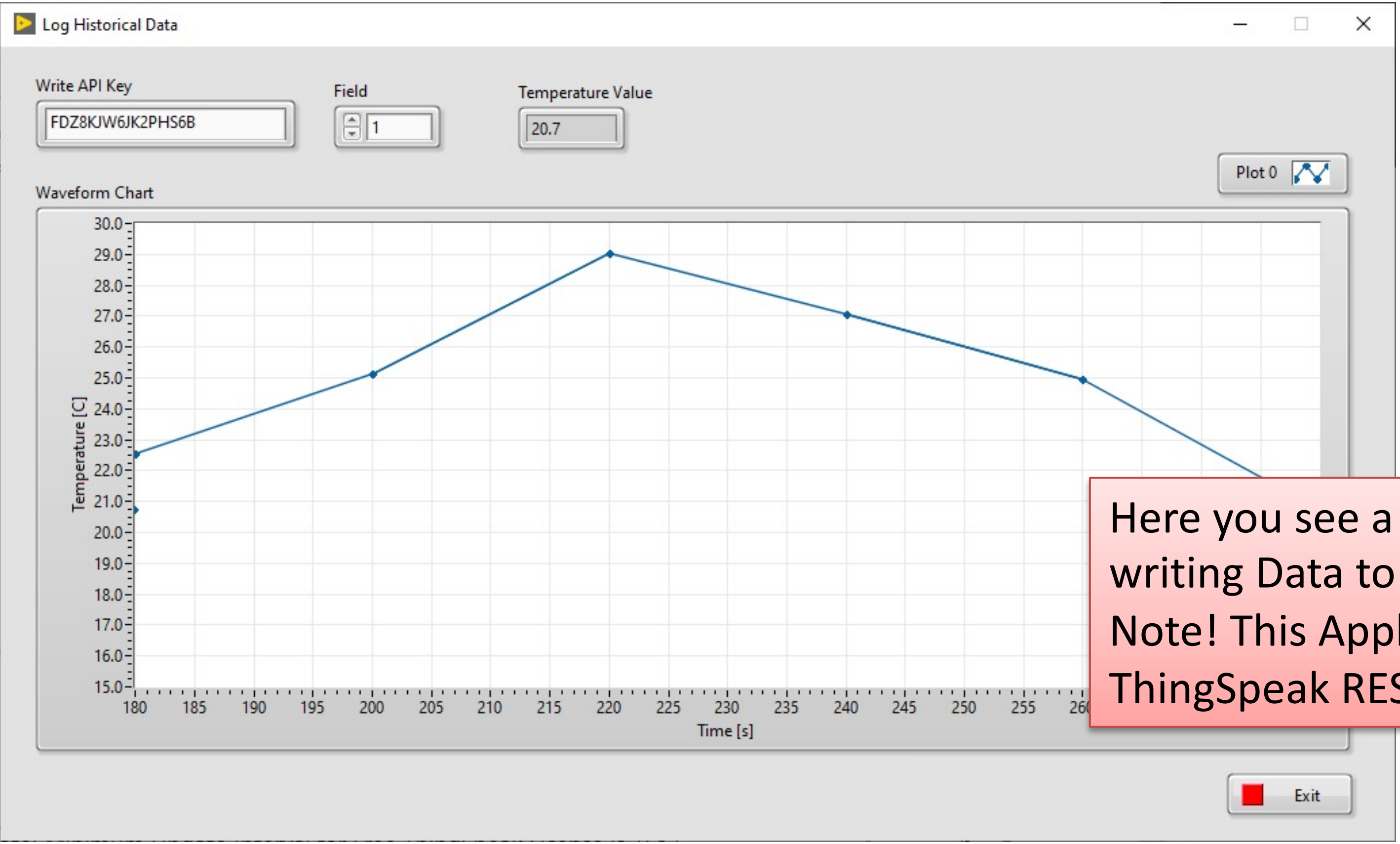
* Topic: channels/[redacted]/subscribe

* QoS: 0

Color: #1FC6A0

Alias:

Subscribe to a Channel **Feed**



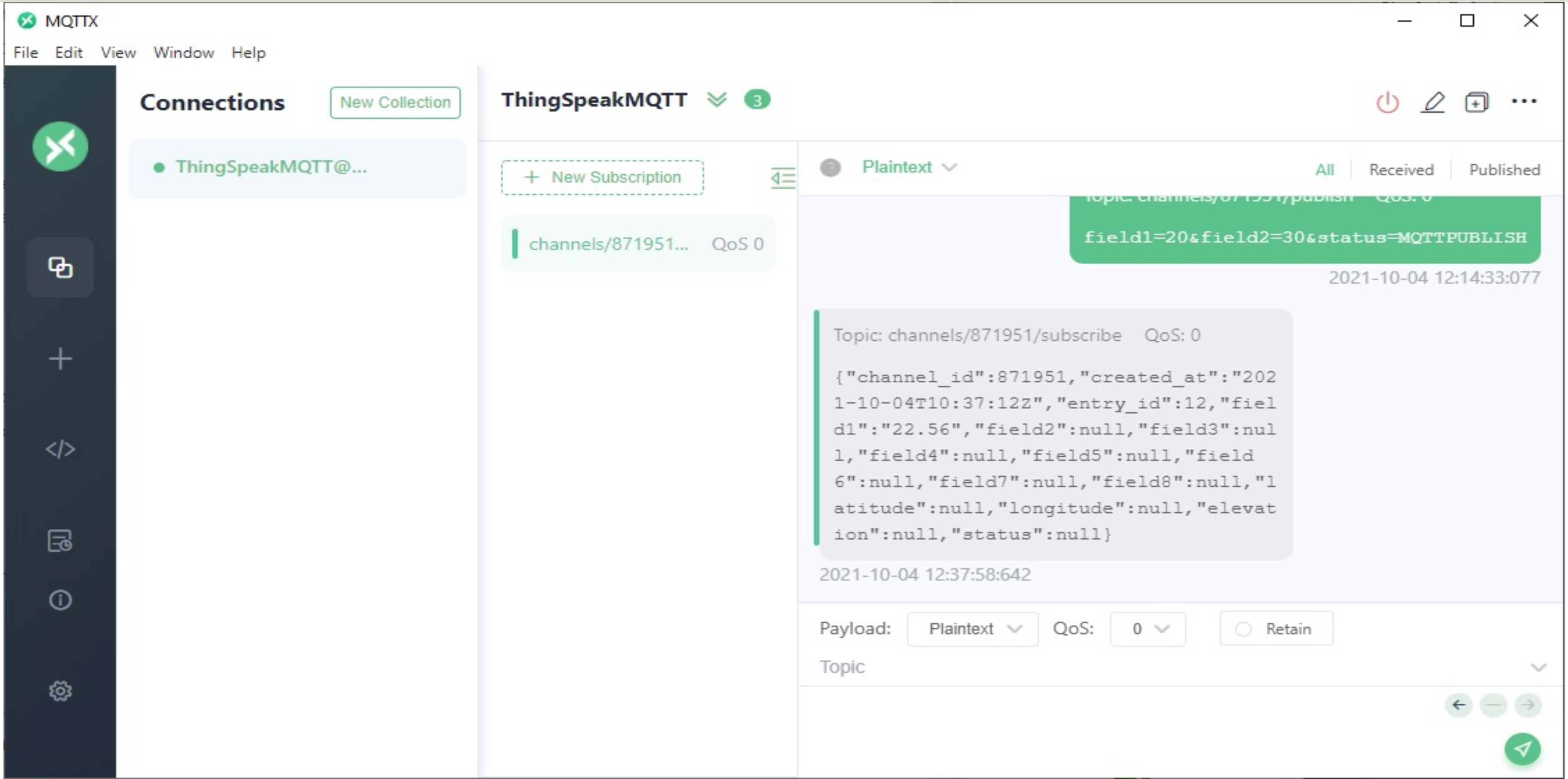
Write API Key: FDZ8KJW6JK2PHS6B

Field: 1

Temperature Value: 20.7

Here you see a LabVIEW Application writing Data to ThingSpeak.
Note! This Application is using the ThingSpeak REST API and not MQTT

Subscribe to a Channel Feed



Topic: channels/871951/publish QoS: 0

```
field1=20&field2=30&status=MQTTPUBLISH
```

2021-10-04 12:14:33:077

Topic: channels/871951/subscribe QoS: 0

```
{"channel_id":871951,"created_at":"202
1-10-04T10:37:12Z","entry_id":12,"fiel
d1":"22.56","field2":null,"field3":nul
l,"field4":null,"field5":null,"field
6":null,"field7":null,"field8":null,"l
atitude":null,"longitude":null,"elevat
ion":null,"status":null}
```

2021-10-04 12:37:58:642

Payload: Plaintext QoS: 0 ○ Retain

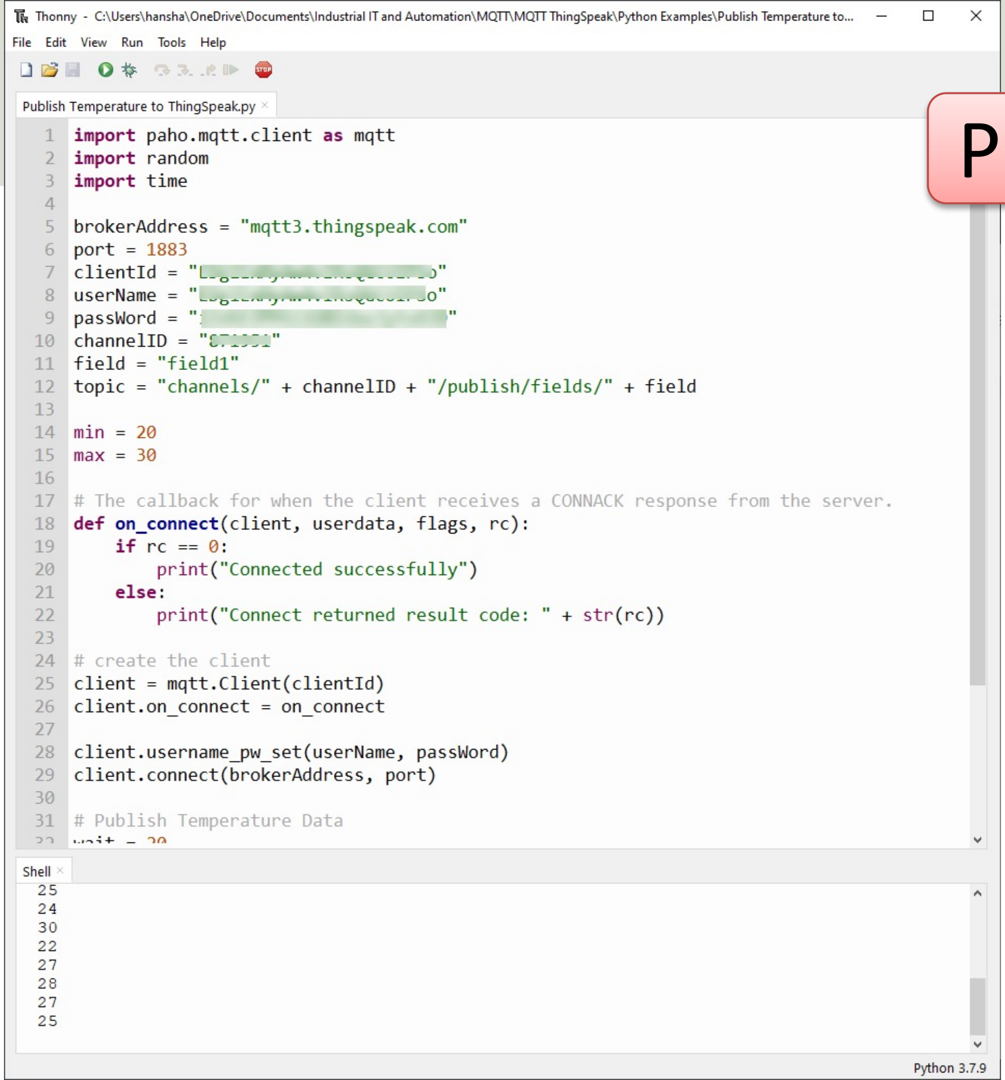
https://www.halvorsen.blog

ThingSpeak and Python

Hans-Petter Halvorsen

Table of Contents

Publish


Thonny - C:\Users\hansha\OneDrive\Documents\Industrial IT and Automation\MQTT\MQTT ThingSpeak\Python Examples\Publish Temperature to...
File
Edit
View
Run
Tools
Help
Publish Temperature to ThingSpeak.py
Shell
Python 3.7.9

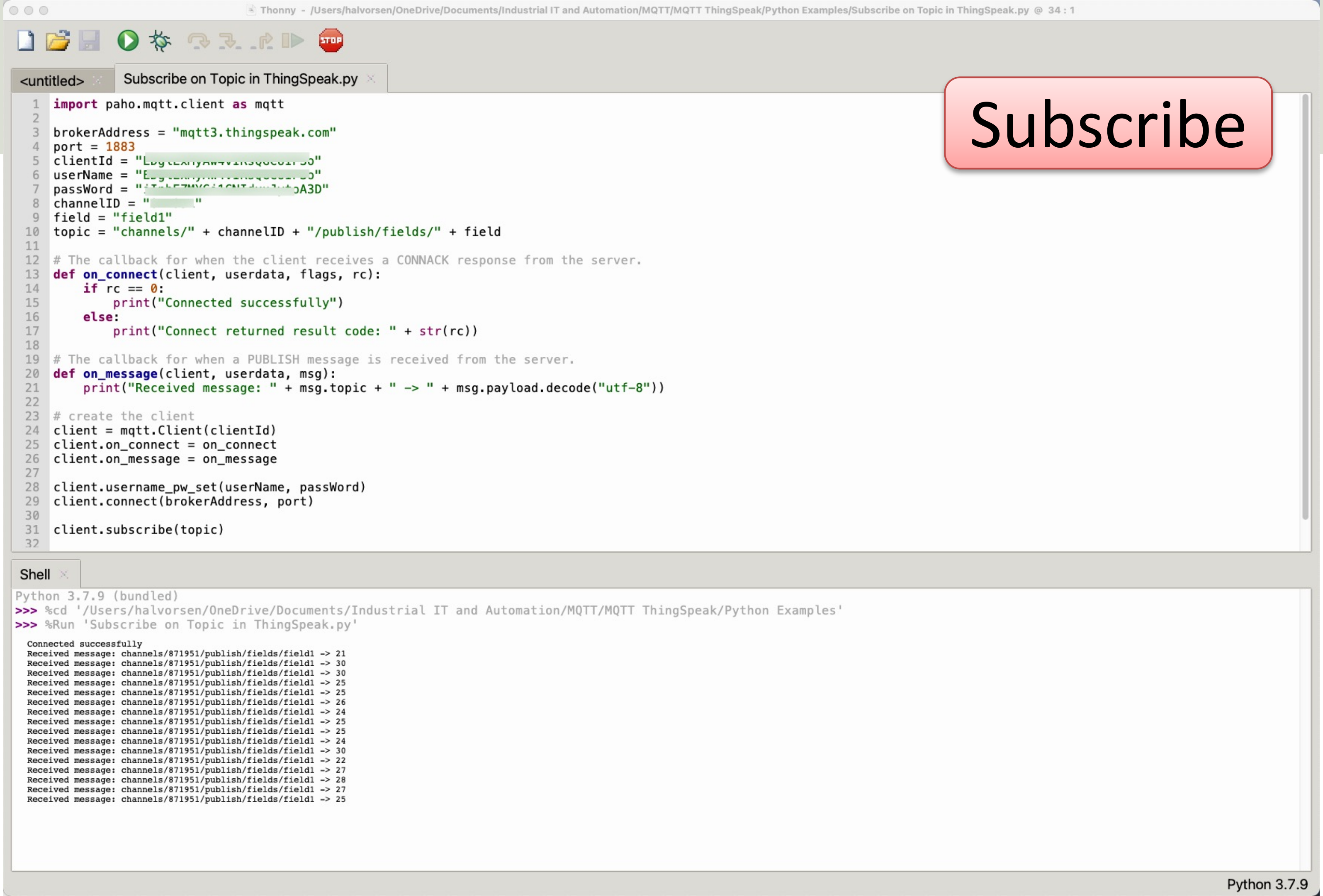
```python
import paho.mqtt.client as mqtt
import random
import time

brokerAddress = "mqtt3.thingspeak.com"
port = 1883
clientId = "[redacted]"
userName = "[redacted]"
passWord = "[redacted]"
channelID = "[redacted]"
field = "field1"
topic = "channels/" + channelID + "/publish/fields/" + field

min = 20
max = 30

# The callback for when the client receives a CONNACK response from the server.
def on_connect(client, userdata, flags, rc):
    if rc == 0:
        print("Connected successfully")
    else:
        print("Connect returned result code: " + str(rc))

# create the client
client = mqtt.Client(clientId)
client.on_connect = on_connect

client.username_pw_set(userName, passWord)
client.connect(brokerAddress, port)

# Publish Temperature Data
wait = 20
```

```
25
24
30
22
27
28
27
25
```

Publish

```
import paho.mqtt.client as mqtt
import random
import time

brokerAddress = "mqtt3.thingspeak.com"
port = 1883
clientId = "xxxxxx"
userName = "xxxxxx"
passWord = "xxxxxx"
channelID = "xxxxxx"
field = "field1"
topic = "channels/" + channelID + "/publish/fields/" + field

min = 20
max = 30

def on_connect(client, userdata, flags, rc):
    if rc == 0:
        print("Connected successfully")
    else:
        print("Connect returned result code: " + str(rc))

# create the client
client = mqtt.Client(clientId)
client.on_connect = on_connect

client.username_pw_set(userName, passWord)
client.connect(brokerAddress, port)

# Publish Temperature Data
wait = 20
while True:
    data = random.randint(min, max)
    print(data)
    client.publish(topic, data)
    time.sleep(wait)
```

Subscribe


Thonny - /Users/halvorsen/OneDrive/Documents/Industrial IT and Automation/MQTT/MQTT ThingSpeak/Python Examples/Subscribe on Topic in ThingSpeak.py @ 34 : 1
STOP
<untitled>
Subscribe on Topic in ThingSpeak.py
Shell
Python 3.7.9

```python
import paho.mqtt.client as mqtt

brokerAddress = "mqtt3.thingspeak.com"
port = 1883
clientId = "[redacted]"
userName = "[redacted]"
passWord = "[redacted]"
channelID = "[redacted]"
field = "field1"
topic = "channels/" + channelID + "/publish/fields/" + field

# The callback for when the client receives a CONNACK response from the server.
def on_connect(client, userdata, flags, rc):
    if rc == 0:
        print("Connected successfully")
    else:
        print("Connect returned result code: " + str(rc))

# The callback for when a PUBLISH message is received from the server.
def on_message(client, userdata, msg):
    print("Received message: " + msg.topic + " -> " + msg.payload.decode("utf-8"))

# create the client
client = mqtt.Client(clientId)
client.on_connect = on_connect
client.on_message = on_message

client.username_pw_set(userName, passWord)
client.connect(brokerAddress, port)

client.subscribe(topic)

```

```
Python 3.7.9 (bundled)
>>> %cd '/Users/halvorsen/OneDrive/Documents/Industrial IT and Automation/MQTT/MQTT ThingSpeak/Python Examples'
>>> %Run 'Subscribe on Topic in ThingSpeak.py'

  Connected successfully
  Received message: channels/871951/publish/fields/field1 -> 21
  Received message: channels/871951/publish/fields/field1 -> 30
  Received message: channels/871951/publish/fields/field1 -> 30
  Received message: channels/871951/publish/fields/field1 -> 25
  Received message: channels/871951/publish/fields/field1 -> 25
  Received message: channels/871951/publish/fields/field1 -> 26
  Received message: channels/871951/publish/fields/field1 -> 24
  Received message: channels/871951/publish/fields/field1 -> 25
  Received message: channels/871951/publish/fields/field1 -> 25
  Received message: channels/871951/publish/fields/field1 -> 24
  Received message: channels/871951/publish/fields/field1 -> 30
  Received message: channels/871951/publish/fields/field1 -> 22
  Received message: channels/871951/publish/fields/field1 -> 27
  Received message: channels/871951/publish/fields/field1 -> 28
  Received message: channels/871951/publish/fields/field1 -> 27
  Received message: channels/871951/publish/fields/field1 -> 25
```

Subscribe

```
import paho.mqtt.client as mqtt

brokerAddress = "mqtt3.thingspeak.com"
port = 1883
clientId = "xxxxxx"
userName = "xxxxxx"
passWord = "xxxxxx"
channelID = "xxxxxx"
field = "field1"
topic = "channels/" + channelID + "/publish/fields/" + field

def on_connect(client, userdata, flags, rc):
    if rc == 0:
        print("Connected successfully")
    else:
        print("Connect returned result code: " + str(rc))

def on_message(client, userdata, msg):
    print("Received message: " + msg.topic + " -> " +
msg.payload.decode("utf-8"))

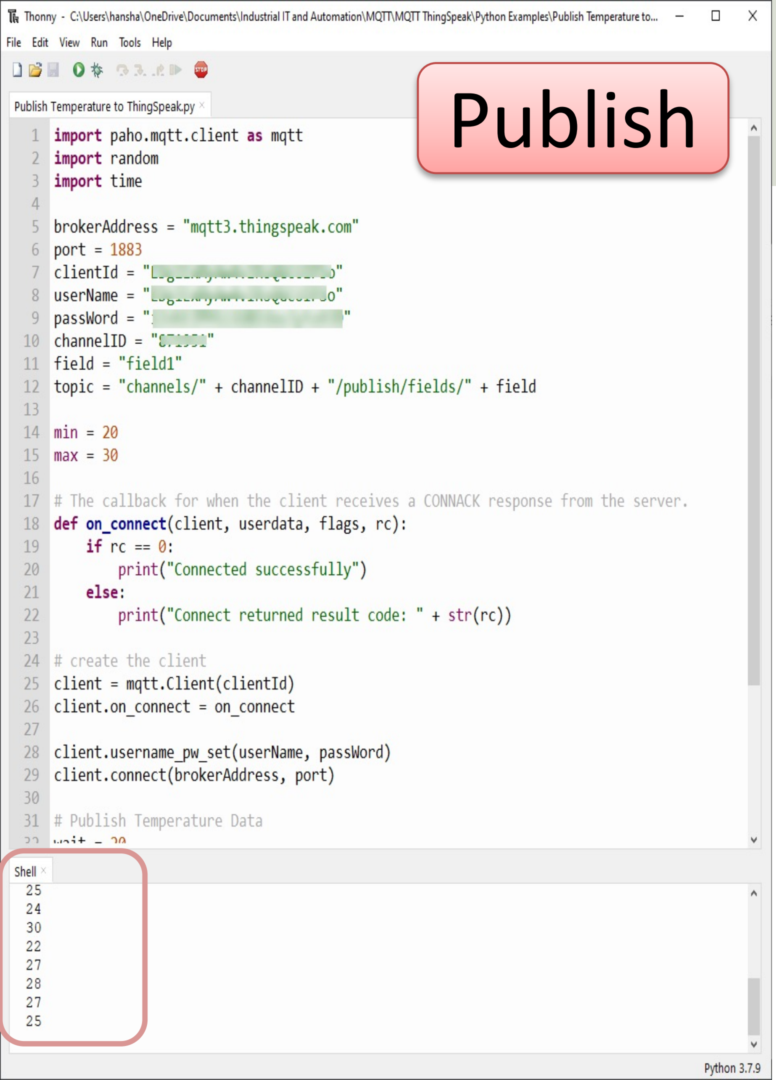
# create the client
client = mqtt.Client(clientId)
client.on_connect = on_connect
client.on_message = on_message

client.username_pw_set(userName, passWord)
client.connect(brokerAddress, port)

client.subscribe(topic)

client.loop_forever()
```

Publish


Thonny - C:\Users\hansha\OneDrive\Documents\Industrial IT and Automation\MQTT\MQTT ThingSpeak\Python Examples\Publish Temperature to...
File
Edit
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Help
Publish Temperature to ThingSpeak.py
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topic = "channels/" + channelID + "/publish/fields/" + field

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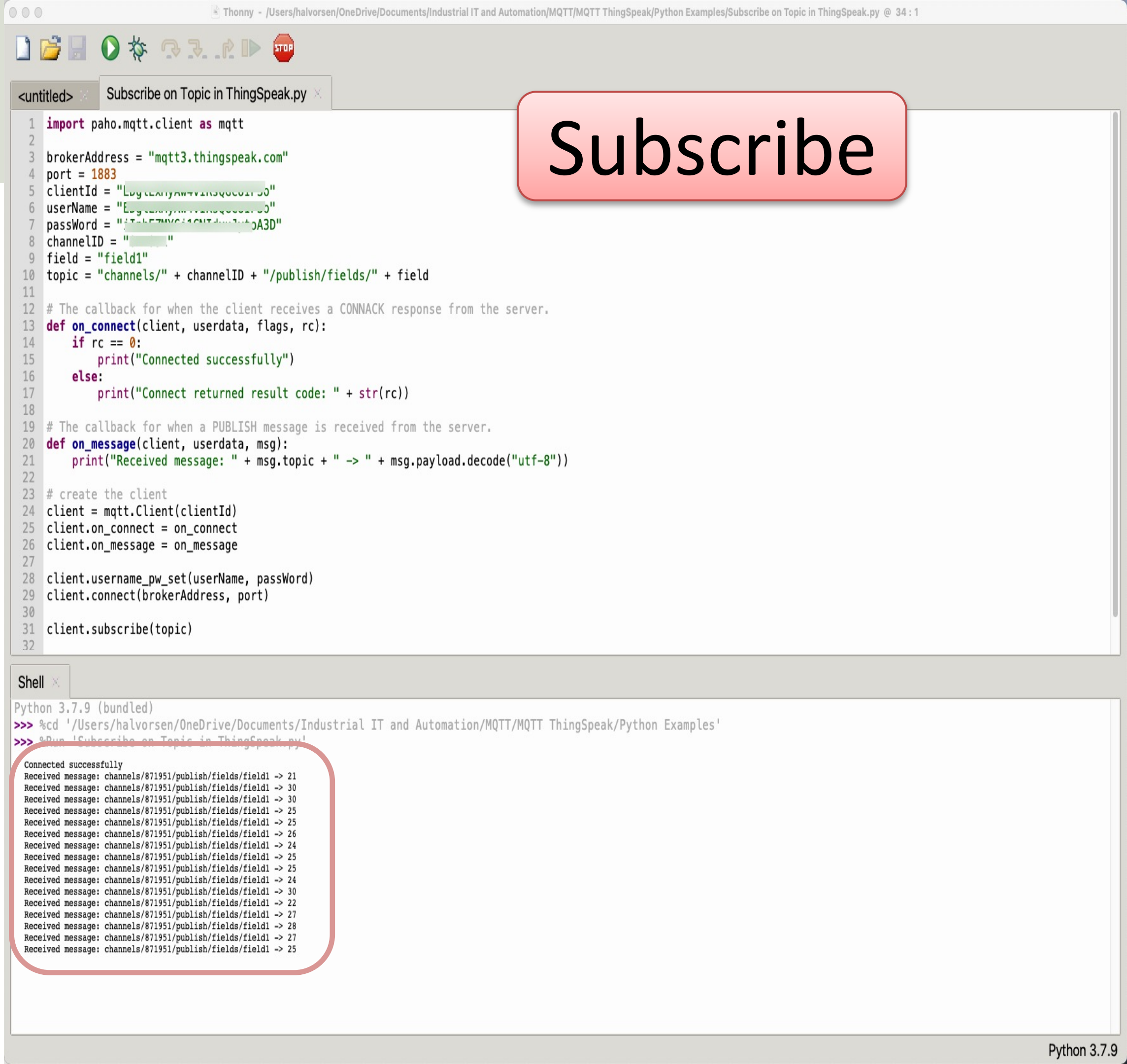
client.on_connect = on_connect

client.username_pw_set(userName, passWord)
client.connect(brokerAddress, port)

# Publish Temperature Data
wait = 20
```

```
25
24
30
22
27
28
27
25
```

Subscribe


Thonny - /Users/halvorsen/OneDrive/Documents/Industrial IT and Automation/MQTT/MQTT ThingSpeak/Python Examples/Subscribe on Topic in ThingSpeak.py @ 34 : 1
<untitled>
Subscribe on Topic in ThingSpeak.py
Shell
Python 3.7.9

```python
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brokerAddress = "mqtt3.thingspeak.com"
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    if rc == 0:
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def on_message(client, userdata, msg):
    print("Received message: " + msg.topic + " -> " + msg.payload.decode("utf-8"))

# create the client
client = mqtt.Client(clientId)
client.on_connect = on_connect
client.on_message = on_message

client.username_pw_set(userName, passWord)
client.connect(brokerAddress, port)

client.subscribe(topic)
```

```
Python 3.7.9 (bundled)
>>> %cd '/Users/halvorsen/OneDrive/Documents/Industrial IT and Automation/MQTT/MQTT ThingSpeak/Python Examples'
>>> %Run 'Subscribe on Topic in ThingSpeak.py'

Connected successfully
Received message: channels/871951/publish/fields/field1 -> 21
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Received message: channels/871951/publish/fields/field1 -> 25
Received message: channels/871951/publish/fields/field1 -> 26
Received message: channels/871951/publish/fields/field1 -> 24
Received message: channels/871951/publish/fields/field1 -> 25
Received message: channels/871951/publish/fields/field1 -> 25
Received message: channels/871951/publish/fields/field1 -> 24
Received message: channels/871951/publish/fields/field1 -> 30
Received message: channels/871951/publish/fields/field1 -> 22
Received message: channels/871951/publish/fields/field1 -> 27
Received message: channels/871951/publish/fields/field1 -> 28
Received message: channels/871951/publish/fields/field1 -> 27
Received message: channels/871951/publish/fields/field1 -> 25
```

Summary

- A short introduction to **MQTT** has been given
- Introduction to some **MQTT Brokers**
- Use of **MQTT Desktop Client** software
  - **MQTT X**
- **Python** Examples
  - **HiveMQ Cloud**
  - **ThingSpeak**

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