Green Computing

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Abstract- *Green Computing is the study of designing, manufacturing, using and disposing computing devices which reduces environment impact. The word "Green Computing" was coined after the "Energy Star" program began back in 1992. The first step towards "Green Computing" was the "Sleep Mode" function of computer monitors. The reason why we have to go green in the workplace such as offices is not only for the benefit of the business but to reduce the carbon footprint in our mother earth. The major approaches to green computing can be done in power management, power supply and storage, video card, display and virtualization. The goal of green computing is to reduce the use of hazardous materials, promote the use of biodegradable materials and Refurbish. Green computing is recently implemented in Zonbu Computer, Fit PC, Sun Ray thin Client, Asus Eee PC and Ultra Protable. This paper deals with the usage of Green computing to save energy and to provide an eco friendly environment.*

Keywords- Green Computing, Virtualization, Docker, Container, Hypervisor.

I. INTRODUCTION

Green computing deals with the study and practice of environmentally sustainable computing. This eco friendly practice can be implemented in day to day life to reduce the environmental impact. The main aim of Green Computing is to reduce the use of hazardous materials, maximize the energy efficiency during the product's life time and promote recyclability or biodegradability of defunct products and factory waste. To practice Green Computing we need to implement energy efficient central processing units, servers and peripherals as well as reduced resource consumption and proper disposal of electronic waste. Now a day's industries and companies are focusing on developing and using such devices. One of the techniques employed by companies is Virtualization in which Server Consolidation is mostly engaged. Another technique is Docker. These two techniques are forming the major elucidation to Green Computing.

II. APPROACHES TO GREEN COMPUTING

Green Computing is a process of reutilizing and rebuilding of electronic devices and computers for overall analysis. The utmost requirement in today's world is to protect our environment and to save energy in this competitive world. The various approaches to Green Computing are:

1. Virtualization :

It is the process of running multiple computer systems on one set of physical hardware. Energy efficiency can be achieved with less physical equipment plugged in, so that less amount of electricity is consumed. Virtualization provides a layer of abstraction called HyperVisor, which lies on the computer hardware. It is a software program that allows multiple Operating Systems in a single machine. Virtualization can be applied to core computing devices such as RAM, CPU, Hard Disk and Network Connection. The most common Virtualizaiton technique is Server Virtualizaiton and Desktop Virtualizaiton. Many industries use Server Virtualization.

2. Energy Consumption:

Environmental protection agency say that around 30% to 40% of computers are kept ON during weekends and even after office hours. Around 90% of the computers remain idle during office hours. Green computing provides optimal use of physical resources. Climate Servers Computing Initiative (CSCI) takes effort to reduce the electric power consumption of PC's in active and inactive states. Another technique is to write energy efficient coding which reduces the software usage of the hardware. Software's can be designed in such a way that the number of resources needed to complete a certain function.

3. Green Manufacturing:

Computer manufacturers are finding alternative eco-friendly materials in the production of computer parts. The lists of material which can be used to produce computer parts are:

- Bamboo : It can be used for making casing for computer and peripherals. This type of casing is sustainable and renewable.
- Recyclable Plastics: Computers can be manufactured using recyclable polycarbonate resin.

- Eco-Friendly Flame Retardant: Flame retardant silicone compounds which are non toxic can be used to produce computer parts.
- Eliminating Lead Soldering: Eliminating Lead soldering will make a big difference, it will prevent toxins leaching into the ground and water supplies at landfills and storage points.

There are some materials which can be avoided in the production of computer parts are:

- Bromine and Chlorine: Bromine and chlorine are used in flame retardants and in the plastic resins in many of the plastic products. During burning, these electronic waste can pollute the water, land and air. Moreover, these compounds do not break down quickly. They linger in the environment for a long period of time. So, Apple products make use of ammonium polyphosphate and methalhydroxides which are safer flame retardant substances.
- Lead: 40% of Lead are found in landfills and water supplies. Lead can damage the human nervous system and can affect the brain development. In computers, Lead can be found in the glass components of Cathode Ray Tube(CRT) monitors, processors and chipsets. VIA Technologies in 2001, introduced a processor which replaced lead with tin, silver and copper composite. In 2007, Intel company also followed the VIA Technologies.
- Mercury: Mercury is used in Cold Cathode Fluorescent Lights(CCFL) used to backlight LCD Screens. In 2008, LCD screens are replaced with LED Displays by DELL Company which is mercury free. These LED consume less power, have long life and can be recycled. Many Leading Computer Manufacturing companies are also following the same concept of getting rid of mercury.

Green Use: As a first step to green use we can follow these rules:

1. Don’t leave your computer running overnight.
2. Unless you are ready don’t turn on your printer.
3. Take Hard Copy when there is need.
4. Reduce the light level in the office.
5. Say no to paper and make use of technologies like e-mail for sending messages.
6. Use only reusable papers.
7. The best screen saver is no screen saver at all - turn off your monitor when you are not using it. This option is second best only to turning off your computer all together.
8. Review your document on the screen instead of printing a draft. If you must print a draft, use the blank back side of used paper.
9. Buy vegetable (or non-petroleum-based) inks. These printer inks are made from renewable resources; require fewer hazardous solvents; and in many cases produce brighter, cleaner colors.
10. Instead of purchasing a new computer, try refurbishing an existing device.

Green Disposal: Green disposal is based on the following three principles Reuse, Refurbish,Recycle.

Reuse :When we are ready to replace a new computer, donate the old computer to anyone who is in need of it.

Refurbish :Upgrade the computer parts such as RAM, Hard Disk instead of discarding it.

Recycle: Recycle the computer through manufacturer programs such as HP's Planet Partners recycling service or recycling facility. Or donate still-working computers to a non-profit agency.

III. SOME GREEN INITIATIVES

(1) RoHS: In February 2003, the European Union adopted the Restriction of Hazardous Substances Directive (RoHS). The legislation restricts the use of six hazardous materials in the manufacture of various types of electronic and electrical equipment. The directive is closely linked with the 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.

(2) VIA Technologies, a Taiwanese company that manufactures motherboard chipsets, CPUs, and other computer hardware, introduced its initiative for "green computing" in 2001. With this green vision, the company has been focusing on power efficiency throughout the design and manufacturing process of its products.[7] Its environmentally friendly products are manufactured using a range of clean-computing strategies like carbon free computing, solar computing and quiet computing.

(3) 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, and 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 save750MW 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 colours consumes different amounts of energy on computer monitors.

(4) Zonbu Computer: The Zonbu is a new, very energy efficient PC. The Zonbu consumes just one third of the power of a typical light bulb. The device runs the Linux operating system using a1.2 gigahertz processor and 512 meg of RAM. It also contains no moving parts, and does even contain a fan.

IV. CONCLUSION

We are in the world of computers; Each and every field is using it. So, we must be aware of the cost and scarcity of energy required to power them. As the need increases the more and more computers are brought and replaced. Green computing is the responsible way to address the issue of global warming. By adapting the green computing in business, education etc. we can protect our environment while reducing energy and paper costs.

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