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 notify its neighbors about the 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 03 found that 01 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

1bit / 1s * 4 neighbors = 4Bps (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 Numb	Message Los	False Possitive Rate			Average
N = 2	3%	0.06	0.01	0.07	0.05
	10%	0.10	0.18	0.15	0.14
	30%	0.36	0.41	0.32	0.36
N = 4	3%	0.00	0.09	0.08	0.06
	10%	0.24	0.20	0.25	0.23
	30%	0.38	0.42	0.48	0.43

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.