Designing and Implementing a VLSM Addressing Scheme

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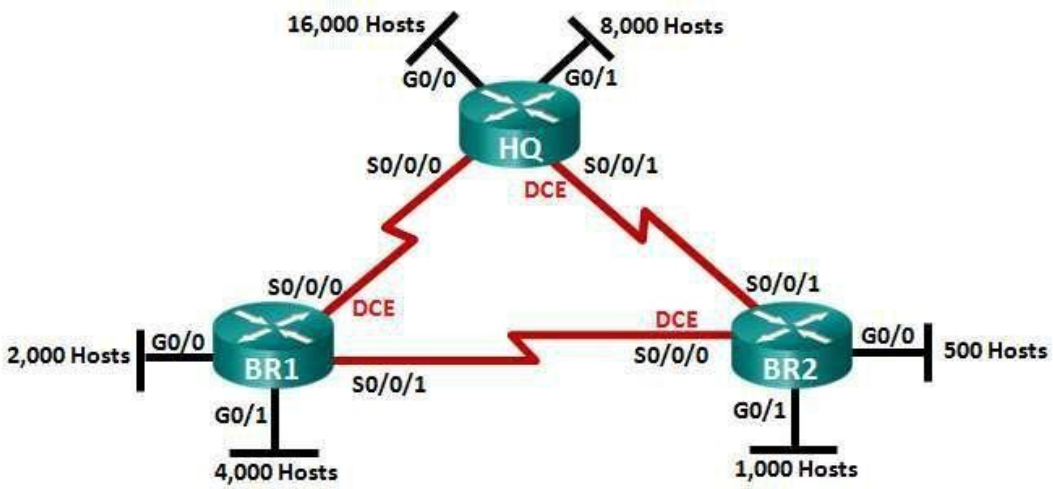
Topology



Objectives

1. **Examine Network Requirements**
2. **Design the VLSM Address Scheme**
3. **Cable and Configure the IPv4 Network**

Background / Scenario

Variable Length Subnet Mask (VLSM) was designed to avoid wasting IP addresses. With VLSM, a network is subnetted and then re-subnetted. This process can be repeated multiple times to create subnets of various sizes based on the number of hosts required in each subnet. Effective use of VLSM requires address planning.

In this lab, use the 175.15.125.0/17 network address to develop an address scheme for the network displayed in the topology diagram. VLSM is used to meet the IPv4 addressing requirements. After you have designed the VLSM address scheme, you will configure the interfaces on the routers with the appropriate IP address information.

Part 1: Examine Network Requirements

In Part 1, you will examine the network requirements to develop a VLSM address scheme for the network displayed in the topology diagram using the 175.15.125.0/17 network address.

Step 1: Determine how many host addresses and subnets are available.

How many host addresses are available in a /17 network? 32760

What is the total number of host addresses needed in the topology diagram? 31500

How many subnets are needed in the network topology? 6

Step 2: Determine the largest subnet.

What is the subnet description (e.g. BR1 G0/1 LAN or BR1-HQ WAN link)? HQ G0/0

How many IP addresses are required in the largest subnet? 16000

What subnet mask can support that many host addresses? 255.255.63.0 (/18)
How many total host addresses can that subnet mask support? 16384

Can you subnet the 172.16.128.0/17 network address to support this subnet?
What are the two network addresses that would result from this subnetting?

Use the first network address for this subnet.

Step 3: Determine the second largest subnet.

What is the subnet description? _____

How many IP addresses are required for the second largest subnet? _____

What subnet mask can support that many host addresses?

How many total host addresses can that subnet mask support? _____

Can you subnet the remaining subnet again and still support this subnet? _____

What are the two network addresses that would result from this subnetting?

Use the first network address for this subnet.

Step 4: Determine the next largest subnet.

What is the subnet description? _____

How many IP addresses are required for the next largest subnet? _____

What subnet mask can support that many host addresses?

How many total host addresses can that subnet mask support? _____

Can you subnet the remaining subnet again and still support this subnet? _____

What are the two network addresses that would result from this subnetting?

Use the first network address for this subnet.

Step 5: Determine the next largest subnet.

What is the subnet description? _____

How many IP addresses are required for the next largest subnet? _____

What subnet mask can support that many host addresses?

How many total host addresses can that subnet mask support? _____

Can you subnet the remaining subnet again and still support this subnet? _____

What are the two network addresses that would result from this subnetting?

Use the first network address for this subnet.

Step 6: Determine the next largest subnet.

What is the subnet description? _____

How many IP addresses are required for the next largest subnet? _____

What subnet mask can support that many host addresses?

_____

How many total host addresses can that subnet mask support? _____

Can you subnet the remaining subnet again and still support this subnet? _____

What are the two network addresses that would result from this subnetting?

_____

_____

Use the first network address for this subnet.

Step 7: Determine the next largest subnet.

What is the subnet description? _____

How many IP addresses are required for the next largest subnet? _____

What subnet mask can support that many host addresses?

_____

How many total host addresses can that subnet mask support? _____

Can you subnet the remaining subnet again and still support this subnet? _____

What are the two network addresses that would result from this subnetting?

_____

_____

Use the first network address for this subnet.

Step 8: Determine the subnets needed to support the serial links.

How many host addresses are required for each serial subnet link? _____

What subnet mask can support that many host addresses?

_____

a. Continue subnetting the first subnet of each new subnet until you have four /30 subnets. Write the first three network addresses of these /30 subnets below.

   _____

   _____

   _____

b. Enter the subnet descriptions for these three subnets below.

   _____

   _____

   _____

Part 2: Design the VLSM Address Scheme

Step 1: Calculate the subnet information.

Use the information that you obtained in Part 1 to fill in the following table.

Subnet Description	Number of Hosts Needed	Network Address /CIDR	First Host Address	Broadcast Address
HQ G0/0	16,000	175.15.0.0	175.15.0.1	175.15.63.255
HQ G0/1	8,000	175.15.64.0	175.15.64.1	175.15.95.255
BR1 G0/1	4,000	175.15.96.0	175.15.96.1	175.15.111.255
BR1 G0/0	2,000	175.15.112.0	175.15.112.1	175.15.119.255
BR2 G0/1	1,000	175.15.120.0	175.15.120.1	175.15.123.255
BR2 G0/0	500	175.15.124.0	175.15.124.1	175.15.125.255
HQ S0/0/0 – BR1 S0/0/0	2	195.152.92.0	195.152.92.1	195.152.92.255
HQ S0/0/1 – BR2 S0/0/1	2	195.152.93.0	195.152.93.1	195.152.93.255
BR1 S0/0/1 – BR2 S0/0/0	2	195.152.94.0	195.152.94.1	195.152.94.255

Step 2: Complete the device interface address table.

Assign the first host address in the subnet to the Ethernet interfaces. HQ should be given the first host address on the Serial links to BR1 and BR2. BR1 should be given the first host address for the serial link to BR2.

Device	Interface	IP Address	Subnet Mask	Device Interface
HQ	G0/0	175.15.0.1	255.255.192.0	16,000 Host LAN
	G0/1	175.15.64.0	255.255.224	8,000 Host LAN
	S0/0/0	195.152.92.0	255.255.255.0	BR1 S0/0/0
	S0/0/1	195.152.93.0	255.255.255.0	BR2 S0/0/1
BR1	G0/1	175.15.96.0	255.255.240.0	2,000 Host LAN
	G0/0	175.15.112.0	255.255.248	4,000 Host LAN
	S0/0/0	195.152.92.1	255.255.255.0	HQ S0/0/0
	S0/0/1	195.152.94.0	255.255.255.0	BR2 S0/0/0
BR2	G0/0	175.15.124.0	255.255.254	500 Host LAN
	G0/1	175.15.120.0	255.255.252	1,000 Host LAN
	S0/0/0	195.152.94.1	255.255.255.0	BR1 S0/0/1
	S0/0/1	195.152.93.1	255.255.255.0	HQ S0/0/1

Part 3: Cable and Configure the IPv4 Network

In Part 3, you will cable the network topology and configure the three routers using the VLSM address scheme that you developed in Part 2.

Step 1: Cable the network as shown in the topology.

Step 2: Configure basic settings on each router.

a. Assign the device name to the router.

Step 3: Configure the interfaces on each router.

a. Assign an IP address and subnet mask to each interface using the table that you completed in Part 2.

b. Configure an interface description for each interface.

c. Set the clocking rate on all DCE serial interfaces to 128000.

```
HQ(config-if)# clock rate 128000
```

d. Activate the interfaces.

Step 4: Save the configuration on all devices.

Step 5: Test Connectivity.

a. From HQ, ping BR1's S0/0/0 interface address.

b. From HQ, ping BR2's S0/0/1 interface address.

c. From BR1, ping BR2's S0/0/0 interface address.

d. Troubleshoot connectivity issues if pings were not successful.

Reflection

Can you think of a shortcut for calculating the network addresses of consecutive /30 subnets?

_____

_____

_____

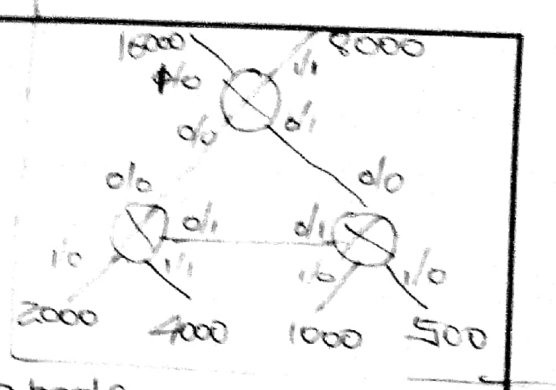
_____

175.15.125.0/17

i.e. 175.15.0|1111101.00000000

SM 255.255.1|0000000.00000000

N/w | Host



=> Maj. N/w id = 175.15.0.0/17

with 15 host bits → 2^{15} = 32760 hosts

required hosts = 31500

-"- n/w = 6

i. $2^h - 2 \geq 16000$

$\Rightarrow h = 14$

$\frac{2^{14}}{256} = 64$

ii. $2^h - 2 \geq 8000$

$\Rightarrow h = 13$

$\frac{2^{13}}{256} = 32$ ⟨32+64 = 96⟩

iii. $2^h - 2 \geq 4000$

$\Rightarrow h = 12$

$\frac{2^{12}}{256} = 16$ ⟨16+96 = 112⟩

IV. $2^h - 2 \geq 2000$

$\Rightarrow h = 11$

$\frac{2^{11}}{256} = 8$ ⟨8+112 = 120⟩

V. $2^h - 2 \geq 1000$

$\Rightarrow h = 10$

$\frac{2^{10}}{256} = 4$ ⟨4+120 = 124⟩

VI. $2^h - 2 \geq 500$

$\Rightarrow h = 9$

$\frac{2^9}{256} = 2$ ⟨2+124 = 126⟩

i 175.15.0.0 to 175.15.63.255/18

ii. 175.15.64.0 to 175.15.95.255/19

iii. 175.15.96.0 to 175.15.111.255/20

IV. 175.15.112.0 to 175.15.119.255/21

V. 175.15.120.0 to 175.15.123.255/22

VI. 175.15.124.0 to 175.15.125.255/23

175.15.126.0 to 175.15.

SM: 255.255

i. .11000000.0 → /18 → 192

ii. .11100000.0 → /19 → 224

iii. .11110000.0 → /20 → 240

IV. .11111000.0 → /21 → 248

V. .11111100.0 → /22 → 252

VI. 11111110.0 → /23 → 254

I 175.15.126.0 to 175.15.126.

$2^h - 2 \geq 2 \Rightarrow h = 2$