VLSM
Week 7

Module : Computer Networks

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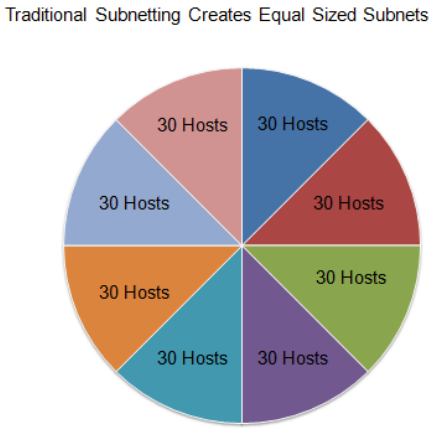
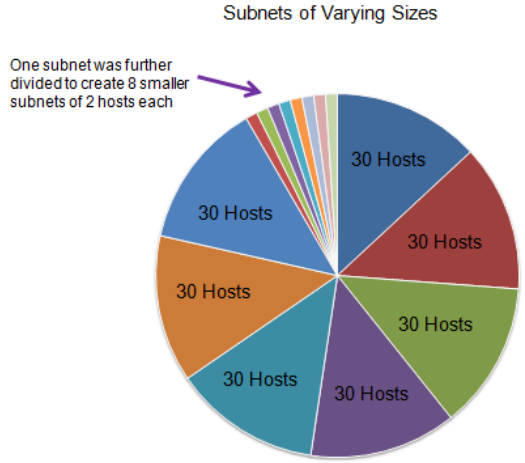
Benefits of Variable Length Subnet Masking

Traditional Subnetting Wastes Addresses

- Traditional subnetting - same number of addresses is allocated for each subnet.
- Subnets that require fewer addresses have unused (wasted) addresses. For example, WAN links only need 2 addresses.
- Variable Length Subnet Mask (VLSM) or subnetting a subnet provides more efficient use of addresses.





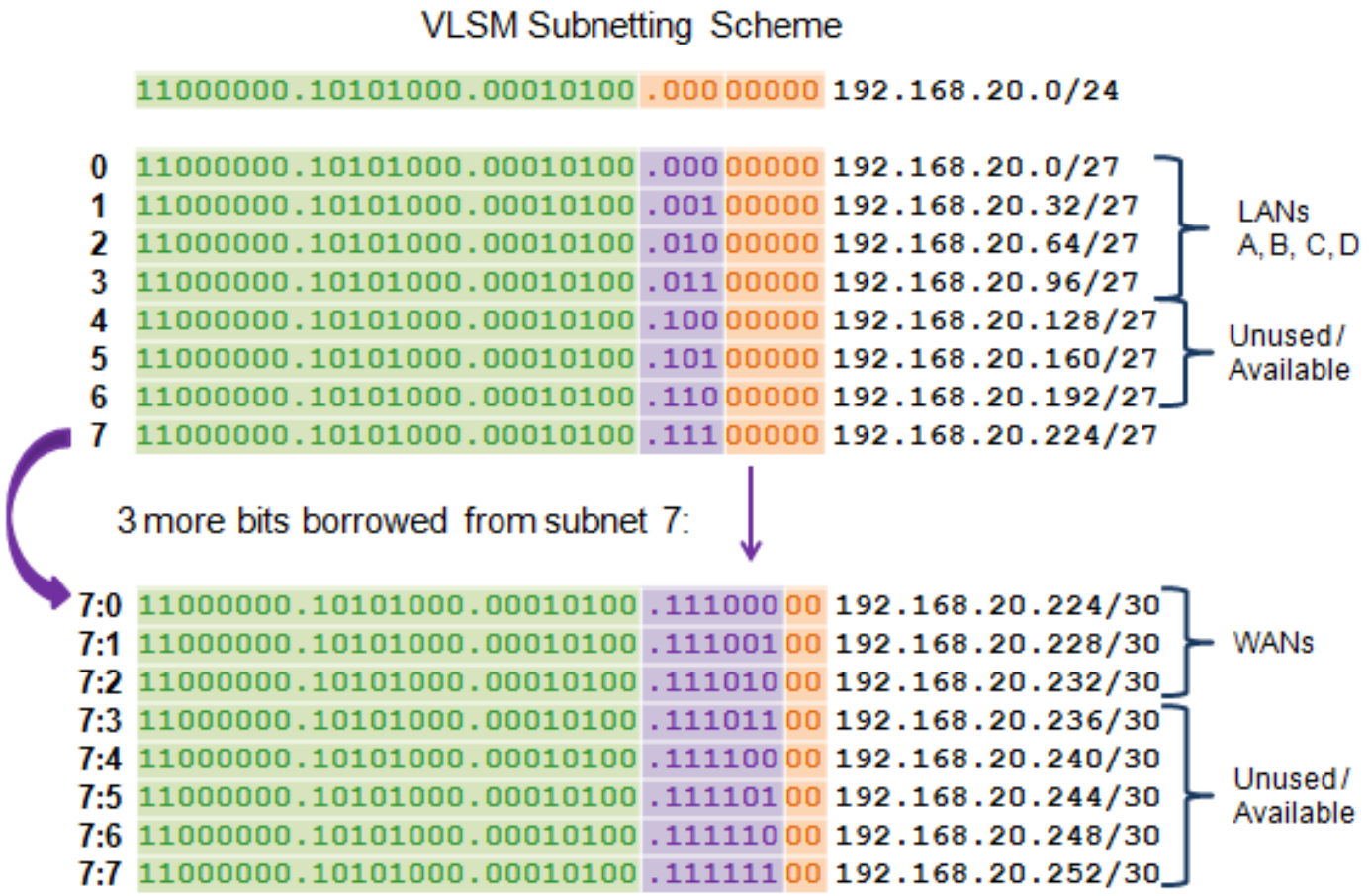
Benefits of Variable Length Subnet Masking

Variable Length Subnet Masks (VLSM)

- VLSM allows a network space to be divided in unequal parts.
- Subnet mask will vary depending on how many bits have been borrowed for a particular subnet.
- Network is first subnetted, and then the subnets are subnetted again.
- Process repeated as necessary to create subnets of various sizes.

Benefits of Variable Length Subnet Masking

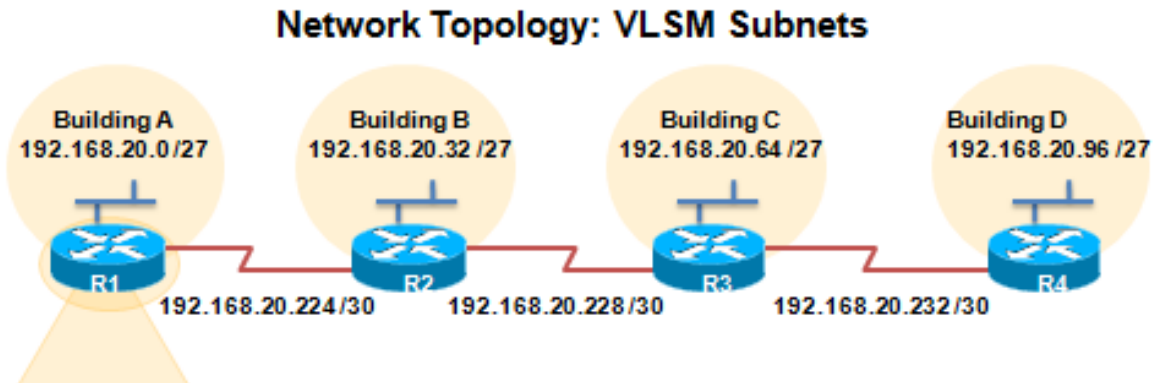
Basic VLSM



Benefits of Variable Length Subnet Masking

VLSM in Practice

- Using VLSM subnets, the LAN and WAN segments in example below can be addressed with minimum waste.
- Each LANs will be assigned a subnet with /27 mask.
- Each WAN link will be assigned a subnet with /30 mask.




```
R1(config)#interface gigabitethernet 0/0
R1(config-if)#ip address 192.168.20.1 255.255.255.224
R1(config-if)#exit
R1(config)#interface serial 0/0/0
R1(config-if)#ip address 192.168.20.225 255.255.255.252
R1(config-if)#end
R1#
```

Benefits of Variable Length Subnet Masking

VLSM Chart

VLSM Subnetting of 192.168.20.0 /24

1

2

	/27 Network	Hosts
Bldg A	.0	.1 - .30
Bldg B	.32	.33 - .62
Bldg C	.64	.65 - .94
Bldg D	.96	.97 - .126
Unused	.128	.129 - .158
Unused	.160	.161 - .190
Unused	.192	.193 - .222
	.224	.225 - .254

	/30 Network	Hosts
WAN R1–R2	.224	.225 - .226
WAN R2–R3	.228	.229 - .230
WAN R3–R4	.232	.233 - .234
Unused	.236	.237 - .238
Unused	.240	.241 - .242
Unused	.244	.245 - .246
Unused	.248	.249 - .250
Unused	.252	.253 - .254

Planning to Address the Network

Allocation of network addresses should be planned and documented for the purposes of:

- Preventing duplication of addresses
- Providing and controlling access
- Monitoring security and performance

Addresses for Clients - usually dynamically assigned using Dynamic Host Configuration Protocol (DHCP)

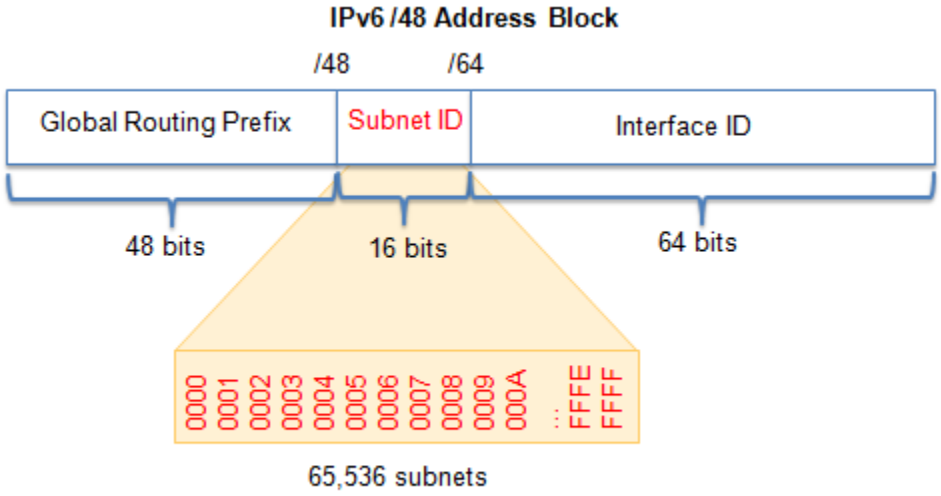
Sample Network Addressing Plan

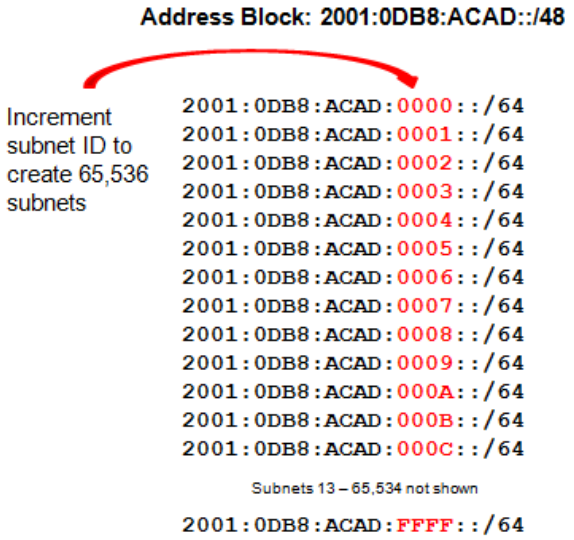
Network: 192.168.1.0/24

Use	First	Last
Host Devices	.1	.229
Servers	.230	.239
Printers	.240	.249
Intermediary Devices	.250	.253
Gateway (router LAN interface)	.254	

Subnetting Using the Subnet ID

An IPv6 Network Space is subnetted to support hierarchical, logical design of the network





VLSM (Variable Length Subnet Mask)

- If you know how to subnet, you can do VLSM.

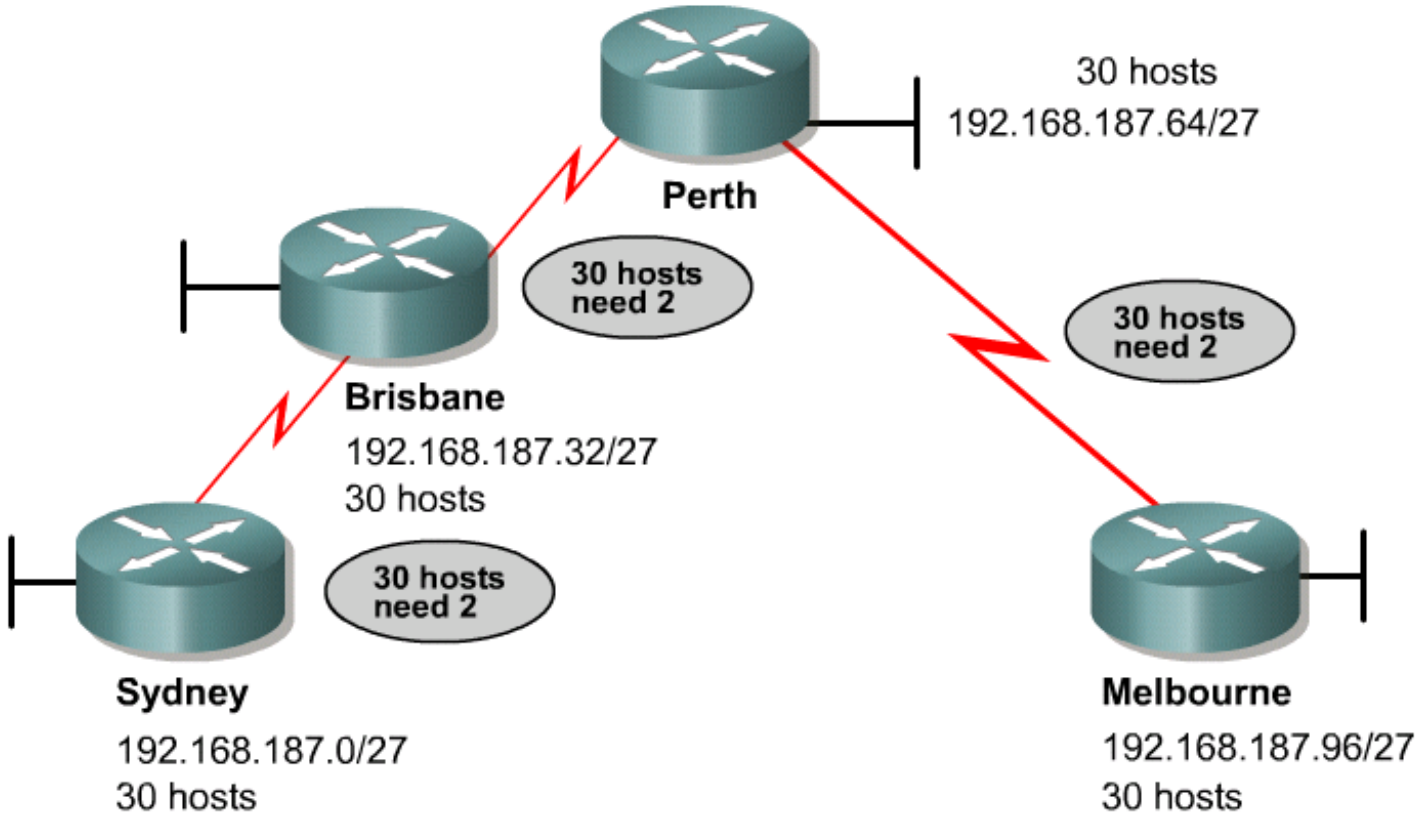
- Example: 10.0.0.0/8
  - Subnet in /16 subnets:
  - 10.0.0.0/16
  - 10.1.0.0/16
  - 10.2.0.0/16
  - 10.3.0.0/16
  - Etc.
    - Subnet one of the subnets (10.1.0.0/16)
    - 10.1.0.0/24
    - 10.1.1.0/24
    - 10.1.2.0/24
    - 10.1.3.0/24
    - etc

What is VLSM and Why is it used?

Subnet Masks		
255.255.255.252	11111111 11111111 11111111 11111100	30 bits
255.255.255.0	11111111 11111111 11111111 00000000	24 bits
255.255.252.0	11111111 11111111 11111100 00000000	22 bits

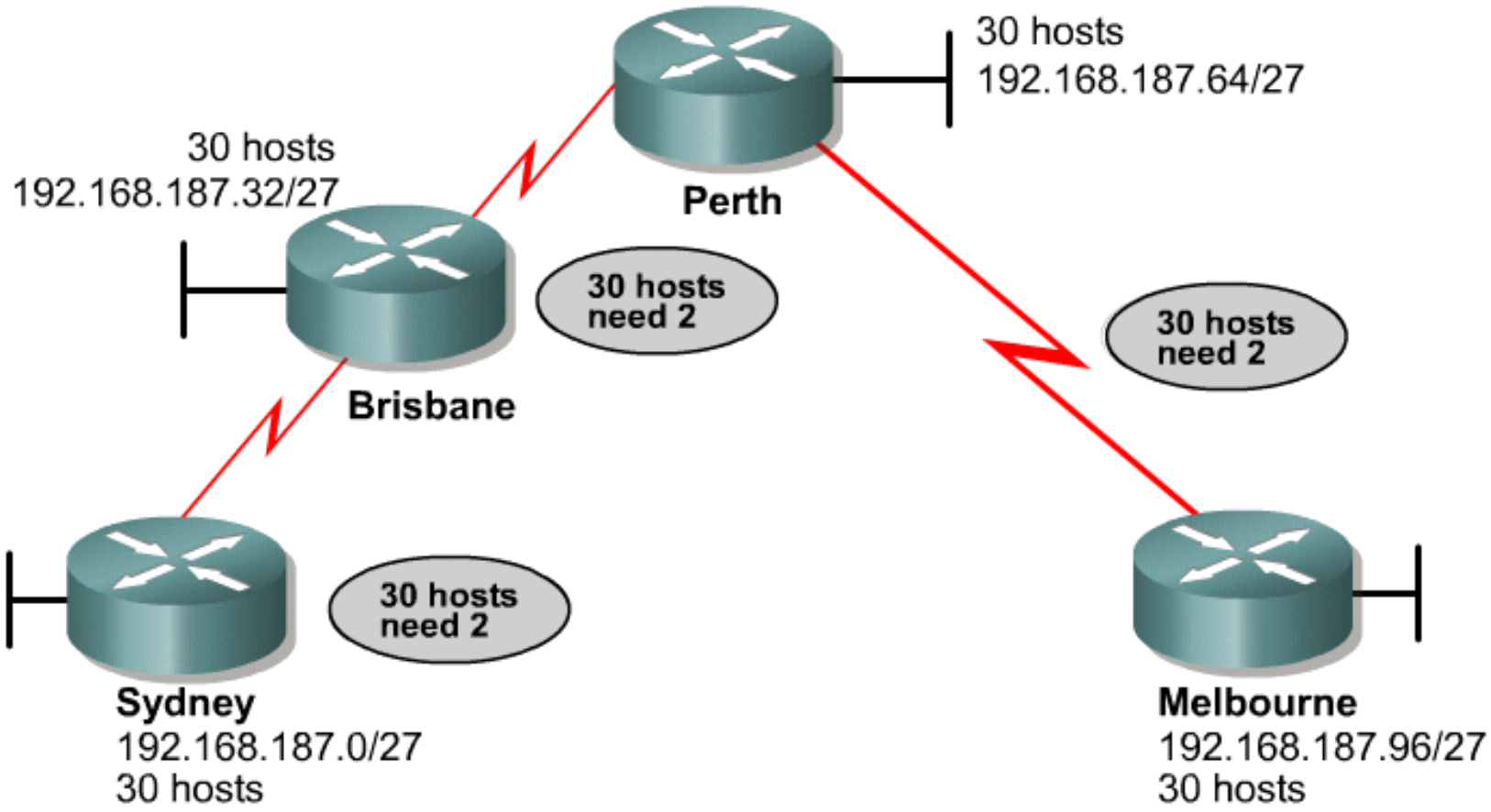
- VLSM allows an organization to use more than one subnet mask within the same network address space.
- Implementing VLSM is often referred to as "subnetting a subnet", and can be used to maximize addressing efficiency.
- Classful routing protocols require that a single network use the same subnet mask. Therefore, network 192.168.187.0 must use just one subnet mask such as 255.255.255.0.
- VLSM is simply a feature that allows a single autonomous system to have networks with different subnet masks. If a routing protocol allows VLSM, use a 30-bit subnet mask on network connections, 255.255.255.252, a 24-bit mask for user networks, 255.255.255.0, or even a 22-bit mask, 255.255.252.0, for networks with up to 1000 users.

A waste of Space



The above addressing scheme is fine for a small LAN. However, this addressing scheme is extremely wasteful if using point-to-point connections

When to use VLSM?



Use VLSM on the point-to-point links to use only two valid host addresses instead of wasting 30

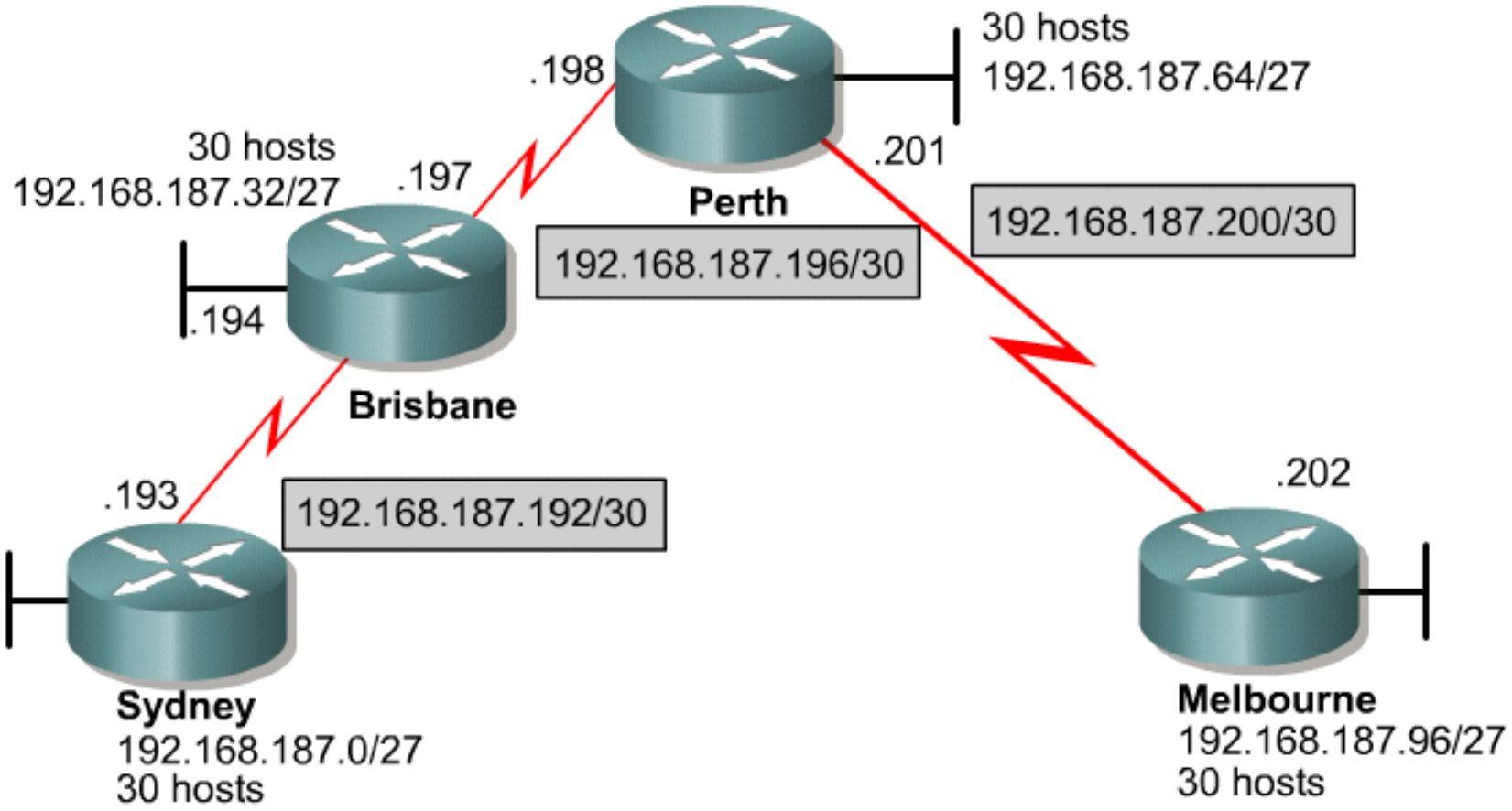
When to use VLSM?

Subnet Number	Subnet Address	
subnet 0	192.168.187.0	/27
subnet 1	192.168.187.32	/27
subnet 2	192.168.187.64	/27
subnet 3	192.168.187.96	/27
subnet 4	192.168.187.128	/27
subnet 5	192.168.187.160	/27
subnet 6	192.168.187.192	/27
subnet 7	192.168.187.224	/27

Subnet Number	Subnet Address	
sub-subnet 0	192.168.187.192	/30
sub-subnet 1	192.168.187.196	/30
sub-subnet 2	192.168.187.200	/30
sub-subnet 3	192.168.187.204	/30
sub-subnet 4	192.168.187.208	/30
sub-subnet 5	192.168.187.212	/30
sub-subnet 6	192.168.187.216	/30
sub-subnet 7	192.168.187.220	/30

Subnet 6 is further broken into /30 subnets for Point-to-Point WAN Links

When to use VLSM?



Notice the /27 bit masks for the LANs, and the /30 for the serial links

Subnetting Exercise 1

Host IP Address	**172.25.114.250**
Network Mask	**255.255.0.0 (/16)**
Subnet Mask	**255.255.255.192 (/26)**

Find:

Number of Subnet Bits	
Number of Subnets	
Number of Host Bits per Subnet	
Number of Usable Hosts per Subnet	
Subnet Address for this IP Address	
IP Address of First Host on this Subnet	
IP Address of Last Host on this Subnet	
Broadcast Address for this Subnet	

Subnetting Exercise 2

Host IP Address	**172.30.172.133**
Subnet Mask	**255.255.240.0**
Number of Subnet Bits	
Number of Subnets	
Number of Host Bits per Subnet	
Number of Usable Hosts per Subnet	
Subnet Address for this IP Address	
IP Address of First Host on this Subnet	
IP Address of Last Host on this Subnet	
Broadcast Address for this Subnet	