Lab 1: Packet analysis at application layer using Wireshark

SCSR1213 Network Communications

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Section : 02

Objective:

1. Understanding of network protocols by observing the sequence of messages exchanged between two protocol entities, delving down into the details of protocol operation, and causing protocols to perform certain actions and then observing these actions and their consequences.

2. To introduce student with Wireshark software tool for packet analyzer.

3. To analyze protocol used in application layer such as http and dns.

Reference material: Computer Networking: A Top-Down Approach, 7th ed., J.F. Kurose and K.W. Ross.

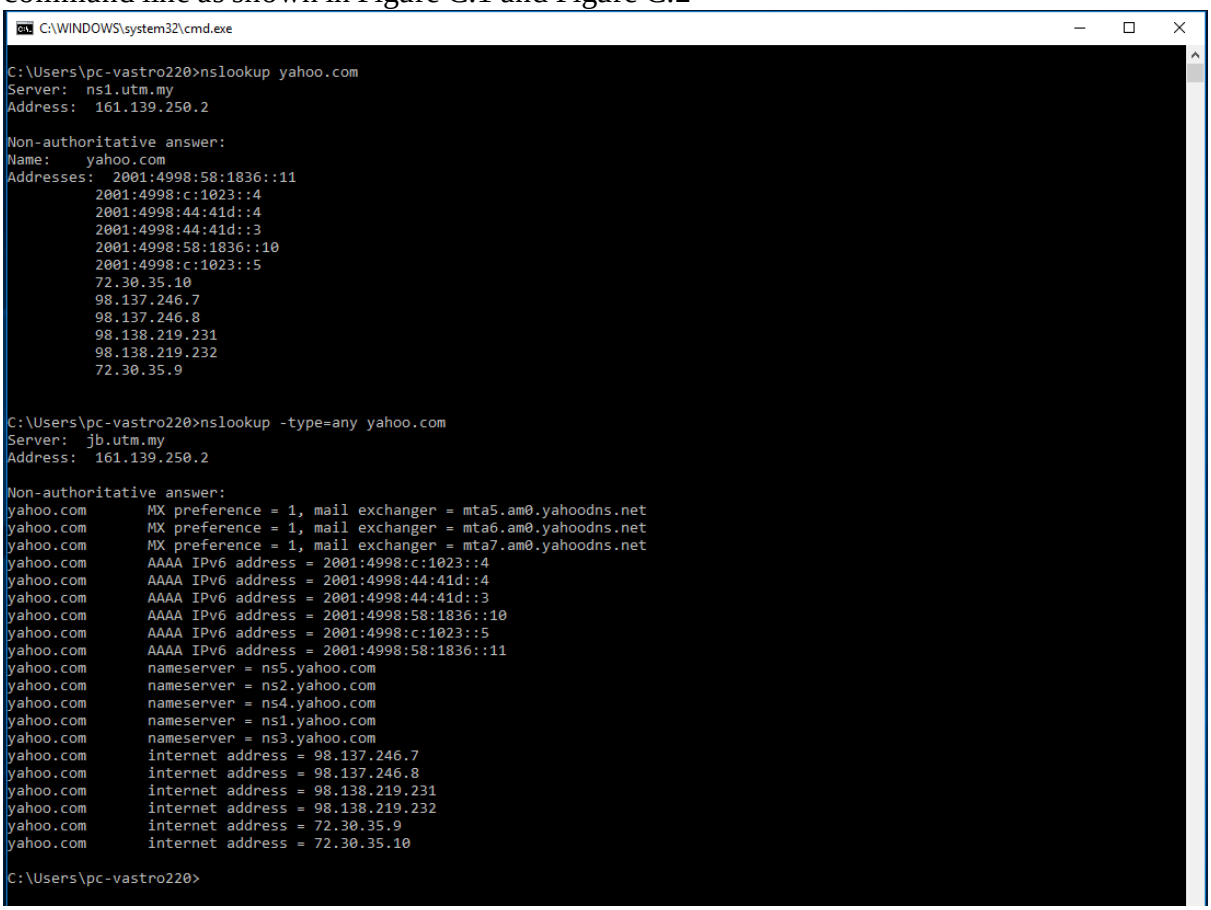
Mark

PART C: DNS Trace

1.0 nslookup

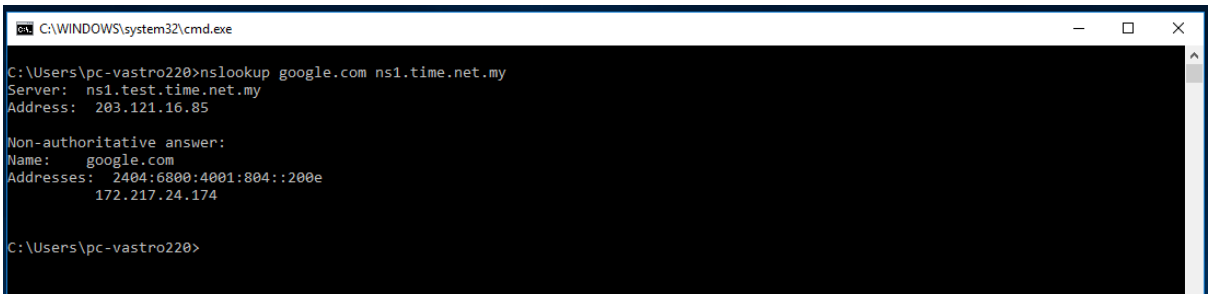
nslookup tool allows the host running the tool to query any specified DNS server for a DNS record. The queried DNS server can be a root DNS server, a top-level-domain DNS server, an authoritative DNS server, or an intermediate DNS server. To accomplish this task, nslookup sends a DNS query to the specified DNS server, receives a DNS reply from that same DNS server, and displays the result.

- To run it in Windows, open the Command Prompt (cmd) and run nslookup on the command line as shown in Figure C.1 and Figure C.2



```
C:\WINDOWS\system32\cmd.exe

C:\Users\pc-vastro220>nslookup yahoo.com
Server:  ns1.utm.my
Address:  161.139.250.2

Non-authoritative answer:
Name:    yahoo.com
Addresses:  2001:4998:58:1836::11
          2001:4998:c:1023::4
          2001:4998:44:41d::4
          2001:4998:44:41d::3
          2001:4998:58:1836::10
          2001:4998:c:1023::5
          72.30.35.10
          98.137.246.7
          98.137.246.8
          98.138.219.231
          98.138.219.232
          72.30.35.9


C:\Users\pc-vastro220>nslookup -type=any yahoo.com
Server:  jb.utm.my
Address:  161.139.250.2

Non-authoritative answer:
yahoo.com       MX preference = 1, mail exchanger = mta5.am0.yahoodns.net
yahoo.com       MX preference = 1, mail exchanger = mta6.am0.yahoodns.net
yahoo.com       MX preference = 1, mail exchanger = mta7.am0.yahoodns.net
yahoo.com       AAAA IPv6 address = 2001:4998:c:1023::4
yahoo.com       AAAA IPv6 address = 2001:4998:44:41d::4
yahoo.com       AAAA IPv6 address = 2001:4998:44:41d::3
yahoo.com       AAAA IPv6 address = 2001:4998:58:1836::10
yahoo.com       AAAA IPv6 address = 2001:4998:c:1023::5
yahoo.com       AAAA IPv6 address = 2001:4998:58:1836::11
yahoo.com       nameserver = ns5.yahoo.com
yahoo.com       nameserver = ns2.yahoo.com
yahoo.com       nameserver = ns4.yahoo.com
yahoo.com       nameserver = ns1.yahoo.com
yahoo.com       nameserver = ns3.yahoo.com
yahoo.com       internet address = 98.137.246.7
yahoo.com       internet address = 98.137.246.8
yahoo.com       internet address = 98.138.219.231
yahoo.com       internet address = 98.138.219.232
yahoo.com       internet address = 72.30.35.9
yahoo.com       internet address = 72.30.35.10

C:\Users\pc-vastro220>
```

Figure C.1: nslookup result



```
C:\WINDOWS\system32\cmd.exe

C:\Users\pc-vastro220>nslookup google.com ns1.time.net.my
Server:  ns1.test.time.net.my
Address:  203.121.16.85

Non-authoritative answer:
Name:    google.com
Addresses:  2404:6800:4001:804::200e
          172.217.24.174


C:\Users\pc-vastro220>
```

Figure C.2: nslookup result

1. Run nslookup to obtain the IP address of a www.microsoft.com server. What is the IP address of that server? Add screenshot to your answer.

```
C:\Users\USER>nslookup microsoft.com
Server:  RT-AC68U-1DD0
Address:  192.168.1.1
```

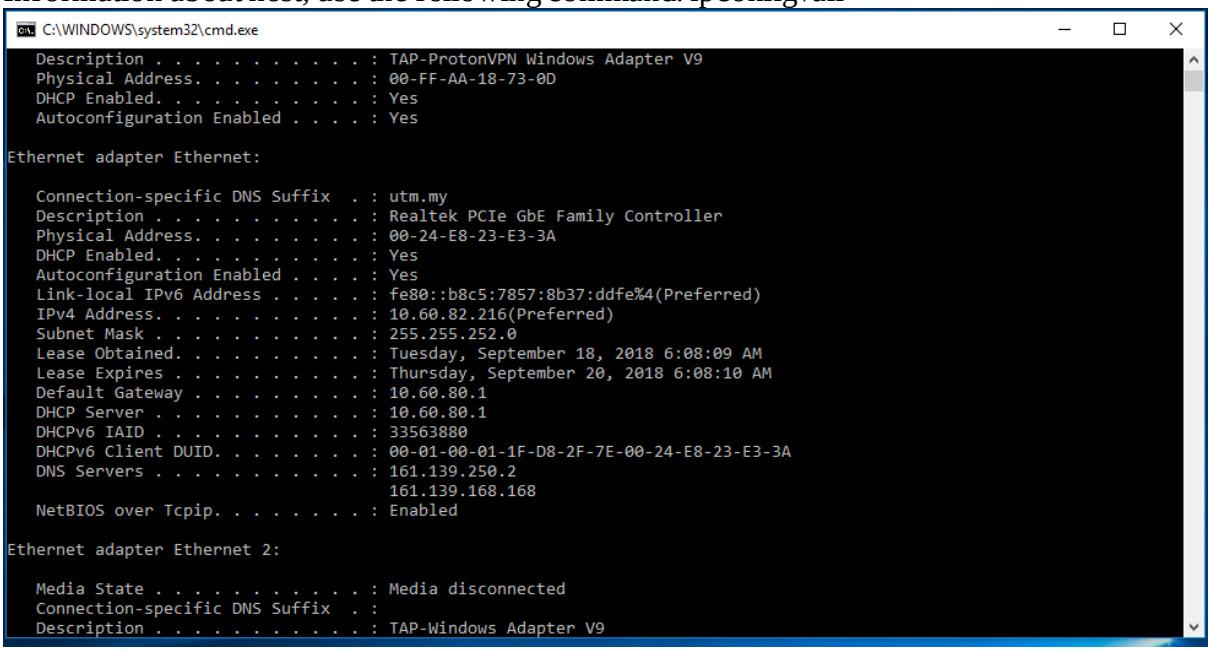
2. Run nslookup to determine the non-authoritative DNS servers for domain microsoft.com. Add screenshot to your answer.

```
Non-authoritative answer:
Name:    microsoft.com
Addresses:  13.77.161.179
          104.215.148.63
          40.76.4.15
          40.112.72.205
          40.113.200.201
```

2.0 ipconfig

ipconfig can be used to show your current TCP/IP information, including your address, DNS server addresses, adapter type and so on.

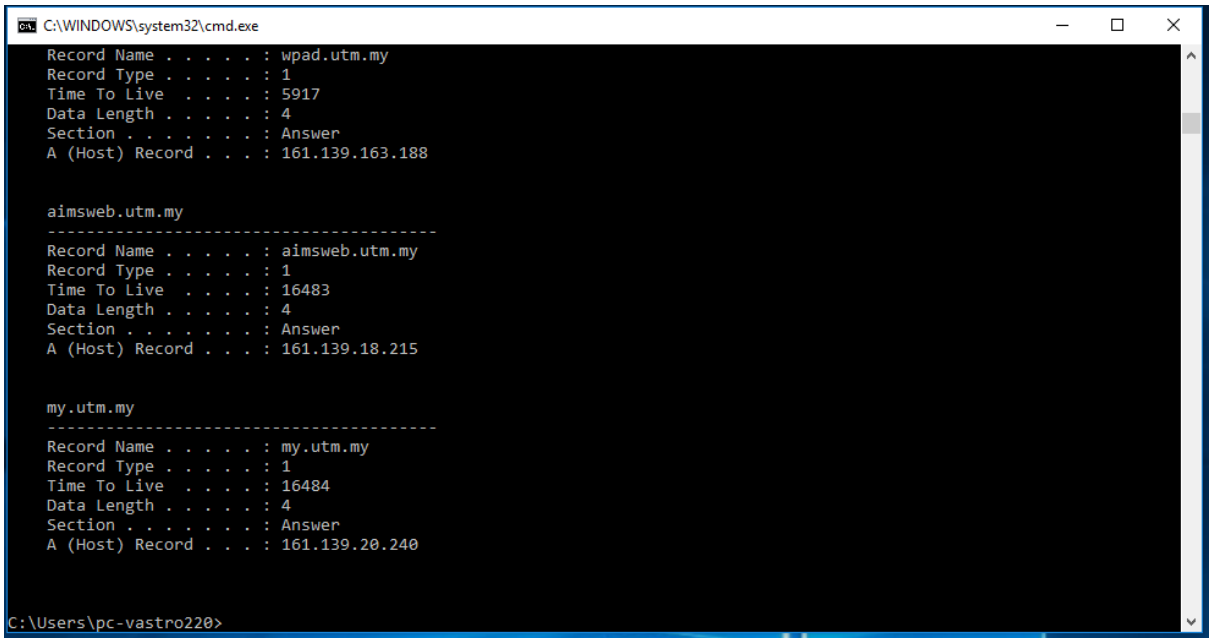
- Information about host, use the following command: ipconfig /all



```
C:\WINDOWS\system32\cmd.exe
   Description . . . . . . . . . . . : TAP-ProtonVPN Windows Adapter V9
   Physical Address. . . . . . . . . : 00-FF-AA-18-73-0D
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes

Ethernet adapter Ethernet:

   Connection-specific DNS Suffix  . : utm.my
   Description . . . . . . . . . . . : Realtek PCIe GbE Family Controller
   Physical Address. . . . . . . . . : 00-24-E8-23-E3-3A
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::b8c5:7857:8b37:ddfe%4(Preferred)
   IPv4 Address. . . . . . . . . . . : 10.60.82.216(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.252.0
   Lease Obtained. . . . . . . . . . : Tuesday, September 18, 2018 6:08:09 AM
   Lease Expires . . . . . . . . . . : Thursday, September 20, 2018 6:08:10 AM
   Default Gateway . . . . . . . . . : 10.60.80.1
   DHCP Server . . . . . . . . . . . : 10.60.80.1
   DHCPv6 IAID . . . . . . . . . . . : 33563880
   DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-1F-D8-2F-7E-00-24-E8-23-E3-3A
   DNS Servers . . . . . . . . . . . : 161.139.250.2
                                       161.139.168.168
   NetBIOS over Tcpip. . . . . . . . : Enabled

Ethernet adapter Ethernet 2:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
   Description . . . . . . . . . . . : TAP-Windows Adapter V9
```

Figure C.3: ipconfig /all result

- ipconfig is also very useful for managing the DNS information stored in your host. Each entry shows the remaining Time to Live (TTL) in seconds.
  Command: ipconfig /displaydns



```
C:\WINDOWS\system32\cmd.exe
    Record Name . . . . . : wpad.utm.my
    Record Type . . . . . : 1
    Time To Live  . . . . : 5917
    Data Length . . . . . : 4
    Section . . . . . . . : Answer
    A (Host) Record . . . : 161.139.163.188


    aimsweb.utm.my
    ----------------------------------------
    Record Name . . . . . : aimsweb.utm.my
    Record Type . . . . . : 1
    Time To Live  . . . . : 16483
    Data Length . . . . . : 4
    Section . . . . . . . : Answer
    A (Host) Record . . . : 161.139.18.215


    my.utm.my
    ----------------------------------------
    Record Name . . . . . : my.utm.my
    Record Type . . . . . : 1
    Time To Live  . . . . : 16484
    Data Length . . . . . : 4
    Section . . . . . . . : Answer
    A (Host) Record . . . : 161.139.20.240


C:\Users\pc-vastro220>
```

Figure C.4: ipconfig /displaydns result

- Flushing the DNS cache clears all entries and reloads the entries from the hosts file.

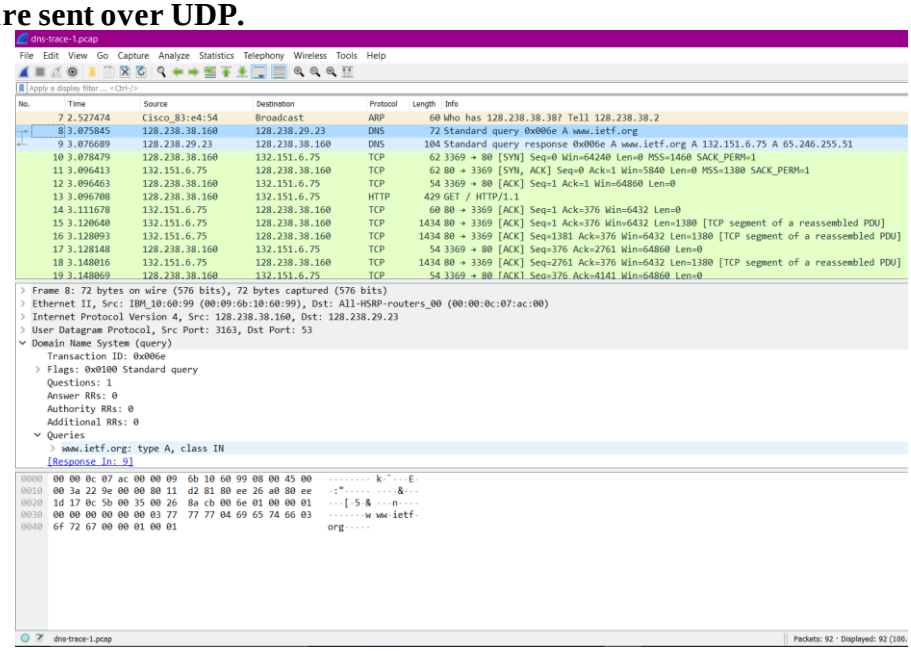
Command: ipconfig /flushdns

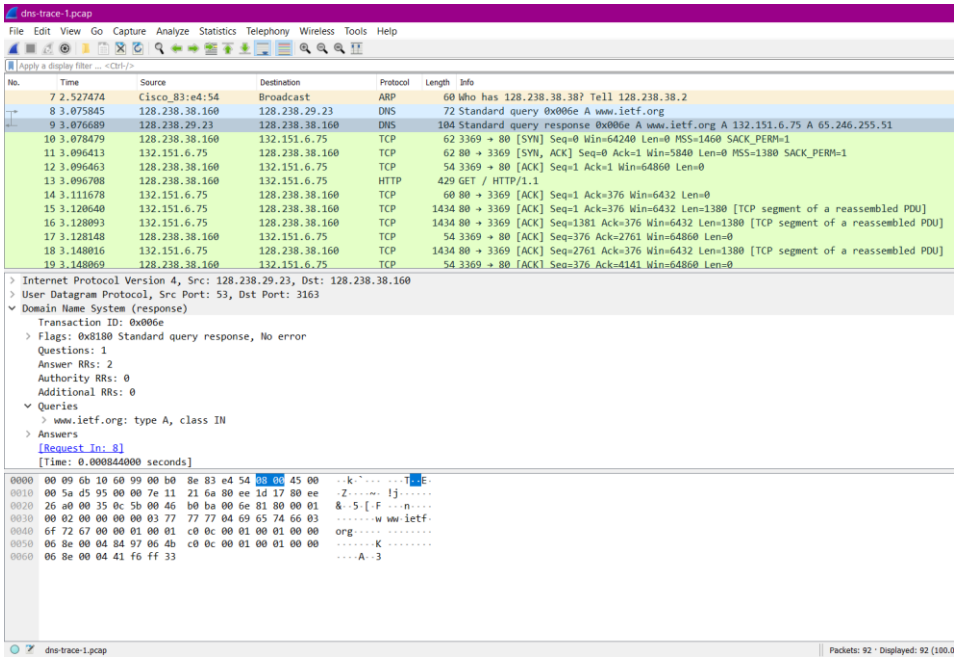
Figure C.5: ipconfig /flushdns result

3.0 Tracing DNS with Wireshark

- Open packet trace file dns-trace-1. Answer the following questions.

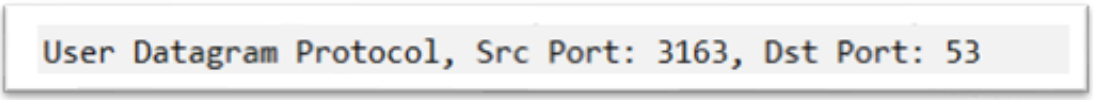
1. Locate the DNS query and response messages. Are then sent over UDP or TCP? Add screenshots in your answer.
   They are sent over UDP.

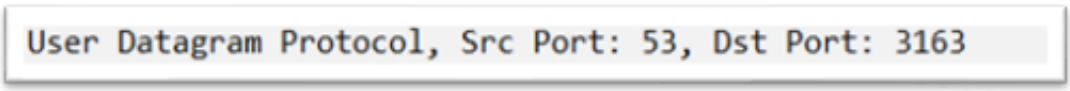




2. What is the destination port for the DNS query message? What is the source port of DNS response message? Add screenshots in your answer.

   The source port of DNS response message is 53.





3. To what IP address is the DNS query message sent? Add screenshots in your answer.
   The IP address is 192.168.1.148

```
indows IP Configuration


thernet adapter Ethernet:

   Media State . . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

ireless LAN adapter Local Area Connection* 1:

   Media State . . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

ireless LAN adapter Local Area Connection* 2:

   Media State . . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

ireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::7c97:78e2:f43f:13f7%7
   IPv4 Address. . . . . . . . . . . : 192.168.1.148
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : 192.168.1.1

thernet adapter Ethernet 4:

   Media State . . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
```

4. Examine the DNS query message. What "Type" of DNS query is it? Does the query message contain any "answers"? Add screenshots in your answer.
   Type A and it does not contain any answers.

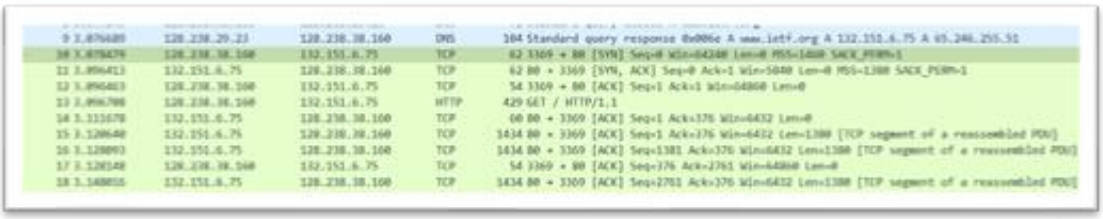
```
    Transaction ID: 0x006e
  > Flags: 0x0100 Standard query
    Questions: 1
    Answer RRs: 0
    Authority RRs: 0
    Additional RRs: 0
  v Queries
    v www.ietf.org: type A, class IN
        Name: www.ietf.org
        [Name Length: 12]
        [Label Count: 3]
        Type: A (Host Address) (1)
        Class: IN (0x0001)
    [Response In: 9]
```

```
    Questions: 1
    Answer RRs: 2
    Authority RRs: 0
    Additional RRs: 0
  ⌄ Queries
    ⌄ www.ietf.org: type A, class IN
        Name: www.ietf.org
        [Name Length: 12]
        [Label Count: 3]
        Type: A (Host Address) (1)
        Class: IN (0x0001)
  > Answers
    [Request In: 8]
    [Time: 0.000844000 seconds]
```

5. Examine the DNS response message. How many "answers" are provided? What do each of these answers contain? Add screenshots in your answer.
   There are 2 answers which contains the host name, type of address, class, TTL, data length and IP address.

```
⌄ Answers
  ⌄ www.ietf.org: type A, class IN, addr 132.151.6.75
      Name: www.ietf.org
      Type: A (Host Address) (1)
      Class: IN (0x0001)
      Time to live: 1678 (27 minutes, 58 seconds)
      Data length: 4
      Address: 132.151.6.75
  ⌄ www.ietf.org: type A, class IN, addr 65.246.255.51
      Name: www.ietf.org
      Type: A (Host Address) (1)
      Class: IN (0x0001)
      Time to live: 1678 (27 minutes, 58 seconds)
      Data length: 4
      Address: 65.246.255.51
  [Request In: 8]
  [Time: 0.000844000 seconds]
```

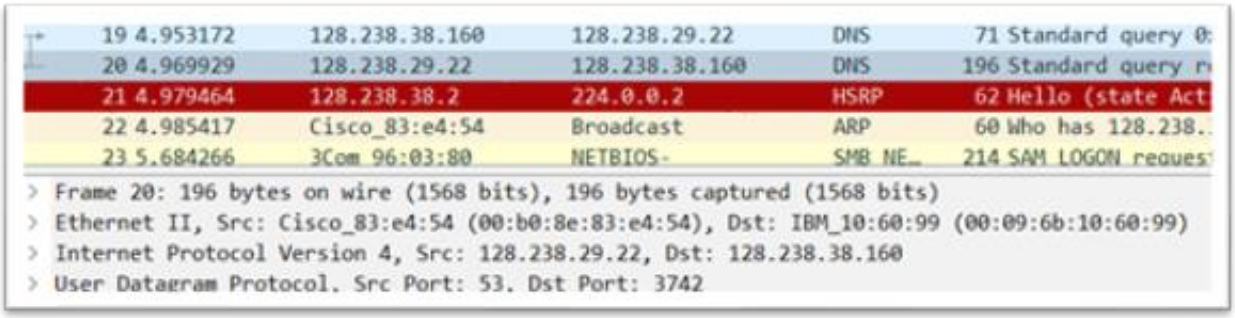
6. Consider the subsequent TCP SYN packet sent by your host. Does the destination IP address of the SYN packet correspond to any of the IP addresses provided in the DNS response message? Add screenshots in your answer.
   Yes. The destination IP address of the SYN correspond to the IP addresses provided in the DNS response message which is 132.151.6.75.



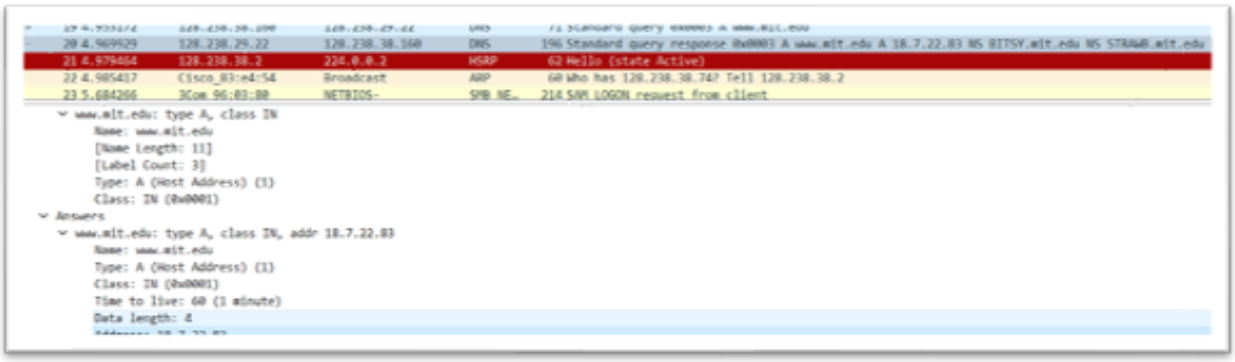
7. This web page contains images. Before retrieving each image, does your host issue new DNS queries? **No.**

- Open packet trace file dns-trace-2 for nslookup.
- We see from Wireshark that nslookup actually sent three DNS queries and received three DNS responses. For the purpose of this lab, ignore the first two sets of queries/responses, as they are specific to nslookup and are not normally generated by standard Internet applications. You should instead focus on the last query and response messages.
- Answer the following questions.

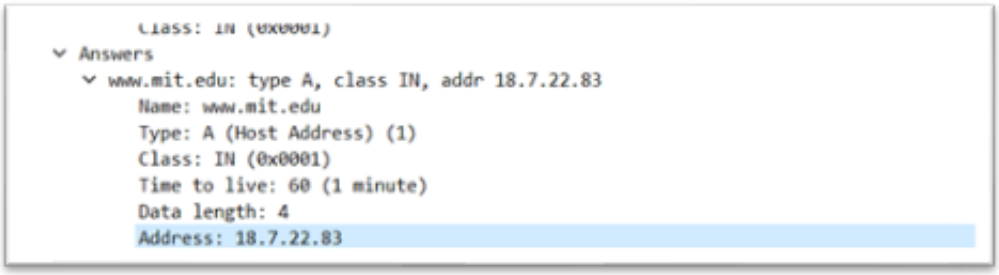
8. What is the destination port for the DNS query message? What is the source port of DNS response message? Add screenshots in your answer.
   The destination port for the DNS query message is 53 and source port is also 53.



9. To what IP address is the DNS query message sent? Is this the IP address of your default local DNS server? Add screenshots in your answer.
No. It sent to 187.22.83 which corresponds to mit.edu.



10. Examine the DNS query message. What "Type" of DNS query is it? Does the query message contain any "answers"? Add screenshots in your answer.
The DNS query message is type A which contain no answer.



11. Examine the DNS response message. How many "answers" are provided? What do each of these answers contain? Add screenshots in your answer.
There is only one answer provided by DNS response message.