Project2 Report

-- Junhao Zhang, You Zhou

In this project, we implemented 4 different topologies: line, full, 2D and imperfect 2D (imp2D), to test how fast gossip and push sum can work on these different topologies.

In gossip, node keep sending out rumors once it heard the rumor once, and terminates when heard about the rumor 100 times, algorithm converge when all nodes get the rumor.

In pushsum, node send out its s and w only when receive others s and w, algorithm converge when sum estimation s/w “did not change more than 1.0e-10 in 3 consecutive rounds”.

When measuring time for algorithm to converge, we do it 3 times and calculate the average, (plot using average), because in some topology, especially like line and 2D topology, which node knows the rumor first can highly affect the results (thinking in line topology, middle node knows rumor first is approximately two times faster than edge node knows rumor first). The original measurements are at appendix and the result plot is shown in figure 1 and figure 2.

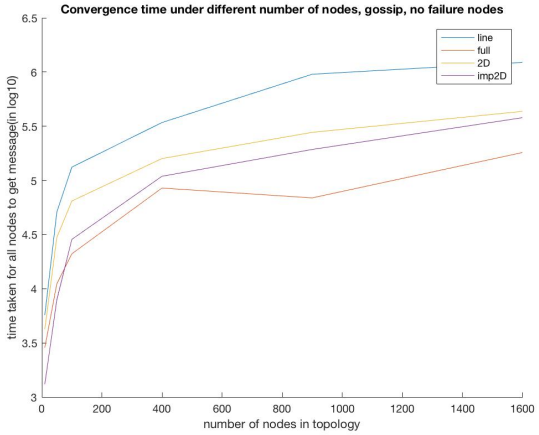

figure 1. Convergence time for gossip on 4 topologies

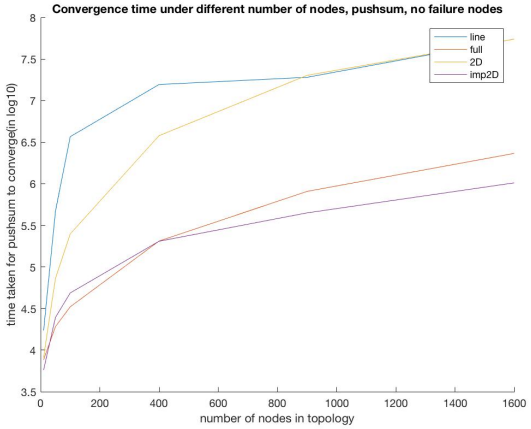

figure 2. Convergence time for push sum on 4 topologies

In gossip:

1. Basically full better than imp2D better than 2D better than line topology. That makes sense, because more connections in topology, faster everybody can get the message.
2. We see that imp2D beats full when the network size is rather small, that may due to the fluctuation of time to converge based on the first node to know the rumor.
3. When network size grows from 1 to 400, time taken grows very much too; But when network size continues growing after 400 nodes, time taken does not grow that much.

In push-sum:

1. Imp2D converges faster than full when network size grows larger than 400 nodes.
2. Time taken on line and 2D topology to converge becomes very close when network size is larger than around 850 nodes.

3. Imp2D converge much much faster than 2D just because we add 1 more random neighbor for each node.

APPENDIX: Original data measured for the plots

Without failure model

Gossip - line topology

time vs numnodes	10	50	100	400	900	1600
1	6197	62789	120766	307581	1247253	1439509
2	5447	40042	198305	326078	824031	1135949
3	5468	50139	78431	391977	791666	1107409
Avg	5704	50990	132501	341879	954317	1227622

Gossip - full topology

time vs numnodes	10	50	100	400	900	1600
1	2828	11300	23471	81983	71429	172294
2	2811	11663	21317	66479	72615	181070
3	2934	10394	18232	106440	62671	188548
Avg	2858	11119	21007	84967	68905	180637

Gossip – 2D topology

time vs numnodes	10	50	100	400	900	1600
1	4218	14830	42082	148463	239714	413591
2	4314	36213	84519	159571	278152	480040
3	4163	38205	66987	169200	314719	406772
Avg	4232	29749	64529	159078	277528	433468

Gossip – imp2D topology

time vs numnodes	10	50	100	400	900	1600
1	1454	10961	31347	123275	207405	386421
2	1076	5382	25760	83393	176504	398275
3	1416	7367	28564	120667	194821	351976
Avg	1315	7903	28557	109112	192910	378891

Pushsum – line topology

time vs numnodes	10	50	100	400	900	1600
1	19411	876563	1517288	30900981	25433255	29143961
2	16278	483938	4599484	11638187	26748096	61668850
3	16055	40578	4936763	4304357	4976048	73961063
avg	17248	467026	3684512	15614508	19052466	54924625

Pushsum – full topology

time vs numnodes	10	50	100	400	900	1600
1	7867	20491	29654	181145	779862	2203848
2	7569	20839	41106	211380	809223	2303634
3	7568	16091	28879	221877	839653	2447964
avg	7668	19140	33213	204801	809579	2318482

Pushsum – 2D topology

time vs numnodes	10	50	100	400	900	1600
1	8138	68756	219414	3467301	21150377	56006130
2	8190	66766	291460	4304401	17867699	48487975
3	8196	83258	238175	3589805	21299004	59879716
avg	8175	72927	249683	3787169	20105693	54791274

Pushsum – imp2D topology

time vs numnodes	10	50	100	400	900	1600
1	5707	21871	45662	175618	380841	672920
2	5605	22910	59180	224205	395480	1280927
3	6026	29423	41369	211596	563837	1122804
avg	5779	24735	48737	203806	446719	1025550