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Correctness

Hash Function:

Takes an integer key as input and returns an array of three integer values. The hash function is designed to distribute the keys across multiple servers.

1. Modulo Operation (% 7): The modulo operation with 7 is used to map the key to one of the seven possible servers (0 to 6) to ensure that the hash values are within a certain range.

2. key % 7 | (key + 2) % 7 | (key + 4) % 7 to distribute to 3 servers.

3. Array of Hash Values: The function returns an array of three integer values, each representing the result of one of the three servers for this object.

The safety condition for a hash table ensures that there is no duplicate object on the same server.

Liveness Condition: It is always possible to insert a object.

```java
public static int[] hashFunction(int key) {
    // hashResult array with 3 values: key % 7, (key+2) %7, (key+4) % 7
    int[] hashResult = new int[3];
    hashResult[0] = key % 7;
    hashResult[1] = (key + 2) % 7;
    hashResult[2] = (key + 4) % 7;
    return hashResult;
}
```

Socket & Concurrent Write:

Use socket connection, ensure reliable and FIFO connection.
Provided by Java library, safety and liveness ensured.

Permitting Write & Read:

Boolean value to indicate if the process is in recovery, basically ensure mutual exclusion access to this object on the server.

Write/Read:

Check liveness of the servers before any operation, try catch block to catch any possible error thrown out when check for liveness. Use HeartBeat message to check availability.

Total Order:

Write request comes to a server(hash(key), so concurrent requests will be numbered and handled by this server as a leader, ensuring the same objects on other servers update correctly. It's the primary server's responsibility.

Report

Write request handles correctly, update the correct object and the server sends out requests to other servers to also update that copy. The value is then updated on all replicas.

Read requests give back the correct result, if the server fails it will give error code.

If the channel is disrupted, error code will throw out using try catch.

Test working goods with duplicate and concurrent requests.

When servers are down, the requests give back error code and retry.

Permitting write and read when recovery.

Avoid read-write conflict and write-write conflict

Detailed explanations on demo day