



A Review Paper on Green Cloud Computing-A New form of Computing

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Abstract- *In cloud computing hosted services are delivered to users by using a network of remote servers over the internet. Cloud users are increasing day by day which has compelled the cloud service provider to open more data centers for hosting their services efficiently. The growing demand of Cloud computing has increased the energy consumption of cloud data centers dramatically. High energy consumption not only increases the operational cost but also reduces the profit margin of cloud service providers and affects the environment by its carbon emission. So, in order to make cloud computing an eco friendly technology some energy-efficient solutions are required. Hence, this paper is addressing the motivation and driving forces for green computing. It also discusses the key issues present in green cloud computing.*

Keywords: VPN, ICT

I. INTRODUCTION

Cloud computing applies virtualization concept for efficient use of hardware and software. It aims to provide ease to its end users with the help of on demand self-service, broad network access, resource pooling, rapid flexibility and measured performance. The emergence of Cloud computing is changing the ownership-based approach to subscription-oriented approach by providing access to scalable infrastructure and services on-demand [1]. In cloud computing resources (hardware or software) are made available by one or more provider. These resources can be used by different users on the paid basis. These services provided by cloud computing are broadly classified as: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS). Cloud service providers such as Amazon, Salesforce, Microsoft, Google, IBM and Sun-Microsystems has established many new data centers for hosting cloud applications, business application, gaming portal, media content delivery and scientific processing. Though cloud computing provide financial benefits but its power consumption and carbon emission has become a major environmental concern. These concern can be resolved by using green computing. Green computing efficiently manages its resources by keeping environment at center.

II. EVOLUTION OF CLOUD COMPUTING

The origins of the cloud are from mainframe computing in the last century. Mainframe systems have provided central storage for software and data. As computing technology became smaller, cheaper and more accessible to more businesses and consumers, computing power began to decentralize itself [8]. Hence there was a rise of Personnel computers. In 1969 J.C.R. Licklider brought ARPANET which has formed the basis of today's internet. In ARPANET multiple systems are connected in a network and data is transferred through circuit switching. With the increase in demand of internet telecommunication companies has started providing virtualized private network (VPN) where many users were sharing same physical infrastructure. This VPN lead to proper bandwidth utilization as provided by [4]. Up to this point the term cloud was not introduced, the first academic use of the term 'cloud' appears to be done by Prof. Ramnath K. Chellappa (currently at Goizueta Business School, Emory University) who originally defined it as a computing paradigm where the boundaries of computing will be determined by economic rationale rather than technical limits[5].

Internet technology has evolved from shared web hosting which was considered as most economical way of web hosting. It was evolved into virtual server where a single server is partitioned into multiple servers. In this case the physical server typically runs a hypervisor which creates, releases, and manages the resources of "guest" operating systems, or virtual machines [6]. In 2000s automated computing came in the form of Grid/utility computing. At this moment it came with full infrastructure demand, multi-tenancy. This utility based computing is known as cloud computing.

III. GREEN COMPUTING

It is also defined as the process of designing, manufacturing, and disposing computer devices which will not affect environment. Information and Communication Technologies (ICT) industry generates about 2% of the total global CO₂ emissions, which is equal to the aviation industry as given by [3]. Most of the IT companies has realized that moving towards green computing will not only save environment but will also cut the overall cost of the system

The core green computing technologies are: Virtualization ,Green Data Center, Green Cloud Computing, Power Optimization and Grid Computing [2]. This technology is beneficial because it:

- 有 Reduces energy consumption of computing resources during peak hours.
- 有 Saves energy during idle state.
- 有 Uses eco-friendly sources of energy.
- 有 Reduces harmful effects of computing resources.
- 有 Reduces computing wastes.

IV. CLOUD EMPOWERING GREEN COMPUTING

Cloud Infrastructure has become an environmental concern regarding energy consumption and carbon emission. Cloud computing uses virtualization concept that is it provides a subset of computing resources so that they can be accessed in ways that give benefits over the original configuration. The following factor has enabled the Cloud Computing to lower energy usage and carbon emissions from ICT:

1. Dynamic allocation-IT companies deploy far more infrastructure than the requirement and guarantees the availability of services to maintain certain level of service While cloud computing does not follow over provisioning concept ,it monitors and predict the demand and allocates resources according to the demand as given by [9]. Thus, datacenters always maintain the active servers according to current demand, which results in low energy consumption. than the traditional approach of over-provisioning.

2. Multi-tenancy- Cloud computing infrastructure reduces overall energy usage and associated carbon emissions. The SaaS providers serve same infrastructure and software to multiple users. This approach is more energy efficient because multiple copies of software need not to be installed on different infrastructure, which can minimize the need for extra infrastructure.

3. Server Utilization- By using virtualization technology, multiple applications can be hosted and executed on the same server in isolation; server running at higher utilization can process more workload with similar power usage.

4. Datacenter Efficiency -The power efficiency of datacenters has major impact on the total energy usage of Cloud computing. By using the most energy efficient technologies, cloud providers can significantly improve the Power Usage Effectiveness (PUE) of their datacenters. By using different load balancing techniques a highly loaded datacenter can transfer its load to idle datacenter. This is achieved by using high speed network, virtualized services, measurement, monitoring and accounting of datacenter.

IV. RESEARCH AREAS FOR GREEN CLOUD COMPUTING

It is forecasted that the environmental footprint from data centers will get triple between 2002 and 2020, which is currently 7.8 billion tons of CO₂ per year[1]. There are reports on Green IT analysis of Clouds and datacenters that shows that Cloud computing is “Green”, while others show that it will lead to alarming increase in Carbon mission. In order to make cloud computing a green computing we need to work on certain areas such as:

- Though cloud is providing multi tenant environment in the form of SaaS but now we need to work on the run time behavior of the software.
- To enable the green Cloud datacenters, the Cloud providers need to understand and measure existing datacenter power and cooling designs, power consumptions of servers and their required cooling level , and its equipment resource utilization to achieve maximum efficiency.
- All available resources should be utilized efficiently but setting up new infrastructure for global coverage, service offering, and competitiveness should not be there. . For instance, redundancy of data and placement geo-diversity required to be maintained to fulfill SLAs with users.
- It is the responsibility of to both service providers and customers to make sure that new technology should not produce any health hazard to human society.

V. CONCLUSION

In this paper, I have presented a brief introduction of cloud; how it has evolved from shared web hosting .This paper has also explained the concept of green computing where all the available resources should be utilized in an efficient and eco-friendly manner. Some of the characteristics of cloud computing promotes it as a green computing. But still some issues are needs to be resolved, to make cloud computing a green cloud computing. These issues are discussed in the paper which will not only reduce overall power consumption at cloud data centers but also reduces CO₂ emission. If these issues are resolved then cloud computing will be completely green computing. This Green cloud computing will be beneficial for service providers as well as for the environment.

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