

Green Computing: Save Energy

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Abstract--As the commitment to reduce environmental impact and power consumption are becoming increasingly important objectives for organizations, architecture leaders are now proactively considering environmental resource. The biggest challenge facing the environment today is global warming, caused by carbon emissions. About 98 percent of CO₂ emissions (or 87 percent of all CO₂-equivalent emissions from all greenhouse gases) can be directly attributed to energy consumption, according to a report by the Energy Information Administration. Many organizations today are speaking openly about a desire to operate in a "green" manner, publishing principles for environmental practices and sustainability on their corporate Web. In addition, many companies are now paying (or will pay in the near future) some kind of carbon tax for the resources they consume and the environmental impact of the products and services they produce, so a reduction in energy consumed can have a real financial payback. Green computing, also called green technology, is the environmentally sustainable to use of computers and related resources like - monitors, printer, storage devices, networking and communication systems - efficiently and effectively with minimal or no impact on the environment. The evaluation, analysis and optimization of the workload demands and IT infrastructures are required to determine the present and future energy consumption needs. Therefore the primary motivation behind this green approach is cost saving and also at the same time there are lots of money savings and eco-friendly.

I. INTRODUCTION

Green computing, the study and practice of efficient and eco-friendly computing resources, is now under the attention of not only environmental organizations, but also businesses from other industries. Green technology focuses on reducing the environmental impact of industrial processes and innovative technologies caused by the Earth's growing population. It has taken upon itself the goal to provide society's needs in ways that do not damage the natural resources. This means creating fully recyclable products, reducing pollution, proposing alternative technologies in various fields, and creating a center of economic activity around technologies that benefit the environment. This paper mainly focuses on the approaches of green computing and also how it can be used to minimize the environmental impacts of computers and other IT related resources effectively. In recent years, companies in the computer industry have come to realize that going green is in their best interest, both in terms of public relations and reduced costs. "Green computing" represents environmentally responsible way to reduce power and environmental e-waste. Virtualization, Green Data Center, Cloud computing, grid computing, Power optimization are the technologies of green computing. Main goals of green computing are to

reduce the use of toxic and hazards materials and improve the energy efficiency, recycling of factory waste. Such practice includes the efficient implementation of server and peripherals as well as reduces the power consumption.

II. HISTORY

In 1992, the U.S. Environmental Protection Agency launched Energy Star, a voluntary labeling program which is designed to promote and recognize energy-efficiency in monitors, climate control equipment, and other technologies. This resulted in the widespread adoption of sleep mode among consumer electronics. The term "green computing" was probably coined shortly after the Energy Star program began.

Green computing practices came into being in 1992, when the Environmental Protection Agency (EPA) launched the Energy Star program. Basically, the whole green aspect came about quite a few years back when the news that the environment was not a renewable resource really hit home and people started realizing that they had to do their part to protect the environment. 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.

III. NEED OF GREEN COMPUTING

Nowadays computing vision is utility based Consumers only need to pay provider only when and how they access, they need not to invest much and there is no need to develop an complex and costly infrastructure, this model of computing is cloud computing .Cloud means a user can access application as a service from anywhere in the world on demand cloud computing services are supported by a state of data centre (data server) which uses the virtual machines for isolation purpose. Data centre management faces the problem of power consumption and application's quality of services [1]. Cloud computing delivers infrastructure platform and software (application) as a service on demand as a subscription based services [2]. To reduce the power consumption here the term green computing is used .When we introduced the term green computing we thought going green with computers. Nowadays the power consumption related to technology is rising rapidly according to the rapid development of Information Technology. The recent U.S. Environmental Protection Agency (EPA) report says that the IT industry consumed approximately 61 billion kilowatt-hours of electricity in 2006. That's 1.5 percent of the total electricity consumed in the United States. At the same time, servers and data centers deployed by the U.S. Federal Government account for about 10 percent, or 6 billion kWh, of the total consumption. Also, the EPA report estimated that IT power consumption could nearly double by 2011.

Therefore IT management has to understand the basic concepts of green computing and how the investments can be improved through this approach.

There are plenty of ways to be green and also in the IT world, the solution falls into three general categories;

- Improve energy efficiency by reducing carbon footprint.
- Reduce e-waste
- Enable lifestyle changes that lower impact on the environment



• Fig. 1: Green Computing

A. Lower Power hardware:

computer systems are made up of hardware i.e. processor onboard graphics, disk, fan etc these hardware should be consumed less power.

B. Virtualization:

It is the use of software to simulate hardware. In the data center stand alone server system replaced with virtual server that run as software on a small number of larger computer via a virtualized server we can efficiently use computer resources.

C. Cloud computing:

It has many benefits it enables anybody to obtain environmental benefits of virtualization. It also remove the need for the user to run high power PCs since it provide infrastructure as a service.

D. Wireless Network Sensor:

Sensor employed in different parts area in a data center to determine the temperature of each area, this will tell which area need to be more cool and where to reduce cooling.

E. Recycle:

Through recycling the waste or equipment we can reduce the environmental pollution.

F. Climate Change:

Researches done in past shows that CO₂ and emission of others affect the global climate and responsible for damage of our environment .Preserve the planet is main goal. Planet like earth is rare. There is no m-class planet in our solar

system and no other star system have m-class planet as we know.

G. Savings:

Green computing can lead to serious cost savings. Reductions in energy costs from servers cooling and lighting.

H. Reliability of Power:

As the energy demands increasing day by day and supply is declining. Energy efficient system ensures healthy power system. Many industries generate their own electricity which motivates to keep the consumption low.

I. Computing Power Consumption has reached a Critical Point:

Data centers have run out of usable power and cooling due to high densities

IV. STEPS TO GREEN COMPUTING

Step. 1 : Develop a sustainable green computing plan.

Discuss with the 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. Organizational policies should include communication and implementation.

Step. 2 : 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.

Step. 3 : 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

Step. 4 : 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.

Step. 5 : 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.

V. RECENT IMPLEMENTATIONS OF GREEN COMPUTING

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, 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 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.

Fit-PC: a tiny PC that draws only 5w: Fit-PC is the size of a paperback and absolutely silent, yet fit enough to run Windows XP or Linux. Fit-PC is designed to fit where a standard PC is too bulky, noisy and power hungry. If you ever wished for a PC to be compact, quiet and green then fit-PC is the perfect fit for you. Fit-PC draws only 5 Watts, consuming in a day less power than a traditional PC consumes in 1 hour. You can leave fit-PC to work 24/7 without making a dent in your electric bill.

B. 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 a 1.2 gigahertz processor and 512 Meg of RAM. It also contains no moving parts, and does even contain a fan. You can get one for as little as US\$99, but it does require you to sign up for a two-year subscription.

C. Sunray thin client:

Sun Microsystems is reporting increased customer interest in its Sun Ray, a thin desktop client, as electricity prices climb, according to Subodh Bapat, 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. Sun says Sunrays are particularly well suited for cost-sensitive environments such as call centers, education, healthcare, service providers, and finance. PCs have more powerful processors as well as hard drives, something thin clients don't have. Thus, traditional PCs invariably consume a substantially larger amount of power. In the United States, desktops need to consume 50

watts or less in idle mode to qualify for new stringent Energy Star certification.

D. The Asus Eee PC and other ultra portables:

The "ultra-portable" class of personal computers is characterized by a small size, fairly low power CPU, compact screen, low cost and innovations such as using flash memory for storage rather than hard drives with spinning platters. These factors combine to enable them to run more efficiently and use less power than a standard form factor laptop. The Asus Eee PC is one example of an ultraportable. 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.

VI. CONCLUSION

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. Through more environmentally aware usage (such as more effective power management and shut-down during periods of inactivity), and by adopting current lower power technologies, computers can already be made significantly more energy efficient. What and how much work done in green computing and how the power consumption is reduced through different approaches and key challenges facing to accomplish the goal. The concept of green computing is popularized in the past few years. Apart from ecological issues, this also deals in economic needs.

REFERENCES

- [1] Zhiwu Liu, Ruhui Ma, Fanfu Zhou, Yindong Yang, Zhengwei Qi, Haibing Guan "Power-aware I/O-Intensive and CPU-Intensive Applications Hybrid Deployment within Virtualization Environments" IEEE 2010.
- [2] R. Yamini, Assistant Professor "Power Management in Cloud Computing Using Green Algorithm" (ICAESM-2012) MARCH 2012.
- [3] Prof. Riyaz A. Sheikh and Dr. U.A. Lanjewar." Green Computing- Embrace a Secure Future" International
- [4] Journal of computer Applications (0975-8887) vol-10-N4 November 2010.
- [5] Michigan State University Board of Trustees, 2004, *Green Computing Guide*, viewed 9th August 2010
- [6] <http://www.espp.msu.edu/news/news05.html>
- [7] idg.com, *IDG*, viewed 12th August 2010, <http://idg.com/www/homenew.nsf/home?readform>
- [8] HP-United States, *HP corporate information*, viewed 12th August 2010,
- [9] <http://www8.hp.com/us/en/hp-information/index.html>