

Green Computing: An Environmental Necessity

Miss.Nimisha Dilip Shetye

Assistant Professor, MKSSS College of Computer Applications for Women Shirgaon, Maharashtra, India

Abstract - In today's world, organizations are constantly searching for ways to conduct their operations in an environmentally responsible manner. As the usage of computer increased it became a necessity for almost every field to use computers for their operations. Also, they have made working and sorting things easier. Nearly all organizations use computing devices to achieve their goals. The stuff that your IT is made up of is often very toxic. It has things such as lead, hexavalent chromium and mercury which are very nasty when put into landfills. Therefore, an alternative eco-friendly and cost effective technology is required in order to reduce the negative impact of computing technology on our Environment. Green computing is a effective and efficient way for designing, manufacturing and using of computers and computer related products that would help preserve natural resources and reduce the harmful impact on the environment. The goal of green computing is to lower down the use of hazardous materials, maximize energy efficiency and popularize biodegradability or recyclability of out-dated products and factory waste. This research paper provides a better understanding and importance of green computing and its need in today's era. It also discusses the approaches for implementing Green computing. This paper also presents some fundamental steps that can be taken to significantly decrease the environmental impact of computing.

1. INTRODUCTION

The goal of the Green computing is to decrease the practice of toxic materials, make best use of energy during the product's lifespan, and encourage recycle of expired products and factory waste. The main objective of the Green Computing is minimizing energy consumption, purchasing green energy, decreasing paper work, increasing equipment disposal properly Green Computing is important because it keeps the world cleaner. It saves our natural resources that we need to survive. . Green computing is low risk factors of our business to not only help the atmosphere its reducing cost. Green computing aims to attain economic viability and improve the way computing devices are used. Green IT practices include the development of environmentally sustainable production practices, energy-efficient computers and improved disposal and recycling procedures

2. ORIGIN OF GREEN COMPUTING

One of the first manifestations of the green computing movement was the launch of the Energy Star program way back in 1992 by U.S environmental protection agency. Energy Star served as a kind of voluntary label awarded to computing products that succeeded in minimizing use of energy while maximizing efficiency. Energy Star applied to

products like computer maximizing efficiency. Energy Star applied to products like computer, monitors, television sets and temperature control devices like refrigerators, air conditioners and similar items. Energy star program minimizing the use of energy while maximizing efficiency one of the first approaches towards green Computing was sleep mode function in computer. Sleep mode function which places a computer on standby mode to a preset period of time According to Wikipedia "The Swedish organization TCO development launch the TCO certification program to promote allow magnetic and electrical emission from cathode Ray Tube (CRT) based computing display. As it developed over time, it began to get the name green computing. One of Green Computing latest programs is tactical instrumentalists. It is not very good because it mainly focuses on cost rather than helping save energy.

3. WHY GREEN COMPUTING?

Green computing benefits the environment. Reduced energy usage from green 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. Put simply, saving energy and resources saves money. The advantages of green technology are realized on both large and small scales. Green technologies are available for an entire organization or for a single employee's workstation. Unfortunately, many companies and business owners are stalled by the initially larger investment in green technology, and fail to realize the long-term benefits and cost savings. Green Computing is important because it keeps the world cleaner. If green computing was never developed, the world would be dirtier than it already is. It also makes our electronic devices work more efficiently and last longer. It teaches people how to be grateful about what they have to not take it for granted. Most people don't appreciate all of the things that they have that other people would never dream of having. For example televisions, computers, lap tops, I pads, x box, etc. If more people would donate old and used electronics, more people in the world would be a lot happier.

3.1 Roads to Green Computing

To promote green computing concepts at all possible levels, the following four approaches are employed:

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

- **Green disposal:** Repurposing existing equipment or appropriately disposing of, or recycling, unwanted electronic equipment
- **Green design:** Designing energy-efficient computers, servers, printers, projectors and other digital devices
- **Green manufacturing:** Minimizing waste during the manufacturing of computers and other subsystems to reduce the environmental impact of these activities

4. STEPS FOR ADOPTION OF GREEN COMPUTING

There are several steps to implement Green Computing, as follows:

1. Develop a sustainable green computing plan. Plan should include recycling policies, recommendations for disposal of used equipment, government guidelines and recommendations for purchasing green computer equipment. Green computing best practices and policies should cover power usage, reduction of paper Consumption, as well as recommendations for new equipment and recycling old machines.
2. Discard used or unwanted electronic equipment in a convenient and environmentally responsible manner. Computers have toxin metals and pollutants that can emit harmful emissions into the environment. Never discard computers in a landfill. Recycle them instead through manufacturer programs such as HP's Planet Partners recycling service or recycling facilities in your community. Or donate still-working computers to a non-profit agency.
3. Make environmentally sound purchase decisions. Purchase Electronic Product Environmental Assessment Tool registered products. EPEAT is a procurement tool promoted by the nonprofit Green Electronics Council to: • Help institutional purchasers evaluate, compare and select desktop computers, notebooks and monitors based on environmental attributes.
4. Recognize manufacturer efforts to reduce the environmental impact of products by reducing or eliminating environmentally sensitive materials, designing for longevity and reducing packaging materials
5. Reduce Paper Consumption. There are many easy, obvious ways to reduce paper consumption: e-mail, electronic archiving, use the —track change feature in electronic documents, rather than redline corrections on paper. When you do print out documents, make sure to use both sides of the paper, recycle regularly, use

smaller fonts and margins, and selectively print required pages.

6. Conserve energy. Turn off your computer when you know you won't use .Turn on power management features during shorter periods of inactivity. Power management allows monitors and computers to enter low-power states when sitting idle. By simply hitting the keyboard or moving the mouse, the computer or monitors awakens from its low power sleep mode in seconds.
7. Use of Energy Star Labeled Products – Energy star label indicates the energy efficiency of the appliance such as TV, which goes between one and ten stars. The greater the number of stars the higher the efficiency. So you can *go green* by purchasing an appliance on the basis of energy star.
8. E-Waste Recycling – E-waste recycling is the reuse or recycling of e-waste such as old computers, monitors etc. Instead of throwing it, always contribute to the non-profits and charities or submit it to the municipal or private recycling bodies.
9. Telecommunication – It is a work arrangement in which people work from home, making use of the internet, telephone, and email.

5. APPROACHES TO IMPLEMENT GREEN COMPUTING

5.1 Virtualization

Computer virtualization refers to the abstraction of computer resources, such as the process of running two or more logical computer systems on one set of physical hardware. The concept originated with the IBM mainframe operating systems of the 1960s, but was commercialized for x86-compatible computers only in the 1990s. With virtualization, a system administrator could combine several physical systems into virtual machines on one single, powerful system, thereby unplugging the original hardware and reducing power and cooling consumption. Several commercial companies and open-source projects now offer software packages to enable a transition to virtual computing. Intel Corporation and AMD have also built proprietary virtualization enhancements to the x86 instruction set into each of their CPU product lines, in order to facilitate virtualized computing.

5.2 Terminal servers

Terminal servers have also been used in green computing methods. Terminal Services for Windows and the Aqua Connect Terminal Server for Mac, both deliver operating systems to end users. All of the computing is done at the server level but the end user experiences the operating system. There has been an increase in using terminal services with thin clients to create virtual labs. Thin clients

use up to 1/8 the amount of energy of a normal workstation. Using thin clients with a terminal server delivers the Windows or Mac operating system to end users while also decreasing energy costs and consumption.

5.3 Power Management

The Advanced Configuration and Power Interface (ACPI), an open industry standard, allows an operating system to directly control the power saving aspects of its underlying hardware. This allows a system to automatically turn off components such as monitors and hard drives after set periods of inactivity. In addition, a system may hibernate, where most components (including the CPU and the system RAM) are turned off. ACPI is a successor to an earlier Intel-Microsoft standard called Advanced Power Management, which allows a computer's BIOS to control power management functions. Some programs allow the user to manually adjust the voltages supplied to the CPU, which reduces both the amount of heat produced and electricity consumed.

5.4 Power Supply

Desktop computer power supplies (PSUs) are generally 70–75% efficient, dissipating the remaining energy as heat. An industry initiative called 80 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.

5.5 Storage

Smaller form factor hard disk drives often consume less power per gigabyte than physically larger drives. Unlike hard disk drives, solid-state drives 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., 4GB i-RAM uses more power and space than laptop drives). Flash based drives are generally slower for writing than hard disks. As hard drive prices have fallen, storage farms have tended to increase in capacity to make more data available online. This includes archival and backup data that would formerly have been saved on tape or other offline storage. The increase in online storage has increased power consumption. Reducing the power consumed by large storage arrays, while still providing the benefits of online storage, is a subject of ongoing research.

5.6 Materials Recycling

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 donated 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 chromium out of landfills, but often computers gathered through recycling drives are shipped to developing 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.

5.7 Telecommuting

Teleconferencing and telepresence technologies are often implemented in green computing initiatives. The advantages are many; increased worker satisfaction, reduction of greenhouse gas emissions related to travel, and increased profit margins as a result of lower overhead costs for office space, heat, lighting, etc. The savings are significant; the average annual energy consumption for U.S. office buildings is over 23 kilowatt hours per square foot, with heat, air conditioning and lighting accounting for 70% of all energy consumed. Other related initiatives, such as hostelling, reduce the square footage per employee as workers reserve space only when they need.

6. CONCLUSIONS

This research paper shows the need & importance of Green computing. We should believe the need of Green computing and as shown in research paper necessary steps should be taken for healthy environment. This paper is a step in achieving green computing by suggesting means and ways to achieve the same. Green computing is not about going out and designing biodegradable packaging for products. The features of a green computer of tomorrow would be such as energy efficiency, manufacturing and materials, recyclability, service model and self-powering.

We should keep in mind all these factors while buying/manufacturing a computer/laptop or while using computer. So that we can help a bit to save our environment. Proper implementation of Green computing will be helping hand in terms to save energy and controlling the pollution.

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