

## AN APPROACH TO REDUCE CARBON EMISSION ON DATA CENTERS

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**ABSTRACT**

*In the recent years, IT industry decline towards the cloud services. With the growing demand of users for cloud services, cloud providers deploy large data centers, which consume very large amount of energy and contribute to high carbon dioxide emission day to day. Cloud computing is itself a greener option to reduce carbon emission on cloud data centers. It cannot be ignores the fact that data centers using cloud vendors, which is big source of carbon emission. Here the discussion of this is based on how to reduce the carbon emission in the cloud infrastructure. The architectural design of data centers requires more innovative and keep together with disciplined operational management.*

**INTRODUCTION:**

Green cloud computing is a practice of using resource efficiently that is environmental ecological and low power consumption on very low cost of operation.

Green cloud data centers includes the architectural design and development, installation, operations, and disposal of the data server machines and their related marginal such as printers, monitors, storage devices etc. In business, carbon emission occurs through end user tools such as laptops, personal computers, mobile gadgets, large data servers, communication equipment and infrastructures. Carbon release from the digital equipment and infrastructures, which creates risk in business field. To reduce carbon emission we need to perform some specific amounts and metrics has to be integrated as a part in the IT- business relationship with respect to Green cloud computing [1].

Thousands of digital devices and internet users share their own photos and documents through some applications, which are helpful for the serious actions of personal or business work. For this kind of activities, it is very important to have a platform, which provides faster access to elastic and low cost IT equipment. In order to provide this platform, the inventive service model called cloud computing has been introduced to the world. In the word of Mr. Taroub Ahmed Mustafa, cloud computing accommodates an easy way to access an extensive set of application services, databases, storage and servers over the internet. Cloud services provides the facility as resistance and Fats access for reliable cost by only paying for the service use by users. Data and services are enduring in common, scalable resource pools, which are dynamically expandable, generally virtualized in a cloud computing architecture and those data and services are available for any verified device through the internet [3].

Google Cloud Platform, Amazon Web Services, IBM Cloud, Oracle Cloud, Microsoft Azure, Adobe, VMware, Virtual Box, Rackspace and Red Hat are some of distinguished cloud service providers and those providers charge their customers for consuming the services according to the usage.

In the different way illumination of cloud computing is, explaining the development models of cloud computing which can be described as a computing methodology that involves computational resource, instead of arranging the personal machine to administrate the request and the demanded applications of the user.

The followings are the different models of cloud:

- **Public cloud:** Public cloud is available for any organization by allowing users to organize and outline services in the cloud environment.
- **Private cloud:** In this cloud, the availability of services is limited and maintained, controlled and deployed for a private organization.
- **Community cloud:** It is allows the users of number of specific organizations with shared services of community.
- **Hybrid cloud:** It is a grouping of any other types of clouds (means combination of private, public and community), which have the capability over the interfaces to move and allow data or applications between more than one cloud.

Three types of Cloud computing Services as shown in the figure 1[2] below.

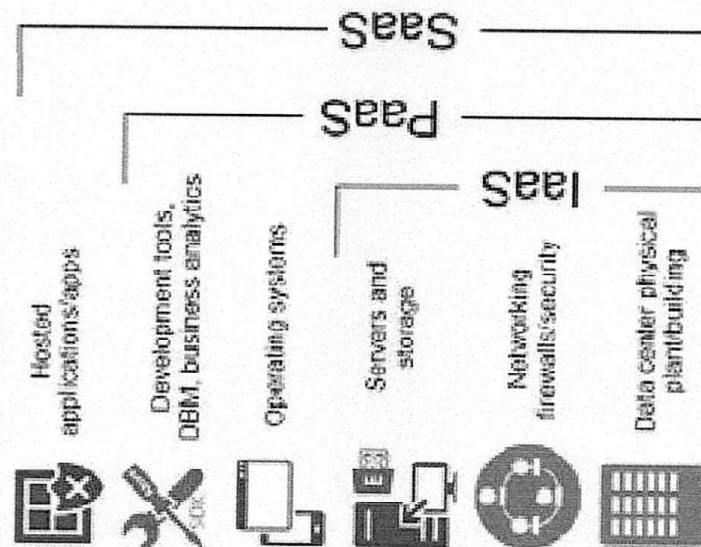


Figure 1

- **Infrastructure as a service (IaaS):** In the Infrastructure as a service merchant proposals access for resources like networking, storage and servers for the users by providing their own applications and platform within the infrastructure. Therefore, it is a replacement for procurement hardware, users can pay for IaaS on demand and there is no any single option even for a single point of failure. This saves money and time. This service provided by the vendors' like Microsoft Azure and Amazon Web Services (AWS).
- **Platform as a Service (PaaS):** PaaS is a third- party provider distributes software tools and hardware for the customers over the Internet. This third-party provider has accommodated the software and hardware on his own organization, so that user can continue with the complete development and deployment environment in the cloud. PaaS includes analytical tools business intelligence (BI) services, infrastructure networking, development tools, DBMS, RDBMS, and middleware. PaaS provided by Windows Azure, Google App Engine and AWS(Amazon Web Services) , Elastic Beanstalk.
- **Software as a Service (SaaS):** SaaS is a service type of cloud computing where hosts requests, and makes them available to customers over the Internet by a vendor service provider. Since different user of the organization does not need to install and run applications on their own cloud data centers or in their digital devices. It reduce the spending of purchasing hardware, software licensing, maintenance cost, cost for installation and support. Dropbox, Cisco WebEx and Google Apps are some real world application as examples for SaaS.

#### APPLICATIONS OF GREEN CLOUD COMPUTING:

In order to increase the resource efficiency and performance there are seven application areas introduced for green IT, which can be applied in Green cloud computing as follows:

- Proper management of power
- Energy efficient resources
- Design of data centers
- Virtualization of servers

##### a) Proper management of Power:

In green cloud computing progress the efficient power consumption, cost effective solution and environment friendly.

In 2015, Rakshith and Sreenivas directed a research on power efficiency of green cloud computing and they have found that servers run at low utilization in data centers can be the key reason of more power consumption in data centers. Since there is a situation where even though usage of resources is fewer, the energy consumption is more than the power spent on usage. As per their research, energy consumption can be identified as the main reason in content distribution system and these demand an accretion of networked

computing resources from one or numerous service providers on data centers across the world. In the system of cloud computing on modern data center, It is mentioned above expenditure is acting as a disapproving design parameter of cloud. The high carbon emission and energy cost are depending on the power and energy consumed by the computer equipment and the connected cooling system [4],

**b) Energy efficient resources:**

The demand increase of cloud data centers high performance cloud computing requires on cloud data centers. As a result more energy consumption by the cloud data centers, carbon emission and the heat generated by processor chips increase gradually. To escape this problem, Green Cloud Computing has introduced. The aim of green cloud computing is to develop high end computing systems like data centers and clouds to meet not only user's quality of service requirements, but also minimize the utilization of electric power. Apart from that, it has defined to manage energy effectively and efficiently [6], Most of the time cloud data centers remain underutilized. There are many virtual machines running on top of these big under-utilized virtual machines. Therefore, it required huge power consumption. So it need to domain noteworthy volume of energy they are migrating virtual machines to other machines and hiding such under-utilized machines. As the data centers raise highly obsessed with energy efficiency, green cloud computing provides a rare opportunity to reduce data center power bills [5].

**c) Design of Data Centers**

Green cloud data centers are the heart of cloud computing and running thousands of server side workloads, data storage and large scale of data and scientific processing. Today, large data centers consume thousand megawatts of electricity.

The simulation of infrastructure of power consumption on the data center a slight scale distribution network in the electric grid. The infrastructure include feeders, transformers, and switchboards that feed power to the computing and cooling infrastructure. Developing a green data center and cooling infrastructure, data center controlling, physical layout and power efficient infrastructure are the major areas that should be considered

**d) Virtualization of Servers**

There are five main types of virtualization as

- Server virtualization
- Application virtualization,
- Desktop virtualization,
- Hardware virtualization and
- Network virtualization.

Green cloud computing server virtualization plays a major role by masking of server cloud resources, including the identity and number of individual processors and physical servers, and cloud server users and operating systems users. To separate one single physical server into many remote virtual servers and their administrative environments, can use different software application. The approaches for the main server virtualization are virtual machine model, paravirtual machine model, virtualization at the operating system layer. In 2012 Sasikumar and Yuvapriya has directed about execution the servers in a cloud data center. In order to reduce power consumption within the cloud data center VM scheduling algorithm can be used. For thermal aware scheduling and power-aware are the main two types of green scheduling systems for super computers. In order to reduce the power consumption on data center, jobs can be scheduled and the pattern is called as the thermal-aware scheduling. It is very helpful to reduce the power consumption needed to control the data center cooling systems. Power-aware scheduling arranged to decrease the server's total power by scheduling the jobs to nodes. Operating the servers is the most valuable function within a Cloud data center. VM schedules algorithm that minimizes power consumption within the data center [5].

**CONCLUSION**

Cloud data centers have become an essential part of current computing infrastructures and demand of consumer as pay per use. There are much company and other organization switch to them on cloud computing based services, cloud solutions, and compliance assurances; It is not wonder that the number of data centers is expected to rise day by day. So there are many new data centers upcoming, It is worth to think about the unpleasant fact of data center power consumption. Means we required some innovative idea and developments