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Activity 6.4.1: Basic VLSM Calculation and Addressing Design

Topology Diagram

192.168.1.0/26 192.168.1.64/26
50 Hosts 50 Hosts

Fa0/0 Fa0/1
HQ
S0/0/1
DCE
S0/0/0

192.168.1.160/27
20 Hosts

192.168.1.224/30 192.168.1.228/30

192.168.1.208/28
12 Hosts

192.168.1.128/27
Fa0/1 S0/0/0
Fa0/0 DCE 192.168.1.232/30 S0/0/1 Fa0/1
BRANCH1 Fa0/0
20 Hosts S0/0/1 S0/0/0 BRANCH2
DCE

192.168.1.192/28
12 Hosts

12 Hosts
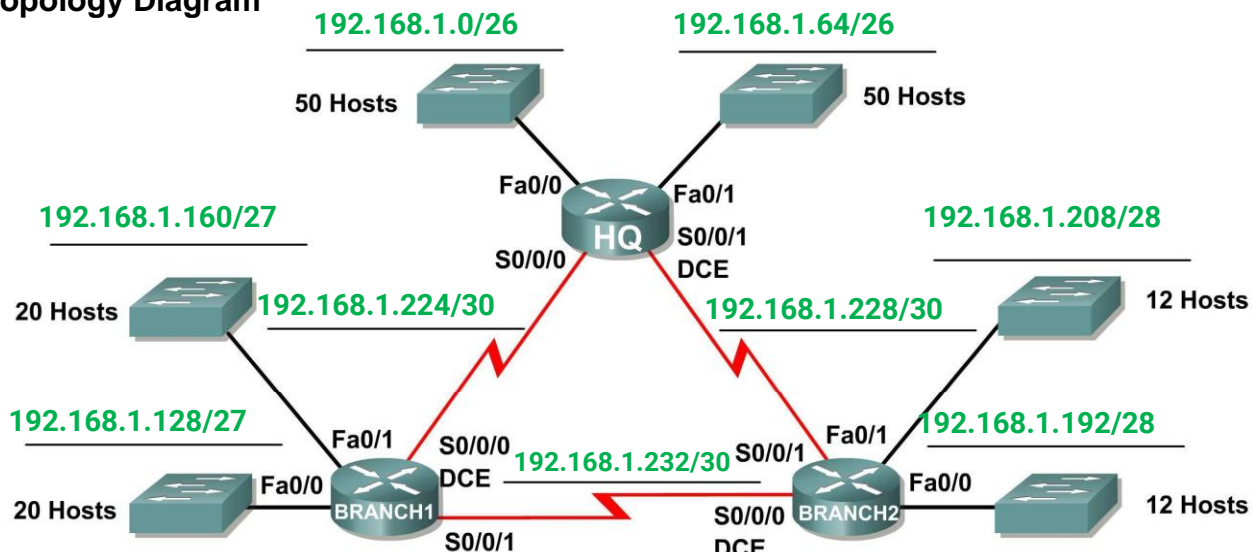
Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
HQ	Fa0/0	192.168.1.1	255.255.255.192	N/A
	Fa0/1	192.168.1.65	255.255.255.192	N/A
	S0/0/0	192.168.1.225	255.255.255.252	N/A
	S0/0/1	192.168.1.229	255.255.255.252	N/A
Branch1	Fa0/0	192.168.1.129	255.255.255.224	N/A
	Fa0/1	192.168.1.161	255.255.255.224	N/A
	S0/0/0	192.168.1.226	255.255.255.252	N/A
	S0/0/1	192.168.1.233	255.255.255.252	N/A
Branch2	Fa0/0	192.168.1.193	255.255.255.240	N/A
	Fa0/1	192.168.1. 209	255.255.255.240	N/A
	S0/0/0	192.168.1.234	255.255.255.252	N/A
	S0/0/1	192.168.1.230	255.255.255.252	N/A

Learning Objectives

Upon completion of this activity, you will be able to:

- Determine the number of subnets needed.
- Determine the number of hosts needed for each subnet
- Design an appropriate addressing scheme using VLSM.
- Assign addresses and subnet mask pairs to device interfaces.
- Examine the use of the available network address space.

Scenario

In this activity, you have been given the network address 192.168.1.0/24 to subnet and provide the IP addressing for the network shown in the Topology Diagram. VLSM will be used so that the addressing requirements can be met using the 192.168.1.0/24 network. The network has the following addressing requirements:

- The HQ LAN1 will require 50 host IP addresses.
- The HQ LAN2 will require 50 host IP addresses.
- The Branch1 LAN1 will require 20 host IP addresses. •   The Branch1 LAN2 will require 20 host IP addresses
- The Branch2 LAN1 will require 12 host IP addresses.
- The Branch2 LAN2 will require 12 host IP addresses.
- The link from HQ to Branch1 will require an IP address for each end of the link.
- The link from HQ to Branch2 will require an IP address for each end of the link.
- The link Branch1 to Branch2 will require an IP address for each end of the link.

Task 1: Examine the Network Requirements.

Examine the network requirements and answer the questions below. Keep in mind that IP addresses will be needed for each of the LAN interfaces.

1. How many subnets are needed? __9___

2. What is the maximum number of IP addresses that are needed for a single subnet? __50___

3. How many IP addresses are needed for each of the BranchBranch1 LANs? __20___

4. How many IP addresses are needed for each of the BranchBranch2 LANs? __12__

5. How many IP addresses are needed for each of the WAN links between routers? __2__

6. What is the total number of IP addresses that are needed? __170___

7. What is the total number of IP addresses that are available in the 192.168.1.0/24 network?

   __254__

8. Can the network addressing requirements be met using the 192.168.1.0/24 network? __Yes__

Task 2: Design an IP Addressing Scheme

Step 1: Determine the subnet information for the largest network segment or segments.

In this case, the two HQ LANs are the largest subnets.

1. How many IP addresses are needed for each LAN? __50__
2. What is the smallest size subnet that can be used to meet this requirement? __/26__

3. What is the maximum number of IP addresses that can be assigned in this size subnet? __62__

Step 2: Assign subnets to HQ LANs.

Start at the beginning of the 192.168.1.0/24 network.

1. Assign the first available subnet to HQ LAN1.

2. Fill in the chart below with the appropriate information.

HQ LAN1 Subnet

Network Address	Decimal Subnet Mask	CIDR Subnet Mask	First Usable IP Address	Last Usable IP Address	Broadcast Address
192.168.1.0	255.255.255.192	/26	192.168.1.1	192.168.1.62	192.168.1.63

3. Assign the next available subnet to HQ LAN2.

4. Fill in the chart below with the appropriate information.

HQ LAN2 Subnet

Network Address	Decimal Subnet Mask	CIDR Subnet Mask	First Usable IP Address	Last Usable IP Address	Broadcast Address
192.168.1.64	255.255.255.192	/26	192.168.1.65	192.168.1.126	192.168.1.127

Step 3: Determine the subnet information for the next largest network segment or segments.

In this case, the two Branch1 LANs are the next largest subnets.

1. How many IP addresses are needed for each LAN? __20__
2. What is the smallest size subnet that can be used to meet this requirement? __/27___
3. What is the maximum number of IP addresses that can be assigned in this size subnet? _30__

Step 4: Assign subnet to BRANCH1 LANs.

Start with the IP address following the HQ LAN subnets.

1. Assign the next subnet to Branch1 LAN1.

2. Fill in the chart below with the appropriate information.

Branch1 LAN1 Subnet

Network Address	Decimal Subnet Mask	CIDR Subnet Mask	First Usable IP Address	Last Usable IP Address	Broadcast Address
192.168.1.128	255.255.255.224	/27	192.168.1.129	192.168.1.158	192.168.1.159

3. Assign the next available subnet to Branch1 LAN2.

4. Fill in the chart below with the appropriate information.

Branch1 LAN2 Subnet

Network Address	Decimal Subnet Mask	CIDR Subnet Mask	First Usable IP Address	Last Usable IP Address	Broadcast Address
192.168.1.160	255.255.255.224	/27	192.168.1.161	192.168.1.190	192.168.1.191

Step 5: Determine the subnet information for the next largest network segment or segments.

In this case, the two Branch2 LANs are the next largest subnets.

1. How many IP addresses are needed for each LAN? __12__
2. What is the smallest size subnet that can be used to meet this requirement? __/28___
3. What is the maximum number of IP addresses that can be assigned in this size subnet? __14__

Step 6: Assign subnets to BRANCH2 LANs.

Start with the IP address following the Branch1 LAN subnets.

1. Assign the next subnet to the Branch2 LAN1. Fill in the chart below with the appropriate information.

Branch2 LAN1 Subnet

Network Address	Decimal Subnet Mask	CIDR Subnet Mask	First Usable IP Address	Last Usable IP Address	Broadcast Address
192.168.1.192	255.255.255.240	/28	192.168.1.193	192.168.1.206	192.168.1.207

2. Assign the next available subnet to Branch2 LAN2.

3. Fill in the chart below with the appropriate information.

Branch2 LAN2 Subnet

Network Address	Decimal Subnet Mask	CIDR Subnet Mask	First Usable IP Address	Last Usable IP Address	Broadcast Address
192.168.1.208	255.255.255.240	/28	192.168.1.209	192.168.1.222	192.168.1.223

Step 7: Determine the subnet information for the links between the routers.

1. How many IP addresses are needed for each link? _2__
2. What is the smallest size subnet that can be used to meet this requirement? __/30___
3. What is the maximum number of IP addresses that can be assigned in this size subnet? __2__

Step 8: Assign subnets to links.

Start with the IP address following the Branch2 LAN subnets.

1. Assign the next available subnet to the link between the HQ and Branch1 routers.

2. Fill in the chart below with the appropriate information.

Link between HQ and Branch1 Subnet

Network Address	Decimal Subnet Mask	CIDR Subnet Mask	First Usable IP Address	Last Usable IP Address	Broadcast Address
192.168.1.224	255.255.255.252	/30	192.168.1.225	192.168.1.226	192.168.1.227

3. Assign the next available subnet to the link between the HQ and Branch2 routers.

4. Fill in the chart below with the appropriate information.

Link between HQ and Branch2 Subnet

Network Address	Decimal Subnet Mask	CIDR Subnet Mask	First Usable IP Address	Last Usable IP Address	Broadcast Address
192.168.1.228	255.255.255.252	/30	192.168.1.229	192.168.1.230	192.168.1.231

5. Assign the next available subnet to the link between the Branch1 and Branch2 routers.

6. Fill in the chart below with the appropriate information.

Link between Branch1 and Branch2 Subnet

Network Address	Decimal Subnet Mask	CIDR Subnet Mask	First Usable IP Address	Last Usable IP Address	Broadcast Address
192.168.1.232	255.255.255.252	/30	192.168.1.233	192.168.1.234	192.168.1.235

Task 3: Assign IP Addresses to the Network Devices

Assign the appropriate addresses to the device interfaces. Document the addresses to be used in the Addressing Table provided under the Topology Diagram.

Step 1: Assign addresses to the HQ router.

1. Assign the first valid host address in the HQ LAN 1 subnet to the Fa0/0 LAN interface.

2. Assign the first valid host address in the HQ LAN 2 subnet to the Fa0/1 LAN interface.

3. Assign the first valid host address in the link between HQ and Branch1 subnet to the S0/0/0 interface.

4. Assign the first valid host address in the link between HQ and Branch2 subnet to the S0/0/1 interface.

Step 2: Assign addresses to the Branch1 router.

1. Assign the first valid host address in the Branch1 LAN1 subnet to the Fa0/0 LAN interface.

2. Assign the first valid host address in the Branch1 LAN2 subnet to the Fa0/1 LAN interface.

3. Assign the last valid host address on the link between Branch1 and HQ subnet to the S0/0/0 interface

4. Assign the first valid host address on the link between Branch1 and Branch2 subnet to the S0/0/1 interface.

Step 3: Assign addresses to the Branch2 router.

1. Assign the first valid host address in the Branch2 LAN1 subnet to the Fa0/0 LAN interface.

2. Assign the first valid host address in the Branch 2 LAN 2 subnet to the Fa0/1 LAN interface.

3. Assign the last valid host address on the link between HQ and Branch2 subnet to the S0/0/1 interface

4. Assign the last valid host address on the link between Branch1 and Branch2 subnet to the S0/0/0 interface.