Gossip Simulator

Team Members

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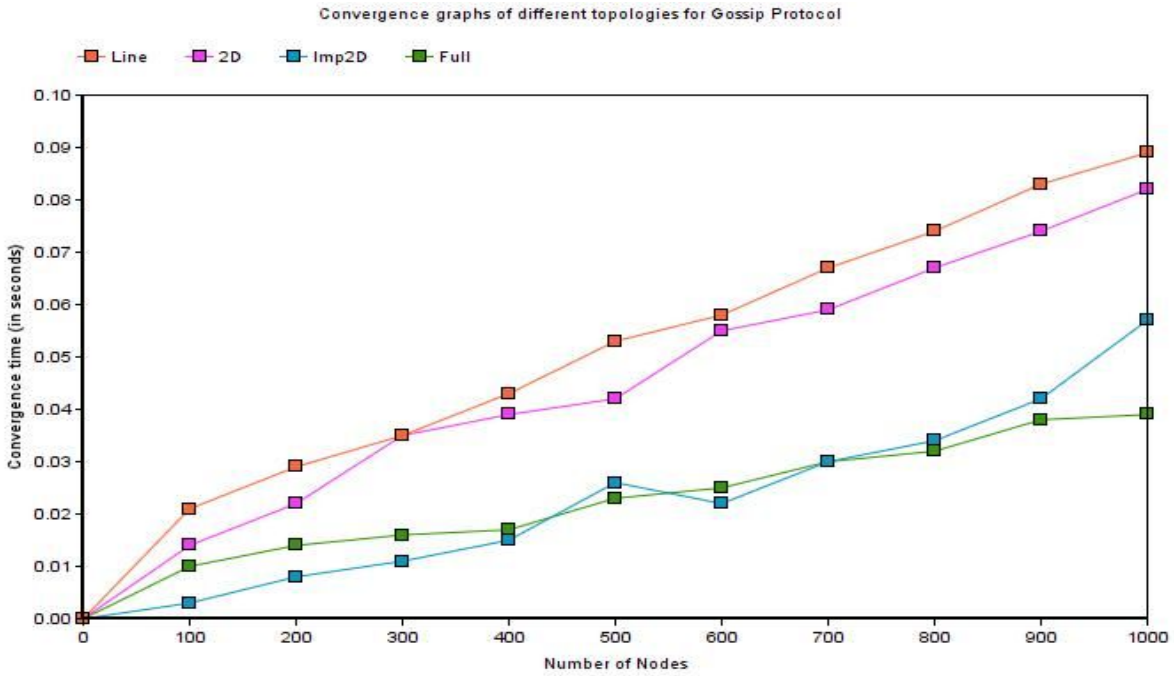
Implementation Details:

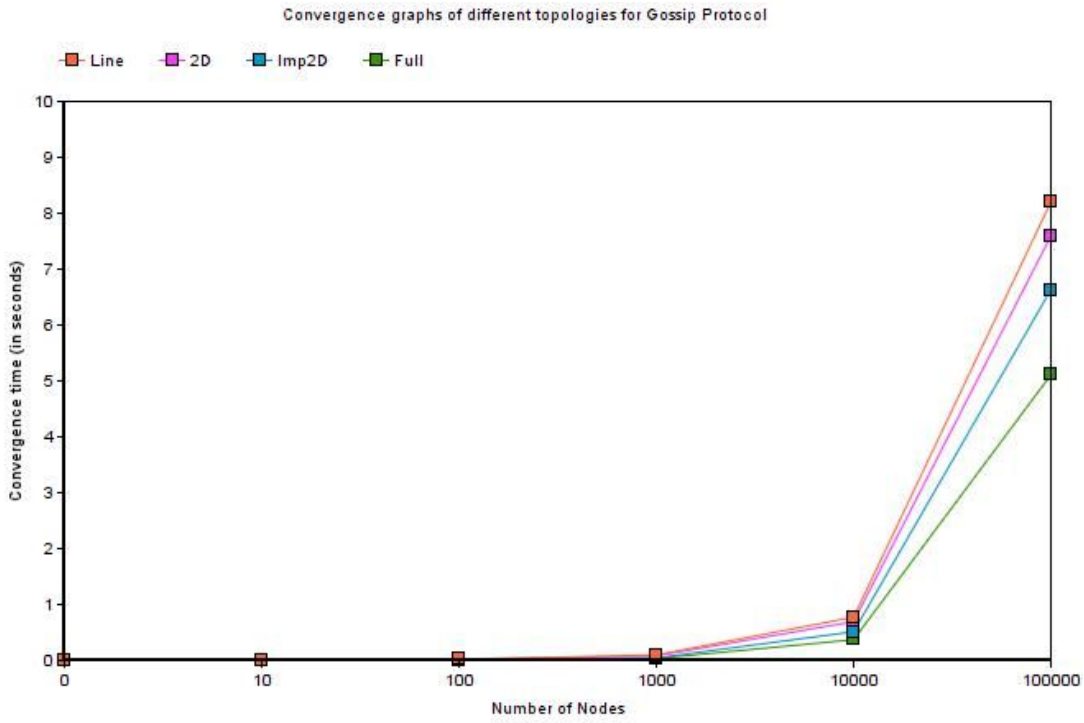
We have assumed that the gossip algorithm converges when all(100%) of the nodes in the network have heard the rumor. In our implementation, we terminate the algorithm when the count of the messages received at each node equals the number of nodes in the network and the node stops transmission of the message at this point.

In the push sum algorithm, we assume that the convergence happens when the difference in the ratios of three consecutive sum is to weight at a node is less than 10^{-10} . The algorithm is terminated after all the nodes in the network achieve convergence. This has to be done because on large networks the average convergence rate differs largely if we terminate the algorithm after convergence is achieved at a single node. The actual average differs widely from the expected average of the network if the algorithm is terminated before 100% convergence is achieved.

Graph Plots for different topologies and algorithms:

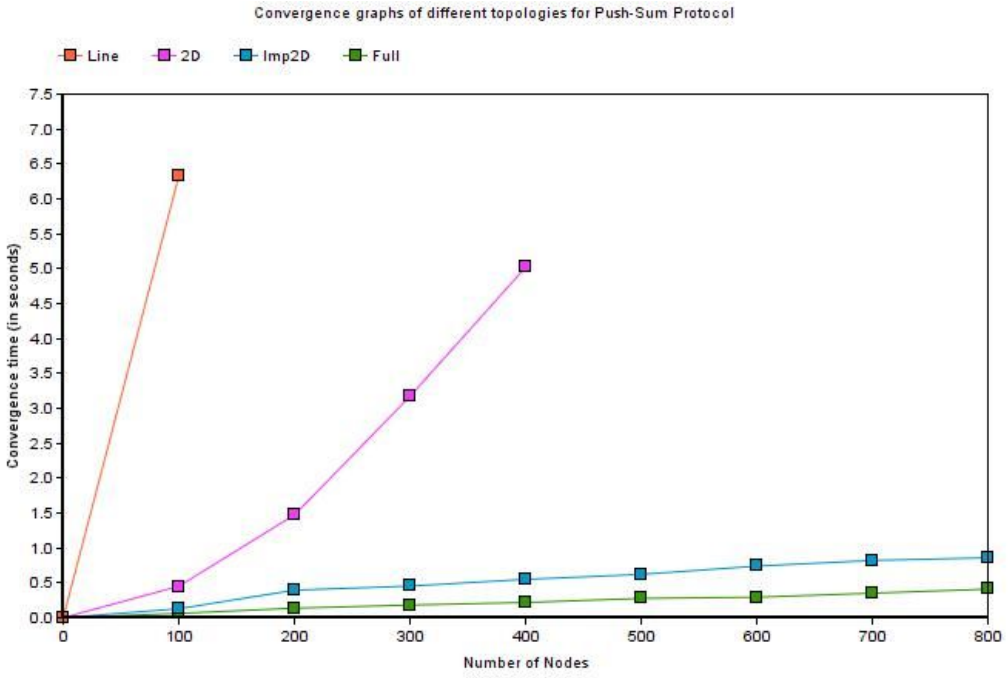
Gossip Protocol:

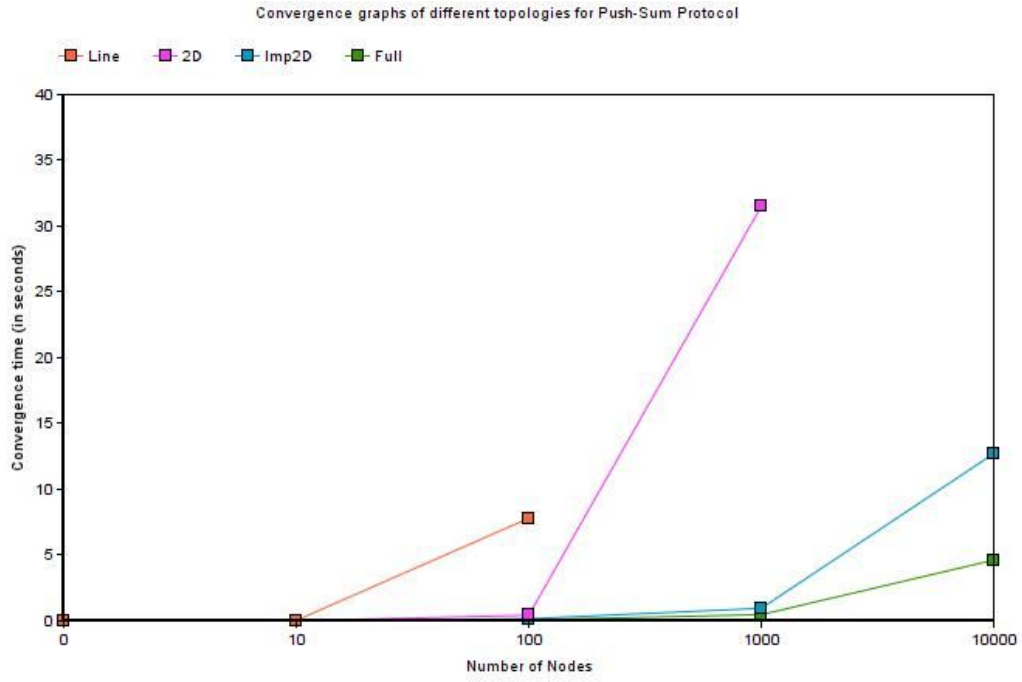




The graphs above plot the convergence time vs the size of the network i.e. the number of nodes in the network for all the given topologies. The first graph is plotted linearly to show the convergence time on smaller networks hence, the number of nodes is restricted to 1000. The second graph is plotted to show the logarithmic convergence time vs the logarithmic number of nodes in a large network.

Push-Sum Algorithm:





The two graphs are plotted to show the convergence time vs the number of nodes in the network for all topologies given. These are also plotted similar to the first two graphs to show the better analysis of data by limiting the number of nodes to 1000. The second graph shows the logarithmic values of convergence time vs the number of nodes.

Analysis:

The convergence time for all topologies ia a logarithmic curve except for line topology. The best performance is shown by the full network on smaller scale networks with number of nodes less than 1000.

However, when the number of nodes in the network are increased the plotted lines seem to increase exponentially. Nevertheless, line topology increases exponentially irrespective of the network being small or large.

The graph plots for both push-sum as well as gossip appear to exhibit similar characteristics as push-sum is just an extension of gossip algorithm where every node has to transmit its value to every other node in the network to obtain an accurate average value of the network.

Interesting Observations:

1. For imperfect 2D topology, the convergence time seemed to double every time we increased the nodes by power of 2 and when a random neighbor is added the convergence time decreased significantly.
2. Line networks overshoots and exponentially increases when nodes count > 300.
3. imp2D closes the gap between full networks when nodes count increases.