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A Review of Energy Consumption Optimization Algorithms Used in Green Cloud Computing

Daljinder Singh[1], Mandeep Devgan[2]
[1]*Student, M.Tech, Information Technology, Chandigarh engineering college, Landran*
[2]*Assistant professor, Information Technology, Chandigarh engineering college, Landran*

Abstract - Cloud computing is presenting utility oriented IT services to users worldwide. It enables hosting of applications from consumer, scientific and business areas. However data centre hosting cloud computing applications consume huge quantities of energy, thereby contributing to high operative costs and carbon footprints to the environment. With energy lacks and global climate change leading our distresses these days, the power consumption of data centres has become a key issue. Thus, we are in essential of green cloud computing solutions that cannot only save energy, but also reduce operational costs. The vision for energy efficient management of cloud computing environments is presented here. A green scheduling algorithm which works by operating down servers when they are not in use is also presented.

Keywords - Cloud Computing, Information Technology services, Energy Efficient and green Scheduling.

I. INTRODUCTION

In cloud computing a model, user's access services based on their needs without respect to where the services are presented. This model has [1] been mentioned to as utility computing, or as Cloud Computing. The advanced term denotes the infrastructure as a "Cloud" from which productions and users can entrance requests as services from anywhere in the world on demand. Hence, Cloud computing can be secret as a new paradigm for the dynamic provisioning of computing services maintained by state-of-the-art data focuses that usually employ Virtual Machine skills for consolidation and environment isolation resolutions. Many computing service providers including Google, Microsoft, Yahoo, and IBM are rapidly deploying data centres in numerous locations around the world to deliver Cloud computing services [2].

Cloud computing transports infrastructure, platform, and software [3] as services, which are made obtainable to consumers as subscription-based services under the pay-as-you-go model. In industry these services are denoted to as Infrastructure as a Service, Platform as a Service, and Software as a Service individually. Clouds aim to drive the design of the next group data centres by architecting them as networks of virtual services so that users can access and deploy requests from anywhere in the world on demand at competitive costs depending on their QoS (Quality of Service) wants [4].

II. GREEN CLOUD COMPUTING

"Green Computing is a model for enabling convenient, environment sustainability in IT sector that can be rapidly provisioned and released with[5] minimal management effort or green provider interaction". Green computing has been extensively accepted from individual to official employee of government. "Green-computing has been permitted by the availability of broadband networks and low-priced end-user devices, along with commodity-computing nodes that can be simply unified and controlled, as well as virtualization to make available the advent of isolating processes that share computers by reducing CO_2 emission rate".

Needs of Green Computing in Cloud

Modern data centres, operating under the Cloud computing model are presenting a variety of applications extending from those that run for a few [6] seconds instance serving requests of web applications such as e-commerce and social networks entrances with transient workloads to those that run for longer phases of time an example imitations or large data set processing on shared hardware platforms. The essential to manage multiple applications in a data centre creates the encounter of on-demand resource provisioning and allocation in response to time-varying workloads. Generally, data centre resources are statically assigned to applications, based on peak load features, in order to preserve isolation and provide presentation guarantees. Until recently, high presentation has been the sole concern in data centre deployments and this demand has been satisfied without [7] paying much attention to energy ingestion.

III. ALGORITHMS USED TO REDUCE ENERGY CONSUMPTION

Following Algorithms are used:

1) H-Green heuristic
2) Fixed priority pre-emptive scheduling
3) Pthread scheduling

1) H-Green Heuristic Algorithm

Energy consumption of wireless entrance networks is in stable increase, which necessitates expansion of more energy-efficient network management methods. Such management schemes must consequence with adaptation of network energy consumption in harmony with daily differences in user activity. They consider conceivable energy savings of wireless local area networks through expansion of a few [14] integer linear programming models.

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Effectiveness of ILP models providing energy-efficient organisation of network resources have been tested on numerous WLAN occurrences of different sizes.

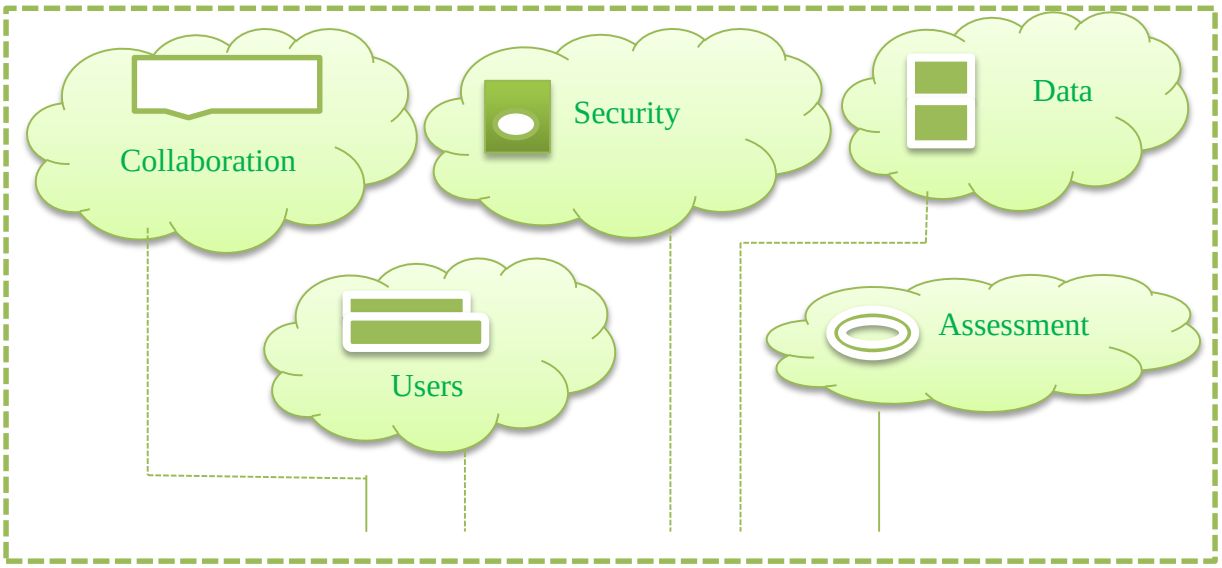

Fig.1 Green Cloud Computing Architecture

2) Fixed Priority Pre-Emptive Scheduling

In particular, significant progress has been made in schedulability analysis of task sets under fixed priority pre-emptive scheduling. The benefits of fixed priority pre-emptive scheduling include relatively low run-time overheads and ability to support tighter deadlines [15] for urgent tasks. While pre-imitability is often necessary in real-time scheduling, it is fallacious to assume that it always results in higher schedulability. Indeed, it can be shown that, in the context of fixed priority scheduling, Pre-emptive schedulers do not dominate non-pre-emptive schedulers, i.e., the schedulability of a task set under non-pre-emptive scheduling does not imply the schedulability of the task set under pre-emptive scheduling. Moreover, pre-emptive schedulers have higher run-time overheads as compared to non-pre-emptive schedulers.

3) Pthread scheduling

The operating system incessantly selects a single line to run from a system wide collection of all threads that are not waiting for the conclusion of an I/O request or are not obstructed by some other activity. Many threaded programs have no cause [16] to interfere with the default conduct of the system's scheduler. However, the Pthreads standard defines a thread-scheduling border that allows programs with real-time tasks to get elaborate in the process. Using the Pthreads scheduling feature, you can elect how threads share the available processing power. You may agree that all threads should have equal access to all available CPUs, or you can give some threads privileged treatment. In some applications, it's beneficial to give those threads that perform significant tasks an advantage over those that perform background work. For illustration, in a process-control application, a thread that responds to input for different devices could be given priority over a thread that simply preserves the log. Used in coincidence with POSIX real-time allowances, such as memory locking and real-time clocks, the Pthreads arrangement feature lets you create real-time applications in which the threads with significant tasks can be definite to complete their tasks in a predictable, finite quantity of time.

IV. OPPORTUNITIES TO APPLY GREEN COMPUTING POLICIES

(i). Efficiency algorithm – pointed to design more efficient algorithms, aiming to reduce completing time and demand per properties.
(ii). Virtualization – allows data midpoints to change physical systems per virtual machines to run on single apparatus.
(iii). Energy waste organisation via software – to reduce the load in slothfulness time;
(iv). Storage media – to change the out-dated storage media for SSD devices.
(v). Processors – to produce processors with higher performance/watt rate;
(vi). Smart rejects of computers and apparatus, inspiring practices like reprocessing and donation.

V. RELATED WORK

A.Jain et.al,[8],2013 discusses that the large amount of CO_2 dissipation in situation has generated the necessity of Green computing. More processor-chips produces more heat, more heat requires more cooling and co oling again produces heats and thus author come to a phase where author need to balance the system by receiving the same

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computing speed at decreased energy consumption. In this paper author proposed dissimilar ideas towards green cloud computing approach. **Bhanu Priya et al., [9],2013** gave a cloud computing metrics to make the cloud green in terms of energy efficiency, dissimilar models of energy has been discussed so that to decrease the consumption of power along with emission of carbon-dioxide to make cloud more green as compared to earlier. This survey takes three major-factors are taken under-consideration; any cloud could be green by following these specific factors, 1st cause to create cloud greener is virtualization, Second one is Work load circulation and third is software-automation, some of the additional factors are also deliberated like pay-per-use as well as self-service that is proved as a key for reduction of energy consumption. **Kaur and Singh et al., [10], 2012** performed the different challenges in the field of energy in cloud computing, a model is suggested by author to compute the energy misused by producing various gases in environment. The proposed-model comprises several fields Data, Record, Analysis, Put on specific guard, restrain together with the virtualization-concept in green-cloud to make it energy-efficient as well as for healthy-environment. **Divya Doraya, [11], 2015** the author stated that cloud clients are increasing day-by-day that has constrained the cloud-service-provider towards opening more data-centres for the purpose of hosting their services more efficiently. The increasing demand of Cloud-computing has also augmented the consumption of energy of cloud-data centres vividly. High consumption of energy not just only upsurges the operational-cost however it also decreases the profit-margin of cloud-service-providers and it also affects the whole environment through its carbon-emission. So as to make cloud-computing an eco-friendly technology, some energy-efficient solutions are mandatory. Hence, this paper is talking about the motivation along with several driving forces required for green-computing. It also deliberates the important problems faced in green-cloud-computing. **Yeanf-Fu Wen, [12], 2014** this study considers the location-aware cloud-storage selection towards executing a remote-data-backup as a strategic so that to tackle energy-efficiency. To gratify the green-computing, a trade-off amongst user-access (that localizes in several-locations) as well as backup (that stores the data at least in two different datacentres) were well-adjusted to diminish the total consumption of energy. The main objective of minimum consumption of energy subjects to the essential link along with access proportion, delay, nodal capacity, service level, as well as cloud-storages selection. This proposed work has developed specific delay, network, access distribution, as well as consumption of energy-models and also recommended a remote-backup-mechanism. The interrelated techniques that are approximation method, WAP cloud-storage, as well as group-based heuristic (GBH), are assessed to show how the control variable disturb the green-cloud-computing-networks.

Table no: 1 Categories of Algorithm

Scheduling Techniques	Parameters Considered	Advantages	Disadvantages
First Come First Serve (First In First Out Technique)	Arrival Time	Easy to implement	Doesn't consider any other criteria for scheduling
Round Robin (Time Slot Based Multi-Threading Technique)	Arrival time, Time quantum	Less complexity and load is balanced more fairly	Pre-emption is required
Min-Min, Max Min (Task Queue Prioritization Technique)	Make span, Expected completion time	Better make span compared to other algorithms	Poor load balancing and QoS factors are not considered

Table no: 2 Summaries of Schedulers

Schedulers	Grid Computing	Cloud Computing	Green Aspect	Static Scheduling	Dynamic Scheduling	Algorithm Used
Grid Scheduling	True	False	False	True	False	Not Found
Green Scheduler	False	True	True	False	True	History prediction algorithm Task Schedule Algorithm
Power –aware Scheduling	False	True	True	False	False	Greedy based algorithm
Central Scheduler	True	False	False	False	True	Simulated annealing Algorithm

VI. METHODS OF GREEN CLOUD COMPUTING

- Lower Power Hardware

Computers can be made less energy consumption [13] devices by using lower power processor, using cooling devices as well as using spinning SSD of small size rather than large size Intel has developed a process that is going to use less power. Low power PCs are green saver so they don't allow fast gaming.

- Virtualization

Virtualization is the process of makes use of efficient system resources. Virtualization fits in green computing by combining servers and maximizing CPU throughput. With virtualization several physical computers can be made one virtual computer on single computer [16].

Advantages of Virtualization:

- Efficient utilization of proper re-sources
- Superior degree of abstraction
- Replication

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- Scalable and flexible infrastructure

This enables frequently accessed files to be warehoused on high-performance, low-capacity drives; whilst files in less use are placed on more power-efficient, low-speed, larger capacity drives [17].

- Internet based Applications

Green computing is not just like government services that are encouraging to reevaluate their use in IT sector. But it has become reality in many countries. In internet based applications, it helps network managers in reducing Co2 emission.

- Storage

There are three routes available for storage of data that makes efficient use of resources. In order to have less power consumption, there is need for optimization of power devices. So it can be achieved by 3.5' hard drive usability or either 2.5" hard disk usability. Lowest power consumption is also achieved by using SSD cards.

VII. CONCLUSION

The providing of resources by cloud has added in many benefits in terms of saving cost but to efficiently and successfully make use of its resources a good scheduler is essential. Further, with the rise in global heating the green computing has appeared and the use of green aspect in scheduling has also taken deliberation. In this paper green feature is introduced in DIET scheduling so that in adding to efficient utilization of resources, power consumption and carbon dioxide emission can be condensed. It has been experimental from the works that utilization of all processing cores in a machine reduces the power consumption. This method is used in the proposed scheduler that not only diminishes the power consumption but also efficiently utilize the cloud properties.

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