

# Module

4

# Standards

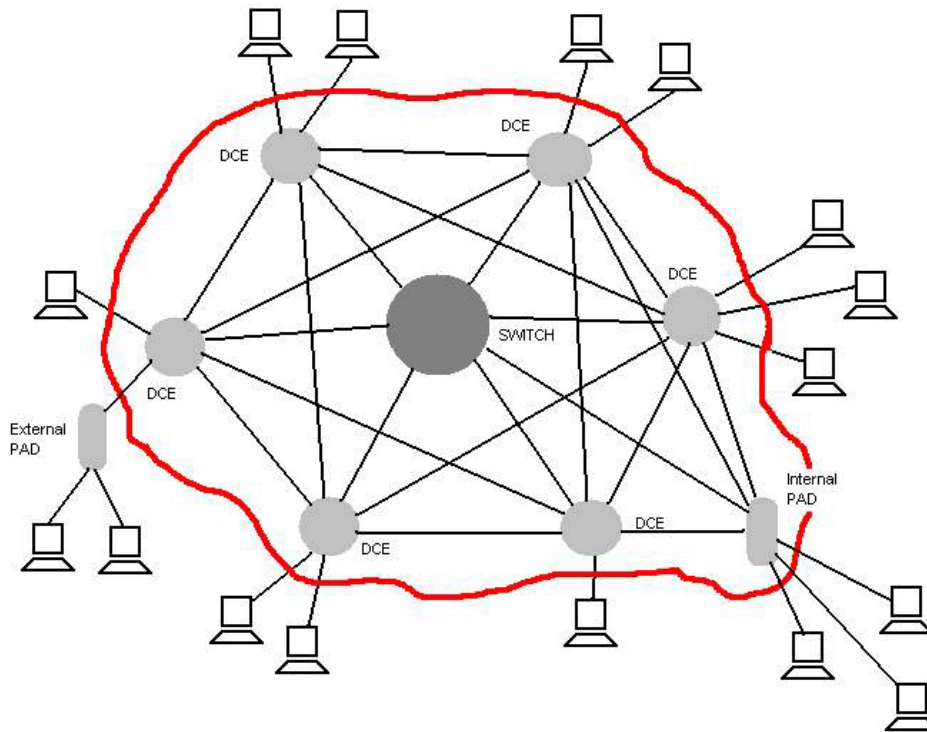
Version 1 ECE , IIT Kharagpur

# Lesson

11

# Network Layer

Version 1 ECE , IIT Kharagpur



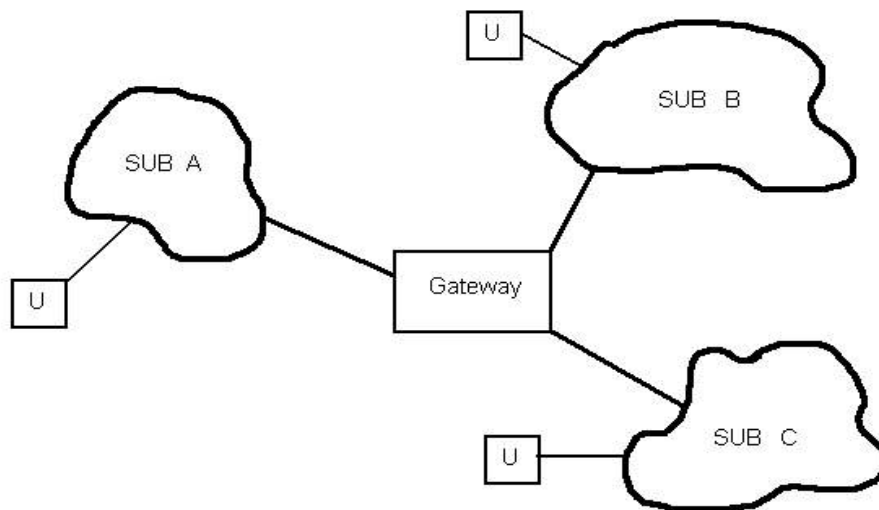
In any network the user is outside the network and hence is not a part of it. In data communication the user terminals are called Data terminating equipment (DTE). The network nodes to which DTEs are connected are called Data Circuit terminating Equipment (DCE). In case of a telephone network, the DCE is an ordinary telephone exchange. In data network, it is a packet switch which is, or rather has to be, a computer. The job of the DCE is routing, packet assembly /disassembly, header generation, header changing, path selection etc. The network may consist of a central switch which serves the DCEs.

For efficient working of the network a network layer protocol is required. ITU specified network layer protocol is X.25. Earlier X.25 supported both Connection Oriented (CO) Service and Connectionless (CL) Service, but it gradually became more CO oriented. X.25 is a continuous protocol, which allows:

1. User-DCE communication
2. DCE-User communication


The communication between two DCEs which is internal to the network may follow any protocol transparent to X.25. The internal network protocol identifies the operation of the network. But the DCE to user protocol has to be standard so that a particular terminal can become compatible with any network. The DCEs are not routers. In fact there is not much to route inside a network. The switch shown in figure 1 is also a DCE that is not connected to any user.

A real network consists of several subnets. The interconnection between



these subnets requires a Gateway. It may be single/ central to the network, or individual subnets may have their own gateways. Here, in this network routing is necessary between different subnets. The Gateways are called Routers. The difference between a DCE and a Router is that the former is directly connected to the user, whereas no user is connected to the Router. Signaling between User ↔ Network and Network ↔ Network are different.

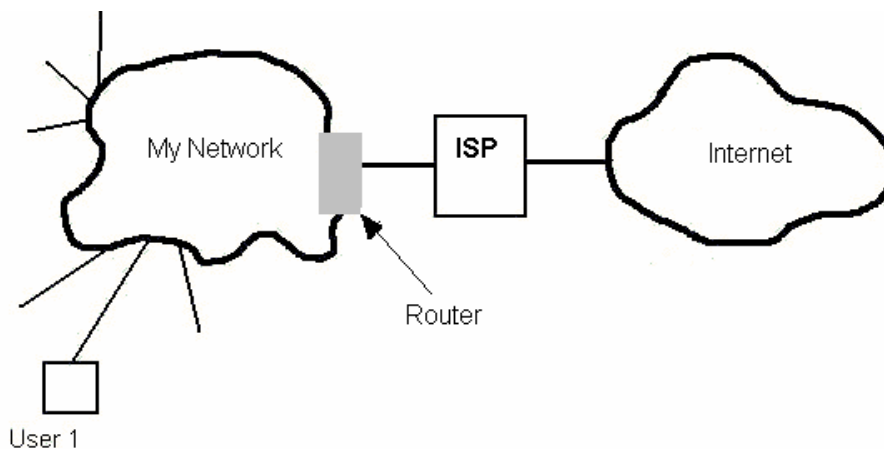
 Router routes data not between paths but between Networks

 X.25 helps the user to access the network. So it is basically an access protocol.

X.25 is costly protocol so we may not implement it for each user. Also in remote places, a DCE may not be available to each user. PAD (Packet Assembler & De-assembler) is then used to connect the users to the network. The PAD is connected to a suitable DCE. PAD may be internal or external to the network as shown in figure 1. The user to the PAD is a local call. Using PAD necessitates that we use additional protocols such as

1. User to PAD protocol
2. PAD protocol
3. PAD to DCE protocol

The Internet Service Providers (ISP) connects the network to the Internet. One of the DCEs or the router of the network is connected to the ISP. To become part of the Internet a network must be connected to the Internet. The ISP provides the required connectivity. A single ISP may be connected to several networks.



The network layer handles packets. In case of CL Service networks each packet should have the full source-destination address. CO Service may be used with lesser addressing overheads.

**👉** ITU physical layer protocol for all digital networks is X.21. An alternative protocol RS-232 provides an interface between both analog and digital networks, as a result, it is more popular.

Actually the X.25 protocol is for the network layer only. Normally it is used with LAP.B in data link layer and X.21 at the physical layer. This whole set is conventionally referred to as X.25.

**👉** LAP.B is a subset of HDLC, which works in the balanced mode of operation.

**👉** In the original ISO document the network layer was termed as Packet level, since it handles packets. Similarly the Datalink and physical layers were called the Frame level and the Physical level.

## Objective Questions

11.01

## Subjective Questions

11.11

## Level 2 Questions

11.21