SIT202: Computer Networks and Communication

Leaning Evidence for Active Class Task 8

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Members in this group activity task:

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Activity 1

1. Do we have enough IP addresses to assign for each device that connect to the network?

- IP addresses, especially IPv4, are hard to come by, especially on public networks. With 32 bits in a conventional IPv4 address, there are roughly 4.3 billion possible unique addresses. However, because of network allocation policies and the separation of addresses into public and private sectors, this pool is progressively diminished. You should have enough private IP addresses, if you're utilizing them, to cover most local networks. However, because the IPv4 pool is being used up, there are far fewer unique IPv4 addresses available on public networks.

2. Do we have any solution?

- To cope with IPv4 addresses being scarce. A number of actions are taken. o Network Address Translation: When devices in a local network use private IP addresses, a router or firewall translates these private addresses into a single public IP address for communication on the public network. This is a common method of conserving public IP addresses. By enabling numerous devices to share a single public IP address, IPv4 IP addresses can be used much more efficiently.

3. Explain a protocol that we can use along with IPv4 to conserve the global IP address space?

- We can use the Dynamic Host Configuration Protocol (DHCP) with IPV4. In order to prevent IP addresses from being squandered, DHCP automatically allocates available IP addresses to connected devices.

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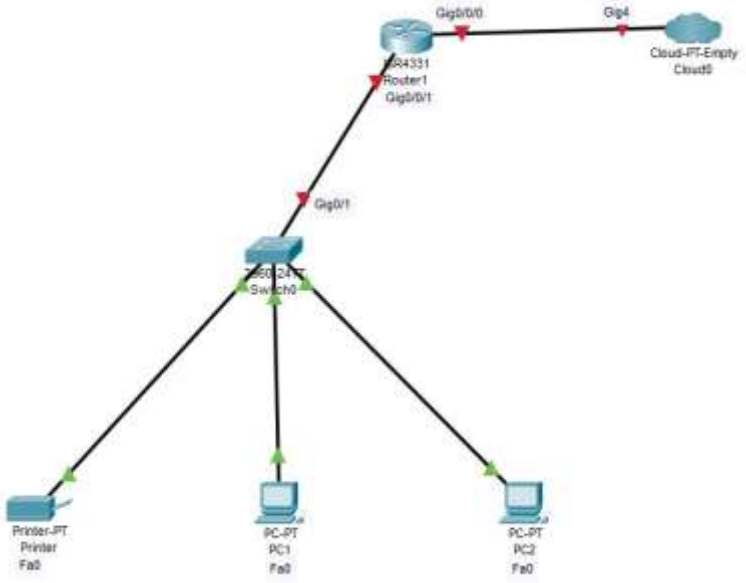
Activity 2

1. One group member can act as a router with a DHCP server and other three members are host devices that try to connect to the network. These host devices could be a PC, a printer, and network storage device. A sample network is shown in the below figure.



2. Assume the all the devices are physical connected as shown in the above figure. Now, your job is to set up the network and establish the connections with the router using DHCP. Each member needs to send/ respond with the correct message and message sequence to establish the connections and receive IP address for each host.

Pavithran AIR
Pavithran
"Welcome to our DHCP network setup roleplay! In this scenario, we have a Router acting as the DHCP Server and three host devices — PC 1, PC 2, and Printer — that need to connect to the network. Let's get started!"
9:12 AM

PC 1 – Raaid
"I am PC 1. I want to join the network, but I need an IP address first."
(Speaks to Router) "Sending DHCP Discover message to the network. Who can provide me an IP address?"
9:15 AM

Shekaina CICRA
PC 2 – Shekaina
(Follows the same action) "I am PC 2, and I also need an IP address."
(Sends DHCP Discover message) "Who is out there to provide me with an IP address?"
Edited 9:18 AM

Nishad
Printer – Nishad
(Receives the IP Address card and speaks) "I have my IP address offer. I am confirming it now!"
(Sends DHCP Request message to the Router) "Sending DHCP Request message to confirm the IP address."
9:19 AM

Kenisha CICRA
Router/DHCP Server- kenisha
"I am the Router, acting as the DHCP Server. I have received your DHCP Discover messages."
"Sending DHCP Offer messages to PC 1, PC 2, and Printer with an available IP address for each of you."
"Sending DHCP Acknowledgment (ACK) to confirm that each device now has an IP address assigned."
(Hands out "ACK cards" to each host device member)
Edited 9:20 AM

PC 1 – Raaid
(Receives the IP Address card and speaks) "I received an IP address offer. I accept this IP address!"
(Sends DHCP Request message to the Router) "Sending DHCP Request message to confirm the IP address."
9:22 AM

Shekaina CICRA
PC 2 – Shekaina
(Receives the IP Address card and speaks) "I also received an IP address offer. I am confirming my IP address as well!"
(Sends DHCP Request message to the Router) "Sending DHCP Request message to confirm the IP address."
9:31 AM

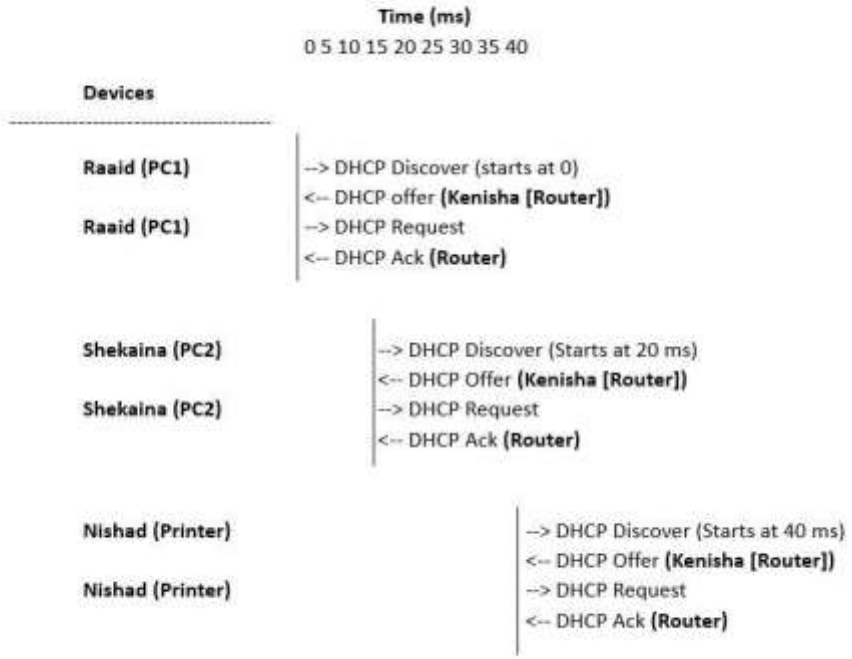
Nishad
Printer – Nishad
(Receives the IP Address card and speaks) "I have my IP address offer. I am confirming it now!"
(Sends DHCP Request message to the Router) "Sending DHCP Request message to confirm the IP address."
9:47 AM

Kenisha CICRA
Router/DHCP Server- kenisha
(Receives the DHCP Request messages) "I have received the DHCP Requests from PC 1, PC 2, and Printer."
"Sending DHCP Acknowledgment (ACK) to confirm that each device now has an IP address assigned."
(Hands out "ACK cards" to each host device member)
PC 1 – Raaid , PC 2 – Shekaina , Printer – Nishad
(Receive the ACK cards) "We have received the DHCP ACK! We are now connected to the network with our IP addresses."
9:58 AM

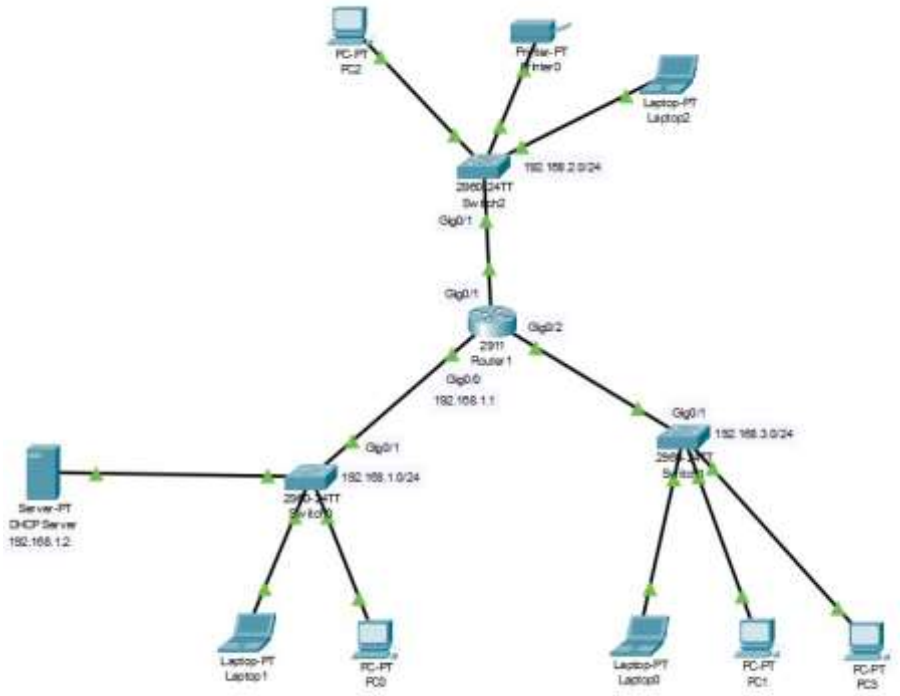
Pavithran AIR
Pavithran
"Great job, team! All devices have successfully received their IP addresses from the DHCP Server and are now connected to the network. Our DHCP setup is complete!"
9:58 AM

3. Draw a timing diagram to indicate the sequence of messages transferred between devices.

Time line diagram



4. Next, we are going to implement a DHCP server in Cisco packet tracer and check the DHCP in action. Make use to take screenshots of the networks you build, analysis, and verifications. Open the packet tracer and implement the following network. You may need to use the same model of the devices shown in the diagram. Today, we are not going to use static IP configuration for the hosts as we are going to check the DHCP in action. Tips: You need to add a module with a fast ethernet port to the router, so that the router can support three LANs as shown in the below network diagram.



Network architecture

a. Set up the DHCP server by configuring network pools, default gateway, and IP address (use the subnets mentioned in the diagram).
b. Set up the router by configuring the interfaces and DHCP (use the subnets mentioned in the diagram).
c. Set up each host with DHCP to obtain IP configuration and verify the IP address and the default gateway configured.
d. Verify the connectivity between each host in the network.

```
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface GigabitEthernet0/0
Router(config-if)#ip address 192.168.1.1 255.255.255.0
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up

Router(config-if)#exit
Router(config)#interface GigabitEthernet0/1
Router(config-if)#ip address 192.168.2.1 255.255.255.0
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up

Router(config-if)#exit
Router(config)#interface GigabitEthernet0/2
Router(config-if)#ip address 192.168.3.1 255.255.255.0
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/2, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/2, changed state to up
```

Router IP Configuration

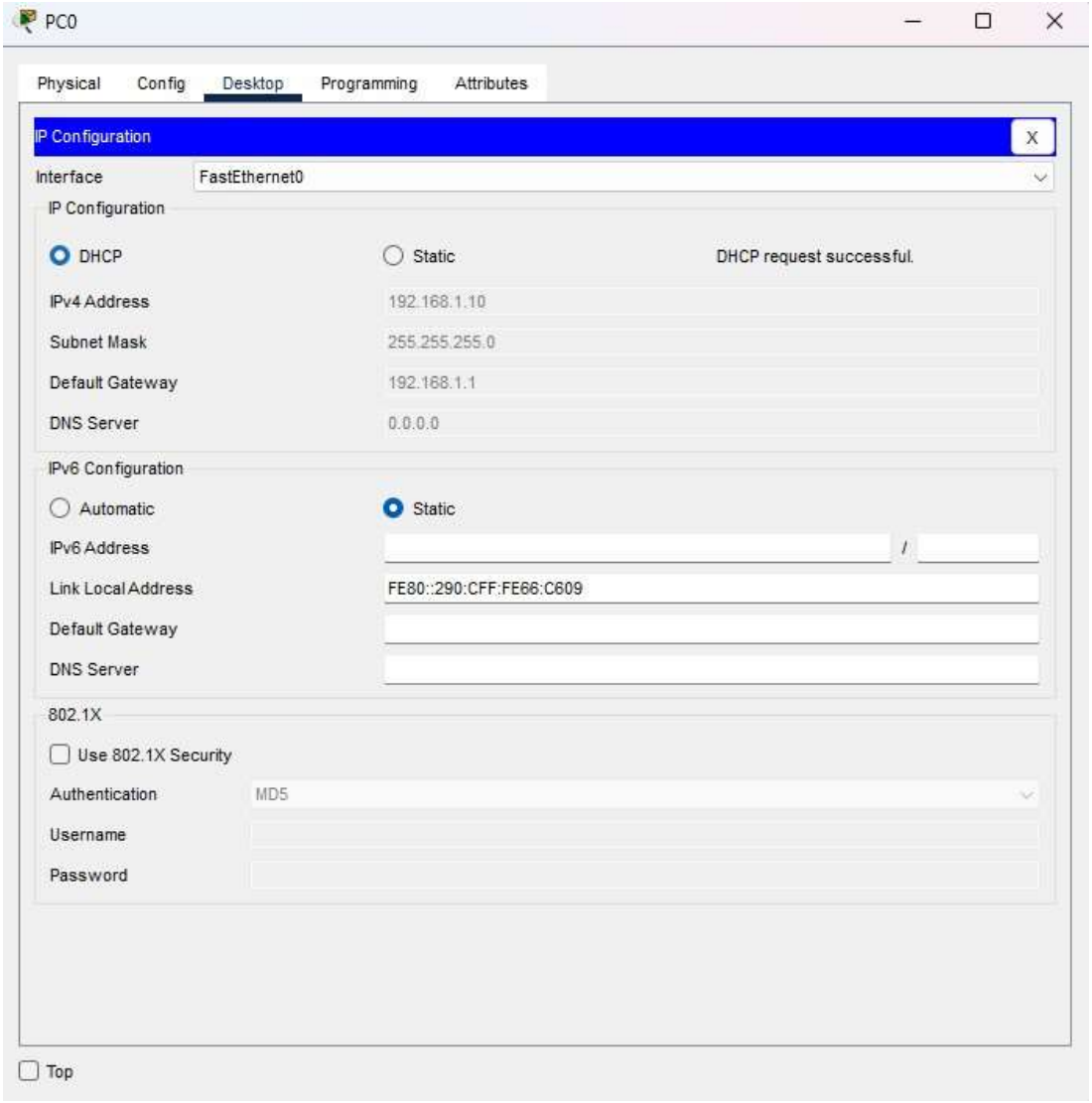
Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
serverPool2	192.168.3.1	0.0.0.0	192.168.3.10	255.255.255.0	100	0.0.0.0	0.0.0.0
serverPool1	192.168.2.1	0.0.0.0	192.168.2.10	255.255.255.0	100	0.0.0.0	0.0.0.0
serverPool	192.168.1.1	0.0.0.0	192.168.1.10	255.255.255.0	100	0.0.0.0	0.0.0.0

Creating DHCP Pools for each subnet

```
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int g0/1
Router(config-if)#ip helpe
Router(config-if)#ip helper-address 192.168.1.2
Router(config-if)#exit
Router(config)#int g0/2
Router(config-if)#ip helper-address 192.168.1.2
Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#wr
Building configuration...
[OK]
```

Enable IP helper address for the other two addresses to enable end device broadcasting to DHCP server



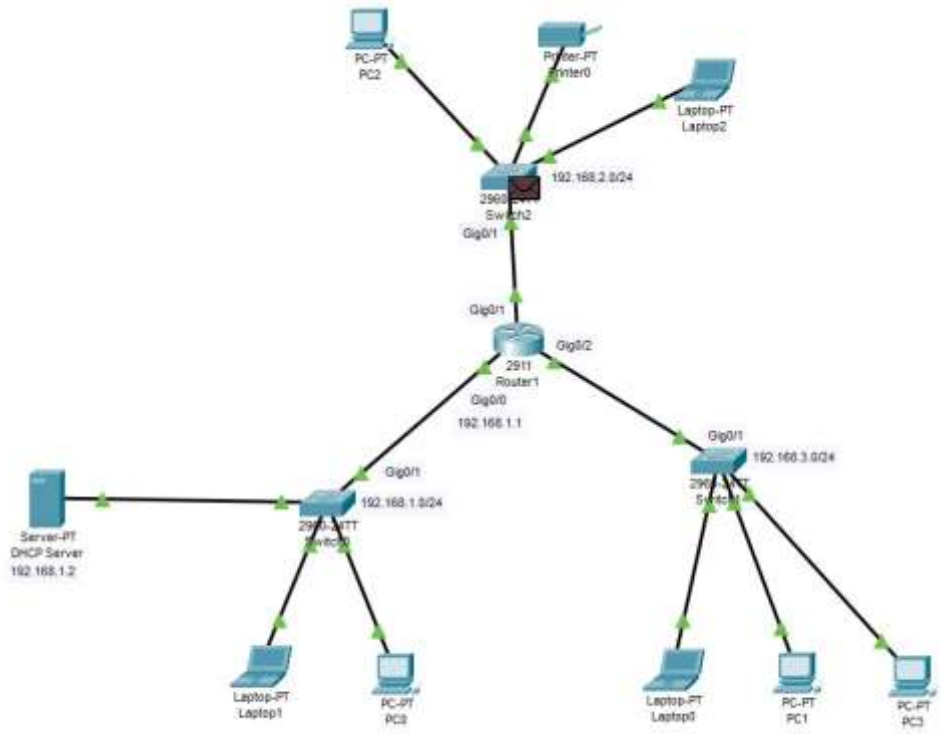
Now each end device as seen above with PC0 can be given an IP address from the DHCP pool.

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	Laptop0	PC2	ICMP		0.000	N	0	(edit)	(delete)
	Successful	Printer0	PC0	ICMP		0.000	N	1	(edit)	(delete)
	Successful	Laptop2	PC3	ICMP		0.000	N	2	(edit)	(delete)
	Successful	Laptop0	Laptop1	ICMP		0.000	N	3	(edit)	(delete)

Thus, we can say that DHCP has been configured and assigned successfully.

Activity 3

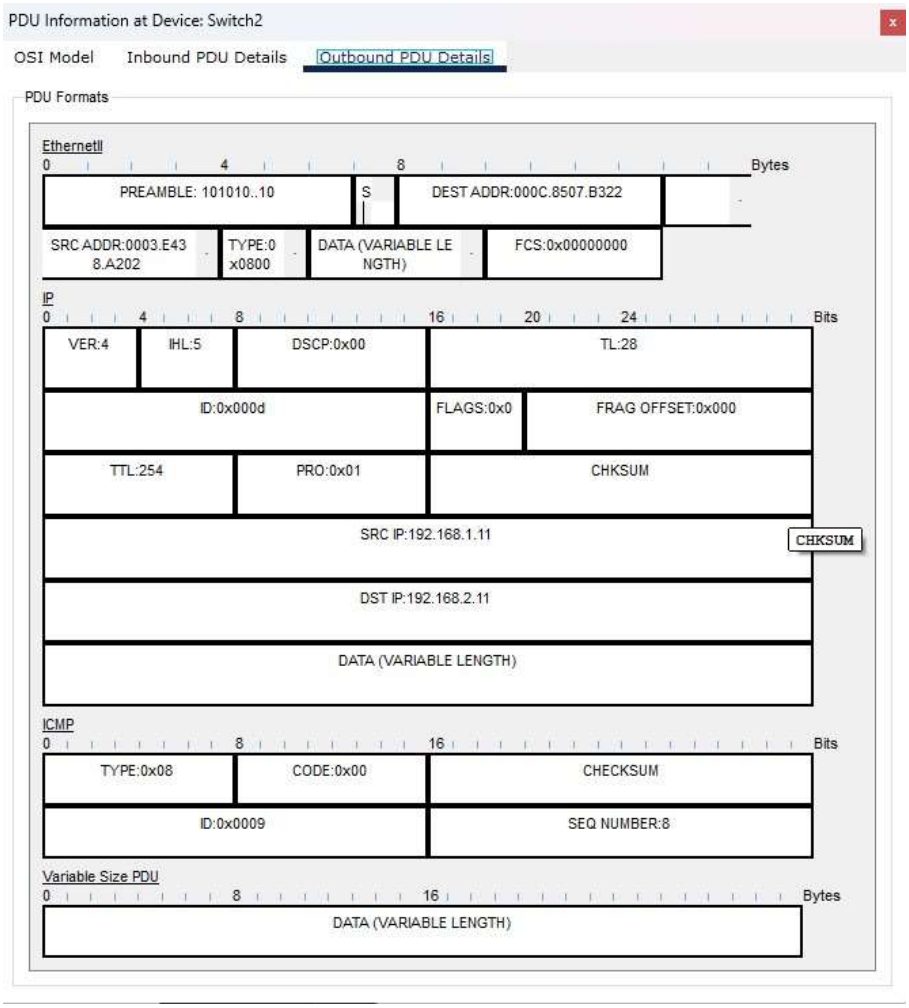
1. Use the Simulation mode and send a simple packet from one host (Host A) from LAN1 to another host (Host B) in LAN2. In simulation tool, you can run the simulation step by step. When you go through each step, pay attention to the type of the message passed (highlighted in the below figure).



- Simulating a ping from Laptop0 to Laptop2

2. You may notice when Host A ping Host B, we use ICMP protocol. Double click on one entry as shown below to explore the ICMP message,

3. You should be able to view the packet details as follows.



4. Explain what information you can find in “outbound PDU details”.

- Outbound PDU details displays the packet’s structure and intricacies on each network layer. As you can see it shows information such as; ○ Destination MAC Address ○ Source MAC Address
    - IP version ○ Header Length ○ Protocol ○ Source IP ○ Destination Ip
    - And ICMP in the Transport Layer

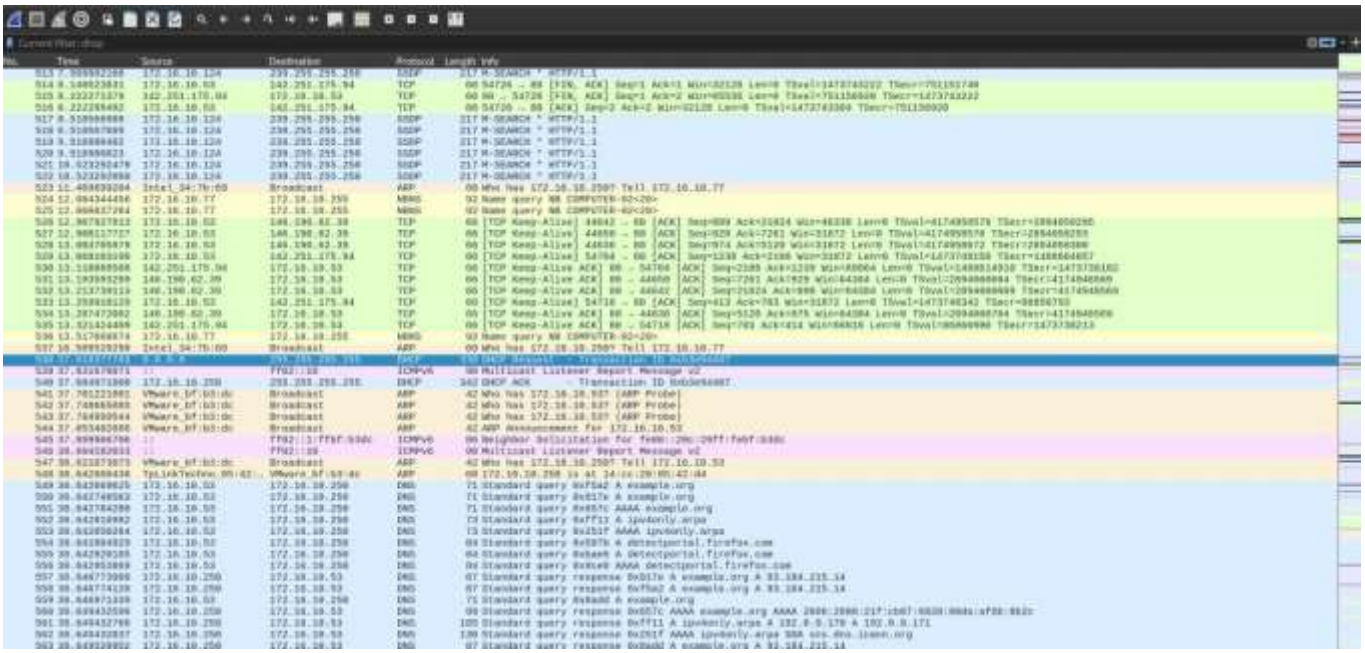
5. Have a closer look at the ICMP message format. Can you identify the type of ICMP message and specific information is in there (type and code)? You can refer to RFC792 for more help. https://datatracker.ietf.org/doc/html/rfc792
    - The type of ICMP message is **0x08** which is a ping (ECHO request) and its ID is **0x0009** and sequence number is 9

6. Can you identify the changes in ICMP message when you use a traceroute from Host A to Host B compared to what you have witnessed in the above question? Note that you can use tracert command in each device (in command prompt) similar to the way that ping command is used.

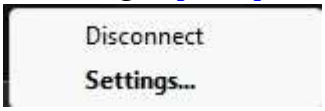
   • The sequence numbers and IDs differ, indicating that the Time to Live (TTL) setting is causing a packet to be discarded after a predetermined amount of time and sending a new one to the next hop.

Above and Beyond Tasks

1. Analyze DHCP in Wireshark (you may want to disconnect your wireless connection and connect it again whilst capturing the packets). You can show the sequence of DHCP messages and the details of those messages.

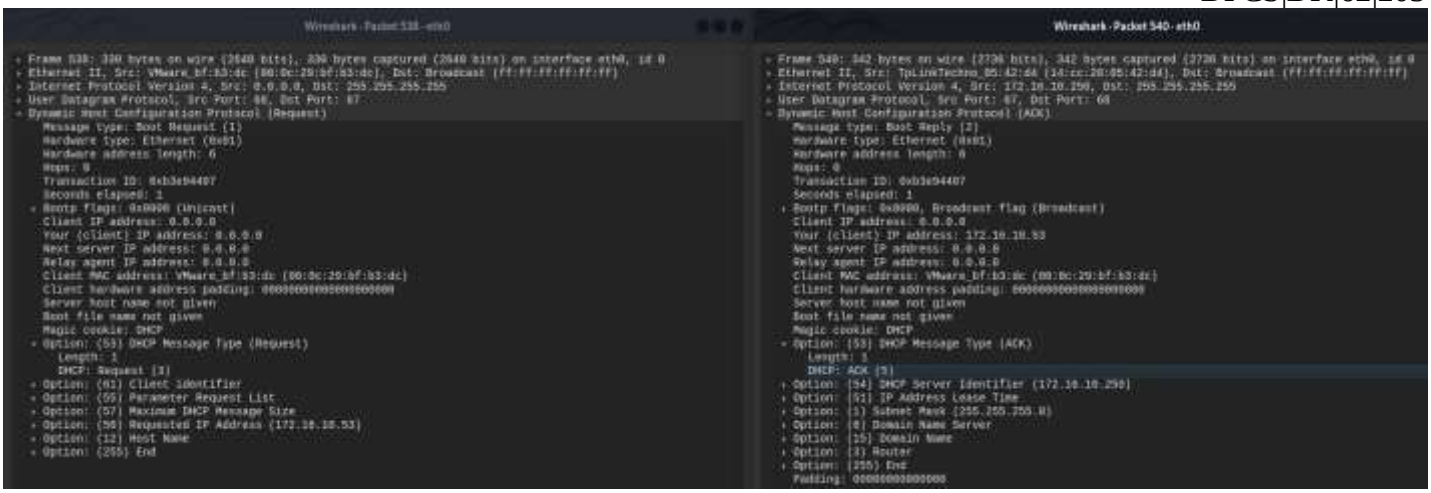


- Enabling Packet Capturing and visiting http://httpforever.com



- Disabling and then re-enabling the Network Adapter in Kali VM to disrupt packet capturing

- Filtering Wireshark by dhcp and as you can see the sequence of DHCP messages with the DHCP Request and DHCP ACK reply.



These are the request and reply packet frames.

2. Why are different inter-AS and intra-AS protocols used in the Internet? What are the examples of these two different types of routing protocols?

- Intra-AS protocols within a single AS whereas Inter-AS protocols handle routing between Aces
- Intra-AS protocols prioritize performance and efficiency while Inter-AS protocols focus on scalability
- An example scenario for Intra-AS could be OSPF where it’s used to efficiently route packets between routers in the same AS. And for Inter-AS BGP is a valid example where its used to manage packets routed across the internet.