COP 5615

Distributed Operating Systems (Fall 2015)

Project 2 - Gossip Simulator

Bonus Part

For the bonus part we implemented a failure model in which we randomly crash a node every 100 milliseconds, and the system is configured to handle these failures and continue spreading the messages to the remaining relevant nodes. Whenever a node failure occurs, the Admin actor is informed of it by Deathwatch. After this the Admin actor make sure that all the active neighbors are informed of the failure so that they can update their neighbor list.

Every 100 milliseconds, a Poison Pill is sent to a random active actor. We placed a limitation on the maximum number of nodes that can be terminated in this manner and set it to 20% of the total number of nodes.

Observation:-

We observed that the "Line" topology is most vulnerable to random deaths in the network. And the "3D" topology is least affected by any failures. The reason "Line" topology is so adversely affected is that because of its design (each node has only two neighbors), any failure in the unexplored part of the network will render a whole segment unreachable.

NOTE – Please note that this code is different than our earlier submission. In our earlier design, an actor died out after finishing its work, as mentioned in the PDF, unlike in the Failure model where death of an actor only occurs via a Poison Pill.

Gossip Algorithm:-

Below are the plots of the performance of the Gossip Algorithm in different topologies for the original implementation and the implementation with the failure model.

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Line Topology

Gossip Line - No Fault Model

Gossip Line - With Fault Model
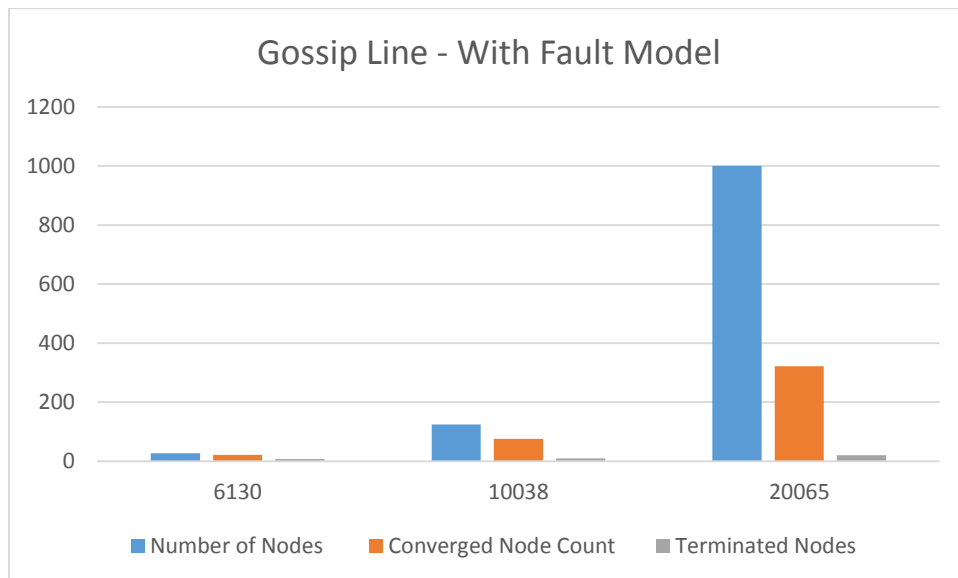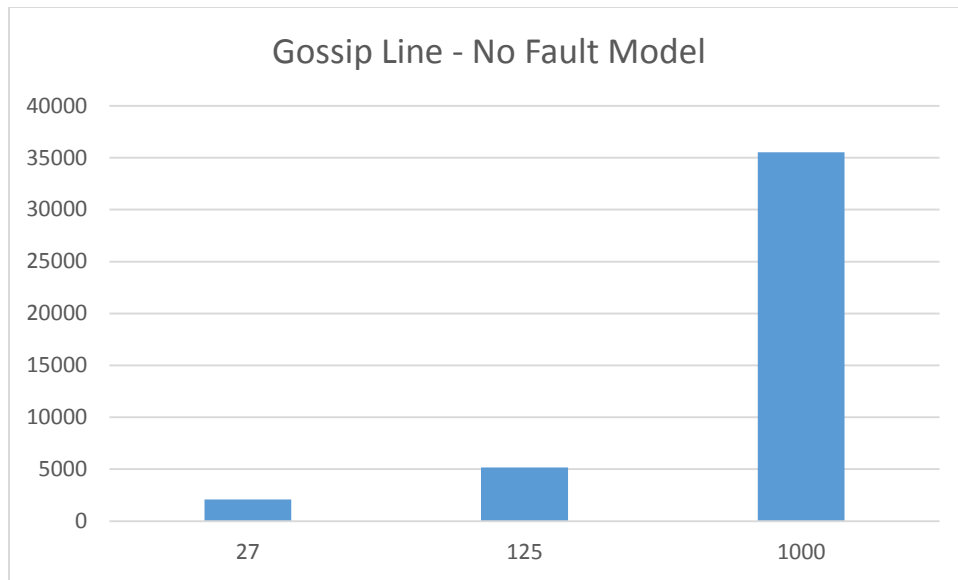
No Fault Model

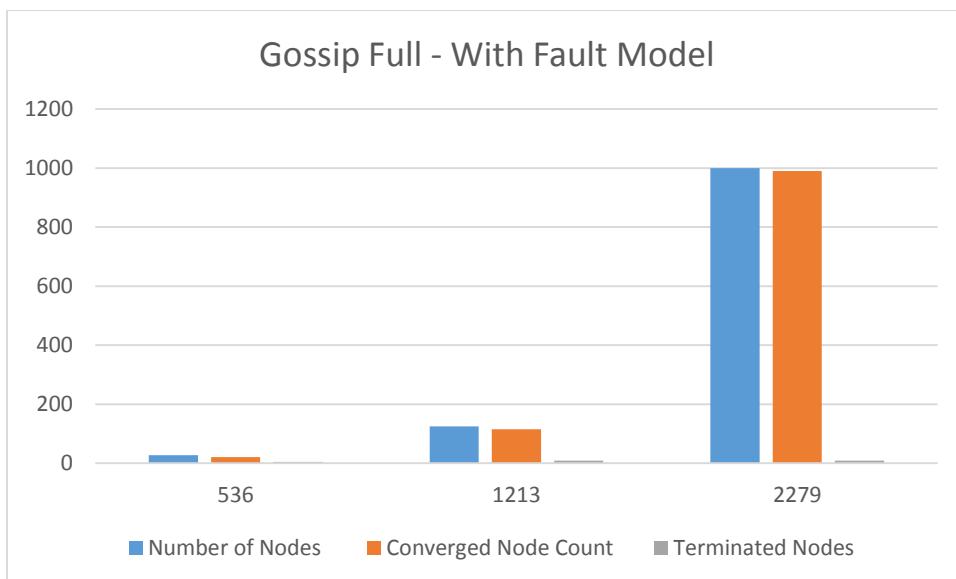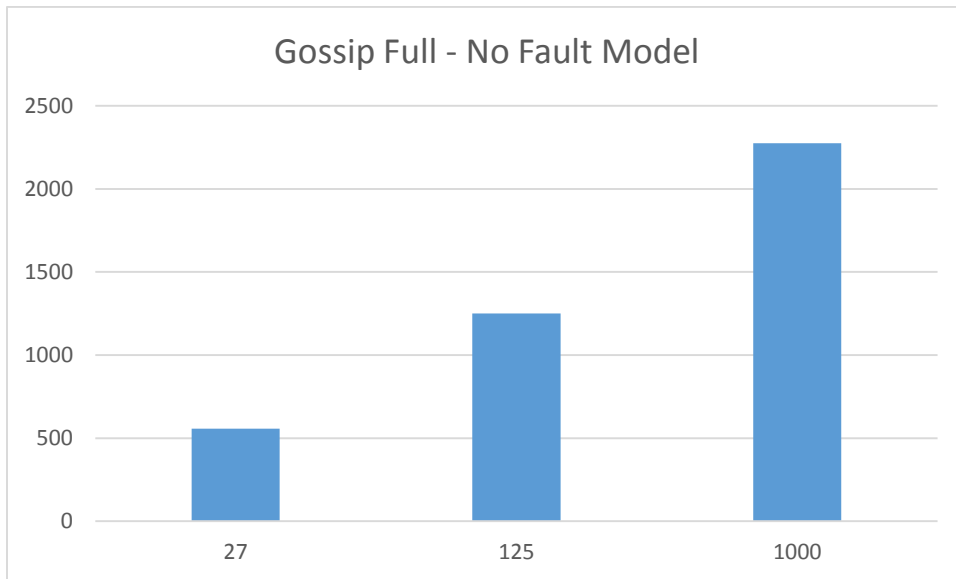| Number of Nodes	Time
27	2068
125	5179
1000	35527
8000	284360

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With Fault Model

Number of Nodes	Time	Converged Node Count	Terminated Nodes
27	6130	22	7
125	10038	76	10
1000	20065	322	20
8000	40145	873	40

Full Topology

Gossip Full - No Fault Model

Gossip Full - With Fault Model

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No Fault Model

Number of Nodes	Time
27	557
125	1250
1000	2275
8000	29352

With Fault Model

Number of Nodes		Converged Node Count	Terminated Nodes
27	536	21	5
125	1213	115	9
1000	2279	990	9
8000	29641	7993	6

3D Topology
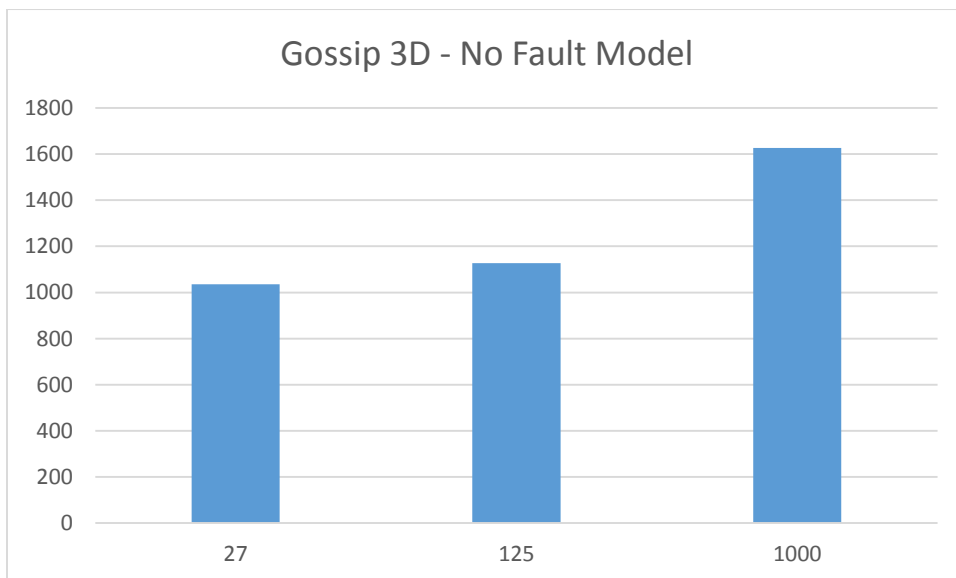
Gossip 3D - No Fault Model

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Gossip 3D - With Fault Model
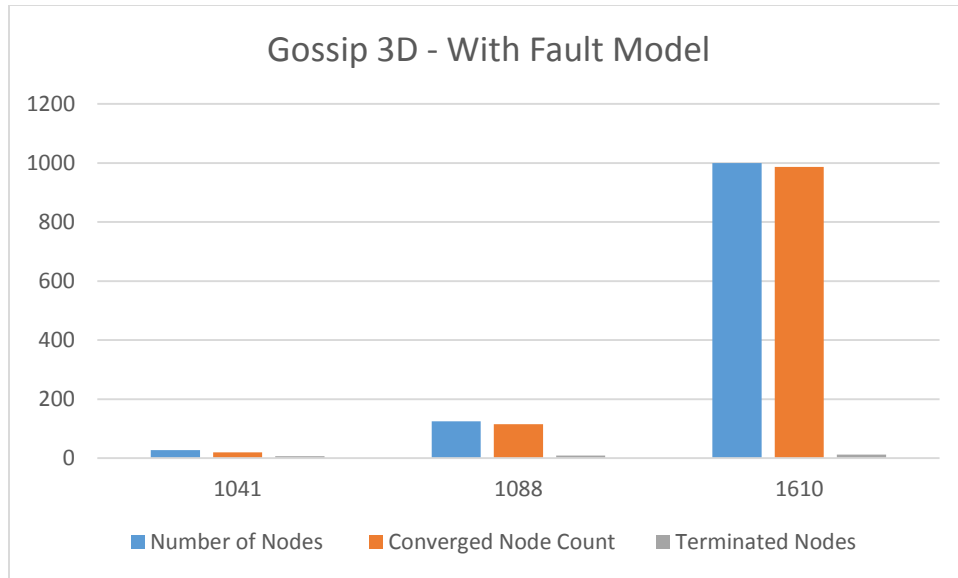
No Fault Model

Number of Nodes	Time
27	1035
125	1127
1000	1627
8000	2204

With Fault Model

Number of Nodes	Time	Converged Node Count	Terminated Nodes
27	1041	20	7
125	1088	115	9
1000	1610	987	12
8000	1930	7988	11

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Imp3D Topology

Gossip imp3D - No Fault Model

Gossip imp3D - With Fault Model
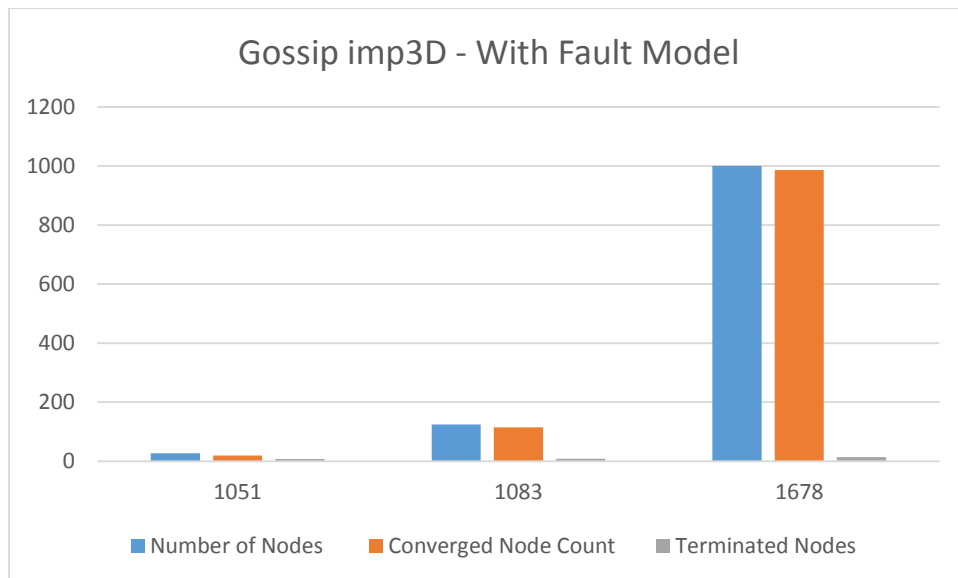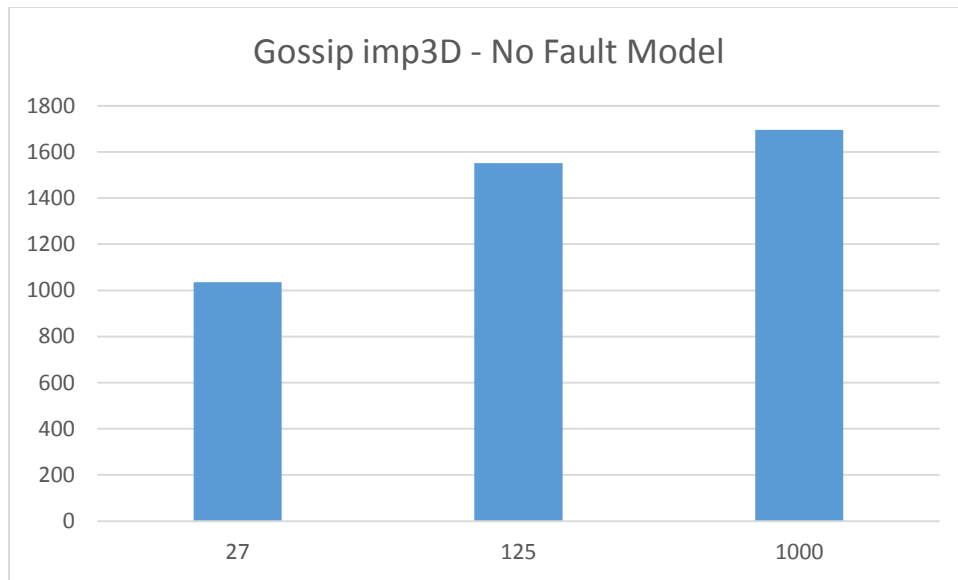
No Fault Model

Number of Nodes	Time
27	1036
125	1552
1000	1696
8000	2266

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With Fault Model

Number of Nodes	Time	Converged Node Count	Terminated Nodes
27	1051	19	7
125	1083	115	9
1000	1678	986	14
8000	2231	7985	14

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Push-Sum Algorithm

Below are the plots of the performance of the Gossip Algorithm in different topologies for the original implementation and the implementation with the failure model.

Line Topology
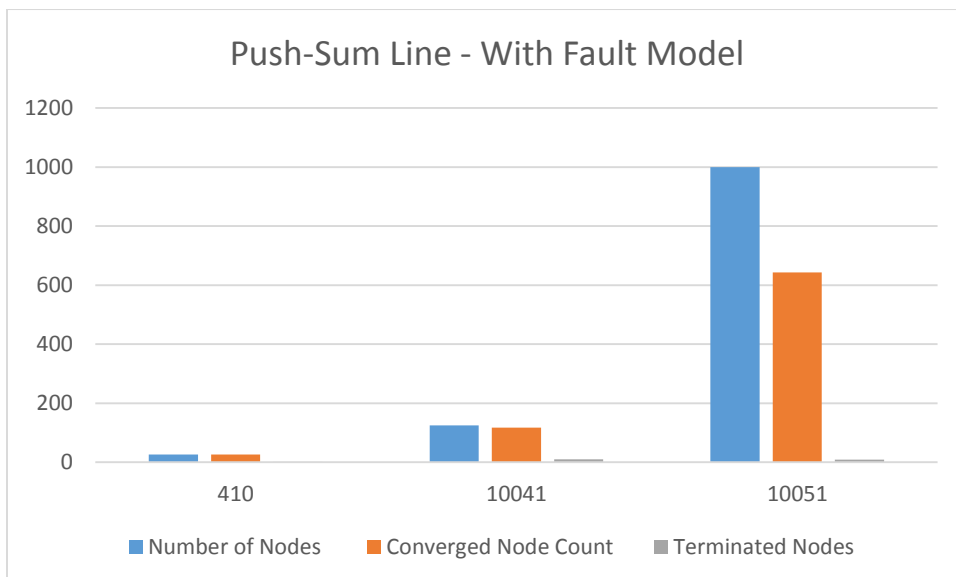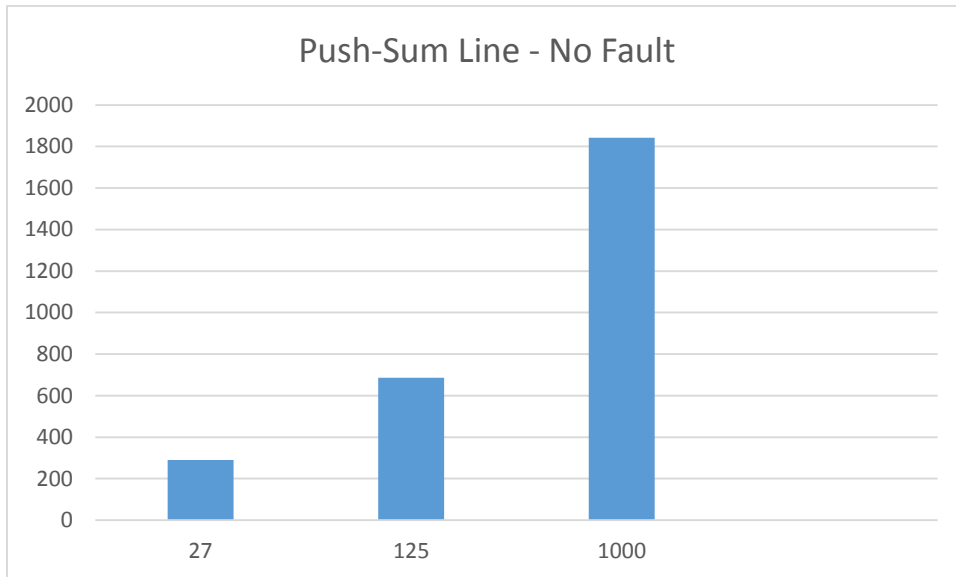
Push-Sum Line - No Fault

Push-Sum Line - With Fault Model

■ Number of Nodes   ■ Converged Node Count   ■ Terminated Nodes

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No fault model

Number of Nodes	Time
27	290
125	686
1000	1842

With Fault Model

Number of Nodes	Time	Converged Node Count	Terminated Nodes
27	410	26	1
125	10041	118	10
1000	10051	643	9
8000	26134	3021	21

Full Topology
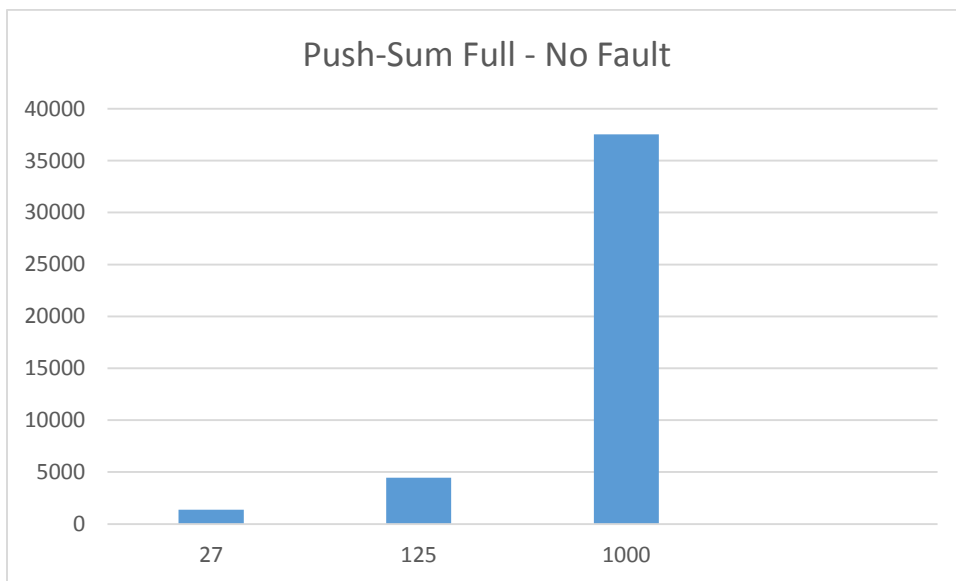
Push-Sum Full - No Fault

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Push-Sum Full - With Fault Model
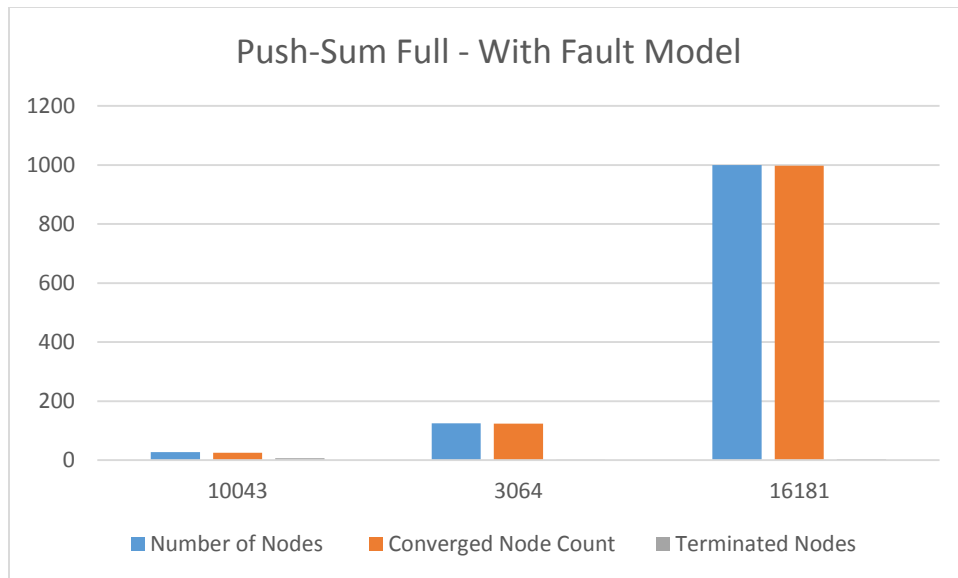
No Fault Model

Number of Nodes	Time
27	1375
125	4451
1000	37540

With Fault Model

Number of Nodes	Time	Converged Node Count	Terminated Nodes
27	10043	25	7
125	3064	124	1
1000	16181	997	3

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3D Topology

Push-Sum 3D - No Fault

Push-Sum 3D - With Fault Model

Legend: ■ Number of Nodes ■ Converged Node Count ■ Terminated Nodes
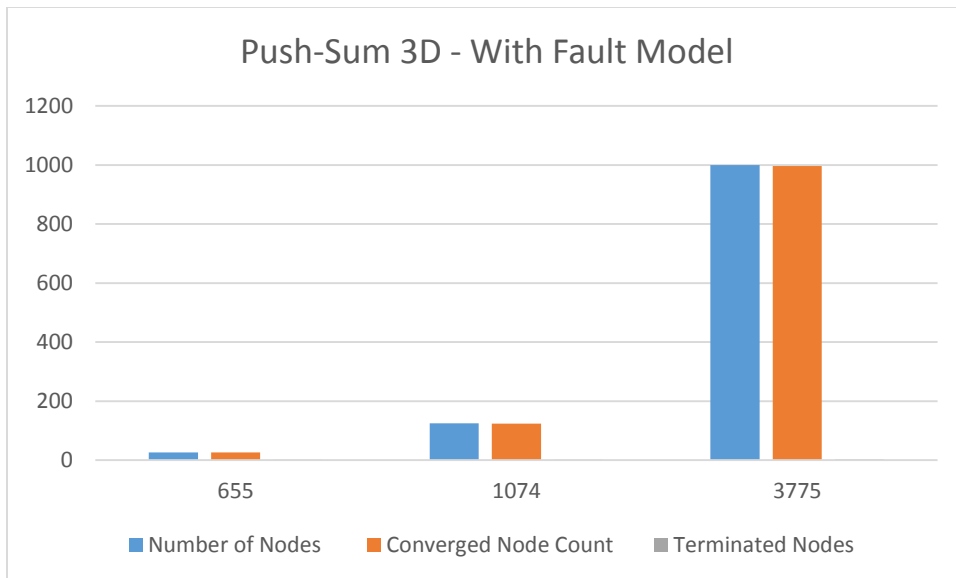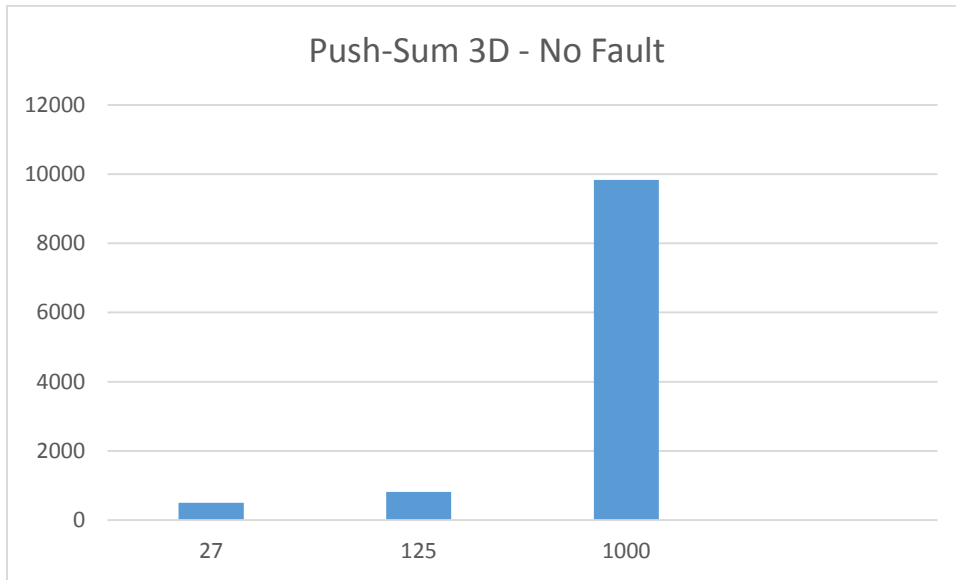
No Fault Model

Number of Nodes	Time
27	497
125	813
1000	9834

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With Fault Model

Number of Nodes	Time	Converged Node Count	Terminated Nodes
27	655	26	1
125	1074	124	1
1000	3775	997	3

Imp3D Topology
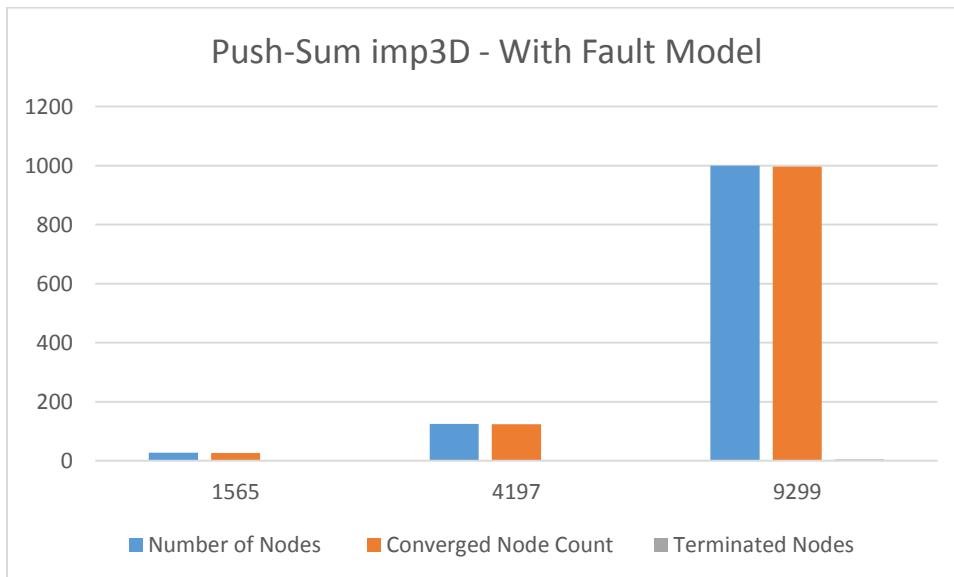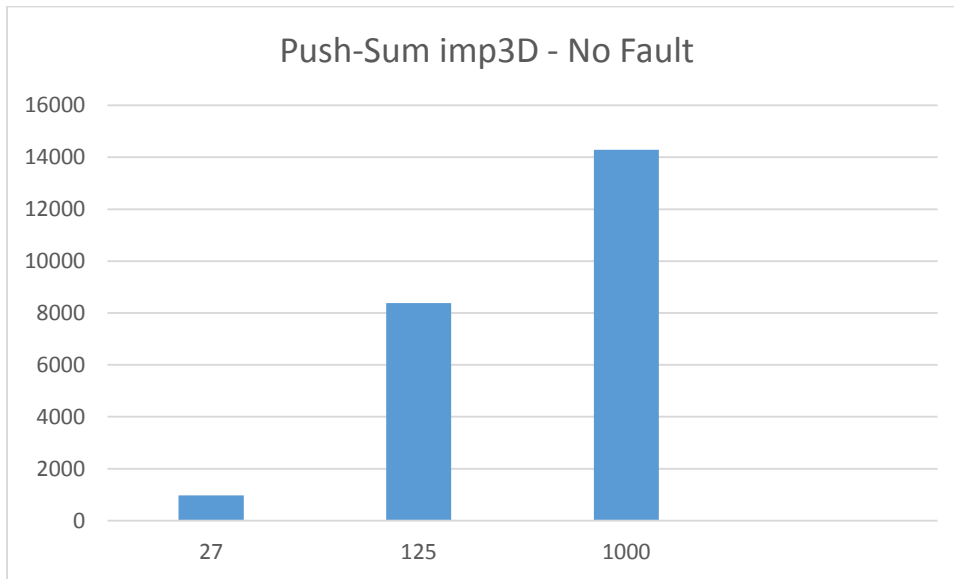
Push-Sum imp3D - No Fault

Push-Sum imp3D - With Fault Model

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No Fault Model

Number of Nodes	Time
27	975
125	8381
1000	14287

With Fault Model

Number of Nodes	Time	Converged Node Count	Terminated Nodes
27	1565	26	1
125	4197	124	1
1000	9299	996	4

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