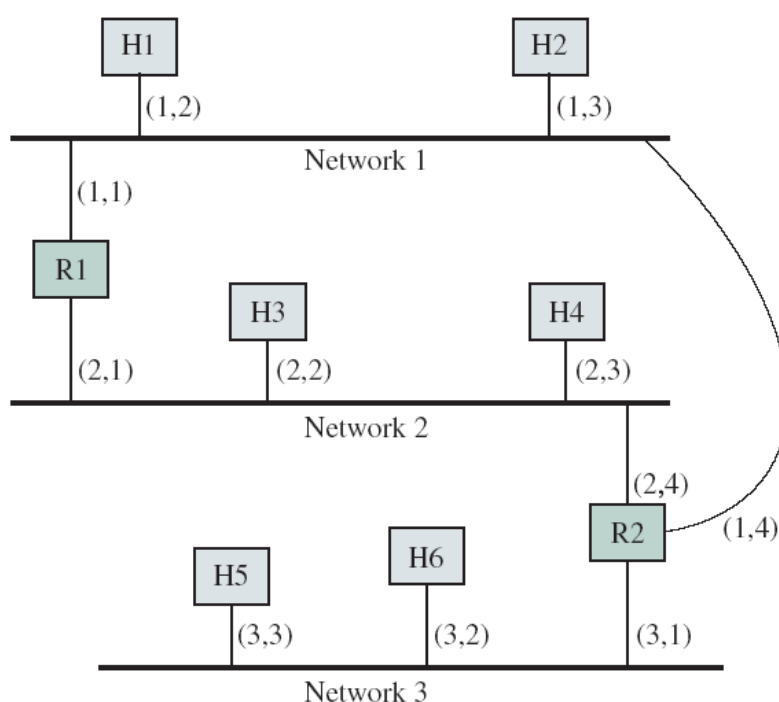


Part I: Exercises (Due 1386/12/26)

1. The president of the Specialty Paint Corp. gets the idea to work with a local beer brewer to produce an invisible beer can (as an anti-litter measure). The president tells her legal department to look into it, and they in turn ask engineering for help. As a result, the chief engineer calls his counterpart at the other company to discuss the technical aspects of the project. The engineers then report back to their respective legal departments, which then confer by telephone to arrange the legal aspects. Finally, the two corporate presidents discuss the financial side of the deal. Is this an example of a multilayer protocol in the sense of the OSI model?
2. What is the principal difference between connectionless communication and connection-oriented communication?
3. Two networks each provide reliable connection-oriented service. One of them offers a reliable byte stream and the other offers a reliable message stream. Are these identical? If so, why is the distinction made? If not, give an example of how they differ.
4. In some networks, the data link layer handles transmission errors by requesting damaged frames to be retransmitted. If the probability of a frame's being damaged is p , what is the mean number of transmissions required to send a frame? Assume that acknowledgements are never lost.
5. Which of the OSI layers handles each of the following:
 - a. Dividing the transmitted bit stream into frames.
 - b. Determining which route through the subnet to use.
 - c. Providing end-to-end communication with reliable service
 - d. Providing node-to-node communication with reliable service.
6. If the unit exchanged at the data link level is called a frame and the unit exchanged at the network level is called a packet, do frames encapsulate packets or do packets encapsulate frames? Explain your answer.
7. Suppose two Ethernet LANs are interconnected by a box that operates as follows. The box has a table that tells it the physical addresses of the machines in each LAN. The box listens to frame transmissions on each LAN. If a frame is destined to a station at the other LAN, the box retransmits the frame onto the other LAN; otherwise, the box does nothing.
 - a. Is the resulting network still a LAN? Does it belong in the data link layer or the network layer?
 - b. Can the approach be extended to connect more than two LANs? If so, what problems arise as the number of LANs becomes large?
8. Compare circuit-switched and packet-switched networks from these aspects:
 - a. Routing protocols
 - b. Delay
 - c. Applications
 - d. Connection-oriented or connection-less
 - e. Have you ever heard about virtual circuit networks? Search and compare it with previous topologies.

9. Suppose a TCP entity receives a digital voice stream from the application layer. The voice stream arrives at a rate of 8000 bytes/second. Suppose that TCP arranges bytes into block sizes that result in a total TCP and IP header overhead of 50 percent. How much delay is incurred by the first byte in each block?
10. Consider an application that transmits data at a steady rate (e.g., the sender generates one packet of N bits every k time units, where k is small and fixed). Also, when such an application starts, it will stay on for relatively long period of time.
- Would a packet-switched network or a circuit-switched network be more appropriate for this application? Why?
 - Suppose that a packet-switched network is used and the only traffic in this network comes from such applications as described above. Furthermore, assume that the sum of the application data rates is less than the capacities of each and every link. Is some form of congestion control needed? Why or why not?
11. The internet below consists of three LANs-interconnected by two routers. Assume that the hosts and routers have the IP addresses as shown.
- Suppose that all traffic from network 3 that is destined to H1 is to be routed directly through router R2 and that all other traffic from network 3 is to go to network 2. What routing table entries should be present in the network 3 hosts and in R2?



- Suppose that all traffic from network 2 to network 3 is to be routed directly through R2. What routing table entries should be present in the network 1 hosts and in R2?

Part II: Projects (Due 1387/1/22)

1. What is Internet phone? Describe some of the existing products for Internet phone. Find some of the Web sites of companies that are in the Internet phone business.
2. Use traceroute to determine the path from your home (or any where outside the AUT) to AUT web sit, while capturing the packets using Ethreal (Ethreal is an open source network protocol analyzer and it is available at: <http://www.ethereal.com>).
 - a. Using the output from traceroute, try to identify how many different networks and service providers are traversed.
 - b. Using the operation of traceroute by examining the contents of the packets.
3. Write a file transfer application that runs over TCP.