# Preserving Data Replication Consistency through ROWA-MSTS

Noraziah Ahmad[1], Roslina Mohd. Sidek[1], Mohammad F.J. Klaib[2], Ainul Azila Che Fauzi[1], Mohd Helmy Abd Wahab[3], and Wan Maseri Wan Mohd[1]

[1] Faculty of Computer Systems & Software Engineering, University Malaysia Pahang, Pahang, Malaysia
noraziah@ump.edu.my
[2] Faculty of Science and Information Technology, Jadara University, Irbid- Jordan
[3] Faculty of Electric & Electronic, Universiti Tun Hussein Onn Malaysia, Johor, Malaysia

**Abstract.** In modern distributed systems, replication receives particular awareness to provide high data availability, reliability and enhance the performance of the system. Replication becomes as significant mechanism since it enables organizations to provide users with admission to current data where and when they need it. Integrated VSFTPD with Read-One-Write-All Monitoring Synchronization Transaction System (ROWA-MSTS) has been developed to monitor data replication and transaction performs in distributed system environment. This paper presents the ROWA-MSTS framework and process flow in order to preserve the data replication consistency. The implementation shows that ROWA-MSTS able to monitor the replicated data distribution while maintaining the data consistency over multiple sites.

## 1 Introduction

The beginning of amazing advance in the growth of computer and hardware in computer world enables user to access information anytime and anywhere regardless of the geography factor. In modern distributed systems, replication receives particular awareness to provide high data availability, reliability and enhance the performance of the system [1, 2, 3, 4, 5]. Nowadays, the interest in distributed system environment has increasingly demanded due organization needs and the availability of the latest technology. Ensuring efficient access to such a huge network and widely distributed data is a challenge to those who plan, maintain and handle replication and transaction performance in network [1, 2, 4]. The need of replicated data in distributed systems environment is to ensure that any data is backed up whenever emergency occurs. The replicated data will be imitative in different server(s) in the distributed environment. These advantages of replication are vital since it enables organizations to supply users with admission to current data anytime or anywhere even if the users are physically remote [6]. Moreover, it also can reduce access delay, bandwidth consumption [6], fault tolerance [1, 5, 7, 8, 9, 10] and load balancing [9].

Preserving consistency and availability of a certain data at a huge network becomes the issues that still unsolved. Data organization through replication introduces low data consistency and data coherency as more than one replicated copies need to be updated.

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Expensive synchronization mechanisms are needed to maintain the consistency and integrity of data among replicas when changes are made by the transactions [3]. There are many examples of replication schemes in distributed systems [1, 3, 5, 6, 7, 8]. Synchronous replication model deploys quorum to execute the operations with high degree of consistency and ensure serializability. It can be categorized into several schemes, i.e., all-data-to-all-sites (full replication) and some-data-items-to-all-sites and some-data-items-to-some-sites. One of the simplest techniques for managing replicated data through all-data-to-all-sites scheme is Read-One Write-All (ROWA) technique. Read operations on an object are allowed to read any copy, and write operations are required to write all copies of the object [3, 6]. An available copies technique proposed by Bernstein et al. [11] is an enhance version of ROWA technique, in terms of an availability of the write operations. Every read is translated into read of any replica of the data object. Meanwhile, every write is translated into write of all available copies of that data object. Branch Replication Scheme (BRS) goals are to increase the scalability, performance, and fault tolerance [1]. In this model, each replica is collected of a different set of subreplicas structured using a hierarchical topology. BRS deploys some-data-items-to-all-sites replication scheme. Meanwhile, Neighbour Replication Grid Daemon using some-data-items-to-some-sites replication scheme. Data item has been replicated from primary to adjacent neighbours replica [12].

In our previous work, we present the development of Read-One-Write-All Monitoring Synchronization Transaction System (ROWA-MSTS) [13]. It has been developed to monitor data replication and transaction performs in distributed system environment. However, the paper not discusses the framework and process flow of ROWA-MSTS in order to preserve the data consistency.

In this paper, we review replication concept and recall ROWA-MSTS in Section 2. In addition, we also present existing application related to ROWA-MSTS. Section 3 proposed ROWA-MSTS framework and process flow. In Section 4, we implement proposed framework by deploying real time application in distributed systems environment. The conclusion of this paper is presented in the last section.

## 2 Related Work

### 2.1 Concept of Replication

Replication is an act of reproducing. It also addresses the management of the complete copying process [17]. In addition, this process involves the sharing information to ensure consistency between redundant resources, as such the software or hardware components. Data replication may take place if the same data is stored in various storage devices. Meanwhile, computation replication occurs when the same computing task is executed many times [5]. For example, a replicated service might be used to control a telephone switch, with the objective of ensure that even if the main controller fails, the backup can take over its functions.

### 2.2 ROWA-MSTS

Read-One-Write- All Monitoring Synchronization Transaction System (ROWA-MSTS) [16] has been developed by using ROWA Read-One-Write-All (ROWA) for