

General Article

Green Computing: Need of the Hour

Swasti Saxena^{†*}

[†]Computer Science and Engineering Department, SRM University, Kattankulathur, Chennai. Tamil Nadu, India

Accepted 07 Feb 2015, Available online 10 Feb 2015, Vol.5, No.1 (Feb 2015)

Abstract

Green computing is an effective study in which disposing, recycling and manufacturing of computers and electronic devices is taken into consideration. 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. In this paper we discuss the wastage of energy by comparing the power usage by small, medium and large organizations; providing steps to utilize the concepts of green computing; recent implementations and their effects on small and large scale.

Keywords: Green Computing, Electronics etc.

Introduction

Green technology comprises of the study of advanced materials to be used in everyday life and the study of new generation techniques. The main topic of concern in green technology is to reduce the environmental impact of industrial processes along with the growth in population resulting in innovative technologies. Basically, the efficient use of computers and computing is what green computing is all about. The triple bottom line is what is important when it comes to anything green and the same goes for green computing. This considers social responsibility, economic viability and the impact on the environment. 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. A central point of research is testing and applying alternative nonhazardous materials in the products' manufacturing process. The idea is to make computers from beginning to end a green product.

Wastage by power usages on small, medium and large scale organizations

Email System Setup: Loss of massive power

During checking of email by user energy is consumed by the client, the network and the server. Switching from a locally hosted email system to cloud based system affects the energy usage of all three but it affects primarily server level energy usage. A cloud-

based email system saves considerable amounts of per-user energy costs once provisioning email servers, providing redundancy, and cooling costs are taken into account.

An email server is a computer that sends outgoing messages to the external network and stores incoming messages until a user downloads or deletes them. Servers can handle large amount of users simultaneously. The reliability of email servers is very important as they have become a very trusted means of communication due to their easy use, efficient delivery results and their accessibility or availability i.e. 24 x7 in all 365 days. To maintain the redundancy and reliability of the email servers additional backup servers are used. For example if 'N' number of servers need to handle an organization's users then for the purpose of redundancy 'N+1' servers are used so that in case of failure of any server the email services may not come to a halt. Energy wastage also happens during the housing and cooling of servers. Thus taking in account of the energy usage by servers on annual basis we get the following results:

Business type	It power per user	Power usage effectiveness	Total power per user	Annual energy per user
Small	8W	2.5	20W	175kWh
Medium	1.8W	1.8	3.2W	28.4kWh
Large	0.54W	1.6	0.9W	7.6kWh

The disadvantages faced by small and medium businesses are magnified once redundancy requirements are added. When comparing server

*Corresponding author Swasti Saxena is B.Tech student

power per user, the large organization uses 1/15th as much energy per user as the small organization. The average PUE of a typical data center today is about 1.87, but for a larger organization with time to make significant measurements and improvements, it can be lower. For our example, we estimated 1.6. Once again, small setups underperform, with both larger per-user energy costs and carbon footprints. When cooling and housing costs are taken into account, the total power per user for a large organization can be 1/20th that of a small business.

Programs running globally to promote 'Green Computing'

- (1) US Environmental Protection Agency's project 'Energy Star' is a program that is designed to promote and identify energy-efficiency in climate control equipment, monitors and other technologies. This resulted in the widespread adoption of sleep mode among consumer electronics. Energy Star reduces the amount of energy consumed by a product by automatically switching it into —sleep mode when not in use or reducing the amount of power used by a product when in —standby mode. Surprisingly, standby —leaking,|| the electricity consumed by appliances when they are switched off, can represent as much as 12 percent of a typical household's electricity consumption. In Australia, standby power is a primary factor for the country's increased greenhouse gas emissions — more than 5 megatons (CO₂ equivalent) annually. Worldwide, standby power is estimated to account for as much as 1 percent of global greenhouse emissions.
- (2) Dell's Plant a Tree for Me project allows customers to offset their carbon emissions by paying an extra 120 rupees to 240 rupees, depending on the product purchased silicon-on-insulator (SOI) technology in its manufacturing, and strained silicon capping films on transistors (known as —dual stress liner technology), have contributed to reduced power consumption in its products.
- (3) VIA Technologies, a Taiwanese company that manufactures motherboard chipsets, CPUs, and other computer hardware, introduced its initiative for "green computing" in 2001. Solar cells fit VIA's power- efficient silicon, platform, and system technologies and enable the company to develop fully solar-powered devices that are nonpolluting, silent, and highly reliable. As part of VIA's pc-1 initiative, the company established the first-ever solar-powered cyber community center in the South Pacific, powered entirely by solar technology.
- (4) HP's Planet Partners recycling service or recycling facilities helps in recycling discarded computers. Thus reducing the amount of discarded computers in landfill and thus in tern reducing toxin metal and other harmful emissions to be released in the environment.
- (5) Electronic Product Environmental Assessment Tool registered products are promoted by non-profit Green Electronics Council help institutional purchasers evaluate, compare and select desktop computers, notebooks and monitors based on environmental attributes by providing a clear, consistent set of performance criteria for the designing 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
- (6) The Climate Savers Computing Initiative (CSCI) has introduced a catalogue that helps people choose green products.
- (7) Restriction of Hazardous Substances Directive (RoHS) adopted by European union in 2003 restricts the use of six hazardous materials in the manufacture of various types of electronic and electrical equipment.
- (8) Waste Electrical and Electronic Equipment Directive (WEEE), which sets collection, recycling, and recovery targets for electrical goods and is part of a legislative initiative that aims to reduce the huge amounts of toxic e-waste.

Steps that can be taken to reduce carbon footprint and to utilize green computing techniques

An increase in the concentration of the main greenhouse gases — carbon dioxide, methane, nitrous oxide, and fluorocarbons — is believed to be responsible for Earth's increasing temperature, which could lead to severe floods and droughts, rising sea levels, and other environmental effects, affecting both life and the world's economy. After the 1997 Kyoto Protocol for the United Nations Framework Convention on Climate Change, the world has finally taken the first step in reducing emissions.

- (1) Offsetting carbon dioxide can be achieved in different ways. One way is to plant trees that absorb CO₂ as they grow, in the region in which the processors were purchased.
- (2) Wetlands also provide a great service in sequestering some of the carbon dioxide emitted into the atmosphere. Although they make up only 4 to 6 percent of the Earth's landmass, wetlands are capable of absorbing 20 to 25 percent of the atmospheric carbon dioxide.
- (3) Solar computing is an effective technique to utilize green computing technique
- (4) Green-computing's initiative is the development of energy-efficient platforms for low-power, small-form-factor (SFF) computing devices. This is done by the application of Quiet Computing techniques.
- (5) One should reduce the paper consumption by recycling paper regularly, using both sides of the paper, using smaller fonts and margins, and selectively printing required pages and use services like emailing and electronic archiving to minimize paper wastage.

- (6) Turn on power management features during shorter periods of inactivity. Power management allows monitors and computers to enter low-power states when sitting idle. Turn off the computer when the period of inactivity is more.
- (7)) Organic light-emitting diodes should be used instead of the regular monitors.
- (8) The manufacturing of disks and boxes needed for video games takes up a lot of resources. Video game manufacturers can offer their games online for download, leading to reduction in e-waste. This move can cut down on the transportation/shipping cost.
- (9) Data centers can potentially improve their energy and space efficiency through techniques such as storage consolidation and virtualization
- (10) Undervolting is a process in which both the amount of heat and electricity consumed is managed manually by the user by adjusting voltage supplied to the user. SpeedStep technology can also be put to practice to automatically manage the power consumption of a computer.
- (11) Best screen saver is no screen saver. Instead switch off the computer and restart it again as and when required.
- (12) While buying a monitor one should keep in mind one's requirements as a 17-inch monitor uses 40 percent more energy than a 14-inch monitor. Also, the higher the resolution, the more energy it needs. Thus one should make one's choice wisely.
- (13) Ink-jet printers, though a little slower than laser printers, use 80 to 90 percent less energy.

Companies using Green Computing Technology

- (1) Dell is a good example of a company with a green image, known for its free worldwide **product-recycling program**.
- (2) VIA C7-M and VIA C7 processors that have a maximum power consumption of 20W at 2.0GHz and an average power consumption of 1W. These energy-efficient processors produce over four times less carbon during their operation and can be efficiently embedded in solar-powered devices. These processors work on the concept of **Quiet Computing**.
- (3) Intel, the world's largest semiconductor maker uses **virtualization software**, a technique that enables Intel to combine several physical systems into a virtual machine that runs on a single, powerful base system, thus significantly reducing power consumption.
- (4)) With the aid of a self-styled ultraefficient evaporative cooling technology, Google Inc. has been able to reduce its energy consumption to 50% of that of the industry average.
- (5) Advanced Power Management which is a joint venture of Intel and Microsoft allows a computer's BIOS to control power management functions in a computer.

- (6) A. 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.

Conclusion

Green computing presents a responsible way to address the issue of global warming. 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 work styles, in terms of the environmental debate computing is definitely both part of the problem and part of the solution. By adopting green computing practices, business leaders can contribute positively to environmental stewardship—and protect the environment while also reducing energy and paper costs.

References

- Maria Kazandjieva, Brandon Heller, Omprakash Gnawali *Green Enterprise Computing Data: Assumptions and Realities*
- Navdeep Kochhar, Arun Garg, *Eco-Friendly Computing: Green Computing'*
- Ismael Solis Moreno and Jie Xu, "Energy-Efficiency in Cloud Computing Environments: Towards Energy Savings without Performance Degradation", University of Leeds, UK.
- Priya Rana (Dec, 2010), "Green Computing Saves Green", Department Of Information Technology, RKGIT, Ghaziabad International Journal Of Advanced Computer And Mathematical Sciences. Vol 1, Issue 1,, Pp 45-51.
- Navdeep Kochhar and Arun Garg (May 2011), "Eco-friendly Computing: Green Computing", Baba Farid College, Bathinda, Punjab. International Journal of Computing and Business Research, Volume 2 Issue 2.
- Tariq Rahim Soomro and Muhammad Sarwar (2012), "Green Computing: From Current to Future Trends". World Academy of Science, Engineering and Technology 63.
<http://www.scribd.com/doc/91046429/green-computing-Report>
<http://www.wisegeek.com/what-is-green-computing.htm>
http://ito.hkbu.edu.hk/eng/user/if_energy-saving-green.html
<http://searchdatacenter.techtarget.com/definition/green-computing>
<http://www.carnegiecyberacademy.com/facultyPages/environment/issues.html>
www.google.com/corporate/datacenters/