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LIVE VIRTUAL MACHINE MIGRATION TECHNIQUE AND SURVEY

Sheetal kumar[1] , Dr.Deepti Malhotra[2]

Abstract - Cloud computing is a dynamic technology in today's world. It provides a platform independent service which is reliable, scalable, on demand etc. Cloud computing depend on allocation of resources to accomplish consistency and economy of measure alike to utility, Virtualization is key concept of cloud computing, it is a technique which allow various operating system run concurrently on single physical server, it is used for balancing the loads on servers, managing the fault occurred and uses comprehensive strategy for energy consumption and system maintenance. There are two type of techniques used in migration i.e., pre copy and post copy, this research paper discusses study of various types of VM live migration, their taxonomies and a comparative examining of these approaches and challenges involved in live VM migration.
Keywords – pre-copy, post-copy, hybrid-copy, virtualization, cloud computing.

1. INTRODUCTION

Cloud computing is a vibrant technology in today's world, the basic concept behind cloud computing is to provide service on the user demand and pay as per usage. Cloud computing provide various services such as platform as service, infrastructure as service and software as service. In cloud the services are provided through internet and works as utility computing where there are no flat charges but charges based on the customer usage, a user can buy the resource from the service provider and pay as per the utilization. Nowadays industries are using more and more cloud services rather than investing on their own. Virtualization refers to the creation of a virtual resource such as storage, server, desktop, operating system, file or network. The main goal of virtualization is to manage workloads by radically transforming traditional computing to make it more scalable. Virtualization has been a part of the IT landscape for decades now, and today it can be applied to a wide range of system layers, including operating system-level virtualization, hardware-level virtualization and server virtualization. Virtualization is the key to cloud computing, since it is the technology allowing the creation of an intelligent abstract layer which hides the complexity of underlying hardware or software. It plays vital part in cloud computing technology, the organization of the paper is as follows: Section 2 comprises of various migrating techniques. Section 3 provides detail background of virtualization. Section 4 analyses of various performance traits. Section 5 comprises detail of live migration in cloud. Section 6 includes various issues and research challenges involved in VMM. Finally, conclusion is given in Section 7.

2. VARIOUS TYPES OF MIGRATION TECHNIQUES

Migration of whole operating system with no any obstruction of application running on it. These techniques provide the facilities of load balancing between servers, server consolidation and failure tolerance in case of immediate failure. The VMM approach are follows:

Energy Efficient Migration Techniques: - Nowadays the conservation of energy is the main perspective of migration so that energy can be optimally utilization. We know that the power consumption is mainly occurred by the servers and their cooling system and also the fact is 70 percent of energy is consumed at their less deployment level so there is a requirement of technique to save the energy of servers.

Fault Tolerant Migration Techniques: - This approach predicts the fault occurrence before it happened, so that required action should be taken to minimize the fault which improves the performance and availability of the servers involved in migration from source to target node.

Load Balancing Migration Techniques: - This approach distributes the load on various servers so that there will be no any overloading on single server, it also helps in reducing the consumption of energy and provide the resource efficiently so that load is balanced all over the migration.

3. BACKGROUND

Virtualization is a technology which allows multiple OS concurrently run on the same physical machine. VMM is an important tool used for administration of clusters and data centers. It also creates transparent separation between software and hardware. It avoids residual dependencies and provides better balancing of load where energy is efficiently used and improved utilization of resource. (VMM) allows the facility to migrate from source to destination. It is one the most

[1] Department of Computer Science & IT, Central university of Jammu, India
[2] Department of Computer Science & IT, Central university of Jammu, India

important tool for managing data center and clusters. It enables separation of software and hardware. Virtual machine migration allows efficient resource utilization, load balancing and energy saving. Virtual machine migration categorized in two types: live and non live migration Cold migration: In this virtual machine is halted and clearly noticed by the customer.
Hot migration: the status of the virtual machine remains the same, user didn't notice any interruption of service during hot migration.
There are two techniques in live migration. These are pre copy and post copy.
Post copy: Firstly, it suspends migration of VM on host node and copy minimum state of processor to goal node and start the VM, again it resumes the transfer of memory pages from host node.
Pre copy: It further splits in two phases i.e., warm up stage and stop and copy stage. In warm-up period firstly hypervisor started replicating entire memory pages from host node to the target while VM is running on host node. There may be some pages which changed during the migration process those pages mark as dirty pages, further dirty pages are recopied and stops until recopied rate is not minimum than dirtying rate of page. In stop-copy stage, the virtual machine stops in the source node and residual pages were recopied to the goal node and virtual machine again started on target node.
Energy management: virtual machine facilitates the management of energy by consolidating the servers where the less utilized servers are switched down and the consolidation servers provide power efficient green cloud.
Online maintenance: In VM migration it is an essential part where up gradation and maintenance of system is essential for availability and reliability of system connected in VM migration without any interruption.
Load balancing: If any one server is overloaded then VM migrate the load from heavy server to the low utilized server.
Clark et.al. [3]. Suggested basic idea for live migration, firstly the hypervisor mark all the memory pages dirty, then these dirty pages are transmitted from host node to destination node over the network until the transferred rate is below some threshold or reached maximum number of the iteration, all the pages which are transmitted from start to destination are marked as clean, so the pages which are left dirtied and not able to reach target node are retransferred over the network to destination. After some time, the VM stop marking on the source node and the pages which are left is transmitted to the goal node and thus virtual machine again started on the target node.
Sapuntzakis et. al. [4] have demonstrated how a complete image of an operating system can be transferred over to the network. Complete image of an operating system means the whole state of a system which includes contents in RAM, cache memory, I/O buffers, state of all the running processes and disk state. Image of an operating system also developed some techniques for data reduction over the internet. A copy-on-write technique also called shadowing is also used for tracking updates to image disks, demand paging and hashing techniques are used to reduce the network overload. Demand paging only send the required block of data and hashing helps to avoid sending already existing blocks at the remote node.
Nelson et. al. [5] represents the VM migration design which performs quick and clear migration of application from source to the destination node during this migration there is no any need of altering the operating system or application. Calculation of performance of VM is based on the industry benchmark where hundreds of VM are migrated simultaneously, which displays the downtime of application and various workloads below one second.
Huang et al. [6]. Designed efficient virtual machine migration that uses Remote Direct Memory Access, this technique provides the connectivity of two geographically located computer through direct access to their memory rather than connecting the operating system and the connection between the two computer is possible by the emerging technology i.e., InfiniBand which helps in directly read write the memory and features high throughput and very low latency.
Luo et. al. [7] designed a three phase algorithm and incremental migration algorithm which enables the VM back to the host node in a quick interval of total migration time, this approach includes the whole system of migration which involve CPU state, memory and storage disk of data.
Bradford et. al. [8] have given a method for migration of VM in this approach live migration of VM does not interfere with the network connections to and from virtual machine. This approach uses local storage for state persistence and the consistency is guaranteed for the local storage at the start and target end during migration. This approach can handle high write intensive virtual machine migration. Researchers have assessed the concerns in live virtual machine migration and proposed several performance traits.
Voorsluys et. al. [9] calculate live VM migration which are running in Xen VM. The results are further analyzed which show that overhead are suitable but not omitted specifically in the system where availability is controlled by rigid SLAs.
Kuno, et. al. [10] demonstrate both the performance of VM migration (hot and cold) and analyzed that the processes performance is decreased during the live migration of system it is due to the writing on memory and communication between OS and also lessen due to migration transmission. Feng et. al. [11] Firstly compare performance of VMotion and XenMotion. Which results in better total migration time of VMotion than XenMotion, both performance decline when handle network with delay and loss of packets.

4. PERFORMANCE METRICS

Various traits analyze performance of virtual machine migration are:
(1)Preparation Time: It is the time when migration started on the host machine and further start dirty its pages.
(2)Down Time: It is the time when virtual machine execution is halted which include processor state transfer.

(3)Resume Time: The time when all the execution shifted from source to the target point, then the time between resuming it to target and end the migration which further eliminates the dependencies on start node.
(4)Pages Transferred: It comprises the total number of memory pages including duplicate in all above time.
(5)Total Migration Time: It is defined as the total time required in whole the migration since from start up to end of migration, it is also significant as it affects releases of the resources.
(6)Application Degradation: It is the degradation of application during the migration form source to destination; it also affects the performance of application.

5. LIVE VIRTUAL MACHINE MIGRATION IN CLOUD

Live VMM is a dynamic mechanism for cloud administration and clustering. This enables administrator to transfer the entire OS with instance from one machine to another thus machine can have brought down for maintenance and load is transferred from one machine to another. In live migration technique the runtime occurring on the host machine is transferred to goal node as VM still running on. VMM consist mainly two types of techniques: Precopy and Post-copy migration technique. In postcopy technique the VM firstly halt the migration in host node and transferred minimum state of processor on the target node further again starts fetching the pages.
Further Pre-copy consist two approach: Warm-up and Stop-and-Copy. In warm-up approach firstly the hypervisor copies all the memory pages from host to goal node and VM is still running on host machine. If any of the page altered while copying, then the pages are recopied until the rate of recopying become less than the rate of copied pages, then stop-and-copy phase is halted on the start node and further remaining pages will copied in target node.
Pre-Copy Phase: In this stage, the VM iteratively copied the active memory pages from host node to goal node, where iteratively is defined as algorithm which performs on round, as it takes some time to completely copied memory pages during VM is operating on the host machine, during memory migration few pages might be infected and resend in another round to make certain memory reliability.

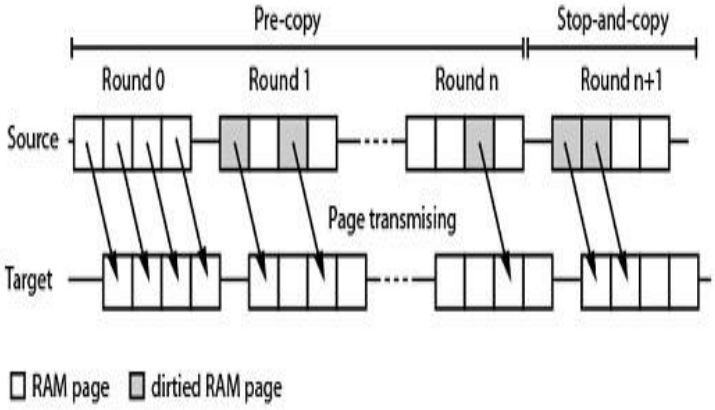

Fig Algorithm presents transfer of memory [12]

Pre-Copy Termination Phase: It is the phase where the stop condition is checked because it may lead to indefinitely iterative condition, stop condition depends on propose of hypervisor but determined by threshold.

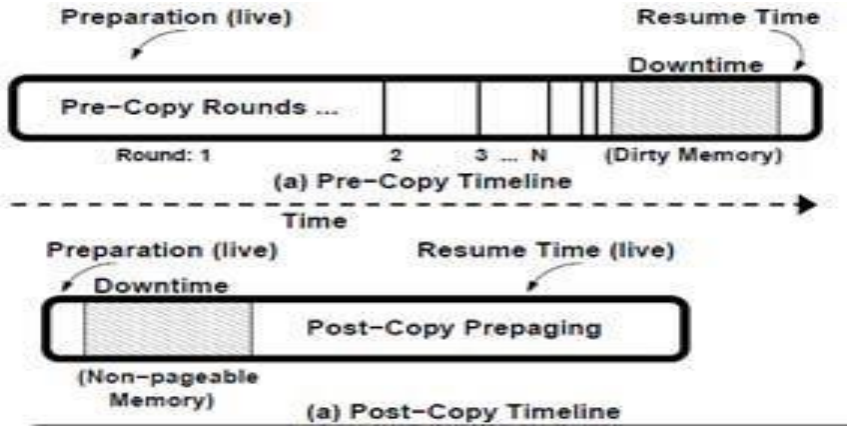

Fig Pre-copy and Post-copy [12]

Stop-and-Copy Phase: Hypervisor discontinue virtual machine at this stage to stop page dirtying and copy the remaining dirty pages and state of CPU register to target node. The hypervisor resumed on the target host, after the migration process is accomplished.

Hybrid Virtual machine migration: This migration technique includes both pre-copy and post-copy, firstly all memory pages copied from host to destination node. Therefore, the page faults occurred in the post-copy phase can be efficiently minimized. The hybrid-copy algorithm copies all memory pages in advance only once and immediately the processor state is also transferred from source to destination takes place.

6. OPEN ISSUES AND RESEARCH CHALLENGES

This work display analysis of various approaches used in VMM. All parameters effect the migration cost value. Hence there is no any particular migration model which evaluates the performance loss and energy overheads in today's world, security of the migration is also one of the important concern in virtual machine migration.

7. CONCLUSION

In this paper different virtual migration techniques are discussed. The paper also presents the various performance traits analyses the performance of the virtual migration techniques.

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