Problem 1

1. Ethernet has a period of silence, which separates each frame. Without a minimum packet size, we no longer require a length field. Ethernet originally requires a length field in case we need to pad a message that is shorter than the minimum packet size. Without a length field, we will not know which bits the padding and which bits are the actual data. However, Nethernet will not pad packets because there is no minimum packet size and does not require a length field.
2. Chart, line chart

   Description automatically generatedNo, this rule is no longer valid in Nethernet. In Ethernet, we must discard packets of length less than 64 bytes because the minimum packet size is 64 bytes. However, in Nethernet, there is no minimum packet size and packets of length less than 64 bytes are valid.
3. Consider stations A and B as shown in the figure to the right. A is trying to send a small packet (< 64 bytes) to B and B is trying to send a large packet (>> 64 bytes) to A. While B is sending the large packet, the small packet that A sends also arrives. According to the new rule given in the problem, a station waits and detects possible transmissions only when the packet size is less than 64 bytes. Therefore, in this case, B would not detect any collisions if we did not implement normal means of error detection in Nethernet.

Diagram

Description automatically generated

1. We want all nodes on the network (even those not sending or receiving) to detect when collisions happen. Consider the scenario in the figure on the right. A is sending a small packet to B and B is sending a small packet to A at the same time. Both A and B will detect collisions because of the new rule of Nethernet (A and B both detect transmissions within the 51.2 usec period). On the other hand, there is no voltage spike at node C. Also, node C is not sending any packets, so it is not waiting for 51.2 usec.

Diagram

Description automatically generated

1. Consider the figure to the right where A is sending to C and B is sending to A at the same time. When A first sends to B, B will receive the clean packet and store it. It will not detect any collisions, so it will not expect retransmissions. However, A will detect a collision while waiting 51.2 usec after sending its small packet (it detects a signal from C). So, A will retransmit its message to B. B will receive the second packet, which is a duplicate.

Problem 2

1. Both bridges will map MAC address V to the upper interface. The packet will go to all three LANs (LANs 1, 2, 3). When B1 receives the packet, it will map V to upper interface and flood (i.e., send the packet to the other interface). So, the packet will be on LAN 2. When B2 receives the packet, it will map V to the upper interface and flood (i.e., send the packet to the lower interface). Then, the packet will be on LAN 3 and the victim V will receive the packet.
2. When S replies to V, the packet will not go to the real victim. B1 will receive S and will look at the destination MAC address V. It will look at its table and see that V is mapped to the upper interface. Thus, B1 will not transmit the message to the lower interface. To pick up the packet, H must be listening for packets whose destinations are MAC address V.
3. Below is the sequence of sends:
   1. **V sends a packet to S**. Both bridges (B1 and B2) will create an entry for the MAC address V and map it to their lower interfaces. Because the destination MAC address (S) is not in the table yet, they also both will flood and send the packet to the other interface.
   2. **H sends a packet to S with a forged source address V.** S will receive the packet because it is on the same LAN. Both bridges will send the packet to the lower interface because they flood. The message will end up on all LANs. Since both bridges already have a mapping for V, they will not create a new entry.
   3. **S replies to V**. Since both bridges have the MAC address V mapped to their lower interfaces, the message will end up on all LANs. Eventually, the victim receives the unsolicited packet from S. All bridges now map S to their upper interfaces.
   4. **The victim V sends a RESET to S.** Since both bridges have S mapped to the upper interface, the message eventually ends up on LAN 1 and S receives the RESET message.
4. A bridge could look at the source MAC address of all packets that it receives. If the MAC address is stored in the bridging table and the interface the message is received from is different than the one stored in the table, then (assuming no corruption) someone forged the source address of their packets.

Problem 3

1. We can stop continuous circulation by adding the following logic. When the bridge receives a packet with source address S and destination address D, we first check if S is already in the bridging table. Then, we check if D is in the bridging table. If D is not in the bridging table (or we are broadcasting), then we flood. This time, we will not send the packet to the interface we have stored for S.

In the given example, when the counterclockwise packet reaches B2, although the bridge floods, it does not send the packet to any of its interfaces because:

1. The packet is coming from the lower interface
2. The source address of the packet (S) is mapped to the upper interface

Similarly, when the clockwise packet reaches B1, we do not send the packet to any interface.

1. What exactly is Alyssa’s method?

Problem 4

1. Below are the sequence of events:
   1. D broadcasts an ARP request on the LAN requesting A’s MAC address (given its IP address)
   2. The bridge receives the ARP request. It maps D’s MAC address to the upper interface. Because the ARP request is a broadcast, the packet floods (i.e., it is transmitted to all other interfaces). So, the message gets on the lower LAN (where A is connected).
   3. A receives the ARP request and sees its own IP address in the message
   4. A sends an ARP reply with its MAC address (which is all 1s) destined to D’s MAC address
   5. The bridge receives the ARP reply. The destination (D) is stored in the bridging table, so it transmits the message to the upper interface.
   6. D receives the ARP reply on the LAN
   7. D puts the message packet with destination MAC address of all 1s on the data link
   8. All nodes on the data link (E, A, B, C) will receive this packet since the MAC address of all 1s is the broadcast address

Bridge table maps MAC to Interface

2. H must look for packets with destination of V?

3. Find a sequence of sends and receives that result in V picking up the packet

Multicast and unicast MAC addresses. All nodes are listening for specific addresses

4.

Problem 3

1. When an unknown destination is seen by bridge, we flood (i.e., send to all other interfaces).

Multicast: A sends to both B1 and B2. B1 sends to B3. B3 sends to B2, so B2 gets the same packet again. The original packet B2 got will go to the lower right LAN. Then, B3 will send it to B1 again.

We have two packets circulating (one clockwise and one couterclockwise) moving through the system very fast.

Solution (maybe): If we are sending to (src, dest) at bridge, also do not send to the interface of src if we have it saved in our bridging table

Problem 4

Masking IP address to only look at the prefix:

IP & mask, where mask == 11111111 111111111 0000000000 0000000000 &

127. 1 2 3

==. 127 1 0 0

A thinks its MAC address is all 1s == FF ; FF ; FF ; FF ; FF ; FF

Broadcast addrtess is FF FF FF FF FF FF, so all nodes will pick up this destination address

Address resolution protocol -> ARP, which maps IP addresses to MAC addresses

1. Hint: it causes a broadcast storm (read problem)

E.g., T = 5, M = 3

But keep T and M general when answering the question