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Physical Design of IoT, IOT Protocols

Unit 01

Chapter01

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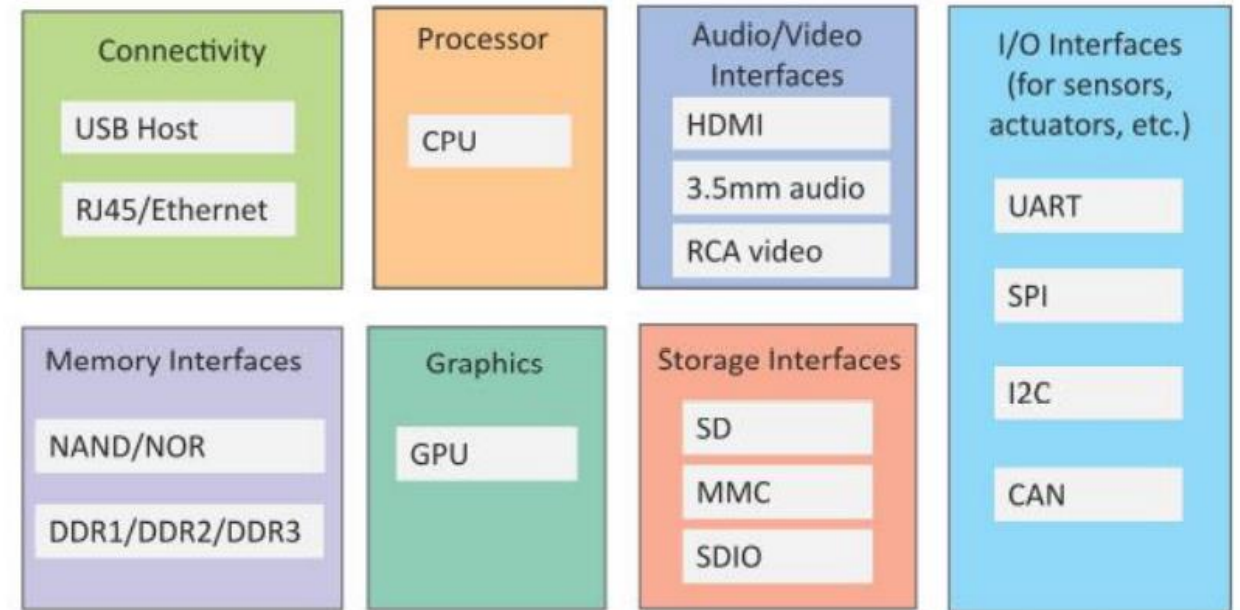
Things in IoT

- 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 constraint

Generic block diagram of an IoT Device

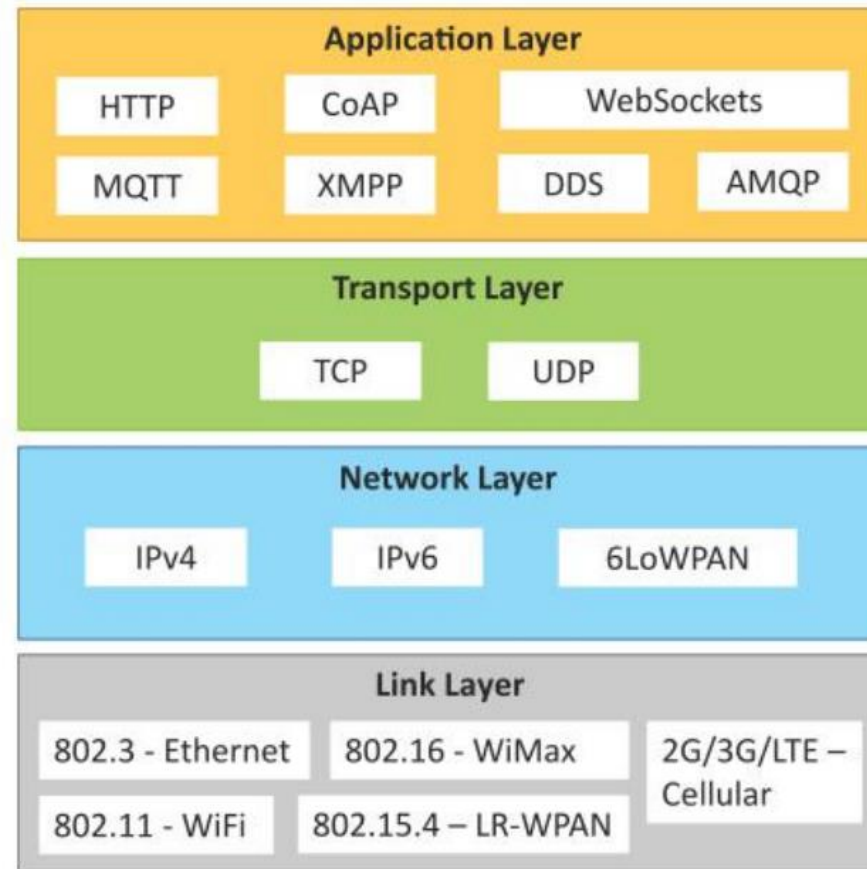
- An IoT device may consist of several interfaces for connections to other devices, both wired and wireless.

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



- An IoT device can collect various types of data from the on-board or attached sensors, such as temperature, humidity, light intensity.
- The sensed data can be communicated either to other devices or cloud-based servers/storage.
- IoT devices can be connected to actuators that allow them to interact with other physical entities (including non-IoT devices and systems) in the vicinity of the device.
- For example, a relay switch connected to an IoT device can turn an appliance on/off based on the commands sent to the IoT device over the Internet.
- IoT devices can also be of varied types, for instance, wearable sensors, smart watches, LED lights, automobiles and industrial machines.
- Almost all IoT devices generate data in some form or the other which when processed by data analytics systems leads to useful information to guide further actions locally or remotely.

IOT Protocols



IOT Protocols

- ❑ **Link Layer:** determines how data is physically sent over the network's physical layer or medium(eg: copper wire, coaxial cable or a radio wave).
- Link Layer determines how the packets are coded and signaled by the hardware device or the medium to which the host is attached (eg.coaxial cable)
 - ✓ 802.3 – Ethernet
 - ✓ 802.11 – Wi-Fi
 - ✓ 802.16 – WiMAX
 - ✓ 802.15.4 – LR-WPAN
 - ✓ 2G/3G/4G

❑ Network Layer/Internet Layer

- Responsible for sending IP Datagrams from source network to destination network.
 - Performs host addressing and packet routing
 - Datagrams contain source and destination addresses which are used to route them from source to destination across multiple networks
- ✓ IPv4
 - ✓ IPv6
 - ✓ 6LoWPAN

□ Transport Layer

- Provides end to end message transfer capability independent of underlying network
- Message transfer capability can be setup on connections either using handshake(as in TCP) or without acknowledgement (as in UDP)
- functions like error-control, segmentation, flow control and congestion control

✓TCP

✓UDP

□ Application Layer

- Defines how the application interface with the lower layer protocols to send data over the network
- Port numbers are used for application addressing (80-http,22-SSH)
- ✓ HTTP:
 - foundation of WWW
 - uses commands like GET,PUT,POST
 - Stateless protocol and each request is independent of others.
- ✓ CoAP: Constrained Application:
 - protocol for machine to machine application meant for constrained environment
 - Is a web transfer protocol and uses request-response model.

❑ Application Layer

✓ WebSocket:

- allows full duplex communication over a single connection for sending messages between clients and servers
- Based on TCP and allows streams of messages to be sent back and forth between client and server while keeping TCP connection open

✓ MQTT: Message queue Telemetry Transport:

- light weight messaging protocol based on publish-subscribe model
- Uses client server architecture where client connects to server and publishes messages to topics on the server
- Broker forward the message to clients subscribed to topics

❑ Application Layer

- ✓ XMPP: Extensible Messaging and presence protocol
 - Used for real-time communication and streaming XML data between network entities
 - Allows sending chunks of XML data from one network entity to another in real-time
 - Is a decentralized protocol
 - Uses client server architecture

❑ Application Layer

✓ DDS: Data distribution Service

- Data centric architecture middleware standard for device to device or machine to machine communication
- Uses publish subscribe model where publishers (devices that generate data) create topics to which subscribers can subscribe
- Publisher is an object responsible for data distribution and subscriber responsible for receiving published data.

❑ Application Layer

- ✓ AMQP: Advanced Message Queuing Protocol
 - Open application layer protocol for business messaging
 - Supports both point to point ,publisher/subscriber, routing and queuing
 - AMQP brokers receive message from publisher and route them over connections to consumers(application that process data)
 - Publishers publish messages to exchange which then distribute message copies to queues.
 - Messages are delivered by broker to consumers which have subscribed to the queues or the consumers can pull the messages from the queue

THANK YOU