CS550 Advanced Operating System

PROJECT PROPOSAL

A Multi Master replication system that can effectively handle data inconsistency and Byzantine fault

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Abstract: This paper presents the multi-master data replication strategy amongst a group of physically distributed system. Data Replication is generally performed to provide a consistent copy of data across all the database nodes. Availability and reliability of data is increased through data replication. Multi-master replication, also known as advanced replication or symmetric replication, allows you to maintain multiple sets of identical data at various sites. In a multi master setup redirecting read queries towards any of the master should yield the same output.

Motivation: The most common type of failure that appear in multimaster replication is data inconsistency, that is same read query from two different machines might yield separate result because they are in a in-coherent state.

Also It is thus crucial to ensure that Multi Master systems work correctly and continuously even in the presence of a variety of unexpected faults or Byzantine Faults.

Traditional systems handle Multimaster replication in following way[4]

I. Asynchronous - Captures any local changes, stores them in a queue, and, at regular intervals, propagates and applies these changes at remote sites. With this form of replication, there is a period of time before all sites achieve data convergence.

   Problem - The data sets at the different master sites in the replication environment can be different for a period of time before the changes have been propagated

II. Synchronous Replication - Propagates any changes made at a local site to other synchronously linked masters in a replication environment during the same transaction as the initial change. If the propagation fails at any of the master sites, then the entire transaction, including the initial change at the local master site, rolls back.

   Problem - If one of the participating machine fails , the entire transaction fails .

We propose a completely different approach where Master replicas do not directly communicate between each other and works virtually independently . Where in a Independent system consult all the replicas when a read query is performed and returns the result if half of the machine in the system response with the same result .

As a by-product , this design solves the Byzantine Fault and Data Inconsistency as we are using the wisdom of the crowd , instead of result from a single source.

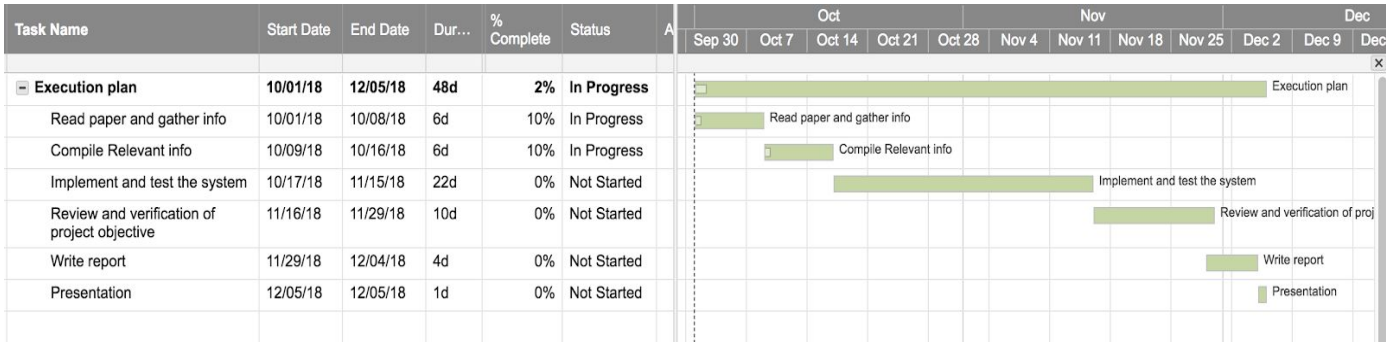
Project Goals:

This project aims to achieve the following -

1) Investigate existing Multi master replication processes and algorithm.
2) Study the resilience of existing designs against data inconsistency and Byzantine fault and their performance
3) Propose and implement a new design to implement performant Multi master replication .
4) Test the new application under various load , access pattern and read write sequence.

Project Execution plan

The figure below shows the basic Gantt chart which serves as a rough project plan.



Task Name	Start Date	End Date	Dur...	% Complete	Status
Execution plan	**10/01/18**	**12/05/18**	**48d**	**2%**	**In Progress**
Read paper and gather info	10/01/18	10/08/18	6d	10%	In Progress
Compile Relevant info	10/09/18	10/16/18	6d	10%	In Progress
Implement and test the system	10/17/18	11/15/18	22d	0%	Not Started
Review and verification of project objective	11/16/18	11/29/18	10d	0%	Not Started
Write report	11/29/18	12/04/18	4d	0%	Not Started
Presentation	12/05/18	12/05/18	1d	0%	Not Started

The above figure is only a rough draft. Constant reviews will be done to ensure that the project proceeds as planned and the goals set out in this document are achieved to a satisfactory extent.

REFERENCES

The following list of references represents an intended reading list. Whether or not a reference is ultimately relevant and in what capacity/extent, to this project will be ascertained during the information gathering process, and as such, all listed below may or may not be referenced. Also additional sources may be chanced upon during the research process.

1) MULTI MASTER REPLICATION IN ORACLE DATABASE
   BOICEA, A[lexandru]; NICULA, A[drian] - I[onut]; SERBAN, A[lexandru] & GRIGORE, E[lena] M[ihaela]
2) Oracle Distributed Systems by Charles Dye
   https://www.oreilly.com/library/view/oracle-distributed-systems/1565924320/
3) Efficient Middleware for Byzantine Fault Tolerant Database Replication
   http://www.gsd.inesc-id.pt/~rodrigo/byzantium_eurosys11.pdf
4) Master Replication Concepts and Architecture
   https://docs.oracle.com/cd/B28359_01/server.111/b28326/repmaster.htm