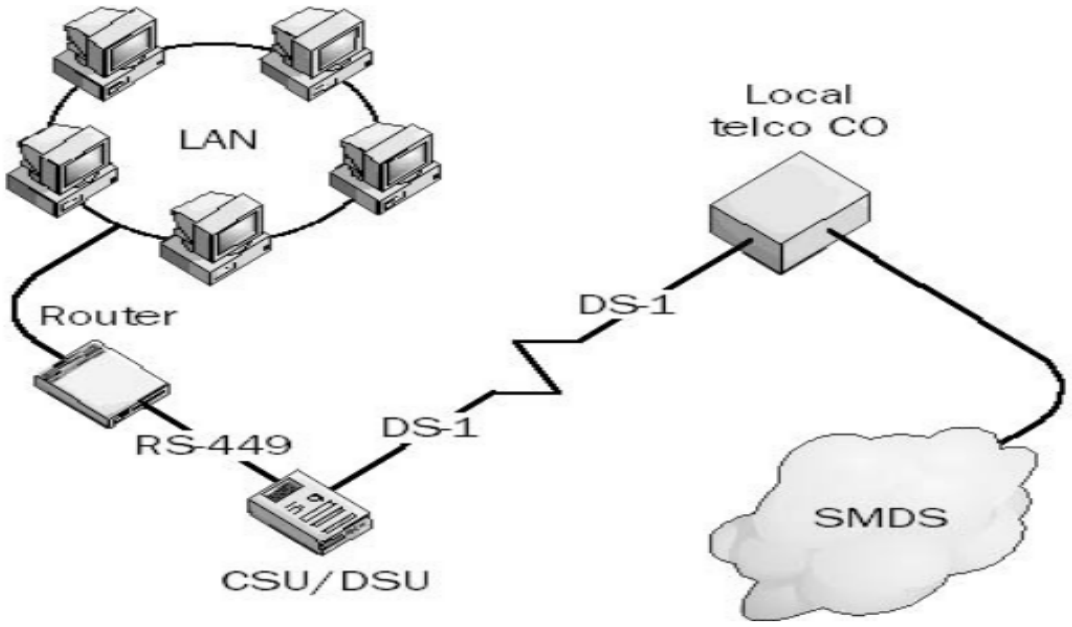
Unit 6-Data Communication Services

6.1 Switched Multimegabit Data Service (SMDS):-

A switched multimegabit data service (SMDS) is a connectionless telecommunications service allowing organizations to exchange large amounts of data over a wide area network (WAN) on a non-constant or burst basis. SMDS is usually provided by telephone companies as a value-added service.

SMDS extends the abilities of an organization's local area network (LAN) over a wide area on an as-needed basis. If a regional office of a commercial bank only needs to send data once a day to the central headquarters, there is no need to have a dedicated wide area network (WAN) connection, which will be idle most of the day. SMDS offers a solution through use of public telecommunications facilities to periodically send a burst of data, but only when and as needed.



6.2 X.25 Network:-

X.25 is the name given to a suite of protocols used for packet-switched wide area network communication. Defined by the International Telegraph and Telephone Consultative Committee in 1976, X.25 had the original purpose of carrying voice signals over analog telephone lines.

X.25 is the oldest packet-switching technique available and was commonly used before the Open System Interconnection (OSI) reference model became standard. Originally developed for use in the 1970s and used widely in the 1980s, X.25 has since fallen out of favor, having been replaced by less complex protocols such as Internet Protocol. Today, it is mostly relegated to ATMs and credit card verification networks.

X.25 protocols work at the physical, data link and network layers of the network. Each X.25 packet contains 128 bytes of data. The protocols themselves cover such tasks as packet assembly at the source, delivery, disassembly at destination, error-checking and retransmission in case of errors.

X.25 has Three Protocol Layers:-

1. **Physical Layer:** It lays out the physical, electrical and functional characteristics that interface between the computer terminal and the link to the packet switched node. X.21 physical implementer is commonly used for the linking.
2. **Data Link Layer:** It comprises the link access procedures for exchanging data over the link. Here, control information for transmission over the link is attached to the packets from the packet layer to form the LAPB frame (Link Access Procedure Balanced). This service ensures a bit-oriented, error-free, and ordered delivery of frames.
3. **Packet Layer:** This layer defines the format of data packets and the procedures for control and transmission of the data packets. It provides external virtual circuit service. Virtual circuits may be of two types: virtual call and permanent virtual circuit. The virtual call is established dynamically when needed through call set up procedure, and the circuit is relinquished through call clearing procedure. Permanent virtual circuit, on the other hand, is fixed and network assigned.

6.3 Frame Relay:-

Frame Relay is a virtual-circuit wide-area network that was designed in response to demands for a new type of WAN in the late 1980s and early 1990s.

- Prior to Frame Relay, some organizations were using a virtual-circuit switching network called X.25 that performed switching at the network layer. For example, the Internet, which needs wide-area networks to carry its packets from one place to another, used X.25. And X.25 is still being used by the Internet, but it is being replaced by other WANs. However, X.25 has several drawbacks:

- X.25 has a low 64-kbps data rate. By the 1990s, there was a need for higher data- rate WANs.

- X.25 has extensive flow and error control at both the data link layer and the network layer. This was so because X.25 was designed in the 1970s, when the available transmission media were more prone to errors. Flow and error control at both layers create a large overhead and slow down transmissions. X.25 requires acknowledgments for both data link layer frames and network layer packets that are sent between nodes and between source and destination.
- Originally X.25 was designed for private lise, not for the Internet. X.25 has its own network layer. This means that the user's data are encapsulated in the network layer packets of X.25. The Internet, however, has its own network layer, which means if the Internet wants to use X.25, the Internet must deliver its network layer packet, called a datagram, to X.25 for encapsulation in the
- X.25 packet. This doubles the overhead.

❖ Disappointed with X.25, some organizations started their own private WAN by leasing T-l or T-3 lines from public service providers. This approach also has some drawbacks.

- If an organization has *n* branches spread over an area, it needs *n(n* - 1)/2 T-I or T-3 lines. The organization pays for all these lines although it may use the lines only 10 percent of the time. This can be very costly.

- The services provided by T-I and T-3 lines assume that the user has fixed-rate data all the time. For example, a T-l line is designed for a user who wants to use the line at a consistent 1.544 Mbps. This type of service is not suitable for the many users today that need to send **bursty data.**

In response to the above drawbacks, Frame Relay was designed. Frame Relay is a wide area
network with the following features:

- Frame Relay operates at a higher speed (1.544 Mbps and recently 44.376 Mbps). This means that it can easily be used instead of a mesh of T-I or T-3 lines.

- Frame Relay operates in just the physical and data link layers. This means it can easily be used as a backbone network to provide services to protocols that already have a network layer protocol, such as the Internet.

- Frame Relay allows bursty data.
- Frame Relay allows a frame size of 9000 bytes, which can accommodate all local area network frame sizes.
- Frame Relay is less expensive than other traditional WANs.
- Frame Relay has error detection at the data link layer only. There is no flow control or error control. There is not even a retransmission policy if a frame is damaged; it is silently dropped. Frame Relay was designed in this way to provide fast transmission capability for more reliable media and for those protocols that have flow and error control at the higher layers.

Architecture:-

Frame Relay provides permanent virtual circuits and switched virtual circuits. Figure shows an example of a Frame Relay network connected to the Internet. The routers are used, as we will see, to connect LANs and WANs in the Internet. In the figure, the Frame Relay WAN is used as one link in the global Internet.

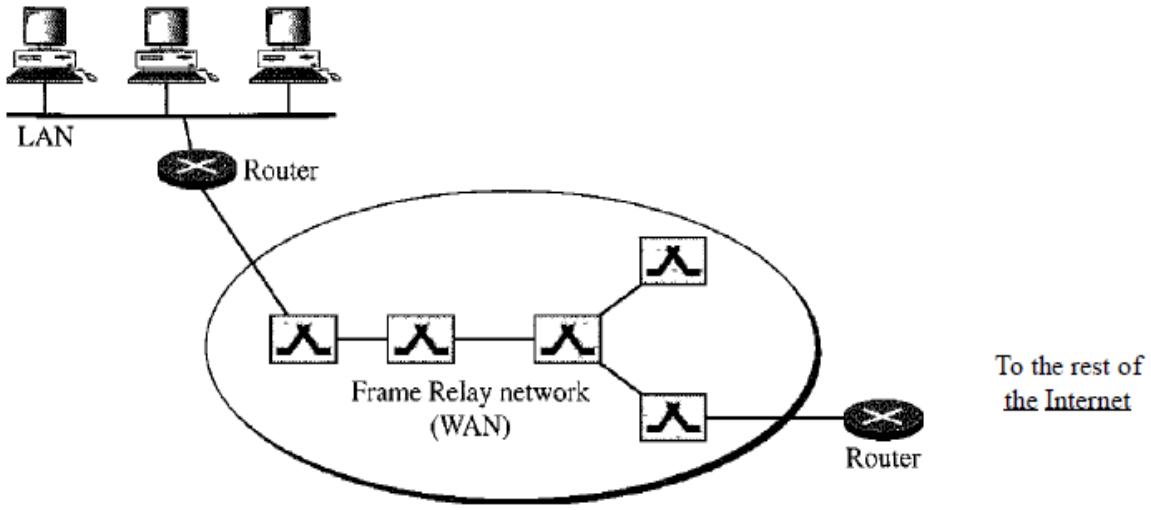


Fig: Frame Relay Network