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Green Computing – Towards Green Future

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Abstract

During recent years, attention in 'Green Computing' has moved research into energy-saving techniques for home computers to enterprise systems' Client and Server machines. Saving energy or reduction of carbon footprints is one of the aspects of Green Computing. The research in the direction of Green Computing is more than just saving energy and reducing carbon foot prints. This study provides a brief account of Green Computing. The emphasis of this study is on current trends in Green Computing; challenges in the field of Green Computing and the future trends of Green computing. Green computing, green IT or ICT Sustainability, refers to environmentally sustainable computing or IT. The goals of green computing are similar to green chemistryreduce 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 department have Green Computing initiatives to reduce the environmental impacts of their IT operations.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.

Keyword-Green computing ,Saving energy ,carbon foot prints, environmentally sustainable computing, initiates to reduce environmental impacts**.**

1.Introduction

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.

1. Problems in Green Computing

1.1 Electronic Waste

Electronic waste is an increasing problem globally due to the quick obsolescence of electronics, which make up a staggering 70% of all hazardous waste. Computer waste is high in many toxic materials such as heavy metals and flame-retardant plastics, which easily leach into ground water and bio-accumulate. In addition, chip manufacturing uses some of the deadliest gases and chemicals known to man and requires huge amounts of resources.

1.2 Wasting Electricity

The manufacturing of a computer consumes 1818 kw/h of electricity before it even gets

turned on and when running, a typical computer uses 120 watts. ***Research shows that most PC's are left idle all day, and many of them are left on continuously.*** Every time we leave computers on we waste electricity without considering where that electricity comes from. The majority of the world's electricity is generated by burning fossil fuels which emit pollutants such as sulphur, and carbon dioxide into the air. These emissions can cause respiratory disease, smog, acid rain and global climate change.

2.Why Green Computing?

1.3 Resource virtualization, enabling energy and resource efficiencies.

Virtualization is a foundational technology for deploying cloud-based infrastructure that allows a single physical server to run multiple operating system images concurrently. As an enabler of consolidation, server virtualization reduces the total physical server footprint, which has inherent green benefits.From a resource-efficiency perspective, less equipment is needed to run workloads, which proactively reduces data center space. From an energy-efficiency perspective, with less physical equipment plugged in, a data center will consume less electricity.

1.4 Automation software, maximizing consolidation and utilization to drive efficiencies.

The presence of virtualization alone doesn't maximize energy and resource efficiencies. To rapidly provision, move, and scale workloads, cloud-based infrastructure relies on automation software.Combined with the right skills and operational and architectural standards, automation allows IT professionals to make the most of their cloud-based infrastructure investment by pushing the limits of traditional consolidation and utilization ratios.The higher these ratios are, the less physical infrastructure is needed, which in turn maximizes the energy and resource efficiencies from server virtualization.

1.5 Pay-per-use and self-service, encouraging more efficient behavior and life-cycle management.

The pay-as-you-go nature of cloud-based infrastructure encourages users to only consume what they need and nothing more. Combined with self-service, life-cycle management will improve, since users can consume infrastructure resources only when they need it -- and "turn off" these resources with set expiration times.In concert, the pay-per-use and self-service capabilities of cloud-based infrastructure drive energy and resource efficiencies simultaneously, since users only consume the computing resources they need when they need it.

1.6 Multitenancy, delivering efficiencies of scale to benefit many organizations or business units.

Multitenancy allows many different organizations (public cloud) or many different business units within the same organization (private cloud) to benefit from a common cloud-based infrastructure.Combined with automation, the ratio between peak and average loads becomes smaller, which in turn reduces the need for extra infrastructure. The result: massive efficiencies and economies of scale in energy use and infrastructure resources.So migrating workloads to cloud resources, or developing new workloads in a cloud-native environment, can help an IT organization contribute to energy-efficiency and sustainability goals.

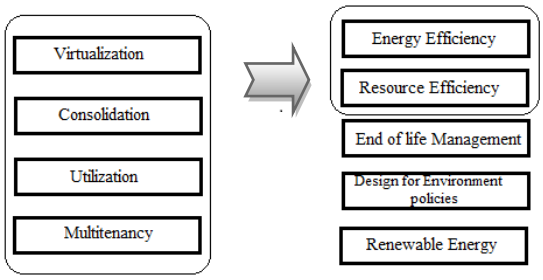

Fig 1. Need of Green Computing

2. Go Green

Here are some suggestions that will help you reduce your computer energy IT equipment to the HVAC equipment to the actual location, configuration and construction of the building.We must concentrate on five primary areas on which to focus energy usage efficient

i. Information technology (IT) systems

ii. Environmental conditions
iii. Air management
iv. Cooling systems
v. Electrical systems

One of the earliest initiatives toward green computing in the United States was the voluntary labeling program known as Energy Star. Similar in Europe and Asia follow this voluntary labeling program. The work habits of computer users and businesses can be modified to minimize adverse impact on the global environment. Here are some steps that can be taken

i. Power-down the CPU and all peripherals during extended periods of inactivity.
ii. Try to do computer-related tasks during contiguous, intensive blocks of time, leaving hardware off at other times.
iii. Power-up and power-down energy-intensive peripherals such as laser printers according to need.
iv. Use liquid-crystal-display (LCD) monitors rather than cathode-ray-tube (CRT) monitors.
v. Use notebook computers rather than desktop computers whenever possible.
vi. Minimize the use of paper and properly recycle waste paper.
vii. Dispose of e-waste according to federal, state and local regulations.
viii. Employ alternative energy sources for computing workstations, servers, networks and data centers.

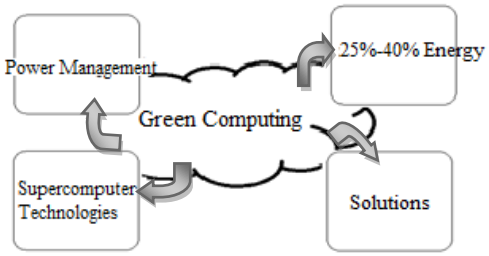

Fig 2 Efficiency of Green computing

ix. Don't use screen savers. They waste energy, not save it.
x. By computers & monitors labelled "energy star" which can be programmed to automatically "power-down" or "sleep" when not in use.
xi. If you are using more than 1 PC, Userful's 10 to 1 advantage can save electricity and your wallet.Turn your computer and peripherals off when not in use. This will not harm the equipment.
xii. Buy ink jet printers, not laser printers. Ink jet printers use 80 to 90 percent less energy than laser printers and print quality can be excellent

3.Future of Green Computing?

The field of "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 populationNanotechnology is also being used in an attempt to manipulate materials at the nanometer scale; scientists are hoping it can transform manufacturing on a global level, from government purchasing to a technological revolution. The huge amount of computing manufactured worldwide has a direct impact on environment issues, and scientists are conducting numerous studies in order to reduce the negative impact of computing technology on our natural resources. Companies are addressing e-waste by offering take-back recycling programs and other solutions, with lower energy consumption and less wasted hardware. A central point of research is testing and applying alternative nonhazardous materials in the products' manufacturing process.

2.1 Developments in Energy Efficiency

The future green technology holds big advancements in shaping energy efficient computers. **The new Energy Star 4.0 specifications include the 80 PLUS standards** that **encourage manufacturers to deploy power supplies** that convert at least 80 percent of the electricity from the wall outlet to actual computing power. ***Intel's Core 2 Duo processor heralds a new era in green computing.*** This processor draws power only for the parts of the chip actually in use. **Marvell's processor chip uses**

power factor correction (PFC) to determine the amount of power any given application requires and uses this information to optimize power usage for maximum efficiency. Such power-saving technologies are poised to become the norm in the future, and further advancements will bring forth more breakthroughs. The development of nanotechnology also translates to greater energy efficiency. The future nano computer chip would be three or four levels of magnitude smaller in size and considerably faster than the ones currently available. Another revolutionary idea that could find breakthrough in the future is harnessing the power needed for the computer to operate from keystrokes, mouse movements, and the light from the monitor.

2.2 Carbon Free Computing

VIA aims to offer the world's first carbon free computers**. Such "carbon free" computers emit greenhouse gasses, but the manufacturers offset such "carbon footprint"** or the amount of greenhouse gas emitted by the computer during its lifetime through many ways such as planting trees. The move toward carbon free computing may also take the shape of the development of solar energy cells. ***VIA's "pc-1"*** initiative aims to not just power the computer entirely through solar cells, but also use solar energy exclusively in its manufacturing process. The thrust toward carbon free computing also takes the shape of developing green power sources with zero carbon emissions. Recent developments suggest the possibility of incorporating renewable energy technologies into structures in creative and unexpected ways.

i) **Sybarithe's Dice House**, a 9 x 9 meter cube that sits on an octagonal plinth is a successful prototype of a carbon free unit. A large thermoplastic umbrella on the garden roof shades and insulates the house and collects solar energy.

ii) **Kennedy and Voilich Architecture's Soft House harvests energy** through solar-energy-collecting textiles hung in the home like curtains. These thin-film photovoltaic textiles generate nearly 16,000 watt-hours of electricity a day.

iii**) A house museum** in Ulricehamn Sweden proposed a revolutionary concept of the using the body heat of visitors and the equipment located inside the building to supply the building's heat. Solar cells on the roof provide part of the energy to run electrical equipment and heat water.

2.3 Advancements in Recycling Technology

While recycling of e-waste has already started in a big way, the future green technology is poised to herald further developments in recycling for a sustainable future. Some of the future works could include:

1. Desktop computer manufacturers reusing or recycle every single part of old computers, leaving zero waste
2. Networking several old computers into one processing unit, accessible by several smaller devices.

Green computing is a booming industry as the world increasingly focuses on sustainable initiatives. All the major companies of the world have embraced some form of green computing technology and look for ways to increase their involvement in the green computing initiative.

4.Five Simple Steps to Green Computing

There are new performance requirements to qualify for the Energy Star rating for desktop and notebook computers, workstations, integrated computers, desktop-derived servers and game consoles. These specifications go into effect on July 20. But businesses don't have to wait until then to initiate more environmentally-friendly computing practices. Here are five first steps you can take toward a green computing strategy.

2.4 Develop a sustainable green computing plan.

Discuss with your business leaders the elements that should be factored into such a plan, including organizational policies and checklists. Such a 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. Organizational policies should include communication and implementation.

2.5 Recycle. 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'sPlanet Partners recycling service or recycling facilities in your community. Or donate still-working computers to a non-profit agency.

2.6 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 •Provide a clear, consistent set of performance criteria for the design of products •Recognize manufacturer efforts to reduce the environmental impact of products by reducing or eliminating environmentally sensitive materials, designing for longevity and reducing packaging materials All EPEAT-registered products must meet minimum requirements in eight areas of environmental impact and be energy efficient to reduce emissions of climate-changing greenhouse gases. To demonstrate corporate social and environmental performance, manufacturers must offer safe end-of-life management and recycling options when products become unusable. "Developing environmentally sound products has long been a priority for HP'sdesign and engineering teams," says Jeri Callaway, vice president and general manager, Americas Commercial Solutions, Personal Systems Group, HP. "We're particularly proud that our business-class products already meet, and in some cases exceed, the basic EPEAT standards without any alteration to their existing design."

2.7 Reduce Paper Consumption.

There are many easy, obvious ways to reduce paper consumption: e-mail, electronic archiving, use the "track changes" feature in electronic documents, rather than red- line 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.

2.8 Conserv e energy.

Turn off your computer when you know you won't use it for an extended period of time. 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. Power management tactics can save energy and help protect the environment.Sustaining the Future"The greatest challenges for businesses trying to be eco-responsible are really understanding what that really means, then making changes that are sustainable over time, while adding business value," explains Frey. "Another challenge is balancing the needs of various stakeholders who each have different ideas of what changes should be made."Some environmental non-governmental organizations would like certain flame retardants removed from electronic products, while the fire safety community is concerned about removing or changing flame retardants in electronics. One problem is that the substitute replacement must be assessed to ensure that environmental and health impacts are lower than the original material; however, since most replacements are fairly new, they have not been necessarily assessed with the same rigor applied to the original materials.Green computing represents a responsible way to address the issue of global warming. By adopting green computing practices, business leaders can contribute positively to environmental stewardship— and protect the environment while also reducing energy and paper costs

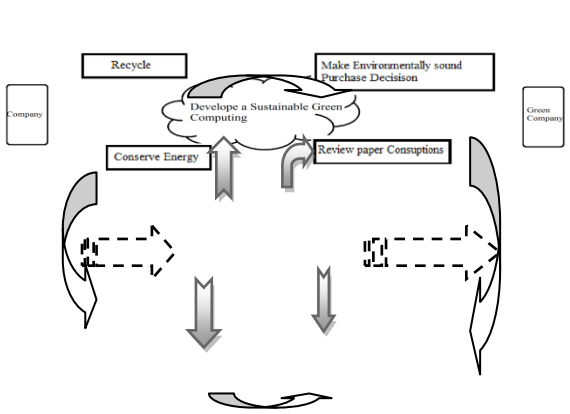

Fig.3 Five Steps to Green Computing

5.Conclusion

Critics have claimed that Green Computing strategies does not saves money as the set up cost for eco-friendly electronics is more than what we save but we personally feel that even if the set up cost is higher than what we save we still can aim towards saving our mother earth using these green computing techniques. As what can be better than building a healthy and a safe place to live on.

6.Acknowledgement

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