



Introduction to Networks

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Chapter 9

9.0 Introduction

9.1 Subnetting an IPv4 Network

9.2 Addressing Schemes



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Network Segmentation

Subnetting

Subnetting is the process of segmenting a larger network into multiple smaller networks called subnetworks or subnets.

Reasons for Subnetting:

- Large networks must be segmented into smaller subnetworks, creating smaller groups of devices and services to:
 - Control traffic by containing broadcast traffic within each subnetwork.
 - Reduce overall network traffic and improve network performance.

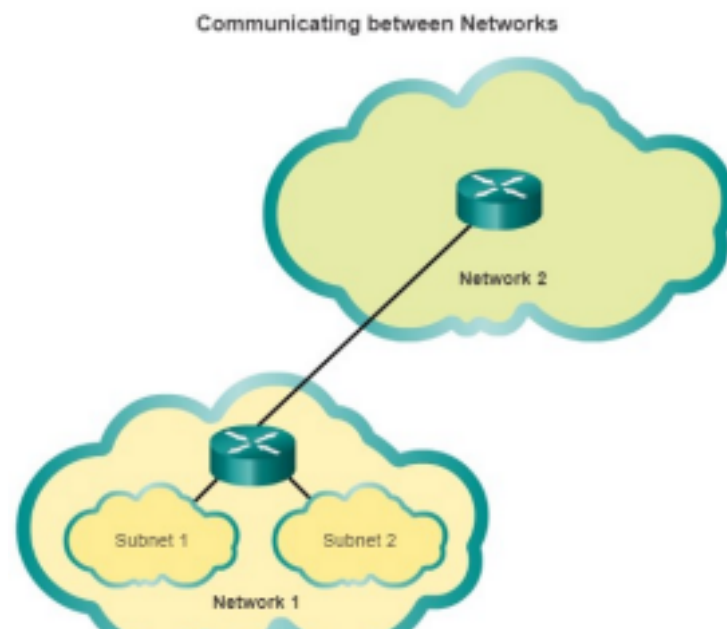


Network Segmentation

Subnetting

Communication Between Subnets

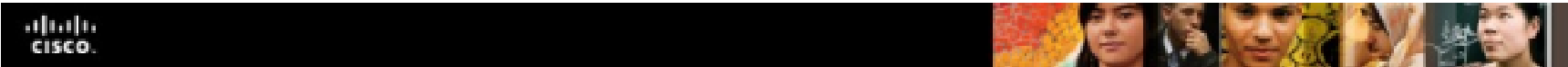
- A router is necessary for devices on different networks and subnets to communicate.
- Each router interface must have an



IPv4 host address that belongs to the network or subnet that the router interface is connected.

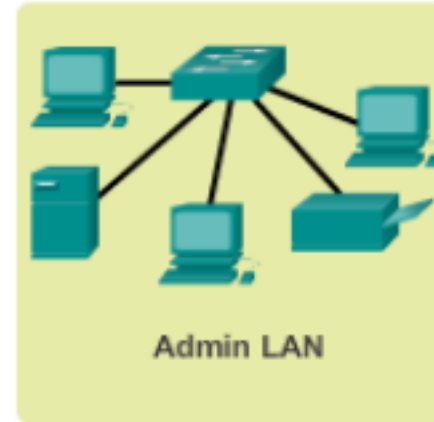
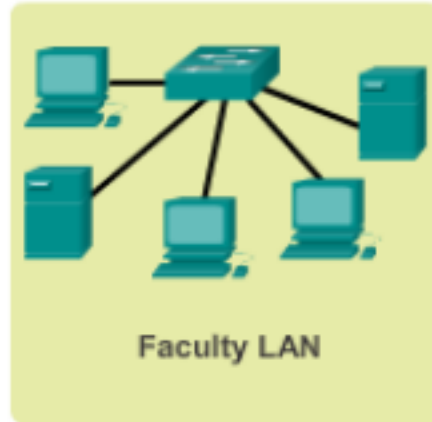
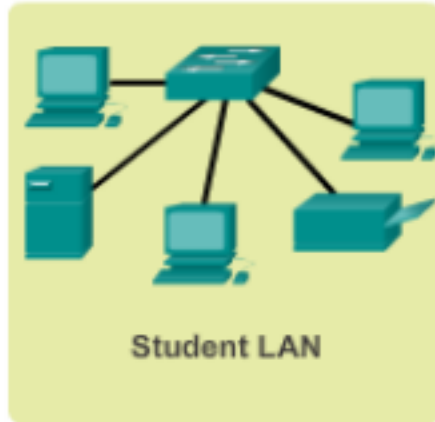
- Devices on a network and subnet use the router interface attached to their LAN as their default gateway.

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IP Subnetting is FUNdamental

The Plan



Planning requires decisions on each subnet in terms of size, the number of hosts per subnet, and how host addresses will be assigned.

Planning the Network

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Basic Subnetting

- Subnets are created by using one or more of the host bits as network bits.
- This is done by borrowing some of the bits from the host portion of the address.
- The more host bits borrowed, the more subnets can be created.
- For each bit borrowed, the number of subnetworks available is doubled.
- For example, if 1 bit is borrowed, 2 subnets can be created. If 2 bits, 4 subnets are created, if 3 bits are borrowed, 8 subnets are created, and so on (2^n ; where n is the number of borrowed bits).
- However, with each bit borrowed, fewer host addresses are available per subnet.

Let's examine the example in Section 9.1.3.1.



Subnetting an IPv4 Network

Basic Subnetting



Original	192.	168.	1.	0	000	0000	Network 192.168.1.0/24
Mask	255.	255.	255.	0	000	0000	Mask: 255.255.255.0

Borrowing 1 Bit from the host portion creates 2 subnets with the same subnet mask

Subnet 0

Network

192.168.1.**0-127/25** Mask:

255.255.255.**128**

Subnet 1

Network

192.168.1.**128-255/25** Mask:

255.255.255.**128**

Subnetting an IPv4 Network

Subnetting

**Calculate
number
of
subnets**



Calculate number

of hosts



$2^7 = 128$ addresses per subnet

$2^7 - 2 = 126$ valid host addresses per subnet

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Subnetting an IPv4 Network

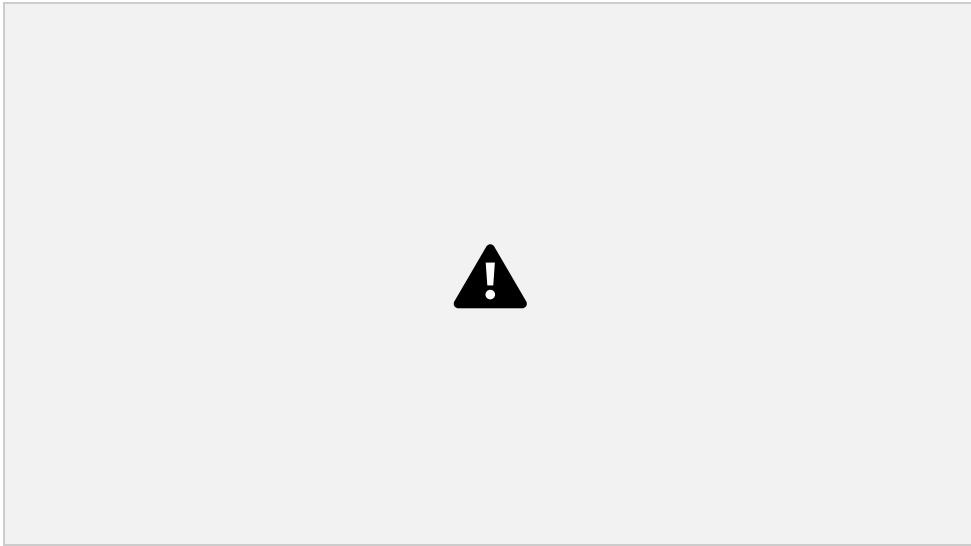
Subnets in Use

Subnets in Use

Subnet 0

Network 192.168.1.**0-127/25**





Network 192.168.1.128-255/25

Subnet 1

Subnetting an IPv4 Network

Creating 4 Subnets

Borrowing 2 bits to create 4 subnets. **$2^2 = 4$ subnets**

Creating 4 Subnets

