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#### TOWARDS SUSTAINABLE COMPUTING: A REVIEW OF GREEN CLOUD COMPUTING TECHNOLOGIES AND PRACTICES

#### Mrs R.B Maria sofia Christ college of arts and science ,kilachery

#### Abstract:

Green cloud refers to the potential environmental benefits that green IT services delivered over the internet can offer to individual companies and society as a whole. The term combines the words green -- meaning environmentally friendly and cloud, the traditional symbol for the internet and the shortened name for cloud computing. There is some confusion around the meaning of the term green cloud (or green cloud computing, in its longer form). In some cases, it's used to describe the environmental benefits that result from the general movement of IT systems to the cloud. For example, the cloud consolidates the total number of data centers and better supports a remote workforce in some organizations, leading to lower resource utilization and the overall reduction of greenhouse gas emissions.

#### I. INTRODUCTION

Cloud computing has become a vital infrastructural demand in modern organizations for many reasons, including cost-effectiveness, scalability, and security. However, cloud computing also addresses two crucial aspects of the green IT approach: energy efficiency and resource efficiency. From an energy efficiency perspective, cloud computing leverages server virtualization to minimize the total physical server footprint, resulting in less electricity consumed.

Cloud computing also saves resources because less equipment is required to run the workloads, and organizations can proactively reduce datacenter space and eventual e-waste footprint. Green cloud computing is simply an approach where companies can use what they already have smartly to minimize energy consumption and overall carbon footprint. The goal of green computing in cloud computing is to develop digital energy-saving solutions that lower carbon



#### What Is Computers in the Cloud—Green?

Green cloud computing is a buzzword in the IT industry that refers to the potential environmental benefits cloud-based services can offer society. The term combines two words: green, which means environmentally friendly, and cloud computing, which is the delivery of IT services over the internet. Green cloud computing has three main goals: to maximize energy efficiencies during the device's lifecycle, promote the use of recyclable materials, and minimize the use of hazardous IT components. You can observe green cloud computing from two perspectives:

• Green hardware. This includes energy-efficient and environmentally friendly information and communications technology (ICT) tools such as servers, network appliances, and storage devices used

in datacenters. It also comprises the power supply units, the cooling equipment, and the building that houses these components.

• Green software engineering methodologies. This includes all the applications that manage datacenters and other cloud-based services. The main idea behind green software engineering methodologies is to build reliable applications that not only meet organizations' requirements but are also energy efficient. For example, developers can implement code and architectural changes that reduce GHG emissions consumed by the applications.Green cloud computing makes it possible to maintain and enhance business operations and processes while looking after the environment.

Green cloud computing enables environmentally conscious corporate operations and processes to be improved and maintained.

1. Customers / Dealers: It is the process of submitting service requests to the cloud from any location in the globe. It is crucial to recognize that users of deployed services and cloud consumers may differ from one another. A consumer could be a business that is implementing a web application, for example, and the workload for that application varies according on how many people are using it.

2. Allocator for Green Resources: It serves as a conduit between users and the cloud infrastructure. For energy-efficient resource management to be supported, there must be interaction.G1.Green Resource Allocator: It serves as a conduit between users and cloud infrastructure. For energy-efficient resource management to be supported, there must be interaction.

3. Virtual Machines: They offer the greatest flexibility in configuring different resource partitions on the same physical computer to satisfy different specific requirements of service requests since they may be dynamically launched and stopped on a signal actual machine to meet accepted demands.

4.Physical Machine: By supplying the hardware infrastructure supporting the physical computer servers, it creates virtualized resources to satisfy service demands. Migrate to Sustainable Green Cloud Computing?

Virtually all CSPs are going green and adopting net-zero practices that have the sole objective of minimizing environmental damage caused by GHG emissions. However, not all cloud practices are energy efficient. You can use these three strategies to migrate to a sustainable green cloud:

Virtualization. Virtualization is the solution that resolves the problem of enormous electricity consumption by on-premises datacenters. For example, an organization can leverage server virtualization to run multiple virtual machines (VMs) on the same physical server. This essentially partitions the physical host into numerous virtual servers, allowing the organization to achieve significant cost savings.

An organization can also use desktop virtualization solutions such as Parallels® Remote Application Server (RAS) to deliver virtual applications and desktops to employees in remote locations. Employees can, in turn, use low-end devices that don't consume much power, such as thin clients, to access these resources from any location.

Cloud optimization tools. Many cloud optimizations that reduce server utilization rates also minimize carbon emissions. However, this may not work in some scenarios, especially those agreements where the company pays in bulk or gets discounted services. To reduce energy consumption in such a scenario, you'll need to have complete visibility of the entire IT infrastructure to optimize the cloud setup.

Carbon-aware CSPs. When selecting a cloud service vendor, it's always best to go with one that is carbon-aware rather than those that run on nonrenewable energy. The Green Web Foundation (GWF) has a database consisting of all the carbon-aware CSPs that you can select from if you want to transition to the cloud.

#### Parallels RAS Supports a Carbon-Neutral Future

Enterprises are making environmental sustainability a high priority because it's good for business and the planet. However, to improve environmental sustainability without compromising other business goals, you need to invest in the right technology.

Such technology should ensure that the core operations of the business run smoothly while enhancing energy efficiencies and extending the lifecycle of the hardware. The technology should also allow

employees to work more efficiently and sustainably by utilizing flexible working models that avoid daily commutes while facilitating innovation.

Parallels RAS—a top-notch virtual desktop infrastructure (VDI)— is one such solution. Parallels RAS is cloud-ready and integrates seamlessly with leading CSPs such as Azure, GCP, and Amazon Web Services (AWS), so companies can use it to transition to green cloud computing with ease. Organizations can leverage the platform's flexible cloud deployment models and use a CSP that best suits their carbon reduction targets.

Parallels RAS also supports various remote access technologies, including remote desktop services (RDS), VDI, and Azure Virtual Desktop, that organizations can use to deliver flexible working styles to employees. For example, a single Parallels RAS site can support up to 2,000 virtual desktops and 5,000 remote desktop session hosts (RDSHs). Running fewer physical servers allows organizations to achieve a higher amount of consolidation, resulting in less energy consumption.

### VI. GREEN CLOUD COMPUTING APPROACHES

GREEN APPS FOR CLOUD COMPUTING

A. The utilization of Terminal Servers and Virtualization

It is the method by which several operating systems run concurrently on a computer system. If they are using their computer, any open programs will show up. It has been discovered that sharing the terminal and using common servers can save 80% on energy.

B. Power Management and Power Supply

Green cloud computing technologies will ensure efficient use of energy.

Computer power consumption is decreased in green cloud computing through power management that makes use of green algorithms.

## VII. GREEN CLOUD COMPUTING GOALS

A. Use less harmful material; it harms the environment.

- B. Data centers that are "green"
- C. Recycling the materials.

B. Eliminating Paper Use to Protect the Environment

You and the rest of your team can travel paperless thanks to these storage choices. Even when working remotely, you can still expect productivity across the entire group or business by utilizing these cloud storage choices that offer drag and drop features for all of your documents. It is not necessary to print any file in order to use Adobe Sign or DocuSign for one signature. With just a computer or laptop and no pages to print, you may download any file, resign it, and email it back to the recipient thanks to these technological advancements.Utilizing those green cloud computing technologies enables . This approach creates a big impact on the environment as you chop down the requirement to regularly purchase paper products, shred your documents, or eliminate your files.

C. Reduction of your Power Consumption to Decrease Energy Use

C. Cutting Down on Power Use to Save Energy

Reducing the amount of power your business uses involves more than just shutting off the lights in your workstation and computer when not in use. Even if it can significantly impact operations, you must be aware of the gravity of power consumption if your business uses on-site servers. We can help you become less dependent on these on-premise servers once you make the switch to the cloud. This means that you'll also need fewer machines in your office, which will free up more space and lessen the demand for air conditioning, which will lower the rate of power consumption. The money saved from these reduced capital expenses can be allocated to other environmentally friendly initiatives or business growth endeavors, such as improving your marketing plan..

## Conclusion

Reducing the electricity consumption of data centers is the goal of the green cloud architecture. The main benefit of the green cloud computing architecture is that it reduces the energy consumption of the internet data center (IDC) while guaranteeing real-time performance. The idea of "going green" has been around since 1992. Although this idea is still in its infancy, it is essential for lowering carbon

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emissions in the atmosphere. The concept aims to save costs while also protecting the environment. It is also anticipated that the risk that the disposal of e-waste poses to human life would dramatically decline. Green computing and cloud computing will enable businesses to lower their carbon footprints while simultaneously fostering an efficient workplace. These days, environmental sustainability and green cloud computing are essential.

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