SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)
Coimbatore-35

DEPARTMENT OF BIOMEDICAL ENGINEERING

19BMT205 IoT in Healthcare

Unit-1 -**Introduction To Internet of Things**

II Year/IV Sem

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ASP / BME / SNSCT

Unit-1 - **Introduction To Internet of Things**

- Introduction

- IoT definition

- Characteristics of IoT

- Physical Design of IoT

- Logical Design of IoT

- Major Components of IoT System

Physical Design of IoT

The "Things" in IoT usually refers to IoT devices which have unique identities and can perform remote sensing, actuating and monitoring capabilities.

IoT devices can:

- Exchange data with other connected devices and applications (directly or indirectly), or

- Collect data from other devices and process the data locally or

- Send the data to centralized servers or cloud-based application back-ends for processing the data, or

- Perform some tasks locally and other tasks within the IoT infrastructure, based on temporal and space constraints
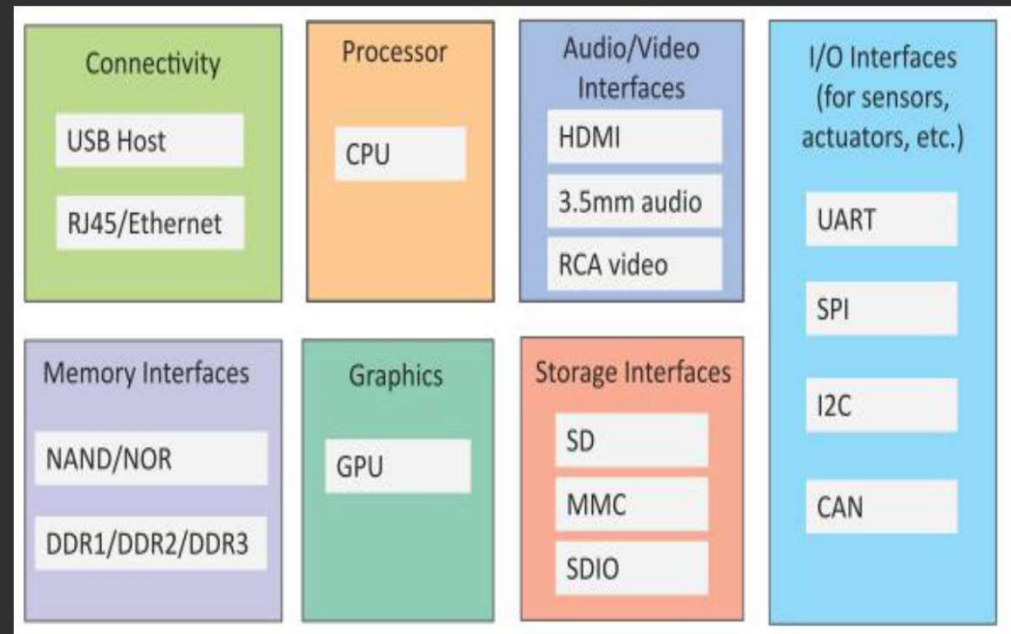
Generic block diagram of an IoT Device

An IoT device may consist of several interfaces for connections to other devices, both wired and wireless.

- I/O interfaces for sensors
- Interfaces for Internet connectivity
- Memory and storage interfaces
- Audio/video interfaces.

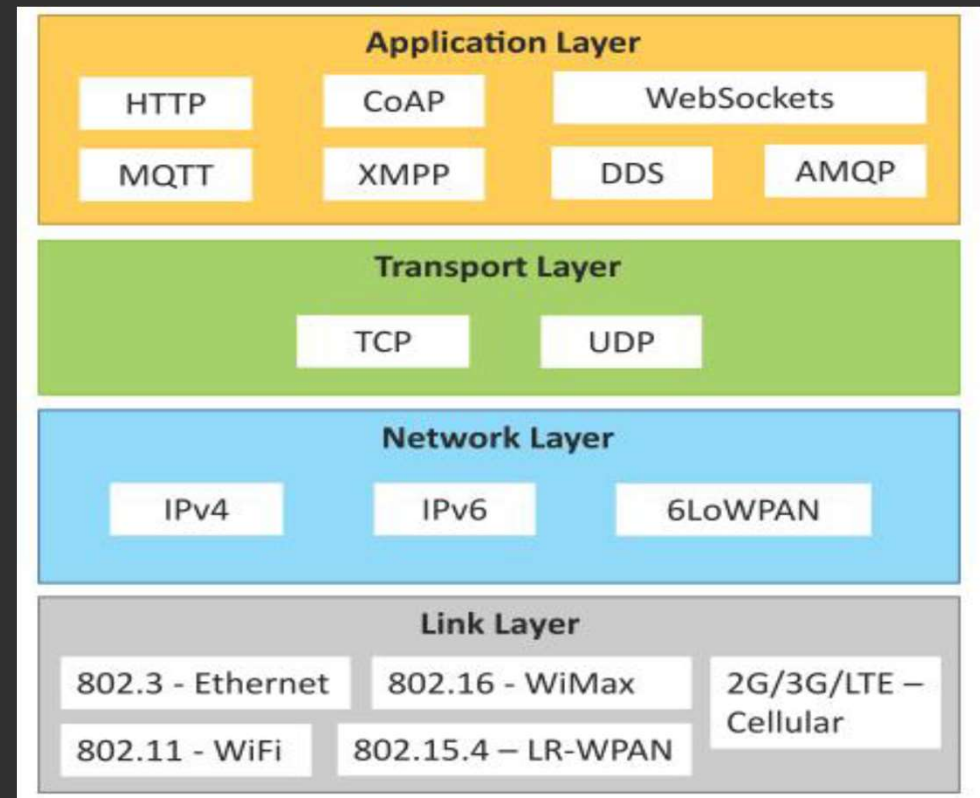| Connectivity	Processor	Audio/Video Interfaces	I/O Interfaces (for sensors, actuators, etc.)
USB Host	CPU	HDMI	UART
RJ45/Ethernet		3.5mm audio	SPI
		RCA video	I2C
Memory Interfaces	**Graphics**	**Storage Interfaces**	CAN
NAND/NOR	GPU	SD	
DDR1/DDR2/DDR3		MMC	
		SDIO	

IoT Protocols

Link Layer

This protocol determines how the data is physically sent over the network layer (e.g. copper wire, coaxial cable or a radio wave).

It determines how the packet are coded and signaled by the hardware device over the medium to which the host is attached.

Example:-

1. IEEE 802.3--Ethernet (wired connection)
2. 802.11 –Wi-Fi
3. 802.16—WiMax
4. 2G/3G/4G—Mobile communication

Application Layer
HTTP   CoAP   WebSockets
MQTT   XMPP   DDS   AMQP

Transport Layer
TCP   UDP

Network Layer
IPv4   IPv6   6LoWPAN

Link Layer
802.3 - Ethernet   802.16 - WiMax   2G/3G/LTE – Cellular
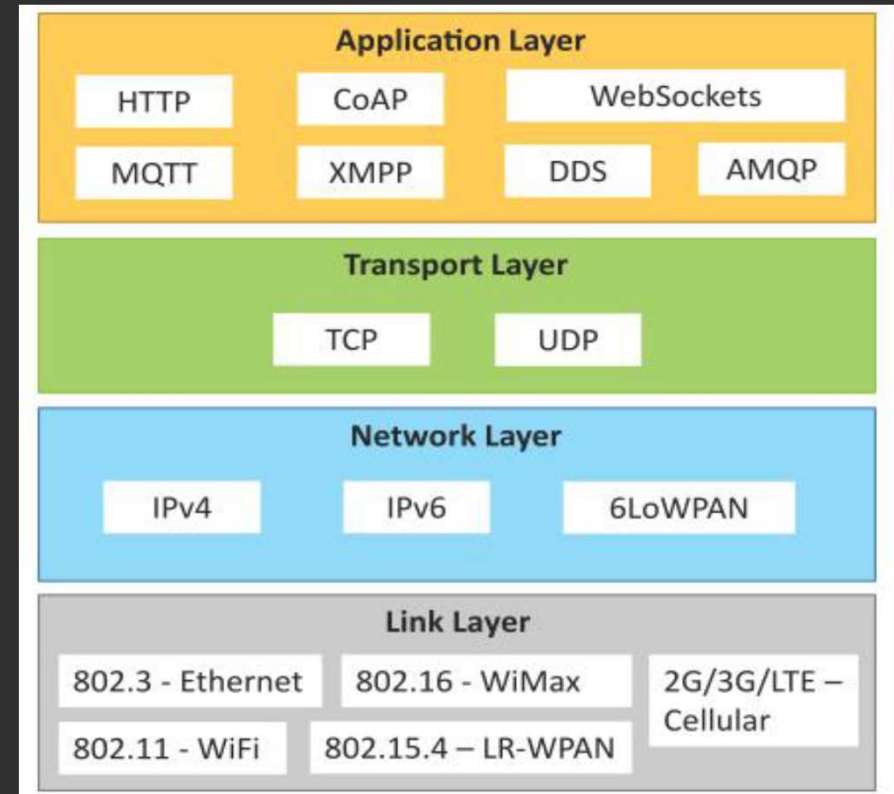802.11 - WiFi   802.15.4 – LR-WPAN

IoT Protocols

Network/Internet Layer

- The network layers are responsible for sending of IP datagram's from the source network to the destination network. It performs host addressing and packet routing. The datagram's consists of source and destination addresses where host identifies using IP schemes as IPV4 and IPV6.

- IPV4:- It is used to identify the devices on a network using hierarchical addressing scheme. It uses 32- bit address that allows total 2^{32} or 4 billion devices

- IPV6:- It is the new version of internet protocol which uses 128-bits address that allows 2^{128} or 3 X 10^{38} address.

Application Layer
| HTTP | CoAP | WebSockets |
| MQTT | XMPP | DDS | AMQP |

Transport Layer
| TCP | UDP |

Network Layer
| IPv4 | IPv6 | 6LoWPAN |

Link Layer
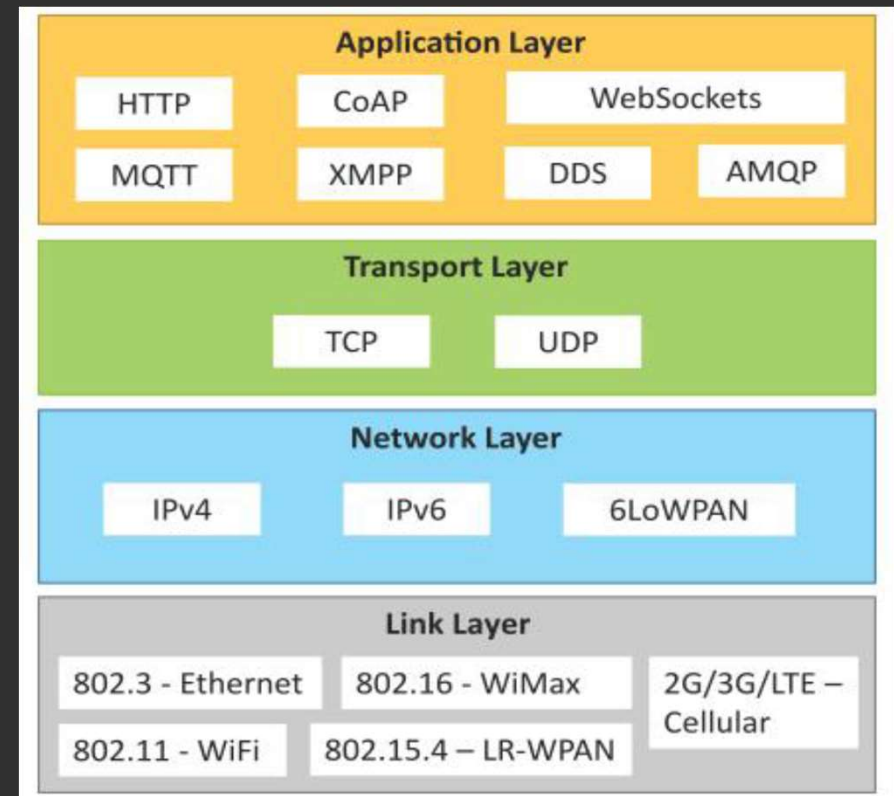| 802.3 - Ethernet | 802.16 - WiMax | 2G/3G/LTE – Cellular |
| 802.11 - WiFi | 802.15.4 – LR-WPAN | |

IoT Protocols

Transport Layer

- The transport layer protocols provide end to end message transfer capability independent of the underlying network. The function of the transport layer is to provide functions such as error control, segmentation, floe control and congestion control.

- TCP: - It is most widely used for data transmission in communication network such as internet .it provides process to process communication using port numbers. It uses port number for communication which keeps Track of segments that are received and transmitted.

- UDP: - It is the simplest protocol that involves minimum amount of communication mechanism. It is connectionless, unreliable transport protocol. It does not provide guaranteed delivery of the message.

Application Layer

HTTP	CoAP	WebSockets
MQTT	XMPP	DDS · AMQP

Transport Layer

TCP	UDP

Network Layer

IPv4	IPv6	6LoWPAN

Link Layer

802.3 - Ethernet	802.16 - WiMax	2G/3G/LTE – Cellular
802.11 - WiFi	802.15.4 – LR-WPAN	

Types of IoT Protocols

- IoT protocols and standards can be broadly classified into two separate categories.
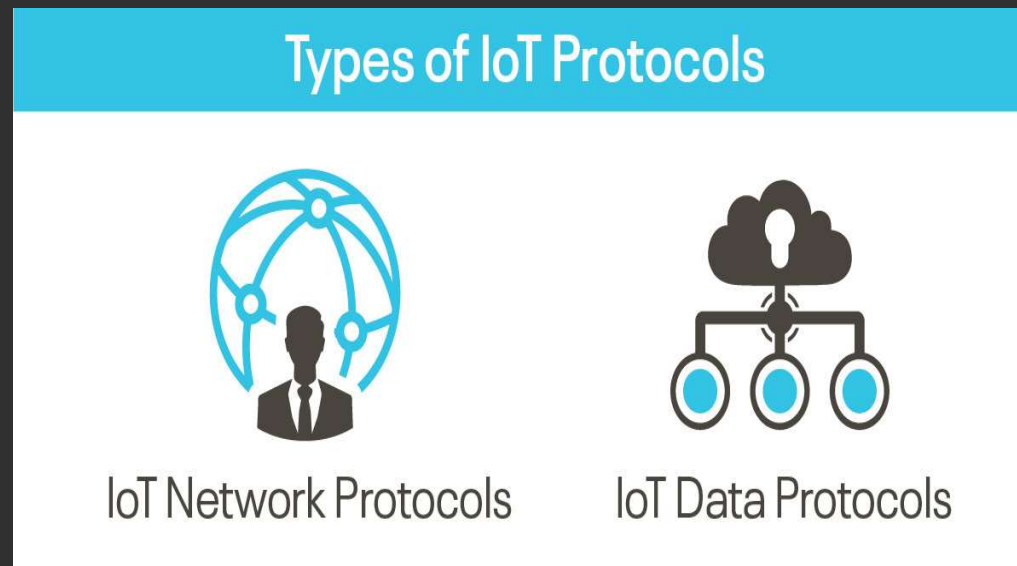
IoT Network Protocols

- IoT network protocols are used to connect devices over the network. These are the set of communication protocols typically used over the Internet. Using IoT network protocols, end-to-end data communication within the scope of the network is allowed.

- Following are the various IoT Network protocols:

  HTTP (HyperText Transfer Protocol)

  LoRaWan (Long Range Wide Area Network)

  Bluetooth

  ZigBee

HTTP (HyperText Transfer Protocol)

- HyperText Transfer Protocol is the best example of IoT network protocol.

- This protocol has formed the foundation of data communication over the web.

- It is the most common protocol that is used for IoT devices when there is a lot of data to be published.

- However, the HTTP protocol is not preferred because of its cost, battery-life, energy saving, and more constraints.

- Additive manufacturing/3D printing is one of the use cases of the HTTP protocol. It enables computers to connect 3D printers in the network and print three-dimensional objects and pre-determined process prototypes.

LoRa Wan (Long Range Wide Area Network)

- It is a long-range low power protocol that provides signal detection below the noise level. LoRaWan connects battery operated things wirelessly to the Internet in either private or global networks.

- This communication protocol is mainly used by smart cities, where there are millions of devices that function with less power and memory.

- Smart street lighting is the practical use case of LoRaWan IoT protocol.

- The street lights can be connected to a LoRa gateway using this protocol.

- The gateway, in turn, connects to the cloud application that controls the intensity of light bulbs automatically based on the ambient lighting, which helps in reducing the power consumption during day-times.

Bluetooth

- Bluetooth is one of the most widely used protocols for short-range communication. It is a standard IoT protocol for wireless data transmission.

- This communication protocol is secure and perfect for short-range, low-power, low-cost, and wireless transmission between electronic devices. BLE (Bluetooth Low Energy) is a low-energy version of Bluetooth protocol that reduces the power consumption and plays an important role in connecting IoT devices.

- Bluetooth protocol is mostly used in smart wearables, smartphones, and other mobile devices, where small fragments of data can be exchanged without high power and memory. Offering ease of usage, Bluetooth tops the list of IoT device connectivity protocols.

ZigBee

- ZigBee is an IoT protocol that allows smart objects to work together.

- It is commonly used in home automation.

- More famous for industrial settings, ZigBee is used with apps that support low-rate data transfer between short distances.

- Street lighting and electric meters in urban areas, which provides low power consumption, use the ZigBee communication protocol.

- It is also used with security systems and in smart homes.