DOS Project – 2

Gossip Simulator

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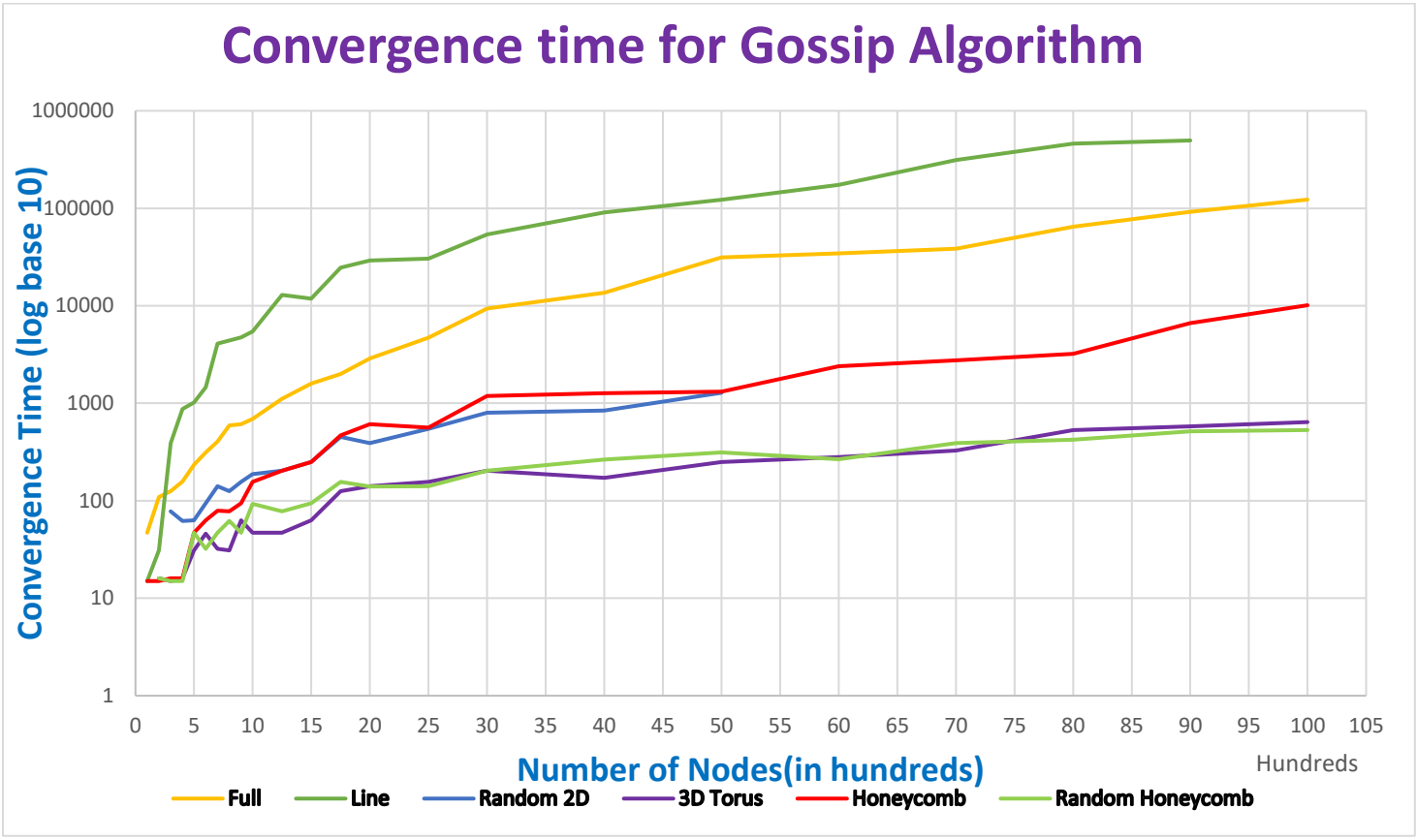
Gossip Algorithm:

In gossip algorithm, every node receives and transmits a message(rumor) to the other nodes depending upon the topology in which they are connected. Every node converges when it has heard the rumor 10 times, that is, it stops transmitting the rumor once it has heard it 10 times. The convergence time is the time required for all the nodes taking part in the algorithm, to converge.

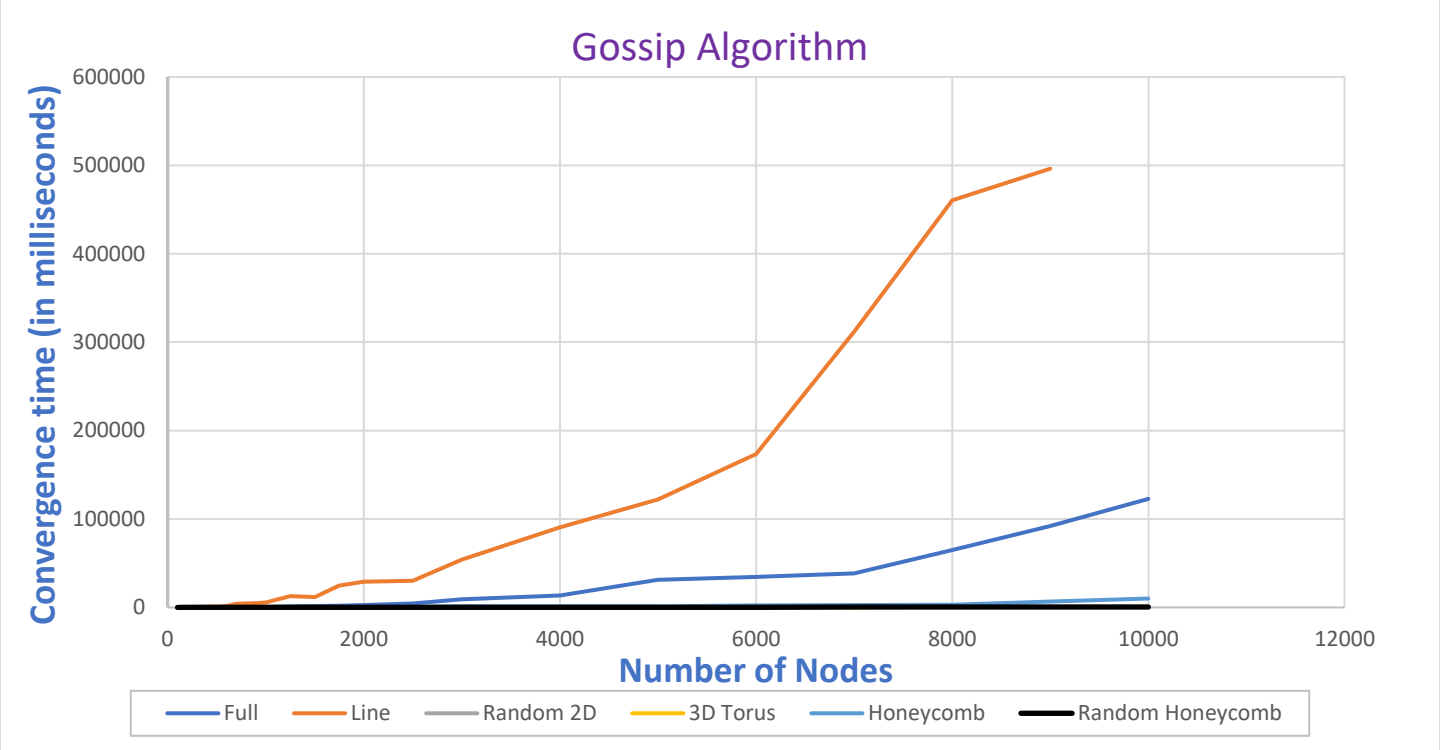
- The convergence time for the topologies are as follows:

No. of Nodes	Convergence Time for each topology (in milliseconds)					
	Full	Line	Random 2D	3D Torus	Honeycomb	Random Honeycomb
100	47	15	-	0	15	0
200	109	31	-	16	15	16
300	125	391	78	15	16	15
400	157	875	62	16	16	15
500	234	1016	63	31	47	47
600	312	1454	94	46	63	32
700	406	4094	141	32	79	47
800	594	4406	125	31	78	62
900	610	4734	156	63	94	47
1000	688	5453	188	47	156	93
1250	1109	12954	203	47	204	78
1500	1594	11797	250	63	250	94
1750	2000	24609	453	125	469	156
2000	2890	29187	390	141	609	140
2500	4688	30375	547	156	563	141
3000	9360	54031	802	203	1188	204
4000	13641	90719	844	172	1266	265
5000	31296	121953	1281	250	1312	313
6000	34453	173407	-	281	2391	266
7000	38563	311579	-	328	2750	390
8000	64906	460547	-	532	3203	422
9000	92235	496218	-	578	6656	516
10000	122797	-	-	641	10125	531

- The Graph of these convergence time (in logarithmic scale) for each topology plotted against the total number of nodes (that is, the total number of actors taking part in the Gossip) is as follows:



- The graph of the convergence times (in milliseconds) for each topology versus the total number of nodes is as follows:



Observations: (For Gossip Algorithm)

- The fastest convergence time is observed for the Random Honeycomb topology followed by 3D torus.
- The maximum number of nodes for which we tried to converge the random honeycomb is 10000 but it could also work for more number of nodes and the maximum number of nodes for which the 3D torus converged is 100000. The Random honeycomb took 531 ms to converge for 10000 nodes whereas 3D torus took 28282 ms for 100000 nodes.
- The line topology takes the maximum amount of time to converge, hence it is the slowest topology. We tried to implement the line topology for 9000 nodes and it took 496218 ms to converge.
- If we compare the convergence times for all the implemented topologies for a constant 5000 nodes we can observe the following pattern of convergence time,

  3D Torus < Random HoneyComb < Random 2D < Honeycomb < Full < Line
- The random 2D topology requires more than 100 nodes to start converging as for the nodes are communicating to each other randomly. A less number of nodes does not allow the rumor to be passed to every node and hence it never converges.

Push Sum Algorithm:

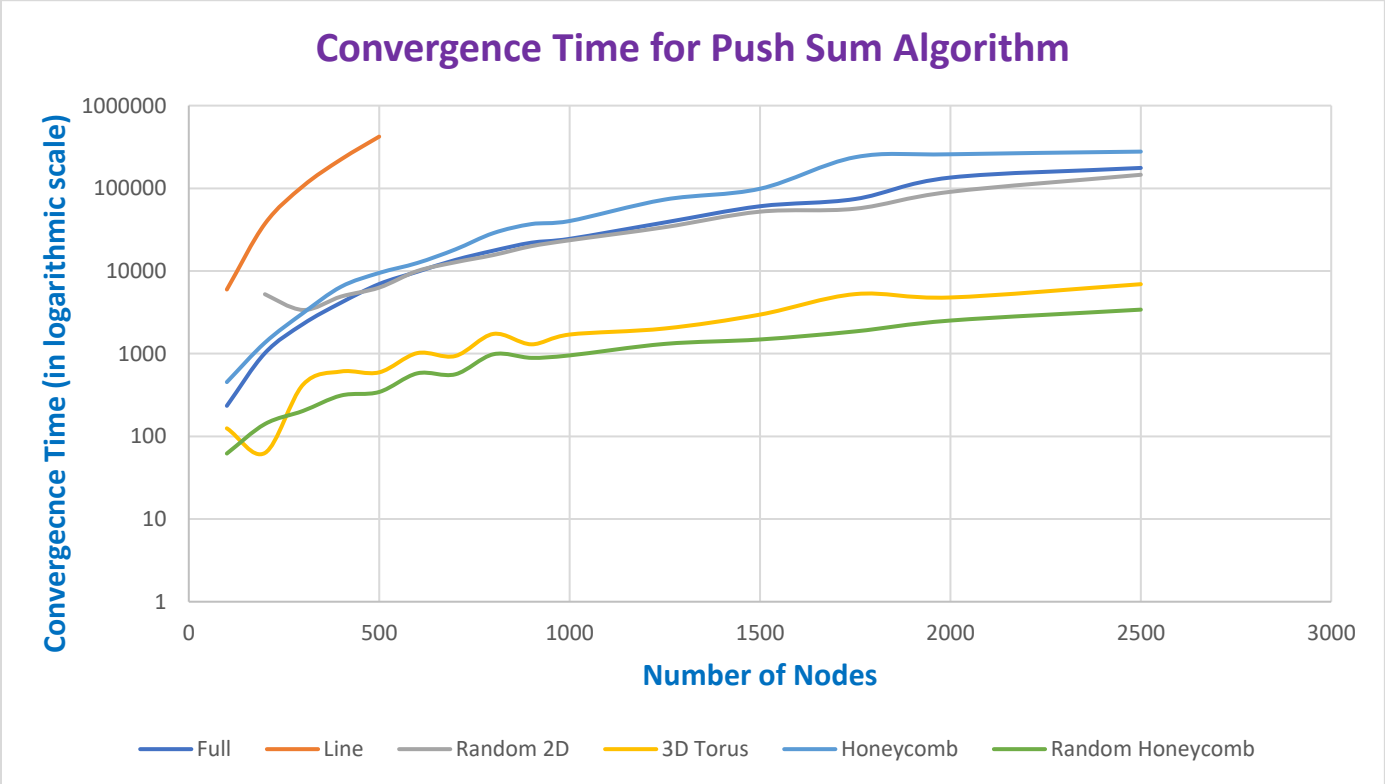
Push Sum Algorithm is a gossipbased protocol used for the computation of sums and averages. The convergence occurs if s/w (sum estimate) ratio does not change more than 10^-10 in three consecutive rounds. We have implemented this algorithm using various topologies.

- The convergence time (in milliseconds) for the topologies are as follows:

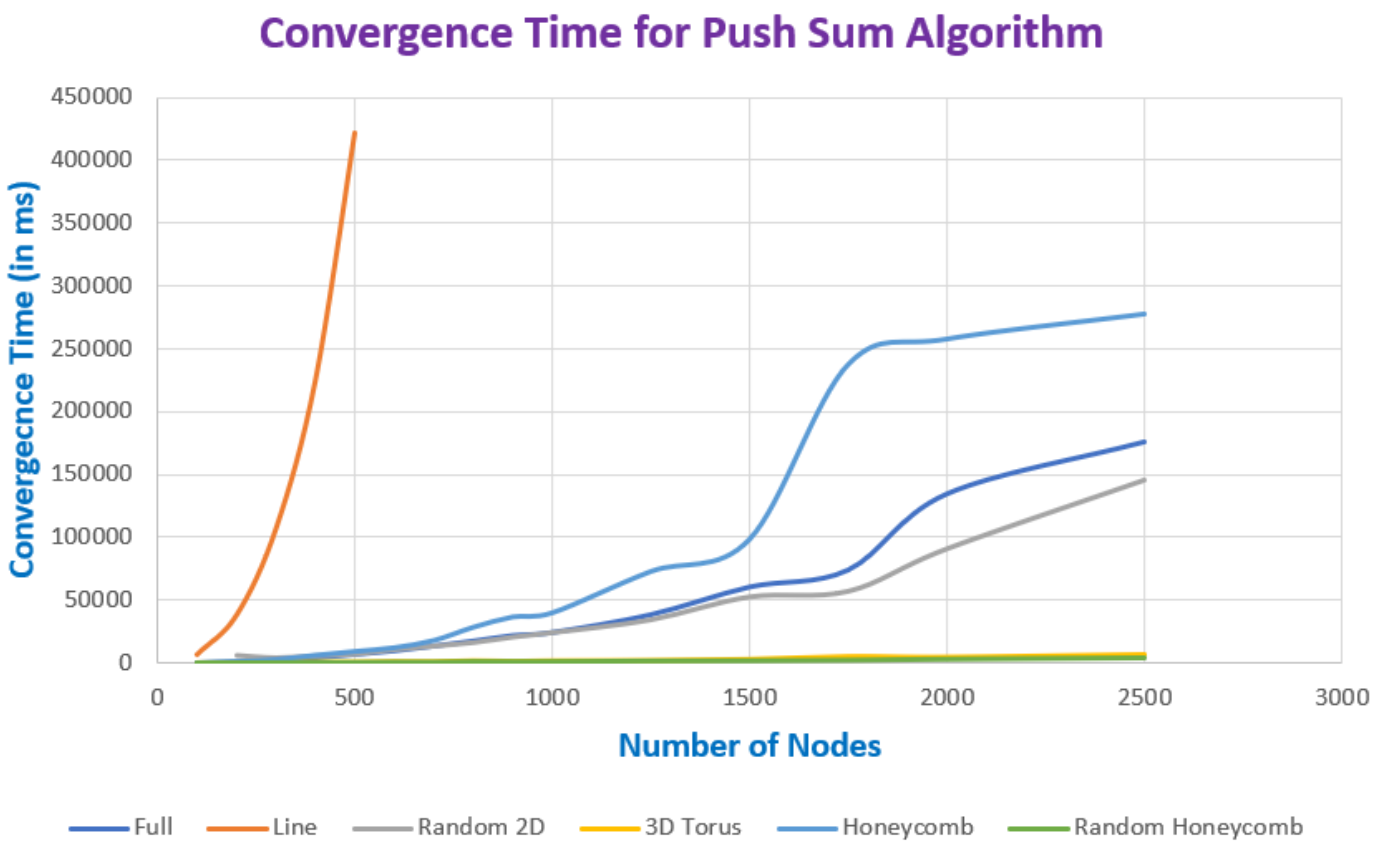
Number of Nodes	Full	Line	Random 2D	3D Torus	Honeycomb	Random Honeycomb

100	234	5969		125	453	62
200	1016	37282	5235	63	1359	141
300	2281	106093	3375	422	3094	203
400	4141	223984	4907	609	6453	312
500	6953	421594	6297	594	9469	344
600	9781	-	9985	1016	12484	578
700	13594	-	12750	937	18219	563
800	17609	-	15594	1734	28735	984
900	21984	-	19968	1297	36937	890
1000	24453	-	23531	1703	40203	953
1250	38625	-	33859	2016	73094	1312
1500	60656	-	52140	2968	98718	1484
1750	74234	-	56641	5250	237688	1859
2000	134828	-	90641	4781	257838	2515
2500	176234		145656	6922	277703	3407

- The Graph of these convergence time (in logarithmic scale) for each topology plotted against the total number of nodes is as follows:



- The graph of the convergence times (in milliseconds) for each topology versus the total number of nodes is as follows:



Observations: (For Push Sum Algorithm)

- The fastest convergence time is observed for the Random Honeycomb topology followed by 3D torus.
- The maximum number of nodes for which we tried to converge the random honeycomb is 30000 and the maximum number of nodes for which the 3D torus converged is 10000.
- The line topology takes the maximum amount of time to converge, hence it is the slowest topology even in push sum algorithm. We could implement the line topology for only 500 nodes and it took 421594ms to converge.
- If we compare the convergence times for all the implemented topologies for a constant 500 nodes we can observe the following pattern of convergence time,

  Random HoneyComb < 3D Torus < Random 2D < Full < Honeycomb < Line
- Similar to Gossip Algorithm, even in Push Sum, the random 2D topology requires more than 100 nodes to start converging as for the nodes are communicating to each other randomly.
- The Push sum algorithm takes more time to converge as compared to the Gossip algorithm for each and every topology in general.