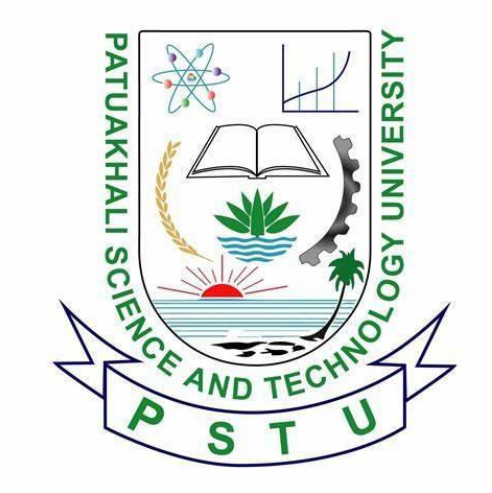

PATUAKHALI SCIENCE AND TECHNOLOGY UNIVERSITY

COURSE CODE CCE-221

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Q2-1. What is the first principle we discussed in this chapter for protocol layering that needs to be followed to make the communication bidirectional?
Ans:
Encapsulation and decapsulation. This encapsulation allows data to be passed from one layer to another, abstracting the complexity of the underlying operations.
By following this principle, bidirectional communication can be achieved by ensuring that each layer on the sender's side has a corresponding layer on the receiver's side to handle the data exchange in both directions.
Q2-2. Which layers of the TCP/IP protocol suite are involved in a link-layer switch?
Ans:
In a link-layer switch **Data link layer and Physical layer** are involved.
Q2-3. A router connects three links (networks). How many of each of the following layers can the router be involved with?
Ans:
a. physical layer
b. data-link layer
c. network layer
A router uses three layers. Network layer, data link layer and physical layer.
Q2-4. In the TCP/IP protocol suite, what are the identical objects at the sender and the receiver sites when we think about the logical connection at the application layer?
Ans:
At the application layer in the TCP/IP protocol suite, the identical objects at the sender and receiver sites are messages.
Q2-5. A host communicates with another host using the TCP/IP protocol suite. What is the unit of data sent or received at each of the following layers?
Ans:
Application Layer: Message - This is the actual data the application wants to send/receive. It could be a web page, an email, a video stream, or any application-specific information.
Transport Layer (TCP/UDP): Segment (TCP) - TCP breaks the message from the application layer into smaller segments for reliable transmission. It adds sequence numbers, checksums, and other control information to ensure the segments arrive in order and without errors. UDP, on the other hand, sends the entire message as a datagram without any guarantees of order or error checking.

Network Layer (IP): Datagram - Here, the segments (or datagrams from UDP) are encapsulated with additional headers containing source and destination IP addresses, allowing routing across the network.
Data Link Layer -Frame - The datagram from the network layer is further encapsulated with headers containing MAC addresses for local network communication.
Physical Layer-Bits- This frame is then converted into electrical or optical signals for transmission on the physical medium (cables, wifi, etc.).

Q2-6. Which of the following data units is encapsulated in a frame?
Ans:
a. a user datagram
b. a datagram
c. a segment

Q2-7. Which of the following data units is decapsulated from a user datagram?
Ans:
Segment. Datagram is decapsulated from Packets and Segment is decapsulated from user datagram.

Q2-8. Which of the following data units has an application-layer message plus the header from layer 4?
Ans:
a. a frame
b. a user datagram
c. a bit

Q2-9. List some application-layer protocols mentioned in this chapter.
Ans:
HTTP (Hypertext Transfer Protocol): The foundation of web communication, used for browsing websites and transferring web pages, images, and other content.
SMTP (Simple Mail Transfer Protocol): The protocol for sending emails between servers.
FTP (File Transfer Protocol): Used for transferring files between computers.

Q2-10. If a port number is 16 bits (2 bytes), what is the minimum header size at the transport layer of the TCP/IP protocol suite?
Ans:
The minimum header size at the transport layer (TCP) of the TCP/IP protocol suite is 32 bits (4 bytes), even though the port number itself is 16 bits.

Q2-11. What are the types of addresses (identifiers) used in each of the following layers?

Ans:

a. Application Layer: Port Numbers

The application layer doesn't use addresses in the same way as lower layers. Instead, it uses **port numbers** to identify specific applications or services running on a host. These ports act like virtual doorways for incoming and outgoing communication.

b. Network Layer: IP Addresses

The network layer relies on **IP addresses**. These are 32-bit (IPv4) or 128-bit (IPv6) logical addresses that uniquely identify a device on a network. Routers use IP addresses to determine the best path for forwarding packets across the network.

c. Data-Link Layer: MAC Addresses

The data-link layer utilizes **Media Access Control (MAC) addresses**. These are unique 48-bit hardware addresses burned into a network interface card (NIC) and identify a specific network device on a local network segment. They are used for communication within a limited physical area.

Q2-12. When we say that the transport layer multiplexes and demultiplexes application layer messages, do we mean that a transport-layer protocol can combine several messages from the application layer in one packet? Explain.

Ans:

No, when we say the transport layer multiplexes and demultiplexes application layer messages, it doesn't necessarily mean combining several entire messages into one packet. Here's why:

Focus on Segments/Datagrams: The transport layer typically breaks down application layer messages into smaller units called segments (TCP) or datagrams (UDP) for efficient transmission.

Multiplexing Individual Messages: Multiplexing refers to the transport layer's ability to handle data streams from multiple applications on a single host. When the transport layer receives data from an application, it attaches the destination port number to the segment/datagram. This allows the transport layer at the receiving host to demultiplex the data and deliver it to the correct application based on the port number.

Q2-13. Can you explain why we did not mention multiplexing/demultiplexing services for the application layer?

Ans:

The application layer is on the top and doesn't provide services to any other layer. This is why multiplexing/ demultiplexing services for the application layer doesn't exist.

Q2-14. Assume we want to connect two isolated hosts together to let each host communicate with the other. Do we need a link-layer switch between the two? Explain.

Ans: No, you typically wouldn't need a link-layer switch to connect just two isolated hosts together for basic communication.

Switch Purpose: Link-layer switches are designed for multi-device networks. They operate at the data link layer (Layer 2) of the OSI model and use MAC addresses to intelligently forward data packets between devices on the same network segment.

Q2-15. If there is a single path between the source host and the destination host, do we need a router between the two hosts ?

Ans:

if there's only one path between the source and destination host, there's no routing decision to be made. The data packets can be directly transmitted between the two devices' network interfaces without needing a router to choose a route.

P2-1. Answer the following questions about Figure 2.2 when the communication is from Maria to Ann:

a. What is the service provided by layer 1 to layer 2 at Maria's site?

Ans: It has given that layer 1 is physical layer and the layer 2 is presentation Layer. The physical layer sends or receives the raw code or the bits, and the presentation layer encrypts and decrypts the data. The raw code is converted into the data. The data is encrypted or decrypted.

b. What is the service provided by layer 1 to layer 2 at Ann's site?

Ans:

Layer 1 at Ann's side, receives the message, removes the envelope and forwards it to the Layer 2 for decryption.

P2-2. Answer the following questions about Figure 2.2 when the communication is from Maria to Ann:

a. What is the service provided by layer 2 to layer 3 at Maria's site?

Ans: The layer 2 is presentation Layer and Layer 3 is application layer.
The data is received from layer 1. then the is decrypted and sent to the application layer.

b. What is the service provided by layer 2 to layer 3 at Ann's site?

Ans: The same this is happened is this case too.

P2-3. Assume that the number of hosts connected to the Internet at year 2010 is five hundred million. If the number of hosts increases only 20 percent per year, What is the number of hosts in year 2020?

Ans:

In 2010, the number of hosts connected to the internet is 500,000,000. So if the increase percentage is 20% or, 0.2, in 2020 the number will be around (1.2010 or 6.2) 6 times as of 2010. So the number will be more than 3,100,000,000.

P2-4. Assume a system uses five protocol layers. If the application program creates a message of 100 bytes and each layer (including the fifth and the first) adds a header of 10 bytes to the data unit, what is the efficiency (the ratio of application layer bytes to the number of bytes transmitted) of the system?

Ans:

Total number of byte = five layer + header = 100 + (10 x 5) = 150 byte

So, the efficiency =

aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaannnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnnn

= 100150x100%

= 66.66%

P2-5. Assume we have created a packet-switched internet. Using the TCP/IP protocol suite, we need to transfer a huge file. What are the advantages and disadvantage of sending large packets?

Ans:

while sending large packets, TCP/IP protocol splits the packages into smaller sub-packages which makes the communication easier. On the other hand, corrupted sub-packages can break the large package while combining all pieces together.

P2-6. Match the following to one or more layers of the TCP/IP protocol suite:

a. route determination

b. connection to transmission media

c. providing services for the end user.

Ans:

a. route determination (Network Layer): This function is primarily handled by the network layer.

b. connection to transmission media (Physical Layer): The data link layer is responsible for establishing and maintaining a connection with the physical transmission media (cables, Wi-Fi, etc.) through network interface cards (NICs).
c. providing services for the end user (Application Layer): This function belongs solely to the application layer. It provides services directly to the end user applications running on the host, such as web browsing, email, file transfer, etc.
P2-7. Match the following to one or more layers of the TCP/IP protocol suite:
a. creating user datagrams
b. responsibility for handling frames between adjacent nodes
c. transforming bits to electromagnetic signals
ans:
a. **creating user datagrams (Transport Layer (UDP))** UDP (User Datagram Protocol) is a transport layer protocol that creates datagrams, which are units of data with source and destination port information but without the guarantees of order or error checking provided by TCP (Transmission Control Protocol).
b. responsibility for handling frames between adjacent nodes (Data Link Layer) The data link layer is responsible for packaging data into frames and adding headers containing MAC addresses for communication between devices on the same network segment (adjacent nodes). It ensures error-free transmission on the physical layer.
c. transforming bits to electromagnetic signals (Physical Layer) The physical layer is the lowest layer in the TCP/IP suite. It deals with the physical transmission of data bits across a cable or wireless medium. This layer converts digital data (bits) into electrical or optical signals that can travel on the physical media.

P2-8. In Figure 2.10, when the IP protocol decapsulates the transport-layer packet, how does it know to which upper-layer protocol (UDP or TCP) the packet should be delivered?

Ans:

In a transport-layer packet, in **the header file of the packet**, there's an identifier to figure out, which upper-layer protocol the packet should be delivered.

P2-9. Assume a private internet uses three different protocols at the data-link layer (L1, L2, and L3). Redraw Figure 2.10 with this assumption. Can we say that, in the data-link layer, we have demultiplexing at the source node and multiplexing. at the destination node?

Ans:

Yes, we can say that we can have demultiplexing at the source node and multiplexing at the destination if the receiver transmits or, return a data or signal.

P2-10. Assume that a private internet requires that the messages at the application layer be encrypted and decrypted for security purposes. If we

need to add some information about the encryption/decryption process (such as the algorithms used in the process), does it mean that we are adding one layer to the TCP/IP protocol suite? Redraw the TCP/IP layers (Figure 2.4 part b) if you think so.

Ans:

Yes, in this case we can think it as a new layer where, information is encrypted or decrypted. And we can use it's header file for storing the algorithms in which information is being encrypted. A Similar figure with a new layer is shown above.

P2-11. Protocol layering can be found in many aspects of our lives such as air travelling. Imagine you make a round-trip to spend some time on vacation at a resort. You need to go through some processes at your city airport before flying. You also need to go through some processes when you arrive at the resort airport. Show the protocol layering for the round trip using some layers such as baggage checking/claiming, boarding/unboarding, takeoff/landing.

Ans:

We can think it as the same way as network protocols. At each side we will have two opposite tasks with identical mechanism.

Both at the source and the destination, we will check baggage.

Then at the same time in the source we will have to board and at the destination we must be un-board.

Again, at the source destination we have to take off and at the destination we have to land.

And the vice versa will occur when we will again return to source from destination.

P2-12. The presentation of data is becoming more and more important in today's Internet. Some people argue that the TCP/IP protocol suite needs to add a new layer to take care of the presentation of data. If this new layer is added in the future, where should its position be in the suite? Redraw Figure 2.4 to include this layer.

Ans:

Yes, adding a new layer is possible. We can add this new layer after Application layer. In this way, Presentation layer will take the message from application to represent data such as encryption algorithms. And presentation layer will again pass data to the transport layer.

P2-13. In an internet, we change the LAN technology to a new one. Which layers in the TCP/IP protocol suite need to be changed?

Ans:

For changing LAN technology to an new one, we may need to replace two layers, data-link layer and physical layer. Data link layer binds the link layer address and physical layer actually transmits the data. So instead of replacing the whole model, we can just change these two layer.

P2-14. Assume that an application-layer protocol is written to use the services of UDP. Can the application-layer protocol uses the services of TCP without change?

Ans:

We can't access TCP without change. As UDP and TCP works in two different way we need to change the application layer a bit. But we don't need to replace the entire model.

P2-15. Using the internet in Figure 1.11 (Chapter 1) in the text, show the layers of the TCP/IP protocol suite and the flow of data when two hosts, one on the west coast and the other on the east coast, exchange messages.

Ans:
Here for the west coast office and east coast office to be connected, we need to add these two WAN through router. We can use 5 TCP/ IP layers to achieve this.
The following image shows the layers of TCP/IP protocol suite to achieve this communication.