

Analytical Study of Computing in Green Environment

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ABSTRACT

In terms of growing awareness about environmental impact of computing, green technology is gaining increasing importance. Green computing refers to the practice of environmentally responsible and efficient use of computing resources while maintaining economic viability and improving its performance in eco-friendly way.

Green computing is an effective study in which disposing, recycling and manufacturing of computers and electronic devices is taken into consideration. The goal of green computing is to lower down the use of hazardous materials, maximize energy efficiency and popularize biodegradability or recyclability of outdated products and factory waste.

Cloud computing becomes a powerful trend in the development of ICT (Information and Communication Technologies) services. Demand on the cloud computing is continually growth that makes it changes to scope of green cloud computing. It aims to reduce energy consumption in Cloud computing while maintaining a better performance.

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. In this paper we focus on analysis of computing in green environment.

Keywords: Cloud Computing, Green Computing, Green Cloud Computing, eco-friendly, energy consumption.

1. INTRODUCTION

Green computing is the term referring to efficient use of resources in computing and IT/IS infrastructure. Efficiency of green computing emphasizes on minimalizing hazardous environmental impact in conjunction with achieving economic viability and improved system performance.

The field of "green technology" covers a board spectrum of subjects – from alternative energy-generation and electricity consumption techniques and use of eco-friendly, recyclable materials to implementing sustainable digital services. The idea is to make computers from beginning to end a green product.

Cloud computing is an emerging computing model [1], which is based on virtualization technology, in response to user requests through the network, and dynamic resource allocation based on user demand.

Green cloud computing can effectively improve the utilization rate of the cloud computing infrastructure, and minimize energy consumption. Users can store, access, and share any amount of information in Cloud. That is, small or medium enterprises/organizations do not have to worry about purchasing, configuring, administering, and maintaining their own computing infrastructure. Cloud computing also offers processing of tremendous amount of data generated almost every day.

Clouds are essentially virtualized datacenters and applications offered as services on a subscription basis as shown in Figure 1.

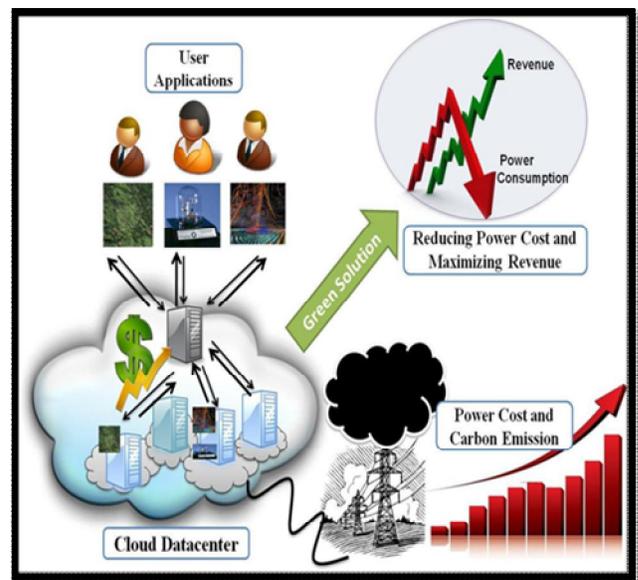


Figure 1: Cloud and Environmental Sustainability

They require high energy usage for its operation [2]. Today, a typical datacenter with 1000 racks need 10 Megawatt of power to operate [3], which results in higher operational cost. Thus, for a datacenter, the energy cost is a significant component of its operating and up-front costs.

2. RELATED WORKS

Cloud computing is offering utility oriented IT services to users worldwide. It enables hosting of applications from consumer, scientific and business domains based on pay-as-you-go model. However data centres hosting significant 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[1] is also becoming increasingly important in a world with limited energy resources and an ever-rising demand for more computational power. How to build a green data center in cloud computing era has become the common focus of attention of the industry. Few earlier stated algorithms:

Kaya et al. proposed a heuristic algorithm for independent task scheduling based on file sharing, but this method does not fully consider the characteristics of cloud computing systems are heterogeneous and dynamic [4].

Zhenget al. proposed an as early as possible scheduling algorithm (ASAP), which may lead to too much focus on control step of the early [5].

William J. et al. proposed a Dual Fitness Genetic Algorithm (DFGA), which can find the task at a given time range [6].

Aiming at the inefficient problem of task scheduling algorithm in cloud computing environment.

ShenLijunet al. used artificial immune principle to realize the global optimization of task scheduling, and proposed a task scheduling algorithm based on immune evolutionary algorithm [7]. The proposed algorithm, can effectively improve the convergence effect, reduce the cost of the task scheduling time.

Dr. Zhang et al. proposed a guaranteed packet and polymorphic ant colony algorithm of cloud service quality, which is based on the completion time of the update of the average completion time [8].

Wang Wenfenget al. proposed a task scheduling strategy based on genetic algorithm in cloud computing ,[9] the goal is to assign the task to the resource node to complete the task time at least, make full use of the resources, and the resource node in the idle state dynamic adjustment of the task allocation.

In [10] proposed an energy-saving scheduling algorithm based on the cloud environment, which used the neural network predictor of energy-saving dispatching.

3. GREEN CLOUD COMPUTING

Green computing is about reducing the environmental footprint of computers or of ICT in general. It is achieved by making data centres and computing devices more energy efficient. Some areas where computing through green environment is done are as follows:

3.1. Energy Usage In Data Centers

With the growth of cloud computing, large scale datacenters have become common in the computing industry, and there has been a significant increase in energy consumption at these data centers, which thus becomes a key issue to address. As the data center industry grows increasingly obsessed with energy efficiency, cloud computing presents a compelling opportunity to reduce data center power bills, according to a leading expert on IT power issues.

Four areas where cloud computing have power efficiency advantages:

3.1.1. Diversity: *Spreading* computing loads across many users and time zones can improve hardware utilization.

3.1.2. Economies of Scale: Computation is cheaper in a large shop than small shop, as fixed costs can be spread over more servers and users.

3.1.3 Flexibility: The management of virtual servers in cloud apps is easier and cheaper than managing physical servers. It also

has reliability advantage that can create savings in the data center. If you can void outages using software to route around problems, you don't need to buy two power supplies for each server.

3.1.4. Enabling Structural Change: The shift to a cloud model enables broader efficiencies in a business that can save money over time.

There is a need to create an efficient Cloud computing system that utilizes the strengths of the Cloud while minimizing its energy footprint. The framework provided in this paper represents many promising ways to reduce power consumption; true sustainable development also depends on finding a renewable and reliable energy source for the data center itself. When combined, many of today's limits in the size of data centers will begin to deteriorate.

3.2. VIRTUALIZATION

There are a number of underlying technologies, services, and infrastructure-level configurations that make Cloud computing possible. One of the most important technologies is the use of virtualization. Virtualization is a way to abstract the hardware and system resources from an operating system. This is typically performed within a Cloud environment across a large set of servers using a Hypervisor or Virtual Machine Monitor (VMM) which lies in between the hardware and the Operating System (OS). One technique being explored is the use of Dynamic Voltage and Frequency Scaling (DVFS) within Clusters and Supercomputers.

A power-aware Cluster supports multiple power and performance modes on processors with frequencies that can be turned up or down. This allows for the creation of an efficient scheduling system that minimizes power consumption of a system while attempting to maximize performance. The scheduler performs the energy-performance trade-off within a cluster. Combining various power efficiency techniques for data centers with the advanced feature set of Clouds could yield drastic results, however currently no such system exists.

3.3 NEED OF GREEN CLOUD FRAMEWORK

There is a pressing need for an efficient yet scalable Cloud computing system. This is driven by the ever-increasing demand for greater computational power countered by the continual rise in use expenditures, both economic and environmental. Green Cloud framework maximizes performance per watt within a Cloud. This outlines the major areas are VM scheduling, VM image management, and advanced datacenter design. Within the framework, it expand functioning of virtual machines in a cloud environment to bring more efficient scheduling system for VMs. The Scheduling section addresses the placement of VMs within the Cloud infrastructure while minimizing the operating costs of the Cloud itself. Using more efficient Air Conditioning units, employing exterior "free" cooling, using completely separated hot and cold isles, or simply picking more efficient power supplies for the servers can lead to incremental but substantial improvements.

3.4 VIRTUAL MACHINE SCHEDULING & MANAGEMENT

In many service oriented scientific Cloud architectures, new VMs are created to perform some work. The idea is similar to sand boxing work within a specialized environment. A. Power-aware VM Scheduling: Currently, there are two competing types of

Green scheduling systems for Supercomputers; power-aware and thermal aware scheduling. In thermal-aware scheduling, jobs are scheduled in a manner that minimizes the overall data center temperature. The goal is not always to conserve the energy used to the servers, but instead to reduce the energy needed to operate the data center cooling systems. In power-aware scheduling, jobs are scheduled to nodes in such a way to minimize the server's total power. The largest operating cost incurred in a Cloud data center is in operating the servers. VM scheduling algorithm that minimizes power consumption within the data center.

4. CONCLUSION

The concept of green computing has began to spread in the past few years and is still gaining its popularity. Green computing is not only manufacturing, using and destroying the computers in environment friendly way, but also exploiting existing computing resources in more efficient way by implementing new concepts like green clouds. Cloud providers need to reduce the electricity demand of clouds and take major steps in using renewable energy sources rather than just looking for economic incentives like cost minimization. In this paper we have discussed about the various technological areas where green environment is helpful in minimizing power consumption and maximizing energy efficiency and recyclability of outdated products and factory based.

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