



SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COURSE NAME :19IT401 COMPUTER NETWORKS

II YEAR /IV SEMESTER

Unit 3-Network layer

Topic 5 : IPv4 addressing



IPv4 ADDRESSES

The identifier used in the IP layer of the TCP/IP protocol suite to identify the connection of each device to the Internet is called the Internet address or IP address.

An IPv4 address is a 32-bit address that uniquely and universally defines the connection of a host or a router to the Internet. The IP address is the address of the connection, not the host or the router.



Address Space



- A protocol like IPv4 that defines addresses has an address space. An address space is the total number of addresses used by the protocol.
- If a protocol uses b bits to define an address, the address space is 2^b because each bit can have two different values (0 or 1).
- IPv4 uses 32-bit addresses, which means that the address space is 2^{32} or 4,294,967,296 (more than four billion).
- If there were no restrictions, more than 4 billion devices could be connected to the Internet.



Three different notations in IPv4 addressing



Binary

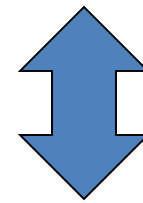
10000000 00001011 00000011 00011111

Dotted decimal

128 • 11 • 3 • 31

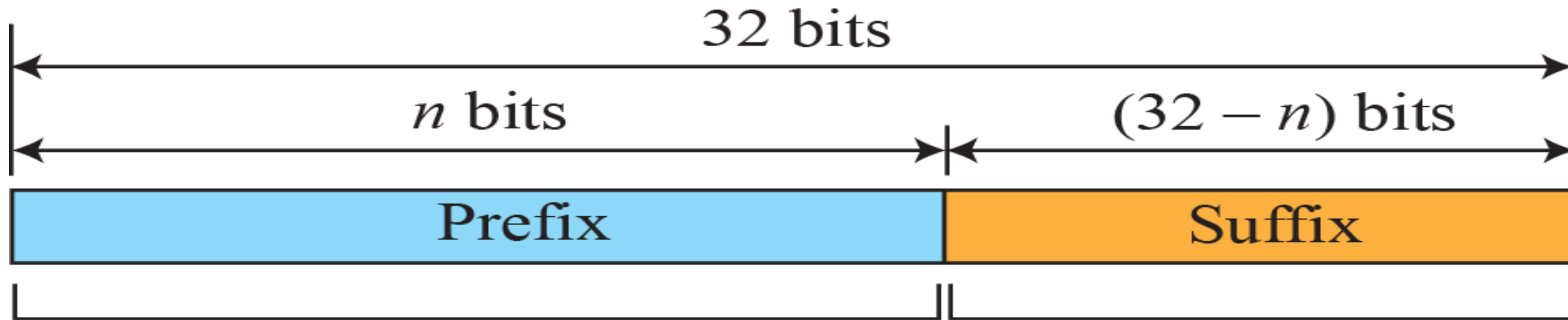
Hexadecimal

80 0B 03 1F



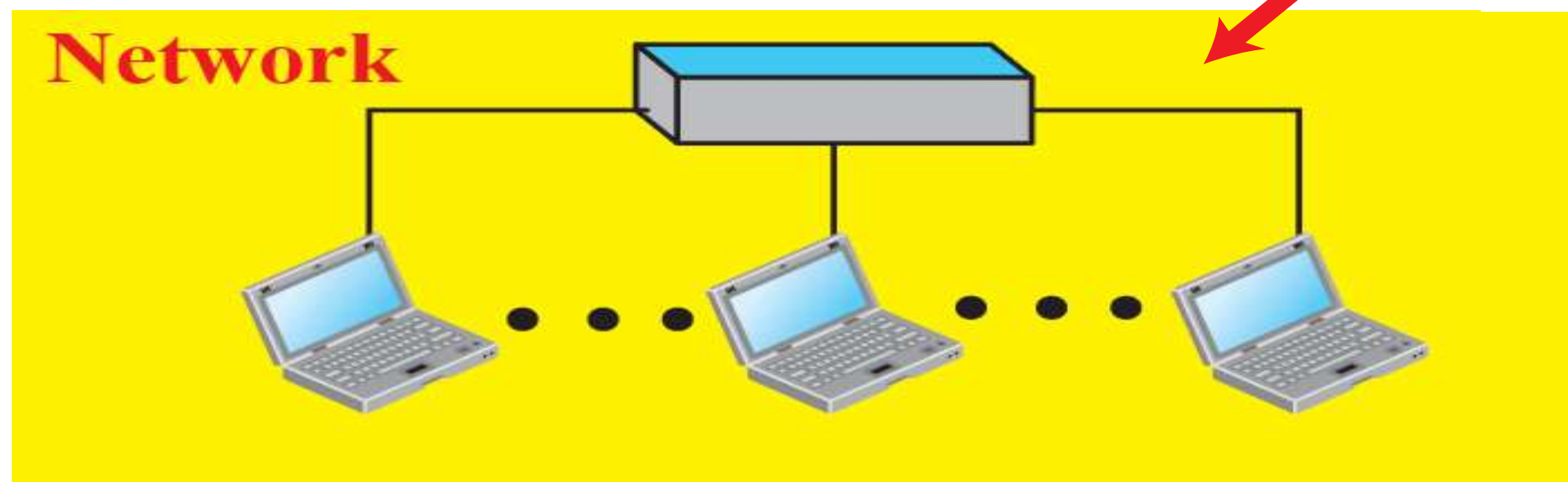


Hierarchy in addressing



Defines network

Defines connection to the node





Classful Addressing



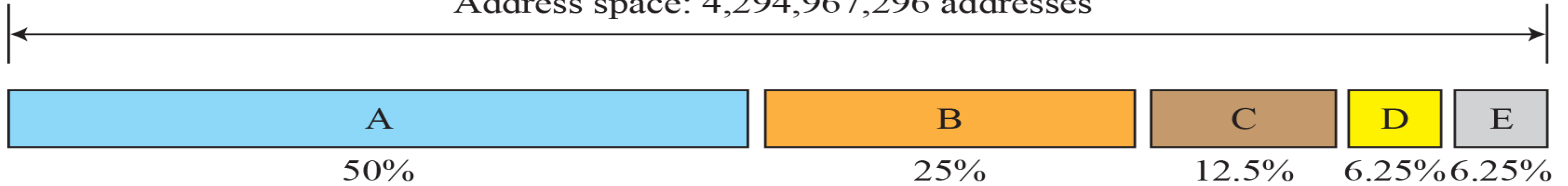
- When the Internet started, an IPv4 address was designed with a fixed-length prefix, but to accommodate both small and large networks, three fixed-length prefixes were designed instead of one ($n = 8$, $n = 16$, and $n = 24$).
- The whole address space was divided into five classes (class A, B, C, D, and E). This scheme is referred to as classful addressing.
- Although classful addressing belongs to the past, it helps us to understand classless addressing.



Occupation of the address space in classful addressing



Address space: 4,294,967,296 addresses



Class A	0	Prefix	Suffix
Class B	10	Prefix	Suffix
Class C	110	Prefix	Suffix
Class D	1110	Multicast addresses	
Class E	1111	Reserved for future use	

Class Prefixes First byte

A	$n = 8$ bits	0 to 127
B	$n = 16$ bits	128 to 191
C	$n = 24$ bits	192 to 223
D	Not applicable	224 to 239
E	Not applicable	240 to 255



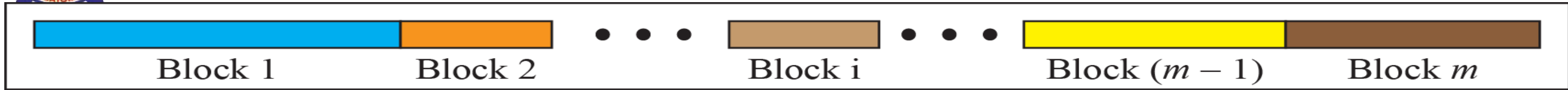
Classless Addressing



- With the growth of the Internet, it was clear that a larger address space was needed as a long-term solution.
- The larger address space, however, requires that the length of IP addresses also be increased, which means the format of the IP packets needs to be changed.
- Although the long-range solution has already been devised and is called IPv6, a short-term solution was also devised to use the same address space but to change the distribution of addresses to provide a fair share to each organization.
- The short-term solution still uses IPv4 addresses, but it is called classless addressing.



Variable-length blocks in classless addressing



Address space



Prefix length ←

Examples:

12.24.76.8/**8**

23.14.67.92/**12**

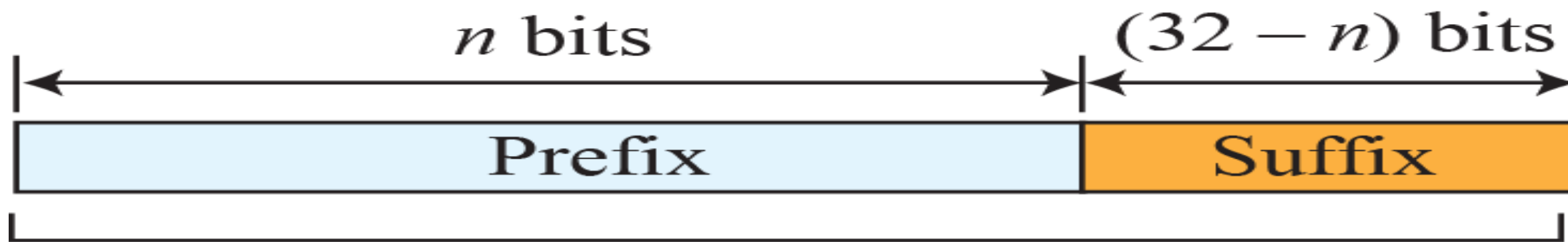
220.8.24.255/**25**



Information extraction in classless addressing

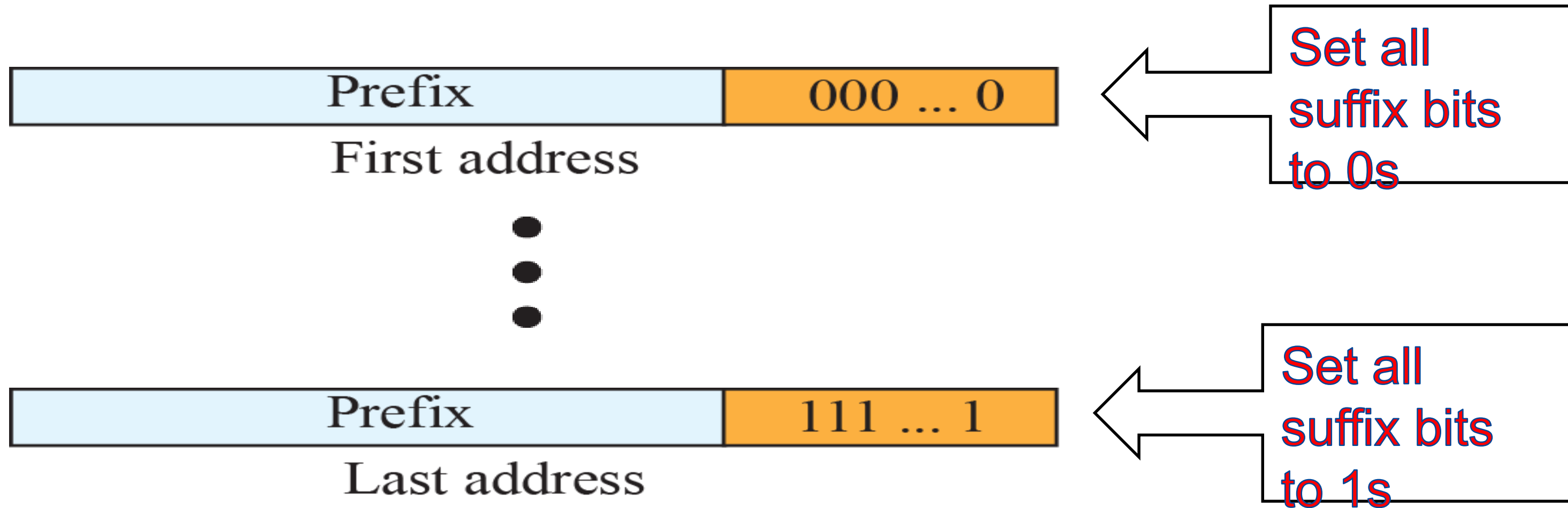


Any address



Number of addresses:

$$N = 2^{32 - n}$$





A classless address is given as 167.199.170.82/27. We can find the above three pieces of information as follows. The number of addresses in the network is $2^{32-n} = 2^5 = 32$ addresses. The first address can be found by keeping the first 27 bits and changing the rest of the bits to 0s.

Address: 167.199.170.82/27	10100111	11000111	10101010	01010010
First address: 167.199.170.64/27	10100111	11000111	10101010	01000000

The last address can be found by keeping the first 27 bits and changing the rest of the bits to 1s.

Address: 167.199.170.82/27	10100111	11000111	10101010	01011111
Last address: 167.199.170.95/27	10100111	11000111	10101010	01011111



Assessment



- a) What is IPv4 addressing?
- b) What is Classless addressing?
- c) What is Classful addressing?





Reference



TEXT BOOKS

Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013.

REFERENCES

1. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
2. Andrew Tanenbaum, Computer Networks, Fifth Edition, Pearson (5th Edition) Education, 2013.
3. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2013.
4. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.