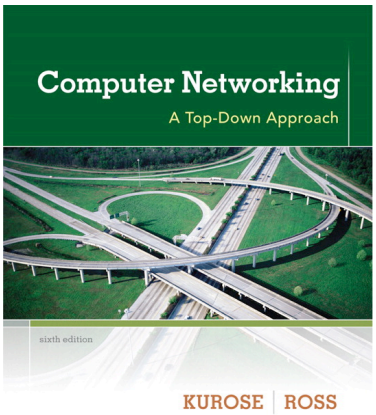
# Wireshark Lab: DHCP v6.0

Supplement to *Computer Networking: A Top-Down Approach, 6th ed.,* J.F. Kurose and K.W. Ross




*"Tell me and I forget. Show me and I remember. Involve me and I understand."* Chinese proverb



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I have modified this lab so that at HMC we can do some DHCP investigation. Tim plans to be in the lab, so hopefully this will all work… If not, well we tried…

Recall that DHCP is used extensively in corporate, university and home-network wired and wireless LANs to dynamically assign IP addresses to hosts (as well as to configure other network configuration information).

This lab is brief, as we'll only examine the DHCP packets captured by a host. If you also have administrative access to your DHCP server (not likely) you may want to repeat this lab after making some configuration changes (such as the lease time). If you have a router at home, you most likely can configure your DHCP server. Because many linux/Unix machines (especially those that serve many users) have a static IP address and because manipulating DHCP on such machines typically requires super-user privileges, we'll only present a Windows version of this lab below. For HMC this is where Tim comes in…

## DHCP Experiment for Windows.

In order to observe DHCP in action, we'll perform several DHCP-related commands and capture the DHCP messages exchanged as a result of executing these commands. Do the following[1]:

1. Begin by opening the Windows Command Prompt application (which can be found in your Accessories folder). As shown in Figure 1, enter "*ipconfig /release*". The executable for *ipconfig* is in C:\windows\system32. This

[1] If you are unable to run Wireshark live on a computer, you can download the zip file http://gaia.cs.umass.edu/wireshark-labs/wireshark-traces.zip and extract the file *dhcp-ethereal-trace-1*. The traces in this zip file were collected by Wireshark running on one of the author's computers, while performing the steps indicated in the Wireshark lab. Once you have downloaded the trace, you can load it into Wireshark and view the trace using the *File* pull down menu, choosing *Open*, and then selecting the dhcp-ethereal-trace-1 trace file. You can then use this trace file to answer the questions below. If the HMC lab goes south, you can try this…

command releases your current IP address, so that your host's IP address becomes 0.0.0.0.

2. Start up the Wireshark packet sniffer, as described in the introductory Wireshark lab and begin Wireshark packet capture.
3. Now go back to the Windows Command Prompt and enter "*ipconfig /renew*". This instructs your host to obtain a network configuration, including a new IP address. In Figure 1, the host obtains the IP address 192.168.1.108
4. Wait until the "*ipconfig /renew*" has terminated. Then enter the same command "*ipconfig /renew*" again.
5. When the second *"ipconfig /renew"* terminates, enter the command "ipconfig/release" to release the previously-allocated IP address to your computer.
6. Finally, enter "*ipconfig /renew*" to again be allocated an IP address for your computer.
7. Stop Wireshark packet capture.

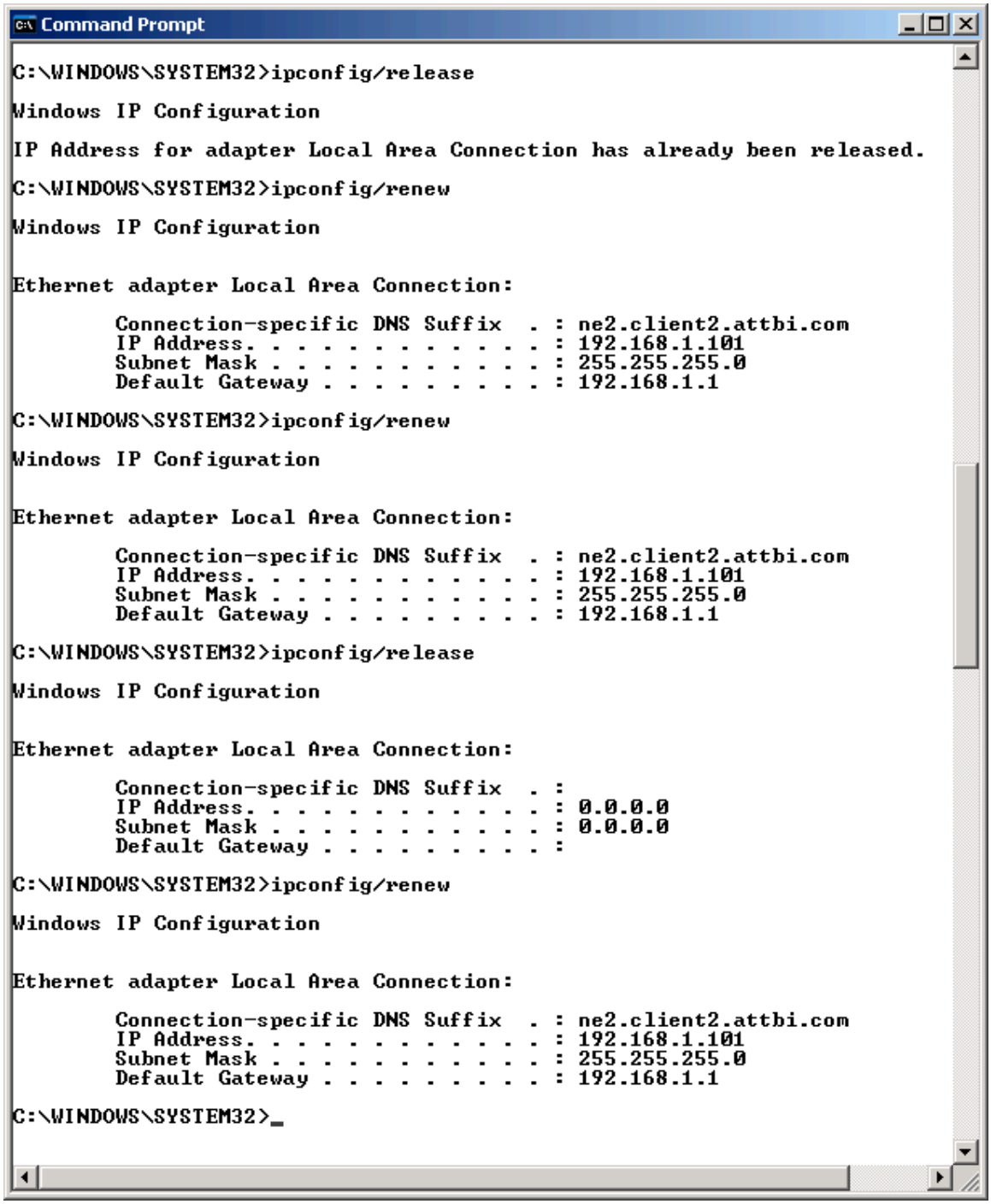


**Figure 1** Command Prompt window showing sequence of *ipconfig* commands that you should enter.

Now let's take a look at the resulting Wireshark window. To see only the DHCP packets, enter into the filter field "bootp". (DHCP derives from an older protocol called BOOTP. Both BOOTP and DHCP use the same port numbers, 67 and 68. To see DHCP packets in the current version of Wireshark, you need to enter "bootp" and not "dhcp" in the filter.) We see from Figure 2 that the first *ipconfig* renew command caused four DHCP packets to be generated: a DHCP Discover packet, a DHCP Offer packet, a DHCP Request packet, and a DHCP ACK packet.

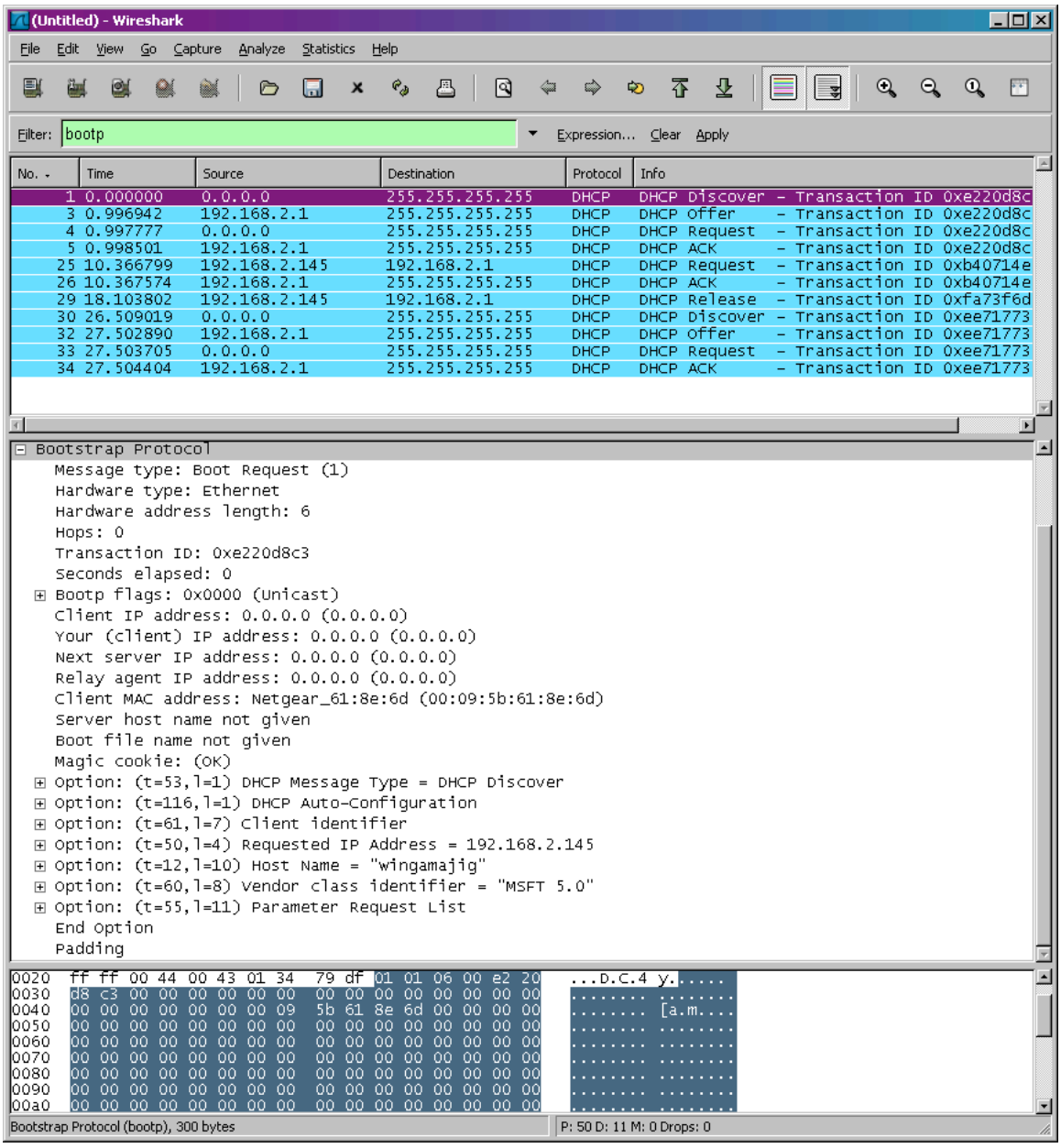


**Figure 2** Wireshark window with first DHCP packet – the DHCP Discover packet – expanded.

## DHCP at HMC:

Mac instructions:

Determine the name of your Wi-Fi interface by running “ifconfig” and seeing which interface is configured. If your Mac has a built-in ethernet port then the Wi-Fi is probably “en1”. If your Mac doesn’t have ethernet then the Wi-Fi is probably named “en0”.  Modify the commands below as needed.

1. sudo ipconfig set en1 none
2. Start a Wireshark packet capture on the Wi-Fi interface.
3. sudo ipconfig set en1 dhcp
4. echo "add State:/Network/Interface/en1/RefreshConfiguration temporary" | sudo scutil
5. sudo ipconfig set en1 none
6. sudo Ipconfig set en1 dhcp
7. Stop the Wireshark packet capture.

For Linux users it will depend which distribution is running; different ones use different DHCP clients. (And some have switched DHCP clients a few times.)

Users probably do not have permission to renew the DHCP lease on the lab Macs, although ITim could always do it for them.

Unless Tim forces a few machines to renew their leases there will not be much DHCP traffic to see (aside from a few unknown machines repeatedly sending out Discover request and not getting any response) as our leases on VLAN 42 are set to last a week.

Since Tim plans to be around he has volunteered to go around to each machine and renew the lease on each of them while students watch the results.

It might also be interesting to view DHCPv6,. The Wireshark filter for it is “dhcpv6”. It’s similar to DHCPv4 but it’s a lot cleaner because it was designed from scratch and isn’t built on top of BOOTP. Again Tim will have to force the lease renewal, but it’s pretty easy.

## What to Hand In:

If this works at HMC, I think you can hand in most of this. In any case do what you can and DOCUMENT what you did…

You should hand in a screen shot of the Command Prompt window similar to Figure 1 above. Whenever possible, when answering a question below, you should hand in a printout of the packet(s) within the trace that you used to answer the question asked. Annotate the printout[2] to explain your answer. To print a packet, use *File->Print*, choose *Selected packet only*, choose *Packet summary line,* and select the minimum amount of packet detail that you need to answer the question.

Answer the following questions:

1. Are DHCP messages sent over UDP or TCP?
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?
3. What is the link-layer (e.g., Ethernet) address of your host?
4. What values in the DHCP discover message differentiate this message from the DHCP request message?
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?
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.
7. What is the IP address of your DHCP server?
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.
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?

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[2] What do we mean by "annotate"? If you hand in a paper copy, please highlight where in the printout you've found the answer and add some text (preferably with a colored pen) noting what you found in what you 've highlight. If you hand in an electronic copy, it would be great if you could also highlight and annotate.

10. Explain the purpose of the router and subnet mask lines in the DHCP offer message.
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?
12. Explain the purpose of the lease time. How long is the lease time in your experiment?
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?
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.