X.25

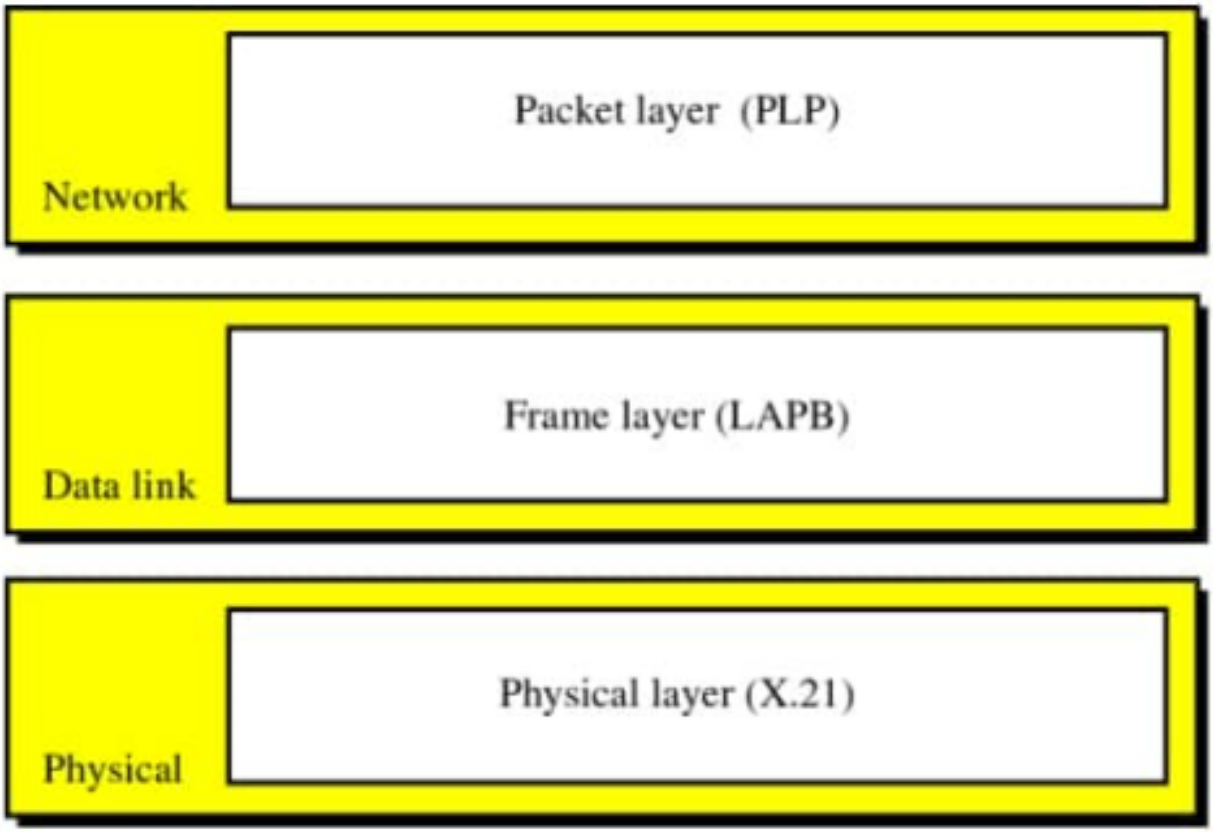
An X.25 network is an older packet-switched network based on Open System Interconnection (OSI) network architecture rather than on TCP/IP architecture. It is mostly used for commercial networks. It allows WAN-to-WAN or LAN connectivity at up to 2Mbps (megabits per second), but due to heavy error-checking protocols, its effective network speed is very slow. A newer network standard known as Frame Relay is derived from the X.25 networking standard.

The main virtue of the X.25 standard is that it is extremely reliable and has superior error-checking capabilities. It also allows for virtual circuits and easy accounting of line usage. This makes the X.25 standard a good choice for networks where a significant amount of "line noise" is in the data transmission media, such as bad phone connections

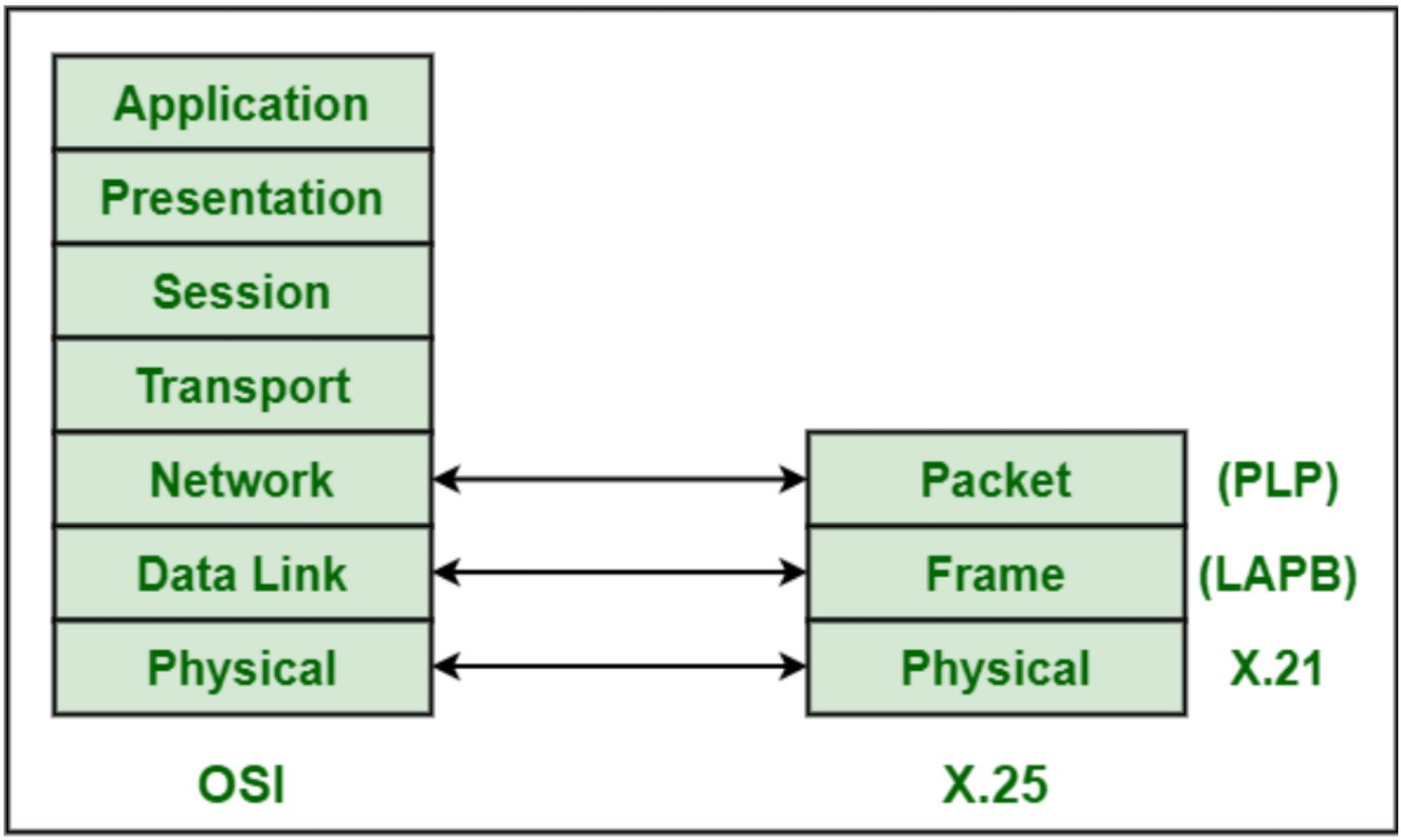
X.25 Layers

- X.25 protocol specifies three layers:
  1. Physical layer
  2. Frame layer
  3. Packet layer
- These layers defines functions of physical layer, data link layer & network layer of OSI model.

X.25 Layers in Relation to the OSI Layers



1. Physical Layer
2. Frame Layer
3. Packet Layer



X.25 Layer Mapping with OSI Model

Physical Layer

- X.25 specifies a protocol named as X.21 at physical layer. It is also called as X.21 bis.
- X.21 has been designed by ITU-T

This layer provides various communication lines that transmit or transfer some electrical signals. X.21 implementer is usually required for linking.

2. **Data Link Layer** :

   Data link layer is also known as Frame Layer. This layer is an implementation or development of ISO High-Level Data Link Layer (HDLC) standard which is known as LAPB (Link Access Procedure Balanced). It also provides a communication link and transmission hat is error-free among any two physically connected nodes or X.25 nodes.

LAPB also allows DTE (Data Terminal Equipment) or DCE (Data Circuit-Terminating Equipment) simply to start or end a communication session or start data transmission. This layer is one of the most important and essential parts of X.25 Protocol. This layer also provides a mechanism for checking in each hop during the transmission. This service also ensures a bit-oriented, error-free, and also sequenced and ordered delivery of data frames or packets.

- **Link Access Procedure Balanced (LAPB) –**
  It is specified by ITU-T Recommendation X usually derived from HDLC. It is the most commonly used protocol that allows establishing a logical connection.

3. **Packet Layer :**

   Packet layer is also known as Network Layer protocol of X.25. This layer generally governs the end-to-end communications among various devices. It also defines how to address and deliver X.25 packets among end nodes and switches on a network with the help of PVCs (Permanent Virtual Circuits) or SVCs (Switched Virtual Circuits). This layer also governs and manages set-up and teardown and also flow control among devices as well as various routing functions

connections.

This layer also defines and explains the format of data packets and also the procedures for control and transmission of data frames. This layer is also responsible for establishing a connection, transmitting data frames or packets, ending or terminating a connection, error and flow control, transmitting data packets

What is Frame Relay?

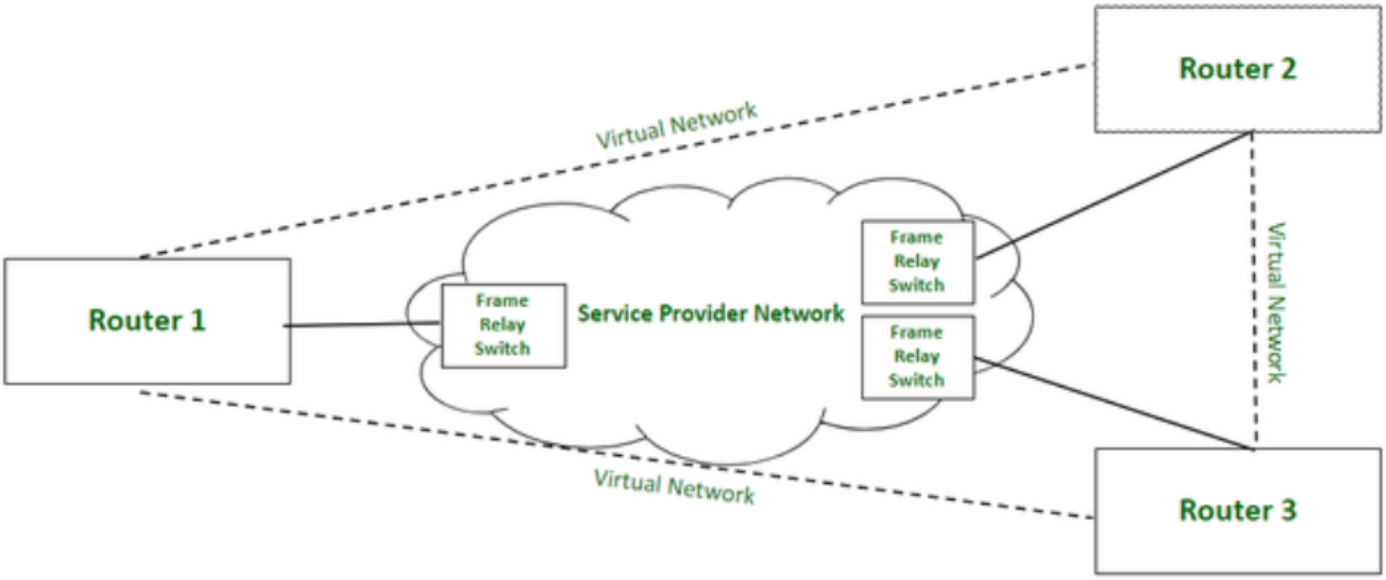
Frame Relay (*frame relay*) is a **packet switching technology** that fragmented into transmission units called frames and sent in high-speed bursts through a digital network. Establishes an exclusive connection during the transmission period called virtual connection.

It uses a technology called fast packet in which error checking does not occur in any intermediate node of the transmission but done at the ends. It makes it more efficient than X.25

How does Frame Relay Work?

Frame Relay is a packet-switching network protocol that is designed to work at the data link layer of the network. It is used to connect Local Area Networks (LANs) and transmit data across Wide Area Networks (WANs). It is a better alternative to a point-to-point network for connecting multiple nodes that require separate dedicated links to be established between each pair of nodes. It allows transmission of different size packets and dynamic bandwidth allocation. Also, it

provides a congestion control mechanism to reduce the network overheads due to congestion. It does not have an error control and flow management mechanism.



Frame Relay Network

Working:

Frame relay switches set up virtual circuits to connect multiple LANs to build a WAN. Frame relay transfers data between LANs across WAN by dividing the data in packets known as frames and transmitting these packets across the network.

Frame relay also deals with congestion within a network. Following methods are used to identify congestion within a network:

1. **Forward Explicit Congestion Network (FECN) –**
   FECN is a part of the frame header that is used to notify the destination about the congestion in the network. Whenever a frame experiences congestion while transmission, the frame relay switch of the destination network sets the FECN bit of the packet that allows the destination to identify that packet has experienced some congestion

while transmission.

2. **Backward Explicit Congestion Network (BECN) –**
   BECN is a part of the frame header that is used to notify the source about the congestion in the network. Whenever a frame experiences congestion while transmission, the destination sends a frame back to the source with a set BECN bit that allows the source to identify that packet that was transmitted had experienced some congestion while reaching out to the destination. Once, source identifies congestion in the virtual circuit, it slows down to transmission to avoid network overhead.

3. **Discard Eligibility (DE) –**
   DE is a part of the frame header that is used to indicate the priority for discarding the packets. If the source is generating a huge amount of traffic on the certain virtual network then it can set DE bits of less significant packets to indicate the high priority for discarding the packets in case of network overhead. Packets with set DE bits are discarded before the packets with unset DE bits in case of congestion within a network.