The improvement of Live Migration in Data Center in different virtual environment

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Abstract

In this paper we are going to reinforce Business Benefits of Cloud Computing, concentrating in backup technology referring to live migration technology. We have compare the time of live migration during a backup transition by using different hypervisors such as: ESX-I, XEN, OpenVZ and Hyper-V on a Cloud, which means that different Data Storage in different locations. Also we have improve the performance of live migration on such Hypervisors by implemented a program code in C called C_Software. It is implemented in User Space and it is part of each operating system which setup over those hypervisor. This means that it is independent from the type of Hypervisor. We are focused on Cloud Technology. From those experiments we can check that live migration is reduced in all Hypervisors mostly in XEN.

Keywords: Hypervisors, Live Migration, Cloud, C Software.

1. Introduction

IT infrastructures in different companies give the possibility to operate efficiently and to adapt the incremental changes in business operations. This is reason that many companies are already using virtualization technology. Some of them are using service-oriented architecture (SOA) to improve their existing IT investments and get additional flexibility and responsiveness from their existing systems infrastructure. Most of the companies are now at the point where they need to move from an internal focus to an external focus on supporting collaboration and new product development by using cloud computing.

There are some benefits to building applications in the cloud. A few of these are listed here: *Almost zero upfront infrastructure investment*: If you have to build a large-scale system it may cost a fortune to invest in real estate, physical security, hardware (racks, servers, routers, backup power supplies), hardware management (power management, cooling), and operations personnel [1]

Just-in-time Infrastructure: In the past, if the application became popular and the infrastructure did not scale we became a victim of own success. Conversely, if you invested heavily and did not get popular, we became a victim of our failure [2]. By deploying applications in-the-cloud with just-in-time self-provisioning, we do not have to worry about the pre-procuring capacity for large-scale systems [1]

More efficient resource utilization: System administrators usually worry about hardware which run out of their capacity or conversely when they have idle capacity. With the cloud, they can manage resources more effectively based on the applications request .

Usage-based costing: With utility-style pricing, the client billed only for the infrastructure that has been used. The client do not pay for allocated but unused infrastructure. This adds a new dimension to cost savings.

Reduced time to market: Parallelization is the one of the great ways to speed up processing. If one compute-intensive or data-intensive job that can be run in parallel takes 500 hours to process on one machine, with cloud architectures [3], it would be possible to spawn and launch 500 instances and process the same job in 1 hour. Having available an elastic infrastructure provides the application with the ability to exploit parallelization in a cost-effective manner reducing time to market.

Cloud backup systems that automatically capture system information, as well as data, enable to easy restore a full system to alternate hardware at a new location, with only minimal technical staff assistance.

In addition, by using solutions that allow to control retention scheduling and policies for data, we can select the level of protection appropriate for specific types of data on a per-server, or even per-folder, basis.

In this paper we continue with Related Works. At third section we are focused to the difference of Cloud

Technology and Virtualization. At the forth section we continue with Experimental Description and results. At the end there are some conclusions.

2. Related works

In [4] there is an improvement performance by using clear page method in XEN by using precopy and postcopy approach. One of the very interesting method is Self Ballooning which reduce the dirty pages and reduce the time migration. In [5] there is a performance of live migration in different Hypervisors. In those hypervisors XEN PV has the best performance. In [6] there is estimated the time of live migration by using TCP and UDP protocol on KVM and OpenVZ Hypervisor. Some test are executed with open source hypervisors with IP Mobility in [7]. In this paper there are some environments which offer the possibility to reduce the time of live migration by using some methods over the hypervisors. Those experiments performed in IP Mobility Phones. In this paper it is clear that the improvement of live migration is not depend on type of Hypervisors.[8]shows us an analytic approach of Hyper-V. Based on this analytic approach, is evaluated the live migration approach and the ratio of this feature with resource utilization.

3. Cloud Computing vs Virtualization

Cloud Computing is beyond the Virtualization Technology. The virtualization are related terms in resource optimization of IT infrastructure. Virtualization is a technology used in Cloud Computing concept. Virtualization is using the same hardware infrastructure to build several virtual servers as per the requirements. For instance if we need a Windows Server and Linux server for different purpose, we can build this in a same physical server by using Virtualization technique above the Hypervisor such as: XEN, OpenVZ, ESX-I, Hyper-V etc. Very interesting question is: Which is the difference between Soft Virtualization and Hard Virtualization?

Virtualization is using the same hardware infrastructure to build several virtual servers as per it needs. If we put this up in a layered architecture layer 1 would be SAN (Storage Area Network), layer 2 would be hardware servers (blade servers) for the resource allocation and the top layer would be host server. Virtualization software like Citrix, VMware's vSphere, Xen, Microsoft Hyper V, Sun xVM will run on the top layer servers which are called host servers. Host server run any operating system and the virtual servers can be built on any operating system as per requirement [9].

Virtualization technique was introduced to achieve the optimized usage of hardware devices and reduce the maintenance burdens and related costs. Virtual sever with the same configuration as dedicated server, will give the exact performance what dedicated server can perform if required. The above mentioned technique is called Soft Virtualization. There is another technique called Hard Virtualization which is done by allocating dedicated resources when building the server. This can be done on branded servers only with the Pre OS. This is basically a physical partition of resources and will not achieve the maximum resource utilization.

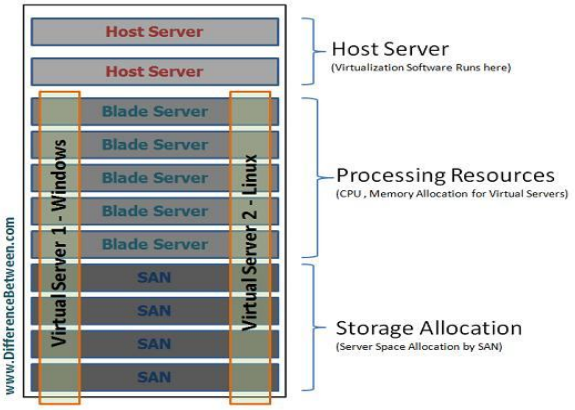

Fig. 1. Big Picture of Data Center

Cloud computing concept is to deliver virtual servers with a specific configuration details with specific operating system, applications and services. The physical location of cores (Processorsor computation power), software, data access and storage space is immaterial to the users. Cloud Computing uses the virtualization technique in order to achieve its criteria. Basically Cloud Computing is a collection of Virtualization Technique, SOA (Service Oriented Architecture), Autonomic and Utility Computing. The business concept behind this is, rather having each physical server for each services or applications on-site, you can hire an off shore or off site virtual server from a cloud computing provider. Corporate can define the requirement specification and give it to the cloud computing provider or calculate the resource requirement and order for a cloud server online. Cloud Computing incorporates IaaS and SaaS (IasSvsSaaS). IaaS means Infrastructure as a Service and SaaS is Software as a Service. Rather than investing on Servers, SAN, Softwares, Rack Space, Network Devices, Bandwidth, maintenance workforce its better to buy a cloud server service from a cloud computing providers. In this model corporate does't need to invest large amount of money in infrastructure and do not need to bare repair costs or maintenance cost. Software as a Service (SaaS) is a concept to provide software services to corporate on the virtual IaaS platform.The installation files or binaries will be kept in the host server where the virtualization software is running and will be installed on virtual servers such as [10]. So with IaaS and SaaS, Cloud computing providers should be able to provide entire solution in a single virtual box according to the customer's needs. For instance if you want to run a server for Microsoft Exchange Server for staff mailing purpose, rather buying a physical server and spend more resources you could buy a cloud box with MS Exchange

installed with internet connection or VPN connection to corporate network.

4. Proposed approach

In C we have built a C program which is independent from the environment because it is implemented in user space.This program is approximately 150 lines code. The functions of this code isas follow:

Initially we simulate a blocking of Server Machine by using a script code in one of the terminal machines fig.2. In order to block a machine we referred to [11]

On the other hand a user space software layer programming in C language is implemented. This software utilizes the pre-copy migration technology by scanning the dirty pages of any kernel process in XEN OPEN_VZ, Hyper-V Hypervisors by perform down system calls. The scanning of those pages is performed by two concurrent daemon processes created from us in C language,(user space). Those concurrent processes by schema 1->1 [12] spawn two kernel process in

Fig. 2. The communication between terminals and Servers machine

OPEN_VZ, Hyper-V Hypervisors by perform down system calls. The scanning of those pages is performed by two concurrent daemon processes created from us in C language,(user space). Those concurrent processes by schema 1->1 [12] spawn two kernel process in order to access the page in physical memory. These processes scan all instructions of dirty pages sequentially.The instructions that historically are not used at the first dirty page transferred at the bottom of the last dirty page see figure below. At the same time the same amount of consumed instruction at the last dirty page transferred in the first one.

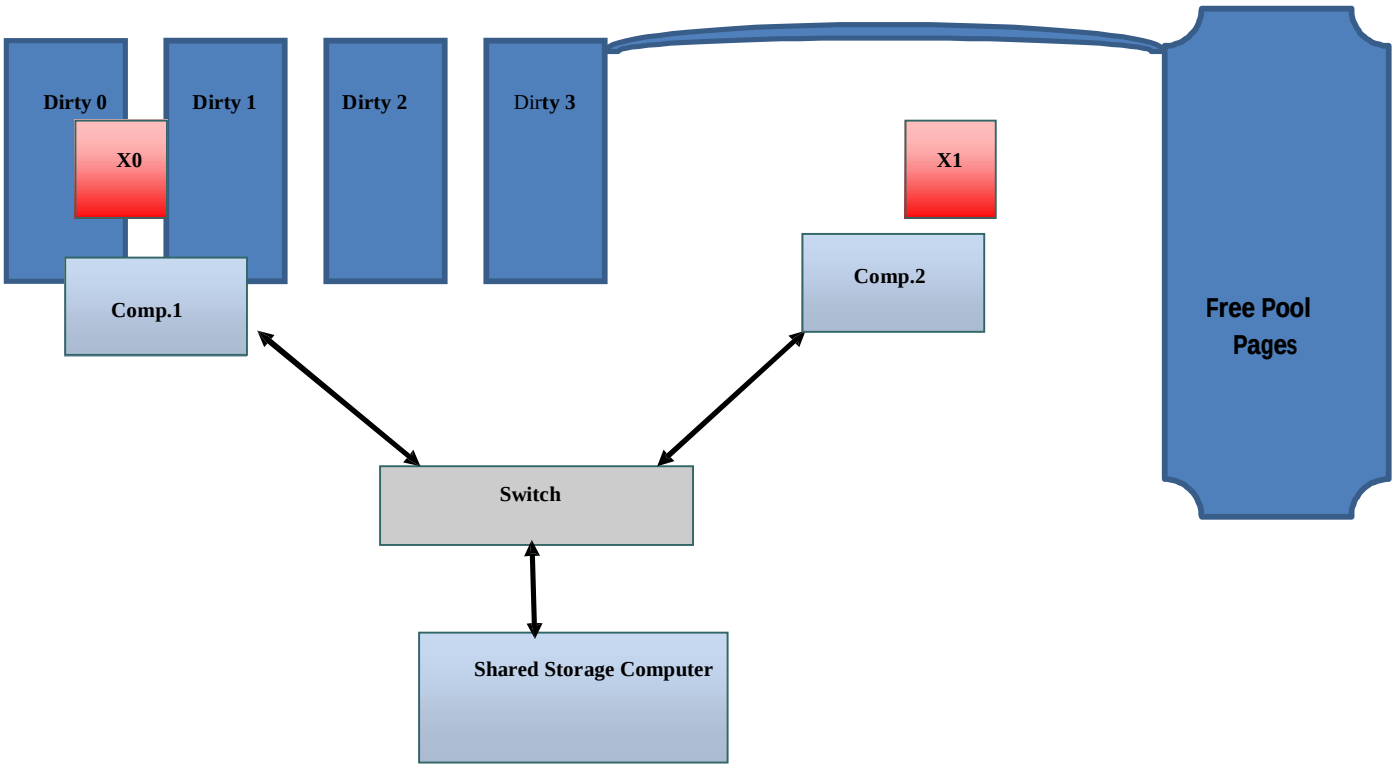

Fig. 2. Simulation of cleaning policy in order to reduce the number of dirty pages which transferred from one host machine to another one

The first process can increment one by one and soon or later the second process will decrease one by one too. The test finished after both processes meet each other. The aim is to reduce the number of dirty pages transferred because those pages increase the time of live migration during the iteration [13]. By reducing the number of dirty pages total time of live migration is smaller than previously. We have calculated this time with different hypervisor by using or not this code. CPU Consumption in Source nodesare higher than normally because of overhead, but the total time of migration after the simulation of a failure is very short.Those experiments are executed in Data Center inside a Cloud.

5. Results of Experiments

We have focused the experiments by using four Hypervisors: ESX-I, Hyper-V, XEN and OpenVZ. The communication between terminals and Data Storage is Optical Fiber Channel. Network media in Terminals, Switches and Servers

support Fiber. Protocol of transport support TCP. Bandwidth of communication is 5 Mbps. Type of transmission is Data Packet. Packet Length 10 kB. Application size is 500 MB. Type of application .exe. No Fault Tolerance feature installed.

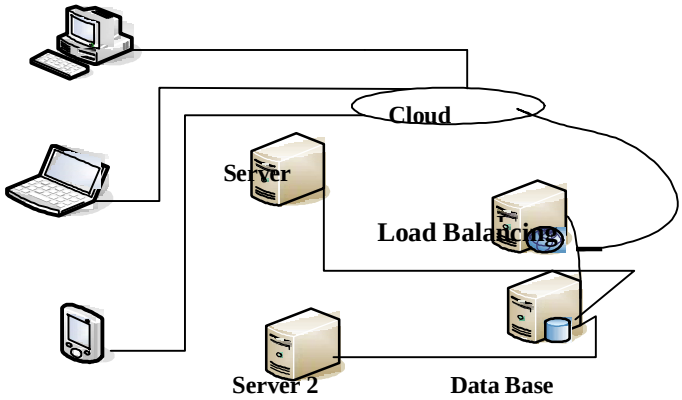

Fig.3 Experimental Environment

Table 1: Time of migration between different Hypervisors

Type of the Hypervisor	Live migration	Live migration time with C Program
ESX-I	35 sec	29 sec
Hyper-V	45 sec	42 sec
XEN	38 sec	31 sec
OpenVZ	40 sec	34 sec

As it looks our software can improve the time migration of different hypervisors because it is implemented in User Space. Anyway the time of decrease is not the same for different Hypervisors. It is very good in XEN but it is poor in Hyper-V. The reason is Xen is open source system and very flexible, while the architecture of Hyper-V is very poor.

6. References

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