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Theoretical Model for Energy Efficient Cloud Network

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Abstract-- Cloud computing offers a utility based service by sharing resources for its clients through using Internet. Because of well advantage features, the popularity of such cloud computing growing very rapidly. As a result, power consumption by cloud data center also increase continuously. Data centers consume lot of electrical power that effects indirectly to the carbon dioxide emission in environment. Beside this, there have many other factors which also effect the power consumption of cloud environment-communication equipments which act as a bridge between users to cloud data center, user devices that are also contribute a small amount of consumption in cloud network. This paper offers a theoretical model that brings down the energy by proper maintenance of overall cloud network.

***Keywords*—**Data center; Energy Consumption; Virtual Machines

I. INTRODUCTION

Cloud service provider serves their services to the customer by sharing the resources using the Internet via web-based applications. Data is hosted by the servers. Cloud computing permit the verified user to access the data from internet through an electronic device .It uses dynamic infrastructure which applies to the service, compute capability, storage capacity and IT domain [1]. User or client can access their necessary service requirement from the cloud by using various pricing policies (i.e. Pay-per-usage, pay-per-month etc) [1]. Users link themselves to their interested cloud network and then access cloud data center through router. A data center compressed with router, LAN, server and computer memory. The user uses a list of devices to access cloud services via the internet include mobile phone, desktop computer, high-end computer, modern mid range computer, laptop, tablet, etc. All users send requests from their device to the cloud service provider and through the router finally make a connection with the cloud data center. In a path from user's device to cloud data center each of router also contribute an important role in a domain of energy consumption. Although network's routers and user uses devices are not directly related to any cloud data server, but these are continuously contribute a prime function towards to the green environment. This paper begins with brief introduction of cloud computing in section 1. Section 2 gives description why energy consumption in cloud should be considered. In section 3 briefly describe power consumption areas in cloud environment. Section 4 presents propose efficiency model. Section 5 presents future direction and last at section 6 concludes this paper.

II. WHY ENERGY CONSUMPTION IN CLOUD SHOULD BE CONSIDERED?

Cloud can offer energy saving computing particularly if the end user migrates themselves towards to the less energy consumption devices. In USA, it is observed that data center consume approximately 1.2 % of total electricity consumption in 2005 [3]. In develop countries transmission and switching network takes 0.4% of total electricity consumption specially for broadband [3].Now, it is an engineering challenge issues as computing tasks rising so fast that need larger server to process fast enough within a little time limit, spread more energy and also need a huge cost to manage such large data centers and its cooling system. Against this, but if managed properly, it can develop an energy saving green cloud platform.

III. POWER CONSUMPTION AREAS IN CLOUD ENVIRONMENT

The user employs a list of devices to access cloud via the internet include mobile phone, desktop computer, high-end computer, modern mid range computer, laptop, tablet, etc.CPU, random access memory, hard disk, power supply unit all are covered with these twists.

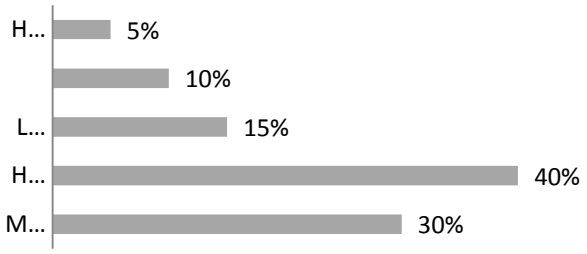

Figure1. Percentage of Power Consumption by Different Devices

Fig. 1 shows a list of commonly used devices that users use basically for personal computing or access the cloud services [4]. Cloud data center provides a collection of hard disks together with necessary equipments. Hard disk arrays that include cache memory, disk controller and power supplies. The server performance depends on the computational features of the job being performed, including the act of floating-point operations, memory accesses and suitability for parallel processing.

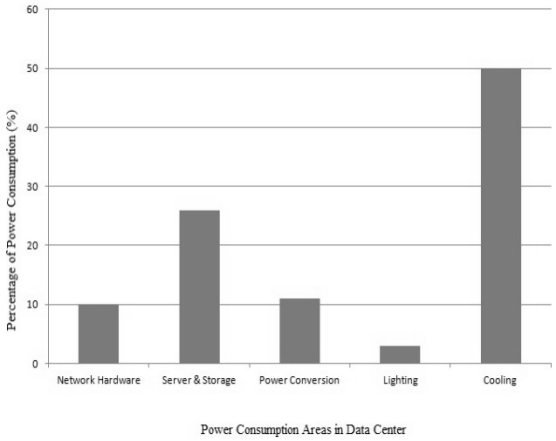

Figure 2. Energy Distribution in Data Center

The fig. 2 shows energy consumption bar graph by various equipments needed for continuous maintenance an active cloud server [4]. Fig.2 shows that most of power is expended on the cooling system.

Network Equipments- the Ethernet switch performs traffic and join two or more routers which do authentication and traffic management. These routers perform all necessary routing and also function as a gateway to neighboring routers.

IV. EFFICENCY MODEL

Proposed architecture based on optimization, monitoring and reconfiguration to get an energy saving cloud architecture. Divide whole cloud infrastructure into three segments-Servers Level, Network Level and Client or User Level.

In server level, the data center is one of the strong components where need to focus on allocating physical machines with less energy consumption.

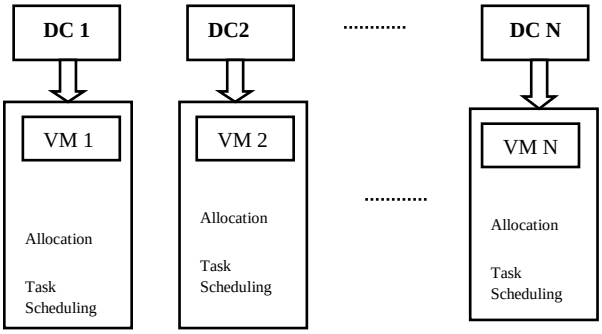

Figure 3. Cloud Server Level

There has lots of mechanism that performs this proper allocation. Then task scheduling approach which helps to schedule various tasks dynamically in server level. Similarly, there have lots of scheduling approach by which various tasks can be scheduled properly.

Second Stage, at network level energy consumption of whole cloud network also minimizes by proper use of network equipments through which user connects the cloud core data center.

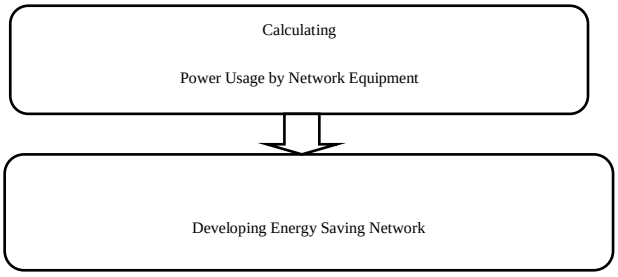

Figure 4. Network Level

The user request travels around the network as a packet of data via the network equipments (Ethernet switches, provider router, core router, gateway router). So, get a more efficient cloud environment, there must require calculating total energy consumption by all these network equipments.

In last level, user uses their devices and one appropriate web browser through which they submit their request to the cloud. We suggest a browser that measures the human activity in the environment.

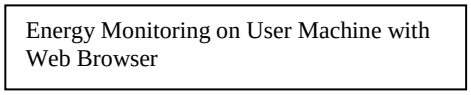

Figure 5. Client Level

So the energy distribution approach managed through combined all of above stage starting from client level to the server level. Finally propose an energy saving cloud model by combining all of these stage properly.

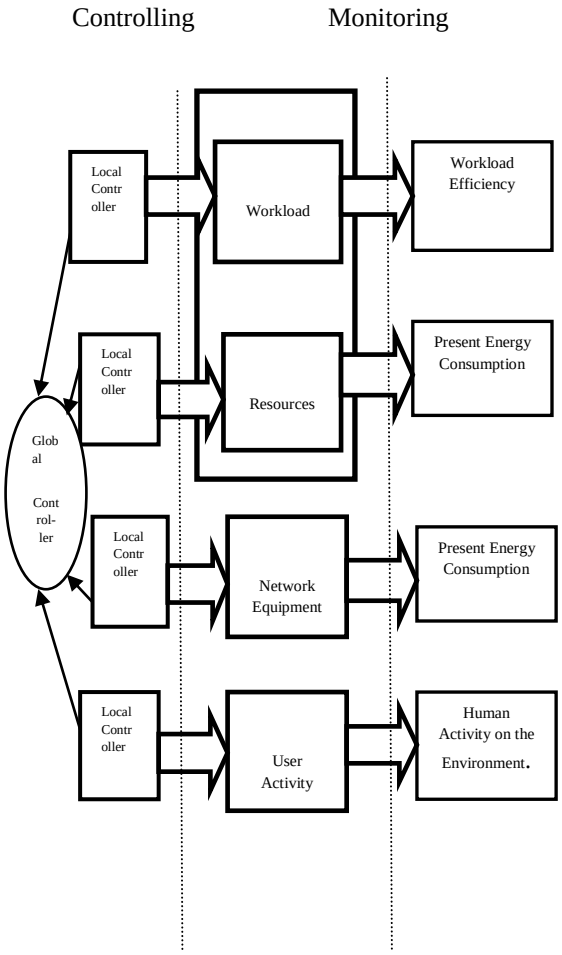

Figure 6. Proposed Efficient Model

In fig.6 combine above 3 levels and try to create an energy saving cloud architecture. In fig.6 at server level, there has one sensor which senses present workload efficiency and total consumption by various resources. Similarly, network level sense energy consumption by various network or connection equipments and finally sense human activity on the environment. All of above three levels properly monitor by a local controller, which are individual for each layer. so the local controller calculates the energy expenditure and send a calculation result to the global controller who at least call for a conclusion whether there need any reconfigure of present cloud environment and finally conducting a right and appropriate decision by global controller. These propose model produce a more energy efficient cloud environment.

V. FUTURE SCOPE

Although the green cloud computing focus on various features to create much more green cloud computing, there have some technological solution are required to make it more "green"- Required to design software that provides the system larger energy efficiency. The operating system and compiler need to be design in such a fashion, resource can be allocated for an application that mange energy efficient performance. Cloud hosting provider need to be focused on existing data center's power, cooling technique, power consumption of server and necessary cooling equipments that achieve maximum efficiency. Thus, required modeling tools that calculate power usage by all the components related to the cloud starting from user PC to cloud data center. Need task scheduling and appropriate resource allocation techniques within the data center which helps to make an energy efficient solution. Allocation of VMs even an efficient mechanism to minimize overall power usage by data center also need to focus to fulfill SLAs with users.

VI. CONCLUSION

In this paper by monitoring and controlling the total energy consumption on various areas in a cloud environment and energy efficient resource allocation framework that encourages both cloud provider and cloud user for achieving higher energy efficiency and preventing SLA violations respectively with the aim of green cloud resources deployment. This overall analysis can give an extra impact by reducing usage of energy, encouraging "green" IOT-based smart solution e-work, e-learning and smart climate control network.

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Author Profile

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