Green Computing Utilization for Optimizing Business Operations

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Abstract: *Green Computing (or Green IT) is considered to be the environmentally responsible manner for businesses to acquire, use and dispose of technology resources. While the term also applies to those systems and devices used at home and for leisure activities, commercial organizations make a much larger footprint on the environment in general. Green computing refers to the practice and procedures ofusing computing resources in an environment friendly way while maintaining overall computing performance. Global warming is on the rise and the average temperature of the Earth's climate system is getting disturbed due to wide range of factors. Climate change and associated impacts vary from region to region across the globe. Nowadays, weather behavior is becoming extremely unpredictable throughout the globe. Green computing plans often include the implementation of energy-efficient central processing units (CPUs), servers and peripheral devices (monitors and other displays). While there's no clear way to estimate cost savings, the EPA's ENERGY STAR site suggests companies could save up to $50 annually for each PC they upgrade, especially when sleep mode and other new power management features are properly configured. That's why organizations should look for electronics with an Energy Star rating of 4.0 and above when making new purchases. Virtualization is yet another great Green Computing option for businesses. Simulated server, desktop and storage system options can help businesses significantly reduce hardware, energy and cooling costs. Some IT experts have suggested that for every dollar invested in business servers, another dollar is needed to keep it running and cooled. By migrating server systems to virtual environments and consolidating their numbers, companies can significantly reduce their power costs as well as the floor space required for their data centers (which could be reallocated for other operations).This paper is a survey of several important literature related to the field of green computing that emphasizes the importance of green computing for sustainable development in business operation such as analysis and design, testing and maintenance.*

Keywords: *Green Computing, Environment and Virtualization.*

I.   Introduction

Enter green computing: the design, manufacture, use and disposal of computing devices in a way that is not detrimental to the environment. Green computing practices were primarily introduced by the US Environmental Protection Agency in 1992 with the launch of the Energy Star programme, a consumer guide to the energy efficiency of products. For manufacturers to earn the right to use the Energy Star label, their products must meet energy use guidelines in three distinct operating modes: standby, sleep mode and while computers are being used. Products bearing the Energy Star label saved US consumers enough energy in 2010 to avoid greenhouse gas emission equivalent to that from 33million cars, while saving them almost $18-billion in utility bills. But South African businesses are not following suit. Tim James, Director at Sustainable IT, a green information technology software and services provider, said business and IT organizations had yet to fully embrace the opportunities that **green computing** brings. Green computing can also develop solutions that offer benefits by "aligning all IT processes and practices with the core. Principles of sustainability, which are to reduce, reuse, and recycle; and finding innovative ways to use IT in business processes to deliver sustainability benefits across the enterprise and beyond. The goals of green computing are quite similar to green chemistry which are to reduce the use of hazardous materials, maximize energy efficiency during the product's lifetime, and promote the recyclability or biodegradability of non-operational products and factory waste. IT departments of many corporate are investing both time and money in green computing initiatives to reduce the environmental impact of their IT operations.

1. Green Use: Reducing the energy consumption of computers and other information systems as well as using them in an environmentally sound manner is of immense importance.

2. Green Disposal: Refurbishing and reusing old computers and Recycling unwanted computers and other electronic equipment.

3. Green Design: Designing energy efficient and environmentally sound components, computers, and servers and cooling equipments.

4. Green Manufacturing: Manufacturing electronic components, computers and other associated sub systems with minimal impact or no impact on the environment. These four paths cover a number of central areas and activities such as: design for environmental sustainability energy-efficient computing power management data

center design, layout and location, server virtualization, responsible disposal and recycling regulatory compliance green metrics, assessment tools and environmental problems. Manufacturing computers and their various electronic and non-electronic components consumes electricity, raw materials, harmful chemicals and water and generates hazardous waste.

All these directly or indirectly increase carbon dioxide emissions and impact the environment. The total electrical energy consumption by servers, computers, monitors, data communication equipment, and cooling systems for data centers is also increasing at a very fast rate. These increase in energy consumption results in increased greenhouse gas emissions. Each personal computer (PC) in use generates about a ton of carbon dioxide every year. Computer components contain lot of toxic materials. As more and more people are using computers, increasingly consumers are discarding a large number of old computers, monitors, and other electronic equipment few years after purchase, and most of this ends up in landfills, polluting the earth and contaminating water due to the presence of various toxic materials in the electronic components. The increased number of computers and their use, along with their frequent replacements, make the environmental impact of IT a major concern for all of us. Consequently, there is increasing pressure on all stake holders—the IT industry, businesses, and individuals—to make IT environmentally friendly throughout its lifecycle, from birth to death to rebirth It is our collective responsibility to safeguard our environment for future generation.

Virtualization: Virtualization is a major strategy to reduce data center power consumption. In virtualization, one physical server hosts multiple virtual servers. Virtualization enables data centers to strengthen their physical server infrastructure by hosting multiple virtual servers on a smaller number of more powerful servers, using less electricity and simplifying the datacenter. Besides getting much better hardware usage, virtualization reduces data center floor space, makes better use of computing power, and greatly reduces the data center's energy demands. Many enterprises are using virtualization to curtail the huge energy consumption of data centers. In order to tackle the issue of data centers' huge power consumption, leading IT enterprises formed a non-profit group called the Green Grid in February 2007. This group has the responsibility to define and propagate the best energy-efficient practices in data center operation, construction, and design, and drive new user-centric metrics and technology standards.

II.   Green Computing processes can benefit businesses

1. Consolidate printers: where possible, employees should share multi-function devices. A commonly accepted goal is one network-connected multifunction device for every ten users, which can significantly reduce electricity, ink, paper and other consumable costs.
2. Introduce thin-clients: these net book-type devices are much less expensive than traditional desktop PCs and require about half the power to operate. Cloud applications and a central server can run a variety of devices, creating a flexible, more efficient workspace for any company.
3. Upgrade power strips: some of the latest versions include timers and sensors that can be programmed to help conserve energy, while addressing the specific needs of each employee.
4. Recycle old equipment: with a variety of Federal, state and local regulations covering the disposal of e-waste, business should consult with experienced IT professionals before replacing their old equipment.
5. Create telecommuting options: with virtual private networks and a myriad of business collaboration tools available, organizations can significantly reduce both their real estate and energy needs by letting more employees work from home.

III.   Advantages of Green Computing in Business operations
3.1 Reduce Costs with Energy-efficient Systems
Going green starts with smart purchasing and usage practices. Because IT accounts for a disproportionate amount of the total energy consumption of a typical business, energy-efficient computing directly impacts the bottom line.

- **Energy certification** – Purchase devices that are Energy Star and EPEAT certified.
- **Power management options** – Make sure devices come with power management options enabled. Sleep mode significantly reduces energy usage. Using hibernation mode or turning the hardware off ensures that the system consumes no power.
- **Protect against malware** – Online threats often consume heavy processing resources, increasing the power used by your computer, even before you become, aware of the problem. Invest in proven anti-malware services.
- **Recycling programs** – At the end of device life, take advantage of recycling programs like those sponsored by both Microsoft and HP.

- **Virtualization** – Reduce operating costs and improve server utilization with virtualized servers.

3.2 Sustain Profits and the Environment with Cloud Computing

For small businesses, maintaining a full IT solution in-house incurs significant cost, from personnel to servers and system maintenance. Servers alone consume large amounts of energy and often operate far below capacity. Migrating to cloud computing often allows organizations to reduce both budget and power usage. Without the need to maintain costly server rooms, companies can focus their resources more effectively. In addition, the scalable nature of cloud computing allows organizations flexibility in designing a solution to expand with company growth.

3.3 Reduce Stress and Your Carbon Footprint with Telecommuting

Telecommuting offers many business benefits, from increased employee satisfaction to reduce overhead. Employees who telecommute spend less time flying and driving to work, directly reducing carbon emissions. At the same time, the deep integration of Microsoft chat and video-conferencing features, Office 365 applications, and Microsoft Cloud storage solutions allows employees to collaborate from multiple locations with ease.

IV.   Recognition for Green Computing

1. E.U. (the European Union) has created the *E.U. Flower Eco Award* for green computing. The 2008 award was handed to ASUS for creating innovative greener laptops.
2. Fujitsu Siemens was recognized for its self-realization to create its own eco-friendly labels that were pasted on its products to educate the consumers about such issues.
3. *Energy Star rating* that is provided by the US EPA (Environmental Protection Agency) will soon get is own dedicated category for green servers. EPA is presently awarding Energy Star Ratings to data centers.
4. *Greenpeace Guide to Greener Electronics*, the 11th edition, 2009 took note of the non-performing IT majors and companies like HP and Lenovo were penalized as they weren't able to fulfill their promise of removing toxic constituents from their products. However, Apple was awarded bonus points as it created a PC-building material that was free of any PVC (polyvinyl chloride)

V.   Question of having a Green Mindset

Friendly business practices that have been put forth by idealistic environmentalists. However, this perception is largely misplaced. Green computing is nothing more than adopting a mindset that helps businesses in performing at the same level of productivity and profit margins, but in a more environment-friendly manner.
The contemporary business practices are heavily dependent on computing solutions and newer ones are always being researched. So, if businesses insist on adopting only greener computing methods, it would mean influencing global research and development teams in creating better computing solutions, i.e. greener, affordable and user-friendly. Once this sort of an approach is developed, there would be a spurt in computing technologies that would put lesser strain on the environment.

VI.   Realization of Being Green without Sacrificing Development

The biggest apprehension that businesses have when eco-friendly computing solutions are proposed, is whether these would be compatible with their business growth. However, this conventional trend has seen some interesting developments in the last few years. It is reported that a growing number of high-end data centers around the globe are feeling the increasing pressure due to rising requirements of space, heat and power, every time they plan to augment their sphere of business or undertake workplace expansions. As a result, not due to environmental concern but to meet their own commercial interests, many organizations have come forward to adopt greener, sustainable computing solutions. Rising expenditures incurred due to power consumption in conventional data centers and the inability to meet the rising demand for physical workspace is forcing such business enterprises to seek greener computing platforms.

VII.   Green Initiatives

There have been many steps taken towards creating technologies that entice the businesses towards greener computing by offering huge savings in energy costs. The adoption of such technologies indirectly helps to reduce carbon footprints and greenhouse gas emissions. Angstrom Microsystems is in the process of launching data centers that would provide eco-compatible cooling technologies. They are on the verge of introducing AMS Liqui Cool — an innovative liquid cooling method that is effective enough to reduce air-conditioning needed in busy data centers by nearly 75%. The growing awareness about computers adding to global warming has led IT giants like Google, Intel, IBM, Dell, Hewlett-Packard and Microsoft in looking for

ways to reduce carbon footprints created in computerized workplaces. A Climate Savers Computing Initiative has been created and its dedication to One major problem that is faced when trying to influence business organizations towards adopting a greener working environment is their perception about the term 'green computing'. It is generally understood that going green invariably leads to compromised productivity due to the absorption of unfeasible eco cause is being backed by the WWF (World Wildlife Fund). The focus is on creating energy-efficient PCs and PC components that might be a bit expensive than their existing counterparts but would be sensible purchases for businesses as their power consumption would be significantly lesser.

VIII. Conclusion

Today a number of business enterprises understand the importance of going green with major green initiatives in their business ventures. Green technologies today have become indispensable. It is rather ironic that the entire world had welcomed the multiplication of more computers across households and workplaces, believing that a computer-centered world would put lesser strain on the environment. As it turns out, computers did provide a paper-free business environment but more forests are now being chopped down just to support the power consumed by electronic computing devices. Further, PCs are heating-up the environment to such an extent that more power is being used to keep the workplaces cooler. It is believed that every PC is able to effectively utilize just about 50% of the total electrical power it consumes. Thus, seeking greener computing solutions isn't about making a choice anymore. The situation is getting grim with every passing day and businesses need to understand the mutual benefit, their commercial interests and the environment, will derive from greener and practical computing technologies.
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