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Experiment#10: Implementing a VLSM Addressing Scheme
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INTRODUCTION

The ability to work with IPv4 subnets and determine network and host information based on a given IP address and subnet mask is critical to understand how IPv4 networks operate.

Variable Length Subnet Mask (VLSM) has been 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 experiment, we use the **172.16.128.0/17** network address to develop an address scheme for the network displayed in the topology diagram (Figure 1). 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 and configure static routing.

TOPOLOGY

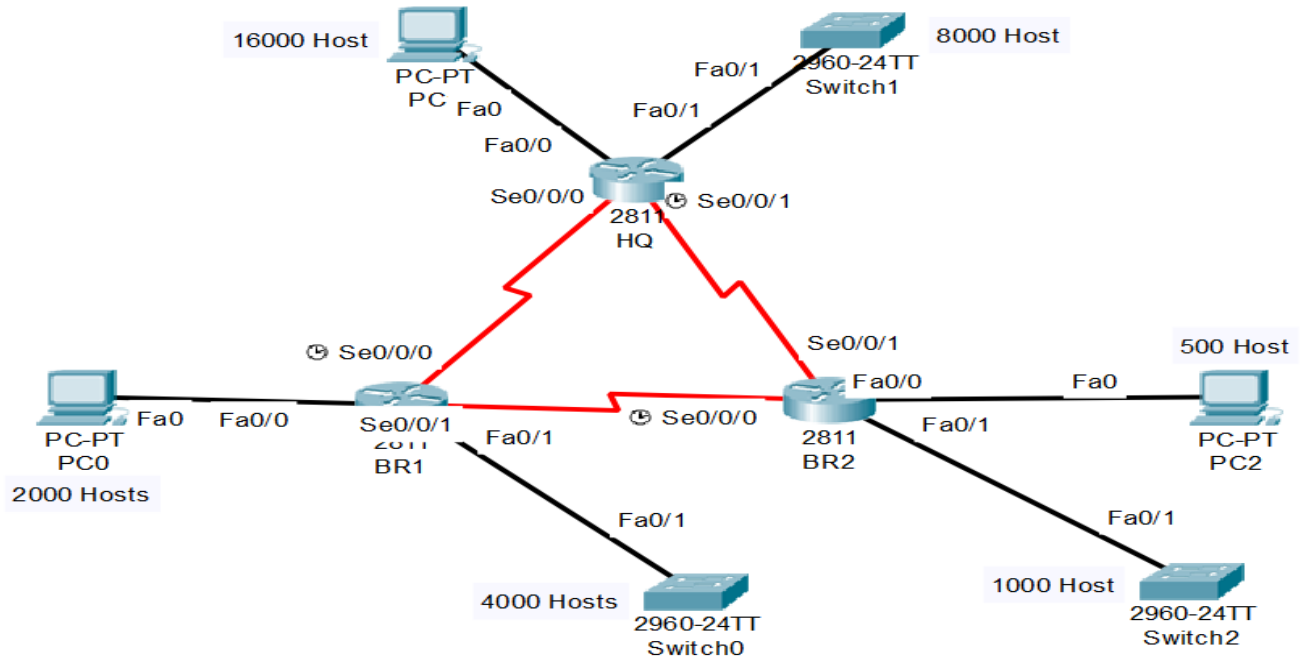

Figure 1: Topology Diagram

EQUIPMENT LIST

- 3 routers (Cisco 2811)
- 3 Switches (Optional: you could assume that you are using multiple VLANs on a single switch)
- 3 PCs (one at least with putty terminal emulation program, to configure routers)
- Console cable to configure the Cisco IOS devices via the console ports
- Ethernet and serial cables, as shown in the topology

1 EXAMINE NETWORK REQUIREMENTS

You will examine the network requirements to develop a VLSM address scheme for the network displayed in the topology diagram using the 172.16.128.0/17 network address.

1.1 DETERMINE HOW MANY HOST ADDRESSES AND SUBNETS ARE AVAILABLE.

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

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

How many subnets are needed in the network topology? _____

1.2 DETERMINE THE LARGEST SUBNET.

What is the subnet description (e.g. BR1 F0/1 LAN or BR1-HQ WAN link)? _____

How many IP addresses are required in the 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 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.

1.3 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.

1.4 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.

1.5 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.

1.6 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.

1.7 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.

1.8 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.

   _____

   _____

   _____

2 DESIGN THE VLSM ADDRESS SCHEME

2.1 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 F0/0	16,000			
HQ F0/1	8,000			
BR1 F0/1	4,000			
BR1 F0/0	2,000			
BR2 F0/1	1,000			
BR2 F0/0	500			
HQ S0/0/0 – BR1 S0/0/0	2			
HQ S0/0/1 – BR2 S0/0/1	2			
BR1 S0/0/1 – BR2 S0/0/0	2			

2.2 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	Gateway
HQ	F0/0			
	F0/1			
	F0/0/0			
	F0/0/1			
BR1	F0/0			
	F0/1			
	S0/0/0			
	S0/0/1			
BR2	F0/0			
	F0/1			
	S0/0/0			
	S0/0/1			
PC0	F0			
PC1	F0			
PC2	F0			

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.

3.1 CABLE THE NETWORK AS SHOWN IN THE TOPOLOGY.

3.2 CONFIGURE BASIC SETTINGS ON EACH ROUTER.

c. Assign the device name to the router.

d. Assign **Class2018** as the privileged mode encrypted password.

e. Assign **NetAdminLab** as the console password and enable login.

f. Assign **NetAdminLab** as the VTY password and enable login.

3.3 CONFIGURE THE INTERFACES ON EACH ROUTER.

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

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

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

i. Activate the interfaces.

3.4 CONFIGURE STATIC ROUTING ON ALL ROUTERS.

On each of the routers add static routes to enable routing for all remote networks (LANs and WANs) as follows:

j. BR1 should send all traffic through HQ except the BR2 LANs which should be routed to BR2.

k. BR2 should send all traffic through HQ except the BR1 LANs which should be routed to BR1.

l. HQ should use the shortest path for each remote network.

m. HQ uses load balancing for the BR1-BR2 WAN.

3.5 TEST CONNECTIVITY.

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

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

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

q. From PC0 ping PC1 _____

r. From PC0 ping PC2 _____

s. From PC2 ping all IPs on all devices one by one.

t. From PC0 use the tracert (traceroute) command to trace the traffic path to HQ F0/1 IP address.

_____
_____
_____
_____
_____
_____

u. From PC1 trace the route to S0/0/0 on BR2.

_____
_____
_____
_____
_____

v. Troubleshoot connectivity issues if pings were not successful.