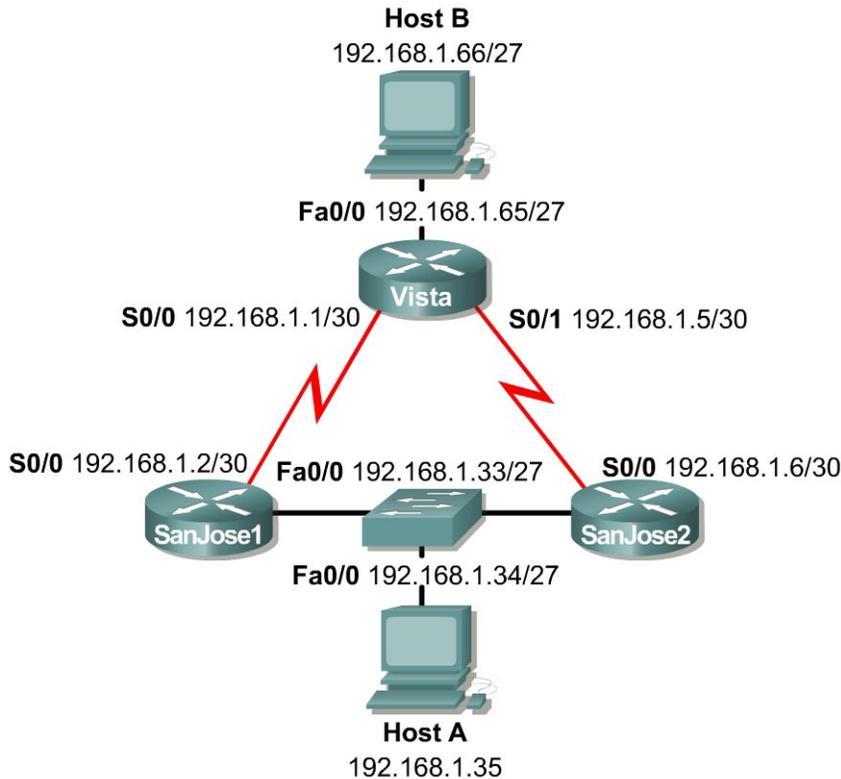


## Lab 2.10.1 Configuring VLSM and IP Unnumbered



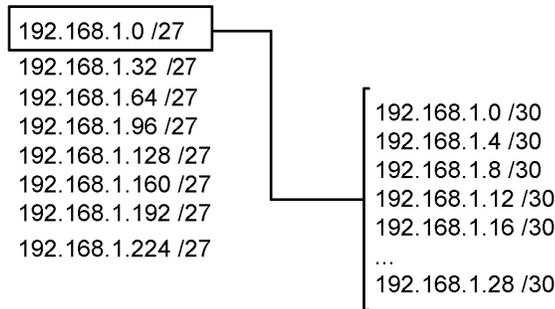
### Objective

In this lab, the student will configure VLSM and test its functionality with two different routing protocols, RIP v1 and RIP v2. Finally, the student will use IP unnumbered in place of VLSM to further conserve addresses.

### Scenario

When International Travel Agency was much smaller, it wanted to configure its network using a single Class C address, 192.168.1.0, as shown in the following table. The routers need to be configured with the appropriate addresses. The company requires that at least 25 host addresses be available on each LAN, but it also demands that the maximum number of addresses be conserved for future growth.

To support 25 hosts on each subnet, a minimum of five (5) bits is needed in the host portion of the address. Five (5) bits will yield 30 possible host addresses ( $2^5 = 32 - 2$ ). If five (5) bits must be used for hosts, the other three (3) bits in the last octet can be added to the default 24-bit Class C mask. Therefore, a 27-bit mask can be used to create the following subnets:



To maximize this address space, the 192.168.1.0 /27 subnet is subnetted further using a 30-bit mask. This creates subnets that can be used on point-to-point links with minimal waste, because each subnet can contain only two possible host addresses.

## Step 1

Build and configure the network according to the diagram. This configuration requires the use of subnet 0, so the `ip subnet-zero` command may be required. This will depend on which IOS version is being used.

**Note:** Host A and Host B are not required to complete this lab.

On all three routers, configure RIP v1 and enable updates on all active interfaces with this network command:

```
SanJose1(config)#router rip
SanJose1(config-router)#network 192.168.1.0
```

Use `ping` to verify that each router can `ping` its directly connected neighbor.

**Note:** Some remote networks might be unreachable. Proceed to Step 2 anyway.

## Step 2

Issue the `show ip route` command on Vista, as shown in the following example:

```
Vista#show ip route
<output omitted>
Gateway of last resort is not set
    192.168.1.0/24 is variably subnetted, 3 subnets, 2 masks
C       192.168.1.64/27 is directly connected, Ethernet0
C       192.168.1.0/30 is directly connected, Serial0
C       192.168.1.4/30 is directly connected, Serial1
```

The 192.168.1.32 /27 subnet is clearly absent from the routing table of Vista.

1. The other routers also have incomplete tables. Why is this so?
-

Because RIP v1 with VLSM is being used, routing has broken down on the network. Remember that VLSM is not supported by classful routing protocols such as RIP v1 and IGRP. These protocols do not send subnet masks in their routing updates. In order for routing to work, RIP v2 must be configured, which does support VLSM.

### Step 3

At each of three router consoles, enable RIP v2 updates and turn off automatic route summarization, as shown in the following example:

```
SanJose1(config)#router rip
SanJose1(config)#network 192.168.1.0           (in case RIP was removed)
SanJose1(config-router)#version 2
SanJose1(config-router)#no auto-summary
```

Configuring **no auto-summary** disables the automatic summarization of subnet routes into network-level routes. This allows subnet information to be sent across classful network boundaries. Note that RIP v1 does not support this feature because it requires VLSM support.

When all three routers are running RIP v2, return to Vista and examine its routing table. It should now be complete, shown as follows:

```
Vista#show ip route
<output omitted>
Gateway of last resort is not set

    192.168.1.0/24 is variably subnetted, 4 subnets, 2 masks
C       192.168.1.64/27 is directly connected, Ethernet0
R       192.168.1.32/27 [120/1] via 192.168.1.6, 00:00:12, Serial1
                    [120/1] via 192.168.1.2, 00:00:13, Serial0
C       192.168.1.0/30 is directly connected, Serial0
C       192.168.1.4/30 is directly connected, Serial1
```

Notice that Vista has received equal cost routes to 192.168.1.32 /27 from both SanJose1 and SanJose2.

### Step 4

Although VLSM has reduced address waste by creating very small subnets for point-to-point links, the IP unnumbered feature can make it unnecessary to address these links altogether. Further maximize address use by configuring IP unnumbered on every serial interface in the WAN. To configure IP unnumbered, use the following commands:

```
SanJose1(config)#interface serial 0/0
SanJose1(config-if)#ip unnumbered fastethernet 0/0

Vista(config)#interface serial 0/0
Vista(config-if)#ip unnumbered fastethernet 0/0
Vista(config-if)#interface serial 0/1
Vista(config-if)#ip unnumbered fastethernet 0/0
```

```
SanJose2(config)#interface serial 0/0
SanJose2(config-if)#ip unnumbered fastethernet 0/0
```

After the IP unnumbered configuration is complete, each serial interface borrows the address of the local LAN interface. Check the routing table on the Vista router again:

```
Vista#show ip route
<output omitted>

Gateway of last resort is not set

    192.168.1.0/27 is subnetted, 2 subnets
C       192.168.1.64 is directly connected, Ethernet0
R       192.168.1.32 [120/1] via 192.168.1.34, 00:00:00, Serial1
                    [120/1] via 192.168.1.33, 00:00:08, Serial0
```

If IP unnumbered were configured on the point-to-point serial links, only the LANs would require addresses in this topology. Because each LAN uses the same 27-bit mask, VLSM would not be required in this case. This would make classful routing protocols, such as RIP v1 and IGRP, viable options.