Project 4

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Concurrent nodes join

- In Project 3, nodes join one by one.
  - A join() RPC call won't return until all fingertable updates, file transfers have taken place.
  - If implemented correctly, all nodes will have the correct fingertable entries.
- In Project 4, nodes may join the DHT concurrently.
  - We cannot guarantee nodes' fingertables are all correct at all times.
  - but all fingertable entries will be updated over time and eventually set to their correct values

join()

- The join() function will be different from Project 3.
- It does not try to create a fingertable with all entries set.
  - fingertable entries (except the first one) are updated by the fixFinger() function.
- Instead, it only uses an existing DHT node to find its successor, i.e., the first entry in the fingertable
- notify() its successor to update the predecessor

getNodeSucc() and getNodePred()

- getNodeSucc() returns the node’s successor, which is the first entry in the node’s fingertable.
- getNodePred() returns the node’s predecessor
  - Initially, the node does not know about its predecessor, and this may return NULL (or a structure indicating the predecessor has not been set).
- getNodeSucc() and getNodePred() may not return the correct value, but the successor and predecessor are periodically updated by the stabilize() and notify() functions.

stabilize()

- A node *n* periodically checks if pred(succ(*n*)) belongs to the interval: (*n*, succ(*n*))
  - succ(*n*) is the first entry in *n*'s fingertable
  - pred(*m*) returns node *m*'s predecessor by calling getNodePred() on node *m*.
- If yes, there exists a node *p* between *n* and succ(*n*)
  - Set *p* to its own successor (set *p* to the first entry in its fingertable)
  - Use the **notify()** function to notify *p* that it (node *n*) is its predecessor
- If the predecessor of succ(*n*) is not set
  - **notify()** succ(*n*) that node *n* is its predecessor

notify()

- notify() takes one node ID, *q*, as input argument
- Node *n* that receives the notify() RPC call
  - will set *q* as its predecessor if its predecessor is currently not set.
  - will set q as its predecessor if *q* is in the interval of (n's current predecessor, n)

- stabilize() and notify() are called periodically and eventually, all predecessors and successors of all nodes in the DHT are eventually set to their correct values

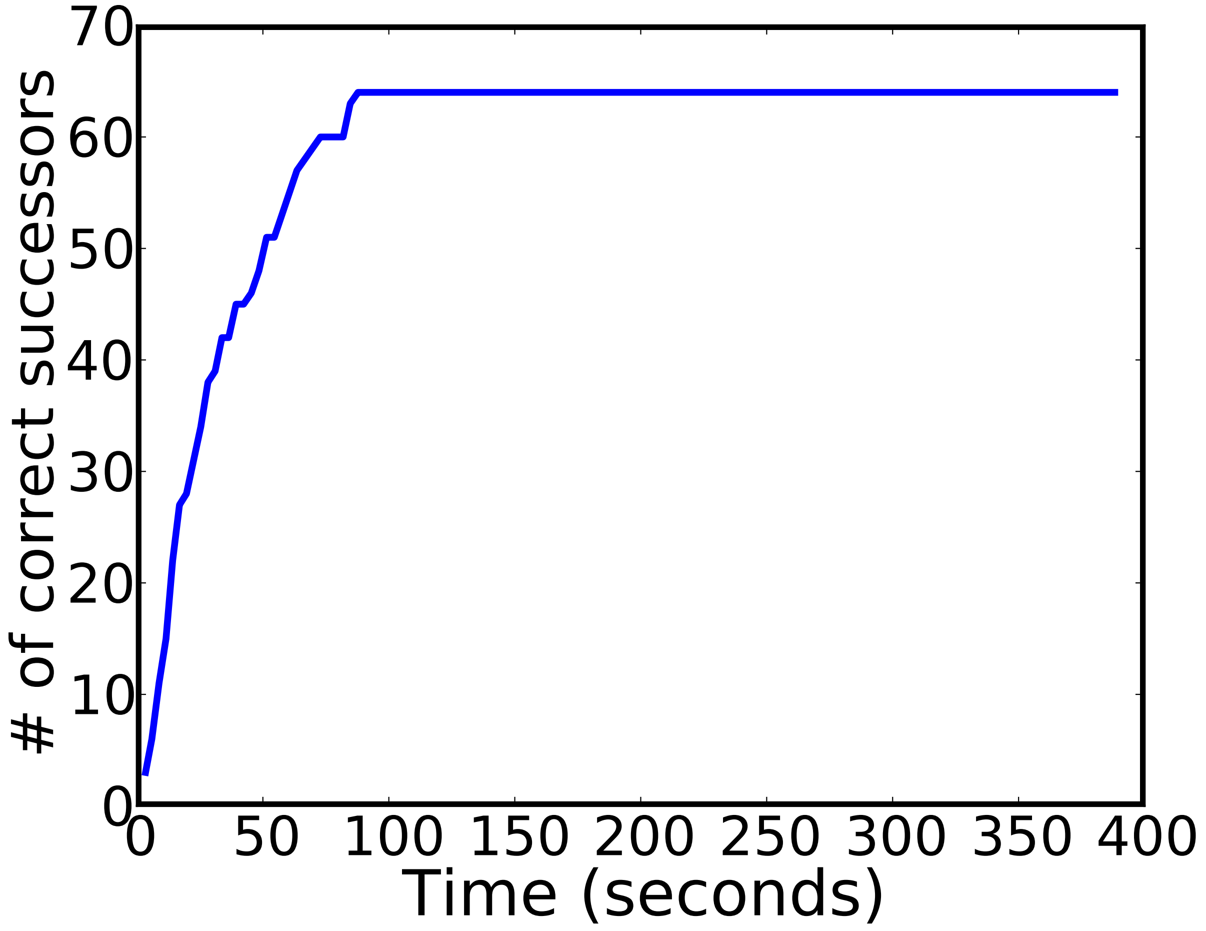
Use fixFingers() to update fingertable entries

- stabilize() and notify() correct nodes' predecessors and successors
- Nodes' fingertable entries are corrected by fixFingers()
- A node periodically selects a fingertable entry at random and updates it using findSucc(id).

Test your implementation

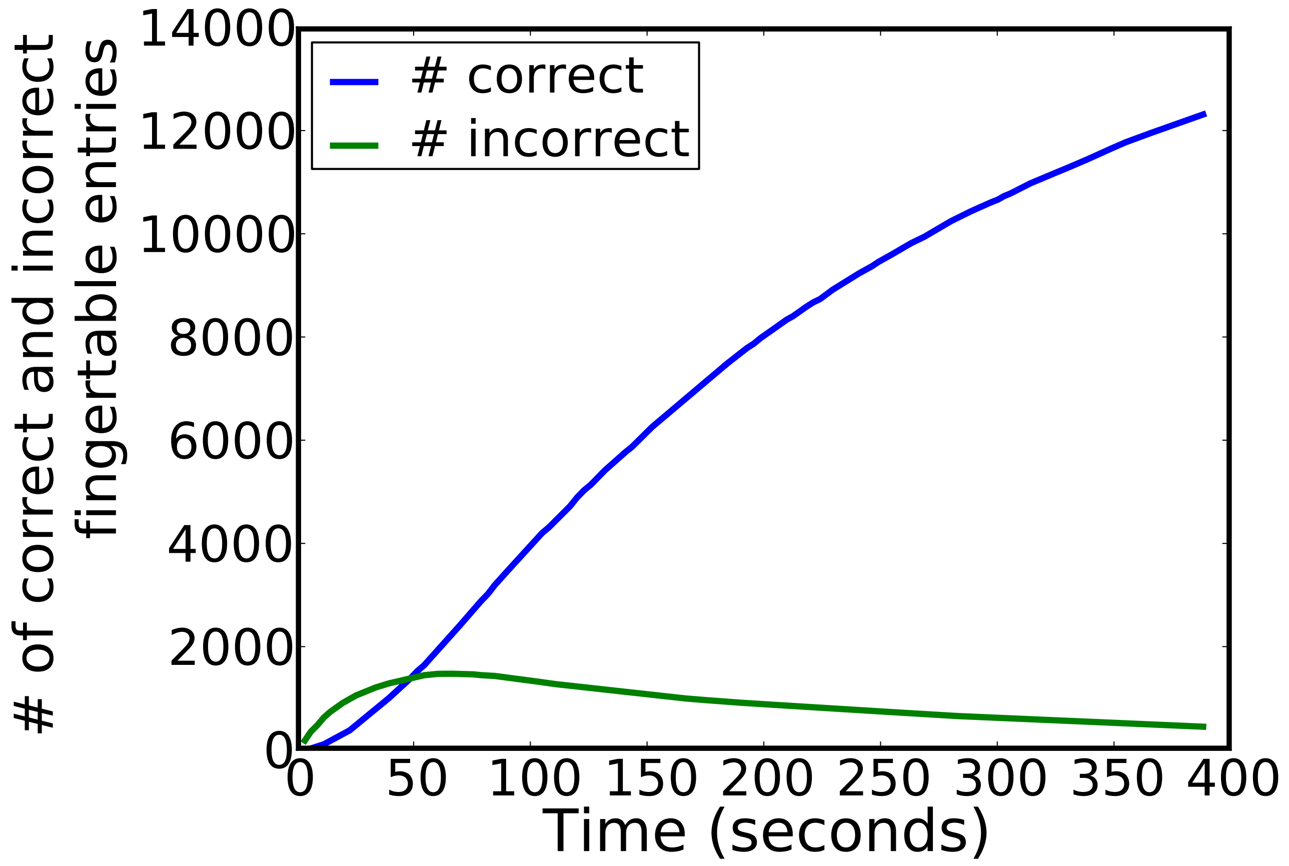
- You will need to write a test program to check if after a sufficient amount of time
    - all nodes' successors are correct
    - all nodes' predecessors are correct
    - the number of correct fingertable entries increases
    - the number of incorrect fingertable entries set by fixFingers first increases then decreases (unset fingertable entries are not counted as incorrect)
- Use cmp_fingertables to determine if fingertable entries are correct

The number of correct successors



64 DHT nodes in total

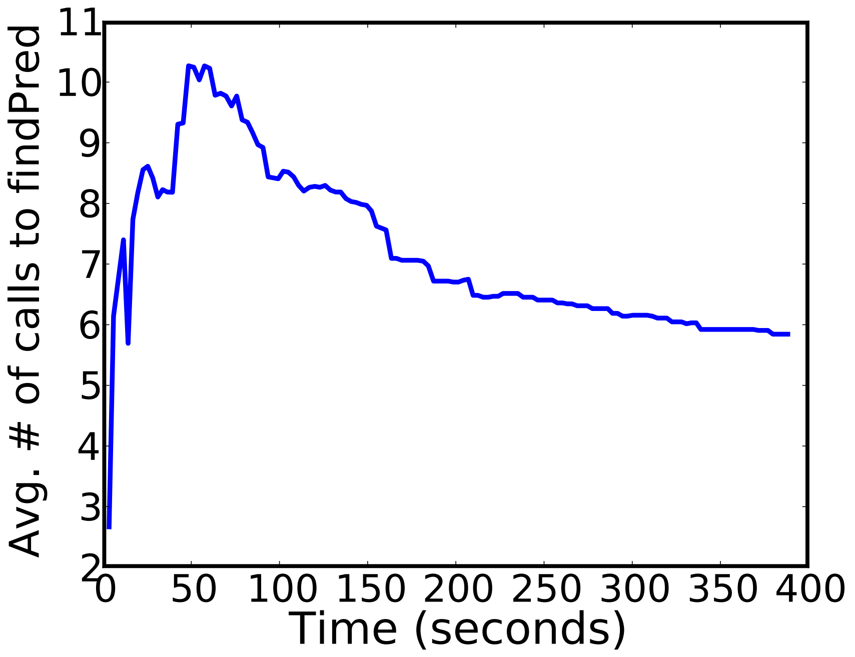
The number of correct/incorrect fingertable entries

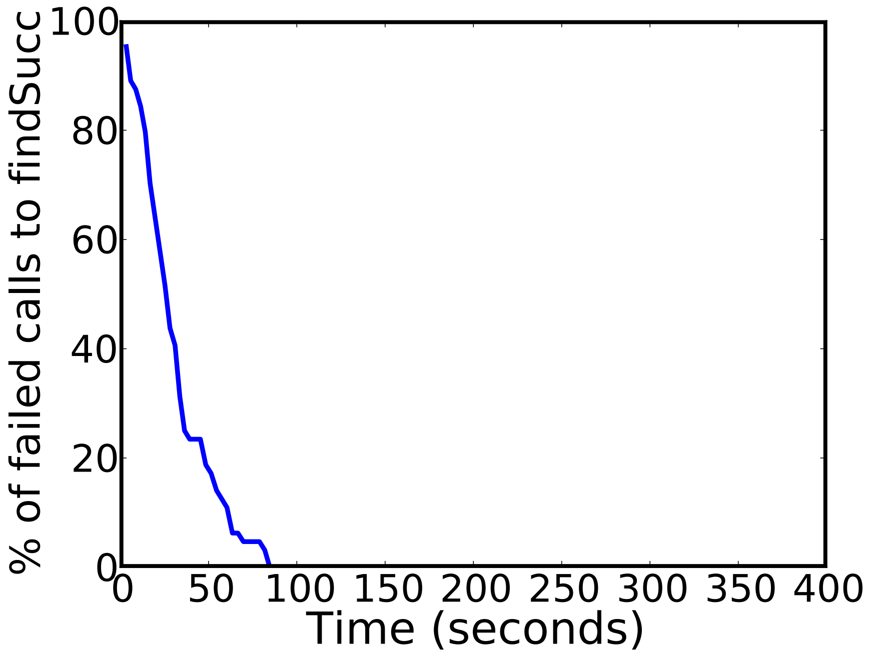


64 DHT nodes in total

Extra 30% credit

- Extend your test program to gauge the performance of the stable Chord protocol.
- Need to output two additional pieces of information:
  - the average number of correct successor nodes returned by findSucc().
  - the average number of calls to findPred() for each correct successor returned
    - Use the optional count field in the NodeID structure.





64 DHT nodes in total