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ANALYSIS REPORT ON GREEN CLOUD COMPUTING: A REPORT

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ABSTRACT

Cloud Computing is getting popular day by day as it reduces the cost of business, provides improved services and security. In simple terms, Cloud computing is the delivery of services via the internet, including servers, storage, databases, and much more. It gives the user power to access anything and anywhere through the internet and you typically have to pay only for the cloud services you use. Green Computing is a recent trend towards operating computer systems to be energy efficient and to reduce carbon footprints and E-waste. Cloud computing is reshaping modern networking with a capacity of environmental protection prospects as well. In This paper will talk about the attainments of green cloud computing and green data centers and why we need them. Then, recent studies with some existing work are briefed and environmental issues are explicitly addressed.

KEYWORDS: ***Green cloud, cloud computing, data center, carbon footprint***

1. INTRODUCTION

Since its arrival, cloud computing has gained a lot of popularity. Green cloud computing is a created term that means making the practices and approaches of the use of technological developments like computing and other IT resources sustainable for latent environment benefits.

The rapidly growing number of industries and companies all around the world makes a substantial impact on the environment. Green cloud computing answers these forthcoming environmental issues by providing options that will lower emitted carbon footprints around the world.

Unsustainability has been gaining significance amongst software program and hardware developers and users in the final two many years, due to the fast boom in power consumption.

More and more businesses are leaning at the cloud services as such many technological programs and practices that can reduce environmental influences are being evolved every day. Green computing makes it viable to keep and enhance enterprise operations and techniques at the same time as looking after the surroundings.

The growth of green cloud computing is closely associated with the evolution of green data centers because the info centers are the core of cloud computing. According to Koomey, the energy consumptions by data centers in 2010 represented 1.3% of the total consumption. A report published by GeSI, which was taken into account "one of the foremost

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comprehensive and well-recognized snapshots of the Internet's energy demand at the worldwide level", estimates a rise in the share of total carbon dioxide (CO2) emissions from ICTs from 1.3% of the global emissions in 2002 to 2.3% in the year 2020

The aids of green cloud computing are focused specifically on energy-saving and carbon footprint reduction. From the strength-efficiency perspective, there are two methods for cloud companies to achieve green cloud computing: enhancing the power efficiency of the cloud and using clean power.

In these facilities, the whole infrastructure is designed to achieve maximum strength efficiency with minimal environmental impact. This includes lightning, electrical, mechanical, construction, and laptop structures. They use low-emission cloth for buildings, use alternative energy assets, and eat minimal electricity resources for operations and upkeep for all devices. Green cloud computing would be a great deal less difficult to put in force if all statistics facilities could have these traits.

2. LITERATURE SURVEY: GREEN CLOUD COMPUTING

Thermal gases, or GHGs, are composite gases or longwave rays in the atmosphere. The main GHGs, also called thermal gases, are CO2, methane, nitrous oxide, hence gaseous gases.

Cloud infrastructure is becoming a major environmental issue in terms of energy efficiency and carbon emissions. the following are the four key factors that have enabled Cloud Computing to measure power consumption and ICT deployment. in this way, organizations can reduce carbon emissions by at least 30-40%.

Hosman and Baikie et al,[10] gave a new challenge in the field of cloud computing, data centers consume a lot of energy and energy is not available every time, so the author is discussing solar use.

Pat Boher e-el[8] researched power management strategies while operating online servers at their low level of usage, with no impact on their performance. They are focusing on the logs of the system because they are the sources of the most input, soliciting power consumption rates on an online server at various levels of usage. The author provides an effective model of CPU and other resources used for energy values, which helps predict long-term energy needs

Bhanu Priya et al., [12] gave computing metrics to make the cloud green in terms of energy efficiency, different energy methods have been talked about in this paper to reduce the power consumption and CO2 emission to make the cloud greener.

The use of cloud computing has attracted the attention of many entrepreneurs, the only concern with cloud computing is the uncontrolled rise of cloud data centers. Improper use of cloud resources opens the way to inefficiency and environmental hazards. To understand the seriousness of this issue, several researchers have contributed to the promotion of the use of the green cloud in various ways. Green Cloud Computing is the process of developing methods and techniques to enhance the professionalism of soft materials to reduce energy consumption and the natural effect of their use. The power utility of the data center provides features such as web-based testing, live machine movement, and advanced machine configuration improvements. CML is responsible for selecting the right resources for all available resources and GML selects the best for it.

As a result of this excellent resource selection, the average response time for services is reduced with reduced energy consumption costs. When handling 500 service requests, the proposed operation uses 4298 W and the comparison methods use a lot of power.

Here is a chart representing carbon emissions in several countries:

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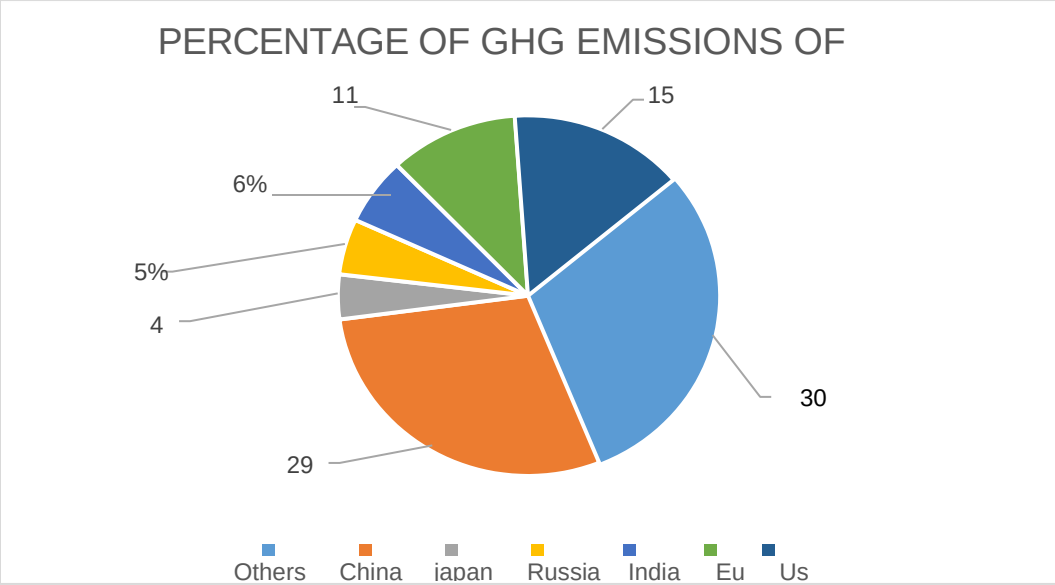

Fig 1. Showing GHG emissions in different countries

2.1 WHY GREEN COMPUTING?

17% of total carbon emissions caused by technology are due to data centers. The electricity needed to run these data centers is 30 billion watts. These servers use up to 90 percent of their energy because they are fully operational all day long. Green computing helps to develop key objectives such as power restriction, improve the use of the equipment, and electronic waste that can be satisfied with the efficient use of computers and other technologies that improve the performance overall. In today's world, there is a need for green computer models to remotely control data centers and servers to make them more economically viable and reliable. As providing the cloud service, service providers must ensure that they are carefully able to provide cost-effective services. But the most difficult and complex task is to reduce the power consumption of data centers. As data grows exponentially, green cloud computing with problem-related infrastructure indicators not only reduces energy consumption but also makes Cloud services more reliable and economically viable.

2.2 GREEN DATA CENTERS

The raw data center is a repository for the storage, management, and distribution of data where equipment, lighting, electricity and computers are designed for energy efficiency and minimal environmental impact. The construction and operation of a green data center involves advanced technologies and techniques.

Here are some examples

- Reduction of structural steps
- The use of building materials that produce less air, carpets and paint
- Formal land reform
- Waste recycling

Installation changes to backup generators

The use of other energy technologies such as photovoltaics, heat pumps, and steam cooling Use of hybrid or electric company vehicles Building and securing a raw data center or other facility can be costly in the future, but long-term savings can achieved by maintenance. Another benefit is that green spaces provide employees with a healthy, comfortable work environment. In addition, green buildings improve relationships with local communities.

The growing pressure from the environment, the general public that governments are providing green incentives: financial support for the construction and maintenance of environmentally friendly technology.

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2.3 GREEN IT BARRIERS AND BENEFITS

Barriers	Benefits
Cost for the establishment is high.	Low use of power.
Difficulties in re-engineering processes and revised procedures.	Utilization of the resources.
Conflicting to the changes and behavior.	Lower the environmental impact.
Enterprise green initiatives are not affiliated properly.	Affordable cost of operations.
At times absence of management and support.	Improves the cooperate image.

Table 1 : Barriers and Benefits

2.4 Benefits of Green Data Center

2.4.1 Reduced Environmental Impact

Raw or stable data centers reduce energy consumption and have less impact on the environment compared to traditional ones. In addition, new equipment and new energy-saving techniques can be easily implemented in stable data centers. These initiatives contribute significantly to reducing carbon footprint and adverse effects on our environment.

2.4.2 Low energy consumption

The visual data center has increased efficiency in power consumption. Virtualization enables IT, staff, to monitor and control equipment from a remote location. Enables data center management to maintain good heat and minimal light. Even a small increase in temperature can significantly reduce energy costs, and a virtual data center enables operators to maintain low energy consumption.

2.4.3 Switch off unused servers

The traditional data center provides a specific storage location according to the needs of the customer company. After a while, as demand increased, the data center automatically allocated additional space. Now, the process usually creates dead server space. On average, up to five of all servers are active or unused mainly for this reason. These servers use energy and other resources even though they increase revenue. Data centers can shut down these servers and reduce power consumption and costs.

2.4.4 Reduction

One of the reasons why we have to pay so much for using data centers is that the power consumption is very much high in traditional data centers. Currently, green or environmentally friendly data centers use a lower amount of power due to continuous monitoring and efficient data management services. Also, such data centers may receive the unused capacity for various applications. In a way, these data centers are using energy efficiently and thus reducing capital expenditure.

Both visible and black data centers are much more efficient and use much less power than traditional data centers. Data center management can help your business take full advantage of such friendly data centers.

The green data center is designed to have a small or minimum effect on the environment. The following are the main features of the green data centers:

• Built from ground to environmentally friendly environment

• Use minimal power sources for efficiency and efficiency - basic computer infrastructure and support for electronic equipment, such as cooling, backup, and lighting

• It usually works with green or renewable energy, such as solar, wind, or hydel

• All infrastructure is powered by low electricity and carbon

• Small waste products containing recyclable or non-recyclable materials

The data center is designed to provide energy efficiency and reduce the impact on the environment. These centres have the same features and features as a standard data center but use less power and space. Reducing the use of energy and the use of energy for complex operations on green alternatives provides

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economic and environmental benefits to organizations.

3. ANALYSIS ON REVIEW ON GREEN COMPUTING AREAS

From the literature review we have shown that there is a huge impact of cloud computing on the earth's environment. At the same time, however, raw computing acts as a computer solution. Many authors have concluded that there must be laws, regulations, and specific policies from government to increase green transformation in the future.

S.N.	Year /Citation No of paper	Main focus /Objectives of Authors	Authors Conclusion
1	2019 [10]	The author is very focused on green computer information. This paper identifies their concept, barriers, and their perspective on information technology.	After the study, some recommendations were made, which could increase the acceptance of the green computer in the emerging group and reduce the negative impact.
2	2018 [11]	The author focuses on the strategies of green computers and their implications for performance and research.	The life strategies presented contain individual metrics to differentiate data center practice into measurable units. This study provides an effective and explicit way to introduce a common concept of computer use.
3	2017 [12]	The authors describe current and future trends in green computers and the challenges they face.	The authors conclude that organizations and researchers have made great efforts to implement environmentally friendly technologies and the various challenges they have overcome.
4	2016 [13]	. The authors determine and review the list of critical success factors (CSFs) of vendors within the development of eco-friendly software. The authors provided a systematic review of the literature from a sample of 74 research papers.	Accurate reviews of the authors' findings suggest that 'marketers have developed green software and savings with raw format software and efficient coding', which are used for 'robust processes',' low carbon emissions through software development processes', consumables, 'paperless books', ‘sorting out the essentials through a green inspector’ and ‘dismissing managers’.
5	2016 [14]	The authors of 2016 had described their various perspectives on cloud metrics and methods, conceptual understanding of algorithms, and model construction provided to scientists and researchers.	The authors lastly concluded that the harmful gases emitted by the operation of various components of the cloud can be compact by placing the optical equipment to process the use of the types of equipment.

Table 2 : Review on Green Computing Areas

4. INNOVATION

4.1 GREEN COMPUTING TECHNIQUES FOR ENERGY EFFICIENCY

1. Hard disk sleep mode: Hard disk and other optical drives are designed to fall asleep after a specific time of inactivity to conserve energy

2. Power off devices when not in use: Shutting down the system in its idle time is the most effective

3. Hibernate Mode: The hibernate mode is an advanced version of standby mode; this mode completely turn off the computer including volatile memory

4. Use a computer and other peripherals in power saver mode: The power saver saves energy by reducing the computer’s performance where possible

5. Renewable Energy sources: For conservation purposes, data centers often require diesel-powered electricity, combustible diesel emissions, such as CO2, NOx, GHG, and particulate matter, the release of a diesel generator into the air, and polluting the nearest

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air quality. One liter of petrol contains 0.73 kg of carbon, so for one liter of fuel 2.6 kg of CO2 is emitted into the air. To overcome this problem there are other ways to generate electricity, we can use solar power, wind power, etc.

6. Free Cooling System: Most data centers receive refrigeration cooling, in this process a compressor supplies or pushes cold water to a network of high-performance steel pipes, such as copper or aluminum, which are connected to the CPU and other equipment. The flow of water absorbs heat and makes it easier for radiators and more. Instead of freezing equipment, we can use free cooling, basically depending on the weather and the weather. It usually works with green or renewable energy, such as wind and solar energy. Various metrics have been developed to measure energy efficiency in data centers.

7. Small and distributed data center

While cloud computing is a reliable and inexpensive way to connect devices to the Internet, the continued growth of Internet Of Things (IoT) and other future technologies has put a strain on internet bandwidth.

Edge computing is considered as another way to use cloud computing to address bandwidth problems.

5. Green Cloud Future & Challenges

5. THE FUTURE OF DATA CENTERS

From small data centers and large distributors to large and large data centers - the future of data centers looks clear and diversified in line with complex business needs.

Considering As we consider the structure, location, structure, and strength of data centers, we need to account for their role in preventing global emissions. Although green centers consume the top 2 to 3% of the world's total electricity, growing demand could increase this consumption significantly. Depending on the specific bandwidth issues.

5.1 Energy efficiency: As of today's clouds design with multiple Central Processing Units, there is a need to build energy and management strategies to support power management with multiple Cu's. Not r cloud capabilities are the data centers, which are a collection of data storing devices and data management software. An effective energy efficiency monitoring system, powerful energy management system, and intelligent power supply decision-making systems are the challenges of research in the field. Given the modern pace of IT, we need a comprehensive and intelligent approach to addressing all the challenges of energy efficiency at the cloud level.

5.2 Virtualization: Many previous studies have focused on building a more efficient cloud performance, but virtualization still faces some reasonable limitations of high. Designing novel techniques with modern technology to enhance the whole lifestyle of the visual process is an important research challenge. The automatic creation of VM with large resources and the sharing of powerful resources and sharing resources without affecting cloud performance are some of the biggest research challenges aa in a good performance.

5.3 Multitenancy: While this is an important character in the green cloud, at the moment most hires have a privacy and security issue. Building safe multi-tenant buildings and secure access to privacy for multiple employer modules are major future research challenges.

5.4 Integration: The design of intelligence support in VM integration, Multi-based threshold value calculation, key resource utilization and server downtime management have become future research challenges in this feild.

5.5 Eco Friendship: This area focuses on the creation of environmentally friendly tools namely carbon emissions calculators to measure the effect of the cloud on the env. You need to make a new complete frame work for the cloud computing on a scale, based on the many features of Green Cloud Computing.

Green cloud computing is an important feature of this field. An important part of the study focused on computer protection and the quality of services. This quality should include both customer satisfaction and meeting environmental protection requirements. The design of the green cloud has two types of challenges: technical and non-technical. Applications can improve and resource management and energy efficiency. The connection between the software components must work properly. Typology must be robust: resources must be automatically added or removed depending on server upload. Some of the open-ended problems are: a strong allocation of resources and energy, a reduction in operating costs and labor time, and a reduction in energy consumption. A VM distribution strategy can reduce energy consumption and cost. Virtualization strategies can be enhanced by moving between devices, as well as VM migration, between geographically distributed data centers. Responsibilities can focus on green cloud data centers.. To solve this problem, a work plan should be developed based on thermal factors, Symmetry 2017, 9, 295 13 of 20 and

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temperature recovery should be improved. The construction of data centers in areas with free cooling facilities is a non-technical solution to this problem.

CONCLUSION

Green cloud computing is an emerging technology and research topic in this technology world of technology lovers. Nowadays, IT companies are advancing when it comes to cloud computing due to increased data storage and computer needs leading to the growth of cloud infrastructure in an environmentally friendly and economical way. Cloud computing is designed and developed in a very advanced way to make servers and data centers more powerful. This paper reviews a brief discussion of the computer cloud, its barriers, and the benefits of the world. Following, annual updates in the green fields of cloud IT where the ideas and conclusions are the same the writers exclaim. This paper concludes that efficiency and power management are considered to be key objectives and specific policies that government should focus on environmental change in the near forthcoming.

This paper discusses the contribution of cloud computing to environmental protection according to the studies in this article conducted to date. The most important features are:

1. The biggest benefits advertised are those that focus on energy efficiency. To comply with environmental protection regulations, cloud service companies must at least reduce energy consumption from non-renewable sources and replace renewable energy. Studies conducted so far have shown that the index of energy consumption is still very high, surpassing the energy available from non-renewable sources.

2. Increased energy consumption from renewable sources will lead to a reduction in CO2 emissions, but given that the initial indicator is not as high as expected, pollution reduction is unlikely to meet the expectations of the organizations.

3. Reducing e-waste is another controversial alternative that leads to higher expectations. The practice of cloud computing could affect the reduction in the amount of equipment required by organizations and the speed of retrieval

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