

Green Cloud Computing: An Overview

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Abstract

Cloud computing is a buzzword now-a-days. Various cloud based services are being used now-a-days like E-mail, ERP solutions, platform for programmers to deploy their applications as well as hardware infrastructure i.e. network capabilities, CPU processing, bandwidth and storage on our desktop, laptop and mobile phones. Cloud computing not only provides the economical as well as efficiency and flexibility to the internet user. Green cloud computing mainly focuses on the energy efficient computing. In this paper, an overview of green cloud computing that includes the services and advantages to the society is given.

Keywords: Cloud computing, Green computing, ICT sustainability.

Introduction

Today we are living in the era of digitization. Everything is going to be digitized whether cell phone or computer as well as also will depend on the internet to perform our routine transaction i.e. paying the electricity or mobile bills, booking the movie, rail or flight ticket, e-shopping, transferring the money etc. Cloud computing has developed from being a gifted commerce idea to one of the top geared sector of the Information Technology. Now, declined organizations are progressively introducing themselves in this technology in order to achieve reliable services at minimal cost. But as small and medium size business are looking forward to adopt least economical computing resources for their business applications, there is a need to identify all the issues while deploying it. The history of Cloud computing notion is on track from 1960, [1] When John McCarthy proposed the model of computation as a public utility. First public usage of the term "Cloud" as a allegory for the internet, appeared in MIT Published paper, in 1996. [2] In 1999, the first step toward this modern term was taken by Salesforce.com, which led the way of delivering business applications through a web. In 2002, Amazon introduced a collection of cloud-based services comprising storage and computation via the Amazon Mechanical Trunk. Mean while, IBM adopted this model in their applications and showed the new computing (Grid, pervasive computing, automated computing and utility computing) methods. The first widely accessible web application was Elastic Compute cloud (EC2) by Amazon, as a commercial web service that let small businesses and

individuals to lease computers on which they can enjoy their own computer applications. In 2007, Google, IBM, and a large number of universities got a huge scale cloud computing research project, around the time the term started. By mid-2008, cloud computing achieved status in media, and many interconnected proceedings happened. To elucidate, Cloud Computing is same in concept of buying a land, constructing a building and then rent it out as whole or by portion. In cloud computing, supplier keeps the software on internet which is then used, paying only for the used services, by end users. There is no comprehensive definition of cloud computing. So far, the simplest operational description of cloud is "Computing paradigm where services and data reside in shared resources in scalable data centers, and those services and data are accessible by any authenticated device over the internet"

Comparison of Grid and Cloud

Grid systems are intended for sharing of resources belonging to diverse managed groups, sustaining large number of users structured in virtual organizations (identifications are improved with VO-related information) and offer domain-specific services. On the other hand, Clouds currently deliver the services of one domain to the outside world; generally support individuals for the distant service applications.

Levels of cloud

The appearances of cloud computing can be categorized into IaaS (Infrastructure as a service), SaaS (Software as a Service) and PaaS (Platform as a Service) [9], where users can strike into these services from Web browsers through Internet formulates them “cloud” services.

A. Infrastructure as a Service

IaaS is an alternate important data center resources such as storage space, physical servers, switches, firewalls and routers with vastly vacant resources in the cloud. It is about having a data warehouse cloud [8]. Number of IaaS providers is in market: Amazon, IBM tenders a 42U data center furnished with pre-installed and configured hardware GoGrid and FlexiScale. Joyent hosts many social network sites (Facebook).

B. Platform as a Service (PaaS)

PaaS is occasionally called “cloudware”, as it shifts resources from user machine into the cloud. PaaS is a model for carrying operating systems and related services into Internet without installation. Its vendors comprised on Coghead, Google (Google App Engine) salesforce.com (Force.com), and Dapper.net. Google’s application development platform, Google App Engine, Yahoo (Pipes), support developers to develop Python-based applications with up to 500 MB of storage. [9]

C. Software as a Service (SaaS)

SaaS is a software representation in which applications are hosted by a vendor or service provider and these applications are available for use through Internet. [10] SaaS vendors comprise on salesforce.com, CRM applications, ERP applications, Citrix (meeting applications), Google Apps comprise on Gmail, Google Docs, Google Talk, , and various others. SaaS desktop applications for users include Zoho Office, Google Apps, Google etc.



Figure 1: Cloud Services with example.

Advantages of cloud computing

The three service levels (SaaS, IaaS, PaaS) working in cooperation to each other in cloud, cutback costs and resources remarkably. Grouping of resources also results in higher performance, stack harmonizing (Controlling the load competency from central position) and absolute utilization of server capability. In this fashion, cloud computing consequences in enhanced resource usage, which is incomparable from maintenance point of view.

- It provides small and medium businesses a break to access web based advance tools as a resource. By grace of cloud, technology access is no more a prime expenditure, as it is same as your other utility services (Electricity, Telephone) you are going to pay just for what you have utilized, nothing applications and managed by SLA.

- Cloud computing is a thought that is based on transforming the stack of IT away from firms into the hands of cloud providers. It buttresses a culture of modernization by eradicating a major fraction of the economic risks linked with bearing out archetype of new ideas.

Need of Green Cloud Computing

Cloud computing offers all the services through the data center. Data centers facilities are heavy consumers of energy, accounting for between 1.1% and 1.5% of the world’s total energy use in 2010. The U.S. Department of Energy estimates that data center facilities consume up to 100 to 200 times more energy than standard office buildings.

Energy efficient data center design should address all of the energy use aspects included in a data center: from the IT equipment to the HVAC(Heating, ventilation and air conditioning) equipment to the actual location, configuration and construction of the building. The U.S. Department of Energy specifies five primary areas on which to focus energy efficient data center design best practices: Information technology (IT) systems, Environmental conditions, Air management, Cooling systems, Electrical systems. Additional energy efficient design opportunities specified by the U.S. Department of Energy include on-site electrical generation and recycling of waste heat. Energy efficient data center

design should help to better utilize a data center's space, and increase performance and efficiency. The efficiency of algorithms affects the amount of computer resources required for any given computing function and there are many efficiency trade-offs in writing programs. Algorithm changes, such as switching from a slow (e.g. linear) search algorithm to a fast (e.g. hashed or indexed) search algorithm can reduce resource usage for a given task from substantial to close to zero. In 2009, a study by a physicist at Harvard estimated that the average Google search released 7 grams of carbon dioxide (CO₂). However, Google disputed this figure, arguing instead that a typical search produced only 0.2 grams of CO₂.

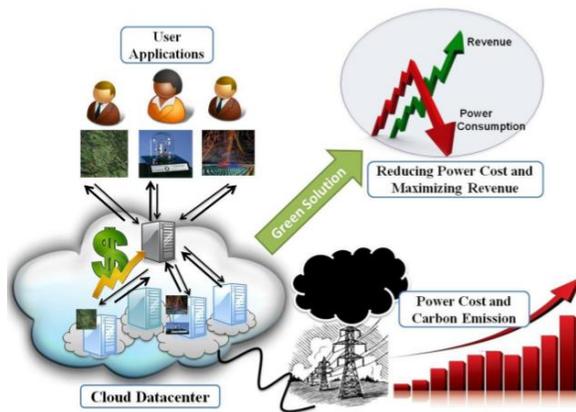


Figure 2: Cloud datacenter and Green solution

Algorithms can also be used to route data to data centers where electricity is less expensive. Researchers from MIT, Carnegie Mellon University, and Akamai have tested an energy allocation algorithm that successfully routes traffic to the location with the cheapest energy costs. The researchers project up to a 40 percent savings on

energy costs if their proposed algorithm were to be deployed. However, this approach does not actually reduce the amount of energy being used; it reduces only the cost to the company using it. Nonetheless, a similar strategy could be used to direct traffic to rely on energy that is produced in a more environmentally friendly or efficient way. A similar approach has also been used to cut energy usage by routing traffic away from data centers experiencing warm weather; this allows computers to be shut down to avoid using air conditioning.

Larger server centers are sometimes located where energy and land are inexpensive and readily available. Local availability of renewable energy, climate that allows outside air to be used for cooling, or locating them where the heat they produce may be used for other purposes could be factors in green siting decisions.

Conclusion

Cloud Computing guarantees momentous paybacks, but also increasing pollutions, so green Cloud computing is the environment and energy savvy step. In addition the cost advantages for huge enterprises have not yet been noticeably confirmed. The center of attention in Cloud development is the emergent of the cloud from the indoors (Private Cloud) to outdoors (Public Cloud). This paper keenly observed, to describe that the major advantages and disadvantages seen by cloud-based applications deploying in small and medium organizations. So, we need to take precaution and requirement to develop energy-efficient cloud solutions in term of hardware and algorithm, then we can save our environment and energy for our next generation.

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