COP5615 – Fall 2019

Project 2 – Bonus Part

Submitted By:

Aswin Matthews Ashok, UFID: 0694-8935

Divy Nidhi Chhibber, UFID: 3138-9199

Failure Models:

1. Node Failure

Implementation:

We introduced node failure based on the failure rate, a parameter which is set within the program and passed as an argument to the actors. When actors receive the rumor for the first time, they decide on whether to process the rumor or fail. A failed node does not react to any messages sent to it except the restart message.

This is a temporary type of failure model. The master periodically pings all the actors who in turn reply with their states. The failed nodes will not reply to this request. The master then sends a restart message to every node it did not receive a reply from. On receiving this restart message, only the failed nodes change their states and become active.

Experiments:

Experiments were performed in the following way:
I.   Failure type is set as "node" and the failure rate is defined in the program.
II. For each algorithm and topology on a network size of 1000 nodes, the convergence time is measured.
III. This test is repeated 5 times for different failures rates ranging from 0 to 30 and the average convergence time for each configuration is plotted.

Observations:

I.   Convergence time for the 'line' topology is affected the most by the failure rate. This can be due to the reason that in this topology, each node has only 2 neighbors and failure of any neighbor will highly impact the convergence time.
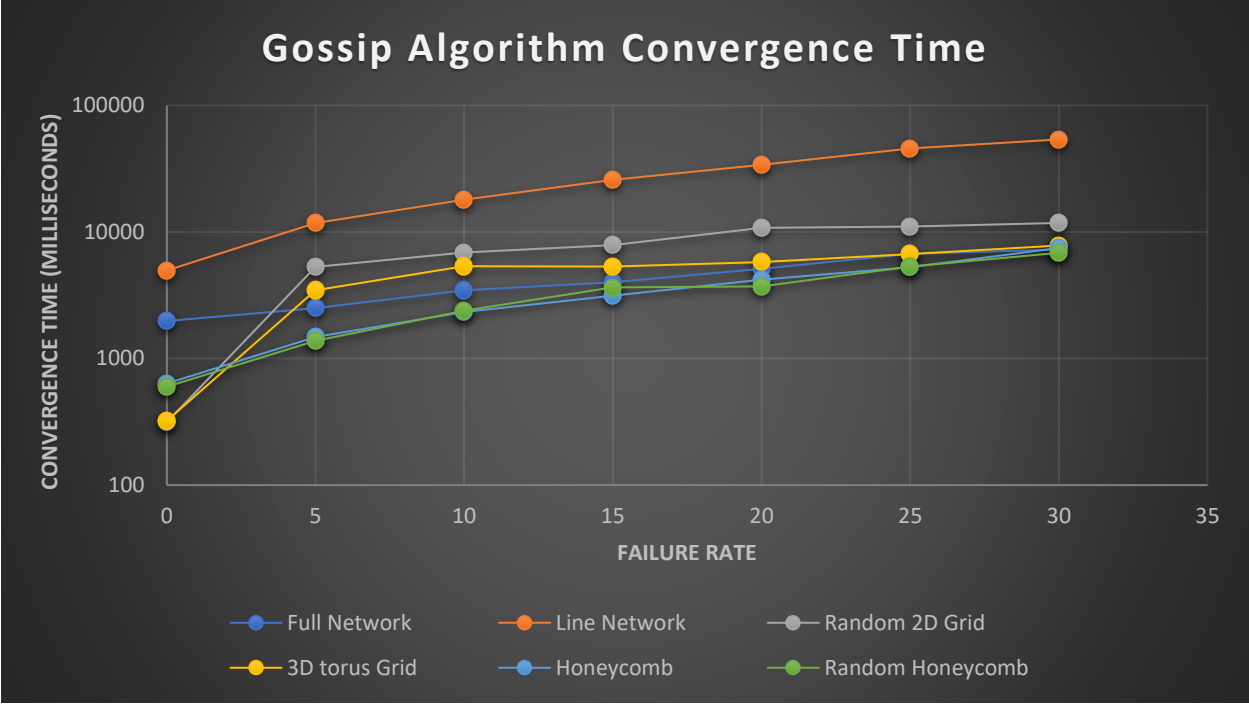II. For the '3D torus Grid' topology, there is little effect of the increased failure rate on the convergence time.

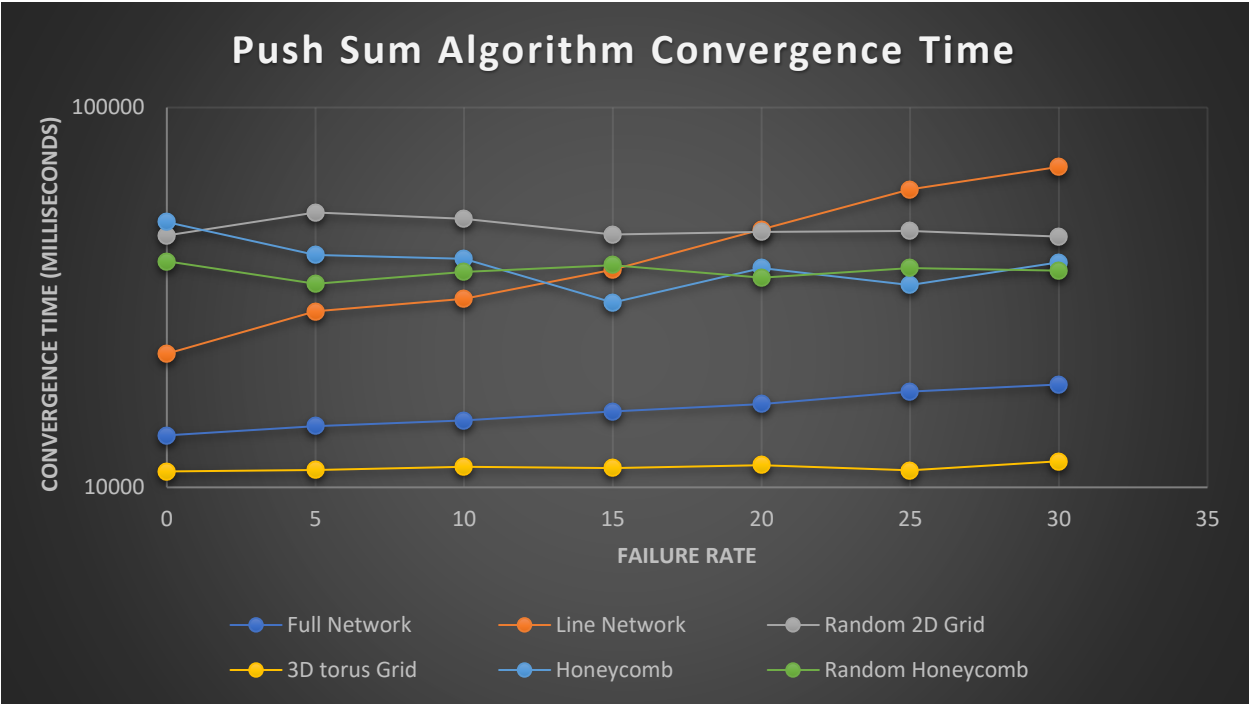*Figure 1: Gossip Convergence for Different Topologies with node failure*

Figure 2: Push-Sum Convergence for Different Topologies with node failure

2. **Connection Failure**

Implementation:

We introduced connection failure based on the failure rate, a parameter that is set within the program and the topology is built based on it. While building the topology, some of the connections that should have ideally existed are now not created. In this model, connection failures are permanent.

Experiments:

I.   Failure type is set as "connection" and failure rate is defined in the program.
II. For each algorithm and topology on a network size of 1000 nodes, the convergence time is measured.
III. This test is repeated 5 times for different failures rates ranging from 0 to 30 and the average convergence time for each configuration is plotted.

Observations:

I.   The 'Random honeycomb' topology has the most stable convergence rate with increasing failure rate.
II. For the gossip alogorith, the 'full' topoly has a very high convergence time for small failure rates.
III. The 'honeycomb' topology shows unexpected behavior with increasing failure rate for the push-sum algorithm.
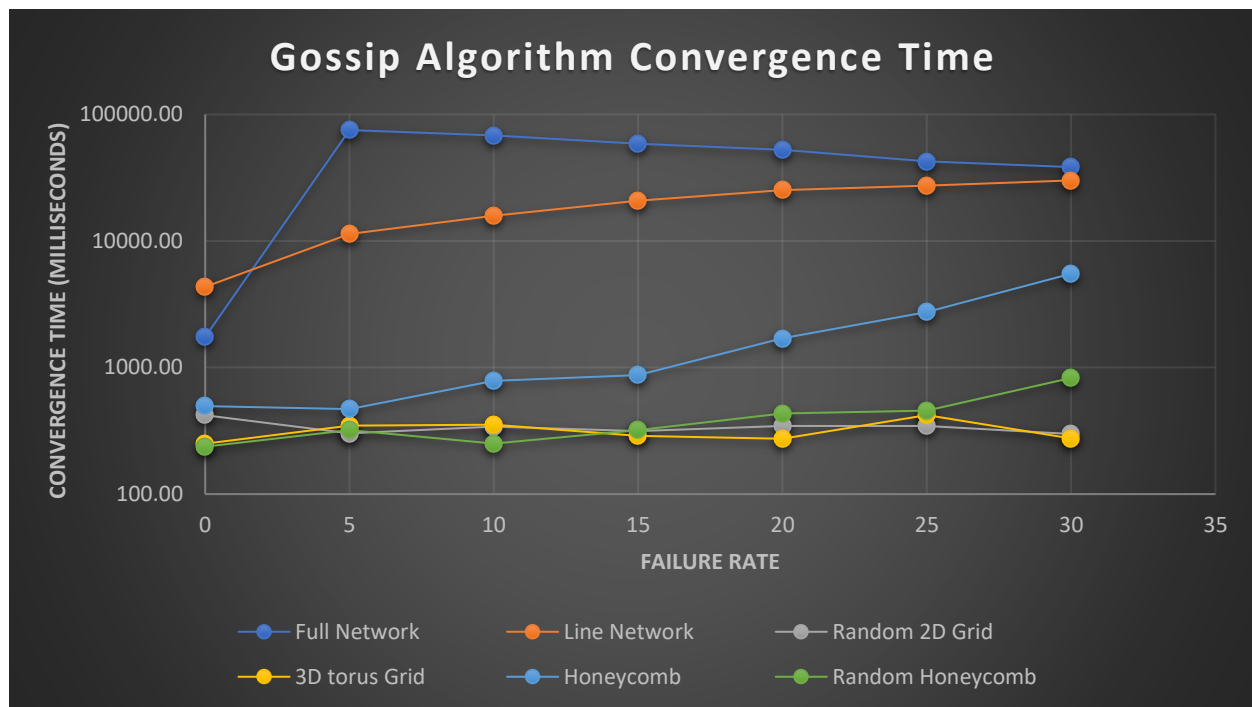
Figure 3: Gossip Convergence for Different Topologies with connection failure
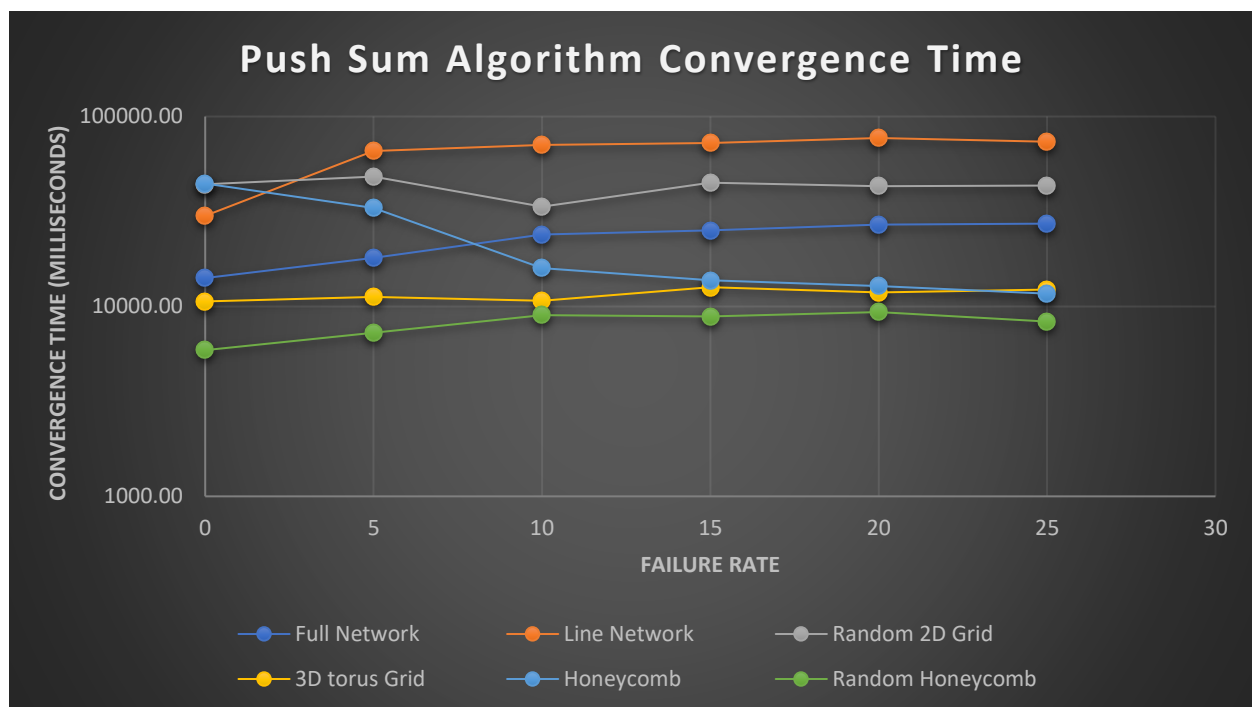

Figure 4: Push-Sum Convergence for Different Topologies with connection failure