1. Are DHCP messages sent over UDP or TCP?

   Answer: UDP

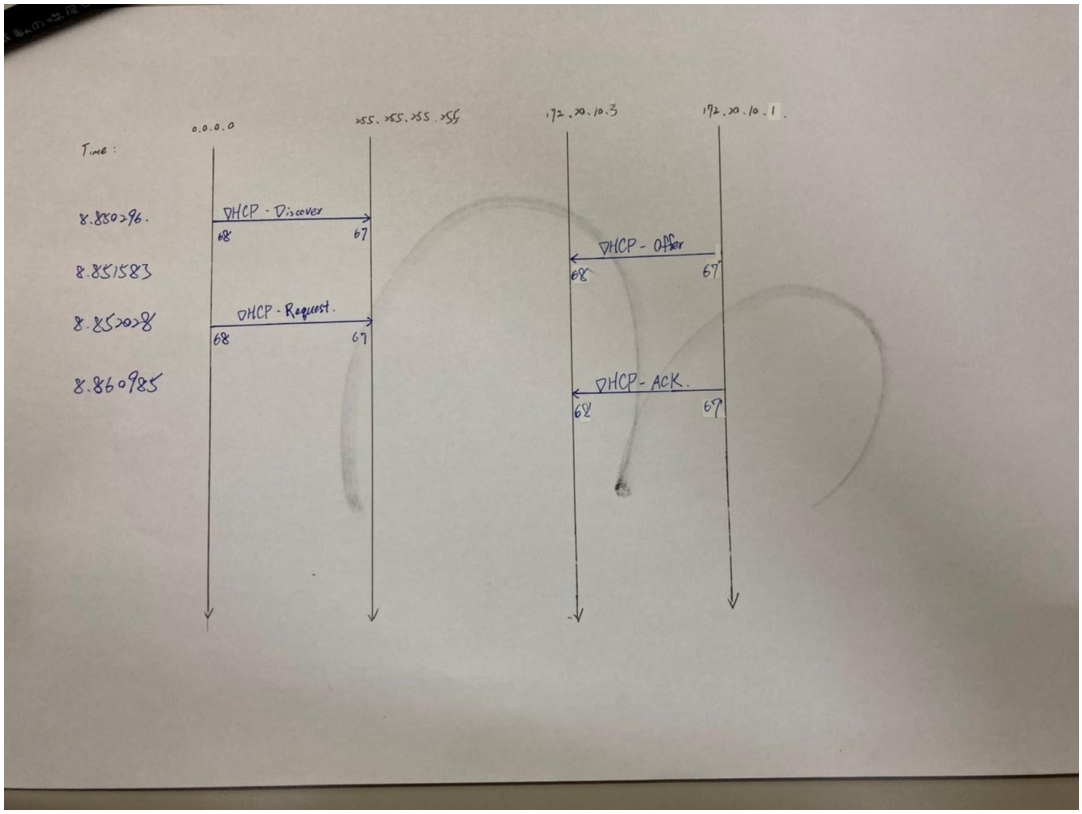
   ```
   > User Datagram Protocol, Src Port: 68, Dst Port: 67
   ```

2. Draw a timing datagram illustrating the sequence of the first four-packet Discover/Offer/Request/ACK DHCP exchange between the client and server. For each packet, indicated the source and destination port numbers. Are the port numbers the same as in the example given in this lab assignment?

   Answer: **Also, the port numbers are the same as in the example given.**

   ```
   > User Datagram Protocol, Src Port: 68, Dst Port: 67
   ```

6376	8.850296	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0xc2cde55b
6377	8.851583	172.20.10.1	172.20.10.3	DHCP	342	DHCP Offer - Transaction ID 0xc2cde55b
6378	8.852028	0.0.0.0	255.255.255.255	DHCP	354	DHCP Request - Transaction ID 0xc2cde55b
6379	8.860985	172.20.10.1	172.20.10.3	DHCP	342	DHCP ACK - Transaction ID 0xc2cde55b



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

   Answer: **26:d0:df:4b:8f:97**

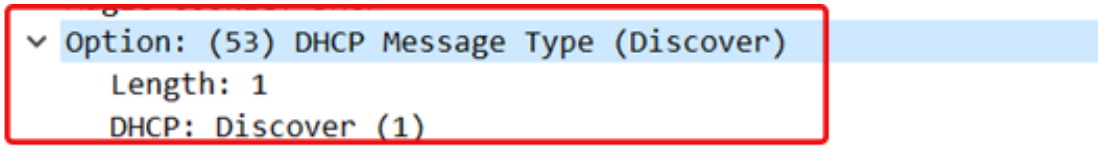
4. What values in the DHCP discover message differentiate this message from the DHCP request message?

   Answer:

   Option: (53) DHCP Message Type (Discover)

   Length: 1

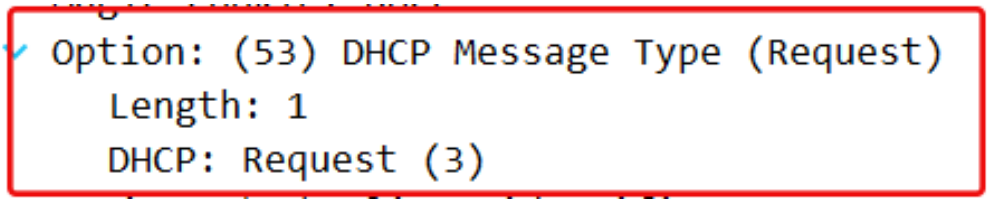
   DHCP: Discover (1)



   Option: (53) DHCP Message Type (Request)

   Length: 1

   DHCP: Request (3)



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

   Answer:

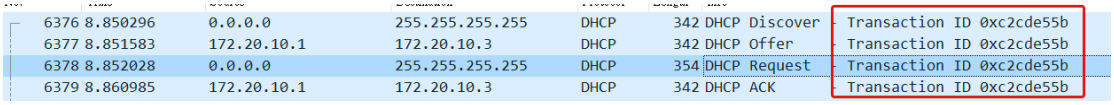
   First:

   Discover Transaction ID: 0xc2cde55b

   Offer Transaction ID: 0xc2cde55b

   Request Transaction ID: 0xc2cde55b

   ACK Transaction ID: 0xc2cde55b

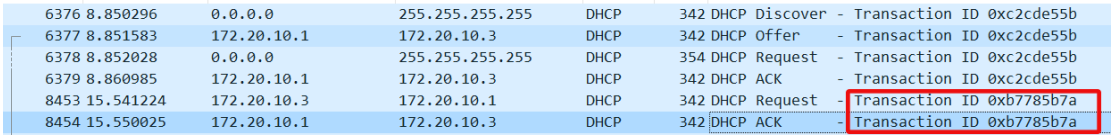


6376	8.850296	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0xc2cde55b
6377	8.851583	172.20.10.1	172.20.10.3	DHCP	342	DHCP Offer - Transaction ID 0xc2cde55b
6378	8.852028	0.0.0.0	255.255.255.255	DHCP	354	DHCP Request - Transaction ID 0xc2cde55b
6379	8.860985	172.20.10.1	172.20.10.3	DHCP	342	DHCP ACK - Transaction ID 0xc2cde55b

   Second:

   Request Transaction ID: 0xb7785b7a

   ACK Transaction ID: 0xb7785b7a



6376	8.850296	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0xc2cde55b
6377	8.851583	172.20.10.1	172.20.10.3	DHCP	342	DHCP Offer - Transaction ID 0xc2cde55b
6378	8.852028	0.0.0.0	255.255.255.255	DHCP	354	DHCP Request - Transaction ID 0xc2cde55b
6379	8.860985	172.20.10.1	172.20.10.3	DHCP	342	DHCP ACK - Transaction ID 0xc2cde55b
8453	15.541224	172.20.10.3	172.20.10.1	DHCP	342	DHCP Request - Transaction ID 0xb7785b7a
8454	15.550025	172.20.10.1	172.20.10.3	DHCP	342	DHCP ACK - Transaction ID 0xb7785b7a

6. A host uses DHCP to obtain an IP address, among other things. But a host's IP address is not confirmed until the end of the four-message exchange! If the IP address is not set until the end of the four-message exchange, then what values are used in the IP datagrams in the four-message exchange? 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.

   Answer:

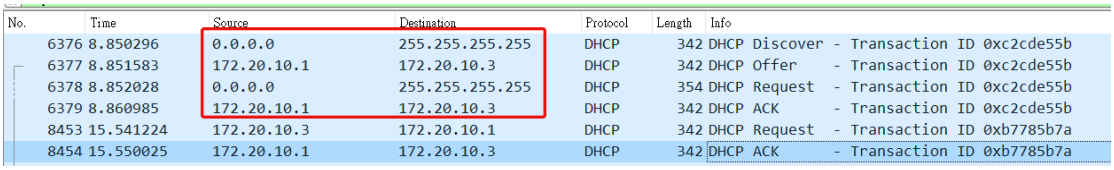
   Discover: 0.0.0.0/255.255.255.255

   Offer: 172.20.10.1/172.20.10.3

   Request: 0.0.0.0/255.255.255.255

   ACK: 172.20.10.1/172.20.10.3

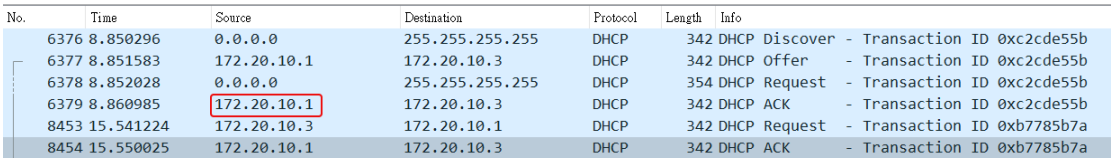
   DHCP client 和 server 都使用 255.255.255.255 當作 destination address。Client 使用 0.0.0.0 的 IP address 當作 source，當 server 端使用實體 IP address 作為 source。



No.	Time	Source	Destination	Protocol	Length	Info
6376	8.850296	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0xc2cde55b
6377	8.851583	172.20.10.1	172.20.10.3	DHCP	342	DHCP Offer - Transaction ID 0xc2cde55b
6378	8.852028	0.0.0.0	255.255.255.255	DHCP	354	DHCP Request - Transaction ID 0xc2cde55b
6379	8.860985	172.20.10.1	172.20.10.3	DHCP	342	DHCP ACK - Transaction ID 0xc2cde55b
8453	15.541224	172.20.10.3	172.20.10.1	DHCP	342	DHCP Request - Transaction ID 0xb7785b7a
8454	15.550025	172.20.10.1	172.20.10.3	DHCP	342	DHCP ACK - Transaction ID 0xb7785b7a

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

   Answer: DHCP server IP address: 172.20.10.1



No.	Time	Source	Destination	Protocol	Length	Info
6376	8.850296	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0xc2cde55b
6377	8.851583	172.20.10.1	172.20.10.3	DHCP	342	DHCP Offer - Transaction ID 0xc2cde55b
6378	8.852028	0.0.0.0	255.255.255.255	DHCP	354	DHCP Request - Transaction ID 0xc2cde55b
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8454	15.550025	172.20.10.1	172.20.10.3	DHCP	342	DHCP ACK - Transaction ID 0xb7785b7a

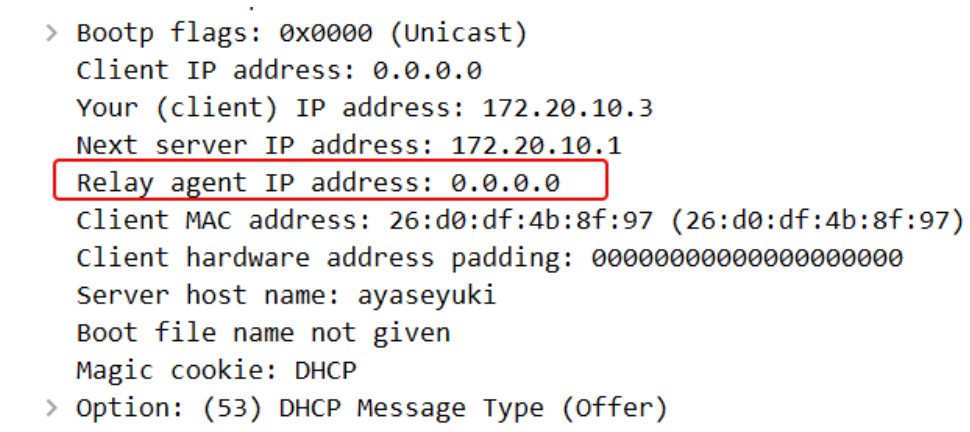
8. What IP address is the DHCP server offering to your host in the DHCP Offer message? Indicate which DHCP message contains the offered DHCP address.

   Answer: 172.20.10.3

```
> Bootp flags: 0x0000 (Unicast)
  Client IP address: 0.0.0.0
  Your (client) IP address: 172.20.10.3
  Next server IP address: 172.20.10.1
  Relay agent IP address: 0.0.0.0
  Client MAC address: 26:d0:df:4b:8f:97 (26:d0:df:4b:8f:97)
  Client hardware address padding: 00000000000000000000
  Server host name: ayaseyuki
  Boot file name not given
  Magic cookie: DHCP
> Option: (53) DHCP Message Type (Offer)
```

9. In the example screenshot in this assignment, there is no relay agent between the host and the DHCP server. What values in the trace indicate the absence of a relay agent? Is there a relay agent in your experiment? If so what is the IP address of the agent?

   Answer: 0.0.0.0



```
> Bootp flags: 0x0000 (Unicast)
  Client IP address: 0.0.0.0
  Your (client) IP address: 172.20.10.3
  Next server IP address: 172.20.10.1
  Relay agent IP address: 0.0.0.0
  Client MAC address: 26:d0:df:4b:8f:97 (26:d0:df:4b:8f:97)
  Client hardware address padding: 00000000000000000000
  Server host name: ayaseyuki
  Boot file name not given
  Magic cookie: DHCP
> Option: (53) DHCP Message Type (Offer)
```

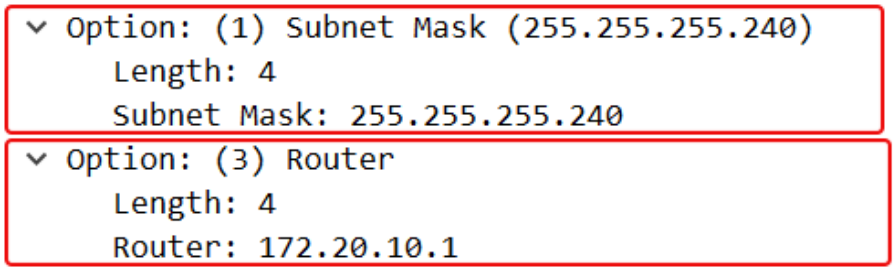
10. Explain the purpose of the router and subnet mask lines in the DHCP offer message.

Answer: **Router line 指出 client 的 default gateway。**

Subnet mask 使 client 知道要使用哪個 subnet mask。

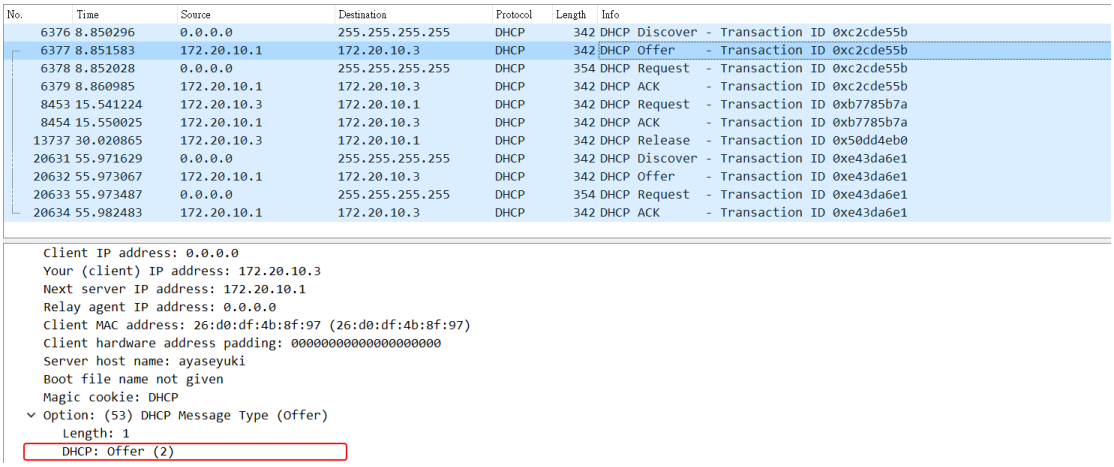
Subnet mask: 255.255.255.240

Router: 172.20.10.1



11. In the DHCP trace file noted in footnote 2, the DHCP server offers a specific IP address to the client (see also question 8. above). In the client's response to the first server OFFER message, does the client accept this IP address? Where in the client's RESPONSE is the client's requested address?

Answer: **The client does not accept this IP address.**



No.	Time	Source	Destination	Protocol	Length	Info
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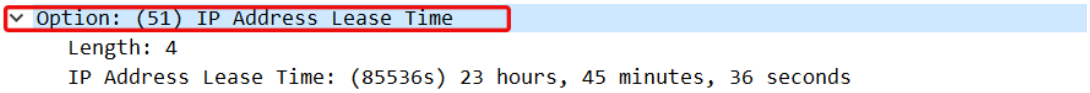
8454	15.550025	172.20.10.1	172.20.10.3	DHCP	342	DHCP ACK - Transaction ID 0xb7785b7a
13737	30.020865	172.20.10.3	172.20.10.1	DHCP	342	DHCP Release - Transaction ID 0x50dd4eb0
20631	55.971629	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0xe43da6e1
20632	55.973067	172.20.10.1	172.20.10.3	DHCP	342	DHCP Offer - Transaction ID 0xe43da6e1
20633	55.973487	0.0.0.0	255.255.255.255	DHCP	354	DHCP Request - Transaction ID 0xe43da6e1
20634	55.982483	172.20.10.1	172.20.10.3	DHCP	342	DHCP ACK - Transaction ID 0xe43da6e1

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

Answer:

租用時間(Lease time) 是 DHCP server 指定一個 IP address 給 client 所使用的時間。在租用期間，此 IP addres 不會給其他 client 使用，除非 client 自己釋放。一旦租用時間到期，DHCP server 可以將此 IP address 給其他 client 使用。

本次實驗的 IP address 租用的時間為: (85536s) 23 hour, 45 minutes, 36 seconds



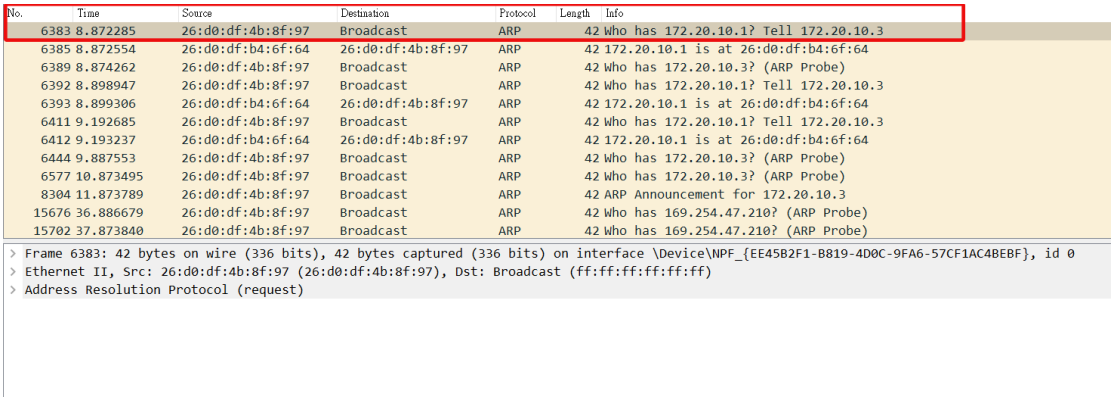
13. What is the purpose of the DHCP release message? Does the DHCP server issue an acknowledgment of receipt of the client's DHCP request? What would happen if the client's DHCP release message is lost?

Answer:

Client 藉由 DHCP server 送出一個 DHCP release 用來取消租用的 IP address。DHCP server 不會回傳 DHCP release 訊息的資訊給 client。如果 client 傳送的訊息遺失，DHCP server 必須等到租用時間到期才能給其他 clemt 使用此 IP address。

14. Clear the bootp filter from your Wireshark window. Were any ARP packets sent or received during the DHCP packet-exchange period? If so, explain the purpose of those ARP packets.

Answer: 有，DHCP server 有給 ARP requests。在給 client IP address 之前，DHCP server 會發布一個 ARP request 去確認此 IP address 尚未被使用。



No.	Time	Source	Destination	Protocol	Length	Info
6383	8.872285	26:d0:df:4b:8f:97	Broadcast	ARP	42	Who has 172.20.10.1? Tell 172.20.10.3
6385	8.872554	26:d0:df:b4:6f:64	26:d0:df:4b:8f:97	ARP	42	172.20.10.1 is at 26:d0:df:b4:6f:64
6389	8.874262	26:d0:df:4b:8f:97	Broadcast	ARP	42	Who has 172.20.10.3? (ARP Probe)
6392	8.898947	26:d0:df:4b:8f:97	Broadcast	ARP	42	Who has 172.20.10.1? Tell 172.20.10.3
6393	8.899306	26:d0:df:b4:6f:64	26:d0:df:4b:8f:97	ARP	42	172.20.10.1 is at 26:d0:df:b4:6f:64
6411	9.192685	26:d0:df:4b:8f:97	Broadcast	ARP	42	Who has 172.20.10.1? Tell 172.20.10.3
6412	9.193237	26:d0:df:b4:6f:64	26:d0:df:4b:8f:97	ARP	42	172.20.10.1 is at 26:d0:df:b4:6f:64
6444	9.887553	26:d0:df:4b:8f:97	Broadcast	ARP	42	Who has 172.20.10.3? (ARP Probe)
6577	10.873495	26:d0:df:4b:8f:97	Broadcast	ARP	42	Who has 172.20.10.3? (ARP Probe)
8304	11.873789	26:d0:df:4b:8f:97	Broadcast	ARP	42	ARP Announcement for 172.20.10.3
15676	36.886679	26:d0:df:4b:8f:97	Broadcast	ARP	42	Who has 169.254.47.210? (ARP Probe)
15702	37.873840	26:d0:df:4b:8f:97	Broadcast	ARP	42	Who has 169.254.47.210? (ARP Probe)