



CS6330/CS4330: COMPUTER NETWORKS

ASSIGNMENT 6

2. Two communicating devices are using a single-bit even parity check for error detection. The transmitter sends the byte 10101010 and, because of channel noise, the receiver gets the byte 10011010. Will the receiver detect the error? Why or why not?
4. Compute the Internet checksum for the data block E3 4F 23 96 44 27 99 F3. Then perform the verification calculation.
5. For $P = 110011$ and $M = 11100011$, find the CRC.
6. A CRC is constructed to generate a 4-bit FCS for an 11-bit message. The generator polynomial is $X^4 + X^3 + 1$.
 - a. Encode the data bit sequence 10011011100 (leftmost bit is the least significant) using the generator polynomial and give the codeword.
 - b. Now assume that bit 7 (counting from the LSB) in the codeword is in error and show that the detection algorithm detects the error.
7.
 - a. In a CRC error-detecting scheme, choose $P(X) = X^4 + X + 1$. Encode the bits 10010011011.
 - b. Suppose the channel introduces an error pattern 100010000000000 (i.e., a flip from 1 to 0 or from 0 to 1 in position 1 and 5). What is received? Can the error be detected?
 - c. Repeat part (6) with error pattern 100110000000000.
- R9. How big is the MAC address space? The IPv4 address space? The IPv6 address space?
- R10. Suppose nodes A, B, and C each attach to the same broadcast LAN (through their adapters). If A sends thousands of IP datagrams to B with each encapsulating frame addressed to the MAC address of B, will C's adapter process these frames? If so, will C's adapter pass the IP datagrams in these frames to the network layer C? How would your answers change if A sends frames with the MAC broadcast address?
- R11. Why is an ARP query sent within a broadcast frame? Why is an ARP response sent within a frame with a specific destination MAC address?
- R15. What is the maximum number of VLANs that can be configured on a switch supporting the 802.1Q protocol? Why?

P1. Suppose the information content of a packet is the bit pattern 1110 0110 1001 1101 and an even parity scheme is being used. What would the value of the field containing the parity bits be for the case of a two-dimensional parity scheme? Your answer should be such that a minimum-length checksum field is used.

P2. Show (give an example other than the one in [Figure 6.5](#)) that two-dimensional parity checks can correct and detect a single bit error. Show (give an example of) a double-bit error that can be detected but not corrected.

P14. Consider three LANs interconnected by two routers, as shown in [Figure 6.33](#).

- Assign IP addresses to all of the interfaces. For Subnet 1 use addresses of the form 192.168.1.xxx; for Subnet 2 use addresses of the form 192.168.2.xxx; and for Subnet 3 use addresses of the form 192.168.3.xxx.
- Assign MAC addresses to all of the adapters.
- Consider sending an IP datagram from Host E to Host B. Suppose all of the ARP tables are up to date. Enumerate all the steps, as done for the single-router example in [Section 6.4](#).
- Repeat (c), now assuming that the ARP table in the sending host is empty (and the other tables are up to date).

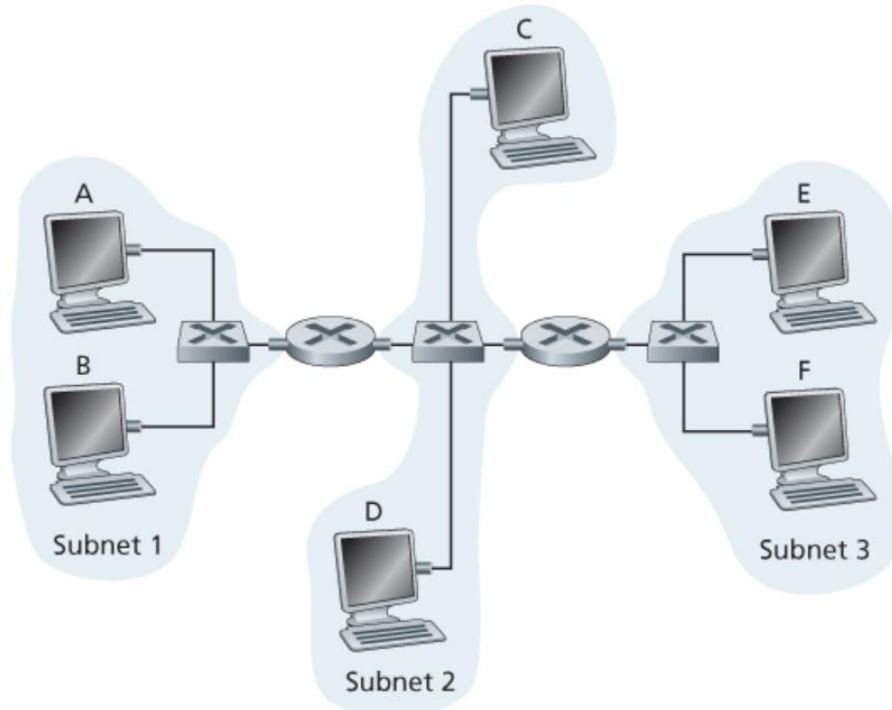




Figure 6.33 Three subnets, interconnected by routers

P15. Consider [Figure 6.33](#) . Now we replace the router between subnets 1 and 2 with a switch S1, and label the router between subnets 2 and 3 as R1.

- a. Consider sending an IP datagram from Host E to Host F. Will Host E ask router R1 to help forward the datagram? Why? In the Ethernet frame containing the IP datagram, what are the source and destination IP and MAC addresses?
- b. Suppose E would like to send an IP datagram to B, and assume that E's ARP cache does not contain B's MAC address. Will E perform an ARP query to find B's MAC address? Why? In the Ethernet frame (containing the IP datagram destined to B) that is delivered to router R1, what are the source and destination IP and MAC addresses?
- c. Suppose Host A would like to send an IP datagram to Host B, and neither A's ARP cache contains B's MAC address nor does B's ARP cache contain A's MAC address. Further suppose that the switch S1's forwarding table contains entries for Host B and router R1 only. Thus, A will broadcast an ARP request message. What actions will switch S1 perform once it receives the ARP request message? Will router R1 also receive this ARP request message? If so, will R1 forward the message to Subnet 3? Once Host B receives this ARP request message, it will send back to Host A an ARP response message. But will it send an ARP query message to ask for A's MAC address? Why? What will switch S1 do once it receives an ARP response message from Host B?

P18. Suppose nodes A and B are on the same 10 Mbps broadcast channel, and the propagation delay between the two nodes is 325 bit times. Suppose CSMA/CD and Ethernet packets are used for this broadcast channel. Suppose node A begins transmitting a frame and, before it finishes, node B begins transmitting a frame. Can A finish transmitting before it detects that B has transmitted? Why or why not? If the answer is yes, then A incorrectly believes that its frame was successfully transmitted without a collision. *Hint:* Suppose at time $t = 0$ bits, A begins transmitting a frame. In the worst case, A transmits a minimum-sized frame of $512 + 64$ bit times. So A would finish transmitting the frame at $t = 512 + 64$ bit times. Thus, the answer is no, if B's signal reaches A before bit time $t = 512 + 64$ bits. In the worst case, when does B's signal reach A?

P21. Consider [Figure 6.33](#)  in problem P14. Provide MAC addresses and IP addresses for the interfaces at Host A, both routers, and Host F. Suppose Host A sends a datagram to Host F. Give the source and destination MAC addresses in the frame encapsulating this IP datagram as the frame is transmitted (i) from A to the left router, (ii) from the left router to the right router, (iii) from the right router to F. Also give the source and destination IP addresses in the IP datagram encapsulated within the frame at each of these points in time.

P26. Let's consider the operation of a learning switch in the context of a network in which 6 nodes labeled A through F are star connected into an Ethernet switch. Suppose that (i) B sends a frame to E, (ii) E replies with a frame to B, (iii) A sends a frame to B, (iv) B replies with a frame to A. The switch table is initially empty. Show the state of the switch table before and after each of these events. For each of these events, identify the link(s) on which the transmitted frame will be forwarded, and briefly justify your answers.

WIRESHARK LAB 6: ETHERNET AND ARP

The lab has been uploaded to the Canvas system under the Wireshark Labs section. You are required to:

1. submit screenshots of your work
2. answer the questions in the lab document.