

CO1507 Introduction to Networking

Lab 2 - Building a Local Area Network

Task 1

Your tutor will divide the room into groups and assign you a group number. These numbers will NOT necessarily be 1,2,3,4... remember your group number

Within your group assign each group member a number - everybody needs to remember both your group number, and your member number

You do not need to be 1,2,3, 4... so long as you all have different numbers and are between 1-254

In the following practical your IP addresses will be:

192.168.your group number.your individual number

The reasons why the address start **192.168** will be explained in future classes but for now it is important, but we won't dwell on why. The network you are building will follow the following topology (adjusting for whether you have 4 or 5 people in your group)

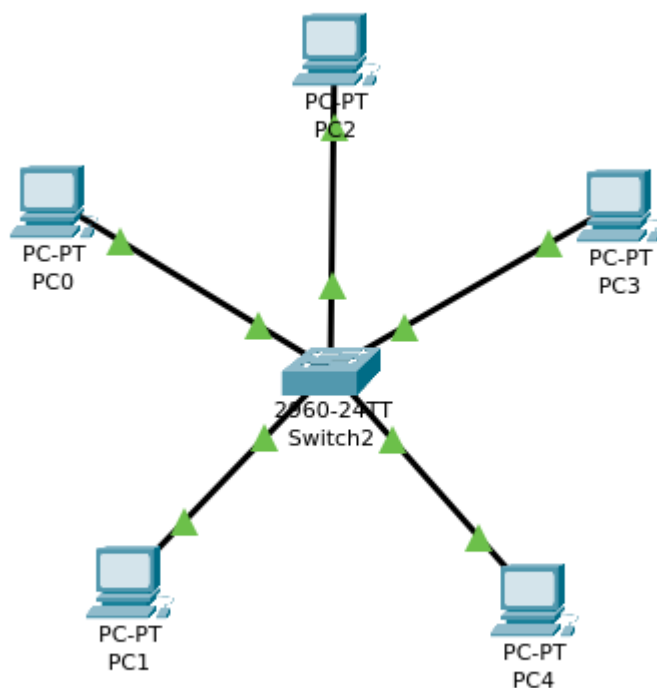


Figure 1: Logical topology of the described network

However physically it will look quite different for a number of reasons.

Equipment:

- 1 x Ethernet cable (UTP) per team member - collect from your tutor

Instead of connecting directly from the back of the PC to a switch we will use the patch panel and rack mounted switches. Your tutor will explain all this at the beginning of the session

However, it's important that you all note down the number of the port you will be connecting - this can be found on the box on your desk (see photos)

Essentially the backs of the PCs are wired to the box on the top of your desk for convenience. Those boxes are then in turn wired to the patch panel in the rack (unless you pull out the cables)

DON'T remove the cable simply note down your number

Each PC in the lab has two available ethernet cards available for student lab work; you only need to use one of them today



Figure 2: The tabletop box clearly showing port numbers for the PCs two available network interface cards

You will need to locate the SAME number on the patch panel.



Figure 3: The patch panel (one of 2 panels in CM142)

In order to connect your PC to a switch in the rack you will need to run an Ethernet patch cable from the correct numbered port on the patch panel, to a free port on the desired switch.

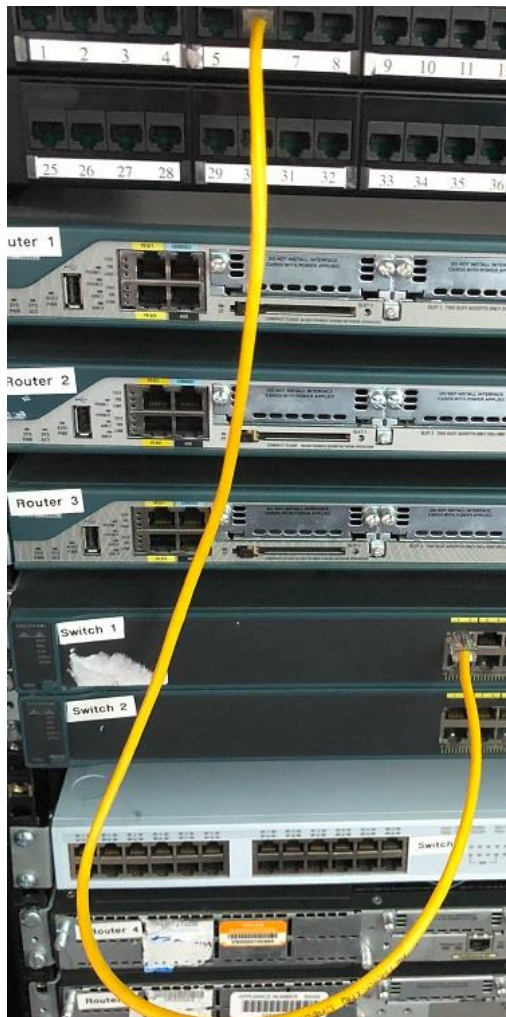


Figure 4: An ethernet patch cable connecting port #6 on the patch panel to switch 1 in the rack

Addressing requirements

Host/PC	IP Address	Subnet Mask
Group member 1	192.168.group number.individual number	255.255.255.0
Group member 2	192.168.group number.individual number	255.255.255.0
Group member 3	192.168.group number.individual number	255.255.255.0
Group member 4	192.168.group number.individual number	255.255.255.0
Group member 5	192.168.group number.individual number	255.255.255.0
Group member 6	192.168.group number.individual number	255.255.255.0

Go to the start menu and type "network" it should reveal "Network Status" in the search results. Open Network status and you should see a screen like below.

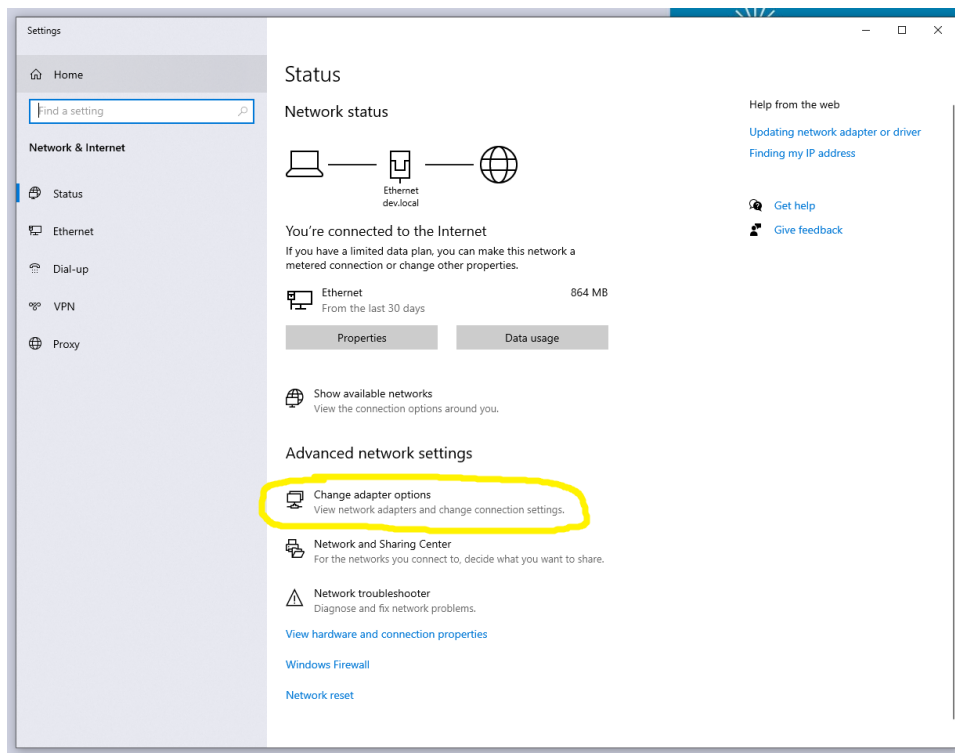


Figure 5: Network status panel

Click on "change adapter options"

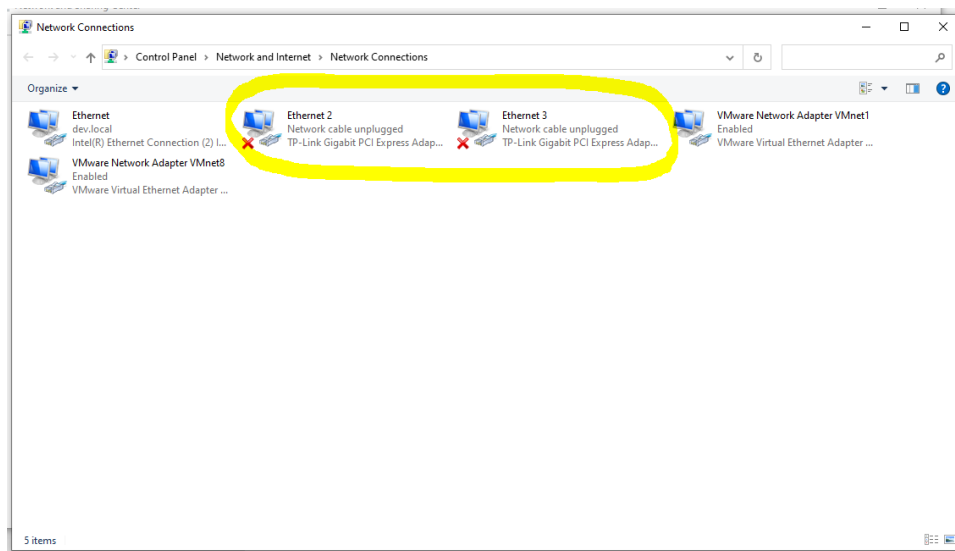


Figure 6: Network interfaces

Warning!

Do not make any changes to the network interface card connected to 'dev.local'

The interface SHOULD be named 'DoNotUse' but I can't guarantee it hasn't been changed by students etc. However regardless of its name do not use the 'dev.local' connection!

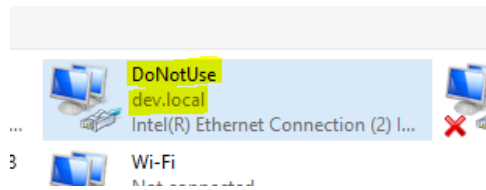


Figure 7: the dev.local connection

Locate the correct interface; it will be one of the two remaining ethernet cards after the 'dev.local' one which we must not touch. Ignore any interfaces named as 'VMWare virtual devices'.

It should be obvious which one it is because the interfaces NOT plugged in should all show with a red cross on them.

Once you have located the correct interface, double click on it.

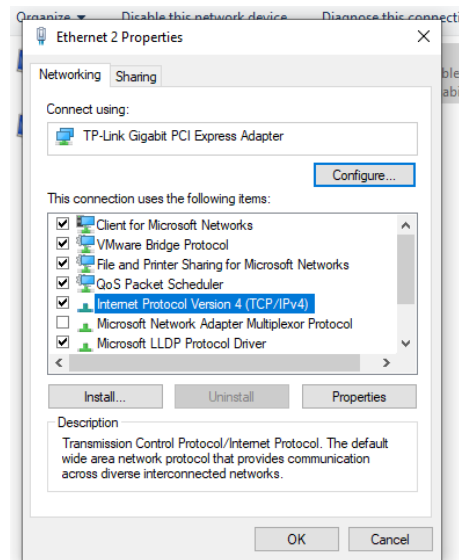


Figure 8: Ethernet properties

Choose "internet protocol version 4"

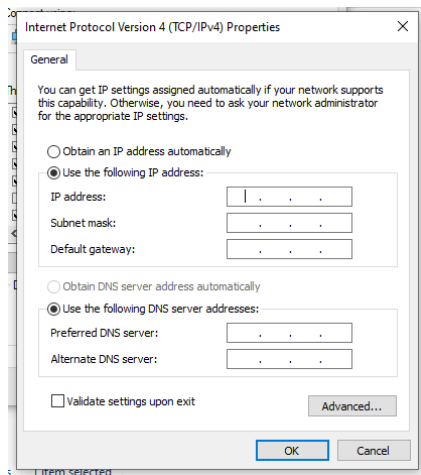


Figure 9: IPv4 settings

Click on the radio button for "Use the following IP address" as it will probably have previously been set to "Obtain an IP address automatically"

Enter the IP address and Subnet mask for your computer.

Refer to the table above substituting...

- The third section of the IP address for your group number (assigned by the tutor)
- The fourth section of the IP address for your individual number (agreed amongst the group members)

Leave "Default Gateway" and all other boxes blank and click "OK"

Repeat steps for each group member - work together and help one another if any of you get stuck!

Task 2 - Testing your network

To open command prompt press the super key (Windows) + r. This opens up a run prompt. Type 'cmd' and press return (Enter) this should open a command prompt

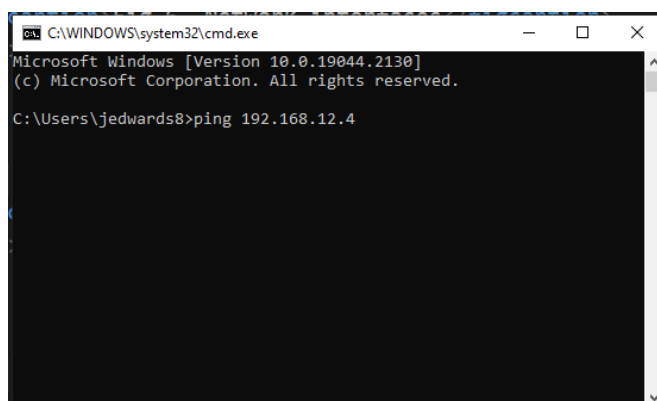


Figure 10: Command prompt showing ping command being entered

From the command prompt type "ping" followed by a space followed by the IP address of one of your group members PC

You should receive 4 responses... If you get either of these messages: "Response timed out" or "Destination host unreachable" then something has gone wrong.

Troubleshoot and then ask your tutor if no solution is found. Once you get a successful response to your ping command, repeat the step for each of the other machines in your group network.

Ensure full connectivity between all machines before proceeding.

```
Pinging 192.168.1.1 with 32 bytes of data:  
Reply from 192.168.1.1: bytes=32 time=11ms TTL=64  
Reply from 192.168.1.1: bytes=32 time<1ms TTL=64  
Reply from 192.168.1.1: bytes=32 time<1ms TTL=64  
Reply from 192.168.1.1: bytes=32 time=1ms TTL=64  
  
Ping statistics for 192.168.1.1:  
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:  
    Minimum = 0ms, Maximum = 11ms, Average = 3ms
```

Figure 11: Successful ping showing 4 responses

Task 3 – Wireshark

From the start menu locate and open a piece of software called "Wireshark" we will use it to view data packets on the network

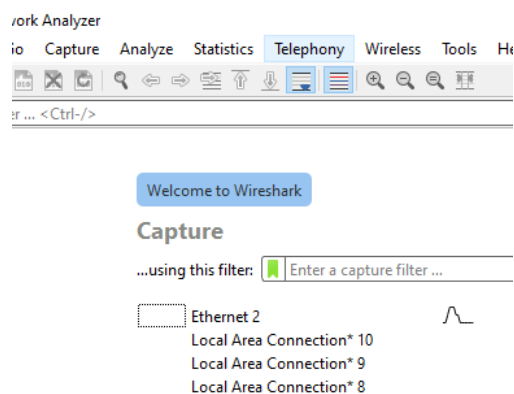


Figure 12: Wireshark

Click on "capture" from the top menu and select "options"

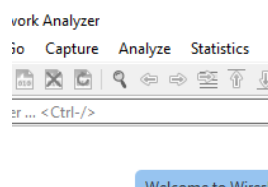


Figure 13: Wireshark

Locate the network interface card which you have connected to the switch and double click on it

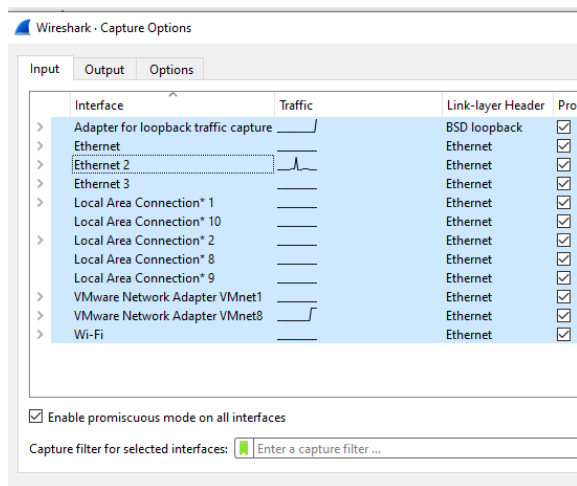


Figure 14: Wireshark

You will probably not see much activity if we are monitoring the correct port

Open your command prompt and ping one of your group members machines again whilst monitoring Wireshark's output. What do you see?

Among your group nominate one member who will change their IP address. Change ONLY the last number in the IP address e.g. from 192.168.10.33 to 192.168.10.34

Once one group members Ip address has been changed the remaining group members should each ping the new address whilst monitoring Wireshark.

This time there should be a slightly different output and you should see a few additional packets.

47	71.626841	Tp-LinkT_04:82:ff	Broadcast	ARP	42 Who has 192.168.10.57? Tell 192.168.10.47
48	75.032272	Tp-LinkT_04:82:ff	Broadcast	ARP	42 Who has 192.168.10.33? Tell 192.168.10.47
49	75.032370	Tp-LinkT_04:57:f7	Tp-LinkT_04:82:ff	ARP	60 192.168.10.33 is at ec:08:6b:04:57:f7
50	75.032390	192.168.10.47	192.168.10.33	ICMP	74 Echo (ping) request id=0x0001, seq=169/43264, ttl=128 (reply in 51)
51	75.032573	192.168.10.33	192.168.10.47	ICMP	74 Echo (ping) reply id=0x0001, seq=169/43264, ttl=128 (request in 50)
52	76.039256	192.168.10.47	192.168.10.33	ICMP	74 Echo (ping) request id=0x0001, seq=170/43520, ttl=128 (reply in 53)
53	76.039452	192.168.10.33	192.168.10.47	ICMP	74 Echo (ping) reply id=0x0001, seq=170/43520, ttl=128 (request in 52)
54	77.061846	192.168.10.47	192.168.10.33	ICMP	74 Echo (ping) request id=0x0001, seq=171/43776, ttl=128 (reply in 55)
55	77.062384	192.168.10.33	192.168.10.47	ICMP	74 Echo (ping) reply id=0x0001, seq=171/43776, ttl=128 (request in 54)
56	78.073858	192.168.10.47	192.168.10.33	ICMP	74 Echo (ping) request id=0x0001, seq=172/44032, ttl=128 (reply in 57)
57	78.073907	192.168.10.33	192.168.10.47	ICMP	74 Echo (ping) reply id=0x0001, seq=172/44032, ttl=128 (request in 56)
58	79.781419	Tp-LinkT_04:57:f7	Tp-LinkT_04:82:ff	ARP	60 Who has 192.168.10.47? Tell 192.168.10.33
59	79.781431	Tp-LinkT_04:82:ff	Tp-LinkT_04:57:f7	ARP	42 192.168.10.47 is at ec:08:6b:04:82:ff

Figure 15: Wireshark showing ARP and ICMP packets

Task 4 – Research

Use the web to research the following questions and log what you find in your notes.

1. What is the Ping utility, and what is it used for?
2. What are ICMP packets?
3. What are ARP packets?
4. Why do we sometimes see ARP packets when we use ping, and other times not?

Your tutor will give a brief explanation to each of these questions toward the end of the class. These are in fact topics we will look at in more depth later in the module

Can you guess now why there was a difference in the packets after an IP address was changed in your network? If not ask your tutor, it is linked to the previous questions

Task 5 – Packet Tracer

Re-create the network you have just built as closely as you can inside the Packet Tracer simulator marking sure all the same addressing requirements are followed. The topology should look like the one at the beginning of this lab sheet.

Test the packet tracer network by ensuring you can ping from each PC.

Another simpler easier way to do a quick test for a connection between two devices in Packet tracer is to use the simple PDU (Protocol delivery unit) tool

Locate the Simple PDU icon along the top bar, it looks like an envelope (see below)



Figure 16: Simple PDU icon

Once the tool has been selected your cursor should change to an envelope icon

Simply click on the first device i.e., the one you want to send a message FROM, and then click on the second device i.e., the one you want to receive it

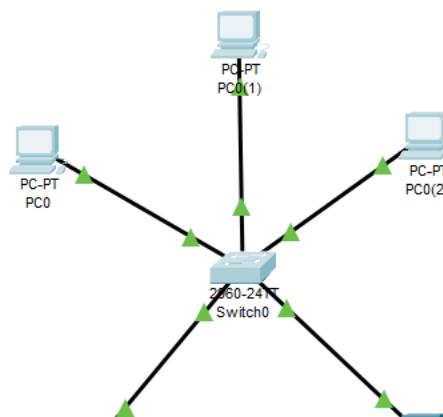


Figure 17: Click on two machines while the simple PDU tool is enabled

The result should show up in the bottom right corner of the screen like so. In this case my connection was successful, and the packet was delivered.

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC0	PC0(1)	ICMP		0.000	N	0	(edit)	

Figure 18: PDU results

If you do not get successful PDU delivery between all hosts on the network troubleshoot. If you have already tested using ping this should NOT be the case anyway.

Next, add an additional PC to the network, this time give it an IP address where you change BOTH the 3rd and 4th number in the address e.g., from 192.168.10.33 to 192.168.20.43 where every other PC has 10 in the third position.

Try to ping the new PC, what happens? why can't this computer be reached?

There are two ways to potentially fix this issue, the most obvious might be to revert the 3rd number in the address back to match all the other PCs. Whilst this would fix the problem there is another way, what else could you change?

Try to fix the network one way or another, it does not matter if you can't figure it out - this is designed to make you think about topics upcoming on the module. Ask your tutor were unsure

Task 6 - Packet tracer WAN

Construct the following topology in packet tracer.

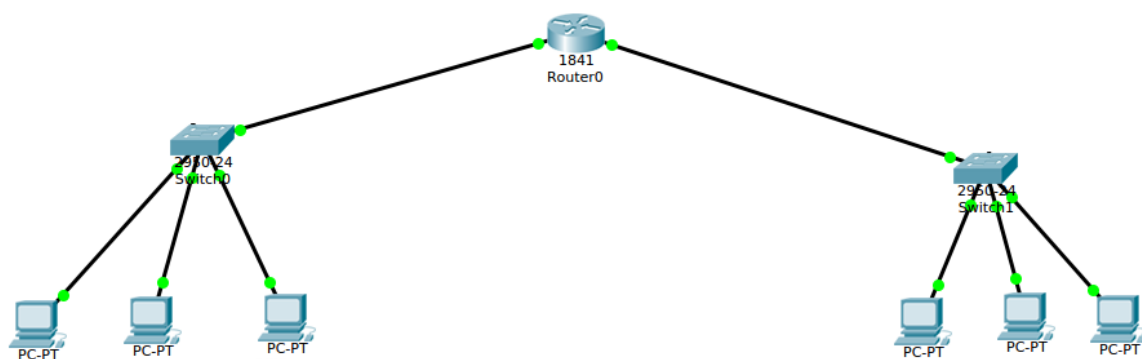


Figure 19: Simple WAN config in Packet Tracer.

We have not discussed how to address all nodes within a Wide Area Network (WAN) yet so use the following schema - it will be explained fully in future sessions.

Left side network addressing:

Interface	IP Address	Subnet Mask
Router	192.168.10.1	255.255.255.0
PC 1	192.168.10.2	255.255.255.0
PC 2	192.168.10.3	255.255.255.0
PC 3	192.168.10.4	255.255.255.0

Right side network addressing:

Interface	IP Address	Subnet Mask
Router	192.168.20.1	255.255.255.0
PC 1	192.168.20.2	255.255.255.0
PC 2	192.168.20.3	255.255.255.0
PC 3	192.168.20.4	255.255.255.0

Test connectivity within the left-hand side of the network. Ensure all 3 PCs can ping one another and ping the router. Repeat the above step for the right-hand side of the network

Attempt to ping from a PC on one side to a PC on the other side. It will not work. Why is this? How could it be fixed? Ask your tutor.

Don't worry this will all be covered in detail in upcoming classes.

Task 7 - Further questions

You will need to refer to the lecture slides and research on the web. Answer the following questions in your notes.

1. What is the main distinction between a local area network (LAN) and a wide area network (WAN)?
2. If a network contains a router which of the above network types, is it?
3. What other sub-classifications of network topology are there besides LAN and WAN? several were mentioned in the lecture, use the web to research
4. What is the primary function of a switch?
5. What are the functions of a router? (There are several important functions of a router, refer to the lecture, and research using the web).
6. What is a collision domain?
7. What is a broadcast domain?
8. What is a broadcast, and what IP address is used for one?
9. What is the difference between a physical and logical topology?
10. What is a MAC address, and how does it differ from an IP address?
11. What is a subnet mask, and what is it used for?

Your tutor will go through the answers briefly toward the end of the class. However, these topics will be covered in detail in upcoming weeks so do not worry.