Emerging Green Cloud Computing and Its Challenges with Possible Solutions

Ranjana Sharma, Assistant Professor,
College of Computing Sciences and Information Technology, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India
Email Id- sharmaranjana04@gmail.com

ABSTRACT: As cloud computing and its usage are in a surge in various industries, making it green is becoming more and more important. Therefore, the goal of this review is to highlight the importance of changing existing cloud computing practices to attain green use of cloud computing to reduce greenhouse gas emissions gases, use less energy, and save money. There are several ways to do it, some of which include scheduling to get maximum efficiency, virtualizing to achieve proportional computing, low cost, and hardware used to produce as much as possible. Other general strategies comprise clusters that produce power utilizing renewable energy controlling power usage and computing. Regardless of the advantages of green cloud computing, there are security issues and networking requirements. The pursuit of novel cloud computing techniques is ongoing for data centers and their industry.

KEYWORDS: Energy, Cloud Computing, Green Cloud, Virtualization, Technology.

1. INTRODUCTION

A cloud is a type of network or the internet. In other words, things that are kept in a remote location are referred to as being in the cloud. A network, such as a "public network" or a "private network", such as a VPN, LAN, or WAN, can be used to supply cloud services. Cloud-based apps include online conferencing, customer relationship management (CRM), and email [1]–[3]. Cloud computing is the practice of modifying, configuring, and gaining access to software through the Internet. It offers internet-wide infrastructure, data storage, and applications. A network service called cloud computing integrates computer resources from both software and hardware.

In the age of fast technological growth, we are gradually exhausting the earth's natural resources. On-premises computers were frequently utilized for calculation in traditional IT sectors, which necessitated extensive planning, expensive costs, and substantial storage. It also led to excessive energy use. To prevent all of this, cloud computing was invented, and as a consequence of its on-demand and pay-as-you-go service, various problems were overcome. As a consequence, IT teams no longer need to have a separate server storage facility, plan ahead of time because it is an on-demand service, or worry about money because it is a pay-per-use facility offering significant discounts if ordered in quantity. The requirement for separate server rooms is not necessary for IT firms, but it is for service providers like "Google", "Microsoft" and "Amazon"., even though cloud computing promotes renewability, these systems use a lot of energy.

1.1. Need and Aim of Green Cloud Computing:

Over the past 10 years, "green computing", which examines how IT infrastructure affects the environment, has drawn a lot of attention. Even when information technology and the environment are studied independently, the expanding impact of information technology on the environment is not taken into consideration. Information technology, according to McKinsey, generates around one gigatons of output annually, or 2% of all global emissions. By 2020, it is anticipated to have reached 1.54 gigatons, or 3% of all land extraction. Although

the need for computers cannot be stopped, we must find ways to offer them in a far more clever and sustainable manner.

1.2. *Green Cloud Computing:*

Green cloud computing not only offers efficient infrastructure and processing, but it also conserves energy. Green computing is a technique for minimizing both the use of computer resources and the effects on the environment. The process of adopting this architecture in data centers is known as green cloud computing. Every industry is seeking to implement environmentally friendly practices into its industries as a response to increased energy consumption. Given its many benefits, cloud computing was welcomed by many IT companies, and it helped the environment by reducing the energy use of businesses' data centers. On the other side, cloud computing does away with the need for a separate data center [4]–[7]. Figure 1 illustrating the pros and cons of the green cloud computing.
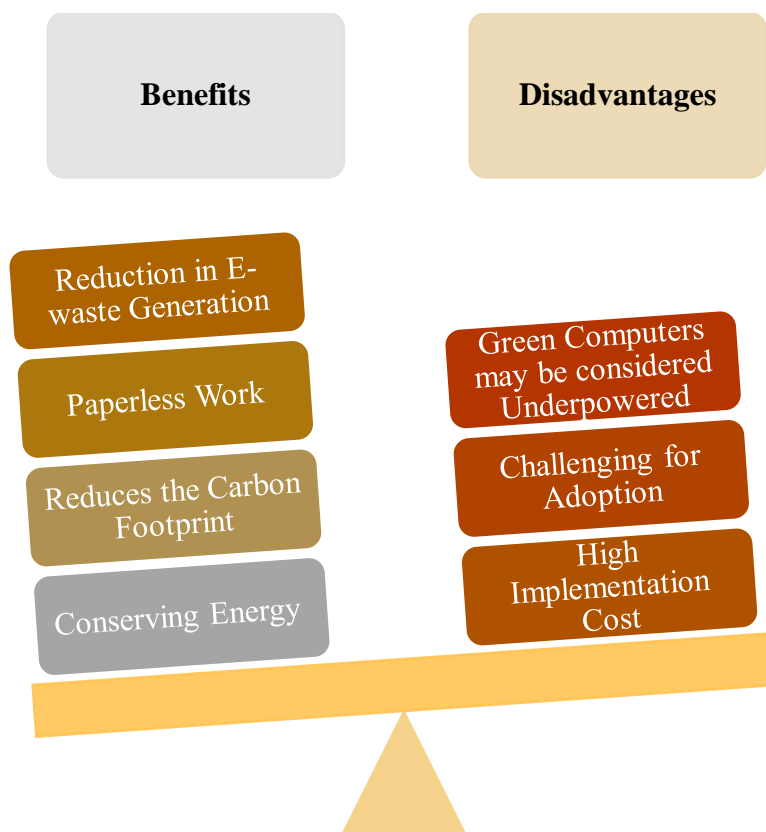

Figure 1: Illustrating the Pros and Cons of the Green Cloud Computing [Google].

Reduced power usage at the data center is the aim. It includes excellent features including visibility placement, virtual machine migration, and online monitoring. The savings might reach 27% thanks to our green cloud architecture framework. It is challenging to provide the required resources and distribute them among different workloads in a data center because of the necessity to manage many applications. Domain data resources have statistical applications that rely on loading characteristics to provide performance guarantees and maintain segmentation. The idea of energy-saving device management was first developed concerning mobile devices that are powered by batteries, where it is necessary to reduce power usage to increase battery life. Mobile device tactics can be used or modified by servers and data centers; however, this type of program requires certain approaches. The secret is to incorporate Dynamic Voltage Frequency Scaling efficiently to increase resource utilization and decrease

the energy consumption of data carriers, resulting in a smaller carbon footprint and significantly contributing to attaining green computing[8].

2. DISCUSSION

The rising usage of cloud technology has resulted in a significant increase in energy usage. This quest for power has considerably contributed to the carbon imprint of the environment. The exponential increase of data centers with hundreds of servers, as well as other infrastructure, is mostly to blame for the ever-growing need for energy. To reduce the environmental effect of cloud computing, energy-efficient solutions are required. Green cloud computing, sometimes known as green information technology, is indeed a possible option to help with energy reduction. Green cloud computing is a term used to indicate the study of designing, manufacturing, and deploying digital equipment in a way that minimizes its environmental effect. These methods not only conserve energy but also minimize operational expenses [9].

2.1. Techniques to Make Cloud Green:

Below are three techniques that can be utilized for making the cloud green, that is explained as follows. Figure 2 illustrating the three major techniques of green cloud computing.

A. Virtualization: Through the simultaneous sharing of a single physical instance of a resource or program with many clients or organizations, virtualization is a technique that improves machine management and energy efficiency. Virtualization enhances the number of accessible system resources in an environmentally responsible manner.

B. Dynamic Voltage Frequency Scaling: A way for reducing the power and energy consumption procedures associated with frequency scaling. Implementing this strategy will cut energy usage and increase resource utilization.

C. Nano Data Centers: A newly designed computing platform that offers computing and storage services through residential gateways managed by Internet service providers (ISPs). Nano Data Centers consume less energy than traditional data centers. They contribute to lower heat dissipation costs, have close access to services, and may self-adapt or self-scale.
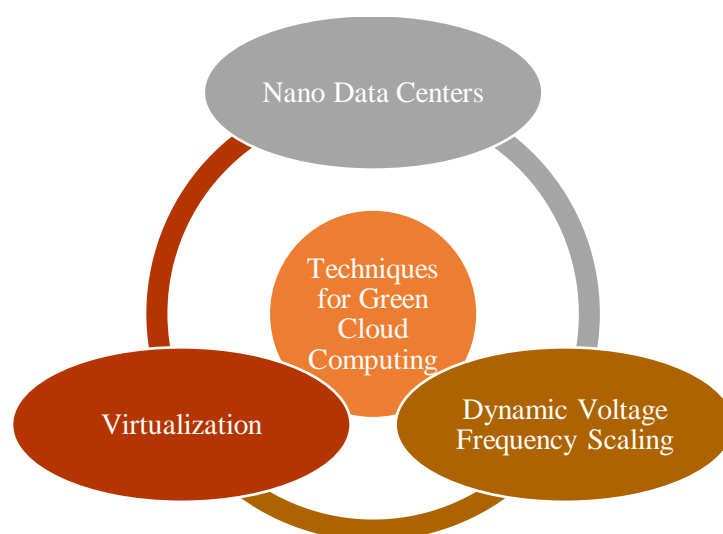

Figure 2: Illustrating the three major techniques of Green Cloud Computing [Google].

2.2. Challenges and Barriers:

To improve cloud computing and virtualization, we must pursue the following strategies [10].

A. Raise awareness of cloud computing through advertising and user research.
B. Form an IT task group to produce a cloud computing development proposal.
C. We must update our information infrastructure by utilizing various software and apps.
D. Keep computer science, information science, and information technology courses at Indian institutions up to date.
E. Develop proficient cloud computing personnel with proper training infrastructure.

As we just stated, there are various issues with green computing. Let's now examine the potential answers.

A. Businesses must implement technology practices including Green Computing.
B. There is an urgent need for technology and computer user awareness.
C. Design and development of programs in computer science (undergraduate and graduate) with a focus on green computing
D. To create a solid Green Computing infrastructure, IT organizations should adopt Energy Star and other standards.
E. We must develop a modern IT policy for green computing.
F. To encourage green initiatives, financial backing from the government is essential.

3. CONCLUSION

The green cloud architecture seeks to reduce data center power consumption. The main advantage of green cloud technology is that it ensures a performance boost while reducing IDC energy usage (Internet Data Center). The concept of turning green has existed since 1992. Green cloud computing is a concept being investigated to save our environment despite its downsides. Although the idea is developing, it is still crucial for lowering environmental carbon emissions. The idea is intended to save both money and the environment. The threat to human life posed by E-waste disposal is also predicted to be greatly reduced.

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