

A Safe Green Approach for Computing

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Abstract— In recent years, we can't just ignore the ongoing issues about climate change and the environment and whereas there appear to be no easy solutions for businesses, the IT community can have a significant impact on the worldwide carbon footprint by adopting a 'greener' approach to computing. Green computing is rising energy costs and potential savings. Energy to manufacture, store, operate, and cool computing systems has grown significantly in the recent years, primarily due to the volume of systems and computing that companies now heavily rely upon. This paper describes about history of green computing, need of the green computing and future of the green computing. The primary objective of such a program is to account for the triple efficiently bottom line (or "People, Planet, Profit").

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I. INTRODUCTION

A. What is Green Computing?

Green computing is the environmentally responsible use of computers and related resources [1] such practices include the implementation of energy-efficient central processing units (CPUs), servers and peripherals as well as reduced resource consumption and proper disposal of electronic waste (e-waste). Green computing includes the dimensions of environmental sustainability, the economics of energy efficiency, and the total cost of ownership, which includes the cost of disposal and recycling [2] It is important to understand and the need of the study of green computing. Green computing is a very hot topic these days, not only because of rising energy costs and potential savings, but also due to the impact on the environment. Energy to manufacture, store, operate, and cool computing systems has grown significantly in the recent years, primarily due to the volume of systems and computing that companies now heavily rely upon. Green IT strives to improve company performance and efficiency whilst offering an attractive economical saving and as such there are no real reasons as to why we shouldn't all be adopting a „greener“ approach to our processes

IT department is usually always the one department that uses the most amount of power which in turn is an excessive amount of overhead for a business as well as a source for toxic waste.

Making IT “Green” can not only save money but help save our world by making it a better place through reducing and/or eliminating wasteful practices and using nontoxic materials.[5]

Green Computing involves minimizing waste by purchasing only what you need, sharing computers and printers, turning off your monitor and computer when not in use, refilling inkjet cartridges with soy or non-petroleum based inks, printing only what is necessary, recycling office paper waste, giving away your computer to charity, family or

friends, choosing computers that minimize energy consumption (laptops consume 1/10 energy of a desktop and inkjets consume 80% less energy than laser printers, smaller monitors consume less energy, energy consumption varies from model to model) and participating in computer recycling programs.

Green Computing is also about finding ways to minimize paper waste - like a dynamic website from Passion Computing that allows you to add, edit and delete pictures and text on your website. An up to date website will reduce the need for catalogues and bulky brochures. It's about using the internet to communicate, and computers to organize your business that will not only save you money, but minimize the pollution to the environment caused by unnecessary travel and badly organized delivery runs.

Green computing is the study and practice of using computing resources [6]

II. A BRIEF HISTORY OF GREEN COMPUTING

One of the earliest initiatives toward green computing in the United States was the voluntary labeling program known as Energy Star. It was conceived by the Environmental Protection Agency (EPA) in 1992 to promote energy efficiency in hardware of all kinds. The Energy Star label became a common sight, especially in notebook computers and displays. Virtualization practices, e-waste, etc. Similar programs have been adopted in Europe and Asia.

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 monitors, television sets and temperature control devices like refrigerators, air conditioners, and similar items. One of the first results of green computing was the Sleep mode function of computer monitors which places a consumer's electronic equipment on standby mode. When a pre-set period of time passes when user activity is not detected. As the concept developed, green computing began to encompass thin client solutions, energy cost accounting.

III. NEED OF GREEN COMPUTING

It is observed that most of the computer energy is often wasteful. This is because we leave the Computer ON even when it is not in use. The CPU and fan consume power; screen savers consume power even when the system is not in use. Insufficient power and cooling capacities can also results in loss of energy. It is observed that most of the data centers don't have sufficient cooling capacities. This result in environment pollution. This could be because of defects in Manufacturing techniques, packaging, disposal of computers and components. Another effect is because of toxicity.

Computing power consumption of companies has reached a critical point. For example, an Ecommerce business

with 100,000 servers can easily spend up to \$20 million a year on server power.

Add another \$10 million for a/c cooling and it tops \$30 million a year in power alone. Clearly there is a huge potential for savings in their infrastructure.

Despite the huge surge in computing power demands, there are many existing technologies and methods by which significant savings can be made. This series is dedicated to the ways a typical organization can reduce their energy footprint while maintaining required levels of computing performance.

So why should a company promote green, or energy efficient computing?

“Information Technology energy demand is growing 12 times faster than the overall demand for energy” and “Data centres emits over 150 metric tons of CO₂ per year, and the volume is increasing rapidly. (As a point of reference, a car produces 18 pounds of CO₂ for every gallon of gasoline it uses.)”[4] It is the need of the hour to educate people about the “GREEN” use of ICT. In order to promote these ideas and create standards and regulations various organizations have been formed. Many technology companies actually belong several of these to further their goals of becoming more “green”.

IV. SOME STEPS TO GREEN COMPUTING

A. *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.

B. *B.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's Planet Partners recycling service or recycling facilities in your community. Or donate still-working computers to a non-profit agency. Organizational policies should include communication and implementation.

C. *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.

D. *Reduce Paper Consumption*

There are many easy, obvious ways to reduce paper consumption:

Email, electronic archiving, use the “track changes” 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.

Conserve 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. Corporate social and environmental performance, manufacturers must offer safe end-of-life management and recycling options when products become unusable.

E. *Reduce Power Consumption*

The use of electricity in our computer is very essential. We had to make use of the computers efficiently to save power and cost. By managing our computer resources effectively, we can save the power. Here the some of the techniques to power saving .By using Power Option in your Control Panel, you can save the power

F. *Turn off monitor*

This mode allows you to turn off the monitor, if the system is idle for more minutes. Use LED, LCD monitors instead of CRTs it will reduce a lot of power. By turning off your monitor you can save half the energy that is used by the system. So turn off the monitor when download in progress or when it is in idle for some minutes. You can automate through this option. Turn of monitor, after it is idle for 10 minutes, that's what we can recommend.

G. *Turn off hard disks*

This mode allows you to turn off hard disks if it is idle. You can automate this and what we recommend is to set the turn off time to 30 minutes or to some other value depending upon your usage.

H. *System Standby / Sleep*

This mode allows you to save a lot of power, Automate this option to save power. It will turn off the monitor, hard drive, sound card, graphics and video cards and almost everything. The current state of your system will be saved in RAM. If you want to use it again, you can move the mouse or touch the keyboard to make everything turn on. Draw back in this

option is if there is a power outage then the unsaved things will be gone. We can recommend this option over Hibernate option for both desktops and laptops. Automate this by after it is idle for 15 minutes.

I. Hibernate

This mode allows you to shut everything down. But the difference from sleep/ standby mode is how it is storing your information in the RAM; it will write all the information to the hard drive and shuts everything down. This allows you to shut down memory as in standby by you cannot. But memory doesn't use much power. So, we recommend this option for only laptop users if it is running on battery. You can automate this idle after 30 minutes.

V. BENEFITS OF GREEN COMPUTING

- We have established that heightened focus on environmental concerns is prompting many organizations to consider the benefits of adopting green technology which include[7]
- Cost
- Efficiency & Improved Performance
- Environmental Sustainability throughout the entire IT lifecycle, making it greener by addressing by addressing key areas including:
 - Green use
 - Green disposal
 - Green design
 - Green manufacturing

VI. FUTURE OF GREEN COMPUTING

Technology is ever-changing and expanding and so any device which is new today will become obsolete tomorrow. Thanks to the advancements happening in the area of information technology, new computers enter the market and soon remain nothing more than a piece of junk. This is precisely why a new area of computing has emerged, which is popularly known as Green Computing. The technology encourages people to use computers as well as accessories that are environmentally-friendly and that cause little or no harm to the environment during their usage or when they are disposed off.

A. Recyclable paper laptop

One of the most environmentally friendly computers that you can think of purchasing is the Recyclable Paper Laptop. This concept laptop is crafted from papers that have been recycled or pulp materials that are essentially packed in layers. Consumers, especially tech geeks keep looking for newer and latest models of computer and junk the old machines by dropping them into landfills. This further adds to the e-waste items. By purchasing the Recyclable paper laptop, you won't have to worry about repairing it as well as it is comparatively easier than the traditional laptops. Besides, the damaged parts of these laptops can be easily replaced with newer ones and then sent across for recycling.

B. IMEC laptop

This unique laptop can be easily powered using just two solar cells and encourages people to understand the importance of

solar energy or alternative energy. This prototype laptop has been designed by industrial designer Jan Leysens and runs completely on solar energy. It is popularly known as the "IMEC Meets Howest" computer and combines the mobility feature of the laptop with solar cells capable of generating renewable energy.

C. Life book Leaf multipurpose laptop

This innovative gadget has been designed using the new environmentally-friendly technology that will further help in revamping laptop productions in future. The idea of designing such a concept based laptop came to designers Carl Burdick and Laura Karnath who were competing for the "Fujitsu Design Award - A life with future computing". Some of the other exciting features of the gadget include OLED touch screen that spreads out easily and can be conveniently folded as a laptop. Its exterior is carved out of polycarbonate, which is optically sensitive material and shatterproof as well

D. LOOP – Ecofriendly desktop computer

This device is the creation of industrial designer Jocko Chan who has made a conscious effort to craft a computer for Dell that is eco-friendly. Better known as the LOOP, you will have to place an order for this system online so that it can be delivered to your home directly. Dell's employees handle any issues pertaining to the repair as well as enhancements of the device. Those components that are in a good shape are used again whereas all the other components are sent for recycling. This computer is ideal for reducing e-waste and is space-saving as well.

E. EVO PC Concept

The EVO PC that is made from materials that are sustainable as well helps a great deal when it comes to reducing carbon footprint in comparison to the traditional computers. This system consists of two primary parts including the EVO Base unit and the EVO Client. The best part about these systems is that all upgrade, maintenance and support related tasks for the PC is done through remote server. This unique PC concept meets all the key environmental issues that are emerging from the usage of today's computers. While the EVO Client is 99 percent smaller in size it also has 96 percent less mass in comparison to the traditional desktop PC. This helps in reducing the material, energy and packaging that is required at the time of production and transportation of the product to the end customer.

F. Compaq EOS sustainable desktop

This environmentally friendly computer is the creation of industrial designer Cody Stonerock who has primarily designed the system for HP brand of computers targeted at low cost computing market. This gadget incorporates very few components and offers basic computing power only. None of the components in this system are fixed, which makes it easy for the consumers to replace any broken component with ease and thereby reduce e-waste and promote recycling. This system has been designed in such a way that the company can easily launch a take back program to allow customers to send their computers back for the purpose of recycling. Even the materials that have been used to design the system are green. While the stand is crafted from

recycled aluminum, the makers have used biodegradable bio resins plastics in the system.

G. *Igglu modular PC concept*

The Igglu Modular PC concept helps in minimizing e- waste and allows for easy upgrading and customization of the system. The makers of this system have devised a service model, whereby the users can simply remove the damaged component and place a new one using their online accounts. This system incorporates color coded and hot swappable modules for optical drives, hard drive, graphic cards, RAMS and PCI drives. Users can easily replace these modules and send them back to the company for recycling.

H. *'Bento' solar-powered concept*

The credit for designing this solar powered system goes to Rene Lee, an American product designer. This system is essentially a combination of notebook, Smart phone and tablet computer that are all packed in a single system. A look at the basic structure of the computing system suggests that it features a 15-inch OLED screen which is enough for accommodating a tablet computer, battery, a Smartphone and a 1TB hard drive. It also features solar panels that are well integrated and used for recharging the on-board lithium-ion battery. Once the system is completely charged, users can remove the tablet computer as well as the Smartphone from the system and use them independently.

I. *Solar Laptop Concept*

The solar laptop concept is the brainchild of designer Nikola Knezevic and is perfect for safeguarding the environment as well as minimizing your electric bill. The top half portion of the laptop is attached to a solar panel that is capable of extracting the maximum amount of sun's rays when it is folded out. Even when the laptop is closed; the solar panel can still attract sun's rays so that the energy can be used for charging the battery of your laptop. This is an ideal solution for professionals and surveyors who work outdoors most of the time.

J. *Luce solar-powered laptop concept*

This concept laptop, which has been created by industrial designer Andrea Ponti is powered using renewable solar energy only. The main aim of the makers of this system is to design a laptop using polycarbonate and incorporate two solar panels in it that are capable of generating electricity for the laptop. While the top portion of the laptop comes installed with one of the PV (photovoltaic) panels, the second is positioned under the transparent touch-keyboard and helps in ensuring that the laptop remains charged throughout the day.

VII. CONCLUSION

Many governments worldwide have initiated energy-management programs, such as Energy Star, an international standard for energy-efficient electronic equipment that was created by the United States Environmental Protection Agency and has now been adopted by several other countries. Now we have future of Green computing .There is lot of technique with green computing .By using these technique we can save energy, pollution and any type of wastage in IT and environment. The good news is that through modern

technology, such as the Aquaforest suite of products, we can adopt greener IT processes which not only have an efficient and economic benefit to an organization, but will also fulfill the brief for the corporate and social responsibilities we all share

REFERENCES

- [1] Baroudi, Hill, Reinhold, and Senxian (2009) Green IT for Dummies,
- [2] The Green Grid (2010) Retrieved from http://www.uh.edu/infotech/news/story.php?story_id=1
- [3] www.gwi-nc.org/services.html
- [4] Baroudi, Hill, Reinhold, and Senxian (2009) Green IT for Dummies
- [5] Green Computing- Embrace a Secure Future International Journal of Computer Applications (0975 – 8887) Volume 10– N.4, November 2010
- [6] GREEN COMPUTING (Internet Sources: Wikipedia; Network world; Environmental Leader; Computer Weekly; Scottish Environment Protection Agency; ITWeb)
- [7] Green Computing The concept of Green Computing Aquaforest Limited www.aquaforest.com