Problem Set – 1: Internetworking

The internet browser goes through multiple steps while trying to fetch and render a webpage once you click on a link.

When we click an address such a [www.northeastern.edu](http://www.northeastern.edu) the browser will create packets of data which are encapsulated at each layer according to the TCP/IP stack and these packets are sent to the ISP, in my case I’ve set my DNS to be google’s DNS and thus it goes to 8.8.8.8 and makes a DNS request to resolve the address route. The ISP will then If it does not have a route to the IP indicated by the request then it will forwards it to the top level DNS which will then pass it a route which will get stored in the ISP’s server memory.

In my case google DNS responded to the query with a DNS standard response packets indicating the route to be followed to reach [www.northeastern.edu](http://www.northeastern.edu) as can be seen in lines 17 through 20 of the wireshark captured data the DNS request is sent over ports 52400 and 64213 to port domain(53) of the DNS server, google DNS replies with an IP of 155.33.17.68 which is the IP address for [www.northeastern.edu](http://www.northeastern.edu) using the same ports.

Once the route has been resolved, the browser then tries to make a TCP connection with the IP address so as to send and receive data/packets. A TCP SYN packet is sent via port 63904 to the port 80 or the HTTP port of the destination. The destination server (northeastern.edu) replies with a SYN ACK packet sent from its HTTP port 80 to the port 63904 of my machine which is the port which sent the SYN packet. Now my browser sends a ACK packet followed by a HTTP GET request using the same ports but the latter uses HTTP.

Now that the TCP handshake has happened and the HTTP GET request has been sent, there is a series of packets which are exchanged between the two IPs and an ACK is sent from either of them to acknowledge receiving the packet. The PSH, ACK packets indicate that the host is acknowledging receipt of some previous data and also transmitting more data at the same time.

All of these packets have been exchanged via my local modem which still needs to resolve my MAC address for the browser to receive those packets and the Address Resolution Protocol helps the router determine which of the machines connected to it need to receive these packets. We can see from lines 42 and 43 of the Wireshark data that ARP is used to resolve my machine’s MAC address, 10.0.0.1 is the IP address of my Modem/Router. This ARP request will usually be broadcast to all the MAC addresses registered with the router and the machine which responds to it will get the packets and the browser can use those packets to render the webpage.

Once even ARP has been resolved, the next communications with the webpage and there are a lot of two way interactions with the webpage since northeastern.edu is a dynamically created webpage, will happen until a FIN ACK packet (line 110) is sent from my browser to the northeastern.edu server responds with an ACK (line 111). The northeastern.edu server also responds with a FIN ACK packet which is met with an ACK packet from my browser (lines 113 & 114).

With this the whole process of connecting to a website and rendering it on the browser is complete.