Project Report

COP5615 - Distributed Operating Systems Principles

The goal is to create an F# application to find convergence of Gossip and push sum algorithms using multiple topologies.

Gossip Algorithm:

The Gossip algorithm is as follows:

- **Starting**: An actor is selected randomly and receives a rumor from the main process.
- **Spread**: The actor selects a random neighbor and tells it the rumor. Next the actors that have the message will again select a random neighbor and send them the rumor.
- **Termination**: Each actor keeps track of the number of times it has heard the rumor. It stops transmitting the rumor further it has received it 10 times.

Push Sum Algorithm:

Push Sum algorithm is as follows:

- **Start**: Every actor maintains s and w where s = xi = I and w = 1. Messages are in pair (s,w).
- **Sending Message**: When a message is sent by an actor, it keeps half of the pair (s,w) to itself, and send the remaining half to its selected neighbor
- **Receiving Message**: When a message is received by an actor, it adds the half message (s/2, w/2) received to its own pair of (s,w).
- **Termination**: If an actor pair (s,w) do not change for more than 10^-10 in 3 consecutive times, the actor will terminate.

Interesting Findings

Gossip

- For 100 nodes, all the 4 topologies converge in similar time.
- As the number of nodes increase, line topology takes much higher time than other 3. This is because, in line topology, there are only two neighbors for each actor.
- Also, for a large number of nodes, the time taken by 2D increases drastically as compared to Full and Imperfect 2D, but it is still much better than line topology.
- Line takes the longest to converge and Imperfect 2D is the fastest.

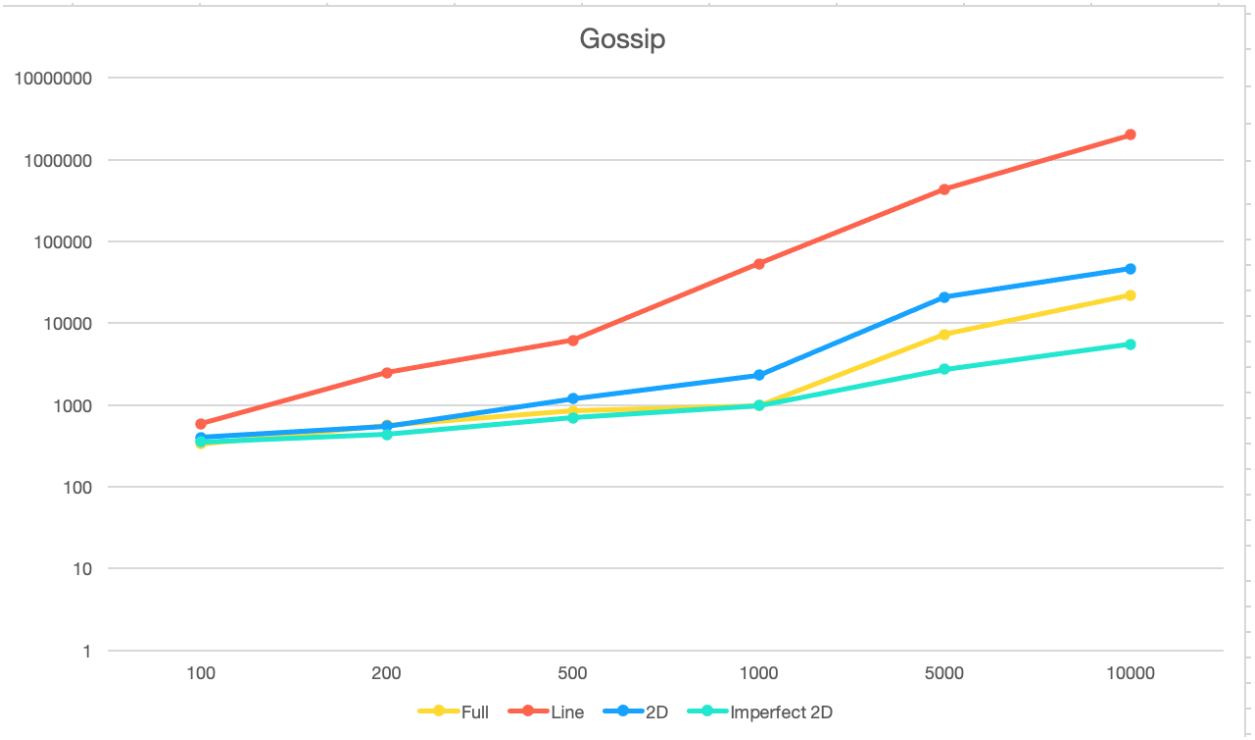
Push Sum

In push sum, all topologies take more time to converge than Gossip. It is because of the termination condition where it has to wait for (s,w) pair in 3 consecutive rounds before terminating.

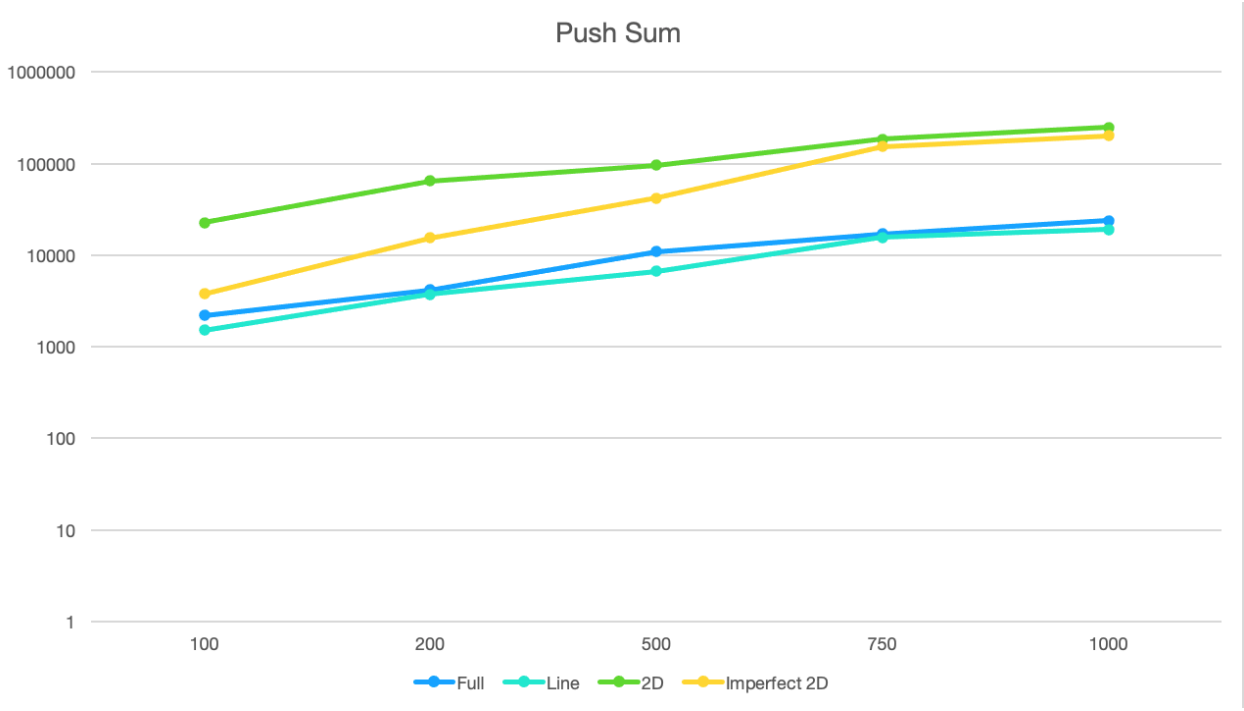
As the number of nodes increase, the time taken to converge also increases. 2D topology has the worst performance among all the topologies for the push sum algorithm in our implementation. 2D performs poorly even when the number of nodes is just 100. Full, Line and imperfect2D have a really good performance.

Graphs

Gossip	No. of Nodes					
Topologies	100	200	500	1000	5000	10000
Full	336	571	848	981	7273	22074
Line	589	2486	6217	53595	436394	2026447
2D	402	554	1198	2321	20838	46367
Imperfect 2D	355	437	701	986	2743	5521



Push Sum	No. of Nodes				
Topologies	100	200	500	750	1000
Full	2195	4185	10960	17101	23795
Line	1510	3757	6690	15632	19026
2D	22754	64696	95932	185152	247883
Imperfect 2D	3763	15428	42275	154334	200807


Push Sum
1000000
100000
10000
1000
100
10
1
100
200
500
750
1000
Full
Line
2D
Imperfect 2D