**CSC8220-Advanced Computer Networks Homework-2**

Swaroop Devaraju

1. The design of protocol and program

**Protocol Used:**

TCP/IP protocol has been used to implement our program. TCP/IP is a protocol suite that provides end-to-end connectivity and specifies how data should be transmitted, addressed, organized, routed and received.

**Program Design:**

Server (Router):

* A server socket is created.
* Then it is set to listen to incoming request calls and if any connection request arrives, it accepts the connection.
* Once connection is accepted, the data from the connection buffer is read and randomly drops the packet with a probability of 19% and a delay between 1 to 10 and sends the packets.

**Probability = 10 + Last panther digit of Swaroop (9) = 19**

**Delay = (random()\*100)%10;**

Receiver:

* A server socket is created.
* Then it is set to listen to incoming request calls and if any connection request arrives, it accepts the connection.
* It sends nack if it doesn’t get any packet gets dropped or else does nothing.

Client:

Sender:

* A socket is created and connection request is sent to the server using connect method.
* Once the server accepts the connection, sender writes the message to the socket and sends to Router.
* If the nack is received, the sender retransmits the packet.

A plot showing that the total number of try to successfully transmit all the packets when changing Y from 0, 20, 40, 60, 80,100.

1. Couldn’t plot a graph because once a packet is dropped the receiver is always sending nack.
2. Find out what is the maximum throughput of your system

**Throughput** – Throughput is the maximum number of packets sent successfully over time.

1. Discuss the factors that impact the throughput and how one can potentially increase the throughput performance

**Factors that Impact throughput:**

1. Bandwidth Delay Product – BDP refers to the maximum number of simultaneous bits that can be transferred between sender and receiver. A higher throughput can be achieved if BDP is very large.
2. Buffers – Buffers are usually used to handle the delays in network. The links with small round trip time usually use a buffer size up to 65,535. To achieve maximum throughput, the buffer size needs to be proportional to the data in flight.

Data in flight= bandwidth\*Round trip time

1. TCP Window size – It refers to the amount of data that a receiver can accept without acknowledging the sender. The window size considerably impacts the throughput of the system. If the window size is high, the packets are sent until the window is filled without acknowledgements which can cause the window to be filled with redundant packets.
2. Packet Loss – If a packet is lost, the sender retransmits the lost packet which eventually decreased the throughput as the same packet is sent again and again.

**How to Increase Throughput?**

The throughput of the TCP network over fast high round trip time links can be improved by using the below options.

1. TCP timestamps – The timestamps are used to evade uncertainties caused due to the 32-bit sequence number fields and estimates accurately the round trip time when multiple losses are present per round trip time.
2. TCP Selective Acknowledgment Options – When multiple losses per window occur, the selective acknowledgement option enables the receiver to precisely inform the sender about which packet has lost.
3. Path MTU Discovery – When losses occur, MTU discovery will avoid the need for in-network fragmentation which increased the throughput.

**Would a NACK-only protocol be preferable to a protocol that uses ACKs? Why or why not? If so, when NACK-only protocol is preferable over ACK protocol?**

NACK-only protocol is not preferred to be used in protocols that uses ACK because it causes more delay and its redundant. NACK protocol can be used where the network is more reliable and a scenario where the delay has to be less.