Green Computing and its Applications in Different Fields

Gaurav Dhawan
Malwa Degree Collage, Kotkapura

Abstract— Green computing as name suggest it is use of computer and its related resources in eco-friendly way. It is practice of using computer and technology in efficient way, so that the energy consume by computer should be minimum and the harmful impact emitted by computer should be reduced by such techniques. It also consists of reduction in use of energy by computer. Reuse, Refurbish and Recycle are three ways by which we can use old computer in efficient way. There are many use of green computing in many fields which are discussed in this paper.

Index Terms— Reuse, Refurbish, Recycle.

I. INTRODUCTION

Green computing is the environmentally responsible and eco-friendly use of computers and their resources. In broader terms, it is also defined as the study of designing, manufacturing/engineering, using and disposing of computing devices in a way that reduces their environmental impact. Many IT manufacturers and vendors are continuously investing in designing energy efficient computing devices, reducing the use of dangerous materials and encouraging the recyclability of digital devices and paper. Green computing practices came into being in 1992, when the Environmental Protection Agency (EPA) launched the Energy Star program [1].

Green computing is also known as green information technology (green IT). Hibernate, restart, sleep are such method by adopting this we can reduce energy consumption used by computer.

Energy Star is symbol for energy efficiency. It helped us all save money and protect the environment through energy efficient products and practices. To reduce greenhouse gas emissions and other pollutants caused by the inefficient use of energy, it was established.

II. CHEMICAL ELEMENT USED IN COMPUTER

A. Lead
Used in soldering of printed circuit boards. Lead can cause damage to peripheral and nervous systems, kidneys and blood system.

B. Mercury
Used in batteries, switches and printed circuit board. Mercury spread into water which easily accumulates in living organism and it enter into food chain through fish that swim in polluted water. It can also cause brain damage.

C. Cadmium
Used in resistor for chips and in semiconductor. It harm human health specially kidneys.
III. GREEN COMPUTING RELATED TERMS

A. **Green ICT:**
Green ICT is about reducing the impact of ICT on the environment. It is about reducing the energy use of computers, servers and data centers. You might even consider the whole life cycle of ICT equipment and look at the rare material use or think about e-waste and recycling.

B. **Green cloud**
It refers to the potential environmental benefits that information technology (IT) services delivered over the Internet can offer society.

C. **Green IT**
It refers to the study and execution of using computers and IT resources in a more well organized and competent way.

IV. GOALS OF GREEN COMPUTING
The goal of green computing reduces 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.

V. POWER MANAGEMENT TECHNIQUES
While computers are not in use they can be activated in “stand-by” mode which can save up to 80% of power consumption. Whereas hibernate can save up to 96% energy consumption. Desktops computers shouldn’t be preferred as they consume 80% more power than Laptops [2]. By identifying power management we can lower energy consumption by:

1. Shut Down the computer when not in use.
2. Turn off External Devices when not in use.
3. Enable energy management settings.
4. Using Devices which take less energy consumption.
5. Using handheld devices rather than PC’s for basic tasks like downloading content, reading e-books.

VI. REUSE, REFRUBISH, RECYCLE

A. **Reuse:**
Donate your computer components to people who may not have or have lesser quality computer like inner city schools, libraries, etc.

B. **Refurbish:**
Rather than discarding your computer when next generation is released, just get a new CPU and memory chip, etc.

C. **Recycle:**
Recycle the plastics and other components, this can greatly reduce waste and toxins.

VII. 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.

VIII. DISADVANTAGES OF GREEN COMPUTING
1. Green computing could actually be quite costly.
2. Some computers that are green may be considerably underpowered.
3. Rapid technology change.

IX. APPLICATION OF GREEN COMPUTING

A. Efficient Resource Energy Management in Data Centre’s
Today, the perception of cloud computing has not only reshaped the field of distributed systems but also fundamentally changed how businesses utilize computing. Cloud computing is offering utilities oriented IT services to users worldwide. It enables hosting of applications from consumer, scientific and business domains. Data centre’s hosting cloud computing applications consume huge amounts of energy, contributing to high operational costs and carbon footprints to the environment. With energy shortages and global climate change leading our concerns these days, the power consumption of data centres has become a key issue. The area of Green computing is also becoming increasingly important in a world with limited energy resources and an ever-rising demand for more computational power. We need green cloud computing solutions that can not only save energy, but also reduce operational costs. An architectural framework and principles that provides efficient green enhancements within a scalable Cloud computing architecture with resource provisioning and allocation algorithm for energy efficient management of cloud computing environments to improve energy efficiency of the data centre. Using power-aware scheduling techniques, variable resource management, live migration, and a minimal virtual machine design, overall system efficiency will be vastly improved in a data centre based Cloud with minimal performance overhead[3].

B. Green Cloud Computing in Energy Efficiency
Cloud computing is a highly scalable and cost-effective infrastructure for running HPC, enterprise and Web applications. The growing demand of Cloud infrastructure has acutely increased the energy consumption of data centers, which has become a critical issue. Data centers hosting cloud computing applications consume huge amounts of energy, contributing to high operational costs and carbon footprints to the environment. With energy shortages and global climate change leading our concerns these days, the power consumption of data centers has become a key issue. Therefore, we need green cloud computing solutions that can not only save energy, but also reduce operational costs. High energy consumption not only translates to high operational cost, which reduces the profit margin of Cloud providers, but also leads to high carbon emissions which is not eco-friendly. Hence, energy-efficient solutions are required to minimize the impact of Cloud computing on the environment. In order to design such solutions, deep analysis of Cloud is required with respect to their power efficiency. We need to address various elements of Clouds which contribute to the total energy consumption and how it is addressed in the literature. [4].

C. Green Wireless Network
Recent advances in networking, caching, and computing will have a profound impact on the development of next generation green wireless networks. These three important areas have traditionally been addressed separately in existing works. A novel framework that jointly considers networking, caching, and computing techniques in a systematic way to naturally support energy-efficient information retrieval and computing services in green wireless networks. This
integrated framework can enable dynamic orchestration of different resources to meet the requirements of next generation green wireless networks. Simulation results are presented to show the effectiveness of the proposed framework [5].

D. Green Parallel Computing of Big Data Systems

Big Data is typically organized around a distributed file system on top of which the parallel algorithms can be executed for realizing the Big Data analytics. The parallel algorithms can be mapped in different alternative ways to the computing platform. Hereby each alternative will perform differently with respect to the environmentally relevant parameters such as energy and power consumption. Existing studies on deployment of parallel computing algorithms have mainly focused on addressing general computing metrics such as speedup with respect to serial computing and efficiency of the use of the computing nodes. We report on the elicitation of green metrics for big data systems that are required when analyzing deployment alternatives. To this end we use the existing systematic literature reviews and identify, and discuss the important green computing metrics for big data systems [6].

E. Preemptive Priority Based Job Scheduling Algorithm in Green Cloud Computing

Green Cloud, a packet simulator focuses on maximizing the system throughput with saving energy on different servers. Job Scheduling is one of the major issues in Green Cloud Computing. Some researchers have been done on the preemptive scheduling on the Clouds as well as Green Clouds but lot more have to be done on Preemptive part of Priority Scheduling of the Green Clouds. To produce maximum throughput of Green Clouds the work has to be done by prioritizing the jobs on every cloud. We have proposed a new Preemptive Priority Based Job Scheduling Algorithm in Green Cloud Computing (PPJSGC). The preemptive part as well as it calculates the energy consumption for scheduling the jobs on the computing servers. The computing servers are allocated to processes based on the best fit as per their energy requirements and server frequency availability. This job is being performed by the DVFS Controller in our algorithm. The load management, low energy consumption, and maximizing the revenue is the key motive of our study [7].

F. Green cloud computing using genetic algorithm

Cloud computing delivers consumers a proficient way to efficiently complete their service demands. The use of energy aware virtual machine allocation algorithms for cloud computing framework provides great elasticity with the capability to migrate virtual machines across physical machines. Data center hosting services consume huge amount of electricity. The ongoing growth of energy consumption by Information and Communication Technology (ICT) at data center side forces researchers to propose innovative ways to reduce the power consumption. A major challenge for cloud providers is proper VM allocations while taking into account of less SLA violations within better response time. An energy aware hybrid algorithm for VM allocation is proposed with considering SLA parameters; response time, throughput. As number of algorithm proposed for energy aware VM allocations like Minimization of Migration (MM). A hybrid energy aware algorithm using genetic algorithm has been proposed. We evaluate the proposed algorithm with three performance metrics; energy consumption, SLA violations, throughput. The results demonstrate the proposed algorithm obtains less energy consumption and SLA violations with high throughput than the MM algorithm [8].

X. CONCLUSION

Consumer only care about speed and price and not cared about ecology impact. New green materials are produced and replace toxic one. Cloud computing business potential and contribution to already aggravating carbon emission from ICT, has lead to a series of discussion whether Cloud computing is really green. To minimize energy consumption in data centre, genetic algorithm can be used. Job scheduling algorithm can be make efficient to divide the jobs and minimize the energy consumption.
REFERENCES


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