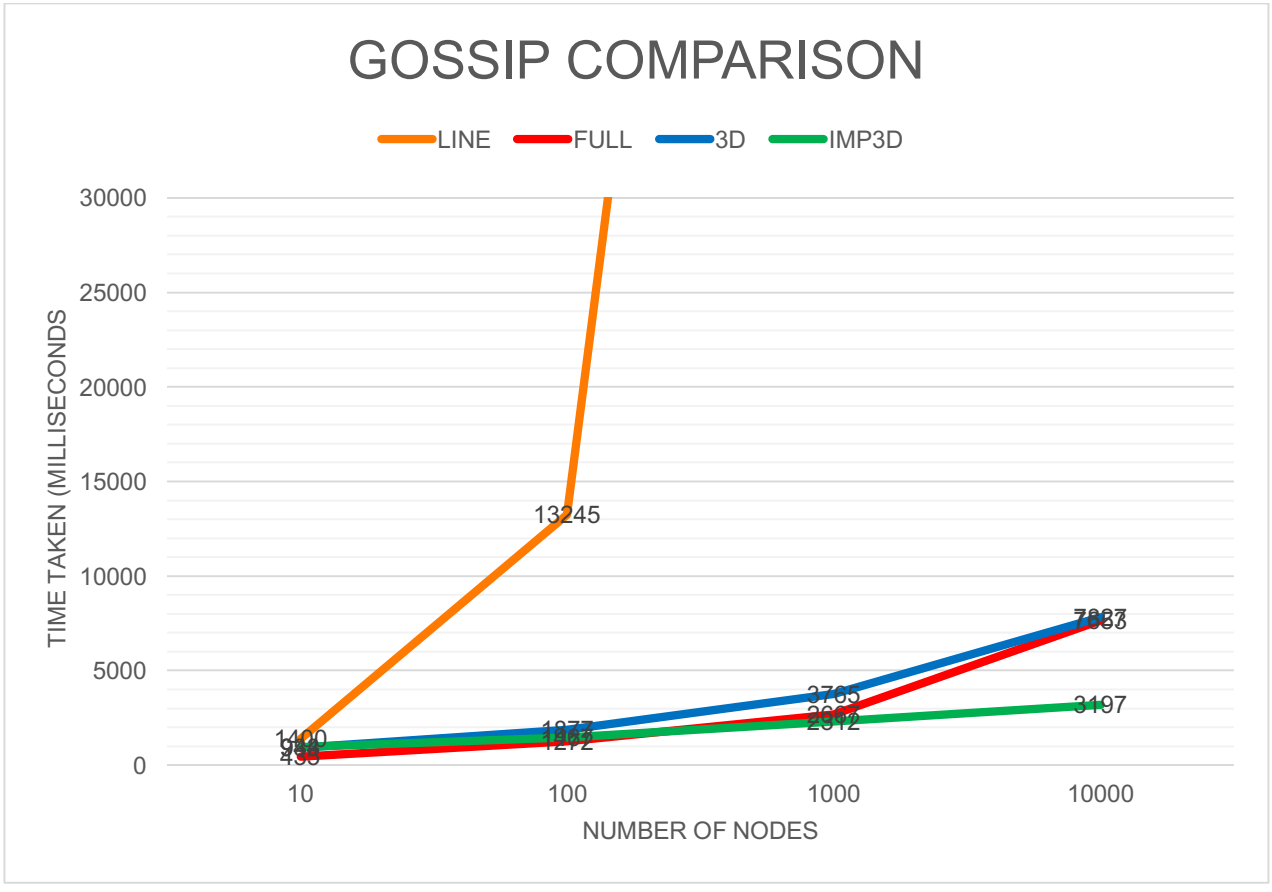
Project 2 Report

Gossip

I tested all the network topologies using the gossip algorithm and increasing the number of nodes by a factor of 10 each time. The convergence here occurred when all nodes in the network received gossip at least once.

- Being linear, line topology took an astonishingly long time to converge and took about 31 minutes when the number of nodes was 10000!
- The rest of the topologies converged much faster, imperfect 3d network being the fastest with 3197 ms for 10000 nodes which is extremely good.
- The raw data and line graph is shown below. All table entries(time) is in milliseconds.



RAW DATA

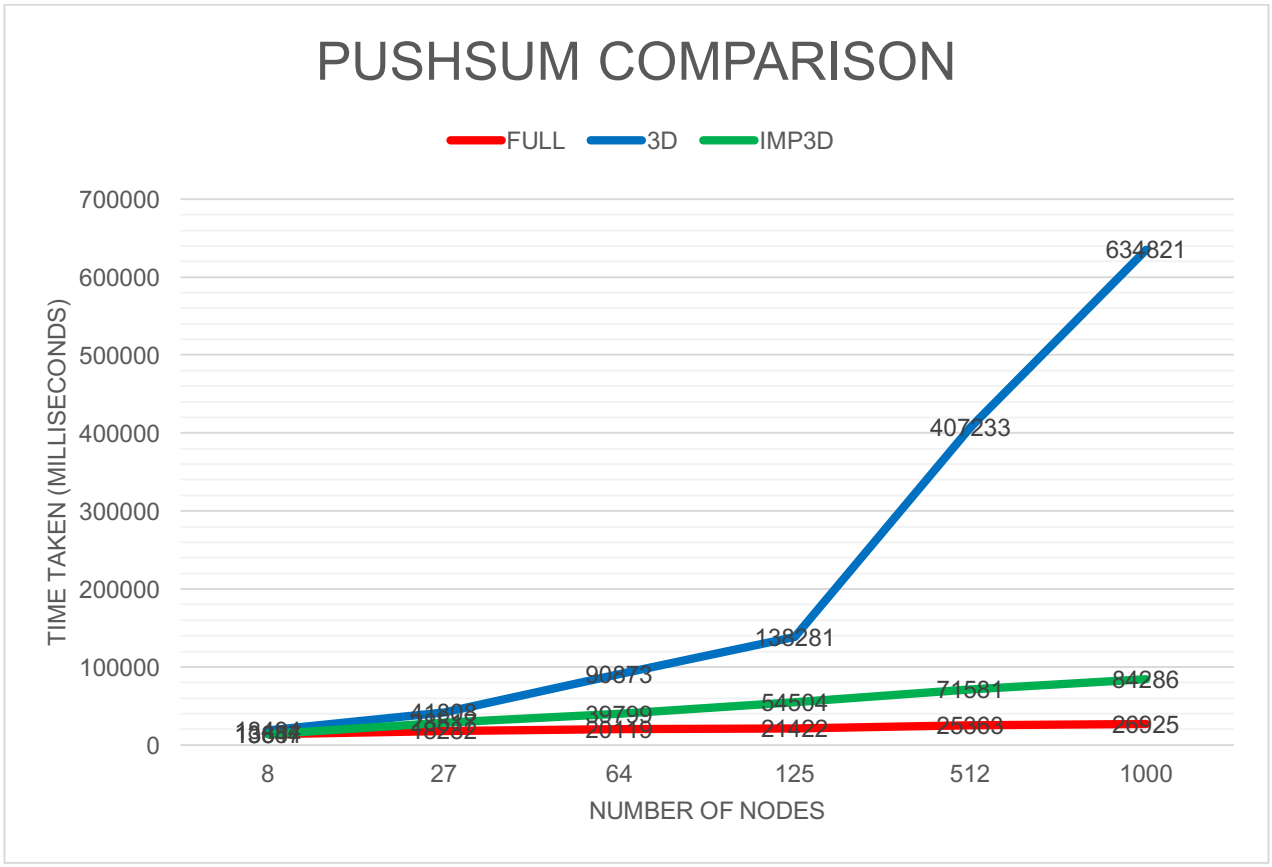
# NODES	LINE(in ms)	FULL(in ms)	3D(in ms)	IMP3D(in ms)
10	1400	435	934	943
100	13245	1272	1877	1467
1000	122434	2667	3765	2312
10000	1859236	5264	7827	3197

All entries in the above table are time taken to converge in milliseconds.

Pushsum

I then tested each network topology with pushsum to calculate the sum of all the nodes in the network. The global convergence occurred when more than 50% of the nodes in the network converged locally. Local convergence occurred when the previous sum/weight value did not change by 0.0000000001 compared to the current sum more than three times.

- I have written detailed analysis about the line topology later in the report.
- Pushsum takes much longer to converge compared to gossip as each node has to send their sum and weight uniformly over the network to all or most of the other nodes.
- The more the number of neighbors => the denser the network => the sum is distributed more uniformly over entire network => faster convergence
- Hence full topology converges the fastest, followed by imperfect 3d and finally 3d.
- In line topology the network is not well connected and not dense. Hence, the sum and weight of each node are not able to uniformly distribute themselves over the network.



RAW DATA

# Nodes	FULL(in ms)	3D(in ms)	IMP3D(in ms)
8	13647	18494	13854
27	18282	41808	28517
64	20119	90873	39799
125	21422	138281	54504
512	25363	407233	71581
1000	26925	634821	84286
10000	42892	2383171	99941

LINE TOPOLOGY

- It is very hard to converge the line topology using pushsum algorithm. I tried to analyze why this happens by changing various parameters like length of each round in pushsum, the counter value at each node to check if previous s/w is similar to current s/w and some others.
- In line topology the sum of each node has to reach all the other nodes, i.e. the sum values and weight values have to spread uniformly throughout the network. This becomes very difficult in line network as each node has maximum 2 neighbors. In a network of 100 nodes it is highly unlikely that the sum value will reach from node 1(at one end of line topology) to node 100(at the other end).
- I changed the convergence parameters and made them extremely strict and achieved the following results for line. All entries in table are time to converge (in ms).
- As we can see line takes much longer to converge compared to the other topologies.
- I did not try line on larger number of nodes as it would take a huge amount of time.

# OF NODES	LINE(in ms)
8	59377
27	549166