Computer Networks: A Systems Approach, 5e

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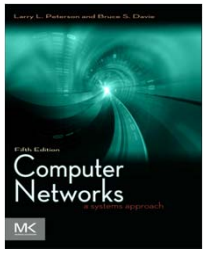


Chapter 3

Internetworking

Problems

- In Chapter 2 we saw how to connect one node to another, or to an existing network.
- How do we build networks of global scale?
- How do we interconnect different types of networks to build a large global network?

Chapter Outline

- Switching and Bridging
- Basic Internetworking (IP)
- Routing

Chapter Goal

- Understanding the functions of switches, bridges and routers
- Discussing Internet Protocol (IP) for interconnecting networks
- Understanding the concept of routing

Switching and Forwarding

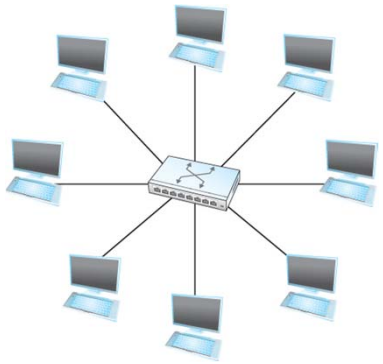
- Store-and-Forward Switches
- Bridges and Extended LANs
- Cell Switching
- Segmentation and Reassembly

Switching and Forwarding

- Switch
  - A mechanism that allows us to interconnect links to form a large network
  - A multi-input, multi-output device which transfers packets from an input to one or more outputs

Switching and Forwarding

Switches add the star topology to the point-to-point link, bus (Ethernet), and ring (802.5 and FDDI) topologies



Switching and Forwarding

Properties of this star topology

- Switches have a fixed number of inputs and outputs – limits the number of hosts supported by a switch
- Large networks have interconnected switches
- Use point-to-point links for connections of switches and hosts
- Additional hosts do not impact performance of current hosts
  - Each host has its own link to the switch
  - Switch will need sufficient capacity to handle its hosts
  - Ethernet is shared media (all hosts must share the same link)

Switching and Forwarding

The last claim cannot be made for the shared media network (discussed in Chapter 2)

- It is impossible for two hosts on the same Ethernet to transmit continuously at 10Mbps because they share the same transmission medium
- Every host on a switched network has its own link to the switch
  - Possible for many hosts to transmit at the full link speed (bandwidth)
  - Switch should be designed with enough aggregate capacity

Switching and Forwarding

- A switch is connected to a set of links
- For each link, the switch runs the appropriate data link protocol to communicate with that node
- Switches receive incoming packets on one of its links and transmit them on a different link(s)
  - This function is referred as ***switching and forwarding***
  - According to OSI architecture this is the main function of the network layer

Switching and Forwarding

- How does the switch decide which output port to place each packet on?
  - It looks at the header of the packet for an identifier that it uses to make the decision
  - Two common approaches
    - *Datagram or Connectionless approach*
    - *Virtual circuit or Connection-oriented approach*
  - A third approach *source routing* is less common

Switching and Forwarding

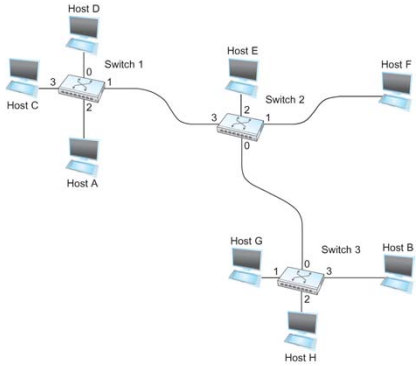
- Assumptions
  - Each host has a globally unique address
  - There is some way to identify the input and output ports of each switch
    - We can use numbers
    - We can use names

Switching and Forwarding

- Datagrams
  - Every packet has information enabling any switch to decide how to get it to destination
  - Every packet contains the complete destination address
  - Switch will use forwarding (routing) tables
    - Easy to set up for small fixed networks
    - Large dynamic networks rely on routing protocols to establish the tables (section 3.3)

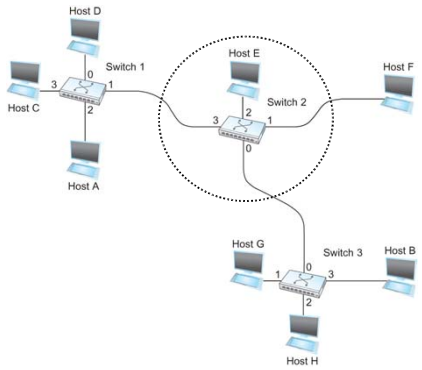
Switching and Forwarding

An example switched network



- To decide how to forward a packet, a switch consults a ***forwarding table*** (***routing table***)

Switching and Forwarding



Destination	Port
A	3
B	0
C	3
D	3
E	2
F	1
G	0
H	0

Forwarding Table for Switch 2

Switching and Forwarding

Characteristics of Connectionless (Datagram) Network

- A host can send a packet anywhere at any time,
- Any packet that turns up at the switch can be immediately forwarded (assuming a correctly populated forwarding table)
- When a host sends a packet,
  - it has no way of knowing if the network is capable of delivering it or
  - if the destination host is even up and running

Switching and Forwarding

Characteristics of Connectionless (Datagram) Network

- Each packet is forwarded independently of previous packets sent to the same destination.
  - Thus two successive packets from host A to host B may follow completely different paths
- A switch or link failure might not have any serious effect on communication if it is possible to find an alternate route around the failure and update the forwarding table accordingly