Solution-for-final - Faculty: Dr. Tarem Ahmed

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Connection Oriented Services

There is a sequence of operation to be followed by the users of connection oriented service. These are:

1. Connection is established.
2. Information is sent.
3. Connection is released.

In connection oriented service we have to establish a connection before starting the communication. When connection is established, we send the message or the information and then we release the connection.

Connection oriented service is more reliable than connectionless service. We can send the message in connection oriented service if there is an error at the receivers end. Example of connection oriented is TCP (Transmission Control Protocol) protocol.

Connection Less Services

It is similar to the postal services, as it carries the full address where the message (letter) is to be carried. Each message is routed independently from source to destination. The order of message sent can be different from the order received.

In connectionless the data is transferred in one direction from source to destination without checking that destination is still there or not or if it prepared to accept the message. Authentication is not needed in this. Example of Connectionless service is UDP (User Datagram Protocol) protocol.

Difference between Connection-oriented and Connection-less Services:

S.NO	CONNECTION-ORIENTED SERVICE	CONNECTION-LESS SERVICE
1.	Connection-oriented service is related to the telephone system.	Connection-less service is related to the postal system.
2.	Connection-oriented service is preferred by long and steady communication.	Connection-less Service is preferred by bursty communication.
3.	Connection-oriented Service is necessary.	Connection-less Service is not compulsory.
4.	Connection-oriented Service is feasible.	Connection-less Service is not feasible.
5.	In connection-oriented Service, Congestion is not possible.	In connection-less Service, Congestion is possible.
6.	Connection-oriented Service gives the guarantee of reliability.	Connection-less Service does not give the guarantee of reliability.

7.	In connection-oriented Service, Packets follow the same route.	In connection-less Service, Packets do not follow the same route.

Ch 24:

Difference between

	Stop and Wait	Go back N	Selective Repate
Frame transmit	1. Only one frame transmitted and wait for ACK. 2. block Bandwidth 3. less efficiency	Multiple Frames transmission	Multiple frame
Sender Window	Size 1	$2^k - 1$	$2^{(k-1)}$
Receiver window	Size 1	1	$2^{(k-1)}$
Efficiency	$\frac{1}{1+2(Tp/Tt))}$	$(2^k - 1)*(\frac{1}{1+2(Tp/Tt))})$	$2^{(k-1)} *(\frac{1}{1+2(Tp/Tt))})$
Retransmission	one	$2^k - 1$	1 and Independent
Packet receive	----------	In order packet	Out of order packet
	Available sequence number 2	----------	----------

ACK`	----------	----------	Can send negative ACK

HW1:

QUS1. Why protocol is needed"

Protocol is basically needed because its important for receiver to understand the sender.

In computer communication protocol also make sure that message gets to the sender properly.

QUS2. Name the four basic network tropology and advantage?

A) MESH

- If suppose, N number of devices are connected with each other in mesh topology, then total number of ports/CABLES that is required by each device is N-1. In the Figure 1, there are 5 devices connected to each other, hence total number of ports required is 4.
- If suppose, N number of devices are connected with each other in mesh topology, then total number of dedicated links required to connect them is ${}^{N}C_2$ i.e. N(N-1)/2. In the Figure 1, there are 5 devices connected to each other, hence total number of links required is 5*4/2 = 10.

Advantage:

1) The use dedicated links.
2) Robust.
3) Privacy and secure
4) Point to point links make fault identification easy.
5) High data transmission

B) Star Topology:

In star topology, all the devices are connected to a single hub through a cable. This hub is the central node and all other nodes are connected to the central node.

Advantage:

1) Easy to install
2) Less cabling
3) Robustness: if one line fails, that significant line will be effected others line will be work fine.

C) Bus Topology:

Bus topology is a network type in which every computer and network device is connected to single cable. It transmits the data from one end to another in single direction. No bi-directional feature is in bus topology.

If N devices are connected to each other in bus topology, then the number of cables required to connect them is 1 which is known as backbone cable and N drop lines are required

Advantage:

1) Easy to install. Like every station need, Adding the printer to bus the all can use the printer
2) Nodes are connected to the backbone cable
3) Extenuation can be made depend on connection

D) Ring topology:

In this topology, it forms a ring connecting a devices with its exactly two neighboring devices.

Advantage:

1. One station is known as monitor station which takes all the responsibility to perform the operations.

2. To transmit the data, station has to hold the token. After the transmission is done, the token is to be released for other stations to use.
3. When no station is transmitting the data, then the token will circulate in the ring.
4. There are two types of token release techniques: Early token release releases the token just after the transmitting the data and Delay token release releases the token after the acknowledgement is received from the receiver.

QUS3: What is internet?

When one or more computer connected with each other they have become internetwork or internet.

QUS4: What is the difference between the Half Duplex and Full Duplex??

Half-Duplex

In a half-duplex device are connected to a point to point connection using network cable.

In a half-duplex device can communicate in one direction.

Just like how WAKITALKIS work.

Full Duplex

In a full duplex device are connected to a point to point connection.

They can communicate both direction

Like telephone communication

QUS4: Difference between circuit switching and packet switching.

Circuit switching	Packet switching
Required advance setup	No required for advance setup
Need reservation of bandwidth	No reservation of bandwidth
Its nota Store and forward technic	Store and forward technic
Physical connection	No physical connection

Physical layer	No physical layer

QUS5: Lan and wan??

Size, distance, coverage, ownership determine wither it's a lan or wan

A lan network normally cover less than 2 miles

On the other hand, wan connected all over the world.

HW 2

Q2-1. What are the types of addresses (identifiers) used in each of the following layers?
a. Application layer: site name or email (specific address).
b. Network layer: logical address (IP address).
c. Data-link layer: link-layer address.

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?
a. application layer : messages
b. network layer: datagrams or packets
c. data-link layer: frames

p2-1

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.

1-Print your boarding pass and check your luggage.
2-Head to security.
3-Find your gate/terminal.
4- Hang out and wait for your plane.
5-Wait for the announcement to board.
6-Get your boarding pass checked.
7-Enter the aircraft.
8-Stow your carry-on items.
9- Get settled in.

P2-3 In an internet, we change the LAN technology to a new one. Which layers in the TCP/IP protocol suite need to be changed?

The only two layers that need to be changed are the data-link layer and the physical layer. The new hardware and software need to be installed in all host, routers, and link-layer switches. As long as the new data-link layer can encapsulate and decapsulate datagrams from the network layer, there is no need to change any protocol in the upper three layers. This is one of the characteristics of the protocol layering.

P2-5

P 2-2

Answer the following questions about Figure 2.2 when the communication is from Maria to Ann:

a. What is the service provided by layer 1 to layer 2 at Maria's site?
Answer: Layer 1 pulls the cipher text from layer 2 and inserts it in an envelope before sending it.

b. What is the service provided by layer 2 to layer 3 at Ann's site?
Answer: layer 2 encrypts or decrypts the cipher text to plaintext and send it to layer 3 so they it could understand easily.

P2-12. 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?

Layer 2 takes the plaintext from layer 3, encrypts it into ciphertext and delivers it to layer 1.

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

Layer 2 receives the ciphertext from layer 1, decrypts it and delivers the plaintext to layer 3

P2-13. Match the following to one or more layers of the TCP/IP protocol suite:

a. Creating user datagrams: Transport, and Network.

b. Responsibility for handling frames between adjacent nodes: Datalink.

c. Transforming bits to electromagnetic signals: physical.

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

a. Route determination: data-link, network.

b. Connection to transmission media: physical.

c. Providing services for the end user: Application

p2-6

. Five protocol layers. 150 byte message. 20 bytes header added at each layer (including 1st and 5th). What is the efficiency?

150 bytes + 5(20 bytes) = 250 bytes $\eta = \frac{150}{250} x\ 100 = 60\%$

HW:3

QUS 1: Distinguish between the process of routing a packet from the source to the destination and the process of forwarding a packet at each router.

Ans:

Forwarding refers to the router-local action of transferring the packet from an input link interface to the appropriate output link interface. Routing refers to the network-wide process that determines end-to-end paths that packets take from source to destination.

QUS 2 : Find the class of the following classful IP addresses:

a. 130.34.54.12 b. 200.34.2.1 c. 245.34.2.8

Ans:

the following classful IP addresses:.

a) 130.34.54.12Ans.

If the address of the first byte is in between 128-191 then the IP address belongs to Class B.

b) 200.34.2.1Ans.

If the address of the first byte is in between 192-223 then the IP address belongs to Class C.

c) 245.34.2.8Ans.

If the address of the first byte is in between 240-255 then the IP address belongs to Class E.

QUS 3 :An organization is granted the block 130.56.0.0/16. The administrator wants to create 1024 subnets.

a. Find the number of addresses in each subnet.

b. Find the subnet prefix.

c. Find the first and the last address in the first subnet.

d. Find the first and the last address in the last subnet.

Total: 38 marks

1) 255.255.255.192 will be the subnet mask ,

2) 62 valid addresses can exist in each subnet,

3) First address in subnet 1 will be 130.56.0.1 and last address is sibnet 1 will be 130.56.0.62 ,

4) First address is 1024 subnet will be 130.56.255.193 and last address in 1024 subnet will be 130.56.255.254.

Explanation :

1)2^n = 1024

Therefore, n = 10.

The address is here is a Class B ,

so, the default mask is /16. 10 bits are necessary for subnets and

hence the correct subnet mask is /(16+10) = /26.

In the format of dotted decimal format, it shall be 192 and therefore, the subnet mask will be 255.255.255.192 .

2) The rest of the bits must be used for the addressed i.e. there will be 32 - 26 = 6 bits available for the address component.

So, a total of 2^6=64 bits shall be available. Also, 2 bits per subnet cannot be allocated and subnet mask will be able to maintain 62 valid addresses

3)First address in subnet 1 = 130.56.0.1

Last address is subnet 1 = 130.56.0.62

The first address can be estimated by ANDing the address 130.56.0.0 with the subnet mask /26 like below: 10000010 00111000 00000000 00000000 (130.56.0.0)

This address can not be allocated, so we will consider the next address: 10000010 00111000 00000000 00000001 (130.56.0.1).

In Similar manner, the last address that can be allocated before the broadcast address will be 130.56.0.62.

4)First address in the 1024 subnet = 130.56.255.193

Last address in 1024 subnet = 130.56.255.254

Total number of addresses

HW4

1. An ISP is granted the block 80.70.56.0/21. The ISP needs to allocate addresses for two organizations each with 500 addresses, two organizations each with 250 addresses, and three organizations each with 50 addresses.

a. Find the number and range of addresses in the ISP block.

b. Find the range of addresses for each organization and the range of unallocated addresses.

c. Show the outline of the address distribution and the forwarding table.

Answer:

P18-14.

Solution of A:-

Given prefix =21

So suffix =32-21=11

So, number of address possible is 2^{11} =2048

Range is 80.70.56.0/21 to 80.70.63.255/21

Solution of B:-

Organization 1 :For 500 address we need to allocate 512 address

So the suffix is $\log_2 512$=9 32-9=23

First address : 80.70.56.0/23

last address : 80.70.57.255/23

Organization 2 :For 500 address we need to allocate 512 address

So the suffix is $\log_2 512$=9 32-9=23

First address : 80.70.58.0/23

last address : 80.70.59.255/23

Organization 3 : For 250 address we need to allocate 256 address

So the suffix is $\log_2 256$=8 32-8=24

First address : 80.70.60.0/24

last address : 80.70.60.255/24

Organization 4 : For 250 address we need to allocate 256 address

So the suffix is $\log_2 256$=8 32-8=24

First address : 80.70.61.0/24

last address : 80.70.61.255/24

Organization 5 : For 50 address we need to allocate 64 address

So the suffix is $\log_2 64$=6 32-6=26

First address : 80.70.62.0/26

last address : 80.70.62.63/26

Organization 6: For 50 address we need to allocate 64 address

So the suffix is $\log_2 64$=6 32-6=26

First address : 80.70.62.64/26

last address : 80.70.62.127/26

Organization 7 : For 50 address we need to allocate 64 address

So the suffix is $\log_2 64$=6 32-6=26

First address : 80.70.62.128/26

last address : 80.70.62.191/26

2. Assume we have an internet with a 9-bit address space. The addresses are divided between three networks (N0 to N2), with 64, 192, and 256 addresses respectively. The internet work communication is done through a router with three interfaces (m0 to m2). Show the internet outline and the forwarding table (with two columns: prefix in binary and the interface number) for the only router that connects the networks. Assign a network address to each network.

(10 marks)

Answer:

3. Show the n leftmost bits of the following network-addresses/masks that can be used in a forwarding table.

a. 170.40.11.0/24 b. 110.40.240.0/22 c. 70.14.0.0./18

Answer:

4. Change each of the following masks to a prefix length:

a. 255.224.0.0 b. 255.240.0.0 c. 255.255.255.128
(2 x 3 = 6 marks)

Answer: Solution of A:-

255.224.0.0

Here

256-224=32=$\log_2 32$=5

256-0=256=$\log_2 256$=8

256-0=25=$\log_2 256$=8

So suffix is =5+8+8=21

Prefix =32-21=11

Solution of B:-

255.240.0.0

Here

256-240=16=$\log_2 16$=4

256-0=256=$\log_2 256$=8

256-0=256=$\log_2 256$=8

So suffix is =4+8+8=20

Prefix =32-20=12

Solution of C:-

255.255.255.128

Here

256-128=128=$\log_2 128$=7

So suffix is 7

Prefix =32-7=25

5. Combine the following three blocks of addresses into a single block:

a. 16.27.24.0/26 b. 16.27.24.64/26 c. 16.27.24.128/25

Answer:

16.27.24.0/26 suffix =32-26=6

Number of address = 2^6 =64

16.27.24.63/26 suffix =32-26=6

Number of address = 2^6 =64

16.27.24.128/25 suffix =32-25=7

Number of address = 2^7 =128

Total address is = 64+64+128=256

So suffix is =$\log_2 256$=8

Prefix is = 32-8=24

So block is

16.27.24.0/24

HW5

1. Can you explain why ICANN has divided the port numbers into three groups: well-known, registered, and dynamic? (5 marks)

Answer:

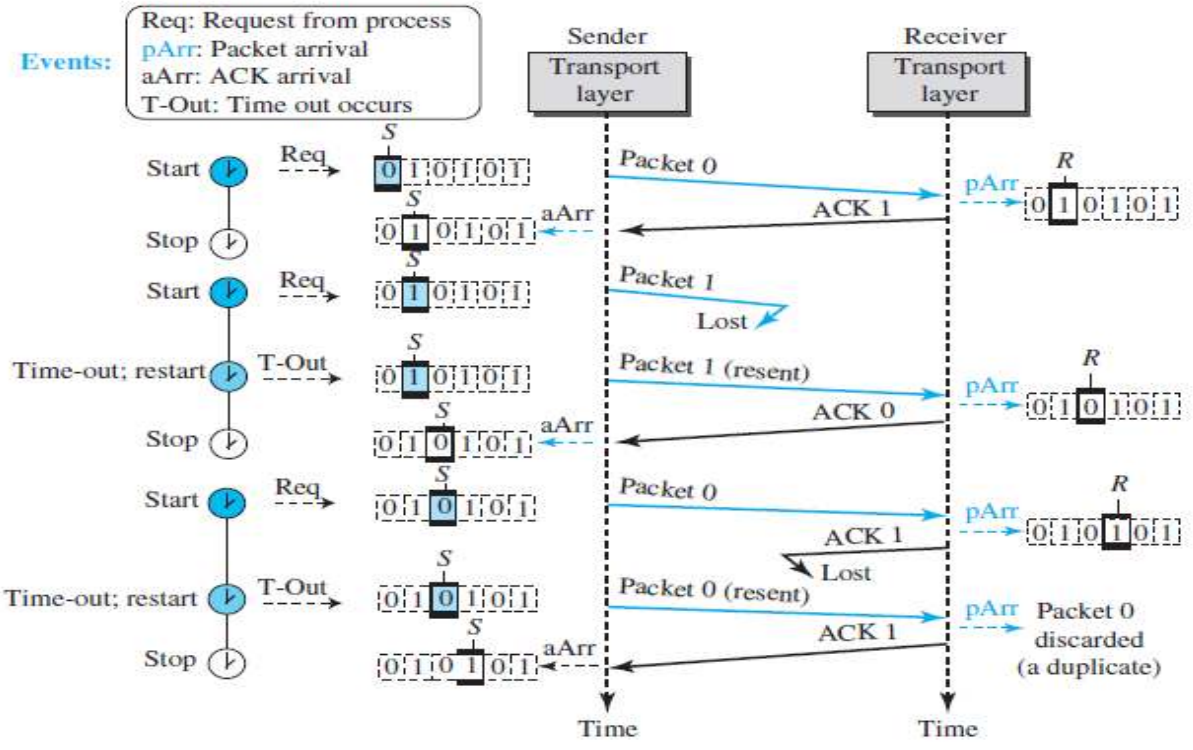
Port number are used to identify a specific application or process running on a system Different system running same application can repeat the port numbers.

Table 144: TCP and UDP Port Number Ranges

Port Range Name	Port Number Range	Description
Well-Known (Privileged) Port Numbers	0 to 1,023	These port numbers are managed by IANA and reserved for only the most universal TCP/IP applications. The IANA assigns these port numbers only to protocols that have been standardized using the TCP/IP RFC process, that are in the process of being standardized, or that are likely to be standardized in the future. On most computers, these port numbers are used only by server processes run by system administrators or privileged users. These generally correspond to processes that implement key IP applications, such as Web servers, FTP servers and the like. For this reason, these are sometimes called *system port numbers*.
Registered (User) Port Numbers	1,024 to 49,151	There are many applications that need to use TCP/IP but are not specified in RFCs, or are not so universally used that they warrant a worldwide well-known port number. To ensure that these various applications do not conflict with each other, IANA uses the bulk of the overall port number range for registered port numbers. Anyone who creates a viable TCP/IP server application can request to reserve one of these port numbers, and if approved, the IANA will register that port number and assign it to the application. These port numbers are generally accessible by any user on a system and are therefore sometimes called *user port numbers*.
Private/Dynamic Port Numbers	49,152 to 65,535	These ports are neither reserved nor maintained by IANA. They can be used for any purpose without registration, so they are appropriate for a private protocol used only by a particular organization

2. Create a scenario similar to Figure 23.22 in which the sender sends three packets. The first and second packets arrive and are acknowledged. The third packet is delayed and resent. The duplicate packet is received after the acknowledgment for the original is sent.

Figure 23.22 *Flow diagram for Example 23.4*



(10 marks)

Answer:

3. Create a scenario similar to Figure 23.22 in which the sender sends three packets. The first and second packets arrive and are acknowledged. The third packet is delayed and resent. The duplicate packet is received after the acknowledgment for the original is sent.

(10 marks)

Answer:

4. In a network using the Selective-Repeat protocol with m = 4 and the sending window of size 8, the value of variables is Sf = 62, Sn = 67, and Rn = 64. Packet 65 has already been acknowledged at the sender site; packets 65 and 66 are received out-of-order at the receiver site. Assume that the network does not duplicate the packets.

a. What are the sequence numbers of pending data packets (in transit, corrupted, or lost)?

b. What are the acknowledgment numbers of pending ACK packets (in transit, corrupted, or lost)?

(5 x 2 = 10 marks)

Answer:

Sf=62, Sn=67, Rn=64Packet 65 has already been ACKed at the sender side Packets 65 and 66 are received out-of-order at the receiver side.

(a) Rn 64 means the receiver is expecting the packet 64, and 62 and 63 already received and ACKed. Also packet 65 is ACKed from the receiver side. Packet 66 is received at the receiver side but not ACKed. So, the sequence number of pending packets is 64

(b) Sn=67 means packets before it is sent. That means packet 64 is already sent and the receiver is expecting it with Rn=64. Also, we have packet number 66 received but not ACKed. Therefore, acknowledgment number of pending ACK packet is 64 and 66.

5. In a network using the Go-Back-N protocol with m = 3 and the sending window of size 7, the values of variables are Sf = 62, Sn = 66, and Rn = 64. Assume that the network does not duplicate or reorder the packets.

a. What are the sequence numbers of data packets in transit?

b. What are the acknowledgment numbers of ACK packets in transit?

(5 x 2 = 10 marks)

Answer:

a.In transit : 65,66

b.ack in transit: 64

6. Using 5-bit sequence numbers, what is the maximum size of the send and receive windows for each of the following protocols?

a. Stop-and-Wait

b. Go-Back-N

c. Selective-Repeat (5 x 3 = 15 marks)

Answer:

1. Using 5-bit sequence numbers, what is the maximum size of the send and receive windows for each of the following protocols?
   a. Stop-and-Wait ARQ
      Send Window = **1**
      Receive Window = **1**
   b. Go-Back-*N* ARQ
      Send Window = $2^5 - 1$ = **31**
      Receive Window = **1**
   c. Selective-Repeat ARQ
      Send Window = $2^5 / 2 = 32 / 2$ = **16**
      Receive Window = $2^5 / 2 = 32 / 2$ = **16**

7. A sender sends a series of packets to the same destination using 5-bit sequence numbers. If the sequence numbers start with 0, what is the sequence number of the 100th packet?
(5 marks)

Answer:

Step 1 of 4

Sequence number of the packet:

• When any host sends large message to another host then system network divides that message into so many packets and send them over the network.

• At the time of receiving, receiver checks whether all packets are reached to them or not.

• When checking is done with the help of sequence number of each packet which is assigned by the network at the time of message partitioning.

Step 2 of 4

The sequence number of any packet can be found with the help of the following formula:

$$\mathbf{seqNo} = (\mathbf{starting\ segNo} + \mathbf{packet\ number} - 1) \bmod 2^{m}$$

m is used to define the number of bits used by system to represent the sequence number.

Step 3 of 4

Consider the following detail:

Sequence number $(m)=5$

Packet number$=100_{th}$

starting segNo $= 0$

Step 4 of 4

Sequence number of the $\mathbf{100_{th}}$ is:

$$\text{seqNo} = (0 + 100 - 1) \bmod 25$$
$$= 99 \bmod 32$$
$$= 3$$

Hence, the sequence number of the $\mathbf{100_{th}}$ is $\boxed{3}$.

Total: 65 marks

Difference between

	Stop and Wait	**Go back N**	**Selective Repate**
Frame transmit	1. Only one frame transmitted and wait for ACK. 2. block Bandwidth 3. less efficiency	Multiple Frames transmission	Multiple frame
Sender Window	Size 1	$2^k - 1$	$2^{(k-1)}$
Receiver window	Size 1	1	$2^{(k-1)}$
Efficiency	$\frac{1}{1 + 2(Tp/Tt))}$	$(2^k - 1)*(\frac{1}{1+2(Tp/Tt))})$	$2^{(k-1)} *(\frac{1}{1+2(Tp/Tt))})$
Retransmission	one	$2^k - 1$	1 and Independent
Packet receive	----------	In order packet	Out of order packet
	Available sequence number 2	----------	----------
ACK`	----------	----------	Can send negative ACK

Connection less	Connection oriented
1. In a connectionless service, the source process (application program) needs to divide its message into size acceptable by the sending transport layer and deliver them to the receiving transport layer.	2. In a connection-oriented service, the client and the server first need to establish a logical connection between themselves.
3. The transport layer treats each message as a single unit without any relation between messages.	4. After end of data exchange, the connection needs to be torn down.
5. When a message arrives from the (sending) application layer, the sending transport layer encapsulates it in a segment and sends it.	6. the connection-oriented service at the transport layer is different from the same service at the network layer.
7. Block the bandwidth	8. In the network layer, connection-oriented service means coordination between the two end hosts and all routers in between.
9. Less efficiency	10. At the transport layer, connection-oriented service involves only the two hosts; the service is end to end.