Report
CSE 322
Computer Networks Sessional
Offline 2

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1 Network configuration

In this assignment, we are required to simulate a network based on specific configuration. The configuration parameters are described below:

1.1 MAC Type: Wireless 802.15.4

IEEE standard **802.15.4** intends to offer the fundamental lower network layers of a type of wireless personal area network (WPAN) which focuses on low-cost, low-speed ubiquitous communication between devices.[1]

1.2 Routing Protocol: DSR

The dynamic source routing (DSR) protocol is a multi-jump on-demand routing protocol designed specifically for mobile nodes. When using the protocol, the network is fully self-organized and autonomic connected, and not use the ground base station and the satellite to build the communication between the nodes.[2]

1.3 Agent Type: UDP

User Datagram Protocol (UDP) is a communications protocol that is primarily used to establish low-latency and loss-tolerating connections between applications on the internet.

It speeds up communications by not formally establishing a connection before data is transferred. As a result, UDP is beneficial in time-sensitive communications, including voice over IP (VoIP), domain name system (DNS) lookup, and video or audio playback.

1.4 Application Type: CBR Traffic

The CBR service category is used for connections that transport traffic at a constant bit rate, where there is an inherent reliance on time synchronisation between the traffic source and destination. [3]

2 Plots

Baseline Parameters: While varying one parameter, we keep other parameters fixed as below:

- Area Size: 500m x 500m
- Number of Nodes: 40
- Number of flows: 20

2.1 Changing Area Size(m)

For different values of area size(m) such as 250m x 250m, 500m x 500m, 750m x 750m, 1000m x 1000m, 1250m x 1250m, we get the following metric plots.

2.1.1 Area Size (m) vs Throughput

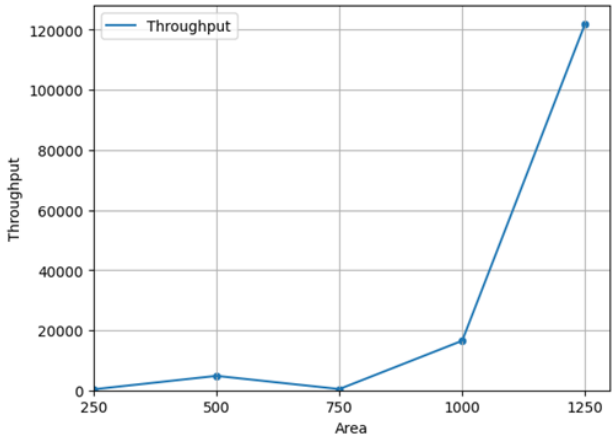

Figure 1: Area Size (m) vs Throughput

2.1.2 Area Size (m) vs Average Delay

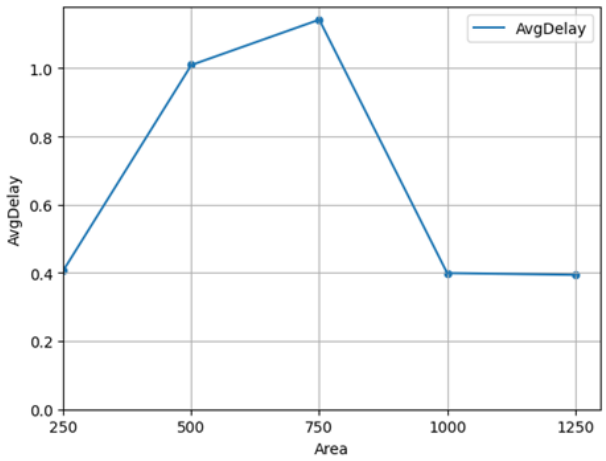

Figure 2: Area Size (m) vs Average Delay

2.1.3 Area Size (m) vs Delivery Ratio

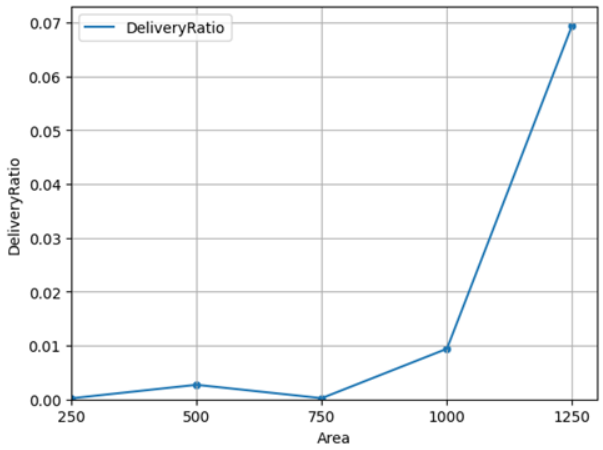

Figure 3: Area Size (m) vs Delivery Ratio

2.1.4 Area Size (m) vs Drop Ratio

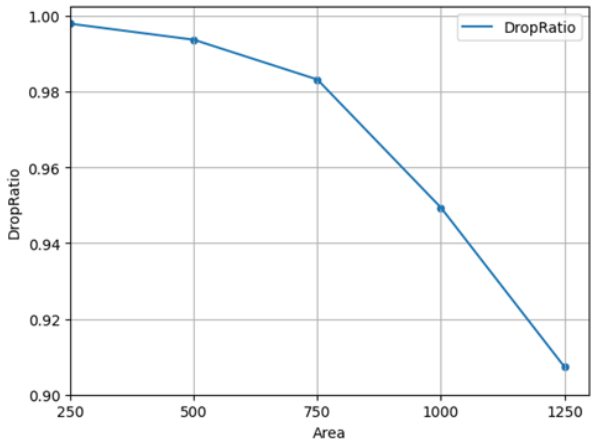

Figure 4: Area Size (m) vs Drop Ratio

2.2 Changing Number of Nodes

For different values of node numbers such as 20, 40, 60, 80, 100, we get the following metric plots.

2.2.1 Nodes vs Throughput

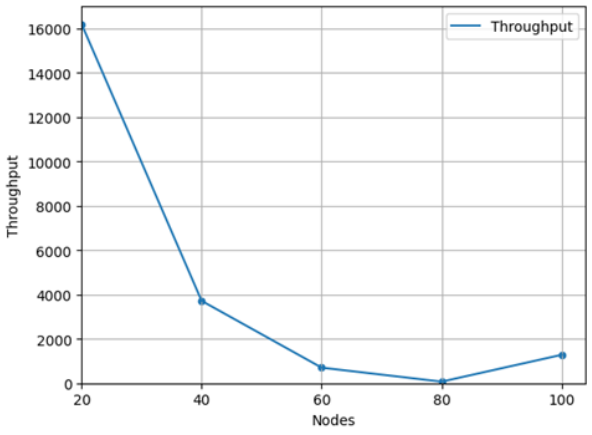

Figure 5: Nodes vs Throughput

2.2.2 Nodes vs Average Delay

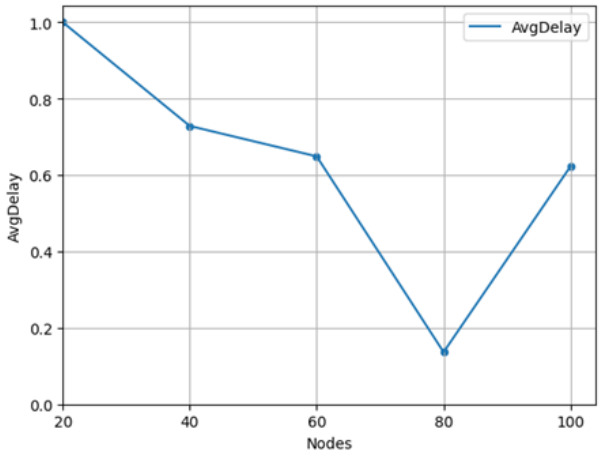

Figure 6: Nodes vs Average Delay

2.2.3 Nodes vs Delivery Ratio

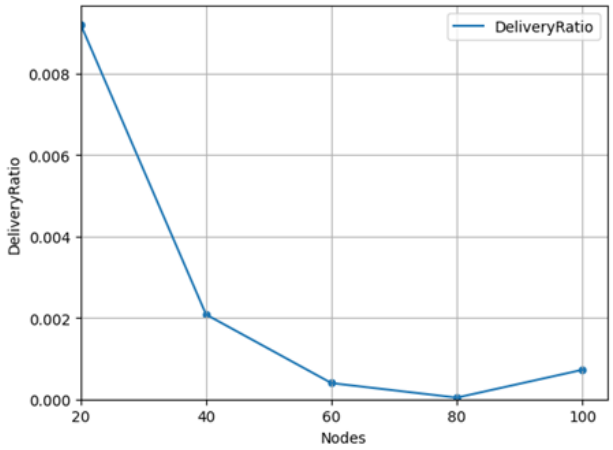

Figure 7: Nodes vs Delivery Ratio

2.2.4 Nodes vs Drop Ratio

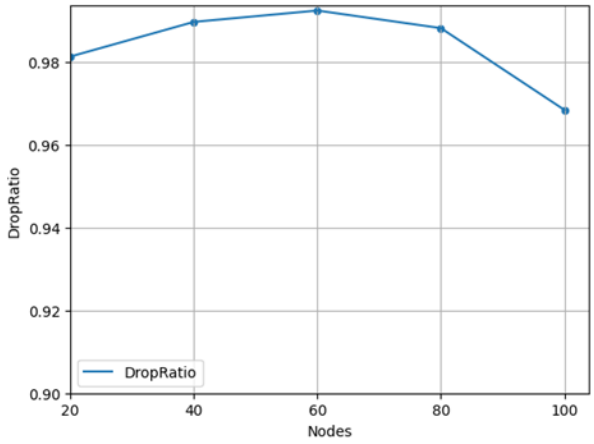

Figure 8: Nodes vs Drop Ratio

2.3 Changing Number of Flows

For different values of area size(m) such as 10, 20, 30, 40, 50, we get the following metric plots.

2.3.1 Flows vs Throughput

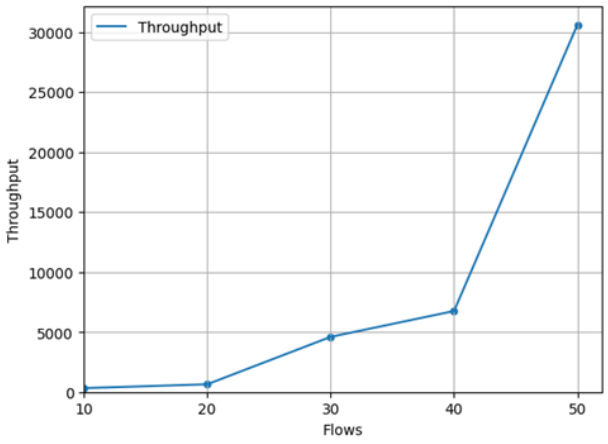

Figure 9: Flows vs Throughput

2.3.2 Flows vs Average Delay

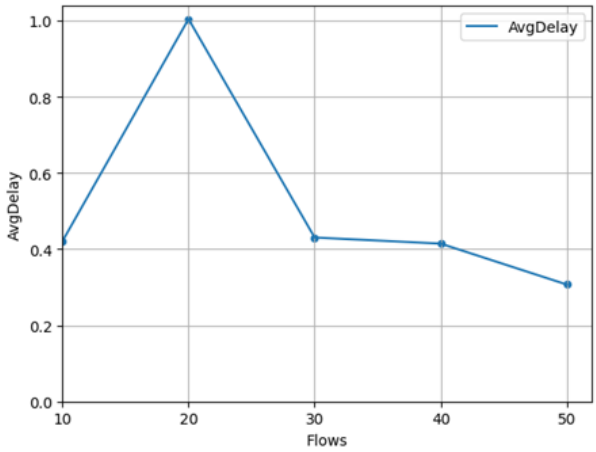

Figure 10: Flows vs Average Delay

2.3.3 Flows vs Delivery Ratio

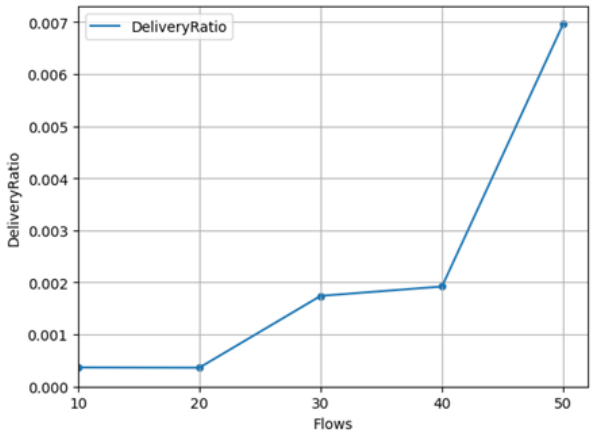

Figure 11: Flows vs Delivery Ratio

2.3.4 Flows vs Drop Ratio

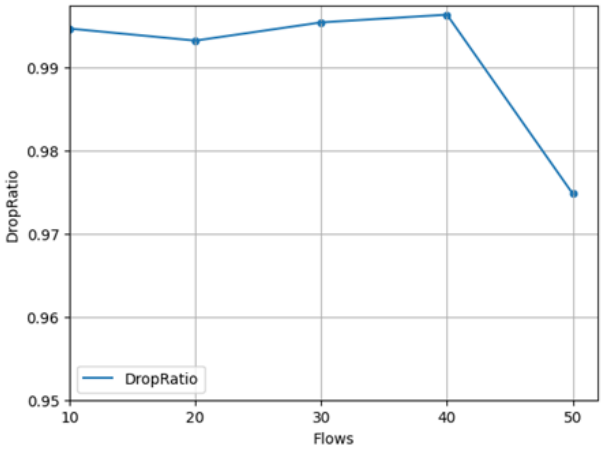

Figure 12: Flows vs Drop Ratio

3 Observation

While simulating multiple instances, the results appeared to be severely inconsistent. Because UDP is an unreliable and connection-less protocol, there are less re-transmission for lack of acknowledgements. There is no flow conotrol or congetion control. This resulted in significantly higher packet loss. We can see from figures 4, 8 and 12 that the **drop ratios are higher than 90%** on average.

Furthermore, because for each flow we were to choose random source and random sink along with random motion at random times made it difficult for the nodes to consistently communicate. When they get out of each other's range, they stop sending signals.

We also observed that, the **throughput and delivery ratio tend to increase with the number of flows**. It can also be observed that **throughput significantly increases with the area size.**

The rest of the plots did not provide any consistent characteristics.

To sum up, CBR traffic over UDP agent and following DSR routing protocol on 802.15.4 MAC layer is not a very good network configuration.

4 References

References

[1] Wikipedia contributors. Ieee 802.15.4. [Online]. Available: https://en.wikipedia.org/wiki/IEEE_802.15.4

[2] Q. Liang, T. Lin, F. Wu, F. Zhang, and W. Xiong, "A dynamic source routing protocol based on path reliability and link monitoring repair," *Plos one*, vol. 16, no. 5, p. e0251548, 2021.

[3] W. contributors, "Traffic contract," 8 2022. [Online]. Available: https://en.wikipedia.org/wiki/Traffic_contract