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Minimization of Energy Consumption Based on Various Techniques in Green Cloud Computing

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ABSTRACT: Cloud computing is an important paradigm in Information Technology field. In Data center, where all physical resources are available, machine consumes power and emits heat which affects the environmental conditions. The Green Cloud computing solves the problem of global warming by providing eco-friendly environment. We studied that the heat emission increases with increase in energy consumption. The main aim of Green Cloud computing is to reduce the energy consumed by physical resources in data center and save energy and also increases the performance of the system. In this paper, we describe various techniques for minimizing the energy consumption.

KEYWORDS: Green cloud computing, Virtualization, Energy consumption, Job scheduling.

I. INTRODUCTION

Cloud computing is internet based computing which provides web services through service providers. These services are provided to the users on rent like pay-as-use model in which user have to pay according to the access or use of the services. The three basic types of services are provided: Infrastructure as a service (Iaas), Platform as a service (Paas) and Software as a service (Saas). Iaas provides the physical resources such as memory, processor etc. Paas provides the framework or platform for developing their own applications by using cloud and there is no need to install any platform on their own machine. Paas services such as .Net etc. Saas is basically used for running the existing applications like facebook. The user does not deal with installation of any software on their physical machine. The cloud provides such software for running these types of applications.

In cloud, the machines are running for providing web services and these machines also consumes some amount of energy for working. The cloud computing which focuses on reduction of energy consumption is known as *Green Cloud computing* [1]. In data center, the physical machines emit heat and harmful gases. The green cloud computing can also be used for e-waste management [2]. The reduction of energy consumption can be controlled on two basis: one is hardware and other is software. For controlling energy consumption on hardware basis, the hardware devices are used and likewise on software devices by using program and algorithms. The energy consumption controlled at software level is easy to maintain and less expensive. These techniques have to be implemented only once and used for data centers. In this paper we are using algorithm for minimizing the energy consumption.

Cloud has virtual machines and machine has number of jobs for execution. There is a need for proper job scheduling because if there are three processes such as P1, P2 and P3. The amount of energy consumed by process P2 is less than the amount of energy consumed by P1 and the amount of energy consumed by P3 is less than P2 but if we follow FCFS (First Come First Serve) algorithm then P2 can't execute before completion of P1 and P3 can't execute before completion of P2. This method consumes much more energy when waiting. We have to reduce the waiting energy.

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II. RELATED WORK

In data centers, if the physical machines consume more energy, these resources will also emit heat and harmful gases. This problem can be minimized by Green Cloud computing which provides the eco-friendly environment. The Green cloud computing reduces the energy consumption and also save energy.

A. *Virtualization and Cooling technique*

Authors in [3] provide another solution for greening the data centers. First is cooling system which minimizes the energy consumption. Various companies uses river water for data center's cooling, open air data centers, air-conditioned system etc. This system is expensive and not efficient for minimizing energy consumption. Second is virtualization technique in which more than one virtual machine loaded on a single physical machine. The virtualization technique provides the abstraction because the internal working hidden from the user. The user only accesses the web services and does not aware about the virtual machines. The virtualization techniques realize that a single physical machine is provided to the single user. This reduces the energy consumption because of single physical machine running. But performance can be degraded, the reason behind the performance degradation is a unbalanced load. Third is nano data center technique which specifies that the large number of small sized data centers should be geographically distributed. Traditional data centers are of large size and few data centers are distributed and this technique consumes more energy because of long distance of data transmission. This nano data center technique reduces the energy consumption because of the short distance between client and data center. These all techniques are used for greening the data centers.

B. *Energy management in public and private cloud*

In cloud computing there are two basic clouds first is public cloud and second is private cloud. Public cloud is accessible from any user through internet but private cloud is only accessible by the particular organization. The analysis of energy consumption is performed on basic web services such as storage as a service, software as a service and processing as a service [4]. Storage as a service provides a service in which user can store their data on cloud not on their personal machine. There is no need to buy any storage device such as hard disk, but the user have to pay according to the usage of the storage devices on cloud. Software as a service provides the latest software to the user through cloud for developing their own applications easily. There is no need to get license for software. Processing as a service is used for performing the computations on user's data and after all operations the result is provided to the user.

There are various energy consumption models which consumes energy. First, user equipments such as processor, memory, display unit etc. these devices consumes energy but at user side. Second, data center consumes energy because there are number of devices used for providing the services to the users. The energy consumption can be reduced by consolidating the servers but for consolidation the servers which are idle and have no task to perform can be turned off. In this method the load is distributed to the few servers and performance can be degraded. This process requires more attention.

The energy consumption analysis is performed on three web services such as storage as a service, software as a service and processing as a service. In case of storage as a service, the user creates their file and store on cloud. After some time if user wants to edit this file then the user must download the file form cloud and after providing the modifications again upload the file on cloud. This process consumes more energy because of uploading and downloading the files on cloud.

Fig.1.shows the comparison of public cloud and private cloud in which the public cloud consumes more energy than private cloud because of load on cloud. The private cloud is accessed by only the members of the organization but the public cloud is accessed by any user. In case of software as a service it also consumes energy for transporting the framework on user's machine through terminal. Last service is processing as a service consumes more energy in public cloud than a private cloud.

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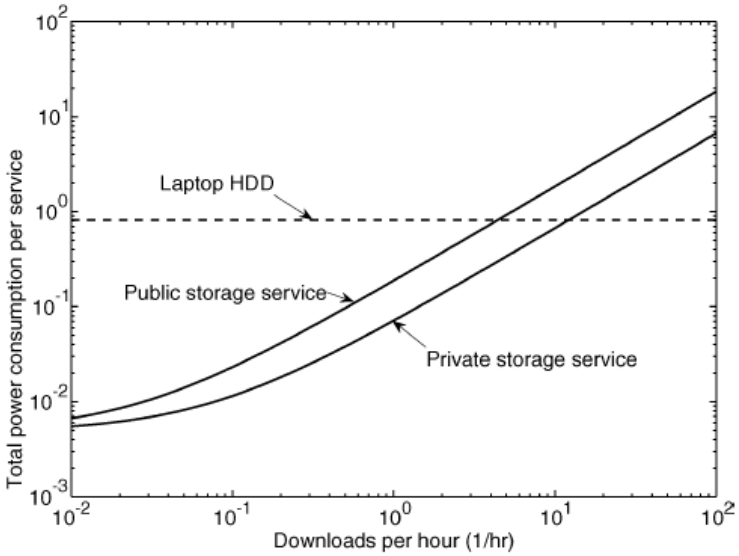

Fig.1.Comparison of public and private cloud in case of storage service.

C. Job Scheduling

In [5], scheduler schedules the tasks by determining the temperature of the task and node. The tasks are generated by Task Generation System. This system determines the temperature of the task by specifying the parameters such as initial temperature of the task, per minute rise in temperature and execution time of the task. This specification is given manually.

After determining the temperature of the task then the prediction method is used for determining the temperature of the node. This prediction method uses two parameters: 1) task specification and 2) energy consumption. In this scheduler FCFS (First Come First Serve) algorithm and priority algorithm is used for scheduling. The priority algorithm schedules tasks according to the temperature of the task and node.

The task, which requires low temperature, has high priority and the high temperature task have low priority. In this algorithm, one additional parameter is used for comparison which is a critical temperature and if any task requires temperature up to critical temperature then this task will not be executed, otherwise system gets failure. Fig.2. shows comparison chart with scheduler and without scheduler. Author says that system performance should not be impacted while energy consumption is being minimized.

Power aware virtual machine scheduling is another technique for reduction of energy consumption [6]. The virtual machines are scheduled according the power consumed by the virtual machines. This scheduling is provided for minimizing the

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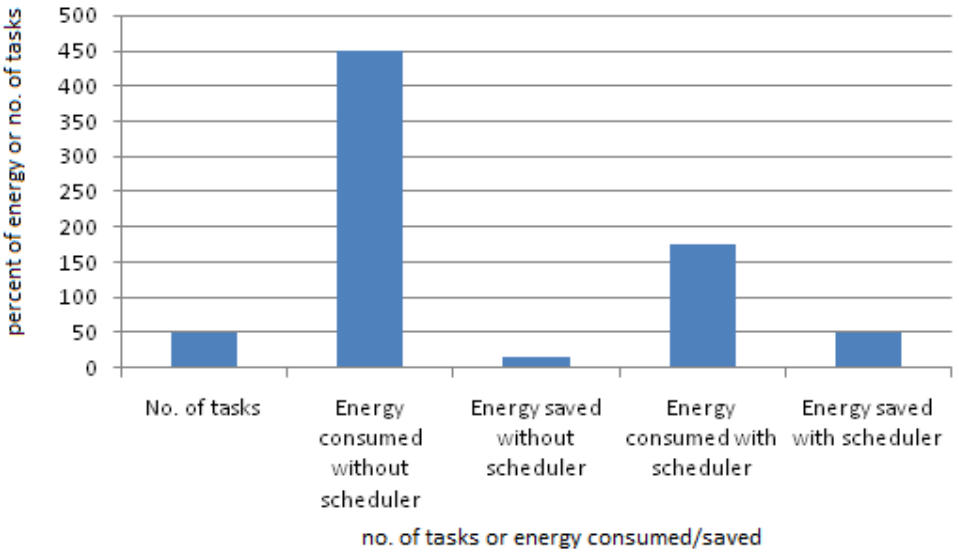

Fig.2. Saved power and energy consumed with/without scheduler

performance overheads but with energy efficiency. But this technique does not providing the greenest data center which is the main aim of green cloud computing. The job grouping is another technique for efficient energy consumption [7]. Jobs are scheduled according to the resource capability. Before the scheduling process, calculate the capability of each resource by selecting them. After calculating the capability resources then allocate the jobs to the resources according their capability. This scheduling technique is basically used for load balancing but with minimum reduction of energy consumption. In [8], the jobs are grouped together on the basis of similar resource requirement. This scheduling technique concentrates only on efficient resource management but with minimal reduction of energy consumption. This reduction is provided by reducing the waiting energy of the jobs.

III. CONCLUSION

In this paper, we present various techniques for reducing the energy consumption by resources in data centers. The Green cloud computing can achieve this goal. Virtualization technique mainly reduces the energy consumption but increases the performance overhead because a single physical machine is responsible for managing various virtual machines. The cooling technique can provide the greenest computing technology but it is an expensive technique. Another technique for reducing the energy consumption is job scheduling and it is not a part of hardware system. This technique is better than other techniques. The existing job scheduling algorithms based on energy consumed by the virtual machines & capability of resources. The priority algorithms schedule jobs according the temperature of the node and groups of jobs. The priority algorithm with grouping is better than other algorithms because it increases the overall performance. Research on this field is very important for environmental conditions.

REFERENCES

1. R. Buyya, A. Beloglazov, J. Abawajy, "Energy-aware resource allocation heuristic for efficient management of data centers for cloud computing", Future Generation Computer Systems, pp.755-768, 2012.
2. B. Agrawal, "Green Cloud Computing", International Journal of Electronics and Communication Engineering & Technology", pp. 239-243, 2013.
3. D. Cavdar, F. Alagoz, "A Survaey of Research on Greening Data Centers", IEEE Symposium on Selected Areas in Communications, pp. 3237-3242, 2012.
4. J. Baliga, R. Ayre, K. Hinton, R. Tucker, "Green Cloud Computing: Balancing Energy in Processing, Storage and Transport", Proceedings of the IEEE, Vol. 99, pp. 149-167, 2011.

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5. S. Arora, V. Chopra, "A Predictive Energy Aware Hybrid Resource Scheduler for Green Cloud Computing", International Journal of Applied Research in Computing, Vol. 1, pp. 1-5, 2013.
6. Y. Ponnusamy, S. Sasikumar, "Application of Green Cloud Computing for Energy Management", International Joural of Computer Science & Information Technology, Vol. 3 (5), pp. 5101-5107, 2012.
7. S. Selvarani, "Improved Job-Grouping based PSO algorithm for Task scheduling", International Journal of Engineering Science and Technology, Vol. 2(9), pp. 4687-4695, 2010.
8. R. Nanduri, N. Maheshwari, R. Raja, V. Varma, "Job Aware Scheduling Algorithm for MapReduce Framework", IEEE International Conference on Cloud Computing Technology and Science, pp. 3-4, 2011.