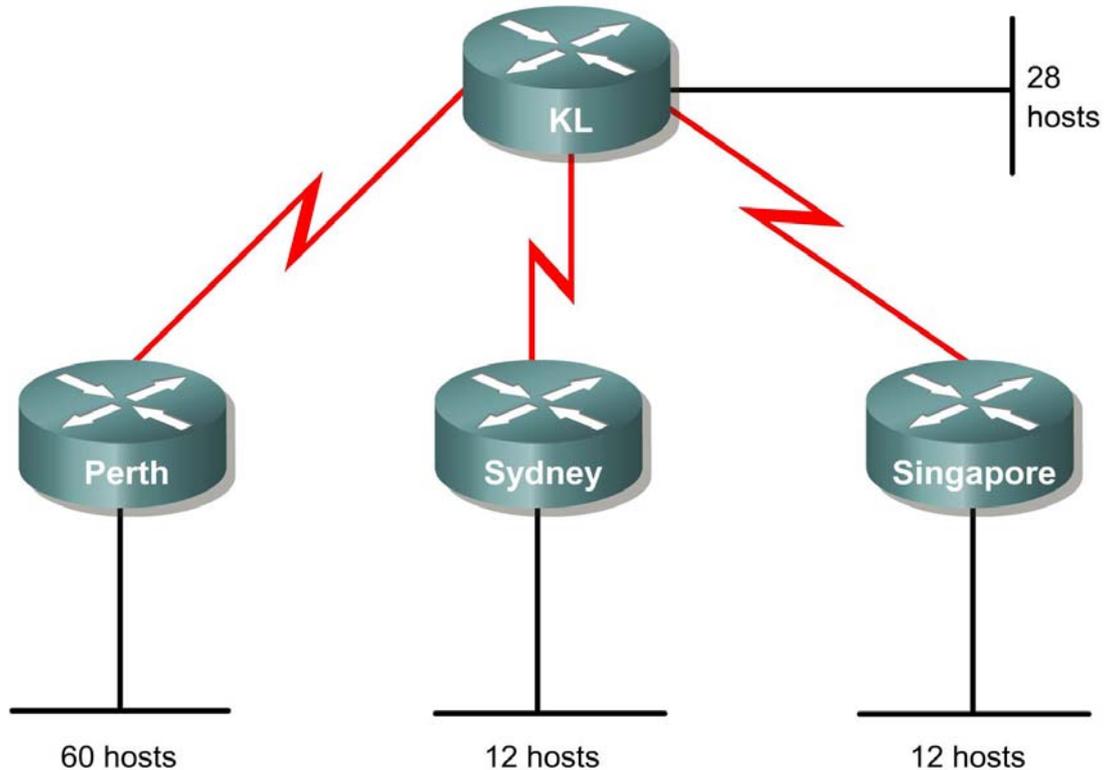# Calculating VLSM Subnets

Objective

The purpose with this worksheet is to use variable length subnet mask (VLSM) to support more efficient use of the assigned IP addresses. This will also reduce the amount of routing information at the top level.

Background/preparation

A class C address of 192.168.10.0/24 has been allocated. Perth, Sydney and Singapore have a WAN connection to Kuala Lumpur. The requirements are the following:

- Perth: 60 hosts
- Kuala Lumpur: 28 hosts
- Sydney and Singapore: 12 hosts each

Step 1 Perth

There are different ways to calculate VLSM subnets, but in this exercise we start to allocate the largest requirements first from the address range. Perth requires the largest number of hosts.

1. How many bits are needed in the host portion to support 60 usable hosts? _____

2. How many bits are left for the subnet portion? _____

3. Use these two bits to divide the allocated address into four equal size address blocks. Use the first subnet (subnet #0) for the Perth subnet, and identify each of its hosts. Remember that it is really important to specify the subnet mask for a network address when VLSM is used. Fill in the table below.

Allocated Address	Subnetwork #	Subnetwork address	Subnet mask	Usable hosts
192.168.10.0/24	0			
	1			
	2			
	3			

4. What is the subnetwork address for the Perth network? _____

5. What is the broadcast address for the Perth network? _____

Step 2 Kuala Lumpur

Continue with the subnet for the network that requires the second highest number of hosts. The Kuala Lumpur network needs 28 hosts.

1. How many bits are needed in the host portion to support 28 usable hosts? _____

2. How many bits are left for the subnet portion? _____

3. Use the next available address (192.168.10.64/26) and sub-divide it further to fulfill the requirements. Fill in the table below.

Allocated Address	Sub-sub-network #	Sub-sub-networks	Mask	Usable hosts
192.168.10.64/26	0			
	1			
	2			
	3			
	4			
	5			

4. Use the first subnet for the Kuala Lumpur network. What is the subnetwork address for this network? _____

5. What is the broadcast address for the Kuala Lumpur network? _____

Step 3 Sydney and Singapore

Now, Sydney and Singapore require 12 hosts each. The next available address starts from 192.168.10.96/27.

1. How many bits are needed in the host portion to support 12 usable hosts? _____

2. How many bits are left for the subnet portion? _____

3. Use the next available address (192.168.10.96/27) and sub-divide it further to fulfill the requirements. Fill in the table below.

Allocated Address	Sub-sub-network #	Sub-sub-networks	Mask	Usable hosts
192.168.10.96/27	0			
	1			
	2			
	3			
	4			
	5			
	...			
	...			

4. Use the first two subnets for the Sydney and Singapore networks. What is the subnetwork address for the Sydney network? _____

5. What is the broadcast address for the Sydney network? _____

6. What is the subnetwork for the Singapore network? _____

7. What is the broadcast address for the Singapore network? _____

Step 4 The WAN links

Each WAN link requires two IP addresses. To use the addresses as efficient as possible, sub-divide your network further to support two IP addresses per network. Start with the next available address.

1. How many bits are needed in the host portion to support 2 usable addresses? _____

2. How many bits are left for the subnet portion? _____

3. Use the next available address (192.168.10.128/28) and sub-divide it further to fulfill the requirements. Fill in the table below.

Allocated Address	Sub-sub-network #	Sub-sub-networks	Mask	Usable hosts
192.168.10.128/28	0			
	1			
	2			
	3			
	...			
	...			

4. Use the first three subnets for the WAN links. What is the subnetwork address for the WAN links? _____
_____
_____

5. What is the broadcast address for the WAN links? _____
   _____
   _____

Solution

The diagram illustrates how the Class C address was subnetted using VLSM. The network address and the broadcast address for each subnet are shown in the corners of each box. Remember that this diagram will differ if you start to calculate the subnets that require the fewest number of hosts first. The best solution is to start with the subnets with the largest number of hosts first, and continue with decreasing number of hosts. This will put the subnets as close to each other as possible, and the routing updates can be summarized to external routers.

LAN - 192.168.10.112 / 28

LAN - 192.168.10.96 / 28

Sing

Sydn

WAN - 192.168.10.128 / 30

WAN - 192.168.10.132 / 30

Kuala

LAN - 192.168.10.64 / 27

WAN - 192.168.10.136 / 30

Perth

LAN - 192.168.10.0 / 26