

CS-425 MP2 Report Group No: 44

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I. Design

A. Algorithm

Machine 01 is selected as an introducer of the network. If there are new nodes join and send message to the introducer. The introducer will send this new joined node its membership list and its neighbors. And it will notify the join of this node to its neighbors as well. When a node leaves, it sends message to introducer about its leaving and introducer will write it down to the log and send this update to its neighbors as well. If a node fails, one of its neighbors will find out that and report to introducer. So the introducer will log it and will not notify its neighbors about the failure to save bandwidth since its neighbors are all able to detect this failure.

B. The reason for scale to N

The membership list size for each node is 4, and it is guaranteed that there are no more than 4 machines failing at the same time. So even if the size of the network is increased, there are sufficient neighbors to detect failures.

C. Message format

1. Nodes to introducer: State_index

JOIN_01 means that node 01 wants to join the network

LEAVE_03 means that 03 leaves the network voluntarily

FAIL_01_03 means that node 01 found that 03 failed

2. Introducer to nodes:

0 means LEAVE, -1 means FAIL, 1 means ALIVE

a) Assign and notify neighbors to the new joined node

NEIGHBORS (Nth Index Status IP){3}

e.g., NEIGHBORS 0 2 1 172.22.156.145 1 3 1 172.22.152.150

2 4 1 172.22.154.146 3 5 0 172.22.156.146

b) Update the status of neighbors for each node

UPDATE Nth index Status

e.g. UPDATE 1 2 0

II. How MP1 used in MP2

Each node stores the failure and status of its neighbors. We can query those records by time when we were interested in previous activities.

III. Measurements

A. Background bandwidth usage -> HeartBeat bandwidth

5bits / 1s * 4 neighbors = 20Bps (For each node)

B. The average bandwidth of a join/leave/fail

Normally each action can finish in 1s.

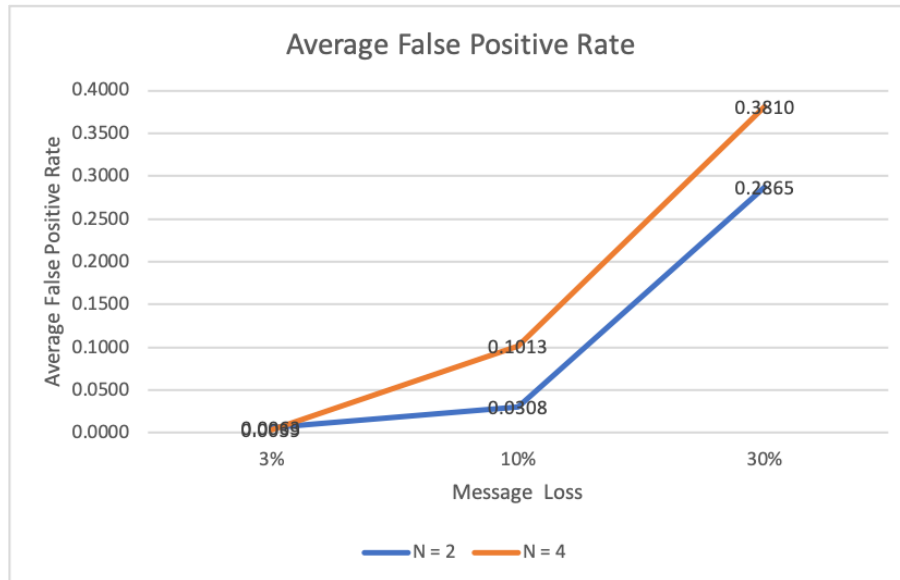
JOIN: Request + membership list = 6 bits / 1s + 95 bits / s = 101 Bps

LEAVE: Request + Update: 7 bits / s + (12 bits / s) * 4 = 55 Bps

FAIL: Report + Update = 8 bits / s + (12 bits / s) * 4 = 56 Bps

C. False positive rate

Nodes Number	Message Loss Rate	False Possitive Rate						Average
N = 2	3%	0.0075	0.0108	0.0046	0.0047	0.0033	0.0068	0.0063
	10%	0.0061	0.0055	0.0179	0.0313	0.0132	0.1111	0.0308
	30%	0.4000	0.4000	0.2857	0.1333	0.3333	0.1667	0.2865
N = 4	3%	0.0074	0.0026	0.0065	0.0017	0.0015	0.0038	0.0039
	10%	0.4000	0.0909	0.0392	0.0339	0.0247	0.0189	0.1013
	30%	0.5000	0.5000	0.2857	0.3333	0.1667	0.5000	0.3810



From the table above we can see that the False Positive Rate increases with the Message loss. It is reasonable because as the probability of message loss goes up, more active nodes will be recognized as failed one because higher chance of heartbeat message loss. In addition, the False Positive Rate also goes with the number of machines because there are higher chance of heartbeat loss as well.