CS3200: Computer Networks

Lecture 15

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Overview of Network Layer

- Concerned with getting packets from the source all the way to the destination; possibly via multiple hops.
- Services provided to the upper layers should be independent of the router technology.
- The transport layer should be shielded from the number, type, and topology of the routers present.
- The network addresses made available to the transport layer should use a uniform numbering plan, even across LANs and WANs.

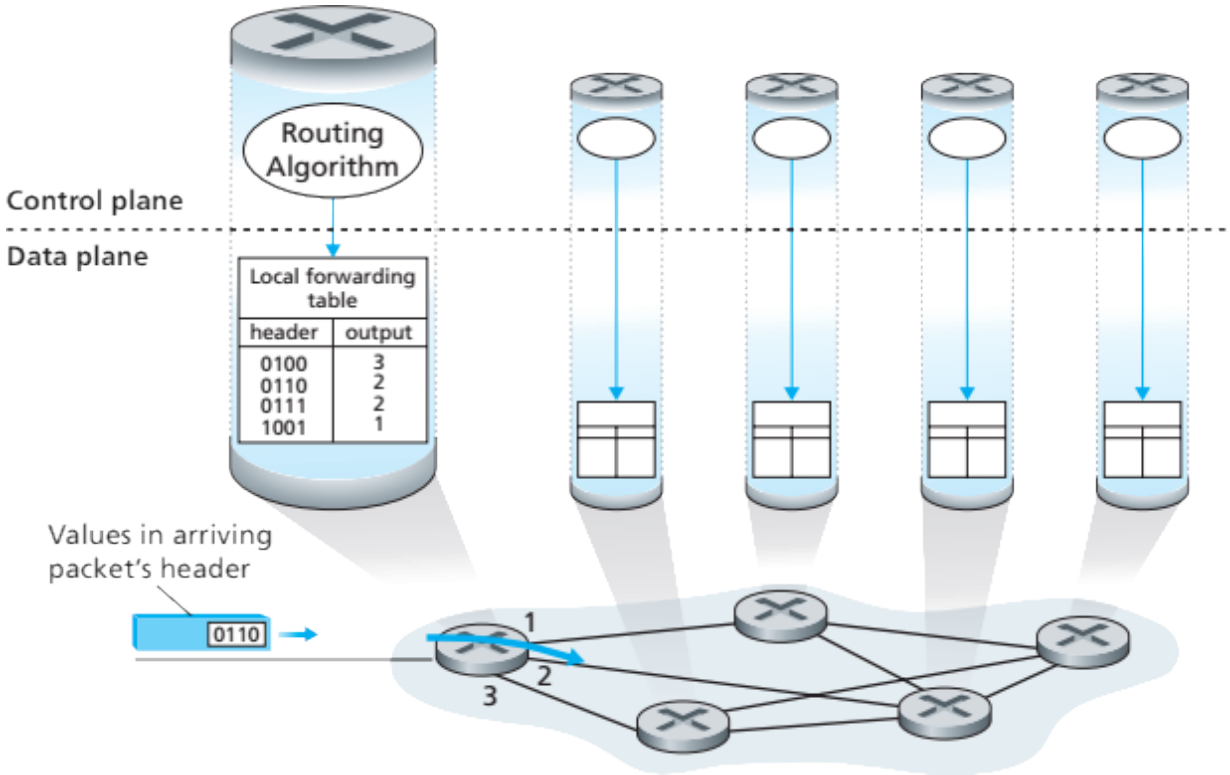
Role of Network Layer

- **Forwarding**: When a packet arrives at a router's input link, the router must move the packet to the appropriate output link. Forwarding is but one function implemented in the data plane.

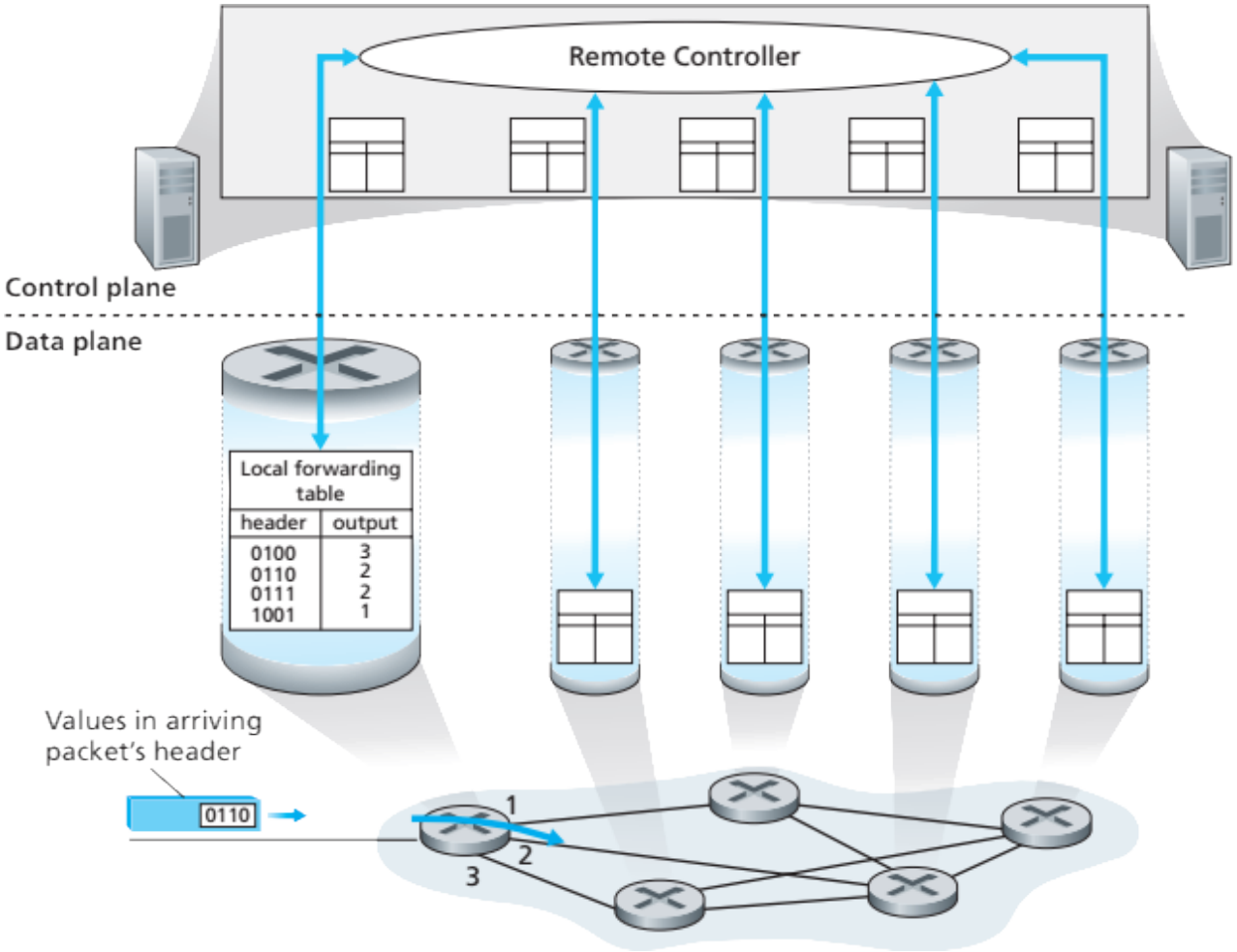
- **Routing**: The network layer must determine the route or path taken by packets as they flow from a sender to a receiver. The algorithms that calculate these paths are referred to as routing algorithms. Routing is implemented in the control plane of the network layer.

Data plane: Sending data. Control plane: Part which enables to send data. Routing helps in getting route table.

Control Plane: The Traditional Approach



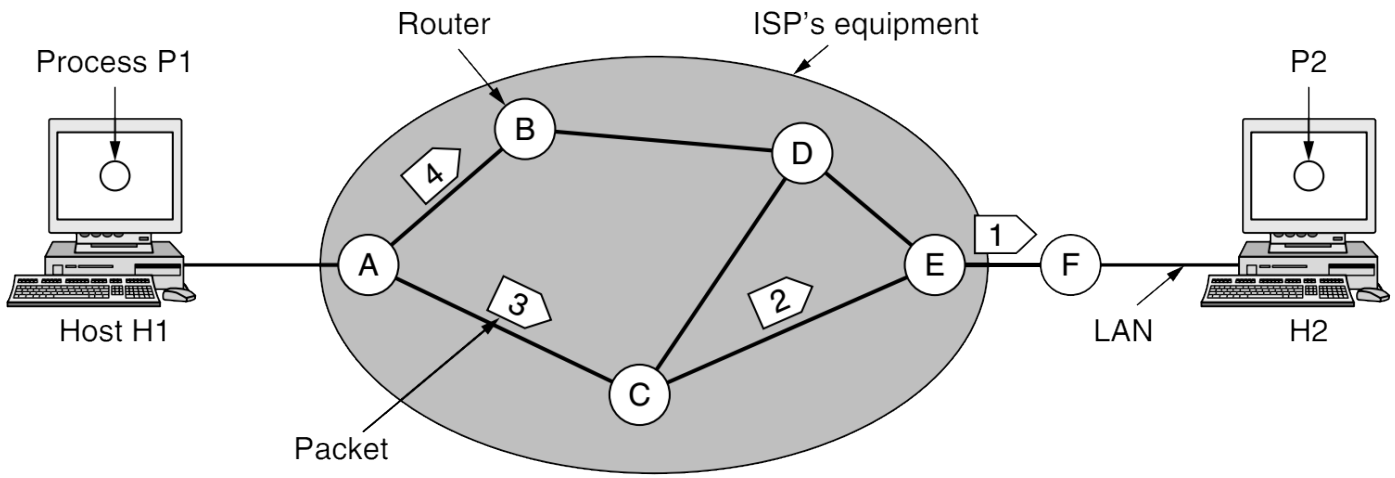
In traditional network, routers & switches are main players that take care of data flow. There are two fundamental elements: Data Plane & Control Planetraditiona



Possible Network Service Model

- *Guaranteed delivery*: Packet sent by a source host will eventually arrive at the destination host.
- *Guaranteed delivery with bounded delay*: Not only guarantees delivery of the packet, but delivery within a specified host-to-host delay bound.
- *In-order packet delivery*: Guarantees that packets arrive at the destination in the order that they were sent.
- *Guaranteed minimal bandwidth*: Emulates the behavior of a transmission link of a specified bit rate between sending and receiving hosts.
- *Security*: Encrypt all datagrams at the source and decrypt them at the destination, thereby providing confidentiality to all transport-layer segments.

Datagram Network — A Connectionless Service



A's table (initially)

Dest.	Line
A	–
B	B
C	C
D	B
E	C
F	C

A's table (later)

A	–
B	B
C	C
D	B
E	B
F	B

C's table

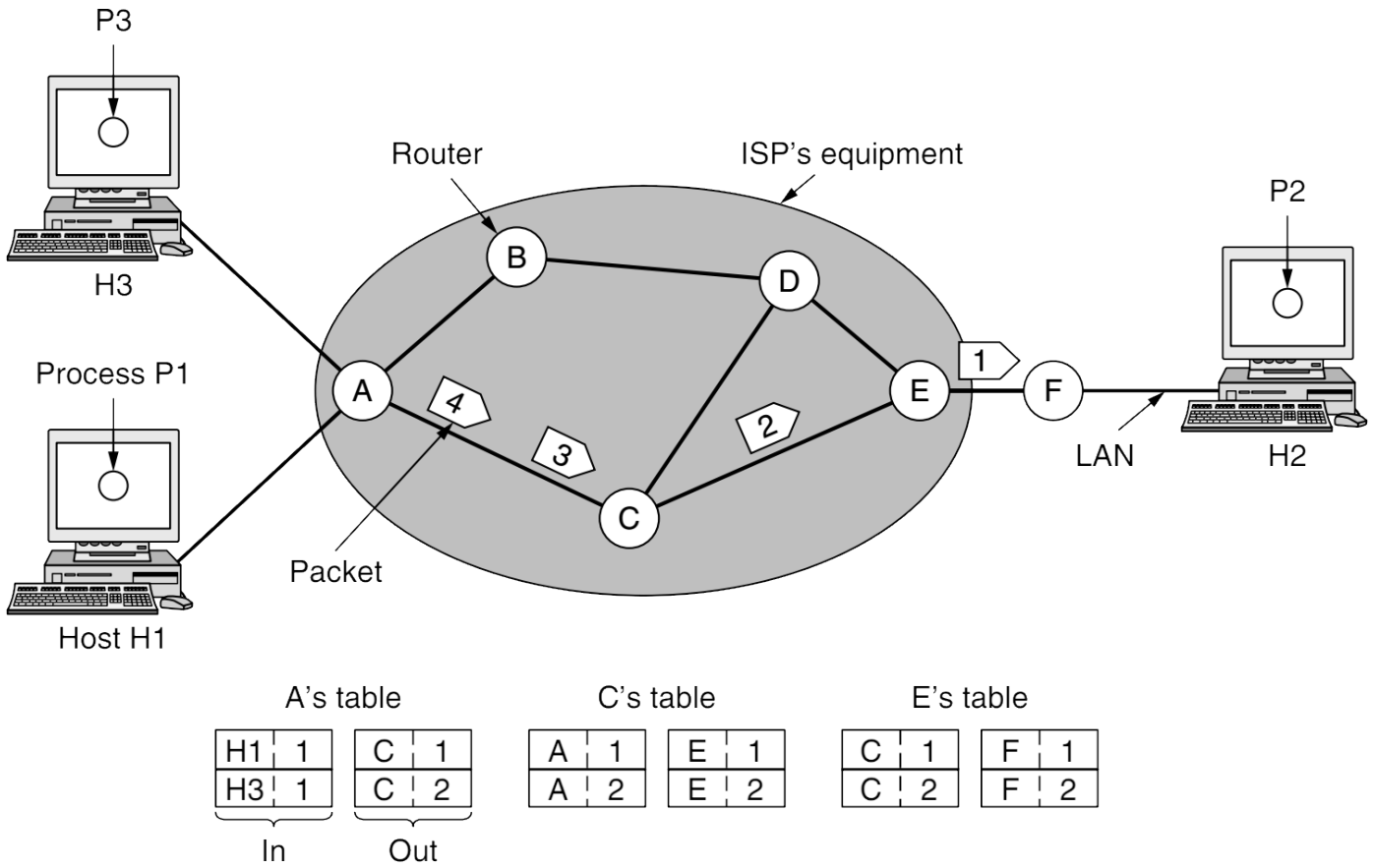
A	A
B	A
C	–
D	E
E	E
F	E

E's table

A	C
B	D
C	C
D	D
E	–
F	F

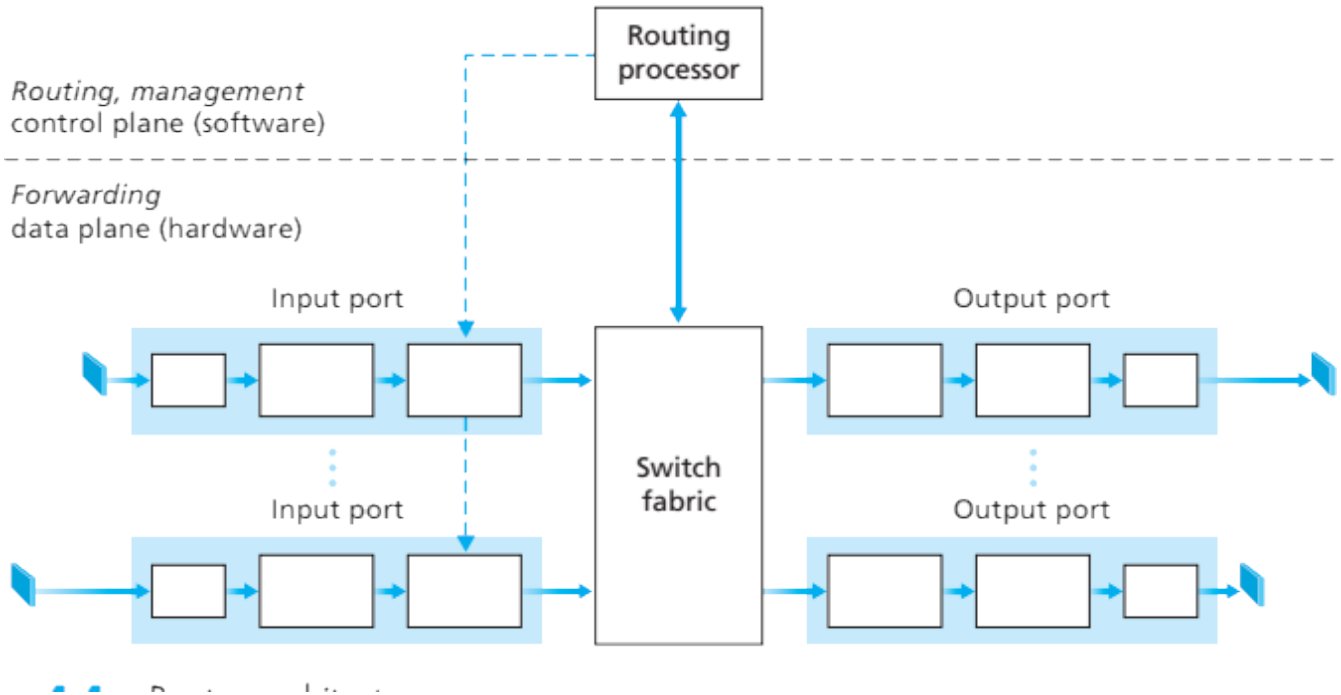
Virtual-Circuit Network — A Connection-Oriented Service

This is userful for inorder traversal of packets.



An example of a connection-oriented network service is **MPLS (MultiProtocol Label Switching)**.

What is inside a router?



Packet Scheduling

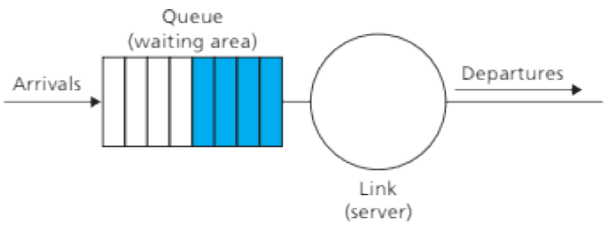


Figure: FIFO model

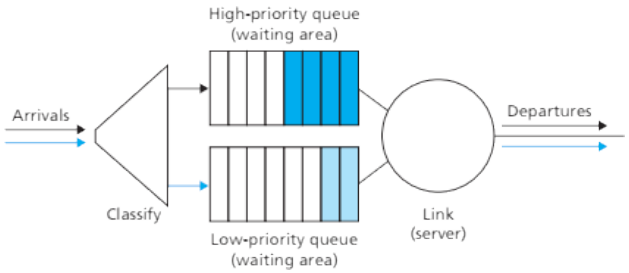


Figure: Priority queuing model

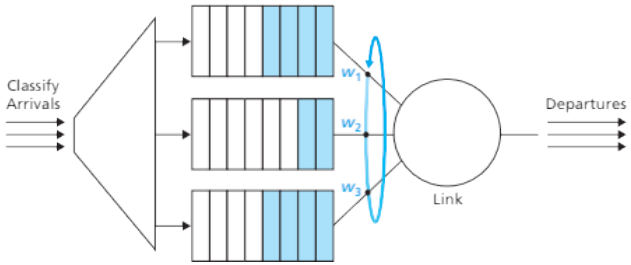


Figure: Weighted fair queuing

For Priority queue model:Premptive: Stop and do servic for high priority immediately and then come back to low priority.Non Premptive: Finish what was be