

# **Production Supporting Systems in Factories**

**ระบบสนับสนุนการผลิตในโรงงานอุตสาหกรรม**

# MQTT

# MQTT

- MQTT is a Client Server publish/subscribe messaging transport protocol.
- It is light weight, open, simple, and designed so as to be easy to implement.
- Ideal for use in many situations
  - Machine to Machine (M2M)
  - **Internet of Things (IoT)**

# Publish/subscribe pattern

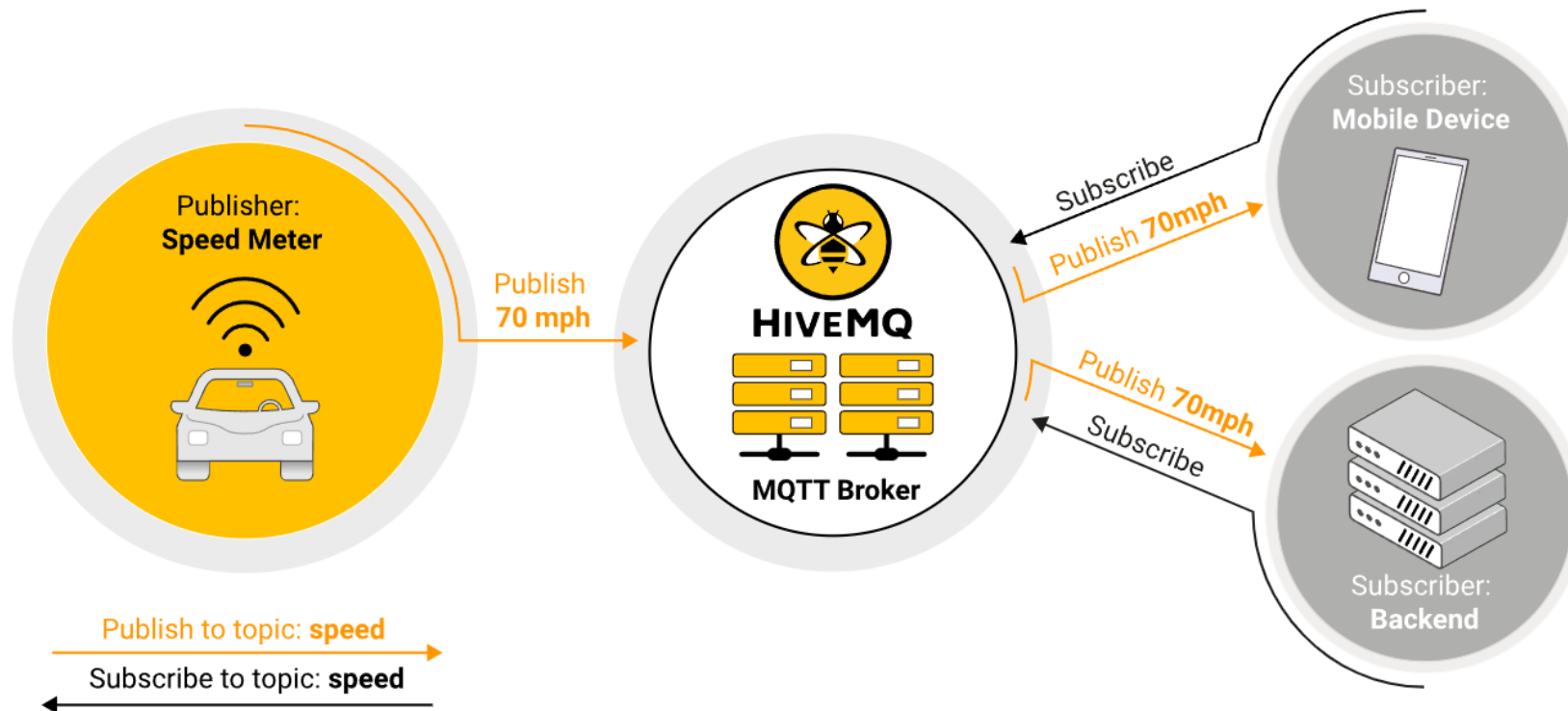
- The publish/subscribe pattern (also known as `pub/sub`) provides an **alternative** to traditional client-server architecture.
  - In client-server architecture, a client communicates directly with an endpoint.

# Publishers and subscribers

- The `pub/sub` model decouples
  - a client that sends a message (the `publisher`) from
  - a client or clients that receive the messages (the `subscribers`).
- The `publishers` and `subscribers` never contact each other directly.
  - In fact, they are not even **aware that the other exists**.

# Broker

- The connection between `publishers` and `subscribers` is handled by a third component (the `broker` ).
- The job of the broker is to filter all incoming messages and distribute them correctly to subscribers.



# Aspects of pub/sub architecture

- **Space decoupling:** Publisher and subscriber do not need to know each other (for example, no exchange of IP address and port)
- **Time decoupling:** Publisher and subscriber do not need to run at the same time.
- **Synchronization decoupling:** Operations on both components do not need to be interrupted during publishing or receiving.



# Topic

- **Topic** refers to an UTF-8 string that the broker uses to filter messages for each connected client.
- The topic consists of one or more topic levels. Each topic level is separated by a forward slash (topic level separator).



# Topic examples

- Each topic must contain at least 1 character.
  - Actually, `/` is a topic.
- Topic string permits empty spaces.
  - `USA/California/San Francisco/Silicon Valley` is a valid topic.
- Topics are case-sensitive.
  - `myhome/temperature` and `MyHome/Temperature` are two different topics.

- Wildcards

single-level  
wildcard  
↓  
myhome / groundfloor / + / temperature  
|  
only one level

- ✓ myhome / groundfloor / livingroom / temperature
- ✓ myhome / groundfloor / kitchen / temperature
- ✗ myhome / groundfloor / kitchen / brightness
- ✗ myhome / firstfloor / kitchen / temperature
- ✗ myhome / groundfloor / kitchen / fridge / temperature

multi-level  
wildcard  
↓  
myhome / groundfloor / #

only at the end  
multiple topic levels

- ✓ myhome / groundfloor / livingroom / temperature
- ✓ myhome / groundfloor / kitchen / temperature
- ✓ myhome / groundfloor / kitchen / brightness
- ✗ myhome / firstfloor / kitchen / temperature

**Enough talk. Let's try it.**

# MQTT Terminal (Android)

- Broker URL/IP :  
1.tcp.ap.ngrok.io
- Client ID : อะไรก็ได้ที่ไม่ซ้ำ
- Port : 25580
- Publish Topic : test/main
- Subscribe Topic : test/main

8:41 87%

← Edit Server

Connection Name  
prodsup **Change**

Client ID  
my-id

Broker URL / IP  
**Broker URL**

Port  
1883

☐ SSL ☐ Web Socket

Enable user authentication ☐

Publish Topic  
test/main

☒ QoS 0 ☐ QoS 1 ☐ QoS 2

☐ Retained


Subscribe Topic  
test/main

☒ QoS 0 ☐ QoS 1 ☐ QoS 2

Cancel Change

# MQTTool (iOS)

- Host : iecmu.com
- Port : 1883
- Client ID : Leave blank

Host:  

Port:  Clean Session: ☒

Client Id:

Leave blank for unauthenticated access

Username:

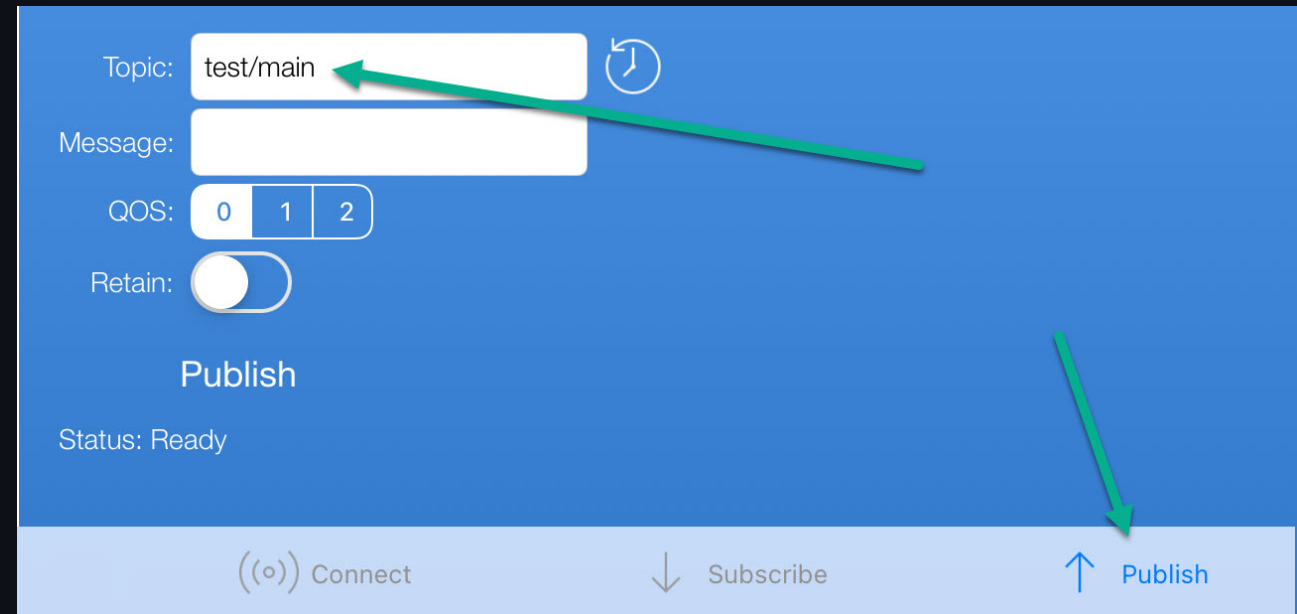
Password:

Disconnect ☐ Save Password ☐

Status: Connected to 35.240.248.118:1883

Click 15

- `topic: test/main`



The image shows a screenshot of an MQTT client interface. It has a blue background with white text and input fields. At the top, there's a 'Topic:' label followed by a text input field containing 'test/main'. To the right of this field is a circular refresh icon. Below the topic field is a 'Message:' label followed by a larger text input field. Underneath the message field are three buttons for 'QOS' with values '0', '1', and '2'. Below the QOS buttons is a 'Retain:' label followed by a toggle switch. A 'Publish' button is located below the Retain toggle. At the bottom of the interface, there's a light blue bar containing three buttons: '((o)) Connect', '↓ Subscribe', and '↑ Publish'. Two green arrows are overlaid on the image: one points from the right edge towards the 'test/main' text in the Topic field, and the other points from the right edge towards the 'Publish' button in the bottom bar.

Topic: test/main

Message:

QOS: 0 1 2

Retain: ☐

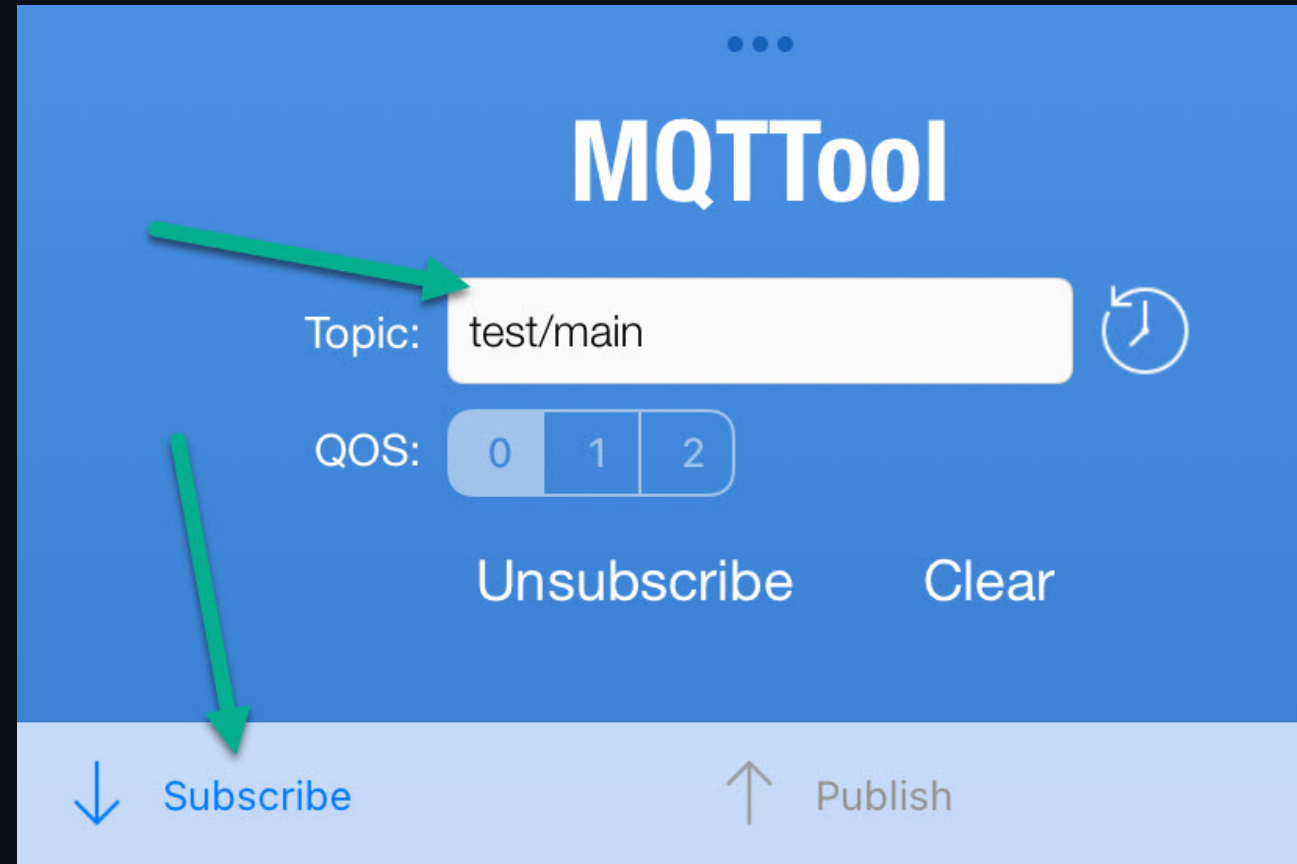
Publish

Status: Ready

((o)) Connect    ↓ Subscribe    ↑ Publish



- `topic: test/main`



The image shows the MQTTTool interface. At the top, there are three blue dots. Below them is the title "MQTTool" in white. A green arrow points to the "Topic:" input field, which contains the text "test/main". To the right of the input field is a circular icon with a clock. Below the input field is a "QOS:" section with three buttons labeled "0", "1", and "2". The "0" button is highlighted. Below the QOS buttons are two buttons labeled "Unsubscribe" and "Clear". At the bottom of the interface is a light blue bar containing two buttons: "Subscribe" (with a blue downward arrow icon) and "Publish" (with a grey upward arrow icon). A second green arrow points to the "Subscribe" button.

# Quality of service

- The Quality of Service ( `QoS` ) level is the guarantee of delivery for a specific message.

# Levels of QoS

- **0: At most once**
  - No guarantee of delivery (fire and forget)
  - Fastest
- **1: At least once**
  - Guarantees that a message is *delivered at least one time* to the receiver.
  - Multiple delivery can occur.
- **2: Exactly once**
  - Each message is *received only once* by the intended recipients.
  - Slowest

# Setting QoS level

There are the two sides of message delivery:

- publishing client → broker
- broker → subscribing client

**publishing client** → **broker**

- The **publishing client** defines the **QoS** level of the message.

## broker → subscribing client

- The broker transmits the message to subscribing clients using the QoS level that each subscribing client defines during the subscription process.
- If the subscribing client defines a lower QoS than the publishing client
  - the broker transmits the message with the lower quality of service.

## General use for QoS level

- 0: You don't mind if a few messages are lost occasionally.
- 1: You need to get every message and your use case can handle duplicates.
  - *Generally recommended.*
- 2: It is critical to your application to receive all messages exactly once.

# Retained message

- A retained message is a normal MQTT message with the `retained` flag set to `true`.
- The broker stores the last retained message and the corresponding QoS for that topic.
- Each client that subscribes to a topic pattern that matches the topic of the retained message receives the retained message immediately after they subscribe.
- The broker stores only one retained message per topic.

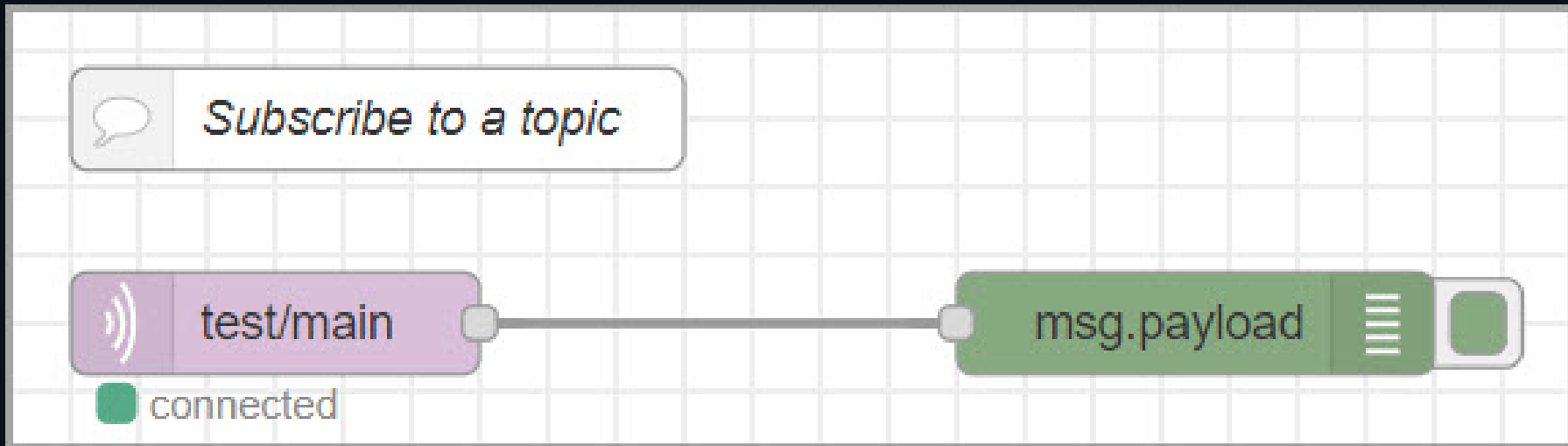


# MQTT in Node-Red

# Subscribe to a topic

- Flow

- mqtt in, debug



- mqtt in node
  - Choose Add new mqtt-broker...
  - Click edit (Next page)
  - Topic : test/main
  - QoS : 1

Edit mqtt in node

Delete Cancel Done

⚙ Properties

🌐 Server ProdSup


Action ProdSup  
Add new mqtt-broker...

📄 Topic test/main

⚙ QoS 1

➡ Output auto-detect (string or buffer)

🏷 Name Name



- Server : 1.tcp.ap.ngrok.io
- Port : 1883

Edit mqtt in node > Add new mqtt-broker config node

Cancel Add

⚙ Properties

🔖 Name ProdSup2

Connection Security Messages

🌐 Server Broker URL Port 1883

☒ Connect automatically

☐ Use TLS

⚙ Protocol MQTT V3.1.1

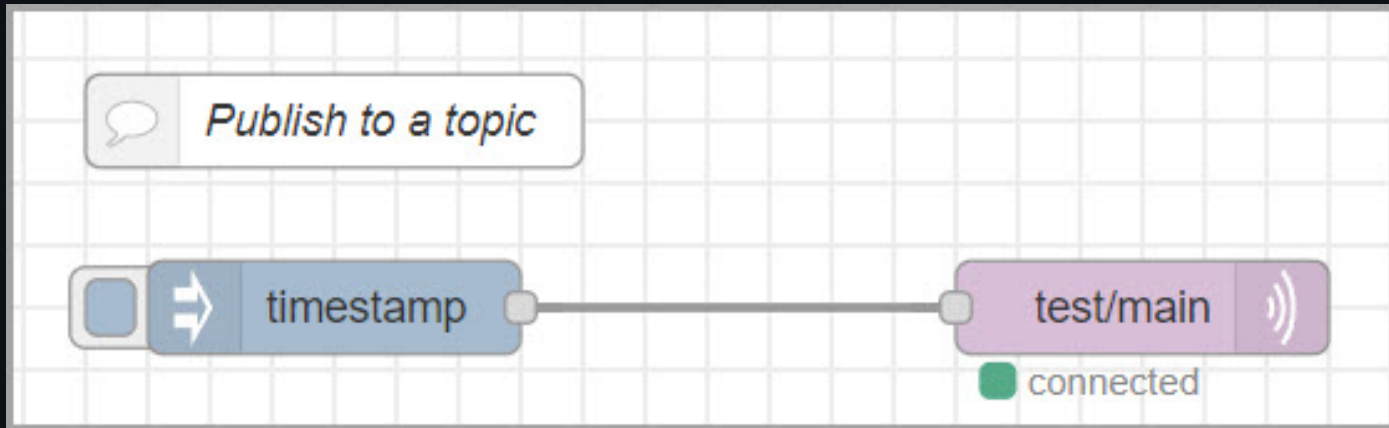
🔖 Client ID Leave blank for auto generated

💓 Keep Alive 60

📄 Session ☒ Use clean session

# Publish to a topic

- Flow
  - inject, mqtt out



- mqtt out
  - Topic: test/main
  - QoS: 1
  - You may choose to Retain message.

### Edit mqtt out node

Delete Cancel Done

#### Properties

Server: ProdSup2

Topic: test/main

QoS: 1 Retain: true

Name: Name

Tip: Leave topic, qos or retain blank if you want to set them via msg properties.