

A Review: A Step toward Green Computing

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Abstract:

Today computational power grows rapidly therefore we have 'Cloud computing' concept to fulfill this need. But, in Cloud computing high performance cloud servers are used for advance computational needs. Due to these computational unit executions, a large amount of power consumed, on the other hand the effect is that some harmful gases are also released in a similar amount of energy. Green Computing is the concept which is trying to confine this procedure by inventing new methods that would work efficiently while consuming less energy and making less population. This paper focuses on Green computing techniques, in order to achieve low power consumptions.

Keywords: Green computing, Energy cost, Data Center, Virtualization.

1. Introduction

Green computing is the study and practice of minimizing the environmental impact of computer system and related resources efficiently and ecofriendly. Some of the major components of green computing include implementation of energy efficient CPUs, server systems and peripherals. Further, green computing focuses on reduced resource consumption and the proper disposal of electronic wastage. It was primarily addressed by enhanced research and development efforts to reduce power usage, heat transmission, cooling needs of hardware devices, in particular processor chips using extensive hardware controls. These solutions benefit for bottom line (people, planet, profit). People mean human capital and it pertains to beneficial business practices toward labor, the community and region in which a corporation conducts its business. Planet means natural capital and it refers to sustainable environmental practices. Profit is the bottom line shared by all commerce within the sustainable framework.

According to National Institute of Standards and Technology (NIST) – “the major objective of cloud computing is to maximize the shared resources and at the same time the disadvantage is its high infrastructure cost and unnecessary power consumption.” Global warming has been a big concern of late, with high power consumption and CO₂ emission. With the continuously increasing popularity and usage of cloud computing, high power consumed and harmful gasses released by data centers. Cloud uses thousands of data centers to processes user queries and to run these data centers bulk amount of power is used for cooling and other processes. This power consumption increases gradually every year

and green computing playing a helpful role to curb these issues. This paper mainly focuses on the approaches of green computing and also how it can be used to minimize the environmental impacts of computers and other IT related resources effectively.

2. Overview of Green Computing

In this present globalized world, with the development of Information Technology, not just at home but also virtually every commercial organizations of any size is heavily reliant upon IT. Even though, this provides numerous good impacts, power consumption related to technology is rising rapidly. At home there is a little we can do regarding our use of IT, other than not leaving our PC's switched on unnecessarily, but for organizations there is massive scope for affecting energy use, recycling and profit through adopting a green approach to IT. Green technology comprises of the study of advanced materials to be used in everyday life and the study of new generation techniques. The main topic of concern in green technology is to reduce the environmental impact of industrial processes along with the growth in population resulting in innovative technologies. Basically, the efficient use of computers and computing is what green computing is all about.

Advantages of Green Computing

1. 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.
2. Conserving resources means less energy is required to produce, use, and dispose of products.
3. Saving energy and resources saves money.

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

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

3. Green Initiatives in Information

It started way back in 1992, when the U.S. Environmental Protection Agency (EPA) launched Energy Star, 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:

A. Improved Data Center Cooling Methods: This is achieved by improving the data center cooling configuration, eliminating considerable amount of energy leaks. IT can result in efficient data centers by following leading practices in data centre layout and rack and server arrangements. Effective approach 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].

B. Efficient Servers usage by Virtualization: Generally, IT companies have been using many server farms or data centers, dedicated to a specific task. These data servers must be efficiently used. 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.

C. Alternative Storage Methods: Storage drives are another main element of data center infrastructure and, as organizations storage needs increase; more energy is used to power these hard drives. It can be reduced by using large capacity drives and performing data center audits to eliminate redundancies in the system.

D. 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.

E. 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.

F. 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.

G. Energy saver initiatives: This includes using energy saving settings and encouraging employees to turn off equipment at the end of the work day and on weekends.

H. Proper Disposal and Recycling: This is so important because it potentially eliminates the threat of harmful toxins being released into the environment and allows for the reuse of equipment reducing the amount of waste. These initiatives exhibit the requirement of going green. Along with above mentioned IT initiatives every sector and area of IT is practicing green strategy and policies because sustainable development of ICT is the future need.

4 Open Research Challenges

Energy is one of the most valuable and scarce resources available to the world, a significant portion of which is now being consumed to power up computers and computing infrastructure. Basically, high-performance parallel 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 exponential growth in computing is rapidly increasing the consumption of precious natural resources such as oil and coal, strengthening the alarming danger of energy shortage. These issues have been raised by the researchers from time to time and the possible measures are being taken. Still there are many areas yet to be explored. Here we present some notable areas of research in green computing:

A. 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.

B. 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].

C. Reduce 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.

D. 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 equipments, 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.

E. 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.

5. Conclusion

Green computing presents a responsible way to address the issue of global warming. Whilst the performance and the breadth of application of computers is increasing, so too is our awareness of the cost and scarcity of the energy required to power them, as well as the materials needed to make them in the first place. However, because computing developments can enable individuals and businesses to adopt greener lifestyles and work styles, in terms of the environmental debate computing is definitely both part of the problem and part of the

solution. By adopting green computing practices, business leaders can contribute positively to environmental stewardship— and protect the environment while also reducing energy and paper costs.

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