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Assignment 1

1. Are DHCP messages sent over UDP or TCP?

Ans: UDP

8999	365.223965543	172.16.4.1	255.255.255.255	DHCP	373	DHCP ACK	- Transaction ID 0xb1aa7efa
9333	375.042085559	0.0.0.0	255.255.255.255	DHCP	354	DHCP Request	- Transaction ID 0xb2a9c101
10840	417.247274130	0.0.0.0	255.255.255.255	DHCP	344	DHCP Discover	- Transaction ID 0x72a8feff
10869	418.369970677	172.16.4.1	255.255.255.255	DHCP	357	DHCP Offer	- Transaction ID 0x72a8feff
10870	418.373376242	0.0.0.0	255.255.255.255	DHCP	370	DHCP Request	- Transaction ID 0x72a8feff
10871	418.373704660	172.16.4.1	255.255.255.255	DHCP	377	DHCP ACK	- Transaction ID 0x72a8feff
11246	434.330207581	0.0.0.0	255.255.255.255	DHCP	364	DHCP Request	- Transaction ID 0x4cdf87a7
11247	434.330565030	172.16.4.1	255.255.255.255	DHCP	377	DHCP ACK	- Transaction ID 0x4cdf87a7
11375	440.367464709	0.0.0.0	255.255.255.255	DHCP	364	DHCP Request	- Transaction ID 0x7f06e41
11376	440.367682957	172.16.4.1	255.255.255.255	DHCP	377	DHCP ACK	- Transaction ID 0x7f06e41
11508	446.396910101	0.0.0.0	255.255.255.255	DHCP	364	DHCP Request	- Transaction ID 0x44e7b22
11509	446.397331184	172.16.4.1	255.255.255.255	DHCP	377	DHCP ACK	- Transaction ID 0x44e7b22
11657	452.414295195	0.0.0.0	255.255.255.255	DHCP	364	DHCP Request	- Transaction ID 0x29eeeb54
11658	452.414888758	172.16.4.1	255.255.255.255	DHCP	377	DHCP ACK	- Transaction ID 0x29eeeb54

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Frame 10840: 344 bytes on wire (2752 bits), 344 bytes captured (2752 bits) on interface enx5091e353d4c0, id 0
Ethernet II, Src: Samson_00:27:c4 (00:e0:99:00:27:c4), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
Internet Protocol Version 4, Src: 0.0.0.0, Dst: 255.255.255.255
User Datagram Protocol, Src Port: 68, Dst Port: 67
Dynamic Host Configuration Protocol (Discover)

2.. Draw a timing diagram illustrating the sequence of the first four-packet

Discover/Offer/Request/ACK DHCP exchange between the client and server. For each packet, indicate the source and destination port numbers.



Discover :

- src port = 68
- dest port = 67

Offer :

- src port = 67
- dest port = 68

Request :

- src port = 68
- dest port = 67

Ack :

- src port = 67
- dest port = 68

3. What is the link-layer (e.g., Ethernet) address of your host?

00:e0:99:00:27:c4

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Client IP address: 0.0.0.0
Your (client) IP address: 0.0.0.0
Next server IP address: 0.0.0.0
Relay agent IP address: 0.0.0.0
Client MAC address: Samson_00:27:c4 (00:e0:99:00:27:c4)
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4. What values in the DHCP discover message differentiate this message from the DHCP request message?

Option 53:DHCP Message Type

Discover:

10840	417.247274130	0.0.0.0	255.255.255.255	DHCP	344 DHCP Discover	- Transaction ID 0x72a8feff
10869	418.369970677	172.16.4.1	255.255.255.255	DHCP	357 DHCP Offer	- Transaction ID 0x72a8feff
10870	418.373376242	0.0.0.0	255.255.255.255	DHCP	370 DHCP Request	- Transaction ID 0x72a8feff
10871	418.373704660	172.16.4.1	255.255.255.255	DHCP	377 DHCP ACK	- Transaction ID 0x72a8feff
11246	434.330207581	0.0.0.0	255.255.255.255	DHCP	364 DHCP Request	- Transaction ID 0x4cdf87a7
11247	434.330565030	172.16.4.1	255.255.255.255	DHCP	377 DHCP ACK	- Transaction ID 0x4cdf87a7
11375	440.367464709	0.0.0.0	255.255.255.255	DHCP	364 DHCP Request	- Transaction ID 0x7f06e41
11376	440.367682957	172.16.4.1	255.255.255.255	DHCP	377 DHCP ACK	- Transaction ID 0x7f06e41

4	Frame 10840: 344 bytes on wire (2752 bits), 344 bytes captured (2752 bits) on interface enx5091e353d4c0, id 0					
	Ethernet II, Src: Samson_00:27:c4 (00:e0:99:00:27:c4), Dst: Broadcast (ff:ff:ff:ff:ff:ff)					
	Destination: Broadcast (ff:ff:ff:ff:ff:ff)					
	Source: Samson_00:27:c4 (00:e0:99:00:27:c4)					
	Type: IPv4 (0x0800)					
	Internet Protocol Version 4, Src: 0.0.0.0, Dst: 255.255.255.255					
	User Datagram Protocol, Src Port: 68, Dst Port: 67					
	Dynamic Host Configuration Protocol (Discover)					
	Message type: Boot Request (1)					
	Hardware type: Ethernet (0x01)					
	Hardware address length: 6					
	Hops: 0					
	Transaction ID: 0x72a8feff					
	Seconds elapsed: 0					
	Bootp flags: 0x8000, Broadcast flag (Broadcast)					
	Client IP address: 0.0.0.0					
	Your (client) IP address: 0.0.0.0					
	Next server IP address: 0.0.0.0					
	Relay agent IP address: 0.0.0.0					
	Client MAC address: Samson_00:27:c4 (00:e0:99:00:27:c4)					
	Client hardware address padding: 00000000000000000000					
	Server host name not given					
	Boot file name not given					
	Magic cookie: DHCP					
	Option: (53) DHCP Message Type (Discover)					
	Option: (61) Client identifier					
	Option: (50) Requested IP Address (172.16.4.215)					
	Option: (12) Host Name					
	Option: (60) Vendor class identifier					
	Option: (55) Parameter Request List					
	Option: (255) End					

Request:

10840	417.247274130	0.0.0.0	255.255.255.255	DHCP	344 DHCP Discover	- Transaction ID 0x72a8feff
10869	418.369970677	172.16.4.1	255.255.255.255	DHCP	357 DHCP Offer	- Transaction ID 0x72a8feff
10870	418.373376242	0.0.0.0	255.255.255.255	DHCP	370 DHCP Request	- Transaction ID 0x72a8feff
10871	418.373704660	172.16.4.1	255.255.255.255	DHCP	377 DHCP ACK	- Transaction ID 0x72a8feff
11246	434.330207581	0.0.0.0	255.255.255.255	DHCP	364 DHCP Request	- Transaction ID 0x4cdf87a7
11247	434.330565030	172.16.4.1	255.255.255.255	DHCP	377 DHCP ACK	- Transaction ID 0x4cdf87a7
11375	440.367464709	0.0.0.0	255.255.255.255	DHCP	364 DHCP Request	- Transaction ID 0x7f06e41
11376	440.367682957	172.16.4.1	255.255.255.255	DHCP	377 DHCP ACK	- Transaction ID 0x7f06e41

Frame 10870: 370 bytes on wire (2960 bits), 370 bytes captured (2960 bits) on interface enx5091e353d4c0, id 0
Ethernet II, Src: Samson_00:27:c4 (00:e0:99:00:27:c4), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
Destination: Broadcast (ff:ff:ff:ff:ff:ff)
Source: Samson_00:27:c4 (00:e0:99:00:27:c4)
Type: IPv4 (0x0800)
Internet Protocol Version 4, Src: 0.0.0.0, Dst: 255.255.255.255
User Datagram Protocol, Src Port: 68, Dst Port: 67
Dynamic Host Configuration Protocol (Request)
Message type: Boot Request (1)
Hardware type: Ethernet (0x01)
Hardware address length: 6
Hops: 0
Transaction ID: 0x72a8feff
Seconds elapsed: 0
Bootp flags: 0x0000, Broadcast flag (Broadcast)
Client IP address: 0.0.0.0
Your (client) IP address: 0.0.0.0
Next server IP address: 0.0.0.0
Relay agent IP address: 0.0.0.0
Client MAC address: Samson_00:27:c4 (00:e0:99:00:27:c4)
Client hardware address padding: 00000000000000000000
Server host name not given
Boot file name not given
Magic cookie: DHCP
Option: (53) DHCP Message Type (Request)
Option: (61) Client identifier
Option: (50) Requested IP Address (172.16.4.215)
Option: (54) DHCP Server Identifier (172.16.4.1)
Option: (12) Host Name
Option: (81) Client Fully Qualified Domain Name
Option: (60) Vendor class identifier
Option: (55) Parameter Request List
Option: (255) End

5. What is the value of the Transaction-ID in each of the first four (Discover/Offer/Request/ACK) DHCP messages? What is the purpose of the Transaction-ID field?

Transaction id : 0x72a8feff

Purpose :

DHCP operates in a client-server (multiple clients allowed); therefore this id helps both client and server to correlate message and respond correctly. This also ensures that a client can identify responses from the correct server, preventing confusion and potential conflicts in configuration.

Id ensures that each DHCP transaction is unique

No.	Time	Source	Destination	Protocol	Length	Info
7829	340.679882928	172.16.4.1	255.255.255.255	DHCP	357	DHCP ACK - Transaction ID 0xc78a33d5
8998	365.223706214	0.0.0.0	255.255.255.255	DHCP	356	DHCP Request - Transaction ID 0xb1aa7efa
8999	365.223965543	172.16.4.1	255.255.255.255	DHCP	373	DHCP ACK - Transaction ID 0xb1aa7efa
9333	375.042085559	0.0.0.0	255.255.255.255	DHCP	354	DHCP Request - Transaction ID 0xb2a9c101
10840	417.247274130	0.0.0.0	255.255.255.255	DHCP	344	DHCP Discover - Transaction ID 0x72a8feff
10869	418.369970677	172.16.4.1	255.255.255.255	DHCP	357	DHCP Offer - Transaction ID 0x72a8feff
10870	418.373376242	0.0.0.0	255.255.255.255	DHCP	370	DHCP Request - Transaction ID 0x72a8feff
10871	418.373704660	172.16.4.1	255.255.255.255	DHCP	377	DHCP ACK - Transaction ID 0x72a8feff

Frame 10840: 344 bytes on wire (2752 bits), 344 bytes captured (2752 bits) on interface enx5091e353d4c0, id 0

Ethernet II, Src: Samson_00:27:c4 (00:e0:99:00:27:c4), Dst: Broadcast (ff:ff:ff:ff:ff:ff)

- Destination: Broadcast (ff:ff:ff:ff:ff:ff)
- Source: Samson_00:27:c4 (00:e0:99:00:27:c4)
- Type: IPv4 (0x0800)
- Internet Protocol Version 4, Src: 0.0.0.0, Dst: 255.255.255.255
- User Datagram Protocol, Src Port: 68, Dst Port: 67
- Dynamic Host Configuration Protocol (Discover)
 - Message type: Boot Request (1)
 - Hardware type: Ethernet (0x01)
 - Hardware address length: 6
 - Hops: 0

Transaction ID: 0x72a8feff

Seconds elapsed: 0

6. For each of the four DHCP messages (Discover/Offer/Request/ACK DHCP), indicate the source and destination IP addresses that are carried in the encapsulating IP datagram.

Destination IP : 255.255.255.255

Source IP:

- discover = 0.0.0.0
- offer = 172.16.4.1
- request = 0.0.0.0
- ack = 172.16.4.1

10840	417.247274130	0.0.0.0	255.255.255.255	DHCP	344	DHCP Discover - Transaction ID 0x72a8feff
10841	417.263232031	Fortinet_09:00:12	Broadcast	ARP	60	Who has 172.16.4.215? Tell 172.16.4.1
10846	417.579290222	Fortinet_09:00:12	Broadcast	ARP	60	Who has 172.16.4.178? Tell 172.16.4.1
10867	418.263306793	Fortinet_09:00:12	Broadcast	ARP	60	Who has 172.16.4.215? Tell 172.16.4.1
10869	418.369970677	172.16.4.1	255.255.255.255	DHCP	357	DHCP Offer - Transaction ID 0x72a8feff
10870	418.373376242	0.0.0.0	255.255.255.255	DHCP	370	DHCP Request - Transaction ID 0x72a8feff
10871	418.373704660	172.16.4.1	255.255.255.255	DHCP	377	DHCP ACK - Transaction ID 0x72a8feff
10873	418.393957871	Samson_00:27:c4	Broadcast	ARP	60	Who has 172.16.4.215? (ARP Probe)
10882	418.439642224	Samson_00:27:c4	Broadcast	ARP	60	Who has 172.16.4.1? Tell 172.16.4.215
10900	418.579285015	Fortinet_09:00:12	Broadcast	ARP	60	Who has 172.16.4.178? Tell 172.16.4.1
10912	419.405953218	Samson_00:27:c4	Broadcast	ARP	60	Who has 172.16.4.215? (ARP Probe)

7. What is the IP address of your DHCP server?

Ans: 172.16.4.1

10869	418.369970677	172.16.4.1	255.255.255.255	DHCP	357	DHCP Offer
10870	418.373376242	0.0.0.0	255.255.255.255	DHCP	370	DHCP Request
10871	418.373704660	172.16.4.1	255.255.255.255	DHCP	377	DHCP ACK
10873	418.393957871	Samson_00:27:c4	Broadcast	ARP	60	Who has 172.16
10882	418.439642224	Samson_00:27:c4	Broadcast	ARP	60	Who has 172.16
10900	418.579285015	Fortinet_09:00:12	Broadcast	ARP	60	Who has 172.16

Option: (54) DHCP Server Identifier (172.16.4.1)

Length: 4

DHCP Server Identifier: 172.16.4.1

8. What IP address is the DHCP server offering to your host in the DHCP Offer message? Indicate which DHCP message contains the offered DHCP address.

The DHCP server offered the IP address 172.16.4.215 to the client machine. The DHCP message with "DHCP Message Type (Offer)" contains the offered DHCP address.

10869	418.369970677	172.16.4.1	255.255.255.255	DHCP	357 DHCP Offer
10870	418.373376242	0.0.0.0	255.255.255.255	DHCP	370 DHCP Request
10871	418.373704660	172.16.4.1	255.255.255.255	DHCP	377 DHCP ACK
10873	418.393957871	Samson_00:27:c4	Broadcast	ARP	60 Who has 172.16.
10882	418.439642224	Samson_00:27:c4	Broadcast	ARP	60 Who has 172.16.
10900	418.579285015	Fortinet_09:00:12	Broadcast	ARP	60 Who has 172.16.
10912	419.405953218	Samson_00:27:c4	Broadcast	ARP	60 Who has 172.16.


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Frame 10869: 357 bytes on wire (2856 bits), 357 bytes captured (2856 bits) on interface enx...
Ethernet II, Src: Fortinet_09:00:12 (00:09:0f:09:00:12), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
  Destination: Broadcast (ff:ff:ff:ff:ff:ff)
  Source: Fortinet_09:00:12 (00:09:0f:09:00:12)
  Type: IPv4 (0x0800)
Internet Protocol Version 4, Src: 172.16.4.1, Dst: 255.255.255.255
User Datagram Protocol, Src Port: 67, Dst Port: 68
Dynamic Host Configuration Protocol (Offer)
  Message type: Boot Reply (2)
  Hardware type: Ethernet (0x01)
  Hardware address length: 6
  Hops: 0
  Transaction ID: 0x72a8feff
  Seconds elapsed: 0
  Bootp flags: 0x8000, Broadcast flag (Broadcast)
  Client IP address: 0.0.0.0
Your (client) IP address: 172.16.4.215
Next server IP address: 0.0.0.0
Relay agent IP address: 0.0.0.0
Client MAC address: Samson_00:27:c4 (00:e0:99:00:27:c4)
Client hardware address padding: 00000000000000000000
Server host name not given
Boot file name not given
Magic cookie: DHCP
Option: (53) DHCP Message Type (Offer)
  Length: 1
  DHCP: Offer (2)
Option: (54) DHCP Server Identifier (172.16.4.1)
  Length: 4

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9. Explain the purpose of the lease time. How long is the lease time in your experiment?

Lease time : 1 hour

- duration for which a client is allowed to use the IP address assigned to it by the DHCP server

Purpose :

1. Ensures IP addresses are not permanently tied up inactive or disconnected devices. After the lease expires the IP address can be reclaimed by DHCP server

2. Network stability → appropriate lease durations can minimize disruptions caused by frequent IP address changes
3. Security → shorter lease time reduces the risk of unauthorized devices obtaining and holding onto IP address for extended periods

10871	418.373704660	172.16.4.1	255.255.255.255	DHCP	377 DHCP ACK	- Transaction ID 0x72a8feff
10873	418.393957871	Samson_00:27:c4	Broadcast	ARP	60 Who has 172.16.4.215? (ARP Probe)	
Option: (54) DHCP Server Identifier (172.16.4.1) Length: 4 DHCP Server Identifier: 172.16.4.1						
Option: (51) IP Address Lease Time Length: 4 IP Address Lease Time: (3600s) 1 hour						

10. Were any ARP packets sent or received during the DHCP packet-exchange period? If so, explain the purpose of those ARP packets.

Ans:

Yes, 3 ARP packets were broadcast-ed during the DHCP packet-exchange period. Its main purpose is to perform availability check of the IP address it intends to offer to the client. Since there is no response to ARP request, it indicates that the IP address is not currently in use on the network therefore the DHCP server proceeds to offer the IP address to the client.

10840	417.247274130	0.0.0.0	255.255.255.255	DHCP	344 DHCP Discover	- Transaction ID 0x72a8feff
10841	417.263232031	Fortinet_09:00:12	Broadcast	ARP	60 Who has 172.16.4.215? Tell 172.16.4.1	
10846	417.579290222	Fortinet_09:00:12	Broadcast	ARP	60 Who has 172.16.4.178? Tell 172.16.4.1	
10867	418.263306793	Fortinet_09:00:12	Broadcast	ARP	60 Who has 172.16.4.215? Tell 172.16.4.1	
10869	418.369970677	172.16.4.1	255.255.255.255	DHCP	357 DHCP Offer	- Transaction ID 0x72a8feff
10870	418.373376242	0.0.0.0	255.255.255.255	DHCP	370 DHCP Request	- Transaction ID 0x72a8feff
10871	418.373704660	172.16.4.1	255.255.255.255	DHCP	377 DHCP ACK	- Transaction ID 0x72a8feff