CSCI 446 Introduction to Computer Networks

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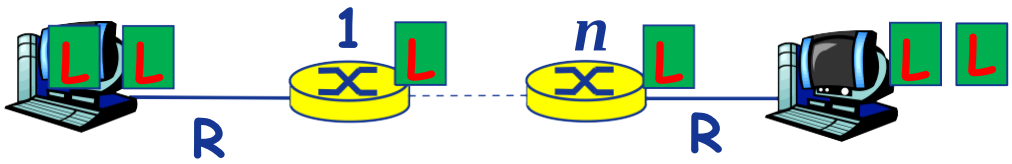
Topic

Data Exchange: Message/Packet Switch (3)

The delivery time of the message for the packet exchange



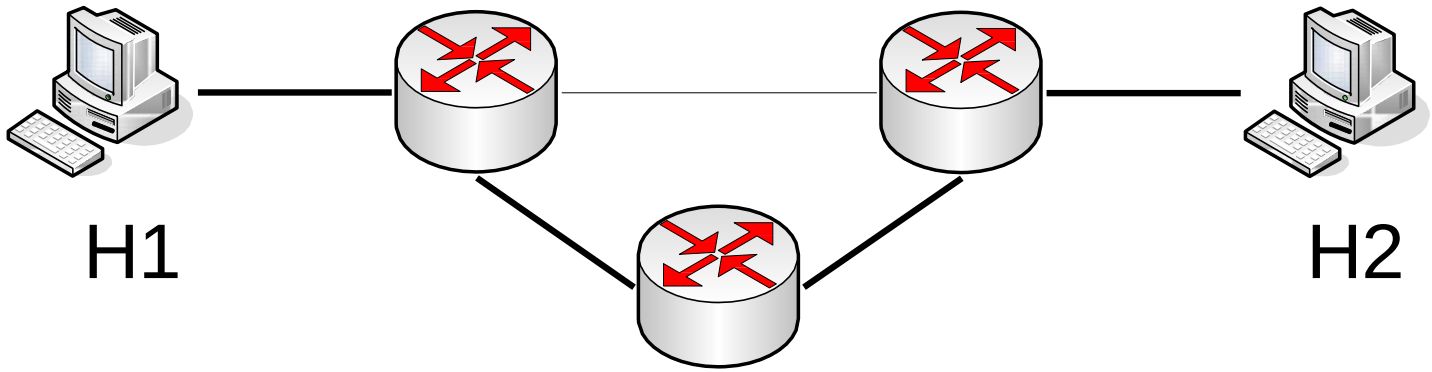
- Message: M bits
- Link bandwidth (data transfer rate): R bps
- Packet length(size): L bits
- #hops: *h*
- #routers: *n*

$$T=M/R+(h-1)L/R$$

$$=M/R+nL/R$$

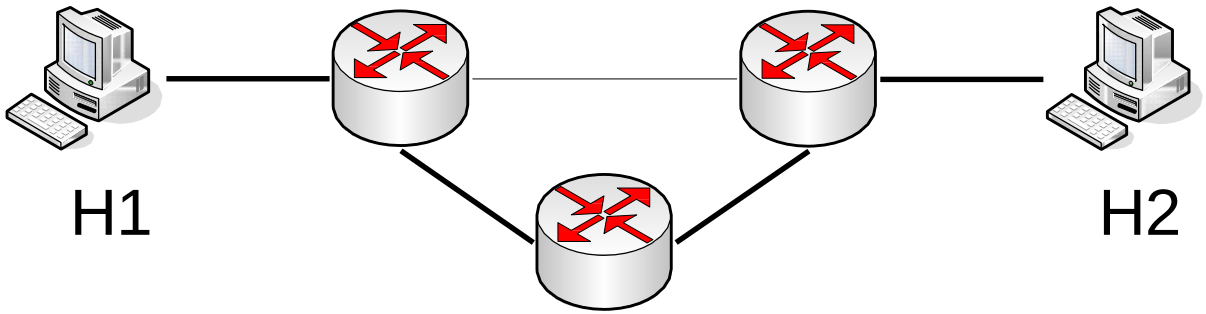
Example 1.1

In the packet-switched network using the "store-and-forward" method shown in the figure below, the data transmission rate of all links is 100 Mbps, the packet size is 1,000 B, and the packet header size is 20 B. If host H1 sends a file with a size of 980 000 B to host H2, without considering the packet disassembly time and propagation delay, what is the minimum time required from H1 sending to H2 receiving?



Example 1.1

Solution. A file with a size of 980 000 B needs to be divided into 1000 packets, each with 1 000 B. The transmission delay required by H1 to send the entire file is (980 000+20*1000)*8/100000000=80ms. According to the basic principle of routing, all data packets should be forwarded by two routers, so we will need to add the time for the last packet to go through the two routers. The transmission delay of each forwarding is 2*1000*8/100000 000=0.16ms. Therefore, it takes at least 80+0.16=80.16ms for H2 to receive a complete file.

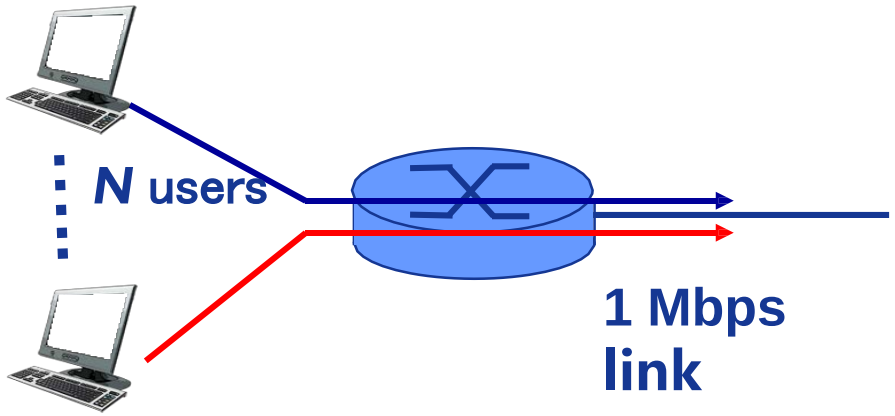


Packet switching vs circuit switching?

Example:

- 1 Mbps link;
- Each user:

1. 100 kbps for "activity"
2. Average activity time 10%



- ❑ **Circuit switching**: 10 users
- ❑ **Packet switching**: For 35 users, the probability of more than 10 users simultaneously active <0.0004
- ❑ Packet switching allows **more users** to use the network at the same time!
- ➢ Full sharing of network resources

Packet switching vs circuit switching?

Is packet switching definitely better than circuit switching?

- Suitable for burst data transmission network
  - Full resource sharing
  - Simple, no call setup
- May cause congestion: packet delay and loss
  - Need protocols to handle reliable data transmission and congestion control
- Q: How to provide circuit-level performance guarantee?
  - For example, bandwidth guarantee required for audio/video applications

Thank you!