

Internetworking – Tutorial 4

Variable Length Subnet Mask

Remember:

IP Address Classes

Class A	1 – 127	(Network 127 is reserved for loopback and internal testing)		
		Leading bit pattern	0	00000000.00000000.00000000.00000000 Network . Host . Host . Host
Class B	128 – 191	Leading bit pattern	10	10000000.00000000.00000000.00000000 Network . Network . Host . Host
Class C	192 – 223	Leading bit pattern	110	11000000.00000000.00000000.00000000 Network . Network . Network . Host
Class D	224 – 239	(Reserved for multicast)		
Class E	240 – 255	(Reserved for experimental, used for research)		

Private Address Space

Class A	10.0.0.0 to 10.255.255.255
Class B	172.16.0.0 to 172.31.255.255
Class C	192.168.0.0 to 192.168.255.255

Default Subnet Masks

Class A	255.0.0.0
Class B	255.255.0.0
Class C	255.255.255.0

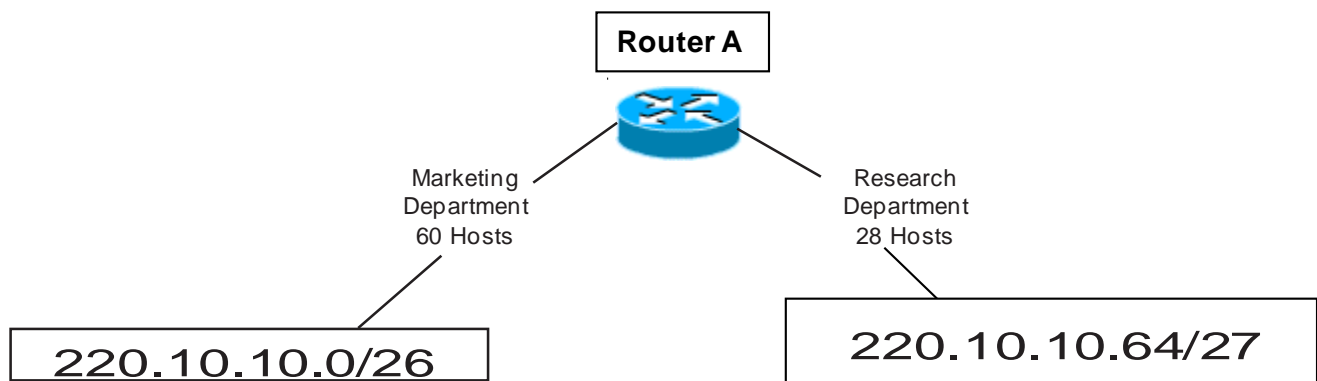
Example A:

The VLSM chart is a method used to visualise the breakdown of subnets and addresses into smaller sizes. By shading or colouring in the boxes you can easily break up your subnets without overlapping your addresses. You can adjust each sub-subnet to the correct size needed.

VLSM Addressing by using a VLSM Chart Method

Using the network diagram and information given create an addressing scheme which utilises variable-length subnet masks. Show the subnet address along with the network prefix in the boxes below, colour or shade the sub-subnets used in the chart. This business will be using the class C address 220.10.10.0.

Remember to start with your largest groups first.



Subnet Name	Subnet Address	Network Prefix /XX	First Usable Host	Last Usable Host	Broadcast Address
Marketing	220.10.10.0	/26	220.10.10.1	220.10.10.62	220.10.10.63
Research	220.10.10.64	/27	220.10.10.65	220.10.10.94	220.10.10.95

Check the VLASM Chart Method on the next page:

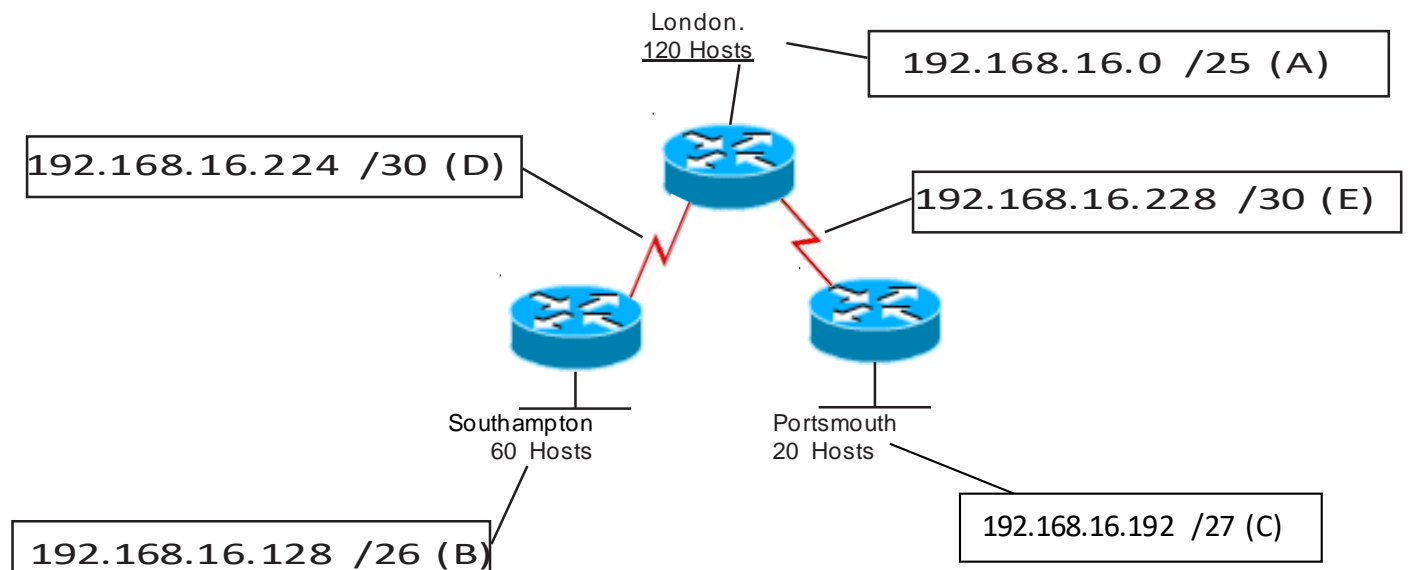
Class C Addresses VLSM Chart 24-30 Bits (4th octet)

/24		/25		/26		/27		/28		/29		/30	
255.255.255.0 256 Hosts		255.255.255.128 128 Hosts		255.255.255.192 64 Hosts		255.255.255.224 32 Hosts		255.255.255.240 16 Hosts		255.255.255.248 8 Hosts		255.255.255.252 4 Hosts	
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3							
					4-7								
				8-15	8-11								
				12-15									
			16-31	16-23	16-19								
				20-23									
			24-31	24-27									
			28-31										
			32-63	32-47	32-39	32-35							
					36-39								
		40-47		40-43									
		44-47											
		48-63		48-55	48-51								
				52-55									
		64-127	64-79	64-71	64-67								
				68-71									
				72-79	72-75								
				76-79									
			80-95	80-87	80-83								
				84-87									
	88-95			88-91									
	92-95												
	96-127		96-111	96-103	96-99								
				100-103									
		104-111	104-107										
		112-127	108-111										
			112-115										
			116-119										
	120-123												
	128-255	128-191	128-159	128-143	128-135	128-131							
					132-135								
				136-143	136-139								
				140-143									
			144-159	144-151	144-147								
				148-151									
			152-155										
			156-159										
			160-191	160-175	16-167	160-163							
					164-167								
		168-175		168-171									
172-175													
176-191		176-183		176-179									
		180-183											
192-255		192-223	192-207	184-191	184-187								
				188-191									
			192-195										
			196-199										
		200-207	200-203										
			204-207										
	208-223	208-215	208-211										
		212-215											
	216-223	216-219											
	220-223												
224-255	224-239	224-231	224-227										
		228-231											
	232-239	232-235											
	236-239												
240-255	240-247	240-243											
	244-247												
248-255	248-251												
	252-255												

Example B:

Using the network diagram and information given create an addressing scheme which utilises variable-length subnet masks. Show the subnet address and CIDR in the boxes below, colour or shade the subnets used in the chart. This company will be using the **Class C** address 192.168.16.0.

Remember to start with your largest groups first.



Subnet	Subnet Address	Network Prefix /XX	First Usable Host	Last Usable Host	Broadcast Address
A	192.168.16.0	/25	192.168.16.1	192.168.16.126	192.168.16.127
B	192.168.16.128	/26	192.168.16.129	192.168.16.190	192.168.16.191
C	192.168.16.192	/27	192.168.16.193	192.168.16.222	192.168.16.223
D	192.168.16.224	/30	192.168.16.225	192.168.16.226	192.168.16.227
E	192.168.16.228	/30	192.168.16.229	192.168.16.230	192.168.16.231

Check the VLASM chart on the next page

Class C Addresses VLSM Chart 24-30 Bits (4th octet)

/24 255.255.255.0 256 Hosts	/25 255.255.255.128 128 Hosts	/26 255.255.255.192 64 Hosts	/27 255.255.255.224 32 Hosts	/28 255.255.255.240 16 Hosts	/29 255.255.255.248 8 Hosts	/30 255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3 4-7
					8-15	8-11 12-15
				16-31	16-23	16-19 20-23
					24-31	24-27 28-31
			32-63	32-47	32-39	32-35 36-39
					40-47	40-43 44-47
				48-63	48-55	48-51 52-55
					56-63	56-59 60-63
		64-127	64-95	64-79	64-71	64-67 68-71
					72-79	72-75 76-79
				80-95	80-87	80-83 84-87
					88-95	88-91 92-95
			96-127	96-111	96-103	96-99 100-103
					104-111	104-107 108-111
				112-127	112-119	112-115 116-119
					120-127	120-123 124-127
	128-255	128-191	128-159	128-143	128-135	128-131 132-135
					136-143	136-139 140-143
				144-159	144-151	144-147 148-151
					152-159	152-155 156-159
			160-191	160-175	16-167	160-163 164-167
					168-175	168-171 172-175
				176-191	176-183	176-179 180-183
					184-191	184-187 188-191
		192-255	192-223	192-207	192-199	192-195 196-199
					200-207	200-203 204-207
				208-223	208-215	208-211 212-215
					216-223	216-219 220-223
			224-255	224-239	224-231	224-227 228-231
					232-239	232-235 236-239
				240-255	240-247	240-243 244-247
					248-255	248-251 252-255

Exercise 1:

You are setting up a business network with the **Class C** address **219.75.160.0/24**. The marketing department will need 19 computers. Research and development need 40 computers. The reception area will need 4 computers. Management requires 12 computers. Divide the network using variable length subnet information.

Complete the provided table with all missing information. You can use the VLSM chart available on the next page.

Remember to work from largest to smallest.

Subnet Name	Subnet Address	Network Prefix /XX	First Usable Host	Last Usable Host	Broadcast Address

Class C Addresses VLSM Chart 24-30 Bits (4th octet)

/24	/25	/26	/27	/28	/29	/30			
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts			
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3 4-7			
					8-15	8-11 12-15			
					16-31	16-23	16-19 20-23		
						24-31	24-27 28-31		
				32-63		32-47	32-39	32-35 36-39	
							40-47	40-43 44-47	
					48-63		48-55	48-51 52-55	
							56-63	56-59 60-63	
			64-127			64-79	64-71	64-67 68-71	
							72-79	72-75 76-79	
					80-95		80-87	80-83 84-87	
							88-95	88-91 92-95	
				96-127		96-111	96-103	96-99 100-103	
							104-111	104-107 108-111	
					112-127		112-119	112-115 116-119	
							120-127	120-123 124-127	
		128-255	128-191			128-159	128-143	128-135	128-131 132-135
								136-143	136-139 140-143
					144-159			144-151	144-147 148-151
								152-159	152-155 156-159
				160-191			160-175	16-167	160-163 164-167
								168-175	168-171 172-175
					176-191			176-183	176-179 180-183
								184-191	184-187 188-191
				192-255		192-223	192-207	192-199	192-195 196-199
								200-207	200-203 204-207
					208-223		208-215	208-211 212-215	
							216-223	216-219 220-223	
						224-255	224-239	224-231	224-227 228-231
								232-239	232-235 236-239
					240-255			240-247	240-243 244-247
								248-255	248-251 252-255

Exercise 2:

A local college is setting up a campus wide network. The technology wing will be on its own network address of 192.168.250.0/24. The office wing will include 15 computers. There are 2 labs of 20 computers each, 2 labs of 30 computers each and one lab of 35 computers.

Complete the provided table with all missing information. You can use the VLSM chart available on the next page.

Remember to work from largest to smallest.

[illegible]

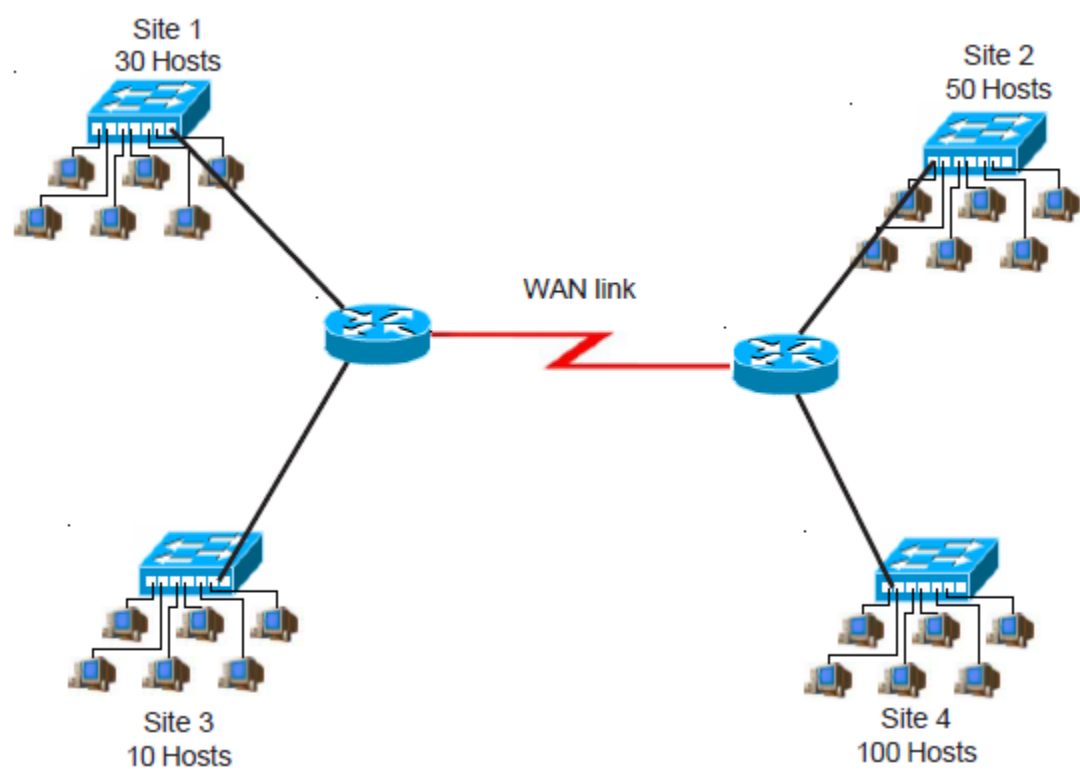
Class C Addresses VLSM Chart 24-30 Bits (4th octet)

/24	/25	/26	/27	/28	/29	/30
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
						4-7
					8-15	8-11
						12-15
				16-31	16-23	16-19
						20-23
					24-31	24-27
						28-31
			32-63	32-47	32-39	32-35
						36-39
					40-47	40-43
						44-47
				48-63	48-55	48-51
						52-55
					56-63	56-59
						60-63
		64-127	64-95	64-79	64-71	64-67
						68-71
					72-79	72-75
						76-79
				80-95	80-87	80-83
						84-87
					88-95	88-91
						92-95
			96-127	96-111	96-103	96-99
						100-103
					104-111	104-107
						108-111
				112-127	112-119	112-115
						116-119
					120-127	120-123
						124-127
	128-255	128-191	128-159	128-135	128-131	
					132-135	
				136-143	136-139	
					140-143	
				144-159	144-151	144-147
						148-151
					152-159	152-155
						156-159
			160-191	160-175	16-167	160-163
						164-167
					168-175	168-171
						172-175
				176-191	176-183	176-179
						180-183
					184-191	184-187
						188-191
		192-255	192-223	192-207	192-199	192-195
						196-199
					200-207	200-203
						204-207
208-223				208-215	208-211	
					212-215	
				216-223	216-219	
					220-223	
224-255			224-239	224-231	224-227	
					228-231	
				232-239	232-235	
				236-239	236-239	
240-255	240-247	240-243				
		244-247				
	248-255	248-251				
		252-255				

Exercise 3: - **Assessed in Quiz #1**

Using the network diagram below and information given create an addressing scheme which utilises variable-length subnet masks. Complete the following table and colour or shade the subnets that you can identify on the provided VLSM chart. This company will be using the **Class C** address **199.55.78.0**.

Remember to start with your largest groups first.



Subnet Name	Subnet Address	Network Prefix /XX	First Usable Host	Last Usable Host	Broadcast Address

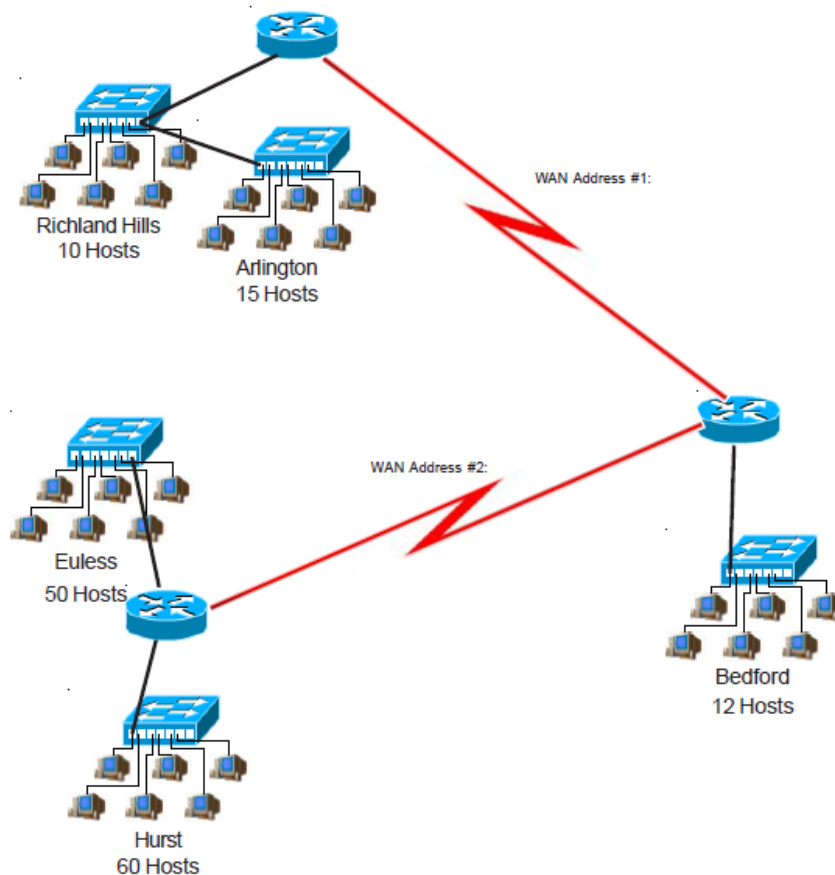
Class C Addresses VLSM Chart 24-30 Bits (4th octet)

/24 255.255.255.0 256 Hosts	/25 255.255.255.128 128 Hosts	/26 255.255.255.192 64 Hosts	/27 255.255.255.224 32 Hosts	/28 255.255.255.240 16 Hosts	/29 255.255.255.248 8 Hosts	/30 255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
						4-7
				16-31	8-15	8-11
						12-15
			32-63	32-47	16-23	16-19
						20-23
				48-63	24-31	24-27
						28-31
				32-47	32-39	32-35
						36-39
				48-63	40-47	40-43
						44-47
			64-127	64-79	48-55	48-51
						52-55
				80-95	56-63	56-59
						60-63
			96-127	96-111	64-71	64-67
						68-71
				112-127	72-79	72-75
						76-79
	128-255	128-191	128-159	128-143	80-87	80-83
						84-87
				144-159	88-95	88-91
						92-95
			160-191	160-175	96-103	96-99
						100-103
				176-191	104-111	104-107
						108-111
		192-255	192-223	192-207	112-119	112-115
						116-119
				208-223	120-127	120-123
						124-127
			224-255	224-239	128-135	128-131
						132-135
				240-255	136-143	136-139
						140-143
			192-223	192-207	144-151	144-147
						148-151
				208-223	152-159	152-155
						156-159
			224-255	224-239	160-167	160-163
						164-167
				240-255	168-175	168-171
						172-175
			192-223	192-207	176-179	176-179
						180-183
				208-223	184-191	184-187
						188-191
			224-255	224-239	192-199	192-195
						196-199
				240-255	200-207	200-203
						204-207
			192-223	192-207	208-215	208-211
						212-215
				208-223	216-223	216-219
						220-223
			224-255	224-239	224-231	224-227
						228-231
				240-255	232-239	232-235
						236-239
			192-223	192-207	240-247	240-243
						244-247
				208-223	248-255	248-251
						252-255

Exercise 4:

Using the network diagram and information given create an addressing scheme which utilises variable length subnet masks. Complete the following table and colour or shade the subnets that you can identify on the provided VLSM chart. This company will be using the **class C** address **223.150.50.0**.

Remember to start with your largest groups first.

[illegible]

Class C Addresses VLSM Chart 24-30 Bits (4th octet)

/24 255.255.255.0 256 Hosts	/25 255.255.255.128 128 Hosts	/26 255.255.255.192 64 Hosts	/27 255.255.255.224 32 Hosts	/28 255.255.255.240 16 Hosts	/29 255.255.255.248 8 Hosts	/30 255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
					4-7	4-7
					8-15	8-11
					16-23	12-15
				16-31	16-23	16-19
					24-31	20-23
					32-39	24-27
					40-47	28-31
			32-63	32-47	32-39	32-35
					40-47	36-39
					48-55	40-43
					56-63	44-47
				48-63	48-55	48-51
					56-63	52-55
					64-71	56-59
					72-79	60-63
		64-127	64-95	64-79	64-71	64-67
					72-79	68-71
					80-87	72-75
					88-95	76-79
				80-95	80-87	80-83
					88-95	84-87
					96-103	88-91
					104-111	92-95
			96-127	96-111	96-103	96-99
					104-111	100-103
					112-119	104-107
					120-127	108-111
				112-127	112-119	112-115
					120-127	116-119
					128-135	120-123
					136-143	124-127
	128-255	128-191	128-159	128-143	128-135	128-131
					136-143	132-135
					144-151	136-139
					152-159	140-143
				144-159	144-151	144-147
					160-167	148-151
					168-175	152-155
					176-183	156-159
			160-191	160-175	160-167	160-163
					168-175	164-167
					176-183	168-171
					184-191	172-175
				176-191	176-183	176-179
					184-191	180-183
					192-199	184-187
					200-207	188-191
		192-255	192-223	192-207	192-199	192-195
					200-207	196-199
					208-215	200-203
					216-223	204-207
				208-223	208-215	208-211
					216-223	212-215
					224-231	216-219
					232-239	220-223
			224-255	224-239	224-231	224-227
					232-239	228-231
					240-247	232-235
					248-255	236-239
				240-255	240-247	240-243
					248-255	244-247
					252-255	248-251
						252-255