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GREEN COMPUTING-AN OVERVIEW

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ABSTRACT

Green computing is the study and practice of using computing resources efficiently. The goals are similar to green chemistry; that is reducing the use of hazardous materials, maximize energy efficiency during the product's lifetime, and promote recyclability or biodegradability of defunct products and factory waste. Taking into consideration the popular use of information technology industry, it has to lead a revolution of sorts by turning green in a manner no industry has ever done before. It is worth emphasizing that this "green technology" should not be just about sound bytes to impress activists but concrete action and organizational policy. Opportunities lie in green technology like never before in history and organizations are seeing it as a way to create new profit centers while trying to help the environmental cause. The plan towards green IT should include new electronic products and services with optimum efficiency and all possible options towards energy savings.

KEYWORDS: Green, Computing, Products, Services, IT, Computer, waste

INTRODUCTION

Green computing, green IT or ICT Sustainability, is the study and practice of environmentally sustainable computing or IT. San Murugesan notes that this can include "designing, manufacturing, using, printers, storage devices, and networking and communications systems — efficiently and effectively with minimal or no impact on the environment. The goals of green computing are similar to green chemistry: 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. Many corporate IT departments have green computing initiatives to reduce the environmental impact of their IT operations. Green ICT and its services present opportunities to deliver low carbon footprints and mitigate carbon emissions because of the unique ability to make energy consumption and greenhouse gas emissions visible through its products and services. Green computing is the practice of using computing resources efficiently. The goals are to reduce the use of hazardous materials, maximize energy efficiency during the product's lifetime, and promote recyclability or biodegradability of defunct products and factory waste. Such practices include the implementation of energy-efficient central processing units (CPUs), servers and peripherals as well as reduced resource consumption and proper disposal of electronic waste (e-waste). In 1992, the U.S. Environmental Protection Agency launched Energy Star, a voluntary labeling program which is designed to promote and recognize energy-efficient in monitors, climate control equipment, and other technologies. This resulted in the widespread adoption of sleep mode among consumer electronics. The term "green computing" was probably coined shortly after the Energy Star program began; there are several USENET posts dating back to 1992 which use the term in this manner.

Why Go Green?

Green computing is a very hot topic these days, not only because of rising energy costs and potential savings, but also due to the impact on the environment. Energy to manufacture, store, operate, and cool computing systems have grown significantly in the recent years, primarily due to the volume of systems and computing that companies now heavily rely upon. Computing power consumption of companies has reached a critical point. For example, an E-commerce business with 100,000 servers can easily spend up to $20 million a year on server power. Add another $10 million for a/c cooling and it tops $30 million a year in power alone. Clearly there is a huge potential for savings in their infrastructure. Despite the huge surge in computing power demands, there are many existing technologies and methods by which significant savings can be made. This series is dedicated to the ways a typical organization can reduce their energy footprint while maintaining required levels of computing performance.

Definition - What does *Green computing* mean?

Green computing is the environmentally responsible and eco-friendly use of computers and their resources. In broader terms, it is also defined as the study of designing, manufacturing/engineering, using and disposing of computing devices in a way that reduces their environmental impact.

Many IT manufacturers and vendors are continuously investing in designing energy efficient computing devices, reducing the use of dangerous materials and encouraging the recyclability of digital devices and paper. Green computing practices came into being in 1992, when the Environmental Protection Agency (EPA) launched the Energy Star program.

ROADS TO GREEN COMPUTING

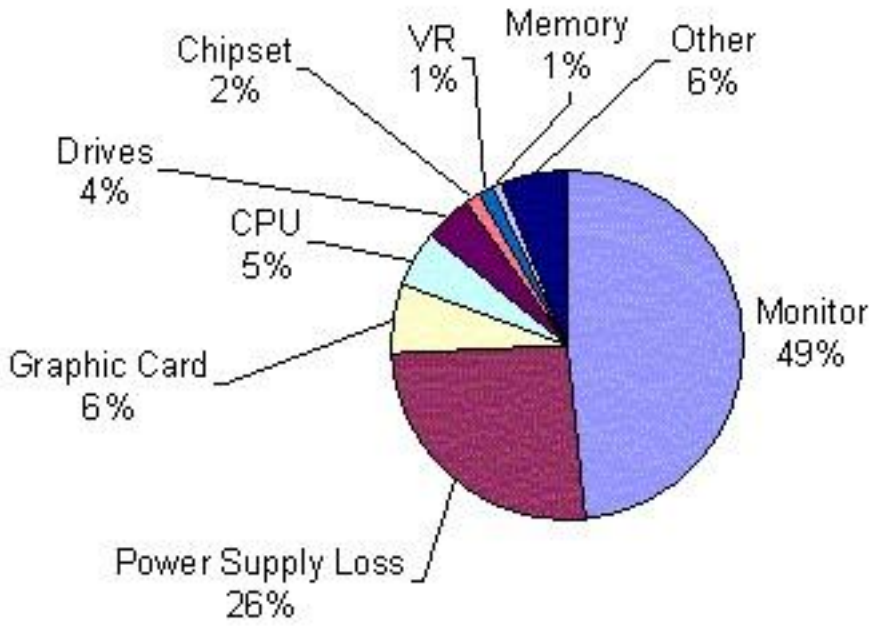
- ***Green use:*** — reducing the energy consumption of computers and other information systems as well as using them in an environmentally sound manner

- ✸ ***Green disposal:*** — refurbishing and reusing old computers and properly recycling unwanted computers and other electronic equipment
- ✸ ***Green design:*** — designing energy-efficient and environmentally sound components, computers, servers, cooling equipment, and data centres.
- ✸ ***Green manufacturing:*** — manufacturing electronic component components, computers, another associated subsystem with minimal impact on the environment.

DEMONS BEHIND GREEN COMPUTING

- ❖ ***Power supply:*** Desktop computer power supplies (PSUs) are generally 70–75%efficient, dissipating the remaining energy as heat. An industry initiative called80 PLUS certifies PSUs that are at least 80% efficient; typically these models are drop-in replacements for older, less efficient PSUs of the same form factor. As of July 20, 2007, all new Energy Star 4.0-certified desktop PSUs must be at least 80%efficient.
- ❖ ***Storage:*** Smaller form factor (e.g. 2.5 inches) hard disk drives often consume less power than physically larger drives. Unlike hard disk drives, solid store data in flash memory or DRAM. With no moving parts, power consumption may be reduced somewhat for low capacity flash based devices. Even at modest sizes, DRAM based SSDs may use more power than hard disks, (e.g., 4GBi-RAMusesmore power and space than laptop drives). Flash based drives are generally slower for writing than hard disks.
- ❖ ***Video card:***
- ★ A fast GPU may be the largest power consumer in a computer. Energy efficient display options include: No video cards used in a shared terminal, shared thin client, or desktop sharing software if display required.
- ★ Use motherboard video output - typically low 3D performance and low power.
- ★ Reuse an older video card that uses less power; many do not require heat sinks or fans.
- ★ Select a GPU based on average wattage or performance per watt.
- ❖ ***Materials:*** Computer systems that have outlived their particular function can be repurposed, or donated to various charities and non-profit organizations. However, many charities have recently imposed minimum system requirements for donating equipment. Additionally, parts from outdated systems may be salvaged and recycled through certain retail outlets and municipal or private recycling centers. Recycling computing equipment can keep harmful materials such as lead, mercury, and hexavalent chromium out of landfills, but often computers gathered through recycling drives are shipped to countries where environmental standards are less strict than in North America and Europe. The Silicon Valley Toxics Coalition estimates that 80% of the post-consumer e-waste collected for recycling is shipped abroad to countries such as China, India, and Pakistan. Computing supplies, such as printer cartridges, paper, and batteries may be recycled as well.

- ***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 reduces the amount of electricity used by the display.
- ***Chilling of data:*** To keep servers at the right temperature, companies mainly rely on air conditioning. The more powerful the machine, the more cool air needed to keep it from overheating. By 2005, the energy required to power and cool servers accounted for about1. 2 % of total U.S electricity conception. By 2010, half of the Forbes Global 2000companies will spend more on energy than on hardware such as servers.



Component Wattage

ADVANTAGES OF GREEN COMPUTING

- 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 mean 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 humans.
- System Wide Green Computing and Individual Green Computing are the best possible way to practice Green Computing. Companies implementing System Wide Green Computing and employees and

individuals practicing individual green computing techniques help in a long way in creating an impact to save the planet.

FACTS ABOUT GREEN COMPUTING

- Computer technology use accounts for 2% of anthropogenic CO2
  - Roughly equivalent to aviation industry
  - IT energy usage will double next 4 years
- A typical desktop PC with a 17-inch LCD monitor requires about 145 watts—110 watts for the computer and 35 watts for the monitor.
- For every 12 consumers who keep power settings enabled for their on their monitors and PCs, CO2 emissions equivalent to removing one average automobile from the road will be avoided.
- If left on 24x7 for one year, this same computer will consume 1,270 kilowatt hours of electricity—that's enough to release 1,715 pounds of carbon dioxide into the atmosphere and the equivalent of driving 1,886 miles in the average car!

RECENT IMPLEMENTATIONS OF GREEN COMPUTING

- ***Blackle:*** Blackle is a search-engine site powered by Google Search. Blackle came into being based on the concept that when a computer screen is white, presenting an empty word or the Google home, your computer consumes 74W. When the screen is black it consumes only 59W. Based on this theory, if everyone switched from Google to Blackle, mother earth would save 750MW each year. This was a really good implementation of Green Computing. The principle behind Blackle is based on the fact that the display of different colors consumes different amounts of energy on computer monitors. 6.2 Fit-PC: a tiny PC that draws only 5w: Fit-PC is the size of a paperback and absolutely silent, yet fit enough to run Windows XP or Linux. fit-PC is designed to fit where a standard PC is too bulky, noisy and power hungry. If you ever wished for a PC to be compact, quiet and green â€œ then fit- PC is the perfect fit for you. Fit-PC draws only 5 Watts, consuming in a day less power than a traditional PC consumes in 1 hour. You can leave fit-PC to work 24/7 without making a dent in your electric bill.
- ***Zonbu Computer:*** The Zonbu is a new, very energy efficient PC. The Zonbu consumes just one third of the power of a typical light bulb. The device runs the Linux operating system using a 1.2 gigahertz processor and 512 Meg of RAM. It also contains no moving parts, and does even contain a fan. You can get one for as little as US$99, but it does require you to sign up for a two-year subscription".
- ***Sunray thin client:*** Sun Microsystems is reporting increased customer interest in its Sun Ray, a thin desktop client, as electricity prices climb, according to Subodh Bapat, vice president and chief engineer in the Eco Responsibility office at Sun. Thin clients like the Sun Ray consume far less electricity than conventional

desktops, he said. A Sun Ray on a desktop consumes 4 to 8 watts of power, because most of the heavy computation is performed by a server. Sun says Sunrays are particularly well suited for cost-sensitive environments such as call centers, education, healthcare, service providers, and finance. PCs have more powerful processors as well as hard drives, something thin clients don't have. Thus, traditional PCs invariably consume a substantially larger amount of power. In the United States, desktops need to consume 50 watts or less in idle mode to qualify for new stringent Energy Star certification.

- ***The Asus Eee PC and other ultra portables:*** The "ultra-portable" class of personal computers is characterized by a small size, fairly low power CPU, compact screen, low cost and innovations such as using flash memory for storage rather than hard drives with spinning platters. These factors combine to enable them to run more efficiently and use less power than a standard form factor laptop. The Asus Eee PC is one example of an ultraportable. It is the size of a paperback, weighs less than a kilogram, has built-in Wi-Fi and uses flash memory instead of a hard drive. It runs Linux too.

PERSPECTIVE WITH RESPECT TO INDIAN SCENARIO

For a long time there was no considerable improvement in the growth of indigenous, authentic hardware equipment manufacturer in the country and almost every company and the household customers were dependant on foreign companies who were either importing the equipments or producing part of them in Indian subsidiaries.

Lack of basic research initiative and congenial infrastructure has resulted in the absence of good patents and commercial production of indigenously built equipments. Due to tax relief given by the Government in the last few years for importing computer hardware accelerated the import and resulted in the minimization of the machines, equipments and peripherals. In this situation many small and medium scale industries were induced to start procuring the hardware at low prices and venture into the building of IT infrastructure for the company. But during the activities price was the most important criterion. At that point of time the basic objective was to build basic infrastructure without considering the principle of green computing. In the later stage when at the recent time the concept is grown enough, it is not possible for most of the small and medium scale companies to redo the task of IT infrastructure development over and above bearing the cost of maintenance and procurement of software.

Even with the old non green hardware it was observed that most of the boards (Around 73.78 % as found in local survey in and around Kolkata, Siliguri, ADDA) faced a question by the stakeholders about the justification for the IT expenditure and they also insisted to calculate the cost benefit ratio of the investment and unfortunately most of the boards failed to give good answer due to confusion and initial fault in planning which resulted in the massive underutilization of the equipments and failure of MID which was not very prudent and robust with respect to the changing business dynamics. So in the backdrop of the above discussion it can be concluded that most of the SMEs will not be interested right now to change their IT

infrastructure to green infrastructure. Even if they are concerned about the concept they will wait until the cost is recovered from the old infrastructure. Though when they will procure any new equipment they will have a choice of green equipment but in that case also price will play a deterrent role decision-making. Regarding the large companies and MNCs cost of procurement of new green equipments is not very tough but again disposal of the old equipments is not a very easy task. Apart from this the problem of homoeostasis of the employee is also a negative factor.

In India the IT backed business intelligence and operation is now in a growth page and the stakeholders are really concerned to maximize the return on investment and as a result of this it will not be easy to implement the principle of green computing in the IT infrastructure.

CONCLUSION

Basically the goal of green computing is similar to green chemistry: reduce the use of hazardous materials, maximize energy efficiency during the product's lifetime, and promote recyclability or biodegradability of defunct products and factory waste. Green computing researchers look at key issues and topics related to energy efficiency in computing and promoting environmentally friendly computer technologies and systems include the energy efficient use of computers, design of algorithms and systems for environmentally-friendly computer technologies, and wide range of related topics. Green computing can lead to a lot of energy savings, reduction in emission of co2 & CFC's which leads to environmental protection. It also leads to serious cost savings over time. Devices use less and less power while renewable energy gets more and more portable and effective. New green materials are developed every yea0r, and many toxic ones are already being replaced by them. The greenest computer will not miraculously fall from the sky one day, itâ„¢ll be the product of years of improvements. The features of a green computer of tomorrow would be like: efficiency, manufacturing & materials, recyclability, service model, self-powering, and other trends. Green computer will be one of the major contributions which will break down the 'digital divide', the electronic gulf that separates the information rich from the information poor. Deals Adopting Green Computing Strategies make sense not only from an ethical, or moral standpoint, but from a commercial stand-point. There are many business benefits achieved 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.

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