An Efficient Resource Utilization in VM Live Migration Techniques using CloudSim a Simulation tool

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Abstract. In the era of cloud resources and edge computing the transferring of data from one node to another node server is a complicated task in which there should be no disruption. While any user is accessing the cloud services then it is required that shifting a virtual machine load from anywhere must be without disturbing the services on front end. There is a key problem which is high resource usage such as network usage, management of various cloud resources, tolerating the fault occurrence, consumption of energy etc. It is also required that the resource consumption should be more efficient when shifting the virtual machine load from one physical host to another particular physical host. This paper identifies a solution to manage the workload on different migration techniques without disruption of services in cloud computing environment.

Keywords: Virtualization, Virtual machine migration, Equal Spread Current Execution Load, Virtual Machine Live migration

1. Introduction

For data processing, storing and proper management of entire resources via Internet, Cloud Computing is a necessary concept. There are data centers in which various Virtual Machines has been associated for data processing and other type of work performed by server unit. Provisioning of computing resources in an efficient manner which follows the enhanced usage of Virtualization via the internet is known as Cloud computing [1]. There is a feature that makes the frequent requirement of this technology is on demand availability which allows pure aggregation of resources such as Shared Memory, CPUs and I/O devices etc. With the help of Virtualization, we can improve the availability of computer systems in a virtualized manner to reduce the demand of keeping resources physically and further maintained them [2, 3].

To provide the better availability of computing resources for fulfilling the user demand, Migration across Virtual Machines can be one of the solutions. Therefore, it has a wide applicability and importance to satisfy the user requirements. And it helps in energy efficiency and overcoming the problem of Load unbalancing across multiple number of node servers etc. There are various methods of Virtual Machine Migration in Cloud Computing [7]:

A. Cold Migration
It is also known as Non-Live Migration because in this method there is downtime and states of Virtual Machine can be lost. It is required to switch off the VM and the state of Virtual Machine is transferred to the destination node server.
Disadvantage: The state of Virtual Machine can be lost.

B. Hot Migration
It is also known as Live Migration because in this method there is no concept of switch off the Virtual Machine and simultaneously the state of Virtual Machine is transferred to the destination node server. The research work offerings are as follows:
Firstly, an algorithm has been designed to get reduce the total migration time by keeping a record of transferring the state and all memory pages on master node server.
After that it has been implemented via a Modelling and simulation tool which is responsible of proper distribution of workload among various data centres and is known as CloudSim.
And the results have been analysed and performed an exact comparison with the existing techniques available on live migration of virtual machine and the entire data sets etc.
The proposed approach gives the better results which can be used to accelerate the migration process.
Further the remaining paper can be organized as: The Section II tells us the critical literature review and proper analysis, Section III described the procedure for proposed framework, Section IV basically explains the practical implementation scenario, further in Section V has discussed the comparison and after Section VI concludes for results and future work.

2. Literature Review
In the present scenario where cloud computing environment has taken a significant aspect in the real world in which there should be no downtime while accessing any service from internet. For providing the high time availability of cloud computing services it is required to apply live migration among virtual machines if any server node got faulty.

In this section, there is a discussion of various techniques on migration which has been given by valuable authors.
At the initial stage Dawei Huang et al. [9] has surveyed various evaluation methods on live migration, after that proposed a benchmark for live migration of virtual machine and compares it to the existing techniques available and provided some results that performed better and gives the idea of performing scalability of the Virtual Machines to take up the heavily loaded node servers and also to manage the multiple migrating requests arise on a single node server. There are certain future directions also still remained to solve and give appropriate benchmark in the running environment of virtualization.
Felix Salfner et al. [10] proposed an approach for some factors that affect the migration process and result in more downtime. The approach is based on memory load and how to access the guest server node on that time. There is a usage of two hypervisors named as VMware ESX Citrix Xen Server. By using those virtualization products an experimental analysis has been done that gives the better results for live migration among virtual machine servers nodes and gives an aspect to manage the memory page load on source node server. Experiment design and load model follows two approaches one is carried on single variable experiments where VMSIZE set to 512MB, 1GB, 2GB, 4GB and 8GB RAM and the other one which is based on multiple variable experiments. And the final results have been used to identify the proactive faulty nodes so that they can be migrated onto the other node server.
An approach named as delta compression algorithm has been proposed by Wood et. al [11] for reducing the migration downtime. This algorithm uses the certain features of pre-copy live migration technique and enhances it by applying the data compression technique which includes data deduplication along with compression.
Deduplication is used to reduce the bandwidth in accessing any requests arises so that it can give the effective results in terms of total migration time.
Ashima Agarwal et. al [12] improves reliability where any fault can arise in the case of disaster. And gives experimental results with the help of Redhat Cluster Suite which is used in Virtual
Distributed Ethernet (VDE). It ensures the decrease in downtime for the entire migration process. VDE are virtual switches that are used for creating the connection between virtual machines for creating better reliable solutions while migrating among virtual machines. Divya Kapil et. al [13] investigates a critical survey available on live migration in cloud computing environment. It involves transferring the memory pages among distinct physical node servers. There are certain future directions discussed with respect to mitigate the downtime and consumption of low bandwidth. The investigations have been compared and analysed the research gaps for creating the strength for migrating the entire load from one node server to another node sever dynamically.

Wenjin Hu et. al [14] proposed an architecture for live migration in virtualization environment to control all the virtualization platform in an appropriate manner to ensure consistency to get reduce loss of data. A technique for profiling in live migration collected and manages basic data analysis from initial point up to end of the migration and calculates the exact downtime for service unavailability. Every analysis performed under profiling in migration procedure must be done upon benchmark server. And discussed on some of the active components of Infrastructure as a service. The analysis carried on to identify the various flaws in between actual service availability and assured quality of service.

Rakesh Kumar Mishra et. al [15] proposed an algorithm with sequence of instructions such as selection of data center on the basis of Round Robin algorithm as there were many issues while selecting data centre randomly. This algorithm works in such a way that equalizes the load evenly among various data centre. There is again an issue that might be the data centres have variation in processing speeds such as some are faster and some are slower. Therefore, we have to select the optimal data centre in terms of cost and overall processing time.

Christina Terese Joseph et. al [16] applied an approach for family Gene for random allocation of various data centres.

Zhou Lei, Exiong Sun et. al [17] has given an approach based on Hybrid-Copy for migration of various virtual machines. In this algorithm Markov Model has been used to predict the accessibility of memory structure.

On the basis of forecasted results, the real situation can be identified.

Nagamani H Shahapure, P Jayarekhab et. al [18] discussed about various parameters of traffic congestion and an additional energy consumption etc. For the same an algorithm has been developed for routing of distance among various virtual machines in the system of live virtual machine migration for applying checks in a fixed interval to maintain a track of various virtual machines.

Naga Malleswari TYJ et. al [19] proposed deduplication approach for virtual machine migration in context of lesser energy consumption as well as reducing the overall cost of the system. The aforesaid algorithm can also be applied for bulky data transfer among various nodes in migration mechanism.

Amro Al-Said Ahmad et. al [20] has been given an approach on scalability analysis which describes about various cloud platforms for increasing the performance of the system if any fault arises.

In this proposed algorithm they have discussed the scalability measures in cloud software’s when auto scaling policies has been applied.

Jyoti Prakash Mishra et. al [21] has given an approach to reduce the overall energy consumption for efficient utilization of various resources such as Virtual Machine, CPU and Memory etc in cloud deployment model.

F. Orts et. Al [22] discussed about the workload distribution based on genetic Algorithm. The computation has been done with the inclusion of complex fluids depending on the statistical analysis. And also applied the basic concept of heterogeneous data in genetic Algorithm.

Mainak Adhikari [23] has proposed an approach on multi objective workflow scheduling using the optimal cloud server by applying a suitable set of VM instances that can minimize the resource consumption which in turn analyse the various parameters and after that an evaluation has been done.
3. Proposed Methodology

There are few constraints and issues in the various above aforesaid techniques of live migration such as migration overhead to transferring the entire memory pages and Virtual Machine state etc. To get rid of this kind of overhead it is requiring further optimizing the transfer of memory pages and other information. There is a need of further optimize the overall response time. In the proposed algorithm the approach is all about reduction in total energy consumption and number of migrations which tells the improved response time while execution of whole system.

The proposed algorithm has been given below:

MN1: Master Node Server which maintains the status of faulty Node.
RC1: Replica Copy of memory pages.
TNx: Target Node servers which will take over the load from faulty Node.
VMi: List of Virtual Machines
VMe: Execution state of VM

For each faulty node n;
MN1 keeps track of faulty node.
MN1 proceeds with RC1 for securing data.
MN1 requests to migrate OS from source Node to TNx.
MN1 checks availability of resources on TNx.
IF Resources are not available.
THEN Selection of TNx.
ELSE Reserve the required resources on TNx.
Suspend VM on Source Node.
Transfer the VMe.
VM Activation at TNx.
END of Transferring of memory pages
MN1 sends the updated Status to the TNx.
END.

From this above mentioned algorithm that is optimized approach from get rid of Page fault and other related issues that can be directly handled by tracker node that is a temporary node which takes care the entire load on the source and destination node server.

4. Implementation Work

The implementation work for the above proposed approach be performed via Cloud Analyst by taking User bases such as UB1, UB2, UB3, UB4 ........UB10 and Data Centers such as DC1, DC2, DC3, DC4 and DC5. The data sample has been mapped through multiple data centers such R0, R1, R2, R3 and R4 separately so that the entire load can be handled directly.

The configuration simulation for existing algorithm has been shown in the figure 1. After that the result be shown in figure 2. The proposed algorithm configuration has been shown in the figure 3.
Figure 1: Configure Simulation for the existing algorithm

Figure 2: Data Center results for the existing algorithm
5. **Result Analysis**

The implementation has been done using Cloud Analyst (A modelling and simulation tool). The results as shown in the figure while we are applying the configuration by taking multiple region selection for various User bases as well as Data centers then it is giving us the improved overall response time 270 ms in comparison to the previous existing algorithm however the total VM cost and total data transfer cost is similar. We are getting improved results by this proposed algorithm.
6. Conclusion

From this above mentioned algorithm that is an optimized approach in terms of overall response time and average data processing time. For equal Spread Current Execution, it is required to spread the entire load to multiple number of regions so that the load on node servers can be directly handled.

This proposed approach gives the better results via Cloud Analyst (A modelling and Simulation tool) for response time as well as data transfer time.

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