CS315: Lab Assignment 6

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1 Wireshark UDP

First, let's capture the packet trace of a DNS request and response, since these utilize UDP (User Datagram Protocol) at the Transport Layer. Below is a screenshot of the obtained UDP segments, and also an image of the nslookup result, after which we'll answer some questions.

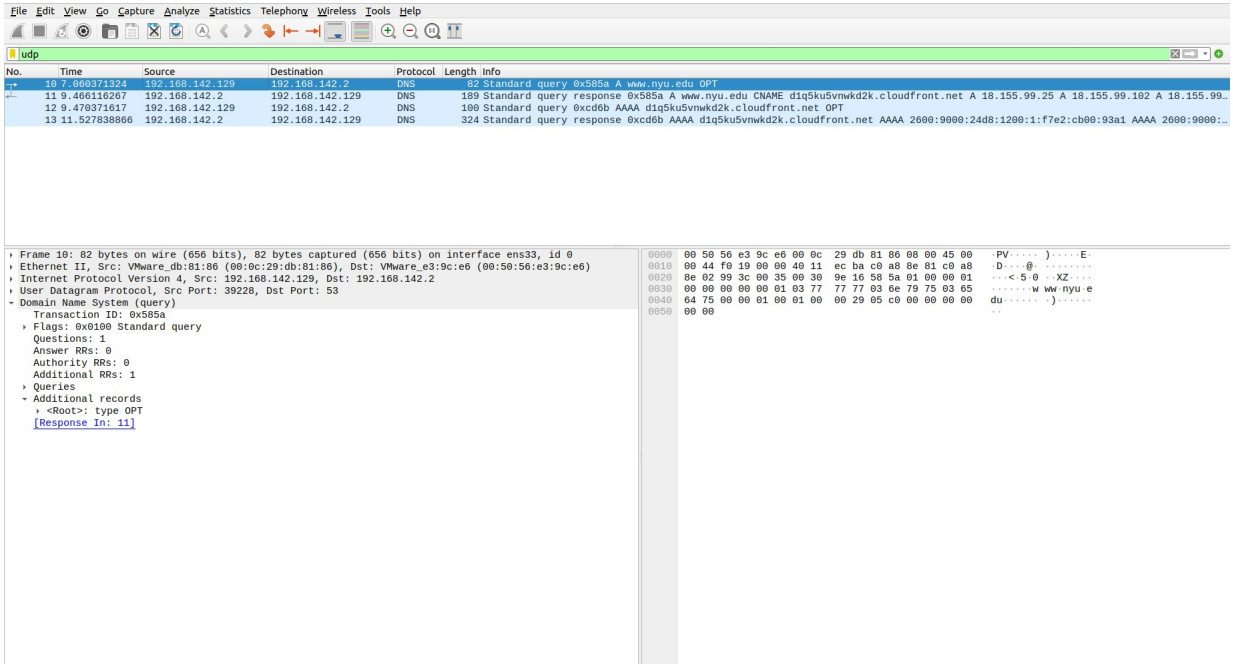

Figure 1: Captured Packet Trace

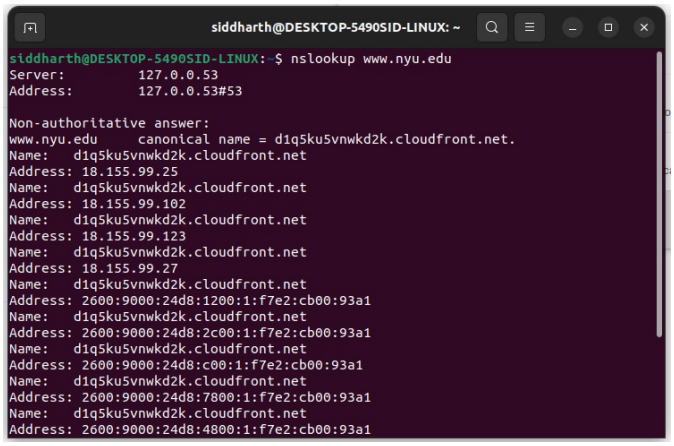

Figure 2: nslookup

(1) Select the first UDP segment in your trace. What is the packet number of this segment in the trace file? What type of application-layer protocol message is being carried in this UDP segment? How many fields are there in the UDP header? What are the names of these fields?

Below is the image of the packet details pane, for the first UDP segment that appears in the trace. Here are some important observations from Figure (3), that answer this question:

- Packet number of this segment in the trace file is **10**.
- This UDP segment carries a message of the DNS (Domain Name System) Application-layer Protocol. More specifically, it is a **DNS Request**.
- The UDP Header has **four** fields, namely:
  1. Source Port
  2. Destination Port
  3. Length
  4. Checksum

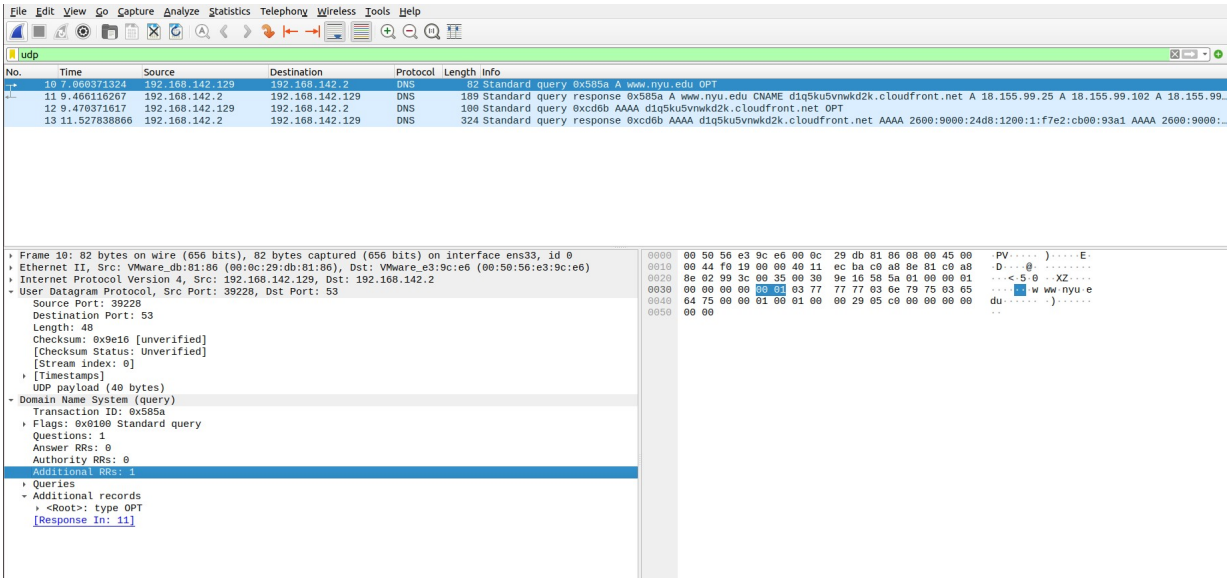

Figure 3: Packet details of first UDP segment

(2) By consulting the displayed information in Wireshark's packet content field for this packet, what is the length (in bytes) of each of the UDP header fields?

From Figure (3), we observe that the UDP header fields (source port, destination port, length, checksum) are of size **2 Bytes each**. Hence, in total, the size of the UDP header is 8 Bytes. The same can be verified by selecting a header field and seeing the number of highlighted hex numbers in the raw data pane.

(3) The value in the Length field is the length of what? Verify your claim with your captured UDP packet.

The value in the Length field is the length of the **full UDP segment**.
Note: Another way to deduce that the header is 8 bytes, is by seeing that the Length field contains 48, and that the UDP Payload size is visible as 40. Hence, the size of the UDP header is $48 - 40 = 8$ bytes. This also verifies the above-mentioned claim.

(4) What is the maximum number of bytes that can be included in a UDP payload?

Since the length field is of 2 bytes (16 bits), it can take values from 0 to $2^{16} - 1$. So, maximum length of a UDP data segment is 65535. However, since 8 Bytes would be taken up by the UDP Header, the maximum number of bytes that can be included in a UDP payload will be: $65535 - 8 =$ **65527 Bytes**.

(5) What is the largest possible source port number?

Since the source port number has 2 bytes allotted to it, it can take values from 0 to $2^{16} - 1$. So, largest possible source port number is **65535**.

(6) What is the protocol number for UDP? Give your answer in decimal notation.

As seen in the packet details pane, in the Protocol field of the IP Datagram section containing the UDP segment, the protocol number for UDP is **17**. (Refer to Figure (4).)

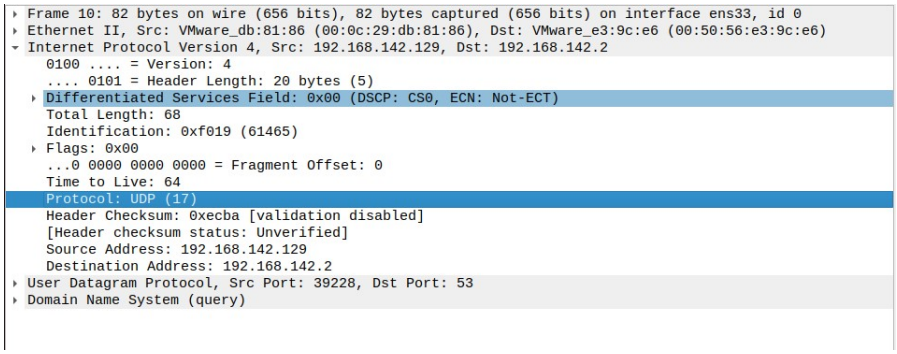

Figure 4: Packet details of first UDP segment

(7) Examine the first pair of UDP packets. What is the packet number of the first of these two UDP segments in the trace file? What is the packet number of the second (reply) of these two UDP segments in the trace file? Describe the relationship between the port numbers in the two packets.

Based on Figure (1), we can observe that:

- First UDP packet has packet number **10**.
- Second UDP packet has packet number **11**.

Note that, as per Figure (1), the source port of the first UDP packet is 39228 and its destination port is 53. Meanwhile, as per Figure (5), the second UDP packet has source port 53 and destination port 39928.

Hence, the source port of the first UDP packet (sent by the host) is the same as the destination port of the second UDP packet (sent by the DNS server as a response). Also, the destination port of the first UDP packet is the same as the source port of the second UDP packet.

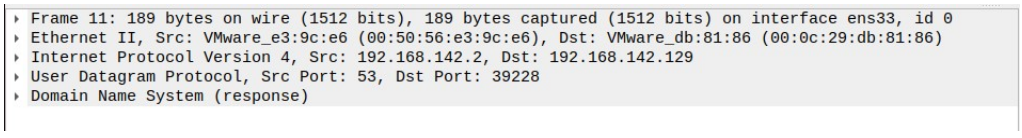

Figure 5: Packet details of second UDP segment

2 Socket Programming

For this part, the files included are: `200010003_server.py` and `200010003_client.py` .

3 Socket Programming: Web Server

For this part, the files included are: `HelloWorld.html` and `200010003_webserver.py`