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Green Computing

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Abstract: **Thrust of computing was initially on faster analysis and speedier calculations and solving of mare complex problems but in the recent past another focus has got immense importance and that is achievement of energy efficiency, minimization consumption of e-equipments. It has also given utmost attention to minimization of e-waste and use of non-toxic materials in preparation of e-equipments. World leaders have also taken move towards this by following some principles. Now it is the time for the end users community to follow some rules of thumb to achieve partly benefit of —Green Computing. In India, the implement ability of principle of — Green Computing is facing a dilemma due to many socio-economic matters and those are linked to be soughed out to pull India in the mainstream movement of —Green Computing.**

I. INTRODUCTION

Green Computing is a recent trend towards designing, building, and operating computer systems to be energy efficient. While programs such as Energy Star have been around since the early 1990s, recent concerns regarding global climate change and the energy crisis have led to renewed interest in Green Computing. Data centers are assign affiant consumers of energy both to power the computers as well as to provide the necessary cooling. It is a new approach to reduce energy utilization in data centers. In particular, our approach relies on consolidating services dynamically onto a subset of the available servers and temporarily shutting down servers in order to conserve energy. The initial work on a probabilistic service dispatch algorithm that aims at minimizing the number of running servers such that they suffice for meeting the quality of service required by service-level agreements. Given the estimated energy consumption and projected growth in data centers, the proposed effort has the potential to positively impact energy consumption.

Green computing is the practice of using computing resources efficiently. The goals are to reduce the use Green computing is a very hot topic these days, not only because of rising energy costs and potential savings, but also due to the impact on the environment. Energy to manufacture, store, operate, and cool computing systems has grown significantly in the recent years, primarily due to the volume of systems and computing that companies now heavily rely upon. Computing power consumption of companies has reached a critical point. For example, an E-commerce business with 100,000 servers can easily spend up to $20 million a year on server power. Add another $10 million for a/c cooling and it tops $30 million a year in power alone. Clearly there is a huge potential for savings in their infrastructure. Despite the huge surge in computing power demands, there are many existing technologies and methods by which significant savings can be made. This series is dedicated to the ways a typical organization can reduce their energy footprint while maintaining required levels of computing performance.

of hazardous materials, maximize energy efficiency during the product's lifetime, and promote recyclability or biodegradability of defunct products and factory waste. 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).

In 1992, the U.S. Environmental Protection Agency launch ed Energy Star, a voluntarylabeling program which is designed to promote and recognize energy-efficiency in monitors, climate control equipment, and other technologies. This resulted in the wide spread adoption of sleep mode among consumer electronics. The term "green computing" was probably coined shortly after the Energy Star program began; there are several USENET posts dating back to 1992 which use the term in this manner.

Figure 1: Green Computing

1.2 Why Go Green?

1.3 Objectives

1.3.1 Climate Change:

First and foremost, conclusive research shows that CO2 and other emissions are causing global climate and environmental damage. Preserving the planet is a valid goal because it aims to preserve life. Planets like ours, that supports life, are very rare. None of the planets in our solar

system, or in nearby star systems have m-class planets as we know them.

1.3.2 Savings:

Green computing can lead to serious cost savings over time. Reductions in energy costs from servers, cooling, and lighting are generating serious savings for many corporations.

1.3.3 Reliability of Power:

As energy demands in the world go up, energy supply is declining or flat. Energy efficient systems helps ensure healthy power systems. Also, more companies are generating more of their own electricity, which further motivates them to keep power consumption low.

Computing power consumption has reached a critical point:

Data centers have run out of usable power and cooling due to high densities.

II. HISTORY OF GREEN COMPUTING

In 1992, the U.S. Environmental Protection Agency launched Energy Star, a voluntary labeling program which is designed to promote and recognize energy-efficiency in monitors, climate control equipment, and other technologies. This resulted in the widespread adoption of sleep mode among consumer electronics. The term "green computing" was probably coined shortly after the Energy Star program began; there are several USENET posts dating back to1992 which use the term in this manner. Concurrently, the Swedish organization TCO Development launched the Certification program to promote low magnetic and electrical emissions from CRT based computerdisplays; this program was later expanded t o include criteria on energy consumption, ergonomics, and the use of hazardous materials in construction. When it comes to PC disposal, it is necessary 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. 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 businesses 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 friendlier 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 trend a green product.

2.2 What is Green Computing?

Green computing is the study and practice of using computing resources efficiently. The primary objective of such a program is to account an expanded spectrum of values and criteria for ensuring organizational (and societal) success. The goals are similar to green chemistry; reduce the use of hazardous materials, maximize energy efficiency during the product‘s lifetime, and promote recyclability or biodegradability of defunct products and factory waste.

Figure 2: Green Earth

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. Elements of such a solution may comprise items such as end user satisfaction, management restructuring, regulatory compliance, disposal of electronic waste, telecommuting.

2.2.1 Origin

In 1992, the U.S. Environmental Protection Agency launched Energy Star, a voluntary labeling program that is designed to promote and recognize energy-efficiency in monitors, climate control equipment, and other technologies. This resulted in the widespread adoption of sleep mode among consumer electronics. Concurrently, the Swedish organization TCO Development launched the TCO Certification program to promote low magnetic and electrical emissions from CRT-based computer displays; this program was later expanded to include criteria on energy consumption, ergonomics, and the use of hazardous materials in construction.

2.2.2. At Present

Currently the ICT industry is responsible for 3% of the world‘s energy consumption. With the rate of consumption increasing by 20% a year, 2030 will be the year when the world‘s energy Consumption will double because of the ICT industry. Organizations use the Green Computing Lifecycle when designing and implementing green computing technologies. The stages in the Lifecycle include Strategy, Design, Implementation, Operations and Continual Improvements. Many governmental agencies have continued to implement standards and regulations that encourage green computing. The Energy Star program was revised in October 2006 to include stricter efficiency

requirements for computer equipment, along with a tiered ranking system for approved products.

The 5 core green computing technologies advocated by GCI are Green Data Centre, Virtualization, Cloud Computing, Power Optimization and Grid Computing.

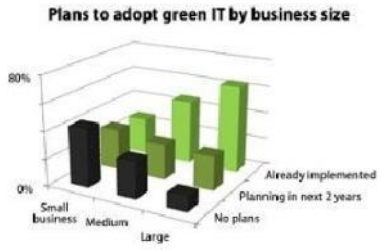

Figure 3: Present Scenario

There are currently many nations that have established state-wide recycling programs forobsolete computers and consumer electronics equipment The statutes either impose a fee foreach unit sold at retail (Advance Recovery Fee model), or require the manufacturers to reclaimthe equipment at disposal (Producer Responsibility model).

2.2.3. Roads to Green Computing

Figure 4: Reduce, Reuse & Recycle[12][2]

Green use:

— reducing the energy consumption of computers and other information systems as well as using them in an environmentally sound manner

Green disposal:

— refurbishing and reusing old computers and properly recycling unwanted computers and other electronic equipment

Green design:

— designing energy-efficient and environmentally sound components, computers, servers, cooling equipment, and data centers.

Green manufacturing:

— manufacturing electronic components, computers, another associated subsystems with minimal impact on the environment

2.3. Regulation and Industry Initiative

*2.3.1. From the Government***:**

Many governmental agencies have continued to implement standards and regulations that encourage green computing. The Energy Star program was revised in October 2006 to include stricter efficiency requirements for computer equipment The European Union's directives 2002/95/EC (RoHS),on the reduction of hazardous substances, and 2002/96/EC (WEEE) on waste electrical and electronic equipment required the substitution of heavy metals and flame retardants like PBBs and PBDEs in all electronic equipment put on the market starting on July 1,2006. The directives placed responsibility on manufacturers for the gathering and recycling of old equipment (the Producer Responsibility model).

2.3.2 From the Industry:

2.3.2.1 Climate Savers Computing Initiative:

CSCI is an effort to reduce the electric power consumption of PCs in active and inactive states. The CSCI provides act along of green
products from its member organizations, andinformation fo r reducing PC power consumption. It was started on 2007-06-12.

2.3.2.2 Green Computing Impact Organization Inc:

GCIO is a non-profit organization dedicated to assisting the end-users of computing products in being environmentally responsible. This mission is accomplished through educational events, cooperative programs and subsidized auditing services. The heart of the group is based on the GCIO Cooperative, a community of environmentally concerned IT leaders who pool their time, resources, and buying power to educate, broaden the use, and improve the efficiency of green computing products and services.

2.3.2.3 Green Electronics Council:

The Green Electronics Council offers the Electronic Products Environmental Assessment Tool (EPEAT) to assist in the purchase of "green" computing systems. The Council evaluates computing equipment on 28 criteria that measure a product's efficiency and sustainability attributes. On 2007-01-24, President George W. Bush issued Executive Order 13423, which requires all United States Federal agencies to use EPEAT when purchasing computer systems.

2.3.2.4 The Green Grid:

It is a global consortium dedicated to advancing energy efficiency in datacenters and business computing ecosystems. It was founded in February 2007 by several key companies in the industry

– AMD, APC, Dell, HP, IBM, Intel, Microsoft, rack able Systems, Spray Cool, Sun Microsystems and VMware. The Green Grid has since grown to hundreds of members, including end users and government organizations, all focused on improving data center efficiency.

2.4. Demons behind Green Computing

2.4.1 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.

2.4.2 Storage:

Smaller form factor (e.g. 2.5 inches) hard disk drive soften consume less power than physically larger drives. Unlike hard disk drives, solid 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., 4GBi-RAM uses more power and space than laptop drives). Flash based drives are generally slower for writing than hard disks.

2.4.3 Video card:

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

2.4.4. Materials:

Computer systems that have outlived their particular function can be repurposed, or donated to various charities and non-profit organizations. However, many charities have recently imposed minimum system requirements for donated equipment. Additionally, parts from outdated systems may be salvaged and recycled through certain retail out lets and municipal or private recycling centers. Recycling computing equipment can keep harmful materials such as lead, mercury, and hexavalent chromiumout of landfills, but ofte n computers gathered through recycling drives are shipped to countries where environmental standards are less strict than in North America and Europe. The Silicon Valley Toxics Coalition estimates that 80% of the post-consumer e-waste collected for recycling is shipped abroad to countries such as China, India, and Pakistan. Computing supplies, such as printer cartridges, paper, and batteries may be recycled as well.

2.4.5. 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.

2.4.6. Chilling of data:

To keep servers at the right temperature, companies mainly rely on air conditioning. The more powerful the machine, the more cool air needed to keep it from overheating. By 2005, the energy required to power and cool servers accounted for about1.2 % of total U.S electricity conception. By 2010, half of the Forbes Global 2000companies will spend more on energy than on hardwaresuch as servers.

2.5. Recent implementations of Green Computing

2.5.1. 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. 6.2 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 P

C to be compact, quiet and green â€œ 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.

2.5.2. 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 a 1.2 gigahertz processor and 512 Meg 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.

2.5.3 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.

2.5.4 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.

2.6 Advantages of Green Computing:

- Reduced energy usage from green computing techniques translates into lower carbon dioxide emissions, stemming from a reduction in the fossil fuel used in power plants and transportation.
- Conserving resources means less energy is required to produce, use, and dispose of products.
- Saving energy and resources saves money.
- Green computing even includes changing government policy to encourage recycling and lowering energy use by individuals and businesses.
- Reduce the risk existing in the laptops such as chemical known to cause cancer, nerve damage and immune reactions in humans.
- System Wide Green Computing and Individual Green Computing is the best possible way to practice Green Computing. Companies implementing System Wide Green Computing and employees and individuals practicing individual green computing techniques help ina long way in creating an impact to save the planet.

2.7 Facts about Green Computing

- Computer technology use accounts for 2% of anthropogenic CO2
- Roughly equivalent to aviation industry
- IT energy usage will double next 4 years
- A typical desktop PC with a 17-inch LCD monitor requires about 145 watts, 110 watts for the computer and 35 watts for the monitor.
- For every 12 consumers who keep power settings enabled for their on their monitors and PCs, CO2 emissions equivalent to removing one average automobile from the road will be avoided.

III. ANALYSIS AND APPROACHES

3.1 Why GREEN COMPUTING?

Our so called technically successful world almost sounds fake .We have great machines and equipments to accomplish our tasks, great gadgets with royal looks and features make our lives more impressive and smooth. Today almost all streams weather its IT, medicine, transportation, agriculture uses machines which indirectly requires large amount of power and money for its effective functioning.

Newton‘s Third Law of Motion states that

―For every action, there is an equal and opposite reaction, therefore consumption of energy sources has a negative reaction on the environment. Data centers use a large amount of power and consequently cooling energy is needed to counteract the power usage. It can be an endless circle of energy waste.

Hence the three main reasons that made us realize the need for growing green are:-

1. Release of harmful gases from electronics.

2. More utilization of power and money.

3. Increase of E-waste and improper disposal.

3.2 Approaches to Green Computing

3.2.1. Virtualization:

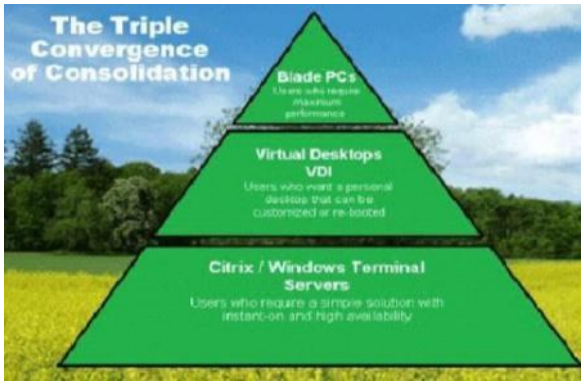

Figure 5: Virtualization [18]

Computer Virtualization means abstraction of computer resources, such as the process of running two or more logical computer systems on one set of physical hardware. Through Virtualization, a system administrator can combine several physical systems into virtual machines on one single, powerful system, thereby reducing power and cooling consumption. In the longer run, more profits and less expenses.

Reducing the number of hardware components and replacing them with Green Computing systems reduces energy costs for running hardware and cooling as well as reducing carbon dioxide emissions and conserving energy.

The phrase ―green computing may conjure up some humorous images if you‘re not familiar with the term. Normally, we think of gas guzzling cars, factories, pesticides, and such when considering environmental concerns. So what does the term ―green signify in the context of everyday computing?

In a world where computers are everywhere, and environmental concerns are growing by the day, we need to consider how we can build, use and dispose of computers in a manner

that's conducive to the health of the environment. That includes reducing the use of lead and other hazardous materials in manufacturing, being careful about energy consumption and paper waste by computer users, and concern for salvage or recycling of old computers. Millions of computers are dumped into landfills each year. That equates to a lot of lead, cadmium, mercury and brominates flame retardants, which will contaminate both water and air.

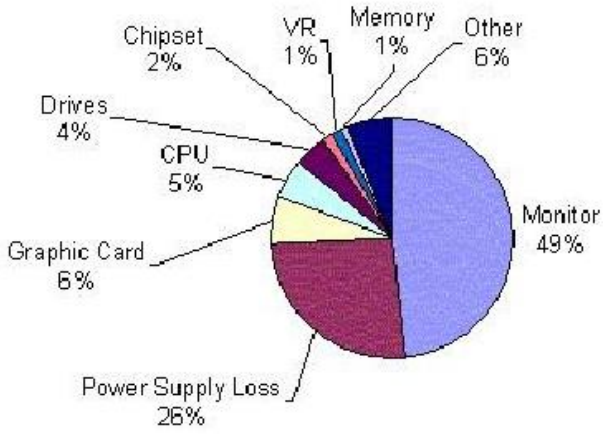

Figure 6: Component Wattage [19]

3.2.2 Algorithm Efficiency

The efficiency of algorithms has an impact on the amount of computer resources required for any given computing function and there are many efficiency trade-offs in writing programs. As computers have become more numerous and the cost of hardware has declined relative to the cost of energy, the energy efficiency and environmental impact of computing systems and programs has received increased attention.

The _energy cost of a single Google search. The Green 500 list, rates super computers by energy efficiency.

3.2.3 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.

3.2.4 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 least80% 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.

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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.

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3.2.7 Materials Recycling

Computer systems that have outlived their particular function can be repurposed, or donated to various charities and non-profit organizations. However, many charities have recently imposed minimum system requirements for donated equipment. Additionally, parts from outdated systems may be salvaged and recycled through certain retail outlets and municipal or private recycling centers. Recycling computing equipment can keep harmful materials such as lead, mercury, and hexavalent chromium out of landfills, but often computers gathered through recycling drives are shipped to developing countries where environmental standards are less strict than in North America and Europe. The Silicon Valley Toxics Coalition estimates that 80% of the post-consumer e-waste collected for recycling is shipped abroad to countries such as China, India, and Pakistan. Computing supplies, such as printer cartridges, paper, and batteries may be recycled as well.

3.2.8 Telecommuting

Teleconferencing and telepresence 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 hotel ling, 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.

3.3 Role of IT Vendors

3.3.1 APPLE

Four areas of particular attention are product and packaging design, materials, energy efficiency, and recycling. Each aspect of the design cycle provides

significant challenges, yet our efforts in these areas have resulted in some impressive results.

Figure 7: Apple cycle [21]

3.3.1.1 Product design:

It all begins here. Reducing the environmental impact of our products starts with the product design phase. Design dictates the quantity of raw materials as well as the type and recyclability of materials used. It also determines how much energy is consumed during manufacturing and product use. For example, the amazingly slim 20-inch iMac is made from highly recyclable glass andaluminum and it is so energyefficient it consumes about the same amount of power as astandard light bulb when on.

3.3.1.2 Materials:

Apple helps to safeguard the environment - as well as consumers, safety –by restricting the use of environmentally harmful compounds in our materials and manufacturing processes. In addition to the substances that have already been restricted or eliminated, Apple is removing elemental forms of bromine and chlorine from our products, not just polyvinylchloride (PVC) and brominates flame retardants (BFRs). Then MacBook family also uses mercury-free light-emitting diode (LED) displays, with arsenic-free display glass.

3.3.1.3 Energy efficiency:

A devices greatest contribution to greenhouse gas emissions comes from its consumptions of energy over time. Apple has made great strides in recent years to optimize the energy efficiency of our hardware and created tools, such as the Energy Saver feature in Mac OSX, that allow consumers to manage the power consumption of their computers. Since 2001, Apple desktop computers, portable computers, and displays have earned the energy starting.

3.3.1.4 Recycling:

Apple‘s holistic, lifecycle approach to recycling includes using highly recyclable materials in products in addition to providing extensive take-back programs that enable consumers and businesses to safely dispose of used Apple equipment. Since our first take-back initiative began in Germany in 1994, we have instituted recycling programs in 95 percent of the countries where our products are sold - diverting over 53million pounds of electronic equipment from landfills worldwide. Apple is on track to eliminate toxic chemicals from our products. In the 2008 Environmental Update Steve Jobs provides an overview on Apple‘s progress to eliminate mercury and arsenic from displays and Brominates Flame Retardants (BFR‘s) and Polyvinyl Chloride (PVC) from internal components. Steve Jobs also talks about Apple‘s policy on climate change, steps taken to improve product energy-efficiency as well as overall recycling performance during 2007.

3.3.2 WIPRO

Wipro Limited, a leading player in Global IT and R&D services, is committed towards environmental sustainability by minimizing the usage of hazardous substances and chemicals which have potential impact on the ecology.
Ithas joined hands with WWF India, one of the largest cons ervation organizations in thecountry, to directly deal with is sues of climate change, water andwaste management and bi odiversity conservation.

Figure 8: Wipro’s portfolio

3.3.2.1 Green Lighting Solutions:

1. Complete range of Brightness Management Products for Green Buildings. Ability to integrate lighting and lighting management systems for Green Building performance standards. Role of Lighting for GREEN buildings: 17%– 20% of the overall building‘s energy usage.
2. Optimize Energy Performance
3. Green Computing24 Department of IT
4. High efficiency luminaries design.
5. High efficiency light sources
6. Compact Fluorescent Lamp, LED, etc.
7. Lighting controls.
8. High efficiency control gear.
9. Personalized controls through task lighting intelligent lighting systems.

3.3.3. GOOGLE

Google's mission is to organize the world's information and make it universally accessible and useful. Hundreds of millions of users access our services through the web, and supporting this traffic requires lots of computers. We strive to offer great internet services while taking our energy use very seriously. That's why, almost a decade ago; we started our efforts to make our computing infrastructure as sustainable as possible. Today we are operating what we

believe to be the world's most efficient data centers. The graph below shows that our Google-designed data centre's use considerably less energy -both for the servers and the facility itself - than a typical data centre. As a result, the energy used per Google search is minimal. In fact, in the time it takes to do a Google search, your own personal computer will use more energy than we will use to answer your query.

Individuals and businesses to adopt greener lifestyles and work styles, in terms of the environmental debate computing is definitely both part of the problem and part of the solution. Through more environmentally aware usage (such as more effective power management and shut-down during periods of inactivity), and by adopting current lower power technologies, computers can already be made significantly more energy efficient. Indeed, just as we now look back and wonder why automobiles a decade or two ago used to guzzle so much petrol, in a decade's time we will no doubt be staggered that a typical desktop PC used to happily sit around drawing 100-200W of power every hour night and day, and when accomplishing no more than displaying a screen saver. The computing industry is more prepared and far more competent than almost any other industry when it comes to facing and responding to rapid change. Environmentally it is not a good thing that most PCs -- especially in companies -- have typically entered a landfill after only a few years in service. However, this reality does at least mean that a widespread mindset already exists for both adapting to and paying money for new computer hardware on a regular basis. Hence, whereas it took decades to get more energy efficient cars on the roads, it will hopefully only take a matter of years to reach a state of affairs where most computers are using far less power than they needlessly waste today.

IV. FUTURE SCOPE

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 tones 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. Opportunities lie in green technology like never before in history and organizations are seeing it has a way to create new profit centers 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.

4.2 Steps to Green Computing

As of Oct. 20, there are new performance requirements to qualify for the Energy Star rating for desktop and notebook computers, workstations, integrated computers, desktop-derived servers and game consoles. These specifications go into effect on July 20.

But businesses don't have to wait until then to initiate more environmentally-friendly computing practices. Here are five first steps you can take toward a green computing strategy.

4.2.1 Develop a sustainable green computing plan

Discuss with your business leaders the elements that should be factored into such a plan, including organizational policies and checklists. Such a plan should include recycling policies, recommendations for disposal of used equipment, government guidelines and recommendations for purchasing green computer equipment. Green computing best practices and policies should cover power usage, reduction of paper consumption, as well as recommendations for new equipment and recycling old machines. Organizational policies should include communication and implementation.

4.2.2 Recycle:

Discard used or unwanted electronic equipment in a convenient and environmentally responsible manner. Computers have toxin metals and pollutants that can emit harmful emissions into the environment. Never discard computers in a landfill. Recycle them instead through manufacturer programs such as HP' Planet Partners recycling service or recycling facilities in your community. Or donate still-working computers to a non-profit agency.

4.2.3 Make environmentally sound purchase decisions

Purchase Electronic Product Environmental Assessment Tool registered products. EPEAT is a procurement tool promoted by the nonprofit Green Electronics Council to:

•Help institutional purchasers evaluate, compare and select desktop computers, notebooks and monitors based on environmental attributes.

•Provide a clear, consistent set of performance criteria for the design of products.

4.2.4 Reduce Paper Consumption:

There are many easy, obvious ways to reduce paper consumption: e-mail, electronic archiving, use the ―track changes‖ feature in electronic documents, rather than red-line corrections on paper. When you do print out documents, make sure to use both sides of the paper, recycle regularly, use smaller fonts and margins, and selectively print required pages.

4.2.5 *Conserve energy:*

Turn off your computer when you know you won't use it for an extended period of time. Turn on power management features during shorter periods of inactivity. Power management allows monitors and computers to

enter low-power states when sitting idle. By simply hitting the keyboard or moving the mouse, the computer or monitors awakens from its low-power sleep mode in seconds. Power management tactics can save energy and help protect the environment

V. CONCLUSION

- So far, consumers have not cared about ecological impact when buying computer s, they have cared about speed and price.
- Now green materials are developed every year, and many toxics ones are already beings replaced by them.
- The greenest computer will not miraculously fall from the sky one day, it will be the product of year of improvements.

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