Go Green with Cloud Computing

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ABSTRACT- In this Era of IT, the use of the Internet is on the climb. Thus, Cloud Computing is mounting speedily. From a student to a business person to the corporate world to big organization all make use of resources (store, share, retrieve) available globally on the cloud. With the gigantic usage of electronic appliances, the concern of saving the energy is unreservedly vital. Thus the mission to conserve energy is rising, thus organizations are moving towards Green IT. This paper focuses on the working of Cloud Computing, and how it can be used to save power and energy, thus the topic" Go Green with Cloud Computing". To make Cloud Computing Environment friendly the techniques like Virtualization, server consolidation, thin clients, proper cooling techniques and the reduction in hardware components of the servers can be used. The objective of this paper is to merge the usefulness of Cloud Computing along with the need to protect the globe and save our environment, thus implementing green strategies with the internet [1] [2].

KEYWORDS -Consolidation, Data Centre, power consumption, solar, resource management.

I. INTRODUCTION

To cope with the competitive world the use of the Internet is so widespread throughout the globe today, to find the information about traveling any destination, study materials on almost any topic, entertainment zone, etc., the only source is browsing the internet. The question arises where does this data come from? At one click you get what you intent to. Colossal data Resides 'somewhere' around the universe and is distributed to all the end users. This 'somewhere' is nothing but 'in the Cloud', not saved directly to your local hard drive. Online connectivity started out as a simple information exchange. In short the whole world has come closer with "Internet". Cloud computing is Internet-based computing, whereby shared resources, software and information are provided with computers and other devices on-demand. There is delivery of business applications online which are accessed from another web service or software like a web browser, while the software and data are stored on servers. Green Computing is the environmentally responsible use of computers and related resources. Such practices include the implementation of energy-efficient central processing units (CPUs), servers and peripherals as well as reduced resource consumption and proper disposal of electronic waste (e-waste).

II. RELATIONSHIP BETWEEN INTERNET AND CLOUD COMPUTING

Clouds often appear as single points of access for all consumers' computing needs. Web applications fulfill the needs of end users by allowing to develop, run and deploy them with reliability, scalability and efficiency. The following figure shows the architecture of cloud computing: [3].
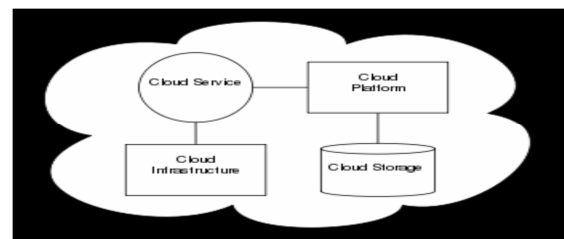

Figure 1: Architecture of Cloud Computing

Cloud computing refers to the delivery of computing resources from a location miles away from the present location. It incorporates combinations of the Infrastructure as a service (IaaS), Platform as a service (PaaS) and Software as a service (SaaS). Infrastructure

as a Service (IaaS) is the delivery of hardware (server and network), and associated software as a service. Platform as a Service (PaaS) is an application development and deployment platform delivered as a service to developers over the Internet. A SaaS manages and hosts a given application in own data center.

III. IMPORTANCE OF GREEN COMPUTING

It is estimated that out of $250 billion per year spent on powering computers worldwide only about 15%of that power is spent computing-the rest is wasted idling. Thus, energy saved on computer hardware and computing will equate tones of carbon emissions saved per year. Thus a revolutionary approach has to be adopted around then the globe to save energy. As statistics say 40-50% of corporate energy consumption goes to IT. Thus Green Computing aims at minimizing energy consumption from the IT, purchasing green energy and using green suppliers, overall energy costs need to be reduced and achieve Environmental friendliness [4].

IV. STRATEGIES TO TURN CLOUD COMPUTING GREEN

The use of Cloud Computing is growing on the rise; there are certain techniques to make it Green. In the implementation point of view cloud computing requires huge data storage for the gigantic amount of data from over the globe. In this reliable data centers are used. Gigantic data centers are set up for clouds to work proficiently. This is the need of cloud computing to have immense storage. This in turn increases the energy consumption as well. Today's data centers consume a lot of electricity. A recent report by the Environmental Protection Agency claims data centers in the US consume 4.5 billion kWh annually, 1.5 percent of the country's total. Perhaps more importantly, this figure has doubled in recent years, and is likely to double again in the next few years. The figure below shows the rising Energy consumption in the years.
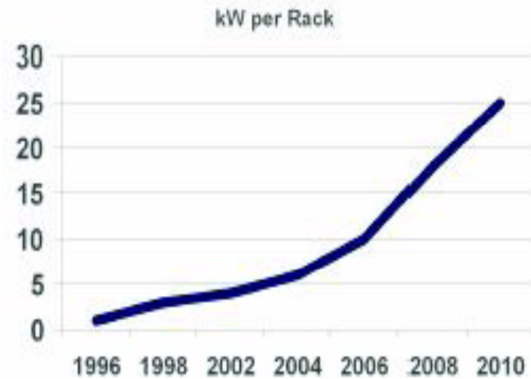

Figure 2: Rising Energy Consumption in the Data Center

Considering the current scenario where processing with cloud is inseparable and also conserves energy for the same for the future. So some approaches are to be designed and implemented to work with both Clouds and Green Techniques to consume energy[5].

A. Virtual Server Consolidation and Virtual Resource Management.

According to the EPA, servers consumed 80 percent of the total IT load and 40% of total data center power consumption. Equipment cooling accounts 50 % of total data center power consumption. To bridge a gap between rising energy and rising se of cloud computing, the concept of Virtualization is implemented. There is an attempt to reduce data center power consumption through data center Virtualization. IaaS (Infrastructure as a Service) is at bottom service level, other levels like PaaS (Platform as a Service) and SaaS (Software as a Service) are built above it. Thus virtualization can be achieved at these levels starting specifically from lowest level (IaaS) to reduce the energy demands of the data center through server consolidation and dynamic management of computer assets across a pool of servers. Virtualization may redefine operating systems and make them develop towards a more robust form of multitenancy that will force them to have separate hardware and application facing components. Thus one way to save power with cloud Computing is by Server Consolidation and Dynamic Virtual Resource Management[6].

B.   Reduce Power by Multicore Servers

General x86 servers typically run only a single application; their processors sit idle 85-95 percent of the time. While sitting idle, these servers use nearly as much power as they do when they are active. Thus, the underutilization of resources must be solved by implementing the concept of massive hyper threading into servers. So, that idle time of the processor will be utilized in useful applications, thus utilizing the power consumed into meaning solutions. Power can be saved by increasing the number of processor cores in a server, since the power-hungry memory and support circuitry is shared. A data center can replace their old, single-processor servers with new servers that have multi core processors, which are more powerful and more energy-efficient.

C.   Cooling Techniques

To reduce the amount of energy needed by computer the reuse of heated air can be made by cooling it again. The power spent on cooling the servers are huge. Electricity that goes into a data center building ultimately turns into heat, and thus there are fans, pumps, and air conditioning equipment to remove all that heat. Cooling is responsible for a 30-70% overhead in energy usage. Thermal management systems and services can be efficient by controlling the amount of cooling sent to each rack of equipment and hence reducing cooling requirements. Evaporation is a powerful tool. Use of the evaporative process with cooling towers can save energy. Data centers can be redesigned to improve air flow and reduce the amount of power used to cool the servers. The use of Solar energy must be maximized, solar panels must be mounted on the roofs to save energy, thus going green[7][8].

D.   Desktop Virtualization

A cloud computing system is a set of IT resources which are designed to be allocated to dynamic applications, rather than be assigned a static set of applications as is the case in client/server computing. In a cloud computing scenario a user requests information from an application. The cloud computing environment must then negotiate resources to run that application. Desktop Virtualization separates a personal computer desktop environment from a physical machine using a client-server computing model. The model stores the resulting "virtualized" desktop on a remote central server, instead of on the local storage of a remote client; thus, when users work from their remote desktop client, all of the programs, applications, processes, and data used are kept and run centrally. This scenario allows users to access their desktops on any capable device. Virtual desktop infrastructure, sometimes referred to as a virtual desktop interface (VDI) is the server computing model enabling desktop Virtualization.

E.   Reduction in Hardware Components

Eco-friendliness can be achieved by using the cloud. Reducing the number of hardware components and replacing them with cloud computing systems reduces energy costs for running hardware and cooling as well as reducing carbon dioxide emissions and conserving energy. Moving applications to the cloud can potentially reduce energy costs for running and cooling hardware. Thus, saving the data on the cloud can make it accessible at anytime at any location. An application is built using the resource from multiple services potentially from multiple locations. Thus the concept of Thin Clients can be adopted which require less hardware and less power. At this point, typically you still need to know the endpoint to access the services rather than providing the cloud you available resources [9]. Behind the service interface is usually a grid of computers to provide the resources.

F.   Reduction in travel requirements for employees/customers

Minimization in traveling ultimately saves energy as well as save energy fuels. If an individual receives the intended task and resources at one click that is gone for transactions online, shopping online, social networking online, this redcap in traversing from one location to another. This is a fundamental change, but offers substantial benefits and cost reductions. With virtualized desktops, they can effectively access their PC's from home. Meetings can be replaced with conference calls, and as internet access speeds improve we can expect the return of video conferencing. Teleconferencing and Telepresence   technologies are often implemented in green computing initiatives.

Webcams are cheap and bandwidth is readily available, so we can send data, voice and video over the internet creating virtual meetings and offices. Voice over IP (VoIP) reduces the telephony wiring infrastructure by sharing the existing Ethernet copper. Thus we can store and access all the required data on cloud at any time at any place with the benefits of saving energy [1][2][3].

V.   CONCLUSION

As mentioned there are various ways in which Cloud Computing and Green Computing can be made up together. These approaches are quite vital as in the current scenario of internet world; the usage of internet resources is on the fire. Every individual is converting themselves to store their important data in the cloud instead of local hard drive as the required data can be accessed from anywhere and anytime with reliability and efficiently. So combining it with saving energy is also equally important. Thus the concepts of Virtualization, Server Consolidation, Virtual Resource Management, Cooling Techniques, Solar energy, usage of Thin Clients, reducing the travel costs, reduce hardware components, and using green Data Centers are the methods through which cloud Computing can go Green. Thus save energy, save power, save resources, save the nation, save the universe and live a healthy and peaceful life. The figure no 4 summarizes the concept of cloud computing with Green Techniques.

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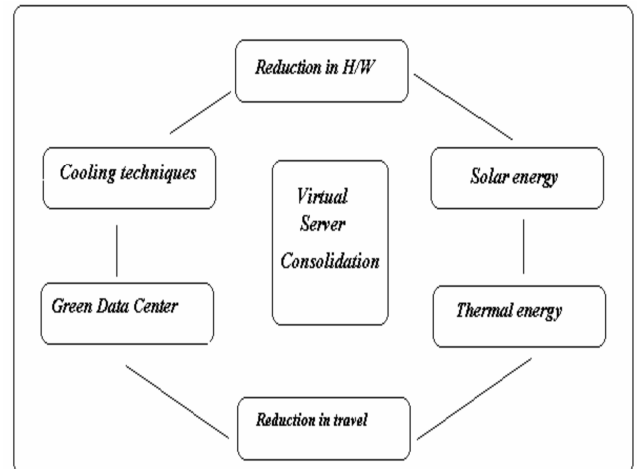
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Figure 4 Green Strategies for Cloud Computing