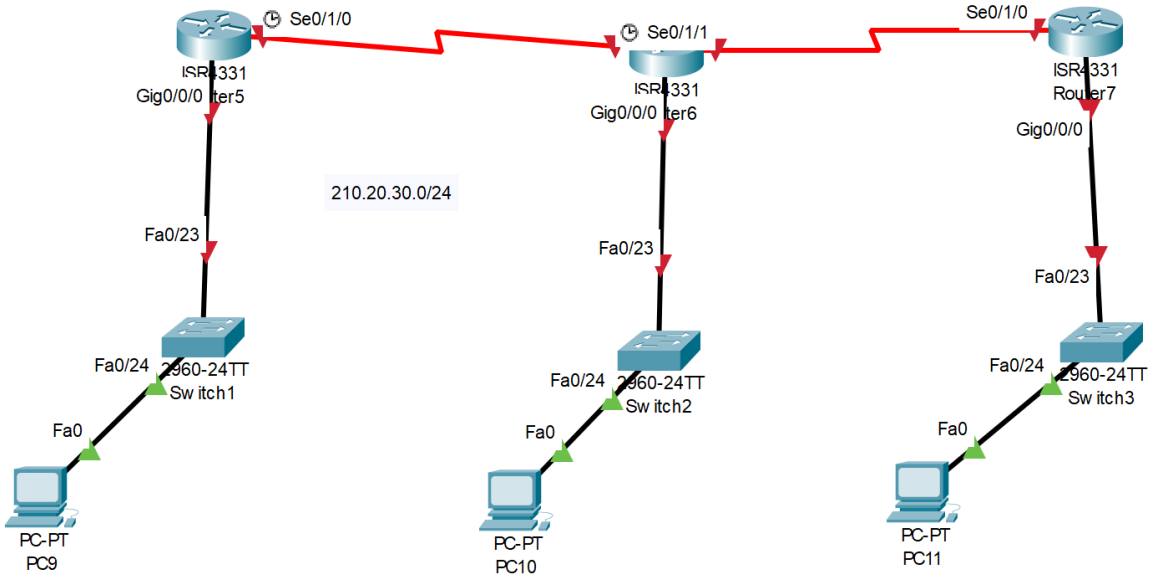
IP Subnetting Example

1. Given the following topology you are required to find the answers to the following questions

a) What class of address is being used?
b) How many networks are in this topology?
c) What does the subnet mask tell you?
d) How many bits do I need to create the new subnet mask
e) What are the network addresses for this topology?

Note if you want to attempt answering these questions do not go to the next page, where the working is shown.



The topology given has the following IP address of 210.20.30.0/24 (This is known as dotted decimal notation, because we say the dot between the numbers when talking to another person). Based on this number and your knowledge of IP address classification you can determine the class of network used.

a) What class is this address?

Remember there are three class of IP address for general use

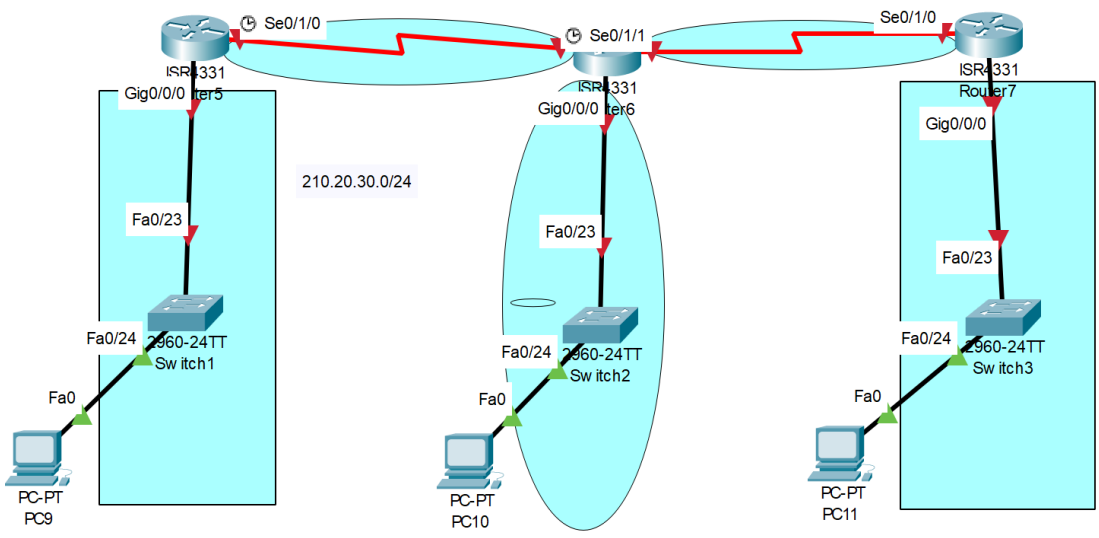
Class A range from 1 to 126 also identified as starting with a **0** in the first octet eg 0XXXXXXX

Class B range from 128 to 191 also identified as starting with a **10** in the first octet, 10XXXXXX

Class C range from 192 to 223 also identified as starting with a **110** in the first octet, 10XXXXXX

By looking at the first digit which is 220 we can see this address belongs to Class C network.

b) How many networks are in this topology? (covered by material in week 3 lecture)



If you look at the topology there are 5 networks remember each router is connected to a different network.

c) The mask of /24 or 255.255.255.0 tells us the boundary between the network bits and the host bits of an IP address. In this example we can see that the boundary occurs after 24 bits of data, that is after the 30. This is the case because each decimal number is represented by 8 bits of binary data. In this case we have 210.20.30.0/24. This means 8 bits are used to represent 210 and then another 8 for 20 and then another 8 for 30. Hence the /24 tells us the boundary between network bits and host bits. The network IP address in binary is;
210.20.30.0 = 11001110.00001010.00011110.00000000 can also be represented in general form as = nnnnnnnn.nnnnnnnn.nnnnnnn.hhhhhhhh.

d) As you have 5 networks. The next step is to work out how many bits do I need to create 5 networks?

The structure of Network C is N.N.N.H where N=node or networks and H=hosts.

When working out the new subnet mask you borrow from the host part of the network.

In this case the 4th Octet or the octet which is signified by H above.

In order to create 5 networks we need to borrow 3 bits because $2^{\wedge 3}$= 8. 8 is the max of network you can create when you borrow 8 bits. If we borrowed 2 host bits that would allow us to create $2^{\wedge 2}$=4 networks, this is not enough as we need 5.

That means we have 5 bits left for host addresses, which implies that each of our subnetworks will have a total of $2^{\wedge 5}$=32 host addresses. In reality we will only have 30 as we can't use the first (why???) and the last (why???). Hint the first address is where all of the host bits are 0.

So the new subnetwork mask will be 255.255.255.11100000 (the 3 green 1s are the bits we borrowed) and where 11100000 converts to 224.

New subnet mask is 255.255.255.224 or slash /27

This also means that each subsequent subnet increases by 32. So the first subnet is 210.20.20.0, the next subnet is 210.20.30.32

e) Network address for the network

To work out the network address

Look at the subnet mask

$128=2^{\wedge 7}$	$64==2^{\wedge 6}$	$32=2^{\wedge 5}$	$16=2^{\wedge 4}$	$8=2^{\wedge 3}$	$4=2^{\wedge 2}$	$2=2^{\wedge 1}$	$1=2^{\wedge 0}$
1	1	1	0	0	0	0	0

If you look at the table you draw a line between 32 and 16.

If you look at the increment is going up by 32

Network address	Subnet mask
210.20.30.0 (can't use this is network address)	255.255.255.24 /27
210.20.30.32	255.255.255.224/27
210.20.30.64	255.255.255.224 /27
210.20.30.96	255.255.255.224/27
210.20.30.128	255.255.255.224/27
210.20.30.160	255.255.255.224/27
210.20.30.196	255.255.255.224/27
210.20.30. 224 (can't use this is broadcast address)	255.255.255.224/27

Pick any five of the available addresses.