A Review on Energy Saving Using Green Computing System

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***Abstract*— During the past few years, there has been an enormous increase in the wide spread acceptance of small hand held devices. A new era of computing called Cloud computing has also emerged due to the increased usage of miniaturized devices. While such services are highly desirable by the end users, recently there have been some environmental concerns due to the increase in the usage of electricity. As a result, a new field of research called Green computing has evolved. This paper highlights some of the important factors that have led to Green computing and also discusses a few approaches being adopted to minimize the overall energy consumption.**

***Index Terms*— Cloud computing, Green computing, Electricity, Global warming, recyclability**

I. INTRODUCTION

Green computing is a very important topic these days, not only because of rising energy costs and potential savings, but also due to the impact on the environment.

Green computing means study of designing computers, servers and associated subsystems such as monitors, printers, storage devices and networking and communication systems efficiently and effectively with minimal or no impact on the environment.

It is the environmentally responsible use of computers and related resources such practices include the implementation of energy efficient central processing units, servers and peripherals as well as reduced resource consumption and proper disposal of electronic waste. [2] It is coming out in many different markets and areas all over the world in today's global technology. It is basically learning to use computer resources more efficiently to help the energy saving as well as the environment. It is very important as we realize the impact greenhouse gas production has on global warming and climate change.

Green computing can maximize the energy efficiency, reduce the hazardous materials such as lead and maximize the recyclability. It reduces the power consumption, cost and carbon emissions. It can also improve the system performance

II. NEED OF GREEN COMPUTING

Climate change and global warming are viewed by many as the two most challenging problems facing the Earth. Green IT and in particular, green computing, are two ways the information and communications technology community is working to address those problems.

With the explosive growth of Internet-enabled cloud computing and high-performance computing centers, IT's energy consumption and sustainability impact are expected to continue climbing well into the future. Efforts are underway in both industry and academia, however, to address it.

As demand for computing and communication continue to grow, servers, networks, and data centers will consume more and more energy. For example, IT resources in the US now consume more than 1.5 per cent of total electricity consumption.

Power consumption of US data centers in 2006 was 1.5 per cent of the total energy consumed, and at a cost of more than US $4.5 billion.

With the expected 30-fold increase in data traffic over the next decade, the overall power consumption of data centers and networks will become an issue of vital importance to the IT and telecommunications industries.

Fig2.1 Implementation of Green Computing

Today, the green communications concept focuses mainly on developing energy-efficient communication techniques for networks. Three main approaches are suggested for power management in communication networks: do less work, reduce operating speed, and turn off idle elements. Doing less work means optimizing processes so that the system executes fewer

operations and thus uses less energy. Decreasing operation speed could prevent redundant resource use from the mismatched speed of sub processes. Finally, shutting down idle network components and links can obviously reduce energy dissipation.

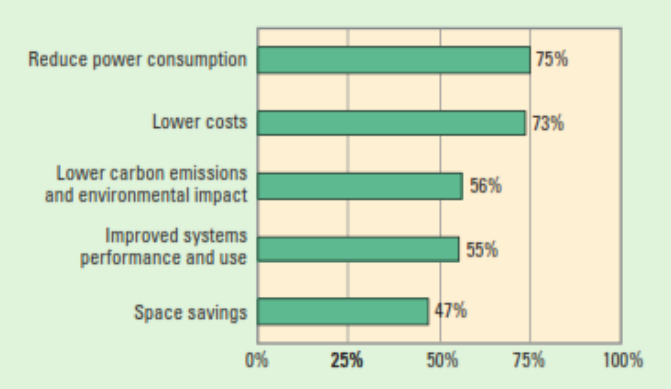

FIG 2.2 Green computing [1]

III. .ENVIRONMENTAL ISSUES AND PROBLEMS

Electricity is a major cause of climate changes because the coal or oil that helps generate electricity also releases carbon dioxide, sulphur and pollutants into the atmosphere. These emissions can cause acid rain and global climate change. So, reducing electric power consumption is a key to reducing carbon dioxide emission and their impact on our environment and global warming.

The total energy consumption by servers, computers, monitors, data communication requirements and cooling systems for data centres is steadily increasing. This increase in energy consumption results in increased greenhouse gas emissions. Each PC in use generates about a ton of carbon dioxide every year.

As energy crisis deepens and the resources deplete, we need to seriously think about making substantial changes in our lifestyle for energy conservation. Green computing is one way of dealing with the energy crisis. It is possible to reduce carbon emissions, save energy and protect the environment as a whole with this approach.

Vampire power is the term used in reference with consumption of electricity by electronic devices while they are in the stand-by or switched-off mode.

Green computing is the practice of using computers and related technology in an environmentally responsible manner. It aims at radically changing the way we go about computing, using the electronic devices and following strict energy conservation guidelines, so as to minimize the damage caused to the environment by computers. This activity is not just limited to saving electricity, but also takes a holistic approach towards environment-friendly use of computers. Devising innovative and environment-conscious techniques for energy generation is also one of its aspects.

IV. GREEN NETWORK SIMULATION

The increasing number of network terminals and demand for high performance are driving network energy consumption increases largely. However, extended Coverage and the large user population make it extremely difficult to analyse the energy cost of large-scale networks. Consequently, Simulation has become an invaluable aid in evaluating network architectures and protocols.

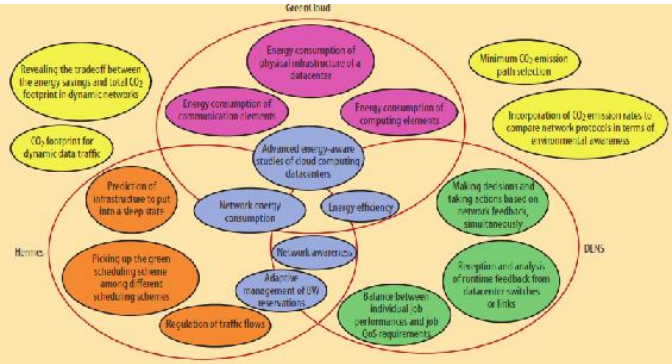

FIG4.1 Classification of the Hermes, Green Cloud, and DENS green simulation environments. The blue ovals show core Specifications that all three simulators meet. The yellow ovals list what future simulator designs must address to fulfil the aims of green simulation.[6]

V. ADVANTAGES OF GREEN COMPUTING

With the advent of upcoming technologies, the need for green computing has become obvious. There are many tools used in the present scenario to deploy green computing. Following are the advantages of green computing:

A. CLOUD COMPUTING

Cloud computing is the latest buzz word in the IT market. There are a lot of Cloud service providers like Google, Amazon, Microsoft, etc. The major challenge for these Cloud service providers is that they need to maintain huge Data Centers to provide uninterrupted service to the users. For this, they continuously keep their servers on and hence, the overall energy consumption has increased exponentially. Cooling of servers consumes the maximum power.

B.RECYCLING

Recycling can be used to save precious energy, time and money spent in manufacturing the electronic items. Fewer resources are used and less money is spent in recycling an electronic item rather than manufacturing from scratch. Even the well developed countries today do not emphasize more on recycling. France, which is said to be an ecology-responsible country, collects only 14% of the e-waste generated in the country. Thus, there is a great scope for recycling electronic items and thereby, preventing environmental damage. The following simple steps can be practiced to conserve environmental resources like electricity, etc.

C. TURNING YOUR COMPUTERS OFF

The practice of switching off computers when not required helps in saving a substantial amount of energy. The estimated amount of energy spent in a single year due to round-the-clock use of computer is $115-$160. Running a computer just 8 hours a day can help save 810 kWh energy on an annual basis. It is believed that turning the computer off can damage it. Computers, in fact, can sustain around 40,000 on/off cycles. Therefore, there is no need to worry about switching off the computer even if you have to do it on a regular basis. The power supply to scanners and printers must be limited when these devices are not in use. All the above practices, if followed, can save a considerable amount of energy.

D. IMPROVING ALGORITHMIC EFFICIENCY

An optimal algorithm takes minimal time and space. Efficient algorithms help to achieve the goal of green computing. Therefore, the overall productivity increases by a substantial margin. A simple computing activity like searching in Google for information can have a severe impact on the environment with respect to the energy consumed and CO2 emitted in the process. Thus, without improving the algorithmic efficiency, one cannot expect reduction in the power consumption even from cloud computing.

VI. SOME STEPS THAT CAN BE TAKEN TO MINIMIZE ADVERSE IMPACT ON THE GLOBAL ENVIRONMENT

- Power-down the CPU and all peripherals during extended period of inactivity.
- Use LCD monitors rather than CRT (cathode ray tube) monitors because LCD generally consumes total 80 W while CRT consumes total 150 W.
- Use notebook computers rather than desktop computers whenever possible.
- Avoid screensavers because it consumes more power.
- Use Hardware and Software with energy star labels because it generally uses 20% to 30% less energy than required by federal standards.
- Employ alternative energy sources for computing workstations, servers, networks and data centers.
- Power-up and Power-down energy intensive peripherals such as laser printers according to need.
- Use devices that can store renewable energy*:* Harness charging devices that make use of solar power, designed for portable and home use. There are also the rechargeable batteries, but stay away from those that are alkaline-based. The most recent developments in rechargeable batteries use lithium-titanium, considered as safer and have longer life cycles.
- Reduce standby power consumption: Use power strips that instantly turn-off electronic equipment that tends to remain idle for a specific period of time.
- Adjust PC settings**:** by turning down the brightness and contrast settings of PC Monitors as this can reduce electrical wastes in power consumption.

VI. FUTURE OF GREEN COMPUTING

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 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. 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 as 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. 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.

VII. CONCLUSIONS

This paper briefs about the challenges faced today due to the rapid increase in the technology. We have discussed about the evolution of Green computing techniques and approaches being widely studied in the present era. As a future work, we would like to continue exploring the literature of green computing and hope to contribute to the same by adopting some of the latest green computing techniques.

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