

Green Computing Technology: Challenges & Trends

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Abstract— Green computing technology is the environment sustainable technology to use of computers and its related resources such as networking and communication systems for effectively with minimal impact of environment. Computer and IT industry in past few years have realized the importance of going green, both in terms of minimize cost and environmental issues. Because of green computing provides an effective approach to protect the environment from risky materials.

The prominence of this overview is present on the need and importance of green computing. Here several challenges and issues of green computing are also discussed to afford the main importance of green computing requirements in today world.

Key Words: Green computing, Energy cost, Environmental issues, Minimal impact.

1.INTRODUCTION

With the improvement of computer technologies and IT services computing technologies have certainly made a big impact. So the developments of computing services increases the efficiency of computers and other its applications (7). As long as computer running it needs a large amount of power which also provides heat and other electricity problems. This is the main problem due to the upgrading services. Recently the Organization for Economic Co-operation and Development urbanized different initiatives for reducing the power consumption of both computing and networking devices (7). This technology simply known's green computing. The term green computing is the study and practices of computing lifecycle process. It includes design manufacturing, use of equipments and safely disposing the unwanted expiry materials. The main aim of green

computing technology is to preserving our planet and improving the computing performance and reducing the energy consumption & carbon footprints (2).

Green computing refers to the art of utilizing computing resources in an efficient and eco-friendly sustainable manner. It encompasses a broad range of subjects from new energy generation techniques to the study of advanced materials to be used in our daily life. Basically it focuses on reducing the environment force of industrial processes and innovative technologies caused by the earth growing population. Which means green technology creates fully recyclable products, reducing pollution to develop the benefit to the environment (4).

The rest of the paper is structure as follows, section 1 provide the basic information and importance of green computing technology. Section 2 embraces the various existing papers which are based on green computing solutions. It is followed by section 3 includes the history and challenges about green computing technology. The next section 4 contains the need and importance of the green computing in recent situations on IT industry and others. Finally section 5 brings to a close with

conclusion of the Green computing technology with its entire benefits.

2.RELATED WORK

In 2014, Shalabh Agarwal, Arnab Datta et al. (9) presents a paper which have made a systematic study of several strategies, approaches and practices of green and energy efficient computing, in context to the growth and impact of the IT industry on environment in the recent years. The plans towards a greener IT-industry should include new electronic products and services with optimum efficiency and all possible options solutions towards energy savings. The features of a green computer of tomorrow would be like: efficiency, manufacturing & materials, recyclability, service model, self-powering, and other trends. The authors discussed, Green computer will be one of the major contributions which will break down the 'digital divide', the electronic gulf that separates the information rich from the information poor.

In 2014, Gaurav Jindal and Manisha Gupta (3) discussed the connotation of green computing and sketch researcher's view on the next generation of IT systems for green computing. Subsequently, this

paper helps to identify key issues relevant to green computing and evaluate different approaches to these problems. Finally the authors point out future directions of research and conclude the paper. As more and more companies include some form of reporting on their goals and achievements in the area of CSR, there is a growing awareness among business leaders that greening their IT practices offers the —double-win of reducing costs while demonstrating a positive environmental commitment. Use mobile phones for your computing needs whenever and wherever possible.

In 2013, Aditya Harbla et al. (1) discussed several research challenges about future computing technologies. The author says the green computing initiatives under way in the IT industry and the new developments to meet green computing requirements. Green computing will be the driving force of future computing. New computing innovations and applications need to fulfill the green computing requirements for the sustainable development of Information and communication technology (ICT). Every research challenge carries a future prospect for employing efficient computing in different areas. They state some

future ideas to analyze better understanding and further challenges on green computing technology.

In 2012, Tariq Rahim Soomro and Muhammad Sarwar (11) present a study to provide a brief discussion of green computing. The author gives a study on current trends in Green Computing; challenges in the field of Green Computing and the future trends of Green Computing. Current challenges to achieve Green Computing are enormous and the impact is on computing performance. Efforts of Governments and Non-Government Organizations (NGOs) are also appreciate-able. Government regulations are pushing Vendors to act green; behave green; do green; go green; think green; use green and no doubt to reduce energy consumptions as well. All these efforts are still in limited areas and currently efforts are mainly to reduce energy consumption, e-Waste but the future of Green Computing will be depending on efficiency and Green products.

3.GREEN COMPUTING TECHNOLOGIES

3.1 History of Green Computing



U.S Environmental Protection Agency launched a voluntary labeling program which is designed to promote and recognize energy efficiency in monitors, climate control equipment and other technologies in 1992 (4). The term green computing was probably created shortly after this labeling program. When a system is completely stopping their working, it is necessary to know how it will be disposal. 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. This considers the social responsibility, economic viability and the impact of the environment (5).

Green computing is an emerging concept towards reducing hazardous material and to save our environment from harmful impacts of the use of computers and other electronic products. Green Computing is concerned with the manufacturing, using and disposing of computers with no impact on environment. Green computing aims to reduce the carbon footprint generated by the Information Systems Business while allowing them to save money (4). The green-Computing, as defined in the

Official Journal of the French Republic on July 12, 2009, the ESTs of information and communication for short eco-ICT, are information technology and communication which design or use can reduce the negative effects of human activity on the environment. Today there is a great need to implement the concept of Green computing to save our environment. Use of computer plays a big role in environment pollution. About 60-70 percent energy is consumed by computers which are not in use but still turned on and that consumed energy is the main reason of CO₂ emission. So now there is a big need to guide a common people for saving of electricity by their own efforts and save environment (10).

3.2 Challenges and issues in green computing

Now a day's infrastructure from IT industry is becoming the bottleneck situation to growing the need of computers. So this is the main challenge in IT industry to develop large number of systems in computers (6). Therefore a new computing system is needed to engage the growing of computer needs. Therefore now researchers are focusing on the cooling system, power and data center space. At one extreme it is the processing power that is important to business and on the other extreme it is

the drive, challenge of environment friendly system, and infrastructure limitations. Green Computing challenges are not only for IT equipments users but also for the IT equipments Vendors. Several major vendors have made considerable progress in this area.

The extraordinary growth in computing technology is rapidly increasing the consumption of precious natural resources like coal and other resources (5). The needed of these types of resources is alarming danger of energy shortage. The designing techniques of the computing technologies made the respect to performance, energy and temperature for the utmost requirements. This is one of the main research challenge in cloud computing. Full equipment life cycle is also the research challenge which is the main area for green maturity model with energy reduction. Data center cooling is a major issue as far as power consumption is concerned. Data centers are backbone of any computing organization and must be reliable and available at every point of time. Measuring the data center effectiveness and maintaining the baseline is an issue. Green software movement has become a research subject for most of the software developers companies because of need for

sustainable development. Most of the research has been done on the characterization, metrics and technical answer for green software, but few have addressed green software from the business perspective (3). The above issues are the challenging research issues in green computing.

4.IMPORTANCE OF GREEN COMPUTING TECHNOLOGY

Today almost all streams weather its IT, medicine, transportation, agriculture uses machines which indirectly requires large amount of power and money for its effective functioning. Green computing is the main method to 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 (8).

Global warming and the problem of minimizing environmental impact from fossil-fuel emissions have raised to the top of global public policy agenda. As a result, businesses and consumers alike have started to embrace environmentally sustainable products that offer low-carbon solutions that can not only reduce their global

greenhouse gas (GHG) emissions, but can do so by more efficient energy consumption and lower costs.

The benefits and importance of Green computing technology is as follows,

- When the user used ENERGY STAR qualified products, it helps energy conservation.
- Donating all old computers and other peripherals to other needed peoples can reduce the rate of e-waste creation. This will be helps to those who cannot buy a system.
- Proper disposal of expired computers and its accessories will be reducing the environmental pollution.
- The manufacturing of disks and boxes needed for video games takes up a lot of resources. Video game manufacturers can offer their games online for download, leading to reduction in e-waste. This move can cut down on the transportation/shipping cost.
- Use of 'Local Cooling' software can help in monitoring and thereby, bringing down the

energy consumed by your computer. This 'Windows' program makes adjustments to the power options of your computer and helps minimize energy consumption.

- Use eco-friendly sources of energy
- Reduce harmful effects of computing resources

5.CONCLUSION

Green computing is the utmost requirement to protect environment and save energy along with operational expenses in today's increasingly competitive world. This solution benefits for all peoples and planet to reduce the developing sector. In this paper it was summarized the major researches of green computing deals with the power management techniques that can be simply helpful to save electricity power when we are using computers, capacity planning, reducing e-waste, data caching and flash disks, and green computing in data centers. This paper also contains the need and importance of the green computing technology in today's complicated world. With the help of this paper the need of Green computing, its challenges and the trends are easily identified to use the green

computing technology for provide the healthy environment.

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