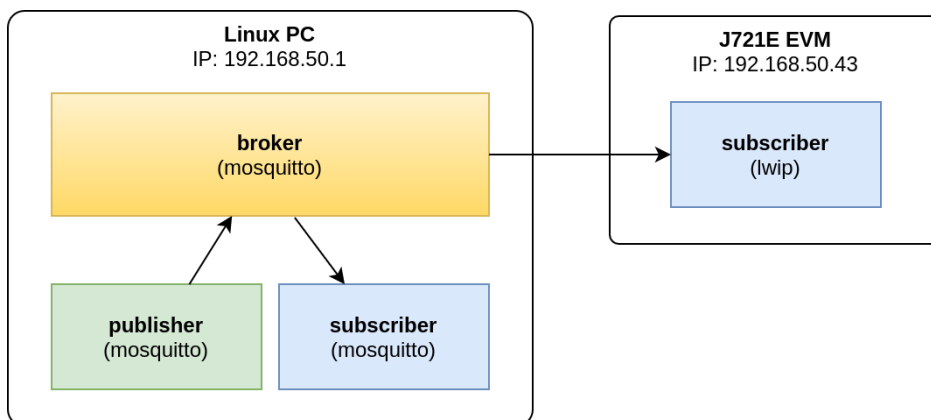


MQTT for IoT edge device

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2. Summary

MQTT Demo



2.1. Broker Installation (Host PC - Linux)

There are two options:

1. Download Mosquitto broker and compile locally
 1. Pros:
 1. Very latest version
 2. Source code to play with (aka debug)
2. Use Ubuntu's mosquitto
 1. Pros:
 1. Effortless installation

2.1.1. Mosquitto Broker from Public Repo

1. Clone [Mosquitto](https://github.com/eclipse/mosquitto) git repository: <https://github.com/eclipse/mosquitto>
2. `git clone https://github.com/eclipse/mosquitto.git`
3. `cd mosquitto/`
`make WITH_CJSON=no WITH_DOCS=no`
4. Run Mosquitto's [Quick steps](#) to make sure compilation is correct:
 - Broker


```
./src/mosquitto
```
 - Subscriber


```
LD_LIBRARY_PATH=./lib ./client/mosquitto_sub -t 'test/topic' -v
```
 - Publisher


```
LD_LIBRARY_PATH=./lib ./client/mosquitto_pub -t 'test/topic' -m 'hello world'
```

2.1.2. Ubuntu's Mosquitto Broker

1. Install Mosquitto Broker and clients:
2. `sudo apt-get install mosquitto`
`sudo apt-get install mosquitto-clients`

Note that the tool versions from Ubuntu and from public repo are likely to be different.

2.2. Broker Configuration

2.2.1. password_file

1. Create a *password file* using below command:
2. `./apps/mosquitto_passwd/mosquitto_passwd -c my_password_file j721e_evm`
3. `./apps/mosquitto_passwd/mosquitto_passwd my_password_file pc_sub`
`./apps/mosquitto_passwd/mosquitto_passwd my_password_file pc_pub`
4. Enter a password for the each user. For simplicity, here we will set password to *1234* for all users.

2.2.2. ACL file

- Copy sample ACL file:

```
cp aclfile.example my_aclfile
```

- Add user created in previous step:
- # J7 EVM connected to Linux PC
- user j721e_evm
- topic topic_qos1
-
- # Linux PC - Subscriber
- user pc_sub
- topic topic_qos1
-
- # Linux PC - Publisher
- user pc_pub
- topic topic_qos1

Note that here we are reusing *topic_qos1* which is defined in lwip mqtt application.

2.2.3. Mosquitto configuration file

1. Copy existing mosquitto.conf file:

```
cp mosquitto.conf my_mosquitto.conf
```

2. Make following changes to the new mosquitto config file:
3. per_listener_settings true
4. listener 1883 <Linux PC IP address>
5. bind_interface <Linux PC interface id>
6. allow_anonymous false
7. password_file my_password_file
- acl_file my_aclfile

2.3. lwIP / Enet LLD

2.3.1. lwIP changes

1. Make the following changes in lwIP contrib's mqtt example app:
2. project /lwip/lwip-contrib/
3. diff --git a/examples/mqtt/mqtt_example.c
 b/examples/mqtt/mqtt_example.c
4. index f57b005..e0d96b0 100644
5. --- a/examples/mqtt/mqtt_example.c
6. +++ b/examples/mqtt/mqtt_example.c
7. @@ -35,6 +35,8 @@
8. /** Define this to a compile-time IP address initialization
9. * to connect anything else than IPv4 loopback

```

10.  */
11.  +/* Broker IP address: 192.168.50.1 */
12.  +#define LWIP_MQTT_EXAMPLE_IPADDR_INIT = IPADDR4_INIT(0x0132a8c0UL)
13.  #ifndef LWIP_MQTT_EXAMPLE_IPADDR_INIT
14.  #if LWIP_IPV4
15.  #define LWIP_MQTT_EXAMPLE_IPADDR_INIT = IPADDR4_INIT(IPADDR_LOOPBACK)
16.  @@ -43,14 +45,21 @@
17.  #endif
18.  #endif
19.
20.  +/* Print to UART */
21.  +extern void EnetAppUtils_print(const char *pcString, ...);
22.  +#ifdef printf
23.  +#undef printf
24.  +#endif
25.  +#define printf EnetAppUtils_print
26.  +
27.  static ip_addr_t mqtt_ip LWIP_MQTT_EXAMPLE_IPADDR_INIT;
28.  static mqtt_client_t* mqtt_client;
29.
30.  static const struct mqtt_connect_client_info_t mqtt_client_info =
31.  {
32.      "test",
33.      - NULL, /* user */
34.      - NULL, /* pass */
35.      + "j721e_evm", /* user */
36.      + "1234", /* pass */
37.      100, /* keep alive */
38.      NULL, /* will_topic */
39.      NULL, /* will_msg */
40.

```

- Note that the IP address set with IPADDR4_INIT() macro is the broker's IP, i.e. 192.168.50.1 in above case.

2.3.2. Enet LLD changes

1. Make the following changes in the Enet lwIP example application:
2. diff --git a/examples/enet_lwip_example/lwipcfg.h
b/examples/enet_lwip_example/lwipcfg.h
3. index 25f01a04..4d80635d 100644
4. --- a/examples/enet_lwip_example/lwipcfg.h
5. +++ b/examples/enet_lwip_example/lwipcfg.h
6. @@ -55,7 +55,7 @@
7. #define LWIP_NETBIOS_APP 0
8. #define LWIP_NETIO_APP 0
9. #define LWIP_MDNS_APP 0
10. -#define LWIP_MQTT_APP 0
11. +#define LWIP_MQTT_APP 1
12. #define LWIP_PING_APP 0
13. #define LWIP_RTP_APP 0
14. #define LWIP_SHELL_APP 0
- 15.

2.3.3. lwIP MQTT contrib app fix

Issue was observed when lwIP stack was handling the received message from broker.

It was root caused to a problem in the sequence of APIs being called by the MQTT example app:

- *mqtt_set_inpub_callback()* sets the *mqtt callbacks* in the *mqtt_client* structure
- *mqtt_client_connect()* clears *mqtt_client* structure which effectively removes the callback
- When MQTT packet is received at a later point, the *incoming data callback* gets called, but it's a NULL pointer

```
diff --git a/examples/mqtt/mqtt_example.c b/examples/mqtt/mqtt_example.c
index f57b005..39ee16d 100644
--- a/examples/mqtt/mqtt_example.c
+++ b/examples/mqtt/mqtt_example.c
@@ -115,14 +124,14 @@ mqtt_example_init(void)
    #if LWIP_TCP
        mqtt_client = mqtt_client_new();

-   mqtt_set_inpub_callback(mqtt_client,
-                           mqtt_incoming_publish_cb,
-                           mqtt_incoming_data_cb,
-                           LWIP_CONST_CAST(void*, &mqtt_client_info));
+
+   mqtt_client_connect(mqtt_client,
+                       &mqtt_ip, MQTT_PORT,
+                       mqtt_connection_cb, LWIP_CONST_CAST(void*, &mqtt_client_info),
+                       &mqtt_client_info);
+
+   mqtt_set_inpub_callback(mqtt_client,
+                           mqtt_incoming_publish_cb,
+                           mqtt_incoming_data_cb,
+                           LWIP_CONST_CAST(void*, &mqtt_client_info));
    #endif /* LWIP_TCP */
}
```

2.4. Test Steps

1. Start mosquitto broker

```
./src/mosquitto -c mosquitto.conf
```

2. Start mosquitto subscriber on PC side

```
LD_LIBRARY_PATH=./lib ./client/mosquitto_sub -h 192.168.50.1 -u pc_sub
-P 1234 -t topic_qos1
```

3. Launch Enet lwIP example application on j721e

4. Start mosquitto publisher on PC side, this command will send a "hello world" message to the subscribers.

```
LD_LIBRARY_PATH=./lib ./client/mosquitto_pub -h 192.168.50.1 -u pc_pub  
-P 1234 -t topic_qos1 -m 'hello world'
```

2.5. Test Logs

2.5.1. Broker

```
~/mosquitto$ ./src/mosquitto -c mosquitto.conf  
1625031933: mosquitto version 2.0.11 starting  
1625031933: Config loaded from mosquitto.conf.  
1625031933: Opening ipv4 listen socket on port 1883.  
1625031933: mosquitto version 2.0.11 running  
1625031941: New connection from 192.168.50.1:40078 on port 1883.  
1625031941: New client connected from 192.168.50.1:40078 as auto-39D4598B-  
BB25-2714-9FFB-695588E5F400 (p2, c1, k60, u'pc_sub').  
1625031954: New connection from 192.168.50.43:54911 on port 1883.  
1625031954: New client connected from 192.168.50.43:54911 as test (p2, c1,  
k100, u'j721e_evm').  
1625031977: New connection from 192.168.50.1:40086 on port 1883.  
1625031977: New client connected from 192.168.50.1:40086 as auto-E3BE9747-  
BB51-F99D-641B-6F9CBEDCD9AF (p2, c1, k60, u'pc_pub').  
1625031977: Client auto-E3BE9747-BB51-F99D-641B-6F9CBEDCD9AF disconnected.
```

2.5.2. Subscriber (PC)

```
~/mosquitto$ LD_LIBRARY_PATH=./lib ./client/mosquitto_sub -h 192.168.50.1 -u  
pc_sub -P 1234 -t topic_qos1  
hello world
```

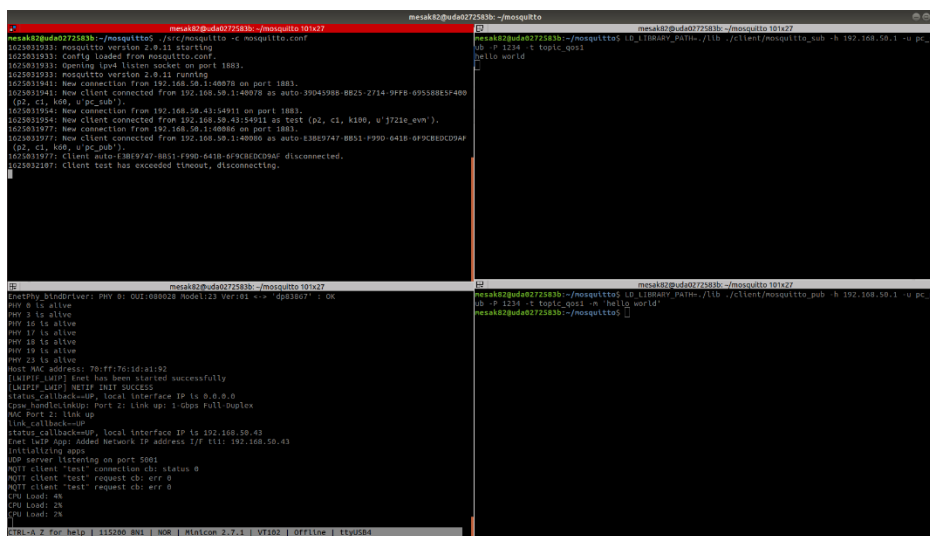
2.5.3. Enet lwIP Client (J721E EVM)

```
=====  
Enet lwIP App  
=====  
Starting lwIP, local interface IP is dhcp-enabled  
CPSW_5G Test on MAIN NAVSS  
EnetBoard_setupPorts: 1 of 1 ports configurations found  
EnetPhy_bindDriver: PHY 0: OUI:080028 Model:23 Ver:01 <-> 'dp83867' : OK  
PHY 0 is alive  
PHY 3 is alive  
PHY 16 is alive  
PHY 17 is alive  
PHY 18 is alive  
PHY 19 is alive  
PHY 23 is alive  
Host MAC address: 70:ff:76:1d:a1:92  
[LWIPIF_LWIP] Enet has been started successfully  
[LWIPIF_LWIP] NETIF INIT SUCCESS  
status_callback==UP, local interface IP is 0.0.0.0
```

```
Cpsw_handleLinkUp: Port 2: Link up: 1-Gbps Full-Duplex
MAC Port 2: link up
link_callback==UP
status_callback==UP, local interface IP is 192.168.50.43
Enet lwIP App: Added Network IP address I/F til: 192.168.50.43
Initializing apps
UDP server listening on port 5001
MQTT client "test" connection cb: status 0
MQTT client "test" request cb: err 0
MQTT client "test" request cb: err 0
CPU Load: 4%
CPU Load: 2%
CPU Load: 2%
```

2.5.4. Publisher (PC)

```
~/mosquitto$ LD_LIBRARY_PATH=./lib ./client/mosquitto_pub -h 192.168.50.1 -u
pc_pub -P 1234 -t topic_qos1 -m 'hello world'
```



```
mesak82@ubuntu077553b:~/mosquitto$ mosquitto
mesak82@ubuntu077553b:~/mosquitto$ mosquitto -c mosquitto.conf
1025032931: mosquitto version 2.0.18 starting
1025032933: Config loaded from mosquitto.conf
1025032933: Opening level listen socket on port 1883.
1025032933: Mosquitto version 2.0.18 running
1025032941: New connection from 192.168.50.1:40070 on port 1883.
1025032941: New client connected from 192.168.50.1:40070 as auto-39043988-BE23-2734-9FFB-095588E5F400
(p2, ci, k08, w'pc_pub').
1025032954: New connection from 192.168.50.43:54911 on port 1883.
1025032954: New client connected from 192.168.50.43:54911 as test (p2, ci, k106, w'j721e_qvm').
1025032977: New connection from 192.168.50.1:40080 on port 1883.
1025032977: New client connected from 192.168.50.1:40080 as auto-E38E9747-8B51-F99D-641B-0F9CBEDC9A9F
(p2, ci, k08, w'pc_pub').
1025032977: Client auto-E38E9747-8B51-F99D-641B-0F9CBEDC9A9F disconnected.
1025032107: Client test has exceeded timeout, disconnecting.

mesak82@ubuntu077553b:~/mosquitto$ mosquitto_pub -h 192.168.50.1 -u pc_pub -P 1234 -t topic_qos1 -m 'hello world'
mesak82@ubuntu077553b:~/mosquitto$
```