Chapter 9: Subnetting IP Networks

Introduction to Networks

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Chapter 9

9.0 Introduction

9.1 Subnetting an IPv4 Network

9.2 Addressing Schemes

9.1 Subnetting an IPv4 Network

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Network Segmentation

Subnetting

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

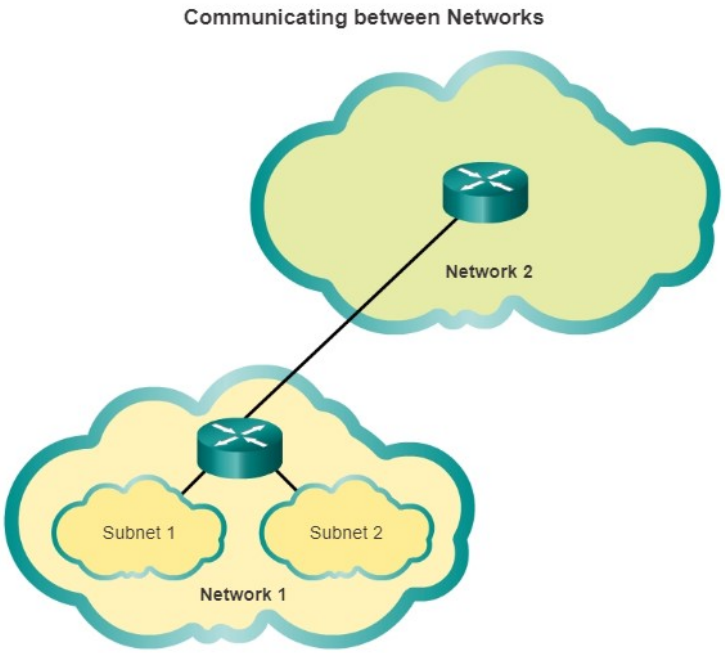
Reasons for Subnetting:

- 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.

Subnetting

Communication Between Subnets

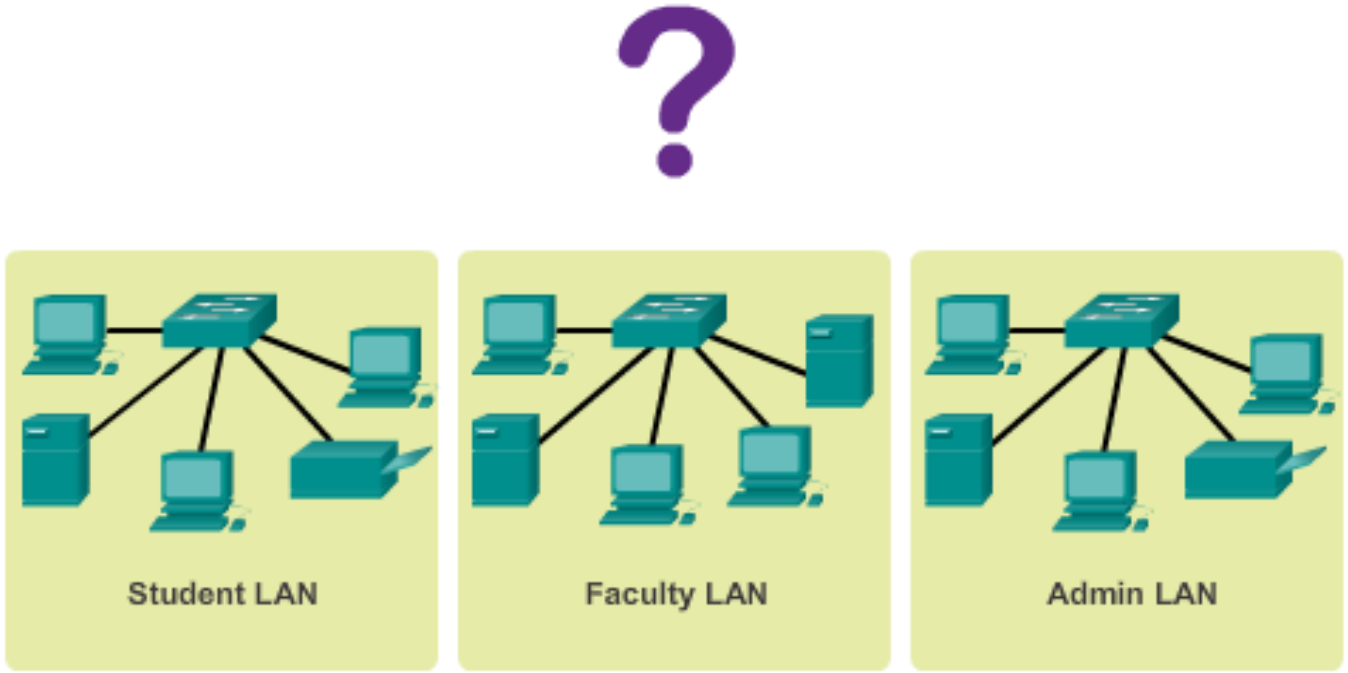
- A router is necessary for devices on different networks and subnets to communicate.
- Each router interface must have an IPv4 host address that belongs to the network or subnet that the router interface is connected.
- Devices on a network and subnet use the router interface attached to their LAN as their default gateway.



IP Subnetting is FUNdamental

The Plan

Planning the Network



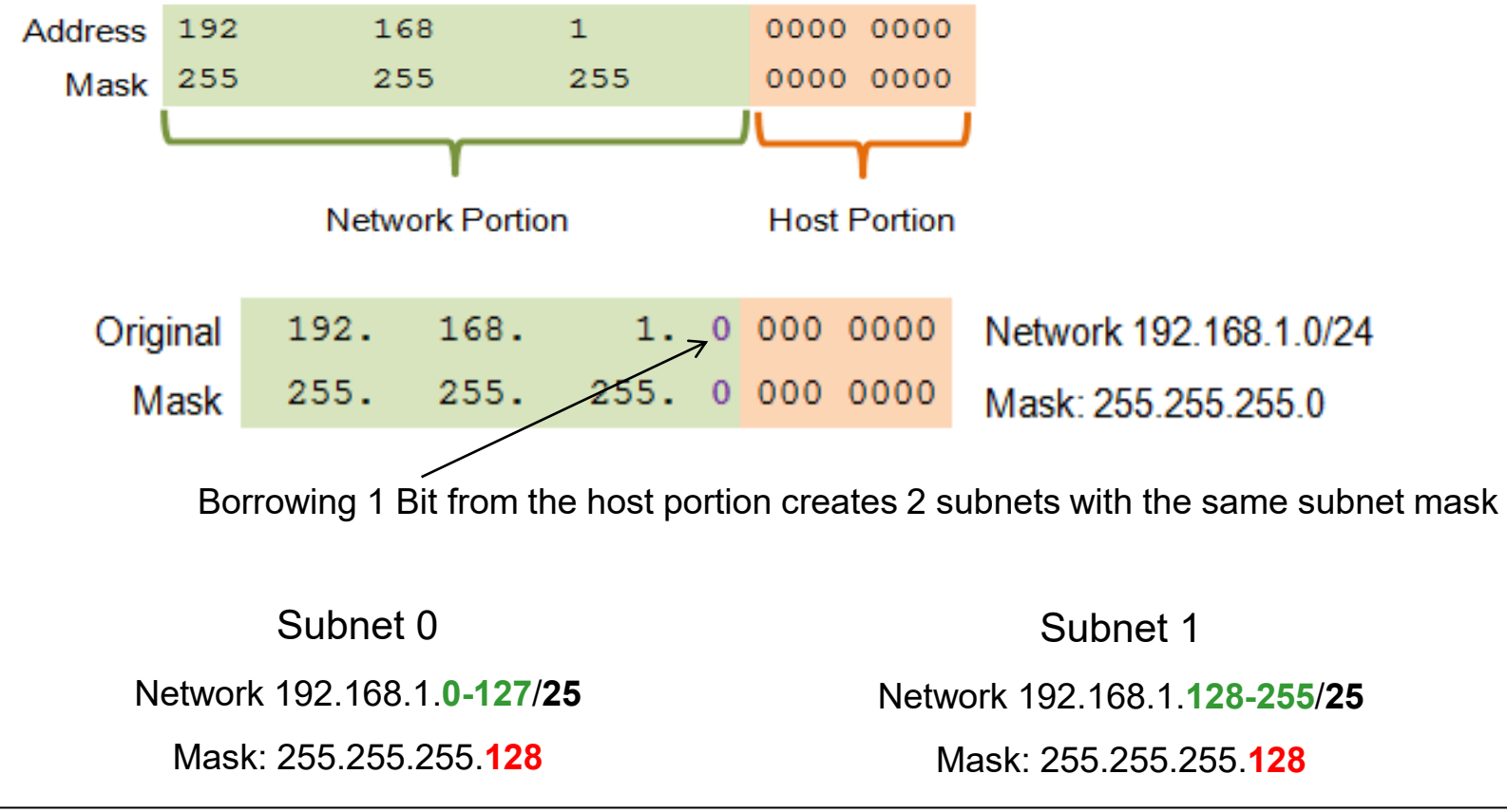
Planning requires decisions on each subnet in terms of size, the number of hosts per subnet, and how host addresses will be assigned.

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.

Basic Subnetting



Subnetting Formulas

Calculate number of subnets

Subnets = 2^n
(where n = bits borrowed)

192. 168. 1. 0 000 0000

1 bit was borrowed

2^1 = 2 subnets

Calculate number of hosts

Hosts = 2^n
(where n = host bit remaining)

192. 168. 1. 0 000 0000

7 bits remain in host field

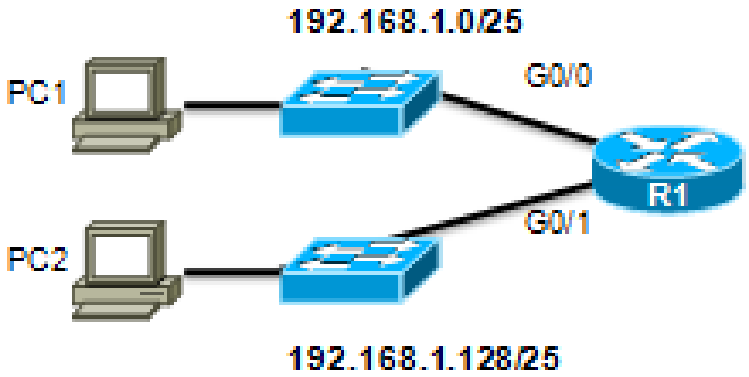
2^7 = 128 addresses per subnet
$2^7 - 2$ = 126 valid host addresses per subnet

Subnets in Use

Subnets in Use

Subnet 0

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



Subnet 1

Network 192.168.1.**128-255**/**25**

Address Range for 192.168.1.0/25 Subnet

Network Address

192. 168. 1. 0 000 0000 = 192.168.1.0

First Host Address

192. 168. 1. 0 000 0001 = 192.168.1.1

Last Host Address

192. 168. 1. 0 111 1110 = 192.168.1.126

Broadcast Address

192. 168. 1. 0 111 1111 = 192.168.1.127

Address Range for 192.168.1.128/25 Subnet

Network Address

192. 168. 1. 1 000 0000 = 192.168.1.128

First Host Address

192. 168. 1. 1 000 0001 = 192.168.1.129

Last Host Address

192. 168. 1. 1 111 1110 = 192.168.1.254

Broadcast Address

192. 168. 1. 1 111 1111 = 192.168.1.255

Creating 4 Subnets

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