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Approaches for 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 centers (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 co2. 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.

INTRODUCTION

"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.

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.

This technology is beneficial as it:

- Reduce energy consumption of computing

- resources during peak operation
- Save energy during idle operation
- Use eco-friendly sources of energy
- Reduce harmful effects of computing resources
- Reduce computing wastes

Why Green Computing?

In a world where business is transacted 24/7 across every possible channel available, companies need to collect store, track and analyse enormous volumes of Data everything from click stream data and event logs to mobile call records and more. But this all comes with a cost to both businesses and the environment. Data warehouses and the sprawling data centres that house them use up a huge amount of power, both to run legions of servers and to cool them. Just how much? A whopping 61 billion kilowatt hours of electricity, at an estimated cost of $4.5B annually.[12] The IT industry has begun to address energy consumption in the data center through a variety of approaches including the use of more efficient cooling systems, virtualization, blade servers and storage area networks (SANs). But a fundamental challenge remains. As data volumes explode, traditional, appliance centric data warehousing approaches can only continue to throw more hardware at the problem. This can quickly negate any green gains seen through better cooling or more tightly packed servers.[6] To minimize their hardware footprint, organizations also need to shrink their "data footprint" by addressing how much server space and resources their information analysis requires in the first place. A combination of new database technologies expressly designed for analysis of massive quantities of data and affordable, resource efficient, open source software can help organizations save money and become greener.[6] Organizations can do so in the following three key areas: reduced data footprint, reduced deployment resources, and reduced ongoing management and maintenance. [6]

Issues and Economic

Green IT practices attract media and management attention today, in part, because of a broader interest and emphasis on corporate social responsibility (CSR) programs. With increasing public awareness of environmental issues, CSR efforts also are tied to initiatives that build a positive environmental brand image. In the infrastructure support and data center management communities, there is a growing body of evidence that IT organizations can also —green up their energy, procurement and recycling practices. These efforts are being closely watched across the industry because, while they contribute to the broader corporate social and environmental agenda, evidence indicates that the initiatives make sound economic sense and in many cases generate substantial savings. With this —win-win opportunity emerging across CGI's network of clients, IT is increasingly becoming a major area of focus and opportunity for organizations looking to adopt green or sustainable business practices. In a practical sense, the new programs target a wide range of energy, cost, environmental and travel-related issues. Among the issues most commonly reported, and those that appear to be fueling the Green IT movement, are the following:[7]

• Rising energy demand with a more limited supply and increasing utility costs

• Management of hazardous waste and electronic equipment disposal (e-waste)

• Increasing gasoline costs, which drive up employee commuting costs leading to retention issues?

• Increasing real estate costs

• Rising airline ticket costs and travel complexities

• A stronger regulatory climate at the federal, state and local levels

Approaches to Green Computing

Virtualization

Computer virtualization refers to the abstraction of computer resources. With virtualization, a system administrator could combine several physical systems into virtual machines on one single, powerful system, thereby unplugging the original hardware and reducing power and cooling consumption. Several commercial companies and open-source projects now offer software packages to enable a transition to virtual computing. Intel Corporation and AMD have also built proprietary virtualization enhancements to the x86 instruction set into each of their CPU product lines, in order to facilitate virtualized computing.

Terminal Servers

Terminal servers have also been used in green computing methods. Terminal Services for Windows and the Aqua Connect Terminal Server for Mac, both deliver operating systems to end users. Using this method user's terminal in to a central server. All of the computing is done at the server level but the end user experiences the operating system. There has been an increase in using terminal services with thin clients to create virtual labs. Thin clients use up to 1/8 the amount of energy of a normal workstation. Using thin clients with a terminal server delivers the Windows or Mac operating system to end users while also decreasing energy costs and consumption.

Power Management

The Advanced Configuration and Power Interface (ACPI), an open industry standard, allows an operating system to directly control the power saving aspects of its underlying hardware. This allows a system to automatically turn off components such as monitors and hard drives after set periods of inactivity. In addition, a system may hibernate, where most components (including the CPU and the system RAM) are turned off. ACPI is a successor to an earlier Intel-Microsoft standard called Advanced Power

Management, which allows a computer's BIOS to control power management functions.

Power Supply

Desktop computer power supplies (PSUs) are generally 70–75% efficient, dissipating the remaining energy as heat. An industry initiative called 80 PLUS certifies PSUs that are at least 80% efficient; typically these models are drop-in replacements for older, less efficient PSUs of the same form factor. As of July 20, 2007, all new Energy Star 4.0-certified desktop PSUs must be at least 80% efficient.

Storage

Smaller form factor (e.g. 2.5 inch) hard disk drives often consume less power per gigabyte than physically larger drives. Unlike hard disk drives, solid-state drives store data in flash memory or DRAM. With no moving parts, power consumption may be reduced somewhat for low capacity flash based devices. Even at modest sizes, DRAM based SSDs may use more power than hard disks, (e.g., 4GB i-RAM uses more power and space than laptop drives). Flash based drives are generally slower for writing than hard disks. As hard drive prices have fallen, storage farms have tended to increase in capacity to make more data available online. This includes archival and backup data that would formerly have been saved on tape or other offline storage. The increase in online storage has increased power consumption. Reducing the power consumed by large storage arrays, while still providing the benefits of online storage, is a subject of ongoing research.

Video Card

A fast GPU may be the largest power consumer in a computer. Energy efficient display options include:No video card - use a shared terminal, shared thin client, or desktop sharing software if display required.Use motherboard video output - typically low 3D performance and low power.Reuse an older video card that uses little power; many do not require heatsinks or fans. Select a GPU based on average wattage or performance per watt.

Display

LCD monitors typically use a cold-cathode fluorescent bulb to provide light for the display. Some newer displays use an array of light-emitting diodes (LEDs) in place of the fluorescent bulb, which reduces the amount of electricity used by the display.

Telecommuting

Teleconferencing technologies are often implemented in green computing initiatives. The advantages are many; increased worker satisfaction, reduction of greenhouse gas emissions related to travel, and increased profit margins as a result of lower overhead costs for office space, heat, lighting, etc. The savings are significant; the average annual energy consumption for U.S. office buildings is over 23 kilowatt hours per square foot, with heat, air conditioning and lighting accounting for 70% of all energy consumed. Other related initiatives, such as hotelling, reduce the square footage per employee as workers reserve space only when they need it. Many types of jobs -- sales, consulting, and field service -- integrate well with this technique.

Few Researches 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.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. 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 cloudcomputing considers 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.

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.

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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