

CSCI-1380: Distributed Systems

Homework #1

Assigned: 02/08/2018

Due: 02/15/2018

1 Chord

1. Consider a Chord DHT with an ID space between is 0 - 127. There are five nodes in the DHT: 100, 3, 125, 50, 67. On which of these nodes are the objects with the following IDs located (each object is on exactly one node):
 - 30
 - 127
 - 56
 - 63
2. What is the finger table for node 100 (assume the finger table has 5 entries)?

	Node ID
0	
1	
2	
3	
4	

3. Given a finger table of size 5. If a client starts a lookup at node 3 for ID 127, how many nodes are consulted (including node 3)?
4. What are the nodes consulted in the above lookup? List them in the order, in which, they are consulted. (e.g., 3 -> X -> Y -> A -> B -> Z).
5. What is the ideal or optimal size for the finger table if the ID space of the DHT is between 0 - 127?
6. One of the servers in the Chord DHT has twice the amount of resources as the other servers in the DHT. How can we make this server receive twice as many objects than the others?

2 Tapestry

1. Given a Tapestry network with the following nodes (the base is 4): 2130, 2231, 3111, 0123, 1000, 3333, 3101, 3121

What is the root for the following objects?

- 2100
 - 3000
 - 1221
 - 0120
 - 3100
2. What is the neighbor table for node 2130 (if there are multiple possibilities for an entry, pick the largest value).

	0	1	2	3
XXXX				
2XXX				
21XX				
213X				

3. If a client performs a lookup for ID 3100 starting at node 0123 (a randomly selected node), what is the route taken by this lookup? (e.g., 0123 \rightarrow X \rightarrow Y \rightarrow A \rightarrow B \rightarrow Z).
4. When adding a node, the optimized table update algorithm uses an Acknowledged Multicast algorithm, starting at the root for the new node, and called on entries sharing the longest prefix between the root and the new node. When inserting node 3201, what are the nodes whose tables get updated? (Note: these nodes are also referred to as need-to-know nodes.)

3 Congestion Control

1. Under what conditions is UDP a better transport protocol than TCP? Why?
2. Consider the TCP Timeline in Figure 1:

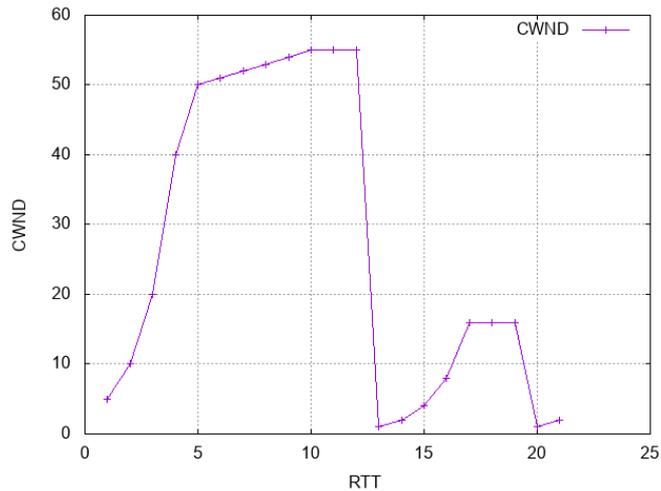


Figure 1: TCP Congestion Window (CWND) over time.

- (a) During which RTTs do Timeouts occur?
- (b) What is the initial SSThresh value?
- (c) During which RTTs is TCP in Slow Start?
- (d) During which RTTs is TCP in AIMD?

4 Handing In

Once finished, you should hand in a PDF with your answers on Gradescope. Gradescope will allow you to select which pages contain your answers for each part of each question. Please do not put your name on any page of your handin! This will allow us to do fully anonymized grading through Gradescope.

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