Project 2 Report-Gossip Simulator

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In this project, we implemented 6 topologies: Full Network, Line, Random 2D Grid, 3D torus Grid, Honeycomb and Honeycomb with a random neighbor.

In the Gossip model, the actor selects a random neighbor to send the rumor and keep track of rumors and records how many times it has heard the rumor. It stops transmitting once it has heard the rumors 100 times.

In push-sum, node send out its quantities s and w only when receiving other node's s and w, algorithm converge when sum estimation s/w did not change more than 1.0e-10 in 3 consecutive rounds.

For measuring the converge time, we calculate it 3 times and write down the average time.

In Figure 1, the line topology is the slowest. When the number of actors is small (<1000), the full network topology is the fastest. However, when the number becomes larger, the 3D and 2D topologies become faster than others. But the building structure time of 2D is much more than 3D. And the honeycomb with a random neighbor topology is faster than honeycomb because of having an extra neighbor.

From the Figure 2, we know that the line topology is always slower than other for pushsum algorithm. The performance of the 3D algorithm and the honeycomb with a random neighbor algorithm are close which are the fastest topologies. And the honeycomb topology is faster than the random 2D when the number of actors is big enough. Finally, there is no random 2D topology statistics found when number of actors is small, it is due to the most nodes may not have neighbors near within the distances (0.1), so the process would fail and terminate.

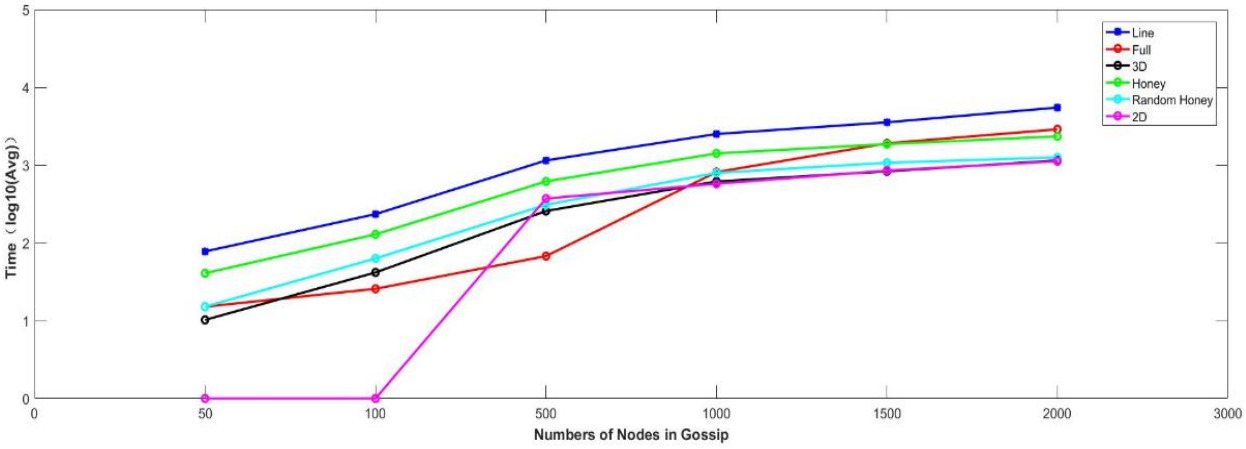

Figure 1 Convergency time for Gossip on 6 topologies

In Gossip:

1. The line is the slowest because an actor only influences two actors, when number of nodes increasing, the time increase exponentially.
2. The full network topology is faster when the number of

nodes is small because every node every node can connect to each other, which is a large chance to be infect other nodes. However, when the number of nodes becomes large, it becomes slow because an actor is easier to send the rumor to the neighbor which has heard the rumor due to the so many neighbors.

3. The honeycomb is faster than line because it has at most three neighbors which is larger than 2. And the honeycomb with a random neighbor has at most 4 neighbors and 3D has at most 6 neighbors, so the speed is 3D>honeycomb with a random neighbor>honeycomb.

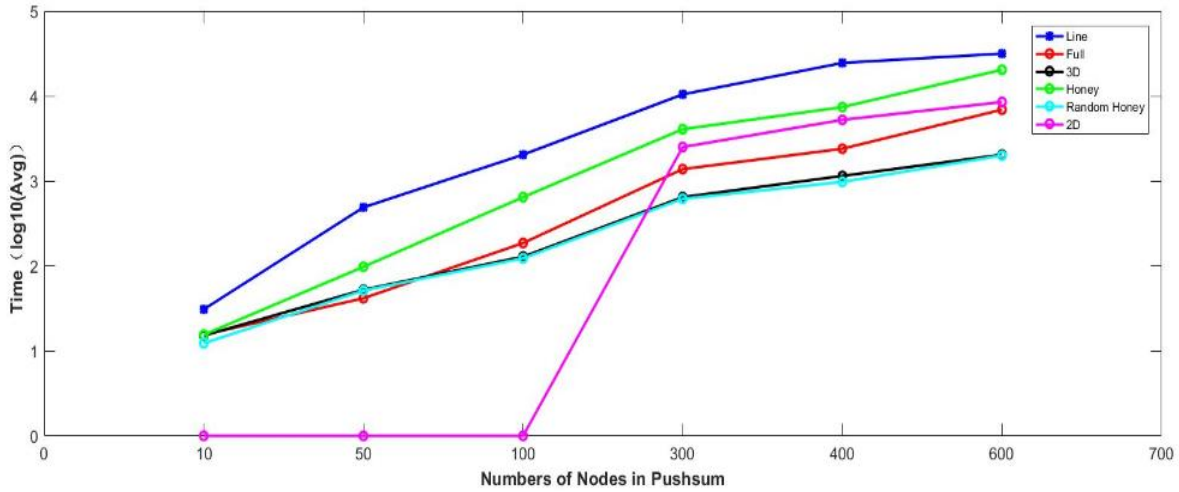

Figure 2 Convergency time for Pushsum on 6 topologies

In Pushsum:

1. The line is the slowest because an actor only influences

two actors, so it will take large time to change the value of s and w for all actors.

2. With the number of nodes increasing, the speed of full network becomes slower because it has less chance to choose the neighbor which has not received the s and w.
3. The speed of 3D, honeycomb with a random neighbor are same with the increasing number, that is because they both can only influence limited number of nodes.

APPENDIX: Original data measured for the plots

Gossip Line

numNodes / Times(ms)	50	100	500	1000	1500	2000
1	63	250	828	2438	3312	5938
2	78	218	1484	2984	3468	5281
3	94	234	1140	2047	3765	5391
Avg	78.3	234	1150.7	2489.7	3515	5536.7
Log10(Avg)	1.89	2.37	3.06	3.40	3.55	3.74

Gossip Full Network

numNodes / Times(ms)	50	100	500	1000	1500	2000
1	15	31	219	844	1797	3328
2	16	32	203	781	1781	3235
3	15	15	187	853	2192	2079
Avg	15.3	26	67.7	826	1923.3	2886.7
Log10(Avg)	1.18	1.41	1.83	2.91	3.28	3.46

Gossip 3D

numNodes / Times(ms)	50	100	500	1000	1500	2000
1	15	31	312	625	828	1141
2	7	46	218	688	766	1234
3	9	47	250	547	922	1047
Avg	10.3	41.3	260	620	838.7	1140.7
Log10(Avg)	1.01	1.62	2.41	2.79	2.92	3.06

Gossip Honeycomb

numNodes / Times(ms)	50	100	500	1000	1500	2000
1	46	172	609	1562	1672	2281
2	15	62	656	1359	1937	2906
3	62	157	594	1312	1953	1922
Avg	41	130.3	619.7	1411	1854	2369.7
Log10(Avg)	1.61	2.11	2.79	3.15	3.27	3.37

Gossip Honeycomb with random neighbor

numNodes / Times(ms)	50	100	500	1000	1500	2000
1	15	62	265	938	1032	1313
2	16	63	296	718	976	1203
3	15	63	359	743	1234	1297
Avg	15.3	62.7	306.7	799.7	1080.7	1271
Log10(Avg)	1.18	1.80	2.49	2.90	3.03	3.10

Gossip 2D

numNodes / Times(ms)	50	100	500	1000	1500	2000
1			375	531	1016	1250
2			406	547	828	985
3			359	640	734	1156
Avg			380	572.7	859.3	1130.3
Log10(Avg)			2.57	2.76	2.93	3.05

Pushsum

Pushsum Line

numNodes / Times(ms)	10	50	100	300	400	600
1	32	469	1765	12580	19297	34437
2	31	563	2203	6109	23719	38875
3	31	438	2172	12718	31578	20656
Avg	31.3	490	2046.7	10469	24876.7	31322.7
Log10(Avg)	1.49	2.69	3.31	4.02	4.39	4.50

Pushsum Full Network

numNodes / Times(ms)	10	50	100	300	400	600
1	16	31	234	1375	2438	6156
2	16	47	171	1360	2515	7125
3	15	46	156	1359	2250	7412
Avg	15.7	41.3	187	1364.7	2401	6900.7
Log10(Avg)	1.19	1.62	2.27	3.14	3.38	3.84

Pushsum 3D

numNodes / Times(ms)	10	50	100	300	400	600
1	16	62	125	688	1287	1563
2	15	47	141	625	1125	2172
3	15	47	125	609	1032	2382
Avg	15.3	52	130.3	640.7	1148	2039
Log10(Avg)	1.18	1.72	2.11	2.81	3.06	3.31

Pushsum 2D

numNodes / Times(ms)	10	50	100	300	400	600
1				2141	5281	7657
2				3172	5829	7891
3				2297	4766	10125
Avg				2536.7	5292	8557.7
Log10(Avg)				3.40	3.72	3.93

Pushsum Honeycomb

numNodes / Times(ms)	10	50	100	300	400	600
1	16	94	704	4375	8265	18469
2	15	94	651	3984	6687	22172
3	16	110	641	4156	7484	20219
Avg	15.7	99.3	655.3	4141.7	7478.7.	20286.7
Log10(Avg)	1.19	1.99	2.81	3.61	3.87	4.31

Pushsum Honeycomb with random neighbor

numNodes / Times(ms)	10	50	100	300	400	600
1	10	62	125	531	953	1829
2	16	46	157	735	828	1672
3	11	47	94	578	1203	2453
Avg	12.3	51.7	125.3	614.7	994.7	1984.7
Log10(Avg)	1.09	1.71	2.09	2.79	2.99	3.30