Computer Networks
2nd Year, 1st Semester
2022

Tutorial 2

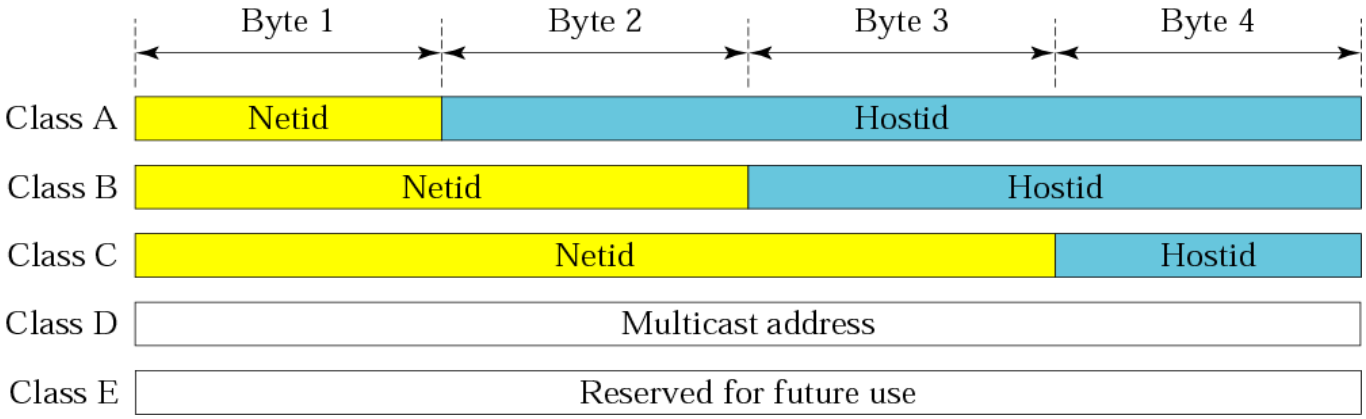
1) State the three types of addresses, operating layer and number of bits used to represent the address used in TCP/IP.

Physical address- layer 2 data link– MAC 48 bits
Logical address- layer 3 network – V4 – 32 bits / V6 – 128 bits
Port address – layer 4 transport layer - 16 bits

2) What is the version of the current IP addressing scheme and the version of the next IP addressing scheme that will be using in the future?

IP V4 – 32 bits
IP V6 – 128 bits

3) For IP addresses in each class show network bits and host bits by a diagram.
Class A
Class B
Class C



4) Write down the ranges of the IP address classes.

Address Class	Range of the first octet
Class A	0 to 127
Class B	128 t0 191
Class C	192- 223
Class D	224 to 239
Class E	240 to 255

5) Write the class, net ID and the host ID of the following addresses

Network Address	Class	Net ID	Host ID	Network address	Broadcast Address
101.2.3.4	A	101	2.3.4	101.0.0.0	101.255.255.255
200.20.10.5	C	200.20.10	5	200.20.10.0	200.20.10.255
192.168.16.100	C	192.168.16	100	192.168.16.0	192.168.16.255
25.10.100.200	A	25	10.100.200	25.0.0.0	25.255.255.255
180.2.150.2	B	180.2	150.2	180.2.0.0	180.2.255.255

6) Find the network address and the subnet mask for the following IP addresses.
   a. 172.19.67.3
      Class – B
      Network address - 172.19.0.0
      Subnet mask – 255.255.0.0

   b. 205.90.46.234
      Class – C
      Network ad = 205.90.46.0
      Subnet mask- 255.255.255.0

   c. 123.65.89.0
      Class – A
      Network ad = 123.0.0.0
      Subnet mask- 255.0.0.0

7) State the type of the following IP addresses.

Class	Private Network Address	No.of Networks
A	10.0.0.0	1
B	172.16.0.0 to 172.31.0.0	16
C	192.168.0.0 to 192.168.255.0	256

   a. 172.16.25.9 – class B private ip address

   b. 192.168.89.0- class C private range network address

   c. 127.0.0.90 – loopback address

   d. 255.255.255.0 – class C subnet mask

   e. 255.255.255.255 – limited broadcast address

   f. 0.0.26.8 – specific host on this network

8. What are two main components of an IP address?
   Net id , host ID

9. Analyze the following IP addresses.

Find out which of the following addresses belong to the same network (no sub -netting / classful IP addressing). Explain why.

I. 123.4.6.2 123.4.78.9 132.14.56.12 123.4.0.0

Class A -- 1,2 ,3 belong to same network

II. 10.0.0.1 10.1.1.1 10.1.2.2 11.0.0.1

Class A first 3 same network

III. 172.16.16.16 172.17.16.16 173.16.16.16 173.16.16.20

Class B 3 and 4 in same network

Classless addressing

10. You are given the network address **180.150.0.0**; you are required to have **5 subnets**. What is the minimum number of Host Bits can you take in to the Network Bits for this purpose?
    Write down the addresses of 5 subnets. (Write in binary where necessary). Write the subnet mask for the network.

    Class B (net id first 2 bytes = 16 bits)

    5 sub nets = 2^3 = 8 = we need 3 bits

    Net ID subnet id host

    180.150 . 000 00000.00000000

			Subnet Address	Subnet mask
180.150	**0 0 0 00000**	**00000000**	180.150.0.0 /19	225.225.224.0
180.150	**0 0 1 00000**	**00000000**	180.150.32.0/19	225.225.224.0
180.150	**0 1 0 00000**	**00000000**	180.150.64.0/19	225.225.224.0
180.150	**0 1 1 00000**	**00000000**	180.150.96.0/19	225.225.224.0
180.150	**1 0 0 00000**	**00000000**	180.150.128.0/19	225.225.224.0
180.150	**1 0 1 00000**	**00000000**		
180.150	**1 1 0 00000**	**00000000**		
180.150	**1 1 1 00000**	**00000000**		

11. A company is granted the network address 203.80.64.0 The company needs six subnets. Design the subnets and subnet mask. Also write the first 2 and last 2 IP addresses of the hosts in each of those subnets.

    203.80.64.0
    Class C
    Net id first 3 bytes (24 bits)
    Bits for 6 subnets = 2^3 = 8 = we need 3 bits

Net ID	Subnet ID	Host ID	Subnetwork address	Subnet mask
203.80.64.	0 0 0	00000	203.80.64.0/27	255.255.255.224
203.80.64.	0 0 1	00000	203.80.64.32/27	255.255.255.224
203.80.64.	0 1 0	00000	203.80.64.64/27	255.255.255.224
203.80.64.	0 1 1	00000	203.80.64.96/27	255.255.255.224
203.80.64.	1 0 0	00000	203.80.64.128/27	255.255.255.224
203.80.64.	1 0 1	00000	203.80.64.160/27	255.255.255.224
	1 1 0			
	1 1 1			

Subnetwork address	Net ID	Subnet ID	Host ID		
203.80.64.0/27	203.80.64.	0 0 0	00000	203.80.64.0/27	Subnet address
	203.80.64.	0 0 0	00001	203.80.64.1/27	First 2 ip addresses
	203.80.64.	0 0 0	00010	203.80.64.2/27	
	203.80.64.	0 0 0	11101	203.80.64.29/27	Last 2 ip addresses
	203.80.64.	0 0 0	11110	203.80.64.30/27	
	203.80.64.	0 0 0	11111	203.80.64.31/27	Broadcast address
203.80.64.32/27	203.80.64.	0 0 1	00000	203.80.64.32/27	Subnet address
	203.80.64.	0 0 1	00001	203.80.64.33/27	First 2 ip addresses
	203.80.64.	0 0 1	00010	203.80.64.34/27	
	203.80.64.	0 0 1	11101	203.80.64.61/27	Last 2 ip addresses
	203.80.64.	0 0 1	11110	203.80.64.62/27	
	203.80.64.	0 0 1	11111	203.80.64.63/27	Broadcast address
203.80.64.64/27	203.80.64.	0 1 0	00000		
203.80.64.96/27	203.80.64.	0 1 1	00000		
203.80.64.128/27	203.80.64.	1 0 0	00000		
203.80.64.160/27	203.80.64.	1 0 1	00000		

First 2 Ip addresses- Next available 2 ip addresees after the sub network address
Last 2 Ip addresses – Just before ip addresses to the broadcast address

12. Show the 8 subnets obtained by subnetting the address 172.16.0.0/16 , the resulting subnet mask, the corresponding broadcast addresses, and the range of valid host addresses.

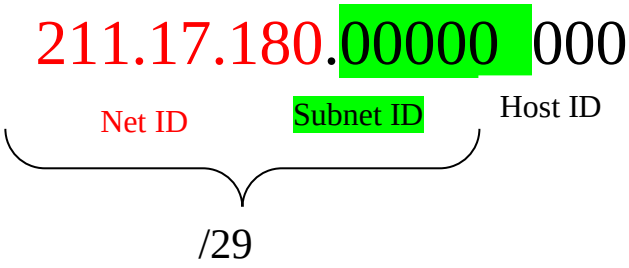
172.16.0.0/16
Class B
Net id first 2 bytes (16 bits)
Bits required for 8 subnets = 2^3 = 8 = we need 3 bits

Net ID	Subnet ID	Host ID	Subnetwork address	Subnet mask
172.16.	0 0 0	00000 00000000	172.16.0.0/19	255.255.224.0
172.16.	0 0 1	00000 00000000	172.16.32.0/19	255.255.224.0
172.16.	0 1 0	00000 00000000	172.16.64.0/19	255.255.224.0
172.16.	0 1 1	00000 00000000	172.16.96.0/19	255.255.224.0
172.16.	1 0 0	00000 00000000	172.16.128.0/19	255.255.224.0
172.16.	1 0 1	00000 00000000	172.16.160.0/19	255.255.224.0
172.16.	1 1 0	00000 00000000	172.16.192.0/19	255.255.224.0
172.16.	1 1 1	00000 00000000	172.16.224.0/19	255.255.224.0

Subnetwork address	Net ID	Subnet ID	Host ID		
172.16.0.0/19	172.16.	0 0 0	00000 00000000	172.16.0.0/19	Subnet address
	172.16.	0 0 0	00000 00000001	172.16.0.1/19	First ip address
	172.16.	0 0 0	11111 11111110	172.16.15.254/19	Last ip address
	172.16.	0 0 0	11111 11111111	172.16.15.255/19	Broadcast address
172.16.32.0/19	172.16.	0 0 1	00000 00000000	172.16.32.0/19	Subnet address
	172.16.	0 0 1	00000 00000001	172.16.32.1/19	First ip address
	172.16.	0 0 1	11111 11111110	172.16.63.254/19	Last ip address
	172.16.	0 0 1	11111 11111111	172.16.63.255/19	Broadcast address
172.16.64.0/19	172.16	0 1 0	00000 00000000	172.16.64.0/19	Subnet address
	172.16	0 1 0	00000 00000001	172.16.64.1/19	First ip address
	172.16	0 1 0	11111 11111110	172.16.95.254/19	Last ip address
	172.16	0 1 0	11111 11111111	172.16.95.255/19	Broadcast address
172.16.96.0/19	172.16.	0 1 1	00000 00000000		
172.16.128.0/19	172.16.	1 0 0	00000 00000000		
172.16.160.0/19	172.16.	1 0 1	00000 00000000		
172.16.192.0/19	172.16.	1 1 0	00000 00000000		
172.16.224.0/19	172.16.	1 1 1	00000 00000000		

13. An organization is granted the block 211.17.180.0 in class C. The administrator wants to create 32 subnets.
    I. Find the subnet mask and the number of addresses in each subnet.

211.17.180.0/24
Class C
To create 32 subnets = 5 bits (2^5 = 32)



Only 3 bits for host portion

Subnet mask = 11111111 11111111 11111111 11111000 = 255.255.255.248
Number of addresses in each host = (2^3 – 2) = 6 IP Addresses

II Find the first and the last address in the first subnet.

First subnet = 211.17.180.0/29
First address = 211.17.180.1/29
Last address = 211.17.180.6/29
Broadcast address= 211.17.180.7/29

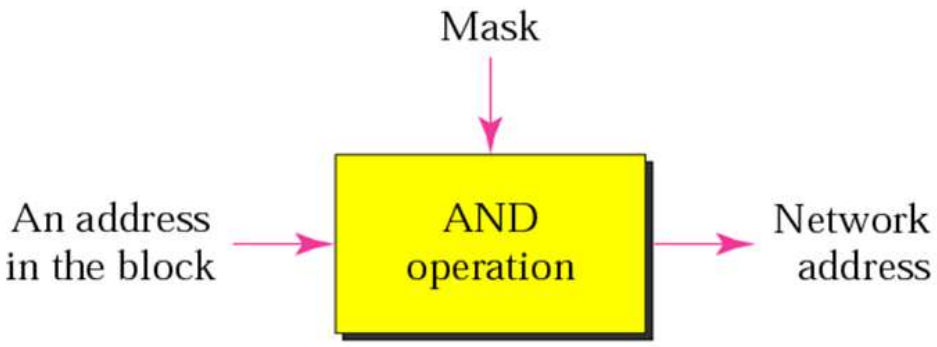
III Find the first and the last address in the last subnet (subnet 31)

Last subnet = 211.17.180.248/29
First address = 211.17.180.249/29
Last address = 211.17.180.254/29
Broadcast address= 211.17.180.255/29

14. compute the sub-network address for the following IP addresses, given the subnet mask,

I.	201.14.78.65	255.255.255.224
II.	180.25.21.172	255.255.255.192
III.	18.250.31.14	255.254.0.0
IV.	10.30.36.12	255.255.255.0
V.	10.6.24.20	255.255.240.0

IP is given and subnet mask is given
Perform bitwise and operation to get the sub network address



I 201.14.78.65 65= 01000001
255.255.255.224 224= 11100000
01000000 = 64

Subnet address =201.14.78.64

II 180.25.21.172 172 =10101100
255.255.255.192 192 =11000000
10000000

Subnet address =180.25.21.128

15. Compute the available number of sub networks and possible host addresses in each subnet.
    g. The subnet mask for a class C network is 255.255.255.192

    Class C – 24 bits are initially belonging to net ID
    Subnet mask 255.255.255.192 = num of bits in net id part of subnet = 26 bits (192 = 11000000)

    Sub net id bits = 26 – 24 = 2 bits
    Num of sub networks = (2^2) = 4
    Possible host addresses in each subnet = 2^(32-26) -2 = 2^6 -2= 62

    h. The subnet mask for a class B network is 255.255.224.0

    Class B – 16 bits are initially belonging to net ID
    Subnet mask 255.255.224.0 **= num of bits in net id part of subnet = 19 bits (224 = 11100000)**

    Sub net id bits = 19 – 16 = 3bits
    Num of sub networks = (2^3) = 8
    Possible host addresses in each subnet = 2^(32-19) -2 = 2^13 -2= 8190

    i. The subnet mask for a class C network is 255.255.255.248
    j. The subnet mask for a class A network is 255.255.248.0

16. RH company has 9 branches in Colombo district. The company network has the network address of 152.16.0.0.
    a. Write subnet addresses which can be given to the branches.

    152.16.0.0.
    Class B
    152.16.0.0/ 16
    Num of subnets = 9
    Num of bits needed = 2^4 = 12

150.16	0000 0000	00000000	150.16.0.0/20
150.16	0001 0000	00000000	150.16.16.0/20
150.16	0010 0000	00000000	150.16.32.0/20
150.16	0011 0000	00000000	150.16.48.0/20
150.16	0100 0000	00000000	150.16.64.0/20
150.16	0101 0000	00000000	150.16.80.0/20
150.16	0110 0000	00000000	150.16.96.0/20
150.16	0111 0000	00000000	150.16.112.0/20
150.16	1000 0000	00000000	150.16.128.0/20
150.16	1001 0000	00000000	
150.16	1010 0000	00000000	
150.16	1011 0000	00000000	
150.16	1100 0000	00000000	
150.16	1101 0000	00000000	
150.16	1110 0000	00000000	
150.16	1111 0000	00000000	

b. How many hosts can be existed in a branch?

Hosts = 2^12 -2 = 4094

c. Calculate the total number of available hosts in all the branches.

Total hosts in all branches = 9X 4094 = 36,846

d. Write the 10th available IP address of the 5th branch.

150.16.64.10/20

e. Write the last 4 IP addresses of the 9th branch.

150.16	1000 0000	00000000	150.16.128.0/20
Last 4 ip addresses of 9th branch			150.16.143.251/20
			150.16.143.252/20
			150.16.143.253/20
			150.16.143.254/20
Broadcast ad	1000 1111	11111111	150.16.143.255/20