NETWORK PROTOCOLS & SECURITY
23EC2210 R/A/E

Topic:

SUBNETTING

Session – 15

AIM OF THE SESSION

To familiarize students with the concepts of Subnetting.

INSTRUCTIONAL OBJECTIVES

This Session is designed to:

1. Describe the need for subnetting.
2. Describe the concepts of subnetting.

LEARNING OUTCOMES

At the end of this session, you should be able to:

1. Understand the need for subnetting.
2. Divided the network into different subnets.

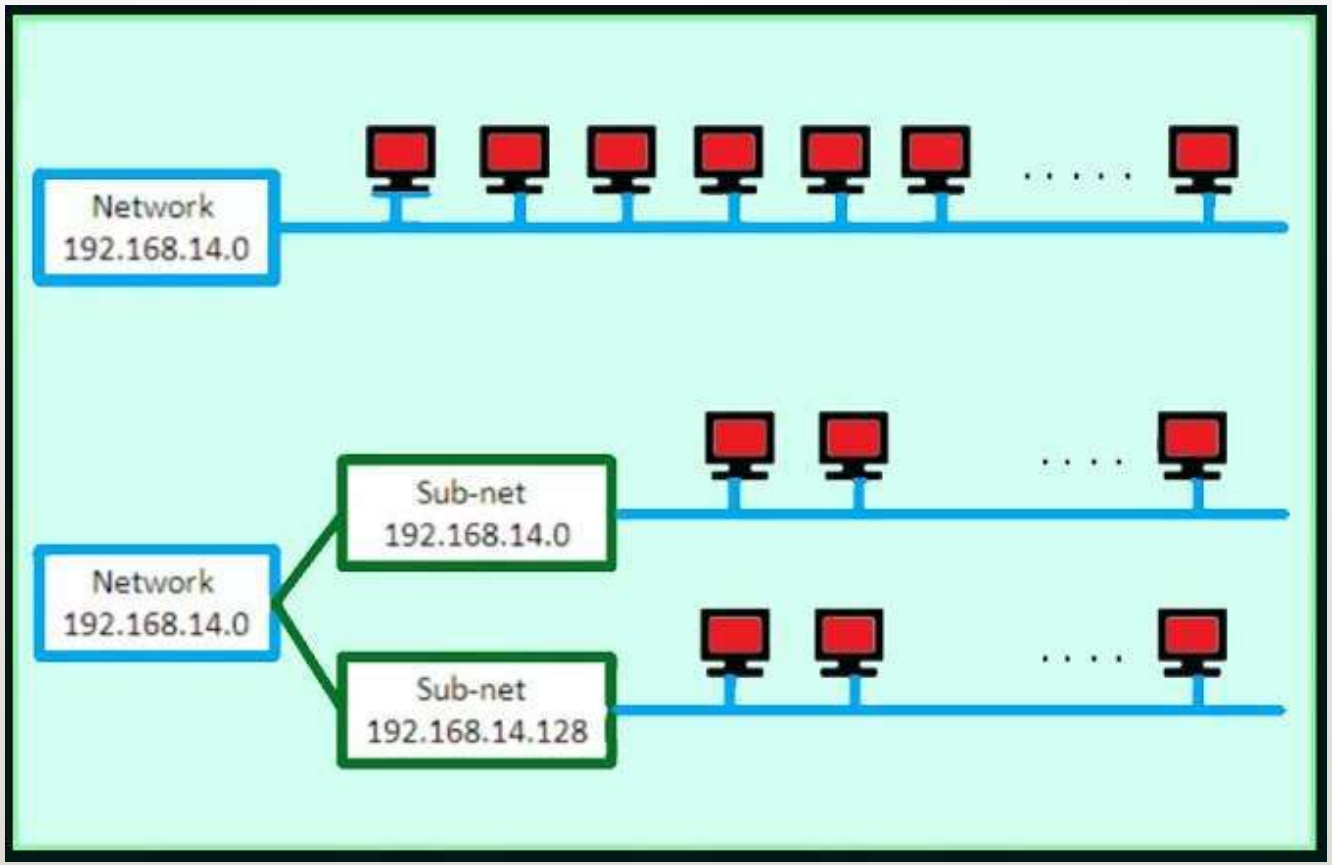
AGENDA

- Subnetting
- Subnet mask
- Subnetting problems

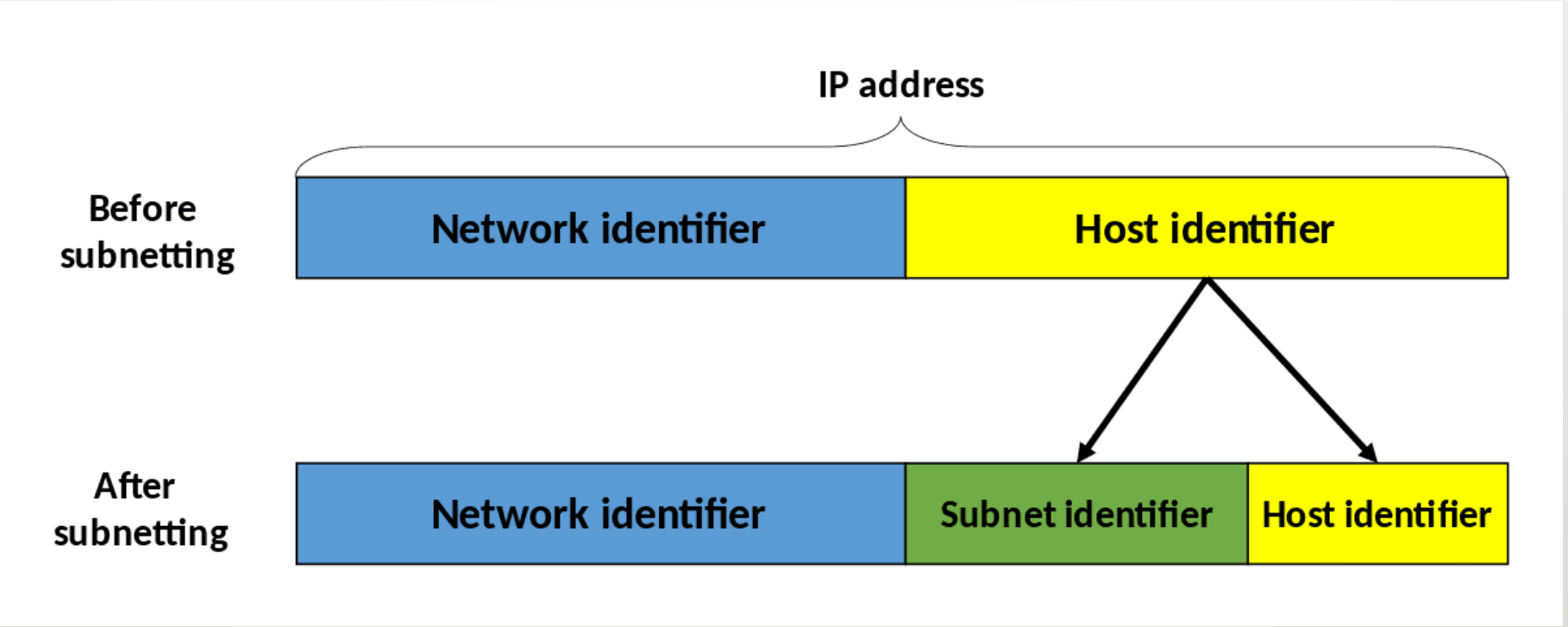
SUBNETTING

- Subnetting is **the process of creating a subnetwork (also known as a subnet) within a network**.
- Network interfaces and devices within a subnet can communicate with each other directly.
- Routers facilitate communication between different subnets.

In **subnetting, a network is divided into several smaller subnetworks (subnets)** with each subnetwork having its own subnetwork address.



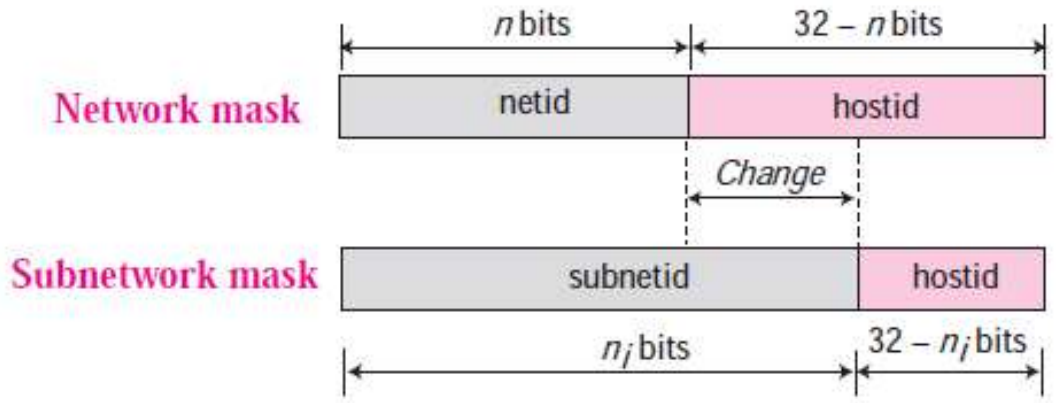
SUBNETTING…


IP address
Before subnetting
Network identifier
Host identifier
After subnetting
Network identifier
Subnet identifier
Host identifier

THREE LEVEL ADDRESSING: SUBNET MASK

- Subnetting increases the length of the netid and decreases the length of hostid.
- When we divide a network to *s number of subnetworks, each subnet will have equal numbers of the* Hosts.

Network mask and subnetwork mask

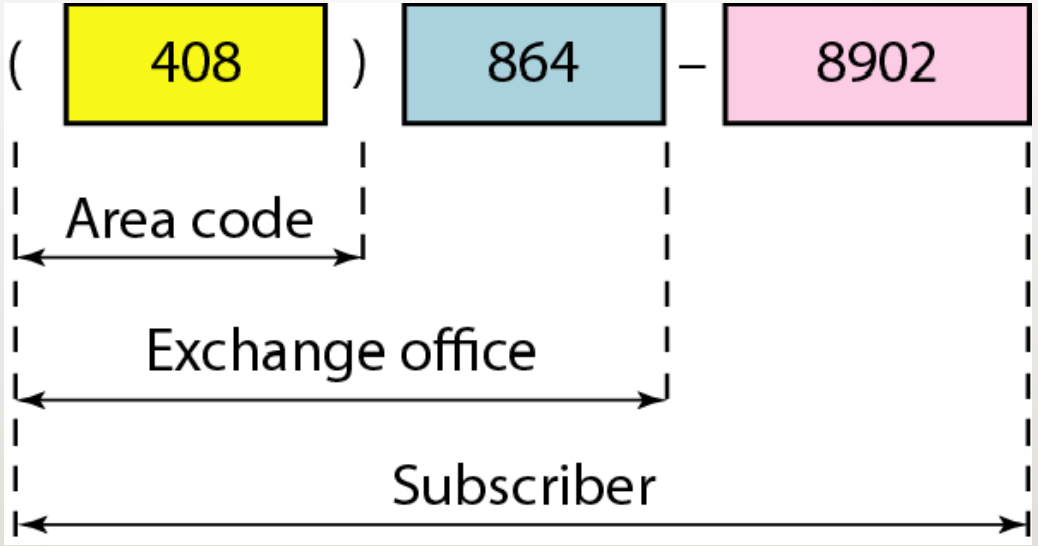


SUBNET MASK TABLE

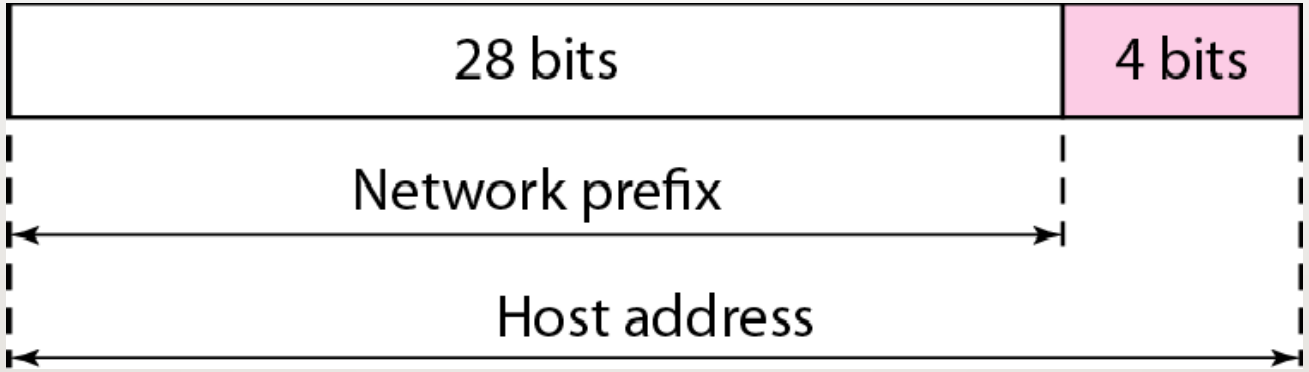
Subnet mask table

Bits	Subnet mask
1	128
11	192
111	224
1111	240
11111	248
111111	252
1111111	254
11111111	255

HIERARCHY IN AN IPV4 ADDRESS

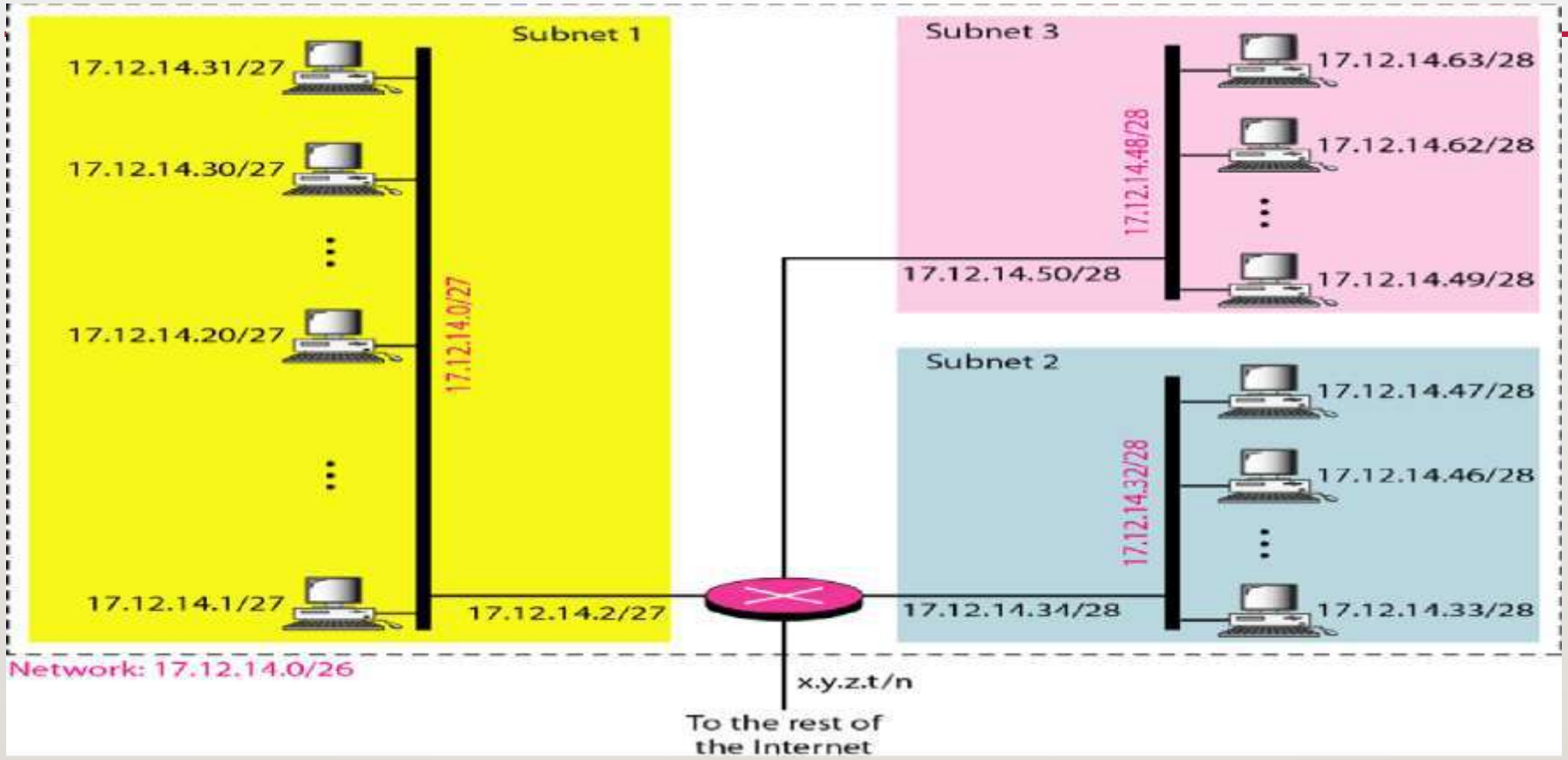


TWO LEVELS OF HIERARCHY IN AN IPV4 ADDRESS

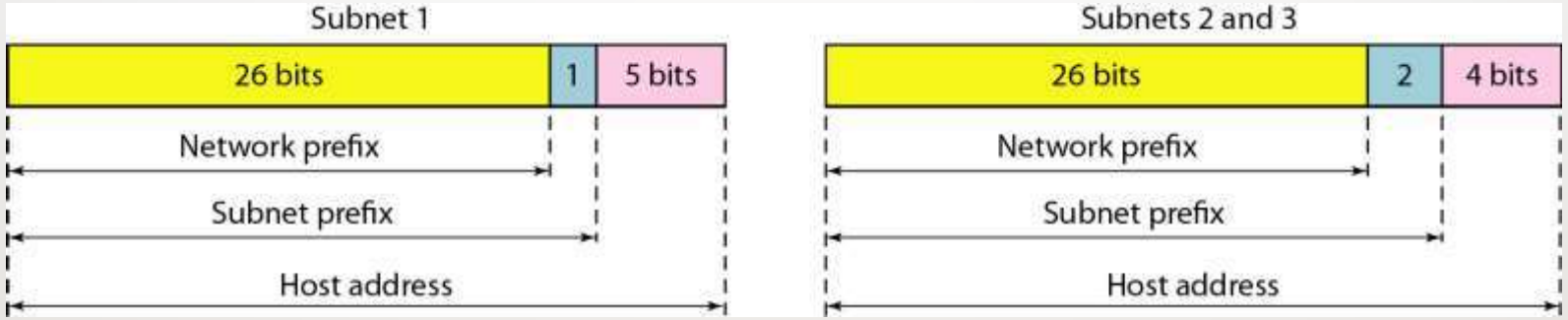


Each address in the block can be considered as a two-level hierarchical structure:
the leftmost *n* bits (prefix) define the network;
the rightmost 32 − n bits define the host.

CONFIGURATION AND ADDRESSES IN A SUBNETTED NETWORK



THREE-LEVEL HIERARCHY IN AN IPV4 ADDRESS



EXAMPLE

An ISP is granted a block of addresses starting with 190.100.0.0/16 (65,536 addresses). The ISP needs to distribute these addresses to three groups of customers as follows:

a. The first group has 64 customers; each needs 256 addresses.

b. The second group has 128 customers; each needs 128 addresses.

c. The third group has 128 customers; each needs 64 addresses.

Design the subblocks and find out how many addresses are still available after these allocations.

EXAMPLE (CONTINUED)

Group 1

For this group, each customer needs 256 addresses. This means that 8 (log2 256) bits are needed to define each host. The prefix length is then 32 − 8 = 24. The addresses are

1st Customer:	190.100.0.0/24	190.100.0.255/24
2nd Customer:	190.100.1.0/24	190.100.1.255/24
. . .		
64th Customer:	190.100.63.0/24	190.100.63.255/24

Total = 64 × 256 = 16,384

EXAMPLE (CONTINUED)

Group 2

For this group, each customer needs 128 addresses. This means that 7 (log2 128) bits are needed to define each host. The prefix length is then 32 − 7 = 25. The addresses are

1st Customer:	*190.100.64.0/25*	*190.100.64.127/25*
2nd Customer:	*190.100.64.128/25*	*190.100.64.255/25*
. . .		
128th Customer:	*190.100.127.128/25*	*190.100.127.255/25*

Total = 128 × 128 = 16,384

EXAMPLE (CONTINUED)

Group 3

For this group, each customer needs 64 addresses. This means that 6 ($log_2 64$) bits are needed to each host. The prefix length is then 32 − 6 = 26. The addresses are

1st Customer:	*190.100.128.0/26*	*190.100.128.63/26*
2nd Customer:	*190.100.128.64/26*	*190.100.128.127/26*
. . .		
128th Customer:	*190.100.159.192/26*	*190.100.159.255/26*

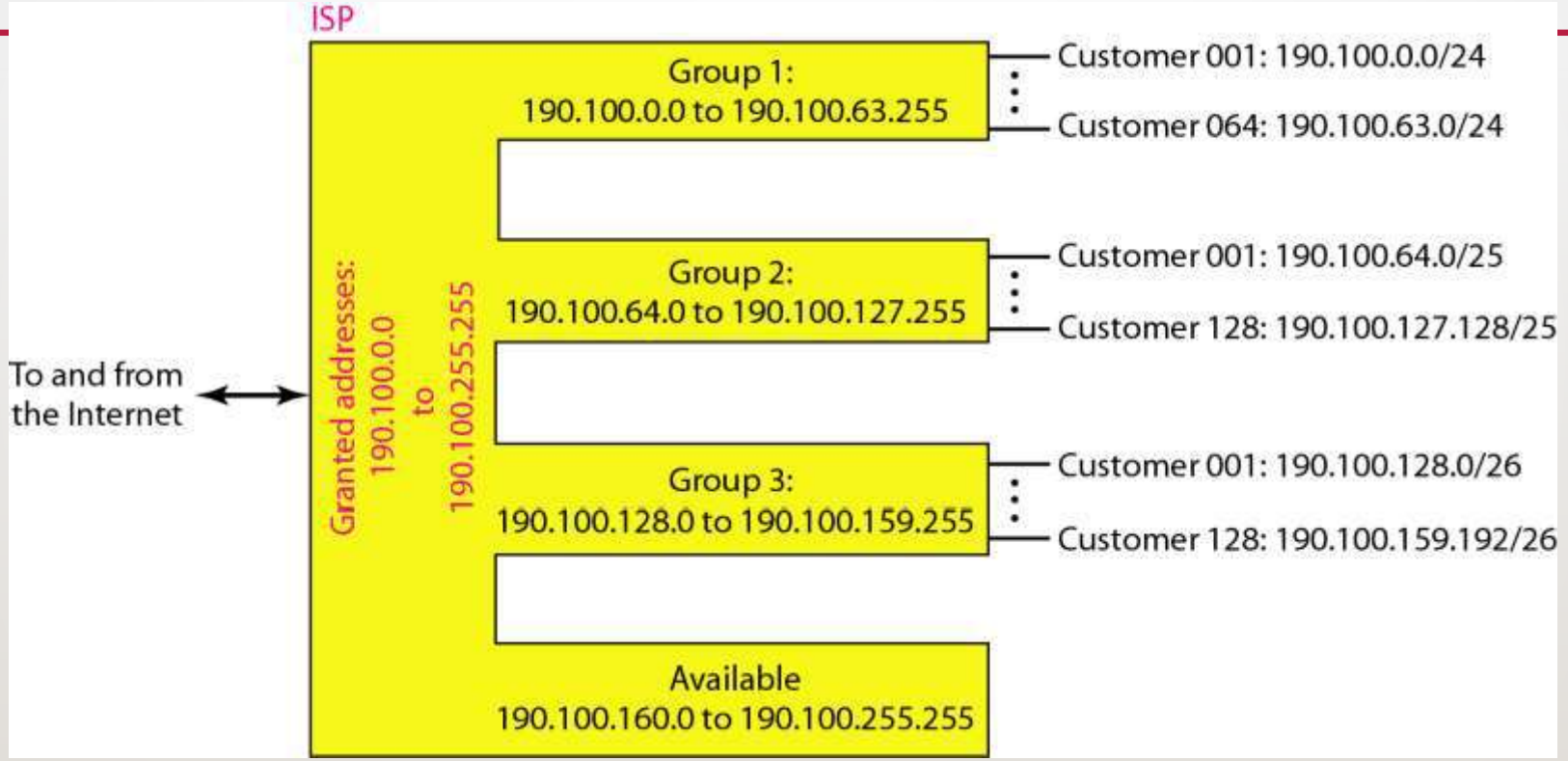
Total = 128 × 64 = 8192

Number of granted addresses to the ISP: 65,536

Number of allocated addresses by the ISP: 40,960

Number of available addresses: 24,576

AN EXAMPLE OF ADDRESS ALLOCATION AND DISTRIBUTION BY AN ISP



EXAMPLE-1

- Assume Class-C Address 198.151.15.10. Say the network is divided into 4 subnets. Calculate the subnet mask. Identify the subnet id, broadcast id, first three and last three host addresses of each subnet.

SOLUTION

EXAMPLE-2

- Divide the network into two subnets using variable length subnetting for the network 192.10.25.130/26 give the first host ID, last host ID, Subnet mask and network address.

SOLUTION

REFERENCES FOR FURTHER LEARNING OF THE SESSION

Reference Books:

1. Data Communications and Networking, Behrouz A. Forouzan, 4th Edition, McGraw Hill.
2. Computer Networks, Tanenbaum, 6th Edition, Pearson.

Sites and Web links:

CISCO Academy
NPTEL, Computer Networks and Internet Protocols, Prof. Soumya Kanti Ghosh, Prof. Sandip Chakraborty IIT Kharagpur. (https://nptel.ac.in/courses/106105183)

THANK YOU

Team – **Networks Protocols & Security**