COMPUTER NETWORK

ASSIGNMENT-2

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Q.1. Every host in an IPv4 network has a 1-second resolution real-time clock with battery backup. Each host needs to generate up to 1000 unique identifiers per second. Assume that each host has a globally unique IPv4 address. Design a 50-bit globally unique ID for this purpose. After what period (in seconds) will the identifiers generated by a host wrap around?

SOLUTION:

$$wrap\ around\ time\ = \frac{total\ ids}{no\ of\ ids\ per\ sec}$$

Total IDs possible with 50-bit $= 2^{50}$

As we know one host generates 1000 ids per sec.

In IPv4 network total no of Hosts= 2^{32}

All hosts generated ids= $2^{32} \times 1000 = 2^{42}(approx)$

$$wrap\ around\ time\ = \frac{2^{50}}{2^{42}} = 2^{8} = 256\,\text{sec}$$

Q.2. In the network 200.10.11.144/27, the fourth octet (in decimal) of the last IP address of the network which can be assigned to a host is___.

Solution

The last or fourth octet of network addresses is 144 144 in binary is 10010000.

The first three bits of this octal are fixed as 100, the remaining bits can get a maximum value as 11111.

So the maximum possible last octal IP address is 10011111 which is 159.

The question seems to be asking about host addresses. The
address with all 1s in host part is broadcast address
and can't be assigned to a host. So the maximum possible last octal in a host IP is 10011110 which is 158.

The maximum possible network address that can be assigned
is 200.10.11.158/31 which has the last octet as 158.

Q.3. An IP datagram of size 1000 bytes arrives at a router. The router has to forward this packet on a link whose MTU (maximum transmission unit) is 100 bytes. Assume that the size of the IP header is 20 bytes. The number of fragments that the IP datagram will be divided into for transmission is.

Solution

MTU = 100 bytes

Size of IP header = 20 bytes

So, size of data that can be transmitted in one fragment = 100 – 20 = 80 bytes

Size of data to be transmitted = Size of datagram – size of header = 1000 – 20 = 980 bytes

Now, we have a datagram of size 1000 bytes.

So, we need ceil(980/80) = 13 fragments.

Thus, there will be 13 fragments of the datagram.

Q.4. Host X has IP address 192.168.1.97 and is connected through two routers R1 and R2 to another host Y with IP address 192.168.1.80. Router R1 has IP addresses 192.168.1.135 and 192.168.1.110. R2 has IP addresses 192.168.1.67 and 192.168.1.155. The netmask used in the network is 255.255.255.224. Given the information above, how many distinct subnets are guaranteed to already exist in the network?

Solution

Given IP addresses are of Class C

default Mask for class C = 24

Here given mask is 11 bits (11111111 11111111 11111111 11100000)

subnet ID: 3 bits

existing subnets: 011, 010 and 100

We can also find the number of subnets by counting the number of network prefixes as each network ID corresponds to a subnet. Subnet Mask – 255.255.255.224 or /27.

Q.5. Consider an IP packet with a length of 4,500 bytes that includes a 20-byte IPv4 header ans 40-byte TCP header. The packet is forwarded to an IPv4 router that supports a Maximum Transmission Unit (MTU) of 600 bytes. Assume that the length of the IP header in all the outgoing fragments of this packet is 20 bytes. Assume that the fragmentation offset value stored in the first fragment is 0. The fragmentation offset value stored in the third fragment is____?

Solution

MTU = 600 bytes and IP Header = 20 bytes

So, Payload will be 600 – 20 = 580 bytes

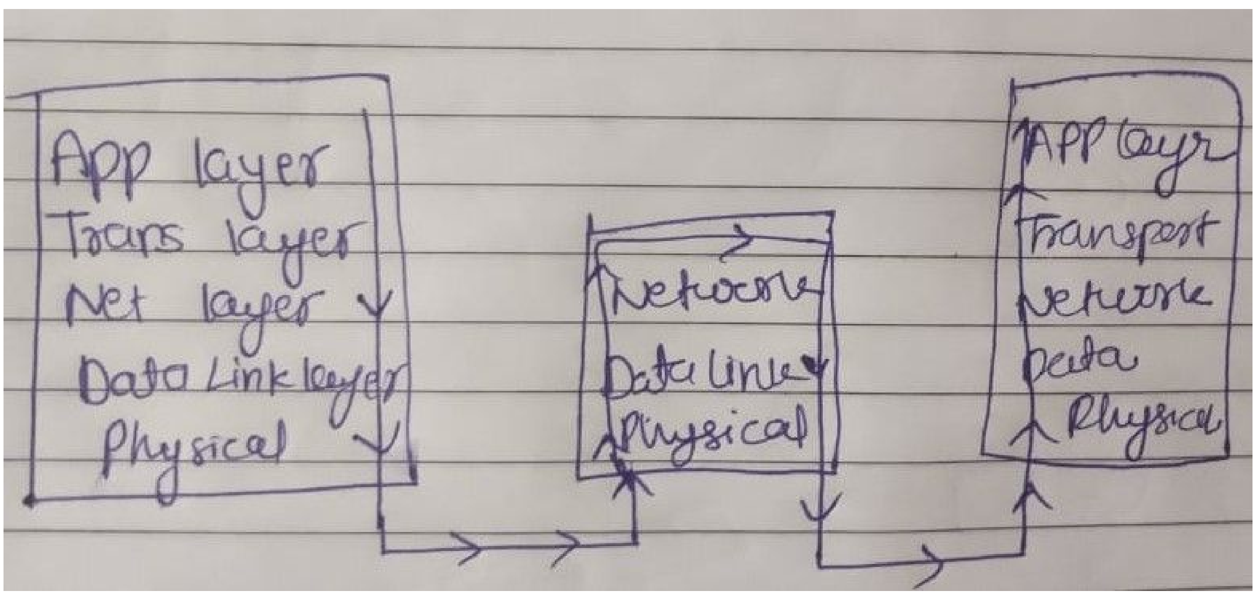
580 is not multiple of 8, but we know fragment size should be multiple of 8. So fragment size = 576 bytes

K_{th} fragmentation offset value = Fragment Size * (K_{th} fragment – 1) / Scaling Factor

Offset value of 3_{rd} fragment = 576 * (3 – 1) / 8 = 144

Q.6 Assume that Source S and Destination D are connected through an intermediate router R. How many times a packet has to visit the network layer and data link layer during a transmission from S to D?

Solution



Router is a network layer device so every packet paases twice through the data link layer in the intermediate router and once in the network layer.

So 3 times in the network layer and 4 times in the data link layer.

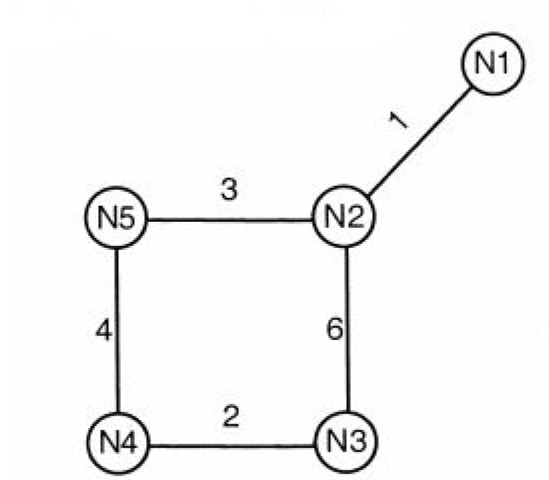
Q.7. A network with bandwidth of 10 Mbps can pass only an average of 15,000 frames per minute with each frame carrying an average of 8,000 bits. What is the throughput of this network?
solution

A network with 10 Mbps bandwidth can pass 15,000 frames and each frame carries 8,000 bit i.e.

120,000,000 bits per minute.

i.e. 120,000,000 / 60 = 2,000,000 = 2 Mbps.

Q.8. Consider a network with five nodes, N1 to N5, as shown below.



The network uses a Distance Vector Routing protocol. Once the routes have stabilized, the distance vectors at different nodes are as follows.

N1: (0, 1, 7, 8, 4) N2: (1, 0, 6, 7, 3) N3: (7, 6, 0, 2, 6) N4: (8, 7, 2, 0, 4)

N5: (4, 3, 6, 4, 0)

Each distance vector is the distance of the best known path at the instance to nodes, N1 to N5, where the distance to itself is 0. Also, all links are symmetric and the cost is identical in both directions. In each round, all nodes exchange their distance vectors with their respective neighbors. Then all nodes update their distance vectors. In between two rounds, any change in cost of a link will cause the two incident nodes to change only that entry in their distance vectors.
52. The cost of link N2-N3 reduces to 2(in both directions). After the next round of updates, what will be the new distance vector at node N3?

Solution

As soon as N2−N3 reduces to 2 ,both N2 and N3 instantly update their distance to N3 and N2 to 2 respectively. So, N2: (1,0,2,7,3) N3: (7,2,0,2,6) becomes this.

After this starts the first round of updates in which each node shares its table with their respective neighbors only.What I mean is tables that will be used for updation at this moment contain the values as N1:(0,1,7,8,4) , N2: (1,0,2,7,3) ,N3: (7,2,0,2,6) ,N4: (8,7,2,0,4) ,N5:(4,3,6,4,0)

SEE at this time all the entries are old except in N2 and N3 where value changes to

2 instead of 6.

Question asks for N3. So focus on that.

N3 receives tables from

N2:(1,0,2,7,3) and

N4:(8,7,2,0,4). Using THIS ONLY original

N3: (7,2,0,2,6) updates to

N3(3,2,0,2,5).

Q.9. Consider a source computer (S) transmitting a file of size 106 bits to a destination computer (D) over a network of two routers (R1 and R2) and three links (L1, L2 and L3). L1 connects S to R1;L2 connects R1 to R2; and L3 connects R2 to D. Let each link be of length 100km. Assume signals travel over each link at a speed of 10^8 meters per second. Assume that the link bandwidth on each link is 1Mbps. Let the file be broken down into 1000 packets each of size 1000 bits. Find the total sum of transmission and propagation delays in transmitting the file from S to D?

Solution

Propagation delay to travel from S to R1 = $\frac{Distance}{Link\ Speed} = \frac{10^5}{10^8} = 1\text{ms}$

Total prorogation delay to travel from S to D = 3×1 ms = 3ms

Total Transmission delay for 1 packet = $\frac{3 \times (Number\ of\ Bits)}{Bandwidth} = 3 \times (1000/\,10^6\ ) = 3$ms.

The first packet will take 6ms to reach D. While the first packet was reaching D, other packets must have been processed in parallel. So D will receive remaining packets 1 packet per 1 ms from R2. So remaining 999 packets will take 999 ms. And total time will be 999 + 6 = 1005 ms