Course No. : CSE 322

Assignment Name: NS2 offline

Submitted By:

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Section : B2

MAC Type:

802.11, part of the more widely used IEEE 802 standard, specifies Media Acess Layer (MAC) and physical layer protocols for implementing wireless local area network (WLAN). This is the world's most widely used wireless networking standard.

It has many versions. ns2 by default uses DCF (Distributed Coordination Function) as the standard. It uses Carrier Sense Multiple Access with Collision Avoidance (CSMA) protocol to determine when to transmit. If the medium is busy, it waits for a random time (backoff) to avoid a collision.

Routing Protocol:

Destination Sequenced Distance Vector (DSDV) is based on Bellman-Ford Algorithm.
It is table driven. Every node keeps a routing table for all destinations like below-

Destination	Next Hop	Number of Hops	Sequence Number	Install Time
A	A	0	A 46	002000
B	B	1	B 36	002200
C	B	2	C 28	002500

[1]

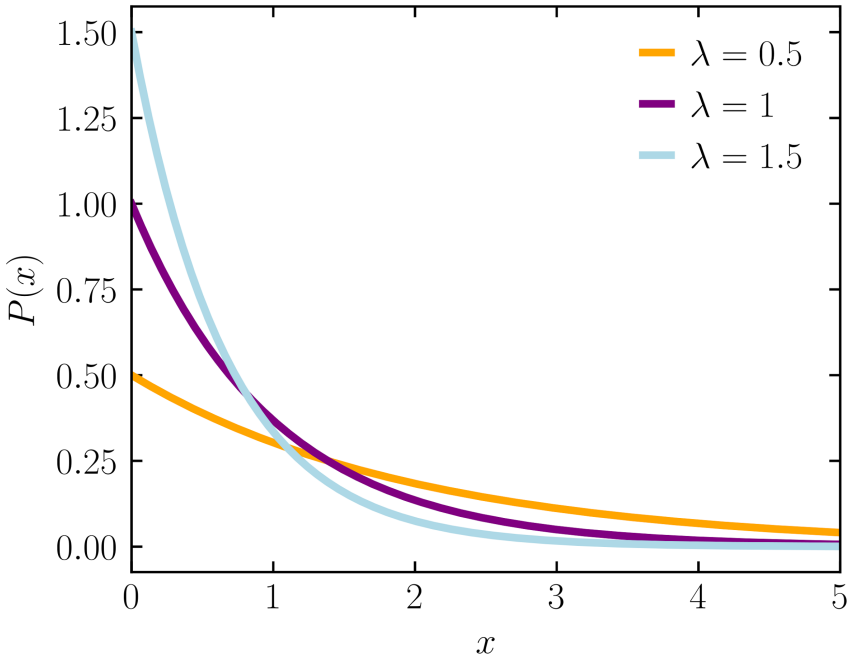
[1] https://en.wikipedia.org/wiki/Destination-Sequenced_Distance_Vector_routing

It guarantees loop-free routing by using sequence numbers along with all possible destinations. Periodically and when there is any change in the network and a table is updated for any node, it broadcasts its table to neighbors until all the nodes have the same information.

This advantage is also one of its drawbacks. All these network message updates generate a lot of traffic, using up a lot of bandwidth and processing power. Maintaining a table also uses up the memory of nodes.

Application:

Exponential application generates traffic patterns matching the exponential distribution function.



[2]

The probability to send a packet at a given time depends on the exponential function. The time between packets is independent and the next packet sent only depends on the time the last packet was sent.

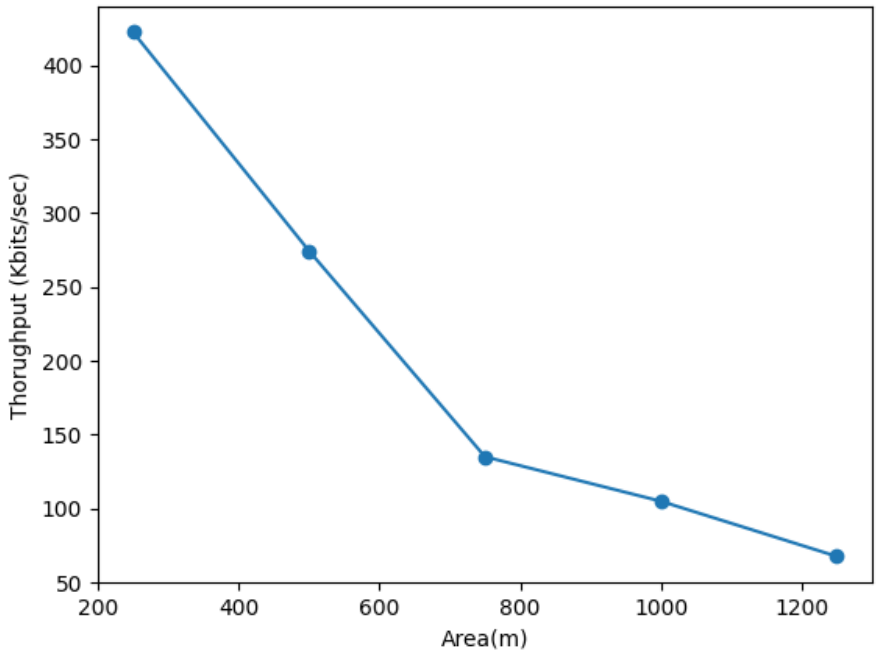
[2] https://en.wikipedia.org/wiki/Exponential_distribution#/media/File:Exponential_probability_density.svg

Agent:

User datagram Protocol (UDP) is a connectionless, unreliable protocol, that is mainly used for fast transmission scenarios where data loss is not the main concern (streaming, video gaming, etc) It is known as a best-effort protocol, meaning it does not guarantee the packet will be received. Like TCP, it does not have any congestion control built in.

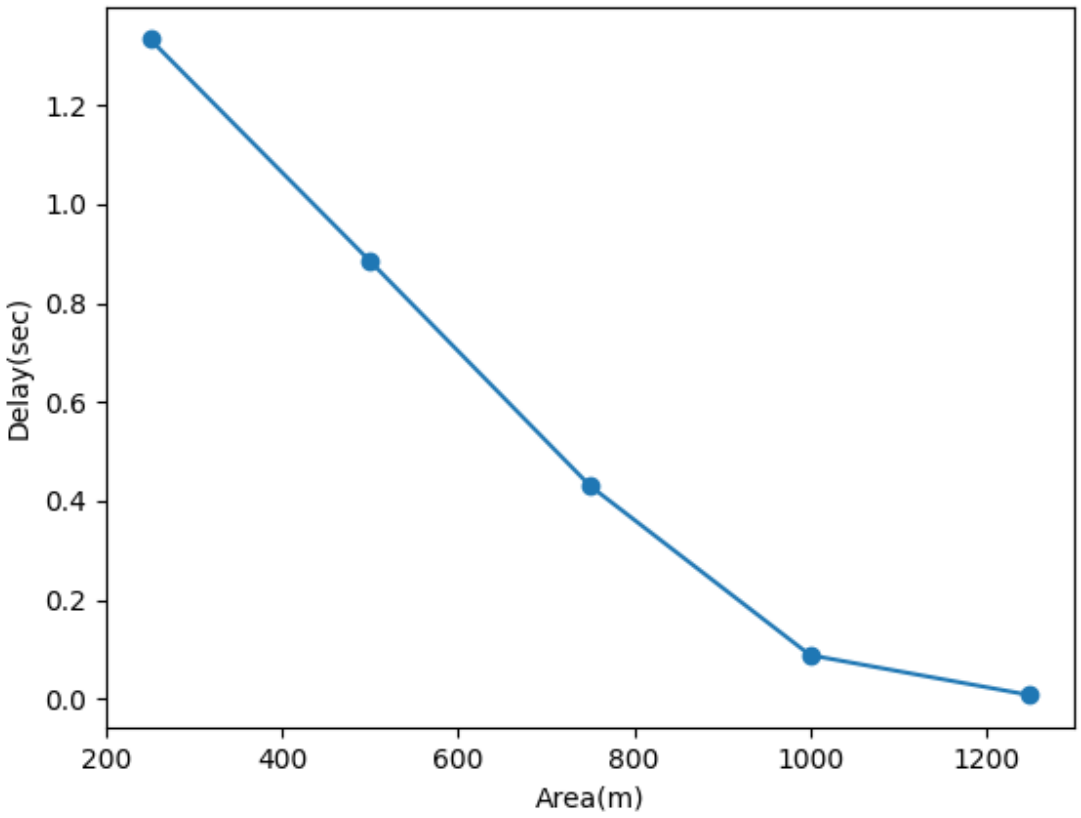
Simulation Graphs:

1. **Throughput vs Area :**



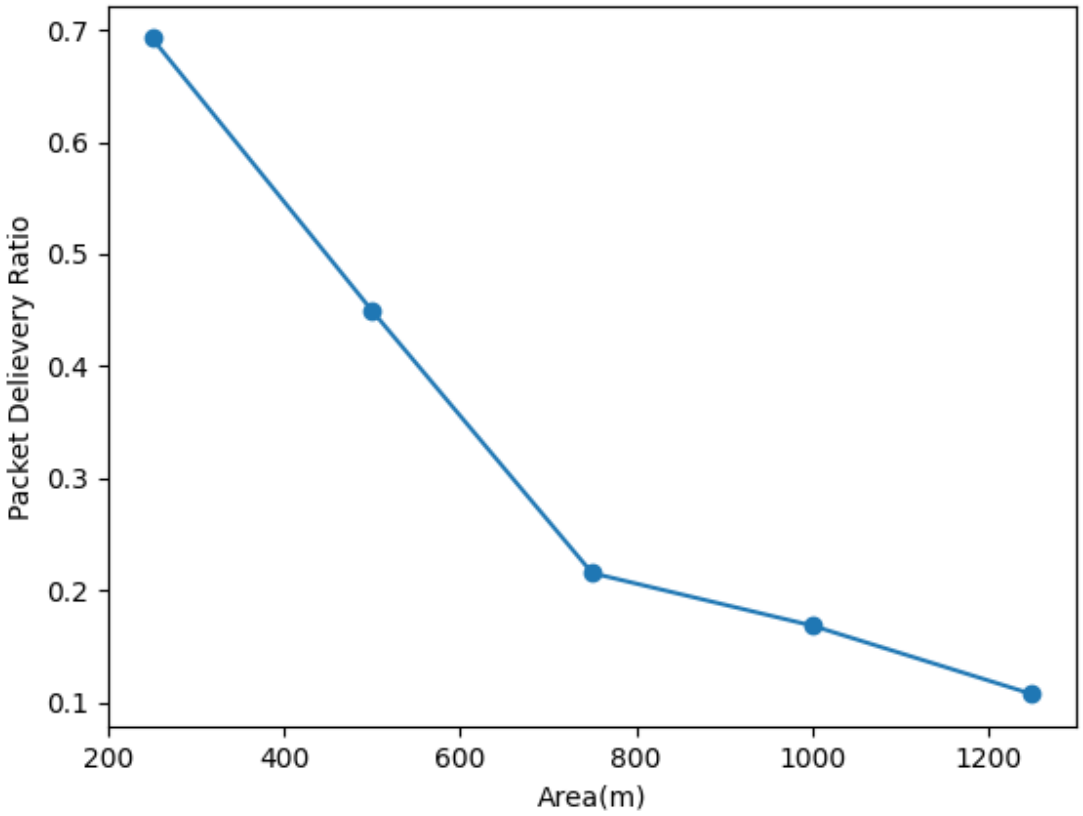
As area is increasing, packet transmission becomes slower. As a result, data throughput is decreasing.

2. **Delay vs Area**



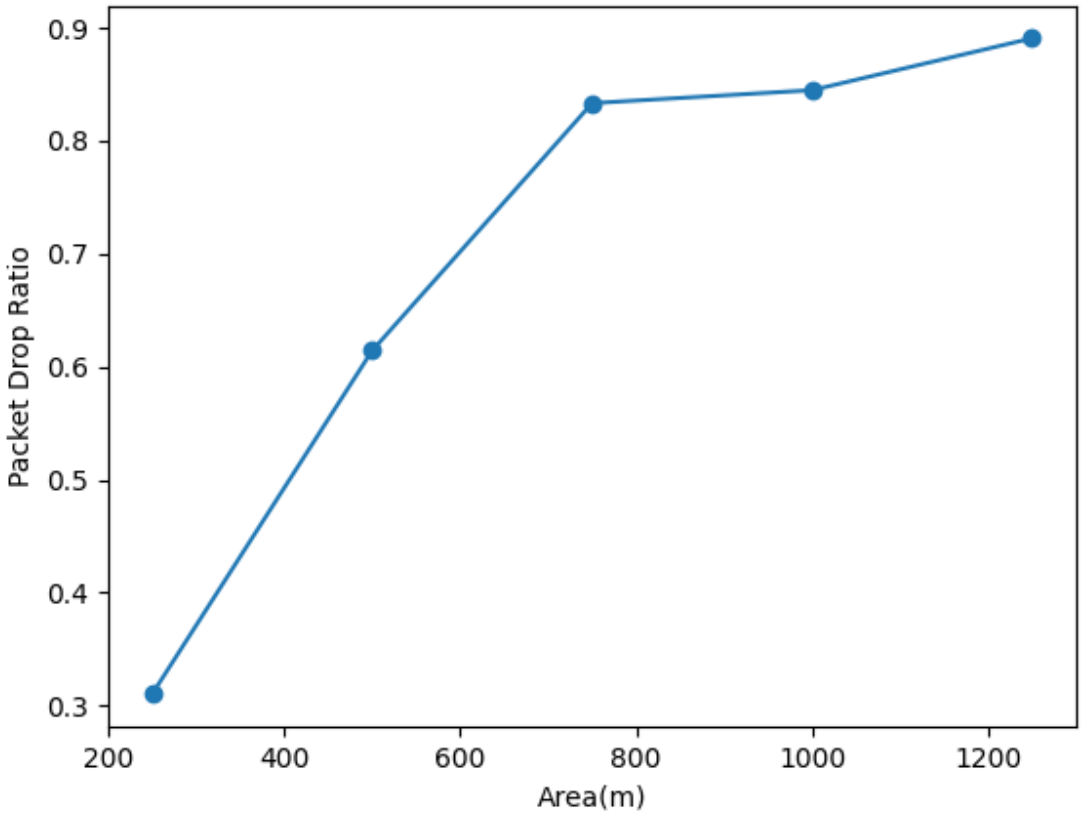
Since the area is increasing, nodes are at longer distance. So, packet should have taken longer and delay should have increased. But, since the nodes are now separated by greater distance, there is more medium to transmit wirelessly. The 802.11 MAC uses CSMA to check for collision. Greater distance leads to less collision probability and so delay is decreasing.

3. **Delivery Ratio vs Area**



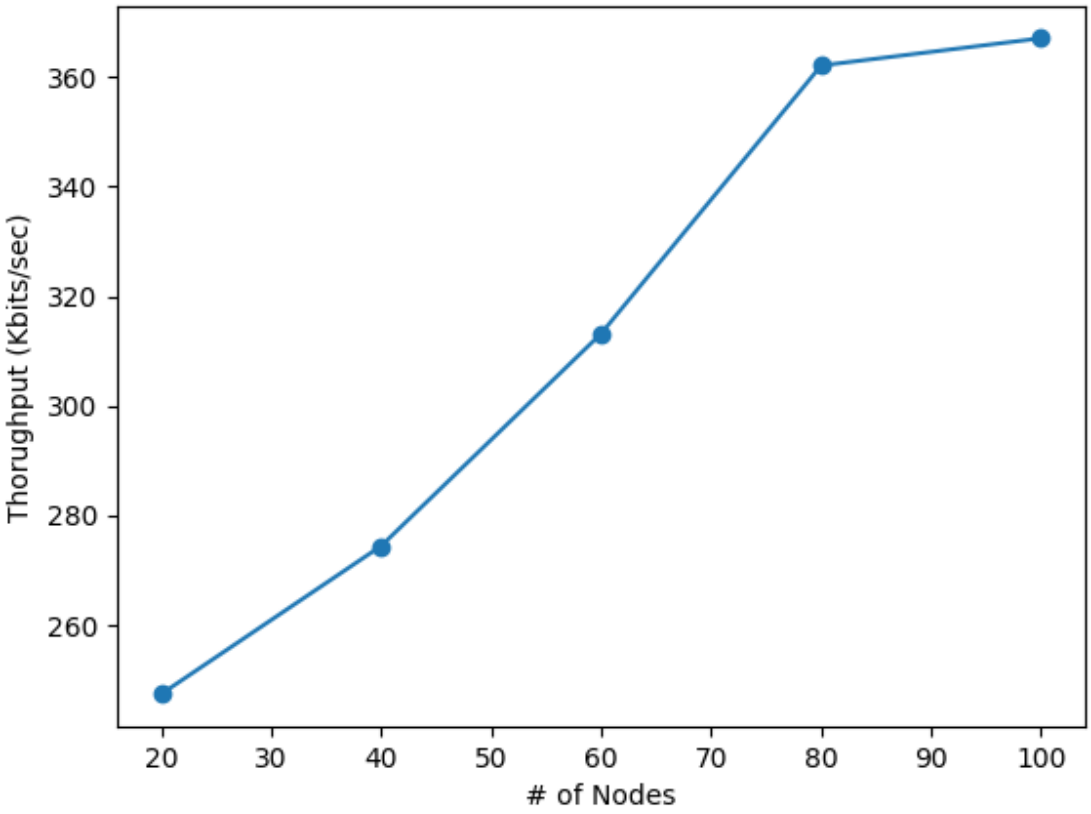
Increased area leads to more packets getting dropped. A larger distance means more hops are needed. More hops mean more queue space requirements. But queue size is fixed, leading to less delivery ratio and more drop ratio.

4. Drop ratio vs Area



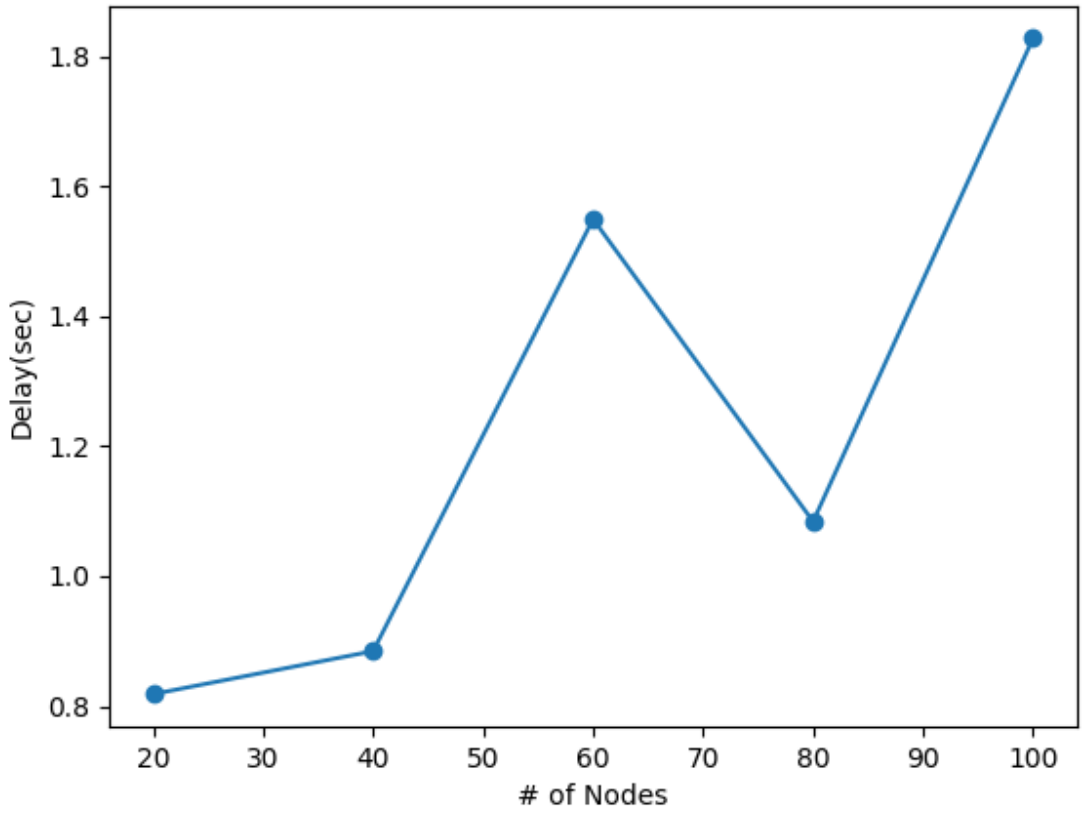
Same explanation as for graph 3.

5. **Throughput vs Node**



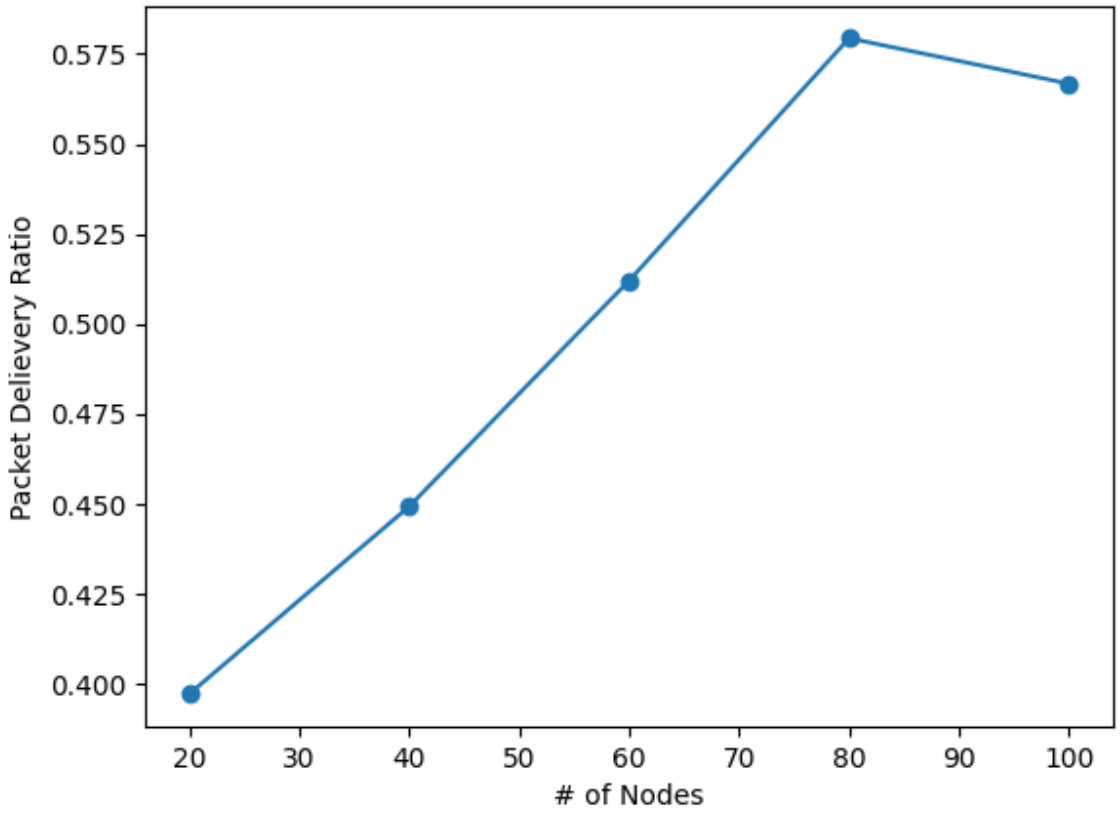
If there are more nodes, then there is more path for data to be sent. So, an increase in throughput is likely. But it flattens out as more nodes start to create congestion when area size is fixed.

6. **Delay vs Nodes:**



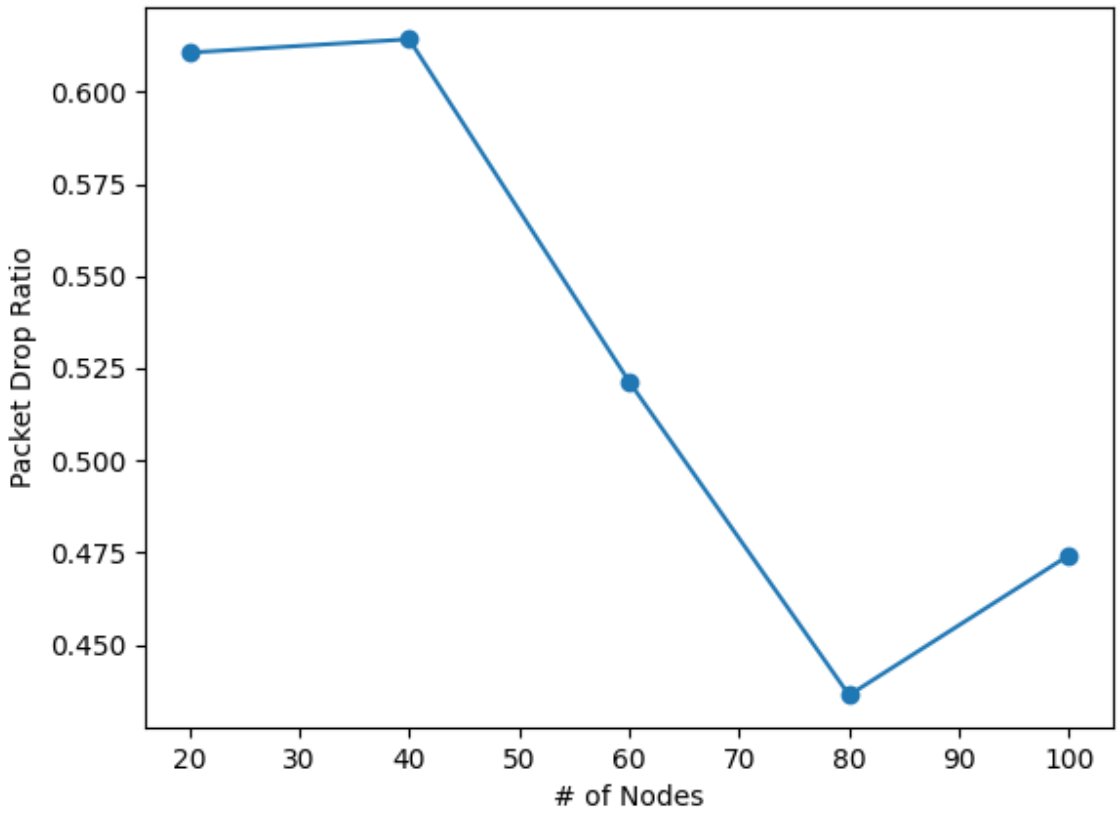
An increase in nodes leads to more congestion and the delay should be increasing. At 80 nodes, I believe the randomness spawns and moves the nodes in such a way, that there is less congestion than expected and the delay is suddenly dropped. Using separate seed values, I have found the overall trend to be upward.

7. **Delivery Ratio vs Nodes:**



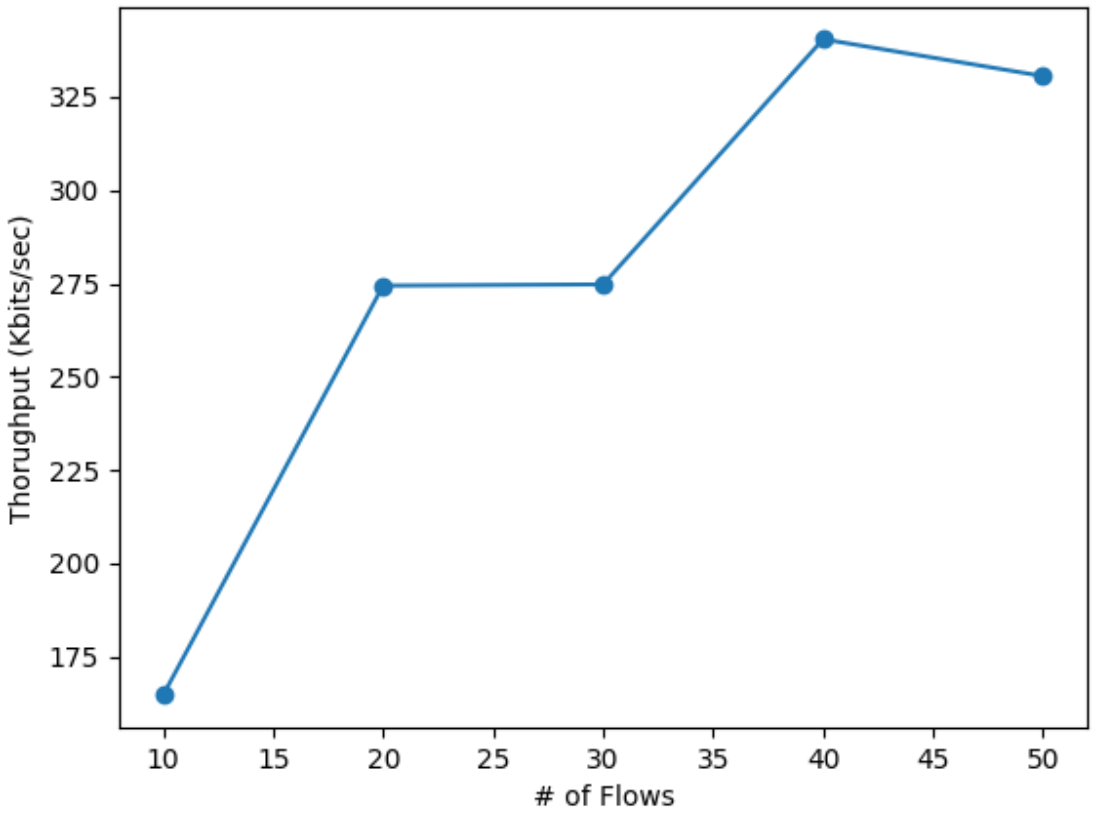
Increasing nodes mean that there are more nodes to use to go to the desired destination. Also, there is more queue space overall. So, the packet delivery ratio should increase overall. As there are more nodes, there are also routing table update packets (DSDV) sent, creating congestion for the application traffic. So, the delivery ratio should be dropping after 80 nodes.

8. **Drop Ratio vs Nodes:**



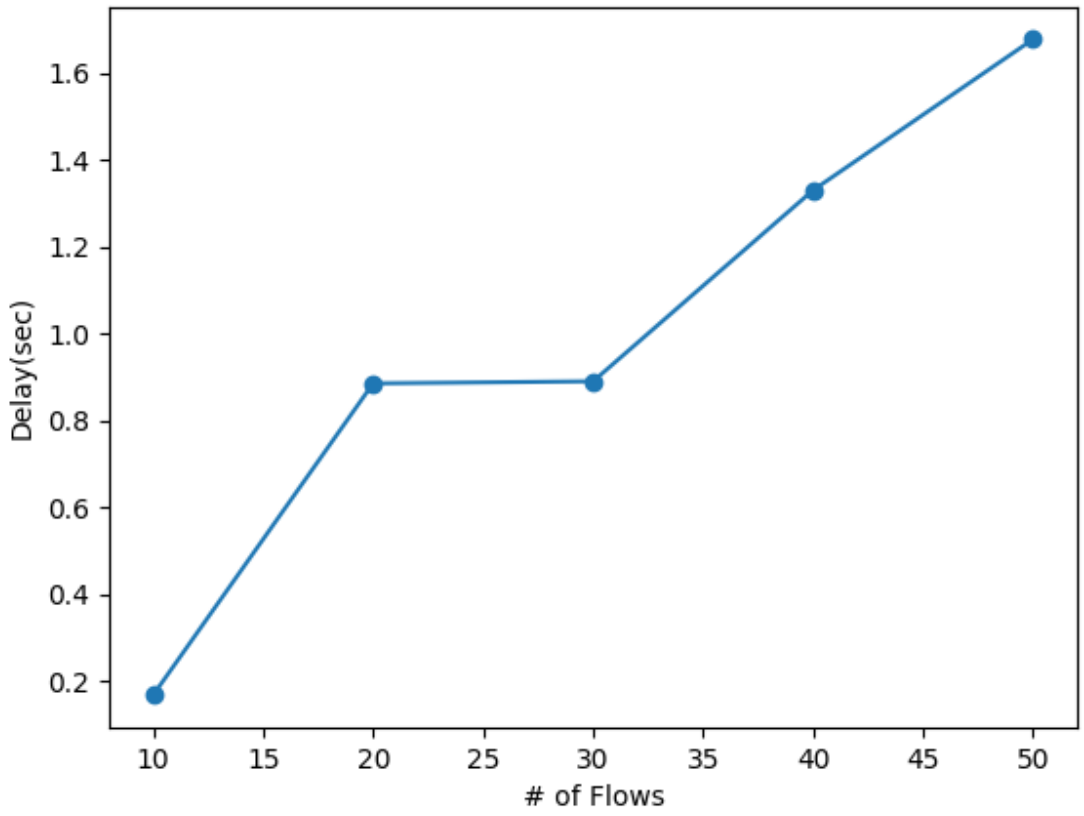
Drop ratio should be dropping for the same reason as given in graph 7.

9. **Throughput vs Flows:**



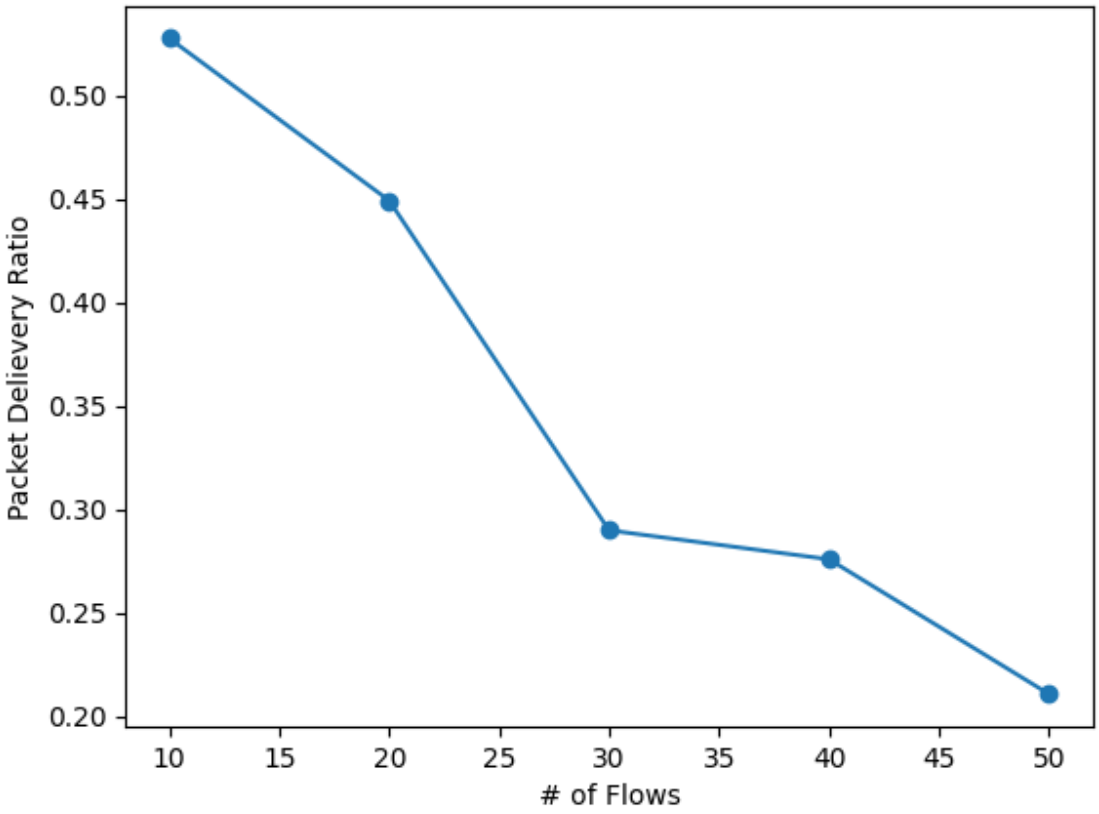
An increase in flow means more data generation. So, throughput should increase as long as it does not create congestion.

10. Delay vs Flows:



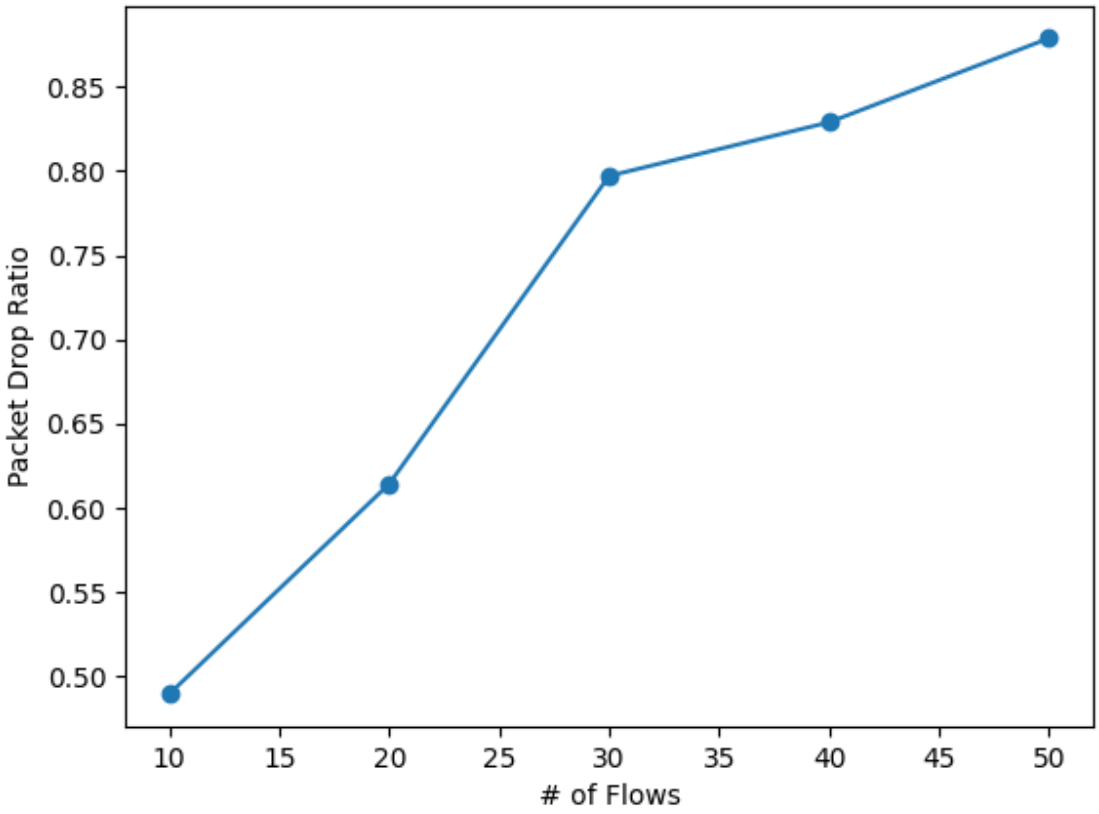
More flow means more traffic, and more packets in transmit. Intermediate nodes will take on average more time for each packet. An increase in delay is expected.

11. Delivery Ratio vs Flow



Increase in flow naturally creates more packets, and for the same capacity to transmit for a given network (nodes and area same) delivery of packets should become harder.

12. **Drop ratio vs Flow:**



The drop ratio should increase for the same reasoning given in graph 11.

Conclusion:

Network statistics vary widely depending on a number of parameters and protocols used. Random position and movement can create inconsistencies in some cases (graph 6). Running on multiple instances with the same parameter and different random seeds and taking their average could have mitigated the problem