Problem Set 1 Report: Internetworking

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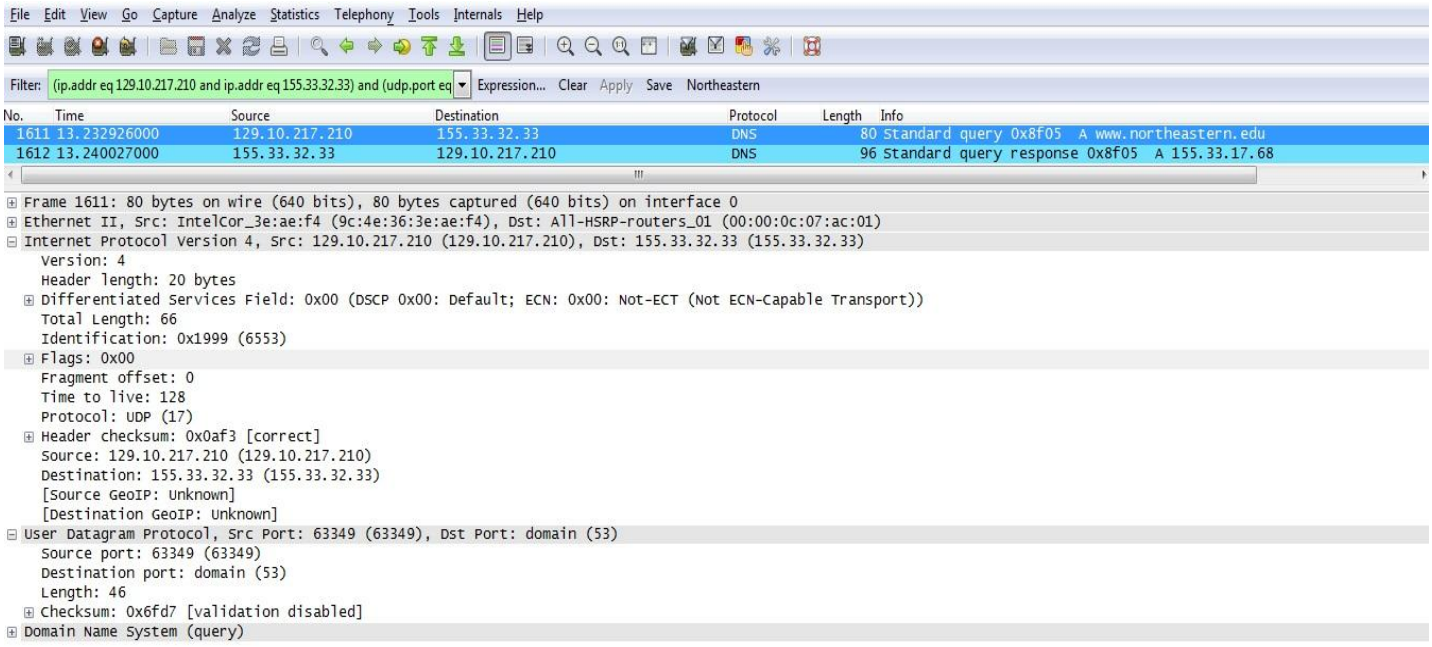
1. Steps taken by a browser when the user requests a web page:

- Even before the webpage is requested, the host broadcasts Address Resolution Protocol (ARP) probe or request packets with an all-zero sender IP address. This is also referred to as broadcasting *gratuitous* ARP messages for updating other host's mapping of the hardware addresses when the sender's IP address has changed.
  ARP Parameters:
  Hardware Type: Ethernet (1)
  Protocol Type: IP (0x0800)
  Hardware Size – 6
  Protocol Size – 4
  Sender MAC address: b4:07:f9:94:e3:f9
  Sender IP Address: 0.0.0.0
  Target MAC address: 00:00:00:00:00:00
  Target IP Address: 129.10.163.52

  Various other parameters have been captured in the **ARP.out** file. This file can be opened by notepad/textpad.

- DNS Query: The browser communicates with the Domain Name Server to translate the server name 'www.northeastern.edu' into an ip address. A standard DNS query is used by the browser to request the ip address.
  DNS query Parameters:
  Source Port – 63349
  Dest Port – Domain (53)
  Source IP – 129.10.217.210
  Dest IP – 155.33.32.33

  Various other parameters have been captured in the **DNS.out** file. This file can be opened by notepad/textpad.



- Once the DNS server responds with the IP address of the requested Domain name, the browser attempts to establish a TCP connection with the server. The browser sends a HTTP request to the web server. The GET request names the **URL** to fetch**:** "http:www.northeastern.edu". The browser identifies itself (**User-Agent** header), and states what types of responses it will accept (**Accept** and **Accept-Encoding**headers). The **Connection** header asks the server to keep the TCP connection open for further requests.The request also contains the **cookies** that the browser has for this domain.

  TCP Parameters: (HTTP Request)
  Source IP: 129.10.217.210
  Source Port: 58428
  Destination IP: 155.33.17.68
  Destination Port: http (80)

  Apart from these parameters, each TCP packet has its own parameters such as Stream Index, Sequence Number, Next Sequence Number, Acknowledgement Number and Header Length. These parameters have been captured in the **TCP.out** file. This file can be opened by notepad/textpad.

- The Web server handles the request. The web server's request handler reads the request, its parameters and cookies and generates a HTML response. The server sends back the HTML response.

  TCP Parameters (Server Response)
  Destination IP: 129.10.217.210
  Destination Port: 58428
  Source IP: 155.33.17.68

Source Port: http (80)

Apart from these parameters, each TCP packet has its own parameters. These parameters have been captured in the **TCP.out** file. This file can be opened by notepad/textpad.

- The browser then renders the HTML page to the user. It also notices tags in the HTML that require fetching of other URL's and sends GET requests to retrieve each of these files.

2) ChatServer.java and ChatClient.java implement the Client-Server chat application. Following are the commands to compile and run the code

```
javac ChatServer.java
java ChatServer 9090                (java ChatServer <Port Number>)
javac ChatClient.java
java chatClient 127.0.0.1 9090      (java ChatServer <IP Address> <Port Number>)
```