

Project 2 Report-Gossip Simulator

Failures Model

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In this project, we set the failure nodes to 10% of the numNodes and implemented 6 different topologies: full network, 3D grid, random 2D grid, honeycomb, line and honeycomb with a random neighbor, to test how fast gossip and push-sum can work on these different topologies and how failure nodes will affect the results.

To achieve the failure model, we randomly choose some nodes as failures. Failures cannot send message and they will be removed from their neighbors' neighbor list which means failures will not be able to send or receive messages.

When measuring time to converge, we do it 3 times and calculate the average (plot using average).

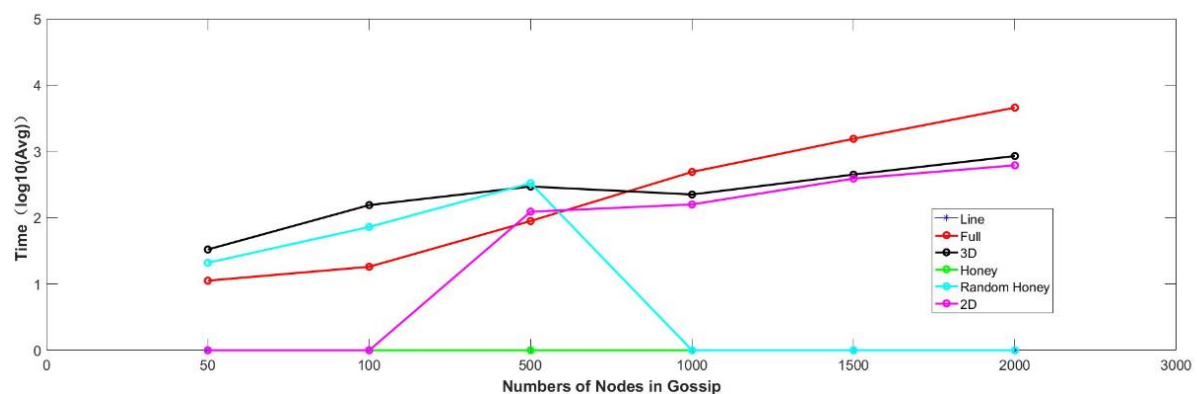


Figure 1 Convergence time for Gossip with failures on six topologies

In Gossip (Figure 1):

1. The 3D and 2D seems similar with those ones in non-failure model, but cost some less time to converge because of less

nodes.

2. Line and honeycomb would be choked and cannot move if failure occurs, this is easy to understand that line has at most two neighbors and honeycomb has at most three neighbors , so some nodes would have no chance to receive the gossip because of the failure nodes, so the time would be unlimited, which we set to 0.
3. The honeycomb with a random neighbor topology looks similar with no failure model when number of nodes is small When the number becomes large, it will be choked, because it has at most 4 neighbors, when the number is large, the 10% failure nodes can have more chance to cause isolation.

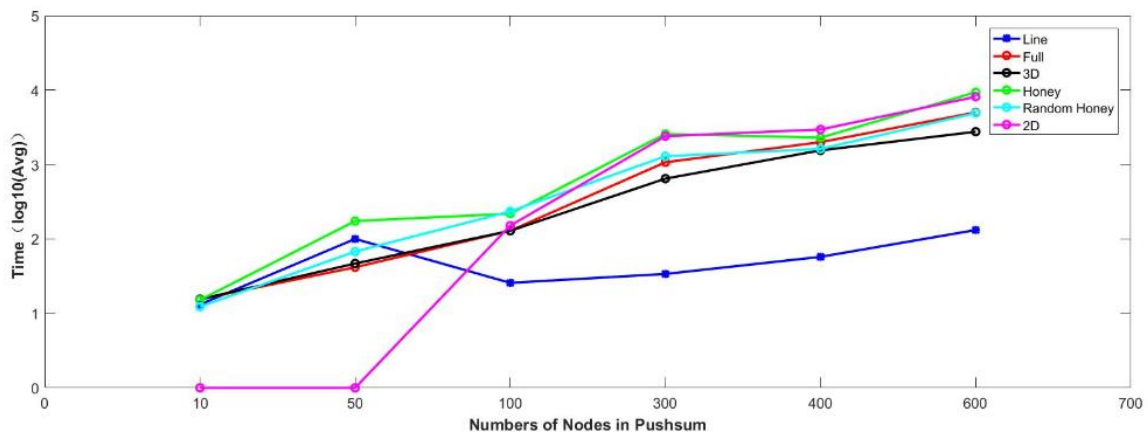


Figure 2 Convergence time for Pushsum with failures on six topologies

In pushsum(Figure 2):

1. The convergence time of the line topology is reduced, and for different numbers of nodes, the time is close. Because the failure nodes divide the network into groups that are isolated from each other. When we run the pushsum algorithm, we choose a isolated group randomly.
2. When applying only a few nodes, it is difficult to build a connected random 2D topology, some nodes are isolated. When number of node increases, it shows a similar trend with other lines since they all have limited number of neighbors.

APPENDIX: Original data measured for the plots

Gossip Line with failure

<div>numNodes</div> <div>Times(ms)</div>	50	100	500	1000	1500	2000
1						
2						
3						
Avg						
Log10(Avg)						

Gossip Full network with failure

<div>numNodes</div> <div>Times(ms)</div>	50	100	500	1000	1500	2000
1	9	16	109	359	1453	4360
2	10	20	94	406	1719	4973
3	15	19	63	734	1500	4391
Avg	11.3	18.3	88.7	499.7	1557.3	4574.6
Log10(Avg)	1.05	1.26	1.95	2.69	3.19	3.66

Gossip 2D network with failure

<div>numNodes</div> <div>Times(ms)</div>	50	100	500	1000	1500	2000
1			109	172	406	719
2			93	156	297	672
3			172	156	469	469
Avg			124.6	161.3	390.7	620
Log10(Avg)			2.09	2.20	2.59	2.79

Gossip 3D network with failure

<div>numNodes</div> <div>Times(ms)</div>	50	100	500	1000	1500	2000
1	47	156	188	375	406	1157
2	15	219	329	265	453	796
3	37	98	359	328	500	656
Avg	33	157.6	292	224	453	869.7
Log10(Avg)	1.52	2.19	2.47	2.35	2.65	2.93

Gossip honeycomb with failure

<div>numNodes</div> <div>Times(ms)</div>	50	100	500	1000	1500	2000
1	32	157	578	1453		1157
2	63	147				796
3						656
Avg						
Log10(Avg)						

Gossip honeycomb with a random neighbor with failure

<div>numNodes</div> <div>Times(ms)</div>	50	100	500	1000	1500	2000
1	32	109	313	657		1157
2	15	47	297	500		
3	16	63	391			656
Avg	21	73	333.7			
Log10(Avg)	1.32	1.86	2.52			

Pushsum with failures

Pushsum Line

<div>numNodes</div> <div>Times(ms)</div>	10	50	100	300	400	600
1	15	63	31	15	125	173
2	15	79	31	79	31	146
3	10	162	15	31	16	79
Avg	13.3	101.3	25.7	34	57.3	132.7
Log10(Avg)	1.12	2.00	1.41	1.53	1.76	2.12

Pushsum Full Network

<div>numNodes</div> <div>Times(ms)</div>	10	50	100	300	400	600
1	16	31	109	1094	2000	4781
2	16	47	140	1094	2047	6047
3	15	46	141	1062	1938	5688
Avg	15.7	41.3	130	1083.3	1995	5050.3
Log10(Avg)	1.19	1.62	2.11	3.03	3.30	3.70

Pushsum 3D Network

<div>numNodes</div> <div>Times(ms)</div>	10	50	100	300	400	600
1	16	47	125	595	1187	2078
2	15	47	203	656	1578	2987
3	16	46	125	687	1922	3250
Avg	15.7	46.7	128	646	1562.3	2771.7
Log10(Avg)	1.19	1.67	2.11	2.81	3.19	3.44

Pushsum 2D Network

<div>numNodes</div> <div>Times(ms)</div>	10	50	100	300	400	600
1			125	2152	2453	9344
2			203	3047	2610	5594
3			125	2015	3828	6984
Avg			151	2404.7	2963.7	8207.3
Log10(Avg)			2.18	3.38	3.47	3.91

Pushsum Honeycomb Network

<div>numNodes</div> <div>Times(ms)</div>	10	50	100	300	400	600
1	15	95	422	2437	1469	8734
2	16	187	437	2783	2188	8547
3	15	250	184	2360	3469	10922
Avg	15.3	177.3	221	2583.6	2375.3	9401
Log10(Avg)	1.18	2.24	2.34	3.41	3.36	3.97

Pushsum Honeycomb with random neighbor

<div>numNodes</div> <div>Times(ms)</div>	10	50	100	300	400	600
1	10	47	187	1453	2000	4625
2	16	63	218	1203	1063	5375
3	11	47	297	1187	1844	4531
Avg	12.3	68	234	1281	1635.7	4843.7
Log10(Avg)	1.09	1.83	2.37	3.11	3.21	3.69