IOSR Journal of Engineering (IOSR JEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
PP 47-49

IOT Messaging Protocols

Nileema Pathak[1],Chanda Chouhan[2],Jyothi Arun[3] ,Vaishali Salvi[4] ,Sumita Chandak[5]

1 (Atharva College of Engineering/ Mumbai University, India)
2 (Atharva College of Engineering/ Mumbai University, India)
3 (Atharva College of Engineering/ Mumbai University, India)
4 (Atharva College of Engineering/ Mumbai University, India)
5 (Atharva College of Engineering/ Mumbai University, India)

***Abstract**: In this connected world today, technology is playing a major role in connecting intelligent things and developing smart applications. Making the connected devices to communicate with each other is very cumbersome. Connecting battery operated devices and constrained network are common challenges in IoT solutions. So, the communication protocol used should be lightweight, should consume less energy and must be suitable for such constrained environments. Various messaging protocols are defined and published to these type of applications. In this paper we will discuss about the popular IoT messaging protocols such as MQTT, MQTT-SN*

I. Introduction

The Internet of Things (IoT) is a network consisting of interconnected physical devices that have built-in sensors. In addition to sensors, the network may have actuators built into physical objects and is interconnected via wired or wireless networks. These interconnected devices can acquire data from sensors, can operate on the data, can identify themselves and be programmed. Taking into consideration the specific requirement of IOT to connect devices of varied types, TCP/IP protocol is not able to fulfill all the requirements. IOT application protocols have to be designed taking into consideration the constrained requirements of the networks. Message Queue Telemetry Transport (MQTT) is a protocol that tries to fit in. It is designed to be lightweight and to make careful use of scarce network resources.

II. What Is MQTT

Message Queue Telemetry Transport (MQTT) is implemented in the application layer. The most common and ubiquitous application layer protocol used is Hypertext Transfer Protocol (HTTP) in client/server applications. HTTP protocol does not function efficiently with constraints resources of IOT applications.

You can compare MQTT to Twitter. IOT devices can publish and subscribe for data in the same network. You can subscribe on some topics and you'll receive messages on topics you subscribe to. The MQTT is called publish/subscribe system and it utilizes a broker, filtering the messages based on your subscription preferences.

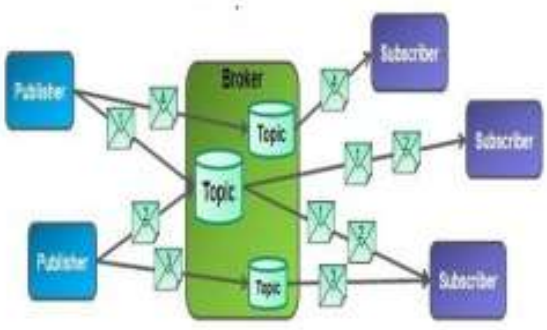

Figure 1. MQTT Protocol

III. How MQTT-SN Is Different From MQTT?

For applications that use wireless sensor networks and have limited bandwidth, limited power the basic MQTT is modified to support sensor networks and is called MQTT-SN. MQTT-SN is designed to perform as well as possible like MQTT, but is adapted to the particular behavior of wireless communication network such as low bandwidth, high link failures, short message length etc. MQTT-SN is optimally designed for the implementation on low cost, battery-operated devices with limited processing and storage resources. MQTT-SN needs a bridge or gateway to translate MQTT-SN messages into MQTT messages.

MQTT-SN and MQTT differences:

1) MQTT-SN uses topic ID instead of topic name. First client sends a registration request with topic name and topic ID (2 octets) to the broker. Topic ID is used for all further communication by the client. This saves media bandwidth and device memory as it is not recommended to keep and send topic names like office/building1/room2/AC1/Temp in memory for each publish message.

2) Topic name to topic ID can be preconfigured in MQTT-SN gateway, so that even registration message can be skipped before publish.

3) A discovery procedure helps clients without a pre-configured server/gateway's address to discover the actual network address of an operating server/gateway. Multiple gateways may be present at the same time which co-operate and work within a single wireless network.

4) The Clients connect to the broker through a gateway device, which resides within the sensor network and connects to the broker.

MQTT-SN components:

MQTT-SN clients, MQTT-SN gateways and MQTT-SN forwarders. MQTT-SN clients connect to a MQTT server via a MQTT-SN gateway using the MQTT-SN protocol. A MQTT-SN gateway may be integrated with a MQTT server. In case of a stand-alone gateway, the MQTT protocol is used between the MQTT server and the MQTT-SN gateway. Its main function is the translation signals between MQTT and MQTT-SN. MQTT-SN clients can also access a gateway via a forwarder in case the gateway is not directly attached to the network. The forwarder simply encapsulates the MQTT-SN frames it receives on the wireless side and forwards them, unchanged to the gateway. It also functions in similar manner in reverse direction by releasing the frames it receives from the gateway and sending them to the clients.

There are two types of Gateways classified depending on how they perform the translation from MQTT to MQTT-SN

1) In Transparent Gateway, for each MQTT-SN client, transparent gateway will form an individual MQTT connection to the MQTT broker.

2) In Aggregating Gateway, the gateway collects data from all the clients and transfers it to the broker using only one MQTT connection. Aggregating gateway is used in applications where WSN network has large number of sensor nodes because it helps in reducing the number of MQTT connections that broker has to create with individual client.

Message flow in a MQTT-SN is as follows,

- MQTT-SN client searches for a gateway in the local network using search gateway broadcast message. MQTT-SN gateway broadcasts advertise messages in the local network to which it is connected.
- The gateways should be a MQTT broker or it should connected to a MQTT broker before advertising.
- MQTT-SN client finds the gateway destination using dynamic discovery and connects to the gateway.
- MQTT-SN clients can work as a publisher as well as subscriber.
- Publishers register the topics that it is going to publish, with gateway to get 2 byte topic ID which helps to reduce the message size.
- Subscriber sends subscribe messages with predefined short topic ID or 2 bytes short topic name. MQTT-SN gateway sends subscription acknowledgement message to the subscriber.
- MQTT broker and MQTT-SN gateway controls the message flow, receives the messages from publishers and routes them to subscribers.

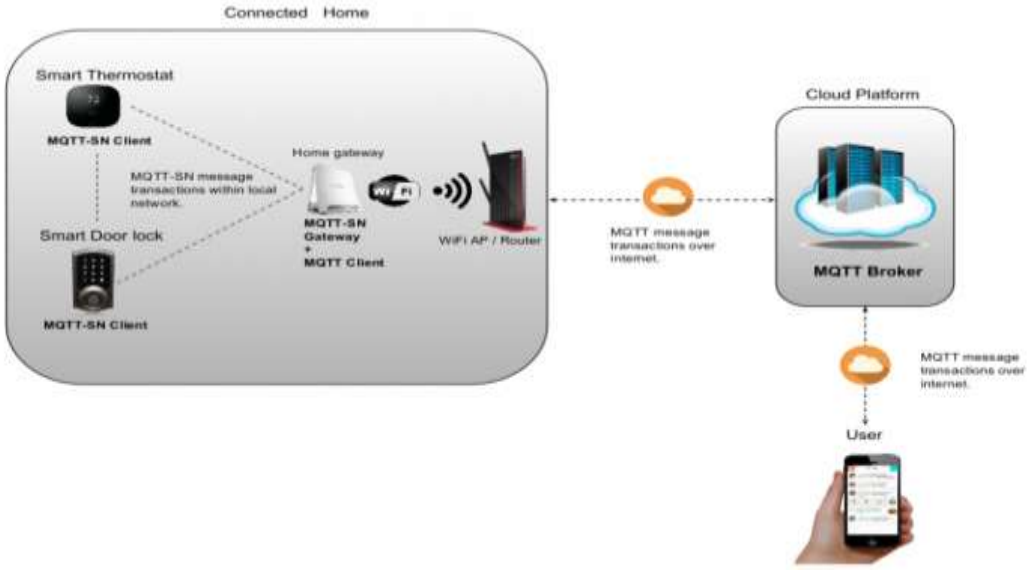

Figure 2. MQTT-SN and MQTT in Home Automation Example

In the above example, home gateway acts as MQTT-SN gateway as well as MQTT client and connects to a MQTT broker. Gateway is responsible for maintaining MQTT sessions with broker and route the messages to MQTT-SN clients. It is also responsible to translate MQTT-SN messages to MQTT and vice versa. A smartphone application acts as a MQTT client and connects to the MQTT broker. It subscribes to current status of smart devices and publishes control messages to smart devices. MQTT broker runs in the cloud. MQTT broker and MQTT-SN gateway controls the message flow between control application and smart physical devices.

IV. Conclusion

The MQTT publish/subscribe communication protocol in IOT allows data to be delivered based on interests rather than individual device addresses. MQTT-SN developed for WSN tries to provide the same features as MQTT communication protocol, yet it encounters challenges like dealing with sleeping clients and limited resources devices.

References

[1]. Application-aware end-to-end delay and message loss estimation in Internet of Things (IoT)— MQTT-SN protocols by Future Generation Computer Systems "Elsevier"
[2]. https://blog.imaginea.com/internet-of-things-messaging-protocols-part-2/
[3]. "MQTT-S – A Publish/Subscribe Protocol For Wireless Sensor Networks" IBM laboratory