SNS COLLEGE OF ENGINEERING

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Department of AI & DS

Course Name – Internet of Things & AI

V Semester

Unit 1 – IoT INTRODUCTION AND APPLICATIONS

Topic 4- Physical Design of IoT

Physical Design of IoT

Things of IoT

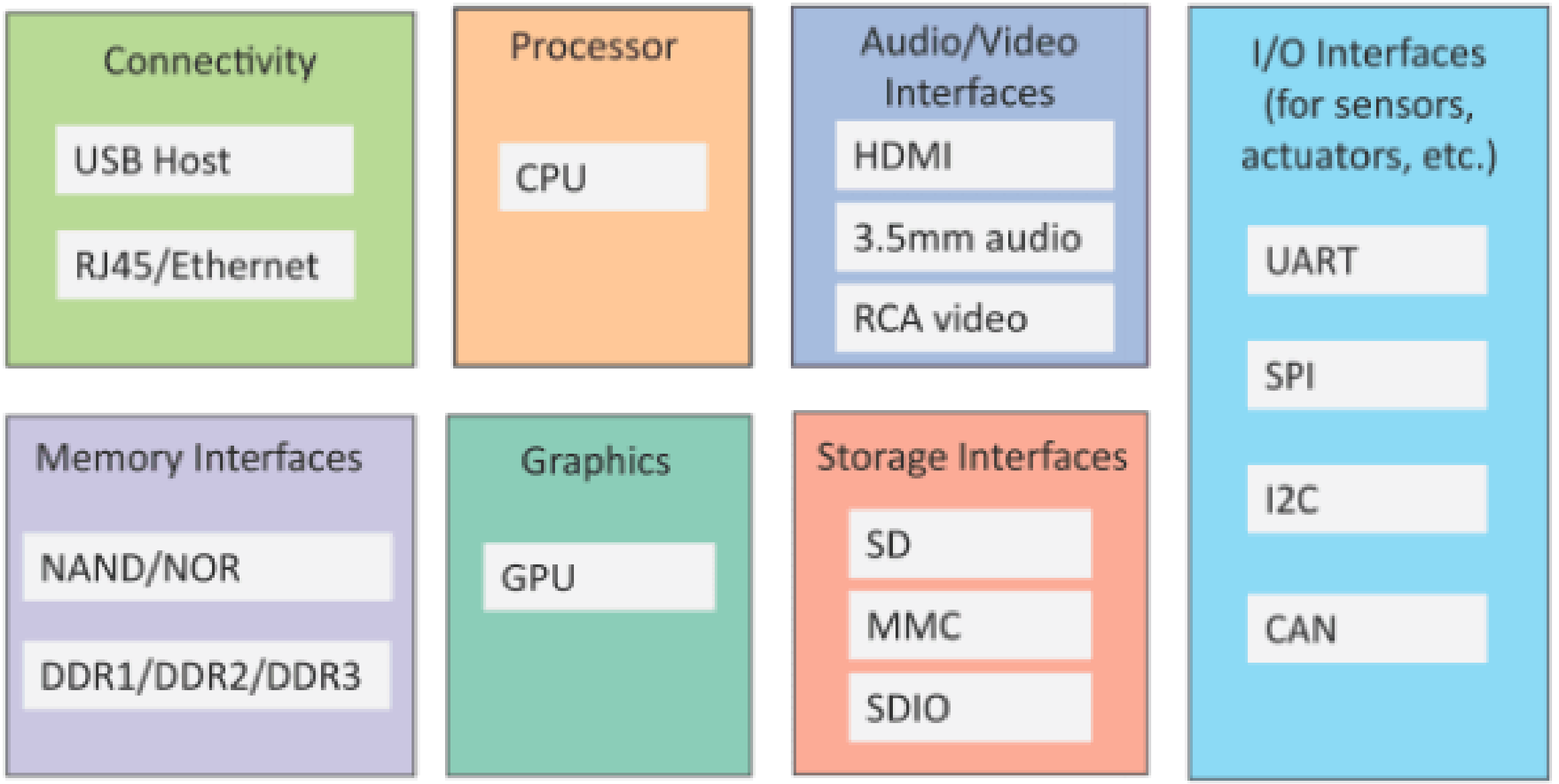
- The “Things” in IoT usually refers to IoT devices which have unique identities and can perform remote sensing, Actuating and monitoring capabilities.

- 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 applications back ends for processing the data.

- An IoT device may consist of several interfaces connections to other devices, both wired and wireless. These include
  I) IoT interfaces for sensors
  II) interfaces for internet connectivity
  III) memory and storage interfaces
  IV) audio video interfaces.
- An IoT Device can collect various types of data from the the onboard or attached sensors, such as temperature , humidity, light intensity.

Physical Design of IoT



Generic block diagram of an IoT Device

Physical Design of IoT

IoT Protocols

Link Layer

- 802.3 – Ethernet
- 802.11 – WiFi
- 802.16 – WiMax
- 802.15.4 – LR-WPAN
- 2G/3G/4G

Network/Internet Layer

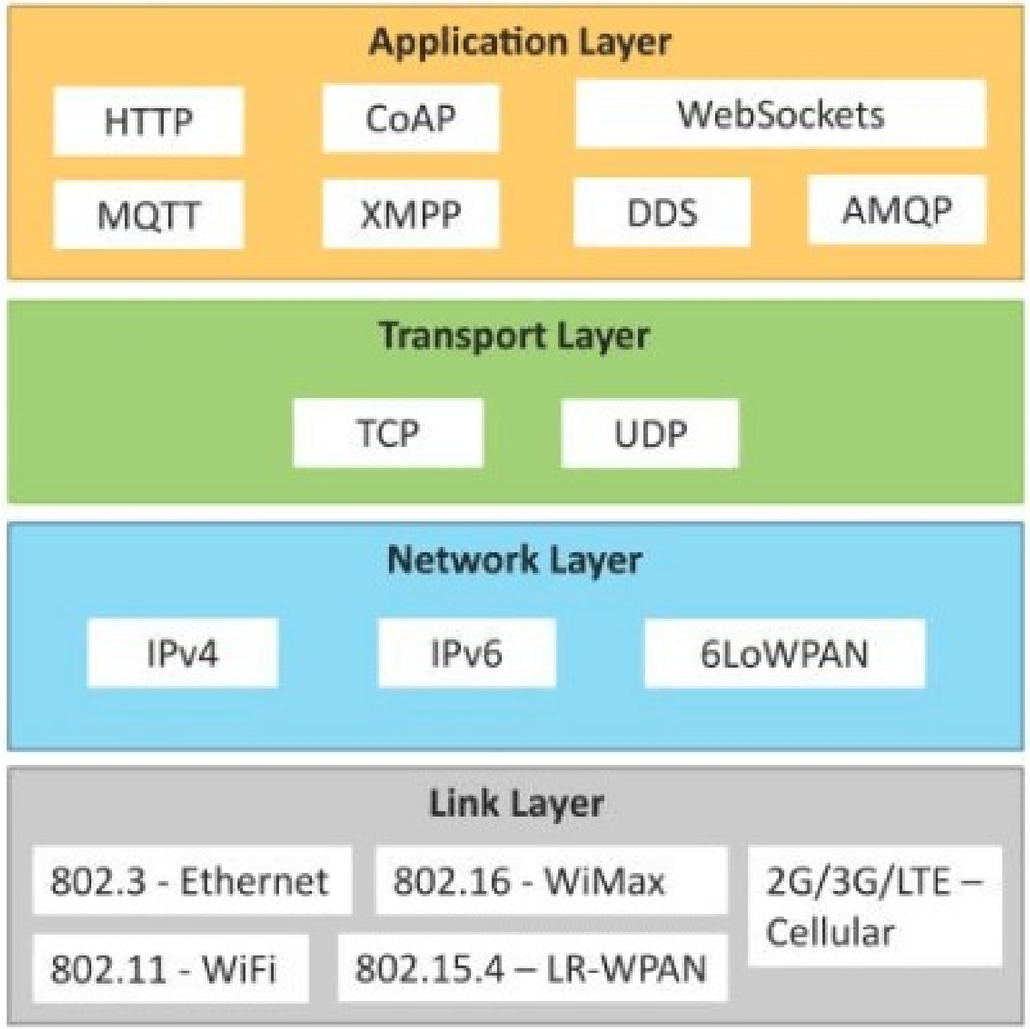
- IPv4
- IPv6
- 6LoWPAN

Transport Layer

- TCP
- UDP

Application Layer

- HTTP
- CoAP
- WebSocket
- MQTT
- XMPP
- DDS
- AMQP



Physical Design of IoT

Link Layer:

1.Link Layer protocols determine how the data is physically sent over the networks physical layer or medium
example copper wire, electrical cable, or radio wave

2.The Scope of The Link Layer is the Last Local Network connections to which host is attached.

3.Host on the same link exchange data packets over the link layer using the link layer protocol.

4.Link layer determines how the packets are coded and signaled by the hardware device over the medium to which the host is attached.

Physical Design of IoT
Communication standard

IoT Protocols

Link Layer

Ethernet

IEEE 802.3 – Ethernet is a wired standard

- 802.3 – 10BASE 5, Coaxial cable
- 802.3i – 10BASE-T, Twisted pair
- 802.3j – 10BASE-F, Fiber connection
- 802.3ae – 10 Gigabit Ethernet, Fiber connection
- Data Rate: 10 Mbps to 40 Gbps

802.11 – WiFi (WLAN)

- 802.11a – 5 GHz,
- 802.11b & 802.11g – 2.4/5 GHz,
- 802.11n - 2.4/5 GHz,
- 802.11ac – 5 GHz
- 802.11ad – 60 GHz
- 1 Mbps to 6.75 Gbps

802.16 – WiMax (Wireless Broadband)

- Worldwide Interoperability for Microwave Access
- WirelessMAN
- 1.5 Mbps to 1 Gbps

802.15.4 LR-WPAN

- Low Rate WPAN
- 40 kbps to 250 kbps
- Suitable for low cost low rate

2G/3G/4G (Mobile Communication)

- 2G – GSM / CDMA, GPRS, EDGE 9.6 kbps to 384 kbps
- 3G – UMTS / CDMA2000, 2 Mbps
- 4G – LTE – 100 Mbps
- Used through cellular networks

Physical Design of IoT

Network layer:

1.The network layer are responsible for sending of IP datagrams from the source network to the destination network.

2.This layer Performs the host addressing and packet routing.

3.The datagrams contains a source and destination address which are used to route them from the source to the destination across multiple networks.

4. Host Identification is done using the hierarchy IP addressing schemes such as ipv4 or IPv6.

Physical Design of IoT

Network / Internet Layer

The network layer are responsible for sending of IP datagrams from the source network to the destination network.

IPv4

- Low address space. 2^32 address space. 32 bit address

IPv6

- Large address space, 2^128 address space, 128 bit address

6LoWPAN

- IPv6 over low power wireless personal area networks
- low power device which have limited processing capability
- it operate in the 2.4 GHz frequency range
- data transfer rate off to 50 kbps.

Transport layer

The Transport layer protocols provides end-to-end message transfer capability independent of the underlying network.

TCP(transmission control protocol)

- Connection oriented, Reliable
- Order of delivery, Retransmission
- Duplicate avoidance

UDP

- Conncetionless, Unreliable
- No order of delivery and retransmission
- Packet loss

Physical Design of IoT

Application Layer

Application layer protocol define how the application interfaces with the lower layer protocols to send the data over the network.

Data are typically in files, is encoded by the application layer protocol and encapsulated in the transport layer protocol ..

- HTTP – Used in Web browsers, basis for WWW
- CoAP - Constrained application protocol, used in M2M, Uses UDP
- WebSocket - full duplex communication over a single socket connections, sending message between client and server, Uses TCP

Physical Design of IoT

Application Layer

- MQTT - Message Queue Telemetry Transport, message protocol based on public -subscribe model
- XMPP - Extensible Messaging and Presence Protocol, real-time communication and streaming XML data between network entities
- DDS - Data distribution service, device-to-device machine to machine communication.
- AMQP - Advanced Message Queuing protocols
- AMQP - Advanced Message Queuing protocol

THANK YOU