Unit 2: IoT Communication protocols

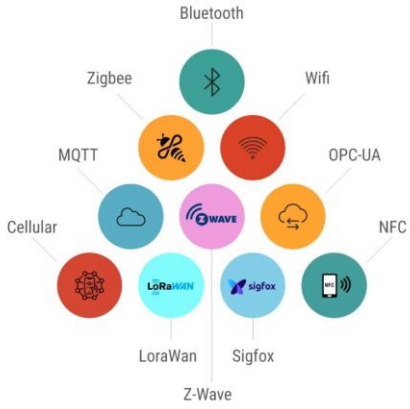
- Basics of given communication protocol along with its applications
- Explain Communication Protocols
  - MQTT
  - Bluetooth Low Energy
  - ZigBee
  - LoRa
  - Wi-fi

Questions to be discussed:

1. Define IoT communication protocols. Discuss about BLE protocol.
2. Differentiate between Bluetooth and Wi-Fi communication protocols.
3. Write short notes on:
   a. MQTT
   b. ZigBee
   c. LoRa
   d. Wi-Fi

IoT protocols:

- It ensure that how IoT devices communicate among with each other on the network.
- IoT protocol is a set of rules that dictates how data gets sent to the internet.
- IoT protocols ensure that information from one device gets read and understood by another device.
- Several Communication Protocols and Technology used in the internet of Things.
- Some of the major IoT Communication Protocols are:
  - MQTT
  - Bluetooth,
  - Zigbee
  - LoRa
  - Wifi etc.

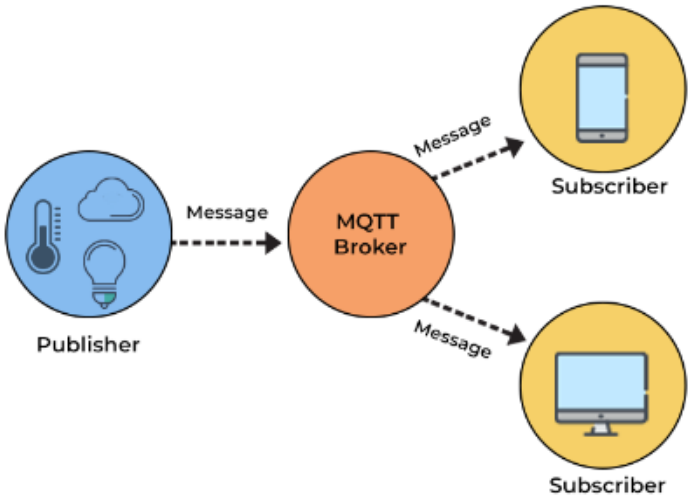


MQTT:

- MQTT stands for **Message Queuing Telemetry Transport**.
- The MQTT protocol was invented in 1999 for use in the oil and gas industry.
- It is a machine to machine IOT connectivity protocol.
- It makes it easy for communication between multiple devices.
- It does not require that both the client and the server establish a connection at the same time.
- This protocol is useful for the connection with the remote location where the bandwidth is a premium.
- It is a publish and subscribe system where we can publish and receive the messages as a client.
- It provides faster data transmission, like how WhatsApp/messenger provides a faster delivery.

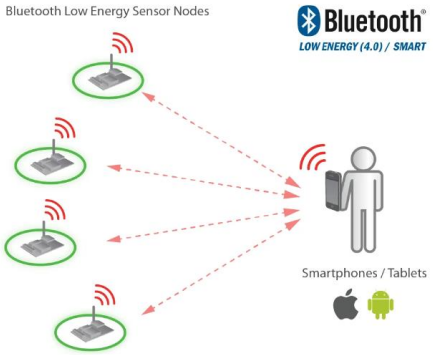
Applications of MQTT:

1. Remote sensing
2. Smart cities
3. Social media platforms
4. Home automation
5. Smart farming
6. Wearables
7. Manufacturing
8. Oil and gas industry



Bluetooth:

- Bluetooth is an important short-range IoT communications Protocols.
- It is also known as Bluetooth Low-Energy (BLE) or Smart Bluetooth.
- The first Bluetooth was developed in the year 1994 by Sven Mattison and Jaap Haartsen.
- They were working in a mobile phone company named Ericsson which is in Sweden.
- Then five companies came forward and joined to form the Bluetooth special interest group.
- Then they developed the Bluetooth protocol specification version 1.0 in the year 1999.
- Up to eight devices can be networked in the Piconet by using Bluetooth.
- Bluetooth offers economic wireless solutions (both data & voice) for short distances.
- It is used in the mobile and stationary environment.

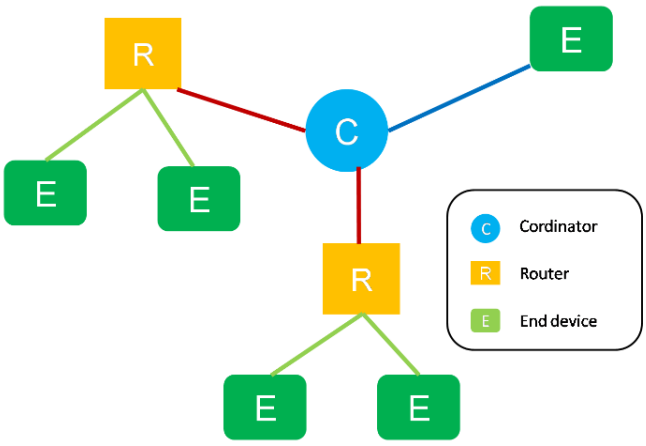


Applications of Bluetooth Protocol:

- Bluetooth hands-free communication
- Car Bluetooth entertainment system
- Technicians' wireless monitoring of CNC machine tools
- Wireless communication with PC's : Mouse, Keyboard, Printer etc.
- Interactive entertainment devices: Gaming controller, Remote contro

ZigBee:

- ZigBee is most popular wireless communication protocol.
- It defines a set of protocols for use in low data rate, short to medium range wireless networking devices like sensors and control networks.
- The target of Zigbee is low cost, low power & battery operated wireless sensors.
- Zigbee Technology is based on IEEE 802.15.4 Standard.
- The Zigbee protocol defines three types of nodes: coordinators, routers and end devices.
- Although all nodes can send and receive data, they each play a different role.
- There is one coordinator in each network whose job is to store information about the network, including security keys.



Applications of ZigBee:

- Home Automation
  - ✓ Security Systems
  - ✓ Meter Reading Systems
  - ✓ Light Control Systems
- Consumer Electronics
  - ✓ Gaming Consoles

- ✓ Wireless Mouse
- ✓ Wireless Remote Controls

➢ Industrial Automation
- ✓ Asset Management
- ✓ Personnel Tracking

➢ Healthcare
➢ Hotel Room Access
➢ Fire Extinguishers

Wi-Fi:

- Wi-Fi stands for Wireless Fidelity.
- It is one of the most popular IoT communication protocol.
- It especially given the availability of Wi-Fi within the home environment within LANs.
- It offering fast data transfer and the ability to handle high quantities of data.
- Currently, the most common WiFi standard used in home is 802.11n, which offers range of 100 Mbps, which is fine for file transfers but may be too power-consuming for many IoT applications.

Applications of WiFi Technology:

➢ Mobile applications
➢ Business applications
➢ Home applications
➢ Computerized application
➢ Automotive segment
➢ Browsing internet
➢ Video conference

LoRa:

- LoRa is also known as LoRa WAN.
- LoRa WAN is one of popular IoT Technology, targets WAN applications.
- It support low-cost mobile secure communication in IoT, smart city, and industrial applications.
- Specifically meets requirements for low-power consumption and supports large networks with millions of devices, data rates range from 0.3 kbps to 50 kbps.

LoRa Application:

- Air Pollution Monitoring
- Agriculture Processing
- Fire Detection
- Home Security
- Indoor Air Quality
- Industrial Temperature Monitoring
- Smart Lighting
- Waste Management
- Water Flow Monitoring

Differentiate between Wi-Fi and Bluetooth:

Wi-Fi	Bluetooth
Wi-Fi stands for Wireless Fidelity.	Bluetooth has no full form.
Wi-Fi is a technology that enables devices to connect to the Internet wirelessly.	Bluetooth is a wireless technology that is used to connect devices in short range.
Wi-Fi requires wireless adaptor on all devices and Wireless Router for connectivity.	Bluetooth requires an Bluetooth adaptor on all devices for connectivity.
Wi-Fi consumes high power.	Bluetooth consumes less power than Wi-Fi.
Wi-Fi is more secure than Bluetooth.	Bluetooth is less secure than Wi-Fi.
Wi-Fi needs high bandwidth.	Bluetooth has a low bandwidth.
Wi-Fi coverage area is up to 32 meters.	Bluetooth coverage area is about 10 meters.