ISSN:0975-9646

Yogesh Eknathrao Gaikwad et al, / (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 5 (6) , 2014, 7367-7370

A Survey: Power efficiency Live Migration for Data Centers in Cloud

Yogesh Eknathrao Gaikwad
M.E. (CSE) Everest College,
Dr.Babasaheb Ambedkar University,
Aurangabad ,Maharashtra,India

Seema Singh Solanki
Assistant Professor , Department of Computer,
Dr. Seema Quadri Institute of Tech,
Aurangabad, India

***Abstract* — As we all know cloud computing is one of the fast spreading technologies for providing IT based Services to its User. We have established large-scale virtualized data-center to meet this requirement. To provide efficient and reliable services to all its user data centers consumes large amount of computation power.**

Due to large consumption of electrical energy has increased cost for the service provider as well as service users. Large consumption of electrical energy Couse large amount of carbon dioxide to emitted, due to this global warming is affected.

We concluded that, from our studies we can reduced the power consumption by live migration of the Virtual machine (VM) by turning off idle machines.

To fulfill this entire requirement we proposed a dynamic threshold based approach for CPU utilization for host at data center.

This will work on dynamic and unpredictable workload to avoid unnecessary power consumption.

Because of this we will achieve energy efficiency with quality of service to the user by controlling service level Agreement violation (SLA)

Keywords:* virtualized*, live migration, service level Agreement violation, energy efficiency

I. INTRODUCTION

Cloud computing is not a product but it's a service provider. Cloud provides infrastructure, platform and software as services, and which are available to users in term of pay-as-you-go model to consumers. Mainly These services in industry are respectively referred to as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).

The key skills of these services is shown in a recent report from Berkeley as: Cloud Computing, the long-held dream of computing as a utility software even more attractive as a service.[10]

Without knowledge of physical location and configuration of the server which is providing the services like computation, software, data access and storage.

Cloud totally works on the principal of virtualization of resources with on-demand and pay-as-you go model policy.[2]The advantage of using cloud as a service is that, it reduced the end-user cost of buying resource. The best feature of cloud is, it increase the storage area of a private computer without any extra storage. Cloud is reliable and flexible and mobile. End-user has no longer need to bother about up gradation of the systems.

Because of cloud computing IT industry shift their focus on innovation rather than worrying about server up gradations and systems issues. Large scale data centers are established in order to provide services.

Data center contain thousands of running computational nodes providing virtualization by placing many virtual machines (VMs) on each node.

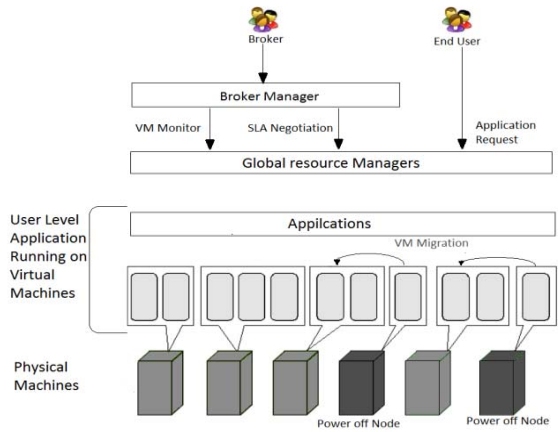

Figure1: System View of Cloud Environment

End-user and brokers are two types of actors on cloud. Once end-user requests for the application on cloud than brokers will process that request.

As per this system, we have considered two main roles for brokers: SLA Negotiation and VM Monitor.

To Monitor the SLA and VM we have SLA manager to care of these things.

There should be control on service level agreement (SLA) and VM Monitor the current stated of virtual machines periodically at specific amount of time.

The global manager will look after all request and decides what type of application is been request and accordingly to this VM machine manages.

1.1 Power Consumption Issues on Data Centers

Issues of power consumption in data centers.

The large amount of electrical energy is use for running a data center. The energy is obtained by the organization outsourcing it to cloud in pay back as service that they used for cloud.

Because of this large amount of carbon dioxide emitted, which will lead to create environmental issues in future.it will directly effect on global warming and greenhouse.

Power utilization by IT infrastructure has doubled from 2000 to 2006 and will double again till 2011.US uses about 61 billion kWh energy which leads to the total cost of 4.5 billion dollar of electricity bill which incurred by the companies. Such data centers in US are alone using 1.5 % entire electricity of US [3].

The highest power used by Facebook's data centers almost 10.52% of total power used for entire IT data centers.at second position it's Google with 7.74% and then You tube with 3.27% and so on[4].

As per our survey, the data taken from 5000 servers showed that only 10-15% of their total capacity is used [5]. Due to inadequate usage result into underutilization of the resources causing large scale unnecessary power consumption.

As per the another survey, an idle machine Couse unnecessarily uses 70% power of data centers [6], which result large amount of energy consumption.

If we are able to save small amount of energy from this, we can support a green revolution. As this extra power can be used at some other areas.

So, from our studies we concluded that the most power is unnecessary wasted because of underutilization and ideality of resources at data centers. In our approach, we have considered these factors to save energy.

1.2 Working of CPU Utilization

To perform a multiple tasks, VMs are placed to fulfill the CPU utilization of its host to perform multiple tasks can be done at once.

1.3 Live Migration Theory

Three reasons for live migrations of VMs are done: Resource requirement, power consumption and affinity of VM.

To solve our problem we can migrate a VM across physical nodes at data centers.

Because of this separate hardware and software and also fault management, load balancing and low-level system [7].

Figure 1 shows live migration for load balancing for two types of VMs: under loaded VM and Overloaded VM.

Those VM which are underutilizing its CPU capacity are known as under loaded VM.

VM those crossed its utilization capacity are known as overloaded VM. for this case ,migration is done to under loaded VM [7,8,9].

If continuously live migration takes place, which leads to performance degradation of the node.to overcome for this issues we have continuous monitoring scheme applied to minimize the VM migration and increase Quality of service by minimizing the SLA violations.

II. Literature Survey

here are many related study and work has been done for saving energy and manage to save energy on data center for cloud.

In [10], in data centers resource allocation is done according to the priority.

In [11], an energy management is proposed by doing multiple calculations for finding minimum power network subsets across a range of traffic pattern.

In [12], as the threshold based reactive approach to dynamic workload handing but this approach is not much suited in IaaS environment.

In [13], again a threshold based approach is proposed using single threshold value as upper limit for utilization but the node has to remain active even if the load is much less than threshold value.

In [14], a DVFS (Dynamic Voltage Frequency Scaling) based scheme is proposed. The systems adjust itself dynamically for lower power consumption using frequency and voltage.

III. System Architecture

We consider the system model same as proposed in [16], the target systems are of IaaS Environment.

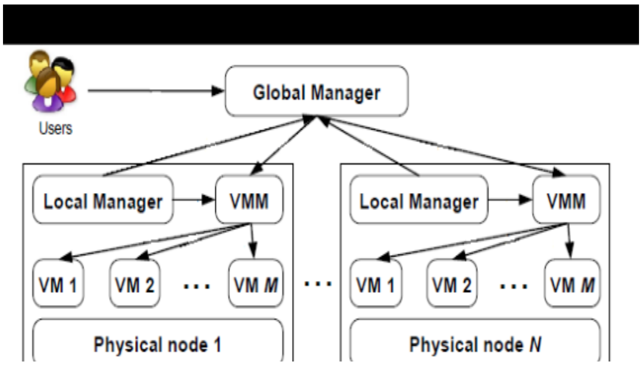

Figure 2: The System Model

As shown in the Figure 2, the system models consist of global and local manager.

As we see local manager, which is a part of VM monitoring, which are place on each node and responsible for keeping continuous check of which to migrate a VM.

As we know the working of this is end-user sends its service request along with some CPU performance, RAM ,memory, and network bandwidth to a global manager which is turn intimates the VM monitor for VM placement.

They working of this is, local manager reports the global manager about utilization check of its node, the check of overall utilization of resource keeps by global manager.

Power v/s Utilization Calculation

Many studies [17,18] shows the power consumption by servers can be described by a linear relation between the power consumption and CPU utilization. These studies as say that an average power consumed by an idle server is 70% of power consumed by fully utilized server. So, we considered the power consumption as CPU utilization P(u) by as shown in (1):

$$P(u) = P_{max} (0.7 + 0.3\,u) \qquad (1)$$

where Pmax is 250 W for modern computing server and u is the CPU utilization[20]. But, CPU utilization change with respect to time i.e. u(t). So the total energy consumed (E) as shown in (2):

$$E = \int_t P(u(t))\,dt \qquad (2)$$

So the total energy consumption can be measured from CPU utilization from this model

Cost Advantage with Migration

We propose decrease in power consumption using live migration which results in decreasing operating cost for the data center. We consider here cost as shown in (3):

$$C_{total} = c * E \quad (3)$$

where c is the cost of 1 kW power. We would also like to show comparison of costs using with and without migration.

3.3 SLA Violation Calculation

QoS needed to be met for Cloud computing environments. QoS is determined in the form of SLA (Service Level Agreement), which is determined either by minimum throughput or maximizes response time. This can differ from system to system. For our studies, we consider SLA violation as shown in (4):

$$SLA = \frac{\Sigma \text{ (requested MIPS)} - \Sigma \text{ (allocated MIPS)}}{\Sigma \text{ (requested MIPS)}} \quad (4)$$

The percentage of this value will show CPU is not allocated even if it is demanded.

Therefore, in order to increase the QoS for the end-users, our prior goal is to minimize this SLA from getting violated.

IV. Conclusion And Future Work

From our study we conclude that how to consolidation VM and how switching off idle servers minimize the consumption of energy. And increase energy efficiency of the resource in cloud data centers.

We proposed this for dynamic and unpredictable workload for the cloud, based on CPU utilization.

We proposed this to try to reduce the power consumption which can be a small step towards Green technology and save world from global warming.

Because of this we also consider the quality of service to the user by reducing the SLA violation.

For our future work, we would like to introduce an optimization policy to meet the cost requirement.

We will also like to test this technique on real time cloud setup and check how it works.

This will be one small step to save world from global warming and save natural resource, by using minimum resource of cloud data center such as infrastructure and reduce emission of carbon dioxide and cost of system.

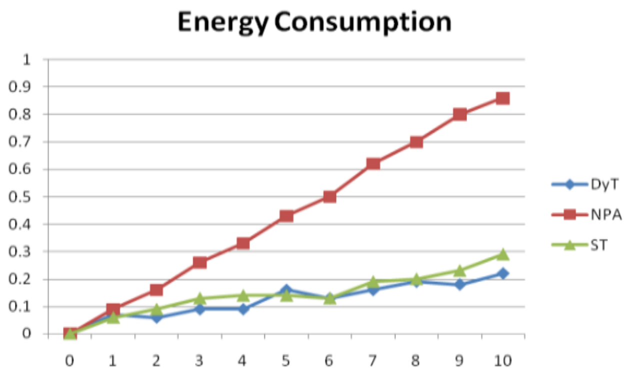

Figure 3: Energy Consumption v/s Host

In figure 3 as shown, NPA uses maximum energy with linear growth. ST and DyT uses almost similar amount of energy with ST using slightly more than DyT.

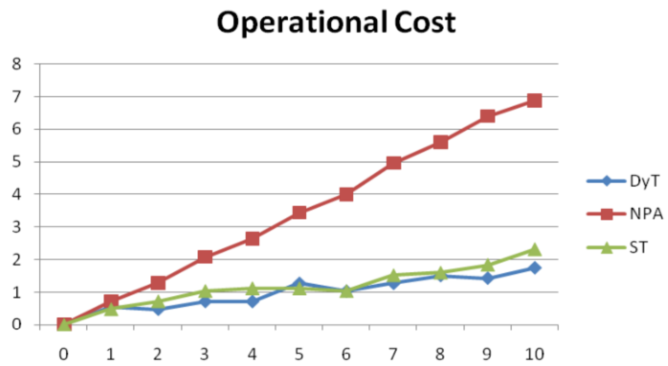

Figure 4: Operational Cost v/s Host

In figure 4 as shown, NPA gives maximum operational cost for datacenters compared to other algorithms. ST and DyT give less amount of cost compared to NPA.

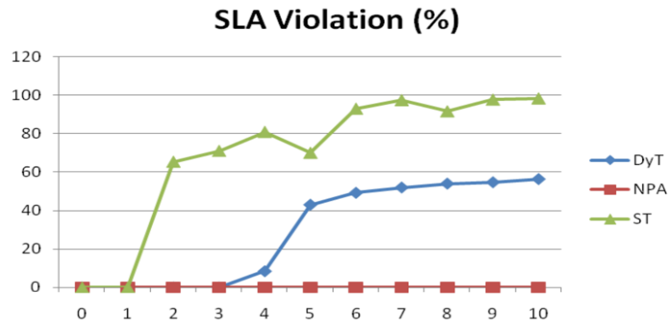

Figure 5: SLA Violation (%) v/s Host

In figure 5, NPA is not using any migration policy so the SLA violation is 0 for this, whereas by using ST we got SLA violation upto 98% which is too high. DyT has tried to minimize this by 35% to 40% .

Reference

[1] R. Buyya, CS Yeo,S. Venugopal, J. Broberg, I. Brandic, "Cloud Computing and Emerging IT Platforms: Vision, Hype, and Reality for Delivering Computing as the 5th Utility, Future Generation Computer Systems, 2011

[2] R. Buyya et al. Market-oriented cloud computing: Vision, hype, and reality for delivering it services as computing utilities. In Proc. of the 10th IEEE Intl. Conf. on High Performance.

[3] R. Brown. "Report to congress on server and data center energy efficiency: Public law 109-431". Lawrence Berkeley National Laboratory, 2008

[4] Peer1 hosting site puts a survey on "Visualized: ring around the world of data center power usage". From engadget.com ,2011

[5] L. A. Barroso and U. Holzle. "The case for energy-proportional computing." Computer, 2007

[6] X. Fan, "Power provisioning for a warehouse-sized computer" In Proc. of the 34th Annual Intl. Symp. On Computer Architecture, 2007

[7] C Clark, K Fraser, S Hand, J G Hanseny, E July,C Limpach, I Pratt, A Wareld ,"Live Migration of Virtual Machines" NSDI'05 Proceedings of the 2nd conference on Symposium on Networked Systems Design & Implementation ,2005

[8] E Arzuaga, D R Kaeli, "Quantifying load imbalance on virtualized enterprise servers." In WOSP/SIPEW "10: Proceedings of the first joint WOSP/SIPEW international conference on Performance engineering, ACM, 2010.

[9] H W Choi, H Kwak, A Sohn, K Chung, "Autonomous learning for efficient resource utilization of dynamic vm migration." In ICS "08: Proceedings of the 22nd annual international conference on Supercomputing, ACM, 2008.
[10] Y. Song, "Multi-Tiered On-Demand resource scheduling for VM-Based data center" In Proc. of the 2009 9th IEEE/ACM Intl. Symp. on Cluster Computing,155, 2009.
[11] B Heller,S Seetharaman, P Mahadevan,Y Yiakoumis, P Sharma,S Banerjee,N McKeown," ElasticTree: Saving Energy in Data Center Networks"NSDI 2010
[12] D. Gmach , "Resource pool management: Reactive versus proactive or let Ss be friends". Computer Networks, 2009
[13] A. Beloglazov, R. Buyya, "Energy efficient allocation of virtual machines in cloud data centers". 10th IEEE/ACM Intl. Symp. on Cluster, Cloud and Grid Computing ,2010.
[14] G Laszewskiy, L Wangz, A J. Youngez, X Hez,"Power-Aware Scheduling of Virtual Machines in DVFS-enabled Clusters, IEEE,2009
[15] VMware Inc. "VMware distributed power management concepts and use", 2010.
[16] A Beloglazov ,R Buyya, "Energy Efficient Resource Management in Virtualized Cloud Data Centers"10th IEEE/ACM International Conference on Cluster, Cloud and Grid Computing, 2010
[17] X. Fan, "Power provisioning for a warehouse-sized computer" In Proc. of the 34th Annual Intl. Symp. On Computer Architecture, 2007
[18] D. Kusic, "Power and performance management of virtualized computing environments via lookahead control". Cluster Computing, 2009.
[19] Jason Sonnek and Abhishek Chandra Virtual Putty: "Reshaping the Physical Footprint of Virtual Machines" HotCloud ,2009
[20] R. yahyapour, C. Perez, E. Elmroth, I. M. Llorente, F. Guim and K. Oberle, " Introduction" . Euro –Par 2011 Parallel Processing .Springer, 2011
[21] R. Calheiros, R Ranjan, César A. F. De Rose, R. Buyya, " CloudSim: A Novel Framework for Modeling and Simulation of Cloud Computing Infrastructures and Services" , 2011

AUTHORS

Yogesh E Gaikwad

ME 2nd Year from CSE from Dr.Babasaheb Ambedkar University,Aurangabad Maharashtra India. I had 4 years of working experience in computer science and technology.

Mrs Seema Singh Solanki

She is currently working as Assistant Professor in the Department of Computer, Dr. Seema Quadri Institute of Tech, Aurangabad, India. Her research area include Reusability of software components.