

Chapter 5. The Network Layer

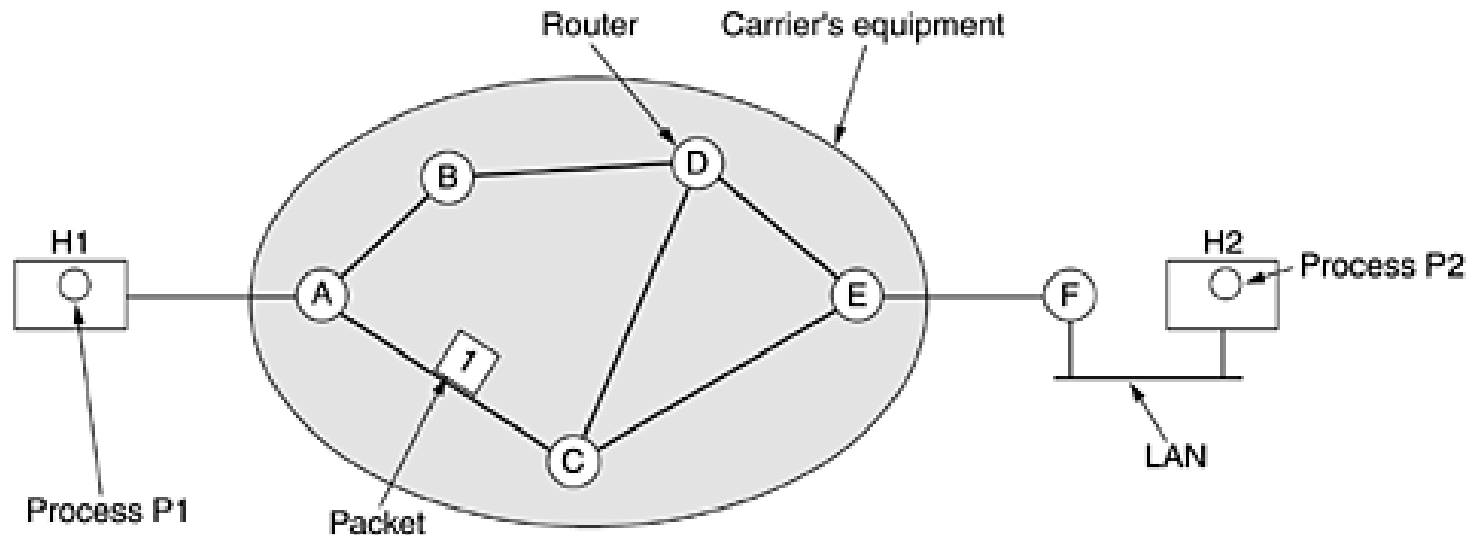
The Network Layer

- The network layer is responsible for packet forwarding including routing through intermediate routers.
- The network layer is the lowest layer that deals with end-to-end transmission.
- To achieve its goals, the network layer must know about the topology of the communication subnet (i.e., the set of all routers) and choose appropriate paths through it.
- It must also take care to choose routes to avoid overloading some of the communication lines and routers while leaving others idle.
- Finally, when the source and destination are in different networks, new problems occur. It is up to the network layer to deal with them.

Network Layer Design Issues

Store-and-Forward Packet Switching

The environment of the network layer protocols



- A host with a packet to send transmits it to the nearest router, either on its own LAN or over a point-to-point link to the carrier.
- The packet is stored there until it has fully arrived so the checksum can be verified.
- Then it is forwarded to the next router along the path until it reaches the destination host, where it is delivered.
- This mechanism is store-and-forward packet switching.

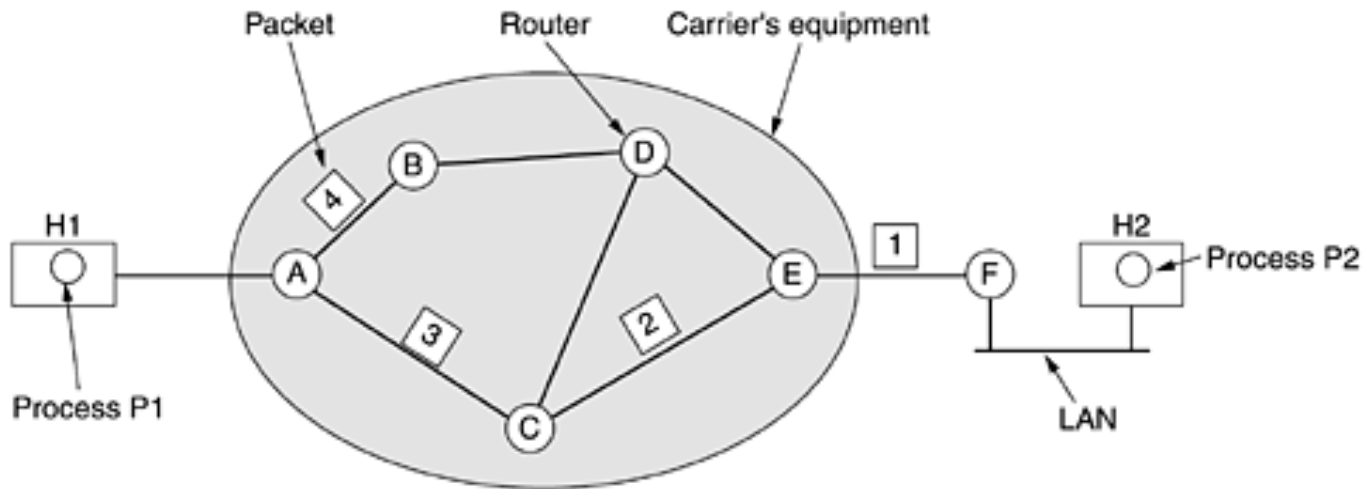
Services Provided to the Transport Layer

- The network layer provides services to the transport layer at the network layer/transport layer interface.
- The network layer services have been designed with the following goals in mind.
 1. The services should be independent of the router technology.
 2. The transport layer should be shielded from the number, type, and topology of the routers present.
 3. The network addresses made available to the transport layer should use a uniform numbering plan, even across LANs and WANs.

- Given these goals, the designers of the network layer have a lot of freedom in writing detailed specifications of the services to be offered to the transport layer.
- This freedom often degenerates into a severe battle between two groups: whether the network layer should provide **connection-oriented** service or **connectionless** service.

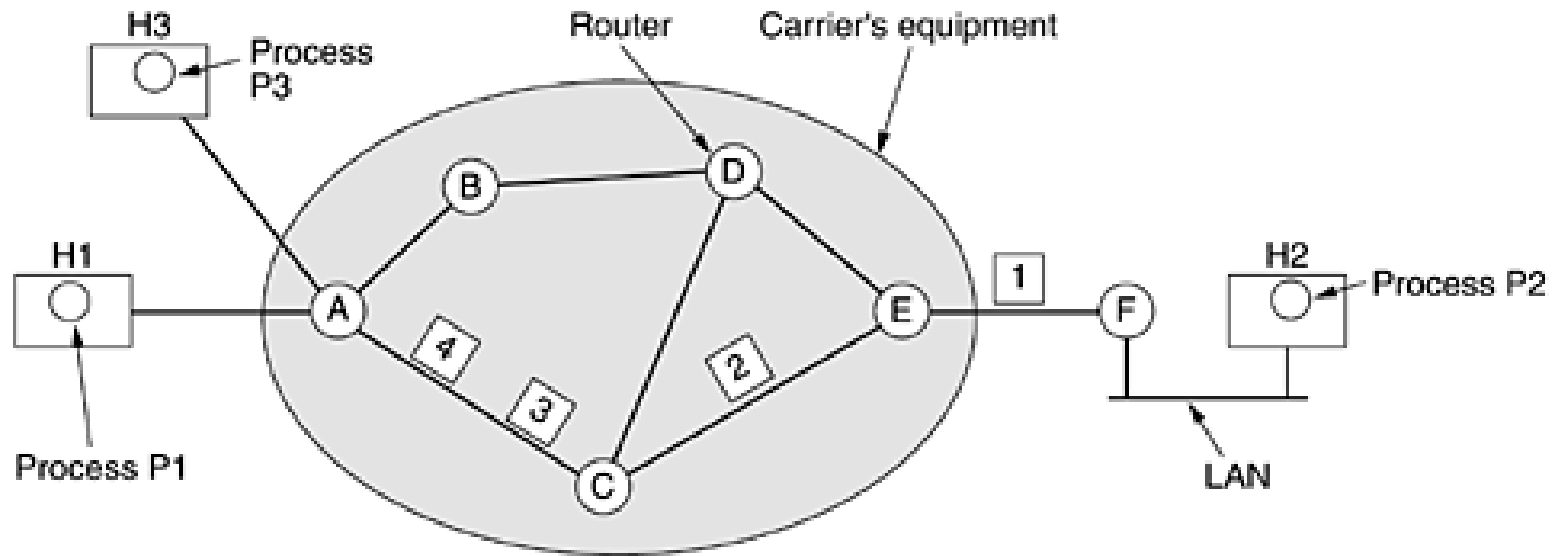
Implementation of Connectionless Service

Routing within a datagram subnet.



- In connectionless service, packets are injected into the subnet individually and routed independently of each other.
- No advance setup is needed. In this context, the packets are frequently called **datagrams** (in analogy with telegrams) and the subnet is called a **datagram subnet**.
- The algorithm that makes the routing decisions is called the **routing algorithm**.

Implementation of Connection-Oriented Service



- In connection-oriented service, a path from the source router to the destination router must be established before any data packets can be sent.
- All packets are routed through same path.
- This connection is called a **VC (virtual circuit)**, in analogy with the physical circuits set up by the telephone system, and the subnet is called a **virtual-circuit subnet**.