

# ASSIGNMENT

## 1. OSI Layers, Ethernet frames, Wire Shark

### OSI Layers:

OSI stands for Open System Interconnection is a reference model that describes how information from a software application in one computer moves through a physical medium to the software application in another computer. OSI consists of seven layers, and each layer performs a particular network function. OSI model was developed by the International Organization for Standardization (ISO) in 1984. OSI model divides the whole task into seven smaller and manageable tasks. Each layer is assigned a particular task.

7 Layers of OSI model:

1. Physical Layer
2. Data-Link Layer
3. Network Layer
4. Transport Layer
5. Session Layer
6. Presentation Layer
7. Application Layer

**1) Physical Layer :** The main functionality of the physical layer is to transmit the individual bits from one node to another node. It is the lowest layer of the OSI model. It establishes, maintains and deactivates the physical connection.

**2) Data Link Layer :** This layer is responsible for the error-free transfer of data frames. It defines the format of the data on the network. It provides a reliable and efficient communication between two or more devices. It is mainly responsible for the unique identification of each device that resides on a local network. It contains two sub-layers:

#### **Logical Link Control Layer**

It is responsible for transferring the packets to the Network layer of the receiver that is receiving. It identifies the address of the network layer protocol from the header. It also provides flow control.

#### **Media Access Control Layer**

A Media access control layer is a link between the Logical Link Control layer and the network's physical layer. It is used for transferring the packets over the network.

**3) Network Layer :** It is a layer 3 that manages device addressing, tracks the location of devices on the network. It determines the best path to move data from source to the destination based on the network conditions, the priority of service, and other factors. The Data link layer is responsible for routing and forwarding the packets. Routers are the layer 3 devices, they are specified in this layer and used to provide the routing services within an internetwork. The protocols used to route the network traffic are known as Network layer protocols. Examples of protocols are IP and Ipv6.

**4) Transport Layer:** The Transport layer is a Layer 4 ensures that messages are transmitted in the order in which they are sent and there is no duplication of data. The main responsibility of the transport layer is to transfer the data completely. It receives the data from the upper layer and converts them into smaller units known as segments. Two protocols used in this layer one is TCP and another one is UDP.

**5) Session Layer:** It is a layer 3 in the OSI model. The Session layer is used to establish, maintain and synchronizes the interaction between communicating devices.

Synchronization: Session layer adds some checkpoints when transmitting the data in a sequence.

If some error occurs in the middle of the transmission of data, then the transmission will take place again from the checkpoint. This process is known as Synchronization and recovery.

**6) Presentation Layer:** A Presentation layer is mainly concerned with the syntax and semantics of the information exchanged between the two systems. It acts as a data translator for a network. This layer is a part of the operating system that converts the data from one presentation format to another format.

**7) Application Layer:** An application layer serves as a window for users and application processes to access network service. In this FTP, HTTP, SMTP protocols are used.

## Ethernet Frames:

Ethernet is one of the most standard LAN technologies used for building wired LANs, operates in data link layer and physical layer. In an Ethernet network, devices share data using packets. They contain, among other things, the Ethernet frame, which is divided into several data sets. These records consist of binary code that provides important information, such as addresses, control information, payload data, and checksums. Ethernet evolution is 4 types,

1. Standard ethernet
2. Fast ethernet
3. Gigabit ethernet
4. 10 Gigabit ethernet

1) Standard ethernet: This is Connection less protocol and unreliable

PREAMBLE	S F D	DESTINATION ADDRESS	SOURCE ADDRESS	LENGTH	DATA	CRC
7 Bytes	1 Byte	6 Bytes	6 Bytes	2 Bytes	46 - 1500 Bytes	4 Bytes

**PREAMBLE** - Ethernet frames begin with a 7-byte. This is a sequence of alternate 0s and 1s that denotes the beginning of the frame and enables bit synchronization between the sender and receiver. Prior to the actual frame beginning, Preamble alerts the receiver that a frame is about to start and enables the receiver to lock onto the data stream.

**Start of frame Delimiter (SFD)** - This 1-byte field is always set to 10101011. The destination address is the next set of bits that will begin the frame, as indicated by SFD.

**Destination Address** - This 6-Byte element contains the MAC address of the device for which the data is intended.

### Advantages:

Simple to implement , Maintenance is Easy , Less cost

## Wireshark :

Wireshark is the network protocol analyser. It lets you see what's happening on your network at a microscopic level. Wireshark includes a wide variety of powerful features, such as packet capture and analysis, real-time network traffic capture, protocol dissection, and more. The tool works on a variety of platforms, including Windows, Linux, and macOS, making it accessible to a wide range of users. Wireshark is a free and open-source packet analyser. It is used for network troubleshooting, analysis, software and communications protocol development,

## 2. MQTT, Pub Sub messages

### MQTT:

MQTT (MQ Telemetry Transport). MQTT is a standards-based messaging protocol, or set of rules, used for machine-to-machine communication. Smart sensors, wearable, and other Internet of Things devices typically have

to transmit and receive data over a resource-constrained network with limited bandwidth. MQTT publish/subscribe protocol provides a scalable and reliable way to connect devices over the Internet.

### **Pub Sub Messages:**

Publish/subscribe messaging, or pub/sub messaging, is a form of asynchronous service-to-service communication used in server less and micro services architectures. In a pub/sub model, any message published to a topic is immediately received by all of the subscribers to the topic. If you publish messages to the global Pub/Sub endpoint, Pub/Sub automatically stores the messages in the nearest Google Cloud region.

## **3. Modbus Frames, RS485 Physical Layer**

### **Modbus Frames:**

Modbus is a data communications protocol originally published by Modicon in 1979 for use with its programmable logic controllers. Modbus has become a de facto standard communication protocol and is now a commonly available means of connecting industrial electronic devices. There are two types of Modbus serial protocols, RS-232 and RS-485. Modbus RS-232 allows concurrent, full-duplex flow of data. Modbus RS-485 is half-duplex, and indicates values using differences in voltage. Modbus messages can also be sent over Ethernet or TCP/IP.

Modbus is typically used to transmit signals from instrumentation and control devices back to a main controller or data gathering system, for example a system that measures temperature and humidity and communicates the results to a computer.

Modbus is an application layer data protocol present at Level 7 of the Open System Interconnection (OSI) model of communication. It provides a connection between servers and clients located on different devices and networks.

### **RS485 Physical Layer:**

RS-485 simply stands for Recommended Standard #485. It is used for Serial communication. RS485 is used in many computer and automation systems. Some of the examples are robotics, base stations, motor drives, video surveillance and also home appliances. In computer systems, RS485 is used for data transmission between the controller and a disk drive. RS-485 is a duplex communication system in which multiple devices on the same bus can communicate in both directions. RS-485 is most often used as half-duplex.