

Fall 2020

# **COP5615 Distributed Operating System Principles**

Report file

## **Project 2**

Group Details

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## Project Description :

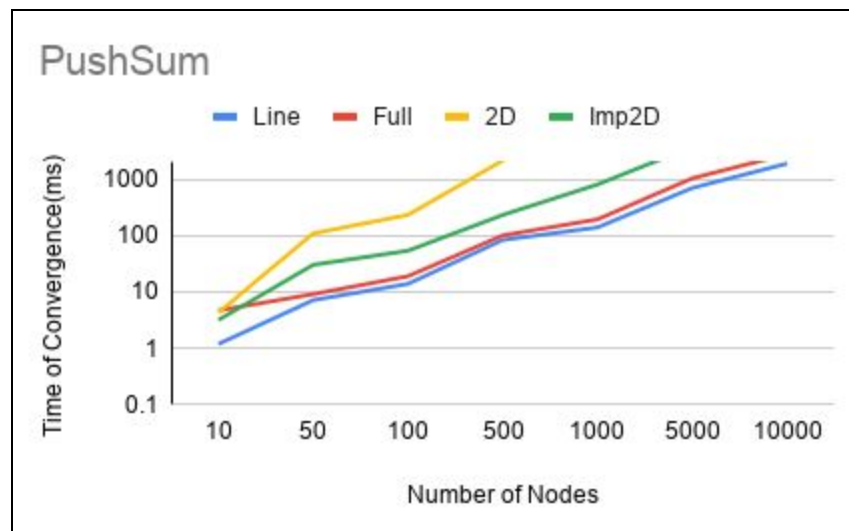
In this project, we have implemented two algorithms, namely gossip and push-sum for four different types of topologies: line, full, 2D and imp2D. While executing the program, three command line inputs were taken: number of actors (numNodes), topology and algorithm.

Each of these topologies are constructed differently based on their number of neighbor nodes. For line topology, all nodes except the first and the last node have two neighbors each; for full topology each node has all other nodes in the topology as its neighbors, a 2D topology has four neighbors (top, bottom, left, right) whereas the imp2D topology has five neighbors, one randomly selected neighbor along with the four regular neighbors.

In the gossip algorithm, a random node from the topology starts a rumour and it consequently forwards the rumour to the other nodes in the topology. The time of convergence is recorded once all the actors in the topology receive the gossip for 10 times.

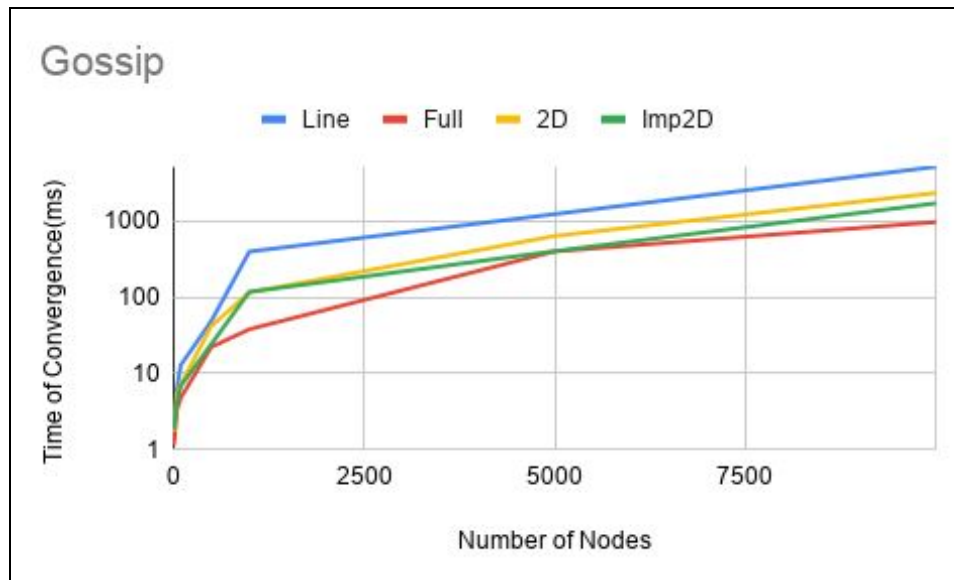
In the push-sum algorithm, a message is sent to each actor in the form of  $s$  and  $w$  values, where  $s$  is the actor number and  $w$  is the weight (initially equal to one). Here, the convergence happens when the average value ( $s/w$  ratio) doesn't change for three consecutive turns w.r.t. the predefined value  $10^{-10}$ .

## Push-Sum Algorithm :



For the push sum algorithm, among 2D, imp2D and full topologies, full topology took least time to converge whereas the 2D topology took maximum time to converge, followed by imp2D topology. Line topology taking similar time as full topology to converge was unexpected since the convergence time should have increased with the increasing number of nodes and less neighbors. This inconsistent behavior might be due to the difference in the calculated average value and the actual average value. It is because of the lesser number of nodes taking part in the convergence.

### Gossip Algorithm :



From the above graph, it can be seen that full topology takes the least amount of time to converge whereas the line topology takes the maximum amount of time to converge. Both 2D and imp2D have convergence times similar to one another, but overall imp2D is comparatively faster than 2D topology due to one extra random neighbor being chosen.

### Project Findings :

- For the given four topologies, other than the exception in the push-sum algorithm for line topology, the time of convergence mainly follows this order :  
**Time (Full) < Time (imp2D) < Time(2D) < Time (line)**
- As the number of nodes in all the topologies increases, the time of convergence also increases.
- Since a random neighbor is chosen in the program, it can be observed that sometimes the time of convergence slightly varies for the same number of numNodes.