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Green Cloud Computing: A Futuristic Approach

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ABSTRACT

By providing numerous services through the internet and utilizing a variety of resources, cloud computing is a solution to diverse computational difficulties. Problems with energy use and carbon emissions are constant in the IT sector. Datacenters are an essential component of cloud computing. Because of this, there is a growing desire to open more and more datacenters. The greater power consumption at data centres raises the costs on an economic and environmental level. Additionally, the greenhouse effect and carbon footprint have increased due to the increasing release of CO_2 and other gases. These are the forces driving the development of green computing. This paper provides a quick insight to cloud computing, associated pertinent research, and several strategies for using green computing. To ensure that the current energy resources are used for our future generations as well as to preserve the environmental balance by reducing carbon emissions, measurement, modelling, and prediction of the energy consumed by various organizations are required. In this work, various research concerns about the application of green computing are elaborated, along with potential answers.

Keywords: *Futuristic approach; Recycling; Voice over internet protocol (VoIP); Server virtualization; Green cloud computing; Dynamic migration algorithm (DMA); Energy management.*

1.0 Introduction

Businesses and the IT sector are now considering green computing as a way to improve environmental conditions for people's quality of life. It's a good technique to protect the environment from the harmful effects of poisonous elements used in the production of computing devices. The phrase "green computing" [1] refers to research and evidence that considers the computing long product life from conception to death in order to save energy. It covers all aspect of computer hardware, including its creation, use, recycling, and disposal [2].

The main goals of green technology are to enhance manufacturing procedures, conserve resources, and recycle significant computing equipment. Due to the growing need for huge data storage and computation, green cloud computing is recognised to be a broad issue and a prominent area of study. In order to take advantage of diverse IT resources, cloud computing has created an ideal and amazing way to design servers and data centres and make them environmentally friendly. The

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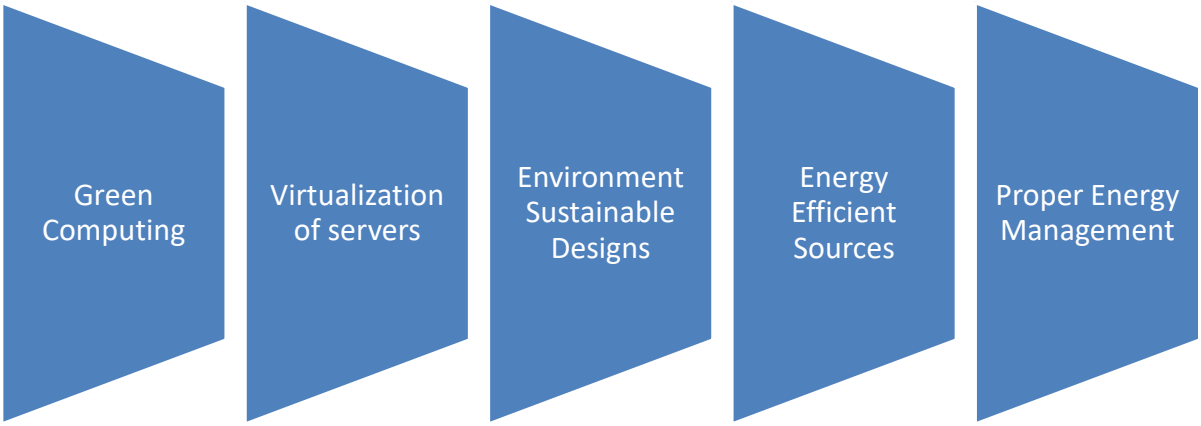
definition of Green ICT, also referred to as Green computing or Green IT, is "Green Computing is the study and practise of efficient and lucrative engineering, making, utilising, and discarding of computers, servers, and ancillary sub-parts as storage devices, displays, printers, networking and communications networks having any significant impact on environment." [3]. Figure 1 illustrates the components of green computing.

Figure 1: Important Points for Green Cloud Computing



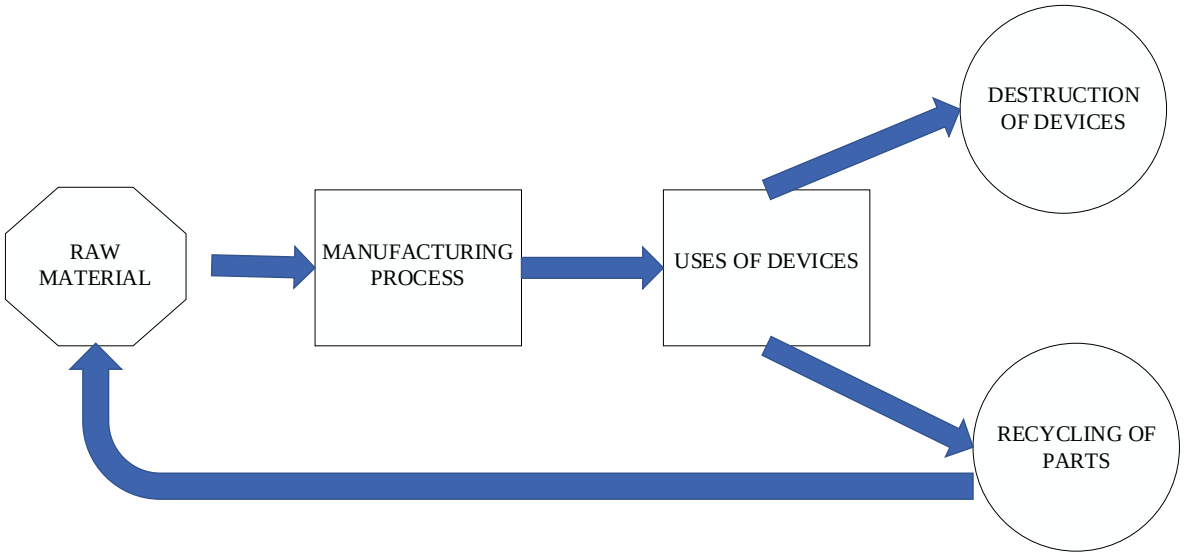
As computer hardware systems become more commonplace and connected into global networks, large-scale deployments of computing devices to provide a range of services are becoming more common [4]. Currently, computers and other electronic devices are employed in almost every industry, notably information technology, medical, education, business, and agriculture, having an explicit or implicit negative impact on the environment. A certain amount of carbon dioxide is created when we use a computer, which obviously has a detrimental effect on the clients.

2.0 Different Problems due to Computing

We use a lot of non-renewable energy when we use computers or other electrical devices. Additionally, a lot of energy is wasted when a computer is not in use because the CPU, fan, and other components as well as software like screen savers consume power. We can see that the energy consumption ratio is larger during sleep state when we analyze the electricity consumption of gadgets to sleep mode.

For instance, an inkjet printer uses five watts when it is not printing, but twelve watts when it is printing. Several toxic substances that are harmful to both individuals and the environment, like Lead, Mercury, and Cadmium [5], are used in the production of computing equipment. When soldering printed circuit boards and other components, including CRT glass, lead is routinely utilized. In some older cathode ray tube monitors, there might be eight pounds of lead. Lead can have a negative impact on a child's intellectual development as well as the endocrine, blood, renal, and central neurological systems. Lead accumulates in the environment, harming biotic elements. Typically, soil's outermost surface collects lead, which can remain there for years and cause significant harm.

Figure 2: Lifecycle of an Electronic Device



Computer waste parts like monitors and printers may contain toxic substances including lead, cadmium, and beryllium. When computers are disassembled and recycled, a variety of fumes and liquids are produced from numerous dangerous components [6]. The normal computer user may not be affected, but the environment will be greatly affected. E-waste recycling and disposal may present a serious risk to employees and locals due to a variety of hazardous exposures during recycling procedures and the leakage of contaminants such as heavy metals from dumps and incinerator ashes. When replacing and re-modelling office computers, we might not give proper E-waste disposal as much thought.

3.0 Approaches to Achieve Environment Friendly Computing

Recycling and properly disposing of waste: This is important because it limits the release of dangerous harmful gases into the atmosphere and permits the repurposing of outdated computer components, hence reducing the amount of garbage produced. Enhanced data centre cooling methods include using water-based air conditioning units in addition to moving servers closer to cooling systems to focus cold air in the desired location and reduce energy losses. Voice over internet protocol (VoIP) is a general term for devices that transmit voice messages or other types of communication over the internet. VoIPs are making telephonic typing less popular, which reduces the amount of metallic trash. Consolidation: Utilizing cloud - based solutions, consolidation is the practise of merging data from various data centres on a single server. At the process level, load balancing is achieved. It reduces energy usage and reduces energy waste. Terminal servers: When pursuing green computing, terminal servers are also essential. When utilizing computers, terminal clients are connected to a server at the centre; the majority of the work is done on the server, even if the end client communicates with the terminal operating system. By combining with tiny clients, where just one-eighth of the total amount of energy is used, it may be possible to reduce energy consumption. There has been an upsurge in the use of terminal services with sensitive customers to build virtual labs.

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4.0 Related Previous Works on Green Computing

S. No.	Purpose	Reference No.	Illustration
1	Reducing the amount of energy that data centres use	[7]	Scaling the speed of web servers via stochastic service decisions.
2	The substitution of components with greater energy efficiency.	[8]	Use of materials with higher energy efficiency. There have only been two technology comparisons.
3	carbon emission control and usage of virtualized servers	[9]	Clique Star Cover Number technique for virtualization to minimalize the consumption of energy.
4	Dynamic migration algorithm (DMA)- to reduce CO_2 emissions and power consumption.	[10]	Less power consumption can coexist with efficient use of resources.
5	Practical online bin packaging algorithm (EVISBP)- Reduced the active number of servers.	[11]	Balancing of load and mitigation of hotspot.
6	The minimum correlation coefficient for VM using fuzzy analytic hierarchy process.	[12]	Reduction in SLA violations and efficient usage of power coexists.
7	Green algorithm- To offer a green method of using energy.	[13]	Operational costs directly got reduced.
8	Three- tiered VM consolidation method- Reduction in the migrations and consumption of energy.	[14]	Reduction in the consumption of energy and violations of SLA.

5.0 Conclusion

Due to the cloud's enormous appeal and numerous advantages, many companies have switched to it. Power-saving techniques are necessary due to the industry's increasing environmental concerns as a major energy consumer and emitter of carbon emissions. Different strategies are carried out in such a great way that a certain decrease in power consumption may be anticipated without impairing the good performance. About 2% of the world's total CO_2 emissions come from the IT industry. The most significant method for improving the efficiency of data centres that adopt cloud computing is server virtualization. This research makes it evident that power control and energy efficiency are important and similar goals. Studies of numerous scenarios show that cloud computing can lower energy use and carbon emissions by improving system efficiency.

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