Gossip Protocol and Push Sum Algorithm

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1 Topologies implemented

- Line topology
- Full topology
- 2D topology
- Imperfect 2D Topology

2 Algorithms implemented

- Gossip Protocol
- Push Sum Algorithm

3 Implementation Details

3.1 Gossip Algorithm

The transmission of message is stopped to a node when it has received the message ten times. For obtaining convergence, all the nodes in the system have to receive the message.

3.2 Push Sum Algorithm

Any actor terminates when it's ratio of s/w does not change more than 10^{-10} in three consecutive rounds. Similar to Gossip, for obtaining convergence, all the nodes in the system have to receive the message.

4 Graphs

4.1 Gossip Algorithm

Nodes	Full	Line	2D	Imp2D
100	14	30	20	25
500	57	590	82	99
1000	83	1048	218	212
2000	156	15343	371	492
5000	592	25961	1233	1121
8000	875	90968	1888	1905
10000	1258	259068	2354	2923

Figure 1: Gossip - readings

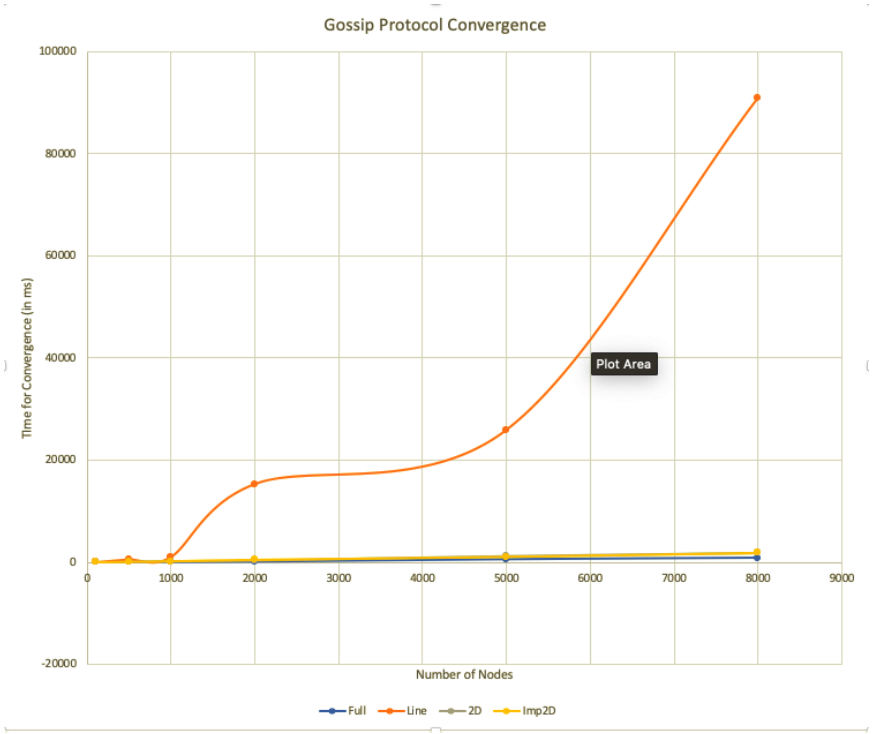

Figure 2: Gossip - Convergence

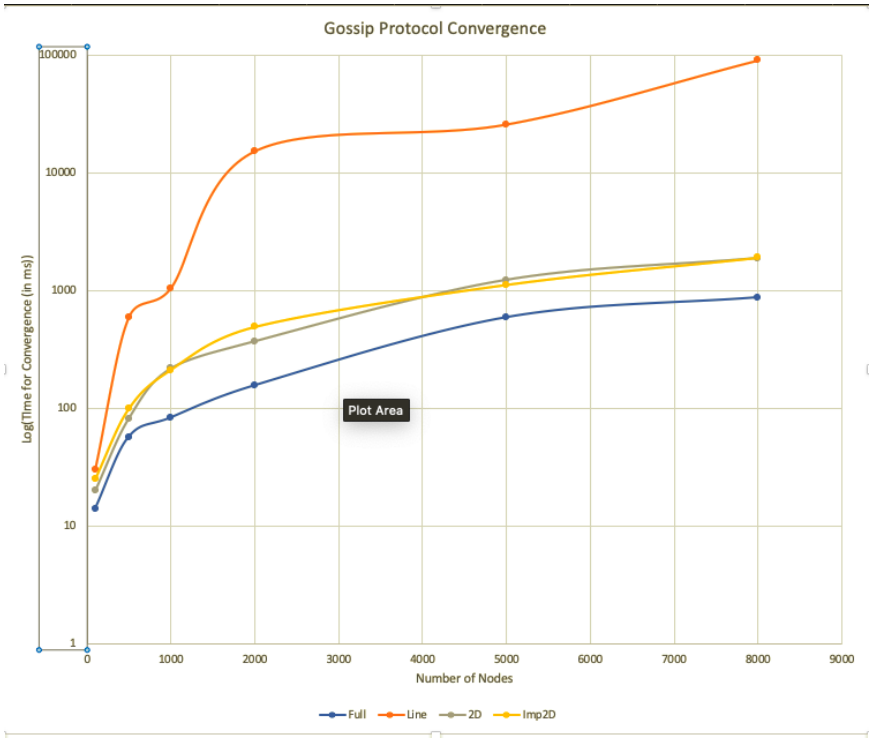

Figure 3: Gossip - Log Convergence

4.2 Push Sum Algorithm

Nodes	Full	Line	2D	Imp2D
1000	186	27660	12760	578
2000	396	96805	49803	989
3000	630	86518	107818	1972
4000	848	149031	179794	2059
5000	961	447110	275989	2442
6000	1235	697145	374274	6845

Figure 4: Push-Sum - readings

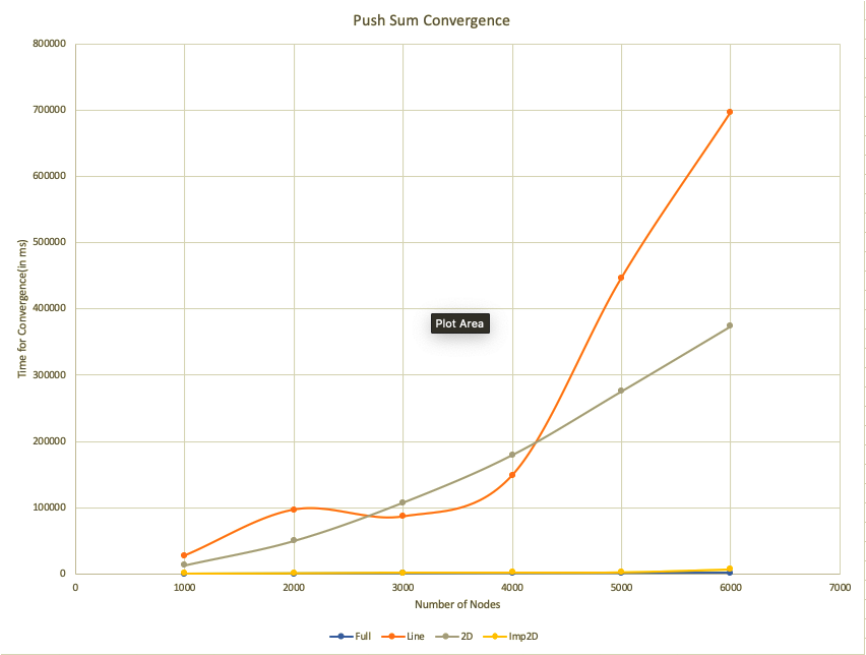

Figure 5: Push-Sum - Convergence

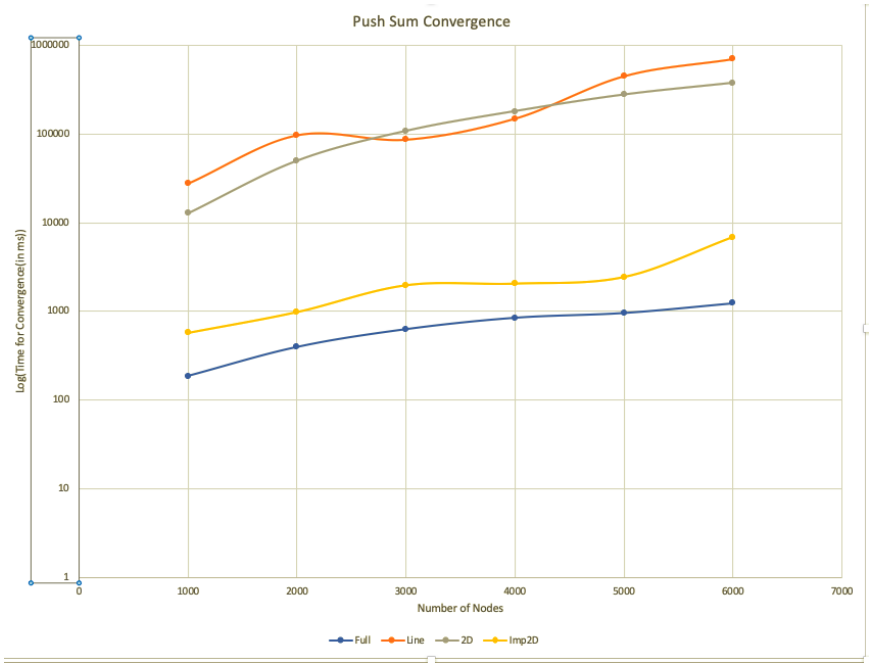

Figure 6: Push-Sum - Log Convergence

5 Observations

- Line topology showed the worst convergence time for both the algorithms. This is understandable, because each node has connections to only two other adjacent nodes it can share the message with.
- Full topology has the fastest convergence because it has connections to every other node. This increases the probability of it's convergence because every node can receive messages from it; each node being the neighbor of every other node.
- Imperfect 2D has somewhat better convergence than 2D. They have similar structures, except the presence of one additional random neighbor for Imperfect 2D. Owing to this extra node, the convergence is faster for imperfect 2d. This is evident in our results, especially for Push-Sum algorithm.
- We can therefore conclude that the presence of more adjacent nodes helps a network to converge faster.