



COMPUTER COMMUNICATION NETWORK

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Department of

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COMPUTER COMMUNICATION NETWORK

Numerical Problems - 2

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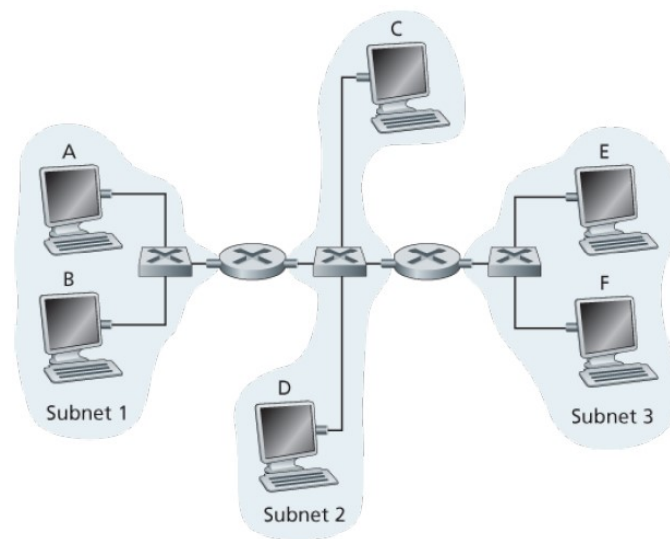
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Problem 1

- Consider three LANs interconnected by two routers, as shown in Figure
- A) Assign IP addresses to all of the interfaces. For Subnet 1 use addresses of the form 192.168.1.xxx; for Subnet 2 uses addresses of the form 192.168.2.xxx; and for Subnet 3 use addresses of the form 192.168.3.xxx.
- B) Assign MAC addresses to all of the adapters.
- C) 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
- D) Repeat (c), now assuming that the ARP table in the sending host is empty (and the other tables are up to date).

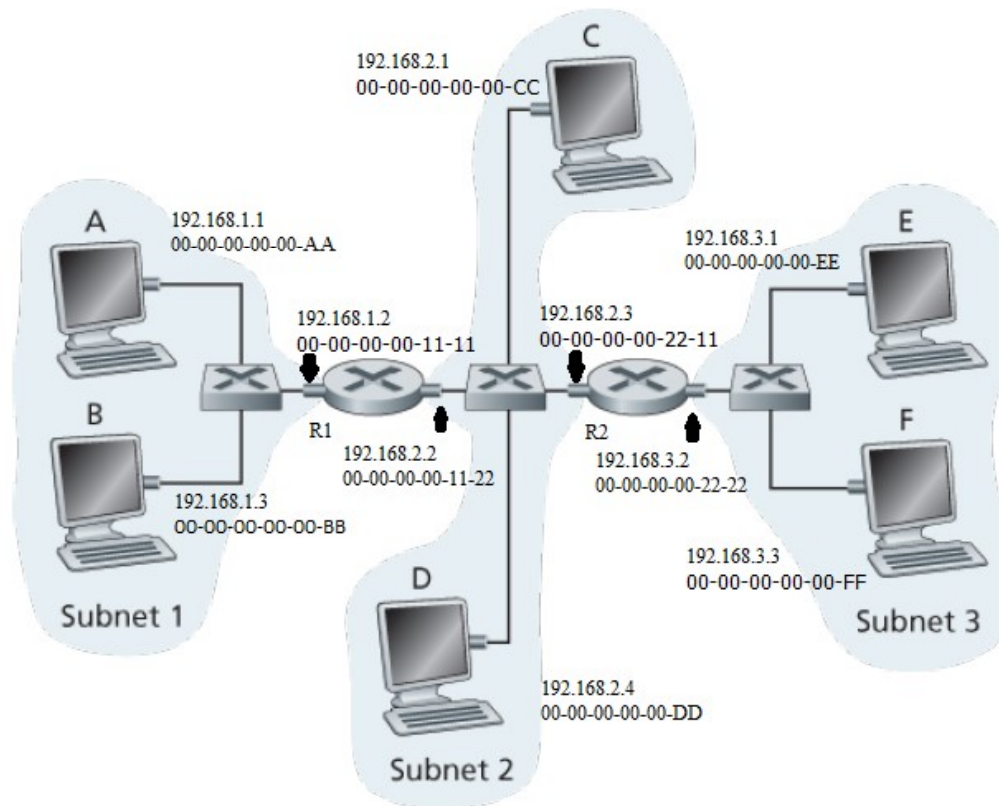


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Problem 1 - Solution

- A) and B)

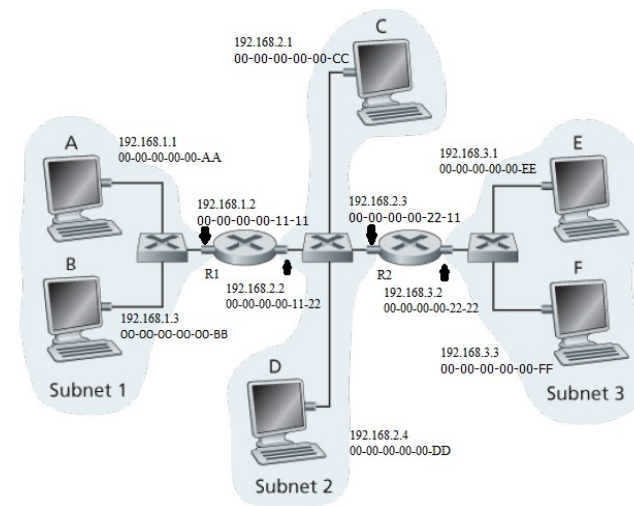


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Problem 1 - Solution

- C) From gateway configuration of E, it finds that that the datagram should be forwarded to 192.168.3.2.
- E creates and Ethernet packet with MAC address 00-00-00-00-22-22.
- R2 receives the packet and extracts the datagram. From packet forwarding table it finds that the datagram need to be forwarded to 198.162.2.2 interface
- R2 sends the Ethernet packet to R1 with destination MAC 00-00-00-00-11-22 and source MAC 00-00-00-00-22-11 using interface with address of 198.162.2.3.
- R1 finds that destination LAN is available on its interface with address 192.168.1.2 and so send Ethernet packet to MAC address 00-00-00-00-00-BB



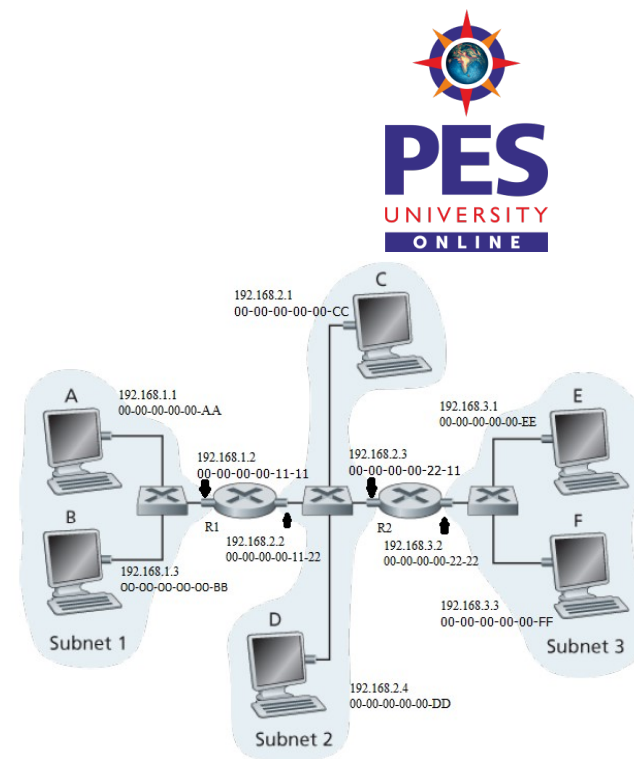
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Problem 1 - Solution

- D) As ARP table at E is empty it need to know MAC address of 192.168.3.2.
- So it sends out ARP query message with broadcast MAC address FF-FF-FF-FF-FF-FF
- R2 receives query message and respond to E using source MAC 00-00-00-00-22-22 and destination MAC 00-00-00-00-00-EE
- After getting the message, E populates its ARP table with MAC address of R2 interface with 192.168.3.2
- Rest of the operation is same as C)



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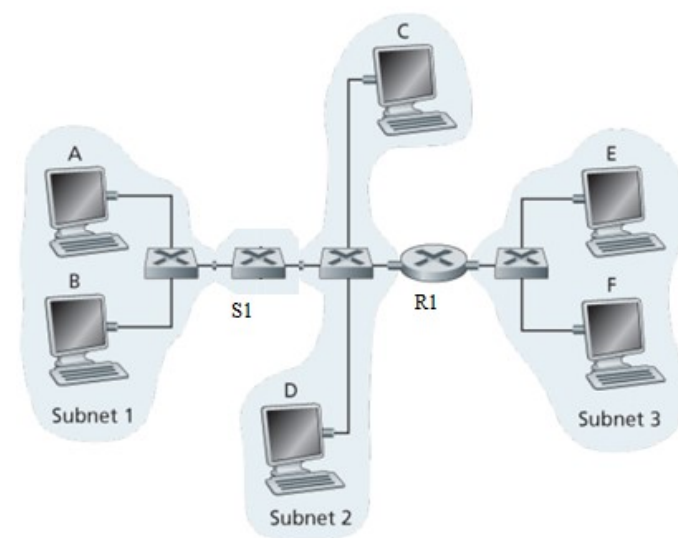
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Numerical Problems - 2



Problem 2

- 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?

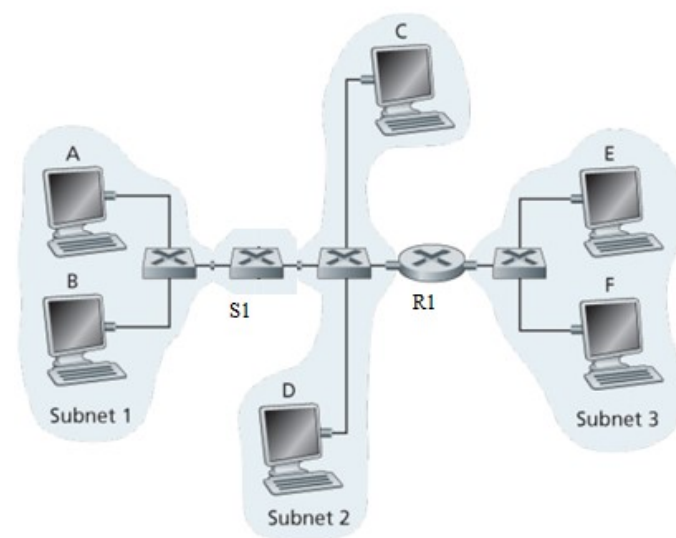


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Problem 2

- 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?

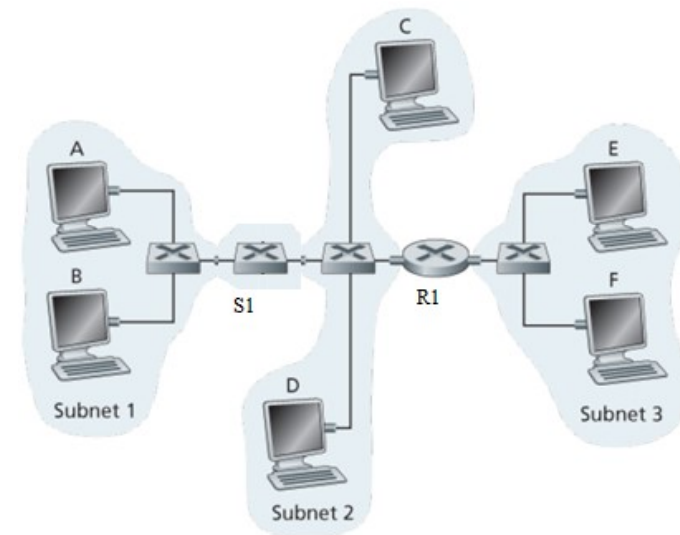


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Problem 2 - Solution

- A) From IP addresses E can understand that both are on the same network. Default gateway router is required when packet need to be sent to different network. So E will not send it to gateway router.
- Source IP and MAC are IP and MAC address of E
- Destination IP and MAC are IP and MAC address of F

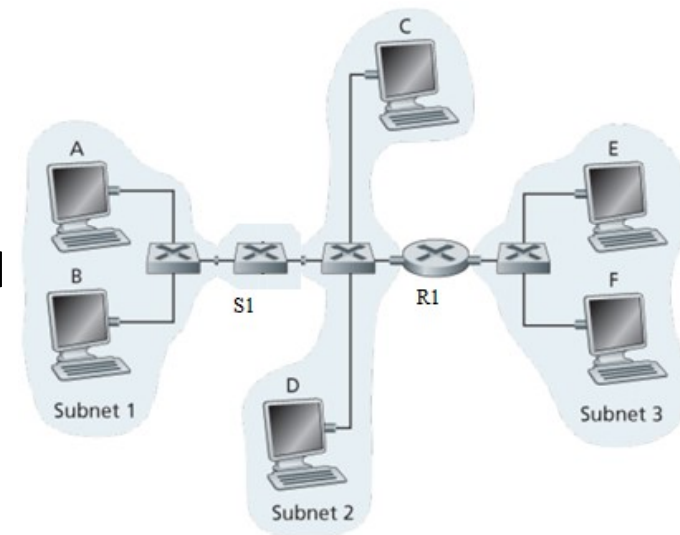


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Problem 2 - Solution

- B) From IP addresses of B, E can understand that both are not on the same network. So there is no need of caching MAC of B and hence no need of sending ARP request.
- Rather it need to know MAC address of default gateway router to handover the packet. If it is not in cache it will send ARP request.
- Source IP is IP address of E
- Source MAC is MAC address of E
- Destination IP is IP address of B
- Destination MAC is MAC address R1 which is gateway



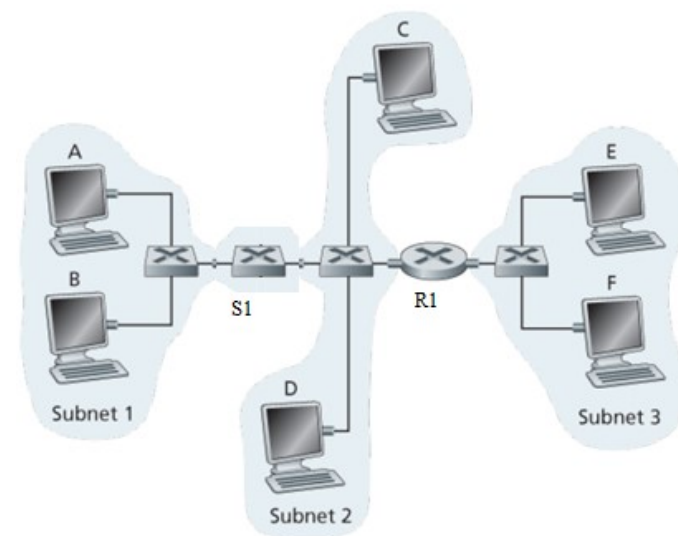
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Numerical Problems - 2



Problem 2 - Solution

- C) As A broadcast ARP message all nodes connected on the LAN will receive
- R1 will also receive the message on the interface it is connected to that LAN but it will not forward as ARP is for a LAN only, no need to forward.
- Switch S1 will learn MAC of A and its connected port from A's query message
- While B responds back it will not send ARP message because it come to know MAC of A from query message
- When switch S1 listen B's response it learns B's MAC address and associated port





THANK YOU

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