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# Scheduler for Minimum Energy Consumption and Better Job Management in Data Center

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***Abstract - In reality, basically Service providers makes a high quality use of IaaS and PaaS to developing their services without consideration of physical components, while users also can access on-demand and pay-peruse services anywhere in Cloud computing. But one of major issue in data centers found is to manage optimum energy, power usage in the systems. The data centres regularly wasted a huge amount of electricity they pulled from the grids; It forms large energy consumption and wastage of time. So there is a strong need of optimisation of three factors CPU utilization, response time for task and number of task executed per minimum time. The current research concern is the unwanted power utilization, energy consumption and more time consumption in data center which is exceptionally gaining attention of researchers with respect to scheduling of the computing resources. In this research proposal hybridization of multilevel feedback queue scheduling and weighted round robin is used to achieve above problem.***

***Key Words - Infrastructure as a service, Platform as a service, Software as a service, Quality Of Service, Service Level Agreements, , Data Centre Efficiency, Thermal Design Power, Power Usage Effectiveness, Dynamic Voltage Frequency Scaling.***

## I. INTRODUCTION

Recently, the emerging cloud computing offers new computing models where resources such as online executions, computing energy, storage and network can be shared as services through the internet[1]. The popular utility computing models using by most of the cloud computing providers (e.g., Amazon EC2, Rack space) is inspiring features for customers whose demand on virtual resources vary with time. Energy utilization is an important concern in content broadcasting system and most broadcasting systems. These demands an improvement of networked computing resources from one or multiple providers on data centers extending around the world. This utilization is censorious design parameter in modern data center and cloud computing systems. The power and energy consumed by the computer equipment and the connected cooling system is a major constituent of these energy cost and high carbon emission. The energy utilization of date centers worldwide is estimated at 26GW corresponding to about 1.4% of worldwide electrical energy utilization with a growth rate of 12% per year [2] [3]. The Barcelona medium-size Supercomputing Center (a data center) pays an annual bill of about £1 million only for its energy consumption of 1.2 MV [4], which is equivalent to the power of 1,200 houses [3] .However, by minimizing this energy utilization, can make hidden cost reduction. Moreover, apart the large energy cost, heat released increases with the higher power utilization increases the chances of hardware system crash [6]. Therefore, minimizing the energy utilization has a important outcome on the total productivity, trust and availability of the system. So it does not only reduce the large cost and improves system trust, but also helps in shelter our natural environment. Thus, reducing the energy utilization of cloud computing system and data center is a challenge because data and computing application are growing in a rapid state that increasingly disks and larger servers are required to process them fast within the required period of time. To deal with this problem and certifying the future growth of cloud computing and data centers is maintainable in an energy-efficient manner, mainly with cloud resources to satisfy Quality of Service (QoS) requirement specified by users via Service Level Agreements (SLAs), thus reducing energy utilization is necessary. The main objective of this work is to present a new energy utilization models that gives detailed description on energy utilization in virtualized data centers so that cloud computing can be more environmental friendly and sustainable technology to drive scientific, commercial and technological advancements for the future.

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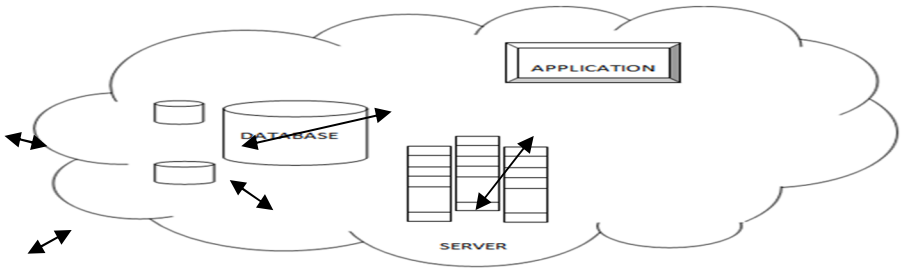


**Fig 1.1** Overview of cloud computing

*A. Energy Consumption Format*

The issue of energy consumption by information technology equipment has been receiving increasing attention in recent years and there is growing recognition of the need to manage energy consumption across the entire information and communications technology (ICT) sector. In the past few years' researches, Cloud based data centers are rapidly increasing because of the huge demand for IT resource. Since more data centers are came into existence the energy consumption of these data centres are also increased to a great extent. In addition to high energy utilization there is an additional pressure on the environment by the form of $CO_2$ emissions. In the virtue of the report of Congress on Server and data centers [4], the data centers are responsible for about 2% of global $CO_2$ emission and they use nearly 80 million megawatt-hours of energy yearly, it is about 1.5 times the total amount of electricity used by the New York City.

By this increasing rate it is possible that by 2020 the total amount of $CO_2$ emitted by these data centers will be nearly 359 megatons. In such a condition it is very importance that the cloud data centers should have better energy efficiency. The biggest problem in poor energy efficiency is that lot of energy are wasted when the servers runs at low consumption. According to the recent research from Pike Research [5], the global market for green data centers will grow from $17.1 billion in 2012 to $45.4 billion by 2016. So on-site server with no visualization will emit about 46 kg of $CO_2$ per year.

*B. Green Cloud Computing*

Green Cloud Computing is technique to achieve not only better processing and utilization of computing resources, but also minimize energy consumption. This is very important for assuring that the future growth of Cloud computing is supportable. Otherwise, Cloud computing with increasingly pervasive front-end client devices interacting with back-end data centers will cause a huge improvement of energy consumption. To locate this problem, data center resources needs to be managed in an energy-efficient manner to perform Green Cloud computing. In particular, Cloud resources need to be allocated not only to satisfy QoS requirements specified by users via Service Level Agreements (SLA), but also to reduce energy usage.

*C. Features Of Cloud Enabling Green Computing*

*1) Multi-Tenancy*: Using multi-tenancy approach, Green Cloud computing reduces unwanted energy usage and minimize carbon emissions. By this approach we can handle multiple customers with a single instance of application. Multiple customers are represents as tenant and they having some authorization to make some changes in the some of the parts of the application. The SaaS providers give multiple organizations on same infrastructure and common software. By this approach they can make an energy efficient environment. But with running time businesses have highly variable demand patterns in general, and hence multi-tenancy on the same server allows the equality of the overall peak demand which can minimize the needs of extra requirements of software and infrastructure. The smaller Randomness in demand stops energy wastage and it gives better results in greater energy savings.

*2) Server Utilization*: In general, on-premise infrastructure run with very low utilization, sometimes it goes down up to 5 to 10 percent of average utilization. By using virtualization, number of applications can be hosted and executed on the same server in isolation, thus make the utilization levels up to 70%. Thus, it dramatically minimizes the number of active servers. Even though high utilization of servers results in more power consumption, server running at higher utilization can process more workload with similar power usage.

*3) Datacenter Efficiency*: The datacenters power efficiency has major role on to the total energy consumption of Cloud computing.

By using the best energy efficient techniques, Cloud data center providers can significantly improve the Power usage effectiveness of their datacenters. Large organization who providers Cloud service can ac maintain PUE levels as low as 1.1 to 1.2, which is about 40% or more power efficient than the common datacenters. The servers design way of modular containers, or advanced energy management through energy supply optimization, water and air based cooling, are all works that have improved PUE in datacenters. Cloud computing is also allows services to be moved between various datacenters who are working with much better PUE values. These are achieved by using high speed network, virtualized services and there measurement, monitoring and accounting of datacenter.

## II. LITERATURE SURVEY

The use of Green Cloud Computing has increased substantially in the recent past. A lot of research has been done to incorporate and enhance the applicability of Green Cloud in real life scenarios with these help of various parameters. Usage of energy is dramatically increases in data centers.

Cavdar et al., [1,6] introduced for improving the energy efficiency of the running data centers, the Green grid is proposing some parameters like Power Usage Effectiveness (PUE) and Data centre Efficiency (DCE) metrics [16], TDP (Thermal Design Power) [1], etc. PUE is the common parameter. According to articles "PUE is a measure of how efficiently a computer data-center uses its power "The range of PUE is varies from 1.0 to infinity. If the value of PUE approaching 1.0 it means efficiency is 100% and full power is used by IT equipment's. In recent years some companies achieved low PUE levels, like Google PUE with 1.13. If the value of PUE is 1.5 it means that energy consumed by IT equipment in 1kWh, by data centre 1.5 kWh and 0.5 WH energy has wasted as fruitless work like cooling, CPU dissipation and other work. In many data centre the value of PUE reached to 3.0 or more but by using correct design 1.6 values should be achievable [5]. This calculation is done in Lawrence Berkley National Labs [19] which illustrate that 22 data centers 22 data centers measured had PUE values in the 1.3 to 3.0 range [19].

Fumiko Satoh et al., [11] also focus on reducing the usage of energy in data centers. But for the future energy management they develop an energy management System for cloud by the use of sensor management function with an optimized VM allocation tool. This system will help to reduce the energy consumption in multiple data centers and results shows that it will save 30% of energy. This system also used to reduce the energy in carbon emissions. Rasoul Beik et al., [18] propose an energy aware layer in software – architecture that calculate the energy consumption in data centers and provide services to the users which uses energy efficiently.

Bhanu Priya et al., [4] gave a cloud computing metrics to make the cloud green in terms of energy efficiency, different energy models has been discussed in this paper to reduce the power consumption and $CO_2$ emission to make cloud more green. This survey takes three major factors under consideration; any cloud can be green by following these factors, first cause to make cloud greener is virtualization, Second is Work load distribution and third is software automation, some other factors are also discussed like pay-per-use and self-service which is proved as a key for reduction of energy consumption.

According to Kliazovich and Pascal Bouvry [8] expenses on cloud data centers maintenance and operation done in cloud are gradually increasing. In this paper author has focused on the work load distribution among the data centers so that energy consumption can be calculated in terms of packet level. By this technique packet level communication is achieved. Packet level simulation of energy has been done through the simulator, like for green cloud NS2 simulator and for cloud only one existing called "cloud-sim". This simulation is done at three levels: "two-tier, three-tier, and three-tier high-speed data center architectures".

Kaur and Singh et al., [14] performed the different challenges in the field of energy in cloud computing, a model is proposed by author to calculate the energy wasted by producing various gases in environment. The proposed model contains various fields Data, Analysis, Record, Put on guard, restrain along with the virtualization concept in green cloud to make it energy efficient and for healthy environment.

Hosman and Baikie et al., [13] gave a new challenge in the field of cloud computing, data centers consumes a lot of energy and energy is available every time is not necessary, so the author is discussing in his paper about the solar energy. How the solar energy can play a vital role in data centers energy consumption is the hot topic of discussion. In this paper author proposed a small level cloud data center which is the combination of three technologies are "less power consumption platform, energy efficient cloud computing and DC power distribution". Owusu et al., [10] performed a survey to establish the current state of the art in the area of energy efficiency in cloud computing. They beautifully mention the field of energy efficiency as a controversial area to cloud computing. This paper discusses one area of controversy; the energy efficiency of cloud computing.

Yamini et al., [17] Introducing the key approaches like virtualization, Power Management, Recycling of material and

telecommuting of green cloud computing very beautifully. The major focus of this paper is the consolidation or scheduling of task and resource utilization in green cloud computing to reduce the high consumption of energy. The decent results shown in the paper not for the direct drastic energy reduction but applies possible saving of electricity in huge cloud data centers.

According to Buyya [20] the demand of cloud is drastically increasing now a day and the consumption of energy and excretion of harmful gases is also extreme which is very harmful and a big issue in the field of health care and also a big reason of the increase in cost of operations in cloud.

Buyya gave a presentable and evidential literature survey of the various different members of cloud which participate in the total energy consumption. Structure of cloud are discussed in this paper which turn on the use of green cloud computing.

A. Beloglazov and Buyya et al., [2] focuses on virtual machine for the reduction of the energy consumption. An author proposes the dynamic reallocation technique for VMs and toggles off the unused servers which results, considerable energy saving in the real Cloud Computing data centers. Nimje et al., [3] addressed the security of the cloud data centres in order to achieve green cloud environment by using virtualization concept.. Virtualization here came in to picture because it reduces the load from the data centres and provides deployment, management and delivery of resources in simple manner.

| Title of Paper | Advantages | Techniques |
|---|---|---|
| A Predictive energy Aware Hybrid Resource Scheduler for Green Cloud computing. | By scheduling of two algorithms it can manage high temperature failure. | Using two algorithms randomly,<br>1. FCFS<br>2. Priority |
| Using Ant Colony System to Consolidate VMs for Green Cloud Computing | Maintaining Quality of system and reducing energy consumption | -By distributed system architecture to perform dynamic VM consolidation to reduce energy by using online optimisation meta heuristic algorithm called Ant Colony System |
| A Tabu Search Algorithm for the Location of Data Centers and Software Components in Green Cloud Computing Networks. | Optimize the network performance, Reduce $CO_2$ emission, Reduce Capital expenditure, Operational expenditure | -Optimizing the cloud data center locations and software components by Tabu algorithm. |
| Study and Analysis of Various Task Scheduling Algorithms in the Cloud Computing Environment | This paper presents a detailed study of various task scheduling methods existing for the cloud environment. | -The performance and efficiency of cloud computing services always depends upon the performance of the user tasks submitted to the cloud system |
| Energy Consumption in Cloud Computing Data Centers | -This paper present formulations and solutions for Green Cloud Environments (GCE) to minimize its environmental impact and energy consumption under new models by considering static and dynamic portions of cloud components | -Investigate energy consumption pattern.<br>-Appling suitable optimization policies direct thought energy consumption model to save 20 % energy |

| | | |
|---|---|---|
| Design of Power Efficient Schema for Energy Optimization in Data Center With Massive Task Execution Using DVFS | - Paper describes that with number of users using data centers rapidly.<br>- Author consider the case of multimedia video sharing web services,<br>- To compromise the high rate of energy consumption by<br>- The millions of user sharing high size of video application. | - Providing high energy consumption by using DVFS ( Dynamic Voltage and Frequency Scaling ) |

Table 1.1 Comparison of some research papers.

From the above comparative study we observe that, Green cloud Computing is a paradigm which helps in monitoring the consumption of the energy and providing environment security from high emission of $CO_2$. Other techniques discussed use Green cloud computing for optimizing the data center performance. This Scheduling mechanism uses a very simple method for data center optimization and task scheduling but there have been some issue with execution and large time consumption in scheduling of job which they were not able to count up-to. This method comprises a different approach for energy optimization in the cloud data center using algorithms for scheduling the task in data center but still there is hybrid methods which can give a better result. In above papers they reducing the total energy consumption but they increase complexities in task scheduling. So from above comparison it shows that there is a large problem with energy consumption and its uses. Data centres wastes a large amount of the electricity and resorces, it makes a large energy consumption and wastage of time. So there is a strong need of optimisation above three factors CPU utilization, response time for task and number of task executed per minimum time.

## III. PROPOSED TECHNOLOGY (HYBRID OF MULTILEVEL FEEDBACK QUEUE SCHEDULING AND WEIGHTED ROUND ROBIN)

The above comparison discursion defined in the previous section shows the problem occurring in data centers to reduce the energy consumption by using various methods. The total energy consumption is much greater than the exact requirement or use of data center. To solve the above problem of misuse of energy in data center the paper proposes a hybrid approach on the two scheduling algorithm in the manner explained below. Various conditions are checked and actions are taken according to the proposed algorithm.

By deploying hybridization of multilevel feedback queue scheduling and weighted round robin to solve out above problem. With the help of the above two algorithms it is possible to manage the high energy consumption issue. With multilevel feedback queue scheduling the entire task can be maintained in an organized queue which is helpful in easy selection of task for execution by the next algorithm (weighted round robin) after formation of a queue of coming tasks then it goes for execution by weighted round robin algorithm. The various steps are:-

**Start This** is the first step of the execution that initializes the process of execution and task for selection.

It is called by user after the submission of the tasks for execution. Scheduler gets all the tasks selected by user and manage them into queue for the execution.

Scheduler gets all tasks detail from cloud server those initialize for execution. It manages them with their configuration in task matrix. This process is under looping condition so that it collects all information about those entire tasks which initialize for execution.

Scheduler find system for execution after checking job status.

On the other hand scheduler arranges systems by getting their specification from the cloud server for generate the execution environment. The whole data and specification stored inside system matrix for manage network of systems and task execution on them.

Scheduler execute task with systems threads those are used to execute task as high priority and low priority. These tasks pattern

reduce waiting time and energy consumption.

Calculate executed tasks and consumption of their energy. If task not execute due to some specification miss match. Than the task stored in unexecuted task list and publish results with consumption of their energy on cloud environment.

## IV. CONCLUSIONS AND FUTURE WORK

From the above literature survey it shows that there is a large problem with cloud computing data centers. Cloud data centers consuming large amount energy in a wasteful manner which causes a large emission of $CO_2$. In this research proposal, we will deploy hybridization of multilevel feedback queue scheduling and weighted round robin to achieve above problem. The hybrid of the two algorithm gives a better scheduling result and low time consumption. The given technology allows the data centre to give its optimal performance and high quality of result.

In our future work, we will develop the algorithm which would help us solving the problem occurring in data center job scheduling and can also use in data over loading. We will work on the implementation of the new algorithm which helps us reach the objectives and further increases the task scheduling for various huge amount of data and for big data centers.

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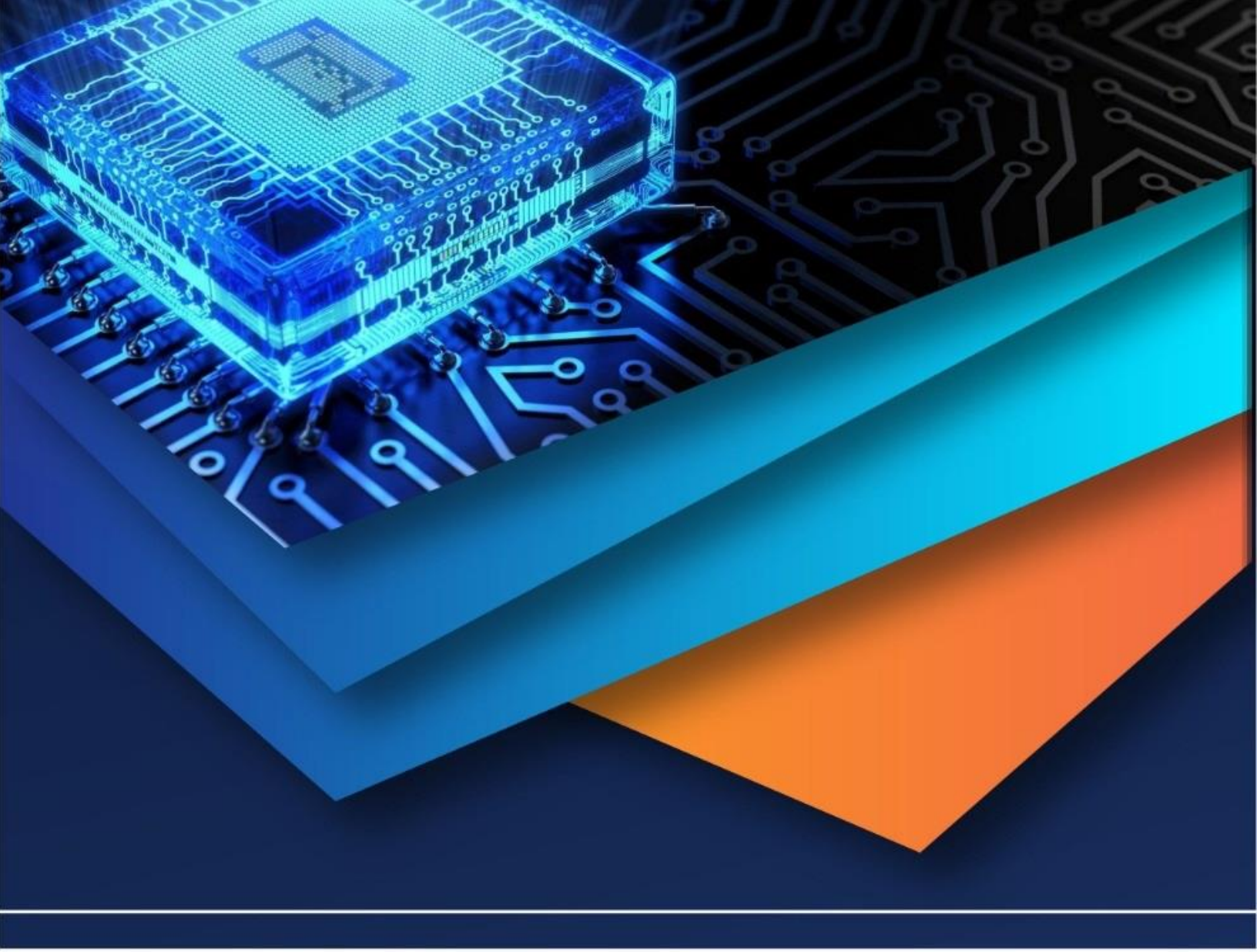

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