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Green Computing: Necessity of Technology

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Abstract: ***In this 21st century technological encroachment has reached to another level. For faster computation and better results computers and other electronic equipment's are the need of every arena. To develop such tools that makes work easier and faster is a challenge for the IT industry. On the contrary, energy shortage and global climate changes are the key issues which are being tackled by the IT industry. Manufacturing and Designing of technical equipment's is easier rather than the designing and manufacturing of such products which are energy efficient and gives effective output. Green computing refers to the same agenda of developing a healthy relation between humans and the nature without decreasing the rate of new creations and deterioration of the resources. Green computing is the study of developing such paraphernalia's that are eco-friendly as well as which results better outputs. This paper covers the essence of green computing, different contribution of IT industry and the ways to resolve them.***

Keywords: Green Computing, Energy Star, Virtualisation, Cloud Computing, Data centre

1. Introduction

Technology seems to be bane sometimes. The imagination of an entrepreneur to make this world a technomart is fulfilled by his effortsbut at the same time the blessings of technology reflects it's another trait. We know that "necessity is the mother of invention", this can easily explain that humans are always in search of minimizing their efforts and get the best result. New gadgets, processors, tablets, android phones all are made to make computation faster than before, but these new discoveries or inventions are alarming.

In today's world scenario sustainability is the main motto of every creation which has already taken place or is going to be happen. It maintains or creates a balance between the various conditions under which the nature and technology congregates together and there is fulfilment of economic and other requirements for both present and future generation. As there is technological progress field so this is liable for more efficient throughput but, on the other hand, it is responsible for more resource consumption which results growth in power exploitation. According to the experts, there is consumption of 1.8 tons of chemicals, fossil fuels to develop a computer and in this era around billions of computers have been sold. It has been observed that 18 percent of the computers are never turned off in United Kingdom. Computers and other electronic devices make two-fifth of the earth's landfill. A simple computer is made up of 4 to 8 pounds of lead[1]. Not only hardware's are responsible for this immense problem software's are also contributing to it in the same proportion.33 terawatt hours energy is used in spam annually, this is just one example. These all results in excessive deterioration of the resources and detriment to the environment. We can say that Comforts lead to an imperceptible consequences and after effect on the environment. IT architects pay very less attention to the factors like optimization of the resources and environmental sustainability while designing any tool.

Green computing is the practical strategy for future use of resources, minimizing the energy usage and maximizing efficiency. Design, Manufacture, Use and Dispose these are the keys on which green computing works on [2]. It provides some ways that can be helpful to gain sustainability. Whether it is related to designing a mouse or designing a computer, IT industry has taken some altruistic attempts to gain a green score card.

2. Organisational Initiatives

In 1992, a voluntary programme was introduced in U.S. by the environmental protection agency. Later on it was converted into energy star programme by John S. Hoffmann known as the initiator of the programme. In this programme there are some plans to promote the energy efficiency equipment's to spread the awareness to use such devices and technologies.

The University of Oxford has taken an initiative to minimize the energy consumption. It is advisable to ask people to switch off their computers when they are idle, but there are conditions when there is remote access. So to encourage people to go green there is usage of Wake-on-LAN service which was first initiated by Intel-IBM. This service allows computers to be turned on or awakened through network messages. It is also possible to initiate message through another network by using sub net directed broadcast.

Electronic product environmental tool known as EPEAT is another witsto go green. It is an online procurement which is designed to help users to evaluate a product's attribute.Products are rated gold, silver, bronze according to the criteria's which are defined by them to rate any product. It was created by Green Electronic Council (GEC) and Environmental Protection Agency (EPA) together [3].

3. IT Contribution

To maintain a balance between environment and technology is not an easy task. IT has accepted this as a challenge and has made some drastic changes in the pattern which are being followed by them for many years. IT deals with hardware and software both and they both are contributing in equal proportion to degrade the resources and power consumption.

3.1. Hardware Approach

3.1.1 DataCentres

Data Centres are the computing clusters that are used to manage, store and disseminates the data or information. Different IT Organizations have their own data centres that acquire enormous amount of energy to work and there is generation of heat. This heat generation from the data centres requires some cooling mechanism that involves use of natural resources, which results harm to nature.

Now IT corporates have made a colossal step. They have established there data centres at those locations which could provide cooling mechanism naturally. Those locations are preferred where there is wind energy and that could help in cooling the data centres. There are some factors on which the efficiency of data centres is calculated.

Power usage efficiency known as PUE is one of the factor on which the efficiency relies. It is the measure of cooling in the data centres and is highly dependent on temperature [4]. It is calculated as-

PUE= total facility power/IT equipment power

Not only the power consumption of any data centre matters but also the size or the infrastructure matters. Data centre infrastructure efficiency known as DCIE is the reciprocal of PUE. It is calculated as-

DCIE= IT equipment power/ total facility power * 100

According to Google's Q3 in 2014 i.e. third quarter report its PUE is 1.13. This score indicates that the demand of the data centre is 1.13 times greater than the necessary requirement to power the equipment.

After realising the need of green computing many organisations have adopted green data centres. IBM is one of the top corporates that has adopted green data centres. Aplicor Inc., Microsoft corp., Qualcomm and many other IT vendors are trying to drive green.

3.1.2Virtualisation

It is another way to go green. It is the creation of an illusion of an operating system, server, desktop, a storage device or network resources. In virtualisation several physical machines are combine into a single powerful system that is responsible for less power consumption and cooling mechanism. Virtual machine, virtual memory they all uses the concept of virtualisation. It helps you to decrease operating expenses through automation, through server consolidation. Through virtualisation the resource utilisation, power consumption could be minimised.

3.1.3Cloud Computing

In cloud computing, there is sharing and accessing of data and resources over the internet. Storing the data in our hard drives is local storage. Despite of local storage, cloud computing gives another feature of storage. Data can be stored on clouds and can be accessed from anywhere according to the user's wish. Cloud computing is not only storing the data on clouds, but it also gives better resource utilisation and power management.

From the case study made by Google in which there is a comparison between energy saving and carbon footprint of using Gmail through the Google apps. It shows that according to the organisations categorization in large, medium and small groups the large organisations have an advantage by providing less servers to the millions of users and the result is less energy and fewer machines are used. Since 2007, Google is utilising energy and has become a carbon neutral company. The annual carbon footprint of a Gmail user is about $1/80^{th}$ that of a small business with locally hosted email servers.

3.2 Software Approach

3.2.1Efficient Algorithm

Programmers could design such energy efficient algorithms that will be helpful to minimize the space, time and energy. Algorithms for networks, topologies and wireless sensors these all are aimed to maximize the lifetime of the products, minimizing the energy usage in computing environment. These algorithmic solutions not only aims to make the product energy efficient but also it helps in removing the space and time complexities. Careful consideration of design, architecture, algorithms and data structures can lead to an application to perform better and consume less energy.

3.2.2Data Efficacy

Data storage in hierarchical manner in the memory is beneficial rather than any other form of storage. In hierarchical design the data remains closer to the processing elements. As there is less data movement then there is efficient use of cache memory, this is referred as data efficacy. This helps in less energy consumption that leads towards green computing.

3.2.3Less Context Switching

When there is change from one process to another in computer's CPU i.e. Central Processing Unit then it is known as Context Switching. In older CPU's the context switching was performed in the entire hardware. But modern CPU's perform context switching through programming. There is context switching between multiple tasks per second. Such algorithms or strategies will be helpful that handles timers and loops efficiently.

4. Recent Activities

4.1Little Green Genie

It is a software that measures the carbon emission of the electronic devices and also it automatically balancesit. By calculating the energy consumption of computer, this information is used to buy a proportionate amount of carbon credits to equalize the use. It automatically purchase the carbon credits from climate friendly, it is a founding member of the international carbon reduction and offset alliance.

4.2 Advanced configuration and power interface

It is also known as ACPI. It is used for efficient handling of power consumption in computers. It was co-developed by Hewlett-Packard, Intel, Microsoft, Phoenix and Toshiba. It mainly emphasise on the process of communication between

the input-output devices and operating system in terms of power usage. It allows computer's BIOS to control power management system. There is automatic turn off and on of the hard drives and monitors after a particular set time period by the user.

4.3Blackle

It is a website powered by Google customs search engine which aims to save energy. Using dark colours on the monitors screen can save energy. Using this fact blackle is introduced. Blackle saves energy as it is predominantly black and requires less power to display.

4.4Zonbu Computers

These are the example of environment friendly computers. These are the PCsthat have proficient ultra-low power design. It uses only fractions of the energy and emits co_2 at relatively lower rate. We can call it carbon neutral.

4.5 Power Strips

These are the strips that are used to save the phantom energy. Phantom Energy is the energy which is still used by the devices when they are switched off. There is continuous power consumption in all the electronic equipment's when they are put off. These strips are used to save this wastage. They are designed in such a way so that they can cut standby power loss and save energy.

4.6Organic Light Emitting Diodes

OLED's are the light emitting diode that are made by placing a series of organic thin films between two conductors [6]. They do not require any backlight and efficient than LCD displays. OLED's are more flexible, thinner, lighter in weight,transparent and provides better brightness. Now there assets are in the process of better usage in the laptops, phones and other electronic devices. Lenovo's S-800 phone is the first product to use these OLED's.

5. Conclusion

Green Computing is not a miracle. These are the efforts to make a synchronisation between nature and rapid technological creations. Precaution is better than cure, it is true if we take precautions to save energy by simply following some steps then we can contribute to save energy. Today cost is no superior issue than the degradation or environment and resources. If green computing is applied then we can make a better world to live.

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