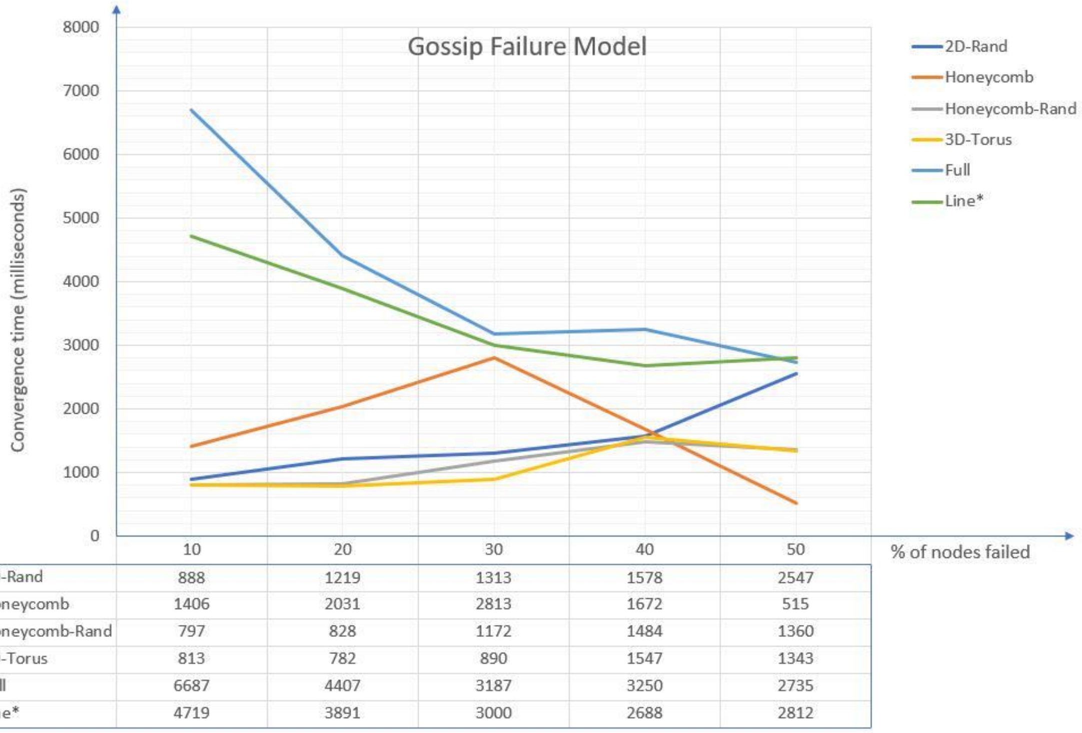
PROJECT-2 BONUS REPORT

Gossip Algorithm observations

1. Line displays inconsistent convergence rate.
2. Full topology has best node convergence during failures, but 2Drand, honeycomb, honeycombrand, 3Dtorus converged at a lower rate than full.
3. It was difficult to do failure analysis for line topology, therefore node count of 100 was fixed, whereas other topologies were tested for 1000 nodes.
4. In case of line topology, an interesting observation has been made – For instance, upon removing one node from the topology, the network breaks into two parts, and the number of nodes converging totally depends on the removed node ID.

Topology	Total Nodes	Time (milliseconds)	Nodes Converged	Nodes Failed	Node Killed
Line	100	6891	73	1	74
	100	2516	19	1	20
	100	4625	36	1	37
	100	7218	95	1	96



	10	20	30	40	50
2D-Rand	888	1219	1313	1578	2547
Honeycomb	1406	2031	2813	1672	515
Honeycomb-Rand	797	828	1172	1484	1360
3D-Torus	813	782	890	1547	1343
Full	6687	4407	3187	3250	2735
Line*	4719	3891	3000	2688	2812

Fig 1: Convergence time for topologies during failure model.

Gossip Failure Model - Convergence Time (milliseconds)

% nodes killed	Full	Line*	2D-Rand	Honeycomb	Honeycomb-Rand	3D-Torus
10	6687	4719	888	1406	797	813
20	4407	3891	1219	2031	828	782
30	3187	3000	1313	2813	1172	890
40	3250	2688	1578	1672	1484	1547
50	2735	2812	2547	515	1360	1343

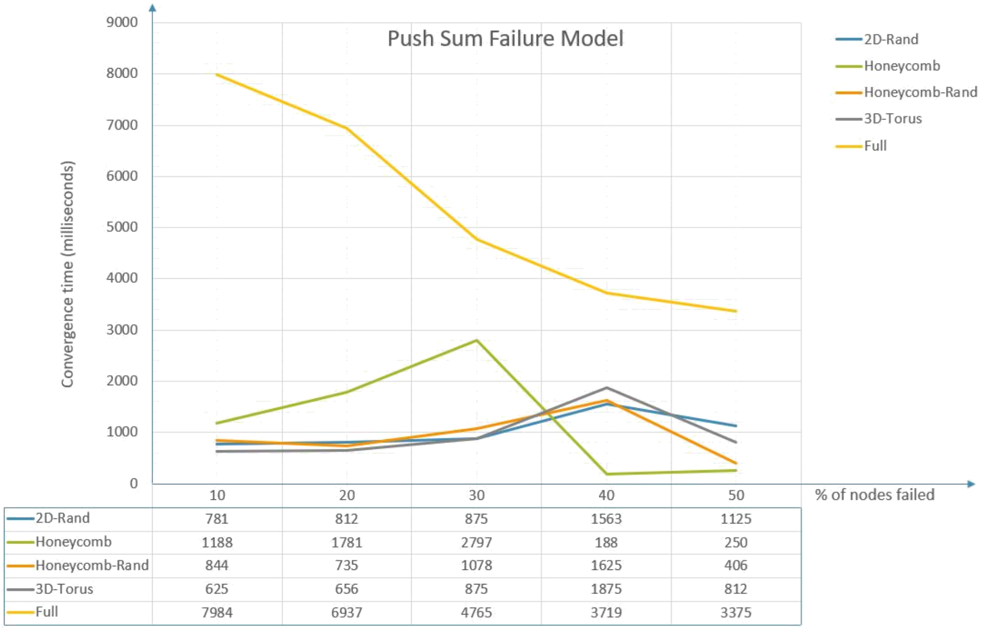
Gossip Failure Model - Percentage of nodes failed to converge

% nodes killed	Full	Line*	2D-Rand	Honeycomb	Honeycomb-Rand	3D-Torus
10	10	48	7.8	18.4	14.9	15.8
20	20	51	22.8	33.5	29.4	28
30	30	70	33.1	51.6	40.8	42.7
40	40	68	43.1	89.8	54.8	52.8
50	50	77	53.2	98.5	64.5	63.7

5. When a percentage of nodes are removed in the full network, all the remaining nodes are converging.
6. Although honeycomb displayed good performance for 10-20% node failure, the performance started to depreciate for more than 20% node failure.
7. Honeycomb-Rand and 3DTorus show consistent convergence rate and display similar behavior.
8. 2Drand shows bad convergence when number of nodes are less than approx. 300, but it's failure model displays good performance.
9. Performance(node coverage in failure model) wise order of topologies: (considering 50% nodes killed)
   P(Full) > P(2D-Rand) > P(3D-Torus) > P(Honeycomb-Rand) > P(Line) > P(Honeycomb)
10. Time wise order of topologies: (considering 50% nodes killed)
    T(Honeycomb) < T(3D-Torus) < T(Honeycomb-Rand) < T(2D-Rand) < T(Full) < T(Line)

Push-sum Algorithm observations

1. Line displays inconsistent, bad convergence rate, couldn’t obtain values to plot.
2. 3D-Torus, honeycombrand, honeycomb show similar convergence rates.



	10	20	30	40	50
2D-Rand	781	812	875	1563	1125
Honeycomb	1188	1781	2797	188	250
Honeycomb-Rand	844	735	1078	1625	406
3D-Torus	625	656	875	1875	812
Full	7984	6937	4765	3719	3375

Fig 2: Convergence time for topologies during failure model

Push Sum Failure Model - Convergence Time (milliseconds)

% nodes killed	Full	2D-Rand	Honeycomb	Honeycomb-Rand	3D-Torus
10	7984	781	1188	844	625
20	6937	812	1781	735	656
30	4765	875	2797	1078	875
40	3719	1563	188	1625	1875
50	3375	1125	250	406	812

Push Sum Failure Model - Percentage of nodes failed to converge

% nodes killed	Full	2D-Rand	Honeycomb	Honeycomb-Rand	3D-Torus
10	10.8	10.6	9.2	11.1	11.5
20	21.2	22.7	20.6	23.2	22.9
30	34.3	34.5	47.3	37.1	37
40	46.3	49.2	99.5	58.5	54.6
50	55	76.1	98.9	97.4	87.6

3. Full displays good coverage of the remaining nodes, in spite of node failures, remaining nodes converge, followed by 2Drand which gracefully handles node failures.
4. Performance (node coverage in failure model) wise order of topologies: (considering 50% nodes killed)
   P(Full) > P(2DRand) > P(3D-Torus) > P(Honeycomb-Rand) > P(Honeycomb) > P(Line)
5. Performance order of topologies is similar for both gossip and push-sum in failure model.
6. Honeycombrand and 3Dtorus display bad performance in case of push-sum algorithm.
7. Time wise order of topologies: (considering 50% nodes killed)
   T(Honeycomb) < T(Honeycombrand) < T(3D-Torus) < T(2DRand) < T(Full)