

# **COP5615 – Distributed Operating Systems**

## **Project-2 Report Oct 1, 2019**

Group Members:

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**Project Definition:** The goal of this project is to determine the convergence of Gossip and Push-Sum algorithms through a simulator based on actors written in Elixir.

### **Topologies Implemented**

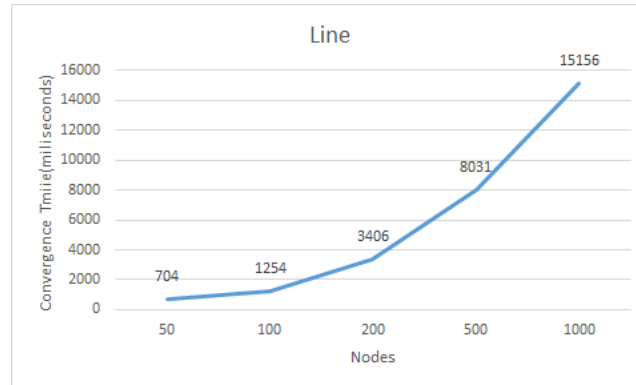
- Full Network: Every actor is a neighbor of all other actors. That is, every actor can talk directly to any other actor.
- Line: Actors are arranged in a line. Each actor has only 2 neighbors (one left and one right, unless you are the first or last actor).
- Random 2D Grid: Actors are randomly position at x, y coordinates on a [0-1.0] x [0-1.0] square. Two actors are connected if they are within .1 distance to other actors.
- 3D torus Grid: Actors form a 3D grid. The actors can only talk to the grid neighbors. And, the actors on outer surface are connected to other actors on opposite side, such that degree of each actor is 6.
- Honeycomb: Actors are arranged in form of hexagons. Two actors are connected if they are connected to each other. Each actor has maximum degree 3.
- Honeycomb with a random neighbor: Actors are arranged in form of hexagons (Similar to Honeycomb). The only difference is that every node has one extra connection to a random node in the entire network.

### **How to run code:**

- Open Command Prompt in proj2\_v1 directory
- Type in command: mix run my\_program.exs (number of nodes) (topology) (algorithm)
- Example: mix run my\_program.exs 100 line gossip

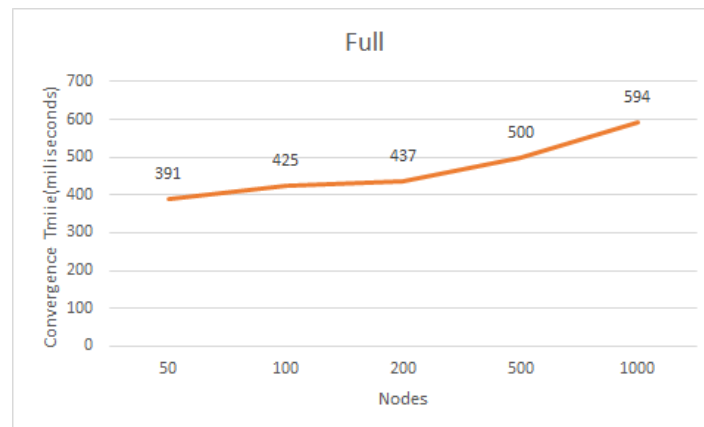
## Line Topology

Nodes	Convergence Time
50	704
100	1254
200	3406
500	8031
1000	15156



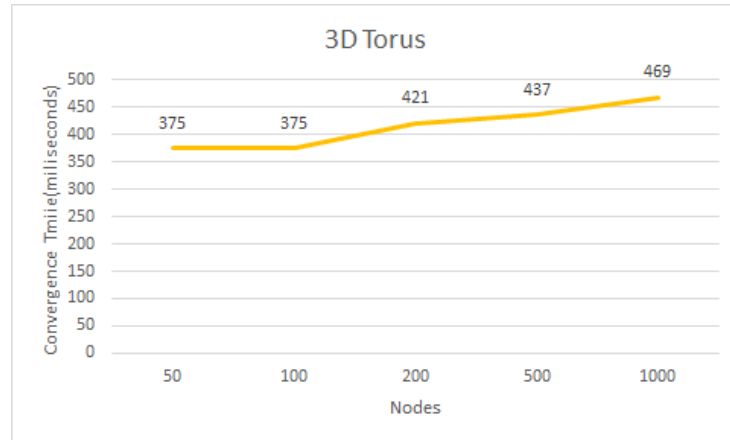
## Full Network

Nodes	Convergence Time
50	391
100	425
200	437
500	500
1000	594



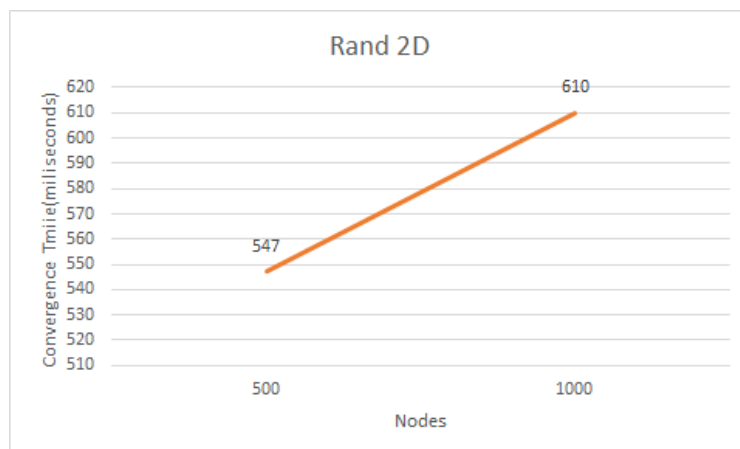
### 3D Torus

Nodes	Convergence Time
50	375
100	375
200	421
500	437
1000	469



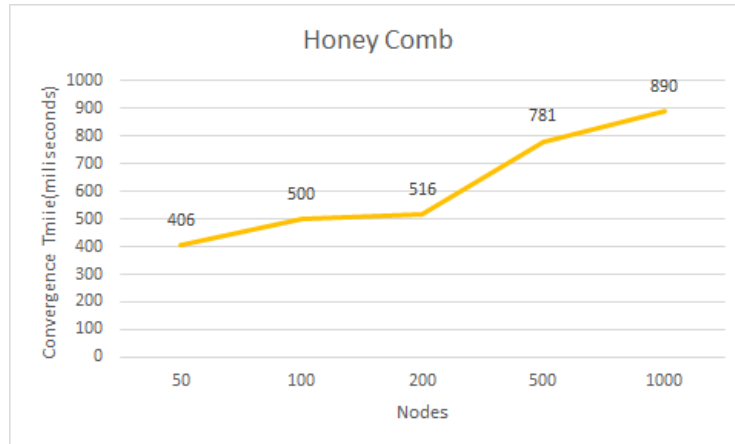
### Random 2D

Nodes	Convergence Time
50	-
100	-
200	-
500	547
1000	610



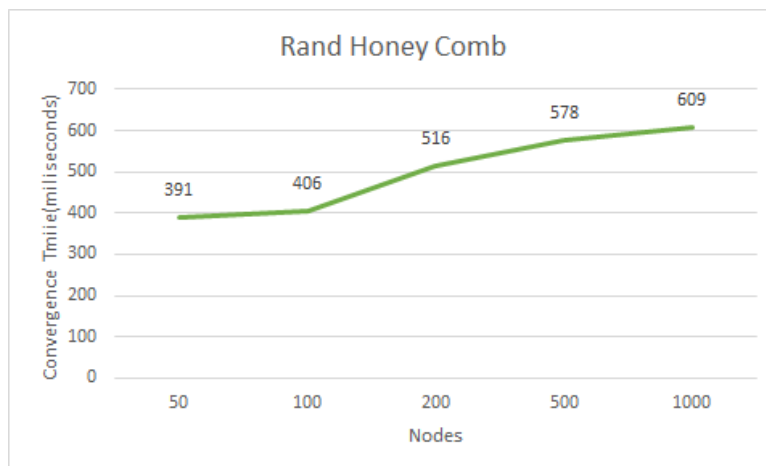
## Honey Comb

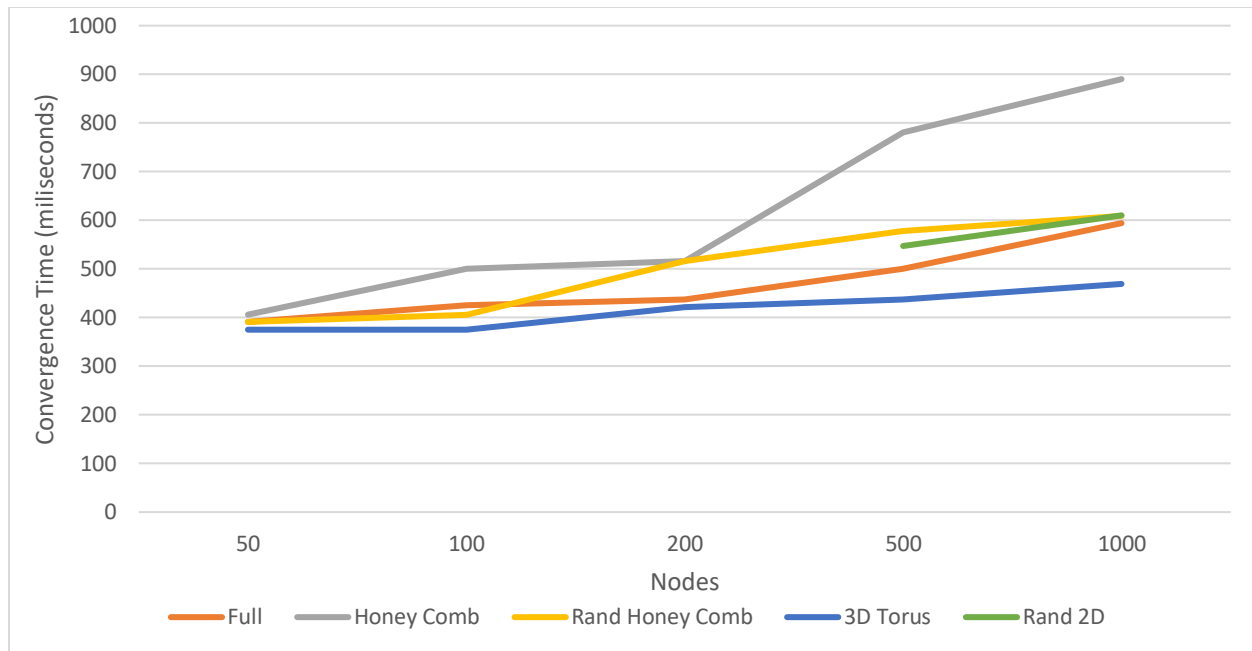
Nodes	Convergence Time
50	406
100	500
200	516
500	781
1000	890



## RandhoneyComb

Nodes	Convergence Time
50	391
100	406
200	516
500	578
1000	609





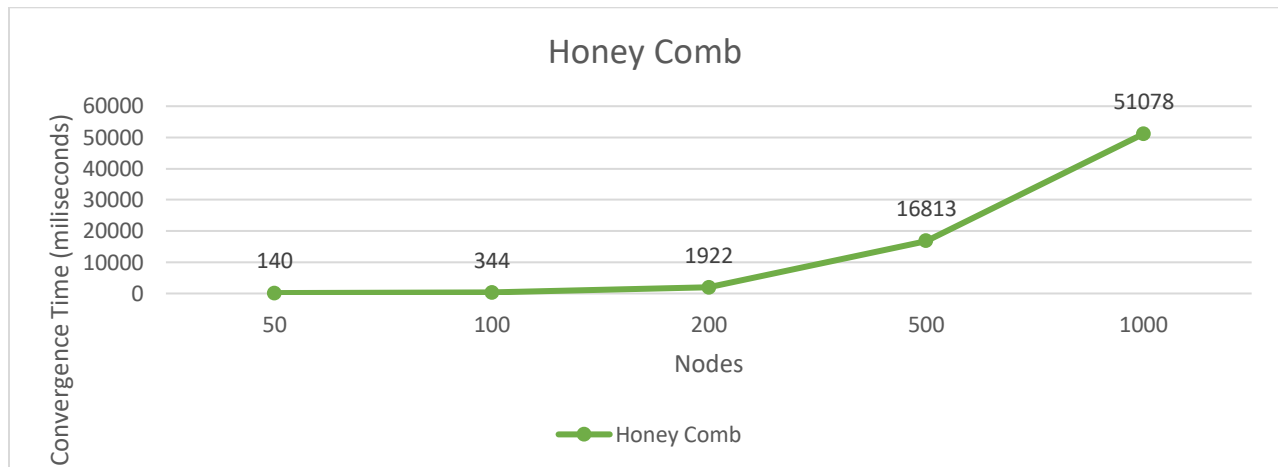
Note: The above graph does not contain topology 'line'

#### Interesting Findings for Gossip:

1. Line Topology takes the maximum time for convergence.
2. The Random 2D topology does not work for less number of nodes since the network cannot be formed if nodes don't have a neighbor to send the rumor.
3. According to our observations, the Full Network Topology and 3DTorus perform the fastest out of all topologies.
4. Between Honey Comb and Random Honey Comb, random honey comb seems to be faster. The reason seems to be that it has one extra neighbor than honey comb which makes gossip faster.

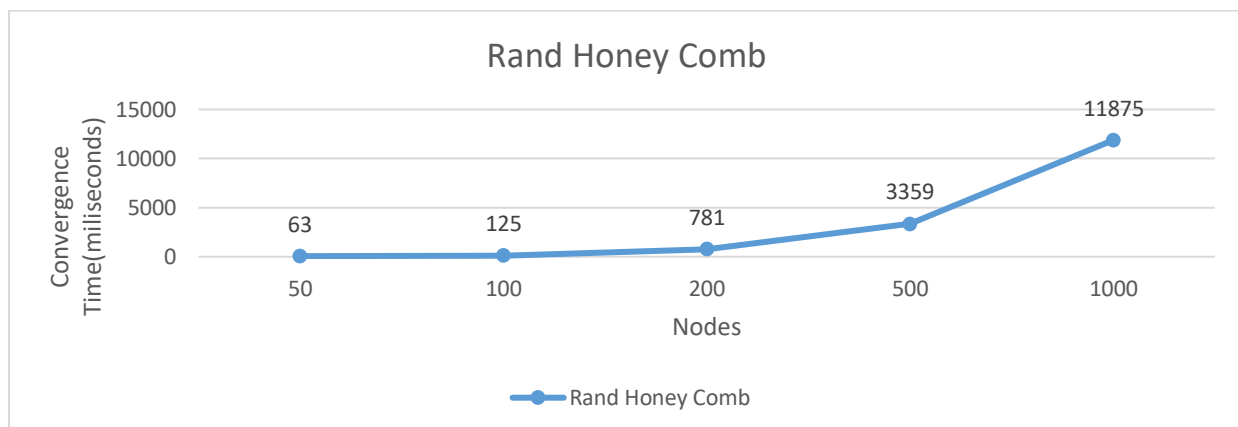
## Push-Sum Honey Comb

Nodes	Convergence Time
50	140
100	344
200	1922
500	16813
1000	51078



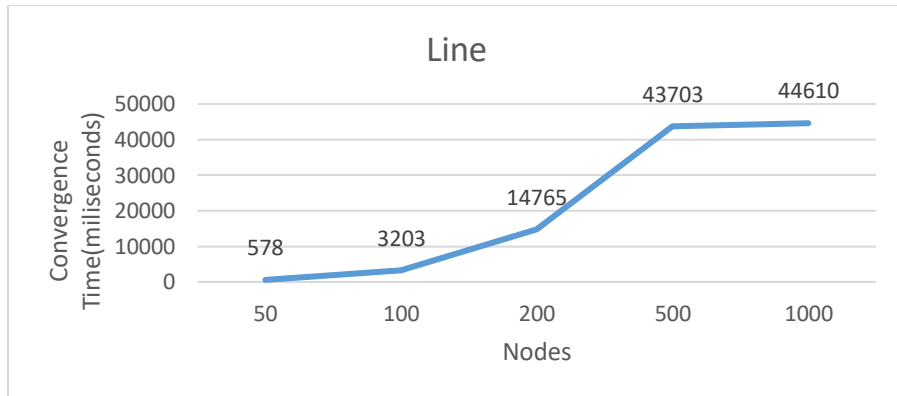
## RandHoney Comb

Nodes	Convergence Time
50	63
100	125
200	781
500	3359
1000	11875



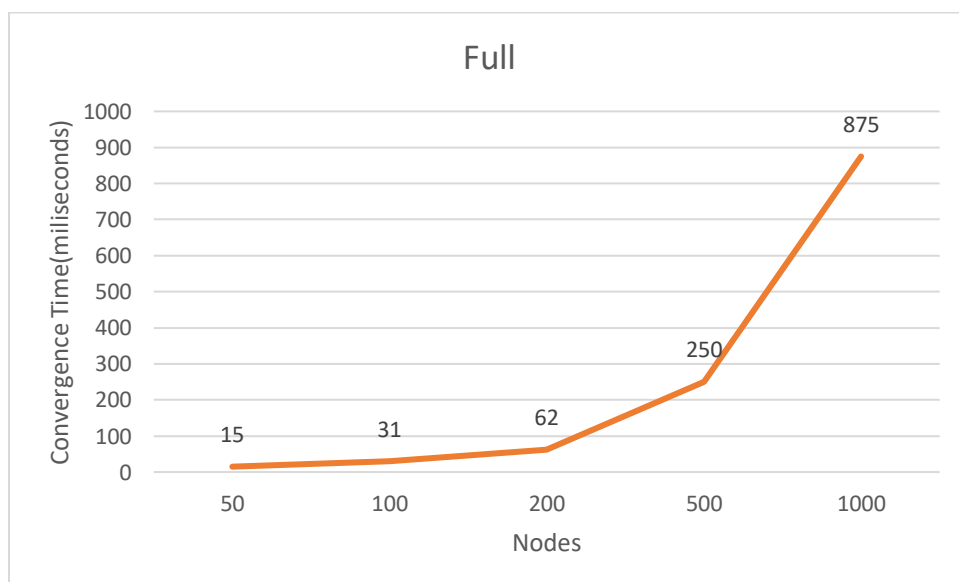
## Line

Nodes	Convergence Time
50	578
100	3203
200	14765
500	43703
1000	44610



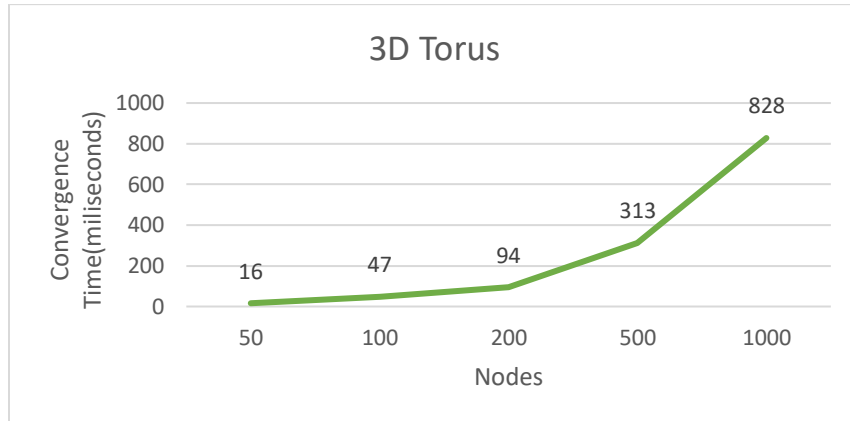
## Full

Nodes	Convergence Time
50	15
100	31
200	62
500	250
1000	875



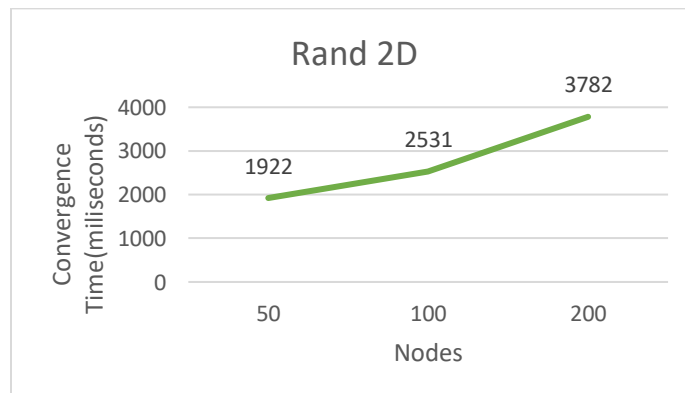
### 3D Torus

Nodes	Convergence Time
50	16
100	47
200	94
500	313
1000	828

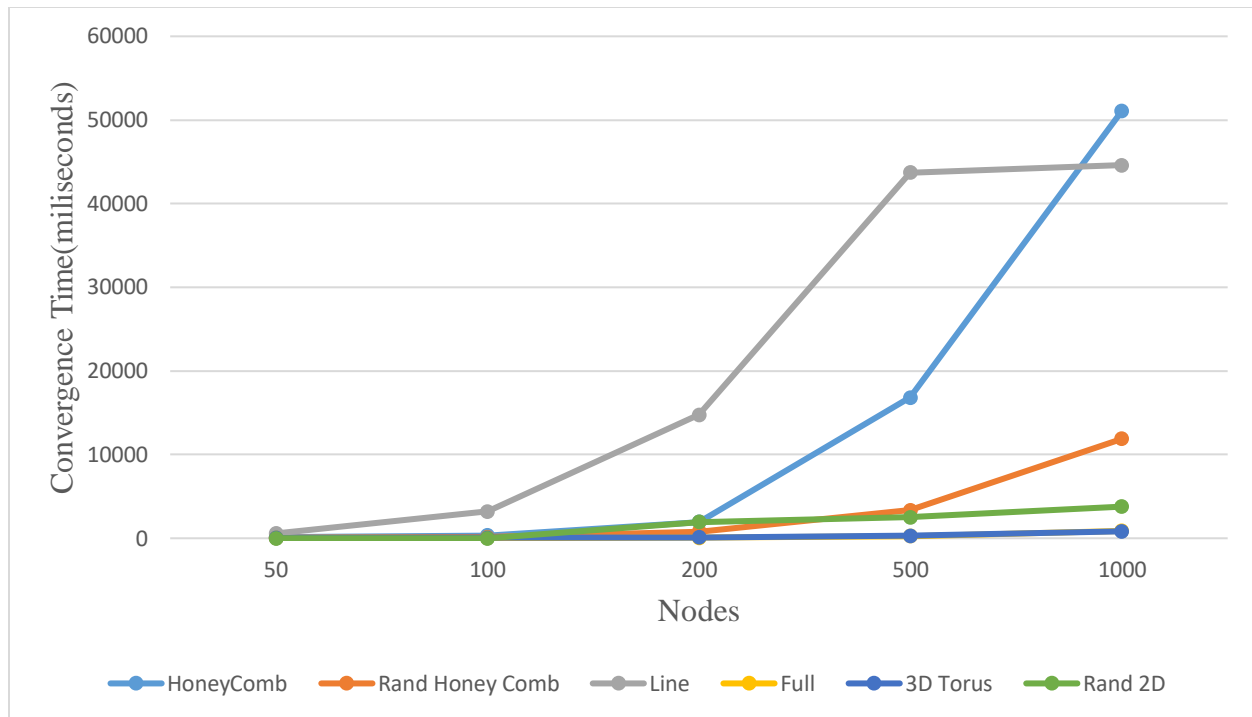


### Random 2D Grid Topology

Nodes	Convergence Time
50	-
100	-
200	1922
500	2531
1000	3782







#### Interesting Observations:

1. Here also, line topology takes the maximum amount of time to converge.
2. Full topology takes the least time for convergence
3. The next fastest is 3D-Torus.

Another interesting observation is that: For smaller number of nodes, push-sum seems to converge faster than gossip. But as the number of nodes increase, convergence time of push-sum is greater than gossip.