An Eco Friendly Approach for Sustainable Computing

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Abstract: *With the impact of climate change, comes the anticipated impact of green computing, hence the urgent need to reduce the carbon emissions produced by the information technology industry. Global carbon emissions from information and communications technologies are estimated as being roughly equal to those of the airline industry. Why? A massive amount of electricity is needed to operate computers, search engines, and peripheral equipment. The manufacture of a computer chip can generate up to 4,500 times it's own weight in waste. Then there's the pressure of consumer demand. People want the latest, the smartest and the fastest technology. We do not yet know how far consumer attitudes will change the anticipated impact of green computing.*

Keywords: Green computing, Sustainable computing, Green technology.

1. Introduction

Green Computing

Green computing or Green IT refers to environmentally sustainable computing or IT. In the article Harnessing Green IT: Principles and Practices, "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." 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. [1]

Concept of Green Technology

Green technology is the application of environmental science to offer economically viable solutions that Conserve the natural environment and resources, and curb the negative impacts of human involvement. The increase of data centers required the constant addition of server, cooling and ventilation equipment that led to an ever increasing demand of energy and increased presence of toxic and hazardous substances such as lead, mercury, cadmium, and others. This made people look at ways to apply green technology in computing to mitigate the serious environmental and health concerns.

2. Need of Sustainable Computing

Sustainable Computing is a new interdisciplinary field that aims to apply techniques from computer science and related fields, such as information science, operations research, applied mathematics, and statistics, to help manage the balance between environmental, economic, and societal needs for a sustainable computing. The ultimate goal is on developing computational and mathematical models, methods, and tools for decision making and policy making concerning the management and allocation of resources for sustainable development which help us to reduce the massive amount of power consumption and maximum uses of eco- friendly computing. [2]

Cutting Carbon Emissions

Astute managers have long since learned cutting carbon emissions means creating a leaner, greener, and more efficient operation. In the early days we saw simple, yet effective education messages like: "Think twice before you print out emails," and "Switch off your computer when you go home at night." Later came more sophisticated measures like Energy Star. Well informed companies are now likely to have entire departments devoted to cutting electricity consumption, and carbon emissions. Information technology systems can account for up to 30% of a company's electricity bills, so some companies start their improvements with a reality check. They review their utility bills, carry out an energy walk, and calculate their carbon footprint. [3]

The Carbon Trust is a not-for-profit organization specializing in advice for businesses. In a best practice partnership with the British computing society the trust has developed a simulation software tool to help companies understand energy use within data centers. A British computing society spokesperson said, "The scale of the problem is worrying. Forecasts based on the current growth of data and associated IT infrastructure translates into a picture of unsustainable power consumption in the long term and power supply capacity issues in the short term. It is crucial that we make effective tools available to enable companies to identify the right steps to take to reduce energy use and carbon."

Green Technology Advances

The major fillip to the contemporary advancements in green technology. The 2003 Restriction on Hazardous Substances (RoHS) directive that restricts the use of many hazardous materials in electronics manufacturing. The 2007 Registration, Evaluation and Authorization of Chemicals

law (REACH) that bans some hazardous chemicals and mandates permission from the European Commission to use other toxic chemicals. These directives make it difficult for PC manufacturers to continue using toxic chemicals such as bominated flame retardants (BFRs), cadmium, selenium, lead, and mercury in the manufacture of computer and peripherals, forcing them to seek green alternatives. The electronic industry has still not witnessed the full impact of RoHS and REACH as research is still ongoing for alternatives to all toxic substances. The future, however, is sure to witness the emergence and widespread use of eco-friendly and energy efficient computers completely free of all harmful toxic elements. [4]

Eco Friendly Components in Computers

Several PC manufacturers already use the more sustainable and less toxic recycled plastics and bio-plastics in their tower and monitor casings. HP uses a biodegradable corn-based plastic case in its printers. Other companies use wood and bamboo wood-encased desktops in computer towers, monitors, amd mouse controls. While most manufacturers have eliminated CRT monitors that emit toxic radiation, the replacement LCD screens are not completely free of toxic materials. As the more energy efficient and toxic-free OLED technology becomes advanced and cost effective, OLED monitors could replace LCD screens as the industry standard. e-ink and IMOD are two other monitor related technological breakthroughs that have the potential to have a significant impact in future green technology. [5] Sustainable packaging solutions presently being used appear not to be a top priority for most companies. HP has however taken the lead to pack its printers in recycled plastics and recycled content paperboard, and ink and toner cartridges in reusable air cushioning rather than molded end caps. With the move toward eco-friendly components in computers gaining both legislative support and popular appeal, the use of eco-friendly sustainable components will become the norm rather than the exception in future.

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.

Carbon Free Computing

The 1997 Kyoto Protocol for the United Nations Framework Convention on Climate Change mandates reduction of carbon dioxide emissions to counter global warming. 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. Toward this end, it has launched the world's first ever solar-powered cyber community center in the South Pacific, powered entirely by solar technology. 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. [6]

Developing a Strategic Approach to a Green Future

With the challenges of climate change, peaking oil prices, and a double dip recession looming, businesses and individuals urgently need to adopt precautionary principles and learn from best practices if they are to lend vision to the anticipated impact of green computing. The U.S. Environment Protection Agency (EPA) has highlighted the need to compare and select equipment based on environmental attributes using the Electronic Product Environmental Assessment Tool known as EPEAT. The EPA even has an in house blog called Greenversations. In this blog, employees on the ground share their expertise in saving energy and green computing. The EPA Green IT unit stresses the importance of "e-cycling." Used electronic products can be refurbished and passed on to charities like Computer Aid International. There are many countries and organizations that are dealing with the anticipated impact of green computing and this short introduction to green computing and sustainable development provides only the tip of the iceberg when it comes to reducing our carbon footprint in the computing world. [8]

Examples of the Application of Green Technology in Computing

Reducing the use of environmentally hazardous materials like CFC, lead and others promoting the use of recyclable materials and minimizing use of non biodegradable components promoting practices such as energy cost accounting, virtualization, e-Waste recycling and the like application of technology with change in lifestyle habits aimed at energy conservation.

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Energy Star Ratings

The first major landmark in the history of green computing was the U.S. Environmental Protection Agency (EPA)'s Energy Star program, launched in 1992. "Energy Star" is a voluntarily labeling program that segregates computers, monitors and other equipment based on their energy efficiency. The biggest impact of the Energy Star ratings was manufacturers introducing the "Sleep mode" in computers to attain a higher rating. Sleep mode places the consumer's electronic equipment on standby when no user activity takes place during the pre-set time. The revised Energy Star Specifications of 2007 place stringent requirements to attain energy star ratings. The new specifications determine efficient use of computing technology through guidelines such as the company's e-waste reduction, regulatory compliance, telecommuting policies, server resource virtualization, energy use cost accounting, thin client solutions, and the like. Existing equipment has to re-qualify to continue using the Energy Star logo. [7]

Application of Green Technology by the Industry

The recent history of green technology in computing is the history of various industry leaders innovating to comply with regulations. To reduce their carbon emission liability required by the 1997 Kyoto protocol, companies such as VIA promoted research on alternative energy sources such as solar cells to power computers. In 2001, VIA established the first ever cyber community center in the South Pacific powered entirely by solar technology.

3. Conclusion

The adoption of green technology in computing has received considerable interest in recent years as more and more companies realize that going green is in their best interest, both in terms of public relations and reduced costs. Manufacturer's today aim to improve energy efficiency by creating designs that minimize power waste and reduce emissions. Companies reduce the amount of toxic waste materials in the manufacturing process by using recyclable materials and offering to recycle old products. The application of solutions such as IP video solutions to reduce in-person meetings, the increased use of Wi-Fi and WiMax networks and other such initiatives are still in their nascent stages of development and further improvements in such green technology initiatives will help conserve the world's precious resources in a much better way. The application of green technology in computing has come a long way since its inception in the early 1990s. An analysis of the history of green computing however indicates that the the concept is still in its nascent stage and has a long way to go.

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