Virtual Machine Migration in Cloud Computing

WAQAS HASAN

Dept. Computer Science, Bahria University Karachi, Pakistan.

Abstract
Cloud computing provides multiple services to users through the internet and these services include cloud storage, applications, servers, security and large network access. Virtual Machine allows the user to emulate multiple operating systems on a single computer; with the help of virtual machine migration users can transfer operating system instances from one computer to multiple computer machines. In this paper we will be discussing VM migration in cloud and also I will explain the whole procedure of VM migration. The two methods through which we can perform VM migration are Live VM migration and NON-live VM migration. VM migration also helps in managing the loads of the multiple machines and with VM we can save power consumption. People have written about cloud computing and virtual machines in previous studies, but in this research, we'll speak about virtual machine migration in cloud computing, as well as the techniques that are used in the VM migration process. I have used table to show the differences between VM migration techniques.

Introduction

Virtual Machine gives users the ability to run multiple operating systems on a single physical device. However, there will come a time when the computer machine's memory will be full, causing the computer machine to slow down. To address this issue, we can use VM migration, which allows users to transfer operating system instances from one physical computer machine to multiple physical computer machines. Previously, in order to use cloud migration techniques, users had to shut down their computer systems in order to transfer the OS, which caused disruption, So, to overcome this problem, a migration technique has been introduced which is called live VM migration. The amount of downtime and disruption caused by live VM migration is negligible.

Hypervisor

Hypervisor which is also called Virtual Machine Monitor is an emulator, hardware, software which gives computer machine the ability to run multiple operating systems (Virtual Machines) at the same time. The virtual machines are also called guest machines and the physical machine in which the guest machines are running is called host machine.

CONTACT Waqas Hasan ✉ waqashasan94@gmail.com ⚲ Dept. Computer Science, Bahria University Karachi, Pakistan.
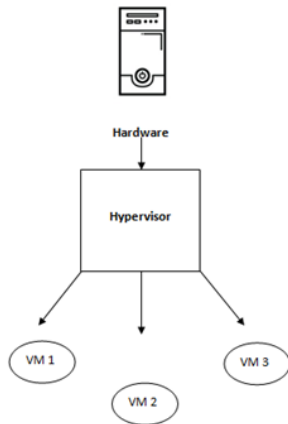
Fig. 1: Hypervisor

Vm Migration has Two Important Things to Consider
Vm Downtime/Latency
Virtual machine downtime is the time at which users can not use services of the VM; during VM downtime the VM services are not available to the users.

Vm Migration Time
The time taken by VM to migrate from host machine to destination machine is called VM migration time.

Objective
The aim of this paper is to learn about virtual machine migration procedures and to assist people in learning more about virtual machine migration and how it is achieved. We will explore the techniques and significance of VM migration, as well as the benefits of VM migration and cloud storage in this paper.
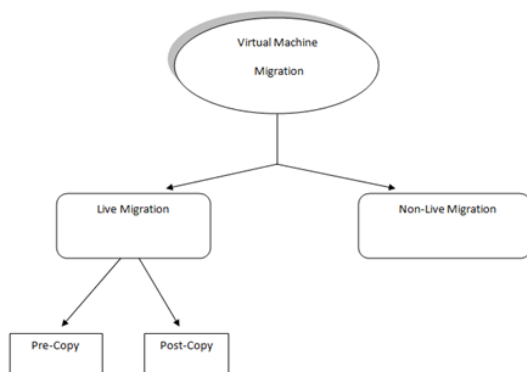
Working

Fig. 2: VM Migration

Non-Live Vm Migration/Cold Migration
Non-live migration is a VM migration procedure in which the VM must be shut down in the host machine before transferring VM from the host computer to the destination computer.

Live Vm Migration/Hot Migration
Live VM migration is a VM migration procedure for transferring virtual machines (VMs) from one machine to another without causing any downtime. No need to shutdown host machine.

Techniques and Methods of Live Vm Migration
There are two types of methods and techniques which are used in live virtual machine migration.

Pre-Copy
Warm-Up-Phase
The hypervisor copies all of the memory from the host machine to the destination machine during pre-copy process, and during warm up phase the VM continues to work on the host machine without any downtime, If any memory pages alter (become "dirty pages") during the pre-copy memory migration phase, the iteration process will re-copy the dirty pages until we have all of the original memory pages.
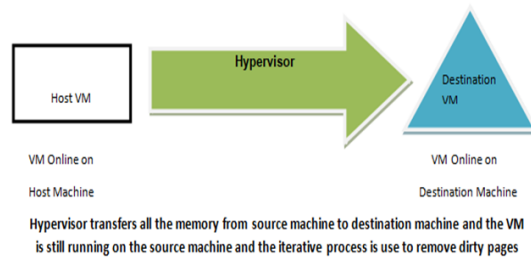

Fig. 3: Warm-up-phase

Stop-And-Copy Phase
In stop-and-copy phase the VM will halt on the host machine server, the remaining dirty pages will passed to the destination machine and then VM would then start at destination computer.
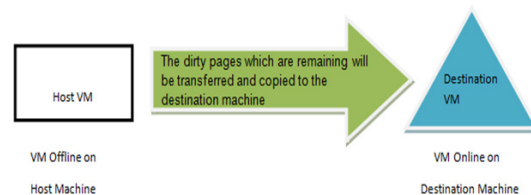

Fig. 4: Stop-and-copy Phase
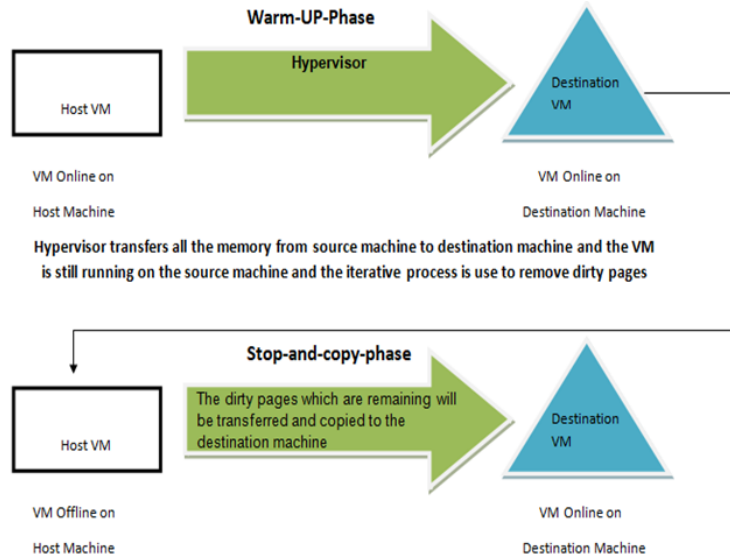
Merging Warm-Up-Phase and Stop-and -Copy Phase

Fig. 5: Merging both phases of Pre-Copy

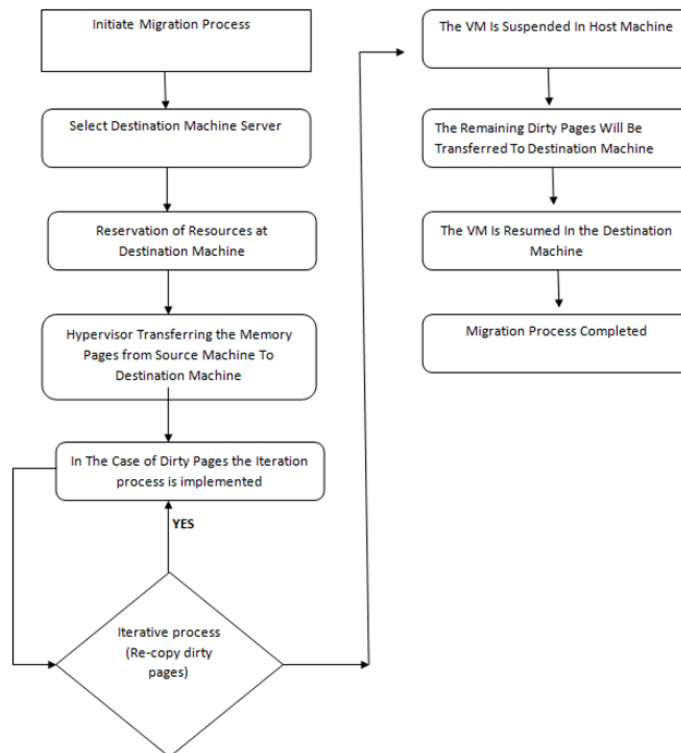## Representation 2(Pre-Copy)

Fig. 6: Representation 2(Pre-Copy)

Post-Copy

Post-copy VM migration begins with the host machine halting and suspending the VM; when the VM is suspended, a limited portion of the VM's execution state is passed to the destination machine, and the VM is then restored at the destination machine. Around the same time, the host machine moves the host machine's remaining memory pages to the destination machine. This is referred to as the pre-paging method; a fault would be generated if the VM on the destination machine attempted to read a memory page that had not yet been transferred to the destination machine. These errors are called network errors, and these errors will stuck at the destination machine and then these errors will be re-routed to the host machine, resulting in faulted pages being generated, and having so many network errors will reduce performance of the VM, to overcome these errors PRE-PAGING process is use.
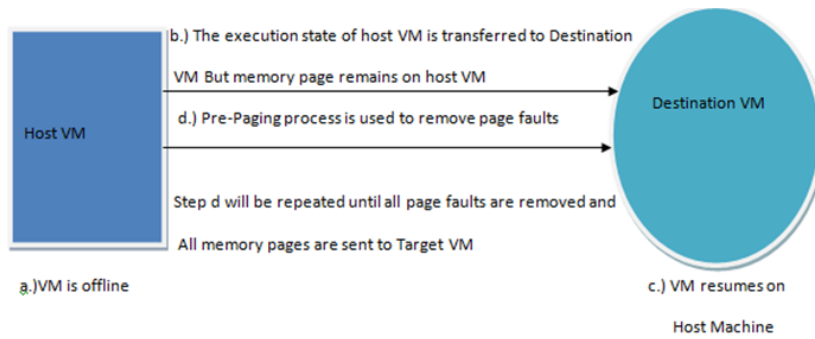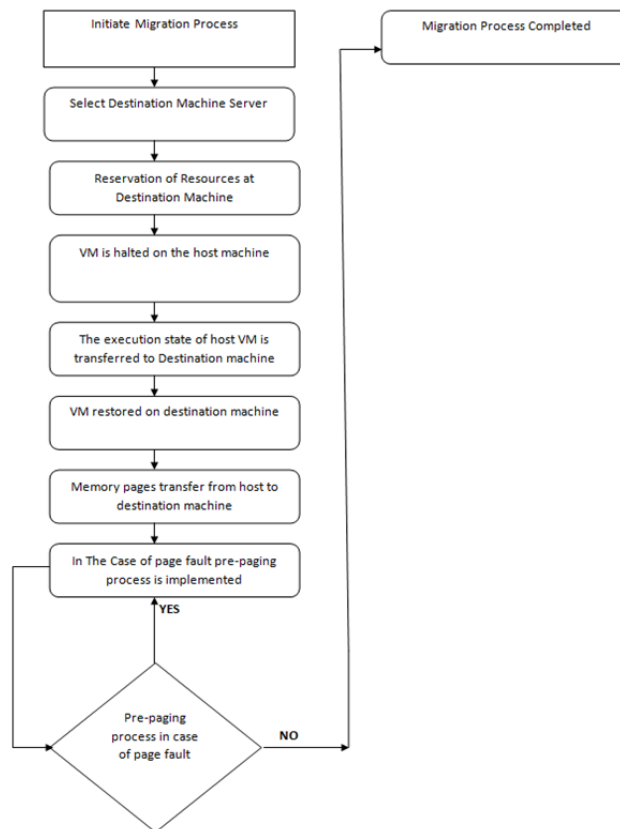

Fig. 7: Post-Copy

Fig. 8: Representation 2(Post-Copy)

Table 1

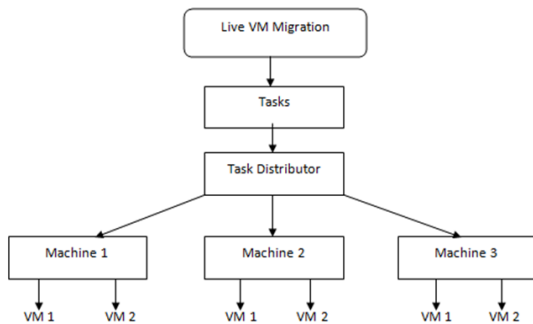|	Advantages	Disadvantages
Pre-Copy	• If you choose to stop the migration process during the warm-up phase, the system will not crash since the VM on the host computer is still functioning. • users have to face a less amount of downtime as compared to post-copy.	• Users have to face small amount of downtime during stop-and-copy-phase • In comparison to post-copy, the overall migration time is higher.
	Advantages	**Disadvantages**
Post-Copy	• In comparison to pre-copy, the overall migration time is shorter.	• Large number of page faults can create performance issues in the VM. • In post-copy the VM is suspended in the host machine at the beginning so the user has to face a higher amount of downtime as compared to pre-copy.

Fig. 9: Task Distributor

Advantages
Performance Handling

• VM migration helps in increasing the performance of the machine by distributing the work load of a single machine to multiple machines
• Sometimes too much load can decrease the performance of the machine so to overcome this problem we can use live VM Migration to distribute load of a single machine to multiple machines

Server Failure Recovery
In case of server failure VM migration transfer user from the bad server to the working server with a very low amount of downtime

Robust
If one VM fail the other VMs will continue to work without any problem

Energy Saving

• VM migration allows the users to save energy by combining the load of several server computers into one single physical unit (machine).
• VM migration allows single machine to handle the workload of multiple machines
• By handling the load of multiple machines the load of the other machines decreases hence less electric energy is used.

Security
• The data in one virtual machine is completely isolated from the other virtual machines which are running in the same physical machine
• Data isolation safe data from viruses
• If a data of single VM is attack by a virus the data of the rest of the VMs will not be affected by the virus because all VMs are isolated and separated from each other

Conclusion
In this survey paper I have explained Virtual memory and VM migration techniques and also explained how these VM migration techniques work.

I have focused mostly on live VM because non-live VM migration is not very efficient because in non-live VM migration the user has to shut down the host computer machine before transferring the VM to the destination machine.

Users have extremely little downtime while migrating to a live VM, making it more dependable and efficient than non-live VM migration.

My final conclusion is that there is room for improvement in both pre-copy and post-copy because they both have issues and drawbacks. In pre-copy, the stop and copy phase produces a little bit of downtime when transferring dirty pages, and in post-copy, the faulted pages create a little amount of downtime.

Conflict of Interest
The authors do not have any conflict of interest.

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