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Green Computing Practices: A solution to save environment

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Abstract: Environmental and energy conservation issues have taken attention in the global business arena in recent Years. The reality of rising energy costs and their impact on international affairs coupled with the increased concern over the global warming climate crisis and other environmental issues have shifted the social and economic consciousness of the business community. Green Computing is the study and practice of using computing resources efficiently. Typically, green computing systems or products take into account the so-called triple bottom line of people, planet, and profit. This differs somewhat from traditional or standard business practices that focus mainly on the economic viability of a computing solution. These focuses are similar to those of green chemistry; reduction of the use of hazardous materials such as lead at the manufacturing and recycling stages, maximized energy efficiency during the product's lifetime, and recyclables or biodegradability of both a defunct product and of any factory waste. In this paper we discuss green computing approach and give green computing solutions that will help for eco friendly environment.

Keywords : Green Computing, energy, green IT, **Microsoft,** business

I. INTRODUCTION

Green computing or **green IT**, refers to environmentally sustainable computing. 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 [3].

With increasing recognition that man-made greenhouse gas emissions are a major contributing factor to global warming, enterprises, governments, and society at large now have an important new agenda: tackling environmental issues and adopting environmentally sound practices. Greening our IT products, applications, services, and practices is both an economic and an environmental imperative, as well as our social responsibility.Therefore, a growing number of IT vendors and users are moving toward green IT and thereby assisting in building a green society and economy.

II. OBJECTIVES

"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.

III. ROADS TO GREEN COMPUTING

To comprehensively and effectively address the environmental impacts of computing/IT, we must adopt a holistic approach and make the entire IT lifecycle greener by addressing environmental sustainability along the following four complementary paths.

- **Green use** — reducing the energy consumption of computers and other information systems as well as using them in an environmentally sound manner
- **Green disposal** — refurbishing and reusing old computers and properly recycling unwanted computers and other electronic equipment
- **Green design** — designing energy-efficient and environmentally sound components, computers, servers, cooling equipment, and data centers
- **Green manufacturing** — manufacturing electronic components, computers, and other associated subsystems with minimal impact on the environment

IV. APPROACHES TO GREEN COMPUTING

A. *Algorithmic efficiency*

The efficiency of algorithms has an impact on the amount of computer resources required for any given computing function and there are many efficiency trade-offs in writing programs. As computers have become more numerous and the cost of hardware has declined relative to the cost of energy, the energy efficiency and environmental impact of computing systems and programs has received increased attention. A study by Alex Wissner-Gross, a physicist at

Harvard, estimated that the average Google search released 7 grams of carbon dioxide (CO2). However, Google disputes this figure, arguing instead that a typical search produces only 0.2 grams of CO2. Algorithms can also be used to route data to data centers where electricity is less expensive. MIT, Carnegie Mellon University, and Akamai project up to a 40 percent savings on energy costs [1].

B. 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. The concept originated with the IBM mainframe operating systems of the 1960s, but was commercialized for x86-compatible computers only in the 1990s. 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. Intel Corporation and AMD have also built proprietary virtualization enhancements to the x86 instruction set into each of their CPU product lines, in order to facilitate virtualized computing [1].

C. Terminal Servers

Terminal servers have also been used in green computing methods. When using terminal servers, users connect to a central server; all of the computing is done at the server level but the end user experiences the operating system [12]. These can be combined with thin clients, which use up to 1/8 the amount of energy of a normal workstation, resulting in a decrease of energy costs and consumption. There has been an increase in using terminal services with thin clients to create virtual labs. Examples of terminal server software include Terminal Services for Windows and the Linux Terminal Server Project (LTSP) for the Linux operating system [13].

D. Power management

Recently a computer activity and putting computers into power saving modes if they are idle. 1000 PC and more can be admisitered very easily resulting in energy consumption reduction of 40 - 80%. University of Berkeley has started an initiative using Auto Shutdown Manager and wireless power meters to measure energy consumption and reduction in real time. They are using a solution called Auto Shutdown Manager. http://www.itpowersaving.com [14].

E. 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 [15].

F. 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). Though most flash based drives are generally slower for writing than hard disks. in a recent case study Fusion-io, manufacturers of the world's fastest Solid State Storage devices, managed to reduce the carbon footprint and operating costs of MySpace data centers by 80% while increasing performance speeds beyond that which is was attainable by multiple hard disk drives in Raid 0. In response, MySpace was able to permanently retire several of their servers, including all heavy-load servers, further reducing their carbon footprint [18].

As hard drive prices have fallen, storage farms have tended to increase in capacity to make more data available online. This includes archival and backup data that would formerly have been saved on tape or other offline storage. The increase in online storage has increased power consumption. Reducing the power consumed by large storage arrays, while still providing the benefits of online storage, is a subject of ongoing research [19].

G. Video Card

A fast CPU 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.
- Select a GPU based on average wattage or performance per watt [1].

H. 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 [22].

V. OPERATING SYSTEM ISSUES

Microsoft has been heavily critizied 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 may have resulted in more energy waste than any other initiative by other vendors [23]. Microsoft claim to have improved this in Vista, though the claim is disputed. 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 organisations have been unable to improve this situation [24]. 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 [25][26].

A. Materials recycling

Recycling computing equipment can keep harmful materials such as lead, mercury, and hexavalent 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. The Silicon Valley Toxics Coalition estimates that 80% of the post-consumer e-waste collected for recycling is shipped abroad to countries such as China and Pakistan. Computing supplies, such as printer cartridges, paper, and batteries may be recycled as well [27[28][29] .

B. Telecommuting

Teleconferencing and telepresence technologies are often implemented in green computing initiatives. The advantages are many; increased worker satisfaction, reduction of greenhouse gas emissions related to travel, and increased profit margins as a result of lower overhead costs for office space, heat, lighting, etc. The savings are significant; the average annual energy consumption for U.S. office buildings is over 23 kilowatt hours per square foot, with heat, air conditioning and lighting accounting for 70% of all energy consumed [30]. Other related initiatives, such as hotelling, reduce the square footage per employee as workers reserve space only when they need it. Many types of jobs – sales, consulting, field service – integrate well with this technique. Voice over IP (VoIP) reduces the telephony wiring infrastructure by sharing the existing Ethernet copper. VoIP and phone extension mobility also made Hot desking and more practical [31] .

VI. CONCLUSION

Green Computing is not only desirable from the economic point of view but it is essential from environmental point of view.With the implementation of green computing practices like software,hardware,power mangement,material recycling,and telecommunication oragnization and government can help in reducing global warming. It is not only seen as an organizational and goverment responsibility but is also the responsibility that must be undertaken by all computer users. Home computer owners must also resort to green computing practices to make the environment more sustainable.

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