GREEN COMPUTING: AN EXPLORATION OF APPROACHES & IMPLEMENTATIONS

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ABSTRACT

As computers have become more & more commonplace and prevailing in our day to day lives, their impact on our lives as well as the environment has grown tremendously. The amount of e-waste generated every year all around the world has reached alarming levels. Green Computing is the study and practice of environment friendly computing resources and application of techniques & methodologies to minimize power consumption & pollution caused by the use of IT. The aim of green computing is to reduce resource consumption and harmful emissions as well as decrease the use & generation of hazardous materials. It encompasses the creation of better hardware that run on less power & development of better algorithms that utilize the underlying hardware in a more efficient manner. The focal point of this paper is to highlight the impact of the IT industry & computing practices on the environment and to show the need for green computing. This paper then goes on to illuminate various solutions, which have been implemented in the recent past in order to realize the goals of greener and more eco-friendly computing.

Keywords: Blackle, Cloud Computing, Energy Efficiency, Green Data Centre, Virtualization

I. INTRODUCTION

Green Computing is an approach witch works for efficient & Eco-friendly computer resources. If we heard the term Green Computing we thought something doing green with computing, but question is HOW we can do this. When we finding the answer of it we conclude that Green computing = Great Computing. By Green Computing we can maximize energy efficiency in products lifetime, reduced CO_2 emission, promote recyclability and reduced the use of Hazardous Materials.

Figure 1: Green Computing [15]

Presently the ICT business is utilizing 3% of the world's energy resources. This energy consumption is supposed to grow at the rate of 20% per year; by 2030 ICT industry would be responsible for doubling the world's energy utilization.

Green Computing is now under the attention of Organizations as well. Organizations using Green computing Approaches to designing, building and operating Computer system to energy efficient. By using Green Computing Approaches like Virtualization, Cloud Computing, Power Management organizations can offer Green Computer that are affordable as well as Eco-friendly.

In present time people are aware about environment and they want Eco-friendly products and equipments in their life. People thought by the less use of paper they save environment but it is not as much as correct, for example if people prefer E-mail over to paper (letters), but this is not so Green. In Europe's largest IT infrastructure company, Mr. Matthew Yeager of Computer Centre claims that sending an e-mail attachment of 4.7 megabytes (MB) creates as much greenhouse gas as boiling a tea-kettle 17.5 times. He claims that an e-mail of 1 MB would be the equivalent to the emission of 19 grams of CO2 and if that mail is copied (cc'd, as we type) to 10 people; its impact is 73 grams of CO2. E-mail is thus not all that green. And e-mails with attachments are worse [8].

Today is the Era of computer if we think about Environment can we reduce the use of computer, is it the solution? No is not. We have to do some small- small steps for it like, simply turning off a PC when not in use can have a major impact on energy consumption as well as on environment.

Current Era belongs to Computer and electronic world this means in future the energy will be a serious issue as today people talk about Global Warming, CO_2 emission and climate change. We have to take it as serious thing to go greener in term of computing to achieve highly Efficient Computing Era.

II. WHY GREEN COMPUTING?

Today companies are manufacturing devices witch are more efficient and accurate but they are more energy consuming and having Toxic, dangerous gases & chemicals(Lead, mercury, Cadmium etc.) witch increasing pollution rapidly because of it the goal of companies is to design devices whose processing is better and consume less amount of energy.

Data canters are the main energy consumption sources. It needed a lot of power and cooling system, if Data canters have insufficient cooling capacity then it cause environmental pollution. Green computing technologies reduce energy consumption, recycling hazardous chemicals.

This technology is beneficial as it [1]:-

- 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.

III. APPROACHES TO GREEN COMPUTING

3.1 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 an efficient management of the system and associated system less power consumed environment.

Figure 2: Green Data Center [16]

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 of Green Data Centers:

- Design must be simple
- Design must be scalable:
- Design must be modular.
- Design must be flexible [9]

3.2 Virtualization

Virtualization is the utilization of PC programming to mimic equipment. Inside server farms, server combination applies virtualization in its substitution of numerous stand-alone physical servers with virtual servers that run as programming on a little number of bigger PCs. To their clients, virtual servers can be arranged to still show up as physical machines on their system. To support further with vitality protection, virtualization can occur at the level of records and additionally servers. To allow this, document virtualization programming is as of now accessible that will designate records crosswise over physical circles in light of their usage rates This empowers every now and again got to documents to be put away on superior, low-limit drives, whilst records in less basic utilization are set on more power-productive, low-speed, bigger limit drives.

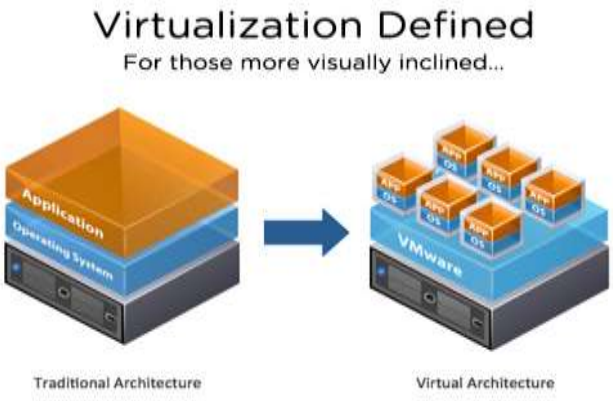

Figure 3: Virtualization [17]

3.3 Cloud Computing

It is the computing model in which programming applications, computing power, information, storage space and possibly even Artificial Intelligence are provisioned & utilized as a service over the Internet. Cloud computing has numerous profits, one of which is empowering anyone to acquire the natural advantages of virtualization. Whilst most servers in organization server farms run at 30 % capacity, most cloud merchant servers run at 80 % capacity or more. By deciding to move to cloud computing and specifically by embracing online PC computing power as PaaS or IaaS, organizations might subsequently possibly diminish their carbon foot print. And also permitting server ability to run at more ideal power consumption, distributed computing can likewise uproot the requirement for most clients to run high-power PCs and laptops.

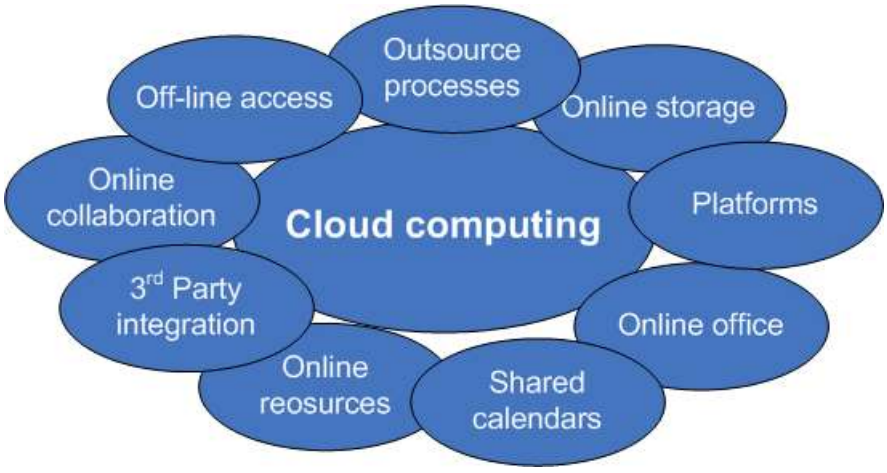

Figure 4: Cloud Computing [18]

IV. RECENT IMPLEMENTATION OF GREEN COMPUTING TECHNOLOGY [14]

4.1 Blackle

Blackle is a search-engine site powered by Google Search. Blackle came into being based on the concept that when a computer screen is white, presenting an empty word or the Google home, and your computer consumes 74W. When the screen is black it consumes only 59W.Based on this theory if everyone switched from Google to Blackle, mother earth would save750MW each year. This was a really good implementation of Green Computing. The principle behind Blackle is based on the fact that the display of different colors consumes different amounts of energy on computer monitors.

4.2 Fit-PC

A tiny PC that draws only 5w: Fit-PC is the size of a paperback and absolutely silent, yet fit enough to run Windows XP or Linux. Fit-PC is designed to fit where a standard PC is too bulky, noisy and power hungry. If you ever wished for a PC to be compact, quiet and green then fit- PC is the perfect fit for you. Fit-PC draws only5 Watts, consuming in a day less power than a traditional PC consumes in 1 hour. You can leave fit-PC to work 24/7 without making a dent in your electric bill.

4.3 Zonbu Computer

The Zonbu is a new, very energy efficient PC. The Zonbu consumes just one third of the power of a typical light bulb. The device runs the Linux operating system using a1.2 gigahertz processor and 512 MB of RAM. It also

contains no moving parts, and does even contain a fan. You can get one for as little as US$99, but it does require you to sign up for a two-year subscription.

4.4 Sunray Thin Client

Sun Microsystems is reporting increased customer interest in its Sun Ray, a thin desktop client, as electricity prices climb, according to Subodh Bapat, vice president and chief engineer in the Eco Responsibility office at Sun. Thin clients like the Sun Ray consume far less electricity than conventional desktops, he said. A Sun Ray on a desktop consumes 4 to 8 watts of power, because most of the heavy computation is performed by a server. Sun says Sunrays are particularly well suited for cost-sensitive environments such as call centers, education, healthcare, service providers, and finance. PCs have more powerful processors as well as hard drives, something thin clients don't have. Thus, traditional PCs invariably consume a substantially larger amount of power. In the United States, desktops need to consume 50 watts or less in idle mode to qualify for new stringent Energy Star certification.

4.5 The Asus Eee PC and Other Ultra Portables

The "ultra-portable" class of personal computers is characterized by a small size, fairly low power CPU, compact screen, low cost and innovations such as using flash memory for storage rather than hard drives with spinning platters. These factors combine to enable them to run more efficiently and use less power than a standard form factor laptop. The Asus Eee PC is one example of an ultraportable. It is the size of a paperback, weighs less than a kilogram, has built-in Wi-Fi and uses flash memory instead of a hard drive. It runs Linux too.

V. CONCLUSION

In this paper we were discussed some Green Computing approaches and its need, witch may help us to reduced the impact of energy consumption in the world. In this paper we also consider Blackle, Zonbu Computer, Sunray thin client and ultra portables PC witch are some recent implementation in Green Computing. For Green Computing There are some approaches like Green data Centers, Virtualization and Cloud Computing witch are very effective to reduced the carbon foot print, permitting server ability to run at more ideal power consumption, and give less power consumed environment. So as the conclusion of this paper we should say that by using or doing this approaches or solutions we will make our Environment healthy and pollution free.

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