

## Project Report (Bonus Part)

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### Failure Model:

We have considered a temporary failure model where, there is a special node that sends messages to random nodes to restart the nodes. While the nodes are restarting, they are disconnected from the network i.e. they can't send or receive messages. We have two parameters that control the failure model: the ratio of nodes that should be restarted (temporary node failure ratio) and the duration for which the nodes are disconnected from the network (failure duration). In this failure model, after the special node has finished restarting the given ratio of nodes, it goes dormant and the network become fully reliable after all the restarted nodes come online.

When a node sends a message, it expects an acknowledgement for that message. If the node does not receive the acknowledgement within a specified timeout period (which we have taken as 5 ms, half the value of send message tick duration), it assumes that the recipient node has disconnected, and transmits the same message to a different node instead. In case of the push-sum algorithm, the node updates its value of  $S$  and  $W$  only when the acknowledgement of the message is received.

### Analysis and Interesting Observations:

In our analysis of the failure model, we ran the push-sum algorithm at different values of temporary node failure ratios for all the topologies with a fixed failure duration of one second and fixed number of nodes (100). For line topology, as the convergence time is significantly large we used a smaller network size of 16 nodes so that we could plot the graphs in the same plot.

From the graph in Figure1 below, the convergence time increases rapidly when the node failure ratio is increased from 0.0 to 0.1. However, after this initial increase, the convergence time does not vary by a significant factor when the node failure ratio is further increased. This means that the push-sum algorithm is very resilient to temporary node failure. The same trend is seen for all topologies. It is quite interesting to see that even sparsely connected topology like line topology exhibits the same behavior as that of a strongly connected network like full topology for this failure model.

\*Graph on the next page

Graphs plotting convergence time vs Temporary Node Failure Ratio for different topologies for push-sum algorithm:

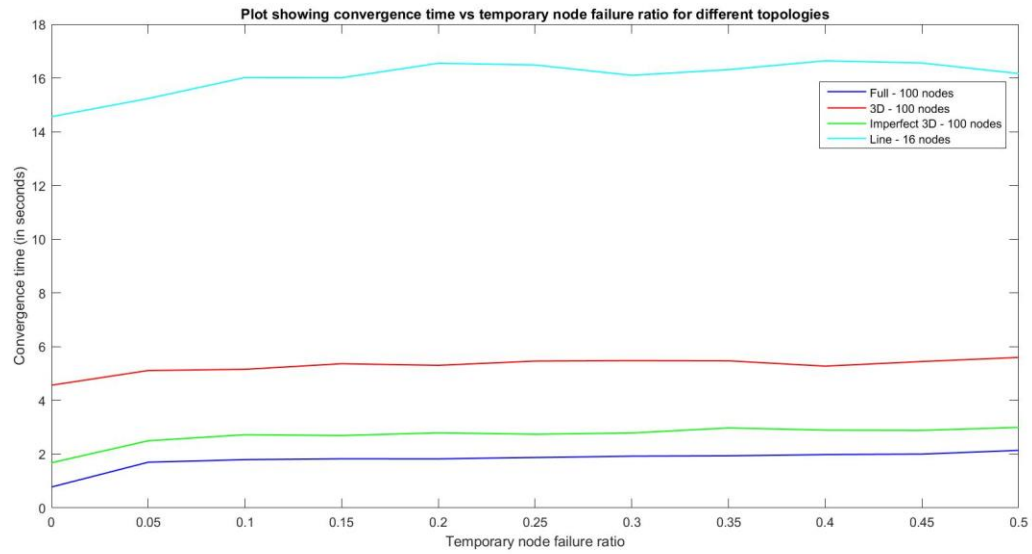


Figure 1: Plot showing convergence time vs temporary node failure ratio with 1 sec failure duration