Ans1.

IP – 200.10.5.86 / 28

Which is 11001000.00001010.00000101.01000100

Subnet Mask 11111111.11111111.11111111.11110000

Hence, by and-ing both the binary numbers we can get the subnetwork address

By adding we get 11001000.00001010.00000101.01000000

Which is 200.10.5.64 / 28

Ans2.

IP – 172.16.0.0/19

Subnet Mask 11111111.11111111.11100000.00000000

Hence, we have 3 subnet bits and 13 host bits

Hence, number of subnets we can have = 2^3 = **8 Subnets**

And number of hosts we can have = 2^13 - 2 = **8190 hosts**

Ans3.

IP – 223.1.23.0/24

1) For the first subnet we need 90 hosts so we can subnet to a /25 network with a maximum of 126 hosts.

So, the subnet will be 223.1.23.0/25 with the range 223.1.23.1 – 223.1.23.126

2) For the second subnet we need 60 hosts so we can subnet to a /26 network with a maximum of 62 hosts.

So, the subnet will be 223.1.23.128/26 with the range 223.1.23.129 – 223.1.23.190

3) For the third subnet we need 12 hosts so we can subnet to a /28 network with a maximum of 14 hosts.

So, the subnet will be 223.1.23.192/28 with the range 223.1.23.193 – 223.1.23.206

Ans4.

a) IPv4 Address Squatting

b) Jim will broadcast an ARP request to the entire network to check if the IP addressed offered is used by any other computer[1].

c) After that Jim will send a DHCPDECLINE response back to the HDCP server, declining the DHCPOFFER.[1]

Ans5.

Network Congestion: It might be possible that the network might be undergoing congestion and the receive window is full, resulting in packet drops.

Slow Hardware: It might be possible for a router or a switch or a cable to be outdated or slow that it might not be able to keep up with the data-rate going through it resulting in packet loss.

Software Issues: It also might be possible that a packet drop occurs because of misconfigured software on a router or a switch or because of some unintentional bug in the hardware Operating System.

Faulty Hardware: Packet Loss also might occur because of faulty or degrading hardware, for e.g. broken ethernet ports, degrading or cut cabling, etc.

Network Jitter: On connections dependent on timing, jitter also results in packet loss. Inconsistent jitter might result in timing issues on the receiving end resulting in packet loss.

Ans6.

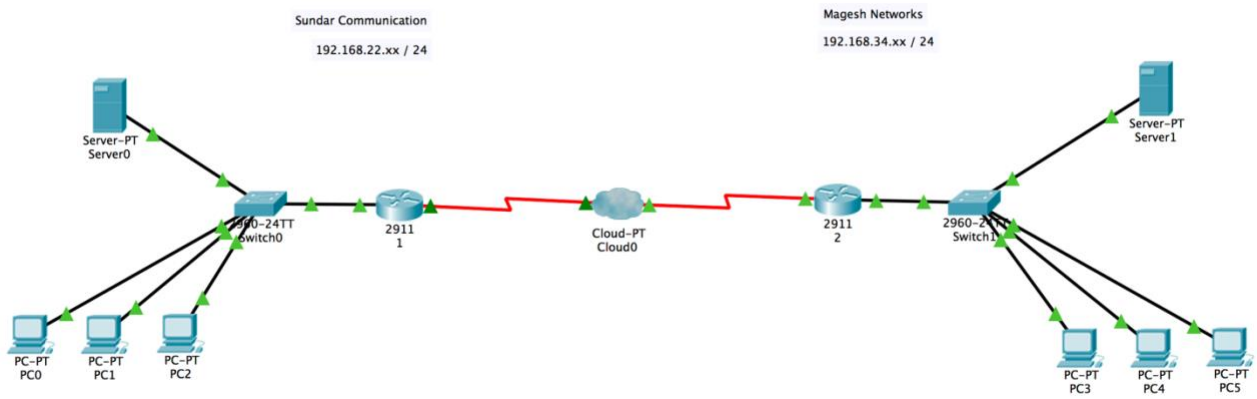
The minimum packet size at the data link layer is 64 bytes. Out of the 64 bytes, ethernet header is of 18 bytes and then minimum data portion is 48 bytes.

Reason why there is a defined minimum packet size constraint lies within the collision detection mechanisms of the data link layer.

The 64-bit size was chosen to ensure that the transmission time is greater than the propagation delay so it's easy to determine the state of the transmission[2]. The minimum size requirement was established to create an overall more efficient network where anything shorter than 64 bytes will be considered a collision. A transmission station will not know of a collision until it is detected by a receiving station. Once detection by a receiving station it will then transmit a JAM signal and break off transmission. This allows us to interpret anything less than 64-bit as collision.

Ans7.

Network Diagram:



IP Addressing:

Given both the networks here are pretty small with only a handful of workstations, we can assume they run a /28 Class C subnetwork with 14 IP addresses, which will allow us with enough room to expand in the future as well.

Let's assume SComm runs on a network address 192.168.22.1 / 28 and MNets runs on a network 192.168.34.1 / 28. Then the companies can contact their ISPs and request their networks to be merged. The ISP can then use one of the many WAN protocols like Frame Relay or HDLC to connect the two locations together.

Network Components:

Router: Routers are layer 3 devices which connect two networks together, for example a LAN to another LAN or a LAN to its ISP. Routers use IP addresses to route incoming datagrams from one place to another. Given the small size of the company, we'd choose to go with an all-in-one router solution would both connect to the ISP and function as the edge router.

Switch: Switches are layer 2 devices which uses MAC addresses to exchange data between the end-users in a LAN. Our router would further then connect to a 24 port switch, through which further the workstation PCs and the server would be connected.

Server: A server can be used for a lot of different purposes, the server that exists in the companies here can function the LAN HDCP server, a NAS, a DNS server etc.

Workstations: These are the end users connected to the company network.

I). SComm is under LAN, because it's just a single internal network.

MNets is under LAN, because it's just a single internal network.

SM Inc. is under MAN, because it's LAN networks joint together over an ISP across a metropolitan area.

II). Tier II or III ISP, because Tier II or III ISPs will be the ISPs who would provide internet access to the end user hence the companies will need to speak to their immediate ISPs to figure out a plan to merge the networks.

III). Classless Network, because most modern network do not use classfull addressing to avoid wasting IP addresses. IP addresses are distributed completely ceaselessly now-a-days.

IV). Classless Network. We'll be merging two classless networks; we'll end up with another classless network.

References:

[1]. RFIC 1541, Pg 15. tools.ietf.org/html/rfc1541

[2]. Vijay K. Garg, Yih-Chen Wang, The Electrical Engineering Handbook.