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GREEN COMPUTING AND INITIATIVES FOR ENVIRONMENTAL ISSUES

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Abstract— During recent years, attention in ‘Green Computing’ has moved research into energy-saving techniques for home computers to enterprise systems ‘Clients and Server machines. It is needed to find a way to handle computers and its devices for save the environment and society from such E-hazards. This study provides a brief account of Green Computing. The emphasis of this study is on current trends in Green Computing; challenges in the field of Green Computing and the future trends of Green computing. Since, it is a qualitative research; the researcher used individual interviews and observations to collect relevant information to fulfill this research .IT 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.

Keywords: Energy Star, Environment, Green Computing, Recycle, Sustainable, Energy cost, data centre

I. INTRODUCTION

The field of "green technology" encompasses a broad range of subjects — from new energy-generation techniques to the study of advanced materials to be used in our daily life. The focus of Green Computing is to reduce the impact of industrial processes and innovative technologies caused by the Earth's growing population. The Increasing progress Regarding the research and development of future network technologies in recent years, such as network virtualization and software defined networking, automatic management, information centric

networking (ICN), cloud networking, automatic management, and open connectivity. There is direct impact on environment issues by the huge amount of computing manufactured worldwide, and scientists are conducting numerous studies in order to reduce the negative impact of computing technology on our natural resources.

A central point of research is testing and applying alternative nonhazardous materials in the products' manufacturing process.

II. HISTORY OF GREEN COMPUTING

In 1992, the U.S. Environmental Protection Agency launched Energy Star, This is a voluntary labeling program whose main aim was to promote and recognize energy-efficiency in monitors, climate control equipment, and other technologies. The conclusion was that it resulted in widespread adoption of sleep mode among consumer electronics. For a PC disposal, we should have enough knowledge which will be needed in order to be involved in green computing. Basically, the whole idea green computing came about quite a few years back when the news came that the environment was not a renewable resource really .The people started realizing that they had to do their part to protect the environment. Basically, the efficient use of computers and computing is what green computing is all about. What is important is the triple bottom line because when it comes to anything green and the same goes for green computing. This considers social responsibility, economic viability and the impact on the environment. Many businesses simply focus on a bottom line, rather than a green triple bottom line, of economic viability when it comes to computers. The idea is to make the whole process surrounding computers friendlier to the environment, economy, and society. This means that the manufacturers should create computers in a way that reflects the triple bottom line positively. Once computers are sold by them the businesses or people use them in a green way by reducing power usage and disposing of them properly or recycling them. The idea is to make computers from beginning to end a green product.

III. GREEN COMPUTING

Sustainable Information Technology and is increasing at a rapid rate in past few years and has been a major focus for IT organization. The target area of first wave of sustainable IT initiatives has been on strategies to increase data Centre efficiency. So power and work distribution, thermal management, product design, virtualization and cloud computing have assumed primacy in terms of both strategic and tactical focus. The second wave of sustainable IT services is nascent and much more difficult to define and implement. Green computing is the practice of using computing and IT resources proficiently.

As a human being it is our prime responsibility and duty to protect the environment and save energy cost and use efficient resources in today's increasingly computing requirements. The analysis and practice of environmentally sustainable computing or It is called as **Green computing** or **Green IT**.

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 [6]. The main aim of green computing is to diminish and to reduce the use of harmful equipment, increasing energy efficiency, and to promote the reusability of computing devices and IT waste. Green computing provides hope and practical strategies for the future. Thus, green IT includes the scope of environmental sustainability, the economics of energy efficiency, and the total cost of possession, which includes the cost of disposal and recycling. It is the study and practice of using computing resources efficiently (7). Some of the major characteristics of green IT includes consolidation, and cloud computing (8). IT companies can merge different areas to save on hardware, to respond to merge security threats, and to conserve energy by reducing power usage and cooling requirements

Green IT can be reached through reduction of energy consumption and waste. We have availability of Energy management and emissions tracking software's. What the IT buys – from computer equipment to paper – directly has great impacts on how green IT is and how green its suppliers are. If an IT organization only purchases technologies with Energy Star, EPEAT, and other energy efficiency ratings, it will help in reduction of energy consumption and greenhouse gas footprint, and it will help drive technology manufacturers to develop products that earn energy efficiency ratings. The matter of fact is, a green IT function needs a waste management program.

IV. Green Initiatives In Information Technology

In 1992, when the U.S. Environmental Protection Agency (EPA) launched Energy Star, it was a controlled labeling program that is planned to promote and recognize energy-efficiency in monitors, climate control equipment, and other technologies. This resulted in the widespread adoption of sleep mode among consumer electronics. Concurrently, the Swedish organization TCO Development launched the TCO Certification program to promote low magnetic and electrical emissions from CRT-based computer displays; this program was later expanded to include criteria on energy usage, ergonomics, and the use of hazardous materials in construction. With time IT industry has taken many initiatives towards green ICT (Information and Communication Technologies). The remarkable green initiatives in IT are:

1) Improved Methods For Data Center Cooling: Improving the data center cooling configuration, eliminating considerable amount of energy leaks are used for achieving this. The result of this is efficient data centers by following leading practices in data center layout and rack and server arrangements. Effective approaches include raised floors to improve airflow, moving cooling systems closer to servers to concentrate cold air in the right place, alternating hot and cool server passageway to improve airflow and using water-based air conditioning systems [9].

2) Use of Virtualization for Effective Server Usage: most of the IT companies use server farms or data centers, dedicated to a specific task. These data servers must be used very efficiently and carefully. One of the mechanisms is load balancing which chooses the optimum resource among many. Also by using virtual software to perform these tasks, a single server may be used to power these virtual servers, dramatically reducing energy consumption.

3) Methods For Alternative Storage: The main element of data center infrastructure are storage devices, as the organizations storage needs increase, the energy needed to power those devices increases. Large capacity devices are used to reduce it and are used to perform data center audits to eliminate repetition in the system

4) Using Thin Clients: With thin clients, each employee has a virtual desktop that includes a mouse, keyboard and screen while the remaining unit is shared by all at a central location.

5) Strengthen Printer's Output Management: Centrally located printer may be used to handle all printing tasks virtually eliminating numerous machines being left on all day sucking up energy and driving up costs.

6) Explore Alternative Sources of Energy: The efficient resource utilization leads towards efficient methods to evolve [4]. With time renewable and natural energy sources are being used to power data centers, such as nuclear or hydroelectric power, solar energy etc. This saves money and generates fewer CO2 emissions.

7) Ways To Save Energy: This includes using energy saving settings and encouraging employees to turn off equipment at the end of the work day and on weekends.

8) Correct Ways Of Disposal and Recycling: It is important because it helps in eliminating the harmful effects of toxins being released into the environment. By using this technique equipment reuse increases and reduces the amount of waste produced. The above initiatives can be used for going green

V. Open Research Challenges

Energy is one of the most valuable and scarce resources available to the world, a great portion of which is now being consumed in order power up computers and computing infrastructure. Basically, most of the high-performance parallel machines and distributed computing system, including data centers, supercomputers, clusters, real-time systems, and grids not only consume considerable amounts of power but also require air-conditioning to keep the systems cool. The abrupt growth in computing is rapidly increasing the consumption of precious natural resources such as oil and coal, strengthening the alarming danger of energy shortage. The researchers raise this issue from time to time and the possible measures are being taken to overcome and to decrease it . Still there are many areas yet to be explored.

Here we present some notable areas of research in green computing:

1: 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 for so that the maximum benefits can be obtained. Designing techniques that are optimal with respect to performance, energy, and temperature are utmost requirement as far as green computing research challenges are concerned.

2: Information Resource Tier Optimization:

The information resource tier represents important data base management systems in the global computation world. General paradigms include databases, directories, file-systems, and flat files. It also includes the integration of different database structures so that different databases can be analyzed irrespective of their storing mechanisms and data structure. Big data research topic is open in this field [10, 11].

3: Decreasing architectural complexity: The research area is open to reduce the number of tiers and component dependency to reduce maximum system use. Intel's core 2 duo is a mechanism which uses power to run only those components which are necessary at any computation [12].

4: Highly efficiency data center design: Bigger data centers can be made much more energy efficient than smaller data centers. Standards are emerging for measuring this, such as the concept of Power Usage Effectiveness (PUE). PUE is defined as the ratio of total facility power divided by IT equipment power [13]. Thus, it is a measure of how much of the power being consumed by the facility is actually being used to power the IT equipment itself rather than all the other things. Therefore it will quiet be a challenge to make the bigger data centers power efficient

5: Developing Green Maturity Model: Full equipment life cycle is the main area for green maturity model, with energy reduction as the best measure of —greenness. The need of maturity models for equipment's, IT organizations, computing techniques is an issue which has been addressed by some researchers but is limited to specific areas. Green maturity model for virtualization [14] depicts that each level describes the degree of green characteristics.

7: Wireless Sensor Network for Data Center Cooling: 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. Wireless sensors could play a big role for managing data centers power management [15].

8: Green Software's: Recently, green software movement has become a research subject for most of the software developers companies because of need for sustainable development [16]. 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. Business organizations are moving towards green software's and still some considerable steps need to be taken.

VI. CONCLUSION

Green computing will be the driving force of future computing. Green computing represents a responsible way to address the issue of global warming. By adopting green computing practices, business leaders can contribute positively to environmental stewardship—and protect the environment while also reducing energy and paper costs. 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. We will further analyze these challenges for better understanding and future research.

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