**Data Link Layer (DLL)**

The main function of this layer is to make sure data transfer is error-free from one node to another, over the physical layer.

The Receiver’s MAC address is obtained by placing an [ARP(Address Resolution Protocol)](https://www.geeksforgeeks.org/how-address-resolution-protocol-arp-works/)request onto the wire asking “Who has that IP address?” and the destination host will reply with its MAC address.

DLL also encapsulates Sender and Receiver’s MAC address in the header.

Functions

* **Physical addressing:** After creating frames, the Data link layer adds physical addresses (MAC addresses) of the sender and/or receiver in the header of each frame.
* **Error control:** The data link layer provides the mechanism of error control in which it detects and retransmits damaged or lost frames.

Packet in the Data Link layer is referred to as **Frame.**

           2. Data Link layer is handled by the NIC (Network Interface Card) and device drivers of host machines.

           3. Switch & Bridge are Data Link Layer devices.

Transport layer

It is responsible for the End to End Delivery of the complete message.

data in the transport layer is referred to as *Segments*

 The sender needs to know the port number associated with the receiver’s application.

**Connection-Oriented Service:** It is a three-phase process that includes

* Connection Establishment
* Data Transfer dgdf
* Termination/disconnection

The transport layer is called as **Heart of the OSI** model.

## ****Session Layer****

This layer is responsible for the establishment of connection, maintenance of sessions, and authentication, and also ensures security.

Funtions used here:

Session establishment, synchronization,dialog controller

Presentation layer:

* **Translation:** For example, ASCII to EBCDIC.
* **Encryption/ Decryption:** Data encryption translates the data into another form or code. The encrypted data is known as the ciphertext and the decrypted data is known as plain text. A key value is used for encrypting as well as decrypting data.
* **Compression:** Reduces the number of bits that need to be transmitted on the network.

Circuit switching

**Inefficient use of resources:**

**Limited scalability:**Circuit switching is not well-suited for large-scale networks with many nodes, as it requires a dedicated communication path between each pair of nodes. This can result in a high degree of complexity and difficulty in managing the network.

**Limited mobility:** Circuit switching is not well-suited for mobile devices or nodes that move frequently, as it requires the establishment of a dedicated communication path. This can result in communication disruptions or dropped calls.

**High setup time:**

**Advantages:**

**Reliability:,quality of service,security,ease of managemnet**

1. **Compatibility:** Circuit switching is compatible with a wide range of devices and protocols, which means that it can be used with different types of networks and applications. This makes it a versatile technology for various industries and use cases.

**Packet switching:**

 the data is broken into small pieces of variable length, called **Packet**.

 packet composes of a payload and various control information. No pre-setup or reservation of resources is needed.

* **Store and forward technique**

More than one path is possible between a pair of sources and destinations. Each packet contains the Source and destination address using which they independently travel through the network.

Imp -> Each packet contains a header, which includes information about the packet’s source and destination, as well as the data payload.

More packets are tranmitted over the network makes the better utilisation of resources.

### delays that can occur in packet switching:

1. **Transmission delay:**This is the time it takes to transmit a packet over a link. It is affected by the size of the packet and the bandwidth of the link.
2. **Propagation delay:**This is the time it takes for a packet to travel from the source to the destination. It is affected by the distance between the two nodes and the speed of light.
3. **Processing delay:** This is the time it takes for a packet to be processed by a node, such as a router or switch. It is affected by the processing capabilities of the node and the complexity of the routing algorithm.
4. **Queuing delay:**This is the time a packet spends waiting in a queue before it can be transmitted. It is affected by the number of packets in the queue and the priority of the packets.

To minimize the delay some algorithm and techniques are used: optimizing routing algorithms,qos.

### **Advantages of Packet Switching over Circuit Switching:**

* More efficient in terms of bandwidth, since the concept of reserving a circuit is not there.
* Minimal transmission latency.
* More reliable as a destination can detect the missing packet.
* More fault tolerant because packets may follow a different path in case any link is down, Unlike Circuit Switching.
* Cost-effective and comparatively cheaper to implement.

### **Disadvantage of Packet Switching over Circuit Switching:**

* Packet Switching doesn’t give packets in order, whereas Circuit Switching provides ordered delivery of packets because all the packets follow the same path.
* Since the packets are unordered, we need to provide sequence numbers for each packet.
* Complexity is more at each node because of the facility to follow multiple paths.
* Transmission delay is more because of rerouting.
* Packet Switching is beneficial only for small messages, but for bursty data (large messages) Circuit Switching is better.

**Application layer**

The telnet command is a command that uses the Telnet protocol to communicate with a remote device or system. Port number of telnet is 23

Smtp: The Port number for SMTP is 25.

**Application layer protocol :**

organizations can use a proxy to observe the traffic of its employees to get the work efficiently done. It can also be used to keep a check on any kind of highly confidential data leakage. Some can also use it to increase their websites rank.

Smtp :

* SMTP is a set of communication guidelines that allow software to transmit an electronic mail over the internet is called **Simple Mail Transfer Protocol**.