

Green Computing

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Abstract— The concept of green computing has begun to spread in the past few years, gaining increasing popularity. Besides the widespread sensitivity to ecological issues, such interest also stems from economic needs, since both energy costs and electrical requirements of IT industry around the world show a continuously growing trend. Green computing is the environmentally responsible use of computers and related resources. Such practices include the implementation of energy-efficient central processing units (CPUs), Servers and Peripherals as well as reduced resource consumption and proper disposal of electronic waste (e-waste). Green computing is the study and practice of efficient and eco-friendly computing. The principle behind energy efficient coding is to save power by getting software to make less use of the hardware, rather than continuing to run the same code on hardware that uses less power. This paper, first discuss the connotation of green computing and sketch researcher’s view on the next generation of IT systems for green computing. Subsequently, this paper helps to identify key issues relevant to green computing and evaluate different approaches to these problems. Finally, paper point out future directions of research and conclude the paper. **Keywords** Eco Friendly Computing, Energy Efficient Coding, Green Computing ,Green IT ,Smart Computing.

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I. INTRODUCTION

Green computing is the study and practice if efficient and eco-friendly computing resources are now under the attention of not only environmental organisations, but also business from other industries. In the recent years, the companies in the IT sector have realized that going GREEN is in their best interest both in terms of public relations and reduced costs. The article will give a glance of several green initiatives that are currently under way in the computer industry, as well as the issues that have been raised regarding these initiatives. This article also takes a look on the future of green computing and learns a more about it. When we hear about the term going green with computers, the very first question arises in our mind is how & why to “GO GREEN”. And in the quest for finding the answers to these questions we landed up with

conclusion- “GREEN COMPUTING GREAT COMPUTING”[1] .The green initiative guided by EFGDC-Eco Friendly Green Computing definition as ,‘the study and practice if designing, manufacturing, using and disposing of computers, servers and associated sub-systems efficiently and effectively with minimal or no impact on the environment ’.

Currently the ICT only is responsible for 3% of the world’s energy consumption. With this rate of consumption increasing 20% by a year, 2030 will be the year when this energy consumption rate by ICT will be double, organisation are using the Green Computing lifecycle when designed and implemented Green computing technology, Life Cycle of this includes Strategy, Design, Implementation, operation an d Continual Improvements. The 5 core green computing technology advocated by GCI is Green data Centre. Virtualization, Cloud Computing Power optimization and grid computing.



Fig. 1

Company like via technology offer green PC’s that are affordable non-toxic and ultra-low wattage. It take responsibility for their outdated products by offering a PC recycling service [2].

Cutting back on these two energy uses - the computers themselves and the energy used to cool down them. It makes a direct impact on company costs. Cutting back on energy used by making things more efficient can bring secondary savings too, which may not be immediately obvious but if you can increase the energy efficiency of front and back-office computing, you may not need to increase hardware resources as quickly as you thought, which can save capital expenditure on the kit, cooling equipment and even the buildings necessary to house them. [3] It provides managers, academicians, scientists, and researchers in various government, public, and private sectors coverage of topical issues like green strategy, green transformation, green technology, green revolution, ecology system, sustainability supply chain, green and sustainable innovation, global warming, energy efficient system, recycling and reuse systems, product usability, reverse supply chain, closed loop supply chain, environmental issues, carbon footprints, renewable energy, applied ergonomics, and climate change.

This paper offers research contributions, constructive debates, and investigations on new legislations on green IT, green processes, healthcare informatics, and applications in terms of environmental and climate issues for both manufacturing and service industry.



Fig.2

II. OBJECTIVES

- To gain an understanding why the green computing is instrumental for the environment.
- To identify key issues relevant to green computing and evaluate different approaches to these problems.

III. LITERATURE REVIEW

When it comes to PC disposal you need to know everything there is to know in order to be involved in green computing. Basically, the whole green aspect came about quite a few years back when the news that the environment was not a renewable resource really hit home and people started realizing that they had to do their part to protect the environment. [4] Many governments worldwide have initiated energy-management programs, such as Energy Star, an international standard for energy-efficient electronic equipment that was created by the United States Environmental Protection Agency in 1992 and has now been adopted by several other countries. Energy Star reduces the amount of energy consumed by a product by automatically switching it into —sleep mode when not in use or reducing the amount of power used by a product when in —standby mode. Surprisingly, standby —leaking, the electricity consumed by appliances when they are switched off, can represent as much as 12 percent of a typical household’s electricity consumption. Basically, the efficient use of computers and computing is what green computing is all about. The triple bottom line is what is important when it comes to anything green and the same goes for green computing. This considers social responsibility, economic viability and the impact on the environment. Many business simply focus on a bottom line, rather than a green triple bottom line, of economic viability when it comes to computers. The idea is to make the whole process surrounding computers more friendly to the environment, economy, and society. This means manufacturers create computers in a way that reflects the triple bottom line positively. Once computers are sold businesses or people use them in a green way by reducing power usage and disposing

of them properly or recycling them. The idea is to make computers from beginning to end a green product. The solution to green computing is to create an efficient system that implements these factors in an environmentally friendly way. A good example would be IT managers purchasing hardware that has been EPEAT approved meaning that maintenance is reduced, the hardware's life is extended, and makes recycling the computer easy once it is no longer necessary. Mobile phones are better than computers – green computing. What do you use your computer for? Surfing Internet, chat, gaming, social networking, downloading, desktop computing including documents, spreadsheets or presentation making or just watching your photos and videos? Today's mobile phones are capable of doing it all, rather sometimes more than the traditional phones. They have faster processors, more ram, faster wireless Internet connectivity and larger memories. Mobile Phones consume very low power. VIA Technologies, a Taiwanese company that manufactures motherboard chipsets, CPUs, and other computer hardware, introduced its initiative for "green computing. If everyone takes into account green computing then our world of computers will have as little a negative impact on our physical world as possible and that is what green computing is all about.

IV. TECHNOLOGIES GREEN COMPUTING

VIA Technologies, a Taiwanese company that manufactures motherboard chipsets, CPUs, and other computer hardware, introduced its initiative for "green computing" in 2001. With this green vision, the company has been focusing on power efficiency throughout the design and manufacturing process of its products. Its environmentally friendly products are manufactured using a range of clean-computing strategies, and the company is striving to educate markets on the benefits of green computing for the sake of the environment, as well as productivity and overall user experience.

A. Carbon-free computing

One of the VIA Technologies' ideas is to reduce the "carbon footprint" of users — the amount of greenhouse gases produced, measured in units of carbon dioxide (CO₂). Greenhouse gases naturally blanket the Earth and are responsible for its more or less stable temperature. An increase in the concentration of the main greenhouse gases — carbon dioxide, methane, nitrous oxide, and fluorocarbons — is believed to be responsible for Earth's increasing temperature, which could lead to severe floods and droughts, rising sea levels, and other environmental effects, affecting both life and the world's economy.



B. Solar Computing

Amid the international race toward alternative-energy sources, VIA is setting its eyes on the sun, and the company's Solar Computing initiative is a significant part of its green-computing projects. For that purpose, VIA partnered with Motech Industries, one of the largest producers of solar cells worldwide. Solar cells fit VIA's power-efficient silicon, platform, and system technologies and enable the company to develop fully solar-powered devices that are nonpolluting, silent, and highly reliable. Solar cells require very little maintenance throughout their lifetime, and once initial installation costs are covered, they provide energy at virtually no cost. Worldwide production of solar cells has increased rapidly over the last few years;

and as more governments begin to recognize the benefits of solar power, and the development of photovoltaic technologies goes on, costs are expected to continue to decline. As part of VIA's —pc-11 initiative, the company established the first-ever solar-powered cyber community center in the South Pacific, powered entirely by solar technology.

C. Lead-Free and RoHS computing :

In February 2003, the European Union adopted the Restriction of Hazardous Substances Directive (RoHS). The legislation restricts the use of six hazardous materials in the manufacture of various types of electronic and electrical equipment. The directive is closely linked with the Waste Electrical and Electronic Equipment Directive (WEEE), which sets collection, recycling, and recovery targets for electrical goods and is part of a legislative initiative that aims to reduce the huge amounts of toxic e-waste. Driven by these directives, VIA implemented a set of internal regulations in order to develop products that are compliant with these accepted policies, including the use of nonhazardous materials in its production of chipsets, processors, and companion chips. In 2001, they focused on lead-free manufacturing, introducing the Enhanced Ball Grid Array (EBGA) package for power efficient VIA processors and the Heat Sink Ball Grid Array (HSBGA) package for their chipsets. In traditional manufacturing processes, lead is used to attach the silicon core to the inside of the package and to facilitate integration onto the motherboard through tiny solder balls on the underside of the package. VIA's lead-free manufacturing technologies do not require a lead bead, and the solder balls now consist of a tin, silver, and copper composite.

D. Energy-efficient computing

A central goal of VIA's green-computing initiative is the development of energy-efficient platforms for low-power, small-form-factor (SFF) computing devices. In 2005, the company introduced the VIA C7-M and VIA C7 processors that have a maximum power consumption of 20W at 2.0GHz and an average power consumption of

1W. These energy-efficient processors produce over four times less carbon during their operation and can be efficiently embedded in solar-powered devices.

VIA isn't the only company to address environmental concerns: Intel, the world's largest semiconductor maker, revealed eco-friendly products at a recent conference in London. The company uses virtualization software, a technique that enables Intel to combine several physical systems into a virtual machine that runs on a single, powerful base system, thus significantly reducing power consumption. Earlier this year, Intel joined Google, Microsoft, and other companies in the launch of the Climate Savers Computing Initiative that commits businesses to meet the Environmental Protection Agency's Energy Star guidelines for energy-efficient devices.

E. vision through the pc-1 initiative

VIA isn't focusing only on the technological aspects of its eco-friendly devices, it's also taking a look at their applications. The VIA pc-1 initiative seeks to enable the next 1 billion people to get connected, by providing wider access to computing and communications technologies. The company is concentrating on empowering new, emerging markets, looking at models that reach beyond individual ownership of a PC, such as local pay-for-use facilities. Products built for such a use are characterized by ultra-efficient energy consumption and the ability to withstand heat and dust in harsh environments. In VIA's own words: "Pc-1 brings together business ingenuity with corporate responsibility and altruism. Helping to build skills and literacy throughout the world and incorporating and preserving cultural content are goals now within our grasp. Information is the oxygen to nurturing social mobility, economic equality and development, and global democracy. Providing not just the tools and the know-how, but the support and the maintenance, is all part of what makes pc-1 the next generation of information technology, the next generation of global development". Among the company's projects under the pc-1 program are

the —tuXlabl computer center in South Africa and an ICT Training Center in Vietnam

V. 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. 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. 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. Organizations can do so in the following three key areas: reduced data footprint, reduced deployment resources, and reduced ongoing management and maintenance. This technology is beneficial as it:-

- Reduces computing wastes.

Global warming and the problem of minimizing environmental impact from fossil-fuel emissions have raised to the top of global public policy agenda. As a result, businesses and consumers alike have started to embrace environmentally sustainable products that offer low-carbon solutions that can not only reduce their global greenhouse gas (GHG) emissions, but can do so by more efficient energy consumption and lower costs.



VI. CONCLUSION

The field of "green technology " encompasses a broad range of subjects — from new energy-generation techniques to the study of advanced materials to be used in our daily life. As part of the VIA Green Computing Initiative, VIA Carbon Free Computing is a natural extension of VIA's leadership in developing the most power efficient computing products on the market. As individuals and organizations around the world look to reduce their impact on the environment, a growing concern is the reduction of one's Carbon Footprint which is a measure of the impact human activities have on the environment in terms of the amount of green house gases produced, measured in units of carbon dioxide (CO₂). It has taken upon itself the goal to provide society's needs in ways that do not damage or deplete natural resources. Mainly this means creating fully recyclable products, reducing pollution, proposing alternative technologies in various fields, and creating a center of economic activity around technologies that benefit the environment. Green IT programs are demonstrating fundamental economic as well as environmental

- 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.

sense, it is understandable why organizations are exploring green computing options with such intense interest across the IT industry. As more and more companies include some form of reporting on their goals and achievements in the area of CSR, there is a growing awareness among business leaders that greening their IT practices offers the —double-win of reducing costs while demonstrating a positive environmental commitment. Use mobile phones for your computing needs whenever and wherever possible.

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VIII. FINDINGS

If we think computers are non-polluting and consume very little energy we need to think again. It is estimated that out of \$250 billion per year spent on powering computers worldwide only about 15% of that power is spent computing- the rest is wasted idling. Thus, energy saved on computer hardware and computing will equate tonnes of carbon emissions saved per year.

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