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Wireshark-DHCP v8.1

Lab 1

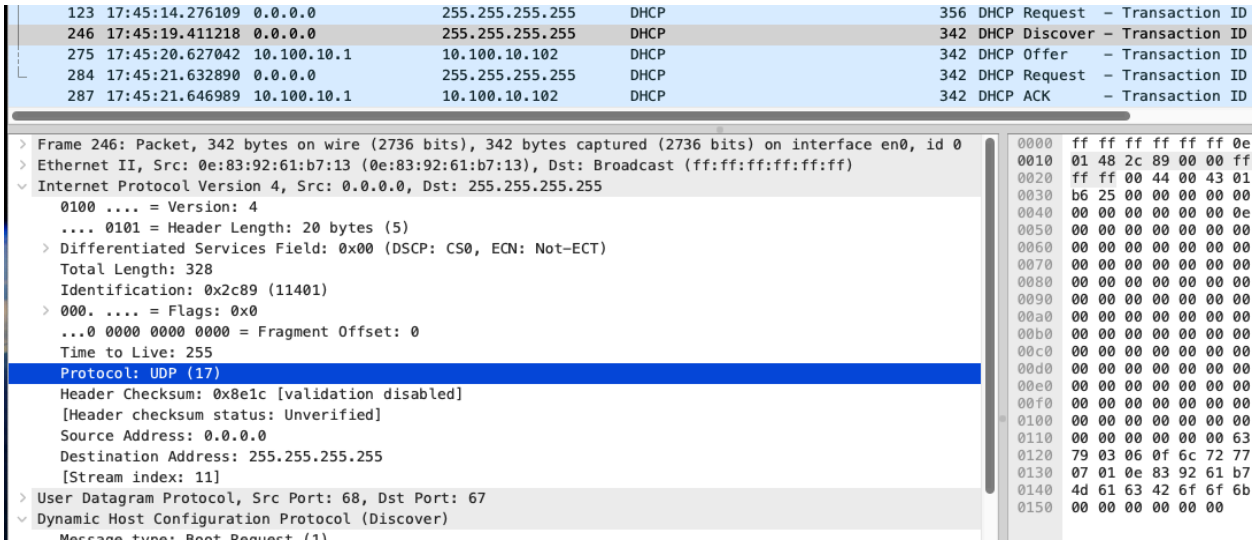
EE450

Abstract

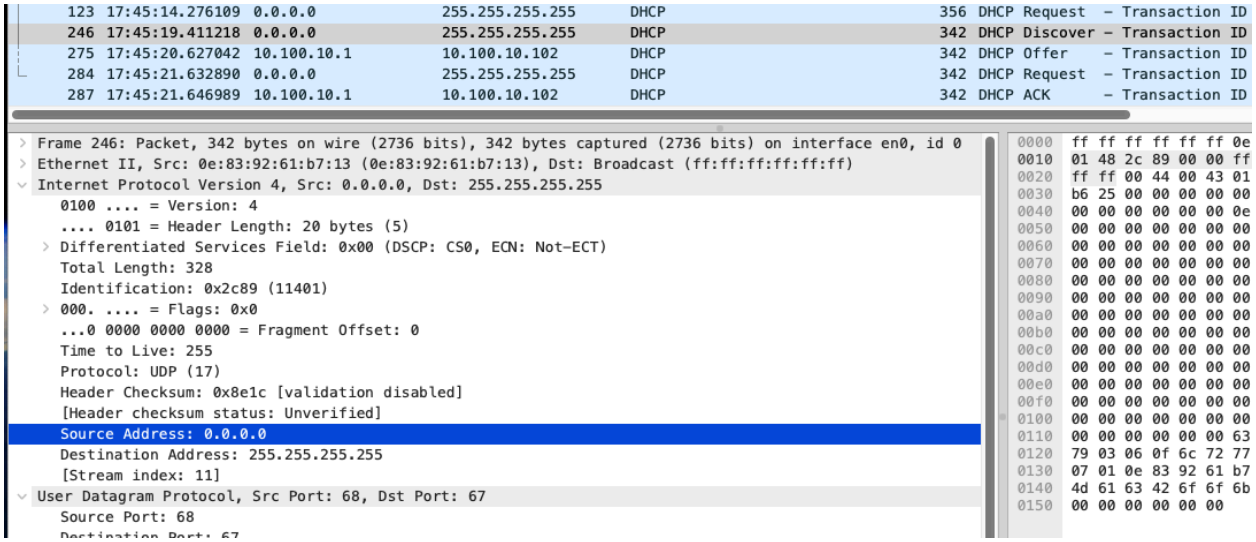
This lab examines the Dynamic Host Configuration Protocol (DHCP) using Wireshark to analyze how a client automatically obtains network configuration. By observing the Discover, Offer, Request, and ACK messages, the DHCP process was studied in detail. The analysis focused on key configuration parameters provided by the server, including the assigned IP address, subnet mask, default gateway (router), DNS server, lease time, and DHCP server identifier. This lab reinforced understanding of DHCP message structure and protocol encapsulation.

Let's explore the questions in the lab to better understand DHCP message structure and protocol encapsulation.

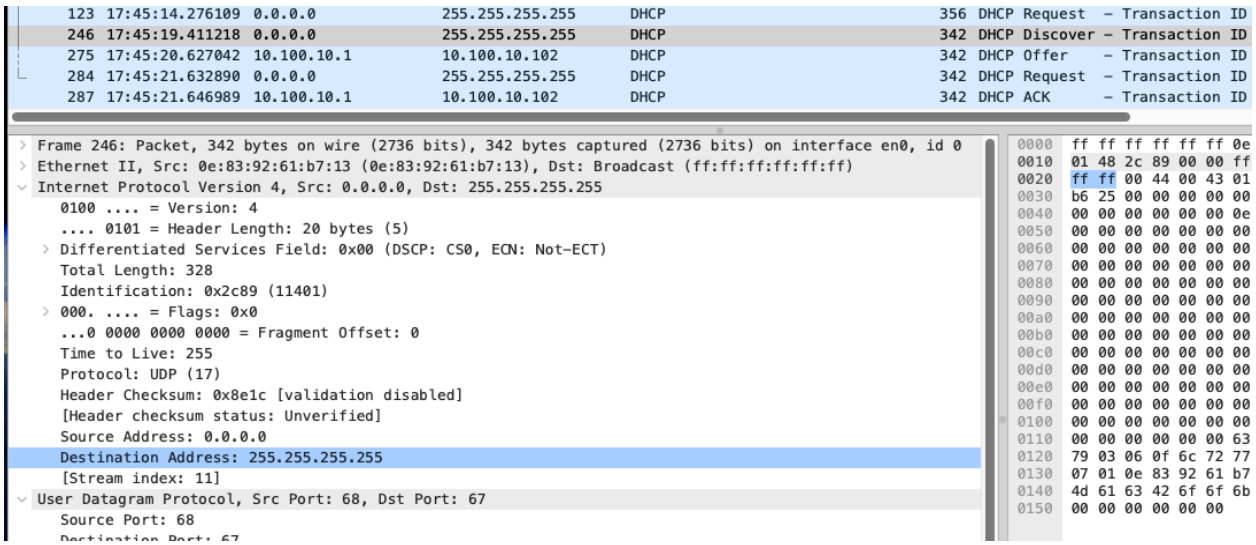
1. **Is this DHCP Discover message sent out using UDP or TCP as the underlying transport protocol?**
   The DHCP Discover message is sent using UDP as the underlying transport protocol. DHCP uses UDP because it is a connectionless protocol, which is appropriate at this stage since the client does not yet know the IP address of the DHCP server and cannot establish a TCP connection.



2. **What is the source IP address used in the IP datagram containing the Discover message? Is there anything special about this address? Explain**
   It is 0.0.0.0 as highlighted below. Because the client (my machine) is still in the discovery phase and has not been acknowledged yet to an IP address by a DHCP server.

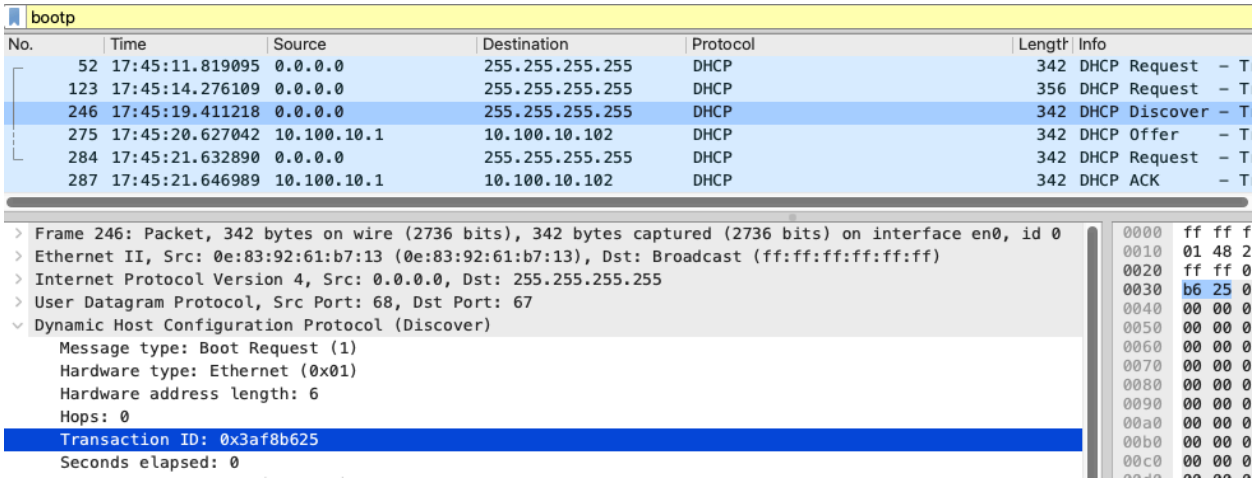


3. **What is the destination IP address used in the datagram containing the Discover message. Is there anything special about this address? Explain.**
   The destination IP address is 255.255.255.255 which is for local broadcasting. Yet my device doesn't know anything other than its MAC address and this is why it is sending discovery messages to everyone on the LAN network to see if there is a server that can give the client an IP address.

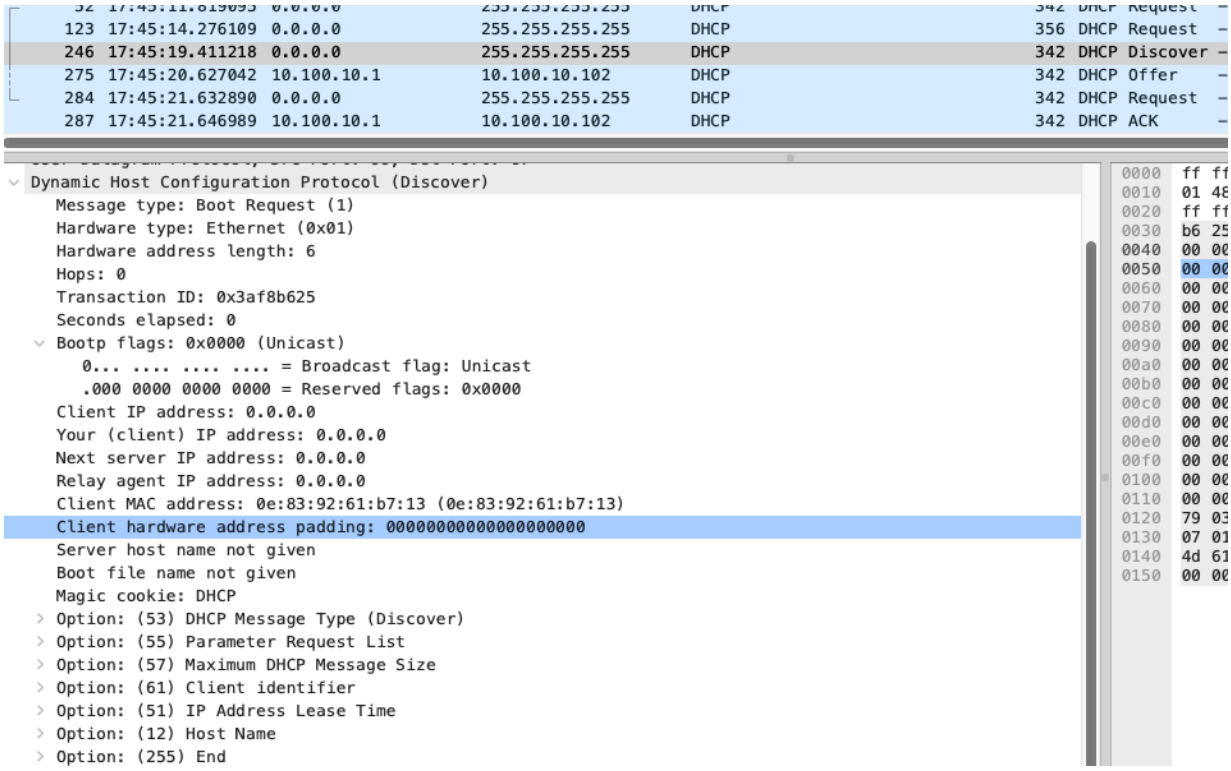


4. **What is the value in the transaction ID field of this DHCP Discover message?**

   The value in the Transaction ID field of the Discover message is **0x3af8b625**. This identifier is used to uniquely match the Discover message with subsequent Offer, Request, and ACK messages within the same DHCP transaction.

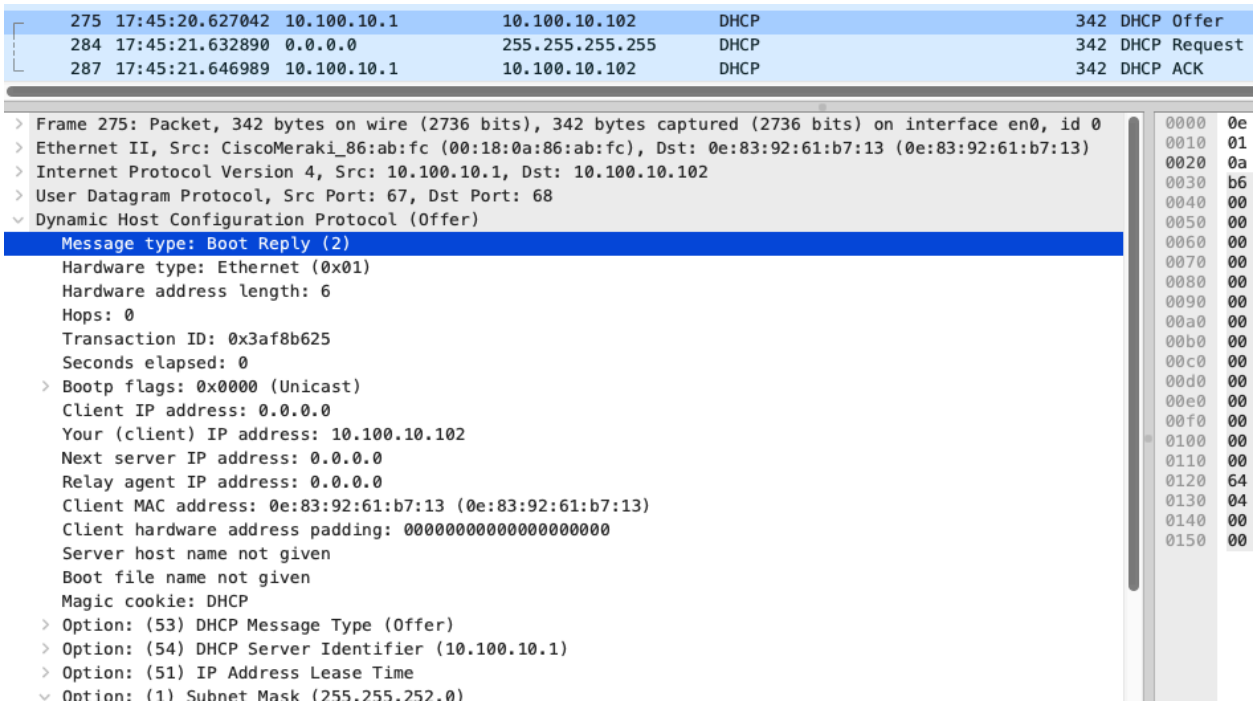


5. **Now inspect the options field in the DHCP Discover message. What are five pieces of information (beyond an IP address) that the client is suggesting or requesting to receive from the DHCP server as part of this DHCP transaction?**
   DHCP Message Type, Parameter Request List, Maximum DHCP Message Size, Client Identifier, IP Address Lease Time, Host Name, End

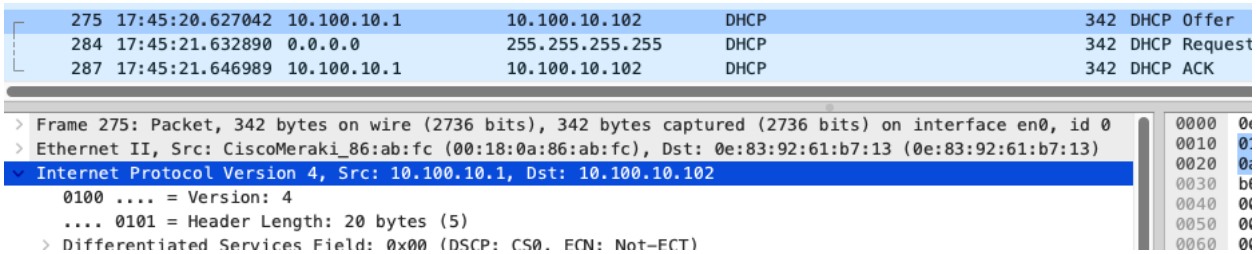


Now let's look at the DHCP Offer message. Locate the IP datagram containing the DHCP Offer message in your trace that was sent by a DHCP server in the response to the DHCP Discover message that you studied in questions 1-5 above.

6. **How do you know that this Offer message is being sent in response to the DHCP Discover message you studied in questions 1-5 above?**
   The message type is noted as Boot Reply and has transaction id identical to the one in the discovery message

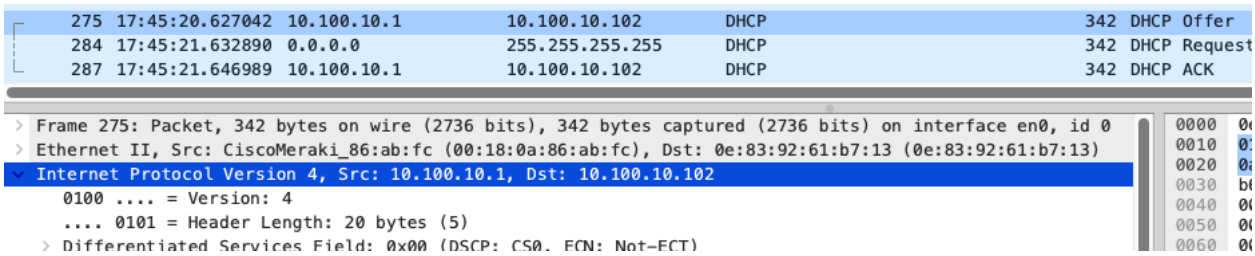


7. **What is the source IP address used in the IP datagram containing the Offer message? Is there anything special about this address? Explain.**
   It is 10.100.10.1 which is sharing the same net id with the offered but not yet assigned IP to the client. The offer comes from a real configured IP address, since the DHCP server already has an assigned address.



8. **What is the destination IP address used in the datagram containing the Offer message? Is there anything special about this address? Explain. [Hint: Look at your trace carefully. The answer to this question may differ from what you see in Figure 4.24 in the textbook. If you really want to dig into this, consult the DHCP RFC, page 24.]**

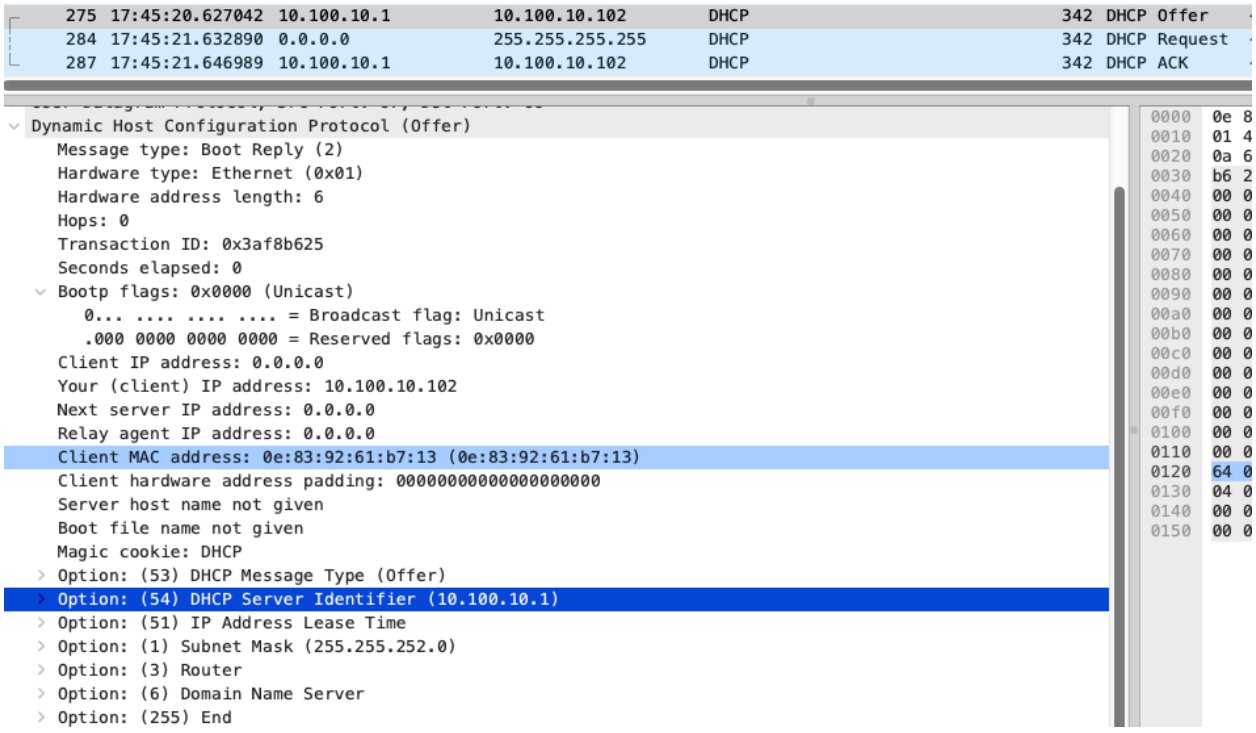
It is 10.100.10.102 . It is the IP address being offered to the client. The client does not yet officially own this IP address. The server is sending the Offer as a unicast instead of a broadcast since in the discovery message, the bootp flags field was set to zero indicating the client is capable of receiving unicast responses.



9. **Now inspect the options field in the DHCP Offer message. What are five pieces of information that the DHCP server is providing to the DHCP client in the DHCP Offer message?**

   Per the image below, the server offers to provide:

   1. DHCP Server Identifier - 10.100.10.1
   2. IP Address Lease Time
   3. Subnet Mask - 255.255.252.0
   4. Router - 10.100.10.1
   5. Domain Name Server (DNS)

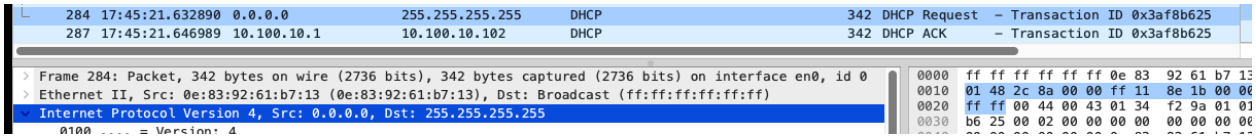


It would appear that once the DHCP Offer message is received, that the client may have all of the information it needs to proceed. However, the client may have received OFFERs from multiple DHCP servers and so a second phase is needed, with two more mandatory messages – the client-to-server DHCP Request message, and the server-to-toclient DHCP ACK message is needed. But at least the client knows there is at least one DHCP server out there! Let's take a look at the DHCP Request message, remembering that although we've already seen a Discover message in our trace, that is not always the case when a DHCP request message is sent. Locate the IP datagram containing the first DHCP Request message in your trace, and answer the following questions.

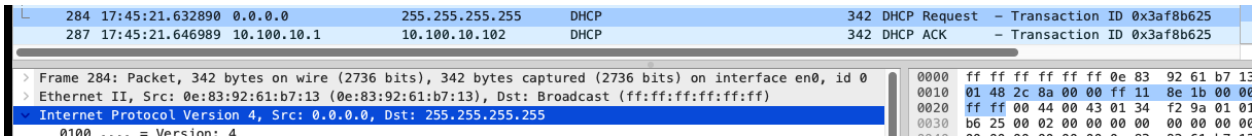
10. **What is the UDP source port number in the IP datagram containing the first DHCP Request message in your trace? What is the UDP destination port number being used?**
    IP datagram contains a UDP segment which is expanded in below snippet
    UDP Source Port (Client)= 68
    UDP Destination Port (Server) = 67

```
Internet Protocol Version 4, Src: 0.0.0.0, Dst: 255.255.255.255
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
  > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 328
    Identification: 0xf4ab (62635)
  v 000. .... = Flags: 0x0
      0... .... = Reserved bit: Not set
      .0.. .... = Don't fragment: Not set
      ..0. .... = More fragments: Not set
    ...0 0000 0000 0000 = Fragment Offset: 0
    Time to Live: 255
    Protocol: UDP (17)
    Header Checksum: 0xc5f9 [validation disabled]
    [Header checksum status: Unverified]
    Source Address: 0.0.0.0
    Destination Address: 255.255.255.255
    [Stream index: 39]
User Datagram Protocol, Src Port: 68, Dst Port: 67
    Source Port: 68
    Destination Port: 67
    Length: 308
```

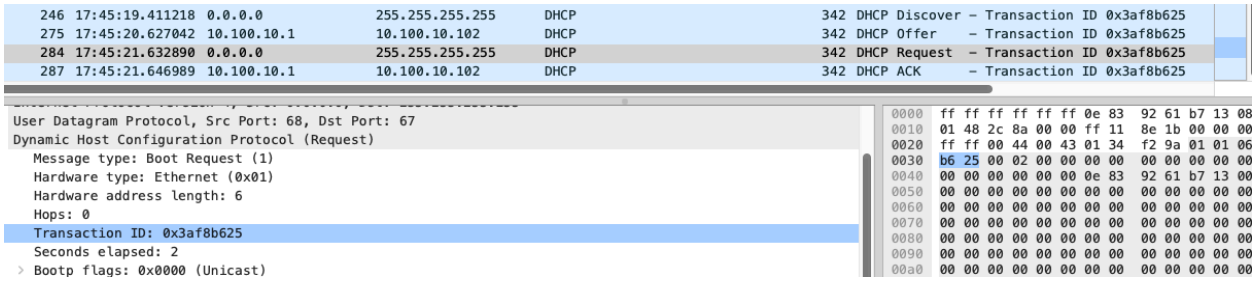
11. **What is the source IP address in the IP datagram containing this Request message? Is there anything special about this address? Explain.**
    It is 0.0.0.0 because the IP address for the client has not been acknowledged/leased by the DHCP server. It gets assigned to the client after it is ACK by the DHCP server.



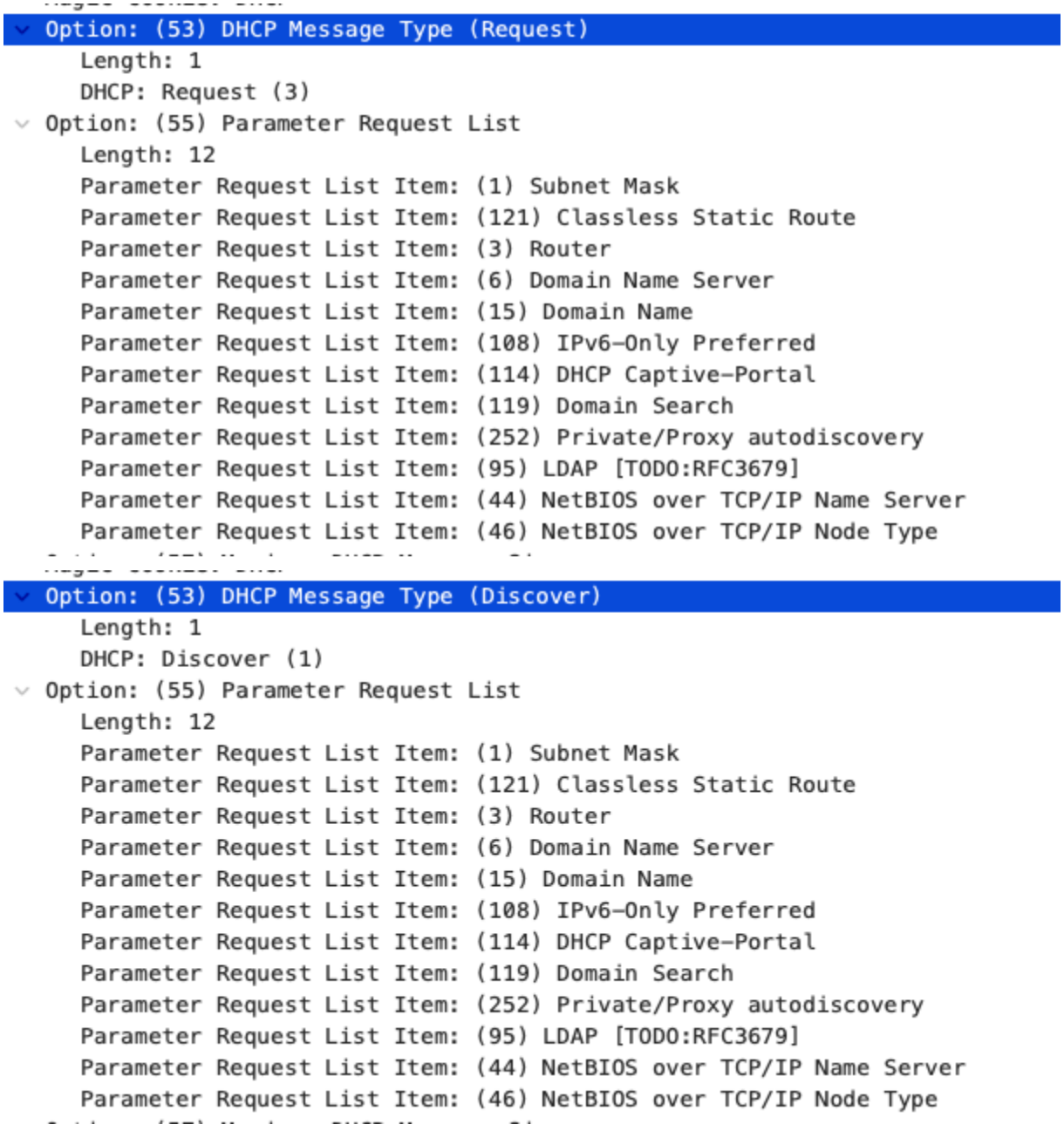
12. **What is the destination IP address used in the datagram containing this Request message. Is there anything special about this address? Explain.**
    It is 255.255.255.255 a local broadcast IP address. The reason is that the client lets the other DHCP servers offering IP addresses know that it rejected their offer.



13. **What is the value in the transaction ID field of this DHCP Request message? Does it match the transaction IDs of the earlier Discover and Offer messages?**
    0x3af8b625 - yes



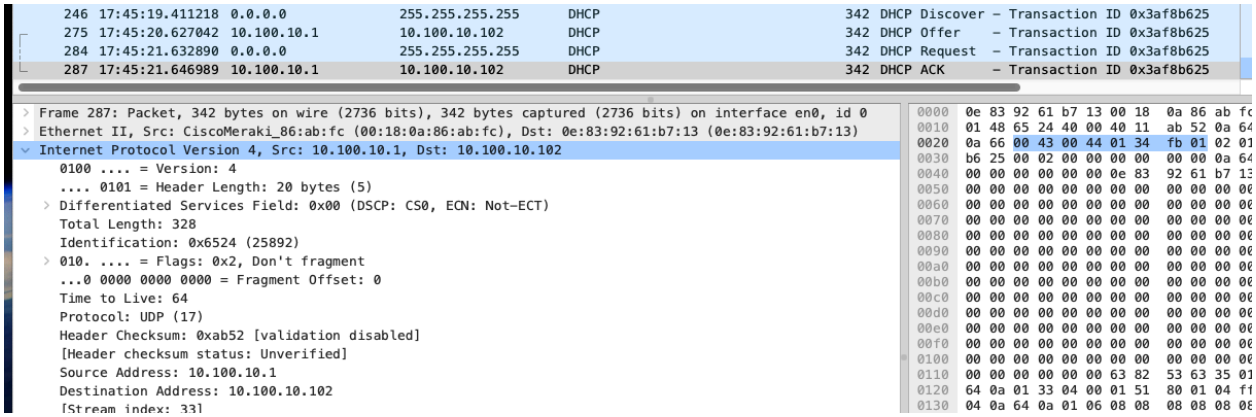
14. **Now inspect the options field in the DHCP Discover message and take a close look at the "Parameter Request List". The DHCP RFC notes that "The client can inform the server which configuration parameters the client is interested in by including the 'parameter request list' option. The data portion of this option explicitly lists the options requested by tag number." What differences do you see between the entries in the 'parameter request list' option in this Request message and the same list option in the earlier Discover message?**
    There is no difference between the Parameter Request List in the DHCP Discover message and the DHCP Request message. The client requests the same set of configuration parameters in both messages.

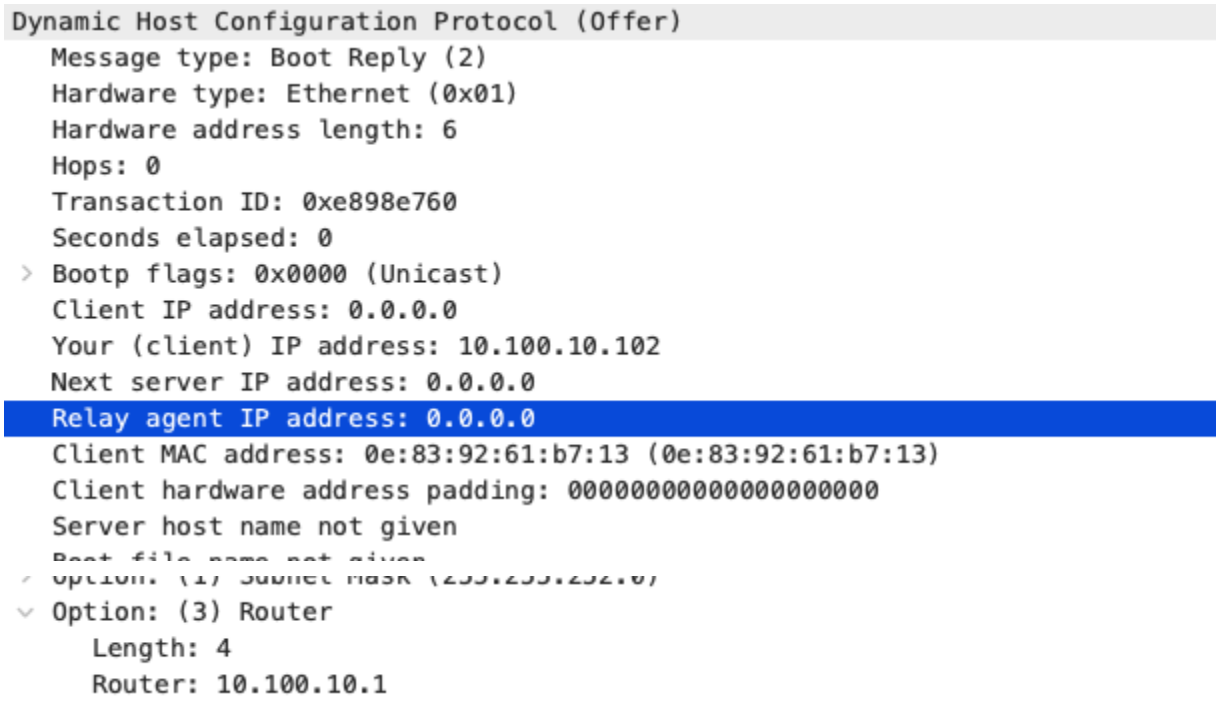


Locate the IP datagram containing the first DHCP ACK message in your trace, and answer the following questions.

15. **What is the source IP address in the IP datagram containing this ACK message? Is there anything special about this address? Explain.**
    The source IP address is 10.100.10.1, which is the DHCP server's IP address. This address is special because it is equal to the DHCP server identifier that assigns the client's IP address and typically represents the router on the local network - the relay agent IP address value is 0.0.0.0 which means the client is talking to the DHCP server

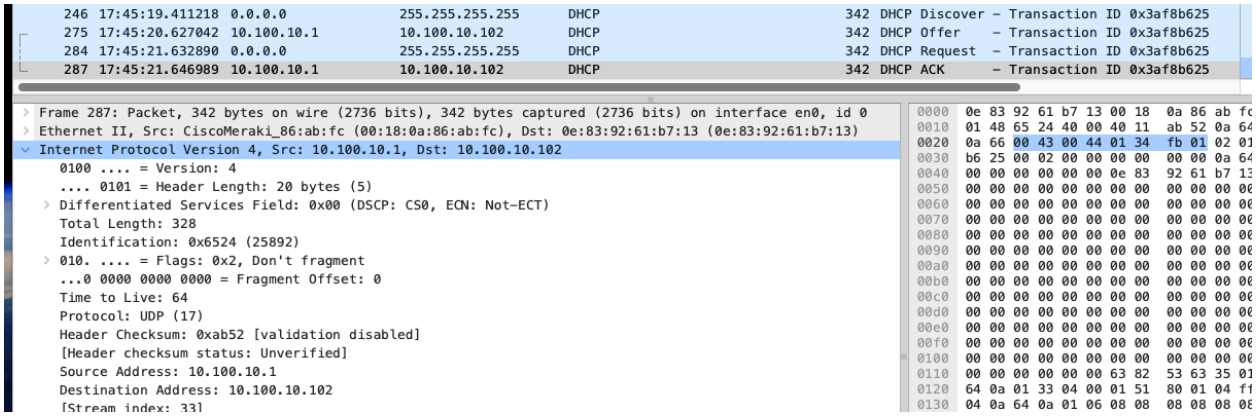
directly - they are on LAN . and the DHCP Server Identifier value is identical to the router's IP address value which means the router and DHCP Server are same device.





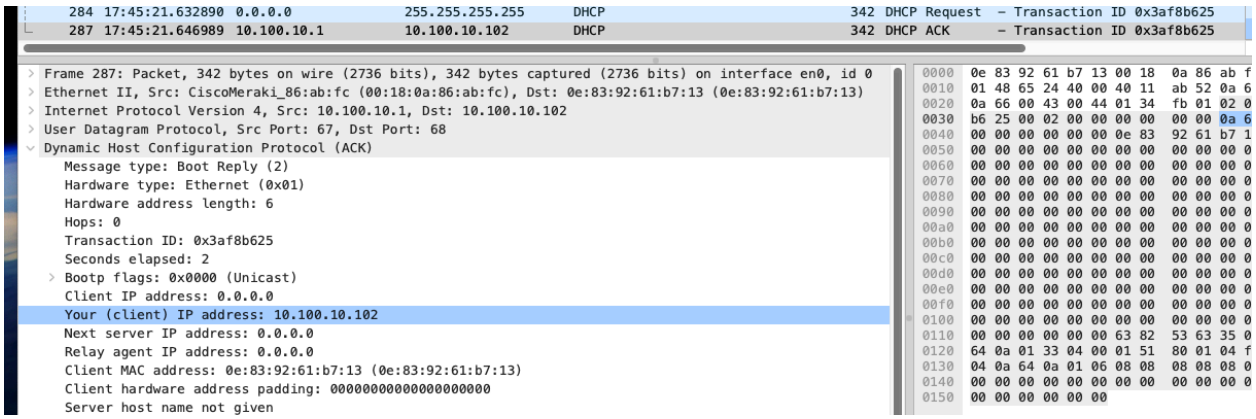
16. What is the destination IP address used in the datagram containing this ACK message. Is there anything special about this address? Explain

The destination IP address is 10.100.10.102, which is the newly assigned IP address of the client; the DHCP server sends the ACK as a unicast to this address, indicating that the client has just been assigned this IP and that the DHCP process has completed successfully.



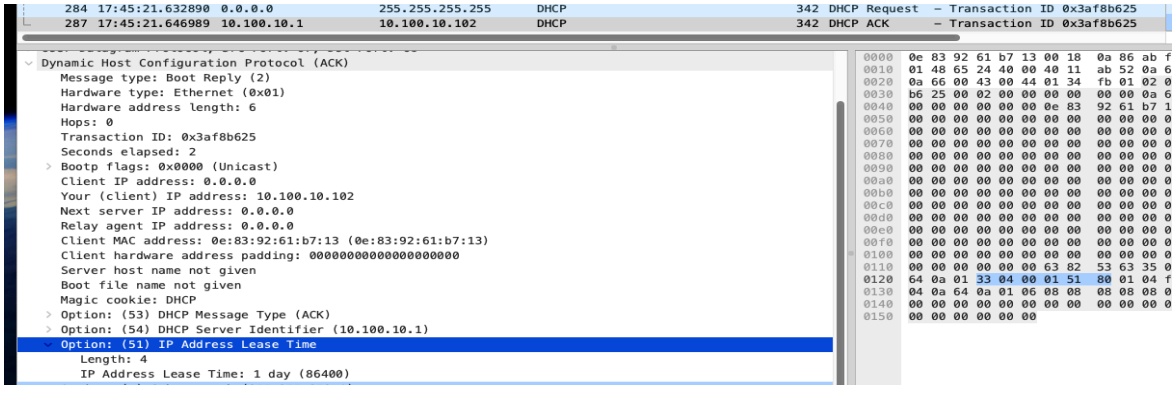
17. What is the name of the field in the DHCP ACK message (as indicated in the Wireshark window) that contains the assigned client IP address?

Your (Client) IP address.



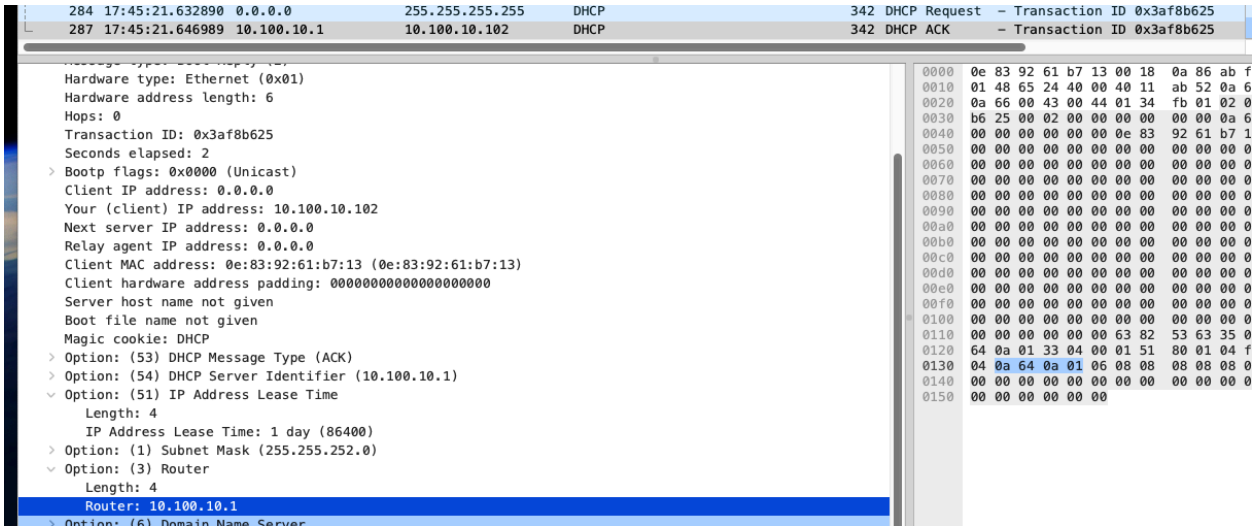
18. For how long a time (the so-called "lease time") has the DHPC server assigned this IP address to the client?

1 Day



19. What is the IP address (returned by the DHCP server to the DHCP client in this DHCP ACK message) of the first-hop router on the default path from the client to the rest of the Internet?

Router: 10.100.10.1



Conclusion

This lab provided a detailed examination of the Dynamic Host Configuration Protocol (DHCP) through packet analysis using Wireshark. By observing the complete four-step DHCP process - Discover, Offer, Request, and ACK - the interaction between the client and server was analyzed across multiple protocol layers, including IP and UDP. The lab reinforced the understanding that DHCP operates over UDP, uses broadcast communication when the client has no assigned IP address, and relies on a transaction ID to correctly associate messages within the same exchange.

Through inspection of the DHCP options fields, key configuration parameters provided by the server were identified, including the assigned IP address, subnet mask, default gateway (router), DNS server, lease time, and DHCP server identifier. The analysis also emphasized the importance of the broadcast flag behavior and the relay agent IP address field in determining whether the DHCP server is on the same local network as the client. In this trace, the value was 0.0.0.0, confirming that no relay agent was involved and that the client and DHCP server were on the same LAN.

Additionally, the distinction between the DHCP Server Identifier (Option 54) and the Router option (Option 3) was examined to determine whether the DHCP server and the default gateway were the same device. Since both options contained the same IP address, it was concluded that the router and DHCP server were operating on the same device in this network configuration.

Wireshark proved to be an effective and powerful tool for protocol analysis. Its layered packet visualization made it possible to observe encapsulation across Ethernet, IP, UDP, and DHCP, and its detailed decoding of protocol fields simplified interpretation of complex packet structures. The ability to filter traffic and inspect individual fields allowed precise correlation of messages within the DHCP exchange. However, the tool requires careful attention to detail and a strong understanding of protocol layering to avoid misinterpretation.

Overall, this lab strengthened understanding of DHCP message structure, protocol encapsulation, automatic IP configuration, and practical methods for analyzing network topology using DHCP packet fields.