

# **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

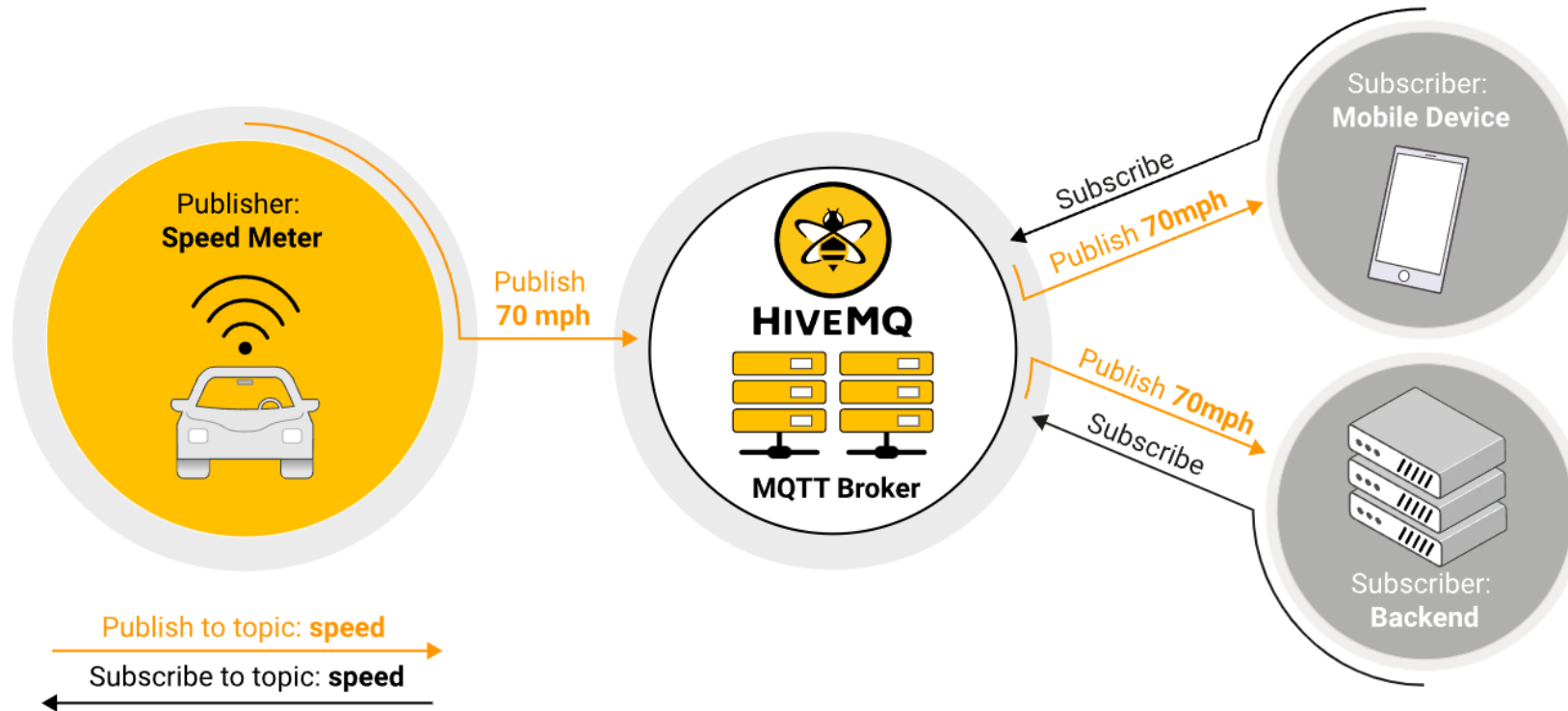
- The publish/subscribe pattern (also known as `pub/sub`) provides an **alternative** to traditional client-server architecture.
  - In client-server architecture, a client communicates directly with an endpoint.

# 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 level  
separator  
↓  
myhome / groundfloor / livingroom / temperature  
└───┬───┘ └───┬───┘  
topic level topic level

# 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 : 35.240.248.118
- Client ID : <<Your ID>>
- Port : 1883
- Publish Topic : test/main
- Subscribe Topic : test/main

8:41 87%

← Edit Server

Connection Name  
prodsup Change

Client ID  
my-id

Broker URL / IP  
35.240.248.118

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 : 35.240.248.118
- Port : 1883
- Client ID : Leave blank

Host: 35.240.248.118 

Port: 1883 Clean Session: ☒

Client Id: MQTTTool-2059422473

Leave blank for unauthenticated access

Username:

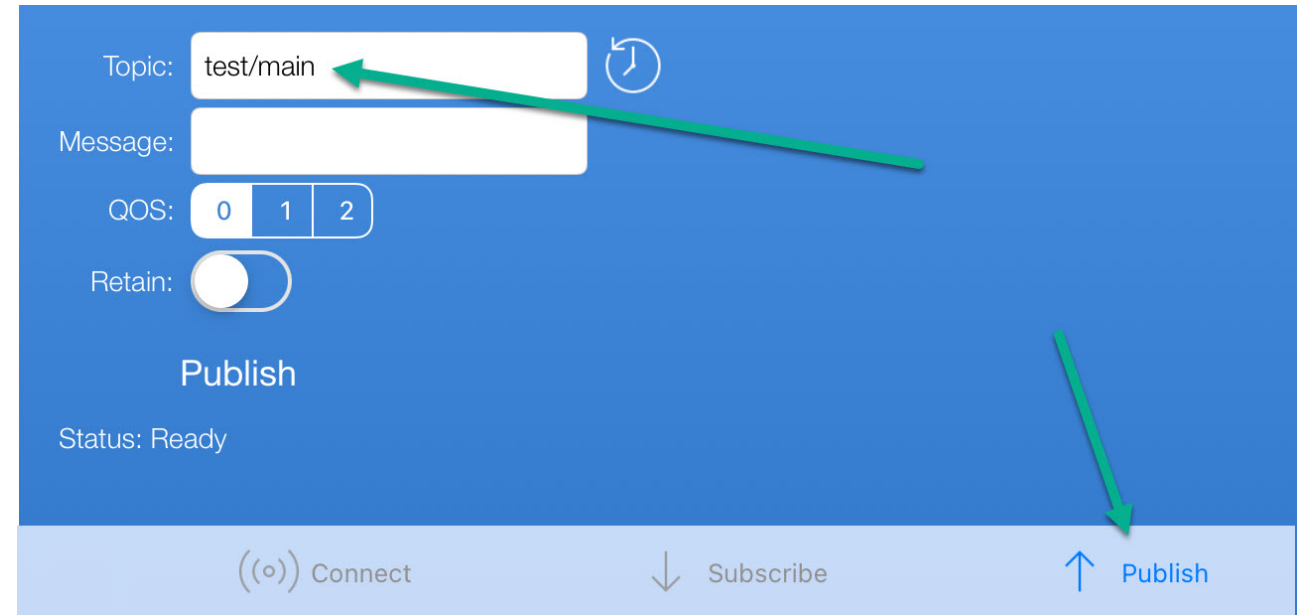
Password:

Disconnect Save Password ☐

Status: Connected to 35.240.248.118:1883

Click <sub>15</sub>

- `topic: test/main`

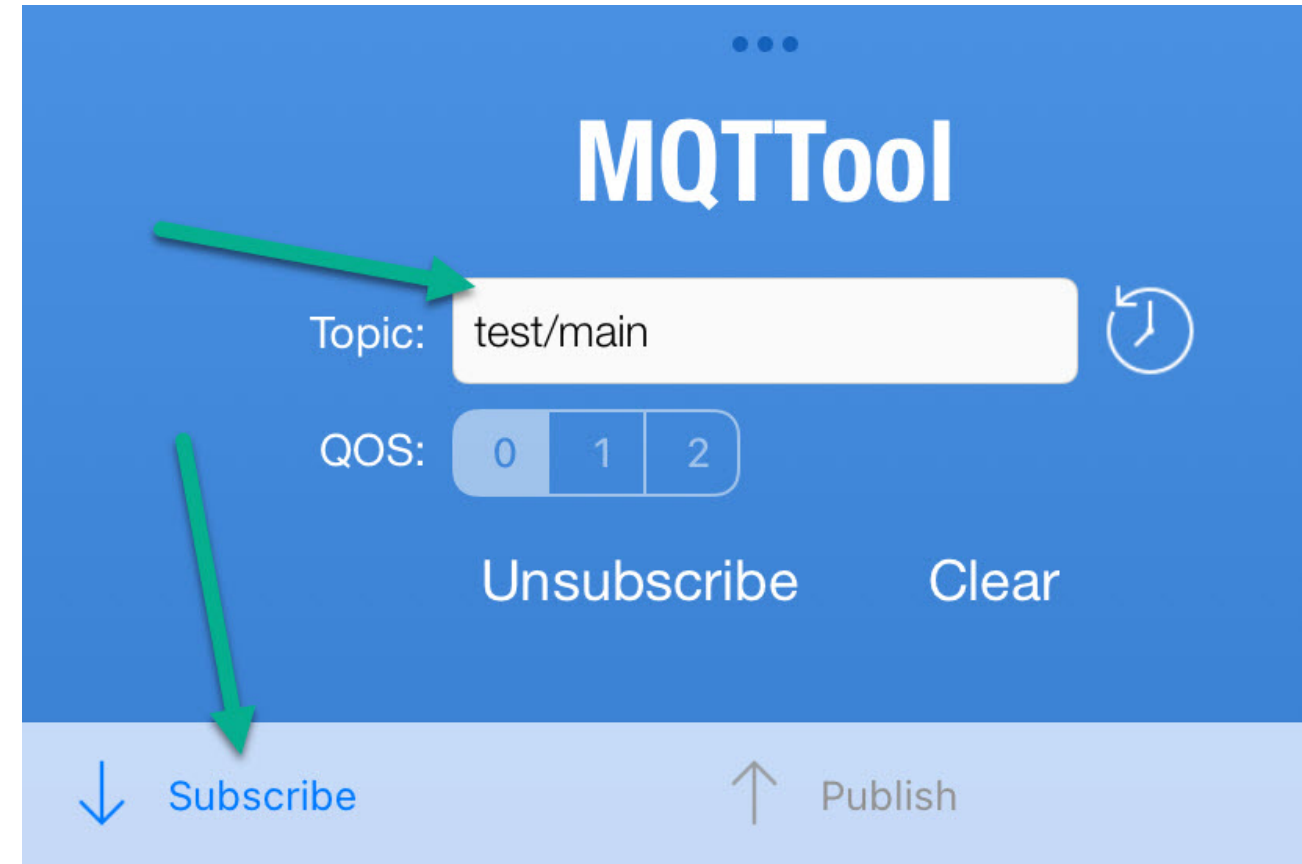


The image shows a screenshot of an MQTT client interface with a blue background. The interface includes the following elements:

- Topic:** A text input field containing "test/main". A green arrow points to this field from the right.
- Message:** An empty text input field.
- QOS:** A selection menu with three options: 0, 1, and 2. Option 0 is currently selected.
- Retain:** A toggle switch that is currently turned off.
- Publish:** A button located below the QOS and Retain settings.
- Status:** A label indicating "Status: Ready".
- Footer:** A light blue bar at the bottom containing three buttons: "((o)) Connect", "↓ Subscribe", and "↑ Publish". A green arrow points to the "Publish" button from the right.



- `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 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.



# Retained message demo

- [Websocket Client](#)
- host : 35.240.248.118
- port : 9001 (Different)

# Connection

● connected

⌵

Host

35.240.248.118

Port

9001

ClientID

clientId-sDP16mLSKq

Disconnect

Username

Password

Keep Alive

60

SSL

☐

Clean Session

☒

Last-Will Topic

Last-Will QoS

0

Last-Will Retain

☐

Last-Will Message

- Topc : test/temperature

## Publish

Topic

test/temperature

QoS

1

Retain

☒

Publish

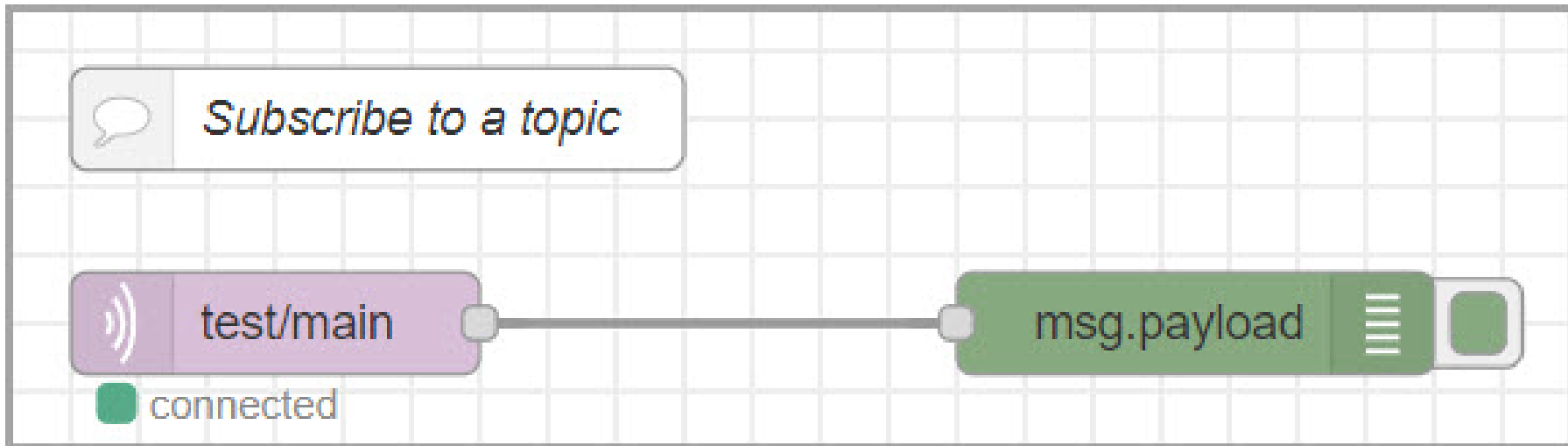
Message

30

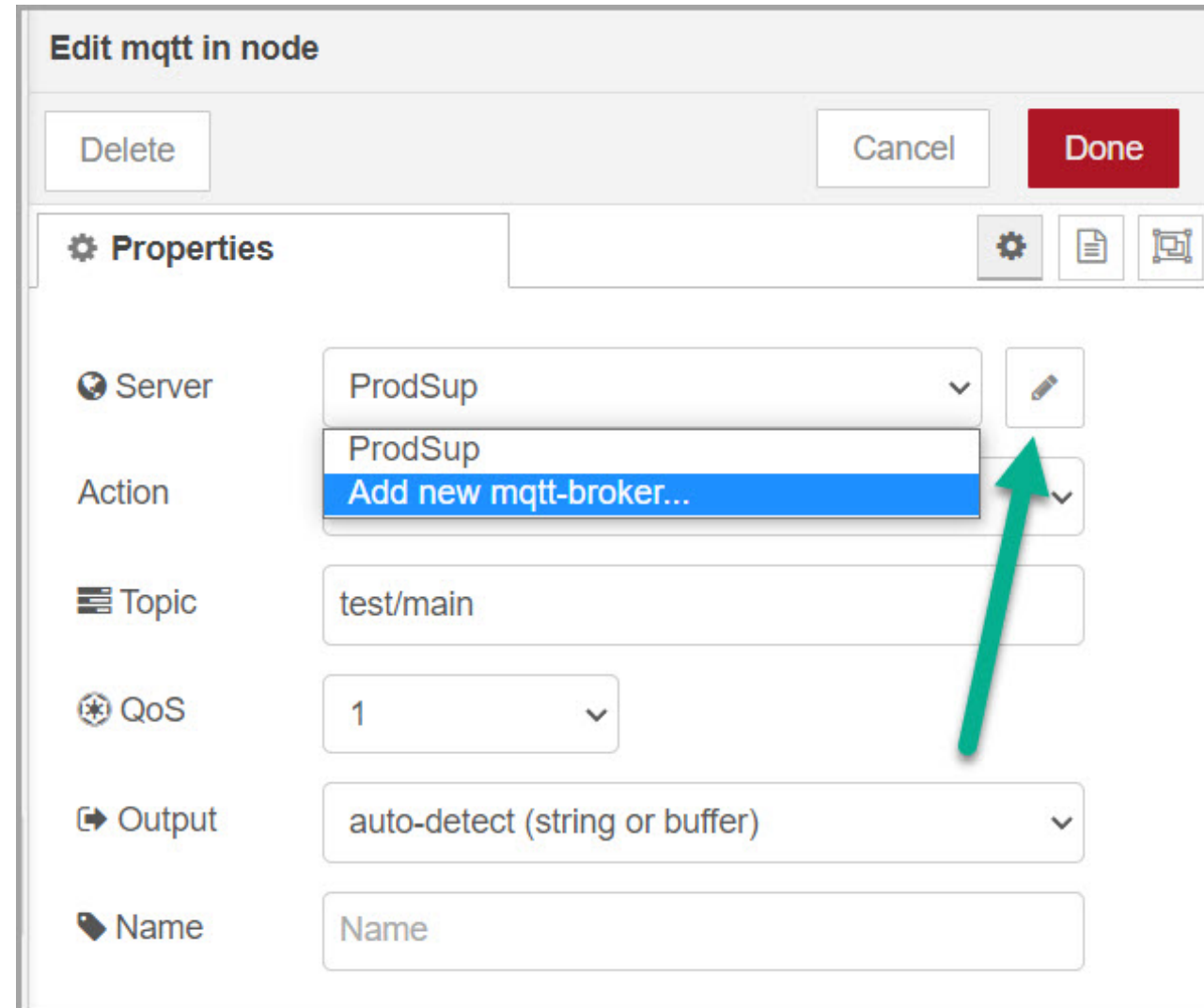
# **Module 3-1: MQTT in Node-Red**

# 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



The screenshot shows the 'Edit mqtt in node' dialog box. At the top, there are three buttons: 'Delete', 'Cancel', and 'Done'. Below these is a 'Properties' section with a gear icon and three sub-panels: 'Server', 'Action', and 'Topic'. The 'Server' panel has a dropdown menu with 'ProdSup' selected. The 'Action' panel has a dropdown menu with 'Add new mqtt-broker...' selected. The 'Topic' panel has a text input field with 'test/main'. Below these are 'QoS' (set to 1), 'Output' (set to 'auto-detect (string or buffer)'), and 'Name' (set to 'Name'). A green arrow points to the 'Add new mqtt-broker...' option in the 'Action' dropdown.

| Property | Value                          |
|----------|--------------------------------|
| Server   | ProdSup                        |
| Action   | Add new mqtt-broker...         |
| Topic    | test/main                      |
| QoS      | 1                              |
| Output   | auto-detect (string or buffer) |
| Name     | Name                           |

- Server : 35.240.248.118
- Port : 1883

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

Cancel Add

⚙ Properties

🔖 Name ProdSup2

Connection Security Messages

🌐 Server 35.240.248.118 Port 1883

☒ Connect automatically

☐ Use TLS

⚙ Protocol MQTT V3.1.1

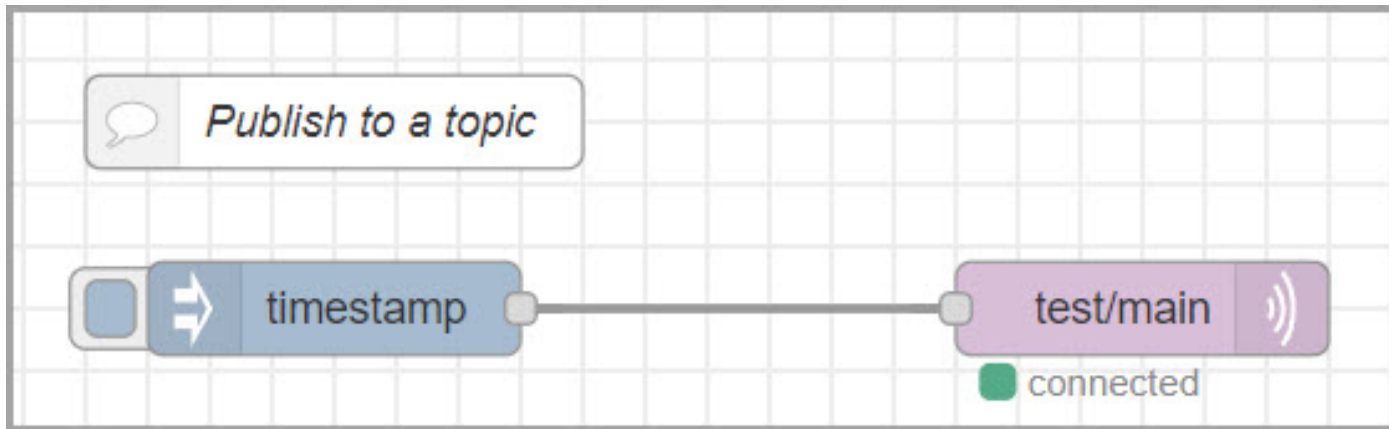
🔖 Client ID Leave blank for auto generated

💓 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.

The screenshot shows a dialog box titled "Edit mqtt out node". At the top, there are three buttons: "Delete", "Cancel", and "Done". Below the buttons is a tab labeled "Properties" with a gear icon. The main area contains several configuration fields:

- Server:** A dropdown menu showing "ProdSup2" with a pencil icon to its right.
- Topic:** A text input field containing "test/main".
- QoS:** A dropdown menu showing "1" with a downward arrow.
- Retain:** A checkbox labeled "Retain" followed by a dropdown menu showing "true" with a downward arrow.
- Name:** A text input field containing "Name".

At the bottom of the dialog, there is a yellow tip box that reads: "Tip: Leave topic, qos or retain blank if you want to set them via msg properties."