Georgia Southwestern State University

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Q1 Response. The following steps detail the process to design a 'class C' sub-netting scheme that maximizes the number of hosts per sub-net for an organization's network with the IP address 182.0.0.0 and the requirement of at most 255 sub-nets.

Step 1: Determine the Number of Bits for Sub-netting

To create 255 sub-nets, you need enough bits to represent that many sub-nets. You can use the formula 2^n to find the number of bits required, where 'n' is the number of bits. In this case, you need to find 'n' when $2^n >= 255$.

$2^7 = 128 < 255$

$2^8 = 256 >= 255$

Accordingly, at least 8 bits are required for this network scheme.

Step 2: Determine the Number of Host Bits

Since IPv4 addresses have 32 bits in total, and it was established in step one that 8 bits are to be allocated for sub netting, 24 bits (32-8 =24) remain for the host addresses within each sub-net.

Step 3: Create the Sub-net Mask

The sub-net mask is created by taking the first 'n' bits for sub-netting and setting them to '1', while the remaining bits for hosts are set to '0'. In this case, the sub-net mask for 255 sub-nets would be:

First octet (255): 11111111

Second octet (255): 11111111

Third octet (255): 11111111

Fourth octet (0): 00000000

Sub-net Mask: 255.255.255.0 (/24 CIDR notation)

Step 4: Determine the Sub-net Ranges

With the 255 sub-nets and a sub-net mask of 255.255.255.0, we can then determine the sub-net ranges—Each sub-net will have a range of host IP addresses, and the third octet will be used for sub-net identification. The method to calculate the sub-nets is shown below:

Sub-net 1: 182.0.1.0/24 (Range: 182.0.1.1 to 182.0.1.254)

Sub-net 2: 182.0.2.0/24 (Range: 182.0.2.1 to 182.0.2.254)

...

Sub-net 255: 182.0.255.0/24 (Range: 182.0.255.1 to 182.0.255.254)

This sub-netting scheme allows for 255 sub-nets, each with the potential to support up to 254 host addresses (since 182.0.0.0 is the network address, and 182.0.255.255 is the broadcast address for each sub-net). A router inside the organization's network should use the **sub-net mask 255.255.255.0** (/24 CIDR notation) to identify the organization's sub-net that a packet is destined for.

Q2 Response: It is critical to allocate enough bits for host addresses and sub-net identification in order to design a 'Class B' sub-netting scheme that allows for at most 1024 hosts per sub-net while maximizing the number of sub-net's per the following steps:

Step 1: Determine the Number of Bits for Hosts

10 bits for host addresses are required to support 1024 hosts per sub-net (2^10 = 1024), which leaves 22 bits for sub net identification (32 total bits - 10 bits for hosts).

Step 2: Create the Sub-net Mask

The sub-net mask is created by taking the first 'n' bits for sub-netting and setting them to '1', while the remaining bits for hosts are set to '0'. In this case, the sub-net mask for 1024 hosts would be:

First octet (255): 11111111

Second octet (255): 11111111

Third octet (252): 11111100

Fourth octet (0): 00000000

Sub-net Mask: 255.255.252.0 (/22 CIDR notation)

Step 3: Determine the Number of Sub-nets

With 22 bits remaining for sub net identification, a maximum of 4,194,304 (=2^22) sub-nets can

be created; However, note that since the scheme seeks to maximize the number of sub-nets,

powers of 2 that are closest to 4,194,304 without exceeding it should be utilized.

2^21 = 2,097,152 sub-nets (to few)

2^22 = 4,194,304 sub-nets (maximum)

Step 4: Determine the Sub-net Ranges

Now the sub-net ranges can be determined based on each sub net having a range of host IP

addresses, while the last two bits of the third octet and all bits in the fourth octet will be used for

host addresses. The method to calculate the sub-nets is shown below:

Sub-net 1: 182.0.0.0/22 (Range: 182.0.0.1 to 182.0.3.254)

Sub-net 2: 182.0.4.0/22 (Range: 182.0.4.1 to 182.0.7.254)

...

Sub-net 4,194,304: 182.255.252.0/22 (Range: 182.255.252.1 to 182.255.255.254)

This sub-netting scheme allows for 4,194,304 sub-nets, each with the potential to support up to

1022 host addresses (since some addresses in each sub-net are reserved for network address and

broadcast address). A router inside the organization's network should use the **sub-net mask

255.255.252.0** (/22 CIDR notation) to identify the organization's sub-net that a packet is

destined for.