



# International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 6, June 2016

## A Study on Green Cloud Computing Technologies

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**ABSTRACT:** Green Cloud is the study and practice of environmentally sustainable computing or IT. This can include "designing, manufacturing, using, and disposing of computers, servers, and associated subsystems such as monitors, printers, storage devices, and networking and communications systems efficiently and effectively with minimal or no effect on the environment. The green computing are similar to green chemistry both reduce the use of hazardous materials, maximize energy efficiency during the product's lifetime and promote the recyclability or biodegradability of defunct products and factory waste. Green computing is important for all classes of systems, ranging from small systems to large-scale data centers. Cloud computing is the whole new concept in IT and cloud based system increases faster, because of this cloud based data centers are increasing greatly which leads to high energy consumption every day and also the emission of CO<sub>2</sub> by these data centers greatly affect the environment. To over-come this problem Green Computing came into existence. The main goal of green computing is to recycle and reuse. Green Computing helps to get the same computing speed at decreased energy consumption. In this paper I discussed about green computing technologies.

**KEYWORDS:** Green Data Centers, Virtualization, Green Cloud Computing, Power Opti-mization, SaaS, DaaS, Paas, Iaas, DRaaS.

### I INTRODUCTION

Green Cloud computing is the effective and environment friendly use of the computer and related resources like all types of hardware and software. Computers are made of poisonous materials like lead, chromium, cadmium and mercury. If computers are buried in land fill, they can leach harmful chemicals into waterways and the environment and if burned release toxic contaminants into the air we breathe. The best solution on these problem is use of green cloud computing. Green Computing reduces the use of hazardous materials, maximize energy efficiency. Cloud Computing is not a very new concept in IT, in fact Cloud Computing is a more advanced version of the Data Processing Service. But this service is costly, produce large amount of CO<sub>2</sub> and consume more energy to overcome from this problem Most of the IT companies now started moving toward green computing not only terms of public relation but also it will reduce the cost. Currently the IT industries are responsible for 3% of the worlds energy consumption with an increase of 20% every year. By 2030 the power consumption will be double.

The Four core green computing technologies are:

- Green Data Center
- Virtualization
  
- Green Cloud Computing
- Power Optimization

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Out of \$250 billion per year spent on powering computers worldwide only about 15% of that power is spent computing. The rest is wasted idling. Therefore, Green Computing is introduced in order to maximize the energy efficiency and increase their cyclability of products and the factory waste. Green Computing is focusing on creating technologies that help to preserve nature and minimize the bad effects of the technological development.

## II BACKGROUND WORK DISCUSSION

### A Green data Center

A green data center is used for the storage, management, and dissemination of data in which

the mechanical, lighting, electrical and computer systems are designed for maximum energy efficiency and minimum environmental impact.

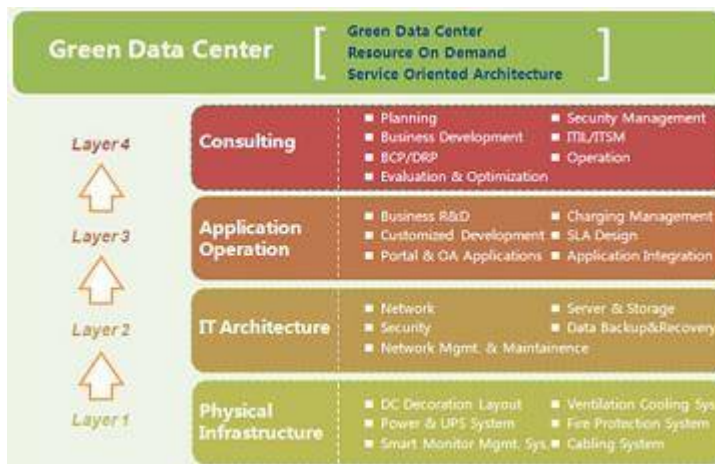


Fig.1.Green Data Center

### Benefits of Green Data Center

- Saving energy consumption

Using scientific planning management, high voltage dc power supply, high efficiency power and electrical equipment, virtualization technology to reduce the energy consumption and the operation cost.

- Modular deployment

Modular data centers no open floor needed, reduce the investment, rapid deployment; Industrialization standard production and reduce the cost.

- Intelligent power distribution monitoring system

Real-time monitoring of power consumption, adjust and optimization power distribution system, balance the three phase power which can improve power supply reliability, reduce harmonic interference and ground zero voltage.

- Advanced cooling technology

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Using row-level air conditioning or close to the refrigeration equipment, intelligent balance refrigeration; Using dynamic natural cooling air conditioning system, optional air contained; Reduce waste, optimize the air distribution and energy saving, rational utilization water resources, natural evaporative cooling.

- Intelligent management system

Through the professional system management tools, ZTE provide comprehensive data center management service, unified management and improve the operation efficiency for the business system, IT equipment and application system.

## B Virtualization

Virtualization is the process of running two or more logical computer systems on one set of physical hardware. Virtualization is to make a single piece of hardware function as multiple parts. Different user interfaces isolate different parts of the hardware, thereby making each one behave and function as an individual, separate entity. One of the primary goals of almost all forms of virtualization is to make the most efficient use of available system resources. Virtualization results in far more efficient use of resources, including energy. In the context of a data center, installing virtual infrastructure allows several operating systems and applications to run on a lesser number of servers, helping to reduce the overall energy used for the data center and for its cooling.



Fig.2. Virtualization

Once the number of servers is reduced, it also means that data center can reduce the building size as well. Some of the advantages of Virtualization which directly impacts efficiency and contributes to the environment include:

- Planned downtime is eliminated by migrating virtual machines from one physical server to another
- Dynamically balance workloads across a server group and provide automatic failover for virtualized applications
- Resource allocation are better monitored and managed
- Virtualization exponentially increases a server groups ability to share resources

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- Server utilization rates can be increased up to 80% as opposed to an initial 10-15%

Virtualization in green cloud reduce the number of servers and maximizing CPU processing power on other servers, you are cutting costs and taking less of a toll on our environment Storage virtualization uses hardware and software to break the link between an application,application component, system service or whole stack of software and the storage subsystem. This allows the storage to be located just about anywhere, on just about any type of device, replicated for performance reasons, replicated for reliability reasons or for any combination of the above. There are two types of virtualization which are widely used.

- Server Virtualization: Virtual server allows several machines to share the same physical server to run instead of having their own server.
- Storage Virtualization: Storing data across multiple server.

## C Green Cloud Computing

Cloud computing is providing utility based services to all the users worldwide. Data centers created for cloud computing applications consume huge amounts of energy, contributing to high operational costs and a large amount of carbon dioxide emission to the environment. It leads to an high level of power consumption and increasing the amount of harmful gases in environment. We need green cloud computing solutions that can not only save energy, but also reduce operational costs and enrich environment sustainability. A cloud is a distributed computing system consisting of a collection of interconnected and virtualized computers. Cloud is dynamically provisioned and presented as uni ed computing resources based on service level agreements established through negotiation between the service provider and consumers.Green cloud is the potential environmental benefits that information technology (IT) services delivered over the Internet can o er society. The term combines the words green meaning environmentally friendly and cloud, the traditional symbol for the Internet and the shortened name for a type of service delivery model known as cloud computing.

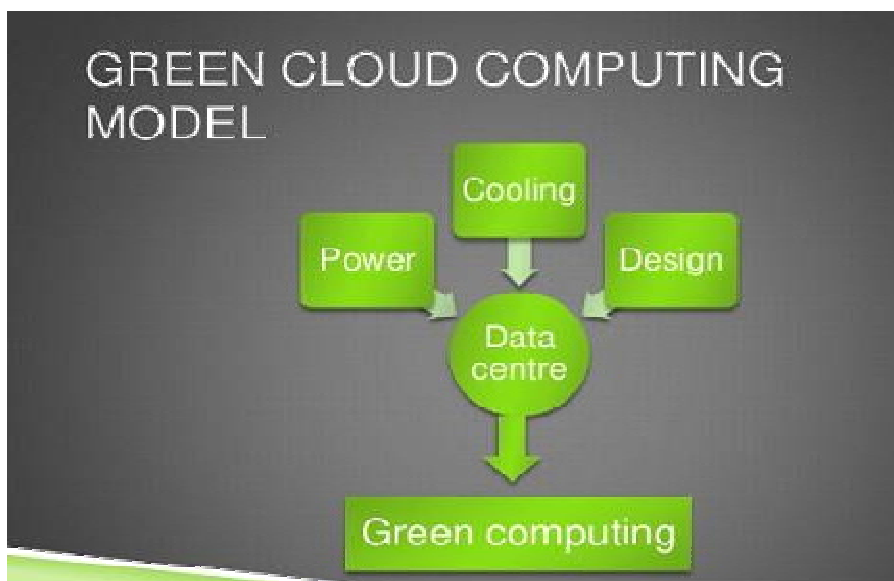


Fig.3.Green cloud computing



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According to market research conducted by Pike Research, the wide-spread adoption of cloud computing could lead to a potential 38% reduction in worldwide data center energy expenditures by 2020. The savings would be primarily achieved by consolidating data centers and maximizing power usage efficiency (PUE), improving recycling efforts, lowering carbon and gas emissions and minimizing water usage in cooling the remaining centers. Benefits of Green Cloud Computing:-

- Reduced Cost
  
- Automatic Updates
  
- Green Benefits of Cloud computing
- Remote Access
- Disaster Relief
- Self-service provisioning
- Scalability
- Reliability and fault-tolerance
- Ease of Use
- Skills and Pro-efficiency
- Response Time
- Increased Storage
- Mobility
  
- Reduced energy usage from green computing techniques translates into lower carbon dioxide emissions, stemming from a reduction in the fossil fuel used in power plants and transportation.
  
- Conserving resources means less energy is required to produce, use, and dispose of products.
  
- Saving energy and resources saves money.
  
- Green computing even includes changing government policy to encourage recycling and lowering energy use by individuals and businesses.
  
- Reduce the risk existing in the laptops such as chemical known to cause cancer, nerve damage and immune reactions in human

## D Power Optimization

Green computing includes the implementation of energy efficiency central processing units (CPUs), peripherals and servers. In addition green technology aims to reduce resource consumption and improve the disposal of electronic waste (e-waste). A typical US data center of 25,000 square feet will use approximately \$2.6 million in energy costs per year at \$0.12 per kWh. Improvements in energy management can save up to 50% of those costs, leaving over a million dollars in savings to motivate interest in changing. All companies are becoming serious about reducing energy through green IT. The growing demands of users for computing services, cloud providers are encouraged to deploy large data centers which consume very high amount of energy and also contribute to the increase in carbon dioxide emission in the environment. Therefore, we require to develop techniques which will help to get more environment friendly computing i.e. Green Cloud Computing.

Green cloud computing can be implemented via three approaches: software optimization, hard-ware optimization, or network optimization in order to reduce the power consumption, as illustrated in Fig. 2.4

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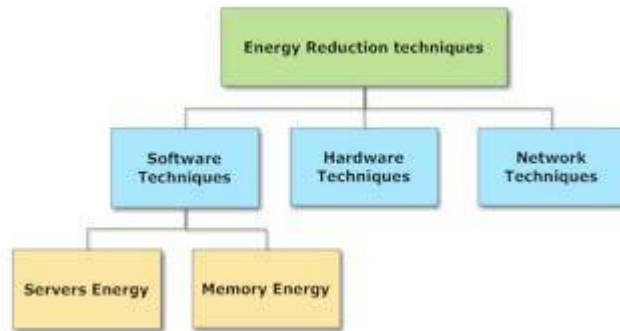


Fig.4. Energy Reduction techniques

- software Technique:

Reducing the energy consumed by servers (by reducing the number of active servers), Reducing the energy consumed by memory (by reducing the number of running memory nodes).

- Hardware Technique:

This technique reduce the consumed energy by utilizing flexible hardware that varies the server computing capability via controlling the frequencies and voltages in the server, which affects the energy consumption. However, as with all other hardware techniques, this approach to green cloud is costly and suffers from poor scalability because of the special hardware requirements.

- Network Technique: Network optimization techniques provide a reduction in the energy consumption with the ability to meet the SLA. On the other hand, a data center is usually constructed with a fixed network topology, which limits the scalability and the flexibility in the data center. This approach needs to be aware of network topology to decide the ow route.

### III. IN-HOUSE DATA CENTER VS GREEN COMPUTING

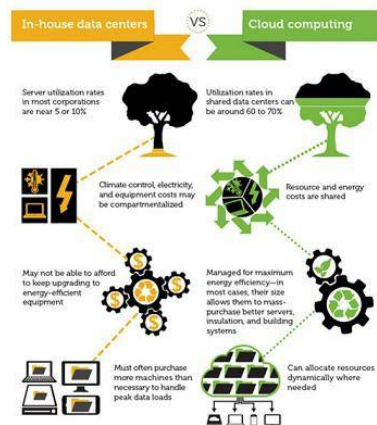


Fig.5. In-house Data Center vs Green Computing



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## **IV. GREEN CLOUD SERVICES**

- Infrastructure as a Service (IaaS): "Infrastructure as a Service (IaaS)", delivers computer infrastructure - typically a platform virtualization environment - as a service. Rather than purchasing servers, software, data-center space or network equipment, clients instead buy those resources as a fully outsourced service.
- Desktop as a Service (DaaS): With DaaS, deployment and management of the desktop environment is simplified. Data and applications are accessed through a virtual environment, allowing businesses and providers to support, patch and maintain one environment rather than managing individual desktops throughout an organization. And, with one central environment, data is more secure while still allowing users the flexibility to choose between working on desktop or mobile devices.
- Software as a Service (SaaS): "Software as a Service (SaaS), sometimes referred to as "software on demand," is software that is deployed over the internet and/or is deployed to run behind a firewall on a local area network or personal computer.
- Disaster Recovery as a Service (DRaaS): Serve Restore, our cloud disaster recovery solution for on-premise physical servers, is often called our better than backup solution. With Serve Restore, our engineers prebuild a fully configured virtual environment for your data. When disaster strikes, we fully manage the recovery of your servers, configuring them to run within our cloud environment in just a couple of hours.
- Backup as a Services (BaaS): Green Clouds backup solution powered by Veeam provides a remote, secure, cloud-based storage destination for existing server infrastructures.

## **V. CONCLUSION**

In this paper we addressed the problem of traditional cloud and the use of green cloud at the same time we enlighten the recent work which has been done in the field of green cloud computer for healthy and greener environment. We also addressed the technologies of green cloud. Consequently we gave a comparative study in the field of green cloud computing. There are many possible directions of future work. While in the paper we address the problem of efficient way to fetch the results from the cloud, save energy, cost and resources so all the features covered in the paper can be achieved. Adopting Green Computing Strategies make sense not only from an ethical, or moral stand-point, but from a commercial stand-point. There are many business benefits achievable through the implementation of a green computing strategy such as cost savings, resilience, disaster recovery, business continuity planning and of course public relations. Given the prolific nature of IT within today's information economy IT leaders have an excellent opportunity to significantly impact the fight against global warming, whilst enhancing the business operation and efficiency. Further we can implement the approach to automate the manager of the green cloud who makes all the decisions regarding the services. We can implement the green cloud for the mobiles because use of mobile in day to day life is increase.

## **VI. ACKNOWLEDGMENT**

I express my profound gratitude to my college for the motivation in the preparation of this paper.

I would like to extend my sincere thanks to my guide, Dr. Jyoti Kharade (Professor), Dept. of MCA for her guidance and whole hearted support and very valued constructive criticism that has driven to complete the paper successfully. Finally I would also wish to record my gratefulness to all my friends and classmates for their help.

**Pooja Subhash Patil**



ISSN(Online): 2320-9801  
ISSN (Print) : 2320-9798

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(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 6, June 2016

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