Green computing: Practice of Efficient and Eco-Friendly Computing Resources

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Abstract

Green Computing is now under the attention of not only environmental organizations, but also businesses from other industries. In recent years, companies in the computer industry have come to realize that going green is in their best interest, both in terms of public relations and reduced costs. This paper will take a look at several green initiatives currently under way in the computer industry.

Keywords: *Environment, VMware, carbon, electric.*

1. Introduction

Green computing is the practice of using computing resources efficiently. Modern IT systems rely upon a complicated mix of people, networks, and hardware, as such, a green computing initiative must be systemic in nature, and address increasingly sophisticated problems. Green computing is the utmost requirement to protect environment and save energy along with operational expenses in today's increasingly competitive world. We at Johnson Controls currently are working on implementation of the green computing practices. But before implementing, it's also important to study about what kind of energy gains and operational gains can be achieved. Hence, analysis of the gap between what we have today and what we'll have to do is essential in order to achieve the benefits of green computing. Currently we are in that stage.

Also, every big change begins from small initiatives. For instance, we started some of the simple but effective initiatives like setting the power options on your computer or in phones to switch to sleep mode when it's not active. When you're going to be away from your PC for more than a few minutes, setting it to stand-by mode and turning off the monitor will save a huge amount of energy.

Interestingly, companies in every industry, from nonprofits to consumer goods, are paying much closer attention to their power bills, as the amount spent on data center power has doubled in the past six years. The good news is that computer companies are talking about greenness and are touting green programs nowadays [1].

Even consumers are now becoming increasingly aware of green technologies and are starting to demand more environmentally friendly products in their homes and workplaces. This trend also encompasses the vehicle market. Automakers have been listening to the

feedback and addressing consumer needs through cars that have better fuel economy, have lower emissions, and include natural materials.

2. Existing works

Technology Business Research (TBR) today announced Dell took the No. 1 position in its inaugural Corporate Sustainability Index (CSI) Benchmark Report for 2009. The report measures the environmental initiatives of 40 companies in the computer hardware, software, professional services and network and telecommunications sectors. Scoring 317.9 points, Dell led the second place firm (BT) by more than 52 points in the overall index ranking [2].

IBM recently launched consulting service being offered by IBM is based on the Lean Six Sigma principles of efficiency. This consulting service is aimed at examining use of energy and water and subsequently providing the control measures to conserve energy.

According to the company sources, IBM in 1990 saved around 4.6 billion kWh of electricity and prevented almost 3 million metric tones of CO2 emissions. So, essentially a reduction in wastage and recycling of the used materials is what is required to ensure green IT. There have been multiple approaches to green computing [3].

According to VMware Inc. the report says that the global leader in virtualization solutions from the desktop through the datacenter and to the cloud, today announced the opening of a new green IT datacenter in East Wenatchee, Washington. Throughout its design and build-out, VMware chose industry best practices to create an energy-efficient facility that utilizes cutting-edge technology and maximizes the use of VMware virtualization software. As a result, VMware expects to achieve $5 million in savings per year from the facility [4].

According to SUN, Today's modern network economics have more and more businesses requiring high computing capability whether it be for searches, Web services, e-commerce, traffic control, or supply chain management. The bottom line is that they all require computing with significant capacity.

SUN approached the problem by pushing the physical technology of the CPU frequency — namely, the number of cycles that a piece of silicon can do. But you quickly run into the law of physics that says that when you force the transistors to switch as quickly as possible, there is a corresponding amount of power consumption and the heat generated by the transistors grows proportionally.

Considering that networking has a quadratic effect, the interaction grows geometrically rather than linearly. The industry has reached a point where it has driven power consumption of these increments to a point that it deviates from what the customer can utilize [5].

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 [6].

The Energy Star program encourages manufactures to create energy-efficient devices that require little power are not in use. For example, many devices switch to standby mode after a specified number of inactive minutes. Personal computers, monitors and printers should comply with the ENERGY STAR program, which was developed by the United States Department of Energy (DOE) and the United States Environmental Agency (EPA). Therefore, computers and devices that meet ENERGY STAR guidelines display an ENERGY STAR label [7].

3. Our work

We love our computers for all the ways they make our lives (and the world) better -- the wealth of knowledge (and democratizing force) of the Internet, the instantaneous communication, the sophisticated tools that help us work and create and share. But this modern world's greatest tool is among our most disposable and resource-heavy items. Performance-wise, computer design has progressed staggeringly well and astonishingly fast but looking at it from a green perspective, the work has barely begun. It takes a lot of energy to create, package, store, and move every 10-20 megabytes of data. Even with energy prices as cheap as they are now, it will soon cost more to power a computer for four years than it does to buy a new one. When a computer dies it either rots in a landfill, or children in the developing world end up wrestling its components apart by hand, melting toxic bits to recover traces of heavy metals.

Manufacturing computers means the use of lead, cadmium, mercury, and other toxics in general and laptop in particular. Normally, computers can contain 4 to 8 pounds of lead alone, according to green experts. It's no wonder that computers and other electronics make up two-fifths of all lead in landfills. To counter this growing pollution threat all over the world due to the growing use of electronic device in general and computers in particular a need to look for a green computer.

So far, consumers haven't cared about ecological impact when buying computers, they've cared only about speed and price. But as Moore's Law marches on and computers commodities, consumers will become pickier about being green. Devices use less and less power while renewable energy gets more and more portable and effective. New green materials are developed every year, and many toxic ones are already being replaced by them. The greenest computer will not miraculously fall from the sky one day, it'll be the product of years of improvements. The features of a green computer of tomorrow would be like: efficiency, manufacturing & materials, recyclables, service model, self-powering, and other trends. Green computer will be one of the major contributions, which will break down the 'digital divide', the electronic gulf that separates the information rich from the information poor.

As 21st century belongs to computers, gizmos and electronic items, energy issues will get a serious ring in the coming days, as the public debate on carbon emissions, global warming and climate change gets hotter. If we think computers are nonpolluting 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. Taking into consideration the popular use of information technology industry, it has to lead a revolution of sorts by turning green in a manner no industry has ever done before. It is worth emphasizing that this "green technology" should not be just about sound bytes to impress activists but concrete action and organizational policy.

Opportunities lie in green technology like never before in history and organizations are seeing it as a way to create new profit centres while trying to help the environmental cause. The plan towards green IT should include new electronic products and services with optimum efficiency and all possible options towards energy savings.

Faster processors historically use more power. Inefficient CPU's are a double hit because they both use too much power themselves and their waste heat increases air conditioning needs, especially in server farms--between the computers and the HVAC. The waste heat also causes reliability problems, as CPU's crash much more often at higher temperatures. Many people have been working for years to slice this inefficiency out of computers. Similarly, power supplies are notoriously bad, generally as little as 47% efficient. And since everything

in a computer runs off the power supply, nothing can be efficient without a good power supply. Recent inventions of power supply are helping fix this by running at 80% efficiency or better. Power management soft-wares also help the computers to sleep or hibernate when not in use. On the far horizon, reversible computing (which also includes quantum computing) promises to reduce power consumption by a factor of several thousand, but such systems are still very much in the laboratories. The best way to recycle a computer, however, is to keep it and upgrade it. Further, it is important to design computers which can be powered with low power obtained from non-conventional energy sources like solar energy, pedaling a bike, turning a hand-crank etc.

4. Analysis of our work

The electric utility industry is in an unprecedented era of change to meet increasing customer demand for greater reliability and different services in the face of substantial regulation and volatile energy costs. This requires new approaches and business models to allow greater network reliability, efficiency, flexibility and transparency. At the same time, the utility industry is digitizing, transforming from an electromechanical environment to a digitized one. New Internet Protocol-enabled networks now allow for network integration along the entire supply chain – from generation, transmission, to end-use and metering -- and create the opportunity for Intelligent Utility Networks (IUN) which applies sensors and other technologies to sense and respond in real-time to changes throughout the supply chain. The IP-enabled network connects all parts of the utility grid - equipment, control systems, applications, and employees. It also enables automatic data collection and storage from across the utility based on a common information model and service-oriented architecture (SOA), which enables a flexible use of information technology. This in turn allows utilities to continuously analyze data so that they can better manage assets and operations.

Electronics giants are about to roll out eco-friendly range of computers (like desktops and laptops) that aim at reducing the e-waste in the environment. Besides desktops and laptops, other electronic hardware products should also be strictly adhering to the restricted use of hazardous substances. In other words, they should be free of hazardous materials such as brominated flame retardants, PVCs and heavy metals such as lead, cadmium and mercury, which are commonly used in computer manufacturing. Reliability about the use of green materials in computer is perhaps the biggest single challenge facing the electronics industry. Lead-tin solder in use today is very malleable making it an ideal shock absorber. So far, more brittle replacement solders have yet to show the same reliability in arduous real-world applications. Replacements like the front runner, a tin/copper/silver alloy, also require higher melting temperatures, which can affect chip life.

a. Here's how designers plan to make future computer more eco-friendly across its entire life span, from manufacture to recycling.
b. Energy-intensive manufacturing of computer parts can be minimized by making manufacturing process more energy efficient.
c. By replacing petroleum-filled plastic with bioplastics—plant-based polymers—require less oil and energy to produce than traditional plastics with a challenge to keep these bioplastic computers cool so that electronics won't melt them landfills can be controlled by making best use of the device by upgrading and repairing in time with a need to make such processes (i.e., upgradation and repairing) easier and cheaper.
d. Avoiding the discarding will not only control e-waste out of dumps but also save energy and materials needed for a whole new computer power-sucking displays

can be replaced with green light displays made of OLEDs, or organic light-emitting diodes.

e. Use of toxic materials like lead can be replaced by silver and copper making recycling of computers (which is expensive and time consuming at present) more effective by recycling computer parts separately with a option of reuse or resale.
f. Future computers could knock 10 percent off their energy use just by replacing hard drives with solid-state, or flash, memory, which has no watt-hungry moving parts.

So far, consumers haven't cared about ecological impact when buying computers, they've cared only about speed and price. But as Moore's Law marches on and computers commoditize, consumers will become pickier about being green. Devices use less and less power while renewable energy gets more and more portable and effective. New green materials are developed every year, and many toxic ones are already being replaced by them. The greenest computer will not miraculously fall from the sky one day, it'll be the product of years of improvements. The features of a green computer of tomorrow would be like: efficiency, manufacturing & materials, recyclability, service model, self-powering, and other trends. Green computer will be one of the major contributions which will break down the 'digital divide', the electronic gulf that separates the information rich from the information poor.

One more vital step can be taken in Green Computing is that to categorize the group of users and types of machines to find out the energy consumption, carbon and scrap of computers affected the environment, which will be my future work naming as 'Categorization of Users and with Work Load and Machines'.

5. Conclusion

So green computing is a mindset that asks how we can satisfy the growing demand for network computing without putting such pressure on the environment. There is an alternative way to design a processor and a system such that we don't increase demands on the environment, but still provide an increased amount of processing capability to customers to satisfy their business needs. Green computing is not about going out and designing biodegradable packaging for products. Now the time came to think about the efficiently use of computers and the resources which are non renewable. It opens a new window for the new entrepreneur for harvesting with E-waste material and scrap computers.

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