National Conference on Recent Advances in Computer Science and IT (NCRACIT)
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
© 2018 IJSRCSEIT | Volume 4 | Issue 1 | ISSN : 2456-3307

Green Computing – Trends and Challenges

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ABSTRACT

Green computing is the environmentally responsible use of computers and related resources. It is the study of efficient and eco-friendly computing. The rationale behind energy efficient coding is to save power by getting software to make less use of the hardware, rather than continuing to run the same code on hardware that uses less power. The concept of green computing has begun to spread in the past few years, gaining increasing popularity. IT industry is putting efforts in all its sectors to achieve Green Computing. The study emphasis on current trends, challenges and the future trends of Green Computing. The main aim of green computing is to lessen down the use of hazardous materials, maximize energy efficiency and biodegradability or recyclability of out-dated products and factory waste of the computer factory. The major concern of present scenario is to prepare such equipments by which efficient energy can be utilized, to minimize e-waste and use of non toxic materials in preparation of e-equipments. We can implement green computing in computer's fields as CPU servers and other peripheral devices (mobile devices). It has been seen that computers and other electronics devices are increasing day by day, so the amount of electricity consumed by them is also increasing. In this way the percentage of co2 in the atmosphere is also increasing. The other toxic materials which are used in electronics industry are also harmful for environment. Equipment Recycling, reduction of paper usage, virtualization, cloud computing, power management, Green manufacturing are the major initiatives towards Green computing.

Keywords : Green Computing, Energy, Electronic Devices, IT, Cloud Computing

I. INTRODUCTION

Green Computing is a process of reutilizing and rebuilding of computers and electronic devices for overall analysis. The goal of green computing is to reduce the dangerous material and increasing the utilization of energy. It implies to practices and ways of utilizing computing resources in an eco friendly way while maintaining overall computing. Green Computing is also referred to as Green IT that refers to the computer, information system and IT applications and predominant strategy to help save and enrich an environment. It is also the way of using computing and IT tools efficiently in an educated environment it is our basic responsibility to protect the environment and conserve energy cost in next generation computing requirements. Green computing or Green IT is the analysis and practice of eco friendly sustainable computing or IT. It is important in IT systems although it presents problems to system designers. Therefore, the designers need to find solutions to reduce the energy consumption during the system design. According to San Murugesan 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. Green computing is the practice of using computing resources efficiently. It is the utmost requirement to protect environment and save energy along with operational expenses in today's increasingly competitive world. Green computing is very much related to other similar movements like reducing the use of environmentally hazardous materials like CFC's promoting the use of recyclable materials, minimizing use of non-biodegradable components, and encouraging use of sustainable resources. The need of green computing is to minimize the use of not so eco friendly equipment, maximizing energy efficiency, and to reutilize computing devices and IT garbage. The main aim of green computing is to reduce toxic materials. Today it is the major issue to prepare such equipments by which we achieve efficient energy and to minimize of e-waste and use of non toxic chemicals and materials in preparation of e-equipments. We can implement green computing in computer's fields as CPU servers and other peripheral devices such as mobile devices. It has been seen that computers and other electronics devices are increasing day by day, so the amount of electricity consumed by them is also increasing and the percentage of CO_2 in the atmosphere is also increasing. The other toxic materials which are used in computer and electronic industry are also harmful for environment. Thus, green IT includes the scope of environmental eco friendly sustainability, the economics of conserving energy, and the total cost of possessing it, which includes the cost of efficiently disposing and reutilizing. It is the study and practice of using computing resources efficiently. The huge amount of computing manufactured worldwide has a direct impact on environment issues, and scientists are conducting numerous studies in order to reduce the negative impact of computing technology on our natural resources. Green technology is gaining more and more public attention through the work of environmental organizations and government initiatives. 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.

II. CURRENT TRENDS IN GREEN COMPUTING

Green Computing refers to the study of designing, engineering, proper usage and disposal of computing devices in such a way that it reduces their impact on the environment.

1. Energy Consumption

According to environmental protection agency around 30% to 40% of computers are kept ON during the weekends and even after office hours and around 90% of these computers remain idle. If we develop any application in green computing environment it will use optimal physical resources. Climate Savers Computing Initiative (CSCI) is an effort to reduce the electric power consumption of PC's in active and inactive states. Another technique is energy efficient coding which means reducing the software usage of the hardware. More efficient algorithm will lead to reduce the number of resources needed to complete a certain computing function.

2. E-Waste Recycling

Many developed countries are stronger in technology hence a huge amount of computer systems and related products are discarded every day. These products are sold out to other developing countries. The recycling trend in green computing tends to keep computing equipment materials like lead and mercury out of landfills and reusing old computer parts to repair or upgrade other computer systems will save energy, reducing the generation of E-waste affecting the environment.

3. Virtualization

The major trend in green computing nowadays is 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, which reduces power and consume less electricity. Many companies and open-source projects now offer software packages to enable a transition to virtual computing.

4. Cloud Computing

Businesses are rapidly moving from traditional system to cloud based system because of its faster scale-up/scale-down capacity, pay-per-use and access to cloud-based services without buying and managing on-premises infrastructure. The pay-per-use facility of cloud infrastructure provides energy and resource efficiencies and promote users to consume only those resources which are essential.

5. Developing a Green Machine

Power management feature in computer system saves energy and money. To make the computer environment friendly, SLEEP and HIBERNATE settings can be used. These functions can be activated either manually or by power management settings of operating system.

6. IT product and Eco-Labeling

An additional trend toward green computing is the "eco-label" which has been supported by several organizations around the world. These eco-labels are given by organizations to IT products based on several factors aiming to save the environment. It also includes the ability of recycling the system, noise energy consumption etc.

7. Modularity

It increases the flexibility of the companies which are planning to develop data centers are now eager to take better modular approach, adding applications and individual components as further requirement. It not only decreases the capital outlay, but it also increases the flexibility which further helps to prevent inefficiencies.

III. CHALLENGES IN GREEN COMPUTING

According to researchers in the past the focus was on computing efficiency and cost associated to IT equipments and infrastructure services were considered low cost and available. Now infrastructure is becoming the bottleneck in IT environments and the reason for this shift is due to growing computing needs, energy cost and global warming. This shift is a great challenge for IT industry. Following are some of the Challenges that Green computing is facing today.

1. Return of Investment

The major problem was educating the stakeholders regarding the environmental impact of computers. For a project that involves Greening, the returns are generally seen after a long period of time. Hence an important challenge in this project was to show immediate returns after the successful implementation of Green IT in the computer center.

2. New Optimization Techniques in Performance-Energy-Temperature aware Computing

The exponential growth in computing activity and the rising concern for energy conservation have made energy efficiency in computers a technological issue of prime importance. The tradeoff between Performance-Energy-Temperature has to be made so that the maximum benefits can be achieved. Designing techniques that are optimal with respect to performance, energy, and temperature are of utmost requirement as far as green computing research challenges are concerned.

3. Disposal of Electronic Wastes

Reliability about the use of green materials in computer is perhaps the biggest challenge that the electronics industry is facing. Electronics giants are about to roll out eco-friendly range of computers that aim at reducing the e-waste in the environment. They are likely to be free of hazardous materials such as brominates flame-retardants, PVCs and heavy

metals such as lead, cadmium and mercury, which are commonly used in computer manufacturing.

4. Perspective with respect to Indian Scenario

In India, the implement-ability of principle of "Green Computing" is facing a dilemma due to many socio-economic matters and those are linked to be soughed out to pull India in the mainstream movement of "Green Computing". Lack of basic research initiative and congenial infrastructure has resulted in absence of good patents and commercial production of indigenously built equipments.

5. Power Consuming

Leaderships in the field are trying to find a generation of IC chips that have high efficiency and give higher performances without consuming too much power but this is not a simple process, it takes a huge effort, amount of a lot of time, and needs high levels of skilled engineers to reach and achieve this goal.

6. Increase in energy requirements

Some people need or prefer to use high processors to achieve their tasks. However, these requirements need a great amount of power with the green computers with the same specifications considered extremely expensive.

IV. CONCLUSION

Green computing is not about going out and designing biodegradable packaging for products. Now the time has come to think about the efficient use of computers and the resources which are non renewable. It opens a new window for the new entrepreneur for harvesting with E-waste material and scrap computers. There is an alternative way to design a processor and a system such that we don't increase demands on the environment, but still provide an increased amount of processing capability to customers to satisfy their business needs. This research paper shows the importance, challenges and the need of Green computing. IT industry is putting efforts in all its sectors to achieve Green computing. Equipment recycling, reduction of paper usage, virtualization, cloud computing, power management, Green manufacturing are the key initiatives towards Green computing. To achieve eco-friendly technologies organizations and researchers are making efficient efforts. Power management techniques, virtualization, improved repair, re-use, recycling and disposal, data center consolidation and optimization, and IT product and eco-labeling are the approaches that have been taken so far by the organizations towards green computing.

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