

Green Computing

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Abstract- *With the fast growing technology the need for computers is being increasing in every field. Increase in amount of electricity consumes the carbon content in the atmosphere. To overcome this, people are trying to minimize the carbon footprint and minimum usage of energy using Green computing. The main focus attention of this paper is to study how to perform the jobs without any deviation by minimizing the power consumption of each functional unit effectively.*

Keywords- *Green Computing, Techno trash, Virtualization, Cloud Computing, Power Management.*

I. INTRODUCTION

Technology is growing tremendously; the big challenge is how to minimize the power consumption and thereby reducing the carbon content in the atmosphere.

Green computing is eco-friendly use of computers and their resources, the implementation of energy-efficient central processing units (CPUs), servers and peripherals reduced resource consumption.

The goal of green computing is to reduce the use of hazardous materials, maximize energy efficiency during the product's lifetime, and promote recyclability.[2]

- Waste - Manufacturing technology creates large amounts of waste and used computers and electronics get thrown out when they break or become outdated Called "technotrash," this techno trash contains all sorts of hazardous materials that are very unsafe for the environment.
- Disrupting ecology - Clearing land where animals used to live ,to build factories and allowing pollution to biodegradability of defunct products and factory waste.

A voluntary labeling program was designed by U.S. Environmental Protection Agency

In 1992 to promote and recognize energy-efficiency in monitors, climate control equipment, and other technologies.

The term "green computing" was probably coined shortly after the Energy Star program began; there are several USENET posts dating back to 1992 which use the term in this manner.

II. PROBLEMS BEING FACED WITHOUT GREEN COMPUTING

The problems are being faced by the increase in technology to our environment are:[8]

- Pollution - Air, water, heat and noise pollution can all be caused by producing and using technology
- Consuming resources - Non-renewable resources such as coal, are used to generate the electricity for technology. contaminate the food chain can greatly affect the environment's natural cycles.
- Health hazards - Using toxic materials that can harm our health can cause cancer and technology addiction can lead to other health problems like obesity and carpal tunnel syndrome.[4]
- Carbon emissions: carbon dioxide and carbon monoxide are greenhouse gasses that are produced by people. These greenhouse gasses trap in the atmosphere and reflect heat and radiation back to the planet's surface, which leads to Global warming.

III. NEED OF GREEN COMPUTING

Due to immense applications of computers it has become the basic need for every human, but the use of computer also increase power usage and also generate a greater amount of heat. More power consumption and greater heat generation means greater emission of greenhouse gases like Carbon Dioxide(CO₂) that has various harmful impacts on our environment and natural resources. This is because we are not aware about the harmful impactsof the use of computer on environment. Personal computers and data centers consume a lot of

energy which use various old techniques and they don't have sufficient cooling systems. Resultant is the polluted environment. [7]

IV. MANY DIFFERENT TECHNOLOGIES ARE BEING ADOPTED FOR SAFE COMPUTING AND ECO-FRIENDLY

In 2011, green computing was introduced VIA Technologies, that manufacture motherboard chipsets, CPU's and other computer hardware, by focusing on power efficiency.[3]

1. Carbon Free Computing- Increase in (CO₂), Methane, Nitrous oxide are responsible for earth increasing temperature which leads to global warming, severe floods and droughts, affecting both life and economy. So to control this, VIA technologies aims to offer world first "PC" products certified carbon free.
2. Solar Computing- The VIA technologies partnered with Mo-tech industries to develop fully solar power devices that are non-polluting, silent and highly reliable.
3. Energy Efficient Computing- In 2005, the company introduced the VIA C7-5 and Via C7 processors that have a maximum power consumption. These energy-efficient processors produce over four times less carbon and can be efficiently embedded in solar power devices.

V. SOME TERMS IN DESIGNING ENERGY EFFICIENT SOFTWARE

In this section we will be discussing some important terms which are important in software engineering. These terms are often used while calculating the energy efficiency in performing a specific job.[1]

- (a) Joule – It is the international standard unit of energy measurement.
- (b) Energy – Energy is defined as the capacity to do work. A device may be called energy efficient provided it requires less energy than a device which takes more energy and less energy efficient.
- (c) Power – It is defined as the amount of energy consumed per unit of time, typically measured in Watts, where one watt equals 1 Joule per second.
- (d) Heat – Heat may be looked upon as form of energy whose absorption makes a body hot and abstraction

makes a body cold. The engineers try to minimize this in computer design as too much heat means more cooling is required (typically by a fan) which requires more energy. So the Hardware and Software should be designed in such a way that the heat generation is minimized.

VI. FUTURE TRENDS

Great challenge for IT industry is growing computing needs, energy cost and global warming. So the future of Green Computing is going to be based on efficiency, rather than reduction in consumption.[9]

The primary focus of Green IT is in the organization's self interest in energy cost reduction, at Data Centers and at desktops, and the result of which is the corresponding reduction in carbon generation. The secondary focus of Green IT needs to focus beyond energy use in the Data Center and the focus should be on innovation and improving alignment with overall corporate social responsibility efforts. This secondary focus will demand the development of Green Computing strategies. There are few efforts, which all enterprises are supposed to take care of:

A. Certifications

There are several organizations providing certificates to green technology. Certificates are provided based on their product quality, material, life of the product and recycling capabilities. In future such certifications together with recommendations and government regulations will put more pressure on vendors to use green technology and reduce impact on environment.

B. Cloud Computing

Cloud Computing is receiving significant attention in Information and Communication Technology services by improving the utilization of Data Center resources. The principle of cloud computing is to provide energy-efficient technology by saving energy, which leads to better utilization of resources.

[5] The National Institute of Standards and Technology (NIST) defines cloud computing as a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction

[6] The NIST describes five essential characteristics, three service models and four deployment models.

Five Essential Characteristics are:

- On-demand self service – Users are able to provision, monitor and manage computing resources as needed

without the help of human administrators □ Broad network access – Computing services are delivered over standard networks and heterogeneous devices

□ Rapid elasticity – IT resources are able to scale out and in quickly and on an as needed basis

□ Resource pooling – IT resources are shared across multiple applications and tenants in a non-dedicated manner

□ Measured service – IT resource utilization is tracked for each application and tenant, typically for public cloud billing or private cloud chargeback.

C. Power Management Tools

Power management is proving to be one of the most valuable and clear-cut techniques in near future to decrease energy consumption. IT departments with focus on saving energy can decrease use with a centralized power management tool. [10]

D. Applications

Green Computing is a diverse field and due to its nature and priority from all fields of life Green Computing has applications in every sector of computing as the goal is to save the environment and ultimately the life. The current main applications of Green Computing are covering following computing sectors:

- **Equipment design:** using green computing the electronic components, computers, and other associated subsystems are designed with the minimal impact on the environment.
- **Equipment recycling:** The main problem of growing e-waste is recycling raw material from end-of-life electronics. recycling reduces the amount of greenhouse gas emissions caused by the manufacturing of new products.
- **Virtualization:** Computer virtualization is the process of running two or more computer systems on one set of physical hardware. The primary goal of virtualization is making the most efficient use of available system resources.
- **Power Management:** Power management for computer systems are desired for many reasons like :
 - Prolong battery life for portable and embedded systems.
 - Reduce cooling requirements.
 - Reduce noise.
 - Reduce operating costs for energy.
 - 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.

VII. CONCLUSION

Green Computing is not only a new trend; it is a technology to become environmentally friendly. Many new and improved ways of using green technology seem to appear every day. So Green computing is the key requirement to protect environment and save energy along with operational expenses in today's increasingly competitive world. Adopting a holistic approach to greening IT is our responsibility towards creating a ecofriendly and sustainable environment.

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