Pune Institute of Computer Technology
Dhankawadi, Pune

A AUDIT COURSE REPORT
ON

Green Computing

SUBMITTED BY

Megh Khaire
Roll No. 31229
TE - 02

Under the guidance of
Prof. S. P. Shintre

DEPARTMENT OF COMPUTER ENGINEERING
Academic Year 2019-20

DEPARTMENT OF COMPUTER ENGINEERING
Pune Institute of Computer Technology
Dhankawadi, Pune-43

CERTIFICATE

This is to certify that the Audit course report entitled

"Green Computing"

Submitted by

Megh Khaire   Roll No. 31229

has satisfactorily completed a Audit Course report under the guidance of Prof. S. P. Shintre towards the partial fulfillment of third year Computer Engineering Semester II, Academic Year 2019-20 of Savitribai Phule Pune University.

Prof. Prof. S. P. Shintre   Prof. M.S.Takalikar
Audit Course Guide   Head
                                        Department of Computer Engineering

Place: Pune
Date:

Contents

1   INTRODUCTION

Today we live in a digital era with very sophisticated digital devices such as computers and mobile phones forming part of our daily lives. These devices are amazing and have revolutionized how humans work, learn, make use of their free time, and communicate with each other. This radical transformation has been possible just in a few decades thanks to the combined efforts of scientists and engineers. However, as in any revolution in human history, we should ask ourselves were we ready for all these changes and are there any negative consequences that we should consider, these questions might bring some different ideas in your mind about the negative impact of these technological advancements, for instance, the security issues involved in handling our private data, ethical issues as an education so dominated by technology might not be the best way to raise children and in general the great dependence we have on these devices. Among these is an increasing concern associated with the total power consumption of computing devices and its implication for the environment. Which leads us to the topic of this report i.e. Green Computing. Green computing is computing done in an energy efficient manner. This report discusses the impact of computing on the environment and how this can be reduced by implementing the concept of green computing.

Green computing is the environmentally responsible and eco-friendly use of computers and their resources. In broader terms, it is also defined as the study of designing, engineering, manufacturing, using and disposing of computing devices in a way that reduces their environmental impact.

2   WHAT IS GREEN COMPUTING?

Green computing is an environmentally sustainable approach to managing information and communication technologies. It enables organizations to improve environmental stewardship by increasing energy efficiency, improving information management and providing appropriate analytical capability.

Green computing is the emerging practice of using computing and information technology resources more efficiently while maintaining or improving overall performance. 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 the recyclability or biodegradability of defunct products and factory waste.

Green computing aims to attain economic viability and improve the way computing devices are used. These Green IT practices include the development of environmentally sustainable production practices, energy-efficient computers and improved disposal and recycling procedures.

3   NEED OF GREEN COMPUTING

3.1   Power Consumption by Electronic Devices

The information technology revolution has been possible due to the miniaturization of integrated circuits. Integrated circuits are electronic circuits, which are used as chips in processing devices, They are called integrated because the electronic components such as transistors, which are used in these devices are directly fabricated on the silicon chip. Consequently, these circuits can be extremely small in size with billions of them occupying a very small area, which has led to the design of some really light but powerful devices. However, a higher processing power implies a larger power consumption, even though these high processing power devices such as mobile phones and computers consume less energy than many home appliances their number is increasing rapidly throughout the world, owing to our endless hunger for technology.

3.2   Power Consumption by Big Data Centers

Big data centers such as Google, Facebook, etc deal with a huge amount of information coming from the internet and social media platforms. Thousands and thousands of computing units in these data centers create a lot of heat. Hence, these data centers are normally located in cold areas of the planet and require gigantic cooling infrastructures. In fact, according to some sources, if we imagine the power consumed by all data centers to be that of a single country, this country would be the fifth-largest energy-consuming country in the world and this is a frightening figure that is just going to get worse. It is therefore of vital importance to create new, greener technologies.

3.3   Toxic waste generated by Electronic Devices

Disposing of computers and their resources produces a lot of hazardous waste that damages our environment. It also releases poisonous heavy metal like lead, mercury, cadmium into the atmosphere. The manufacturing of computer products relies heavily on the use of toxic chemicals for electrical insulation, soldering, and fire production. Long term exposure to such toxic chemical fumes can result in significant health problems.

4 Different Approaches to achieve Green Computing

4.1 Virtualization

Computer virtualization is 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. One of the primary goals of almost all forms of virtualization is making the most efficient use of available system resources.

4.2 Power Management

Lower power consumption also means lower heat dissipation, which increases system stability, and less energy use, which saves money and reduces the impact on the environment. Power management is required for prolonging battery life for portable and embedded systems,and to reduce cooling requirements and noise. Data centers can potentially improve their energy and space efficiency through techniques such as storage consolidation and virtualization.

4.3 Power Supply

Power supplies in most computers aren't designed for energy efficiency. In fact, most computers drain more power than they need during normal operation, leading to higher electrical bills and a more dire environmental impact. But with advancements in technology energy efficient computer systems are being developed, which will reduce the consumption of power. Minimizing the electricity consumption of computers and their peripheral devices and using them in an eco-friendly manner will help reduce the environmental impacts caused by computers. Using laptops, which require less energy, instead of personal computers can be also considered as an alternative approach to save energy.

4.4 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. 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. Cloud storage is a rapidly emerging trend which might provide a solution to this persistent problem of data storage. Cloud computing addresses two major ICT challenges related to Green computing – energy usage and resource consumption. Virtualization, Dynamic provisioning environment, multi-tenancy, green data center approaches are enabling cloud computing to lower

carbon emissions and energy usage up to a great extent. Large enterprises and small businesses can reduce their direct energy consumption and carbon emissions by up to 30% and 90% respectively by moving certain on-premises applications into the cloud.

4.5   Algorithmic Efficiency and Resource Allocation

The efficiency of algorithms affects the amount of computer resources required for any given computing function and there are many efficiency trade-offs in writing programs. Algorithm changes, such as switching from a slow (e.g. linear) search algorithm to a fast (e.g. hashed or indexed) search algorithm can reduce resource usage for a given task from substantial to close to zero.

Algorithms can also be used to route data to data centers where electricity is less expensive. Researchers from MIT, Carnegie Mellon University, and Akamai have tested an energy allocation algorithm that successfully routes traffic to the location with the cheapest energy costs. The researchers project up to a 40 percent savings on energy costs if their proposed algorithm were to be deployed. However, this approach does not actually reduce the amount of energy being used; it reduces only the cost to the company using it. Nonetheless, a similar strategy could be used to direct traffic to rely on energy that is produced in a more environmentally friendly or efficient way. A similar approach has also been used to cut energy usage by routing traffic away from data centers experiencing warm weather; this allows computers to be shut down to avoid using air conditioning. Larger server centers are sometimes located where energy and land are inexpensive and readily available. Local availability of renewable energy, climate that allows outside air to be used for cooling, or locating them where the heat they produce may be used for other purposes could be factors in green siting decisions.

4.6   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 (LED) in place of the fluorescent bulb, which reduces the amount of electricity used by the display. Light on dark color schemes, also called dark mode, is a color scheme that requires less energy to display on new display technologies, such as OLED. This positively impacts battery life and energy consumption. While an OLED will consume around 40% of the power of an LCD displaying an image that is primarily black, it can use more than three times as much power to display an image with a white background, such as a document or web site. This can lead to reduced battery life and energy usage, unless a light-on-dark color scheme is used.

4.7   Materials Recycling

Computer recycling refers to recycling or reuse of a computer or electronic waste. 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 out of landfills. Obsolete computers are a valuable source for secondary raw materials, if treated properly, However if not treated properly they are a major source of toxins and carcinogens.

Computing supplies, such as printer cartridges, paper, and batteries may be recycled as well.

5 Our approach towards Green Computing

Government regulation, however well-intentioned, is only part of an overall green computing philosophy. The work habits of computer users and businesses can be modified to minimize adverse impact on the global environment. Here are some steps that can be taken:

- Power-down the CPU and all peripherals during extended periods of inactivity.

- Try to do computer-related tasks during contiguous, intensive blocks of time, leaving hardware off at other times.

- Power-up and power-down energy-intensive peripherals such as laser printers according to need.

- Use liquid-crystal-display (LCD) monitors rather than cathode-ray-tube (CRT) monitors.

- Use notebook computers rather than desktop computers whenever possible.

- Use the power-management features to turn off hard drives and displays after several minutes of inactivity.

- Minimize the use of paper and properly recycle waste paper.

- Dispose of e-waste according to federal, state and local regulations.

- Employ alternative energy sources for computing workstations, servers, networks and data centers.

6 Advantages and Disadvantages

6.1 Advantages of Green Computing

- Reduced energy usage from green computing techniques translates into lower carbon dioxide emissions, stemming from a reduction in the fossil fuel used in power plants and transportation.

- Conserving resources means less energy is required to produce, use, and dispose of products.

- Saving energy and resources saves money.

- Green computing even includes changing government policy to encourage recycling and lowering energy use by individuals and businesses.

- Reduce the risk existing in the laptops such as chemical known to cause cancer,nerve damage and immune reactions in humans.

- System Wide Green Computing and Individual Green Computing is the best possible way to practice Green Computing. Companies implementing System Wide Green Computing and employees and individuals practicing individual green computing techniques help in along way in creating an impact to save the planet.

- Life expectancy of computing devices can increase and can lower the energy costs. Decreased vitality use from green figuring systems converts into bringing down carbon dioxide discharges, coming from a decrease in the non-renewable energy source utilized in control plants and transportation.

6.2 Disadvantages of Green Computing

- It can be quite expensive.

- Green computers may not be easily available.

- Some users may have high processing needs, which requires them to opt for high powered computers. need them to do.

7 CONCLUSION

The objective of this audit course was to study the impact of electronic devices on the environment and adopt a Green Computing strategy as a weapon to counter these environmental impacts. The fact that with Green Computing we are getting closer to having in our hand's devices that are based on circuits that are greener and having innovative functionalities is exciting. This Green Computing initiative will aid in bettering these devices to be less dependent on energy sources thereby becoming less of a concern for the environment of the planet. To achieve this, I would like to plead for a society that is aware of the challenges of the future, a society that supports research and innovation to advance and overcome these challenges, and that makes responsible use of technology so that the future generations can enjoy a new and greener technological world.