PROJECT REPORT : HW1

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1. The speed tests were conducted on LAN on personal laptop.
   http://www.testmyspeed.com :

   >Download : 75.01 Mbps

   >Upload: 0.40 Mbps

   http:// www.speedtest.net :

   >Download : 81.95 Mbps

   >Upload: 65.33Mbps

   We can observe that there is a wide difference between the speeds from two websites, especially in upload speeds.

   Reasons for why they are different could be:

   a. The difference between download and upload speeds arises since downloading occurs on a much larger scale. Hence, larger bandwidths are alloted for downloading.
   b. Each website has its own server for testing the speed. These servers are not in the same place geographically and don't have the same internet route.
   c. Some servers use multithreading, where more than one connections are opened to the host, to mask the congestion issues.
   d. Also, to get better averages, they might remove the extreme values obtained. (Eg: 20% values from bottom and 10% from top).

2. **a)**
   Ping is a computer network administration software utility, to check if a given IP Address can accept and send requests or not. It ensures whether the computer(host) that we want to access is operating or not. It measures the round trip time of data sent from the user to the destination computer and echoed back to the user. it basically gives us the latency in retrieving anything from the server.

   It uses **Internet Control Message Protocol (ICMP).** The way it works is that first the host computer sends an **ICMP Echo Request Packet** and waits for an **ICMP Echo Reply**. It can repoet about packet losses and errors that occur and also the minimum, maximum and average round trip times.

   b)
   i. **www.google.com:**
      IP Address : 216.58.203.68
       Packets   : Sent = 4, Received = 4, Lost = 0 (0% loss)
      Approximate round trip times in milli-seconds:
            Minimum = 3ms, Maximum = 14ms, Average = 6ms
   ii. **www.rice.edu:**
      IP Address : 128.42.206.11
      Packets   : Sent = 4, Received = 4, Lost = 0 (0% loss)

Approximate round trip times in milli-seconds:
Minimum = 282ms, Maximum = 293ms, Average = 289ms

iii. **www.iitd.ac.in:**
IP Address : 10.7.174.111:
Packets   : Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 1ms, Maximum = 9ms, Average = 3ms

Server closest : www.iitd.ac.in
Server farthest : www.rice.edu
"www.iitd.ac.in" is the closest server in terms of RTT since the servers for this website are inside IIT and hence geographically closest to us. On the other hand, those for "www.rice.edu" are the farthest (in US). Since, www.google.com is one of the most popular website used, it has its servers across the globe. So, the time is less than that for www.rice.edu, which is mostly used by people in US. So, when a request is sent, the number of hops are maximum for www.rice.edu, as maximum number of router switching takes place in that case. There is always a latency that arises due to queuing during router switching.

3. The commands have been run n a GCL machine for this question:
   a. Local : 127.0.0.1
      Ethernet : 10.208.20.232
   b. Ethernet : Address - 64:00:6a:13:37:cd
                  MTU - 1500
   c. Ethernet : IPv6 Address - fe80::6600:6aff:fe13:37cd/64
      IPv6 Address is 128 bits long.

MTU stands for "Maximum Transmission Unit". It is basically the size of the largest packet (protocol data unit) that the layer can pass onwards, for a communication protocol of a layer. The larger the value of MTU, better is the transmission efficiency.

4. **TraceRoute:**

   • **TraceRoute to www.iitd.ac.in**
     Tracing route to www.iitd.ac.in [10.7.174.111] over a maximum of 30 hops:
     1   1 ms   1 ms   1 ms 10.192.32.14
     2   1 ms   1 ms   1 ms 10.254.238.5
     3   3 ms   1 ms   1 ms 10.254.236.22
     4   1 ms   1 ms   1 ms www.iitd.ac.in [10.7.174.111]
     Trace complete.

   • **TraceRoute to www.cse.iitd.ac.in**
   Tracing route to bahar.cse.iitd.ac.in [10.208.20.4] over a maximum of 30 hops:
     1   1 ms   1 ms   1 ms 10.192.32.14
     2   2 ms   1 ms   1 ms 10.254.238.5
     3   9 ms   2 ms   8 ms 10.254.208.6
     4   1 ms   1 ms   1 ms bahar.cse.iitd.ernet.in [10.208.20.4]
     Trace complete.

- The first two routers are common for both the cases (10.192.32.14 & 10.254.238.5) while the last two differ. Both the paths have 4 routers in total. Traceroute sends 3 packets with same timestamp.
- Generally, the RTT for routers further should be longer for the farther ones, than for the closer ones. But, practically, it sends 3 packets with different TTLs for different routers. Hence, RTT comes out to be different for each router .
- So, for calculating RTT down the path, we observe that load on the initial path is much lesser and hence the total RTT comes out to be less. And, so we can say that the RTT to routers further along the path is smaller than for those closer to the source.

5. Latency : Normal Distribution with mean = 0.025ms and standard deviation = 0.01ms
   Packet Loss : 0.01%
   Timer for packet loss : 3 ms

   a) Without Netem

RTT vs Packets for RC=2000 without Netem

RTT vs Packets for RC=8000 without netem
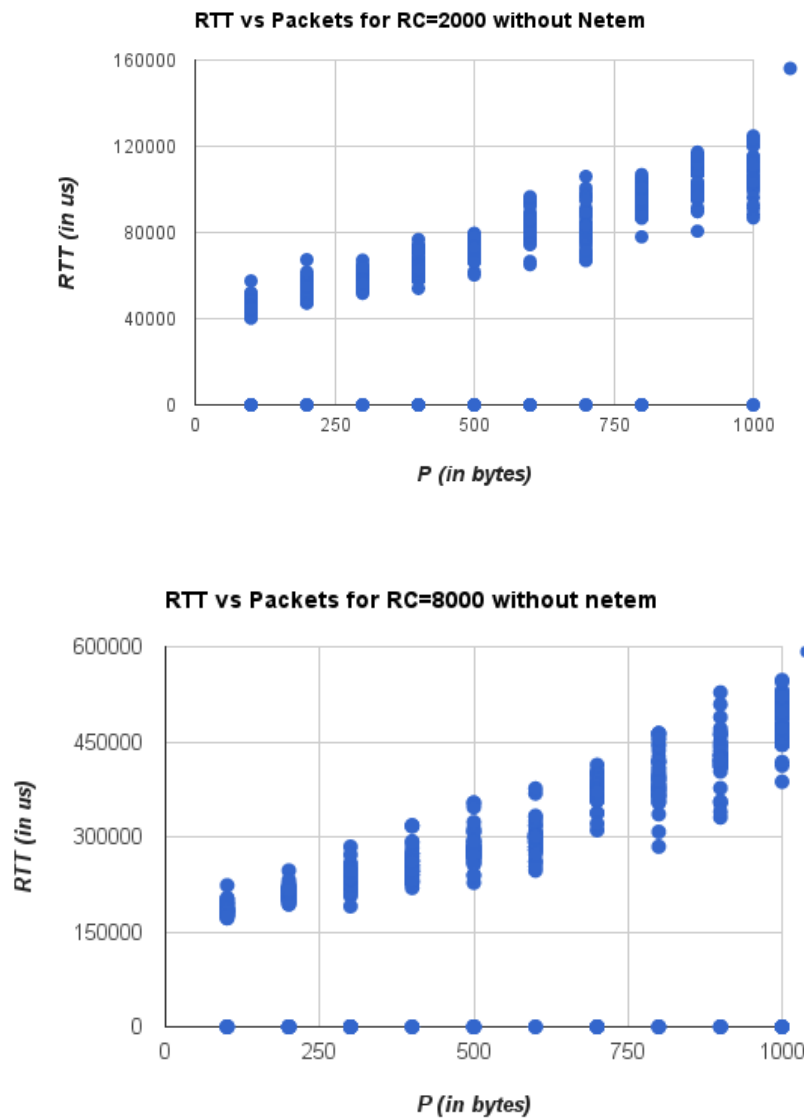
We can see the following observations :

- As the packet size increases, there is an increase in the average RTT value, which can be seen by the slope.
- We see some points at RTT = 0, they arise due to the packet losses. Hence RTT for them has been denoted by 0.
- We can see that packet loss is relatively lesser for T=2000 (no packet loss at P = 900 bytes).

b) With Netem:

RTT vs Packets for RC=2000 with Netem

RTT vs Packets for RC=8000 with netem
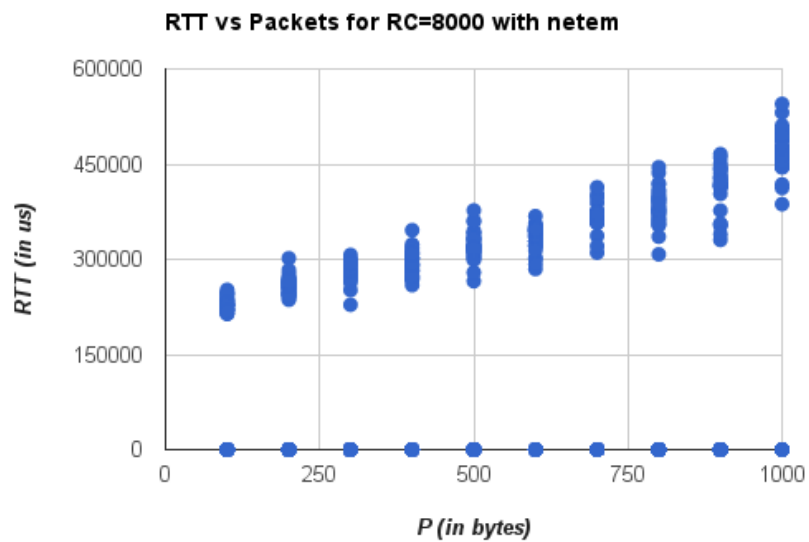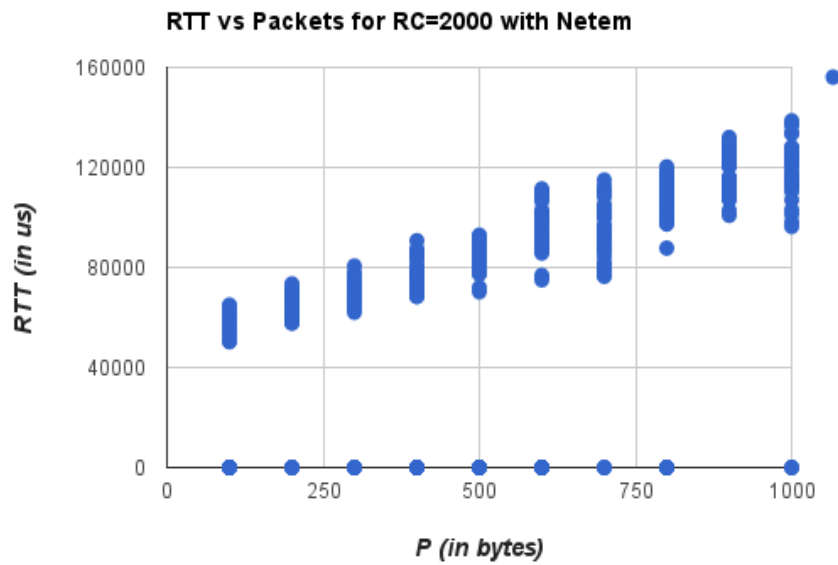
The scatterplot is different from that of without netem in following terms :

- There is a shift in the complete graph. The RTT values with Netem are higher, since a latency has been induced externally.
- The packet loss is quite high for these as compared to those without Netem, since a packet loss has been artificially created.

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References:

- http://testmy.net/ipb/topic/28902-why-do-my-results-differ-from-speedtestnet-ookla-speed-tests/
- https://en.wikipedia.org/wiki/Ping_(networking_utility)
- http://searchnetworking.techtarget.com/definition/ping
- https://en.wikipedia.org/wiki/Maximum_transmission_unit