Abridged energy consumption in cloud environment using efficient load balancing

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***Abstract*— Cloud computing is a internet based service that provide us services like platform(Paas), software(Saas), infrastructure as a service(Iaas) and everyone wants to take benefit and migrate to cloud services using the cloud computing. As usage of cloud going to increase day by day, it ultimately increases the burden on cloud servers due to which energy consumption is also increasing which is very harmful for environment. There are various IT and non-IT equipment running the applications of cloud in data center. So power consumption can be reducing up to certain extent if resources can be properly managed. Here we prepare a new method of load balancing.**

***Index Terms*— Cloud, SAAS, PAAS, IAAS, cloud computing.**

I. INTRODUCTION

Cloud computing is the latest and innovative technology in IT world. It is having many advantages over traditional existing system like:

- Decreased management overhead up to certain extent.
- Improve security and backup
- Remote data access etc.

Cloud is having thousands of data center as per the requirement to fulfill user demand. Data center is having bulk amount of equipments which require megawatts of power for cooling the devices. Goal of green computing is to minimize the hazardous material use, minimize energy conservation to reduce CO2 emission during the product life cycle. It also promotes recycling of disposal product and electronic waste (e-waste).
Several energy metrics have been proposed to improve the efficiency of data center.

1. **PUE(Power Usage Effectiveness)-** It is a metric which conclude the data center energy efficiency. PUE=Total facility power/IT equipment Power.

2. **Data Center infrastructure efficiency (DCIE)-** It is reverse of PUE and represented in % form.

3. **Data center performance efficiency (DCPE)-** It is a metric calculated as :

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DCPE=Useful work/Total facility power

As computers and peripherals are also drawing significant amount of energy in sleep and standby modes which is responsible for CO2 emissions so, there is need for green environment for us to survive.

Green computing means "designing, manufacturing, using, and disposing of different equipments efficiently and effectively with minimal or no impact on the environment."

Green computing is based on five main principles.
Research
Reduce
Reuse
Recycle
Rescue
Revive

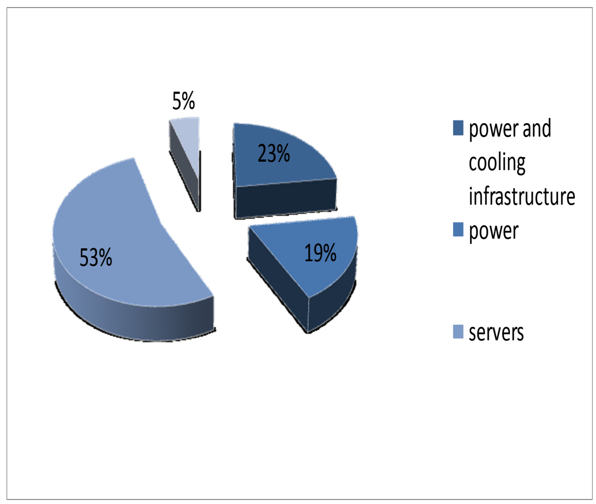

figure 1. Distribution of energy consumption in cloud data center

II. LITERATURE REVIEW

Risk and Energy Consumption Tradeoffs in Cloud Computing Service via Stochastic Optimization Models by Jue Wang, Siqian Shen.[1]. The models dynamically monitor and predict customer requests for each period, and proactively switch servers on/off according to estimated customer requests. QoS levels are maintained by either enforcing zero unsatisfied requests, or imposing a joint chance constraint to bound possible failures in a backlogging model. The models to handle dynamic job arrives with unknown distributions. By incorporating stochastic processes techniques and queueing theories, to examine dynamic decisions and large-scale data uncertainty, and employ scalable stochastic optimization tools to derive real-time operations in Clouds.

PoWER - Prediction of Workload for Energy Efficient Relocation of Virtual Machines [2] by Kashifuddin Qazi, Yang Li, and Andrew Sohn. Here in this paper PoWER performs better than another FFT-based time series method in predicting VM loads and freeing resources on Physical Machines for our test loads. But the workload increases due to which the energy consumption is more.

An Energy-Efficient Self-Provisioning Approach for Cloud Resources Management by[3] Hanen Chihi, Walid Chainbi, Khaled Ghedira. This work presents a resources provisioning approach based on an unsupervised predictor model in the form of an unsupervised, recurrent neural network based on a self-organizing map. Another unique feature of our work is a resources administration strategy for energy saving in the cloud. An agent-based architecture for cloud infrastructure self-administration. A related study is underway. They are also developing a self optimization scheduling application in the cloud.

Experimental Analysis of Task-based Energy Consumption in Cloud Computing Systems[4] by Feifei Chen, John Grundy, Yun Yang, Jean-Guy Schneider and Qiang He. An energy consumption model for cloud computing systems is implemented here. To operationalise this model, extensive experiments to profile the energy consumption in cloud computing systems based on three types of tasks: computation-intensive, data-intensive and communication intensive tasks. They integrate an energy cost rate and an "energy dirtiness rate" into energy consumption model to factor in the costs, monetary and environmental of cloud energy generated by different resources. This enhanced energy cost model will be investigated in order to minimize total energy costs while meeting system performance needs.

Green Cloud Computing: Balancing Energy in Processing, Storage, and Transport Jayant Baliga, Robert W. A. Ayre, Kerry Hinton, and Rodney S. Tucker[5]. Here in this paper the implemention for the energy efficiency in greed clouds is proposed as well as the storage cost is also computed. The number of file downloads per hour increases, the energy consumption in transport grows and storage as a service consumes more power than storage on local hard disk drives. The energy savings from cloud storage are minimal.

Energy-Optimal Mobile Cloud Computing under Stochastic Wireless Channel[6] Weiwen Zhang, Yonggang Wen, Member, IEEE, Kyle Guan, Member, IEEE, Dan Kilper, Senior Member, IEEE, Haiyun Luo, Member, IEEE, and Dapeng Oliver Wu, Fellow, IEEE . In this paper they formulate both scheduling problems as constrained optimization problems, and obtain closed-form solutions for optimal scheduling policies. Furthermore, for the energy-optimal execution strategy of applications with small output data, they derive a threshold policy, which states that the data consumption rate, defined as the ratio between the data size (L) and the delay constraint (T), is compared to a threshold which depends on both the energy consumption model and the wireless channel model. In the future they can evaluate the performance by running real applications with intensive computation and show the applicability of theoretical framework. In addition, they will consider the multi-task offloading in a more fine-grained choice for mobile application execution.

Low-Emissions Routing for Cloud Computing in IP-over-WDM Networks with Data Centers[7] by Mirko Gattulli, Massimo Tornatore, Riccardo Fiandra, and Achille Pattavina. Here in this paper various routing algorithms that are implemented are proposed. The routing algorithms provides the shortest path from source and the destination, these routing algorithms are implemented in the cloud environment for the access of the data centers are proposed. Configurations with larger transport energy requirements (such as IP basic and IP-over-SDH) benefit less from renewable-energy-aware algorithms can be implemented in the future.

Round Robin Algorithm – This Algorithm is based on the concept of time slice distribution. As according to decided time slice each node have to perform the job and other are waiting for their turn for performing operations.

Equally spread Current Execution Algorithm- Job is assigned to nodes on the basis of the priority of the node. Load size are first check the status of the node. Load balancer maintain the status of each node.

Throttled Algorithm- In this Algorithm Job manager maintain the listing of nodes . Among various nodes a specific node is selected for assigning the job. Its depends upon node to whether accept the job or not.

Honey Bee Foraging Algorithm- Dhinesh et al. proposed[8] an algorithm named honeybee behavior inspired load balancing algorithm.

This algorithm analyze the behavior of honey bees that uses the method to find and gather food. There is a class of bees called the scout bees and the another type was forager bees .The scout bee which scavenge for food sources, when they find the food, they come back to the hive to broadcast this news by using a dance called waggle dance. The dance , gives the idea of the quality and quantity of food . It also clear the distance from the bee hive. Forager bees then follow the Scout Bees to the location and they come back and inform others about the food left. In load balancing the servers are grouped into virtual servers. Each virtual server have its request queue. Serving server have to calculate the profit and compare it with colony profit. If profit is high then only the server stay in the current virtual server.

Biased Random Algorithm- [10]A virtual graph is created to represent the load by indegree on a particular node(server). When server start working on a particular job its indegree get incremented. Execution get started from any node.

Active clustering[9]- At the time of executing a job, job initiate to search for the match maker. If match maker found the process gets intiated.

CONCLUSION

Co2 emission and energy consumption is responsible for environmental imbalance up to certain extent and it is having many disadvantages. As cloud computing migrate us to a fast growing information technology fields. So, there is need of research of find energy efficient algorithms for ecological balance and reduce energy consumption in data centers.

Result as per the proposed algorithm in cloud simulator.

	Power Consumption	
Equipment	**Idle**	**Full Load**
Modern Mid-range Computer	63 W	91W
Old Mid-range Computer	111W	196W
Modern High-end Computer	98W	162W
Low-end laptop	13W	14W
Terminal	5W	6W
2.5" HDD	0.189W	2.1W

Table 1. Work analysis on various parameters in idle and Full Load

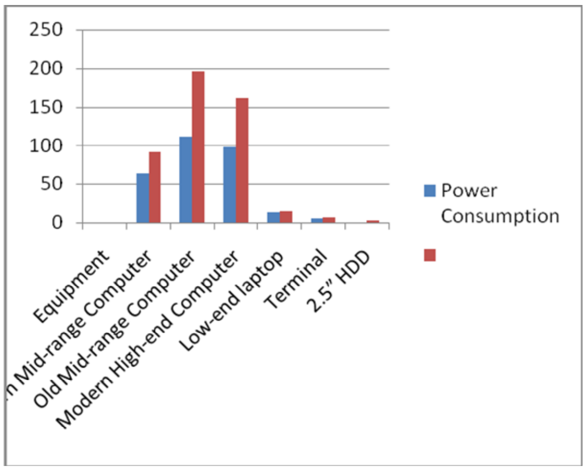

Figure 1 Shows Graph Representation of Table 1

	Power Consumption
Storage	4.2 KW
Content Server	198 KW
Computation Server	325 KW
LAN	2.76 KW
GateWay Router	4.7 KW

Table 2. Work analysis on power consumption by various equipments

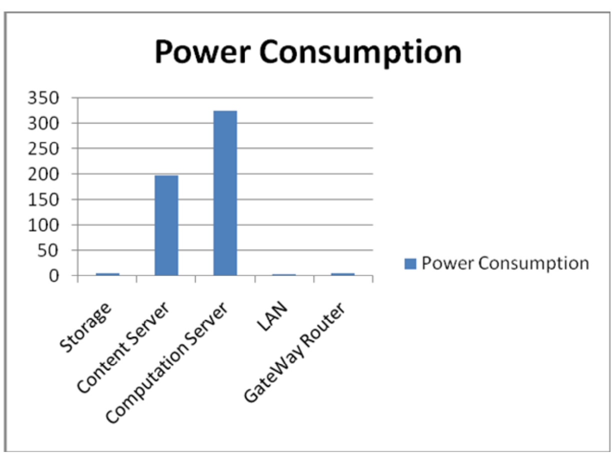

Figure 2 Shows Graph Representation of Table 2

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