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MODELING FUZZY BASED REPLICATION STRATEGY TO IMPROV DATA AVAILABILITY IN CLOUD DATA CENTERS

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***Abstract*—** In large-scale cloud environments, data management is an essential process that needs to be taken into consideration. The utilisation of file replication makes the management of this circumstance very straightforward. This project intends to increase the amount of data that is readily available in cloud data centres by distributing replicas across multiple data centres. It's possible that how replicas are made will be determined by how well the data in the cloud data centre can be used and how easily it can be accessed. During the process of replication, the data that is accessed the most frequently is taken into consideration. The process of selecting the most effective copy to install in a number of data centres is referred to as replica selection.

***Index Terms*—** Computing in the cloud, data centres, and replication are examples of index terms

I. INTRODUCTION

Cloud computing is a model that can be used to describe a shared resource pool that provides access on demand. Cloud computing, which is based on the use of the internet, gives users on-demand access to a shared pool of resources that can be accessed from any location in the world at any time. Users don't have to worry about the installation or upkeep of the system. Providing the user with hosted services is a component of it. These services can be broken down into three main categories: infrastructure-as-a-service, platform-as-a-service, and software-as-a-service. The management of data presents the most significant challenge for cloud computing. The efficient management of data in cloud data centres ensures a high availability of the data stored there. In the approach that has been suggested, there are three primary categories. The creation of replicas may fall under the purview of the first section, depending on the accessibility of various data. The selection of the best copy for the procedure is the second step, and it is determined by how well the network is operating. The third section discusses the process of installing replicas in data centres as well as replacing old ones when necessary. The method for choosing the optimal quantity of replicas is incorporated into the final stage, which also makes use of a replica selection mechanism that is based on fuzzy logic. The availability of the data can be increased using this replication method.

II. REPLICATION OF DATA

The process of data replication is one method that can be used to address the requirements for data integration. Replicating data ensures that all of the data is in sync and available, encourages efficient data growth, and increases revenue by utilising the most recent data. The synchronisation of real-time analytical data adds value to a wide variety of big data systems as well as mobile applications, and it also makes event-driven business more effective.

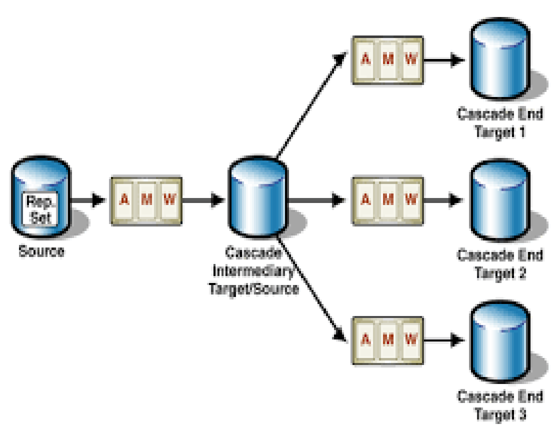

Fig. 1 Data Replication

Because of its powerful data replication capabilities, which enable the transfer of massive amounts of data with very low latency, data replication is ideal for the distribution of workload across multiple sites and for maintaining continuous data availability. Figure 1 depicts the fundamental approach to data replication, in which the source data are duplicated and stored in three different targets. This approach was used to replicate the data.

Data replication refers to the process of maintaining replicas, which can also be thought of as numerous copies of the data. The availability of data is improved through the process of replication, which makes it possible to access the data even in the event that access to some of the replicas is denied. In addition, it improves system performance by lowering latency for users and preventing them from accessing remote networks by enabling them to use nearby copies of the data instead.

WORKS THAT ARE INTERCRETED

Cloud computing is plagued with significant challenges regarding the implementation of data management strategies. The investigation into replication has been going on for some time now. The processes of data replication can be broken down into two distinct categories. One type of replication is known as static replication, and another type is known as dynamic replication. In static replication, both the number of hosts and the number of replicas are set in stone. On the other hand, dynamic replication has the ability to automatically create and delete clones depending on how easily the data can be accessed.

In 2012, Bakhta meroufel et al. published a strategy for dynamic replication on a hierarchical grid that takes into consideration the possibility of a system crash failing. [1] The foundation for dynamic replication is provided by the accessibility of data as well as its widespread use. The proportion of available data might increase if it is particularly well-liked, depending on how popular the data is. Even in the event that there are malfunctions, this strategy will ensure availability. Najme Mansouri and colleagues came up with the idea for the Dynamic Hierarchical Replication (DHR) algorithm in 2012 [6]. This algorithm is made up of three components, including replica selection, replica choice, and replica replacement. The DHR algorithm effectively shortens the amount of time required to access files by virtue of the limited amount of storage space available at Grid locations. When there is not enough space for the new replica, DHR deletes files that are already present in the local area network (LAN) or files with a short transfer time. This happens when there is not enough room for the new replica. It stores replicas of the files in the location that has the most access, as opposed to storing the originals in a number of different locations. In 2015, Reena S. More and her colleagues came up with the idea for the custom partitioning algorithm [7].

The fundamental idea behind the custom partitioning method is to break down a massive problem into a number of more manageable subproblems. In the proposed approach, the data would be replicated on a high-performance node, which would result in less energy being consumed during the processing of the data as well as a reduction in the cost of replication. A multi-objective offline optimization method was developed by Sai-Qin Long et al. (2014) [8] for efficient replica management. MORM (Multi-objective Optimized Replication Management) is responsible for determining both the replication factor and the replication architecture. It does this through the use of an auto immune algorithm. The MORM scheme and the programme both take into account the historical data and incorporate it into their respective workflows. MORM replication management was developed so that a replication factor and replication layout approach for files could be selected that would maximise the achievement of all the key goals. As a result, the MORM replica strategy was implemented as a means of controlling the quantity of copies of the highly replicated file.

WORK TO BE PROPOSED

The primary goals of this project are to increase the amount of data that is readily available by storing replicas in a number of different data centres and to decrease the amount of energy that is consumed by setting a limit on the number of replication copies that are created based on how frequently a resource is utilised. User requests were redirected to the following zones that were operational whenever one of the primary data centres experienced an outage for any reason. Reduced energy consumption resulted from the implementation of our fuzzy logic-based strategy. We are referring to a method called MORM, which stands for "Multi objective Optimized Replication Management," in order to increase the amount of data that is readily available in cloud data centres.

A. System Architecture

Four modules make up the proposed architecture.

1. One of the modules is data centre configuration.

2. Making copies

3. Replica choice

4. Placing a duplicate

Configuration of the Data Center, to start

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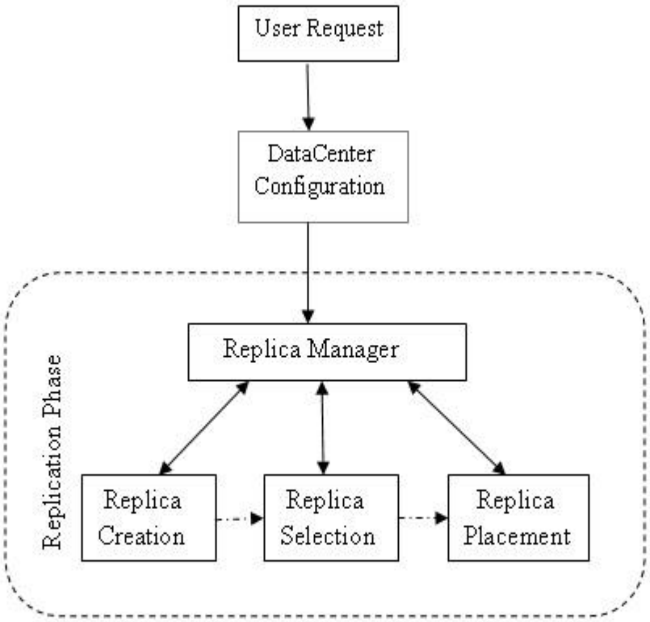


Fig. 2. Architectural diagram of proposed system

The fundamental information of the data centre configuration module, such as the data centre name, data centre region, and number of virtual machines, is configured by the cloud owner or another user with the appropriate authorization. The level of customer service provided directly influences the price settings. Which may be different depending on who is using it?

Manager of Replicas, Level Two

The replica manager is responsible for managing all of the functions involved in the replication phase. These are some of them: 1. replica development

2. Replica choice

3. Placing a replica.

The replica manager contains all of the information pertaining to the replicas, including where they are located, how large they are, and how many there are. In the event that the primary data centre experiences an outage or crash, the replica manager will move the user request to a different zone that is operational.

a) Replica Development

During the replica construction phase, replication takes place, with its timing being determined by the number of user requests. The process of creating replicas generates the required quantity of additional copies and stores them in a variety of data centres. There are many widely used file systems, such as the Google File System (GFS) and the Hadoop Distributed File System, both of which set a cap of three on the number of replication copies that can be active at the same time (HDFS).

After the replica has been successfully installed in the primary Data centre, the user will immediately be able to access the file. If the primary data centre (primary available zone) does not have the file in question, the user will be immediately redirected to another data centre that has a replica copy of the resource that was requested. If the primary data centre does not already contain the object, and if it has the storage space necessary to accommodate a new copy of the original resource, then the replica will be constructed there and placed there.

b) The Choosing of the Replicas

The process of selecting a replica entails selecting the data centre that houses the best replica out of all of the data centres (such as primary and secondary zones), as well as selecting the data centre that houses the replica of the item that will be most helpful for provisioning when it is required. When the best copy is used, there is less strain placed on the network in terms of bandwidth consumption.

The capability and performance of the data centre that is accessible are the only factors that are taken into consideration when selecting replicas. The user requests that are sent in when a particular data center's resource fails or crashes as a result of a natural disaster are handled by the secondary available zone. This results in an increased capacity for the system to tolerate errors.

The replica selection contains the best possible selection of data for user requests, which may help with both minimal memory consumption and quick data processing in cloud data centres. This is because the replica selection contains the best possible selection of data. When selecting a replica, there are two scenarios that need to be taken into consideration:

1. To reduce your need for bandwidth, select a replica from the data centre that is nearby.

2. Select a region of the network that has the fewest user requests in order to reduce the amount of congestion. c) Replica Placement.

During the step known as "replica placement," the newly manufactured copies are transferred to the correct Data Center. The availability of data has increased as a result of the

	Closest data center	**Optimize response time**	**Reconfigure dynamically**
Overall response time	Avg (ms) - 571.23 Min (ms) - 38.86 Max (ms) -1245.12	Avg (ms) - 570.21 Min (ms) - 39.36 Max (ms) - 1260.12	Avg (ms) - 571.70 Min (ms) - 39.11 Max (ms) - 1245.61
Data center processing time	Avg (ms) - 0.27 Min (ms) - 0.02 Max (ms) - 0.86	Avg (ms) - 0.27 Min (ms) - 0.01 Max (ms) - 0.87	Avg (ms) - 0.75 Min (ms) - 0.02 Max (ms) – 30.01
Data center request servicing times	Avg (ms) - 0.27 Min (ms) - 0.02 Max (ms) - 0.86	Avg (ms) - 0.27 Min (ms) - 0.01 Max (ms) - 0.87	Avg (ms) - 0.75 Min (ms) - 0.02 Max (ms) – 30.01
Total virtual machine cost ($)	0.50	0.50	3.26
Total data transfer cost ($):	0.64	0.64	0.64
Grand total: ($)	1.14	1.14	3.90

placement of the same resource (a replica of the original resource) in a number of different data centres. In order to reduce the amount of storage space required, the replicas are moved to new data centres that do not have that resource, and the process of updating the replicas continues on a consistent basis after the move.

5. TOOL ANALYSIS

Analyst of the cloud: A cloud simulator that is entirely based on a graphical user interface and makes it easier to evaluate social networking tools in relation to the geographic distribution of users and data centres is needed.

There are three different policies for service brokers available:
1. Closest data centre connection

b. Reduce the amount of time needed for reactions c. Dynamically reorganize

The design of the cloud analyst tool is shown in Figure 3, and the various colours denote the various regions. Here, six geographical areas are covered. Each region contains one or more user bases that are connected to data centres located in unidentified regions.

TABLE I. Comparison between three scenarios for 10 UB & 1DC

Scenario 2: 50 User Bases & 1 Data Center

Data center region : 3
No.of data centers : 1
No.of userbase : 50

A) Evaluation of service broker laws:

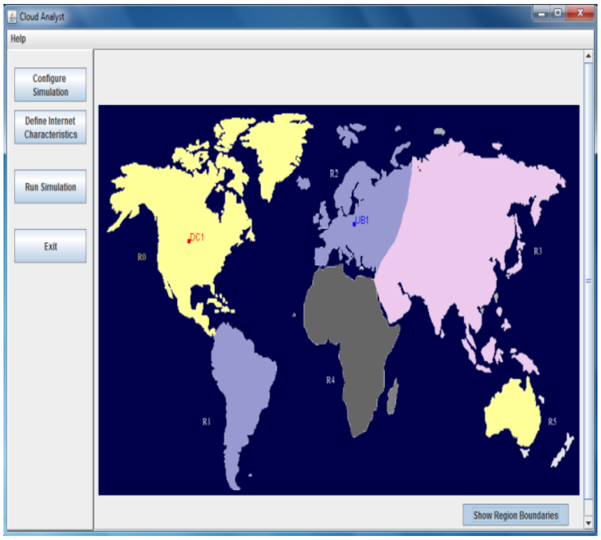
Comparison of the various situations

Closest Data Center, Optimize Response Time, and Dynamically Reconfigure

Ten user bases and one data centre in scenario one

Data centre region: 3 Data centre count: 1 User count: 10

Fig. 3. Cloud analyst screenshot



	Closest data center	**Optimize response time**	**Reconfigure dynamically**
Overall response time	Avg (ms) - 647.14 Min (ms) - 37.79 Max (ms) - 1300.12	Avg (ms) - 647.48 Min (ms) - 38.61 Max (ms) - 1305.11	Avg (ms) - 647.78 Min (ms) – 38.41 Max (ms) - 2680.01
Data center processing time	Avg (ms) - 0.25 Min (ms) - 0.01 Max (ms) - 0.90	Avg (ms) - 0.25 Min (ms) - 0.01 Max (ms) - 0.90	Avg (ms) - 0.86 Min (ms) - 0.01 Max (ms) – 1635.01
Data center request servicing times	Avg (ms) - 0.25 Min (ms) - 0.01 Max (ms) - 0.90	Avg (ms) - 0.25 Min (ms) - 0.01 Max (ms) - 0.90	Avg (ms) - 0.86 Min (ms) - 0.01 Max (ms) – 1635.01
Total virtual machine cost ($)	0.50	0.50	3.25
Total data transfer cost ($):	3.20	3.20	3.20
Grand total: ($)	3.70	3.70	6.46

TABLE II. Comparison between three scenarios for 50 UB & 1 DC

In terms of response time, processing time, data transfer costs, and other factors, the two service broker policies—optimize reaction time and closest data center—are essentially equivalent. When compared to the reconfigure dynamically policy, the other two are superior in terms of performance and cost.

VI. PROPOSED ALGORITHM

Algorithm : Replica placement

```
Input: Integer r, the number of replicas
Input: Integer dc, the number of datacenters

Output: Replicas [0...dc - 1][0...r -1]

 for all i such that i = 0 or i < 3 do
 //(i – maximum allowable count of replicas. Where i=3)
{
        Preload node dc's replicas with dc
}
for all i such that i < 3 do
{
        repeat until i=3
        z = random node, s.t. 0 = z < dc
        v = Rep[z]
        until z = i
        if v = i and Rep[i] = z then
        {
                valid rep = 1
                if Rep[i]== v or Rep[i]== Rep[z] then
                {
                        valid rep = 0
                }
                if valid rep then
                {
                        Rep[z]= Rep[i]
                        Rep[i] = v
                }
        }
}
```

The algorithm that was mentioned above also contains a description of the replication placement algorithm. In this scenario, the number of replicas and the number of data centres serve as inputs, and the output is the number of replicas that have been successfully replicated across the specified number of data centres. If there are zero or fewer than three copies of a resource, you need to preload the original copy before beginning the replication process. The newly formed replica needs to be placed on node z, which is supposed to be a random node, and the replica count needs to be set to equal the number of datacenters that are supposed to contain the resource. Proceed in this manner until the number 3 is reached. If a replica does not perfectly match the resource from which it was copied, then that replica is not valid (i.e., valid rep=0), but if it does match the resource exactly, then it is valid (i.e., valid rep=1).

VII. IMPLEMENTATION RESULTS

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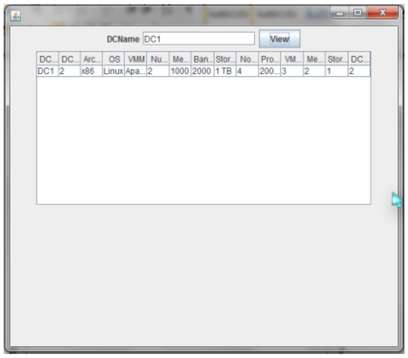

Fig. 4. Screen shot for displayed DC details

Figure 4 shows, the retrieved details of the particular data center. The cloud service provider can insert or modify data from the cloud. These features only accessible by the cloud service provider.

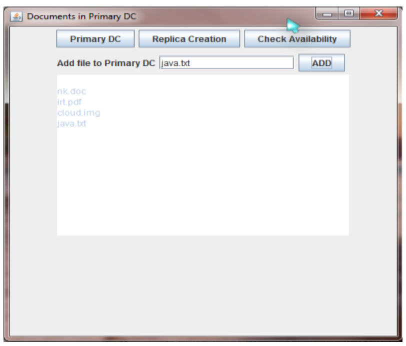

Fig. 5.Screen shot for DC documents

Figure 5 shows, the available documents in primary data center. These data are handled by the user and managed y the service provider.

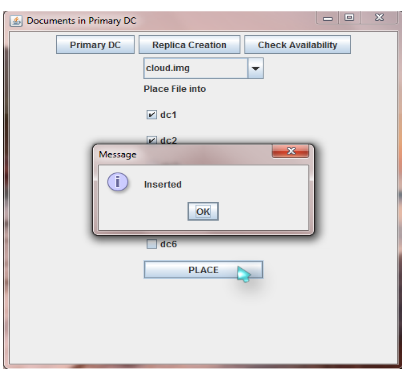

Fig. 6. Screen shot for replica creation

Figure 6 shows the replica creation method. The selected file (cloud.img) placed in two different data centers DC1 and DC2.

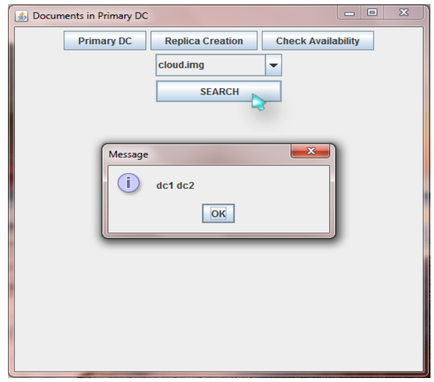

Fig. 7. Screen shot for checking availability

Checking the availability of the file is shown in Figure 7. Both Data Center 1 and Data Center 2 have copies of the file called "cloud.img."

The implementation that was described earlier incorporates modules for the configuration of data centres as well as the creation of replicas. It is the responsibility of the service provider to configure the settings for the data centre. The process of making copies of a file stored in the cloud in accordance with the frequency with which that file is accessed is referred to as replica creation.

VIII. IMPLEMENTATION IN TOOL

(CLOUD ANALYST)

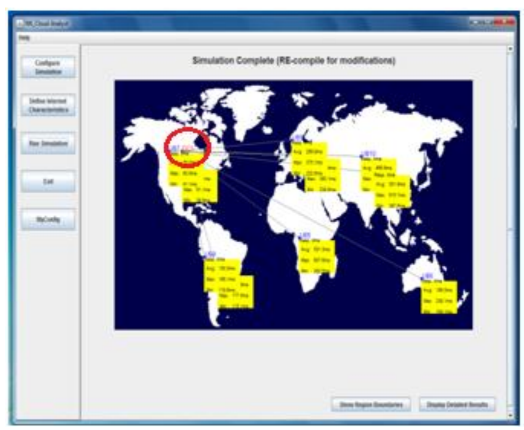

Fig. 8. Simulation with Single Data Center & 10 User Bases

The results of the simulation are depicted in Figure 8, which uses a single data centre and ten user bases. The idea of replication is impossible to realise in this setting due to the existence of a single data centre.

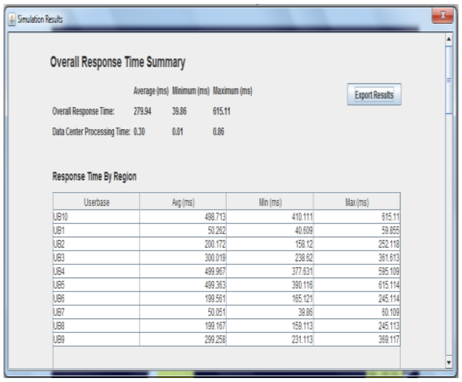

Fig. 9. Overall Response Time Summary (For Fig 8.1)

Figure 9 shows the response time for each user bases as well as the overall response time. Here, the response time is taken as the measurement for our algorithm.

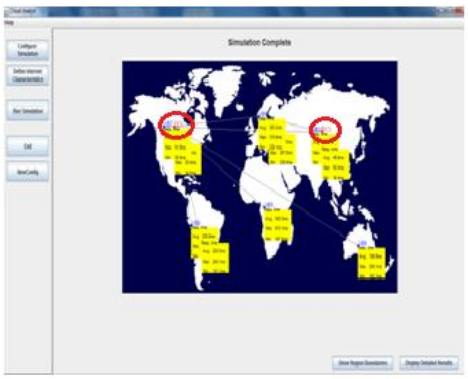

Fig. 10. Simulation with 2 Data Centers & 10 User Bases

Figure 10 shows the simulation result with two data center and 10 user bases. Here, replication concept takes place. Because, same resource can hold by two different data centers.

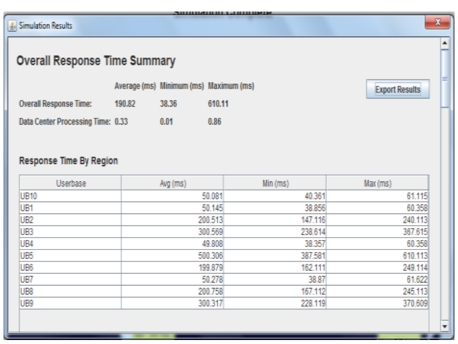

Fig. 11. Overall Response Time Summary (For Fig 8.3)

The amount of time it takes to respond to each user base is displayed in Figure 11, along with the total amount of time it takes. In this particular iteration of our algorithm, the measurement that we use is the response time.

When compared to the utilisation of a single data centre concept, the overall response time and the response time for each specific user base that is served by the network of data centres is significantly lower (Figure 9). (Figure 11).

IX.CONCLUSION

An efficient strategy for the creation of replicas has been proposed as a means of raising the amount of data that is made available in cloud data centres. In order to provide customers with the optimal environment, the data centre must first be configured by an authorised user or a cloud service provider. Within the replica creation module, data copies are generated according to the frequency with which it is used. The algorithm was developed to facilitate efficient deployment of replicas. As a direct consequence of this, the response time of each data centre slowed down. In subsequent work, we will concentrate on developing an efficient technique for replica handling in order to bring down both the associated costs and the amount of storage space required.

REFERENCES

[1]. (2013) "Managing Data Replication and Placement Based on Availability" by Bakhta Meroufel and Ghalem Belalem 147–155 in AASRI Procedia, Volume 5.

[2]. "Federation in Cloud Data Management: Challenges and Opportunities," by Gang Chen, H.V. Jagadish, Dawei Jiang, David Maier, and Beng Chin Ooi (2014) IEEE Transactions on Knowledge and Data Engineering, Volume 26, Number 7, Pages 1670–1679.

[3]. "Optimal replica placement in hierarchical Data Grids with location assurance," J. Parallel Distrib. Comput. No.68, pp. 1517–1538; Jan-Jan Wu, Yi-Fang Lin, and Pangfeng Liu (2008)

[4]. "Survey of Techniques and Architectures for Designing Energy-Efficient Data Centers" IEEE Journal, Vol. 6, pp. 1231–1245; Junaid Shuja, Kashif Bilal, Sajjad A. Madani, Pavan Balaji, and Samee U. Khan (2015).

[5]. "Optimizing expansion techniques for ultra scale cloud computing data centres" Simulation Modeling Practice and Theory, Vol.12, pp.1569–1584, Mahmoud Al-Ayyoub, Mohammad Wardat, and Yaser Jararweh (2015)

[6]. Ishita Trivedi, Sanjeev Sharma, and Sanjay Bansal The International Journal of Distributed and Parallel Systems (IJDPS) published "A Dynamic Replica Placement Algorithm to Enhance Multiple Failures Capability in Distributed System" in its Vol. 2, No. 6 issue in November 2011.

[7]. Distributed Metadata Management Scheme in HDFS, Mrudula Varade and Vimla Jethani (2013) International Journal of Scientific and Research Publications, Vol. 3, Issue. 5, 1 ISSN, pp. 2250-3153.

[8]. "A dynamic replica management technique in data grid," Najme Mansouri and Gholam Hosein Dastghaibyfard (2012) 35th volume of Journal of Network and Computer Applications, pages 1297–1303.

[9]. Replica selection strategies in data grid, Reda Alhajj, Ken Barker, Rashedur M. Rahman (2008), J. Parallel Distributed Computing, No.68, pp. 1561–1574.

[10]. In their 2015 paper "An Energy Efficient QoS Based Replication Strategy," Reena S. More and Prof. Nilesh V. Alone Vol. 3, No. 6 of the International Journal of Innovative Research in Computer and Communication Engineering

[11]. Complete and fragmented replica selection and retrieval in Data Grids, Ruay-Shiung Chang and Po-Hung Chen, Future Generation Computer Systems No.23, pp. 536-546, 2007.

[12]. "MORM: A Multi-Objective Optimized Replication Management technique for Cloud Storage Cluster," Sai-Qin Long, Yue-Long Zhao, and Wei Chen (2014) pages. 234–244 of Journal of Systems Architecture, Volume 60.

[13]. "Fuzzy Authorization for Cloud Storage," IEEE Transactions on Cloud Computing, Vol. 2, No. 4, pp. 422-436, by Shasha Zhu and Guang Gong, Fellow, IEEE.

[14]. "Disaster-Aware Data centre Placement and Dynamic Content Management in Cloud Networks" IEEE Vol. 7, No. 7/J. Opt. Commun. Netw. 1943-0620, pp.681-695. [15] "A cloud approach to unified lifecycle data management in architecture, engineering, construction, and facilities management: Integrating BIMs and SNS." Advanced Engineering Inf.

[15]. Information Systems, Vol. 48, pp. 274–278. YoungJinChoi, SangHakLee, JinHwanKim, YongJuKim, HyeonGyuPak, GyuYoungMoond, JongHeiRa, and Yong-GyuJung (2015) "The approach to secure scalability and high density in cloud data-center."