

# **COP5615- Distributed Operating System Principles Fall 2023**

## **Programming Assignment #3**

### **REPORT**

#### **PA3\_Team15**

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## Overview:

In this project we implemented Gossip and Push-Sum algorithms for information propagation and sum computation, respectively, within a distributed system simulated using F# and the Akka framework. Here, the Asynchronous Gossip algorithm is employed, where actors asynchronously share rumors with random neighbors until each actor has heard the rumor 10 times. In the Push-Sum algorithm, actors maintain state variables  $s$  and  $w$ , and messages exchanged contain pairs  $(s, w)$ . Actors iteratively update their values based on received messages, selecting random neighbors for communication. The termination criterion is when an actor's  $s/w$  ratio remains unchanged more than  $10^{-10}$  for three consecutive rounds. This experiment involves exploring various network topologies, such as a full, 2D, line, and imperfect 3D grid, to observe their impact on the dissemination speed of Gossip protocols.

## How to Run:

Run the Project using the below command:

Command: `dotnet run <numNodes> <topology> <algorithm>`

Where numNodes is the number of actors, topology is one of "full", "2D", "line", "imp3D", the algorithm is one of "gossip", "push-sum".

Usage: `dotnet run 10 line gossip`

## What is working:

Convergence of Gossip algorithm for all topologies - Full, Line, 2D, Imperfect 3D

Convergence of Push Sum algorithm for all topologies - Full, Line, 2D, Imperfect 3D

## Largest Network:

Number of Nodes for Gossip Algorithm:

Full: 10000

Line: 5000

2D: 10000

Imperfect 3D: 10000

### Number of Nodes for Push Sum Algorithm:

Full: 80

Line: 80

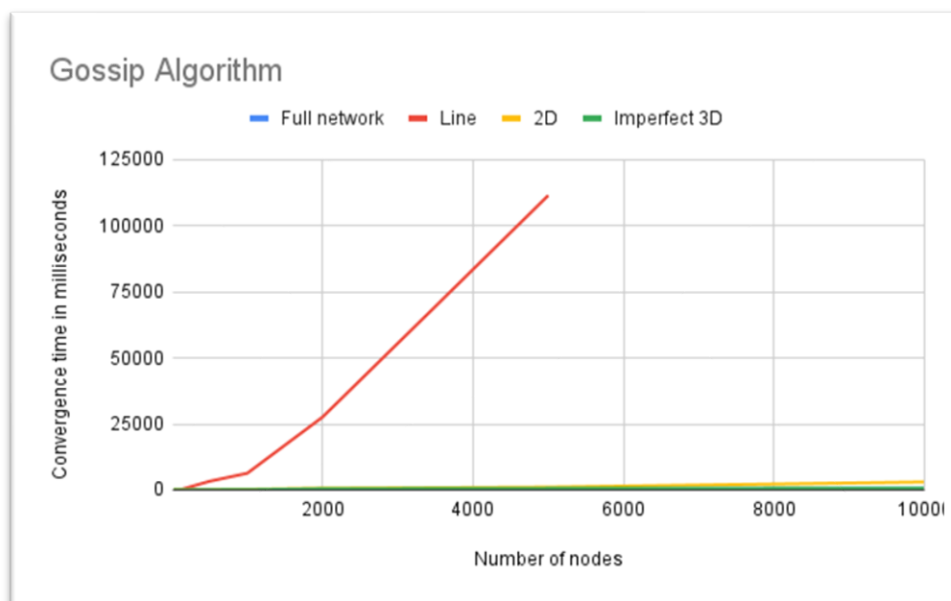
2D: 80

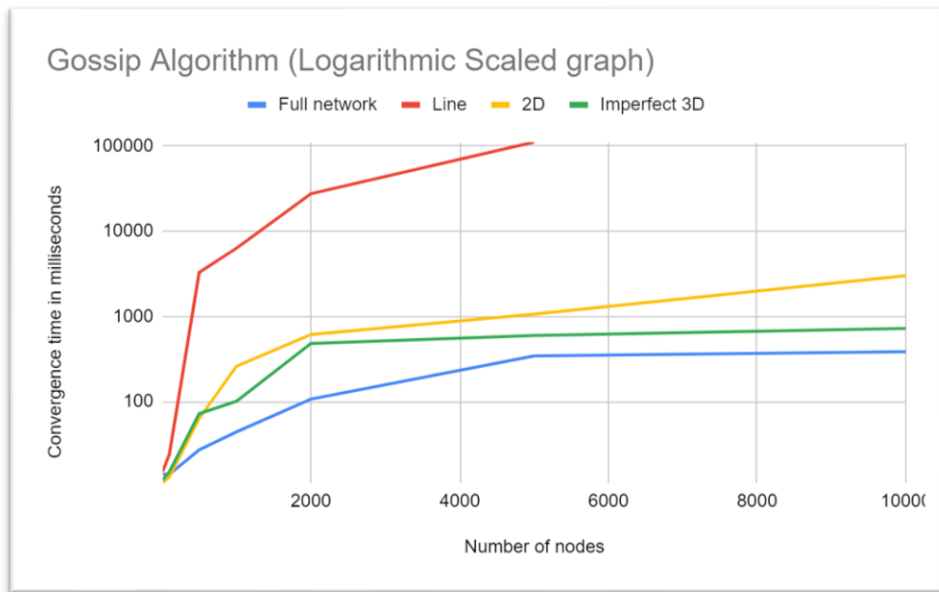
Imperfect 3D: 80

### Results:

#### Gossip Algorithm:

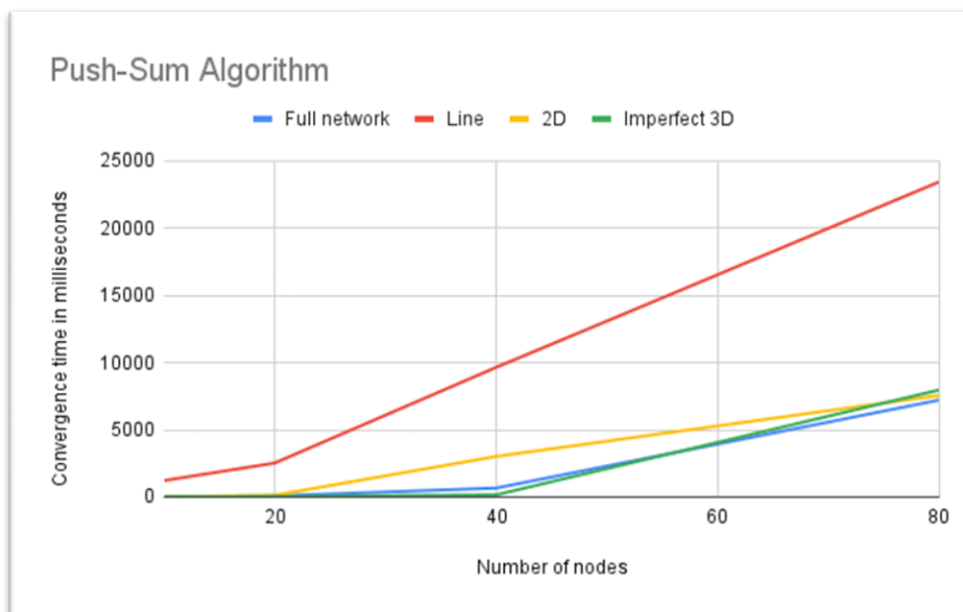
	Convergence time in ms			
Number of nodes	Full network	Line	2D	Imperfect 3D
10	14	15	11	12
100	14	24	13	15
500	27	3295	63	72
1000	44	6337	260	101
2000	107	27612	614	482
5000	344	111452	1066	598
10000	385	-	3011	724





Push-Sum Algorithm:

	Convergence time in ms			
Number of nodes	Full network	Line	2D	Imperfect 3D
10	20	1218	20	16
20	79	2525	128	37
40	665	9653	3021	160
80	7216	23440	7562	7971



# Push-Sum Algorithm (Logarithmic Scaled graph)

