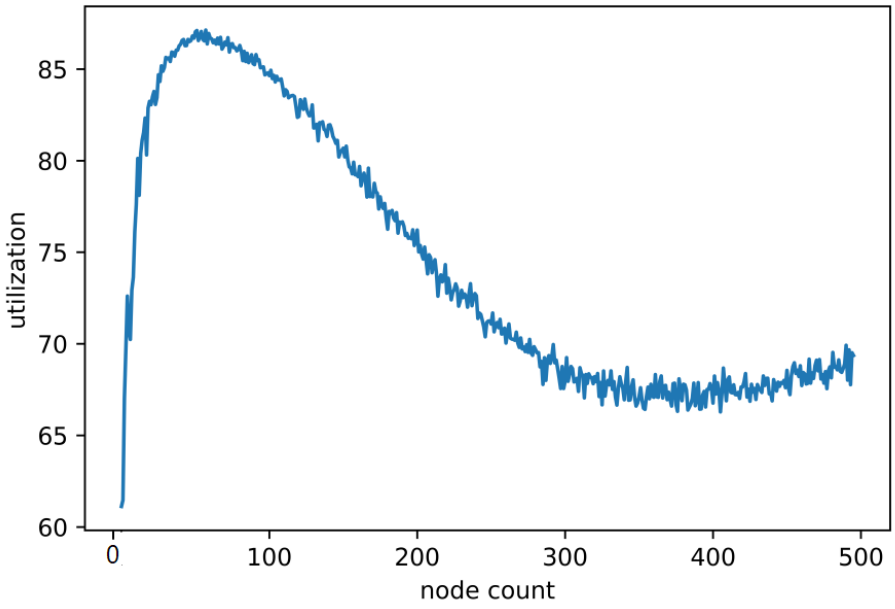
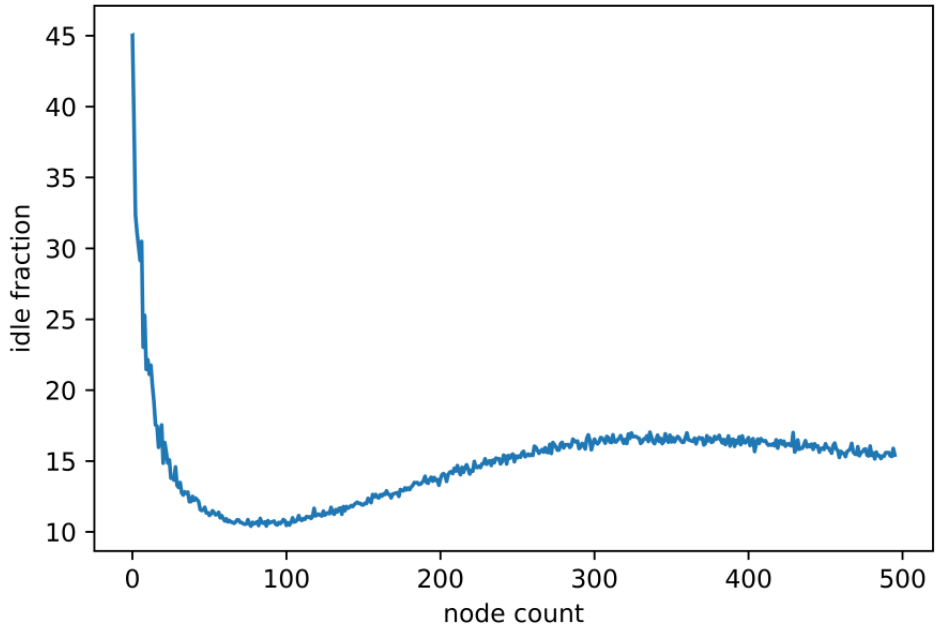
(a)



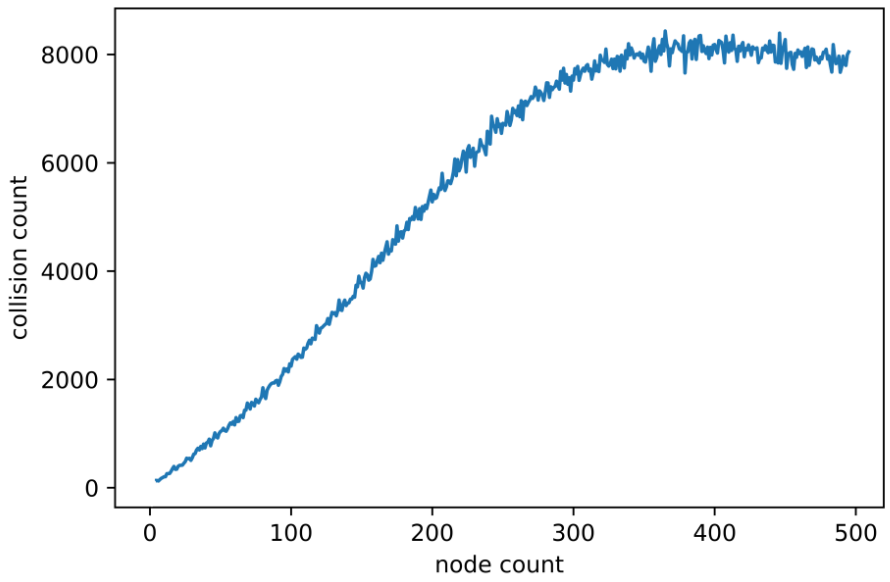
X is the node count from 5 to 500, Y is the channel utilization in percentage.

(b)



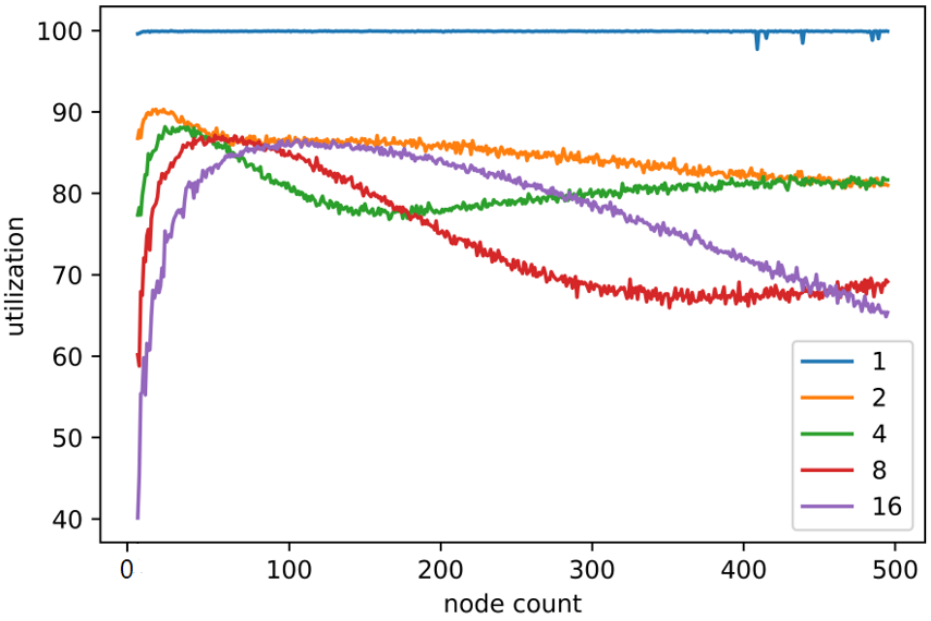
X is the node count from 5 to 500 and Y is the idle fraction in percentage.

(c)



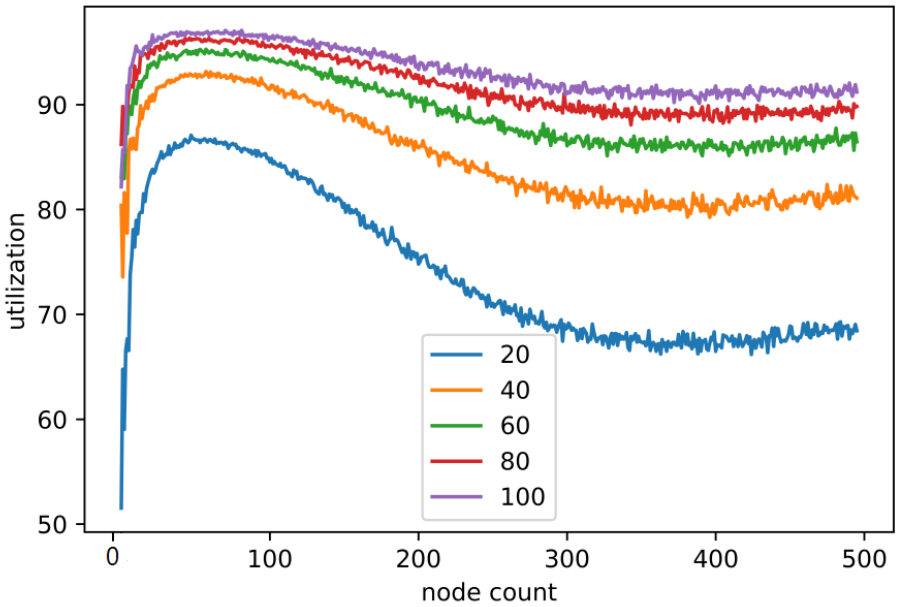
X is node count from 5 to 500, Y is the collision count.

(d)



X is node count from 5 to 500, Y is the utilization in percentage. In each line, it has different initial R values.

(e)



X is node count from 5 to 500, Y is the utilization in percentage. In each line, it has different initial packet length values.

(f)

1. With the initial R changes

For different node count part. It will first increase the utilization and then decrease. When there are not too many nodes in the channel to send data, the channel cannot fully be utilized. In this case, when the node count become larger, the idle fraction of the channel will decrease, which will increase the channel utilization. However, when there are too many nodes in the channel, the possibility of collision will also increase. When the collision happen we cannot use the channel to send data which will decrease the utilization.

For the different initial R part. The utilization will increase as we decrease the initial R values. When the R is smaller, the node will wait less time to send the data which will increase the utilization. However, the less wait time will also increase the possibility of collision. And this is why there is some node point that the smaller R value will have a lower utilization compared to the larger R value.

2. With the packet length changes

For different node count part. It will first increase the utilization and then decrease. When there are not too many nodes in the channel to send data, the channel cannot fully be utilized. In this case, when the node count become larger, the idle fraction of the channel will decrease, which will increase the channel utilization. However, when there are too many nodes in the channel, the possibility of collision will also increase. When the collision happen we cannot use the channel to send data which will decrease the utilization.

For the different packet length part. The utilization will increase as we increase the packet length. This is because in the process, when the channel is used to send data, other nodes will freeze and forgive to send data as long as the channel is occupied. Since the packet length become longer, the time that used to send data will longer when some point a node wants to send data and there is no collision, and the freezing time will become longer. And the time used to send data will also increase which increases the utilization. Besides, in the freeze time, there will be no collision which also increase the utilization.