

IOT CHARACTERISTICS

IoT Characteristics

- Dynamic and self adapting
- Self configuring
- Interoperable communication protocols
- Unique identity
- Integration into information network



Dynamic and Self Adapting



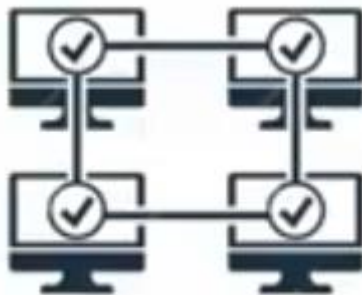
Surveillance System



Self Configuring



Weather monitoring



Interoperable Communication Protocols



Unique Identity

IP Address

URI
[Uniform Resource Identifier]

RFID Tags

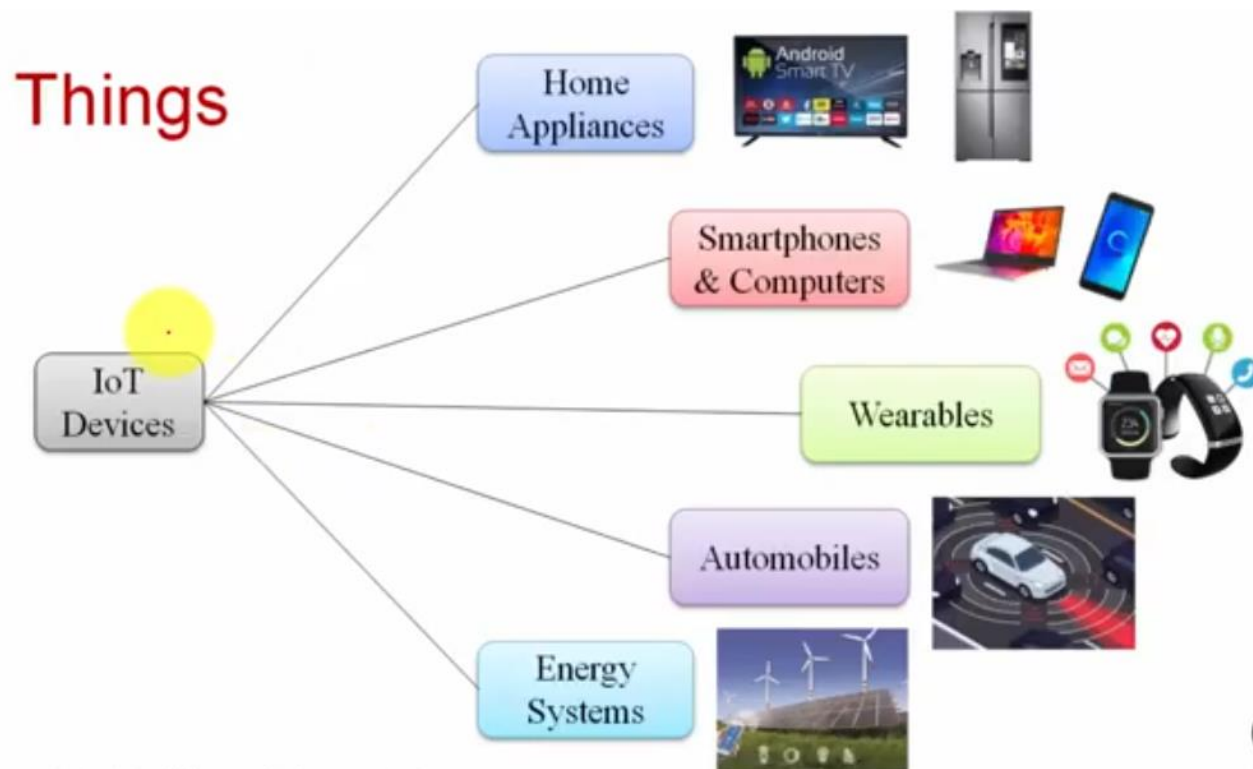


Integration into Information Network

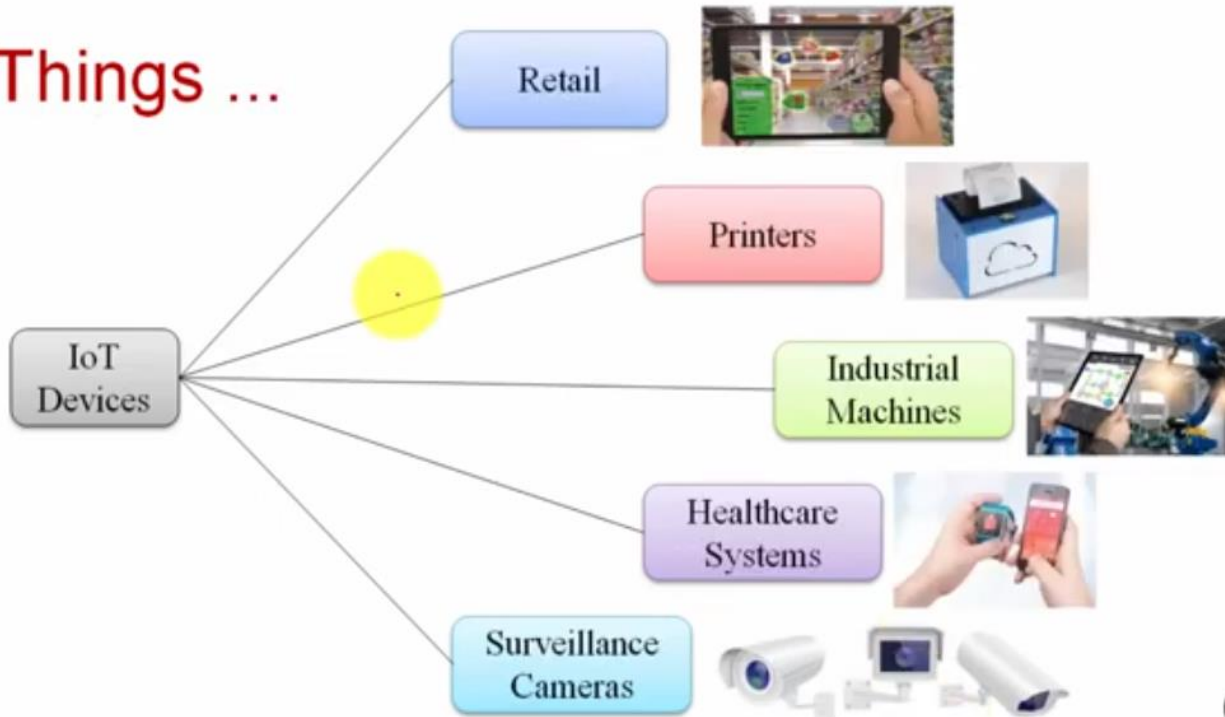


Physical Design of IoT

- Things
- IoT Protocols

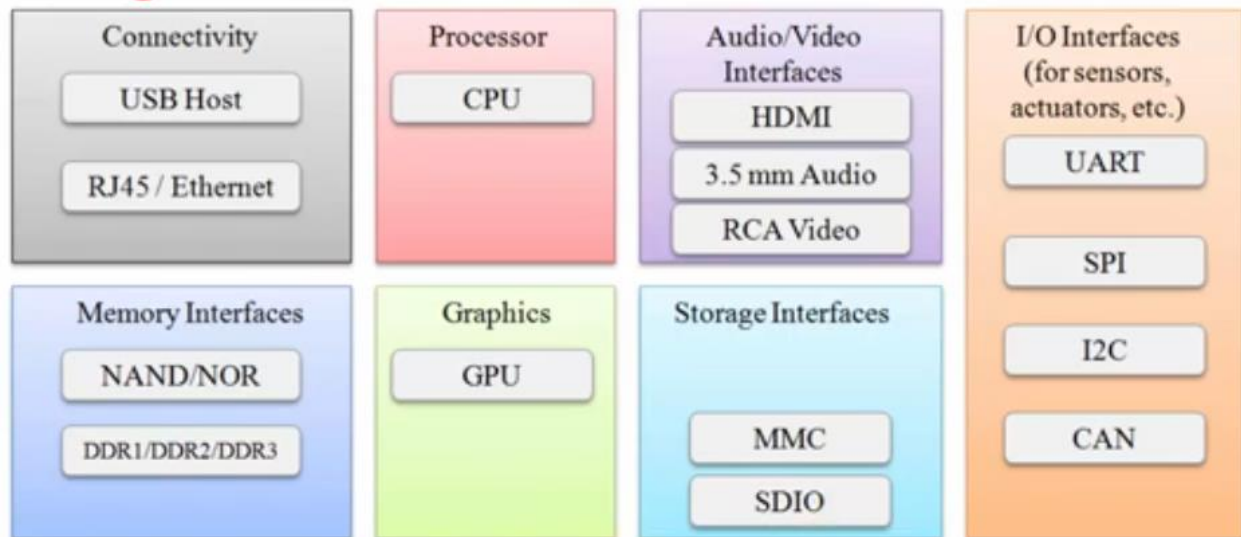


Things ...



- Things in IoT refers to IoT devices
- Things have unique identities
- Things can perform:
 - Sensing
 - Actuation
 - Monitoring

- Things can:
 - Exchange data with other connected devices and applications
 - Collect data from other devices
 - Process the data either locally or send it to centralized servers or cloud
- IoT devices can have several interfaces like:
 - I/O interfaces for sensors
 - Interface for Internet connectivity
 - Memory and storage connectivity interfaces
 - Audio/video interfaces



Generic block diagram of an IoT device

Protocols Basics – Why Protocol?



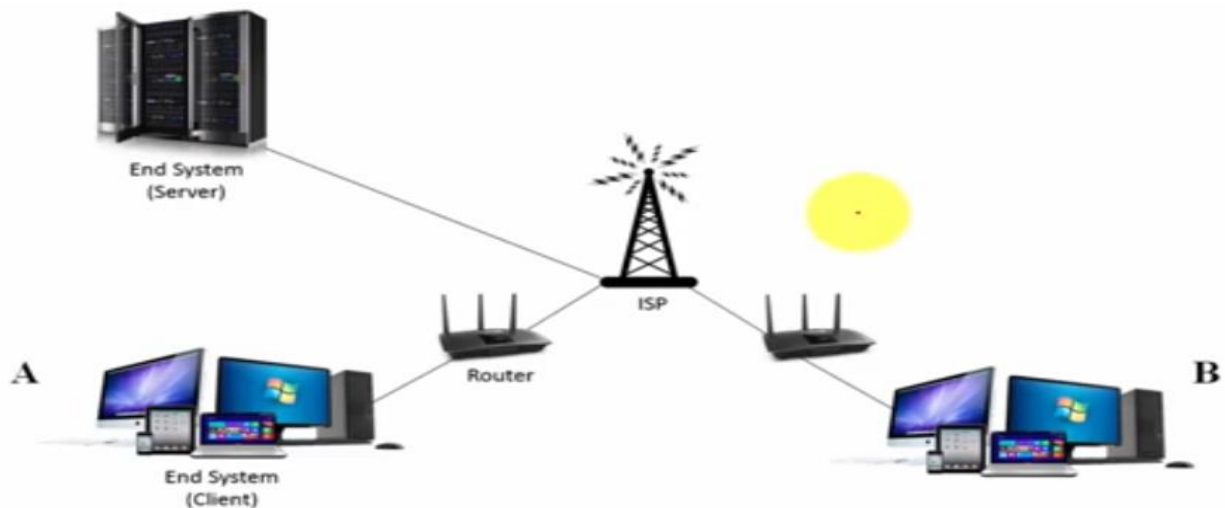
FOR SYSTEME COMMUNICATION



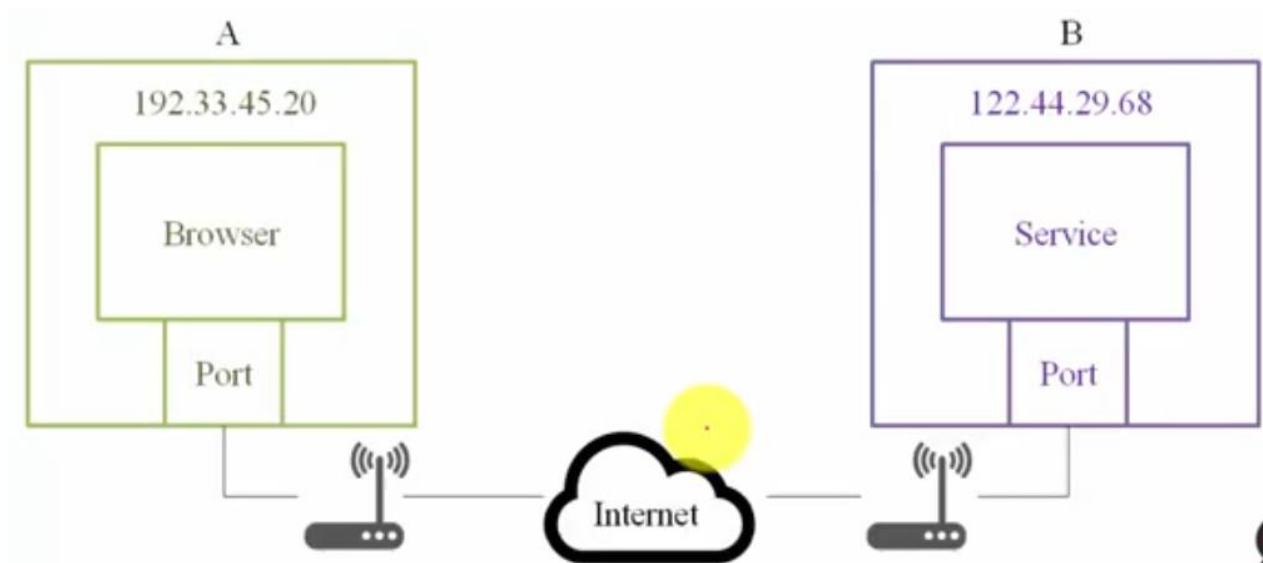
Protocols Basics – Definition

- A protocol is a set of rules that governs the communication between two or more devices
- The protocol defines the rules, syntax, semantics and synchronization of communication and possible error recovery methods

Sample Network



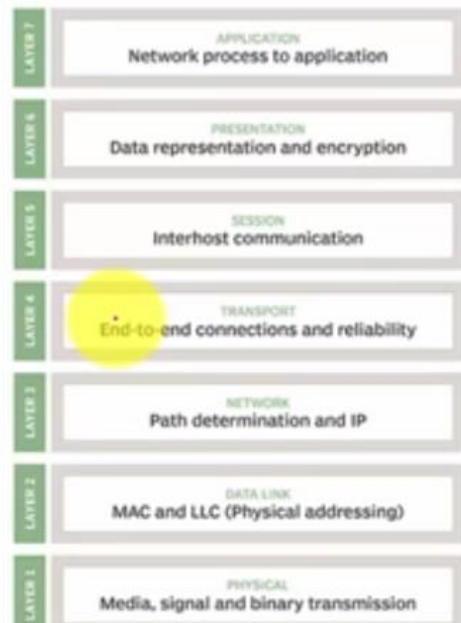
Host, Ports and Sockets



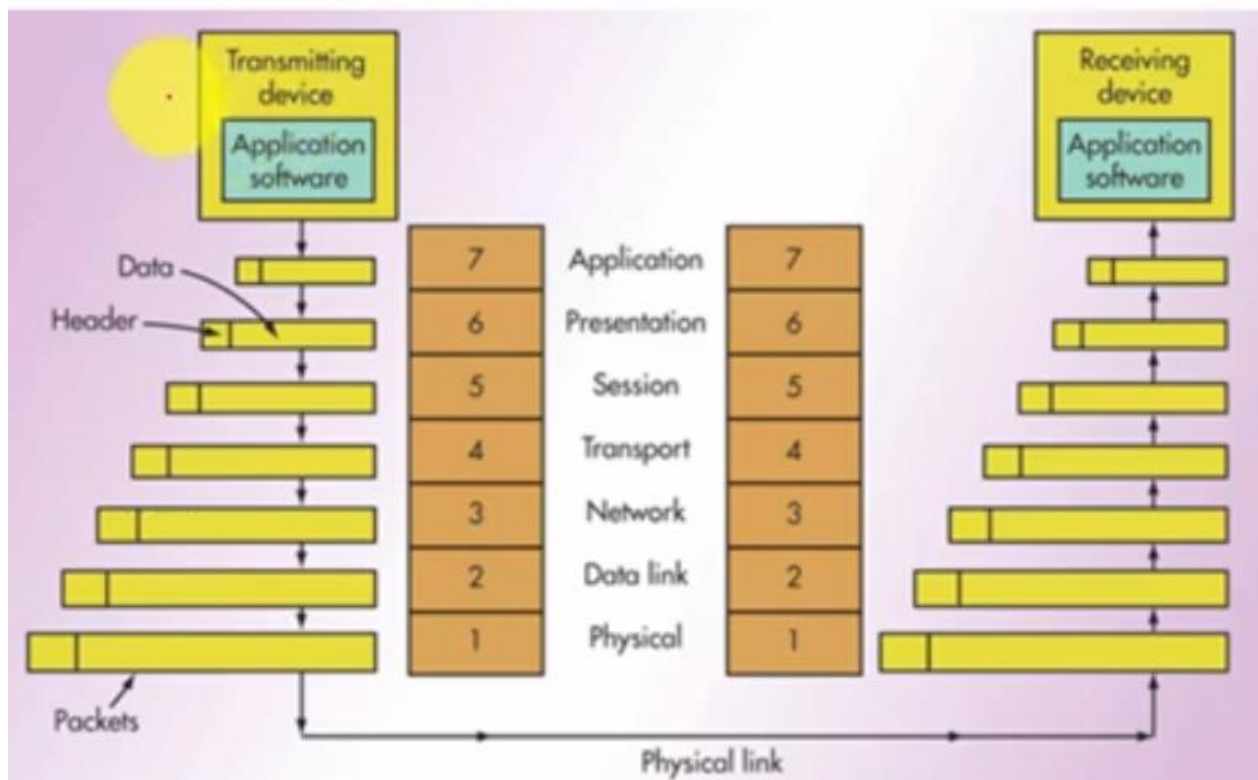
MODEL OF PROTOCOL

Open Systems Interconnection

The OSI model



7	Application Layer	Human-computer interaction layer, where applications can access the network services
6	Presentation Layer	Ensures that data is in a usable format and is where data encryption occurs
5	Session Layer	Maintains connections and is responsible for controlling ports and sessions
4	Transport Layer	Transmits data using transmission protocols including TCP and UDP
3	Network Layer	Decides which physical path the data will take
2	Data Link Layer	Defines the format of data on the network
1	Physical Layer	Transmits raw bit stream over the physical medium



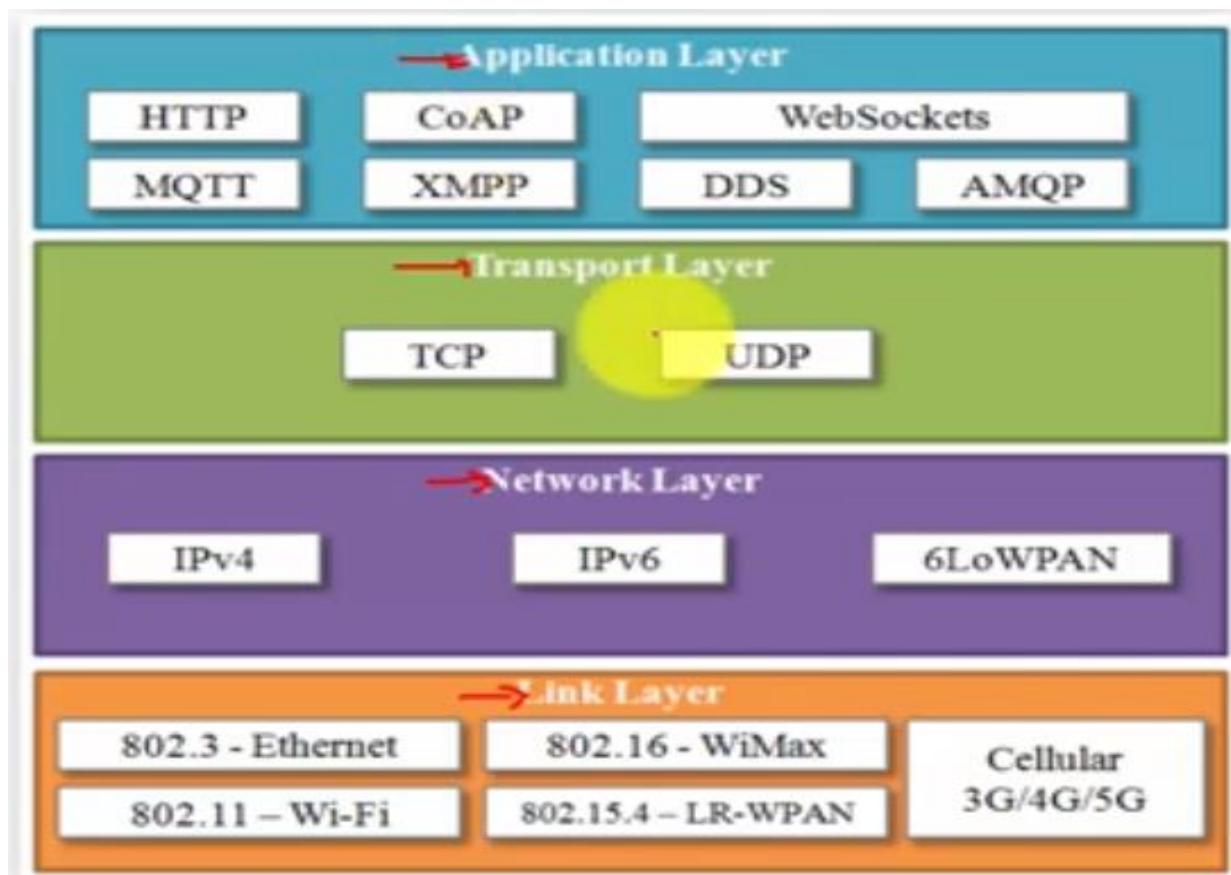
OSI MODEL

Application Layer
Presentation Layer
Session Layer
Transport Layer
Network Layer
Data Link Layer
Physical Layer

TCP/IP MODEL

Application Layer
Transport Layer
Internet Layer
Network Access Layer

IoT Protocols



Link Layer Protocols

Standard	Name	Medium	Speed	Range
IEEE 802.3	Ethernet	Coaxial/ Twisted-pair/ Fiber optic	10 Mbps – 40 Gbps +	100 m
IEEE 802.11	Wi-Fi	Radio Waves	1 Mbps – 6.75 Gbps	30 m
IEEE 802.16	WiMax	Radio Waves	1.5 Mbps – 1 Gbps	50 Km
IEEE 802.15.4	LR-WPAN	Bluetooth	40 Kbps – 250 Kbps	10 m
2G/3G/4G	Cellular	Radio Waves	9.6 Kbps – 100 Mbps	16 Km

Network Layer Protocols

- IP^v4 (32-bit addresses)
- IPv6 (128-bit addresses)
- 6LoWPAN (IPv6 over Low power Wireless Personal Area Network)

Transport Layer Protocols

- TCP (Transmission Control Protocol)
- UDP (User Datagram Protocol)

Application Layer Protocols

- HTTP (HyperText Transfer Protocol)
 - Uses TCP, Stateless, Request-Response Model
- CoAP (Constrained Application Protocol)
 - Uses UDP, Request-Response Model
- MQTT (Message Queue Telemetry Transport)
 - Follows publish-subscribe model
 - No security
 - Used with low power devices
- XMPP (Extensible Messaging and Presence Protocol)
 - Real-time communication, For sending XML data
- AMQP (Advanced Message Queuing Protocol)
 - Supports both point-to-point and publisher-subscriber models
 - High performance and secure protocol
 - Uses TCP
- WebSocket
 - Full-duplex connection over a single socket connection
 - Uses TCP
- DDS (Data Distribution Service)
 - Middleware standard, Reliable than MQTT
 - Follows publish-subscribe model
 - Uses UDP

- Using all the information from previous steps, we will develop the application (code) for the IoT system

