

## Homework 3

*Due: November 13th, 2014, 11:59pm*

### Question 1

You are sitting in your home and you ssh into the ssh.cs.brown.edu, which is done over TCP. This connection takes very little bandwidth, and you are happy. Your roommate comes along and starts transferring a very large file over FTP to a friend in another city. Assume that both of these flows share the same router, that they are the only two flows leaving your house, and that the bottleneck link is the link between your router and your ISP.

- a. What is the effect that this new flow has on your ssh connection?
- b. Unhappy, you buy another router that has more buffer space for queues. Does that make your ssh connection better or worse?

### Question 2

What does it mean for a TCP connection to be (a) sender limited, (b) network limited, and (c) receiver limited? If you have complete access to all of the TCP variables and segment header fields, how can you distinguish between these three scenarios?

### Question 3

Suppose you have a TCP flow on a single link between two machines, with a bandwidth of 1Gbps ( $10^9$  bits/s) and an RTT of 10ms.

- a. Assuming an initial congestion window of size 1 segment, and an MSS of 1250B, how long does it take for the window to reach the bandwidth-delay product?
- b. What is the minimum size of the data for the connection to reach this state?
- c. If you transmit a 20KB file, what is the effective bandwidth that you achieve, assuming that the initial window is 1 segment? What fraction of the link bandwidth does this correspond to? (Effective bandwidth will be the total size of the file divided by the time)
- d. Your OS kernel could (and sometimes does) remember the size of the window of a connection between your machine and a host X, and then use this value and go into congestion avoidance mode directly, instead of starting from scratch at slow start. Give one reason why this would be good for new connections, and one reason why this could backfire.

**Question 4 - DNS**

- a. The DNS root hints file is a file that all DNS resolvers have to be able to bootstrap their resolution abilities. It is located at `http://www.internic.net/domain/named.root`, and it has entries for each root server as such:

```

.                3600000      NS      A.ROOT-SERVERS.NET.
A.ROOT-SERVERS.NET. 3600000      A       198.41.0.4
A.ROOT-SERVERS.NET. 3600000      AAAA    2001:503:ba3e::2:30
;
.                3600000      NS      B.ROOT-SERVERS.NET.
B.ROOT-SERVERS.NET. 3600000      A       192.228.79.201
B.ROOT-SERVERS.NET. 3600000      AAAA    2001:500:84::b
...

```

If you have only this file, how can you use the information in it, and `dig`, to look up `www.facebook.com`? List the steps you need to take, using the syntax `dig <name> @<server> <record type>`.

- b. Suppose you run a website at `www.foo.net`.
- Which name servers need to change their databases if you decide to change the name to `www.foo.com`?
  - To `web.foo.net`?
  - What needs to change if you decide to keep the name `www.foo.net`, but change the IP address?