PW 4 : MQTT Lab Exercise Using Mosquitto on Localhost

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Objective

- Understand the basics of the MQTT protocol.
- Install and run the Mosquitto MQTT broker locally.
- Use Mosquitto command-line tools (`mosquitto_pub` and `mosquitto_sub`) to publish and subscribe to messages.
- Verify message flow between publisher and subscriber.

Lab Requirements

- A computer with Linux, macOS, or Windows.
- Mosquitto broker and clients installed.
- Terminal or command prompt access.

Part 1: Installing Mosquitto (if not already installed)

1. **On Ubuntu/Debian:**
   Open a terminal and run:

```
sudo apt-get update
sudo apt-get install mosquitto mosquitto-clients
```

Listing 1: Install Mosquitto on Ubuntu/Debian

2. **On macOS:**
   If you have Homebrew installed, run:

```
brew update
brew install mosquitto
```

Listing 2: Install Mosquitto on macOS

3. **On Windows:**
   Download the installer from `https://mosquitto.org/download/` and follow the installation instructions.

Part 2: Running the Mosquitto Broker

1. Open a terminal or command prompt.
2. Start the Mosquitto broker on localhost (default port 1883) by entering:

```
mosquitto
```

Listing 3: Start Mosquitto Broker

3. The broker will start and listen for MQTT connections. Leave this terminal open.

Part 3: Using MQTT Clients to Publish and Subscribe

Step 3.1: Subscribe to a Topic

1. Open a new terminal or command prompt.
2. Use the `mosquitto_sub` command to subscribe to a topic. For example, subscribe to `test/topic`:

```
mosquitto_sub -h localhost -t "test/topic"
```

Listing 4: Subscribe to a Topic

3. This terminal will now wait and display any messages published to the topic `test/topic`.

Step 3.2: Publish a Message

1. Open another new terminal or command prompt.
2. Use the `mosquitto_pub` command to publish a message to `test/topic`. For example, publish the message `"Hello, MQTT!"`:

```
mosquitto_pub -h localhost -t "test/topic" -m "Hello, MQTT!"
```

Listing 5: Publish a Message

3. Check the subscriber terminal; it should display the message "Hello, MQTT!".

Part 4: Additional Testing and Options

- **Quality of Service (QoS):**
  You can specify a QoS level (0, 1, or 2) for both publishing and subscribing. For example:

```
mosquitto_pub -h localhost -t "test/topic" -m "QoS Test" -q 1
```

Listing 6: Publish with QoS

- **Retained Messages:**
  Publish a message as retained so new subscribers immediately receive it:

```
mosquitto_pub -h localhost -t "test/topic" -m "Retained Message" -r
```

Listing 7: Publish a Retained Message

- **Subscribing with Wildcards:**
  Use wildcards to subscribe to multiple topics. For example:

```
mosquitto_sub -h localhost -t "test/#"
```

Listing 8: Subscribe with Wildcard

Troubleshooting Tips

- **Broker not running:** Ensure that the Mosquitto broker is running in its own terminal.
- **Firewall issues:** Verify that your firewall settings allow connections on port 1883.
- **Incorrect host:** Confirm that `-h localhost` is correctly specified if running on the local machine.

Conclusion

This lab exercise introduces students to the basics of MQTT using the Mosquitto broker on a local machine. By following the steps above, students can:

- Install and run Mosquitto.
- Use command-line tools to publish and subscribe to MQTT topics.
- Experiment with QoS, retained messages, and wildcard subscriptions.

This hands-on experience lays a foundation for understanding MQTT's lightweight messaging model, which is widely used in IoT applications.