GREEN COMPUTING AS A MANDATORY REVOLUTION FOR PROPER END-OF-LIFE

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Abstract- Green computing is the study and realization of using computing resources efficiently as well as eco-friendly. Computers certainly make up a large part of many people lives and traditionally are extremely damaging to the environment. Manufacturers of computer and its parts have been espousing the green cause to help protect environment from computers and e-waste in any way. Probably the Energy Star has probably initiated the "green computing" movement by sustaining the control on the use of toxic materials, conserving the energy wasted by computer like machines at idle time. This article is obviously an effort to spread out the basic need of green computing to protect the environment.
Keywords- Green Computing, Landfill, E-waste, EPEAT, Recycling, EUP, Green browsers, Green search engine, Green computing certification etc.

Citation: Praveen Tripathi (2012) Green Computing as a mandatory revolution for proper end-of-life. Journal of Information and Operations Management ISSN: 0976–7754 & E-ISSN: 0976–7762, Volume 3, Issue 1, pp-174-177.

Introduction

Computer waste is high in many toxic materials such as heavy metals and flame-retardant plastics. These flame-retardant plastics are easily leached into ground water and bio-accumulate. Even manufacturing of chip uses some of the fatal gases and deadliest chemicals known to man. Waste of electricity is also an issue on manufacturing such computers. As a study says 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 of electricity. Global warming and environmental change have also become big issues today. And Green computing is a good effort to avoid it to delay it at least.

What is 'green' in Green Computing?

In Green computing, the word 'green' means to consider the environment and eco-system in the field of the computing say it is hardware manufacturing, application development, operating system functioning of anything else. Also, in-vain paper waste must also be reduced by utilizing the superfast 'electronic' concept viz. e-mail e-zines, e-tickets etc. The motive of the green computing movement is to conserve the green ecosystem for the safe, healthy and proper end-of-life. The plan towards green computing should include the electronic products and services with optimum efficiency and all possible options towards energy savings. It is worth saying that this green IT computing should take concrete action on organizational policy to uphold the green computing revolution, For example Hewlett Packard has care for this program by implementing HP Total Care advisor.

What is Green Computing?

The green computing encompasses from new energy-generation techniques to the study of advanced materials to be used in our daily life to limit the use of eco-harming waste such as toxic waste, flame-retardant material etc. It has taken upon itself the goal to provide society's needs in ways that do not damage or deplete natural resources. Companies are addressing e-waste by offering take-back recycling programs and other solutions, with lower energy consumption and less wasted hardware. Carbon free computing is one of the best practice in this area. VIA technology, a well known for manufacturing the motherboard chipsets, CPUs, and other computer hardware, has already introduced its initiative for "green computing" in 2001. The idea is to reduce the "carbon foot-

print" of users by providing the environmentally friendly products in the market. The carbon footprint is the amount of greenhouse gases produced, measured in units of carbon dioxide (CO2). Carbon dioxide, methane, nitrous oxide, and fluorocarbons — is believed to be responsible for global warming, which could lead to melt the icebergs and thereby become the reason for severe floods and droughts, rising sea levels, and other environmental effects, affecting both life and the world's economy. The effective way to control this natural calamity is to implement green computing.

Why Green Computing?

Why Green Computing? This question does not only belongs to the change in the technology to eliminate the use of toxic metals and waste but also belongs to help protect pollution free environment. Few considerations below depicts the basis for promoting the harmful agents which harms to

Computer energy is often wasteful: Leaving the computer on when not in use (CPU and fan consume power, screen savers consume power)

Printing is often wasteful: how many of you print out your emails or meeting agenda sprinting out partial drafts for a "paperless" society, we tend to use *more* paper today than before computer-prevalence

Pollution

- manufacturing techniques
- packaging
- disposal of computers and components

Toxicity

As we will see, there are toxic chemicals used in the manufacturing of computers and components which can enter the food chain and water!

Energy Usage Profile (EUP) for efficient power consumption

Power save was specifically developed as not to hinder day-to-day operations, allowing IT to set strict parameters on when energy-saving actions are implemented. No unwanted power-downs and no lost productivity. Even power companies in the North America are now offering significant rebates to organizations and individuals that utilize recognized methods to reduce power consumption. The Green500 provides rankings of the most energy-efficient supercomputers in the world. Green500.org shows that a prototype of IBM's next-generation Blue Gene/Q supercomputer is No. 1 on the list in terms of energy efficiency. According to Green500.org, IBM supercomputers are the most energy-efficient in the world. To check the energy usage profile of a computer system we can classify our system into following areas

Hardware EUP: By catching and then restraining the power consumption of various hardware components of our system viz. Hard disks, towers and monitors.

The breakdown in table 1 shows the details for the components in this server, which will be useful for us later.

Table 1- Sample Power Usage in Watts

Component	Idle	Average	Maximum
CPU	40.8		130
HDD	14.35		17
DIMM1	3		3
DIMM2	3		3
Video	18.3		25.6
NIC	4.95		4.95
CD/DVD	2		18
Other electrical components	~297.35		~398.45
Total	383.75	454.39	600

*Presented by Peter Koen in one of his paper

4.2- Application's EUP: By developing the power saver algorithms, which back-senses the idleness of our system components and cut the power of that particular wing.

4.3- Operating system EUP: By attaching the utilities to the operating systems to monitor the user or process so that the power flow can be hold enough, if not required for particular span of time.

By manufacturing all the internal as well as external components in green is also not a bad practice to aware the user of the computer system. Whereas, various perceptive organizations have already been placed their steps to aware the computer users about green computing revolution such as:

- Green web surfing
- Green browsers
- Green with Yahoo!
- Green Firefox
- Ecosearch etc.

While millions of people tap into Google without considering the environment, a typical search generates about 7 grams of CO2. Boiling a kettle generates about 15 grams. Google operates huge data centers around the world that consume a great deal of power," said Alex Wissner-Gross, a Harvard University physicist whose research on the environmental impact of computing is due out soon. "A Google search has a definite environmental impact."

Greenseng: A green search engine to conserve energy

Greenseng is a standard search engine, pulling results from Google's Custom Search to produce results. But instead of relying on a dubious method of energy conservation, CO2Stats measures the amount of energy used by its servers and the computers of its users and purchases renewable energy certificates. By using Greenseng search engine, the carbon emissions of the electricity consumption are neutralized by CO2Stats. The following is the logo of Greenseng search engine:

If you have green site certification then you are also appended in the list of the bodies doing their efforts to implement the green computing.

Get Green Site Certification for your website

To get the green site certification for your web site registers your website at *www.co2stats.com*. The site will give answers to the following relevant questions also:

- What is Green Certified Site?
- How does Green Certified Site work?
- Who uses Green Certified Site?
- Is Green Certified Site easy to use?
- Are reseller/enterprise solutions available?

And the benefits you get after getting the green site certifications are:

- Improve your visitor engagement.
- Neutralize your site's footprint.
- Improve your site's energy efficiency.
- Get more traffic with a green website.
- Full international support.

Activities on the laboratories: Policies for sustaining *green computing* are required at the initial time

Microchip fabrication has over 400 distinct steps which involve four general phases which are layering, oxidation, Patterning and Etching. Layering is the application of a thin layer of desired material (generally silicon or aluminum). Oxidation is changing a semiconductor silicon layer into a insulation silicon dioxide layer. Patterning is carving of a dense, maze like set of furrows into a layer and etching is the use of solvents or particle bombardment to alter the layer pattern. Throughout, the process requires a great deal of ultra-pure water and the chips are bathed in chemical solvents. There are few chemical elements which are used to manufacture both the internal as well as external components. A list of few chemical elements found in computers and components can be classified as below:

Elements in bulk

lead, tin, copper, silicon, carbon, iron and aluminum

Elements in small amounts

cadmium and mercury

Elements in trace amounts

- germanium, gallium, barium, nickel, tantalum, indium, vanadium, terbium, beryllium, gold, europium, titanium, ruthenium, cobalt, palladium, manganese, silver, antimony, bismuth, selenium, niobium, yttrium, rhodium, platinum, arsenic, lithium, boron, americium

List of examples of devices containing these elements

- Tin: solder
- Copper: copper wire, printed circuit board tracks
- Aluminum: nearly all electronic goods using more than a few watts of power
- Iron: steel chassis, cases & fixings
- Silicon: glass, transistors, ICs, Printed circuit boards.
- Nickel & cadmium: nickel-cadmium rechargeable batteries
- Lithium: lithium-ion battery
- Zinc: plating for steel parts
- Gold: connector plating, primarily in computer equipment
- Mercury: fluorescent tubes (numerous applications), tilt switches (pinball games, mechanical doorbells)
- Sulphur: lead-acid battery

Lead as a chemical element is used in soldering of printed circuits boards and other relevant components

Problems with lead

 Lead causes the following problems-

- Lead can cause damage to the central and peripheral nervous systems, blood system, kidneys, endocrine system and cause negative effects on child brain development
- Lead accumulates in the environment and has toxic effects on plants, animals and microorganisms

Electronics contribute 40% of the total amount of lead found in landfills and can make its way from landfills into the water supplies

Disposing the obsolete or old devices with the green one

There are plenty of the options to start the green computing. Disposing the obsolete or old device, reusing of computers, refurbish or upgrading of device is a good step to initiate the green computing. Donate your computer components to people who may not have or have lesser quality computers. This will however leads to the older computers being dumped but there is probably no way around the older computers would be discarded anyway. Again, rather than discarding your obsolete computer when the next generation is released, just get a new processor and memory chips instead of replacing them. If companies can recycle the plastics and other computer component, this can greatly reduce waste and fatal toxins. Recyclable chemicals should be used by the manufacturers of the computers for the purpose. Some of the top notch companies are doing their great efforts on maintaining the carbon footprints by taking care of green computing. These companies are: Nokia, Dell, Lenovo, Sony Ericsson, Samsung, Motorola, Toshiba, Fujitsu Siemens, Acre, Apple, HP, Panasonic, Sony etc.

HP's five steps to Green Computing: HP Total Care Advisory

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. Here are five first steps you can take toward a green computing strategy:

Develop a sustainable green computing plan

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.

Recycle

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.
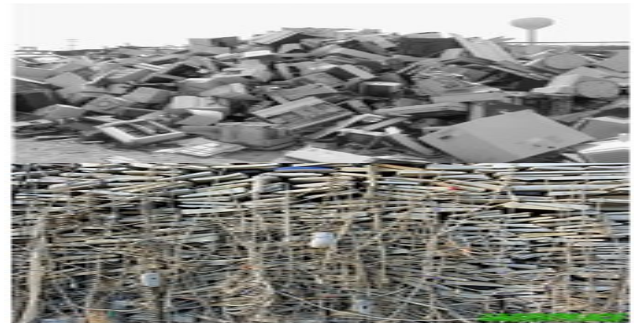

Fig.1- Discarded computer/electronic components

In the above figure, discard used or unwanted electronic equipment in a convenient and environmentally responsible manner. We should also remember that incineration of computer components leads to air pollution and airborne toxins.

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 sen-

sitive materials, designing for longevity and reducing packaging materials

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 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 algorithms can save energy and help protect the environment. We Must always use the computer powe setting as per ur usage of our computer system.

Below is the printscreen of a typical windows machine that depicts the power saving setting
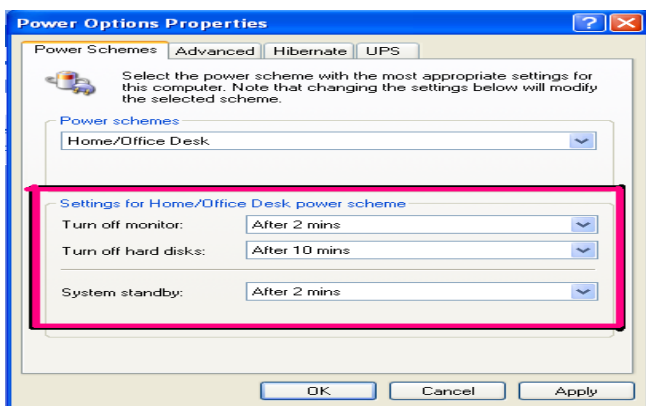
We should always utilize this feature by settings the power features of moniter, hard disks and system to conserve the energy.

Other considerations

To sustain the environment we should be cautious while using system. We should always power off the monitor if going out of the cabin for hours or even one hour. It conserves the power drastically if all the users of the system take care of it. Flame retardants are also a very sensitive issue in this era. So we should optimally make use of the eco-friendly metals which can easily recycle.

Use of paper to print in-vain is also unhealthy practice. According to the Columbia University Guide to Green Computing, if the paper used each year for personal computing were laid end to end, it would circle the Earth more than 800 times.

According to some other study, a typical desktop personal computer with a 17-inch flat LCD monitor requires about 100 watts of electricity. And if such machine left open for one year, this machine will consume 874 Kilowatt hours of electricity, which is good enough to release 750 pounds of carbon-di-oxide into the atmosphere. It is really awesome that we are not serious about it. We also know that using screensavers does not means saving energy. Screensavers are itself programs which uses the memory of our PC and time of

our CPU, thereby gives both the space and time complexity more than zero always.

Telecommuting is also the approach to implement the green computing at the first order. Teleconferencing and telepresence are the active consideration to support the green computing. The reason is simple; increased worker satisfaction, reduction of greenhouse gas emissions related to travel or transport, and increased profit margins as a result of lower overhead costs for office space, heat, lighting, etc. Many of the jobs, such as sales, consulting, and field service, integrate well with this technique. To support this movement in New Zealand, the concept of eDay has been evolved, which is considered as an electronic waste collection day.

Green computing education programs

To educate students how to build and maintain systems while reducing its negative impact on the environment few certifications are being run by some educational groups. Some of the program which influence the awareness and key work in the field of green computing are CGCUS, CGCA, CGCP certifications. Moreover, CompTIA Strata Green IT is a course designed exclusively for the IT managers, which make aware the managers about the green computing. Information Systems Examination Board (ISEB) Foundation Certificate in Green IT is another program to understand as well as utilize the knowledge about green computing. These programs are making aware all the IT professionals to sustain the green computing movement. CRT monitors typically use more power than LCD monitors. They also contain significant amounts of lead. LCD monitors typically use a cold-cathode fluorescent bulb to provide light for the display. The manufacturers of the computer components are the responsible persons of the first order.

Conclusion

The motive of the "green computing" movement is to initiate the robust steps in thrust areas of computing say software, hardware or middleware to restrict of limit the use of eco-harming elements. Also, the mission is to act like an eye opener for all the human beings to help protect the environment by keeping the environment greener than the green. From the top management point of view, some new policies must be appended in the code of conduct of all the organizations especially which are directly connected to effect green. Avoidance or least use of toxic materials will not only help survive the green but also will restrain the various pollution at one go.

References

[1] Wikipedia, the free encyclopedia (2012) *http://en.wikipedia.org.*
[2] Cree LED Backlight Solution Lowers Power Consumption of LCD Displays (2005) 09-17.
[3] Research reveals environmental impact of Google searches. (2009) *http://www.foxnews.com.*
[4] Powering a Google search.(2009) *Official Google Blog. Google.*
[5] Reardon Marguerite (2009) *Energy-aware Internet routing coming soon.*
[6] HP Advisory *Five Steps to Green Computing.*