Project Report

Distributed Operating Systems

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Implementation Details :

Gossip algorithm :

The algorithm is predicated on the fact that each actor selects a random neighbor and forwards it the rumors. The implementation was done by keeping in mind that a node cannot forward the messages more than 10 times, but it can still receive it. If all the nodes have received the intended message, then the convergence criteria can be deemed as achieved. The program terminates as soon as convergence is achieved.

Push-Sum Algorithm:

In this algorithm, every actor maintains two quantities s and w. Initially, s = xi = i (that is actor number i has value i) and w = 1, the actor terminates if its s/w did not change more than 10-10 in 3 consecutive rounds.

Topologies implemented :

- **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.

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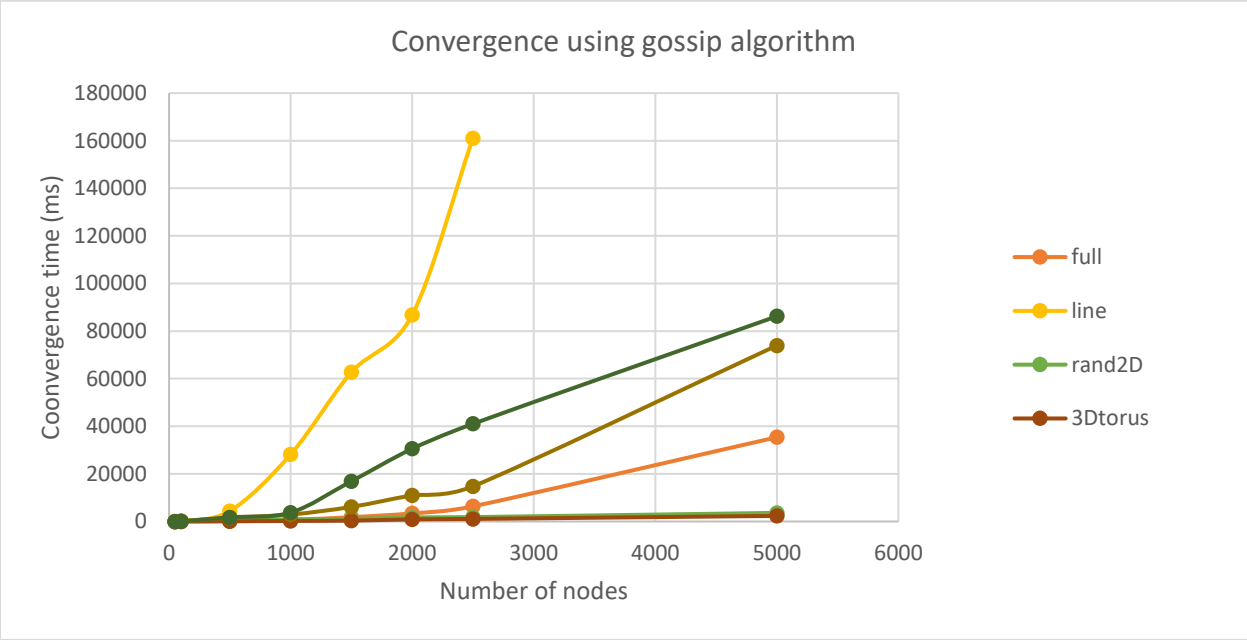
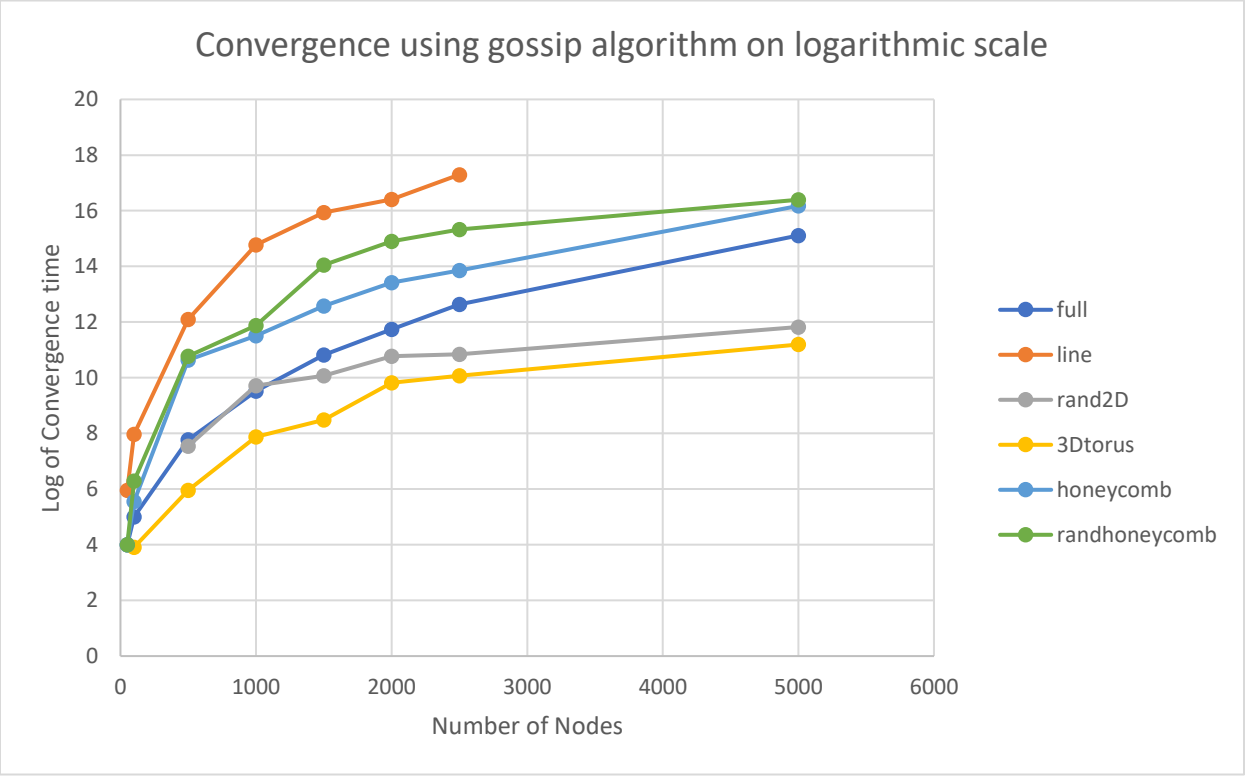
Graphs for Gossip and Push-Sum algorithms

- **Gossip algorithm**





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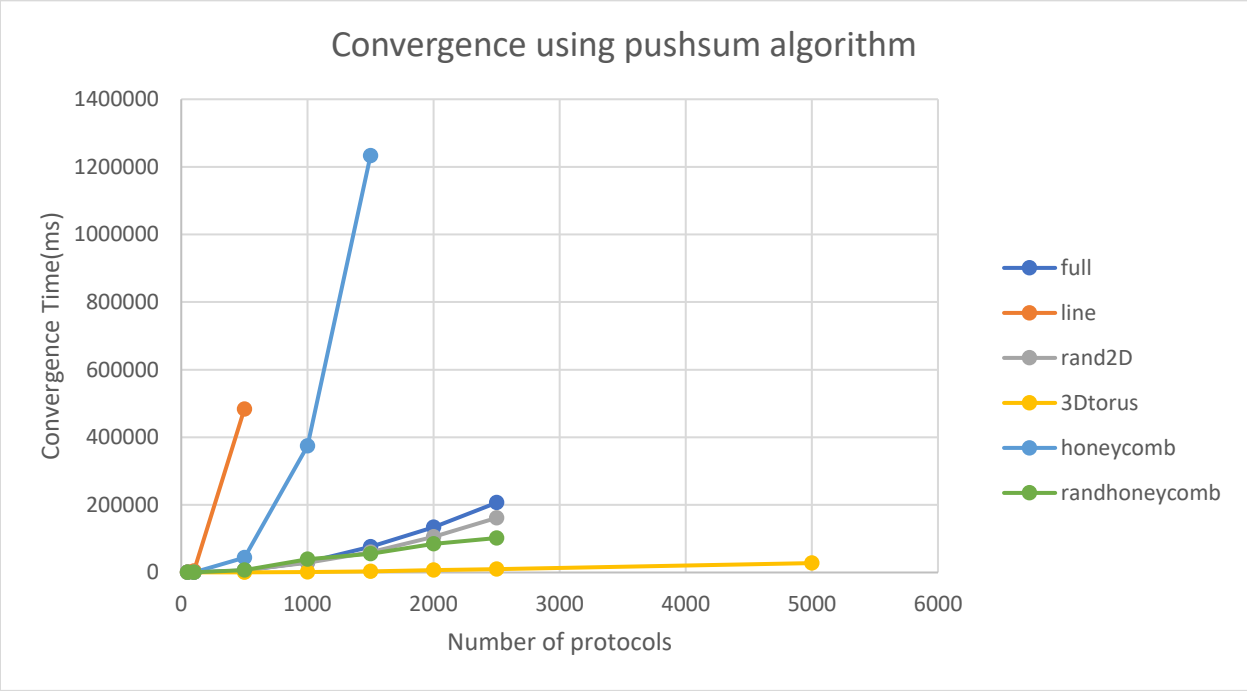
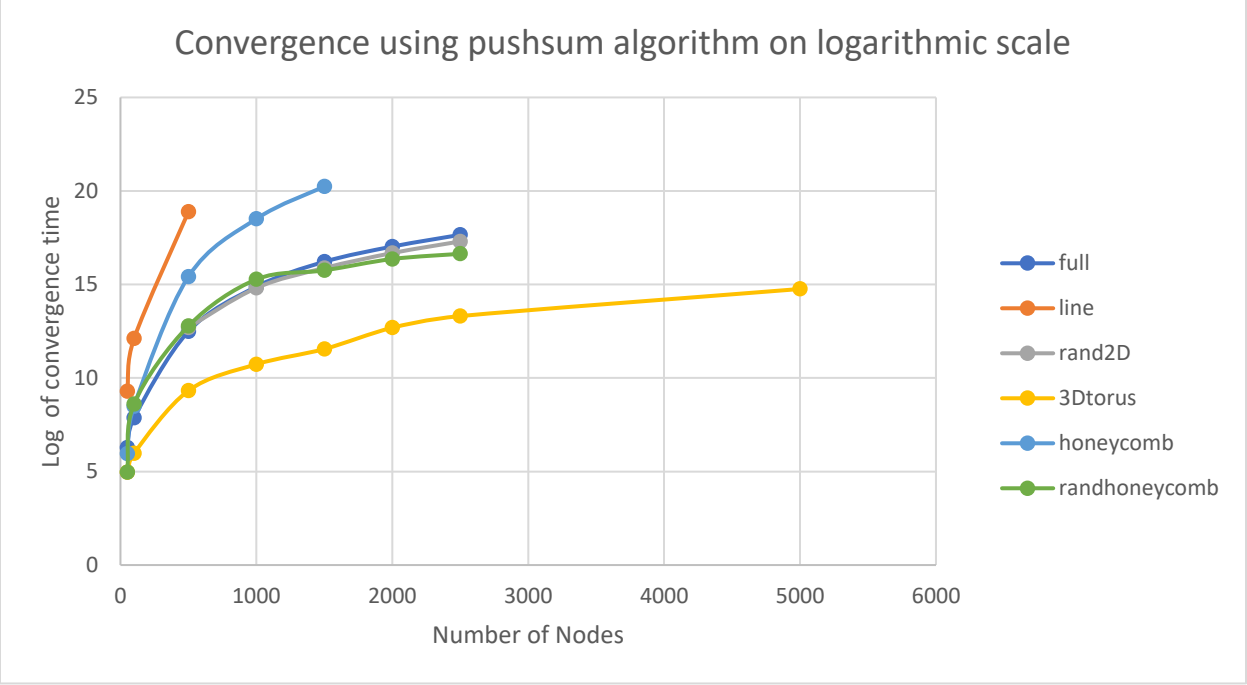
- Push-Sum Algorithm





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Observations

After going through the above graphs and comparing the convergence time for gossip and push-sum algorithms for different topologies, we came to the following conclusions:

- The topology that took least amount of time to converge for both gossip and push-sum algorithm was found to be "*3Dtorus"*.
- The topology that took maximum time to converge for both gossip and push-sum algorithms was found to be "*line*" which can be attributed to the fact that it has a maximum of two neighbors and hence it takes a significant amount of time to transmit the message.
- We were able to achieve convergence by using "*random 2D*" topology only if the number of nodes were around 500 or more than that.
- For gossip algorithm , if the number of nodes are less then "*honeycomb*" topology performs better than *"honeycomb-with-random-neighbors"*, but we can observe through trends on the graph that the performance of honeycomb-with-random-neighbors improves as number of nodes increase in comparison to that of honeycomb.
- For gossip algorithm the order of convergence in terms of time was found to be *3Dtorus < rand2D < full < honeycomb < randhoney < line*
- For Push-Sum algorithm the order of convergence in terms of time was found to be *3Dtorus < randhoney < rand2D < full < honeycomb < line*