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

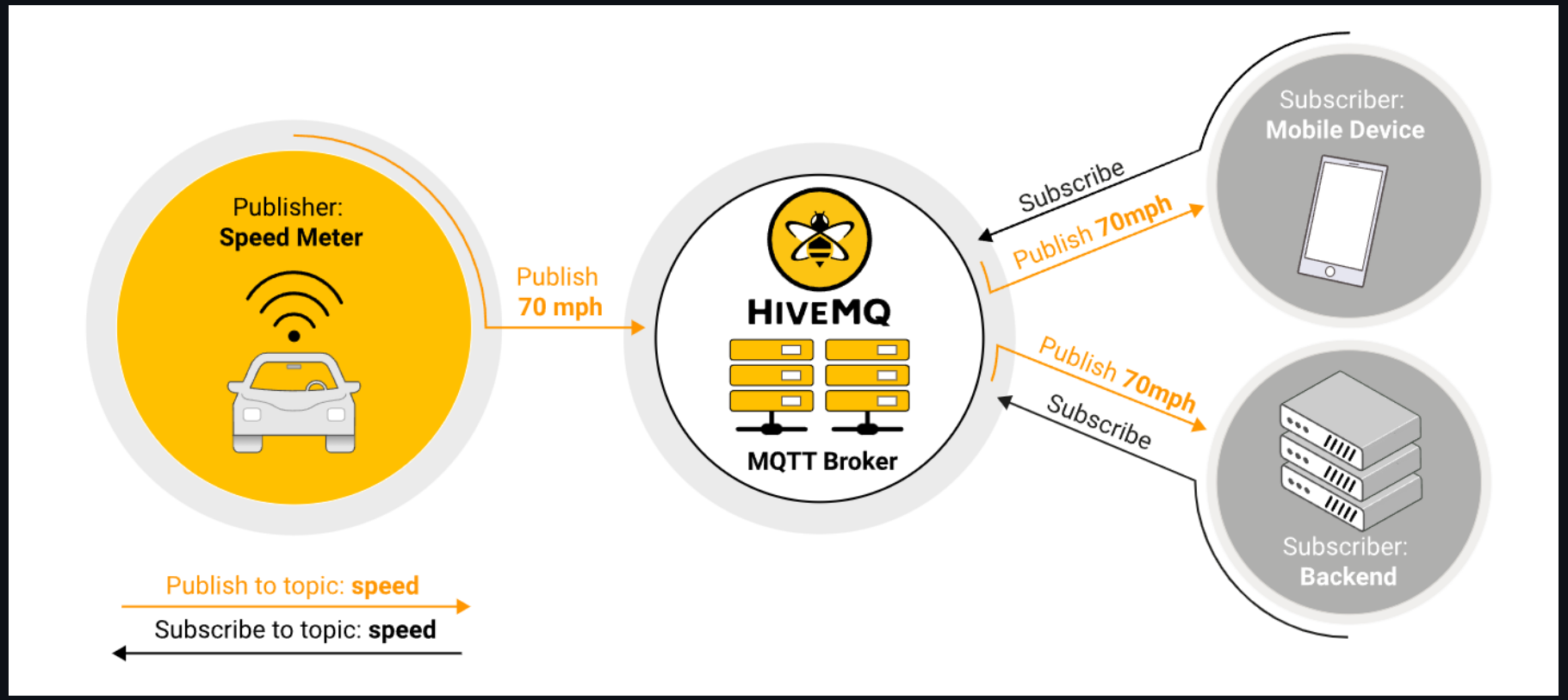
- The publish/subscribe pattern (also known as `pub/sub`) provides an **alternative** to traditional client-server architecture.
  - In client-server architecture, a client communicates directly with an endpoint.

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 `subscibers` 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.


Publisher:
Speed Meter
Publish
70 mph
HIVEMQ
MQTT Broker
Subscribe
Publish 70mph
Publish 70mph
Subscribe
Subscriber:
Mobile Device
Subscriber:
Backend
Publish to topic: speed
Subscribe to topic: speed

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.

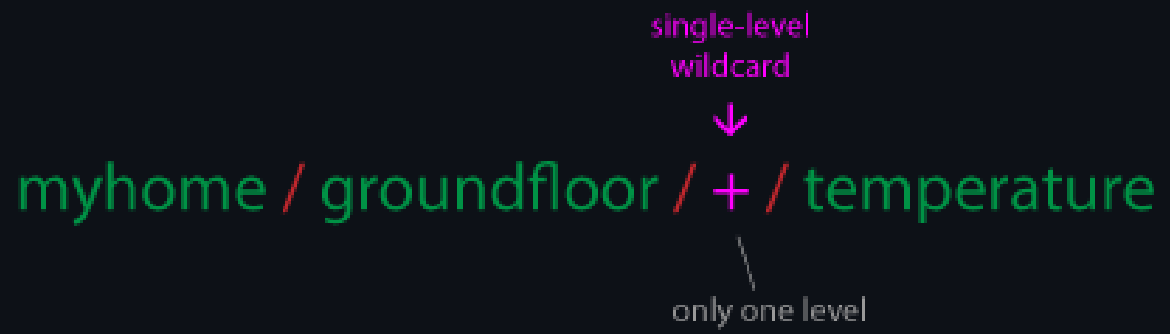
Topic

- `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).

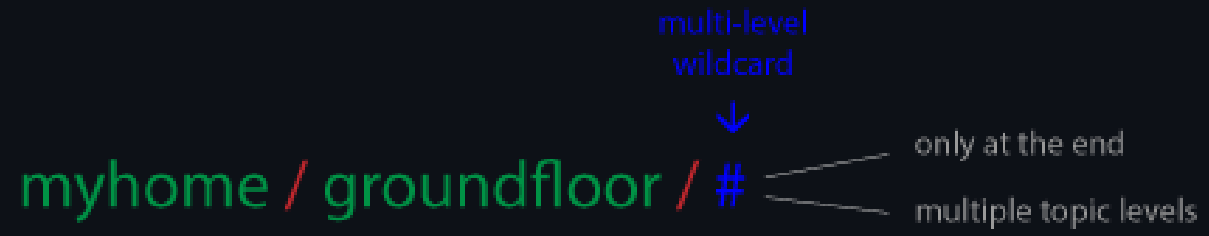
Topic examples

- 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



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

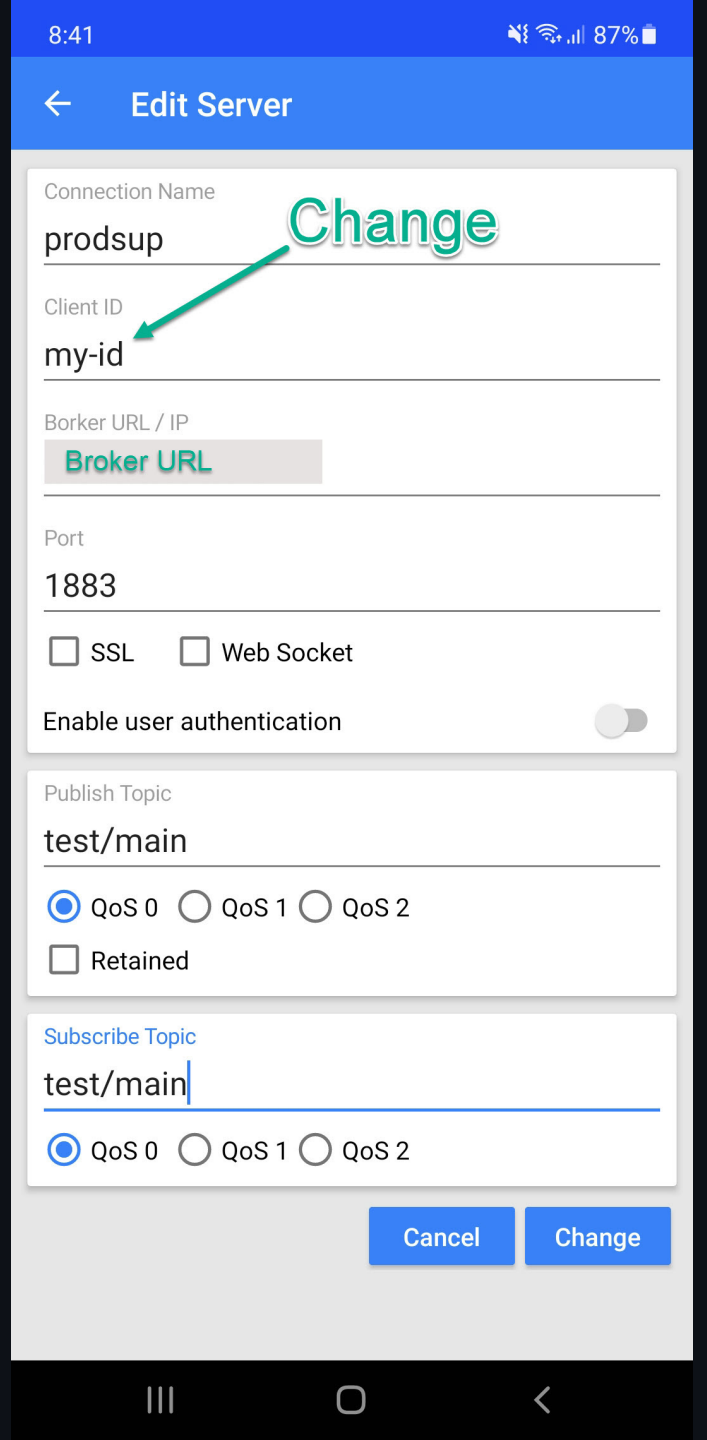


- myhome / groundfloor / livingroom / temperature
- myhome / groundfloor / kitchen / temperature
- myhome / groundfloor / kitchen / brightness
- myhome / firstfloor / kitchen / temperature

Enough talk. Let's try it.

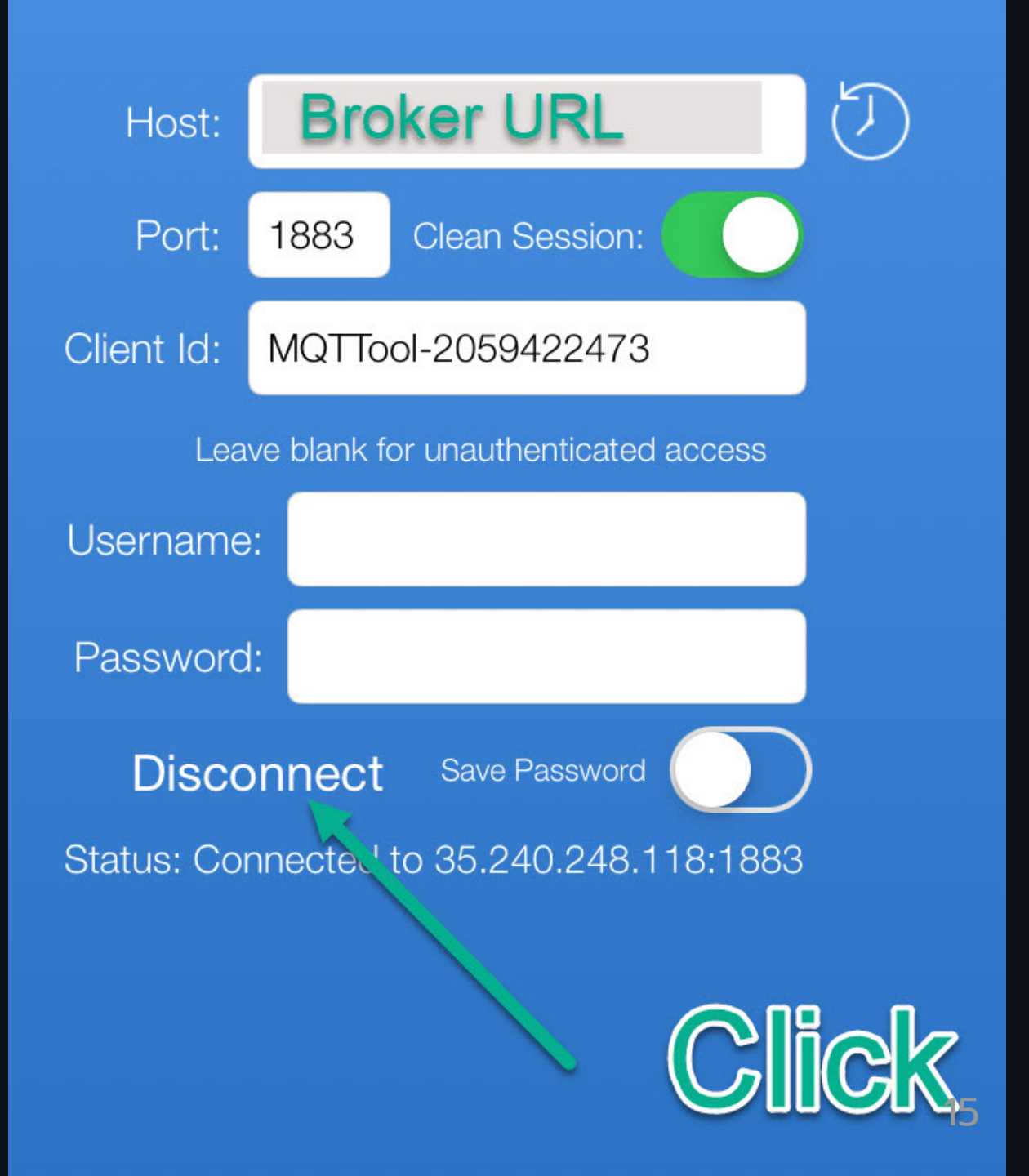
MQTT Terminal (Android)

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

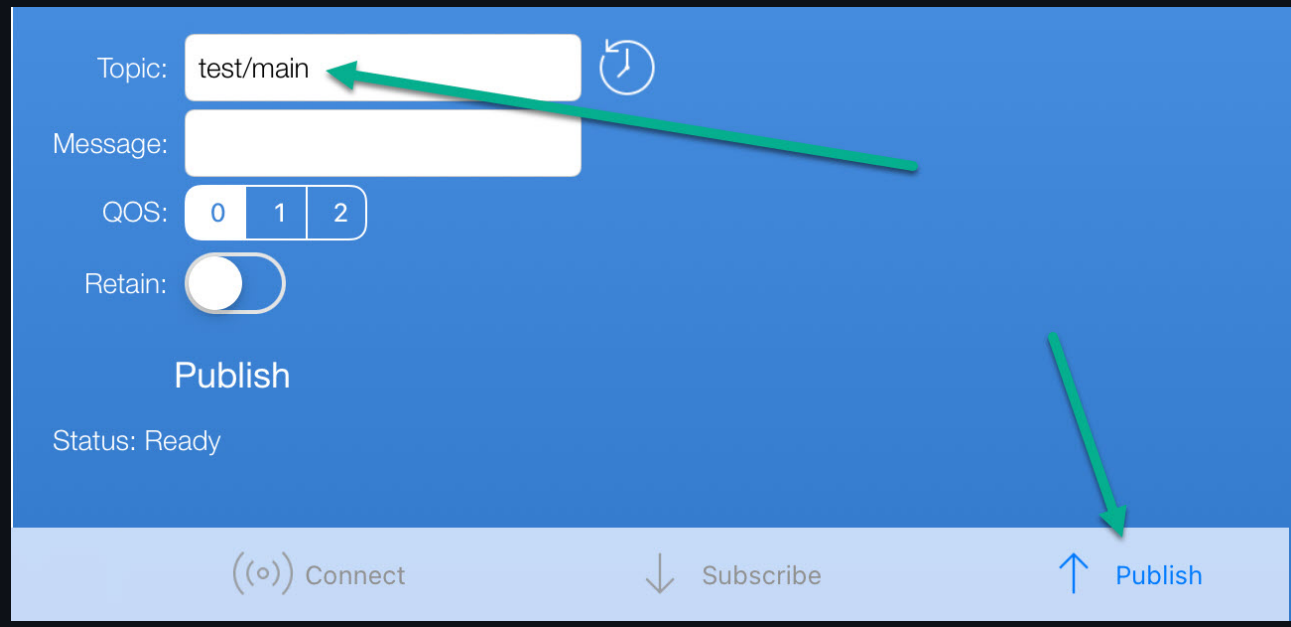


MQTTool (iOS)

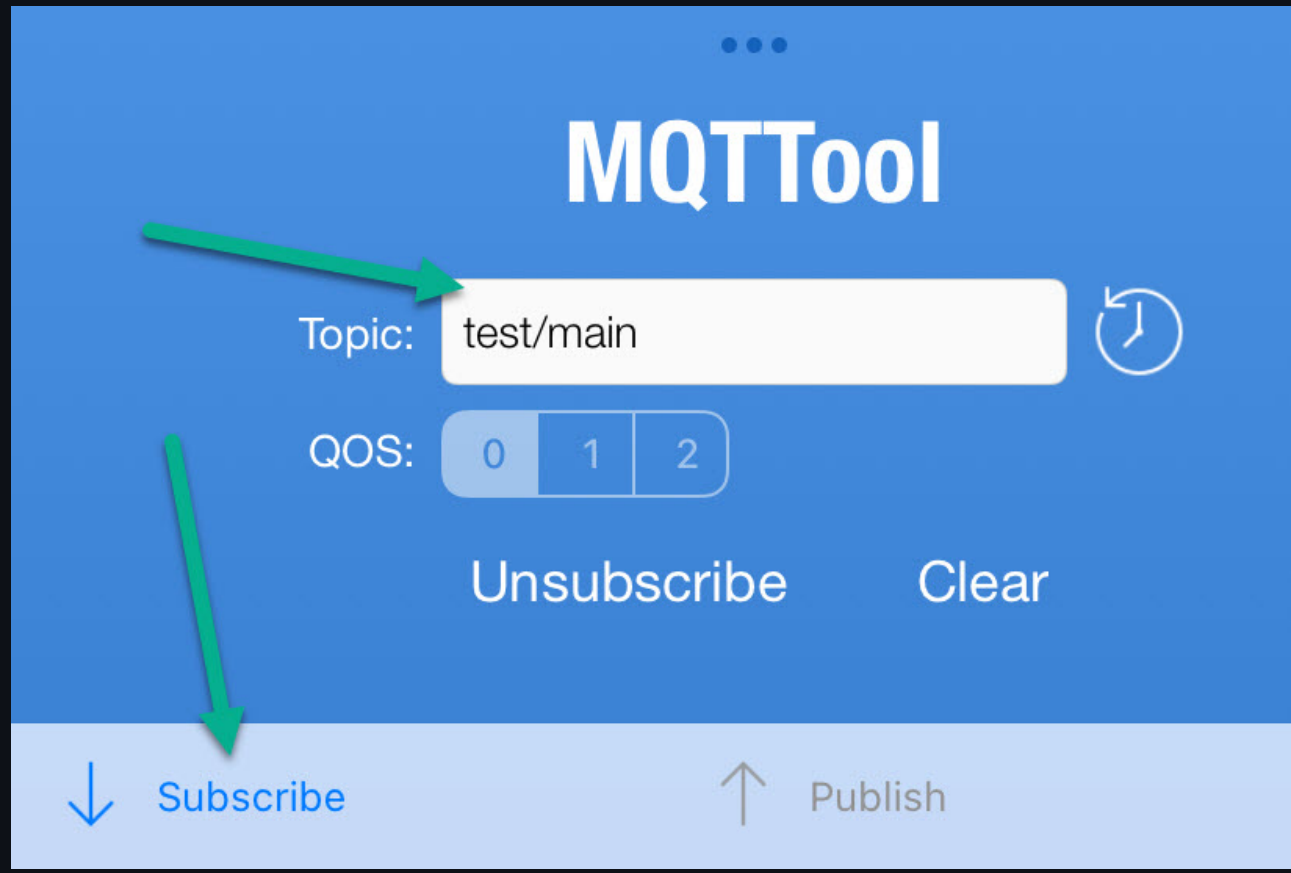
- `Host` : `iecmu.com`
- `Port` : `1883`
- `Client ID` : Leave blank



- `topic` : `test/main`



- `topic` : `test/main`



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.

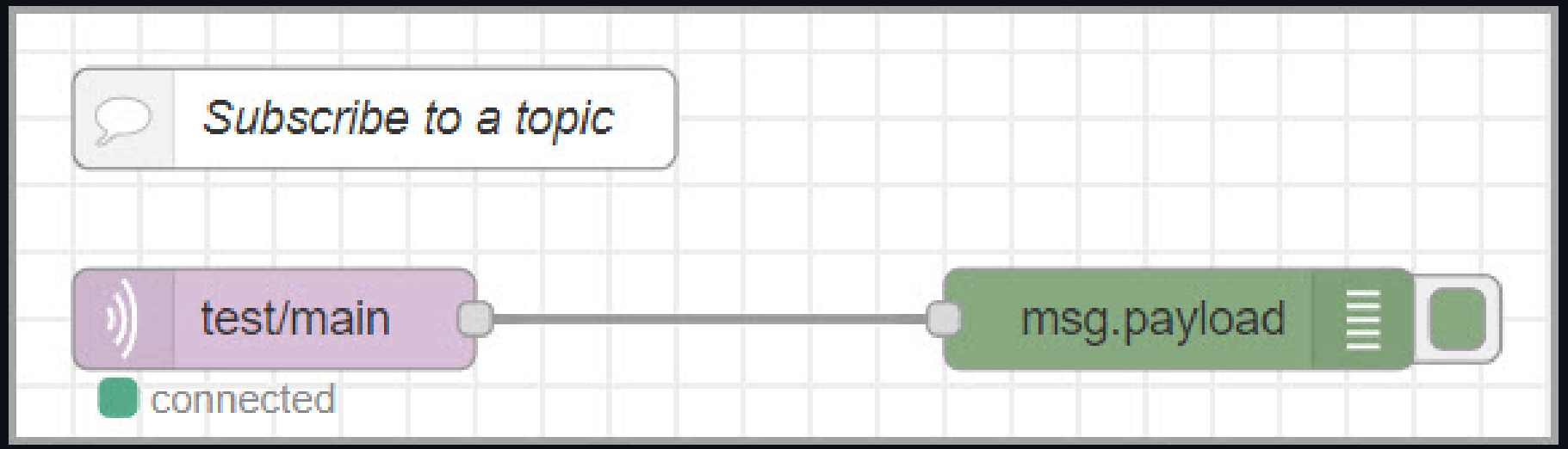
Retained message

- 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 subscsribes 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.

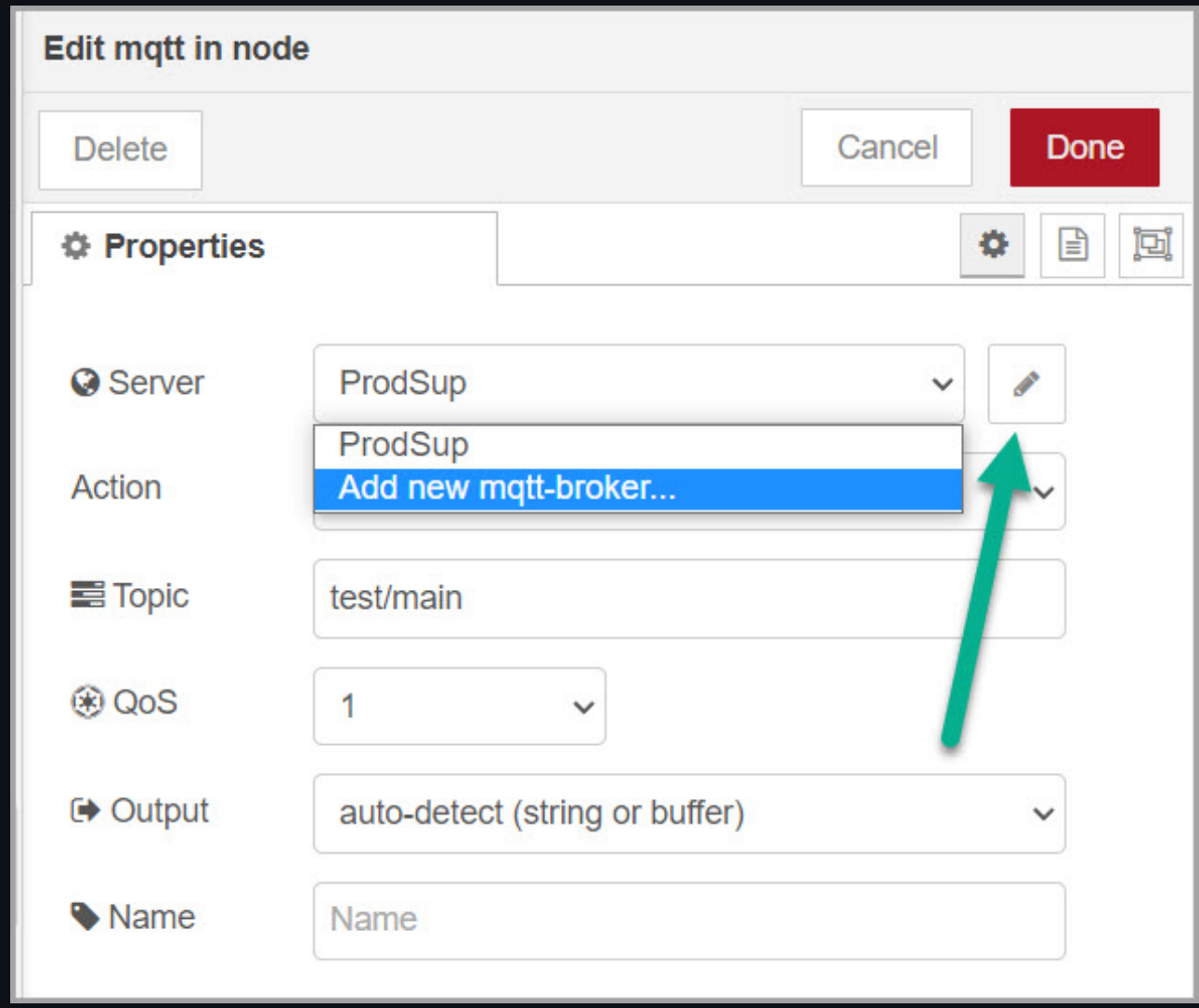
MQTT in Node-Red

Subscript to a topic

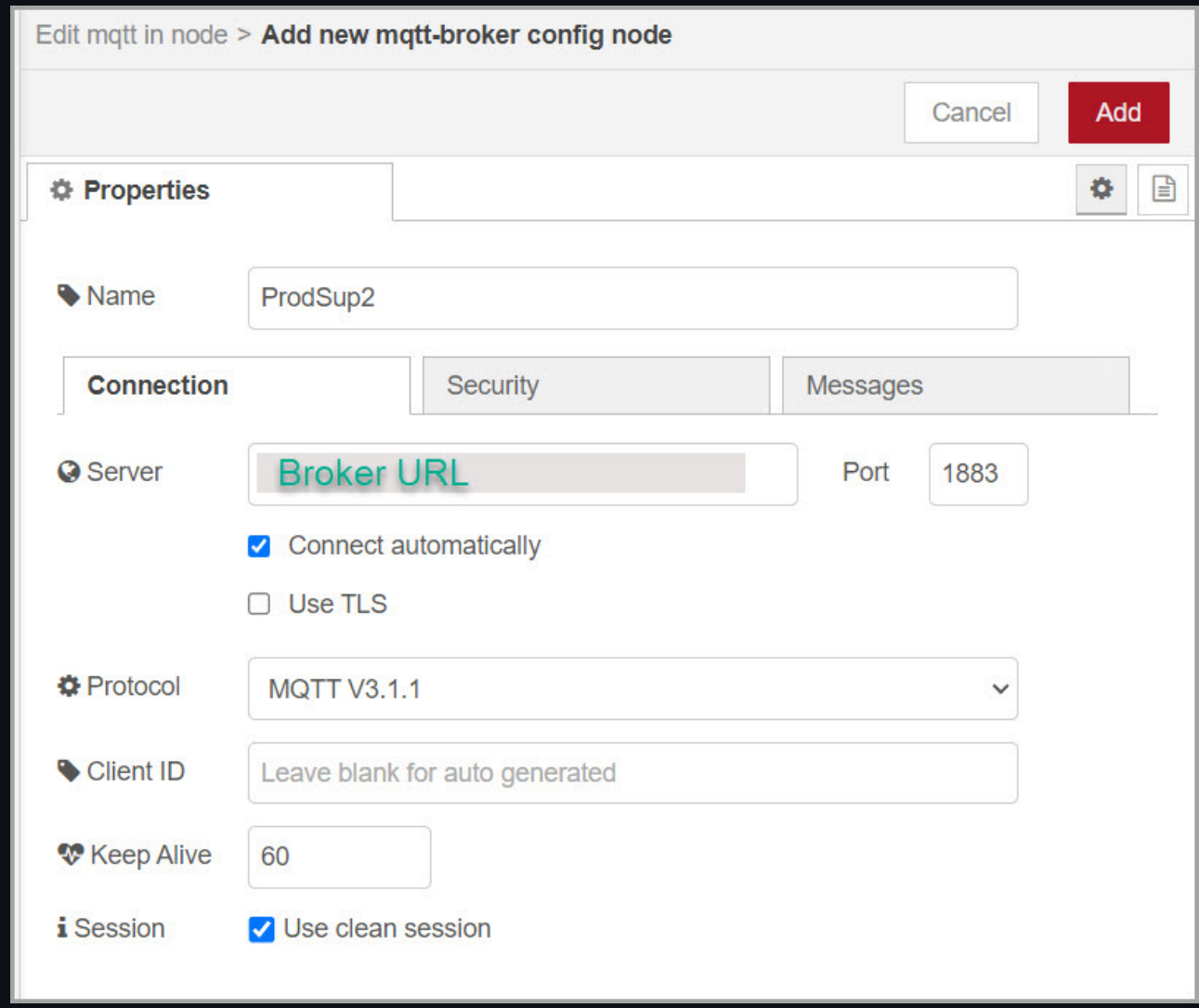
- Flow
  - `mqtt in`, `debug`



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

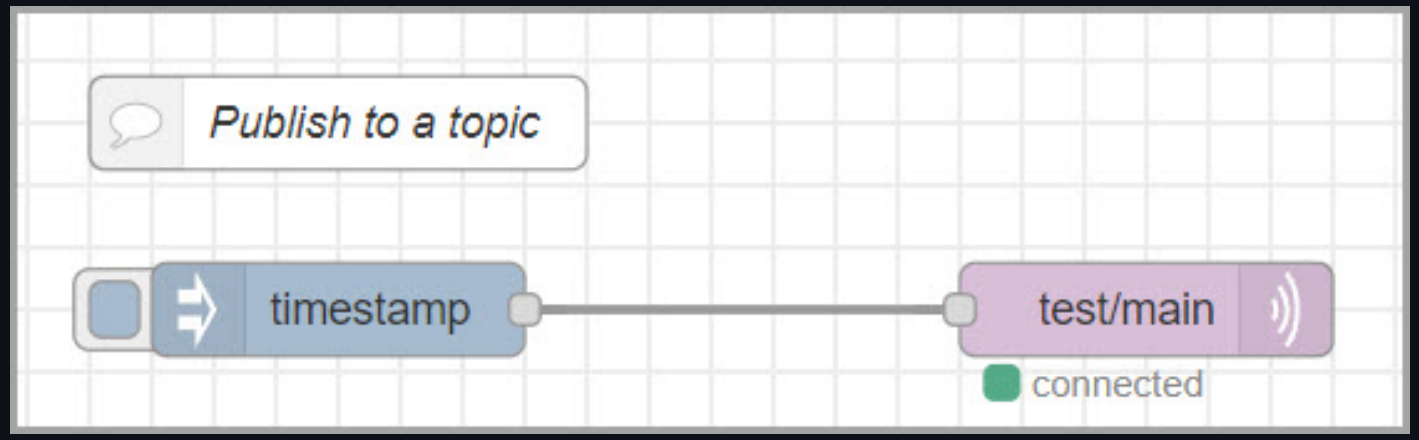


- `Server` : `1.tcp.ap.ngrok.io`
- `Port` : `1883`



Publish to a topic

- Flow
  - `inject`, `mqtt out`



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