ISSN (ONLINE): 2395-695X
ISSN (PRINT): 2395-695X

International Journal of Advanced Research in Basic Engineering Sciences and Technology (IJARBEST)
Volume 2, Special Issue 19, October 2016

GREEN COMPUTING: WAY TO EFFECTIVE NEW TECHNOLOGICAL APPROACH

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Abstract- Green is the burning topic these days. The first thing that may come to mind when we think of "Green Computing" is simply using less electricity, but there's a lot more to that. The challenge of green computing have become clear; the need for clean water and air; affordable and reliable delivery of energy; the dwindling supply of fossil fuel; the reality of climate change and its implications for future generations. Various computer manufacturers are getting involved in trying to save the environment. Through our research paper we take a little effort to aware the common man about the various initiatives taken by various manufacturers of computer and its devices for green computing.

Keyword- **Green Computing, Virtualization, Sustainability**

I. INTRODUCTION

"Greening" your computing equipment is a low-risk way for your business to not only help the environment but also reduce costs. It's also one of the largest growing trends in business today. Making a conscious decision to go green in the workplace, not only improves your bottom line, but also reduces your carbon footprint.

Green Computing or Green IT refers to environmentally sustainable computing or IT. It is "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. Green IT also strives to achieve economic viability and improved system performance and use, while abiding by our social and ethical responsibilities. Thus, green IT 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. It is the study and practice of using computing resources efficiently.

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 recyclability or biodegradability of defunct products and factory waste.

II HISTORY OF GREEN COMPUTING

One of the first manifestations of the green computing movement was the launch of the Energy Star program way back in 1992. 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, virtualization practices, E-Waste, etc.

III CAUSE FOR GREEN COMPUTING

A. Uses lot of electricity

Most of the natural resources are being used to get the electricity, that all have some impacts on the environment.

B. Creates lots of toxic waste

Most of us are updating our computers, throwing our outdated computer resources, peripherals, and other hardware devices etc, these are the hazardous toxic waste we are producing that really damaging the environment now a days.

C. Impact of Electricity to the Environment

The Electric power produces more pollution to the environment. They are Air pollution, Water Pollution and Land pollution. Fossil fuel power plants release air pollution and require lot of water. Nuclear power plants release lot of radio active energy and hazardous waste. Even renewable energy sources affecting water and wild life and even hurting the food chain too.

Air pollution impacts on Climate change, Acid rain, Ozone, Air toxics
Water pollution impacts on Consumption of water resources, Polluting water bodies
Land pollution impacts on Degrade and devalue the land, impacting ecosystem and aesthetics.

D. Impact of Toxic waste to the Environment

The computer crowding our landfills contains lead, mercury, cadmium, beryllium and traces of many other hazardous materials. Incineration, this releases heavy metals like lead, mercury and cadmium into air and ashes. Even recycling the electronics can harm the workers and the environment surrounding them.

IV WAYS FOR GREEN COMPUTING

A. Reduce Power Consumption

The use of electricity in our computer is very essential. We had to make use of the computers efficiently to save the 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

B. 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.

C. 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.

C. 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.

D. 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.

E. Reduce Toxic Waste

Reducing e-waste is very much important. By practicing Green Computing, we had to know how to properly dispose the computers and other hardware devices. First check the manufacturer information that they may take back your old product back. In now a day many concerns take the old gadgets from you to get them recycled. Depending on where you live you can take the old parts of your computers to nearby retailers, electronics repair shop they can dispose your products easily to recycler.

F. Cloud Computing

Use latest technologies that avoid to setting up your own hardware/software infrastructure, with cloud computing you can do that. HaaS means hardware as a service allows you to use hardware from remote location through visualization.

V. APPROACHES TO GREEN COMPUTING

A. Virtualization

Computer virtualization refers to the abstraction of computer resources, such as the process of running two or more logical computer systems on one set of physical hardware. With virtualization, a system administrator could combine several physical systems into virtual machines on one single, powerful system, thereby unplugging the original hardware and reducing power and cooling consumption. Several commercial companies and open-source projects now offer software packages to enable a transition to virtual computing.

B. Terminal Servers

Terminal servers have also been used in green computing methods. Terminal Services for Windows and the Aqua Connect Terminal Server for Mac, both deliver operating systems to end users. Using this method, users terminal in to a central server. All of the computing is done at the server level but the end user experiences the operating system.

C. Power Management

The Advanced Configuration and Power Interface (ACPI), an open industry standard, allows an operating system to directly control the power saving aspects of its underlying hardware. This allows a system to automatically turn off components such as monitors and hard drives after set periods of inactivity. In addition, a system may hibernate, where most components (including the CPU and the system RAM) are turned off. ACPI is a successor to an earlier Intel-Microsoft standard called Advanced Power Management, which allows a computer's BIOS to control power management functions.

D. Power Supply

Desktop computer power supplies (PSUs) are generally 70–75% efficient, dissipating the remaining energy as heat. An industry initiative called 80 PLUS certifies PSUs that are at least 80% efficient; typically these models are drop-in replacements for older, less efficient PSUs of the same form factor. As of July 20, 2007, all new Energy Star 4.0-certified desktop PSUs must be at least 80% efficient.

E. Storage

Smaller form factor (e.g. 2.5 inch) hard disk drives often consume less power per gigabyte than physically larger drives. Unlike hard disk drives, solid-state drives store data in flash memory or DRAM. With no moving parts, power consumption may be reduced somewhat for low capacity flash based devices. Even at modest sizes, DRAM based SSDs may use more power than hard disks, (e.g., 4GB i-RAM uses more power and space than laptop drives). Flash based drives are generally slower for writing than hard disks.

F. Video Card

A fast GPU may be the largest power consumer in a computer. Energy efficient display options include:
No video card - use a shared terminal, shared thin client, or desktop sharing software if display required.
Use motherboard video output - typically low 3D performance and low power.
Reuse an older video card that uses little power; many do not require heatsinks or fans. Select a GPU based on average wattage or performance per watt.

G. Display

LCD monitors typically use a cold-cathode fluorescent bulb to provide light for the display. Some newer displays use an array of light-emitting diodes (LEDs) in place of the fluorescent bulb, which reduces the amount of electricity used by the display.

H. Operating System Issues

Microsoft has been heavily criticized for producing operating systems that, out of the box, are not energy efficient. Due to Microsoft's dominance of the huge desktop operating system market this omission may have resulted in more energy waste than any other initiative by other vendors. Microsoft claim to have improved this in Vista. This claim is disputed in the community. This problem has been compounded because Windows versions before Vista did not allow power management features to be configured centrally by a system administrator. This has meant that most organizations have been unable to improve this situation.

Again, Microsoft Windows Vista has improved this by adding basic central power management configuration. The basic support offered has been unpopular with system administrators who want to change policy to meet changing user requirements or schedules. Several software products have been developed to fill this gap.

I. Materials Recycling

Computer systems that have outlived their particular function can be repurposed, or donated to various charities and non-profit organizations. However, many charities have recently imposed minimum system requirements for donated equipment. Additionally, parts from outdated systems may be salvaged and recycled through certain retail outlets and municipal or private recycling centers.Recycling computing equipment can keep harmful materials such as lead, mercury, and chromium out of landfills, but often computers gathered through recycling drives are shipped to developing countries where environmental standards are less strict than in North America and Europe.

VI EFFECTIVE STEPS TO MAINTAIN GREEN COMPUTING

There are steps you can take to save money, and protect the environment.

Here are some specific examples:

- Buy energy efficient computers
- Buy hardware appropriate for the job
- Turn off your computer when you will not be using it for several hours
- Print smarter!
- Enable power management features on your computer
- Recycle your old computers

VII RECENT IMPLEMENTATION OF GREEN COMPUTING

A. 'BLACKLE' Search-engine

Fig. 1. *'BLACKLE' Search-engine*

Blackle search-engine site powered by Google Custom Search as shown in Fig.1. This is because when your computer screen is white, the energy consumes 74W, whereas when the screen black, it consume only 59W.

B. ZonbuComputer

Fig 2. ZonbuComputer

Zonbu computer is a new and a very energy efficient PC as shown in Fig.2. The Zonbu just one third of power of atypical light bulb. The Device runs the Linux OS using a 1.2 GHz Processor and 512 MB RAM.

C. Fit PC

Fig 3.Fit PC

Fit-PC is the size a paperback and absolutely silent, yet fit enough to run Windows XP or Linux as shown in Fig.3. Fit-PC only 5 Watts, consuming in a day less power than a traditional PC consumes in 1 hour.

D. Sunray thin client:

Fig 4.Sunray thin client:

Sun Microsystems is reporting increased customer interest in its Sun Ray as shown in Fig.4, a thin desktop client, as electricity prices climb, according to SubodhBapat, vice president and chief engineer in the Eco Responsibility office at Sun. Thin clients like the Sun Ray consume far less electricity than conventional desktops, he said. A Sun Ray on a desktop consumes 4 to 8 watts of power, because most of the heavy computation is performed by a server.

E. The Asus Eee PC and other ultra portables:.

Fig 5.The Asus Eee PC and other ultra portables:

The Asus Eee PC is one example of an ultraportable as shown in Fig.5. It is the size of a paperback, weighs less than a kilogram, has built-in Wi-Fi and uses flash memory instead of a hard drive. It runs Linux too.

VIII COMPANIES WHO TAKE INITIATIVES FOR GREEN COMPUTING

A. Dell

Dell is a member of illustrious Leadership Club of the U.S. EPA's Green Power Partnership. It is an environmental leader in the IT field, purchasing 129% of its conventional electricity usage in green power company wide. That is, Dell purchases green power for its international operations as well.

Investment in green power is not Dell's only step towards operating an environmentally sustainable business. According to their web site, certain lines of Dell computers such as the Latitude E-Series laptops and the Optiplex desktops are designed for energy efficiency. These same computer models are noted for a reduction or elimination of harmful chemicals such as PVC and mercury.

Dell has been able to improve the energy efficiency of their desktop computers by 50% in the last five years and the efficiency of their laptop computers by 16% in the five years. Using LED monitors in the laptop computers is one technological advance that has allowed an increase in energy efficiency. Certain types of dell notebook computers are now being shipped to customers in packaging made from sustainable harvest bamboo, which is better for the environment than traditional paper packaging.

B. HP (Hewlett-Packard)

Hewlett-Packard Company or HP is an American multinational information technology corporation headquartered in Palo Alto, California, United States. Hp take various initiative to Green Computing are:

1) HP Eco Solutions: HP Eco Solutions program encompasses the strategy to achieve the commitment of providing customers with inventive, high-quality products and services that are environmentally sound.

2) Supply Chain Leadership: HP requires its suppliers, around the world, to meet its own stringent environmental standards includes - Responsible purchasing power -Transparency - Setting Standards –Accountability

3) Environmentally efficient packaging: HP is committed to reducing the weight, bulk and environmental impact of packaging.

4) Energy and Climate: HP business notebooks offer better battery life, reduced energy bills and smaller carbon footprints.

5) Materials innovation: Hp business notebooks minimise the use of hazardous substances

C. IBM

Today's energy and climate related issues are at the top of IBM's strategic agenda, IBM solutions can help customers reduce costs and systemically minimize energy, water, carbon emissions and waste. IBM is helping customers to become more energy efficient, implement new ways of source, manufacture and distribute goods and services in a more sustainable manner, enable safe and renewable sources of energy and manage resources at a macro level, transforming entire industries.

IBM has unveiled a $1 bn-a-year service initiative aimed at building and redesigning data centres that consume less energy.

IBM claims that the savings for customers are great inn going green – by using IBM technologies such as their blade servers instead of others vendor's technologies, a customer with a 25000 square foot data centre should be able to save as much as 42 percent on energy consumption.

D. Intel

Intel, as the world's largest chip-maker and one of the largest technology companies on the planet, is leading the charge with green initiatives and technologies across its whole range of products. Intel's newest Core i3, i5 and i7 processors use the very latest technologies to minimize the amount of unnecessary power that gets used. These chips use 32nm process and are built using high-k+transistor technology. This means that a CPU is exceptionally small and made of materials that don't overly leak electricity. The end result is that they require less electricity and create less heat, making them more efficient.

E. Microsoft

Microsoft Corporation is an American multinational software corporation headquartered in Redmond, Washington that develops, manufactures, licenses, and supports a wide range of products and services related to computing. The company was founded by Bill Gates and Paul Allen on April 4, 1975. Microsoft is the world's largest software maker measured by revenues. It is also one of the world's most valuable companies.

The Environmental Sustainability Dashboard for Microsoft Dynamics AX is a cost-effective solution designed to track an organization's energy consumption, carbon footprint and related costs. The Dashboard, which is certified by the Global Reporting Initiative (GRI), enables organizations to confidently report and manage complex environmental metrics so that both the organization and the planet will benefit.

- Energy-Smart Buildings Through a pilot program and white paper

- Reducing and Managing Computer Energy Consumption

- Reducing Travel and Carbon with Unified Communications

F. Sun Microsystems

Sun Microsystems manufacture computers, computer components, computer

software, and information technology services and also developed the platform independent java and NFS (Network File System) are also the development of Sun Microsystems.

Sun Microsystems launching a new set of data storage products that use open source and solid- state memory drives to cut their energy consumption to the quarter that of traditional data storage systems. Solid state drives have no moving parts and require less power to operate than mechanical disk drives. Sun says that a smaller energy bill, combined with standard hardware and an open source system, means the storage product dubbed the 7000 or Amber Road family can offer cost savings of 75 percent compared with competing storage technology.

G. Wipro

Wipro Ltd is a global information technology, consulting and outsourcing company with 140,000 employees serving over 900 clients in 57 countries. Wipro believes that being an integral part of society, corporate organizations must play an active role in furthering the cause of sustainability.

Initiatives of Wipro for green computing.

- Green Lighting Solutions.

- Green IT solutions Applications like e- Freight, Emission Compliance Management System and Energy Efficiency Solutions.

- Products like Wipro Greenware.

- Green Testing Lab at Sarjapur campus that test products to confirm that they are “green” compliant.

- Wipro EcoEnergy.

IX CONCLUSION

Adopting Green Computing Strategies make sense not only from an ethical, or moral stand-point, but from a commercial stand-point. There are many business benefits achievable through the implementation of a green computing strategy such as cost savings, resilience, disaster recovery, business continuity planning and of course public relations. So Green computing is the utmost requirement to protect environment and save energy along with operational expenses in today's increasingly competitive world.

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