ECE 570

Project Report 1

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Simulation Parameters :

Frameslot = 50 micro seconds

Distance = 2000m

Bit rate = 100 Mbps

Packet Size = 1000 bytes

Simulation Duration = 6 sec

Summary:

Summary (Simulation Duration : 6.0 sec)

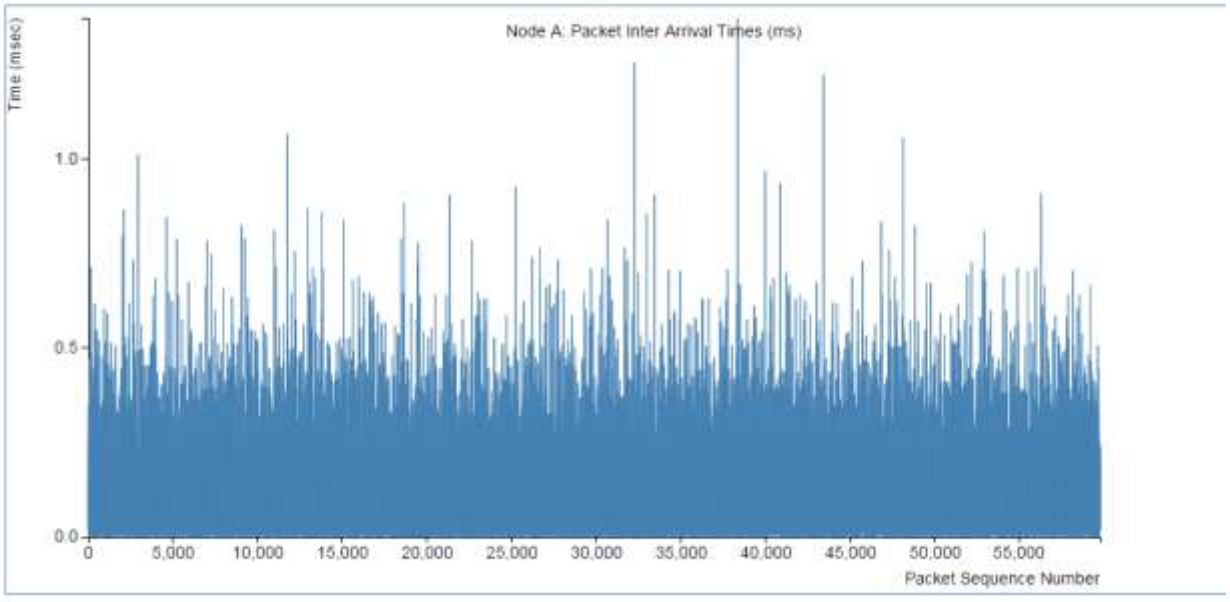
Node	Packets Delivered	Throughput	Average End to End Delay	Average Inter Arrival Time	Collisions per packet
A	24137	32 Mbps	1755.389 msec	0.100 msec	1.030
B	24246	32 Mbps	1811.453 msec	0.100 msec	1.025

Inter-packet Arrival Times:

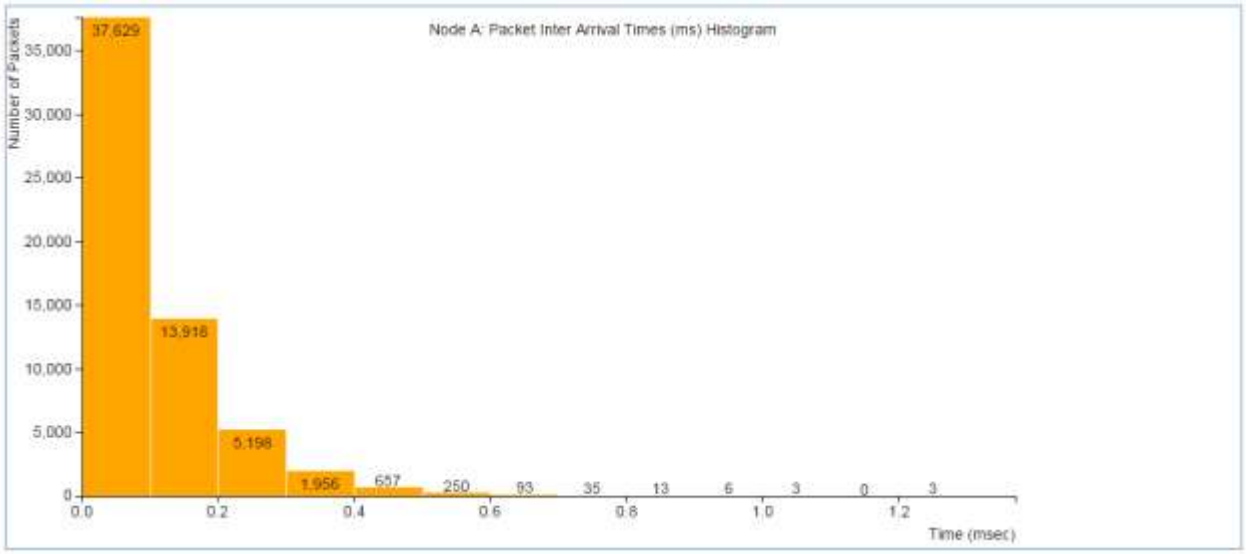
We observe that the inter-packet are exponentially distributed with mean around 0.100 msec (as indicated in the Summary above), which corresponds to 2 frame slots.

Node A:

Inter Arrival Time (msec) vs Packet Sequence Number

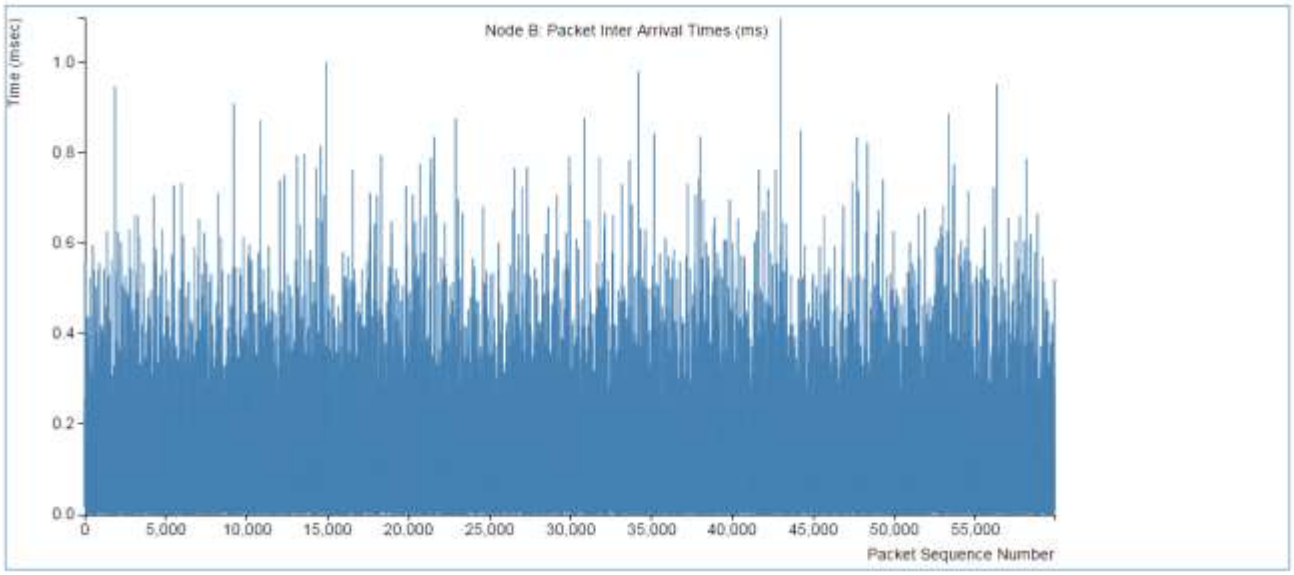


Histogram : Number of Packets vs Inter Arrival Time (in msec)

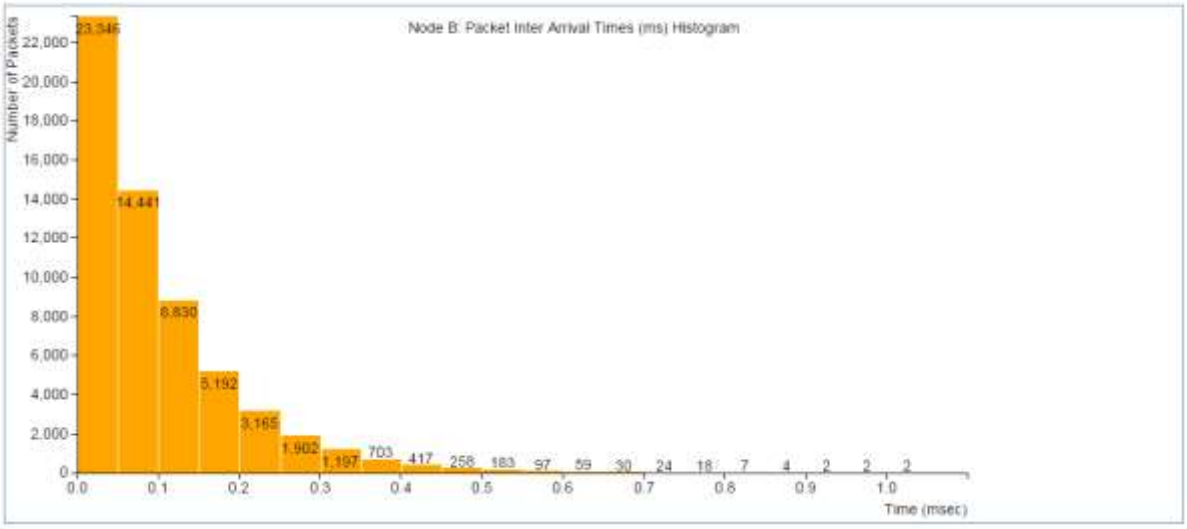


Node B:

Inter Arrival Time (msec) vs Packet Sequence Number



Histogram: Number of Packets vs Inter Arrival Time (in msec)

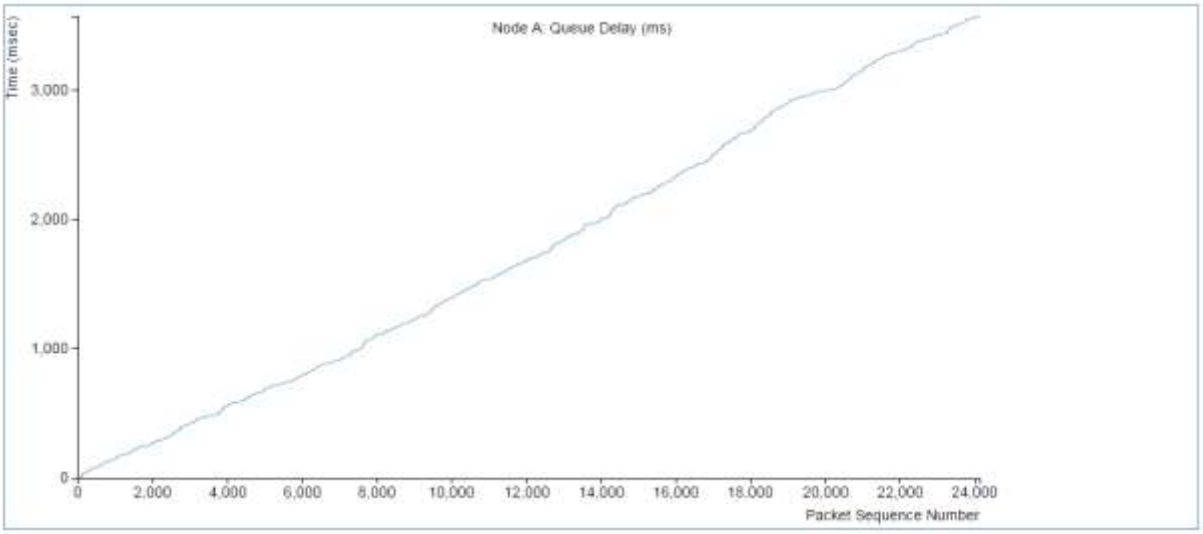


Queue Delay :

The queue delay increases with time. This is because the rate at which packets arrive is greater than the rate at which they are being transmitted. This type of queue is unstable.

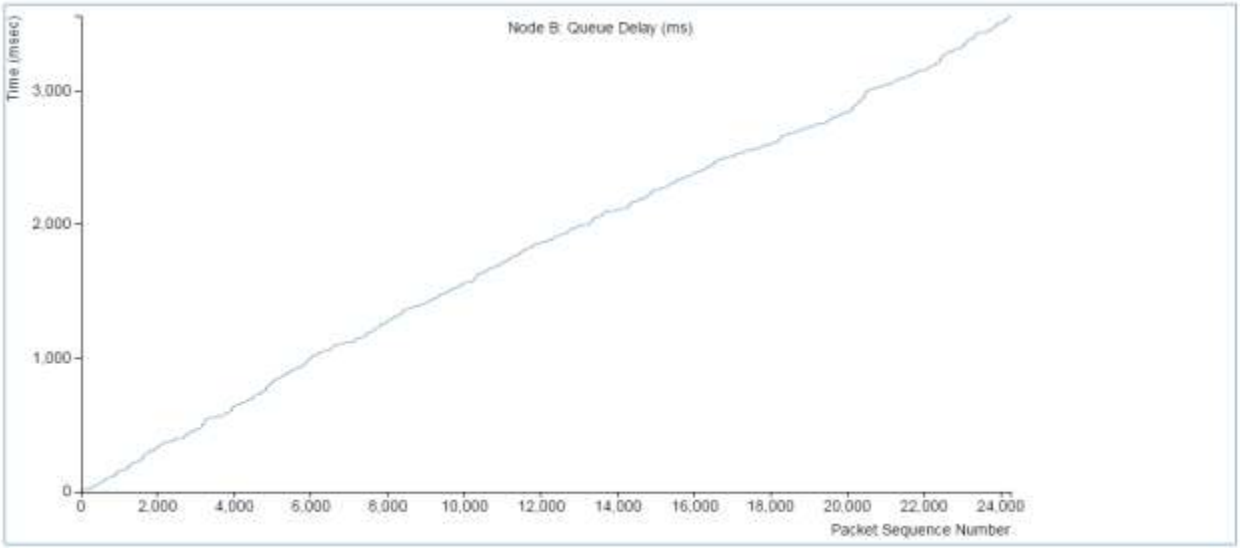
Node A:

Queue Delay vs Packet Sequence Number



Node B:

Queue Delay vs Packet Sequence Number



Effect of Increasing Inter Node Distance:

With an Inter Node Distance of 10km instead of 2km, we observe that the throughput reduces and average Collisions per packet increases.

This is expected as nodes will have to wait for a longer time ($2T_p$**)** before transmitting the next frame. The packets also have a larger distance to travel and hence more chance of colliding with another packet.

Summary (Simulation Duration : 6.0 sec)

Node	Packets Delivered	Throughput	Average End to End Delay	Average Inter Arrival Time	Collisions per packet
A	8868	12 Mbps	2501.896 msec	0.100 msec	2.265
B	9133	12 Mbps	2531.830 msec	0.100 msec	2.199

Effect of Increasing Frame Slot :

With a Frame Slot of 500 micro seconds instead of 50 micro seconds, we observe that the average Collisions per packet reduces. This is because successive packets are separated by a longer duration and a packet can travel longer before the next packet is generated.

The throughput also reduces as a less number of packets are generated in the simulation interval.

This is expected as nodes will have to wait for a longer time ($2T_p$**)** before transmitting the next fra

Summary (Simulation Duration : 6.0 sec)

Node	Packets Delivered	Throughput	Average End to End Delay	Average Inter Arrival Time	Collisions per packet
A	5954	8 Mbps	0.187 msec	1.008 msec	0.072
B	6099	8 Mbps	0.193 msec	0.984 msec	0.071

Implementation:

Entities:

Node, Bus, Packet Generator, Packet

Node Behaviour:

1. The node checks if it has a packet to send. If the the bus is idle, the node transmits a packet to the bus. If the bus is busy, the node will wait till the bus is idle.

2. If the node starts receiving another packet within a 2Tp interval, the nodes detects a collision, stops transmitting and backs off exponentially. It marks the bus as busy.

3. If the node does not receive another packet within a 2Tp interval, the node has successfully captured the channel. If Td < 2Tp, the node goes to step 1. Else, the node continues to transmit for a further Td - 2Tp duration. Then, the node stops transmitting and goes to step 1.

4. If the node receives an "idle" message from the bus, it marks the bus as free and goes to step 1

Bus Behaviour:

1. When a node starts transmitting a packet, the bus sends a "busy" message, along with the packet, to all other nodes after the corresponding propagation delays. This corresponds to the transmission of the first bit of a packet to all nodes. The bus maintains a counter of number of nodes that are currently transmitting. It increments this counter.

2. When the node stops transmitting to the message, the bus decrements the counter of number of nodes currently transmitting. If 0 nodes are currently transmitting on the bus, the bus sends an "idle" message to all other nodes after the corresponding propagation delays. This corresponds to delivery of the last bit of the last packet on the bus to all nodes.

Packet Generator Behaviour:

1. The packet generator keeps on generating packets using an exponential distribution with a mean of a packet every "1/lambda" frame slot.