Green Computing

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Abstract: **- Green computing in the sense , computers have negative impacts to our environment as well as users. The waste of hardware materials contains chemicals which are toxic. A computer left for so many hours will produce high electronic cost as well as it produces carbon-di-oxide in the atmosphere . But now-a-days , more and more computers producing unnecessary greenhouse gases every year which can cause global warming . so it is important for an software developer to use the computer in a eco-friendly manner. So it's necessary to learn about green computing ,**
Green computing is designing, manufacturing, using and disposing of computers, server and associated subsystems efficiently with minimal impact on the environment.

For example,

- Replace a CRT monitor with an LCD monitor , LCD monitor can use one-half of the energy consumed by CRT and it also result in less eye-strain;

It is mainly concerned whatever we are wasting and damaging our environment,

5 STEPS TO DEVELOPE GREEN COMPUTING:

- Develope a sustainable green computing plan, Whatever we do we need a plan before doing something, that is recycling policy, that is we should discard the unwanted electronic materials in a convenient manner and it should environmental friendly.

- Computer has some toxic materials which can emit harmful radiations to environment,

  Like discarding the waste computers in a open landfills may cause pollution.
- We should reduce paper consumption which is very very important , there are easy ways to do that eg, e-mail.
- While printing a document we can use both sides of the paper.
- Turn off the computers when you are not in use for a long period of time that preserves energy.

CORE OBEJECTIVES:

- Green environment
- Cost saving
- Energy saving
- Secure future
- Social responsibility

CONCLUSION:

SINCE EARTH IS HOME TO MILLIONS OF SPECIES OF LIFE

Let's do our part to protect the environment and save our money too.!!

INTODUCTION:

Green computing, Green ICT as per IFG International Federation of Green ICT and IFG Standard, green IT, or ICT sustainability, is the study and practice of environmentally sustainable computing or IT [1]. San Murugesan [2] notes that Green IT "is the study and practice of 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 impact on the environment". Murugesan [2] lays out the following four paths along which he believes the environmental effects of computing should be addressed

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

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, 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.

A green computer or green IT system is one where the entire process from design, manufacture, use, and disposal involves as little environmental impact as possible. In other words, a green initiative is taken in consideration of all facets of a computer‘s life, from design to disposal. In the design aspect, a green computer is created to perform without a negative environmental impact. Such design includes everything from materials and components to how the computer uses its power supply. Nowadays, most computers are built with a sleep or hibernate mode that allows them to power down when not in use and, therefore, save on energy impact.

A green computer will also take into account how it impacts the environment during its life. One way to make a green computer reduce its usage impact is to extend its longevity. The longer the computer lasts, the less impact it will have on the environment because disposal, normally the most significant green influence of the computer‘s cycle, will be delayed for a longer period of time. To increase a computer‘s longevity, we suggest looking toward upgrades and modularity. For example, building a new computer from scratch produces a greater environmental effect than building a new RAM module for replacement in computing equipment. computer virtualization is helping to make large strides in green computing technology. Through the phenomenon of virtualization, it is now possible to operate two or more computers on the physical hardware of a single computer. In this manner, you could create the ultimate green computer; one that exists logically, but not physically.

The logical units use all the material components of the physical computer, but are devoid of physical structure themselves. This means that the environmental impact of logical computers is virtually eliminated. The ideal green computer, therefore, may lie in virtual green computing. Terminal servers can also be used to create a greener computer. When using a terminal server, you are connected to a central terminal where all the computing is done. The operating system is experienced by the end user on the terminal. These terminals can be matched up to thin clients who depend on the server to do most of their computing. This type of green computing setup typically consumes as little as one eighth of the energy of a conventional workstation.

Overview of Green Computing :

• Green computing or green IT, refers to environmentally sustainable computing or IT.

• The study and practice of 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 impact on the environment.

Computing The Goals of Green:

• 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.

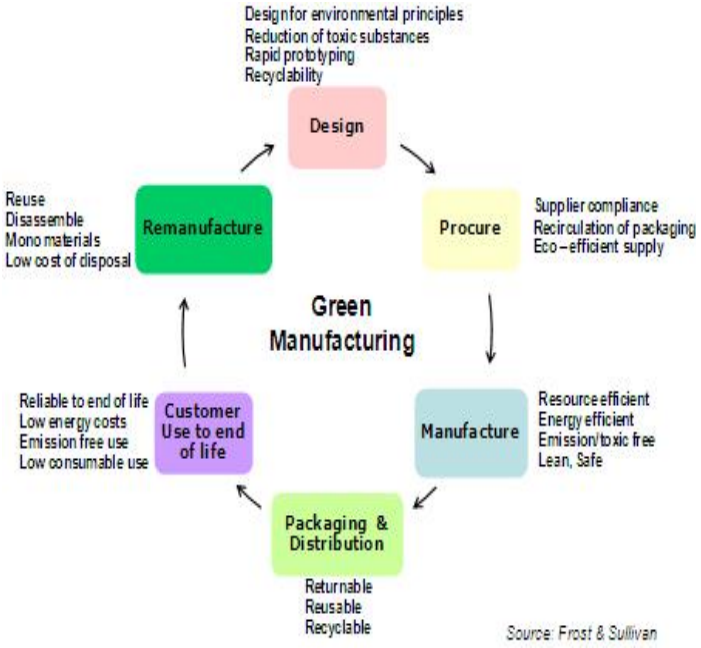
• Research continues into key areas such as making the use of computers as energy-efficient as possible, and designing algorithms and systems for efficiency-related computer technologies.

Problem:

According to a report from the United Nations University, it takes about 1.8 tons of chemicals, fossil fuels and water to produce a typical desktop computer -- and worldwide over one billion PCs have been sold. A December 2006 Computer Weekly article on green computing also reported a Carbon Trust estimate that office equipment currently accounts for around 15 per cent of total UK energy use. This figure is expected to rise to about 30 per cent by 2020, with computer equipment to account for about two-thirds of this energy consumption. In April 2007, a Gartner Press Release also estimated that the global information and communications technology (ICT) industry accounts for about 2 per cent of global carbon dioxide emissions, or roughly the same as aviation. Personal computer power use is ripe for making environmental savings. The Climate Savers Computing Initiative estimates that the average desktop PC wastes over half of the power delivered to it. Estimates from other sources concur. Intel, for example, estimate that a typical business desktop could reap a 60 per cent energy saving by implementing what they term "aggressive power management". According to these issues, the environment is being affected by e-wastes and as a result human life is in quite trouble. Many of the components found in popular computers are not only harmful to the environment, but also potentially harmful to humans. So it is needed to find a way to handle computers and its devices for save the environment and society from such E-hazards.

Objectives of the study :

In recent years focus of enterprises and technology firms has been shifted towards Green Computing rapidly. Green Computing discusses the options to support critical computing needs in sustainable manner by reducing strains on resources and environment. One of the main objectives of this study is to find out current trends on green computing, its implications, and the challenges for implementing green computing. This paper is organized as follows: next, section 2 reviews current trends in the field of Green Computing; section 3 will explore the challenges of Green Computing; section 4 will discuss the future trends towards Green Computing; and finally this study summarized the issues related to Green Computing and concludes.



Energy Star:

• Energy Star is an international standard for energy efficient consumer products originated in the United States of America.
• It was first created as a United States government program during the early 1990s, but Australia, Canada, Japan, New Zealand, Taiwan and the European Union have also adopted the program.

• Devices carrying the Energy Star logo, such as computer products and peripherals, kitchen appliances, buildings and other products, generally use 20%–30% less energy than required by federal standards.

Energy star specification:
• Energy Star specifications differ with each item, and are set by either the Environmental Protection Agency or the Department of Energy. The following highlights product and specification information available on the Energy Star website.

Energy Star items:

• Computers

• Servers

• Appliances

• Heating and cooling systems

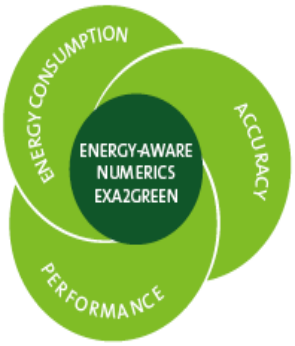
• Home electronics

• Imaging equipment

Current Trends on Green Computing:
Current trends of Green Computing are towards efficient utilization of resources. Energy is considered as the main resource and the carbon footprints are considered the major threads to environment. Therefore, the emphasis is to reduce the energy utilization & carbon footprints and increase the performance of Computing. There are several areas where researchers are putting lots of efforts to achieve desired results:

A. Energy Consumption:
Organizations are realizing that the source and amount of their energy consumption significantly contributes to Greenhouse Gas (GhG) emissions. In response to this finding, organizations are currently using the following equation:
Reduced energy consumption = Reduced greenhouse gas emissions = Reduced operational costs for the data center
It means adopting fewer and more energy efficient systems while refactoring application environments to make optimal use of physical resources is the best architectural model. According to Environmental Protection Agency in around 30% to 40% of personal computers are kept 'ON' after office hours and during the weekend and even around 90% of those computers are idle.

B. E-Waste Recycling:
Based on the Gartner estimations over 133,000 PCs are discarded by U.S. homes and businesses every day and less than 10 percent of all electronics are currently recycled. Majority of countries around the world require electronic companies to finance and manage recycling programs for their products especially under-developed Countries. Green Computing must take the product life cycle into consideration; from production to operation to recycling. E-Waste is a manageable piece of the waste stream and recycling e-Waste is easy to adopt. Recycling computing equipment such as lead and mercury enables to replace equipment that otherwise would have been manufactured. The reuse of such equipments allows saving energy and reducing impact on environment, which can be due to electronic wastes [2].



C. Data Center Consolidation & Optimization:

Currently much of the emphasis of Green Computing area is on Data Centers, as the Data Centers are known for their energy hunger and wasteful energy consumptions. United State Department of Energy (DoE) reported in its study in 2006 that United States data centers consumed 1.5% of all electricity and their demand is increasing by 12% per year and cost $7.4 billion per year by 2011. According to DoE's current report in July 2011 Data Centers are consuming 3% of all US electricity and this consumption will double by 2015 [3]. With the purpose of reducing energy consumption in Data Centers it is worthwhile to concentrate on following [4]:

- Information Systems – efficient and right set information systems for business needs are a key in building Green Data Centers. As per green computing best practices efficient servers, storage devices, networking equipments and power supply selection play a key role in design of information systems.
- Cooling Systems – it is suggested by the researcher s that at the initial stage of design process for data center cooling systems, it is significant to consider both current and future requirements and design the cooling system in such a way so it is expandable as needs for cooling dictates.
- Standardized environment for equipment is must for Data Center Air Management and Cooling System.
- Consider initial and future loads, when designing & selecting data center electrical system equipment.

D. Virtualization:

One of the main trends of Green Computing is virtualization of computer resources. Abstraction of computer resources, such as the running two or more logical computer systems on one set of physical hardware is called virtualization. Virtualization is a trend of Green computing it offers virtualization software as well as management software for virtualized environments [5]. One of the best ways to go towards green and save enough space, enough resources, and the environment is by streamlining efficiency with virtualization. This form of Green Computing will lead to Server consolidation and enhance computer security [6]. Virtualization runs fewer systems at higher levels of utilization. Virtualization allows full utilization of computer resources and benefits in:

- Reduction of total amount of hardware;
- Power off Idle Virtual Server to save resources and energy; and
- Reduction in total space, air and rent requirements ultimately reduces the cost.

E. IT Products and eco-labeling:

Another approach to promote Green Computing and save environment is to introduce policies all around the World, so that, companies design products to receive the ecolabel [7]. There are several organizations in the world which support ―eco-label‖ IT products. These organizations provi de certificates to IT products based on factors including design for recycling, recycling system, noise energy consumption etc.

CHALLENGES:

According to researchers in the past the focus was on computing efficiency and cost associated to IT equipments and infrastructure services were considered low cost and available. Now infrastructure is becoming the bottleneck in IT environments and the reason for this shift is due to growing computing needs, energy cost and global warming. This shift is a great challenge for IT industry. Therefore now researchers are focusing on the cooling system, power and data center space. At one extreme it is the processing power that is important to business and on the other extreme it is the drive, challenge of environment friendly system, and infrastructure limitations [9]. Green Computing challenges are not only for IT equipments users but also for the IT equipments Vendors. Several major vendors have made considerable progress in this area, for example, Hewlett-Packard recently unveiled what it calls ―the greenest computer ever‖—the HP rp5700 de sktop PC. The HP rp5700 exceeds U.S. Energy Star 4.0 standards, and has an expected life of at least five years, and 90% of its materials are recyclable [3]. Dell is speeding up its programs to reduce hazardous substances in its computers, and its new Dell OptiPlex desktops are 50% more energy-efficient than similar systems manufactured in 2005, credit goes to more energy-efficient processors, new power management features, and other related factors [3]. IBM is working on technology to develop cheaper and more efficient solar cells plus many other solutions from IBM to support sustainable IT. According to researchers of Green Computing following are few prominent challenges that Green computing is facing today [9]::

- Equipment power density / Power and cooling capacities;
- Increase in energy requirements for Data Centers and growing energy cost;
- Control on increasing requirements of heat removing equipment, which increases because of increase in total power consumption by IT equipments;

- Equipment Life cycle management – Cradle to Grave; and
- Disposal of Electronic Wastes

Findings & Conclusion:

Whilst the performance and the breadth of application of computers is increasing, so too is our awareness of the cost and scarcity of the energy required to power them, as well as the materials needed to make them in the first place. However, because computing developments can enable individuals and businesses to adopt greener lifestyles and workstyles, in terms of the environmental debate computing is definitely both part of the problem and part of the solution. Through more environmentally aware usage (such as more effective power management and shut-down during periods of inactivity), and by adopting current lower power technologies, computers can already be made significantly more energy efficient. Indeed, just as we now look back and wonder why automobiles a decade or two ago used to guzzle so much petrol, in a decade's time we will no doubt be staggered that a typical desktop PC used to happily sit around drawing 100-200W of power every hour night and day, and when accomplishing no more than displaying a screensaver.

The computing industry is more prepared and far more competent than almost any other industry when it comes to facing and responding to rapid change. Environmentally it is not a good thing that most PCs -- especially in companies -- have typically entered a landfill after only a few years in service. However, this reality does at least mean that a widespread mindset already exits for both adapting to and paying money for new computer hardware on a regular basis. Hence, whereas it took decades to get more energy efficient cars on the roads, it will hopefully only take a matter of years to reach a state of affairs where most computers are using far less power than they needlessly waste today. Product Longevity As per Gartner and Fujitsu reports on product life cycle it is obvious that the product durability and/or longevity are one of the best approaches towards achieving Green Computing objectives [13]. Long life of product will allow more utilization of products and it will put a control on unnecessary manufacturing of products. It is obvious that government regulations will push the products vendors to make more efforts to increase the product life. Technology is not a passive observer, but it is an active contributor in achieving the goals of Green Computing.

IT industry is putting efforts in all its sectors to achieve Green computing. Equipment recycling, reduction of paper usage, virtualization, cloud computing, power management, Green manufacturing are the key initiatives towards Green computing. Current challenges to achieve Green Computing are enormous and the impact is on computing performance. Efforts of Governments and Non-Government Organizations (NGOs) are also appreciate-able. Government regulations are pushing Vendors to act green; behave green; do green; go green; think green; use green and no doubt to reduce energy consumptions as well. All these efforts are still in limited areas and currently efforts are mainly to reduce energy consumption, e-Waste but the future of Green Computing will be depending on efficiency and Green products. Future work in Green Computing discipline will also rely on research work in academics since this is an emerging discipline and there is much more need to be done. There is need for more research in this discipline especially within academic sector.

CONCLUSION:

It can be observed that green computing is the need of the hour to protect the environment. As more and more time passes the need of computers as a dependable machine increases and so does its use. So computer penetration is increasing globally at an amazing rate. This makes it all the more necessary to maintain green computing procedures throughout the life cycle of a computer from manufacturing through day-to-day operation till the end of its operating stage. In this regard according to David Wang, the data center architecture of Teradata," Every step consumes energy and buying a new, more efficient computer may not always be the right answer"[32]. Thus, it can be safely concluded that in order to have a healthy and clean environment all stake holders must work collaboratively for a healthier and greener environment for our future generations.

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