CS 6378: Project II

Instructor: Ravi Prakash

Assigned on: March 7, 2017
Due date: March 30, 2017

This is a project to be done individually and you are expected to demonstrate its operation either to the instructor or the TA.

Let there be seven data servers, S_0, S_1, ... S_6 and five clients, C_0, C_1, ..., C_4. There exist communication channels between all servers, and from each client to all the servers. All communication channels are FIFO and reliable when they are operational. Occasionally, a channel may be disrupted in which case no message can be communicated across that channel. There exists a hash function, H, such that for each object, O_k, H(O_k) yields a value in the range $0 - 6$.

- When a client, C_i has to insert/update an object, O_k, it performs the write at three servers numbered: H(O_k), H(O_k)+1 modulo 7, and H(O_k)+2 modulo 7.

- When a client, C_j has to read an object, O_k, it can read the value from any one of the three servers: H(O_k), H(O_k)+1 modulo 7, or H(O_k)+2 modulo 7.

In this project you are required to implement the following:

1. A client should be able to randomly choose any of the three replicas of an object when it wishes to read the value of the object. If a client tries to read an object that is not present (has not been inserted earlier by any client), the operation should return with an error code.

2. When a client wishes to update/insert an object into the data repository, it should be able to successfully perform the operation on at least two, and if possible all the three servers that are required to store the object.

3. If a client is unable to access at least two out of the three servers that are required to store an object, then the client does not perform updates to any replica of that object.

4. If two or more clients try to concurrently write to the same object and at least two replicas are available, the writes must be performed in the same order at all the replicas of the object.

You will need to demonstrate that you have implemented all the requirements mentioned above. For instance, you may need to selectively disable some channel(s) for a brief period of time so that a client is only able to access two or one replica of an object. If at least two replicas of the object are accessible from a client, updates to that object should be allowed. However, if only one replica of the object is accessible from a client, the client should abort the update and output a corresponding message.

You must also selectively disable some channels so that the clients and servers get partitioned into two components, each with a subset of clients and servers such that some writes are permitted in one partition, while other updates are permitted in the other partition.

1 Point Distribution

Design Document (20%): Employ appropriate software engineering practices to prepare this document.

Implementation (30%): Source code of your well structured and well documented program. You are required to write your code in C, C++ or Java.

Correctness (35%): Description of the various design choices you have made, for example the hash function, the voting protocol for permitting writes, etc. and what are the safety and liveness conditions you set about satisfying. The description should indicate how the safety and liveness conditions are satisfied.

Report (15%): Results of all your experiments presented in an understandable form.

2 Submission Information

The project is to be submitted via eLearning.