DISTRIBUTED OPERATING SYSTEMS

COP5612 – Fall 2020

PROJECT: 2

GOSSIP AND PUSH-SUM ALGORITHM

Members:

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Implementation Details

- **Asynchrous Gossip** : Gossip algorithms are used for group communication and for aggregate computation. The algorithm we have developed is determine convergence of Asynchronous Algorithms through a simulator based on actors in F# and Akka Framework.
- The convergence condition we have used is such that every actor will hear the rumor 10 times before before converging.
- **Push-Sum Model** : In this algorithm, s = xi = i , w = 1 is assigned to each actor and messages are sent and received in pairs of the form (s, w). Upon receiving, an actor should add the received pair to its own corresponding values and send a message, (keeping half of s and w by the sender) to a random neighbor.

System Information:

- MacBook Pro early 2016 model
- 16 Gb RAM.
- 4 cores

Execution:

- Run program in a terminal using the command
  dotnet fsi "--langversion:preview" project-2.fsx Nodes topology protocol
- Nodes - Number of Actors involved ,
- Topology - full, 2D, line, imp2D,
- Protocol - gossip, push-sum

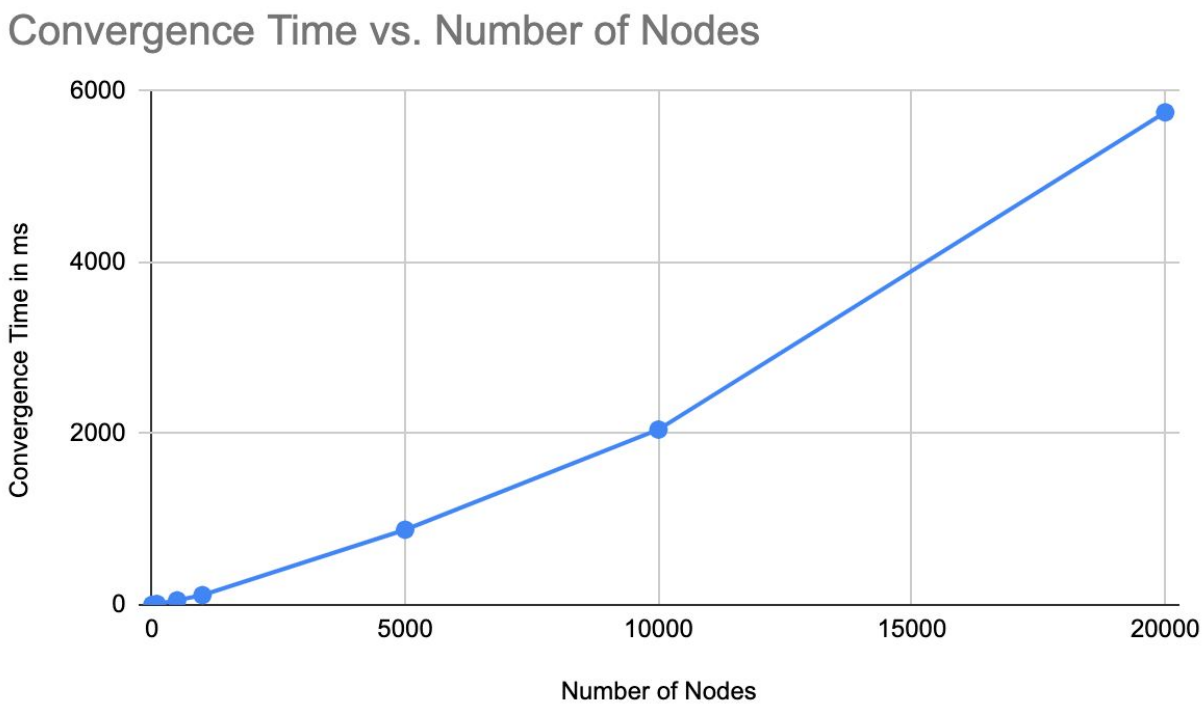
Results:

- ## Gossip Protocol :

We tested the Gossip protocol in different topologies and the number of nodes were used up to 20,000.

➔ Full NetworkTopology:

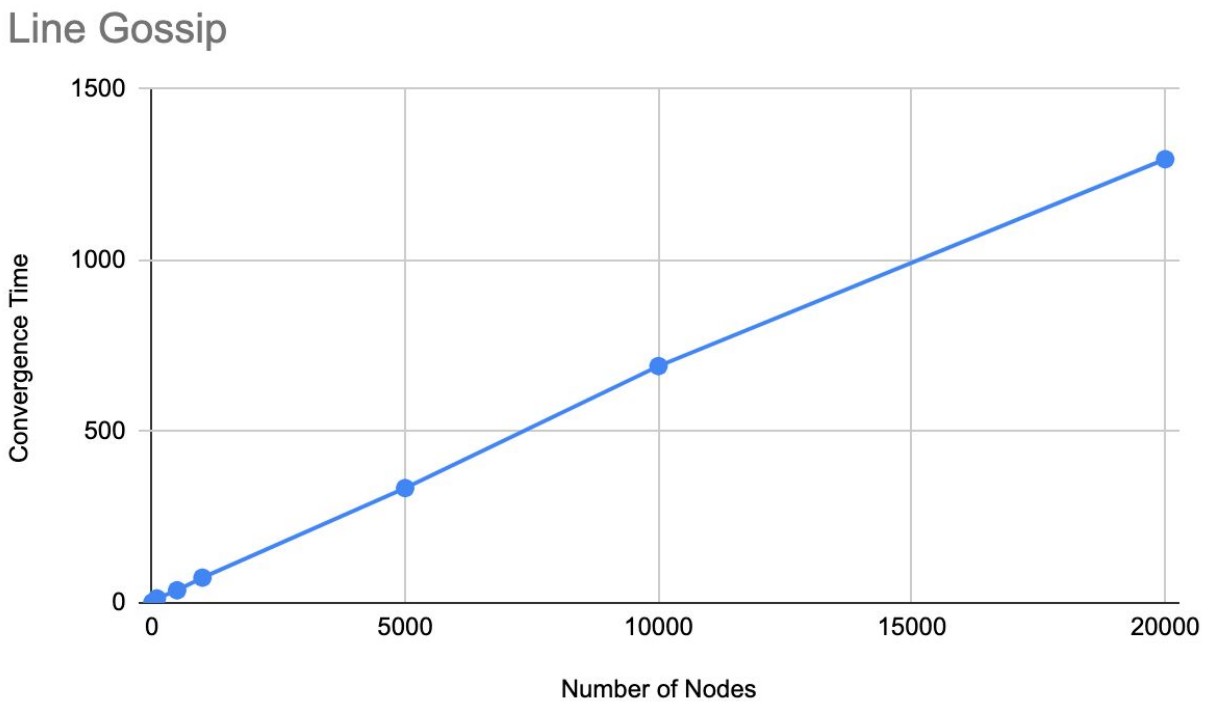
Number of Nodes	10	100	500	1000	5000	10000	20000
Convergence of Time	1.02	10.21	52.68	113.75	877.5	2047.24	5752.47



➔

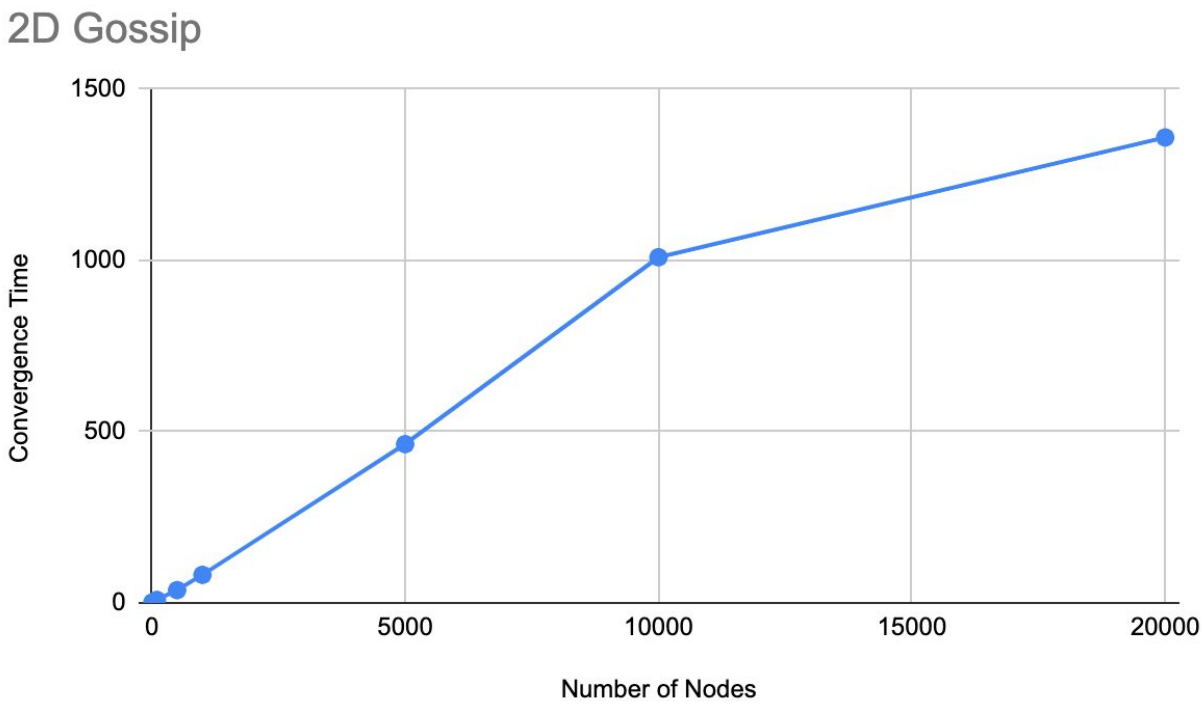
➔ **Line Topology:**

Number of Nodes	10	100	500	1000	5000	10000	20000
Convergence Time	1	12.97	36.71	73.65	335.17	691.41	1295.41



➔ **2D Grid Topology:**

Number of Nodes	10	100	500	1000	5000	10000	20000
Convergence Time	1.08	8.59	37.24	81.77	463.41	1009.23	1358.83



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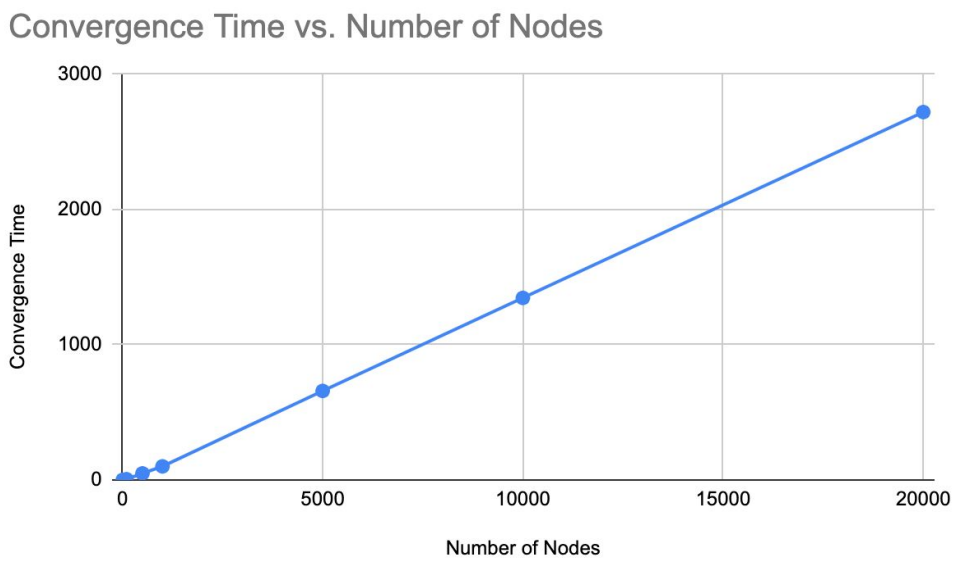
➔ **Imperfect2D Topology:**

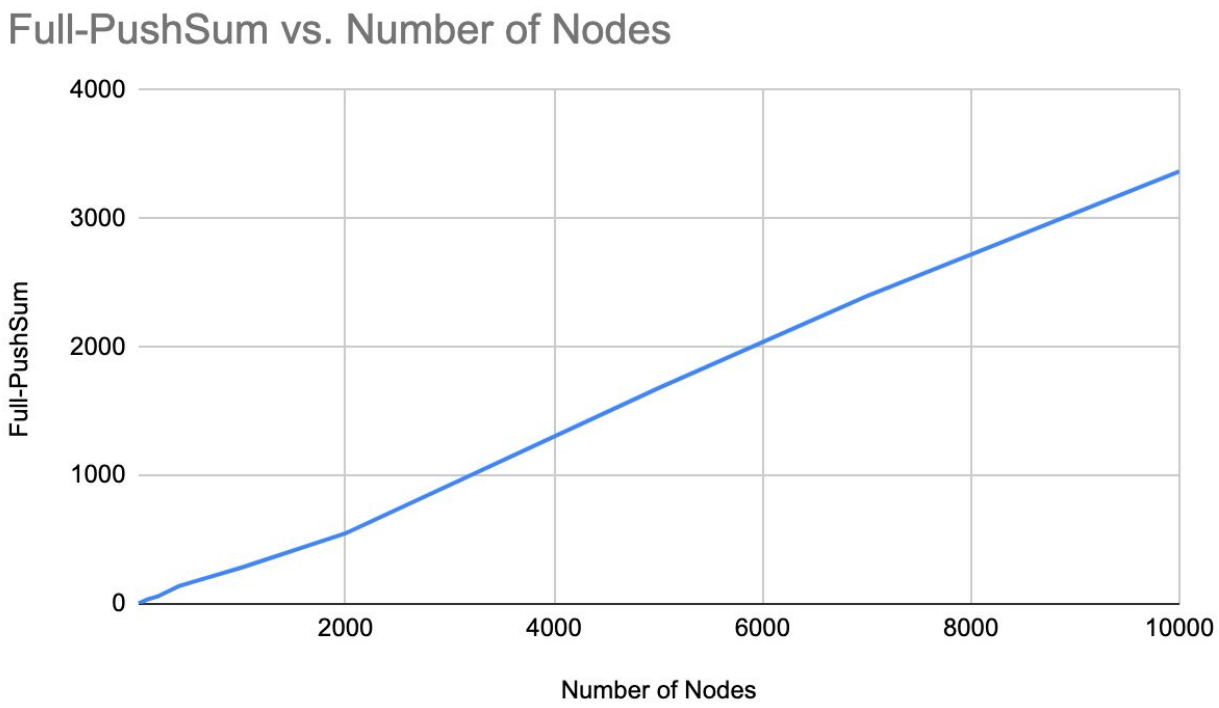
Number of Nodes	10	100	500	1000	5000	10000	20000
Convergence Time	1.01	5.29	48.35	100.17	658.14	1346.12	2720.49



- **Push Sum Protocol :**

We tested the Gossip protocol in different topologies and the number of nodes were used up to 20,000.

➔ **Full NetworkTopology:**



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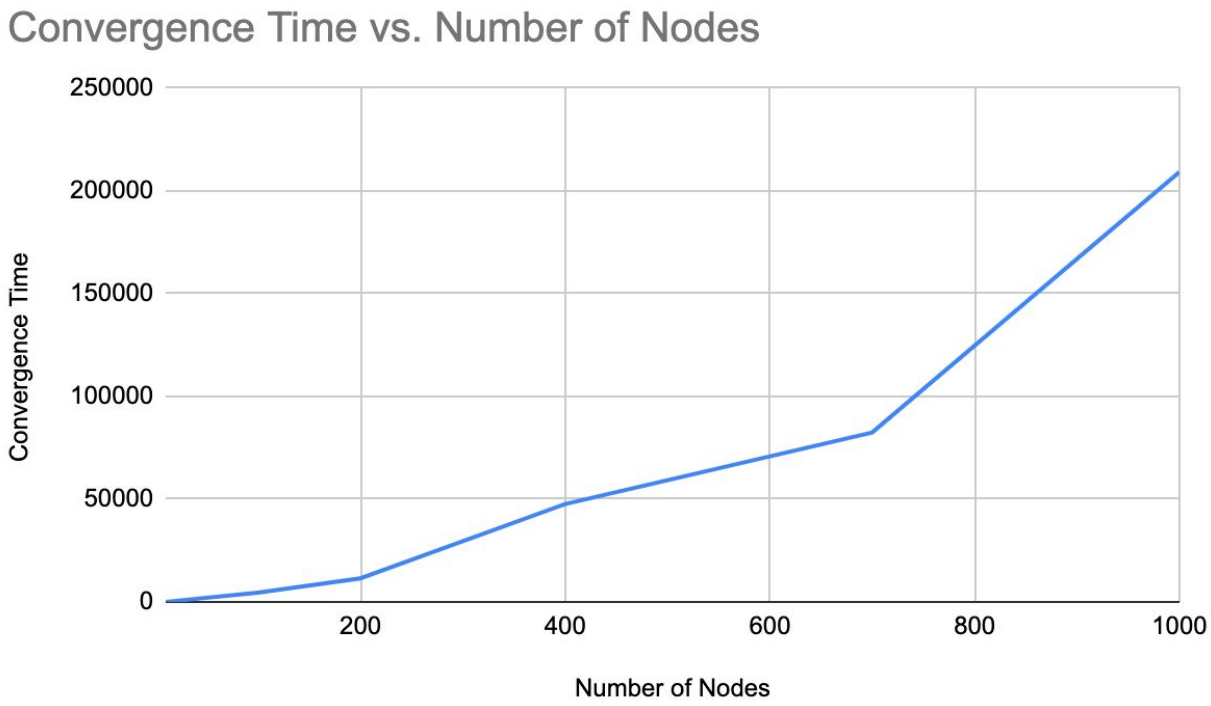
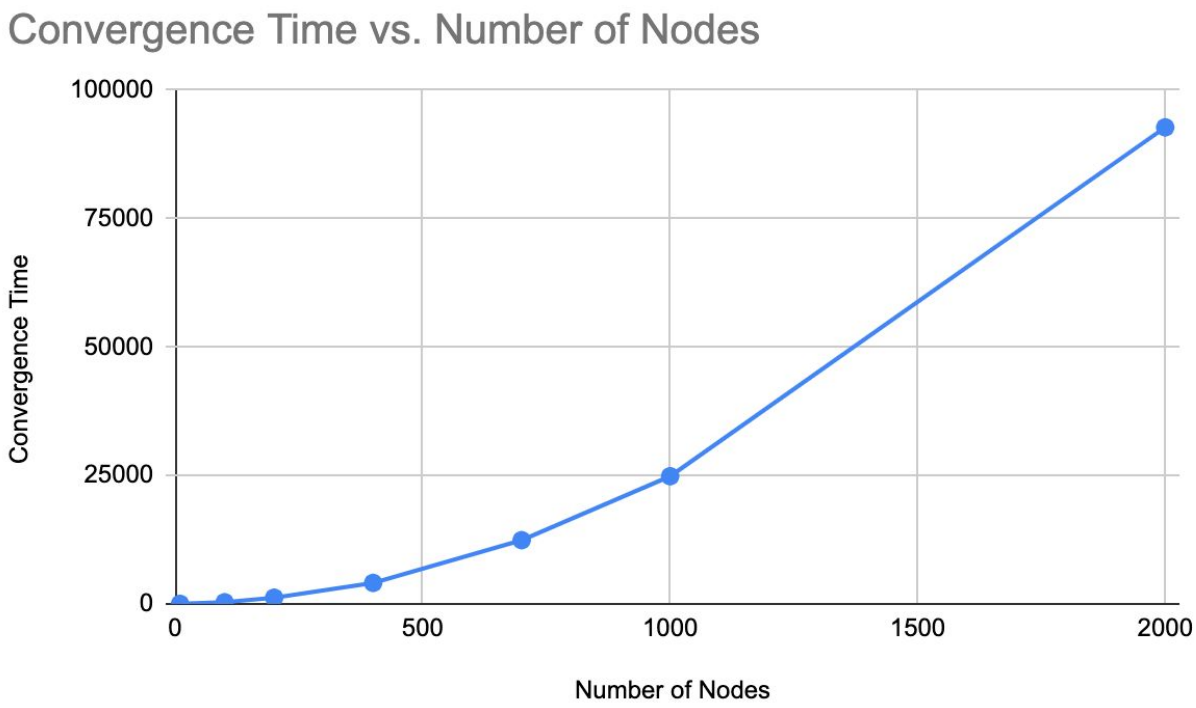
Number of Nodes	10	100	200	400	700	1000	2000	5000	7000	10000
Convergence Time (in ms)	2.39	34.63	57.99	137.76	210.2	282.19	548.54	1678.32	2396.06	3367.09

➔ **Line Topology:**



Number of Nodes	10	100	200	400	700	1000
Convergence Time(in ms)	8.59	4533.36	11472.91	47603.32	82467.27	209183.79

➔ **2D Grid Topology:**



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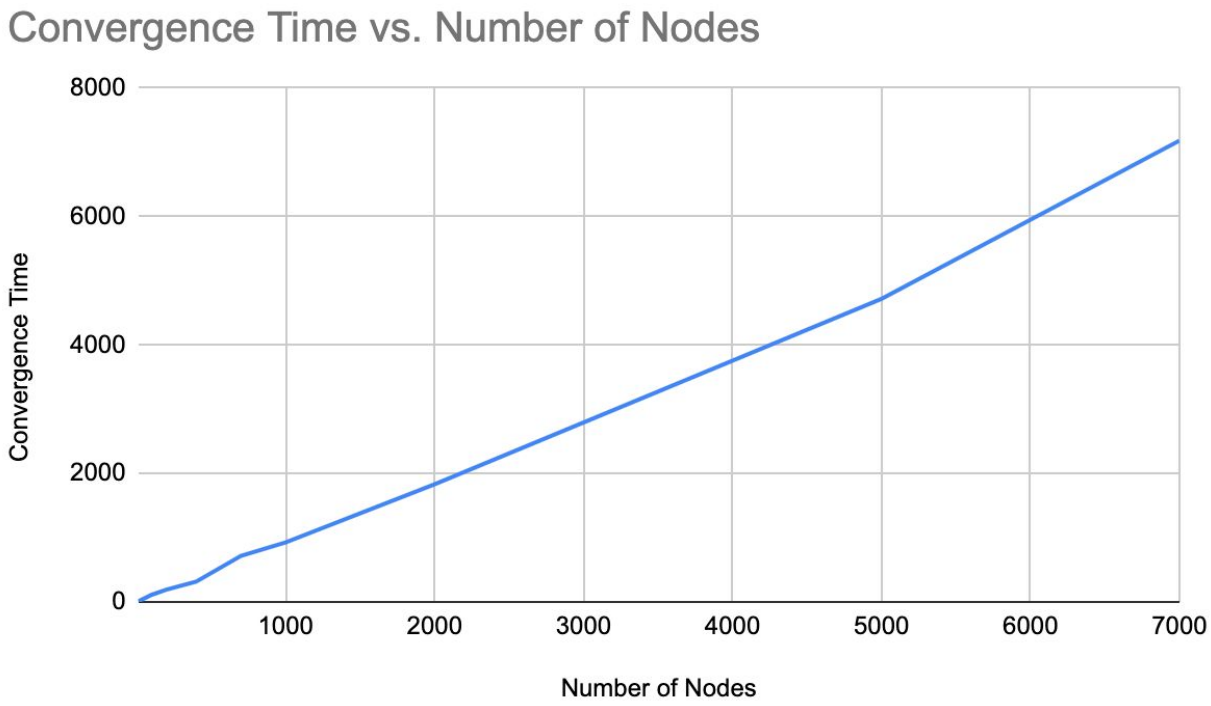
Number of Nodes	10	100	200	400	700	1000	2000
Convergence Time (in ms)	6.97	315.98	1203	4078.29	12399.66	24847.92	92751.23

➔ **Imperfect 2D Grid Topology:**

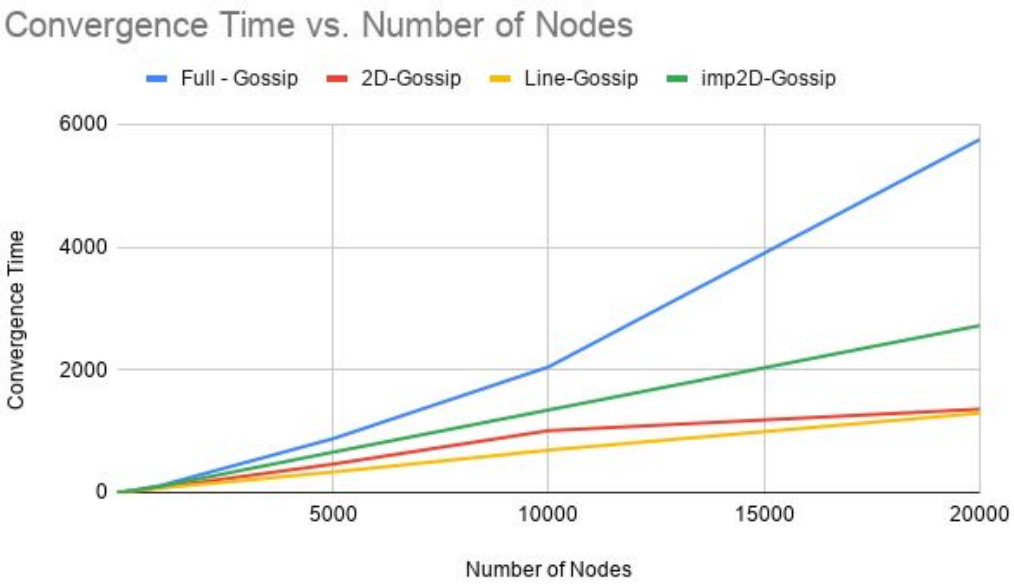


➔

Number of Nodes	10	100	200	400	700	1000	2000	5000	7000
Convergence Time(in ms)	5.2	108.69	189.38	314.55	717.17	926.6	1829.29	4718	7180.1

Interesting Findings:

Gossip Protocol:
By comparing the graphs, we found that in Gossip Protocol, Imperfect 2D Grid and Full Network topologies have the lowest probability to converge faster.



Push-Sum Protocol:
By comparing the graphs, we found that in Push-Sum Protocol, Imperfect 2D Grid and Full Network topologies have the highest probability to converge faster.