

Layered Architectures: Addressing, Encapsulation, and Layers Working Together II

Instructions:

- You are required to do each step (in part-1 and part-2) as instructed below.
 - You are required to write a report and submit within a week from your practical session. In your report, each problem/question should be addressed.
 - You are advised to **note any outputs and take trace files with you** when you leave the laboratory for later examination. These notes/files might help prepare a good report.
 - If you need laboratory computers to examine the trace files at a later time, approach the Instructors.
 - Once this practical session is over, there will be 'Lab Evaluation' to test and evaluate the skills and knowledge gained in this and earlier sessions (Lab3 + Lab4). This evaluation is done individually.
 - Marks: 60% from the Lab Evaluation and 40% from the reports (for Lab3 + Lab4).
 - Time: 2 hours.
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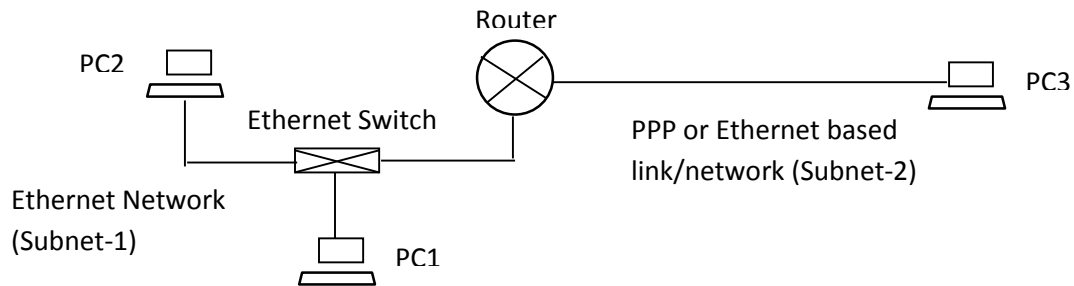


Fig. 1 Network scenario 1

- Make sure that the network shown in Fig. 1 has been configured properly (as you did in Lab-3. Consult the Instructor).
- Identify IP and MAC addresses used for devices/interfaces and mark them on Fig.1.
- Find (1) the routing table at PC2 and (2) Router's routing table. Show them (write).

Part-1: Transmission through different/many physical networks: Layers working together

Sending a packet from PC2 to PC3

- a. Use the *ping* tool to send frames from PC2 to PC3. Use the Wireshark at PC2 and PC3 to capture the frames sent and received. Save the trace-files (file names: CO223_Lab4_1a_PC2, CO223_Lab4_1a_PC3).
 1. Analyze the trace-file at PC2 (CO223_Lab4_1a_PC2) and identify the frames associated with your ping command. (You may use *filter* in the Wireshark).

2. Select a frame which is sent from PC2 as a result of the ping command. Give the frame no. in your trace. (In your report, attach a screenshot of the Wireshark panes with the selected frame)
- b. In the selected frame, observe the encapsulations by the different layers and the different fields in the headers.

1. State the source and destination IP addresses in the IP header of the packet.
2. Refer to the PC2's Routing table that you provided. Describe the steps/actions that take place once the packet is formed and how the packet is passed on to the respective network interface card/module towards the destination.
3. State the source and destination MAC addresses in the Ethernet header of the frame.
4. State **the component (PC1/PC2/PC3/Router-NIC-1 or Router-NIC-2)** associated with each of the following addresses of the selected frame:

Table 1: Components associated with addresses in the headers in the frame/packet sent from PC2 to Router

IP addresses	MAC addresses
Source IP address:	Source MAC address:
Destination IP address:	Destination MAC address:

5. Draw the frame with its different encapsulations and mark/label the IP addresses and MAC addresses at the correct places.
- c. Consider that the frame is sent by PC2 and received by the Router. Briefly describe how the Ethernet header is processed and the packet is passed on to the IP layer at the router.
- d. Refer to the Router's routing table that you provide and to the packet's destination IP address, and describe the steps/actions that take place at the IP layer of the router. Particularly describe how it determines the correct interface/NIC to which the packet should be sent to. Identify this interface/NIC.
- e. At this interface/NIC (above), further encapsulation is done and the frame is formed.
1. Guess and draw the frame with its different encapsulations and mark/label the IP addresses and MAC addresses at the correct places.
 2. State **the component (PC1/PC2/PC3/Router-NIC-1 or Router-NIC-2)** associated with each of the following addresses in the frame:

Table 2: Components associated with addresses in the headers in the frame/packet sent from Router to PC3

IP addresses	MAC addresses
Source IP address:	Source MAC address:
Destination IP address:	Destination MAC address:

- f. Analyzing the trace-file at PC3 (CO223_Lab4_1a_PC3) and ensuring that this frame is correctly received by the destination PC3.
1. What is the frame no. (in your trace) of the selected frame that is sent from PC2 and received by PC3? (In your report, attach a screenshot of the Wireshark panes with the selected frame)

2. Check the IP addresses and the MAC addresses of this frame in the Wireshark and verify that they are the same as you provided in *part-1.e.1*.
- g. Layers (In terms of the layers of network reference model or architecture) working together:
1. Compare the two tables, Table 1 (*part-1.b.4*) and Table 2 (*part-1.e.2*), and describe how two addressing methods (IP addresses and MAC addresses) are effectively used in order to transmit through many, possibly, dissimilar networks.
 2. Describe how the layers work together in the above PC2 to PC3 transmission.
- h. [Homework] How do you relate the above experiment with transmissions in the Internet and particularly the issue of 'layers working together'?

Part-2: Application processes

Web surfing: PC2 (Web-client) and PC3 (Web-server)

- a. Send a web request from PC2 to PC3 and download web contents from PC3 (server). Use the Wireshark at PC2 and PC3 to capture the frames sent and received. Save the trace-files (file names: CO223_Lab4_2a_PC2, CO223_Lab4_2a_PC3).
- b. From the trace file 'CO223_Lab4_2a_PC3', find the frame associated with the 'HTTP request' received from PC2. Observe how encapsulation is done at each layer. Particularly,
 1. Find the data (HTTP request):
 - How is the HTTP request (data) specified? (give few lines)
 2. Find the transport layer header information:
 - Transport layer protocol:
 - **Source port no.: (what does this value mean?)**
 - **Destination port no.: (what does this value mean?)**
 3. Find the Network layer header information:
 - Network layer protocol:
 - **Protocol type: (what does this value mean?)**
 - Source IP address:
 - Destination IP address:
 4. Find the Link layer header information:
 - Link layer protocol:
 - **Protocol Type: (what does this value mean?)**
 - Source MAC address:
 - Destination MAC address:
- c. In the above frame, give the ratio (or percentage) of full control message size (headers) to the frame size.
- d. In your trace file CO223_Lab4_2a_PC2, search through the frames and find a frame (or frames) which carries (carry) the contents that you see in your web-browser at PC2. (In your report, attach a screenshot of the Wireshark panes with the selected frame showing the contents)