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Green Cloud Computing

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Abstract : It is well known that cloud networks and data centers consume a lot of energy. The cloud computing infrastructure is not only expensive to maintain, but also unfriendly to the environment. Today organizations have come to realize that going green is in their best interest and are moving towards implementation of green cloud computing. Green cloud computing is becoming a popular trend today with the emergence of Internet-driven services in all areas of life. This paper provides a brief introduction to green cloud computing.

Key words: green computing, cloud computing, green cloud computing

Introduction

The effects of global warming are noticeable all over the world. Rising levels of global warming and environmental concerns have made companies to be aware of their carbon footprint, energy consumption, and e-waste.

Cloud computing refers the vast economies of scale, rapid market adoption velocity, and potential revenue growth of cloud computing initiatives. It provides computing power and resources as a service to users worldwide. However, the growing demand of cloud infrastructure has significantly increased the energy consumption which leads to high carbon emissions which is not environmentally friendly. Cloud service providers are being asked to be responsible towards the society by reducing the environmental impact of their business operations while keeping the desired quality of service [1].

In recent years, there have been two major trends in the ICT industry: green computing and cloud computing. The combination of these two trends leads to green cloud computing. The green cloud computing is an energy efficient tool and also makes business to be more environmentally responsible. It utilizes resources efficiently so as to decrease the impact of IT processes on the environment. It seeks to achieve the sustainable development of cloud computing and reduce the possible impact of cloud systems on the environment. Green cloud computing can produce solutions that can make the IT resources energy efficient while minimizing the operational costs. Green cloud computing is known to be a hot area for research [2].

Cloud Computing

Cloud computing (or cloud) is an emerging paradigm which enables outsourcing of all IT needs such as storage, computation, and software through the Internet. It refers to the remote computing resources, usually in data centers, that provide services to users over the Internet. Cloud refers to a pool of data centers on which various services are deployed through Internet and also on which data is stored, retrieved, and processed. A typical data center has three main components: data storage, servers, and a local area network.

Like electricity supply, the cloud provides a new kind of "utility" that is delivered through wired or wireless networks. Common characteristics of clouds include on-demand self-service, broad network access, resource pooling, rapid elasticity, and measured service. In cloud computing, the cloud providers are responsible for hardware and software management. Cloud providers include Google, Apple, Microsoft, IBM, and Yahoo; they operate clouds commercially [3]. They have set data centers at different locations to provide users with a variety of cloud computing and storage service. Cloud services are offered as "metered" services where providers have an accounting model for measuring the use of the services [4]. Some consider the cloud computing as a best way to increase energy efficiency and create a more sustainable environment. The Cloud Computing Interoperability Forum (CCIF) is developing a standardized cloud computing ecosystem to achieve cloud interoperability.

Cloud computing provides three service models and four deployment models. The available service models are classified as SaaS (Software-as-a-Service), PaaS (Platform-as-a-Service), and IaaS (Infrastructure-as-a-Service). The cloud deployments are classified mainly into four types: Public Cloud, Private Cloud Community Cloud, and Hybrid Cloud.

Energy consumption of data centers is a bottleneck in cloud computing technology since cloud data centers consume inordinate amounts of energy. The cloud providers deploy data centers which need energy for monitors, consoles, fans for processors, cooling system, etc. This high demand of energy tends to increase cost and carbon emission which reduces its efficiency. Using renewable energy sources for cloud computing is important and environmentally friendly. Implementing green computing solutions is wise not only from a moral standpoint, but also from a profit-making standpoint.

Many businesses are leveraging cloud computing benefits such as faster scale-up/scale-down of capacity, pay-as-you-go pricing, and access to cloud-based services and applications. The pay-as-you-go pricing compels the users to consume just what is needed and nothing more. With cloud computing, we can reduce the e-waste production by reducing hardware and software.

Green Computing

Green computing refers to the eco-friendly and environmentally responsible usage of computers and their resources. It is about reducing the environmental footprint of ICT.

It is the movement towards a more environmentally sustainable computing. The goal of green computing is to reduce the use of hazardous materials and minimize factory waste.

There is no easy way to green computing. We must strive to minimize greenhouse gases and waste, while increasing the effectiveness of IT, such as computers, data centers, and computer networks. A green computing activity must cover all territories: people, organizations, equipment, and networks.

Cloud computing is the latest trend in the field of green computing. Green Computing is the future technology that supports environment, reuse consumed power and energy, and optimize the resources efficiently. It does away with the hardware servers and uses virtual servers. Thus, cloud computing is energy-efficient technology for ICT [5]. Green computing is the future technology which supports environment, reuse consumed power, and optimize the resources efficiently.

Green Cloud

In green cloud, green means environment-friendly while the cloud represents the Internet service delivery model. The development of green cloud computing is related to the evolution of green data centers since the data centers are the core of the cloud computing. The goal of green cloud computing solutions is not only to save energy but also to minimize the energy consumption. Green cloud can help consolidate workload and achieve significant energy saving for cloud computing environment. It also guarantees the real-time performance for many performance-sensitive applications [6].

The green cloud computing concept has an important role in reducing energy consumption in IT industries. Green cloud computing is becoming important due to the increasing concerns about environmental issues by cloud service providers. Data management and efficient infrastructure are critical to facilitate green cloud computing. Green mobile communications would be a foundation for green cloud computing [7].

Benefits and Challenges

The main benefits of green cloud computing are energy saving and carbon-footprint reduction. When your company uses green cloud computing, you save energy through resource pooling. Green cloud computing solutions save energy and reduce operational costs. It makes it possible to work from anywhere at any time so that employee can work from home if needed.

Perhaps the most challenge to cloud computing is related to data privacy. Customers should be able to trust that cloud service providers will not misuse their sensitive data [8].
Energy consumption is another main obstacle to the green cloud computing.

Conclusion

Green cloud computing is regarded as a hot area for research. It is becoming important in a world with limited energy resources and an ever-increasing demand for more computational power. It has a potential to be a powerful technology which can contribute to green IT and carbon emissions. Although the research on green cloud computing is still at an early stage, it is becoming more and more popular.

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