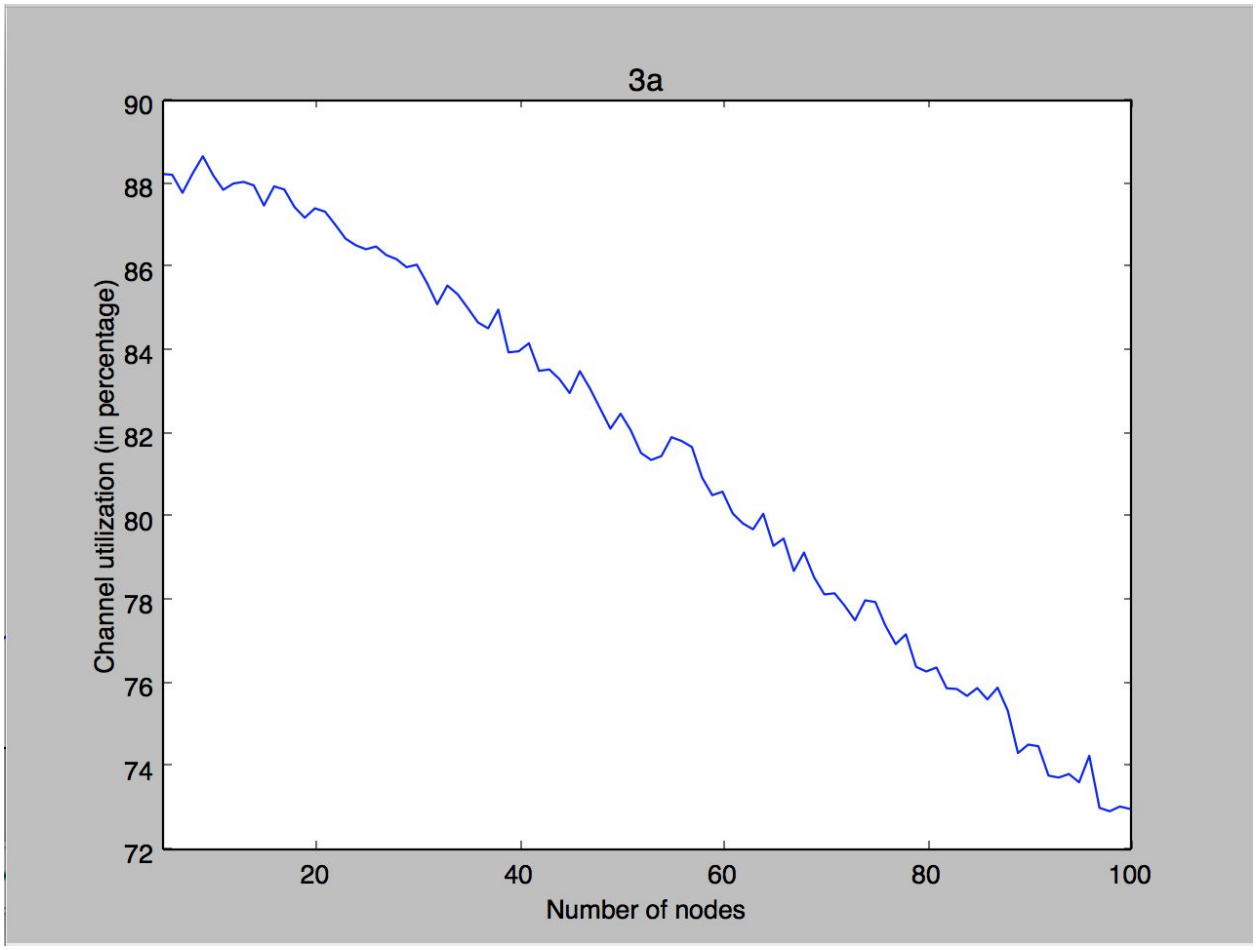
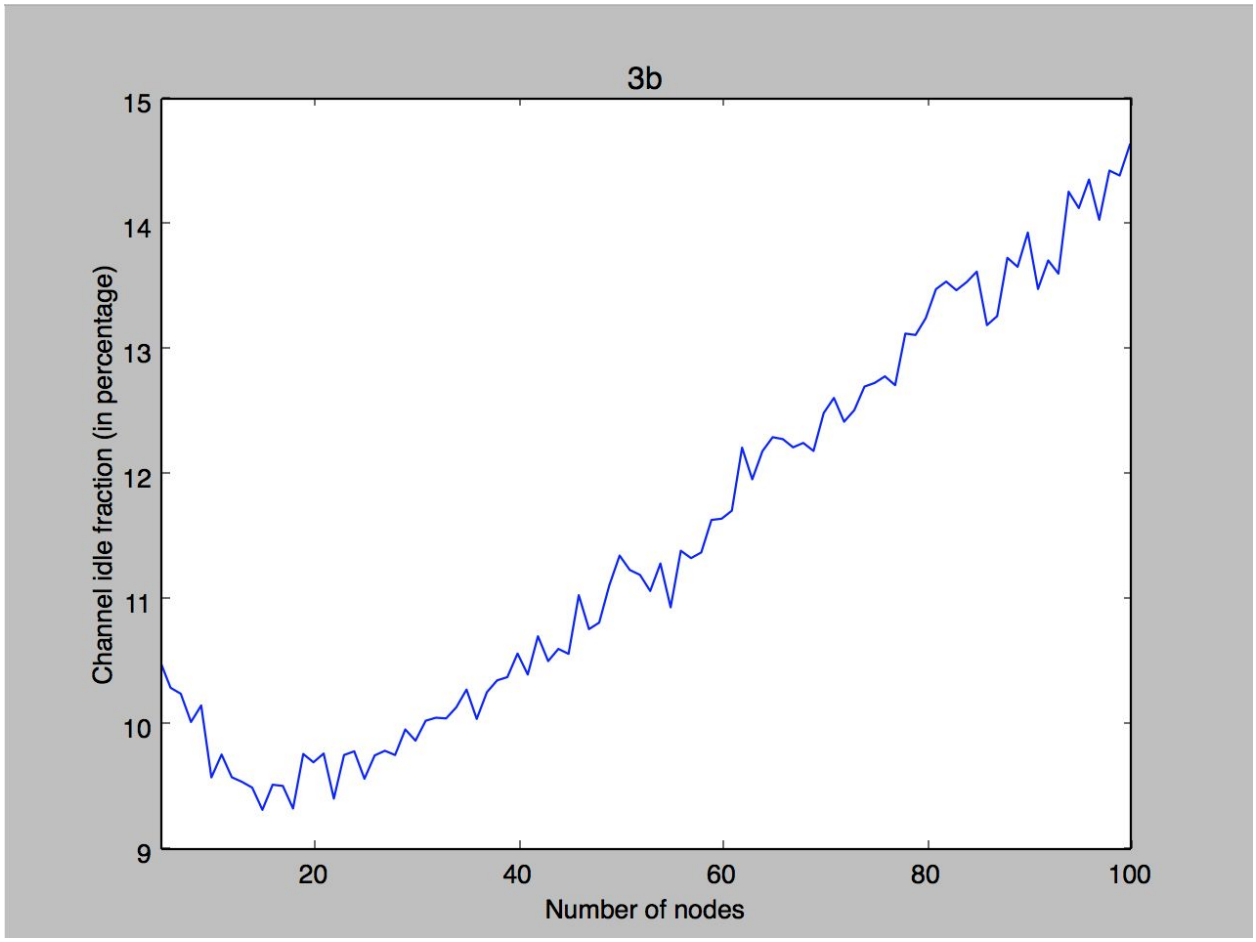
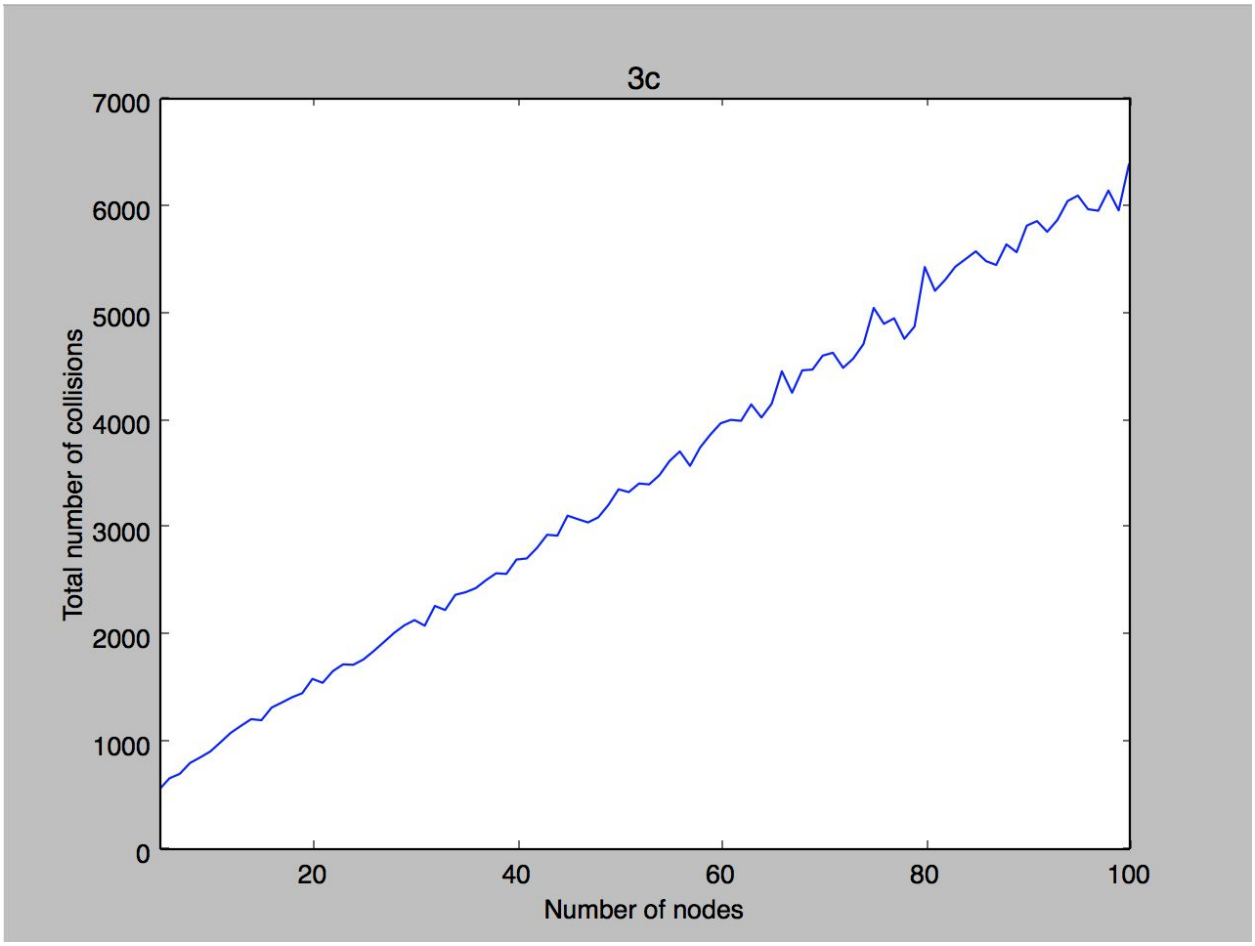
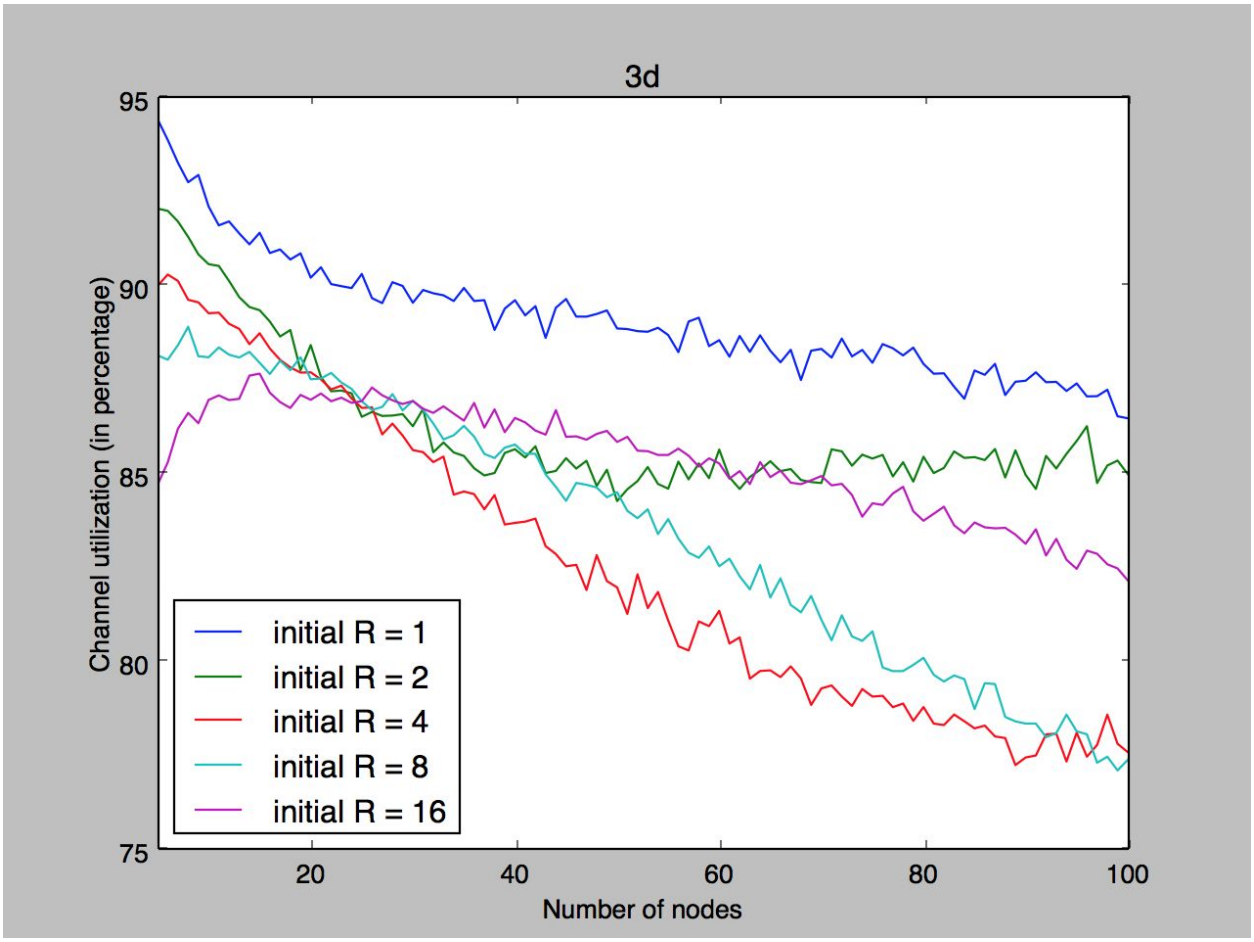
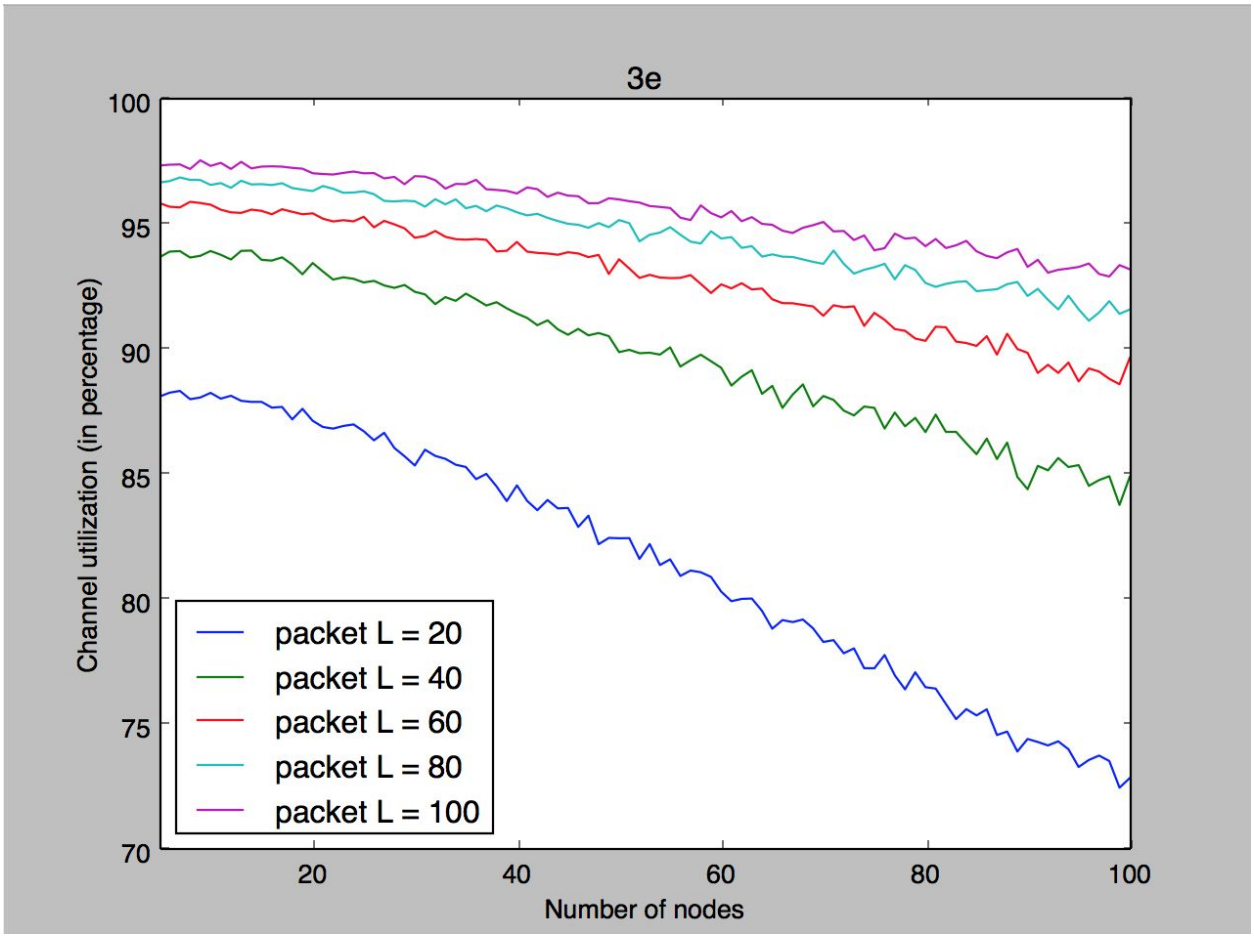

3a
Channel utilization (in percentage)
90
88
86
84
82
80
78
76
74
72
20
40
60
80
100
Number of nodes


3b
Channel idle fraction (in percentage)
15
14
13
12
11
10
9
20
40
60
80
100
Number of nodes


3c
Total number of collisions
Number of nodes
0
1000
2000
3000
4000
5000
6000
7000
20
40
60
80
100


3d
Channel utilization (in percentage)
Number of nodes
75
80
85
90
95
20
40
60
80
100
initial R = 1
initial R = 2
initial R = 4
initial R = 8
initial R = 16



f) As the number of nodes in a network increases, the amount of channel utilization generally increases or stays constant initially. This is because in a network with very few nodes, much of the channel time is wasted by periods of time when all nodes are backing off and none are sending packets. So when new nodes are added in this stage, these periods of wasted time become shorter and less frequent. However, past a certain number of nodes, the number of packet collisions increases to a point where the delays incurred by exponentially increasing backoffs and wasted slots during packet collisions become greater factors.

When the starting backoff window varies, in networks with few nodes, channel utilization may be greater when R is lower, as nodes waste less time backing off before each packet. However, in networks with large numbers of nodes, there is a tradeoff between reducing the number of packets that collide (large R) and letting nodes attempt to send packets after only waiting for short periods of time (small R).

When the length of packets increases, less time must be wasted per packet in deciding which node gets to send, meaning the channel utilization may be greater.