

# Energy Saving using Green Cloud Computing

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**Abstract:** *Cloud computing focus on the data computing efficiency whereas green cloud computing is a new thinking which is based on cloud computing architecture and focuses on the energy efficiency of device and computing. Green Cloud Computing is an approach used to improve the utilization of computing resources those are being used in cloud computing network such as storage, servers, its application, and services and reduce energy consumption of these resources which improves power efficiency. This is done by various technologies such as virtualization and virtual machines migration. This paper reviews the various techniques purposed by the different authors to make cloud computing more energy efficient. The main objective of this paper is to study and analyse the concept of energy efficient data centre architecture, resource allocation and optimization.*

**Keywords:** Cloud Models, Energy saving, Cloud Computing, Computing Servers, Cloud deployment models, Cloud services models, Networks, PaaS, IaaS, DaaS, Digital Equipment, Cloud Communication

## I. INTRODUCTION

Today's world is of computers and computers are everyone's need. Rather this has become the basic need because many sectors earn their basic needs due to this basic need i.e. Computers. So, Green Cloud Computing helps to own these computers virtually with the minimum energy consumption. However, cloud computing consumes a lot of energy but Green Cloud Computing will be in use for future. Any endeavor or measure taken to save the environment must think about the Green Cloud Computing at the first thought. Its goal is to save energy and it is energy efficient because cloud computing disadvantage is that it is one of the causes of global warming and CO<sub>2</sub> emissions. Data centers are serving as the networking hubs and plays the important part in the connection among various countries in the world, so these need to be well maintained. Data centers are increasing day by day which emits lot of CO<sub>2</sub>s. That's why Green Cloud Computing came into picture. Let's discuss more about this topic further.

Green computing is defined as an environment sustainable computing. Green computing efficiently manages its resources by keeping environment at center. The main objective of green computing is to increase the energy efficiency and reduce CO<sub>2</sub> emission. The researchers have provided a variety of software and hardware solutions to the problem of energy efficiency in cloud operation by minimizing the impact of cloud computing on the environment. Virtualization technology can be used to get better resource isolation and less energy consumption through live migration and consolidation.

## II. LITERATURE SURVEY

A Study of Energy Saving Techniques in Green Cloud Computing

Authors: Balwinder Kaur, Navjot Kaur and Rachhpal Singh

**Abstract:** Cloud computing focus on the data computing efficiency whereas green cloud computing is a new thinking which is based on cloud computing architecture and focuses on the energy efficiency of device and computing. Green Cloud Computing is an approach used to improve the utilization of computing resources those are being used in cloud computing network such as storage, servers, its application, and services and reduce energy consumption of these resources which improves power efficiency. This is done by various technologies such as virtualization and virtual

machines migration. This paper reviews the various techniques purposed by the different authors to make cloud computing more energy efficient. The main objective of this paper is to study and analyse the concept of energy efficient data centre architecture, resource allocation and optimization.

Energy Saving Approaches for Green Cloud Computing

Authors: Amandeep Verma, Bharti Wadhwa

Abstract: Cloud Computing is an emerging technology and is being used by more and more IT companies due to its cost saving benefits and ease of use for users. But it needs to be environment friendly also. Therefore, Green Cloud Computing is the requirement of the today's world. This paper reviews the efforts made by various researchers to make Cloud Computing more energy efficient, to reduce the carbon footprint rate by various approaches and also discusses the concept of virtualization and various approaches which use virtual machines scheduling and migration to show how these can help to make the system more energy efficient. The summary of the main features of the proposed work of different authors that we have reviewed is also presented in it.

Analysis on Energy Efficient Green Cloud Computing

Authors: Monali Jumde, Snehlata Dongre

Abstract: Cloud computing offers subscription-based storage and resources. Cloud computing provides various services to cloud users. Increased use of information and communication technologies (ICT) has led to increase energy cost as well also increased emission of greenhouse gases like CO<sub>2</sub>. Since energy is an important asset, green cloud computing comes into picture. Green cloud computing can be achieved by applying various approaches, which uses lesser power as well as emits less CO<sub>2</sub> gas, which is hazardous to environment. Energy efficient technologies results in decreased overall energy consumption.

Green Cloud Computing Achieving Sustainability Through Energy Efficient Techniques, Architectures, and Addressing Research Challenges

Authors: Prabdeep Singh, VikasTripathi

Abstract: Green cloud computing aims to reduce the environmental impact of cloud computing. It contributes significantly to the world's energy use and carbon emissions. The cloud computing industry allows users from all over the world to access resources and processing power. Comparing it to specialist high-performance computing hardware results in cost savings and better performance. Large data centres are required for this service, which consumes a lot of energy and produces a lot of carbon dioxide. Utilizing energy-efficient procedures and sustainable infrastructures, data centres become more sustainable and reduce their carbon impact.

### **III. WORKING PRINCIPLE**

#### **A. PRINCIPLE OF OPERATION**

Green cloud computing means using technology in a way that helps the environment. It's about using computers and other digital equipment smartly and sustainably to reduce harmful effects on the planet. Green cloud is a sophisticated packet-level simulator for energy-aware cloud computing data centres with a focus on cloud communications. It offers a detailed fine-grained modelling of the energy consumed by the data centre IT equipment, such as computing servers, network switches, and communication links. Cloud computing delivers computing resources over the internet using virtualization and a pool of shared resources. Users access services, store data, and run applications remotely, eliminating the need for local infrastructure.

- The nature of computers and code, what they can and cannot do.
- How computer hardware works: chips, CPU, memory, disk.
- Necessary jargon: bits, bytes, megabytes, gigabytes.
- How software works: what is a program, what is "running"
- How digital images work.
- Computer code: loops and logic.

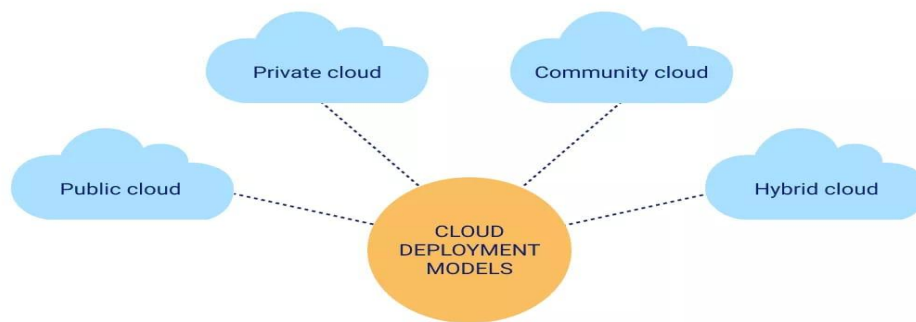
## B. CLOUD MODELS

There are 2 types of cloud models i.e. service models and the other are deployment models. The deployment models include: Public, Private, Hybrid and Community models. The service models include: IaaS, PaaS and SaaS.

## C. CLOUD DEPLOYMENT MODELS

Following are cloud deployment models,

- Public Cloud:** It is a type of deployment model in which virtual machine can be identified on the World Wide Web (www). It is open to all public.
- Private Cloud:** It is a type of deployment model in which machine can only be accessed in a private network. It is limited to an organization.
- Hybrid Cloud:** It is a type of deployment model which is a combination of both public and private cloud.
- Community Cloud:** It is a type of deployment model in which Cloud is shared among multiple organizations.

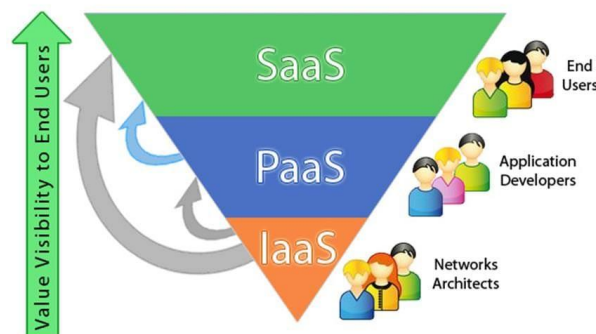


**Fig.1 CLOUD DEPLOYMENT MODELS**

## CLOUD SERVICE MODELS

Following are cloud service models,

- IaaS:** It stands for "Infrastructure as Service". It also known as "Hardware as Service" because it provides hardware components virtually like CPU, Operating Systems, RAM, Networking, Storage Drives etc. In this type of Service model, Applications and Data is managed by Client, rest components like Runtime, Middleware, Operating Systems, Virtualization, Servers, Storage and Networking is managed by Cloud Provider.
- PaaS:** It stands for "Platform as a Service". In this type of Service model; Applications, Data, Runtime, Middleware, Operating Systems are managed by Client, rest components like, Virtualization, Servers, Storage and Networking are managed by Cloud Provider.
- SaaS:** It stands for "Software as a Service". In this type of Service model, all the components like Applications, Data, Runtime, Middleware, Operating Systems, Virtualization, Servers, Storage and Networking is managed by Cloud Provider.



**Fig.2CLOUD SERVICE MODELS**

#### IV. TECHNOLOGYS

- **Virtualization:** Virtualization creates a simulated, or virtual, computing environment as opposed to a physical environment. Virtualization often includes computer-generated versions of hardware, operating systems, storage devices, and more. This allows organizations to partition a single physical computer or server into several virtual machines. Each virtual machine can then interact independently and run different operating systems or applications while sharing the resources of a single host machine. By creating multiple resources from a single computer or server, virtualization improves scalability and workloads while resulting in the use of fewer overall servers, less energy consumption, and less infrastructure costs and maintenance.
- **Renewable Energy Sources:** Data centres can harness renewable energy sources such as solar, wind, or hydroelectric power to minimize their reliance on fossil fuels and reduce carbon emissions.
- **Energy-Efficient Hardware:** Using energy-efficient servers, storage devices, and networking equipment can significantly decrease power consumption in data centres.
- **Dynamic Resource Allocation:** Implementing dynamic resource allocation techniques allows cloud providers to scale resources up or down based on demand, optimizing energy usage and reducing wastage.
- **Data Centre Location:** Locating data centres in regions with cooler climates or access to renewable energy sources can help reduce cooling costs and overall energy consumption.
- **Energy-Aware Scheduling Algorithms:** Intelligent scheduling algorithms can allocate computing tasks to servers with lower energy consumption or prioritize tasks during off-peak energy hours.
- **Data Compression and Deduplication:** Utilizing techniques like data compression and deduplication reduces the amount of data stored and transmitted, leading to lower energy consumption for storage and network operations.
- **Green Data Centre Design:** Designing data centres with energy-efficient cooling systems, efficient airflow management, and optimized building materials can contribute to significant energy savings.
- **Power Management Software:** Implementing power management software to monitor and control energy usage across servers, networking equipment, and other hardware components can improve efficiency.

#### ADVANTAGES

1. Using Energy Wisely.
2. Mobility.
3. Data Security.
4. Safe for Environment.
5. Creating Less E-Waste.
6. Increases Energy Efficiency.
7. Low cost.
8. Recycling

#### APPLICATIONS

1. Public Charging Infrastructure.
2. Antivirus Applications
3. Home Charging.
4. Online Data Storage.
5. Fleet Charging.
6. Autonomous Vehicle Charging.
7. Backup and Recovery.
8. Industrial Applications.
9. Public Transportation.
10. Big Data Analysis.

## V. CONCLUSION

By the study of the past papers, it is been concluded that we have discussed about the Green Cloud computing, energy saving measures, cloud computing and its harmful effects on the nature because the use of IT resources inefficiently. We also discussed about PUE, DCiE methods, GCA architecture and reviewed the Consolidation methods of servers. The paper starts by introducing the concept of cloud computing, green computing and then the various techniques by which Information technology is moving towards Green IT. An efficient and effective use of computing resources in cloud make it Green Cloud computing, some approaches discussed in this paper use workload allocation and scheduling and sever profiling without use of virtualization others make use of virtualization technique.

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