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A POWER CONSTRAINED OPTIMIZATION ALGORITHM FOR ENERGY REDUCTION IN CLOUD COMPUTING

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ABSTRACT

Cloud computing is a new exemplar for data sharing and storing in cloud centers and it achieves the phenomenal growth for remote accessing resources via networks. But, succeeding the power consumption controls, concurrently achieving the performance oriented tasks are the most crucial issues for cloud services. For that, the system is implemented with three important energy saving schemes for monitoring cloud services and also to reduce the server idle energy consumptions. In existing, the optimization of energy is done in cloud servers only when the arrival rate is low. By using this EGCM the problems of server wake up, and cloud system congestion is overcomed, but it cannot able to eliminate the unnecessary idle energy saving when arrival rate increases and also it cannot allocate resources or switch the resources between idle and sleep status during the execution of process.. Here, the main objective of the proposed work is to reduce idle energy consumption without sacrificing performance and without violating (SLA) for that, the system introduces new examining methodology called Artificial Association Bee [AAB]. The new method is used to solve the constrained optimized problem and support the cloud service providers or server for energy saving and optimization. The new method reduces unwanted idle energy consumption by switching idle to sleep modes in an iterative manner, when more tasks are performed in the cloud service execution process. Such as the new AAB methodology provides an effective server performance for loading or sharing or providing the services to the cloud clients, and also it achieves energy consumption, with a help of iterative modes. The Simulation results show that efficient energy reduction is verified by applying energy saving schemes.

Index Terms— Energy consumption scheme, reply time, AAB,EGCM

I. INTRODUCTION

The cloud computing could be a new service paradigm for spreading a data of enumerate resources which will be very quick access and support for combined foundation. An individual or company will solely use their own servers to manage application data or stored information data. Nowadays the users will get their cloud services from the cloud supplier based upon users wants with a help of demand access. Amazon web, Google Application engine is the best example for cloud services like PaaS, SaaS and IaaS [1]. In the cloud, the workload equalization is more complex because of reply time and latency from Server or service provides. So, the cloud severs consumes high power to complete their task. However, most of the energy is extremely affected from low utilization and idle time for certain days, month because of random information arrivals. In fact, the server utilizes only 40 percent of energy on average busy time during the execution. The growth of cloud usage most companies are preferred for cloud infrastructure at same time energy consumption and its operational cost are tremendously growing. Such a reason the energy saving during the idle time in server is more complex, even the cloud server have basic steps to reduce power like shutting down servers when the data process is low. But this processes is not a efficient way to save energy because, sometimes it affects the systems control and collapse the cloud servers [2].

Some of the negative effects caused are burst arrival, server energy consumption overhead due to making conscious power off state, most importantly violation of [SLA] service level agreement because, shut down servers are needed to sacrifice their resource for making quality service. The service Level Agreement is an agreement which is used to debate and compromise the Quality of Service when a cloud server process is in critical state like an energy consumption problem. If the cloud service provider not able to provide the accurate services to the clients, then the provider must pay the penalty it means the provider must allocate additional power sources to the particular client. So, reducing the energy consumption in cloud server has several responsibilities with avoiding the violation of SLA rules and constraints. Here the cloud server uses the N-Polices control method for avoiding the switching problem. The N-Policy is widely used in various areas like Network Communication, wireless media, etc., In that, the cloud server is powered on to work, only when the number of tasks in a queue is higher or equal to the N-policy threshold, or else moves the power off state based upon the data travel. So, the performance of energy consumption in cloud server is more complex and very hard to control when multiple data are needed to execute their task. For that the system considers three important policies and also to find out the best policy scheme to reduce new energy consumption for cloud server methodology which is also compared in previous

policies performances for making a well qualified power saving cloud server [3].

A. The contribution of this research can be followed

On cloud server, they are using three important policy schemes for power consumption, so which is used to analyze and find out the best policies for power safety during the heavy load data is executed. And one of the most important challenge tasks is to reduce the energy consumption with the help of N-policies for that the system measure the response time from client to server as well as server to the client, and also addresses the performance oriented takes, cost for achieving quality performance with energy consumptions. Here the three policies are,

- ISN (Idle to sleep N-Policy).
- SN (Sleep N-Policy).
- SI (Sleep to Idle N-Policy).

1. Idle to Sleep N-Policy:

In ISN policy the data are entered into idle state during the execution time and its switch the data in sleep mode once the cloud server is not able to allocate the resource for all those data execution. Such that time this policy is occur the process overhead. It cannot able to continue the process for execution and cannot able to provide the resource for execution. So the main disadvantage in this policy is process overhead [4].

2. Sleep N-Policy:

In SN policy the data are entered into to sleep state during the execution. In that the server accepts the sleep mode repeatedly when data needed resource to execute. Here too the main disadvantage is energy overload and system crash because of an unexpected power off[4].

3. Sleep to Idle N-Policy:

In this Sleep to idle policy is more effective to save power consumptions and also support to execute the data in continuous manner that means without sacrifice the own resource it provide the services to all data for execution. Such as this policy allows the data in sleep mode only once in an operation for process comparison and it change the idle state when the resource is allocated. So comparing past two policies the last policy is called SI Policy is more perfect to energy consumption, operation cost, quality service provider and shows efficient performance results.

Here the system is introducing the new methodologies is called Artificial Association Bee to optimize the energy consumption and support to take decision for providing services to clients in any effective manner for achieving the cost saving and effective energy saving without sacrifice the resources in fixed response time [4].

II RELATED WORK

In recent years the energy saving in cloud system is more familiar research topics. Like Power Management, Resource Partitioning, Partitions Algorithm, switching virtual machine to another virtual machine etc.,

A. ***Energy Consumption in VM's:***

In earlier days the Multidimensional memory allocation model and VM arrangement logarithm are mostly used for the Power reducing tasks to achieve the power safety for the VM arrangement problem. Here the VM task needs the resource for executing the data means, then the algorithm check the Memory allocation state to know the status of previous resource usability for every possible memory allocation. Based on that the cloud server, select the suitable memory allocation according to the virtual machine for minimizing the continually executing virtual machine [5, 6].

The second problem is considered the budget of power safety in the virtual machine. The target of this problem is to monitor the VM when multiple applications are executed under different VM. So the VM must aware the global usability tradeoff. For that, the system develops virtual energy management framework [VEMF] which is used to integrate the many VM distributed managers. So here the energy was saved under the central point of view and maintain the energy constraints in the physical hardware when the task is executed.

The third problem is power preservation. In that it has two important issues to be monitored for power preservation that is, the arrangement of VM and Behavior of VM. For that, the Dynamic instructions are used for finding out optimized solutions. But the fact, time is more complex to save the power preservation [7].

Finally the researcher researches the energy consumption by using performance evaluation with the help of VM. They investigate VM by using large amount data to be executed and also monitor the server during the execution of the data. But none of them achieve the goal.

So, that's the main reason the proposed works are developing and monitor the energy consumption in VM with high performance in cloud servers [8, 9].

B. Energy-Consumption in Cloud Foundation:

Earlier research found the basic theoretical idea by implementing those ideas in system for modeling, controlling and data power managing tasks are done in cloud data centers. For that the researchers analyzed those data power management centers and also construct the resource arrangements model that could be supportable for each other energy consumption management system. So, the goal of this concept is to reduce the power in data centers and also achieve optimized the power cost for that, the system can concentrate on gathering the data which is depends upon curve consumption [10].

One of the main problems is inflating the income of cloud service providers and their energy usage cost. Even the Scheme based services are available in the cloud service providers, but those schemes are followed services level agreements of user demands. So, the decision was taken at approximately such as, the service providers can earn the money based upon power on the server during the processing time. Similar like the power off the server is not considered for paying money to the service providers.

By using variety aware data monitoring and resource Handling systems are having capable of changing capacity suppliers in variety aware data monitoring system. By using K-Standards clustering, the Variety aware data loads can be divided into separate group. Those groups are having a separate behavior based upon performance and resource gathering. Here the changing capacity suppliers are used to the optimization problem like variety of data loads, configuration rate in cloud servers [11, 12].

The new level of growth in cloud computing for managing energy consumption is developing a framework which is used to manage and control the cloud infrastructure for making power consumption with quality of service. To reduce the energy cost of the cloud system the framework was used the simulation called discrete event method. By using the discrete event method the cloud system can able to control and handle the natural resources in data centers to effectively optimize SLO violations. So the framework is evaluated on the amount of power taken to the single application complete their tasks.

The holistic data management framework is used to embed the virtual cloud data centers and connected to the distributed cloud data centers via networks. The main concept of this work is increasing cloud service providers with user friendly that means, the cloud infrastructure is more flexible for cloud users when they work their tasks. For that the framework simulations are tested under data center by connecting multiple cloud data center via NSFNet topology network. Here are selected location oriented data center is highly supported for a green power source to decrease environmental pollutions [13].

All over the previous Energy-Consumption in Cloud Foundation are focused on reducing the network performance oriented problems, energy devices cost and its operational oriented problem are monitored for making power consumption in cloud servers. But still the Energy Consumption is a problem facing in cloud providers, server and cloud users. That's the main reason the proposed model introduces for making effective power consumption with low cost of cloud services. This was done by creating new algorithm is called Artificial Association Bee with a help of efficient Green computing method. The Artificial Association Bee finds out best N-polices based on that evaluated under N-Polices scheme to effectively reduce the idle power in the server, without sacrifice the own resource it provides the services to all data for execution in cloud centers and the proposed algorithm is highly achieved the energy consumption with effective performance in the cloud data center and cloud server [10].

III ANALYSIS OF ISN, SN VERSUS SI POLICIES FOR ENERGY CONSUMPTION

Normally in a spreading cloud system contain physical service provider, VM and work dispatcher. In that the cloud work dispatcher is our main designed contribution work. For that the system can consider and identify the getting work request data from clients and response them to the particular VM from the server. That means the request and response will be made within the fixed arrival time in the cloud server [14].

Here there are 3 important states are defined the server behavior mention like busy mode, sleep mode and idle mode. The busy mode defines that the server is currently working or executing the data. An idle mode defines that the server is currently present state and indicate that server is free. The sleep mode defines that, the server is currently working and there is no resources are available for executing the data so, the server mentions those kind of data are allocated at sleep mode or queue mode for until the data can get the resources for execution [15].

The main contribution of this work is energy consumption for that the new system is used to eliminate the server idle power during the execution and the non execution state in the cloud environment. In that the first N-policy is called **idle to sleep mode policy**. In this Policy Which is normally working in server like work busy mode to sleep mode during the data execution in the cloud server. Here the sleep mode only has a responsibility to save the energy [16].

A. The ISN-Policy work flow Procedure

Procedure 1: The server can switch the sleep mode from busy mode if all data can be executed.

Procedure 2: The server can wait in idle mode for executing the data and server can also monitor the queue state data too. This process was done before the server enters into sleep mode.

Procedure 3: If the work comes during the idle mode, then the server can immediately switch into a busy state for processing the data execution. Here until the server stay in idle mode all kinds of data can able to execute their task.

Procedure 4: If none of the data currently present in the idle mode at the fixed time, then the server can able to moves sleep mode.

Procedure 5: Finally the server is always remains to the sleep mode that, number of work in the queue state is must be less than the currently controlled resources. Or else the server can move to the sleep mode.

B. There are two cases normally occurred in the ISN-Policy

No1: The serve is normally started during the data comes in idle mode for processing these data.

No2**:** The Server can start the busy mode if the number of workload has stayed in queue state is more than the energy Policy value when a sleep mode is got expires.

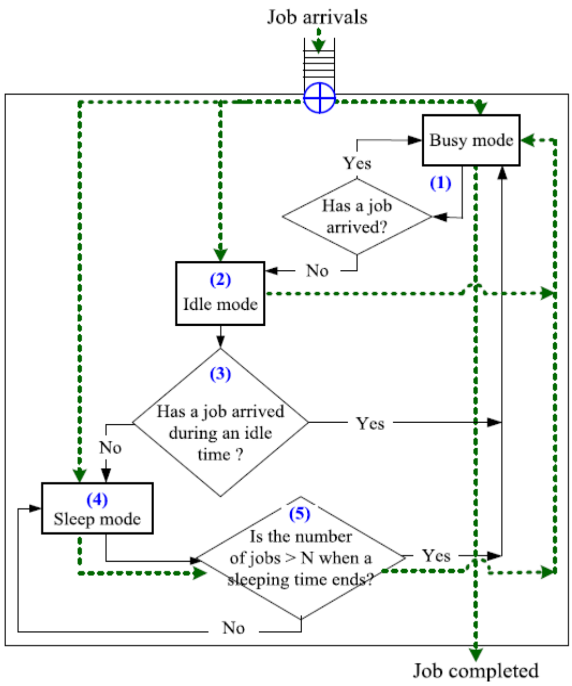

Fig 1 Work Flow of the ISN -Policy

The problem is that, the server can able to allow and stay in idle mode even there is no job or work is currently presented in the server. Even though the switching process like idle to sleep and sleep to idle is used for energy consumption, but the fact is the ISN-policy have a major drawback that is, the server can allow the idle mode even if there is none of the data is executed. Same time the server cannot able to maintain and provide the services to all over the data for executed, so the server can be a struggle because of high load such that time the server can be unexpectedly switched off and restarted so in ISN-policy is not a quality policy for maintain the energy efficiency [17, 18].

The next level of energy consumption scheme is called **Sleep N-Policy.** In this policy is only concentrate the busy mode and sleep mode so, here the idle mode is not present. The benefit of these kinds of policy is the server can only hold the data in busy and sleep mode during the execution. Suppose if the data enter into the idle mode when none of the data are executed, then the server can automatically switch to sleep mode. Similarly the server can get started at the busy mode, which, depending upon the queue state and also avoid the switching process too. So here this policy is used to help the system as directly moves to sleep mode for power safety [19].

C. The Sleep N-Policy work flow Procedure

Procedure1: Currently No work is executed in the server then it can move in sleep mode immediately

Procedure 2: The server waits in sleep mode until the number of work in the queue state is minimized from the overall workload or else the server can move their task at busy mode to execute the data.

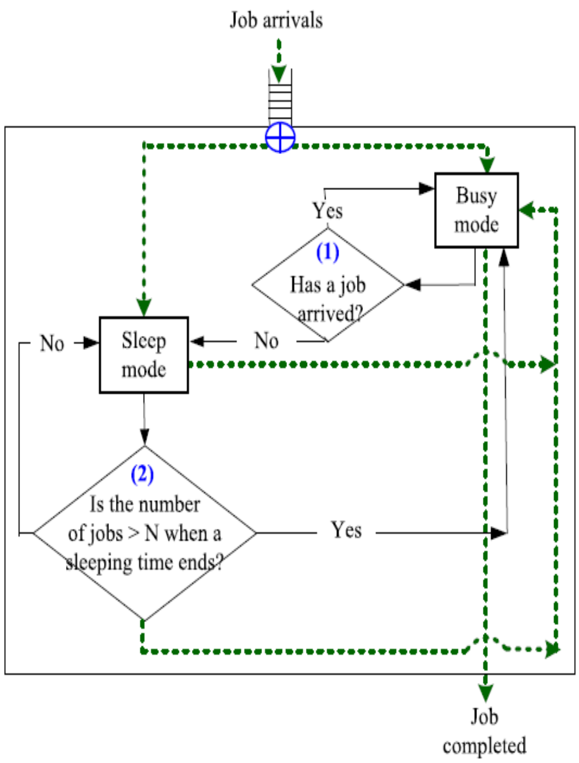

Fig 2 Work flow of the SN- Policy

In this Sleep N-policy has some important issue occurred during the execution of the data in the cloud server. That is, it doesn't have an idle mode so in this policy only have a busy mode as well as sleep mode. For that, those types of policy are used when minimum data loads are available in the server if suppose the high work load is coming to execute for that the system needed resource, then the server can get struggle and switching over to busy mode and the system is totally collapsing, so this policy is also not provide the quality energy consumption services to the cloud server[20].

The final and system evaluates policy, namely as sleep to the Idle N-Policy. This policy is similar to previous policy but the major difference is time. That means here the server can able to stay on sleep with at the fixed time. So, the SIN-policy in sleep mode is got expires, then the server can automatically shift to idle mode or busy mode, which depending upon the data arrived to the server [21].

D. The Sleep to Idle N-Policy work flow Procedure

Procedure1: In idle mode, there is no workload is currently present and then the server can moves to sleep mode.

Procedure2: In SN policy the server can stay in sleep mode at fixed time. Within the fixed time the server can allocate the resource or else the workload can move to idle mode or busy mode without affecting another process.

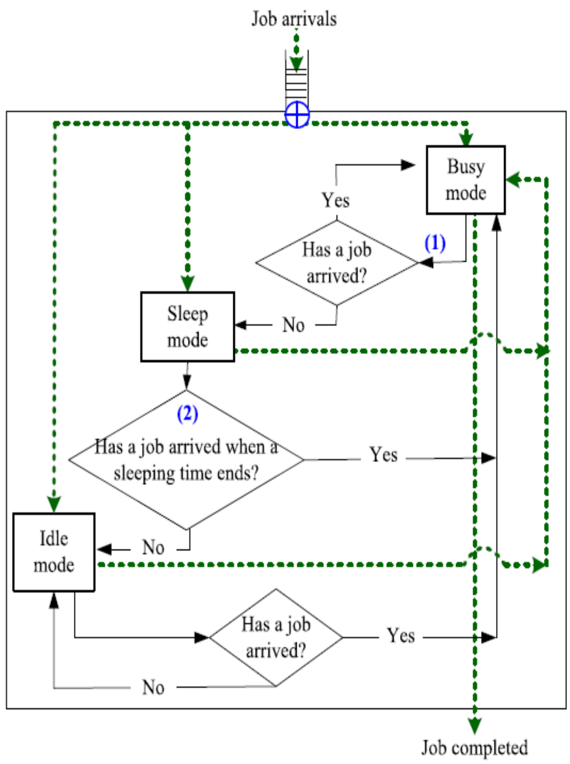

Fig 3 Work flow of the SI N- Policy

To compare than previous policy the SI Policy is provided the effective energy consumption because of this switching method. It can able to handle the large amount of data during the execution in the server because of the switching process. When a multiple number of workload needed for resource then server can check the possibility to allocate the resource or else those workloads are moved into sleep state at a fixed time. This type of process the server can easily allocate the resources. So here it can able to maintain large amount workload as well as it can allocate resources for execution during the idle state. It cannot eliminate or without sacrifice the own resource it provide the services to all data for execution. Such that, this policy can achieve high effective energy consumption in cloud server [22, 23].

IV SYSTEM DESIGN FOR PREVIOUS ALGORITHM

Begin Initialize all parameters includes cost, time, policy, arrival rate

Step1: For I to n and set the current service rate.

Step2: For j to n set the current all parameter cost, time, policy;

Step3: For Measure the system usage and current test parameters are satisfy the constraint of (i) rand (), then Calculate the response time; Else Return to step 1 and begin to test a next index; End;

Step4: If the current test parameters satisfy the constraint of (ii) W less than ssx, then Record the current joint values of (node) and Identify it as the approved joint parameters; Else Return to step 1 and begin to test a next index; End

Step5: When all the test parameters have been done current set of the Approved parameters; Bring cost parameters and test all approved joint parameters.

Step6: In case combined value are obtain the low cost value in all testing; Else Return to step 5 and begin to test a next approved parameter. End.

A. *Drawbacks Of Existing System*

- EGC (Efficient green control algorithm) algorithm is for solving constrained optimization problems and making Energy/performance tradeoffs in systems with different power-saving policies**.**
- The system with the energy policies can significantly improve response time and give optimized result only when the arrival rate is low, so if the systems arrival rate is high this algorithm does not reduce energy optimize.

B. *System design for Artificial Association Bee Algorithum*

Step1: Set mi a current service rate;

Step2: Set N_j a current N parameter;

Step3: Calculate the system utilization. If the current test parameters satisfy the constraint of then Calculate the response time; Else Optimized the constrained using ABC Assign the employee Return to step 1 and begin to test a next index; after getting the onlooker bee and scout bee. End;

Step4: If the current test parameters satisfy the constraint of then Record the current joint values of (m_i; N_j) and Identify it as the approved joint parameters; Else Return to step 1 and begin to test a next index; End;

Step5: When all the test parameters have been done, then current set of the approved parameters Bring cost parameters into the objective function by using Eq. (6) and test all approved joint parameters

Step6:If the joint values can obtain the minimum cost value in all testing, Else Return to **step5** and begin to test a next approved parameter.

End;

Here the proposed algorithm only aims to run all process in the SN policy and also whatever be the arrival rate the algorithm aims to make the process in this mode only.If this constraint is satisfied best virtual machine is selected and if not the algorithm checks itereatively for best virtual machines [24].

C. *Mathematical Notation*

The energy minimization problem can be stated mathematically as Minimize F

Where F = F($=C_0P_B + C_1P_I + C_2 + C_3P_S + C_4/E[C] + C_5W + C_6L$ Subject to $0<=r<=1, w<=x$;

- C_0 Power consumption cost when a server is in a busy mode per unit time;
- C_1 Power safety rate when a server is in an idle mode per unit time;
- C_2 Power consumption cost per service rate per unit time;
- C_3 Power consumption cost when a server is in a sleep mode per unit time;
- C_4 Server startup cost incurred by activating a server;
- C_5 Cost incurred by jobs waiting in a system per unit time;
- C_6 Cost incurred by congestion management per unit time [25]

V COMPARSION OF PERFORMANCE CALCULATION

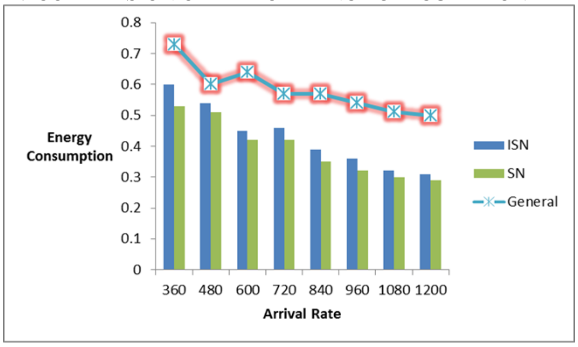

Fig 4 Existing Sytem

From the figure 4 it is noted that the power saving policies can effectively reduce energy only when the arrival rate is low.for a cloud provider who focuses on reducing energy implementing SN policy is a better choice to deal with varying arrival rates.

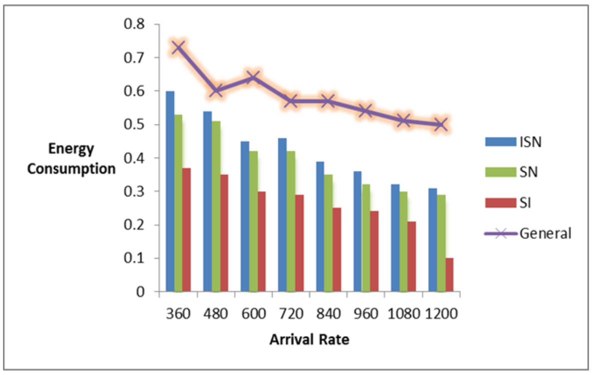

Fig 5 Proposed System

From the Figure 5 it is shown that the introduction of new energy policy SI can effectively reduces energy consumption when the arrival rate increases. Also it supports the process from normal to high arrival rates.

VI. CONCLUSION

Need for energy consumption is that data centers are becoming increasingly famous for the provisioning of computing the resources. The Energy and operational expenses of data centers have sky rocketed with the increase in computing capacity. There occurs a condition for consumption of energy in the cloud especially in data centers. Our proposed algorithm allows cloud provider to optimize decision making in service Rate and mode switching restriction so as to minimize energy consumption without sacrificing service level agreement. Results shows that the system with SI policy can reduce energy when the arrival rate increases when compared with general energy saving schemes.

REFERENCES

[1] Amokrane, A., M.Zhani, R. Langar and G.Pujolle, Greenhead Virtual data center embedding across distributed infrastructures. IEEE Transactions on Cloud Computing **1**(1): 1-14 (2013)

[2] Antony Thomas, G. Krishnalal and V. P. Jagathy Raj, International conference on Information and communication Technologies (ICICT). (2014),

[3] Beloglazov, A., B.Buyya and A.Zomaya, A taxonomy and survey of energy-efficient data centers and cloud computing systems. Advanced Computing **82**: 47-108 (2011)

[4] Chiang, Yi-Ju, Yen-Chieh Quyang and Hsien-Ching, An efficent Green control algo-rithm in cloud computing for optimization reduction. IEEE Transactio ns on cloud computing **3**(2):145 (2015).

[5] Calheiros, R. R. Ranjan and R. Buyya, Virtual machine provisioning based on analytical performance and QoS in cloud computing environments. Proc. International Conference on Parallel Processing (2011).

[6] Duggan, G. and P.Young, A resource allocation model for energy management systems.Proc. IEEE International System Conference (2012)

[7] Guazzone, M., C.Anglano and M.Canonico, Energy efficient resource management for cloud computing infrastructures. IEEE International Conference on Cloud Computing Technology Science (2011).

[8] Huang, D., X. Jiang, H. Chen and S. Wu, Virtual machine based energy-efficient data center architecture for cloud computing: A performance perspective. IEEE/ACM International Conference on Green Computing and Communication (2010).

[9] Keqin, Li, Improving multicore server performance and reducing energy consumption by workload dependent dynamic power management IEEE transactions on cloud computing **3**(2): 1-16 (2015), .

[10] Lee,Y.C. and A.Y.Zomaya, Energy efficient utilization of resources in cloud computing systems Supercomputing **60**(2): 268-280 (2012).

[11] Mazzucco, M., D.Dyachuky and R.Detersy, Maximizing Cloud Providers Revenues via Energy Aware Allocation Policies,' IEEE 3rd International Conference on Cloud Computing (2010),

[12] Nathuji,R., K.Schwann, M.Somani and Y.Joshi, VPM tokens: Virtual machine-aware power budgeting in datacenters. Cluster Computing Vol. 12. (2009)

[13] Song, J., T. Li, Z.Wang and Z.Zhu, Study on energy consumption regularities of cloud computing systems by a novel evaluation model. Computing **95**(4): 269-287 (2013).

[14] Sodan,C., J.Machina and K.McNaughton, parallism via multi threaded and multicore cpu, Computer 43 (3): 24-32 (2010),

[15]Yang,J.S., P.Liu and J.Wu, Workload characteristics aware virtual machine consolidation algorithms,'in Proc. IEEE 4th International conference (2012).

[16] Yi-Ju chiang, Yan Chieh, O, and R.Chinghsien, An Efficient Green Control Algorithm in Cloud Computing for Cost Optimization. IEEE Transactions on cloud computing **3**(2): 155 (2015)

[17] Yang, J.S., P.Liu and J.Wu, Workload characteristics aware virtual machine consolidation algorithms. Proc. IEEE 4th Int. Conference on Computing. Technology and Science (2012).

[18] Yasa, R. and H.Kdima, Multi objective approach for energy aware work flow ini cloud computing (2013).

[19] Zhang, Q., Q. Zhu, M. F. **Zhani**, **R. Boutaba** and **J. Hellerstein,** Dynamic heterogeneity-aware resource provisioning in the cloud, IEEE Transactions on Cloud Computing **2**(1): 14-28 (2014).

[20] Zhai, B. and D.Sylvester, Theoretical and practical limits of dynamic voltage scaling. Conference 41st design automation (2004).

[21] Zhu, X. and T.Yang, Real time tasks oriented energy-aware scheduling in virtualized clouds IEEE Transactions on Cloud Computing **2**(2): 168 (2014)

[22] Zhang, T. and Y.Lin, The designs of information security protection framework to support smart grid. Proc International conference power system technologies (2010).

[23] Zhao, C., S. Zhang and J. Xie, Independent Tasks scheduling based on genetic algorithm in cloud computing (2010).

[24] Zhao, G. and D.Wang, Cloud task scheduling based on load balancing ant colony optimization. Sixth International Conference IEEE (2011)

[25] Zhi Yang and Changqin Yin, A cost based resource scheduling paradigm in cloud computing. 12th International conference on parallel and distributed computing (2011).