



**Ministry of Higher Education and Scientific
Research Al-Mustaqbal University College
Department of Technical Computer Engineering**

Lecture Number: 7

Computer Networks 3rd Stage

Lecturer: Hussein Ali Ameen

hussein-awadh@mutaqbal-college.edu.iq

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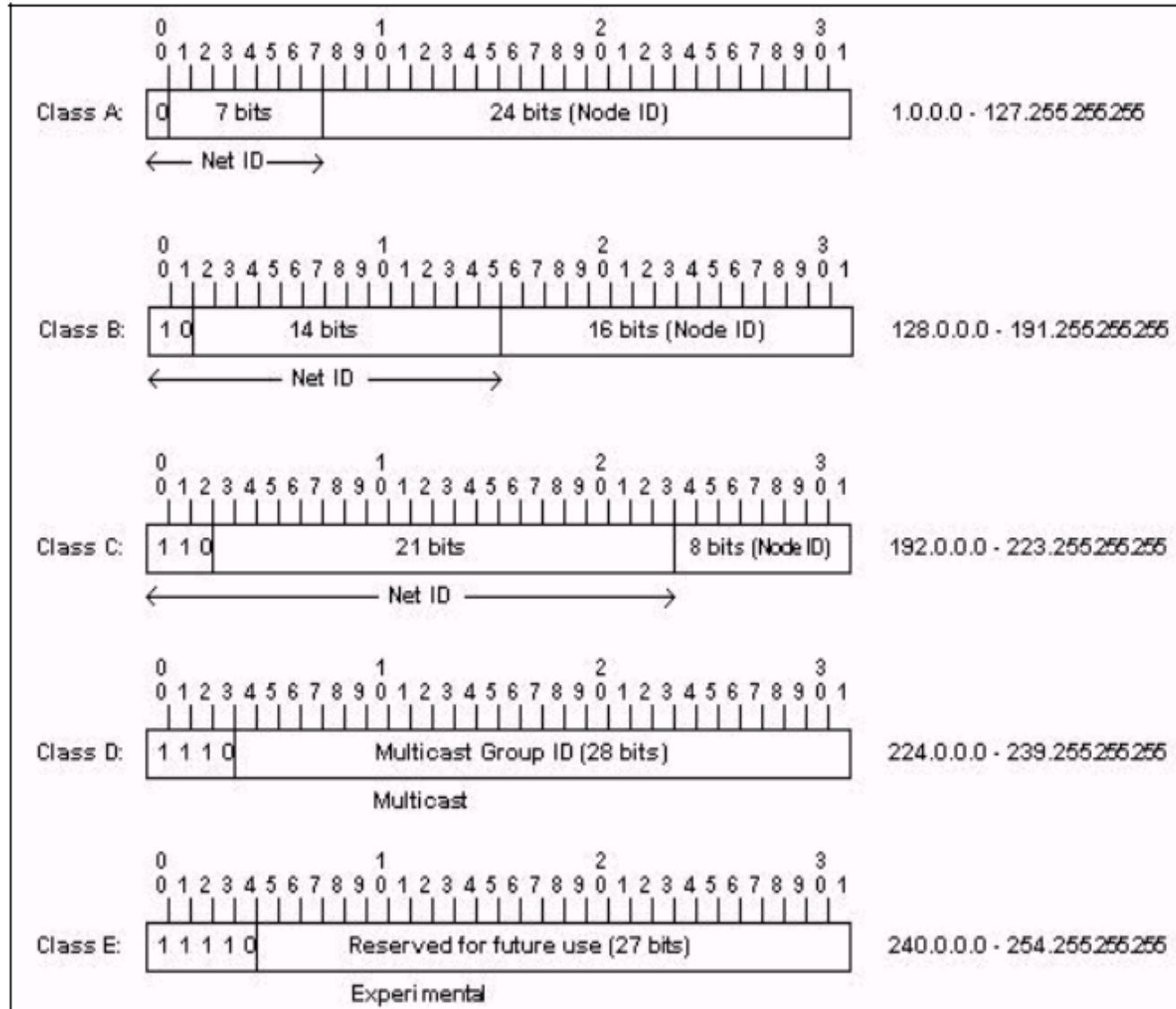
IP Addressing & Subnetting

- IP Addressing
- Subnetting
- VLSM
- CIDR

IP Addresses

- An IP address is an address used to uniquely identify a device on an IP network.
- The address is made up of 32 binary bits which can be divisible into a network portion and host portion with the help of a subnet mask.
- 32 binary bits are broken into four octets (1 octet = 8 bits)
- Dotted decimal format (for example, 172.16.81.100)

IP Address Classes



IP Address Classes

- Class A: The first octet is the network portion. Octets 2, 3, and 4 are for subnets/hosts
- Class B: The first two octets are the network portion. Octets 3 and 4 are for subnets/hosts
- Class C: The first three octets are the network portion. Octet 4 is for subnets/hosts

Private Address Range

Address Class	Reserved Address Space
Class A	10.0.0.0 - 10.255.255.255
Class B	172.16.0.0 - 172.31.255.255
Class C	192.168.0.0 - 192.168.255.255

Network Masks

- Distinguishes which portion of the address identifies the network and which portion of the address identifies the node.
- Default masks:
 - Class A: 255.0.0.0
 - Class B: 255.255.0.0
 - Class C: 255.255.255.0

Subnetting

- Creates multiple logical networks that exist within a single Class A, B, or C network.
- If you do not subnet, you will only be able to use one network from your Class A, B, or C network, which is unrealistic
- Each data link on a network must have a unique network ID, with every node on that link being a member of the same network

Benefits of Subnetting

- 1) Reduced network traffic
- 2) Optimized network performance
- 3) Simplified management
- 4) Facilitated spanning of large geographical distances

IP Subnet-Zero

- This command allows you to use the first and last subnet in your network design.
- For example, the Class C mask of 192 provides subnets 64 and 128, but with the IP subnet-zero command, you now get to use subnets 0, 64, 128, and 192

Subnetting a Class C Address

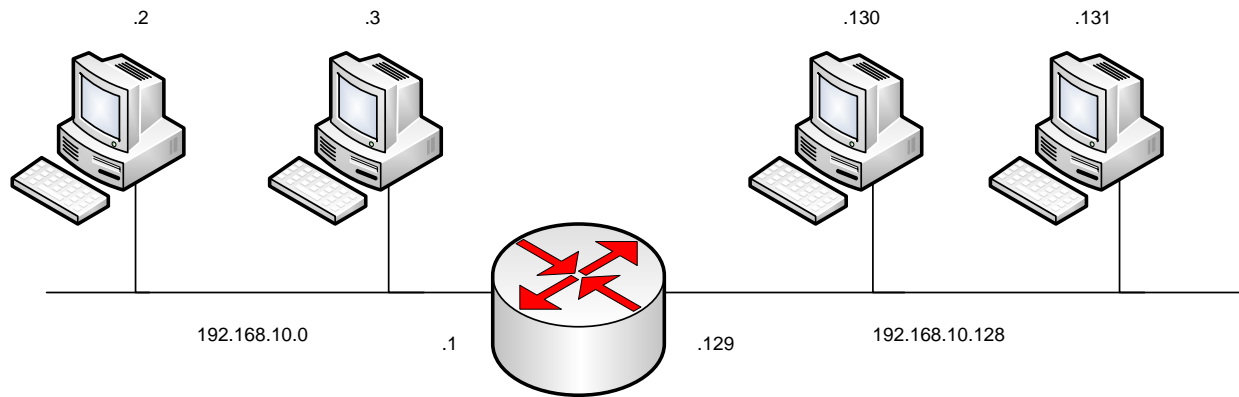
- How many subnets does the chosen subnet mask produce?
- How many valid hosts per subnet are available?
- What are the valid subnets?
- What's the broadcast address of each subnet?
- What are the valid hosts in each subnet?

Practice Example #1 C: 255.255.255.128 (/25)

Network 192.168.10.0

- How many subnets? Since 128 is 1 bit on (10000000), the answer would be $2^1 = 2$.
- How many hosts per subnet? We have 7 host bits off (10000000), so the equation would be $2^7 - 2 = 126$ hosts.
- What are the valid subnets? $256 - 128 = 128$. Remember, we'll start at zero and count in our block size, so our subnets are 0, 128.
- What's the broadcast address for each subnet? The number right before the value of the next subnet is all host bits turned on and equals the broadcast address. For the zero subnet, the next subnet is 128, so the broadcast of the 0 subnet is 127.
- What are the valid hosts? These are the numbers between the subnet and broadcast address

Logical Network Implementation



Practice Example #2C: 255.255.255.224 (/27) Network 192.168.10.0

- How many subnets? 224 is 11100000, so our equation would be $2^3 = 8$.
- How many hosts? $2^5 - 2 = 30$.
- What are the valid subnets? $256 - 224 = 32$. We just start at zero and count to the subnet mask value in blocks (increments) of 32: 0, 32, 64, 96, 128, 160, 192, and 224.
- What's the broadcast address for each subnet (always the number right before the next subnet)?
- What are the valid hosts (the numbers between the subnet number and the broadcast address)?

Practice Example #2C: 255.255.255.224 (/27) Network 192.168.10.0

Subnet Address	0	32	192	224
First Host	1	33		193	225
Last Host	30	62		222	254
Broadcast Address	31	63		223	255