Green Computing Approach in Dynamic Resource Allocation for VM Environment

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***Abstract*— Cloud computing becomes very popular in cloud users by providing of various resources anywhere any time. A cloud service is any resource that is provided over the Internet and this is on demand service. This is provided by dynamic flexible resource allocation mechanism, for reliable and insures service in pay-as-you-use manner to users. In cloud computing, dynamic flexibility in resource allocation propose by virtualization technology. Virtualization technology provides data center resources allocation dynamically based on the application request. For reliable and efficient service need Efficient Dynamic Resource Allocation Strategy for VM Environment in Cloud. In this paper, we implement dynamic resource allocation system which allocated resources in VM environment. Here used skewness algorithm which measure uneven utilization of multiple resources of each VMs and according skew value load balance across VMs. It improves resource utilization of server by minimizing skew value of each VM. In this work implement future load prediction algorithms to prevent overload by effective load balancing and task migration among VMs. This achieve optimize performance in server with optimal resource utilization with minimum energy consumption.**

***Index Terms*— Green Computing, Cloud computing, Dynamic Resource Allocation, Virtualization, Virtual machine.**

I. INTRODUCTION

Cloud computing empower customers to scale up and down their resources based on demands. Cloud computing technology frame the resources as a one point of access to the client and cost is pay per consumption. Cloud computing is a technology where a resources dynamically issue to private and public networks. The cloud computing model grants individuals and businesses to acquire information and computer resources from anywhere that a network connection is accessible. Cloud business become more and more favorite in current years and deployment of cloud infrastructure is the fundamental potential of IT communities. Cloud computing is not application oriented, this is a service oriented [11]. Cloud computing provide dynamic specification, it issue machines to store data and add or remove the machines depending upon workload. Now days cloud computing platforms provided by Microsoft, Amazon, Google, and IBM. Cloud computing is an environment for sharing resources without depending upon infrastructure. So, it provide scalability to access the applications and its associated data from anywhere at any time. Cloud computing include new Green technologies which optimizing the server usage and reduce energy costs and battle global warming.

Green Computing:

The green computing technologies can reduce energy consumption. The temperature of global world is increasing very quickly. There are many factors but computers/electronics industry causes over emission of greenhouse gas and use much energy consumption which is the main root cause of current global warming. The energy consumption may be reduced by introduction of green computing. We can prepare and manufacture such devices which take low energy, give out low heat and gases. Air stream, weather, medicine, transportation, agriculture uses machines which take much amount of power, money and consumption of energy. It has been seen that there are three main areas which affect our daily life, air which we breathe, water which we drink and food which we eat and the soil on which we live. The data centers use a large amount of power/energy and release a lot of amount of heat and gases. In our daily life we use AC's. Refrigerators, inverters, UPS and computers. These items take a large amount of energy and evolve heat and gases. These gases are very harmful our lives. It has been seen that AC and refrigerators release CFC type gases. The battery of inverters release also harmful chemicals like lead. It causes lungs type diseases like cancers, asthma. The large amount of heat destroys greenhouses gases like CO2 which create global warming. A large amount of heat create floods, melting of glaciers, drought and increase the temperature of the earth. Many companies are trying to resolve these problems. Companies are trying to establish such devices which can take low consumption of energy and release low amount of heat.[13]

Virtualization technology:

Cloud computing is based on the virtualization technology. Virtualization technology provides mechanism that allocates the resources dynamically based on the application request. Virtualization in which computing components running on a virtual basis rather than real, so that management and optimizes resource utilization. It is the concept used to attain maximum utilization with limited fixed resources. Virtualization technology can enlarge the capacity of the hardware by simple software re-configuration process and intends are to totally utilize the expensive mainframe resources. Load balancing of the entire system can be managed dynamically by using virtualization technology where it becomes feasible to remap virtual machines (VMs). However, in order to get the best performance, the virtual machines have to totally utilize its resources by modifying cloud computing environment dynamically [10].

Dynamic resource allocation:

In cloud computing, Resource allocation is the process of appointing available resources dynamically to the required cloud applications. In cloud the resource allocation is based on the infrastructure as a service (IaaS) and it provided provision use resource which can include in operating systems and applications to the consumer. Resource allocation techniques should be optimized to avoid resource contention, resource fragmentation, over provisioning of resources emerge in cloud. There might be situation that two applications try to access the same resource at the same time and some case appear when there are limited resources and the demand for resources is high. Resource allocation techniques should satisfy multiple applications which need different types of resources such as cpu, memory, I/O devices [12].

II. BACKGROUND

Clouds service provides platform to access applications and related data from anywhere, anytime that a network connection is accessible. But the major challenges in cloud computing is resource optimization and efficient allocation. Even there is challenge in resource allocation that they meeting customer needs, data center management, application requirements, and dynamic scalable service. The application is responsible to scale up and scale down the computer resources dynamically. In Cloud systems by using virtualization open a new scope to contention-aware scheduling, as in virtual machines remapping of resource possible with live migration provide dynamically scheduling of VMs to minimize the contention on shared caches and memory controllers. This effect show non-uniform memory accesses (NUMA) in multisocket systems which used in cloud servers. Virtual machine monitors (VMMs) provide platform to create virtual machines (VMs) and allocate physical resources to VM. In VM live migration technology provides mechanism to remapping VMs on PM even applications are running [9].

In the last few years dynamic resource allocation based on application demands in cloud computing has attracted attention of the research community. They research innovative ideas and techniques to face challenge. Since data centers host multiple applications on a common server platform; they can dynamically reallocate resources among different applications. The research communities proposed scheme that perform reallocation on platforms provide dynamic resource allocation.

III. ISSUES IN DYNAMIC RESOURCE ALLOCATION

As a demand of each VM changes at run time, it is complicated to dynamically allocate resources of data center to each spot market as maximize total revenue. To overcome this problem there is a solution Market analysis, dynamic scheduling and consolidation mechanism that allocate resource to each spot market. Here uses market economy to rearrange the demand by dynamically alter the price of each VM. When total demand is high, the mechanism up the price and low demand, lower the price. Dynamic resource allocation framework consists of Market Analyzer, Capacity planner and VM scheduler. In this framework analyze the market situation and forecast the future demand use AR (auto regressive model). Capacity planner decides the anticipated price of each VM. In the fixed pricing a VM type does not change price and uniform pricing a VM type is change price at run-time.VM scheduler make scheduling decision for maximize revenue and optimize dynamic resource allocation [8].

In these paper data center resources allocated dynamically by using virtualization technology and it depends on application request and optimizing the number of servers in use to support green computing. To propose it used virtualization technology and skewness to achieve goal:

- Overload avoidance: The potential of a PM should be enough to fulfill all VMs the resource required and it should use resource below high limit to avoid overload.
- Green computing: The number of PMs in used should be decrease as they meet the requirement of all VMs. PMs that not in used can be turned off to save energy.

Virtualization technology provides resource allocate mechanism for datacenter which gives on demand application resource. Skewness algorithm used to measure the unevenness multiple resource utilization of a server. To minimize skewness here combine different types of loads. Skewness can be measured by Hot and Cold spot.

- Hot spot: If consumption of any resources is over a hot threshold. It specifies that the server is overloaded and some VMs running on it might be migrated.
- Cold spot: If consumption of resources is under a cold threshold. It specifies that the server is usually idle and it should be turn off to save energy.

In this paper propose load prediction algorithm that can forecast the future resource required for applications without looking inside the VMs. Load prediction algorithm (EWMA) predict the CPU load and measure the load every minute and predict the load in the next minute using past history [3].

In cloud computing allocation of the resource efficiently is a demanding job. In this paper proposed mechanism that allocates resource to cloud users with minimum wastage and maximum profit. The proposed resource allocation algorithm is based on time, cost and number of processor request. Here in this work used priority algorithm that determine priority between different user request based on parameters like cost of resource, time required to access resources, number of processors required to run the job or task. In Resource Allocation system client send the request for task to the cloud server and cloud runs that task given by the client. The cloud has admin that decides priority between the different user's request which has different task with parameters such as time, processor request, importance and price [2].

In this used Virtualization and VM migration allow data center resource allocation services and use minimum number of physical servers. In previous works there is problems in SLA violation in which not received thorough analysis. The propose algorithm will

keep the migration in less time and minimum number of migrations. Here virtual machines placing using bin packing algorithm and gradient search technique. The heuristic based VM migration depends on following: Finding when a physical server to be overloaded or under loaded. Selection of VMs that might be migrated from an overloaded server to under loaded server. These called as live migration of VMs which conserve free resources to prevent SLA violation and optimize utilization by minimum number of migration with efficient live migration of VM [7].

IV. PROPOSED WORK

In our research work we are propose Dynamic resource allocation system that uses virtualization technology to allocate resources dynamically based on application demands. We proposed resource management system that supports green computing and avoid overload by minimizing the number of servers used. We proposed the "skewness" concept to measure the un-evenness in the multiple resource utilization of a server and avoid overload by adding different workloads and optimize utilization of server resources. For effective load distribution we used adapt load balancer. We develop load prediction algorithm that predict future load and prevent overload in the system. By live VM migration we effectively save energy used and achieve good performance.

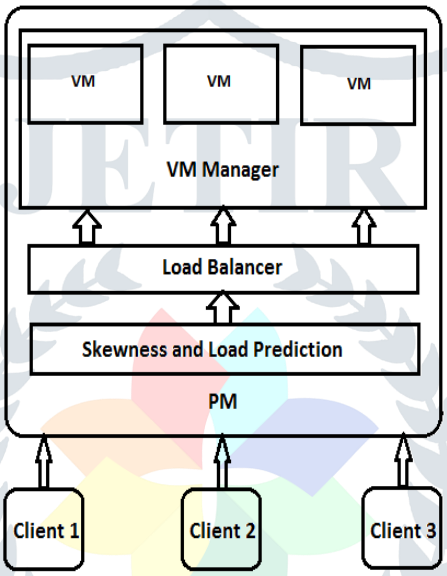

Fig.1. Dynamic resource allocation system on single PM

In this proposed resource management system we design resource allocation algorithm which dynamically allocated resource for cloud user in server. In this proposed work for effective resource allocation used adapt load balancer which presented below in algorithm which makes decision on the basis of skew value of all VMs and future predicted load on server.

A. Dynamic resource allocation algorithm

The adapt load balancer presented in this algorithm; it is adapt load balancer because here we using additional decision using skew value of VMs. First, VM List provided as an input to it. In this operation in order to know how we balance the load among VMs it first finds out by checking under loaded or overloaded VMs from available VMs on server and adds the VM to under loaded/overloaded list. Here we check under loaded/ overloaded VM by skew value of VM and add skew value in priority list and sort in assenting order. In the next step, it gets a list of job already allocated to VM and response time for new task. Every allocation of resource to task this algorithm checks available server resource and predict future load to avoid overload on server.

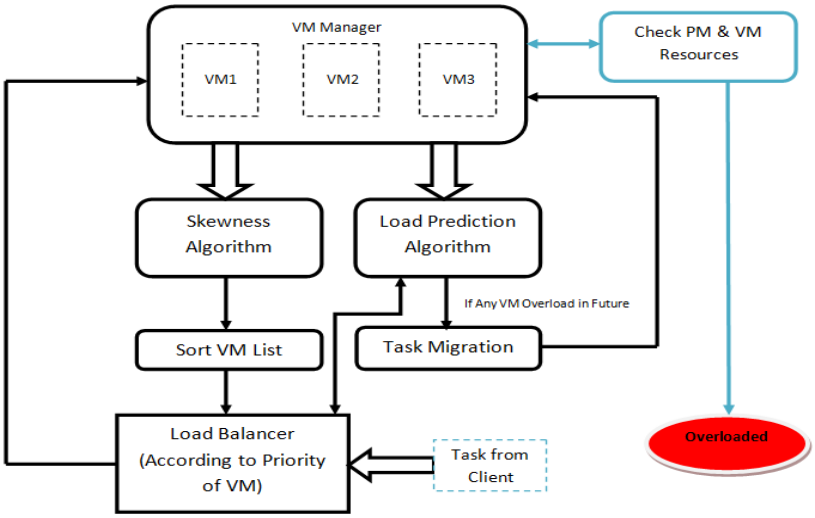

Fig.2 Flow of Dynamic resource allocation algorithm on single PM

B. Load Balancer:

The adapt load balancer presented in this work; it is adapt load balancer because here we using additional decision using skew value of VMs. First, VM List with resource utilization value provided as an input to dynamic resource allocation algorithm. In this work for effective load balancing calculate uneven utilization of resources among VMs and it measures in skew value. After calculating skew value of VM by skewness algorithm, according to skew of VMs sort VM list in assenting order. In the next step, scheduler assign task to VM according to priority. Every allocation of resource to task in VM system checks available resource and predict future load to avoid overload on server.

C. Skewness Algorithm:

Skewness is a measure of the asymmetry or unevenness of the probability distribution. A distribution may either be positively or negatively skewed. The concept of skewness is introduced to compute the unevenness in the utilization of multiple resources on a server. It is inspired by the fact that if a PM runs too many memory-intensive VMs with light load, much resource will be wasted because it does not have enough memory for an extra VM. The concept of skewness is used to qualify the unevenness in the utilization of multiple resources on a server. Let n be the number of resources and ri be the utilization of the i-th resource. The resource skewness of a server p is defined as follows,

$$\text{Skewness} = \sqrt{\sum_{i=1}^{n} \left(\frac{r_i}{\bar{r}} - 1\right)^2} \quad \ldots\ldots\ldots\ldots (1)$$

Where, $\bar{r}$ is the average utilization of all resources for server. By minimizing the skewness, the different types of workloads can be combined nicely and improve the overall utilization of servers.

D. Load Prediction Algorithm:

FUSD (Fast Up and Slow Down) algorithm the future resource needs of VMs are predicted based on previous statistics.

$$E(t) = \alpha * E(t-1) + (1-\alpha) * O(t),\ 0 \leq \alpha \leq 1 \quad \ldots\ldots (2)$$

Where, E(t) estimated Load, O(t) observed load and α is a constant reflecting a trade-off between stability and responsiveness.

This algorithm used the above formula to predict the load on the VM server. They measure the load every minute and predict the load in the next minute. As for example, if the sequence of O( ) is 20, 30, 40, and 50, then it is logical to predict the next value to be 60 at a=-1.

E. Green Computing:

Green computing achieve by minimizing the temperature on server by minimizing ideal VM.

Where,

$$temperature(p) = \sum_{r \in R} (r - r_t)^2 \quad \ldots\ldots\ldots\ldots (3)$$

Where R is the set of the overloaded resources in server p and rt is the hot threshold for resource r.

V. EXPERIMENTAL RESULTS

In experiment we create VM manager showing in Fig. 3, that manage the virtual machine running on PM by ON/OFF virtual machine directly from VM it. VM manager itself works as dynamic resource allocation system which provides provision to add task and schedule it on VMS. The Scheduling decision of load balancer is taken by dynamic resource allocation algorithm.

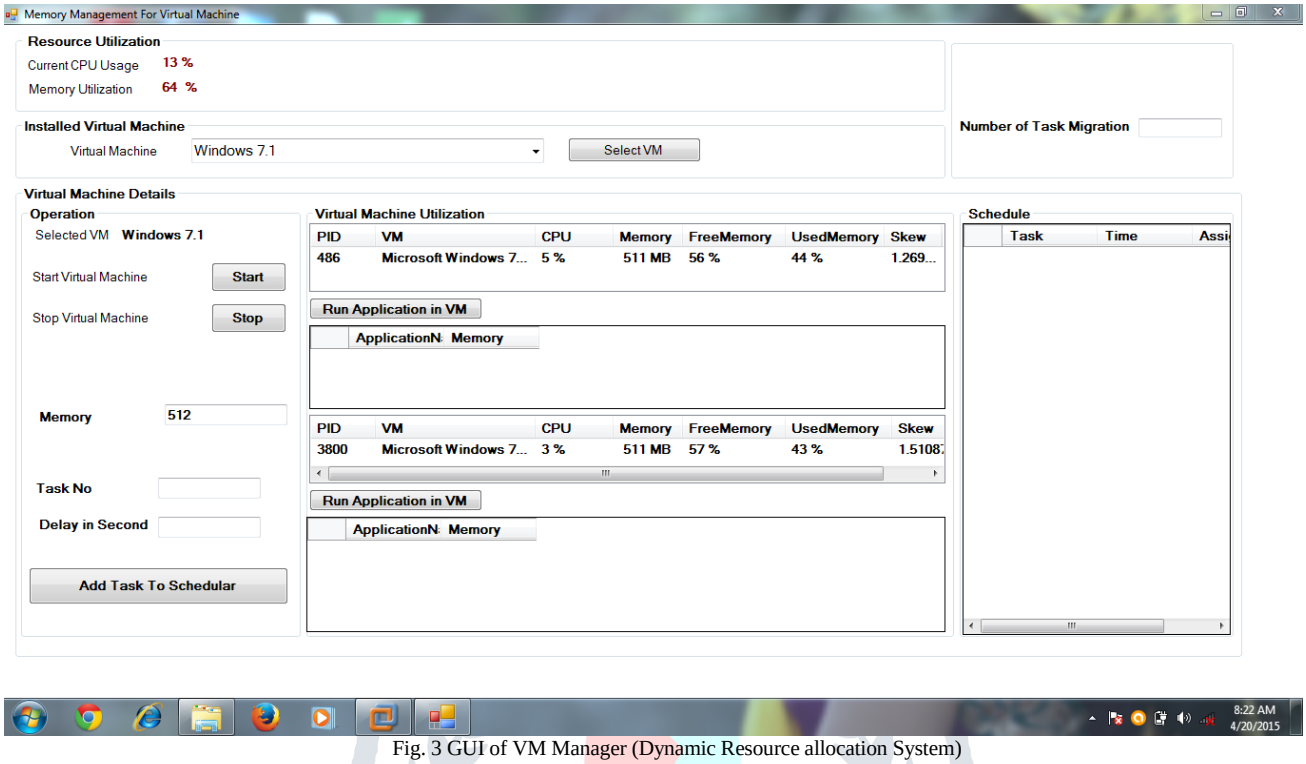

Fig. 3 GUI of VM Manager (Dynamic Resource allocation System)

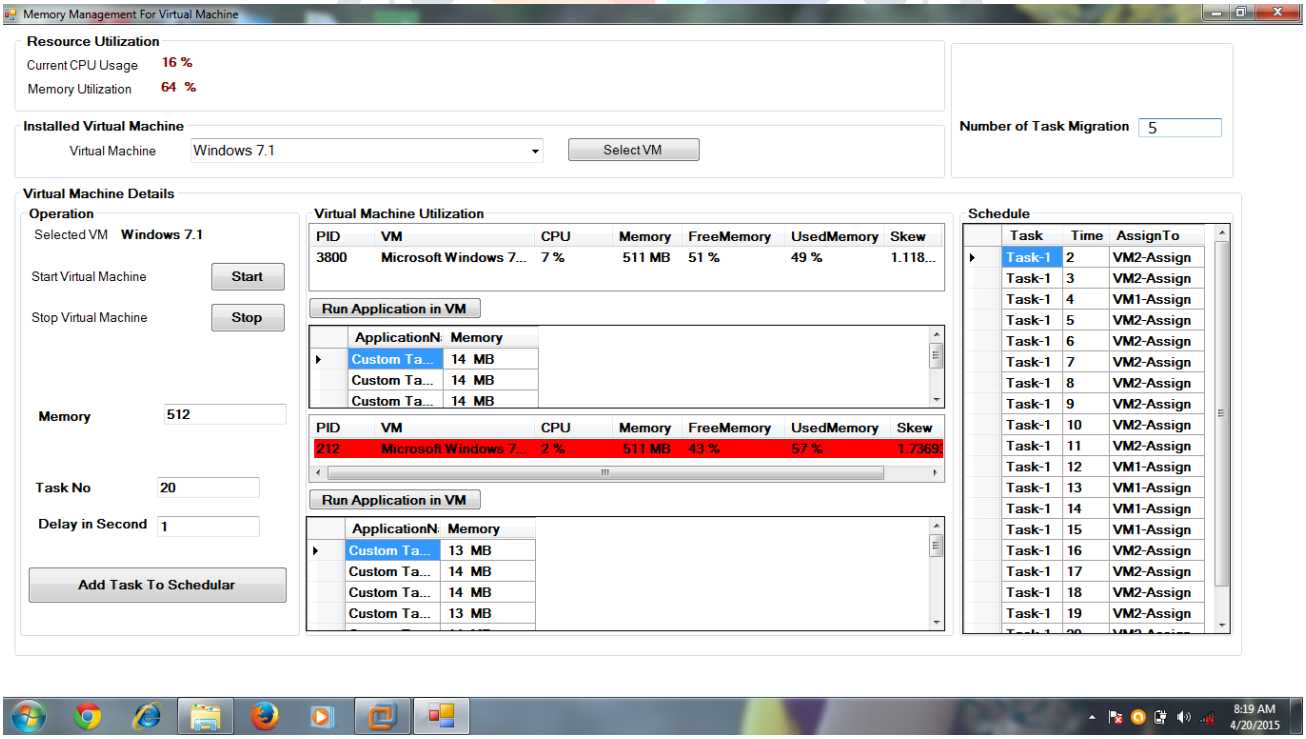

Fig. 4 Scheduling of task with task migration.

TABLE I
EXPERIMENTAL RESULT OF SKEWNESS ALGORITHM

Skewness Algorithm				
VM	**CPU**	**Memory**	**Skew**	**Priority**
VM1	10	31	0.72	1st
VM2	56	5	1.18	3rd
VM3	10	63	1.02	2nd
VM4	5	75	1.24	4th

TABLE III
EXPERIMENTAL RESULT OF LOAD PREDICTION ALGORITHM

E(t-1)	O(t)	α	E(t)
50	60	-1	70
50	60	-0.7	67
50	60	-0.5	65
50	60	-0.2	62
50	60	0	60

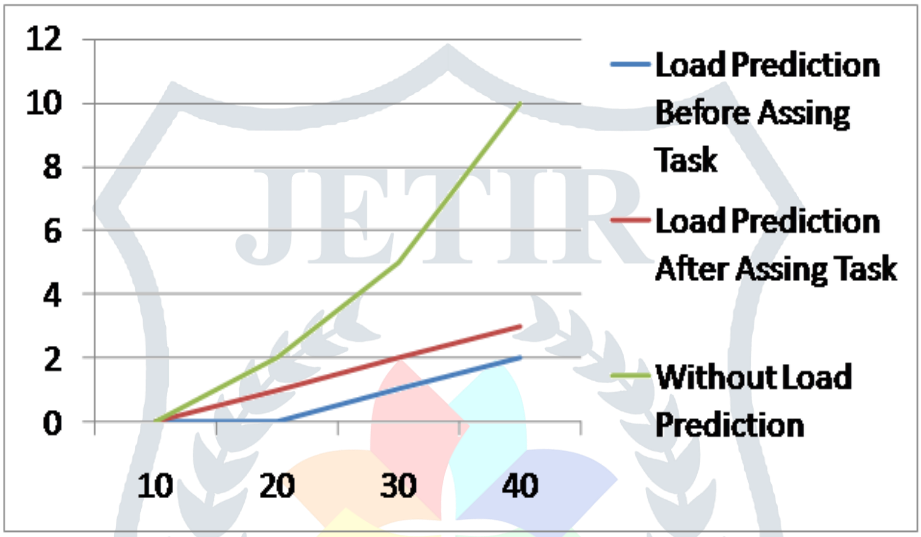

Fig. 6 Effect of Load Prediction on Task Migration.

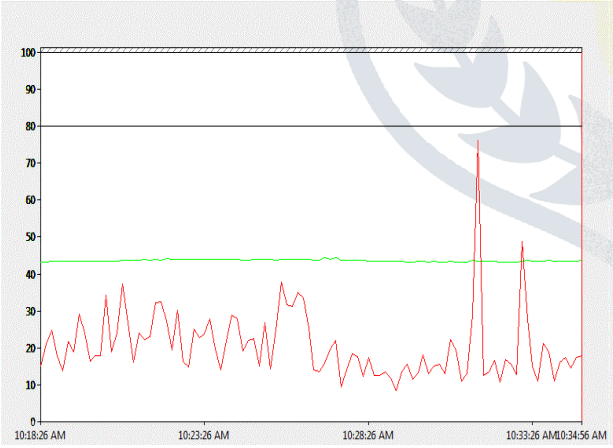

Fig. 7 Resource utilization of Server i.e. PM

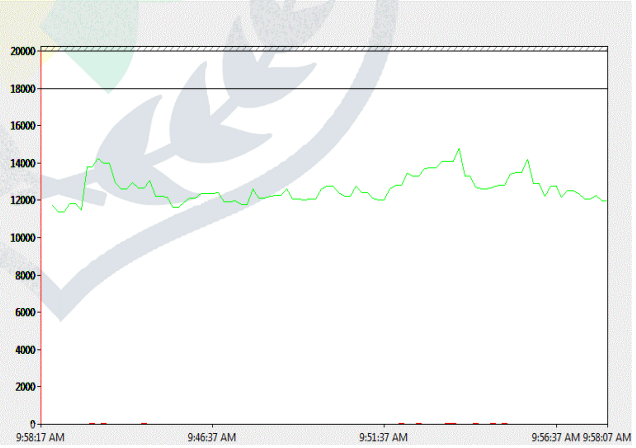

Fig. 8 Power Utilization of Server i.e. PM

VI. CONCLUSION

In this project, we implement a dynamic resource allocation system that avoid overload in server effectively by allocating resource evenly among VMs. Otherwise, the physical machine is overloaded and it can decreases performance of virtual machines. We used the concept of skewness to calculate the uneven utilization of multiple resources on the server among VMs and checks available server resource and predict future load to avoid overload on server. Proposed work achieve optimize performance in terms of server resource utilization with minimum energy consumption and task migration among VMs. On future we adopt load predicting to improve scheduling effectiveness and implement this approach in datacenter having Virtual environment.

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