

# PROJECT REPORT

## Team members: -

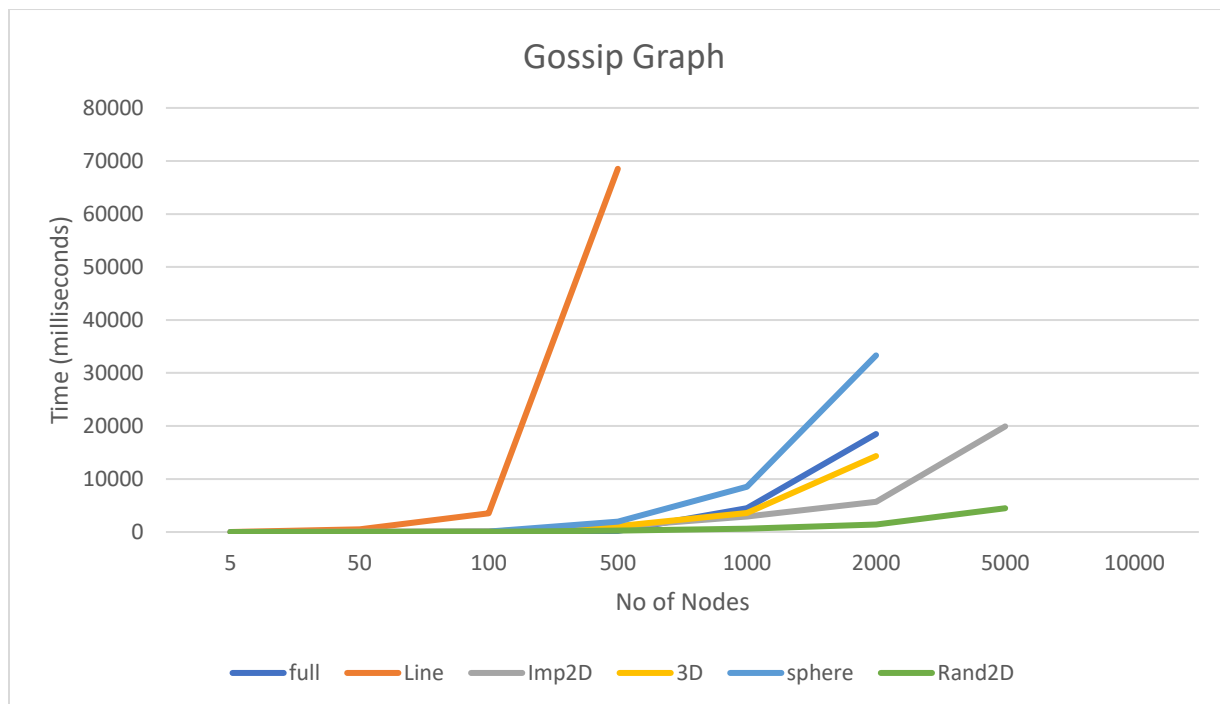
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## Implementation: -

We have assumed that convergence of Gossip Algorithm occurs when All the nodes in the network have heard the rumor at least once. In our implementation, when a node hears the rumor for the first time, it marks itself as converged but keeps sending and receiving rumors. When a node hears the rumor for the 10th time, it stops transmitting the rumor further. When convergence is achieved, the program prints the convergence time and terminates. For Push-sum algorithm, we have assumed that convergence of a node happens when its s/w ratio (Average Estimate) has not changed more than a factor of  $10^{-10}$  in three consecutive messages receive rounds. We terminate the program after all the nodes have achieved convergence and then calculated the total time taken to converge the algorithm. We do this because on a large network, if we terminate the program after the convergence of very first node then the average estimate of the other nodes in the network will differ from that of the converged node. So, to provide more fault tolerance we have terminated the program after the convergence of all the nodes in the network

## Graphs Gossips:



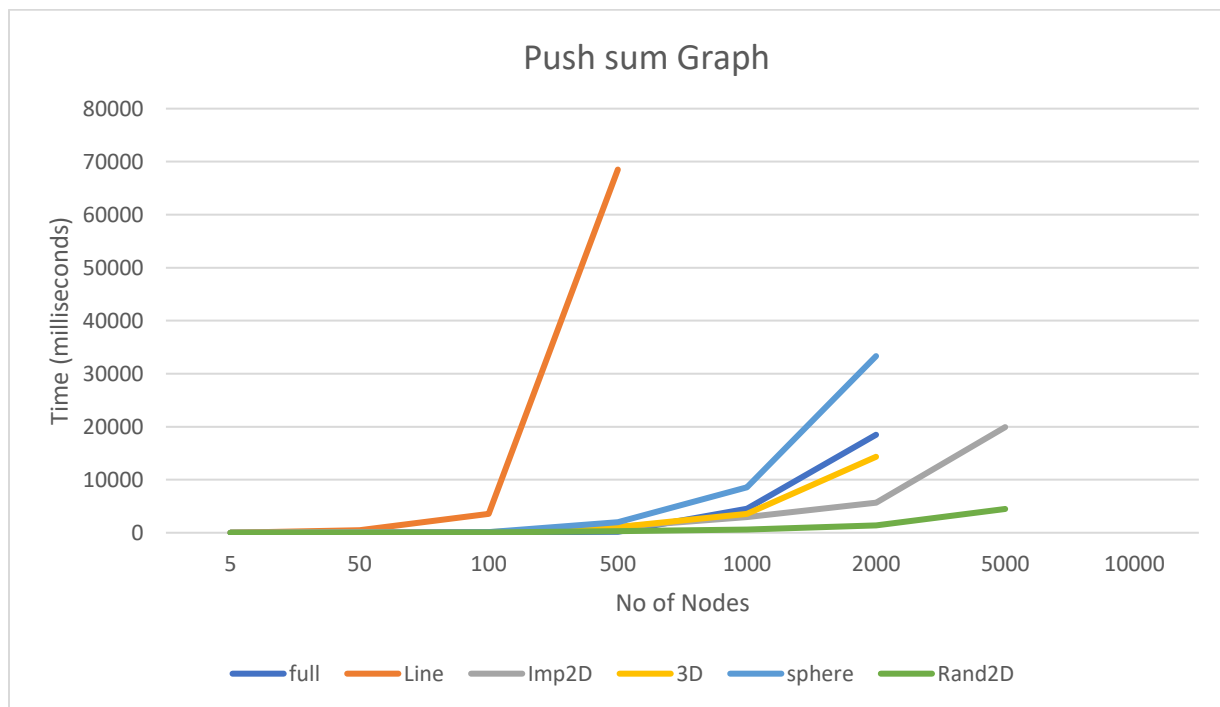
### Gossip Values:

Nodes	Full	Line	Imp2D	3D	sphere	Rand2D
5	0	0	0	0	0	0
50	0	15	0	0	15	0
100	16	31	16	16	16	16
500	125	719	31	46	47	31
1000	453	3640	63	141	187	47
2000	2563	12688	141	172	469	110
5000	16438	-	781	922	2031	400
10000	-	-	1391	2765	6922	860

### Inference from the Gossip Graph:

- Line topology has the largest converging time of all
- Best converging time is given by Random 2D and the second-best converging time is of Imperfect line. For smaller no of nodes both have similar converging time.

### Push sum Graph:



**Push sum Values:**

Nodes	Full	Line	Imp2D	3D	sphere	Rand2D
5	0	0	0	0	0	0
50	0	500	31	46	31	16
100	47	3546	63	109	94	46
500	187	68515	1063	1110	1985	297
1000	4500	-	2937	3578	8562	610
2000	18484	-	5687	14328	33321	1391
5000	-	-	19922	-	-	4485

**Inference from Push-sum graph:**

- Line topology perform the worse here
- Rand2D has the best performance in term of converging time. Second best is imperfect line which has around four time the converging time of random 2d.

**Interesting finding:**

Convergence time for both full and Random2d topology is almost same for nodes less than 100, but as soon as the number of nodes increases the difference between the converging time of both increases exponentially in both push sum as well as gossip. This is opposite to the expected behavior, as we thought that Full topology should perform best but memory constraints comes in factor here which limits the performance of Full Topology. In case of Random 2D topology limiting number of neighbors which does not pose any memory limit as well as blend of randomization makes it the best topology to implement in both gossip algorithm as well as push sum algorithm.