



SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai



DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COURSE NAME :19IT401 COMPUTER NETWORKS

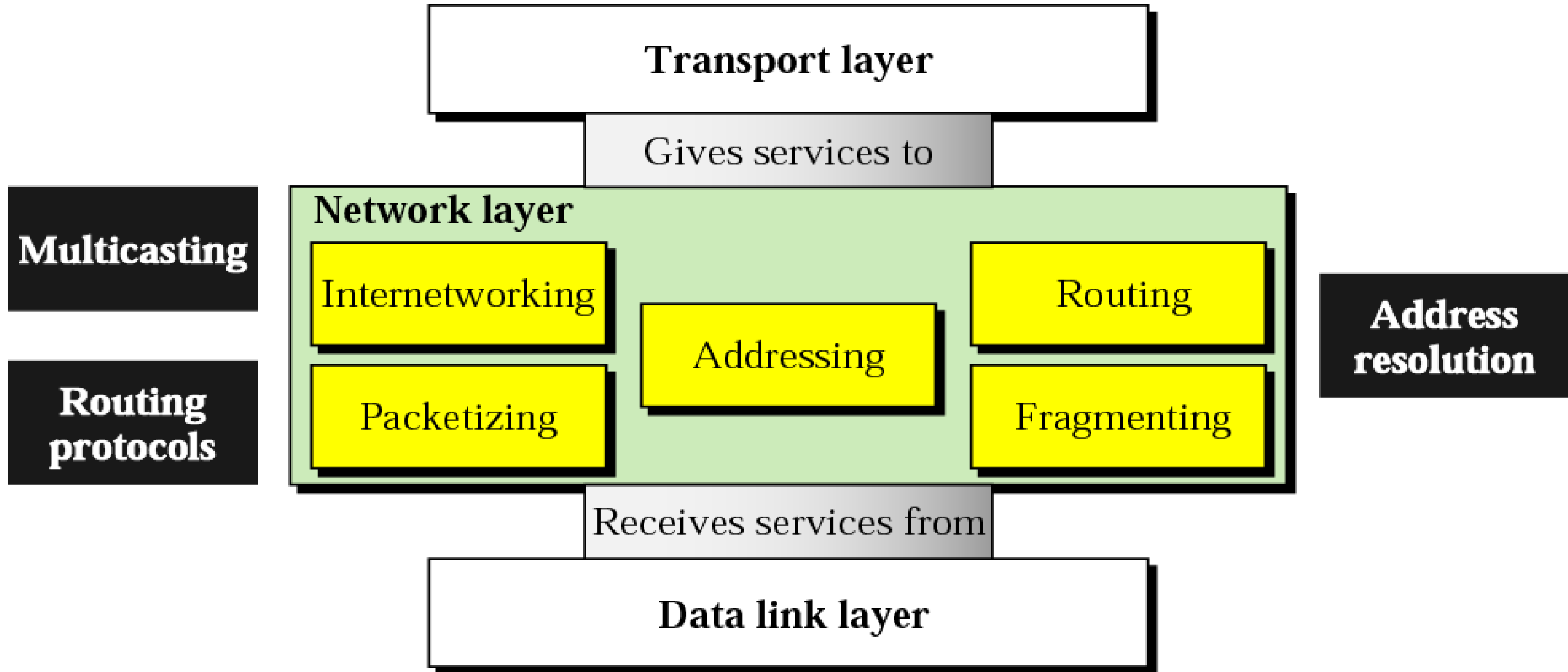
II YEAR /IV SEMESTER

Unit 3-Network layer

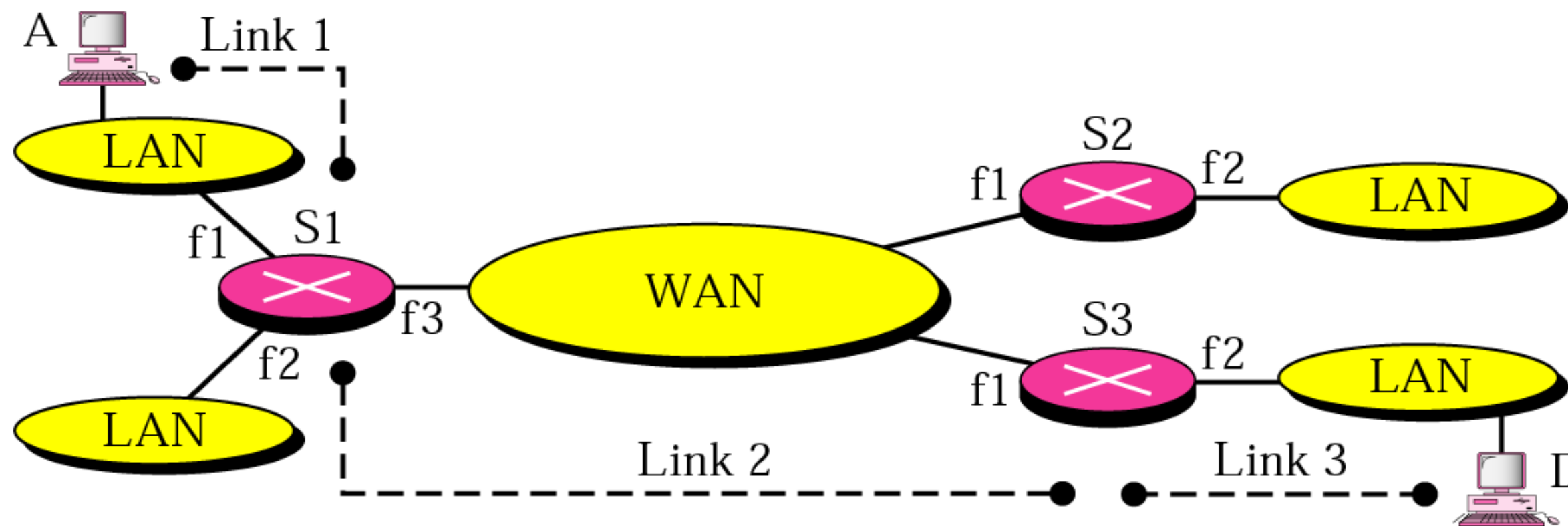
Topics 1,2 and 3 : Services, Virtual circuit and Datagram
networks

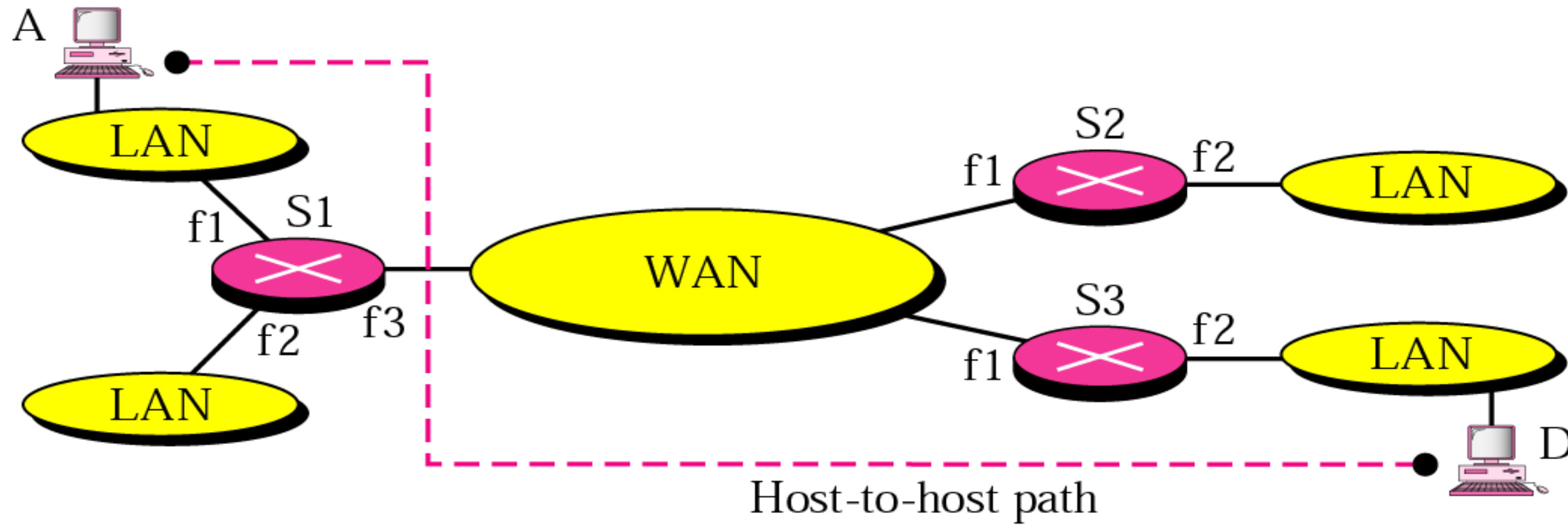


Network layer services



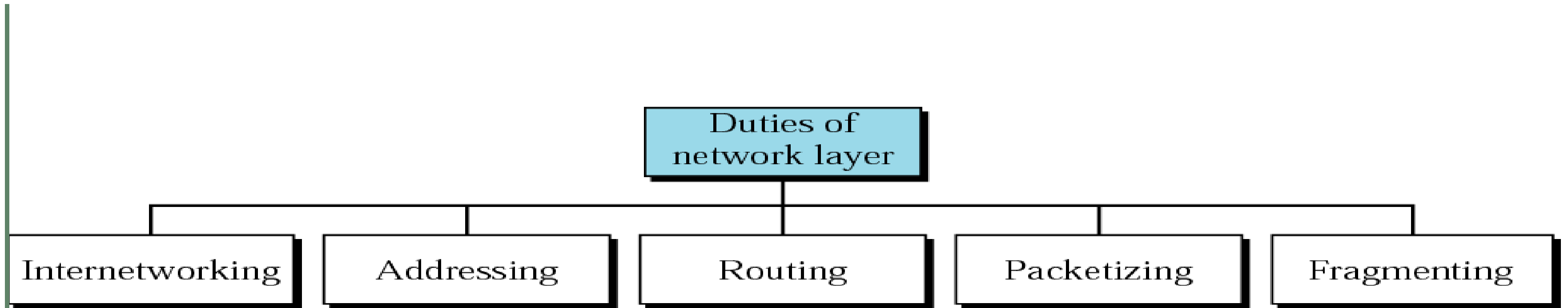
Links in an internetwork







Network Layer Services





Network Layer Services



✓ Packetizing

- ✓ Encapsulating the payload (data received from upper layer) in a network-layer packet at the source and decapsulating the payload from the network-layer packet at the destination.
- ✓ Duty of the network layer is to carry a payload from the source to the destination without changing it or using it.
- ✓ The source is not allowed to change the content of the payload unless it is too large for delivery and needs to be fragmented.
- ✓ If a packet is fragmented, the header needs to be copied to all fragments and some changes are needed



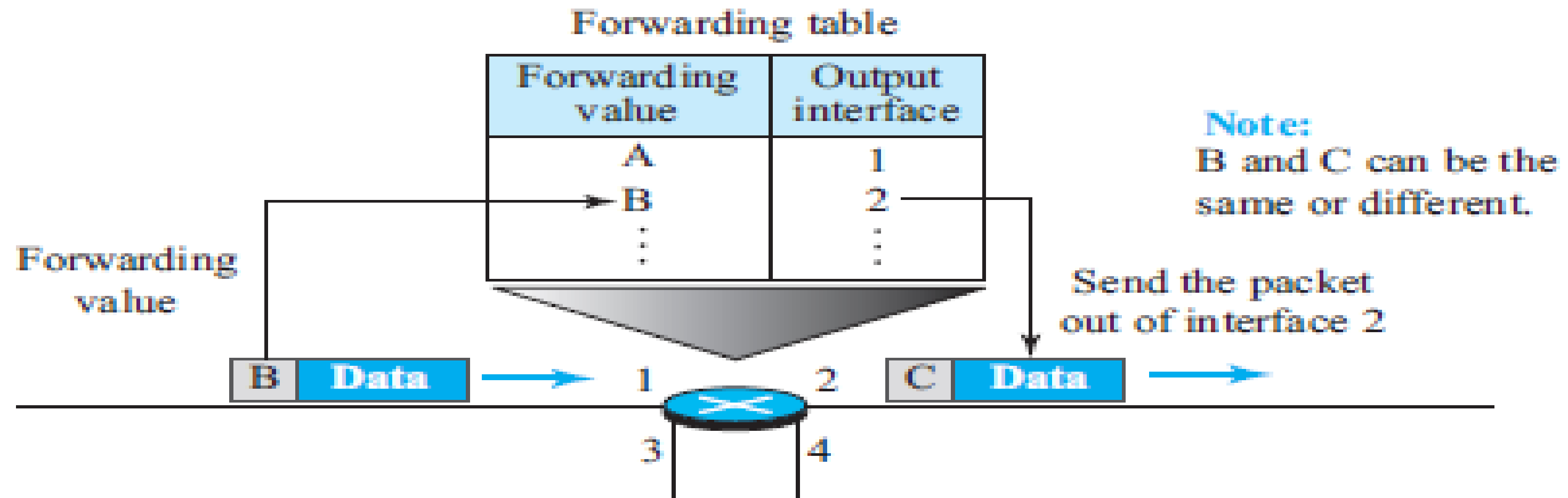
✓ Routing

- ✓ The network layer is responsible for routing the packet from its source to the destination.
- ✓ A physical network is a combination of networks (LANs and WANs) and routers that connect them. This means that there is more than one route from the source to the destination.
- ✓ The network layer is responsible for finding the best one among these possible routes.
- ✓ The network layer needs to have some specific strategies(Routing protocols) for defining the best route.



- ✓ Forwarding
- ✓ If routing is applying strategies and running some routing protocols to create the decision-making tables for each router, *forwarding can be defined as the action applied by each router when a packet arrives at one of its interfaces.*
- ✓ When a router receives a packet from one of its attached networks, it needs to forward the packet to another attached network (in unicast routing) or to some attached networks (in multicast routing).
- ✓ To make this decision, the router uses a piece of information in the packet header, which can be the destination address or a label, to find the corresponding output interface number in the forwarding table.

2 Forwarding process





Other services

Error control -the packet in the network layer may be fragmented at each router, which makes error checking at this layer inefficient.

Flow control-the upper layers that use the service of the network layer can implement buffers to receive data from the network layer as they are ready and do not have to consume the data as fast as it is received. So Lack of flow control

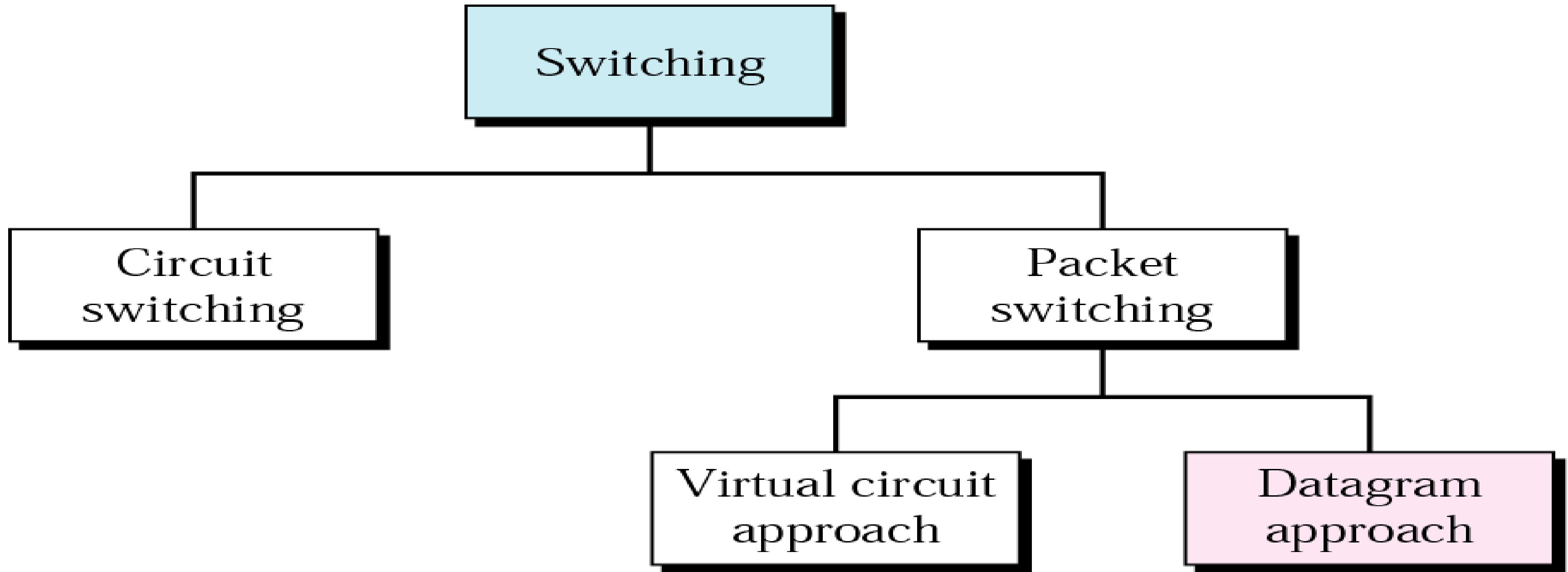
Congestion control -Congestion may occur if the number of datagrams sent by source computers is beyond the capacity of the network or routers. In this situation, some routers may drop some of the datagrams. Not implemented in Internet

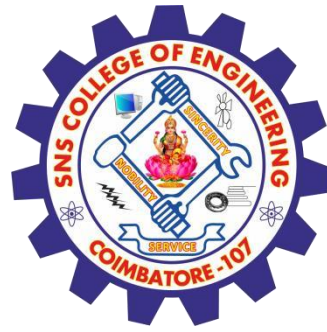
QoS- The Internet has thrived by providing better quality of service to support multimedia applications. However, to keep the network layer untouched, these provisions are mostly implemented in the upper layer

Security- Security was not a concern when the Internet was originally designed because it was used by a small number of users at universities for research activities; other people had no access to the Internet. The network layer was designed with no security provision



Packet switching





Packet switching



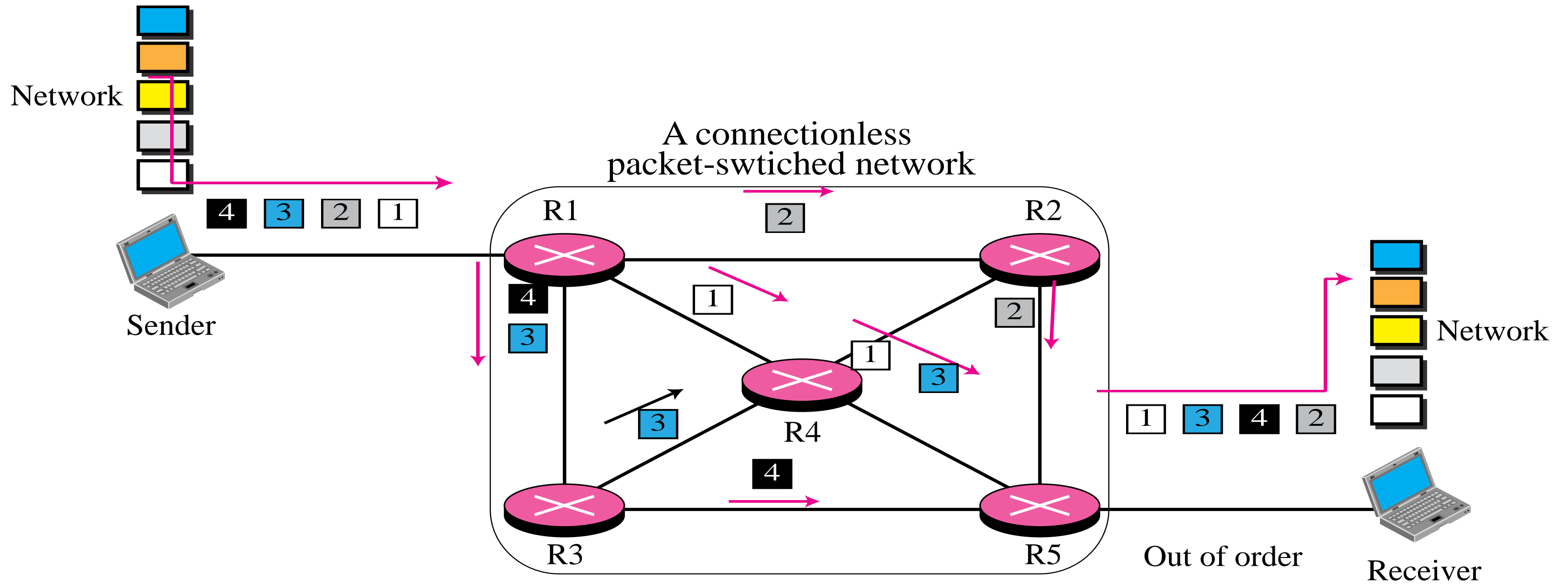
- ✓ The network layer is designed as a packet-switched network. This means that the packet at the source is divided into manageable packets, normally called datagrams.
- ✓ Individual datagrams are then transferred from the source to the destination.
- ✓ The received datagrams are assembled at the destination before recreating the original message.
- ✓ The packet-switched network layer of the Internet was originally designed as a connectionless service, but recently there is a tendency to change this to a connection-oriented service.



A connectionless packet-switched network



In a connectionless packet-switched network, the forwarding decision is based on the destination address of the packet



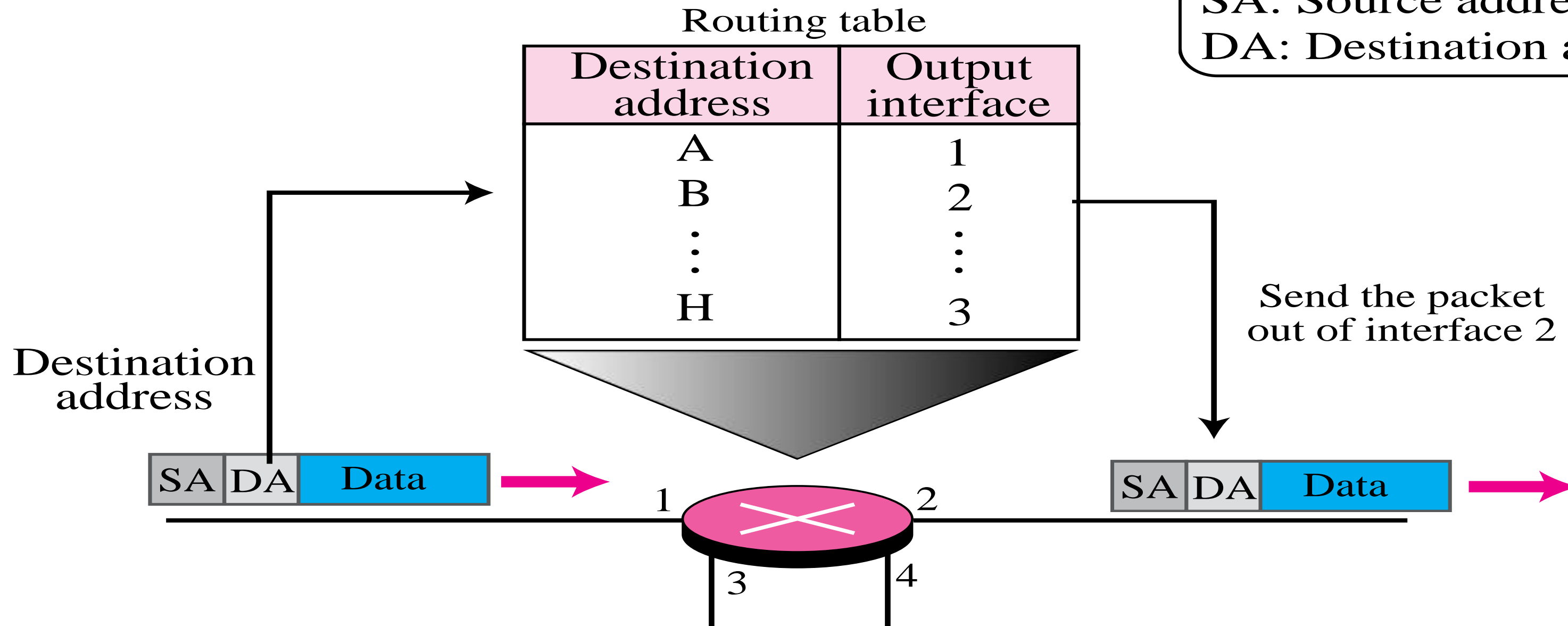


Forwarding process in a connectionless network



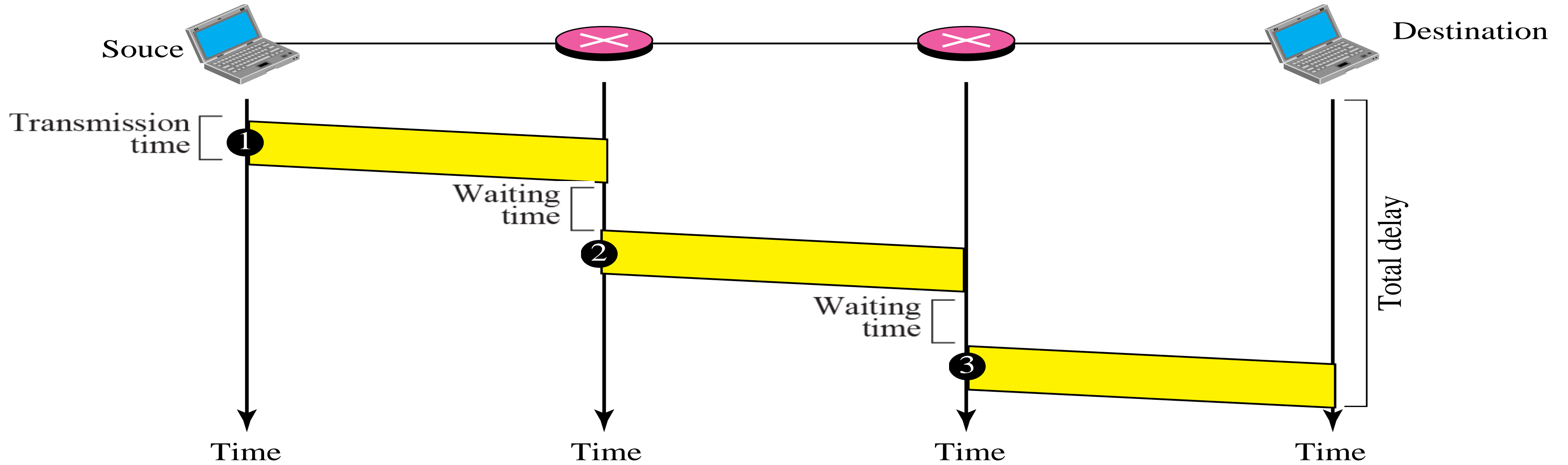
Legend

SA: Source address
DA: Destination address





Delay in a connectionless network

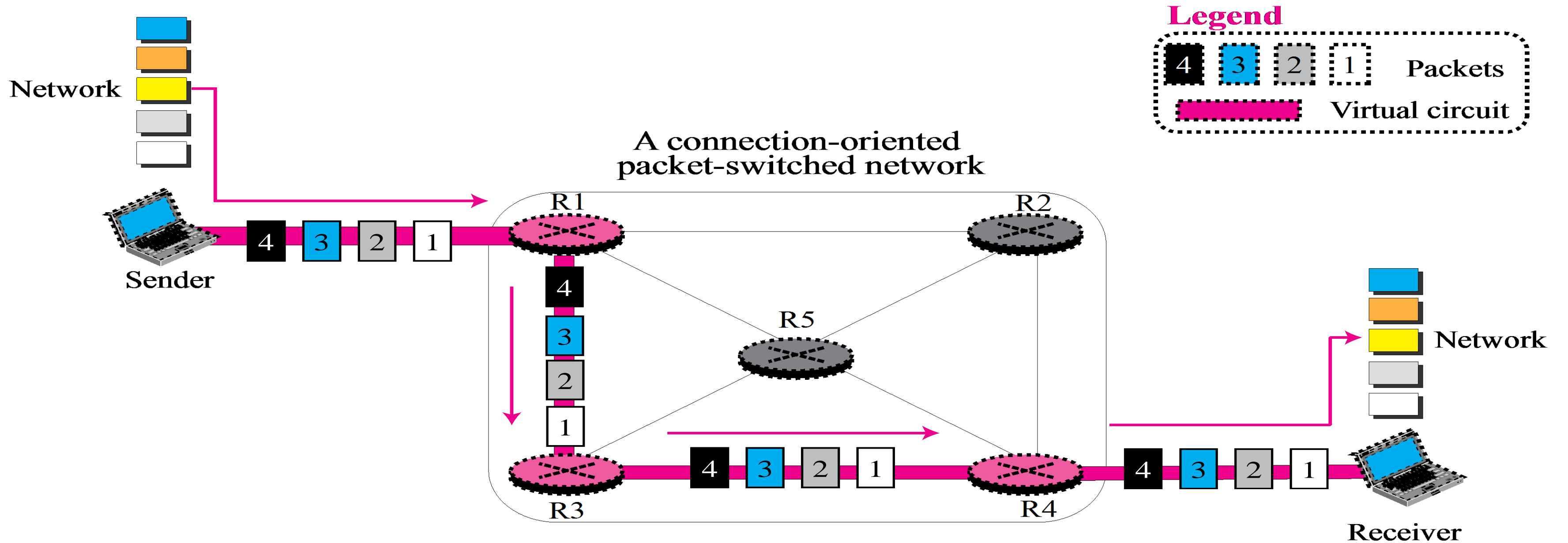


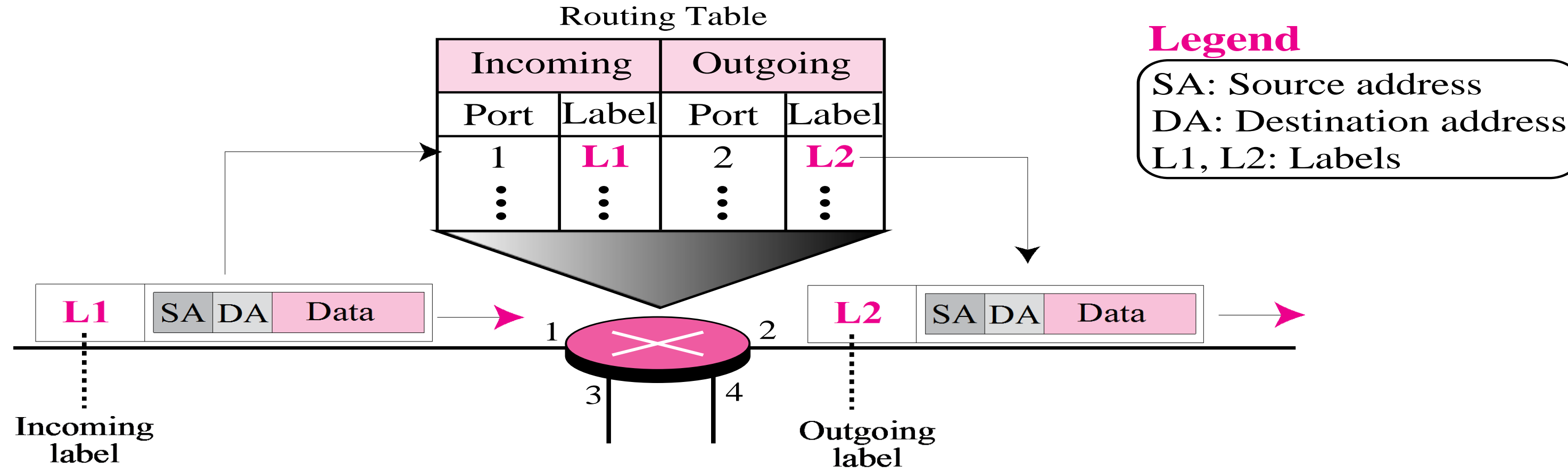


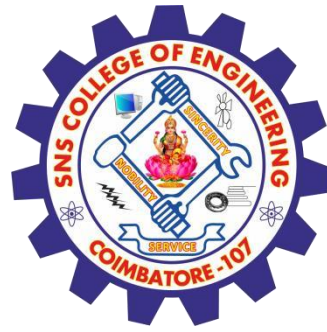
A connection-oriented packet switched network



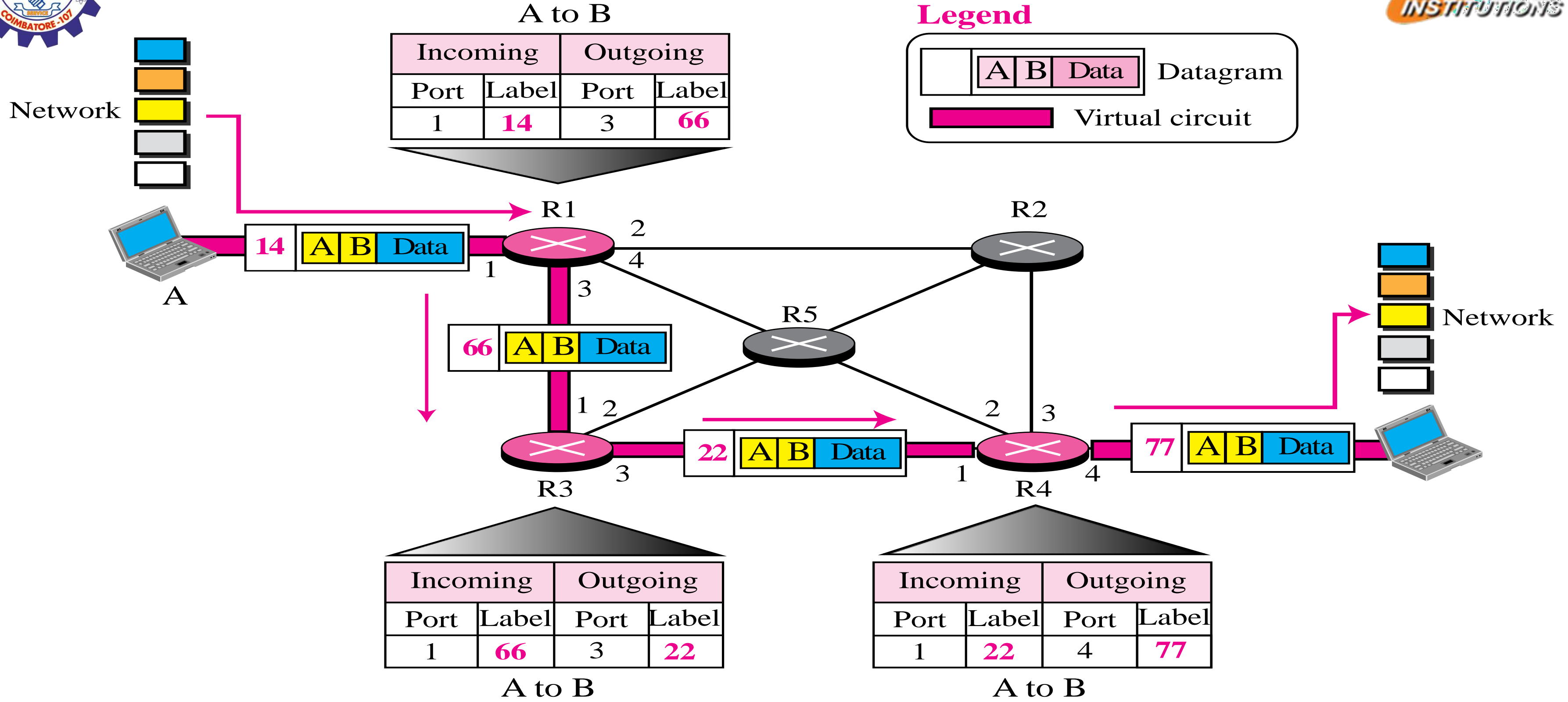
In a connection-oriented packet switched network, the forwarding decision is based on the label of the packet.



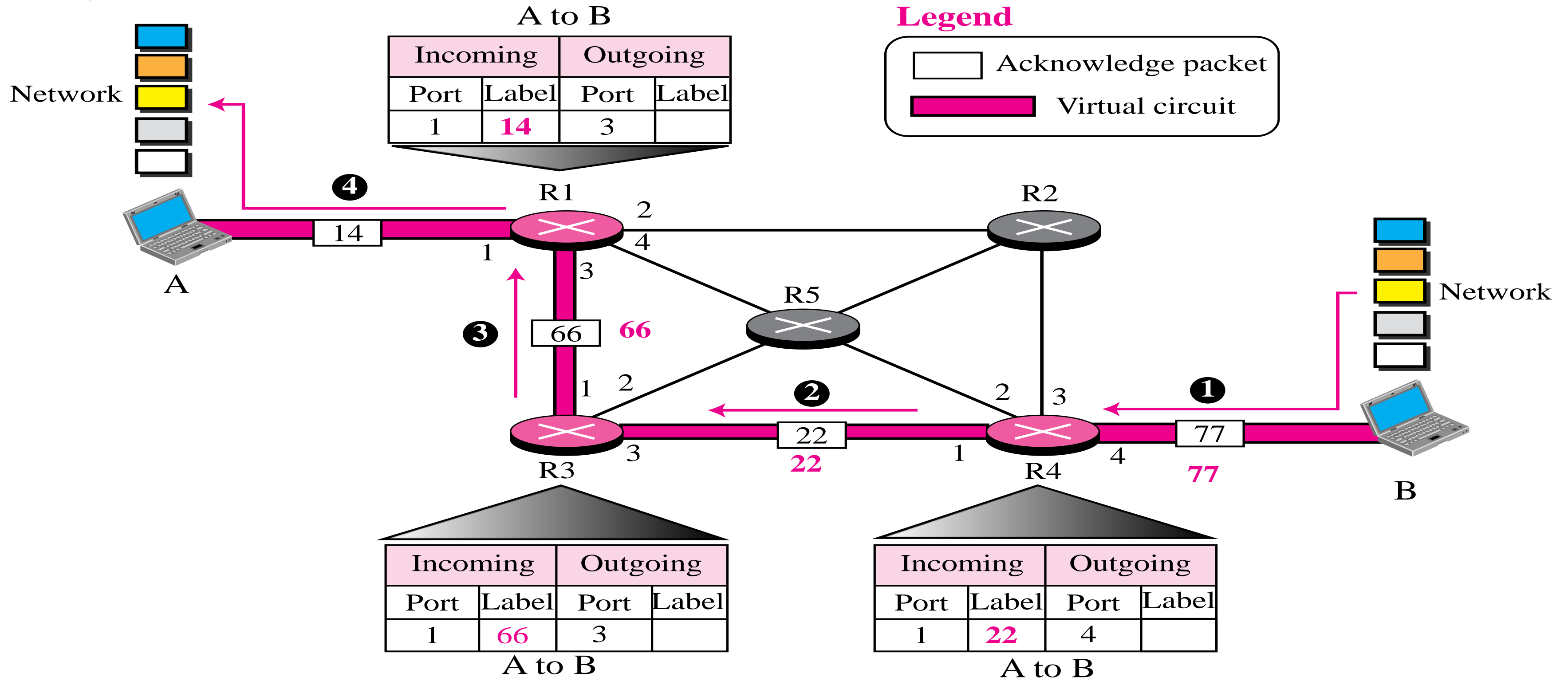


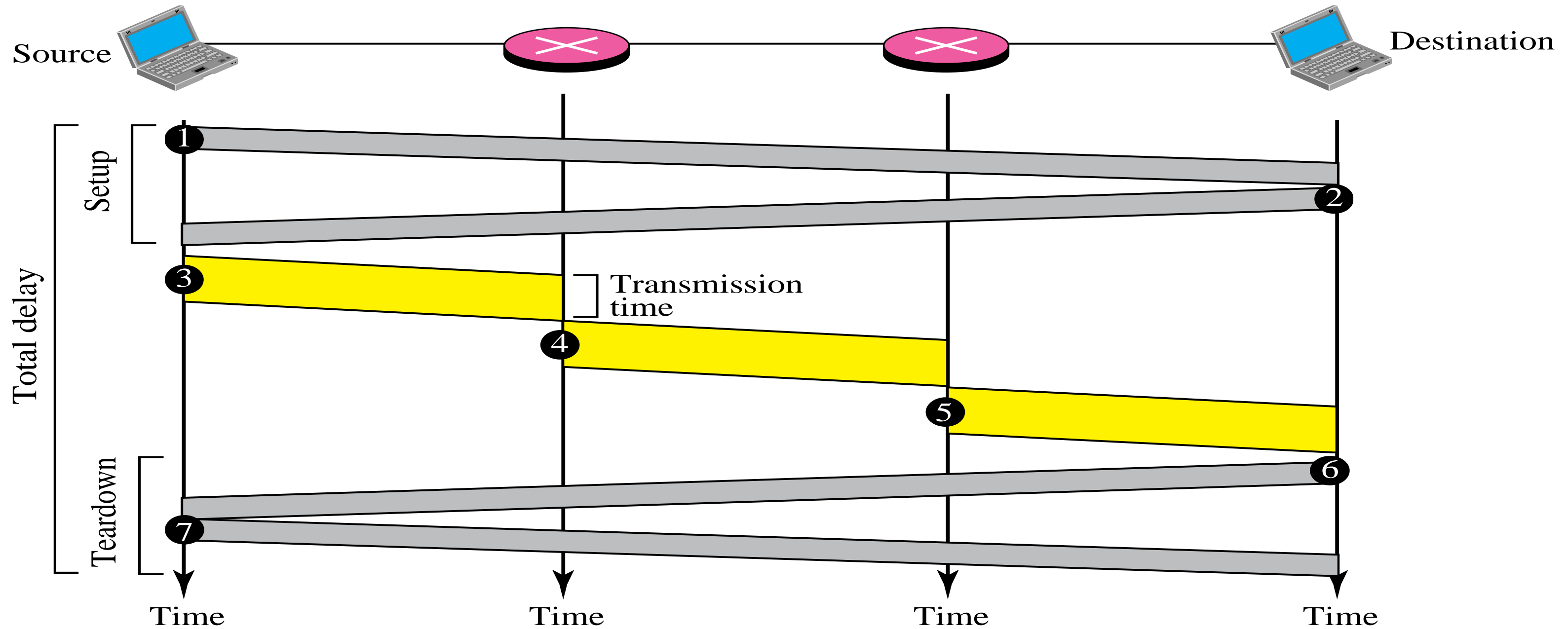


Flow of one packet in an established virtual circuit



Setup acknowledgement in a virtual-circuit network







Assessment



- a) List Network layer services.
- b) What is Packet switching?
- c) What is Virtual circuit switching?
- d) Compare connection oriented and connectionless network.





Reference



TEXT BOOKS

Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013.

REFERENCES

1. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
2. Andrew Tanenbaum, Computer Networks, Fifth Edition, Pearson (5th Edition) Education, 2013.
3. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2013.
4. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.