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INTRODUCTION TO GREEN COMPUTING MODEL FOR CLOUDS

BY

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ABSTRACT

In this article, the author collects some definitions and concepts related to green computing model for clouds. Greening your computing equipment is a low-risk way for your business to not only help the environment, but also to reduce costs. Reducing energy usage, which also reduces carbon-dioxide emissions and your energy bill, is the most effective thing you can do. Green computing can be defined as the efficient use of computing resources. Computing reduced power consumption is environmentally less expensive. It is also associated with the proper use of computing resources and plays a vital role in minimizing their dangerous impact on surroundings. The strength of public and community opinion shifting in favour of environmental responsibility is also growing rapidly. Computing is also an area of human activity in which there are real environmental savings to be made, some of which can be achieved by implementing relatively straight-forward practical measures with existing hardware.

Keywords: Green Computing, Cloud Computing, Green Cloud, Green Technologies, Green Use, Green Manufacturing, Green Products, Green Disposal.

INTRODUCTION

Green computing is the practice of using computing resources efficiently. The green computing practices are designing, manufacturing and disposing Computer servers with no impact on the environment. It reduces the use of dangerous materials and maximizes energy efficiency during the product's lifetime and promotes the recyclability of outdated products and factory waste. It also makes use of computers as energy-efficient as possible, and designs algorithms and systems for efficiency-related computer technologies.

1. Purpose of the study

The purpose of this article is to have some necessary idea about green computing. The plan towards green cloud should include new electronic products and services with optimum efficiency and all possible options towards energy savings.

2. Literature Survey

Ullman & Haggerty (2010), conducted a study on "Embracing the Cloud: Six Ways to Look at the Shift to Cloud Computing".

Cloud computing is the latest paradigm shift for the delivery of IT services. Where previous paradigms (centralized, decentralized, distributed) were based on fairly straightforward approaches to technology and its management, cloud computing is radical in comparison. The literature on cloud computing, however, suffers from many divergent definitions and viewpoints. Rather than providing a strict definition for cloud computing, this article starts with a loose cloud metaphor, incorporates a number of related IT concepts and proposes six new ways to view cloud computing. These viewpoints and the authors' cloud metaphor are helping to transform the delivery of IT services at New Jersey Institute of Technology, offering a model for how these "views of the cloud" might do the same for other institutions.

Paquet, K. G. (2013), conducted a study on "Consumer Security Perceptions and the Perceived Influence on Adopting Cloud Computing: A Quantitative Study Using the Technology Acceptance Model".

Cloud computing may provide cost benefits for organizations by eliminating the overhead costs of software, hardware, and maintenance. The purpose of the study is to describe certain variables of adopting

cloud computing, and to compare their security concerns with adoption. The study extends the technology acceptance model (TAM) to measure the organization's acceptance and use of cloud computing based on the organization type, cloud certification, and security concern. This research study is based on the security themes from the IBM information security capability reference model to help identify the key security areas. The target population for the study consists of information security managers in various organizations throughout the United States. Based on the organization type, one can conclude that there is not a significant relationship between the adoption of cloud computing and organization types. Overall, more than half of the respondents would feel more secure in adopting cloud computing with cloud providers possessing a cloud security certificate. There failed to be enough data to support a significant correlation between the security themes and the adoptions of cloud computing. In combining all of the participants' responses, the following three security themes appeared in the top ranking as being a concern: transaction and data integrity, identity and access management, and privacy.

Lahiri & Moseley (2013). conducted a study on "Migrating Educational Data and Services to Cloud Computing: Exploring Benefits and Challenges".

Cloud computing is currently the buzzword in the Information Technology field. Cloud computing facilitates convenient access to information and software resources as well as easy storage and sharing of files and data, without the end users being aware of the details of the computing technology behind the process. This article explores cloud technology as an emerging new computing trend for delivering educational services; it evaluates the benefits of using cloud computing in education; discusses concerns about the cloud; and attempts to discover whether cloud computing truly enables the efficient management of resources, thereby improving the efficiency of educational institutions. The article ends with a checklist of important considerations for educational organizations contemplating for migrating their data and services to cloud providers.

3. The History of Green Computing

The U.S Environment fortification Agency instigated energy star, an intended classification program in the year 1992, which is planned to encourage and distinguish energy-efficiency in monitors, weather control equipment and other technologies. This resulted in the extensive implementation of sleep mode in computers and electronics fashionable among consumer electronics. Many governmental agencies are persistent to implement standards and regulations that encourage green computing. The energy star program was revised in October 2006 to contain stricter competence necessities for computer equipment, along with a tiered grade system for permitted products. Green Computing Impact Organization (GCIO) is a non-profit association dedicated to assisting the end-users of computing products in being environmentally responsible motivating community of environmentally concerned information technology leaders who pool their time, resources and buying power to educate, broaden the use, and improve the efficiency of green computing products and services (Maheshwari, 2013).

4. Cloud computing

Cloud computing is computing in which large groups of remote servers are networked to allow centralized data storage and online access to computer services or resources. Clouds can be classified as public, private or hybrid.

5. Green cloud

Green cloud is a buzz word that refers to the potential environmental benefits, that information technology services delivered over the Internet can offer society. Green means Environmental Friendly and Cloud means shortened name for a type of service delivery model known as cloud computing (Haritha, 2012).

5.1 Green Cloud Architecture

In the green cloud architecture, users submit their cloud service requests in the form of new structural design. A user service request can be of three types i.e., software, platform or infrastructure. The cloud providers can record their services in the form of green offers to a community

register which is accessed by green agent. Green broker gets the current status of energy constraints for using a variety of cloud services from carbon secretion register. The carbon secretion register maintains all the data related to energy competence of cloud service. This data may include cooling efficiency of cloud datacenter which is providing the service, the network cost and carbon emission rate of electricity, green agent calculates the carbon secretion of all the cloud providers who are offering the requested cloud service. (Kumar, & Buyya, 2011).

6. Green Computing

The study of green computing consists of practice of designing, manufacturing, disposing of computers, servers, associated subsystems efficiently and effectively with minimal or no impact on the environment. Two major issues associated with green computing are: reduction in energy consumption and pollution control (Kumara, & Anuradha, 2011)

6.1 Objectives of Green Computing Strategies

- Minimizing energy expenditure
- Purchasing green energy
- Reducing the paper and other consumables used
- Minimizing equipment removal necessities
- Reducing travel requirements for employees / customers

6.2 Key concepts of Green Computing

- Growing public environmental awareness
- Increasing impacts on environmental and human health
- Corporate social responsibility

6.3 Need for Green Computing

The following are some necessities for Green Computing (Neha Sahni, 2011):

- Computer energy is often extravagant: goodbye the computer on when not in use
- Printing is often wasteful: Print out your emails or meeting agendas
- Pollution: Due to industrialized, covering, removal techniques
- Toxicity: Poisonous chemicals involved in the manufacturing.

The following are the 5 simple steps to Green Computing

- Develop a sustainable green computing plan
- Recycle
- Make environmentally sound purchase decisions
- Reduce paper consumption
- Conserve energy

6.4 Green Computing Usage

According to Janssen (2007), the following Green Computing uses are listed.

- Use the hibernate or sleep mode when away from a computer for extended periods.
- Use flat-screen or LCD monitors, instead of conventional cathode ray tube (CRT) monitors.
- Buy energy efficient notebook computers, instead of desktop computers.
- Activate the power management features for controlling energy consumption.
- Make proper arrangements for safe electronic waste disposal.
- Turn off computers at the end of each day.
- Refill printer cartridges, rather than buying new ones.
- Instead of purchasing a new computer, try refurbishing an existing device.

7. Green computing and green technology

Green computing and green technology refer to the environmentally responsible use of computers and any other technology related resources. Green computing includes the implementation of the best practices, such as energy efficiency central processing units, peripherals and servers. In addition, green technology aims to reduce the resource consumption and improve the disposal of electronic waste (Panda, 2013).

7.1 Green Technologies

Green technology encompasses a broad range of subjects from new energy-generation techniques to the study of advanced materials to be used in our daily life.

Green technology focuses on reducing the environmental impact of industrial processes and innovative technologies caused by the Earth's growing population. It has taken upon itself the goal to provide the society's needs in ways that do not damage or deplete natural resources. Mainly this means creating fully recyclable products, reducing pollution, proposing alternative technologies in various fields and creating a center of economic activity around technologies that benefit the environment. These are some green technologies which were used at the time of computing (Dawood Ameera, 2011). They are power saving by link status, cable length, time-based power over Ethernet, Wi-Fi scheduler, share-port, LCD standby, and smart FAN.

8. Roads to Green Computing

To comprehensively and effectively address the environmental impacts of computing, we must adopt a holistic approach and make the entire technology lifecycle greener by addressing environmental sustainability along the following four complementary paths (Jaya Sharma, 2012).

Green use: Minimizing the electricity consumption of computers and their peripheral devices and using them in an eco-friendly manner.

Green manufacturing: To reduce the environmental impacts, minimize waste during the manufacturing of computers and other subsystem of these activities (Assadi, 2012).

Green design: Green design was the designing of computer as energy use of PC, reducing energy consumption and energy star. That is energy resourceful computers, servers, printers, projectors and other digital devices.

Green Disposal: Green Disposal was repurposing an existing computer or appropriately disposing, or recycling unwanted electronic equipment.

Reuse: Donate your computer components to people who may not have or have lesser quality computers. *Refurbish:* Rather than discarding your computer upgrade it. Change its some of the parts in order to make it new.

Recycle: One of the major challenges is recycling the printed circuit boards from the electronic wastes (Yedavalli, 2014).

9. Approaches to Green Computing

According to Agrawal(2011), the approaches of Green Computing are stated as follows.

Virtualization: Computer virtualization is the method to operate two or more logical computer systems on one set of physical hardware.

Power Management: Power management for computer systems were most wanted for many reasons. Some of the reasons are prolonged battery life for portable and embedded systems, reduce cooling requirements, reduced noise and reduced operating costs for energy and cooling.

Power supply: Climate savers computing initiative promotes energy saving and reduction of greenhouse gas emissions by encouraging the development and use of more efficient power supplies.

Storage: There are three routes available, all of which vary in cost, performance and capacity. Some examples for storage are desktop hard drive, laptop hard drive and solid state drive.

Video Card: Energy efficient display option includes no video card - use a shared terminal, shared thin client or desktop sharing software if display required. Uses motherboard video output - typically low 3D performance and low power.

Display: LCD monitors typically use a cold-cathode fluorescent bulb to provide light for the display. Some newer displays use an array of light emitting diodes (LEDs) in place of the fluorescent bulb which reduce the amount of electricity used by the display.

Telecommuting Strategies: Telecommuting technologies implemented in green computing initiatives have advantages like increased worker satisfaction and reduction of greenhouse gas emissions, related to travel and increased profit margins.

Materials Recycling: Parts from outdated systems may be salvaged and recycled through certain retail outlets

and municipal or private recycling.

Resource Allocation: Resource allocation is used to assign the available resources in an economic way. It is a part of resource management, project management resource allocation is the scheduling of activities and the resources required by those activities while taking into consideration both the resource availability and the project time.

Terminal Servers: Terminal servers have also been used in green computing. When using the system, users at a terminal connect to a central server, all of the actual computing is done on the server, but the end user experiences the operating system on the terminal.

Operating system support: The dominant desktop operating system, Microsoft Windows, has included limited PC power management features since Windows 95. The most recent release, Windows 8 retains these limitations, but does include refinements for more efficient user of operating system timers, processor power management and display panel brightness.

10. Measures for Green Computing

According to (Barnatt 2012), measures for plummeting energy expenditure involves the following six areas.

Lower power hardware: Intel announced the new computing mantra to be performance per watt green computing, in general, and lower power hardware, in particular started to go main stream.

Virtualization: Virtualization is the use of computer software to simulate hardware. Within data centres, server consolidation applies virtualization in its replacement of many stand-alone physical servers with virtual servers that run as software on a small number of larger computers.

Cloud computing: Cloud computing is where software applications processing power, data and even artificial intelligence are accessed potentially over the Internet.

Energy efficient coding: Measures are intended to permit computers to most energy-efficient run existing applications, an alternative approach to power saving is energy efficient coding.

Improved repair, re-use, recycling and disposal: In Green computing, more effective disposal is hardware repair, the recycling of old computer hardware into a second-use situation, the re-use of components from personal computers beyond repair and/or the less frequent upgrading of computer equipment in the first place. Personal computers are one of the most modular and hence the most repairable products purchased by individuals and organizations.

Less pollutant manufacture: Less pollutant computer manufacture is something that clearly needs to be undertaken by those companies who make the hardware in the first place. Individuals and organizations can play an important role in their choice of new hardware.

11. Advantages of Green Computing

- Energy saving
- Environmentally friendly
- Cost-effective
- Save more money per year
- Conserving resources
- Reduces the risk
- Saving the planet

12. Disadvantages of Green Computing

- High start up cost
- Not readily available
- Still in experimental stages
- Scarifies performance for battery life
- Not suitable for everyone

13. Implementation

The records centre are inspected and unused equipments and softwares are removed. Virtualize applications, storage space and servers in the data centre wherever appropriate and consider consolidating the data centres. Download software as a replacement for buying software on disks in plastic wrapping. Fit the personal computer which was premeditated to fit where a usual personal computer is too massive, loud and power hungry. Fit- personal computer draws only 5 watts, consuming less power in a day than a traditional personal computer consuming in 1 hour. Thin clients like the sun ray

consume far less electricity than conventional desktops. Sunrays are particularly well suited for cost-sensitive environments such as call centres, education, healthcare, service providers and finance. It must be easy to portables by preparing as small size, fairly low, power CPU, compact screen, low cost and uses flash memory for storage.

Conclusion

Implementing green computing approaches makes common sense not only from an ethical, or moral stand-point, but also from a profit-making stand-point. There are many computing developments which can enable individuals and businesses to take on greener lifestyles and work fashions, in terms of the environmental argument computing, which is definitely both part of the problem and part of the solution. The features of a green computer of tomorrow would be like: efficient, manufacturing & materials, recyclability, service model, self-powering, and other trends. The plan towards green computing should include new electronic products and services with optimum efficiency and all possible options towards energy savings. Through more environmentally attentive practice and by adopting modern lower power technologies, computers can already be made significantly more energy-efficient. The computing industry is more prepared and far more experienced than almost any other manufacturing when it comes to in front of and responding to rapid change. So green computing is the extreme constraint to save the environment from harm and save energy along with equipped everyday expenditure in today's progressively more aggressive globe.

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