Report-Bonus

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We tested failure implementation by stopping random nodes and deducing whether the network was able to converge for upto 90%.

Failure Implementation

How did we do it?

1. We assume that the probability that a link between two nodes is broken is one in a thousand (0.001), i.e. it is possible that one neighbor link is broken for every 1000 neighbor links.
2. We randomly closed some of the nodes in the network to see if the network is still able to converge with the rest of the available nodes.

We could have implemented two approaches to make the network fault tolerant:

1. After every cast to the node, it should check what neighbours are alive. The problem in this approach would would occur when the network topology is fully connected and has a large number of nodes. It will certainly waste lot of time in fully connected network to check all connected nodes every time, but it can be done in rest of the network topologies. We could simply neglect the dead neighbours and cast the same node again, which would save some time, but if large number of nodes were to die, it could have been problematic as a node would end up casting itself multiple times.

We took second approach with assuming that failure of a large number of nodes in any network is occurs extremely rarely. Our benchmark test would be to cause nodes in the network to fail by an increment of 10% starting at 0 and continue testing till we are able to get some meaningful result out of it.
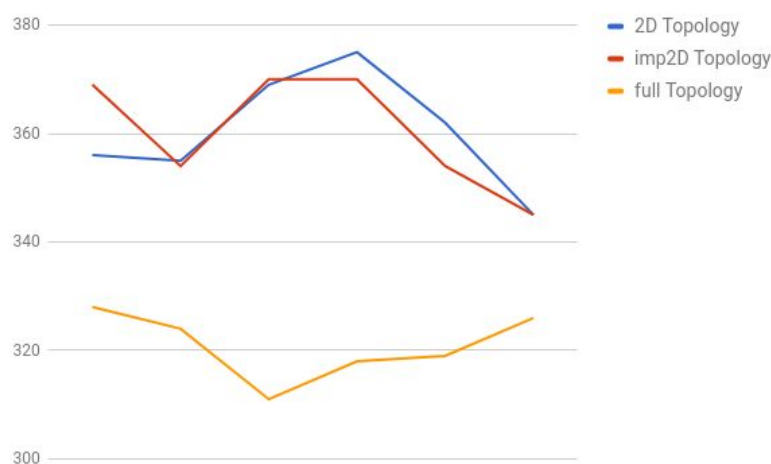
Gossip Protocol

Fig 1: percentage change in time wrt initial time (without failure) vs percent number of nodes that failed

Push-Sum

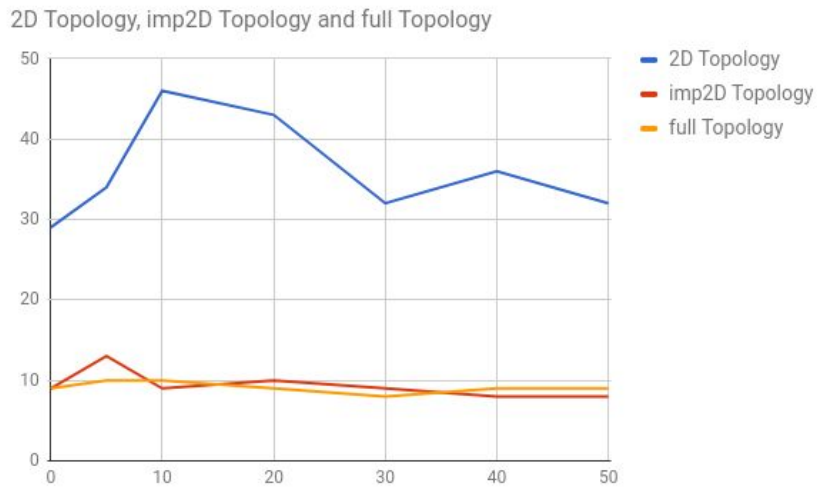2D Topology, imp2D Topology and full Topology

Fig 2: Time vs percentage number of nodes failure in a push-sum protocol

Analysis

After the analysis of the failure protocol, we can say that these algorithm are robust and work with in failure conditions as well. We found that line topology would not work with the permanent failures as the network gets divided into disjoint sets. On the other hand we did not see any visible difference in time for other topologies.