

Chapter 8 - Sections & Objectives

- 8.1 Subnetting an IPv4 Network
 - Implement an IPv4 addressing scheme to enable end-to-end connectivity in a small to medium-sized business network.
 - Explain how subnetting segments a network to enable better communication.
 - Explain how to calculate IPv4 subnets for a /24 prefix.
 - Explain how to calculate IPv4 subnets for a /16 and /8 prefix.
 - Given a set of requirements for subnetting, implement an IPv4 addressing scheme.
 - Explain how to create a flexible addressing scheme using variable length subnet masking (VLSM).
- 8.2 Addressing Schemes
 - Given a set of requirements, implement a VLSM addressing scheme to provide connectivity to end users in a small to medium-sized network.
 - Implement a VLSM addressing scheme.

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Chapter 8 - Sections & Objectives (Cont.)

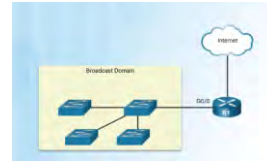
- 8.3 Address Schemes
 - Explain design considerations for implementing IPv6 in a business network.
 - Explain how to implement IPv6 address assignments in a business network.

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Network Segmentation Broadcast Domains

- Devices use broadcasts in an Ethernet LAN to locate:
 - Other devices** - Address Resolution Protocol (ARP) which sends Layer 2 broadcasts to a known IPv4 address on the local network to discover the associated MAC address.
 - Services** - Dynamic Host Configuration Protocol (DHCP) which sends broadcasts on the local network to locate a DHCP server.
- Switches propagate broadcasts out all interfaces except the interface on which it was received.



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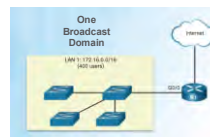
8.1 Subnetting an IPv4 Network

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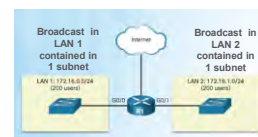
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Network Segmentation Problems with Large Broadcast Domains

- Hosts can generate excessive broadcasts and negatively affect the network.
 - Slow network operations due to the significant amount of traffic it can cause.
 - Slow device operations because a device must accept and process each broadcast packet.
- Solution: Reduce the size of the network to create smaller broadcast domains. These smaller network spaces are called *subnets*.



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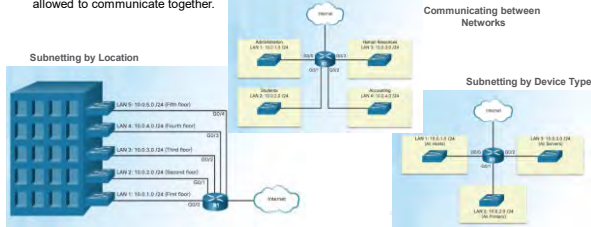


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Network Segmentation

Reasons for Subnetting

- Reduces overall network traffic and improves network performance.
- Enables an administrator to implement security policies such as which subnets are allowed or not allowed to communicate together.



Subnetting an IPv4 Network

Subnetting on the Octet Boundary

Subnet Address (256 Possible Subnets)	Host Range (65,534 possible hosts per subnet)	Broadcast
10.0.0.0/16	10.0.0.1 - 10.0.255.254	10.0.255.255
10.1.0.0/16	10.1.0.1 - 10.1.255.254	10.1.255.255
10.2.0.0/16	10.2.0.1 - 10.2.255.254	10.2.255.255
10.3.0.0/16	10.3.0.1 - 10.3.255.254	10.3.255.255
10.4.0.0/16	10.4.0.1 - 10.4.255.254	10.4.255.255
10.5.0.0/16	10.5.0.1 - 10.5.255.254	10.5.255.255
10.6.0.0/16	10.6.0.1 - 10.6.255.254	10.6.255.255
10.7.0.0/16	10.7.0.1 - 10.7.255.254	10.7.255.255
...
10.255.0.0/16	10.255.0.1 - 10.255.255.254	10.255.255.255

- Subnetting Network 10.x.0.0/16
- Define up to 256 subnets with each subnet capable of connecting 65,534 hosts.
- First two octets identify the network portion while the last two octets are for host IP addresses.

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Subnetting an IPv4 Network

Octet Boundaries

Networks are most easily subnetted at the octet boundary of /8, /16, and /24

Prefix Length	Subnet Mask	Subnet Mask in Binary (n = network, h = host)	# of hosts
/8	255.0.0.0	nnnnnnnn.hhhhhhhh.hhhhhhhh.hhhhhhhh 11111111.00000000.00000000.00000000	16,777,214
/16	255.255.0.0	nnnnnnnn.nnnnnnnn.hhhhhhhh.hhhhhhhh 11111111.11111111.00000000.00000000	65,534
/24	255.255.255.0	nnnnnnnn.nnnnnnnn.nnnnnnnn.hhhhhhhh 11111111.11111111.11111111.00000000	254

- Prefix length and the subnet mask are different ways of identifying the network portion of an address.
- Subnets are created by borrowing host bits for network bits.
- More host bits borrowed, the more subnets that can be defined.

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Subnetting an IPv4 Network

Subnetting on the Octet Boundary (Cont.)

Subnet Address (65,536 Possible Subnets)	Host Range (254 possible hosts per subnet)	Broadcast
10.0.0.0/24	10.0.0.1 - 10.0.0.254	10.0.0.255
10.0.1.0/24	10.0.1.1 - 10.0.1.254	10.0.1.255
10.0.2.0/24	10.0.2.1 - 10.0.2.254	10.0.2.255
...
10.0.255.0/24	10.0.255.1 - 10.0.255.254	10.0.255.255
10.1.0.0/24	10.1.0.1 - 10.1.0.254	10.1.0.255
10.1.1.0/24	10.1.1.1 - 10.1.1.254	10.1.1.255
10.1.2.0/24	10.1.2.1 - 10.1.2.254	10.1.2.255
...
10.100.0.0/24	10.100.0.1 - 10.100.0.254	10.100.0.255
...
10.255.255.0/24	10.255.255.1 - 10.255.255.254	10.255.255.255

- Subnetting Network 10.x.x.0/24
- Define 65,536 subnets each capable of connecting 254 hosts.
- /24 boundary is very popular in subnetting because of number of hosts.

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Subnetting an IPv4 Network

Classless Subnetting

Subnetting a /24 Network

Prefix Length	Subnet Mask	Subnet Mask in Binary (a = network, b = host)	# of subnets	# of hosts
/25	255.255.255.128	nnnnnnnn.nnnnnnn.nnnnnnn.ahhhhhhh 11111111.11111111.11111111.00000000	2	126
/26	255.255.255.192	nnnnnnnn.nnnnnnn.nnnnnnn.ahhhhhh 11111111.11111111.11111111.00000000	4	62
/27	255.255.255.224	nnnnnnnn.nnnnnnn.nnnnnnn.ahhhhhh 11111111.11111111.11111111.00000000	8	30
/28	255.255.255.240	nnnnnnnn.nnnnnnn.nnnnnnn.ahhhhhh 11111111.11111111.11111111.00000000	16	14
/29	255.255.255.248	nnnnnnnn.nnnnnnn.nnnnnnn.ahhhhhh 11111111.11111111.11111111.00000000	32	6
/30	255.255.255.252	nnnnnnnn.nnnnnnn.nnnnnnn.ahhhhhh 11111111.11111111.11111111.00000000	64	2

Subnets can borrow bits from *any* host bit position to create other masks.



Video Demonstration – The Subnet Mask (Cont.)

Subnetting 192.168.1.0/24

192	168	1	0
255	255	255	128
11000000	10101000	00000001	00000000
11111111	11111111	11111111	10000000
N	N	N	Sn H

Subnet bits = $2^1 = 2$
Host bits = $2^7 = 128 - 2 = 126$
Subnetworks = 2

Subnetting 192.168.1.0/24

192	168	1	68
255	255	255	128
11000000	10101000	00000001	01000100
11111111	11111111	11111111	10000000
11000000	10101000	00000001	00000000
192	168	1	0

```
192.168.1.0 /25 —> 192.168.1.127 /25
192.168.1.128 /25 —> 192.168.1.255 /25
```



Subnetting an IPv4 Network

Video Demonstration – The Subnet Mask

Binary

- ANDING

- Convert IP address and Subnet Mask to Binary (line up vertically like an addition problem)
- Logically AND (1 and 1 = 1, all other combinations = 0)
- Result is network address for original IP address

- Classful Subnetting

- Class A /8 255.0.0.0
- Class B /16 255.255.0.0
- Class C /24 255.255.255.0



Video Demonstration – Subnetting with the Magic Number

- Magic number technique used to calculate subnets

- Magic number is simply the place value of the last one in the subnet mask
- /25 11111111.11111111.11111111.10000000 magic number = 128
- /26 11111111.11111111.11111111.11000000 magic number = 64
- /27 11111111.11111111.11111111.11100000 magic number = 32



Subnetting an IPv4 Network

Video Demonstration – Subnetting with the Magic Number (Cont.)

The Magic Number is the last 1 in Binary

192	168	1	0
255	255	255	224
11000000	10101000	00000001	00000000
11111111	11111111	11111111	11110000

Sn H

The Magic Number is? 32

192.168.1.0/27	192.168.1.128/27
192.168.1.32/27	192.168.1.160/27
192.168.1.64/27	192.168.1.192/27
192.168.1.96/27	192.168.1.224/27

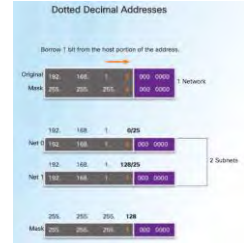
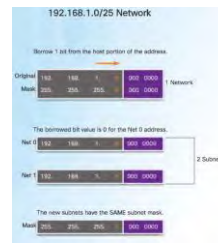
The Magic Number is? 32

192.168.1.0/27 192.168.1.128/27
192.168.1.32/27 192.168.1.160/27
192.168.1.64/27 192.168.1.192/27
192.168.1.96/27 192.168.1.224/27



Subnetting an IPv4 Network

Classless Subnetting Example



Subnetting an IPv4 Network

Video Demonstration – Subnetting with the Magic Number (Cont.)

Subnetting 172.16.0.0/16 -->/23

172	16	0	0
255	255	254	0
10101010	00010000	00000000	00000000
11111111	11111111	11111110	00000000
		Sn	H H

What is the magic number? 2

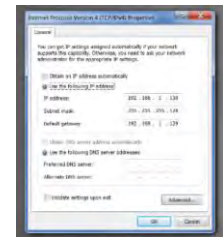
172.16.0.0 — 172.16.1.255 /23
172.16.2.0 /23
172.16.4.0 /23

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Subnetting an IPv4 Network

Creating 2 Subnets

- /25 Subnetting Topology



Subnetting an IPv4 Network

Video Demonstration – Creating Two Equal-sized Subnets (/25)

Create 2 Equal-sized Subnets from 192.168.1.0 /24

- Subnet Mask - 11111111.11111111.11111111.10000000

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
128	64	32	16	8	4	2	1
1	0	0	0	0	0	0	0

- Magic Number = 128
- 192.168.1.0 /25 (start at 0)
- 192.168.1.128 /25 (Add 128)



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Subnetting an IPv4 Network

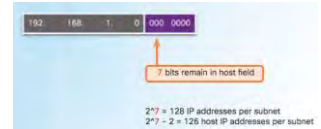
Subnetting Formulas (Cont.)

Calculate Number of Hosts Formula

$$2^n - 2$$

n = the number of bits remaining in the host field

Calculating the Number of Hosts



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Subnetting an IPv4 Network

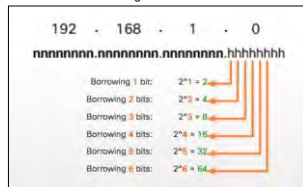
Subnetting Formulas

Calculate Number of Subnets Formula

$$2^n$$

n = bits borrowed

Subnetting a /24 Network



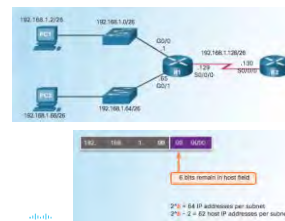
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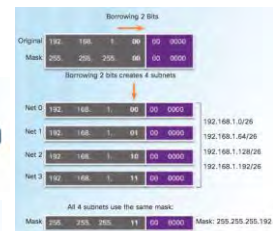
Subnetting an IPv4 Network

Creating 4 Subnets

- /26 Subnetting Topology



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Subnetting an IPv4 Network Creating 4 Subnets (Cont.)

- /26 Subnetting Topology

Net 0	Network	192.168.1.00	00 0000	192.168.1.0
	First	192.168.1.00	00 0001	192.168.1.1
	Last	192.168.1.00	11 1110	192.168.1.62
	Broadcast	192.168.1.00	11 1111	192.168.1.63
Net 1	Network	192.168.1.01	00 0001	192.168.1.64
	First	192.168.1.01	00 0001	192.168.1.65
	Last	192.168.1.01	11 1110	192.168.1.126
	Broadcast	192.168.1.01	11 1111	192.168.1.127
Net 2	Network	192.168.1.10	00 0010	192.168.1.128
	First	192.168.1.10	00 0011	192.168.1.129
	Last	192.168.1.10	11 1110	192.168.1.190
	Broadcast	192.168.1.10	11 1111	192.168.1.191

Subnetting an IPv4 Network Video Demonstration – Creating Four Equal-sized Subnets (/26)

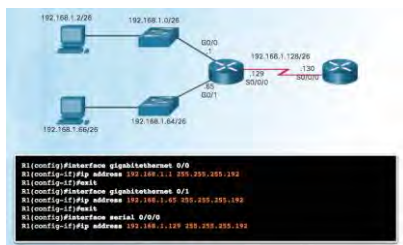
Create 4 Equal-sized Subnets from 192.168.1.0 /24

- Subnet Mask in Binary – 11111111.11111111.11111111.11000000
- $2^2 = 4$ Subnets
- Magic Number = 64
- 192.168.1.0 /26
- 192.168.1.64 /26
- 192.168.1.128 /26
- 192.168.1.192 /26



Subnetting an IPv4 Network Creating 4 Subnets (Cont.)

- /26 Subnetting Topology



Subnetting an IPv4 Network Video Demonstration – Creating Eight Equal-sized Subnets (/27)

Create 8 Equal-sized Subnets from 192.168.1.0 /24

- Borrow 3 bits – 11111111.11111111.11111111.11100000
- Magic Number = 32
- 192.168.1.0 /27 (Start at 0)
- 192.168.1.32 /27 (Add 32 to previous network)
- 192.168.1.64 /27 (Add 32)
- 192.168.1.96 /27 (Add 32)
- 192.168.1.128 /27 (Add 32)
- 192.168.1.160 /27 (Add 32)
- 192.168.1.192 /27 (Add 32)
- 192.168.1.224 /27 (Add 32)



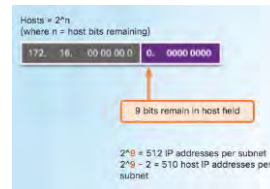
Subnetting a /16 and /8 Prefix Creating Subnets with a /16 prefix

Subnetting a /16 Network

Prefix Length	Subnet Mask	Network Address (n = network, h = host)	# of subnets	# of hosts
/17	255.255.128.0	nnnnnnnn.nnnnnnnn.hhhhhhhh.hhhhhhhh 11111111.11111111.00000000.00000000	2	32768
/18	255.255.192.0	nnnnnnnn.nnnnnnnn.hhhhhhhh.hhhhhhhh 11111111.11111111.00000000.00000000	4	16382
/19	255.255.224.0	nnnnnnnn.nnnnnnnn.hhhhhhhh.hhhhhhhh 11111111.11111111.00000000.00000000	8	8190
/20	255.255.240.0	nnnnnnnn.nnnnnnnn.hhhhhhhh.hhhhhhhh 11111111.11111111.00000000.00000000	16	4094
/21	255.255.248.0	nnnnnnnn.nnnnnnnn.hhhhhhhh.hhhhhhhh 11111111.11111111.00000000.00000000	32	2046
/22	255.255.252.0	nnnnnnnn.nnnnnnnn.hhhhhhhh.hhhhhhhh 11111111.11111111.00000000.00000000	64	1022

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Subnetting a /16 and /8 Prefix Calculating the Hosts



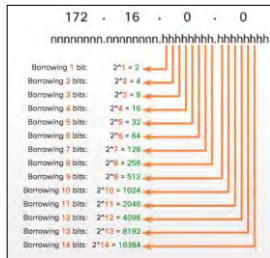
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Address Range for 172.16.0.0/23 Subnet

Network Address	172.16.00.00.0 0.0000.0000	= 172.16.0.0/23
First Host Address	172.16.00.00.0 0.0000.0001	= 172.16.0.1/23
Last Host Address	172.16.00.00.0 1.1111.1110	= 172.16.1.254/23
Broadcast Address	172.16.00.00.0 1.1111.1111	= 172.16.1.255/23

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Subnetting a /16 and /8 Prefix Creating 100 Subnets with a /16 prefix



Subnetting a /16 and /8 Prefix Video Demonstration – Creating One Hundred Equal-sized Subnets

- An enterprise network requires 100 equal-sized subnets starting from 172.16.0.0/16

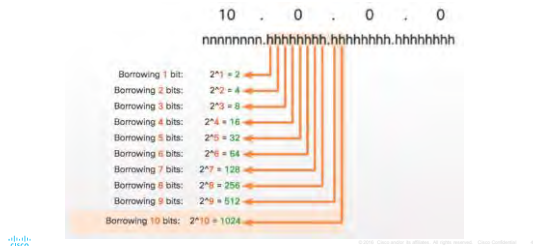
- New Subnet Mask
- $11111111.11111111.11111111.00000000$
- $2^7 = 128$ Subnets
- $2^9 = 512$ hosts per subnet
- Magic Number = 2
- 172.16.0.0/23
- 172.16.2.0/23
- 172.16.4.0/23
- 172.16.6.0/23
- ...
- 172.16.254.0/23



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Subnetting a /16 and /8 Prefix

Creating 1000 Subnets with a /8 Network



Subnetting a /16 and /8 Prefix

Video Demonstration – Subnetting Across Multiple Octets

The Magic Number is the last 1 in Binary

10	0	0	0
255	0	0	0
00001010	00000000	00000000	00000000
11111111	11100000	00000000	00000000
Sn	H	H	H

The Magic Number is? 32

10.0.0.0/11 10.128.0.0/11

10.32.0.0/11 10.160.0.0/11

10.64.0.0/11 10.192.0.0 – 10.224.0.0/11

10.96.0.0/11 10.224.0.0/11



New Challenge Problem: Create over 300 Equal-sized Subnets of 20,000 Hosts each starting from 10.0.0.0/8

Subnetting a /16 and /8 Prefix

Creating 1000 Subnets with a /8 Network (Cont.)



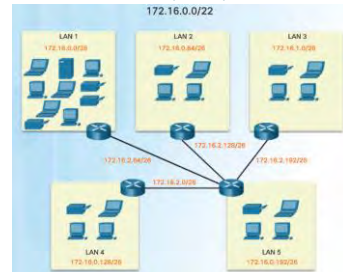
Subnetting to Meet Requirements Subnetting Based On Network Requirements

Host devices used by employees in the Engineering department in one network and Management in a separate network.



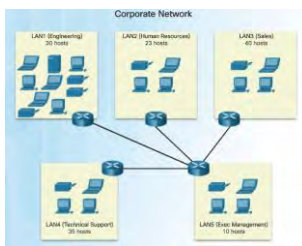
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Subnetting to Meet Requirements Network Requirement Example (Cont.)



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Subnetting to Meet Requirements Network Requirement Example



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Network portion	Host portion	
10101100.00010000.000000	00.00000000	172.16.0.0/22
	10 host bits	2 ¹⁰ = 1,022 hosts

	Network Portion	Host Portion	Dotted Decimal
	10101100.00010000.000000	00.00 000000	172.16.0.0/22
5	10101100.00010000.000000	00.00 000000	172.16.0.0/24
1	10101100.00010000.000000	00.01 000000	172.16.0.64/28
2	10101100.00010000.000000	00.10 000000	172.16.0.128/28
3	10101100.00010000.000000	00.11 000000	172.16.0.192/28
4	10101100.00010000.000000	01.00 000000	172.16.1.0/28
5	10101100.00010000.000000	01.01 000000	172.16.1.64/28
6	10101100.00010000.000000	01.10 000000	172.16.1.128/28
Notes 7 - 13 not shown			
14	10101100.00010000.000000	11.10 000000	172.16.3.128/28
15	10101100.00010000.000000	11.11 000000	172.16.3.192/28

4 bits borrowed from host portion to create subnets

Subnetting to Meet Requirements Lab – Calculating IPv4 Subnets

Lab – Calculating IPv4 Subnets

Objectives

Part 1: Determine IPv4 Address Subnetting

Part 2: Calculate IPv4 Address Subnetting

Background / Scenario

The ability to work with IPv4 subnets and determine network and host information based on a given IP address and subnet mask is a key skill for network administrators. This lab will demonstrate how to calculate the network and host information for a given IP address and subnet mask. The lab will also demonstrate how to calculate the network and host information for a given IP address and subnet mask.

Required Resources

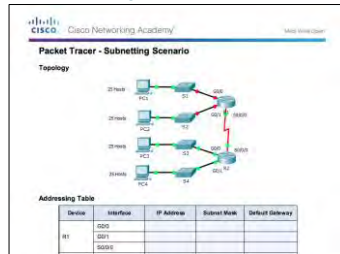
- 1 PC (Windows 7 or 8) with Internet Explorer
- Optional: IPv4 address calculator

Part 1: Determine IPv4 Address Subnetting

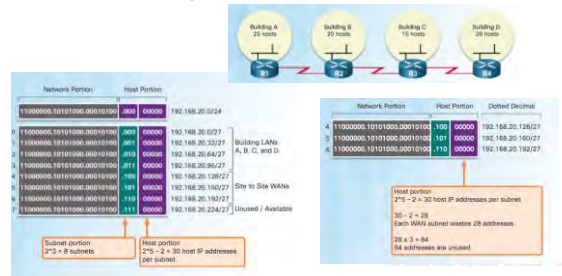
Scenario You are given the network and host information, as well as the number of hosts, given in the table below. You are to determine the network and host information for the given IP address and subnet mask. The result will be the network address, 172.16.0.0/22. If the network has been determined, you will also determine the network and host information for the given IP address and subnet mask. The result will be the network address, 172.16.0.0/22. If the network has been determined, you will also determine the network and host information for the given IP address and subnet mask.

IP Address	Subnet Mask	Network Address	Host Address
172.16.0.0	255.255.0.0	172.16.0.0	172.16.0.0
172.16.0.0	255.255.0.0	172.16.0.0	172.16.0.0

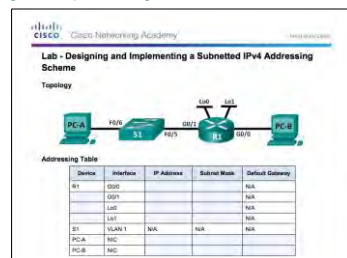
Subnetting to Meet Requirements Packet Tracer – Subnetting Scenario



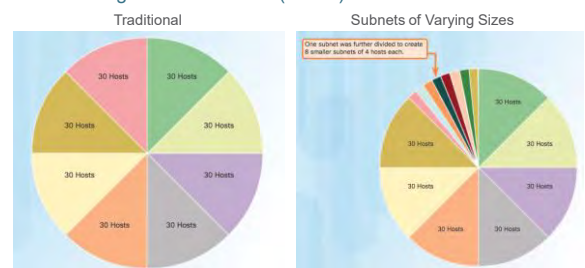
Benefits of Variable Length Subnet Masking Traditional Subnetting Wastes Addresses



Subnetting to Meet Requirements Lab – Designing and Implementing a Subnetted IPv4 Addressing Scheme



Benefits of Variable Length Subnet Masking Variable Length Subnet Masks (VLSM)



Benefits of Variable Length Subnet Masking Basic VLSM

Basic Subnetting

	Network portion	Host portion	Dotted Decimal	
	11000000.10101000.00010100	00000000	192.168.20.0/24	
0	11000000.10101000.00010100	0000	192.168.20.0/27	LANs A, B, C, D
1	11000000.10101000.00010100	0001	192.168.20.32/27	
2	11000000.10101000.00010100	0100	192.168.20.64/27	
3	11000000.10101000.00010100	0101	192.168.20.96/27	
4	11000000.10101000.00010100	1000	192.168.20.128/27	
5	11000000.10101000.00010100	1001	192.168.20.160/27	
6	11000000.10101000.00010100	1100	192.168.20.192/27	
7	11000000.10101000.00010100	1111	192.168.20.224/27	
Subnet 7 will be subnetted further.				

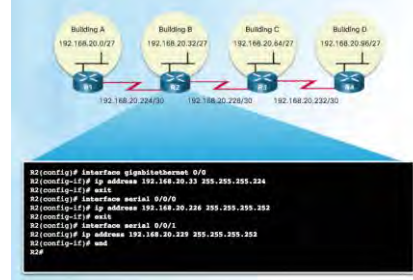
Subnetting a subnet

LANs A, B, C, D

Unused / Available

Subnet 7 will be subnetted further.

Benefits of Variable Length Subnet Masking VLSM in Practice



Benefits of Variable Length Subnet Masking Video Demonstration – VLSM Basics

- Basic VLSM
- Subnets do not have to be equal sizes, as long as their address ranges do not overlap.
- When creating subnets it is easier to work from larger to smaller.

Network	Hosts
192.168.1.0/24	254
192.168.1.0/26	64
192.168.1.64/26	32
192.168.1.128/26	32
192.168.1.192/26	32
192.168.1.224/26	32



Benefits of Variable Length Subnet Masking VLSM Chart

VLSM Subnetting of 192.168.20.0/24

Building	Network	Hosts
Building A	192.168.20.0/27	32
Building B	192.168.20.32/27	32
Building C	192.168.20.64/27	32
Building D	192.168.20.96/27	32
Unused	192.168.20.128/27	32
Unused	192.168.20.160/27	32
Unused	192.168.20.192/27	32
Unused	192.168.20.224/27	32

Device	Network	Hosts
WAN R1-R2	192.168.20.224/27	32
WAN R2-R3	192.168.20.224/27	32
WAN R3-R4	192.168.20.224/27	32
Unused	192.168.20.224/27	32
Unused	192.168.20.224/27	32
Unused	192.168.20.224/27	32
Unused	192.168.20.224/27	32

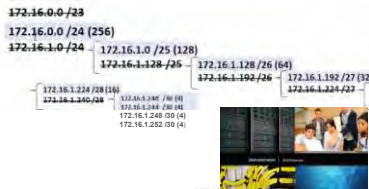
Benefits of Variable Length Subnet Masking

Video Demonstration – VLSM Example

- Given the network 172.16.0.0 /23 creates subnets:

- 1 network for 200 hosts - 256
- 1 network for 100 hosts - 128
- 1 network for 50 hosts - 64
- 1 network for 25 hosts - 32
- 1 network for 10 hosts - 16
- 4 point-to-point networks for 2 hosts each – 4x4 = 16

/23 = 2^9 hosts = 512
 $256+128+64+32+16+16 = 512$ hosts needed
 Address range 172.16.0.0 – 172.16.1.255



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Structured Design

Network Address Planning



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8.2 Addressing Schemes

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Structured Design

Planning to Address the Network



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- Each host in an internetwork must have a unique address.
- Need proper planning & documentation.
- Must provide & control access to servers from internal hosts and external hosts.
- Layer 3 STATIC address assigned to a server can be used to control access to that server.
- Monitoring security and performance of hosts means network traffic is examined for source IP addresses that are generating or receiving excessive packets.

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Structured Design

Assigning Addresses to Devices

- Devices that require addresses:
 - End user clients**
 - Can be set for DHCP to save time and manual errors.
 - A change in the subnetting scheme requires reconfiguration of DHCP server. IPv6 clients use DHCPv6/SLAAC.
- Servers**
 - Configured with static addresses.
 - Private addresses translated to public addresses if accessible from the Internet.
- Intermediary devices**
 - Set with static addresses for remote management.
- Gateway**
 - Router interface used to exit the network.

Network: 192.168.1.0/24

Use	First	Last
Host Devices	.1	.229
Servers	.230	.239
Printers	.240	.249
Intermediary Devices	.250	.253
Gateway (router LAN interface)	.254	

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Structured Design

Lab – Designing and Implementing a VLSM Addressing Scheme

Lab – Designing and Implementing a VLSM Addressing Scheme

Topology

Objectives

Part 1: Examine the Network Requirements.

Part 2: Design the VLSM Addressing Scheme.

Part 3: Configure and Verify the IP Network.

Background / Scenario

Variable Length Subnet Mask (VLSM) was designed to assist routing of addresses. With VLSM, a network is subdivided into smaller (as needed) subnets. This process can be done recursively until all needed subnets are created. To be able to use the 172.16.0.0/16 network address in creating an address scheme for this scenario, all of the following steps must be followed:

1. Determine the number of subnets required.
2. Determine the number of hosts required per subnet.
3. Determine the VLSM addressing scheme.
4. Configure the network.
5. Verify the network.

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Structured Design

Packet Tracer – Designing and Implementing a VLSM Addressing Scheme

Packet Tracer - Designing and Implementing a VLSM Addressing Scheme

Topology

The network consists of the following topology:

Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	E0/0	192.168.1.1	255.255.255.0	
R1	E0/1	192.168.1.2	255.255.255.0	
R1	E0/2	192.168.1.3	255.255.255.0	
R1	E0/3	192.168.1.4	255.255.255.0	
R1	E0/4	192.168.1.5	255.255.255.0	
R1	E0/5	192.168.1.6	255.255.255.0	
R1	E0/6	192.168.1.7	255.255.255.0	
R1	E0/7	192.168.1.8	255.255.255.0	
R1	E0/8	192.168.1.9	255.255.255.0	
R1	E0/9	192.168.1.10	255.255.255.0	
R1	E0/10	192.168.1.11	255.255.255.0	
R1	E0/11	192.168.1.12	255.255.255.0	
R1	E0/12	192.168.1.13	255.255.255.0	
R1	E0/13	192.168.1.14	255.255.255.0	
R1	E0/14	192.168.1.15	255.255.255.0	
R1	E0/15	192.168.1.16	255.255.255.0	
R1	E0/16	192.168.1.17	255.255.255.0	
R1	E0/17	192.168.1.18	255.255.255.0	
R1	E0/18	192.168.1.19	255.255.255.0	
R1	E0/19	192.168.1.20	255.255.255.0	
R1	E0/20	192.168.1.21	255.255.255.0	
R1	E0/21	192.168.1.22	255.255.255.0	
R1	E0/22	192.168.1.23	255.255.255.0	
R1	E0/23	192.168.1.24	255.255.255.0	
R1	E0/24	192.168.1.25	255.255.255.0	
R1	E0/25	192.168.1.26	255.255.255.0	
R1	E0/26	192.168.1.27	255.255.255.0	
R1	E0/27	192.168.1.28	255.255.255.0	
R1	E0/28	192.168.1.29	255.255.255.0	
R1	E0/29	192.168.1.30	255.255.255.0	
R1	E0/30	192.168.1.31	255.255.255.0	
R1	E0/31	192.168.1.32	255.255.255.0	
R1	E0/32	192.168.1.33	255.255.255.0	
R1	E0/33	192.168.1.34	255.255.255.0	
R1	E0/34	192.168.1.35	255.255.255.0	
R1	E0/35	192.168.1.36	255.255.255.0	
R1	E0/36	192.168.1.37	255.255.255.0	
R1	E0/37	192.168.1.38	255.255.255.0	
R1	E0/38	192.168.1.39	255.255.255.0	
R1	E0/39	192.168.1.40	255.255.255.0	
R1	E0/40	192.168.1.41	255.255.255.0	
R1	E0/41	192.168.1.42	255.255.255.0	
R1	E0/42	192.168.1.43	255.255.255.0	
R1	E0/43	192.168.1.44	255.255.255.0	
R1	E0/44	192.168.1.45	255.255.255.0	
R1	E0/45	192.168.1.46	255.255.255.0	
R1	E0/46	192.168.1.47	255.255.255.0	
R1	E0/47	192.168.1.48	255.255.255.0	
R1	E0/48	192.168.1.49	255.255.255.0	
R1	E0/49	192.168.1.50	255.255.255.0	
R1	E0/50	192.168.1.51	255.255.255.0	
R1	E0/51	192.168.1.52	255.255.255.0	
R1	E0/52	192.168.1.53	255.255.255.0	
R1	E0/53	192.168.1.54	255.255.255.0	
R1	E0/54	192.168.1.55	255.255.255.0	
R1	E0/55	192.168.1.56	255.255.255.0	
R1	E0/56	192.168.1.57	255.255.255.0	
R1	E0/57	192.168.1.58	255.255.255.0	
R1	E0/58	192.168.1.59	255.255.255.0	
R1	E0/59	192.168.1.60	255.255.255.0	
R1	E0/60	192.168.1.61	255.255.255.0	
R1	E0/61	192.168.1.62	255.255.255.0	
R1	E0/62	192.168.1.63	255.255.255.0	
R1	E0/63	192.168.1.64	255.255.255.0	
R1	E0/64	192.168.1.65	255.255.255.0	
R1	E0/65	192.168.1.66	255.255.255.0	
R1	E0/66	192.168.1.67	255.255.255.0	
R1	E0/67	192.168.1.68	255.255.255.0	
R1	E0/68	192.168.1.69	255.255.255.0	
R1	E0/69	192.168.1.70	255.255.255.0	
R1	E0/70	192.168.1.71	255.255.255.0	
R1	E0/71	192.168.1.72	255.255.255.0	
R1	E0/72	192.168.1.73	255.255.255.0	
R1	E0/73	192.168.1.74	255.255.255.0	
R1	E0/74	192.168.1.75	255.255.255.0	
R1	E0/75	192.168.1.76	255.255.255.0	
R1	E0/76	192.168.1.77	255.255.255.0	
R1	E0/77	192.168.1.78	255.255.255.0	
R1	E0/78	192.168.1.79	255.255.255.0	
R1	E0/79	192.168.1.80	255.255.255.0	
R1	E0/80	192.168.1.81	255.255.255.0	
R1	E0/81	192.168.1.82	255.255.255.0	
R1	E0/82	192.168.1.83	255.255.255.0	
R1	E0/83	192.168.1.84	255.255.255.0	
R1	E0/84	192.168.1.85	255.255.255.0	
R1	E0/85	192.168.1.86	255.255.255.0	
R1	E0/86	192.168.1.87	255.255.255.0	
R1	E0/87	192.168.1.88	255.255.255.0	
R1	E0/88	192.168.1.89	255.255.255.0	
R1	E0/89	192.168.1.90	255.255.255.0	
R1	E0/90	192.168.1.91	255.255.255.0	
R1	E0/91	192.168.1.92	255.255.255.0	
R1	E0/92	192.168.1.93	255.255.255.0	
R1	E0/93	192.168.1.94	255.255.255.0	
R1	E0/94	192.168.1.95	255.255.255.0	
R1	E0/95	192.168.1.96	255.255.255.0	
R1	E0/96	192.168.1.97	255.255.255.0	
R1	E0/97	192.168.1.98	255.255.255.0	
R1	E0/98	192.168.1.99	255.255.255.0	
R1	E0/99	192.168.1.100	255.255.255.0	
R1	E0/100	192.168.1.101	255.255.255.0	
R1	E0/101	192.168.1.102	255.255.255.0	
R1	E0/102	192.168.1.103	255.255.255.0	
R1	E0/103	192.168.1.104	255.255.255.0	
R1	E0/104	192.168.1.105	255.255.255.0	
R1	E0/105	192.168.1.106	255.255.255.0	
R1	E0/106	192.168.1.107	255.255.255.0	
R1	E0/107	192.168.1.108	255.255.255.0	
R1	E0/108	192.168.1.109	255.255.255.0	
R1	E0/109	192.168.1.110	255.255.255.0	
R1	E0/110	192.168.1.111	255.255.255.0	
R1	E0/111	192.168.1.112	255.255.255.0	
R1	E0/112	192.168.1.113	255.255.255.0	
R1	E0/113	192.168.1.114	255.255.255.0	
R1	E0/114	192.168.1.115	255.255.255.0	
R1	E0/115	192.168.1.116	255.255.255.0	
R1	E0/116	192.168.1.117	255.255.255.0	
R1	E0/117	192.168.1.118	255.255.255.0	
R1	E0/118	192.168.1.119	255.255.255.0	
R1	E0/119	192.168.1.120	255.255.255.0	
R1	E0/120	192.168.1.121	255.255.255.0	
R1	E0/121	192.168.1.122	255.255.255.0	
R1	E0/122	192.168.1.123	255.255.255.0	
R1	E0/123	192.168.1.124	255.255.255.0	
R1	E0/124	192.168.1.125	255.255.255.0	
R1	E0/125	192.168.1.126	255.255.255.0	
R1	E0/126	192.168.1.127	255.255.255.0	
R1	E0/127	192.168.1.128	255.255.255.0	
R1	E0/128	192.168.1.129	255.255.255.0	
R1	E0/129	192.168.1.130	255.255.255.0	
R1	E0/130	192.168.1.131	255.255.255.0	
R1	E0/131	192.168.1.132	255.255.255.0	
R1	E0/132	192.168.1.133	255.255.255.0	
R1	E0/133	192.168.1.134	255.255.255.0	
R1	E0/134	192.168.1.135	255.255.255.0	
R1	E0/135	192.168.1.136	255.255.255.0	
R1	E0/136	192.168.1.137	255.255.255.0	
R1	E0/137	192.168.1.138	255.255.255.0	
R1	E0/138	192.168.1.139	255.255.255.0	
R1	E0/139	192.168.1.140	255.255.255.0	
R1	E0/140	192.168.1.141	255.255.255.0	
R1	E0/141	192.168.1.142	255.255.255.0	
R1	E0/142	192.168.1.143	255.255.255.0	
R1	E0/143	192.168.1.144	255.255.255.0	
R1	E0/144	192.168.1.145	255.255.255.0	
R1	E0/145	192.168.1.146	255.255.255.0	
R1	E0/146	192.168.1.147	255.255.255.0	
R1	E0/147	192.168.1.148	255.255.255.0	
R1	E0/148	192.168.1.149	255.255.255.0	
R1	E0/149	192.168.1.150	255.255.255.0	
R1	E0/150	192.168.1.151	255.255.255.0	
R1	E0/151	192.168.1.152	255.255.255.0	
R1	E0/152	192.168.1.153	255.255.255.0	
R1	E0/153	192.168.1.154	255.255.255.0	
R1	E0/154	192.168.1.155	255.255.255.0	
R1	E0/155	192.168.1.156	255.255.255.0	
R1	E0/156	192.168.1.157	255.255.255.0	
R1	E0/157	192.168.1.158	255.255.255.0	
R1	E0/158	192.168.1.159	255.255.255.0	
R1	E0/159	192.168.1.160	255.255.255.0	
R1	E0/160	192.168.1.161	255.255.255.0	
R1	E0/161	192.168.1.162	255.255.255.0	
R1	E0/162	192.168.1.163	255.255.255.0	
R1	E0/163	192.168.1.164	255.255.255.0	
R1	E0/164	192.168.1.165	255.255.255.0	
R1	E0/165	192.168.1.166	255.255.255.0	
R1	E0/166	192.168.1.167	255.255.255.0	
R1	E0/167	192.168.1.168	255.255.255.0	
R1	E0/168	192.168.1.169	255.255.255.0	
R1	E0/169	192.168.1.170	255.255.255.0	
R1	E0/170	192.168.1.171	255.255.255.0	
R1	E0/171	192.168.1.172	255.255.255.0	
R1	E0/172	192.168.1.173	255.255.255.0	
R1	E0/173	192.168.1.174	255.255.255.0	
R1	E0/174	192.168.1.175	255.255.255.0	
R1	E0/175	192.168.1.176	255.255.255.0	
R1	E0/176	192.168.1.177	255.255.255.0	
R1	E0/177	192.168.1.178	255.255.255.0	
R1	E0/178	192.168.1.179	255.255.255.0	
R1	E0/179	192.168.1.180	255.255.255.0	
R1	E0/180	192.168.1.181	25	

8.4 Chapter Summary

Conclusion

Chapter 8: Subnetting IP Networks

- Implement an IPv4 addressing scheme to enable end-to-end connectivity in a small to medium-sized business network.
- Given a set of requirements, implement a VLSM addressing scheme to provide connectivity to end users in a small to medium-sized network.
- Explain design considerations for implementing IPv6 in a business network.

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Conclusion

Packet Tracer - Skills Integration Challenge

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Packet Tracer - Skills Integration Challenge

Topology

Addressing Table

Device	Interface	IPv4 Address	Subnet Mask	Default Gateway
Branch-A	G0/0			N/A
	E0/1			N/A
	E0/2	172.20.31.204	255.255.255.252	N/A

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