CSCI-1380: Distributed Computer Systems
Homework #4
Assigned: 04/25/2019
Due: 05/02/2019

1 Failures in General

Your team has informed you that the cluster is designed for the strongest consistency model available. The cluster is set to a size of 7.

- If your team is expecting non-byzantine failures, what is the max number of simultaneous node failures that this cluster can tolerate? What happens to the system if your cluster experiences more failures? Explain.
- If your team is expecting byzantine failures, what is the max number of simultaneous node failures that this cluster can tolerate?

2 Eventual Consistency: Dynamo and Cassandra

Your team is deploying Dynamo with a replication factor of 3. The ID of the Dynamo nodes are in a space of 0-255. The IDs of the Dynamo nodes are: 3, 60, 29, 192, 299, 230, 185, 320.

1. Please identify the set of servers where the following objects are stored:

Keys	Servers
45	
90	
4	
170	

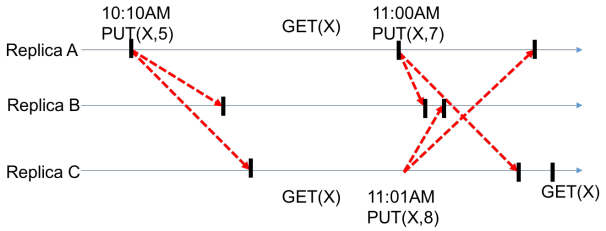

Figure 1: Timeline.

2. In Figure 1, we present the timeline of the interactions between two clients and two replicas (A and C). The figure also shows replication between the replicas (dashed lines).

   - If this system is using Dynamo, what is the value returned by Replica C for the last Get? Why?
   - If this system is using Cassandra, what is the value returned by Replica C for the last Get? Why?

3 Consensus Services: Zookeeper

Your team is using Zookeeper as the consensus service. Figure 2 shows the current code for checking and aquiring locks. How would you change the code to use Zookeeper while ensuring that you avoid busy-wait and herd problems. You want a version that uses ZooKeeper and minimizes CPU overheads. Once your code has the lock, it must call the function "doAmazingWork()". Once "doAmazingWork()" returns, you should relinquish the lock. You goal is to replace "getLock()" and "releaseLock()" with Zookeeper specific concepts.

```
DoneWork = false

While(!DoneWork) {

    if(getLock()){
        doAmazingWork()
        releaseLock()
        DoneWork = true;
    }

}
```

Figure 2: Code Snippet.

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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