

CO1507 Introduction to Networking

Lab 5 - The physical layer and beyond

Task 1: Ethernet cable

We are going to construct Ethernet cable from lengths of raw UTP and affix RJ-45 connectors

Though Ethernet cables can be bought cheaply and are widely available, you may need to do this under certain circumstances for example if..

- You need a very specific length
- You need to repair a broken cable
- You need a very LONG length
- You are wiring up a building or room where cables are run through walls and trunking

To do this you will need to..

- Collect a length of UTP cable from the tutor - work in pairs, one is the technician, the other is the coach who will oversee the process. Swap roles when one end is complete.
- Strip the outer insulating layer off the tip of the cable
- Un-pair, and straighten the 8 individual wires
- Arrange the wires in the correct order according to the TIA/EIA 578B Wiring pinout diagram
- Insert the wire into the RJ-45 connector assuring each wire remain in the correct order and go far enough in
- Crimp the connector to make a permanent connection and secure the wire
- Swap roles, repeat at the other end of the cable.

The following tools will be required, these must be borrowed one at a time from the front of the classroom and returned as we don't have 1 of each per student

- Rotary cutting tool
- Wire snippers
- Crimping tool
- Cable testing tool



Fig 1. Cable preparation tools. R-L Cable tester, Crimping tool, rotary cutter, alternate rotary cutter (only one type in each kit)

Your tutor will show the following video to the class at the beginning of the session - watch CAREFULLY as I will provide clear instructions and advice on how to approach the task - it is worth taking this task SLOWLY and CAREFULLY for best results

[Video here](#)

Later in the class you may refer back to the video if you forget steps.

Here is the ethernet wiring diagram pinout. The same pattern should be followed at BOTH ends of the cable

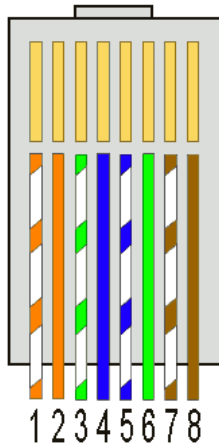


Fig 2. TIA/EIA 568B pinout viewed from back of RJ45 connector (side without tab)

When you and your partner have completed the cable ask the tutor to borrow a tester unit and check to see if the cable functions correctly

It does NOT matter if it does not work. This is a learning process and the "journey" what is of value **not** the destination

Task 2: Data-link Layer onwards (ARP)

Construct the following network in Packet Tracer

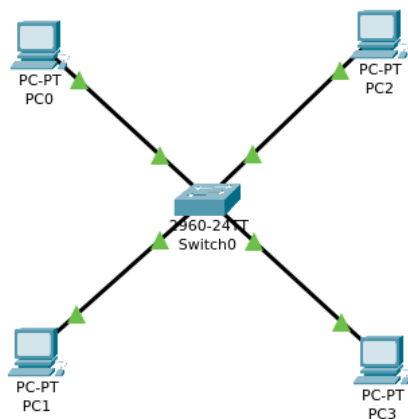


Fig 3. LAN in Packet Tracer

Use the networking address: 172.16.200.0 netmask: 255.255.255.0 to appropriately address the network hosts. If you do not know how to do this you need to refer back to earlier weeks before asking the tutor for help.

Test for FULL connectivity by pinging between PCs

On each of the 4 PCs goto to Desktop >> Command Prompt

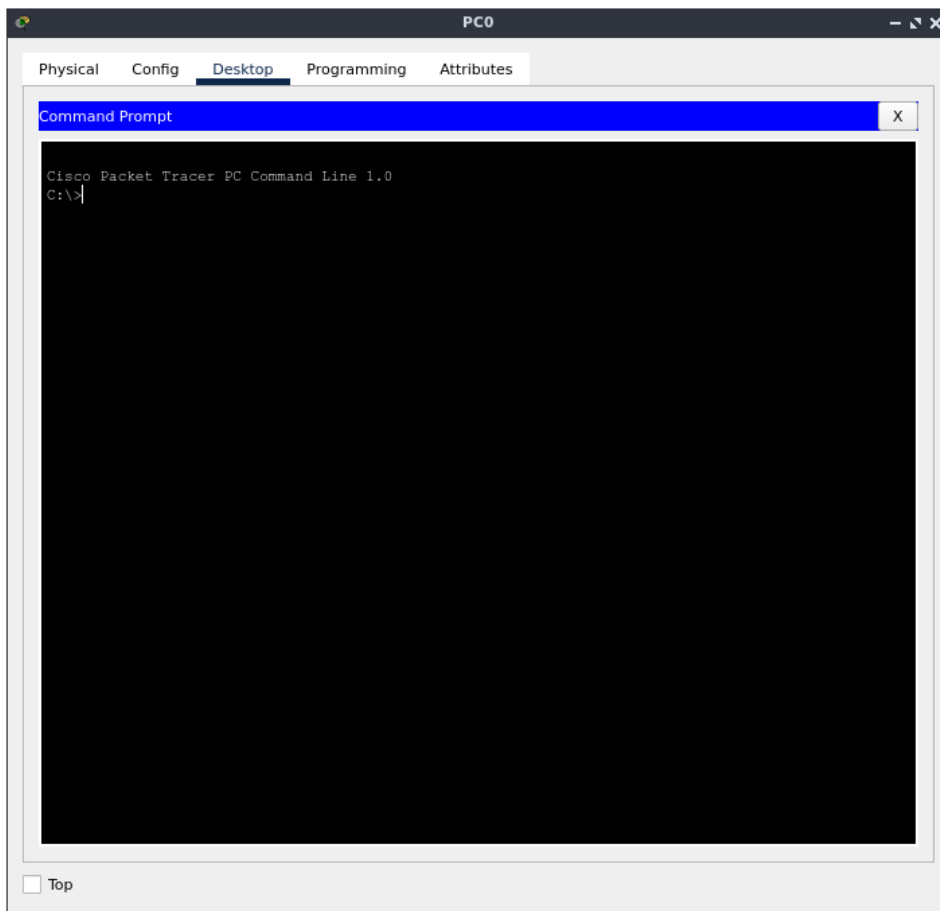


Fig 4. Command prompt in Packet Tracer

1. Issue the command:

```
arp -a
```

2. What do you see? Record the output of the first PC in your notes

3. Issue the command (Again on the first PC)

```
arp -d
```

4. Repeat step 2. What has changed? how is the output different?

5. Ping PC 2 and make sure you receive a reply

6. Issue the command:

```
arp -a
```

What has changed? how is the output different?

Task 3: DHCP server configuration

Construct the network below. Use the following network addresses

LAN A: (left) IP: 192.168.10.0 Mask: 255.255.255.0

LAN B: (right) IP: 172.16.0.0 Mask: 255.255.0.0

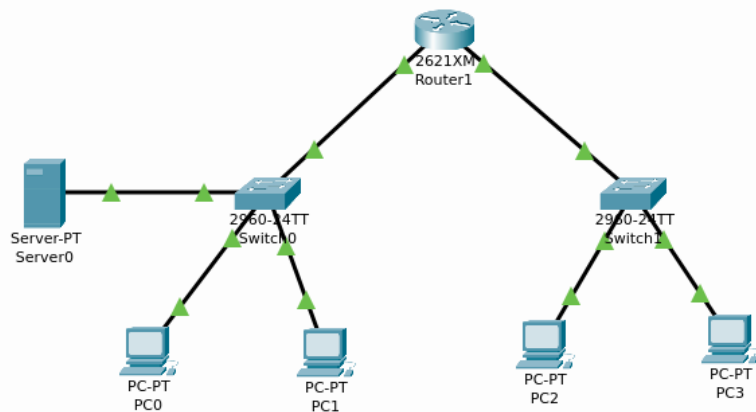


Fig 5. WAN with server

First configure the IP addresses, subnet masks, and default gateways then test the network for functionality. There is a server in the left side subnet which we will use as a DHCP server. Assign the server itself the **LAST valid host address** on the network. Meanwhile the router interfaces should be the **FIRST valid host IP addresses**

Test to see you can PING the server from the local area PCs

Click on the server and navigate to the 'Services' tab and choose 'DHCP' down the left hand side of the panel

Within this panel you need to first check the Service "on" radio button.

Next set the default gateway which should be the IP address of your router i.e. the first valid host address.

Next set the start IP address, this will be the beginning of the range from which the DHCP service will allocate addresses, you have ALREADY USED the first valid host address on the network, so you need to start from at least the second. I recommend .10 to reserve a few static addresses for future expansion.

Next set the subnet mask which will be 255.255.255.0

Finally set the maximum number of users. Set this to 10. This might seem very small but there are actually only 2 other hosts on our network so far so this is enough.

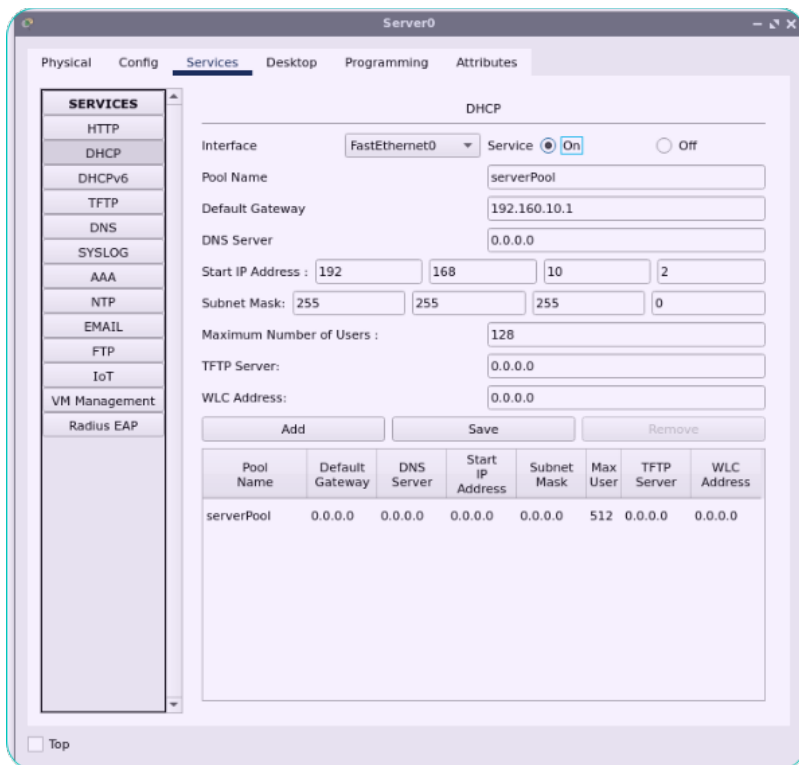


Fig 6. DHCP config in Packet Tracer

Next reconfigure the 2 PCs in the local area network to attain their IP address via DHCP rather than being statically assigned

By now you should have 2 PCs assigned their address over DHCP, the server itself which is statically assigned, and the router which is statically assigned

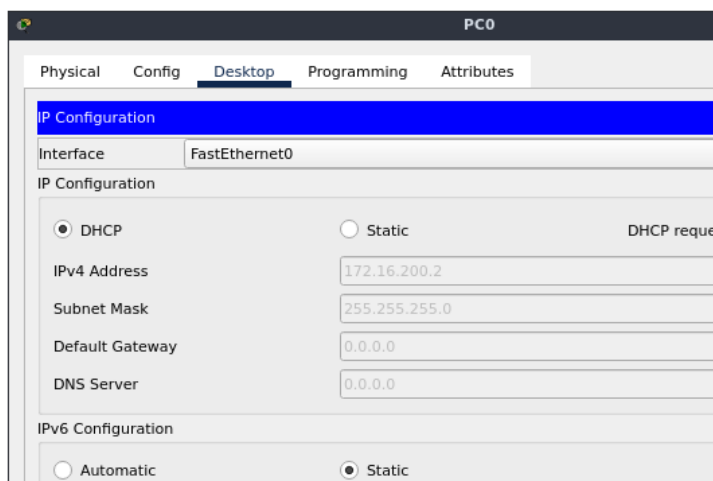


Fig 7. PC set to DHCP in Packet Tracer

FINALLY: when you have all this working. Add a secondary server to the other side (e.g. LAN B) to provide DHCP service there as well on the appropriate address ranges. Ask your tutor for help if you do not understand.

Task 4: Binary and Hex recap and practice

1. Fill in the following table of BINARY to DECIMAL conversions. Ask your tutor if you get stuck

128	64	32	16	8	4	2	1	Decimal conversion
1	0	1	0	1	0	1	0	
0	1	0	1	0	1	0	1	

128	64	32	16	8	4	2	1	Decimal conversion
0	1	0	1	1	1	0	1	
1	0	1	0	1	1	0	0	
1	1	0	1	1	0	1	1	
1	1	0	0	0	1	0	1	

2. Fill in the following table of HEX to BINARY conversions. Ask your tutor if you get stuck

4096	256	16	1	Binary conversion
A	B	1	F	
3	C	E	9	
F	E	4	B	
A	B	5	6	
C	D	6	4	
E	F	9	6	

3. Fill in the following table of HEX to DECIMAL conversions. Ask your tutor if you get stuck

16	1	Decimal conversion
1	F	
3	C	
4	B	
A	B	
D	6	
E	6	

Task 5: Questions:

Make notes to each of the answers to the following questions. The answers can be found within the lecture this week, and also by researching on the web. Your tutor will go through answers before the end of the session.

IMPORTANT: Keeping notes is important for your eventual revision and assessment. Do not neglect it.

1. At what layer in the OSI model does ARP operate?
2. Why does the use of ARP slow down network operation?
3. Why is ARP essential for network operation?
4. How many bits are in a MAC address?
5. What is the MAC address of the PC (of one of its network interface cards) you are using right now? how would you find this information?
6. What is the destination MAC address in an ARP request?
7. What is the purpose of ARP tables?
8. Why are ARP tables cleared automatically after a period without communication?
9. What is the name for the section of a network within which ARP broadcasts are detected?

10. Which device does NOT forward the ARP requests in the previous questions
 11. What command manually clears the ARP table on a Windows PC?
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