# CSE 322

## OFFLINE -2

## On

## Network Simulator - 2


## Submitted By:

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# Description of Parameters

## 1. Wireless Mac Type 802.15.4

IEEE 802.15.4 is a standard for wireless personal area networks (WPANs) that defines the physical and data link layers for low-rate wireless personal area networks (LR-WPANs). It provides-

- Low data rate
- Short-range wireless communication.
- Energy-efficient for battery-powered devices
- Supports both peer-to-peer and star network topologies
- Reliable and secure communication through encryption and error correction
- Supports multiple frequencies (2.4 GHz, 915 MHz, 868 MHz, etc.)
- Robust performance in noisy environments
- Low-complexity hardware design suitable for low-cost devices
- Widely supported by the IoT industry with many available devices and solutions.

## 2. DSDV Routing Protocol

DSDV (Destination-Sequenced Distance-Vector) is a table-driven routing protocol for ad hoc mobile networks. It is based on the distance-vector algorithm and provides loop-free routing by using a unique sequence number assigned by the destination node for each of its routes. Here are some key features of DSDV:

- Loop-free: DSDV prevents routing loops by using unique sequence numbers assigned by the destination.
- Destination-sequenced: The routes in the routing table are maintained and updated based on the sequence number assigned by the destination.

- Table-driven: DSDV uses a routing table to store information about the network and update it as necessary.
- Full-duplex communication: DSDV supports two-way communication between nodes, allowing for real-time updates of the routing table.
- Periodic updates: The routing table is periodically broadcast to all nodes to maintain updated information about the network.
- Scalable: DSDV can handle large networks with many nodes, making it suitable for large-scale ad hoc networks.

# 3. UDP Agent

UDP (User Datagram Protocol) is a transport layer protocol in the Internet protocol suite. It is a connectionless and unreliable protocol that provides minimal error checking and handling compared to TCP (Transmission Control Protocol). The features of it are-

- Connectionless: Unlike TCP, UDP does not establish a reliable connection between the sender and receiver, making it faster and more efficient for some types of applications.
- Unreliable: UDP does not provide reliable delivery of packets and does not guarantee that packets will arrive at the destination or in the correct order.
- Minimal overhead: UDP adds minimal overhead to the data being transmitted, making it suitable for applications that require high-speed data transfer.
- Simple: UDP has a simple header structure, making it easier to implement and less resource-intensive than TCP.
- Multicast support: UDP supports multicast, allowing one sender to send a single packet to multiple receivers simultaneously.

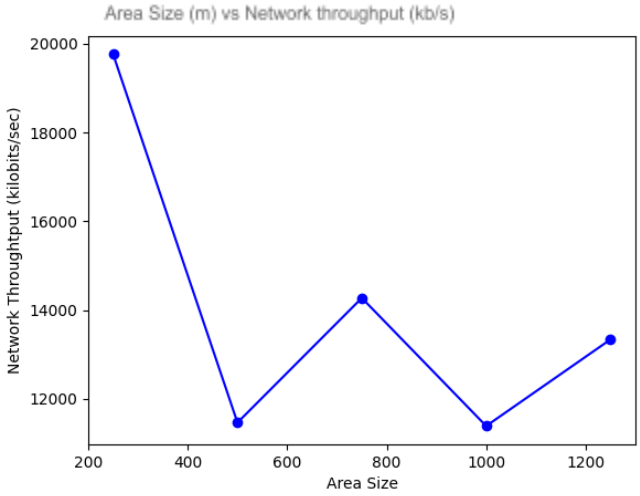
- Checksum: UDP includes a checksum in its header to detect errors in the data being transmitted.
- Fast: UDP's connectionless and unreliable nature makes it faster than TCP, as it does not need to establish and maintain a connection, retransmit lost packets, or perform flow control.

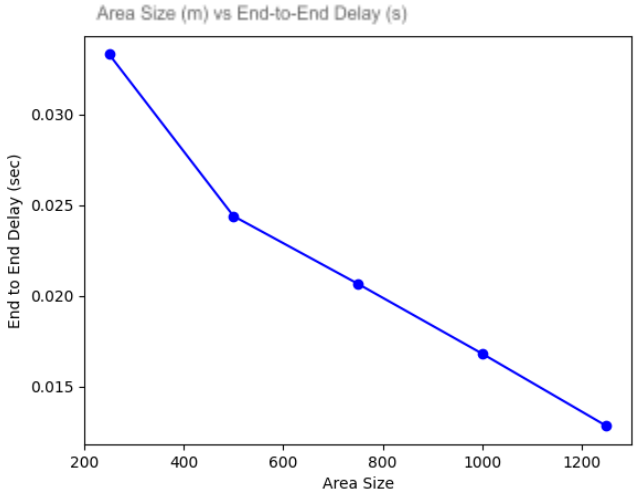
# 4. CBR Traffic Application

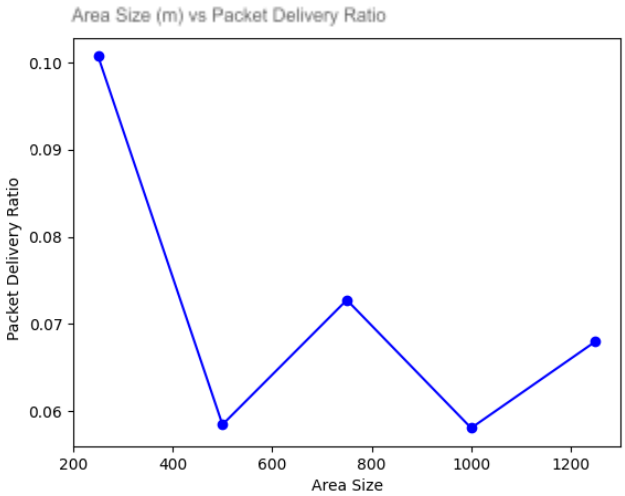
CBR (Constant Bit Rate) traffic is a type of traffic pattern in computer networks that generates a constant and deterministic data rate. It is used in applications that require a predictable and consistent data transfer rate, such as audio and video streaming, voice over IP (VoIP), and real-time gaming.

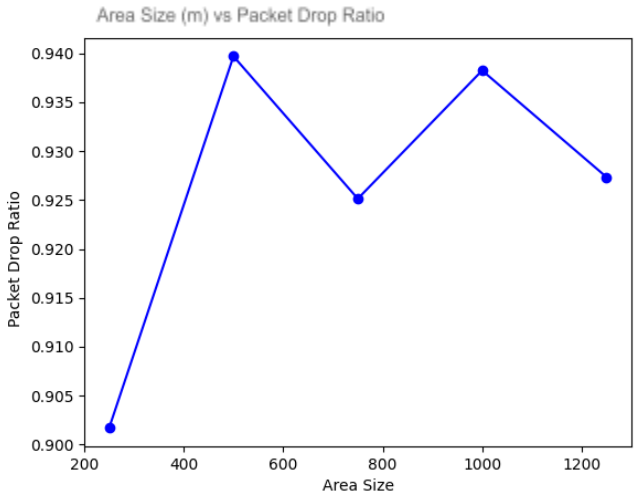
- Constant data rate: CBR traffic generates a constant and deterministic data rate, which is specified in advance and remains consistent, regardless of network conditions.
- Predictable: CBR traffic provides a predictable and consistent data rate, making it well-suited for real-time applications that require a steady flow of data.
- Deterministic: CBR traffic is deterministic, meaning that its behavior can be predicted and controlled. This makes it well-suited for applications that require predictable and consistent performance.
- Reliable: CBR traffic provides a reliable data rate, ensuring that applications receive the required amount of data at the specified rate.
- Consistent: CBR traffic provides a consistent data rate, ensuring that applications receive the required amount of data at a constant rate.
- Efficient: CBR traffic provides an efficient and predictable data transfer rate, making it well-suited for real-time and streaming applications that require a steady flow of data.

# - Analysis

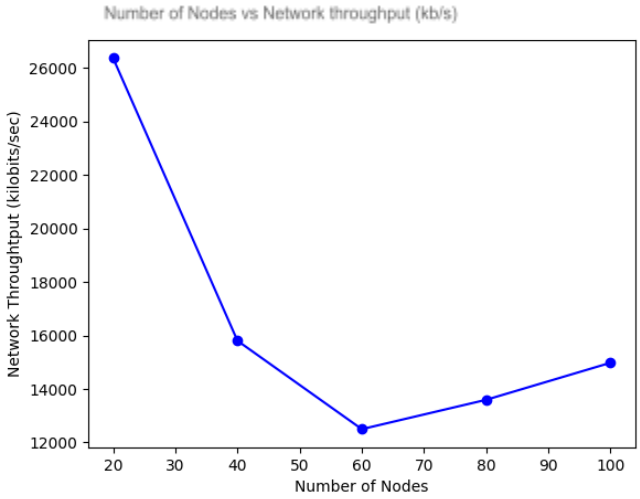


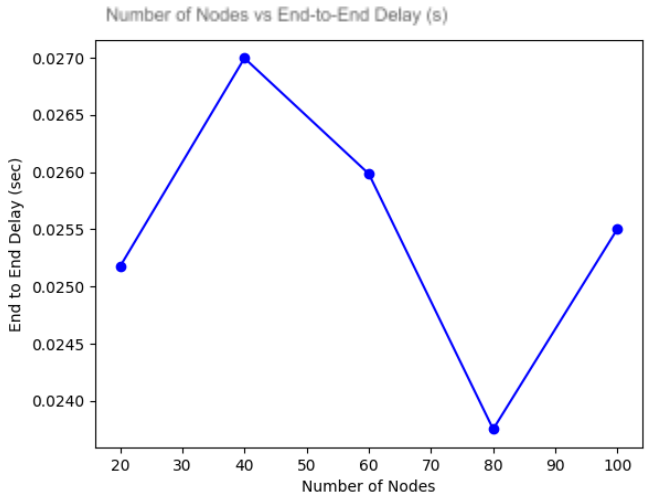



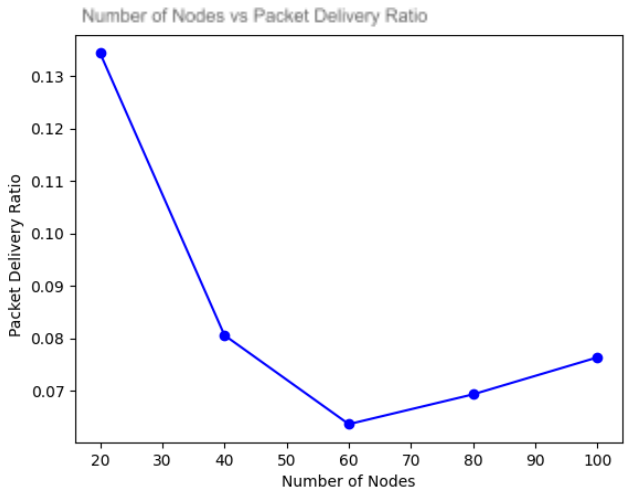



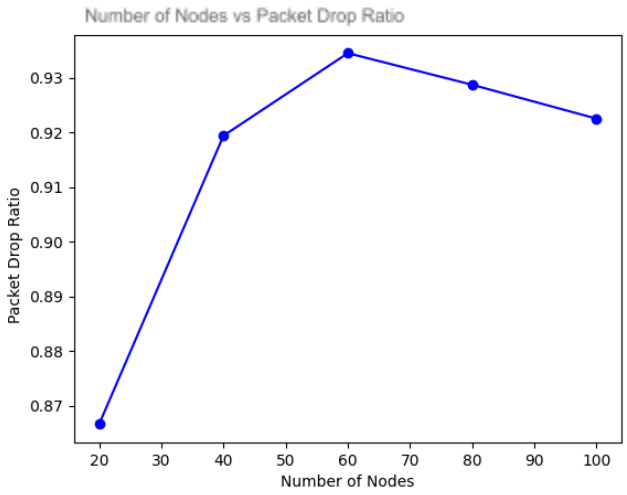




Here we can observe that network throughput tends to drop as the size increases. As the packet drop ratio increases with area size, delivery ratio and network throughput drops. On the other hand, end to end delay is supposed to rise with area size but it drops with area size increasing. This is because as the distance between nodes rises, the probability to drop the packet increases. Hence, flow between two distant nodes usually drops and flow between two close nodes creates small delays.

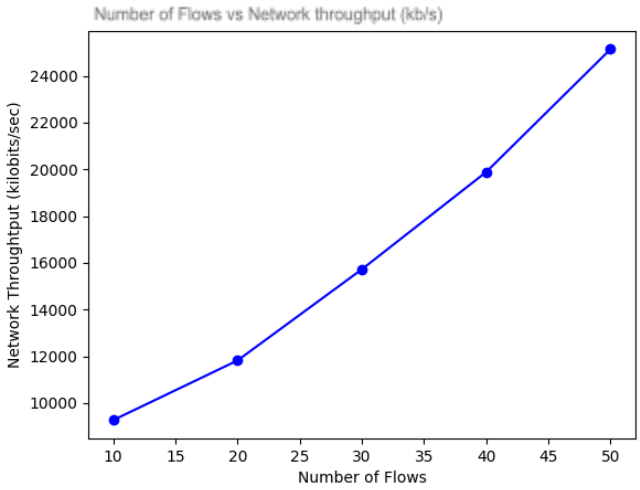


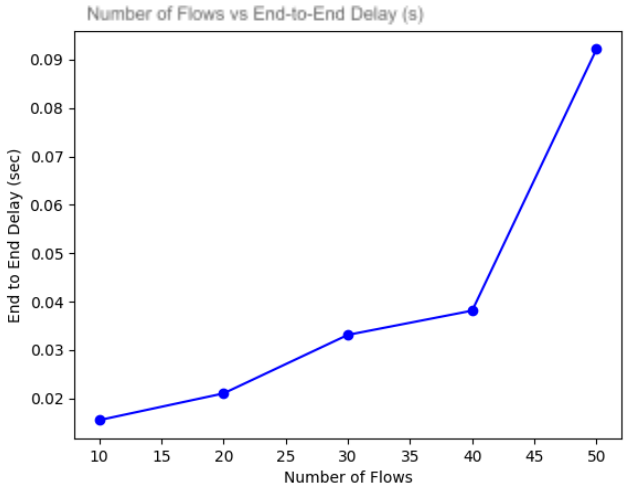



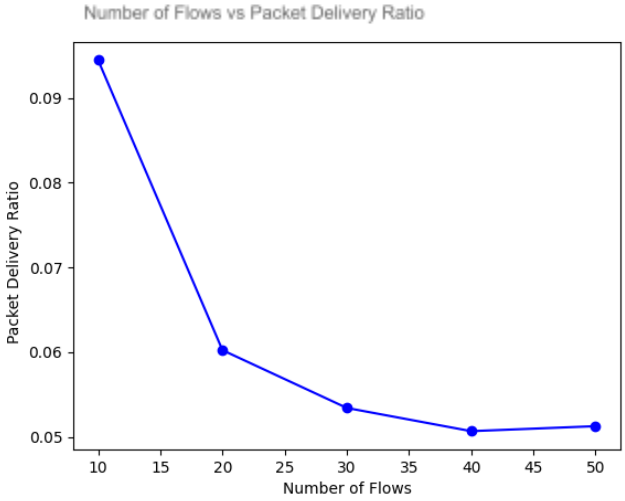



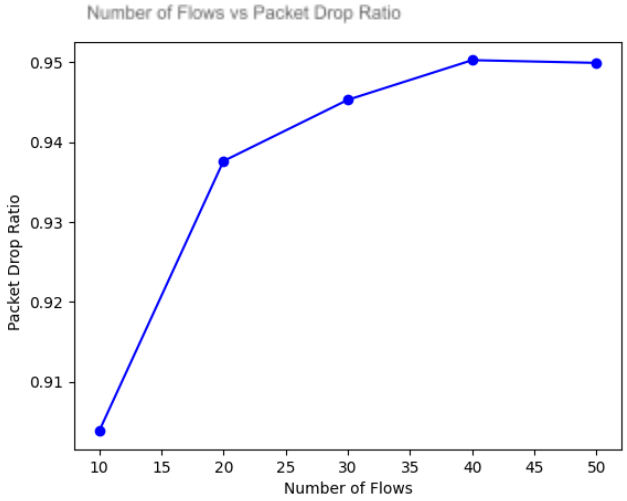




These 4 graphs vary the number of nodes in the network. At first, increasing the number of nodes causes a drop of network throughput and delivery ratio. It is because we used a fixed area size of 500m x 500m. Initially creating new nodes makes the nodes distant which causes them to drop packets. But as we increase the number of nodes even more, delivery ratio and network throughput starts to rise. But the behavior of end to end delay is a bit irregular. Firstly it rises with the number of flows but suddenly starts to drop and it rises again. Increasing the number of nodes should result in shorter end to end delay as the hop distance becomes lesser.




Finally, These graphs observe the behavior of the network with respect to the number of flows. It is fairly obvious that rising the number of flows will also raise the network throughput. But it also causes more packets to drop. As increased number of flows cause traffic congestion, drop ratio increases rapidly. Consequently, Delivery ratio drops rapidly. On the other hand, as the number of flows increases, the network becomes more congested, and packets may have to compete for bandwidth, leading to longer end-to-end delays.

# Conclusion

Analyzing all the graphs, we can conclude that-

- The graph of packet drop ratio is inversely proportional to the graph of delivery ratio
- UDP is unreliable as it doesn't establish a connection before communication.
- Wireless mac type 802.15.4 is difficult to scale as rising the number of nodes or increasing area size causes higher drop ratio.
- Packet drop ratio is immense. More than 90% of packets get dropped in this network.
- Some packets get unnoticed as the sum of the number of dropped packets and the number of received packets is smaller than the number of sent packets.