**COP5612 – Fall 2015**

**Project 2 – Gossip Simulator**

**Report**

**Points to note:**

1. For every number\_of\_nodes, we have run the program 5 times and considered average of the 5

results as the result plotted on graph

2. Considering the fact that there might not be a convergence time for the system as a whole, we have

considered the convergence time when system doesn't converge any more for 30 seconds

**Findings & Observations:**

1. The order in which convergence takes time for a typical topology as per our observation:

Full (fastest) < Imperfect3D < 3D < Line (slowest)

**Reason:** We conclude that the more active neighbors you have, the faster the convergence is

2. The order in which convergence takes time for an algorithm as per our observation:

Gossip < Push-Sum

**Reason:** Compared to a simple self-counter for Gossip, Push-Sum implements a stringent check on message variation and accordingly increments self-counter.

3. As number of nodes increase, for a given time *'t'* the convergence rate achieved in time *t*:

Full (most) < Imperfect3D < 3D < Line (least)

**Reason:** This is mainly because the topologies convergence time discussed in observation #1 above

**[BONUS]**

As part of bonus failure model implementation, we have included checks in actor gossip calls to avoid sending messages to the nodes that have closed down. This is in line with the concept of Gossip wherein, the rumor stops disseminating if the corresponding neighbor is down (failed).

**Observation:** In case the gossiper node randomly selects a neighbor which is down (failed), the convergence time for the gossiper node increases because it has to go through the process of selecting an active neighbor.

Please find below graph that depicts convergence time as a function of the size of the network for each of the algorithms\*

*\*Disclaimer: The graph just plots convergence time vs network size. In our opinion, this graph cannot be used to correctly interpret the performance of the (algorithm,topology,network size) combination as there is no guarantee that we'll encounter convergence of 100% of the nodes. Therefore, we have also included the percentage of nodes converged in our findings (table).*

**Gossip:**

The below table illustrates the number of nodes and the time it took for the nodes to converge for Gossip algorithm.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Nodes** | **Line** | | **3D** | | **Imperfect 3D** | | **Full** | |
|  | **Time(ms)** | **% convergence** | **Time(ms)** | **% convergence** | **Time(ms)** | **% convergence** | **Time(ms)** | **% convergence** |
| **8** | **17** | **62.5** | **14** | **87.5** | **38** | **100** | **6** | **100** |
| **27** | **45** | **77.7** | **57** | **96.2** | **62** | **96.2** | **29** | **100** |
| **64** | **80** | **87.5** | **111** | **100** | **95** | **100** | **48** | **100** |
| **125** | **224** | **96.8** | **205** | **99.2** | **219** | **96** | **111** | **100** |
| **216** | **227** | **97.68** | **515** | **99.07** | **354** | **97.2** | **136** | **99.5** |
| **343** | **368** | **99.4** | **422** | **99.4** | **390** | **98.5** | **167** | **100** |

Graph to represent the convergence time (vertical axis) taken as a function of number of nodes(horizontal axis):

**Push-Sum:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Nodes** | **Line** | | **3D** | | **Imperfect 3D** | | **Full** | |
|  | **Time(ms)** | **% convergence** | **Time(ms)** | **% convergence** | **Time(ms)** | **% convergence** | **Time(ms)** | **% convergence** |
| **8** | **483** | **75** | **808** | **75** | **1052** | **87.5** | **18** | **87.5** |
| **27** | **2245** | **81.45** | **4128** | **74.07** | **4343** | **88.88** | **91** | **96.29** |
| **64** | **7572** | **54.69** | **6414** | **81.25** | **6430** | **82.81** | **194** | **98.44** |
| **125** | **2617** | **20** | **9346** | **74.4** | **9873** | **71.2** | **205** | **99.2** |
| **216** | **3061** | **10.18** | **9261** | **56.48** | **24523** | **68.52** | **304** | **99.54** |
| **343** | **5132** | **16.29** | **38871** | **40.82** | **23947** | **57.72** | **595** | **99.71** |
| **512** | **808** | **99.8** |  |  |  |  |  |  |
| **729** | **1014** | **99.8** |  |  |  |  |  |  |
| **1000** | **1841** | **99.9** |  |  |  |  |  |  |
| **1331** | **6476** | **99.92** |  |  |  |  |  |  |

The below table illustrates the number of nodes and the time it took for the nodes to converge for Push-Sum algorithm.

Graph to represent the convergence time (vertical axis) taken as a function of number of nodes(horizontal axis):