Computer Networks - HW2

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Question 1

The propagation speed is $2.5 \times 10^8 \, \frac{m}{s}$. The distance is $2500km \equiv 2.5 \times 10^6 \, m$. Therefore, we divide the latter by the former, we would left with time, which is the propagation time.

$$\frac{2.5 \times 10^6 \, \frac{m}{s}}{2.5 \times 10^8 \, m} = 10 \, ms$$

As you can see it does not depend on neither packet length nor transmission rate.

More generally, the formula is given as:

$$t = \frac{d}{s}$$

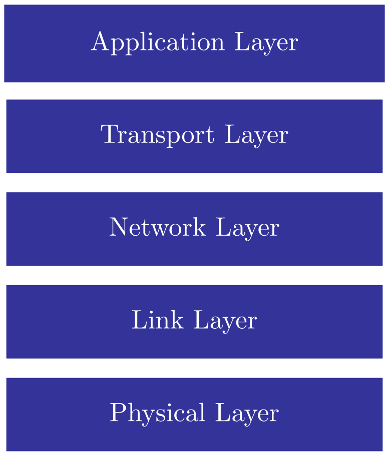
Question 2

Suppose *system A* want to sent packet to *system B*. Steps involved in this process are given below:

1. System A first breaks large file into small pieces named *chunks*.
2. It adds separate headers for each chunks so that each chunk appers like separate packet.
3. Header file in chunks contain IP address of receiver; here, *system B*.
4. Switch system uses IP present in header to determine link to destination.

When we travel from one city to another and we do not know the path, we would ask for path and go on that. Which is analogous to the switching process.

Question 3



1 Application Layer

The application layer is responsible for communication between applications running on two different end systems. A message or data transferred from one end is readable for the corresponding application on the other end. These applications include web browsers, email clients, etc.

2 Transport Layer

On the sending end, the transport layer is responsible for collecting the application layer message from the relevant end-point and transferring it to the network layer to be communicated over the network. The receiving end collects the message from the network layer and passes it on to the relevant end-point where the application layer can access that message.

3 Network Layer

The network layer is responsible for transferring data from one system to another on the network. The transport layer passes a segment and the destination address to the network layer. Then, it is the responsibility of the network layer to transfer the data to the destination end-system over the network. This layer also takes care of the routing of data on intermediate routers.

4 Link Layer

When a packet is being transferred over the internet, several intermediate devices are between the two end systems. These devices may be routers, switches, or other computers. The link layer is responsible for communication between one device and its immediate neighbor. The link-layer is mostly implemented in technologies like ethernet, Wi-Fi, token ring, etc.

5 Physical Layer

The physical layer is responsible for breaking the data frame into bits, converting it into a form that can be transmitted over the physical communication line, and transferring it. This form could be light pulses (fiber-optic), radio waves (for wireless communication, or electric pulses (for wired communication). On the receiving end, the physical layer collects the stream of bits and reassembles it into a data frame that is then passed onto the link layer for further processing.

Question 4

The IP address of the destination host and the port number of the destination socket.

Question 5

The address `10.10.10.0/24` is in prefix format. We can deduce the subnet mask format as:

IP: `10.10.10.0`

Subnet mask: `255.255.255.0`

To have eight subnets, we need $\log_2 8 = 3$ bits. With respect to the subnet mask, we use the fourth octet to achieve this.

	First octet (Dec.)	Second octet (Dec.)	Third octet (Dec.)	Fourth octet (Bin.)
Original IP	10	10	10	00000000
Subnet 0	10	10	10	00000000
Subnet 1	10	10	10	00100000
Subnet 2	10	10	10	01000000
Subnet 3	10	10	10	01100000
Subnet 4	10	10	10	10000000
Subnet 5	10	10	10	10100000
Subnet 6	10	10	10	11000000
Subnet 7	10	10	10	11100000

The new subnet mask would become: `255.255.255.11100000` which is `255.255.255.224`.

The network ID of each subnet is the address of is:

	First octet	Second octet	Third octet	Fourth octet (Bin.)	ID
Subnet 0	10	10	10	00000000	10.10.10.0
Subnet 1	10	10	10	00100000	10.10.10.32
Subnet 2	10	10	10	01000000	10.10.10.64
Subnet 3	10	10	10	01100000	10.10.10.96
Subnet 4	10	10	10	10000000	10.10.10.128
Subnet 5	10	10	10	10100000	10.10.10.160
Subnet 6	10	10	10	11000000	10.10.10.192
Subnet 7	10	10	10	11100000	10.10.10.224

The broadcast ID of each subnet is:

	First octet	Second octet	Third octet	Fourth octet (Bin.)	ID
Subnet 0	10	10	10	00011111	10.10.10.31
Subnet 1	10	10	10	00111111	10.10.10.63
Subnet 2	10	10	10	01011111	10.10.10.95
Subnet 3	10	10	10	01111111	10.10.10.127
Subnet 4	10	10	10	10011111	10.10.10.159
Subnet 5	10	10	10	10111111	10.10.10.191
Subnet 6	10	10	10	11011111	10.10.10.223
Subnet 7	10	10	10	11111111	10.10.10.255

Question 6

We can deduce from the class A network ID the subnet mask format as:

Subnet mask: `255.0.0.0`

To have eight subnets, we need $\log_2 8 = 3$ bits. With respect to the subnet mask, we use the second octet to achieve this.

	First octet (Dec.)	Second octet (Bin.)	Third octet (Dec.)	Fourth octet (Dec.)
Original IP	14	00000000	0	0
Subnet 0	14	00000000	0	0
Subnet 1	14	00100000	0	0
Subnet 2	14	01000000	0	0
Subnet 3	14	01100000	0	0
Subnet 4	14	10000000	0	0
Subnet 5	14	10100000	0	0
Subnet 6	14	11000000	0	0
Subnet 7	14	11100000	0	0

The new subnet mask would become: `255.11100000.0.0` which is `255.224.0.0`.

The network ID of each subnet is the address of is:

	First octet	Second octet (Bin.)	Third octet	Fourth octet	ID
Subnet 0	14	00000000	0	0	14.0.0.0
Subnet 1	14	00100000	0	0	14.32.0.0
Subnet 2	14	01000000	0	0	14.64.0.0
Subnet 3	14	01100000	0	0	14.96.0.0
Subnet 4	14	10000000	0	0	14.128.0.0
Subnet 5	14	10100000	0	0	14.160.0.0
Subnet 6	14	11000000	0	0	14.192.0.0
Subnet 7	14	11100000	0	0	14.224.0.0

The first valid address of each subnet is:

	First octet	Second octet (Bin.)	Third octet	Fourth octet	ID
Subnet 0	14	00000000	0	1	14.0.0.1
Subnet 1	14	00100000	0	1	14.32.0.1
Subnet 2	14	01000000	0	1	14.64.0.1
Subnet 3	14	01100000	0	1	14.96.0.1
Subnet 4	14	10000000	0	1	14.128.0.1
Subnet 5	14	10100000	0	1	14.160.0.1
Subnet 6	14	11000000	0	1	14.192.0.1
Subnet 7	14	11100000	0	1	14.224.0.1

The broadcast ID of each subnet is:

	First octet	Second octet (Bin.)	Third octet	Fourth octet	ID
Subnet 0	14	00011111	255	255	14.31.255.255
Subnet 1	14	00111111	255	255	14.63.255.255
Subnet 2	14	01011111	255	255	14.95.255.255
Subnet 3	14	01111111	255	255	14.127.255.255
Subnet 4	14	10011111	255	255	14.159.255.255
Subnet 5	14	10111111	255	255	14.191.255.255
Subnet 6	14	11011111	255	255	14.223.255.255
Subnet 7	14	11111111	255	255	14.255.255.255

The last valid address of each subnet is:

	First octet	Second octet (Bin.)	Third octet	Fourth octet	ID
Subnet 0	14	00011111	255	254	14.31.255.254
Subnet 1	14	00111111	255	254	14.63.255.254
Subnet 2	14	01011111	255	254	14.95.255.254
Subnet 3	14	01111111	255	254	14.127.255.254
Subnet 4	14	00011111	255	254	14.159.255.254
Subnet 5	14	00111111	255	254	14.191.255.254
Subnet 6	14	01011111	255	254	14.233.255.254
Subnet 7	14	01111111	255	254	14.255.255.254

Question 7

We can deduce from the class B network ID the subnet mask format as:

Subnet mask: `255.255.0.0`

The offset is given as 16.

	First octet (Dec.)	Second octet (Dec.)	Third octet (Bin.)	Fourth octet (Dec.)
Original IP	150	87	00000000	0
Subnet 0	150	87	00000000	0
Subnet 1	150	87	00010000	0
Subnet 2	150	87	00100000	0
Subnet 3	150	87	00110000	0
Subnet 4	150	87	01000000	0
Subnet 5	150	87	01010000	0

The new subnet mask would become: `255.255.11110000.0` which is `255.255.240.0`.

The network ID of each subnet is the address of is:

	First octet	Second octet	Third octet (Bin.)	Fourth octet	ID
Subnet 0	150	87	00000000	0	150.87.0.0
Subnet 1	150	87	00010000	0	150.87.16.0
Subnet 2	150	87	00100000	0	150.87.32.0
Subnet 3	150	87	00110000	0	150.87.48.0
Subnet 4	150	87	01000000	0	150.87.64.0
Subnet 5	150	87	01010000	0	150.87.80.0

The first valid address of each subnet is:

	First octet	Second octet	Third octet (Bin.)	Fourth octet	ID
Subnet 0	150	87	00000000	1	150.87.0.1
Subnet 1	150	87	00010000	1	150.87.16.1
Subnet 2	150	87	00100000	1	150.87.32.1
Subnet 3	150	87	00110000	1	150.87.48.1
Subnet 4	150	87	01000000	1	150.87.64.1
Subnet 5	150	87	01010000	1	150.87.80.1

The broadcast ID of each subnet is:

	First octet	Second octet	Third octet (Bin.)	Fourth octet	ID
Subnet 0	150	87	00001111	255	150.87.15.255
Subnet 1	150	87	00011111	255	150.87.31.255
Subnet 2	150	87	00101111	255	150.87.47.255
Subnet 3	150	87	00111111	255	150.87.63.255
Subnet 4	150	87	01001111	255	150.87.79.255
Subnet 5	150	87	01011111	255	150.87.95.255

The last valid address of each subnet is:

	First octet	Second octet	Third octet (Bin.)	Fourth octet	ID
Subnet 0	150	87	00001110	254	150.87.15.254
Subnet 1	150	87	00011110	254	150.87.31.254
Subnet 2	150	87	00101110	254	150.87.47.254
Subnet 3	150	87	00111110	254	150.87.63.254
Subnet 4	150	87	01001110	254	150.87.79.254
Subnet 5	150	87	01011110	254	150.87.95.254

Question 8

We can deduce from the class B network ID the subnet mask format as:

Subnet mask: `255.255.0.0`

To have four subnets, we need $\log_2 4 = 2$ bits. With respect to the subnet mask, we use the third octet to achieve this.

	First octet (Dec.)	Second octet (Dec.)	Third octet (Bin.)	Fourth octet (Dec.)
Original IP	141	85	00000000	0
Subnet 0	141	85	00000000	0
Subnet 1	141	85	01000000	0
Subnet 2	141	85	10000000	0
Subnet 3	141	85	11000000	0

The new subnet mask would become: `255.255.11000000.0` which is `255.255.192.0`.

The network ID of each subnet is the address of is:

	First octet	Second octet	Third octet (Bin.)	Fourth octet	ID
Subnet 0	141	85	00000000	0	141.85.0.0
Subnet 1	141	85	01000000	0	141.85.64.0
Subnet 2	141	85	10000000	0	141.85.128.0
Subnet 3	141	85	11000000	0	141.85.192.0

The broadcast ID of each subnet is:

	First octet	Second octet	Third octet (Bin.)	Fourth octet	ID
Subnet 0	141	85	00111111	255	141.85.63.255
Subnet 1	141	85	01111111	255	141.85.127.255
Subnet 2	141	85	10111111	255	141.85.191.255
Subnet 3	141	85	11111111	255	141.85.255.255