Project 3 - Failure Mode Report

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2. How to use failure mode

scalac project3bonus.scala

scala project3bonus numNodes numRequests numFailures

3. How it works

In our implementation of failure mode of pastry, the number of failed nodes can be specified as a parameter of the command line as shown above. All failures will be created after the join step of the whole network. All other functions works as before.

4. How failures are handled

When failures occur, there are mainly two parts that need to be fixed to bring the network back to health, the dead node IDs that lies in the LEAFSETs of other nodes and the dead node IDs that lies in the ROUTING TABLEs of other nodes. These are the only two ways that the dead nodes may affect the whole system.

To update the LEAFSETs, the nodes in the LEAFSETs of every dead node will filter out the dead nodes' ID after detection of the failures. Then we need to refill the LEAFSETs with new alive nodes. To do this, the node that needs to refill its LEAFSET will ask the farthest node that lies in the same side of the dead node (either larger LEAFSET or less LEAFSET).

To update the ROUTING TABLES, the nodes that have the dead IDs already stored in their ROUTING TABLEs will first filter out the dead ID. Then they will ask the nodes with IDs that are CLOSE to the IDs of the dead nodes. These CLOSE nodes typically lie in the positions that are near the dead nodes' IDs in the routing table.

For example, if the node with ID 10211302 (in RED) is dead, this node will ask nodes with ID 10200230 and 10222302 (in BLUE) for possible alive node to fill the vacant position.

Even the above mentioned mechanisms are used to fix the failures. The average number of hops will still increase first because some of the nodes will not get a proper replacement of the dead node's ID. But the average hops will decrease when the failed nodes lead to few nodes in the network as shown in the table below.

numNodes	numRequests	numFailures	Average Hops
100	10	0	2.25
100	10	10	7.12
100	10	20	6.87
100	10	50	2.10
1000	10	0	3.55
1000	10	300	16.49
1000	10	500	3.64
1000	10	700	1.02

The system with failures will have some hops increased. But the reaching destination is guaranteed.