Internet Fundamentals - Subnetting Prac 2

Part 1 - VLSM

In last week's prac we looked at basic subnetting, where all subnets created have the same size. Generally, however, we have different size requirements for our different subnets, so the basic approach can lead to a lot of waste, especially when creating subnets for WAN links. VLSM (variable length subnet masks) allow us to create subnets of varying sizes from one block of addresses.
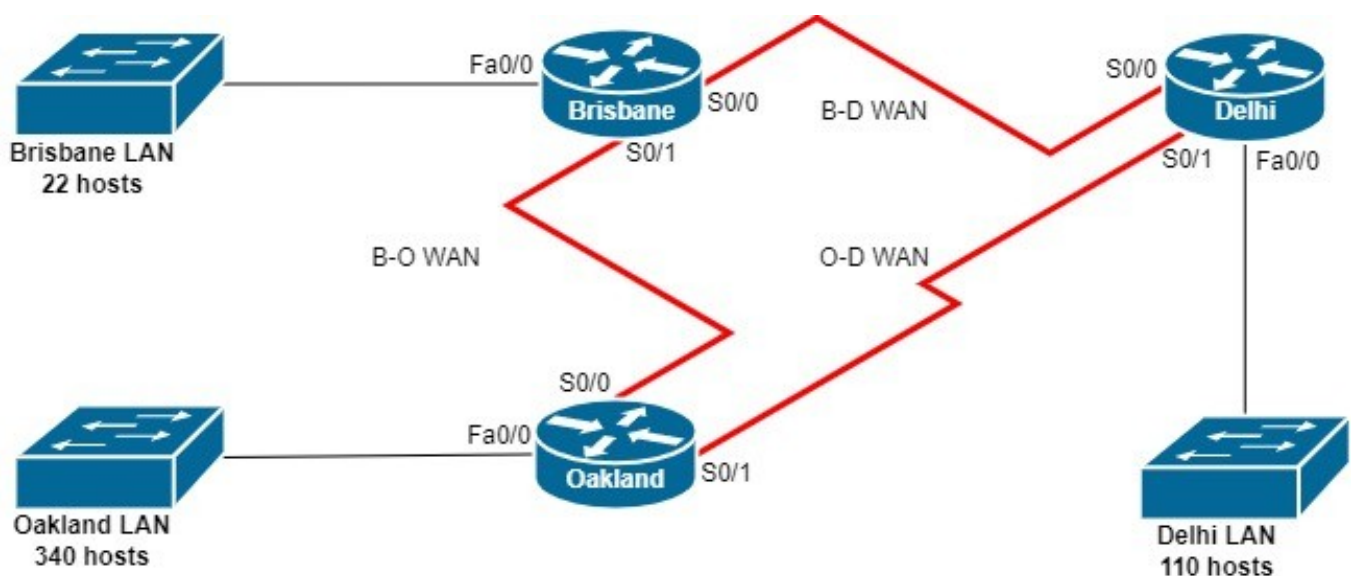
Suppose we have the above network, and we are given the class B block 175.175.0.0/16 to use. How should we create our subnets? The simplest approach is to arrange the required subnets in descending order of size and then create the subnets beginning at the start of our class B block.

Subnet	Hosts	Size	Host bits	Subnet address	Broadcast address
Oakland LAN					

	9		

Delhi LAN

7		

Brisbane LAN

5		

Brisbane – Delhi WAN

	1	

Delhi – Oakland WAN

	1	

Oakland – Brisbane WAN

	1		

To determine the necessary size, we consider the next power of 2 larger than the number of hosts. Even if the number of hosts is already a power of 2, we need to use the next largest size, as we can't use the first or last addresses as host addresses. Recall that if a subnet has size 2^H, then we need H bits for the host part of the address. So, for the Lagos LAN we need a subnet of size 512, and because $2^9 = 512$, we need 9 host bits for this subnet. 9 host bits means 32 - 9 = 23 network bits, so our subnet mask will be /23.

Subnet	Hosts	Size	Host bits	Subnet address	Broadcast address
Oakland LAN	340	512	9		
Delhi LAN	110	128	7		
Brisbane LAN	22	32	5		
Brisbane – Delhi WAN	2	4	2		
Delhi – Oakland WAN	2	4	2		
Oakland – Brisbane WAN	2	4	2		

Now we need to determine the subnet addresses and masks. The Oakland LAN comes first, so its subnet address will be 175.175.0.0/23. We know that the last address will 175.175.1.255/23 (because we have 512 addresses) and this is the broadcast address. We then create the Delhi LAN subnet beginning at the next address: 175.175.2.0.
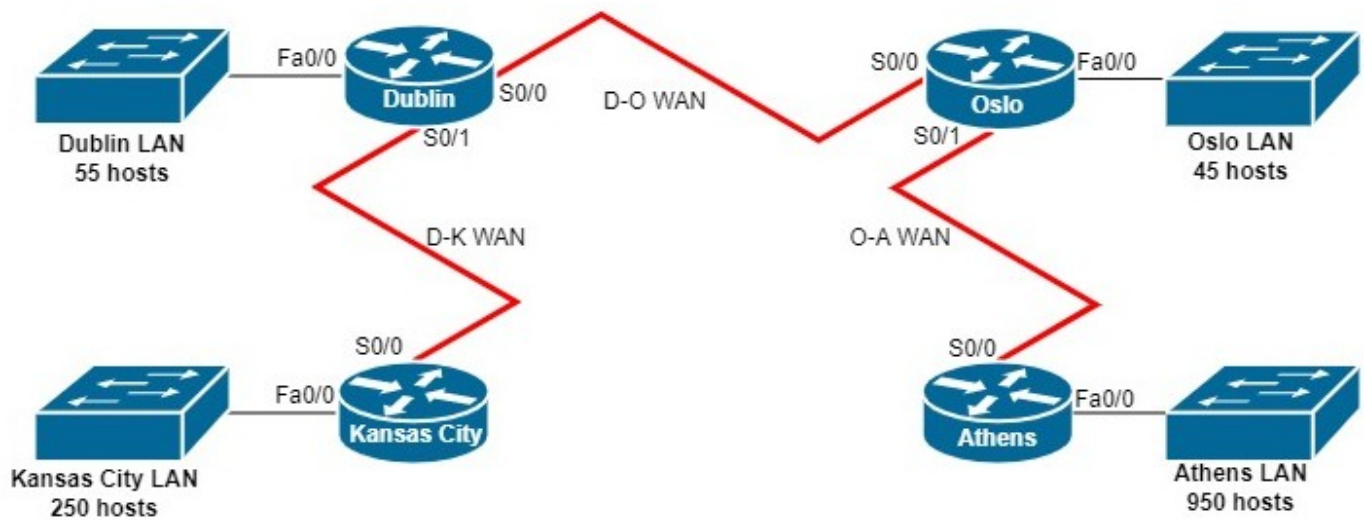
Subnet	Hosts	Size	Host bits	Subnet address	Broadcast address
Oakland LAN	340	512	9	175.175.0.0/23	175.175.1.255/23
Delhi LAN	110	128	7	175.175.2.0/25	175.175.2.127/25
Brisbane LAN	22	32	5	175.175.2.128/27	175.175.2.159/27
Brisbane – Delhi WAN	2	4	2	175.175.2.160/30	175.175.2.163/30
Oakland – Brisbane WAN	2	4	2	175.175.2.164/30	175.175.2.167/30
Delhi – Oakland WAN	2	4	2	175.175.2.168/30	175.175.2.171/30

Now that we have our subnets, we need to determine the addresses for each of the router interfaces we are using. For router interfaces on a LAN or WLAN, generally the first usable host address will be allocated. For WANs, the interface of one router will receive the first usable address, and the other router will receive the second usable address. For the WANs, we will allocate the first address to whichever router appears higher in the diagram, and if they are the same height, the leftmost router. However, this choice is arbitrary, and either interface may be allocated the first address.

Router	Interface	Address
Brisbane	Fa0/0 (Brisbane LAN)	175.175.2.129/27
	S0/0 (B-D WAN)	175.175.2.161/30
	S0/1 (B-O WAN)	175.175.2.165/30
Delhi	Fa0/0 (Delhi LAN)	175.175.2.1/25
	S0/0 (D-B WAN)	175.175.2.162/30
	S0/1 (D-O WAN)	175.175.169/30
Oakland	Fa0/0 (Oakland LAN)	175.175.0.1/23
	S0/0 (O-B WAN)	175.175.2.166/30
	S0/1 (O-D WAN)	175.175.170/30

Task 1.

Given the above network, and the class B block 183.200.0.0/16, fill out the table of subnets below, and then allocate addresses to the router interfaces.

Subnet	Hosts	Size	Host bits	Subnet address	Broadcast address
Athens LAN	950				

183.200.0.0/22

183.200.4.255/22

Kansas City LAN

183.200.5.0/24

183.200.5.255/24

Dublin LAN

183.200.6.0/26

183.200.6.63/26

Oslo LAN

183.200.6.64/26

183.200.6.127/26

Dublin - Kansas City WAN

183.200.6.128/30

183.200.6.131/30

Dublin - Oslo WAN

183.200.6.132/30

183.200.6.135/30

Oslo - Athens WAN

183.200.6.136/30

183.200.6.139/30

Router	Interface	Address

Dublin
Fa0/0   (Dublin LAN)

183.200.6.1/26

S0/0   (D-K WAN)

183.200.6.129/30

S0/1   (D-O WAN)

183.200.6.133/30

Oslo
Fa0/0   (Oslo LAN)

183.200.6.65/26

S0/0   (O-D WAN)

183.200.6.134/30

S0/1   (O-A WAN)

183.200.6.137/30

Kansas City
Fa0/0   (Kansas City LAN)

183.200.5.1/24

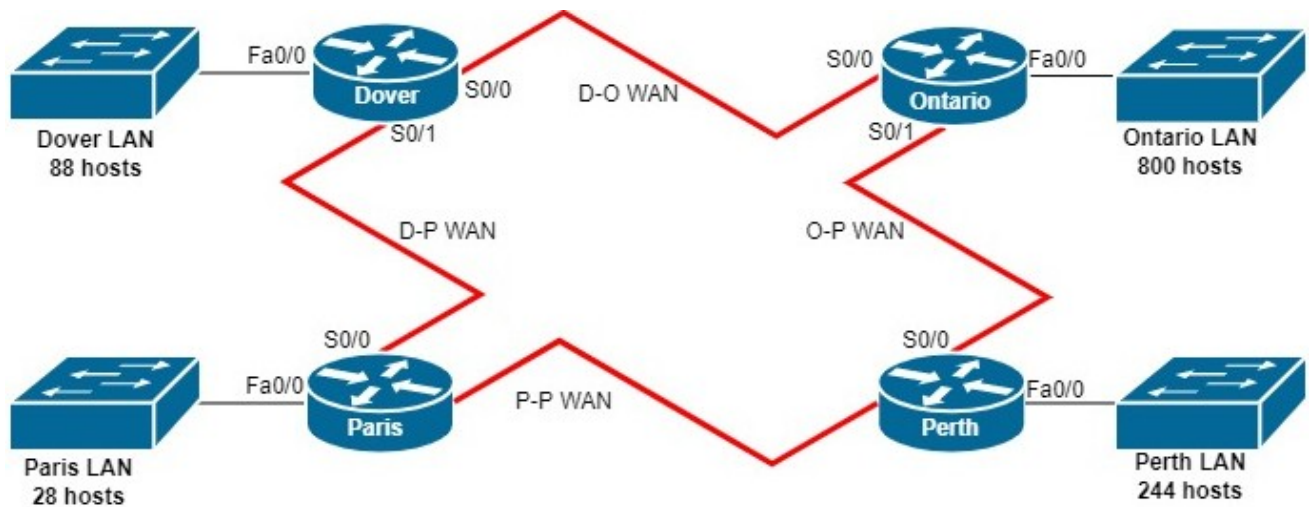S0/0   (K-D WAN)

183.200.6.130/30

Athens
Fa0/0   (Athens LAN)

183.200.0.1/22

S0/0   (A-O LAN)

183.200.6.138/30

Task 2.

Given the above network, and the class B block 137.101.0.0/16, fill out the table of subnets below. Remember to order by descending size!

Subnet	Hosts	Size	Host bits	Subnet address	Broadcast address

Ontario LAN

137.101.0.0/22

137.101.4.255/22

Perth LAN

137.101.5.0/24

137.101.5.255/24

Dover LAN

137.101.6.0/25

137.101.6.127/25

Paris LAN

137.101.6.128/27

137.101.6.159/27

Dover - Ontario WAN

137.101.6.160/30

137.101.6.163/30

Dover - Paris WAN

137.101.6.164/30

137.101.6.167/30

Ontario - Perth WAN

137.101.6.168/30

137.101.6.171/30

Paris - Perth WAN

137.101.6.172/30

137.101.6.175/30

Router	Interface	Address

Dover
Fa0/0   (Dover LAN)

137.101.6.1/25

S0/0   (D-O WAN)

137.101.6.161/30

S0/1   (D-P WAN)

137.101.6.165/30

Ontario
Fa0/0   (Ontario LAN)

137.101.0.1/22

S0/0   (O-D WAN)

137.101.6.162/30

S0/1   (O-P WAN)

137.101.6.169/30

Paris
Fa0/0   (Paris LAN)

137.101.6.129/27

S0/0   (P-D WAN)

137.101.6.166/30

S0/1   (P-P WAN)

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137.101.6.173/30
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Perth
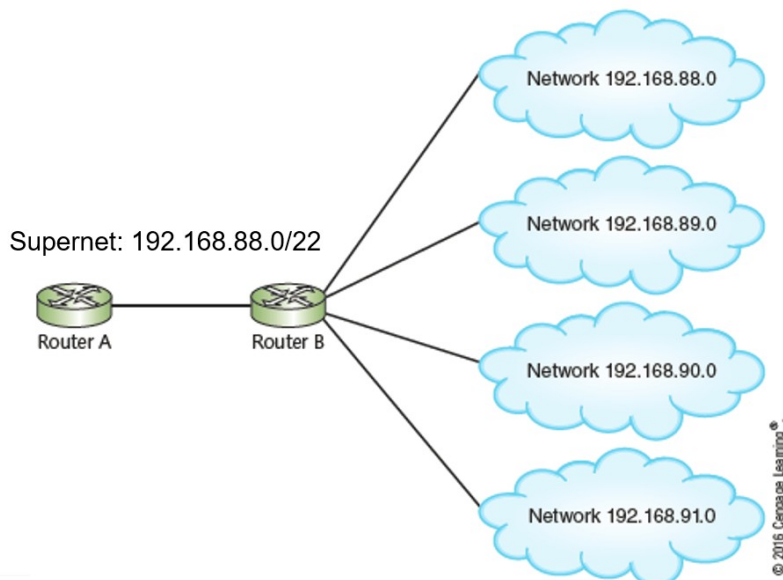Fa0/0   (Perth LAN)

137.101.5.1/24

S0/0   (P-O WAN)

137.101.6.170/30

S0/1   (P-P WAN)

137.101.6.174/30

Part 2 - Supernetting

Supernetting (aka address or route summarisation) allows us to combine nearby subnet addresses into a single address to reduce the size of routing tables, or to create a larger network out of contiguous class B blocks.

To determine the supernet address and mask, we need to look at the binary for the dissimilar octet for each of the networks we'll be combining. Let's determine the supernet for the following:

- 223.101.64.0/24
- 223.101.66.0/24
- 223.101.67.0/24
- 223.101.68.0/24

Dissimilar octet	Convert to binary and determine common bits
64	01000000
66	01000010
67	01000011
68	01000100

We take the common bits and fill the rest with zeros to obtain <mark>01000</mark>000 = 64, so our supernet address is 223.101.64.0. Because we have 5 common bits among the dissimilar octets, and 16 common bits from the two similar octets, the mask is 16 + 5 = 21.

So overall our supernet is 223.101.64.0/21.

Task 3.

Determine the supernet for
- 223.101.135.0/24
- 223.101.138.0/24
- 223.101.140.0/24
- 223.101.141.0/24

Dissimilar octet	Convert to binary and determine common bits

135

10000111

138

10001010

140

10001100

141

10001101

The superset is 223.101.128.0/20

(Hint: the address is <u>not</u> 223.101.135.0)

Task 4.

Determine the supernet for
- 223.101.200.0/22
- 223.101.204.0/22
- 223.101.208.0/22
- 223.101.212.0/22

Dissimilar octet	Convert to binary and determine common bits
200	

11001000

204

11001100

208

11010000

212

11010100

The superset is 223.101.192.0/19