DADTKV

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Abstract

This project focuses on developing ***DADTKV****, a distributed transactional key-value store.* ***DADTKV*** *enables concurrent data access through a multi-tier architecture. Clients submit transactions using a specialized library, and transactions are coordinated through leases and consensus algorithms. This project leverages C# and gRPC to create a robust and fault-tolerant distributed system for efficient data management.*

1. Introduction

This project introduces a complex architecture with three tiers, encompassing client applications, transaction managers, and lease manager servers. **DADTKV**'s primary data unit is the *DadInt* key-value pair, with a focus on strict serializability to ensure data consistency.

2. Implementations

TODO

2.1. Manager

The Manager process is the main entry point for the system. It is responsible for reading the system configuration and starting the other processes.

Lease Managers are the first processes to be created and then the Transaction Managers. This, however, does not guarantee that the Lease Managers are ready before the Transaction Managers. Because of that, each process notifies the Manager, through a *gRPC* call, that it is ready to work.

After all Lease and Transaction Managers are ready, the Manager demands each one to start their operations. It is also at this time that the Manager will start the Client processes.

2.2. Clients

Client processes are very simple, in the state that they cycle through the list of operations that they have to execute, over and over again.

They will just send requests to a Transaction Managers predetermined by the Manager and wait for the response.

In case the given Transaction Manager is suspected of not being available, the Client will try another Transaction Manager it thinks is correct. This works by detecting if the gRPC call fails because the server is unable to accept it.

2.3. Transaction Managers

TODO

2.4. Lease Managers

When the Lease Manager is ordered to start by the Manager, it will create the timer responsible for the creation of *Paxos* instances. This timer runs every *slotDuration* milliseconds.

Lease requests are stored in a *buffer queue*, so that no requests are lost between between *Paxos* instances. Whenever a new instance is created, it will lock and fetch all requests from the *buffer*, clear, and unlock it for more requests to be received.

Paxos is extended to allow the Proposer to provide a *SHA256 hash* of the Lease requests (value) it wishes to propose on the Prepare message. The Propose message comes as a response to the *gRPC* Prepare call, and will include the respondents' Lease requests if the hashes are different – this allows for the Proposer to make more complete proposal.

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References

[1] I. M. Author. Some related article I wrote. *Some Fine Journal*, 99(7):1–100, January 1999.

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