ISSN: 0975-766X
CODEN: IJPTFI
Available Online through *Review Article*
www.ijptonline.com

COMPARISON OF LIVE MIGRATION OF VIRTUAL MACHINES IN CLOUD COMPUTING ENVIRONMENT

V.Jayanthi, S.Nagadevi
PG Student, Department of Computer Science, SRM University, Chennai.
Assistant Professor(O.G),Department of Computer Science, SRM University, Chennai.
Email: jayanthiv1993@gmail.com

Received on 11-01-2017 *Accepted on: 30-02-2017*

Abstract

Cloud computing is an emerging computing technology which aims to share data calculations and services transparently among users of a massive grid. It relies on sharing of resources to achieve coherence and economy of scale, similar to an electricity network. In cloud computing, a virtual machine (VM) is an emulation of a computer system. A key feature of live migration is the movement of a virtual machine from one physical host to another without shutting down the client. Live-migration performance testing motivates the need for a better multi-VM migration strategy. Live Migration is always be used when transferring Multiple VMs. The system goal is to efficiently migrate multiple Virtual Machines(VMs) within the hosting infrastructure with minimum service interruptions(downtime) and also to minimize the total migration time by optimising the bit rate for migrating large pools of VMs.

1. Introduction

Cloud computing is a type of Internet-based computing that provides shared resources and data to computers. Cloud computing can be categorized into the following types: Public Cloud is a publicly accessible cloud environment owned by a third party cloud provider. The cloud provider is responsible for the creation and ongoing maintenance of the public cloud and its resources. Private cloud is owned by a single organization [1].It allows an organization to use cloud computing technology as a means of centralized accesses to resources by different parts, locations or departments of the organization. Hybrid Cloud is a cloud environment comprised of two or more different cloud deployment models. The series of cloud computing are broadly divided into three categories:

- Infrastructure as a Service(Iaas):- which allows customers to use computing resources such as storage platform as a service which is a development platform, and processing power.

- Platform as a Service (PaaS):- It is a development platform supporting the full "Software Life Cycle" that allows cloud consumers to develop cloud services and applications.
- Software as a Service (SaaS):- which delivers special purpose software that is remotely available to consumers.

Cloud computing is also divided into five layers including clients, applications, platform, infrastructure and servers. In a cloud data centre, virtualization technology is widely accepted because of its imposing advantages in cost savings, resource utilization, resource management[2]. One of the most significant advantages of live migration is the fact that it facilitates passionate maintenance. If an unavoidable failure is suspected, the potential problem can be resolved before failure of service occurs. Live migration allows an administrator to take a virtual machine offline for maintenance or upgrading without causing the system's users to downtime., in which work is shared among computers in order to optimize the utilization of available CPU resources.Fig.1 depicts the VM migration from one host to another.

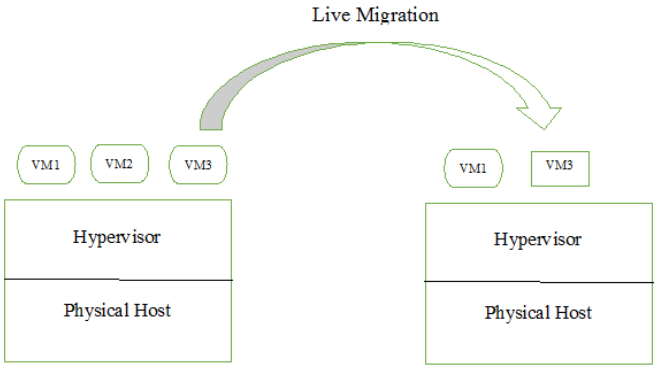

Fig.1 Migration of Virtual Machine.

2. Related Work-Live Migration of Virtual Machine (VM)

The Pre-Copy and Post-Copy technique [3] has been used to analyse the performance of live migration of virtual machine in multi-tier workloads in virtualization environment**.** In live migration the workloads are classified as single-tier workload and Multi-tier workloads. A single-tier workload runs on single host and does not exchange data with another host. The Multi-tier workloads are composed of a set of workloads running on different hosts. Multi-tier workloads based on features such as Group work, Interactive and Single-Node Failure. The Pre-Copy and Post-Copy technique is used for analysing the performance of live migration in multi-tier workloads. The Pre-Copy technique is used to copy all the memory pages from one host to another host while virtual machine is still running on the source. In post-Copy technique few subset of execution state of virtual machine is transferred to the target by suspending the virtual machine at source.

The experimental results shows that multi-tier workloads on virtual machines can work as well as those on traditional physical machines. But due to migration overhead, live migration will cause performance decrease in multi-tier workloads in an unstable environment**.**

The Routing and Bandwidth Allocation (RBA)[5] algorithm is used to measure the performance of livemigration of Virtual Machine in cloud environment. This is an optimization Algorithm which is calculated in terms of migration blocking probability and network resources. The probability in which a live VM migration cannot be accommodated in network resources utilization. Then the only possibility is that to provision VM migration requests with bandwidth that could be beneficial for efficient network resource utilization. In order to improve the network performance, bandwidth has been allocated for the purpose of migration in virtual machine. Bandwidth is reserved in source and destination data centres. By assigning high bandwidth performance can be achieved in live migration of virtual machine. But the problem is performance decreases with low bandwidth assignment.

Dynamic Resource Allocation Algorithm [6] had been proposed for scheduling tasks for Iaas cloud system. The two online Dynamic Resource Allocation Algorithm are Dynamic Cloud min–min scheduling (DCMMS) and Dynamic Cloud list scheduling (DCLS). Originally min-min algorithm does not consider the task dependency but in dynamic min-min algorithm, the mapped task need to be updated to maintain the task dependency in every scheduling step. In Resource Allocation model, there are two different modes for renting the computer capacities such as Advanced Reservation(AR) (i.e) the resources are reserved in advance they should be available at specific time and another mode is Best-effort. Requests are placed in a queue and resources are provisioned as soon as possible. The Algorithm adjust the resource allocation dynamically based on the updated information of the actual task executions. In Infrastructure-as-a-Service (IaaS) cloud computing, computational resources are provided to remote users so that he/she can request multiple cloud services simultaneously. In cloud system the processing can be done in parallel in order to improve the performance. The main benefit is that the algorithm can significantly improve the performance and reduce the energy consumption in cloud system.

Pre-Copy mechanism [7] has been implemented to obtain two metrics namely Total Migration time and Downtime. Bandwidth Allocation mechanism has been designed based on Pre-Copy mechanism. The bandwidth has to be theoretically analysed to obtain the Total Migration time and Downtime. In Pre-copy migration, the OS execution is not stopped during the transfer. All the pages are transferred using the minimum bandwidth at first round. The bandwidth used for subsequent rounds equals the summation of the dirtying rate of the previous round and a constant

increment. A maximum bandwidth value is given to avoid too much of bandwidth in migration. The results shows that the bandwidth obtained from experimented model guarantees both total migration time and downtime. In order to guarantee bandwidth, a transport protocol rSAB is designed. rSAB is proposed to allocate bandwidth to VM migration flows. The reciprocal-based model well characterizes the dirtying frequency of the memory pages. Based on the results of the reciprocal-based model, the delay bound of live migration can be guaranteed. The problem with migration is that maximum bandwidth value has to be allocated for migration to take place.

Remote Page-fault Filter (RPFF) [8]is used for Post-Copy live migration of virtual machine. Pre-Copy Live migration causes network overhead which leads to slow migration whereas Post-Copy live migration approach can provide quick migration with low network overhead but would lead to a lot of remote page faults. The remote Page faults would degrade the application performance. Hence we need to improve the post-copy approach by eliminating unnecessary remote page faults. In post-copy live migration With RPFF, remote page requests caused by page overwriting operations are redirected to local memory instead of fetching the pages from the source host over the network. The problem in live migration of virtual machine is that lot of page faults occurred in post-copy approach.

Multiple VMs migration scheduling Algorithm [9] is used to maximize the performance of migration. Live Virtual Machine(VM)migration allows the application or VM to move from one host to another without disconnecting the client. Live migration consists of two approaches namely Pre-copy live migration and Post-Copy live migration approach.

In Pre-Copy live migration approach all memory pages of migrating VM are transferred to target Physical Machine (PM) and memory pages are copied iteratively at copy phase and sent to the target PM whereas in Post-Copy live migration approach the VM at source PM is stopped at the beginning of migration, memory pages are sent to target PM to resume its operation there.VM migration scheduling is an Optimized Algorithm to migrate multiple VMs on any data centre with minimum total migration time and total migration downtime. The authors done this experiment through simulation. The result shows that the algorithm can migrate multiple VMs to reduce the total migration time and downtime. The problem is that live VM migration ignore the inter-VM dependencies, and network topology and its bandwidth.

VM buddies [10] has been used to solve the correlated VM migrations problem in multi-tier application. Inorder to reduce the migration cost, VM buddies coordinates VM migrations with a synchronization protocol and an optimal network bandwidth allocation algorithm. Bandwidth allocation is done based on static workload migration and

dynamic workload migration. The static workload migration uses single VM as building block to analyse the migration cost. But the migration completion time has negative effect on application performance. The dynamic workload migration page dirtying rates has been temporarily changed to design the bandwidth. In VMbuddies, network bandwidth must be allocated to each migration process to minimize total migration cost of multitier applications. The problem is that the bandwidth allocation leads to performance degradation but it reduces the migration cost of multi-tier applications.

Eviction Time [11] is a new metric has been introduced for live migration of Virtual Machine. Eviction time is the time to evict from one or more VMs from source host. With Eviction time the source can be taken offline quickly. To reduce eviction time source and destination has to be decoupled by Scatter-Gather live migration. The source should quickly unload the state of migrating VMs, preferably at its maximum transmission rate, whereas the destination should retrieve and resume the VMs. To reduce the eviction time Scatter-Gather live VM migration for migrating one or more VMs in cloud environment. The benefit of scatter-Gather approach is to reduce the eviction time. The eviction time would leads to increase in network overhead.

Geometric programming model and online multi-VM live migration algorithm [12] is used for live migration of Virtual Machine(VM) in cloud environment. The geometric program is used to minimize the total migration time via optimal bit-rate assignments. But multi-VM live migration algorithm reduces the migration time based on bandwidth allocation for each dirty page memory transfer. The online Algorithm has been compared with offline Algorithm to analyse the performance of live migration of Virtual Machine. The performance of VM live migration is based on two parameters namely downtime and total migration time [14].The downtime measures the impact of the migration on the end-user's apperceive quality of service, whereas the total migration time measures the network infrastructure in cloud environment. The benefit of geometric programming model is to minimize the total migration time and downtime. But the problem is that the number of Iteration process in pre-copy phase is not efficient. Since the time for VM pre-copy increases.

Hierarchy Token Bucket Algorithm [13] is used to improve the performance of live VM migration traffic and VM to VM communication. Live migration allows the VM or application to move from one host to another without disconnecting the client. Live migration is based on three approaches namely Pre-Copy, Post-Copy and Hybrid approach.

In Pre-Copy approach, the memory pages are copied to the state before its execution on destination node. The Post-copy approach transfers the execution state at destination node at the beginning of migration phase. The hybrid approach is the variation of Post-Copy approach but limited Pre-Copy approach. The benefit of token bucket algorithm is that it helps to reduce live VM migration latency and downtime. Due to live migration traffic, it leads to communication overhead.

3. Comparison of Live Migration of Virtual Machine(VM)

S.No	Approaches	Advantages	Disadvantages
1.	The Pre-Copy and Post-Copy technique	Multi-tier workloads on virtual machines can work as well as those on traditional physical machines.	Live migration will cause performance decrease in multi-tier workloads due to migration overhead.
2.	The Routing and Bandwidth Allocation (RBA)	Reduce in energy consumption.	Performance decreases with low bandwidth assignment.
3.	Dynamic Resource Allocation Algorithm	It improves the performance and reduce the energy consumption in cloud system.	Increase in migration cost.
4.	Pre-Copy mechanism	The total migration time and downtime reduces.	Migration will take place only if maximum bandwidth is allocated.
5.	Remote Page-fault Filter(RPFF)	It leads to degrade the application performance.	Lot of page faults occurred in post-copy approach.
6.	Multiple VMs migration scheduling Algorithm	The total migration time and downtime reduces.	Live VM migration ignore the inter-VM dependencies, and network topology and its bandwidth.
7.	VMbuddies	The migration cost of multi-tier applications reduces.	The bandwidth allocation leads to performance degradation.

8.	Eviction Time	Scatter-Gather approach is to reduce the eviction time.	It leads to increase in network overhead.
9.	Geometric programming model and online multi-VM live migration algorithm	Minimizes the total migration time and downtime.	The number of Iteration process in pre-copy phase is not efficient. Since the time for VM pre-copy increases.
10.	Hierarchy Token bucket Algorithm	It helps to reduce live VM migration latency and downtime.	It leads to communication overhead**.**

4. Conclusion

Live migration is to move the virtual machine from one physical machine to another without any disturbance to clients. Live virtual machine migration is helpful for the cloud service providers as it saves the server energy consumption and the time to allocate the memory space requested by the clients. Efficient Live migration technique as discussed in the above algorithm leads to reduction in migration overhead and also reduction in the total migration time and user perceived service interruption(downtime). Efficient VM migration results in increase in reliability with business activity.

5. References

1. Swapnil M. Parikh,"A Survey on Live Virtual Machine Migrations and its Techniques", in Computer Engineering and Intelligent Systems,2014.
2. Nikhil Karkare," A Survey on the Live Migration of Virtual Machines", in Proceedings with International Journal of Engineering Research & Technology,2014.
3. Xiaohong Jiang, Fengxi Yan, Kejiang Ye," Performance Influence of Live Migration on Multi-Tier Workloads inVirtualization Environments", in Proceedings with The Third International Conference on Cloud Computing, GRIDs, and Virtualization,2012.
4. Qiang Huang, Fengqian Gao, Rui Wang, Zhengwei Qi," Power Consumption of Virtual Machine Live Migration in Clouds", in Proceedings with Third International Conference on Communications and Mobile Computing,2011.

5. Omran Ayoub, Luca Pace, Francesco Musumeci, Achille Pattavina," Dynamic Routing and Bandwidth Assignment for Live Virtual Machines Migrations", in Proceedings with 20th International Conference on Optical Network Design and Modeling (ONDM 2016), May 9-12, 2016, Cartagena, Spain
6. Jiayin Li , Meikang Qiu , Zhong Ming, Gang Quanc, Xiao Qin , Zonghua G , "Online optimization for scheduling preemptable tasks on IaaS cloud systems", in Proceedings with IEEE transaction on parallel distributed computing,2012.
7. Jiao Zhang, Fengyuan Ren, Ran Shu, Tao Huang, and Yunjie Liu," Guaranteeing Delay of Live Virtual Machine Migration by Determining and Provisioning Appropriate Bandwidth", in Proceedings with IEEE transactions on computers,2016.
8. Kui Su, Wenzhi Chen, Guoxi Li, Zonghui Wang," RPFF: A Remote Page-fault Filter for Post-copy Live Migration", in Proceedings with IEEE International Conference on Smart City/SocialCom/SustainCom together with DataCom 2015.
9. Tusher Kumer Sarker and Maolin Tang," Performance-driven Live Migration of Multiple Virtual Machines in Datacenters", In Proceedings with IEEE International Conference on Granular Computing (GrC),2013.
10. Haikun Liu and Bingsheng He," VMbuddies: Coordinating Live Migration of Multi-Tier Applications in Cloud Environments", in Proceedings with IEEE transactions on parallel and distributed systems 2015.
11. Umesh Deshpande, Danny Chan, Steven Chany, Kartik Gopalan, Nilton Bilaz," Scatter-Gather Live Migration of Virtual Machines", in Proceedings with IEEE Transactions on Cloud Computing 2015.
12. Flavio Esposito, Walter Cerroni," GeoMig: Online Multiple VM Live Migration", in Proceedings with IEEE International Conference on Cloud Engineering 2016.
13. Robayet Nasim, Andreas J. Kassler "Network Centric Performance Improvement for Live VM Migration ", in proceedings with IEEE 8th International Conference on Cloud Computing,2008.
14. Felix Salfner, Peter Troger, Andreas Polze," Downtime Analysis of Virtual Machine Live Migration", in Proceedings with The Fourth International Conference on Dependability,2014.