CSE 322: Computer Networks Sessional

Report on Network Simulator 2 (NS2) Offline

Department of Computer Science and Engineering

Bangladesh University of Engineering and Technology

Somonindro Roy

ID : 1805049

Section : A

MAC type : Wireless MAC 802.15.4

IEEE 802.15.4 is a technical standard which defines the operation of a low-rate wireless personal area network (LR-WPAN). It specifies the physical layer and media access control for LR-WPANs. It 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. It can be contrasted with other approaches, such a Wi-Fi, which offer more bandwidth and requires more power. The emphasis is on very low cost communication of nearby devices with little to no underlying infrastructure, intending to exploit this to lower power consumption even more.

Key 802.15.4 features include:

1. Real time suitability by reservation of Guaranteed Time Slots (GTS).
2. collision avoidance through CSMA/CA.
3. integrated support for secure communications.
4. power management functions such as link speed/quality and energy detection.
5. Support for time and data rate sensitive applications because of its ability to operate either as CSMA/CA or TDMA access modes. The TDMA mode of operation is supported via the GTS feature of the standard.
6. IEEE 802.15.4-conformant devices may use one of three possible frequency bands for operation (868/915/2450 MHz).

Routing protocol : DSR (Dynamic Source Routing)

Dynamic Source Routing (DSR) is a routing protocol for wireless mesh network. It is similar to AODV in that it forms a route on-demand when a transmitting node requests one. However, it uses source routing instead of relying on the routing table at each intermediate device. To avoid using source routing, DSR optionally defines a flow id option that allows packets to be forwarded on a hop-by-hop basis.

This protocol is truly based on source routing whereby all the routing information is maintained (continually updated) at mobile nodes. It has only two major phases, which are Route Discovery and Route Maintenance. Route Reply would only be generated if the message has reached the intended destination node (route record which is initially contained in Route Request would be inserted into the Route Reply).

Agent type : TCP Reno

TCP (Transmission Control Protocol) is known as a connection-oriented protocol, which ensures reliability, and is also responsible for congestion control mechanisms in the network. TCP Reno is a technique of TCP congestion control, this is used when the sender receives three duplicate acknowledgments. TCP Reno is an extension of TCP Tahoe (the first in-built congestion control algorithm).

Aplication type : FTP

The File Transfer Protocol (FTP) is a standard communication protocol used for the transfer of computer files from a server to a client on a computer network. FTP is built on a client-server model architecture using separate control and data connections between the client and the server. FTP users may authenticate themselves with a clear-text sign-in protocol, normally in the form of a username and password, but can connect anonymously if the server is configured to allow it. For secure transmission that protects the username and password, and encrypts the content, FTP is often secured with SSL/TLS (FTPS) or replaced with SSH File Transfer Protocol (SFTP).

Varying area size : (taking 5 samples for each case)

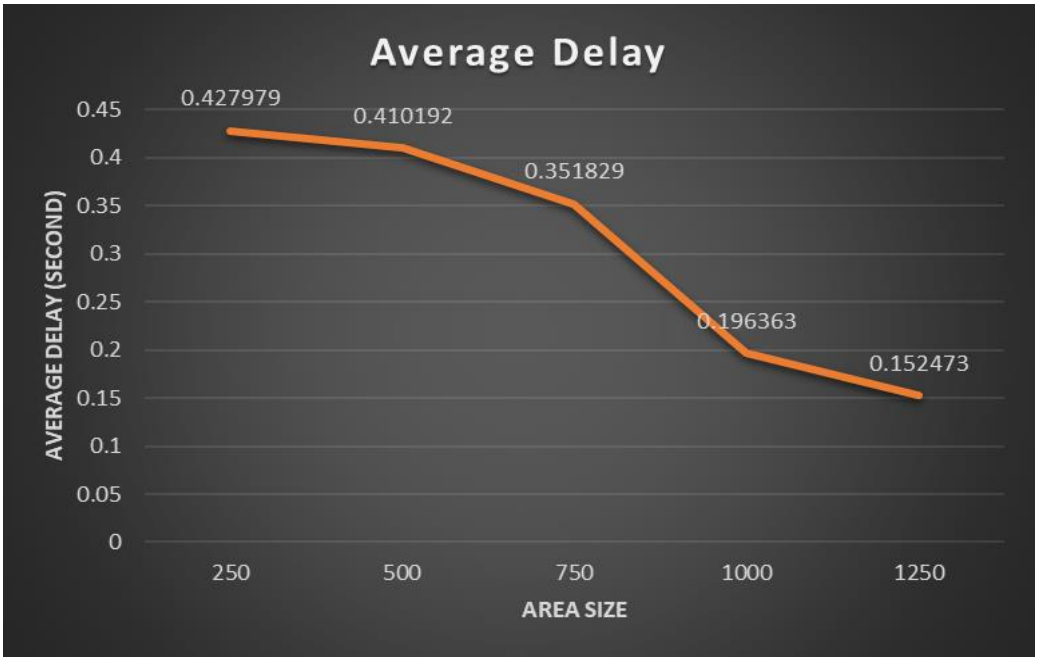
Number of Nodes = 40 and Number of Flows = 20

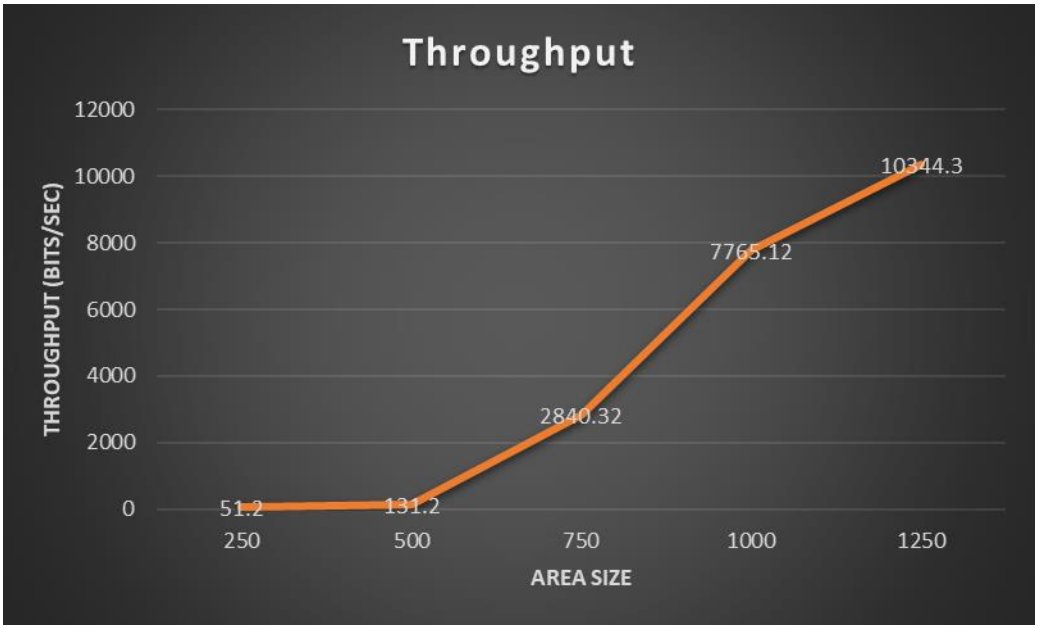
Area Size	Sent Packets	Dropped Packets	Received Packets	Throughput (bits/sec)	Average Delay (sec)	Delivery ratio	Drop ratio
250	682	195	488	1565.44	0.296821	0.715543	0.285924
	119	105	14	44.8	0.651624	0.117647	0.882353
	110	101	9	28.8	0.668188	0.0818182	0.918182
	106	99	7	22.4	0.84193	0.0660377	0.933962
	131	114	16	51.2	0.427979	0.122137	0.870229
500	268	151	114	368	0.457272	0.425373	0.563433
	192	138	53	174.08	0.464258	0.276042	0.71875
	326	164	162	520.32	0.566858	0.496933	0.503067
	156	114	45	144	1.00885	0.288462	0.730769
	161	121	41	131.2	0.410192	0.254658	0.751553
750	112	97	15	51.2	0.135288	0.133929	0.866071
	1652	189	1461	4677.12	0.289639	0.884383	0.114407
	457	154	309	988.8	0.444015	0.676149	0.33698
	1079	206	887	2840.32	0.351829	0.822057	0.190918

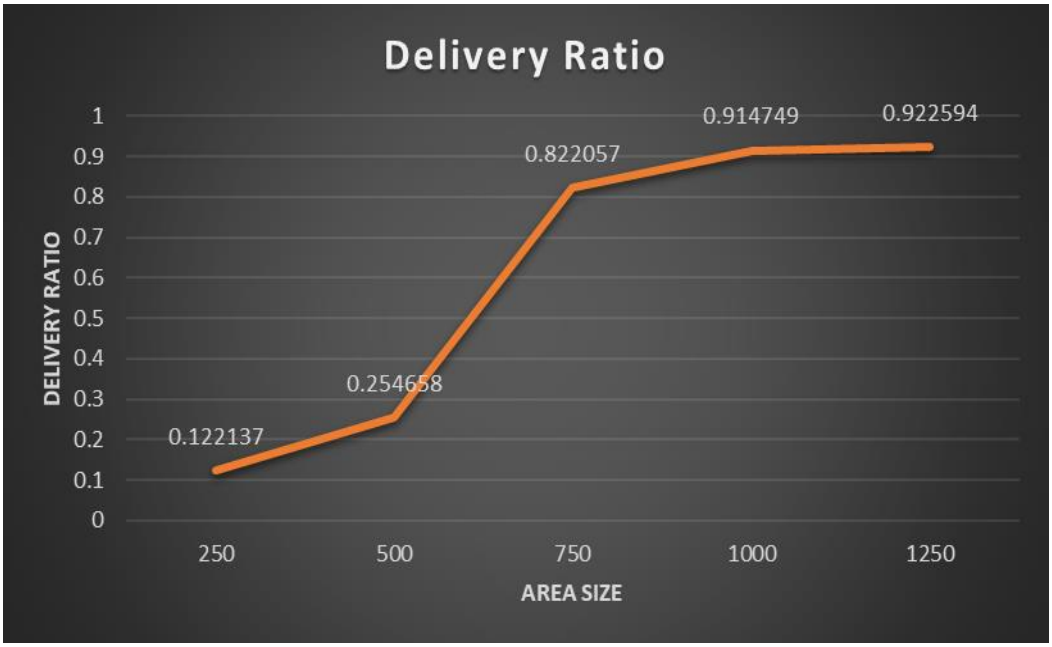
	2503	213	2280	7323.52	0.244091	0.910907	0.0850979
1000	1234	149	1077	3452.16	0.220099	0.872771	0.120746
	4178	177	4007	12828.2	0.129368	0.959071	0.0423648
	3957	194	3759	12037.8	0.138673	0.949962	0.049027
	2651	229	2425	7765.12	0.196363	0.914749	0.0863825
	900	148	750	2409.6	0.288098	0.833333	0.164444
1250	3501	253	3230	10344.3	0.152473	0.922594	0.0722651
	296	150	140	448	0.300401	0.472973	0.506757
	765	147	617	1985.92	0.198119	0.806536	0.192157
	4641	218	4406	14105.6	0.215795	0.949364	0.0469726
	563	116	448	1436.16	0.13935	0.795737	0.206039

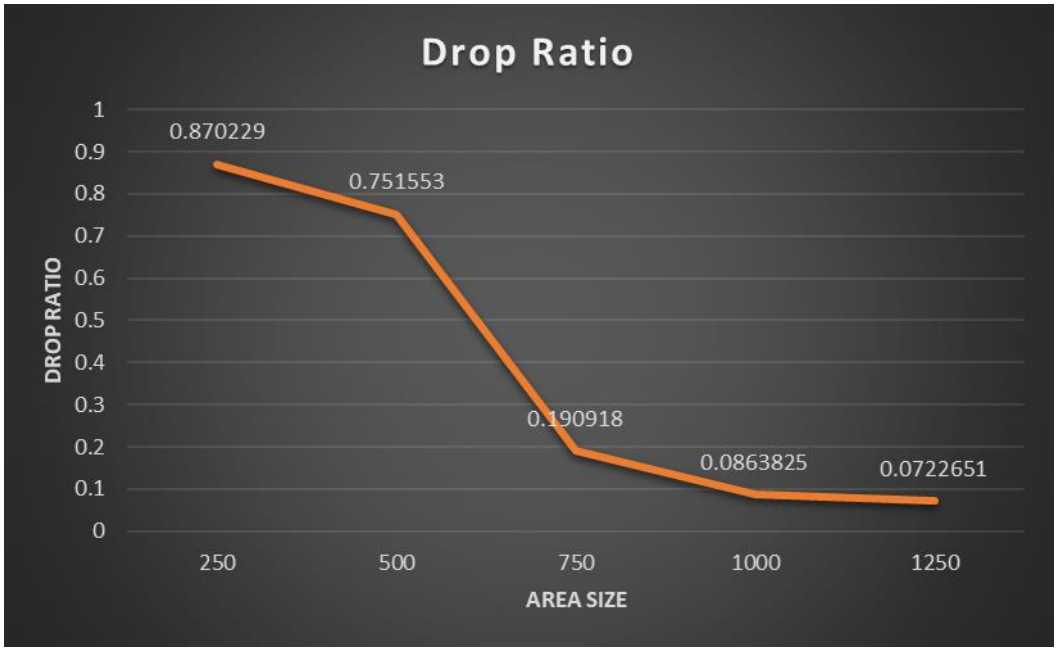
The final data :

Area Size	Sent Packets	Dropped Packets	Received Packets	Throughput (bits/sec)	Average Delay (sec)	Delivery ratio	Drop ratio
250	131	114	16	51.2	0.427979	0.122137	0.870229
500	161	121	41	131.2	0.410192	0.254658	0.751553
750	1079	206	887	2840.32	0.351829	0.822057	0.190918
1000	2651	229	2425	7765.12	0.196363	0.914749	0.0863825
1250	3501	253	3230	10344.3	0.152473	0.922594	0.0722651




Throughput
THROUGHPUT (BITS/SEC)
12000
10000
8000
6000
4000
2000
0
51.2
131.2
2840.32
7765.12
10344.3
250
500
750
1000
1250
AREA SIZE


Delivery Ratio
DELIVERY RATIO
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.122137
0.254658
0.822057
0.914749
0.922594
250
500
750
1000
1250
AREA SIZE



Varying number of nodes : (taking 5 samples for each case)

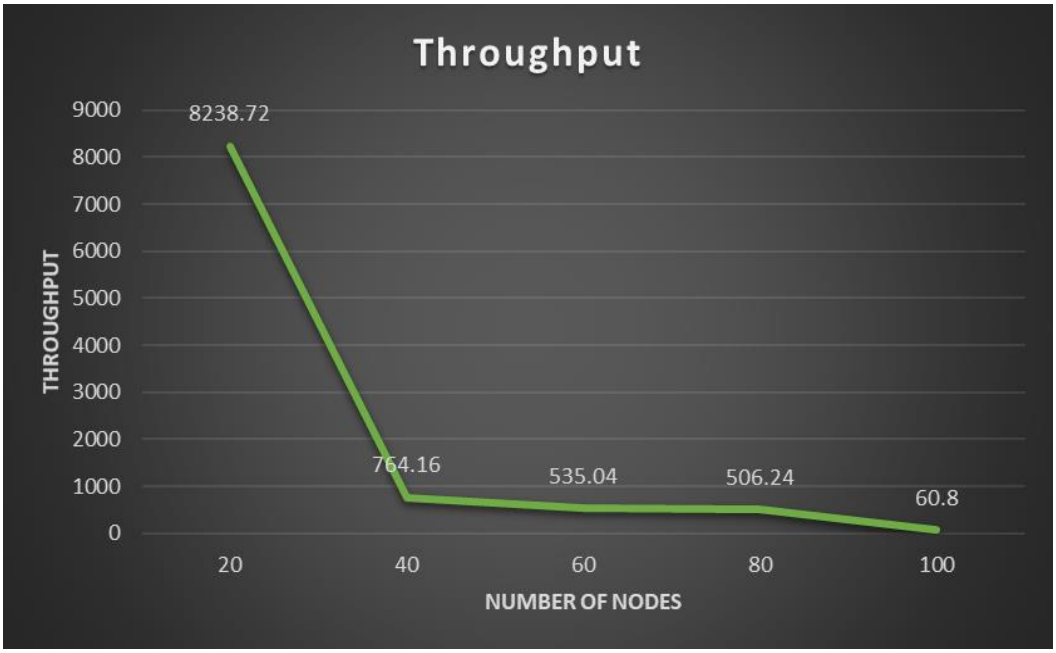
Area Size = 500 and Number of Flows = 20

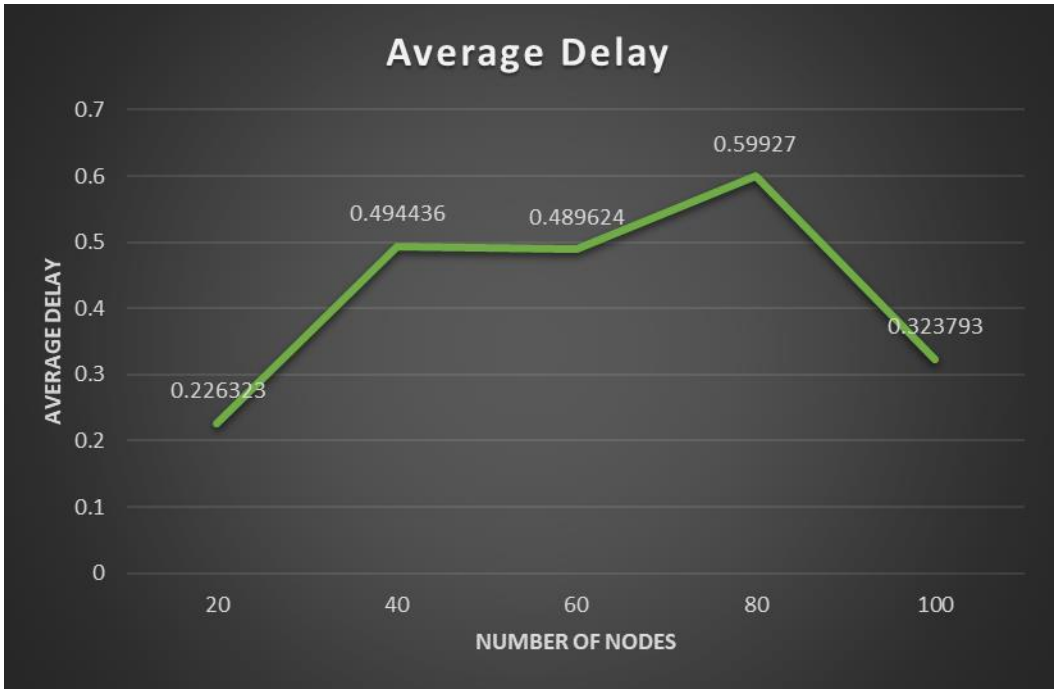
Number of Nodes	Sent Packets	Dropped Packets	Received Packets	Throughput (bits/sec)	Average Delay (sec)	Delivery ratio	Drop ratio
20	2281	223	2069	6643.84	0.381648	0.907058	0.0977641
	2118	266	1854	5948.16	0.441762	0.875354	0.12559
	2801	241	2570	8238.72	0.226323	0.917529	0.0860407
	3127	281	2861	9189.76	0.311156	0.914934	0.0898625
	4638	187	4433	14189.4	0.194968	0.9558	0.0403191
40	305	189	121	392.96	0.571359	0.396721	0.619672
	236	140	101	323.2	0.454268	0.427966	0.59322
	395	162	237	764.16	0.494436	0.6	0.410127
	136	113	23	75.52	0.596566	0.169118	0.830882
	328	160	166	531.2	0.526335	0.506098	0.487805
60	253	107	146	467.2	0.180577	0.577075	0.422925
	247	146	96	307.2	0.359953	0.388664	0.591093
	295	164	134	428.8	0.465888	0.454237	0.555932
	284	121	166	535.04	0.489624	0.584507	0.426056
	246	152	86	275.2	0.237762	0.349593	0.617886
	232	160	71	227.2	0.320983	0.306034	0.689655

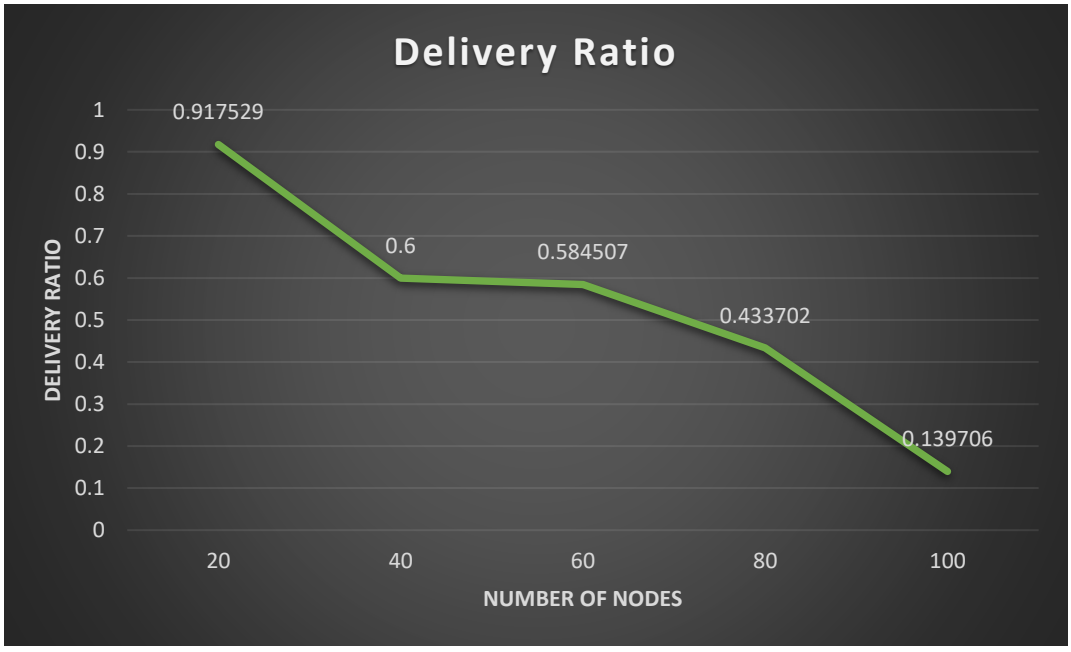
80	214	151	64	204.8	0.401496	0.299065	0.705607
	139	115	28	92.8	0.74858	0.201439	0.827338
	362	208	157	506.24	0.59927	0.433702	0.574586
	378	202	178	569.6	0.502192	0.470899	0.534392
100	100	99	3	9.6	0.823858	0.03	0.99
	100	98	3	9.6	1.43572	0.03	0.98
	102	101	2	6.4	0.467943	0.0196078	0.990196
	136	118	19	60.8	0.323793	0.139706	0.867647
	246	170	76	243.2	0.408775	0.308943	0.691057

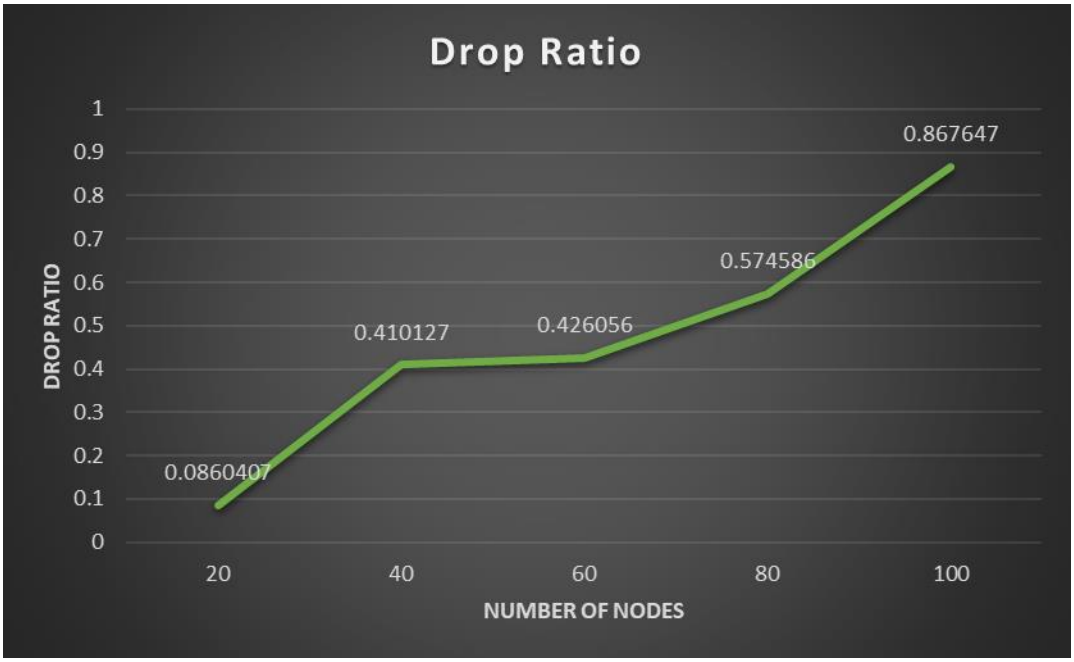
The final data :

Number of Nodes	Sent Packets	Dropped Packets	Received Packets	Throughput (bits/sec)	Average Delay (sec)	Delivery ratio	Drop ratio
20	2801	241	2570	8238.72	0.226323	0.917529	0.0860407
40	395	162	237	764.16	0.494436	0.6	0.410127
60	284	121	166	535.04	0.489624	0.584507	0.426056
80	362	208	157	506.24	0.59927	0.433702	0.574586
100	136	118	19	60.8	0.323793	0.139706	0.867647




Average Delay
AVERAGE DELAY
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.226323
0.494436
0.489624
0.59927
0.323793
20
40
60
80
100
NUMBER OF NODES


Delivery Ratio
DELIVERY RATIO
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.917529
0.6
0.584507
0.433702
0.139706
20
40
60
80
100
NUMBER OF NODES



Varying number of flows : (taking 5 samples for each case)

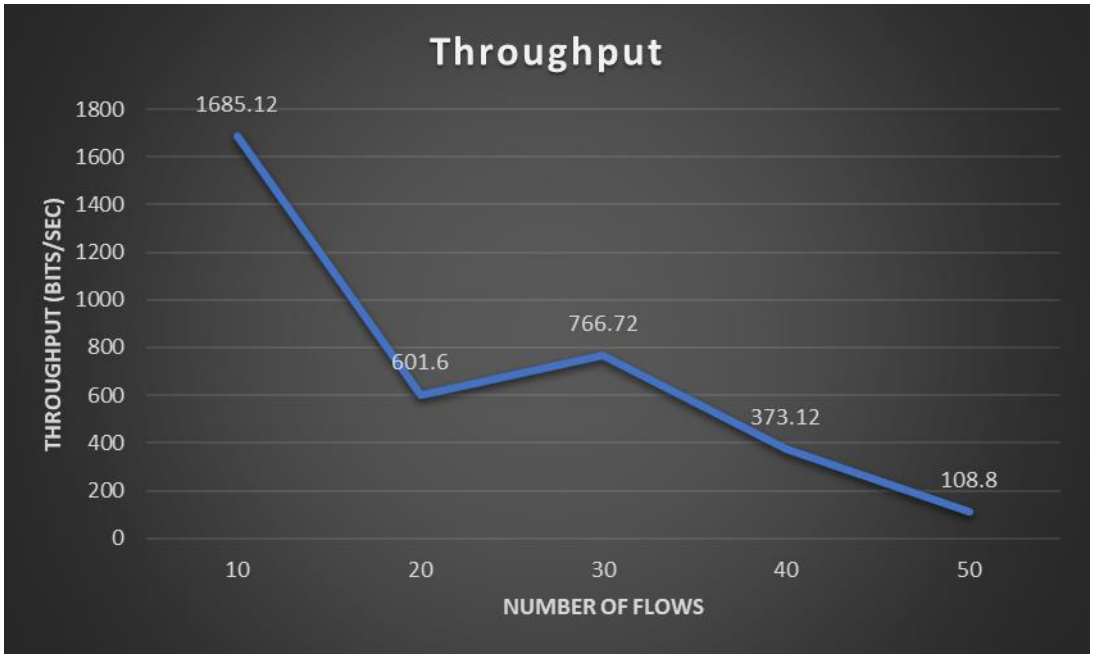
Area Size = 500 and Number of Nodes = 40

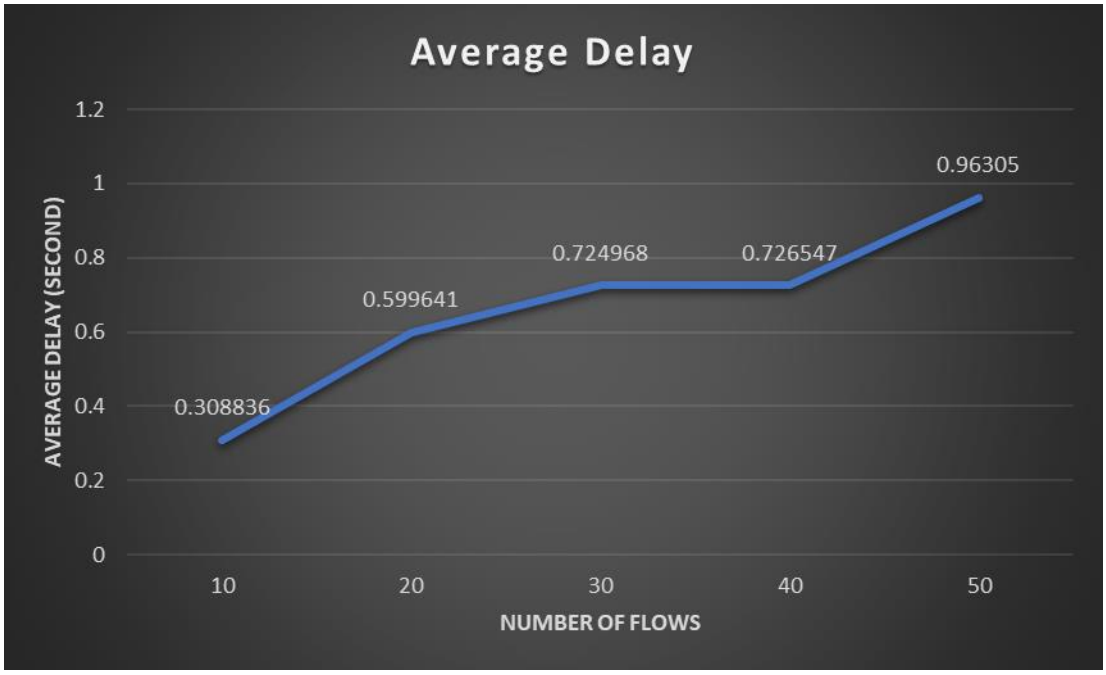
Number of Flows	Sent Packets	Dropped Packets	Received Packets	Throughput (bits/sec)	Average Delay (sec)	Delivery ratio	Drop ratio
10	196	65	137	443.52	0.307038	0.69898	0.331633
	643	115	526	1685.12	0.308836	0.81804	0.178849
	425	90	339	1092.48	0.268347	0.797647	0.211765
	493	80	408	1311.36	0.238433	0.827586	0.162272
	138	84	56	181.12	0.498217	0.405797	0.608696
20	287	144	148	478.72	0.534818	0.515679	0.501742
	1039	163	878	2821.12	0.256149	0.845043	0.156882
	330	146	188	601.6	0.599641	0.569697	0.442424
	309	179	121	387.2	0.393251	0.391586	0.579288
	374	180	198	637.44	0.56092	0.529412	0.481283
30	235	188	48	153.6	0.536698	0.204255	0.8
	162	158	6	19.2	0.594311	0.037037	0.975309
	200	170	30	96	0.611513	0.15	0.85
	171	154	21	69.12	0.931701	0.122807	0.900585
	439	198	239	766.72	0.724968	0.544419	0.451025
	307	245	61	197.12	0.535534	0.198697	0.798046

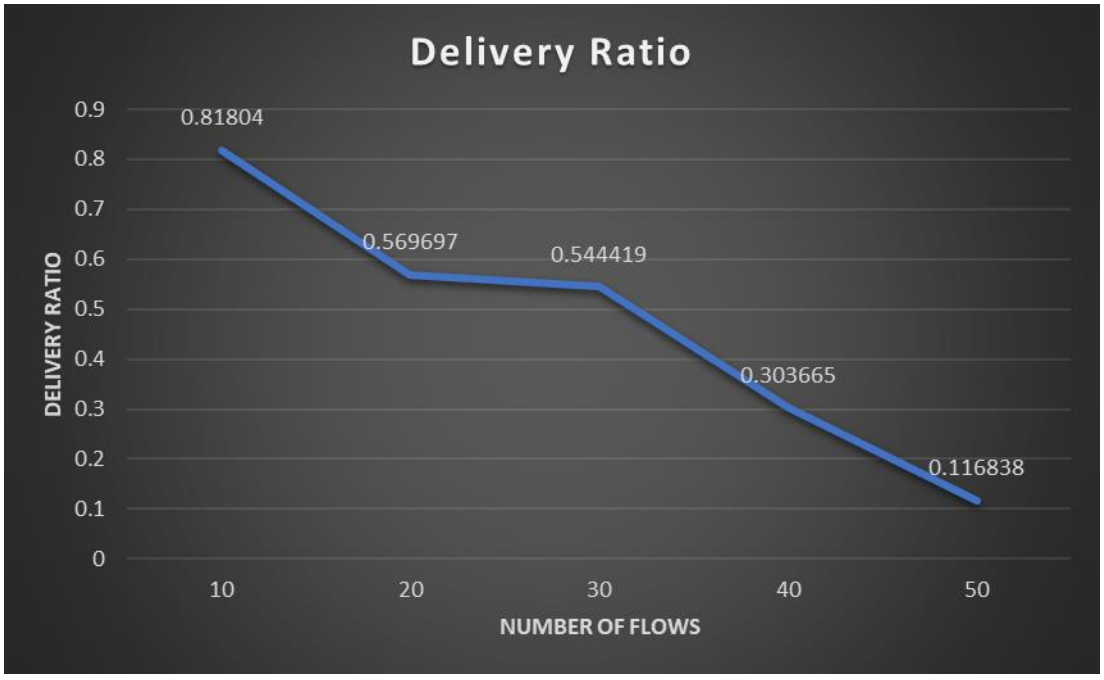
40	200	196	3	9.6	1.28325	0.015	0.98
	223	201	23	75.52	1.03311	0.103139	0.901345
	382	260	116	373.12	0.726547	0.303665	0.680628
	404	253	147	472.32	0.881077	0.363861	0.626238
50	255	250	6	19.2	0.815211	0.0235294	0.980392
	291	258	34	108.8	0.96305	0.116838	0.886598
	250	242	4	12.8	1.64873	0.016	0.968
	259	253	6	19.2	0.875356	0.023166	0.976834
	255	248	10	35.2	1.1485	0.0392157	0.972549

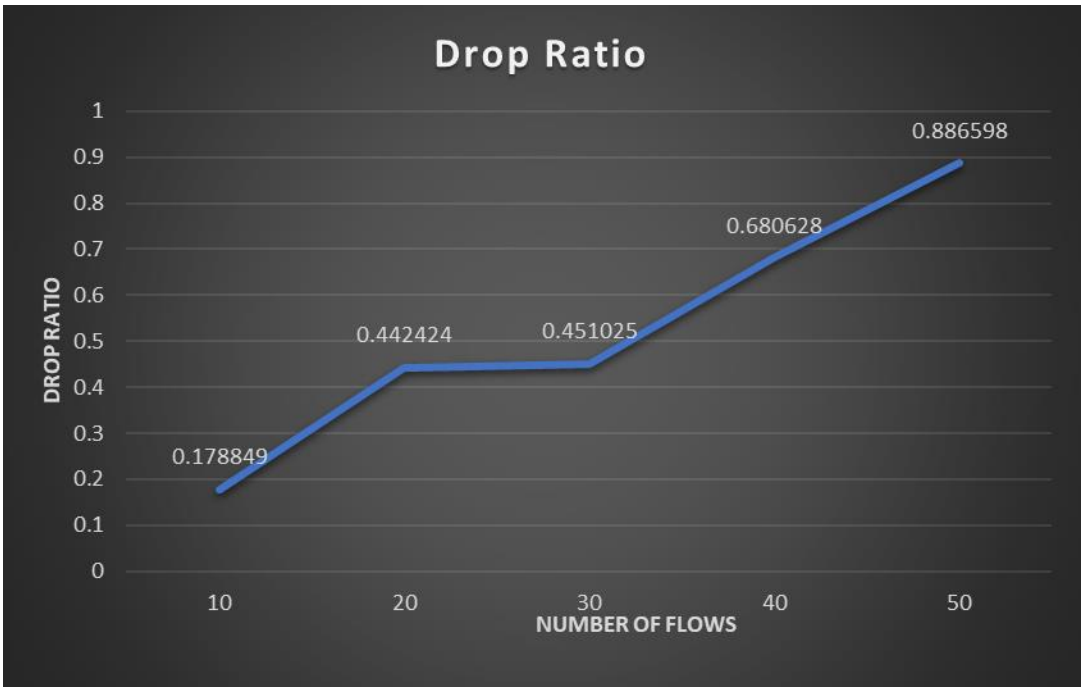
The final data :

Number of Flows	Sent Packets	Dropped Packets	Received Packets	Throughput (bits/sec)	Average Delay (sec)	Delivery ratio	Drop ratio
10	643	115	526	1685.12	0.308836	0.81804	0.178849
20	330	146	188	601.6	0.599641	0.569697	0.442424
30	439	198	239	766.72	0.724968	0.544419	0.451025
40	382	260	116	373.12	0.726547	0.303665	0.680628
50	291	258	34	108.8	0.96305	0.116838	0.886598




Average Delay
AVERAGE DELAY (SECOND)
1.2
1
0.8
0.6
0.4
0.2
0
0.308836
0.599641
0.724968
0.726547
0.96305
10
20
30
40
50
NUMBER OF FLOWS


Delivery Ratio
DELIVERY RATIO
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.81804
0.569697
0.544419
0.303665
0.116838
10
20
30
40
50
NUMBER OF FLOWS



Observations:

If we increase area size (keeping number of nodes and flows constant) , node density decreases and so it will be less congested. As a result , we can see from the graphs that with the increase of area size, drop ratio and average delay decreases and on the other hand, throughput and delivery ratio increases.

If we increase number of nodes (keeping number of flows and area size constant) , node density increases and so it will be more congested. As a result , we can see from the graphs that with the increase of number of nodes, drop ratio and average delay increases and on the other hand, throughput and delivery ratio decreases.

If we increase number of flows (keeping number of nodes and area size constant) , it will be more congested and more packets will be stored in queue. As a result , we can see from the graphs that with the increase of number of nodes, drop ratio and average delay increases and on the other hand, throughput and delivery ratio decreases.