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A STUDY ON VM CONSOLIDATION ALGORITHM IN CLOUD COMPUTING

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Abstract-Cloud computing technology has been a new buzzword in the IT industry and expecting a new horizon for coming world.The rapid growth in demand for computational power driven by modern service applications combined with the shift to the Cloud computing model have led to the establishment of large-scale virtualized data centers. Such data centers consume enormous amounts of electrical energy resulting in high operating costs and carbon dioxide emissions. Dynamic consolidation of virtual machines (VMs) and switching idle nodes off, allow Cloud providers to optimize resource usage and reduce energy consumption. In this paper,we do a study on VM consolidation algorithm inorder to understand how this algorithm reduces the amount of power-on PM and Average power consumption with power saving.
Keywords-Cloud computing, Virtual Machine, Scheduling Techniques, Data center, Energy efficiency,Live Migration.

1. INTRODUCTION:

A cloud subjects to a particular IT condition that is intended with the end goal of remotely provisioning versatile and measured IT assets. We can do different things with the cloud, for example, Create new applications and administrations, Store and reinforcement information, Host sites and web journals, Stream sound and video, Deliver programming on request, Analyze information for examples and make forecasts.

There are different challenges in cloud:

- Automated benefit provisioning.
- Virtual machine relocation.
- Server union.
- Traffic administration and investigation.
- Data security.
- Storage advancements and information administration.

Dynamic workload consolidation among various servers in light of virtualization innovations [6] has been broadly concentrated to empower datacenters to enhance resource use and reduce power utilization. In particular, all the virtual machines (VMs) facilitating different applications are required to be combined into a subset of physical machines (PMs) through VM migration(relocation) [7], while other idle PMs (servers) can be changed to bring down power states or close down. Be that as it may, beneficial combination isn't as unimportant as theoretically pressing the most extreme number of VMs into the insignificant number of PMs. There are various practical issues to be tended to, for example, VM relocation cost [6– 8], resource contention and execution interference between co-located VMs [9– 10], and also cloud SLA violation [11, 12]
The rest of the paper is organized as follows basicdifference between data center and cloud data center are explained in section II . VM consolidation algorithms are explained in section III. Conclusion and future work remarks are given in section III.

2. BASIC DIFFERENCE BETWEEN DATA CENTER AND CLOUD DATA CENTER

The fundamental distinction between the cloud and data centre is where a cloud is an off-preface type of registering that stores information on the Internet,while a data centre subjects to on-start equipment that stores information inside an association's local network. Since the cloud is an outside type of registering, it might be less secure or take more work to secure than a server. In the event that your cloud lives on a few server farms in various areas, every area will likewise require the best possible safety efforts.

For most independent companies, the cloud is a more financially perception choice than a server farm. Since you will assemble a framework from the beginning and will be in charge of your own support and organization, a server farm takes any longer to begin and can cost organizations $10 million to $25 million every year to work.

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3. VM CONSOLIDATION ALGORITHM

A.Adaptive Threshold-Based Approach For Energy-Efficient Consolidation Of Virtual Machines In Cloud Data Centers

The cloud providers try to optimize the usage of resources and energy consumption through Dynamic consolidation of virtual machine and by switching off the nodes that are not being used .Here the novel technique for dynamic consolidation of Virtual machines is proposed which is based on adaptive utilization thresholds.

B. Allocation Policies:

The operation of the system can be classified into two parts:

1. The Virtual Machines that have to be migrated is selected.
2. The selected VMs and the new VMs which are requested by the users on physical nodes are placed. The discussion of these parts are made in the following:

C. Fixed Utilization Thresholds:

Anton Beloglazov et al., has proposed four methods for choosing the VM's to migrate.The first method, Single Threshold depends on setting an upper utilization threshold for hosts and placing VM's while the total utilization of the CPU is kept below this threshold. The other three methods are based on setting the upper and lower utilization thresholds for host and total utilization of the CPU is kept between these thresholds. He has proposed three policies which chooses the VMs that have to be migrated from an over utilized host:

1. Minimization of Migrations (MM) –To minimize migration overhead the least number of VMs should be migrated
2. Highest Potential Growth (HPG) – The VMs whose CPU usage is low are migratedand hence the total potential increase is minimized.
3. Random Choice (RC) –Randomly, necessary number of VMs are chosen.

D. Dynamic Utilization Thresholds:

Fixed values for the thresholds are not suitable for an environment with dynamic and unpredictable workloads, in which different types of applications can share a physical resource. Here a technique is proposed which does the auto-adjustment of the utilization thresholds.

The MM policy for VM selection is applied for DT algorithm. The complexity of the algorithm is proportional to the sum of the number of non over-utilized host and the product of the number of over-utilized hosts and the number of VMs allocated to these over-utilized hosts.

The Technique for the energy efficient threshold-based dynamic consolidation of VMs with auto-adjustment of the threshold values is been given. The behavior of the DT algorithm can be adjusted by changing its parameters which inturn reduces the energy consumption.

E.Dynamic Resource Allocation Using Virtual Machines For Cloud Computing Environment

Zhen Xiao et al., has introduced a concept as "skewness" which measures the uneveness in the multidimensional resource utilization of a server. Different types of workload can e combined and the overall utilization of server resources can be improved by minimizing skewness.

F. The Skewness Algorithm

The concept of strain is introduced in order to quantify the variation of the usage of multiple resources on the server. Let n be the number of resources .r is the average utilization of all resources and $r_i$be the utilization of the i^{th} resource. The resource skewness is defined as follows:

$$skewness(p) = \sqrt{\sum_{i=1}^{n}\left(\frac{r_i}{\bar{r}} - 1\right)^2}$$

The details of this algorithm are given below

G. Hot And Cold Spots

The server is defined as hotspot if the utilization any of its resources is above a hot threshold. This indicates that some VMs which are running should be migrated since the server is overloaded. It is defined that the temperature of a hot-spot as the square of its resource utilization beyond the hot threshold. Here R is the set of overloaded resources in server p and r_t is the hot threshold for resource r.

$$temperature(p) = \sum_{r \in R}(r - r_t)^2$$

The degree of overload is reflected by the temperature of the hotspot. The temperature is zero if server is not a hot spot. If the utilizations of all the resources are below a cold threshold then the server is called cold spot

H. Hot Spot Mitigation

The list of hot spots in the system are sorted in the descending order of temperature. They have aimed at eliminating all the hot spots or to keep their temperature as low as possible. In case of ties, the VMs are selected whose removal can reduce the skewness of the server the most.The reduction of the skewness can be negative which means the server is selected whose skewness increases the least. From overloaded server, each run of the algorithm migrates away atmost one VM

I. Green Computing

When the average utilizations of all resources on active server go below the green computing threshold, the green computing algorithm is used. In the ascending order of the memory size, the cold spots in the system are sorted. The memory size of a cold spot is defined as the aggregate memory size of all VMs running on it, so that the under-utilized server can be shut down before migrating the VMs.

For cloud computing services, the design , implementation and evaluation of resource management system is presented. The framework multiplexes virtual to physical resources adaptively in light of the evolving request. By utilizing the skewness metric, the VMs can be combined with different resource characteristics appropriately.

J.A Novel Energy Optimized And Workload Adaptive Modeling For Live Migration

The paper presents two models namely Energy guided migration model, Workload adaptive model which are based on energy consumption and workload. One model chooses the best migrating VM candidate with minimal energy consumption and the other model chooses the best migrated physical server candidate based on both energy consumption and workload characteristics.

Energy guided migration model selects the best migrating VM which reduces the energy consumption without disturbing the performance. A Workload adaptive model adopts a method which uses large quantity of data for clustering and then to represent workload behaviors several clusters are generated. In addition to this an optimal cluster is obtained which describes the optimal energy efficiency workload.

K. Workload Adaptive Model

Following three correlations should be examined to build an energy saving model that adaptively varies with the workload:

- The correlation between workload and performance.
- The correlation between workload and migration moment.
- The correlation between workload and energy.

The live migration problem can be solved by combining the energy guided model and workload adaptive model .To initialize the workload cluster for each physical server, a large data will be collected. The current workload of work adaptive model will be collected and then the updation of the workload cluster in predefined time interval is done. Once the workload exceeds the workload threshold, the energy guided model would be adapted to select one migrated VM and one optimal destination physical server is selected by applying the workload adaptive model**.**

In workload adaptive model a static method is adapted. The unnecessary live migrations are avoided by analyzing the workload characteristics. It also avoids the unnecessary live migration when workload would decrease in a moment. The selection of migrated server becomes stable.

L. Miyakodori:A Memory Reusing Mechanism For Dynamic Vm Consolidation Memory Reusing Mechanism

Live Migration Techniques are used to optimize VM placements. This paper proposes a memory reusing mechanism to reduce the amount of data transferred during Live Migration.

Live migration with memory reusing:

Every memory page of a VM has an age, which shows how often the page has been refreshed since the boot of the VM. At the point when a VM boots, ages of all the memory pages are set to zero. We call the arrangement of all ages of a VM as the age table of the VM. An age server deals with the age tables of all the VMs. We utilize the tuple (V, X) to suggest to the age table of VM V related with have X.

The behavior ofMiyakoDori when a VM V is migrated from host A to host B for the first time. At this stage memory reusing is not utilized because no memory image is kept yet.

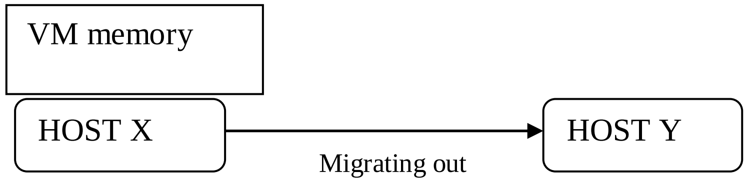
1) Stop temporarily VM V on host X.

2) Detect memory pages that have been updated since the boot time of VM V by using dirty page tracking.

3) Send updated page numbers to the generation server, which propagates the changes to (V, X).

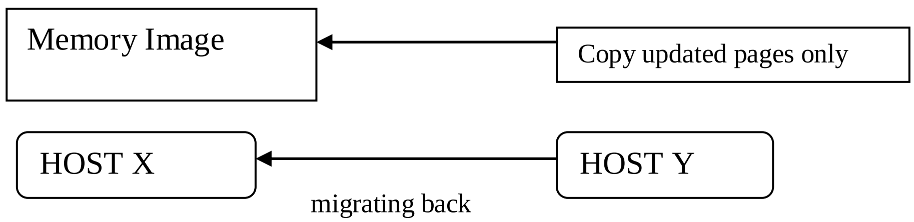
4) Resume VM V. This pause is less than a second because the data transferred is quite small.

5) Migrates VM V to host Y by using a normal live migration mechanism, but keeps the memory image on host X for possible later reuses.



The behavior of MiyakoDori when a VM V is migrated back from host Y to host X is explained. The differences from the previous procedure is emphasized.

1) Stop temporarily VM V on host Y.
2) Detect memory pages that have been updated since the last migration to host Y by using dirty page tracking.
3) Send updated page numbers to the generation server, which propagates the changes to (V, Y).
4) The generation server compares (V, X) with (V, Y) to find reusable pages, i.e. the pages that have the same generations in the two generation tables.
5) The generation servers ends reusable page numbers to the hosts.
6) Resume VM V.
7) Migrates VM V to host X, without transferring reusable memory pages.



This paper has proposed the concept of memory reusing through which the amount the memory transferred is reduced during live migration.They have implemented a prototype system namedMiyakoDori.

4. CONCLUSION

Energy efficiency in Data Centers is one of the most challenging issues faced by Cloud service providers. It is not possible to keep control over the power and energy consumption due to the increase in data and processing as the performance will be affected.we studied on VM consolidation algorithm in order to understand how these algorithm can reduce the number of power-on physical machine and average power consumption with power saving. In future we practically compare the algorithms to check the efficiency in power in different environment setup.

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