

DOS PROJECT 2 BONUS REPORT

Submitted By:
Shashank Ranjan, 03937125
Vipul Mittal, 51901508

FAILURE MODEL IMPLEMENTATION:

In our failure model, while sending message if a node encounters a neighbor which has failed, it randomly selects another neighbor to send the message to. If all the neighbors of the node fail, the node stops sending the message.

DECIDING THE FAILED NODES:

We take percentage of nodes to fail as argument and randomly shut down those nodes after creating the topology.

sbt "run <total # of nodes> <topology> <algorithm> <% 'age of nodes to fail>"

EXPERIMENT:

Keeping the size of network constant (total no. of nodes = 1000), we increased %'age of failed nodes in the network for different topologies and ran both Gossip Algorithm and the Push Sum Algorithm.

The tables below show our findings.

RESULTS:

Gossip Protocol:

S No.	Topology	Network Size	% 'age of failed nodes	Convergence Time (in milliseconds)
1	Full	1000	0	583
2	Full	1000	5	583
3	Full	1000	10	528
4	Full	1000	20	509
5	Full	1000	50	482
1	Line	1000	0	19
2	Line	1000	5	20
3	Line	1000	10	25
4	Line	1000	20	39
5	Line	1000	50	15

1	3D	1000	0	281
2	3D	1000	5	274
3	3D	1000	10	203
4	3D	1000	20	101
5	3D	1000	50	35
1	Imp3D	1000	0	500
2	Imp3D	1000	5	453
3	Imp3D	1000	10	429
4	Imp3D	1000	20	416
5	Imp3D	1000	50	244

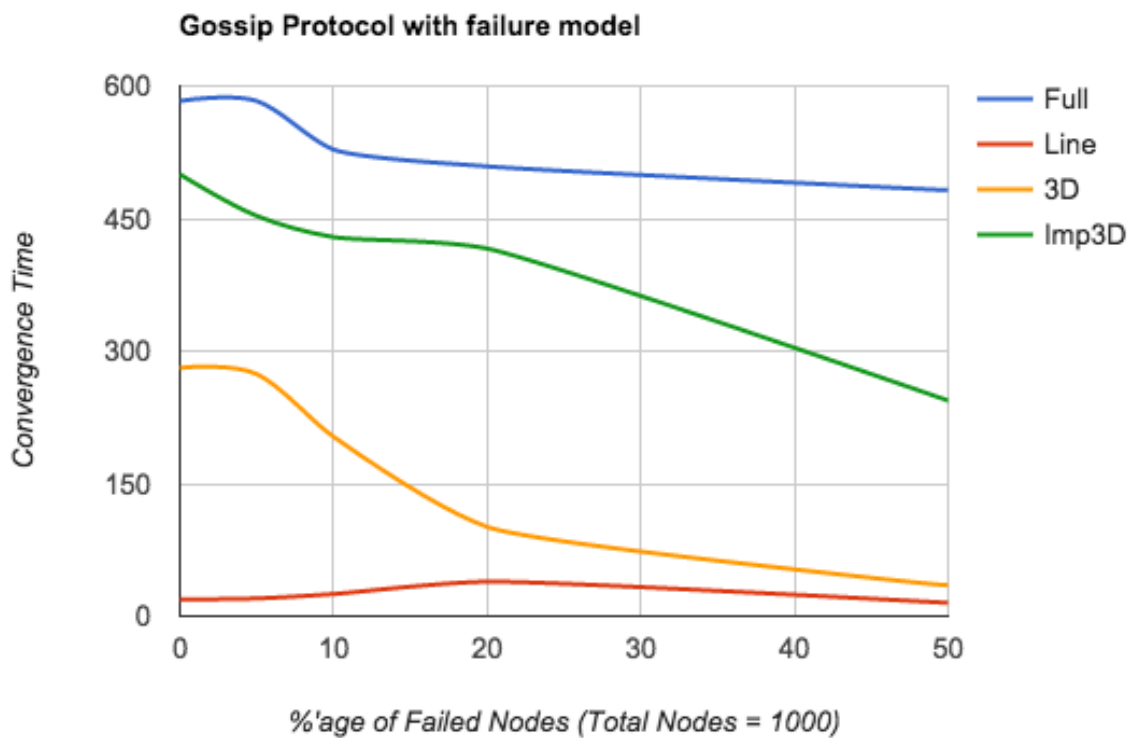
Push Sum Protocol:

S No.	Topology	Network Size	%'age of failed nodes	Convergence Time (in milliseconds)
1	Full	1000	0	6284
2	Full	1000	5	12526
3	Full	1000	10	17232
4	Full	1000	20	26398
5	Full	1000	50	42150
1	Line	1000	0	99999
2	Line	1000	5	633
3	Line	1000	10	50
4	Line	1000	20	24
5	Line	1000	50	54
1	3D	1000	0	72771
2	3D	1000	5	70813
3	3D	1000	10	61786
4	3D	1000	20	64714
5	3D	1000	50	100791

1	Imp3D	1000	0	5680
2	Imp3D	1000	5	4087
3	Imp3D	1000	10	2631
4	Imp3D	1000	20	1541
5	Imp3D	1000	50	823

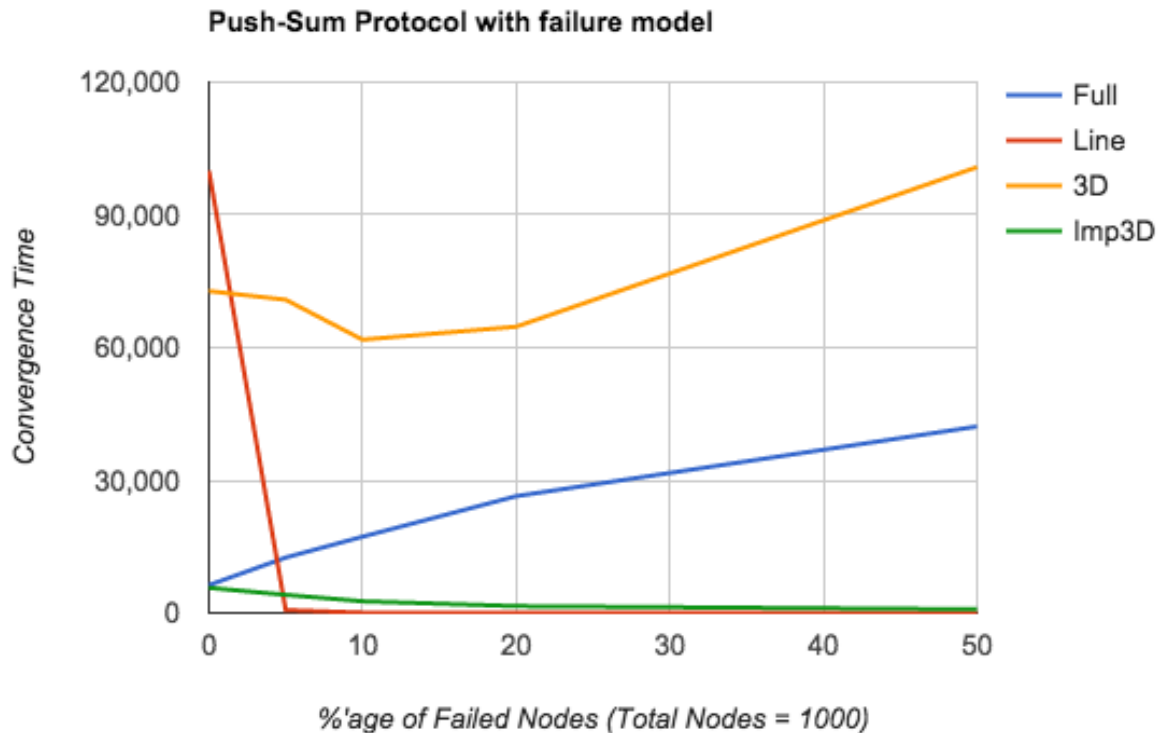
OBSERVATIONS:

Gossip Algorithm:



1. For Full topology, increasing the number of failed nodes decreases the convergence time but it continues to be high. We can observe a sharp dip in blue graph at 10% failure after which convergence more or less remain constant.
2. For Line topology, our failure model does not cause much change in the convergence time and the graph is more or less constant.
3. For 3D and imp3D topologies, the graphs more or less follow the same trajectory even though the convergence values for imp3D are higher. This show that our failure model has similar effect on both topologies.

Push Sum Algorithm:



1. For the full topology, we can see a gradual increase in convergence time with increase in number of failed nodes. This could be attributed to the fact that decrease in number of nodes means slower convergence of values at individual nodes.
2. For line topology, we see a sharp dip in convergence time. This could be due to the fact that since we randomly select nodes to fail, a node failing at close to the start of the chain means all the nodes after the failed node are isolated and won't receive the messages. Therefore convergence will occur within the nodes before the failed node in the chain. This may result in faster convergence.
3. For 3D topology, the graph shows a local minima before increasing. This shows that initially the convergence time may decrease with failed nodes but later on lower number of active nodes cause the convergence to happen slowly as in case of full topology.
4. For Imp3D, the graph is close to a constant, showing failed nodes have no effect on convergence time.