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A Study about Green Computing

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Abstract*— In past a few years computer paradigm is shifted to remote data centres and the software and hardware services available on the basis of pay for use .This is called Cloud Computing, In which user have to pay for the services .Cloud provide the services – Software as a service ,platform as a service and infrastructure as a service .These services provided through the remote data centres (since the data is scattered /distributed over the web.), as Software application and other services migrated on the remote data centre ,management of these data centre in important. Data centre management faces the problem of power consumption. At present cloud computing based system waste a great amount of power and produces co_2. Since many servers don't have a good quality cooling system. Green computing can enable more energy efficient use of computing power .This survey paper show the requirement of green computing and techniques to save the energy by different approaches.

Keywords*— Green computing, Cloud Computing, Virtualization, Iaas, SaaS, Paas.

I. INTRODUCTION

Today's computing vision is utility based Consumers only need to pay provider only when and how they access, they need not to invest much and there is no need to develop an complex and costly infrastructure, this model of computing is cloud computing .Cloud means a user can access application as a service from anywhere in the world on demand cloud computing services are supported by a state of data centre (data server) which uses the virtual machines for isolation purpose. Data centre management faces the problem of power consumption and application's quality of services [1]. Cloud computing delivers infrastructure platform and software (application) as a service on demand as a subscription based services [2]. To reduce the power consumption here the term green computing is used .When we introduced the term green computing we thought going green with computers [3]. Green computing concentrates on energy efficiency reducing recourse consumption. In many organization IT department is generally consumed a lot of power [3] Green computing is environmentally responsible use of computing. As computer system increasing so the amount of energy conservation and the carbon contents are increasing in atmosphere. Measure being taken to reduce the problem superficially called "green computing". Green Computing is practice of designing manufacturing, using and disposing of computer server and associated sub system such as monitors, printer's storage devices networking and communication system efficiently and effectively with no impact on environment [5].The Technical processes adopted by the industries creates challenges in the management of the waste. Green computing shows how to use resources efficiently and how to reduce the waste Green computing is the requirement to save the energy with the expenses .Currently the implementation on green computing practice is going on, but firstly we have to know what kind of energy should be gained and how it is achieved. So analysis of the gap what are the resources we have and what we are going to do to achieve the benefits of green computing.

"Green computing" represents environmentally responsible way to reduce power and environmental e-waste. Virtualization, Green Data Center, Cloud computing, grid computing, Power optimization are the technologies of green computing. Main goals of green computing are to reduce the use of toxic and hazards materials and improve the energy efficiency, recycling of factory waste. Such practice includes the efficient implementation of server and peripherals as well as reduces the power consumption.

II. NEED FOR GREEN COMPUTING

Green computing is a new technology whose goal is to design better computer system means their processing is better and consume less amount of energy. Many studies already show that power cost has a more percentage of the total management cost of data center. Use of computer system and IT services makes life easier and work faster, it increase resulting of greater power consumption, which increase emission of green house gas like CO2. Since the computer system consume power and its peripherals also consume power even when these are not in use. Data center needed a lot of power and cooling system, if the required power and cooling capacities are insufficient then it will result in loss of energy. Study shows that most of data centers don't have sufficient cooling capacity this is the cause of environmental pollution. Green computing is deals with concepts reduce energy consumption, recycling eliminate hazardous elements but it also deals with reduce in the business travel sharing the resources (cloud computing) and optimization. There are a lot of fundamental steps that can be taken to significantly decrease the power consumption and impact on environment.

Lower Power hardware: computer systems are made up of hardware i.e. processor onboard graphics, disk, fan etc these hardware should be consumed less power.

Virtualization: It is the use of software to simulate hardware. In the data center stand alone server system replaced with virtual server that run as software on a small number of larger computer via a virtualized server we can efficiently use computer resources.

Cloud computing: It has many benefits it enables anybody to obtain environmental benefits of virtualization. It also remove the need for the user to run high power PCs since it provide infrastructure as a service.

Wireless Network Sensor: Sensor employed in different parts area in a data center to determine the temperature of each area, this will tell which area need to be more cool and where to reduce cooling.

Recycle: Through recycling the waste or equipment we can reduce the environmental pollution.[6]

Fig 1 – Green Computing

- ✓ Climate Change: Researches done in past shows that CO2 and emission of others affect the global climate and responsible for damage of our environment .Preserve the planet is main goal. Planet like earth is rare. There is no m-class planet in our solar system and no other star system have m-class planet as we know.
- ✓ Savings: Green computing can lead to serious cost savings. Reductions in energy costs from servers cooling and lighting.
- ✓ Reliability of Power: As the energy demands increasing day by day and supply is declining. Energy efficient system ensures healthy power system. Many industries generate their own electricity which motivates to keep the consumption low. Computing Power Consumption has Reached a Critical Point: Data centers have run out of usable power and cooling due to high densities [7].

III. APPROACHES TO GREEN COMPUTING

A. **Green Data Center**: - Data centers or computer center has a computer system and its associated system such as telecommunication system data storage system. It needs backup power supply, some cooling system and security system. A green data center is a data center which has a efficient management of the system and associated system less power consumed environment.

Practical requirement of data centers are as follows:

- Provide a physical secure location for server.
- Should provide all-time network connectivity in data center.
- Should provide necessary power to operate all equipment.

Characteristics

- Design must be simple
- Design must be scalable:
  The design should be scalable because once it finalize must work for any size of computer center.
- Design must be modular.
- Design must be flexible.

B. **Virtualization: -** Virtualization, a term that used to the various techniques, methods or approaches to create a virtual environment, such as a virtual hardware platform, virtual operating system (OS), storage device, or network resources.

i. Challenges: - Complexities of licensing are the issue with virtualization. For example a Linux based server offers a virtualized windows server must satisfy licensing requirements. Because of this licensing issue flexibility of virtualization and benefits of on demand virtualization is hampered. Some venders of proprietary software have attempted to update licensing scheme to address the virtualization but flexibility and cost issues are opposing requirements. Virtualized desktop results in dependence on centralized servers (for computing and SAN storage) and the network (and higher-bandwidth requirements). Dependency on centralized server and network leaves the end users vulnerable to server. The user able to operating locally through an outage, but when user logs off or reboots the machine

it become dead This is in contrast with thick clients where the user operate locally continue until the connectivity can be restored.

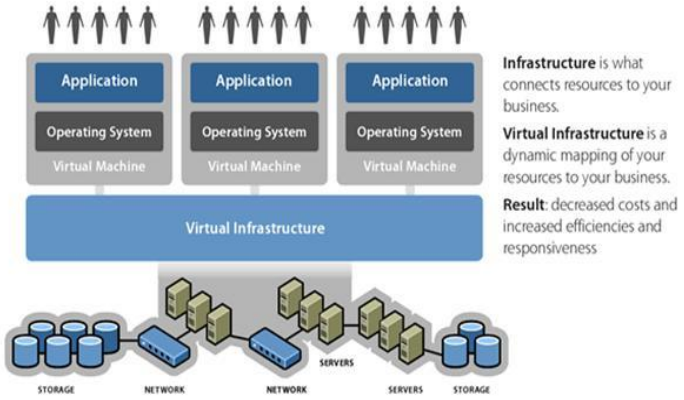

Fig 2 – Virtualization

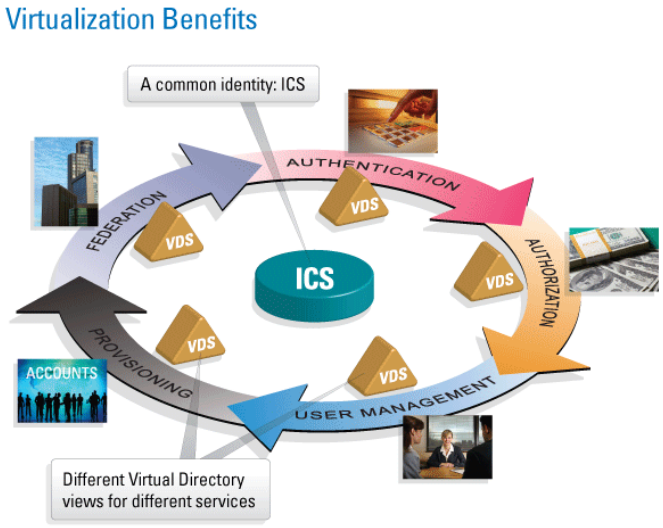

Fig 3 – Virtualization Benefits

C. **Cloud Computing:** Cloud computing name comes from the cloud shaped symbol in which the complex infrastructure is hidden as it contain in its system diagram. Cloud computing delivered the computing resources as a service over the internet. Cloud computing provide user's data, software remotely End user can use the cloud services or cloud application through a web browser or a mobile app while the software and user's data is stored on remote data server. As well as Cloud computing allows companies to avoid infrastructure cost, and focus on projects that differentiate their business. Cloud computing allows enterprises to get their application up running faster with improved man power and less maintenance and enable IT to more rapidly adjust resources to meet the unpredictable business demand.

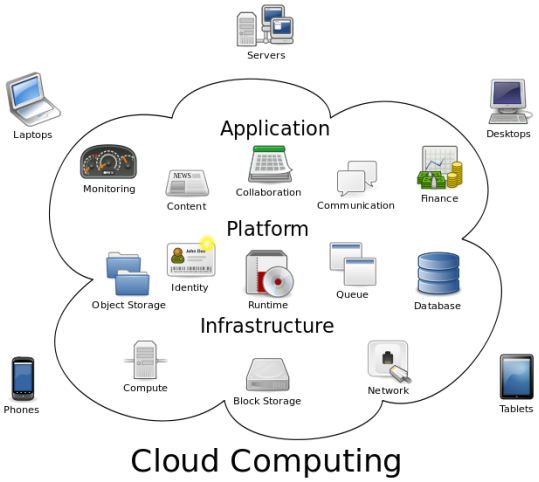

Fig 4 – Cloud Computing

i. **Infrastructure as a service (IaaS):-** Infrastructure as a service: - In the cloud service model providers offers Physical or more often virtual machine. A hypervisor such as Xen or KVM runs the virtual machine. Hypervisors pools within a cloud support system can support large number of virtual machine and can maintain the saleability of services according to customer requirements.

IaaS clouds offer other additional resources such as virtual machine disk, image library, IP address, and firewalls etc, Iaas providers supply these resources on demand from their data centres.

ii. **Platform as a service:-** In the Paas model, Cloud provider offers computing platform including operating system, execution environment, database and web server. Developer can develop and run their software on a cloud platform without any complexity and cost of buying and managing the hardware and software layer.

iii. **Software as a service**: - In the SaaS model providers install application software in the cloud and users can access the software from clients. Cloud users do not manage the infrastructure and platform. SaaS eliminates the need to install the software and run the application on the user's own computer which simplifies maintenance and support.

Cloud application are different from others in their scalability, scalability can be achieved by cloning onto multiple VM's at run time to meet work demands.

IV. FEW REASERCHES TO REDUCE THE POWER CONSUMPTION

A. POWER AWARE HYBRID DEPLOYMENT

To deal with challenges like trade off power consumption and QoS, a lot of efforts ongoing on the power aware and Qos aware application deployment based on the work researcher Zhiwu Liu ma, Fanfu Zhou Yindong Yang and researcher Zhengwei Qi Habing Guan presented a I/O and power CPU intensive application hybrid deployment to optimize resource utilization within virtualization environments. In this they investigate the resource allocation between virtual machines where 1/0 and CPU-Intensive applications reside, to realize power-aware applications hybrid deployment. To demonstrate the problem of I/0 and CPU resource in virtualization environment, They use Xen as the Virtual Machine Monitor for experiments. Under different resource allocation configurations, they evaluate power efficiency up to 2 % - 12 %, compared to the default deployment.

They also conclude the more CPU resource that the CPU-Intensive applications in the hybrid deployment applications need to satisfy QoS.They get that server virtualization techniques provide a smooth mechanism for power-performance tradeoffs in modem data centers running heterogeneous applications. Virtual Machine Monitors (VMMs) are gaining popularity in enterprise data centers. But traditionally, VMM schedulers have focused on fairly sharing the processor resources among domains while leaving the scheduling of I/O resources as a secondary concern [8].

This can result in unpredictable 1/0 behavior, and poor and/or unpredictable application performance and power efficiency. They focus on the unpredictable 1/0 behavior under current VMM schedulers. In order to implement motivation and achieve CPU Intensive and I/O-Intensive applications hybrid deployment within virtualization environments, we face some challenges to explore the unpredictable 1/0 behavior. Before expressing these challenges, they make some additional introductions. Their work will focus on Xen VMM, which is an open source virtual machine monitor based on the Linux kernel [8]. Also we need to give a demonstration on virtual 1/0 implementation in Xen in the next paragraph. Organization of Xen effectively consists of two elements: the hypervisor and the driver domain. One of the major functions of the driver domain is to provide access to the actual hardware I/0 devices. The hypervisor grants the driver domain direct access to the devices and does not allow the guest domain to access them directly. Therefore, all I/0 traffic must pass through the driver domain. So the performance of server residing in guest domain will depend on CPU allocated to the driver domain.

They make the power model, which shows the relationship between power and server utilization within the test bed .In other sub section resource utilization under various workload is recorded and at the last they introduce power efficiency evaluation proposal which they used and the improvement of power efficiency under different configuration is shown. Firstly they calculated power consumption and calculate power efficiency.

- **Power and Utilization:** Power consumption is expressed as a percentage of peak power across the data center. The model of wang rt.al [10] to estimate power consumption, for a fixed operating frequency, the power consumption of the server is approximately linear functions of the server utilization.

After completion of two other sections they conclude from the analysis, they obtain that CPU-Intensive and 1/0-Intensive applications hybrid deployment can improve power efficiency.

B. POWER MANGEMENT USING GREEN ALGORITHM

In this research study R.Yamini said that today's environmental challenge is global warming, which caused by emission of carbon .Energy crisis brings green computing and green computing needs algorithm and mechanism to be redesigned for energy efficiency. Various approaches to the green IT are virtualization, Power management, recycling and telecommunicating. The basic principles of cloud computing is to make the computing be assigned in great number of distributed computer or remote server. Cloud computing is an extend of grid computing, distributed computing and parallel computing Currently, a large number of cloud computing systems waste a tremendous amount of energy and emit a considerable amount of carbon dioxide. Thus, it is necessary to significantly reduce pollution and substantially lower energy convention. The analysis of energy consumption in cloud computing consider both private and public clouds. Cloud computing with green algorithm can enable more energy-efficient use of computing power. This paper concluded that task consolidation particularly in clouds has become an important approach to streamline resources usage and in turn improve energy efficiency. Based on the fact that resource utilization directly relates to energy consumption,

have successfully modelled their relationship and developed two energy conscious task consolidations heuristic. The result in this study should not have only a direct impact on the reduction of electricity bills of cloud infrastructure providers, but also imply possible savings in other operational cost of course the reduction in the carbon footprint of clouds is another important spinoff[3] .

C. POWER AND ENERGY MANAGEMENT FOR SERVER SYSTEM

According to Ricardo Bianchini and Ram Rajamony Power and energy consumption are key concerns for data centres. These centres house hundreds or thousands of server and supporting cooling infrastructures. Previous research on power and energy management for servers can ease installation, reduce costs, and save the environment. Given these benefits, researches have made important strides in conserving energy in servers. Inspired by this initial progress, researches are delving deeper into this topic. In this paper, survey the previous work, describe ongoing efforts, and discuss the challenges [11].

V. CONCLUSION

This paper is survey or a brief study about a green computing in a cloud environment .The study will also tells the approaches of green computing. What and how much work done in green computing and how the power consumption is reduced through different approaches and key challenges facing to accomplish the goal. The concept of green computing is popularized in the past few years. Apart from ecological issues, this also deals in economic needs. This paper aimed to provide a survey on the current state-of-the-art in green computing. In addition, details of some real solutions have been showed as well. In the future we can save more energy through several approaches which are shown in the paper like virtualization, data centre and many other approaches. i.e. cooling of server, we can analysis the energy conservation and optimize it.

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