Report Assignment 3

* We have done an analysis of the transmission throughput, forwarding delay and the jitter variation in a broadband network where we have used a CSMA (carrier sense multiple access) channel with four client server pairs. We have used UDP in the application layer. We have used RngSeedManager::SetSeed(System\_Time) to randomize our simulations so that we can model the real life network. Also to give varying data rates at the application layer we have varied the packet size.
* Calculating packet size: We have fixed the inter packet interval at 0.01 seconds. If we are asked for a data rate of 16 Kbps or 16000bps or 16000/8 bytes per second we set the packet size to be 16000/8 bytes per second \* 0.01 seconds so we get 20 bytes as packet size. Similar calculations follow the other data rates.
* As we increase the data rate the number of dropped packets have increased due to the queuing buffer getting filled up in a short span of time.
* Throughput: Throughput has been calculated as the ratio of total size of packets successfully transmitted to the difference between last deque time and first deque time. At small data rate,throughput is increasing almost linearly but as the data rate increases throughput tends to achieve a maxima. This indicates that the effect of losing data packets due to increased packet size leading to the queuing buffer filling up quickly is comparable to the effect of increased packet size. The first is trying to decrease throughput while the latter is increasing throughput.
* Forwarding delay: Forwarding delay is measured as the time between en queuing and receiving a packet. Forwarding delay is also increasing almost linearly with data rate. The reason is because the channel has a fixed bandwidth and we are now sending bigger packets at fixed intervals. As such the queuing time increases.
* Jitter: We have calculated jitter as the standard deviation of frame delays of individual frames. Jitter also shows an increase with greater data rates. This means that the frame delays are varying widely at greater data rates. A possible reason is that as we increase the data rate each client fills up their queue quickly. We are using CSMA channel that follows the rule of sense before transmission. So each client transmits its packet only when the channel is not used by anybody. As such different packets may have to wait different amounts of time before they get transmitted into the channel. The entire system as such takes a longer time to come into a steady dynamic state.