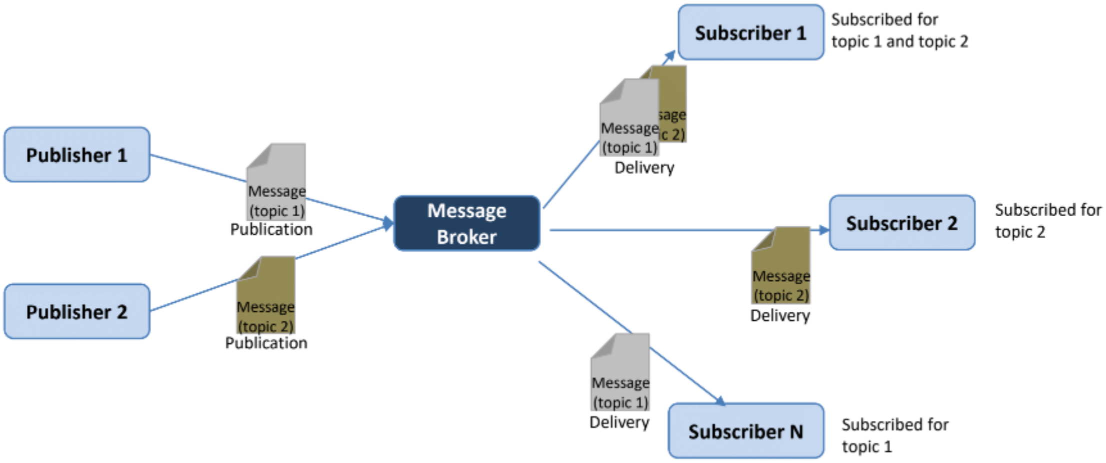
MQTT

September 20, 2019

1 Introduction



We could briefly resume the structure of the MQTT communication paradigm in this way, there are 3 type of actors:***Publisher***,***Subscriber***,***Broker***.
The ***Publisher*** is the actor that wants to send messages tagged by a *topic* while the ***Subsciber*** is the actor that wants to receive messages that belong to variable number of topic. The ***Broker*** is the actor in the middle: it receives the messages from all the publisher and forwards each of them to the suscriber according to the *topic*. Here below you can find the examples for the implementation of a publisher and a subscriber

[1]:

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

class MyPublisher:
    def __init__(self, clientID,broker):
        self.clientID = clientID

        # create an instance of paho.mqtt.client
        self._paho_mqtt = PahoMQTT.Client(self.clientID, False)
        # register the callback
        self._paho_mqtt.on_connect = self.myOnConnect
        self.messageBroker = broker

    def start (self):
        #manage connection to broker
        self._paho_mqtt.connect(self.messageBroker, 1883)
        self._paho_mqtt.loop_start()

    def stop (self):
        self._paho_mqtt.loop_stop()
        self._paho_mqtt.disconnect()

    def myPublish(self, topic, message):
        # publish a message with a certain topic
        self._paho_mqtt.publish(topic, message, 2)

    def myOnConnect (self, paho_mqtt, userdata, flags, rc):
        print ("Connected to %s with result code: %d" % (self.messageBroker,␣
↪rc))
```

[ ]:

```
class MySubscriber:
        def __init__(self, clientID,topic,broker):
            self.clientID = clientID
            # create an instance of paho.mqtt.client
            self._paho_mqtt = PahoMQTT.Client(clientID, False)

            # register the callback
            self._paho_mqtt.on_connect = self.myOnConnect
            self._paho_mqtt.on_message = self.myOnMessageReceived

            self.topic = topic
            self.messageBroker = broker


        def start (self):
            #manage connection to broker
            self._paho_mqtt.connect(self.messageBroker, 1883)
            self._paho_mqtt.loop_start()
            # subscribe for a topic
            self._paho_mqtt.subscribe(self.topic, 2)

        def stop (self):
            self._paho_mqtt.unsubscribe(self.topic)
            self._paho_mqtt.loop_stop()
            self._paho_mqtt.disconnect()

        def myOnConnect (self, paho_mqtt, userdata, flags, rc):
            print ("Connected to %s with result code: %d" % (self.
↪messageBroker, rc))

        def myOnMessageReceived (self, paho_mqtt , userdata, msg):
            # A new message is received
            print ("Topic:'" + msg.topic+"', QoS: '"+str(msg.qos)+"' Message:␣
↪'"+str(msg.payload) + "'")
```

1.1 General purpose MQTT implementation

Let's look at the two pieces of code written below

[1]:

```
import paho.mqtt.client as PahoMQTT

class MyMQTT:
    def __init__(self, clientID, broker, port, notifier):
        self.broker = broker
        self.port = port
        self.notifier = notifier
        self.clientID = clientID

        self._topic = ""
        self._isSubscriber = False

        # create an instance of paho.mqtt.client
        self._paho_mqtt = PahoMQTT.Client(clientID, False)

        # register the callback
        self._paho_mqtt.on_connect = self.myOnConnect
        self._paho_mqtt.on_message = self.myOnMessageReceived


    def myOnConnect (self, paho_mqtt, userdata, flags, rc):
        print ("Connected to %s with result code: %d" % (self.broker, rc))

    def myOnMessageReceived (self, paho_mqtt , userdata, msg):
        # A new message is received
        self.notifier.notify (msg.topic, msg.payload)


    def myPublish (self, topic, msg):
        # if needed, you can do some computation or error-check before␣
↪publishing
        print ("publishing '%s' with topic '%s'" % (msg, topic))
        # publish a message with a certain topic
        self._paho_mqtt.publish(topic, msg, 2)
    def mySubscribe (self, topic):
        # if needed, you can do some computation or error-check before␣
↪subscribing
        print ("subscribing to %s" % (topic))
        # subscribe for a topic
        self._paho_mqtt.subscribe(topic, 2)

        # just to remember that it works also as a subscriber
        self._isSubscriber = True
        self._topic = topic

    def start(self):
        #manage connection to broker
        self._paho_mqtt.connect(self.broker , self.port)
        self._paho_mqtt.loop_start()

    def stop (self):
        if (self._isSubscriber):
            # remember to unsuscribe if it is working also as subscriber
            self._paho_mqtt.unsubscribe(self._topic)

        self._paho_mqtt.loop_stop()
        self._paho_mqtt.disconnect()
```

from MyMQTT import MyMQTT

class DoSomething(): def **init**(self, clientID): # create an instance of MyMQTT class self.clientID = clientID self.myMqttClient = MyMQTT(self.clientID, "iot.eclipse.org", 1883, self)

```
def run(self):
    # if needed, perform some other actions befor starting the mqtt communication
    print ("running %s" % (self.clientID))
    self.myMqttClient.start()

def end(self):
    # if needed, perform some other actions befor ending the software
    print ("ending %s" % (self.clientID))
    self.myMqttClient.stop ()

def notify(self, topic, msg):
    # manage here your received message. You can perform some error-check here
    print ("received '%s' under topic '%s'" % (msg, topic))
```

1.2 Exercise 1

Try to create a script that mimics a light that has a status that can be on/off and has to to the topic *led*. Then create a client that uses MQTT to set the status of the light

1.3 Exercise 2

Try to improve the previous exercise by creating a REST client to set the status of the light. You can use the file *’index.html’* as page for the GET request, when you will click on the button the page will execute a PUT request where the uri indicates the status we want to set.

1.4 Exercise 3

For this exercise you’ve to make a client to follow the data coming from a group of sensors of temperature and humidity tht are on a building of the ”IoT s.pa.”. The fake data are published from the script *”sensors.py”*, the building has 5 floors (from 0 to 4) with 3 room for each floor and one sensor in each room , for a total of 15 sensors. Each sensor publish the collected data on a topic of this kind:

```
buildingID/floorID/roomID/sensorID
```

so for example the sensor on the room 2 of the 3rd floor would publish it on :

```
IoT s.p.a/2/3/dht_025
```

Knowing that we want to create a client that give the possibility to choose how what data to retrieve according to three options

- Data from all the sensors of the building
- Data from all the sensor on a single floor
- Data from the sensor in a single room

If you feel bold enough you can try to give the user the possibility to change his idea and change what he wants to monitor, as in the example below

[1]:
```
run Exercise3.py
```

```
Connected to localhost with result code: 0
dc23137 has started
This is the client to follow the data coming from the sensors of the building of
IoT s.p.a.
What kind of data you want to retrieve
        a: data from all the building
        f: data from a particular floor
        r: data from a particular room
        c: to go back to this menu
        q: to quit

 a

subscribing to IoT s.p.a./#

 c

What kind of data you want to retrieve
        a: data from all the building
        f: data from a particular floor
        r: data from a particular room
        c: to go back to this menu
        q: to quit

 f

Type the floor [0-->4]

 3

subscribing to IoT s.p.a./3/#

 c

What kind of data you want to retrieve
        a: data from all the building
        f: data from a particular floor
        r: data from a particular room
        c: to go back to this menu
        q: to quit

 r

Type the floor [0-->4]

 4

Type the room [1-->3]

 1

subscribing to IoT s.p.a./4/1/#

 c

What kind of data you want to retrieve
        a: data from all the building
        f: data from a particular floor
        r: data from a particular room
        c: to go back to this menu
        q: to quit

 q

dc23137 has stopped
```

1.5 Exercise 4

Try to create a simple chat client that uses MQTT. We would like two have at leat two client that are subscribed to the same topic (i.e. *"chat"*) but can also publish to this topic. We want to have a client that allows to write a new message only if the last message has been written from another user, that means:

YES

John: Hi

Yoko: Hi, how are you?

John: Good

NO

John: Let

John: it

John: be