Batch: A1 Roll No.: 1611015

Experiment / assignment / tutorial No.____1___

Grade: AA / AB / BB / BC / CC / CD /DD

Signature of the Staff In-charge with date

Experiment No.:1

TITLE: IP classes and Implementation of Subnet mask concept.

AIM: To study IP classes and Implementation of Subnet mask concept.

An IP (Internet Protocol) address is a unique identifier for a node or host connection on an IP network. Subnetting an IP Network can be done for a variety of reasons, including organization, use of different physical media (such as Ethernet, FDDI, WAN, etc.), preservation of address space, and security. The most common reason is to control network traffic. In an Ethernet network, all nodes on a segment see all the packets transmitted by all the other nodes on that segment. Performance can be adversely affected under heavy traffic loads, due to collisions and the resulting retransmissions. A router is used to connect IP networks to minimize the amount of traffic each segment must receive.

This experiment enables student for identifying the class of the IP address and design particular subnets as per user requirements.

Expected Outcome of Experiment:

CO: Elaborate various network layer services and protocols in wired and wireless technology

Books/ Journals/ Websites referred:

1. A. S. Tanenbaum, "Computer Networks", Pearson Education, Fourth Edition
2. B. A. Forouzan, "Data Communications and Networking", TMH, Fourth Edition

Pre Lab/ Prior Concepts: IP Address, Classes, Subnet concept

New Concepts to be learned: Subnet mask calculation, Subnet address calculation

Stepwise-Procedure:

Applying a subnet mask to an IP address allows to identify the network and node parts of the address. The network bits are represented by the 1s in the mask, and the node bits are represented by the 0s. Performing a bitwise logical AND operation between the IP address and the subnet mask results in the *Network Address* or Number.

Default subnet masks:

Class A - 255.0.0.0 - 11111111.00000000.00000000.00000000
Class B - 255.255.0.0 - 11111111.11111111.00000000.00000000
Class C - 255.255.255.0 - 11111111.11111111.11111111.00000000

Additional bits can be added to the default subnet mask for a given Class to further subnet, or break down, a network. When a bitwise logical AND operation is performed between the subnet mask and IP address, the result defines the *Subnet Address* (also called the *Network Address* or *Network Number*). There are some restrictions on the subnet address. Node addresses of all "0"s and all "1"s are reserved for specifying the local network (when a host does not know its network address) and all hosts on the network (broadcast address), respectively. This also applies to subnets. A subnet address cannot be all "0"s or all "1"s. This also implies that a 1 bit subnet mask is not allowed. This restriction is required because older standards enforced this restriction. Recent standards that allow use of these subnets have superseded these standards, but many "legacy" devices do not support the newer standards. If you are operating in a controlled environment, such as a lab, you can safely use these restricted subnets.

CIDR -- Classless **I**nter **D**omain **R**outing:

The "classful" system of allocating IP addresses can be very wasteful; Under supernetting, the classful subnet masks are extended so that a network address and subnet mask could, for example, specify multiple Class C subnets with one address.

For example, If about 1000 addresses are required, it could be possible to supernet 4 Class C networks together:

192.60.128.0 (11000000.00111100.10000000.00000000)Class C subnet address
192.60.129.0(11000000.00111100.10000001.00000000) Class C subnet address
192.60.130.0(11000000.00111100.10000010.00000000) Class C subnet address
192.60.131.0(11000000.00111100.10000011.00000000) Class C subnet address
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192.60.128.0 (11000000.00111100.10000000.00000000) Supernetted subnet address
255.255.252.0 (11111111.11111111.11111100.00000000)Subnet Mask 192.60.131.255 (11000000.00111100.10000011.11111111) Broadcast address

In this example, the subnet 192.60.128.0 includes all the addresses from 192.60.128.0 to 192.60.131.255. In the binary representation of the subnet mask, the Network portion of the address is 22 bits long, and the host portion is 10 bits long. Under CIDR, the subnet mask notation is reduced to simplified shorthand. Instead of spelling out the bits of the subnet mask, it is simply listed as the number of 1s bits that start the mask. In the above example, instead of writing the address and subnet mask as 192.60.128.0, Subnet Mask 255.255.252.0 .the network address would be written simply as: 192.60.128.0/22 Which indicates starting address of the network, and number of 1s bits (22) in the network portion of the address.
Subnet mask in binary

11111111.11111111.11111100.00000000.

The use of a CIDR notated address is the same as for a Classful address. Classful addresses can easily be written in CIDR notation as Class A = /8, Class B = /16, and Class C = /24
To calculate the number of subnets or nodes,

No. of Nodes/ Subnets $=2^n-2$

Where n = number of bits in either field.

Multiplying the number of subnets by the number of nodes available per subnet gives you the total number of nodes available for your class and subnet mask. Also, note that although subnet masks with non-contiguous mask bits are allowed, they are not recommended.

Example:

10001100.10110011.11011100.11001000	140.179.220.200IP Address
11111111.11111111.**111**00000.00000000	255.255.**224**.000Subnet Mask
10001100.10110011.11000000.00000000	140.179.192.000Subnet Address
10001100.10110011.11011111.11111111	40.179.223.255 Broadcast Address

1. Program starts with taking IP address from user and the number of subnets from the user.
2. Then the calculation for subnet mask is done as specified in methodology.
3. Then with AND ing with subnet mask the subnet addresses are calculated.

IMPLEMENTATION: (printout of code)
Due to length of code ,it's provided in separate file

CONCLUSION:
Classfull and classless Ip addressing was understood and implemented and subnetting of addresses in both are implemented successfully.

Post Lab Questions

1. Which of the following is private IP address?
   A. 12.0.0.1 B. 168.172.19.39
   C. 172.15.14.36 D. 192.168.24.43
   Ans: option D:192.168.24.43
   Explanation:
   Private IP addresses range between 10.0.0.0-10.255.255.255, 172.16.0.0-172.31.255.255, 192.168.0.0-192.168.255.255. option D comes in that range so it private address.

2. Which class of IP address provides a maximum of only 254 host addresses per network ID?
   A. Class A
   B. Class B
   C. Class C
   D. Class D
   Ans: option C: Class C
   Explanation: class C has 24 bit network and 8 bit host id. Ie. 2 ^8=256 addresses, out of which one is network and other is last address.so 254 addresses per network ID.

3. What is the address range of a Class B network address in binary?
   A. 01xxxxxx
   B. 0xxxxxxx
   C. 10xxxxxx
   D. 110xxxxx

   Ans: option C: 10xxxxxx
   Explanation : range of B is 128-191 which is in binary same as option c

4. Which two statements describe the IP address 10.16.3.65/23?
   1.The subnet address is 10.16.3.0 255.255.254.0.
   2.The lowest host address in the subnet is 10.16.2.1 255.255.254.0.
   3.The last valid host address in the subnet is 10.16.2.254 255.255.254.0.
   4.The broadcast address of the subnet is 10.16.3.255 255.255.254.0.
   A. 1 and 3
   B. 2 and 4
   C. 1, 2 and 4
   D. 2, 3 and 4

   Ans : option B: 2 and 4
   Explaination : The mask 255.255.254.0 (/23) used with a Class A address means that there are 15 subnet bits and 9 host bits. The block size in the third octet is 2 (256 – 254). So this makes the subnets in 0, 2, 4, 6, etc., all the way to 254. The host 10.16.3.65 is in the 2.0 subnet. The next subnet is 4.0, so the broadcast address for the 2.0 subnet is 3.255. The valid host addresses are 2.1 through 3.254

5. What is the maximum number of IP addresses that can be assigned to hosts on a local subnet that uses the 255.255.255.224 subnet mask?

   A. 14 B. 15
   C. 16 D. 30

   Ans: option D : 30
   Explanation : A /27 (255.255.255.224) is 3 bits on and 5 bits off. This provides 8 subnets, each with 30 hosts.

6. You need to subnet a network that has 5 subnets, each with at least 16 hosts. Which classful subnet mask would you use?

   A. 255.255.255.192 B. 255.255.255.224
   C. 255.255.255.240 D. 255.255.255.248

   Ans : option B :255.255.255.224
   Explanation: You need 5 subnets, each with at least 16 hosts. The mask 255.255.255.240 provides 16 subnets with 14 hosts-this will not work. The mask 255.255.255.224 provides 8 subnets, each with 30 hosts

7. You have a network that needs 29 subnets while maximizing the number of host addresses available on each subnet. How many bits must you borrow from the host field to provide the correct subnet mask?

   A. 2 B. 3
   C. 4 D. 5

   Ans: option D : 5
   Explaination: A 240 mask is 4 subnet bits and provides 16 subnets, each with 14 hosts. We need more subnets, so let's add subnet bits. One more subnet bit would be a 248 mask. This provides 5 subnet bits (32 subnets) with 3 host bits (6 hosts per subnet)

Date: 14-8-18 **Signature of faculty in-charge**