

Optimization of Energy Usage for Computer Systems by Effective Implementation of Green Computing

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-----ABSTRACT-----

Abstract—Today Computers are widely used throughout the globe from any kind of organization to home. Due to the versatile power of computer machine we can't think a moment about the world without computer. From millions of transactions, learning any topic, searching web to home entertainment computer has become an essential part of day to day life. Too much amount of usage of computer systems in the world also require heavy amount of electricity. As per the thermodynamics rules it is not possible to utilize this electricity exhaustedly but also results in wastage of some part in heat form of energy. Not only this is enough about electricity but wastage part of computer systems also creates environmental problems too due to carbon synthesized materials. Our earth is also passing through the global warming, Green house effect and the ozone layer is becoming thin. In this regards, it is necessary to think about the environmental issues concerned with using computers because it is not possible to decrease the usage of computers but can be used optimistically. Here is an effort made to deal with such problems by effective implementation of technologies and which is also known as Green Computing.

Keywords – Green Computing, Carbon footprint, Green House Effect, Environment, Energy, Cloud Computing, Parrallel Computing, E-waste, optimization.

I. INTRODUCTION

Use of computer systems is increasing day by day. Such an excessive use of computers generates environmental issues. To gain work from computers require tremendous electricity that also increases the cost. What will happen if electricity shortage arises? It is necessary to use electricity very carefully. But there is no chance to decrease the use of computers then only thing remains is to optimize the use of energy. Today we have available the number sources of electricity production but what about the future?

Second issue is the carbon footprint that the computer leaves which creates environmental problems. Today green house effect is facing the problem of increased volume of the carbon dioxide. The massive use of computers in entire world instead of solving this problem it increases it with slow velocity.

Third issue is the wasting of the electric energy in form of heat. It is not possible to utilize cent percent input electricity but wasted in one form or another. Then what the solution? Is it possible to decrease the wastage of electricity? Air conditioners are used to keep computer cold to decrease wastage of energy but what about the cost

keeping air conditioners to continue? Air conditioners also require electricity.

Forth issue is regarding not utilizing the potential inherent computing power which is concerned with hardware and software. Hardware issues are CPU utilization by organizing different architectures whereas software issues deal with optimum algorithm design and implementation.

Fifth and last but not least issue is about how we are using computers. That means wasting of computing power by ignoring some of the common actions.

This paper is all about how to optimize computing power so as to minimize the electricity usage as well as wastage and minimize the effect in environment. Thus environment friendly optimized use of computer systems will indirectly decrease the maintenance cost and will help to survive our earth. Green computing helps to overcome these problems.

Green computing is a new technology and research towards effective use of computer resources and disposals of e-waste without harmful to environment. Green computing is involved from home computer usage to large network usages. The problem of environment is not only due to computers but as an IT field is growing fast it considers green computing as an essential technology for environment friendly IT solutions.

II. OPTIMIZE LIMITED ENERGY SOURCE

Computers consume electricity and it is necessary to optimize the usage of electricity. We can improve the efficiency of electricity usage in following manner[1].

A.By reducing the power consumption.

B.Reducing the use of hardware prepared through harmful materials.

C.By increasing the life-time of the product using efficient power management.

D.It may be possible of using solar computers as a new source of energy. Solar is only the natural source available forever and involving it in computer will help make green computing success.

E.Nuclear powerplants are other sources for electricity that emits less carbon.

Many devices are operated through batteries and life time of battery is crucial. Effective use of such devices increases the life time of batteries.

Research indicates that the use of CRT monitor consumes more power than compared to LCD or LED. The power consumption of CRT alone overtakes the power consumption of CPU, HD, DVD, RAM and other peripherals. Power used by a computer with CRT monitor consumes more power for only monitor but less power for most of the other hardware with compare to a system with LCD or LED computers. But cumulative effect of total power consumption excesses for CRT computers due to CRT monitor alone. Minor differences exist between LCD and LED computers. So is it possible to utilize the efficient power consumption by optimizing it for all the hardware? If we take advantages of display devices and other hardware then the power consumption can be maximum utilized.

III. OPTIMIZE WASTAGE FOR CLEAN ENVIRONMENT

The computers are being made with varieties of materials and carbon is at center. One of the issues is to reduce carbon footprint which is defined as emission of greenhouse gases produced measured in units of CO₂ – Carbon Dioxide [2][5]. Equipment after consuming electricity emits carbon in environment creating the effect of greenhouse effects. Reduction in carbon emission is critical for environment because the effect of it imbalances the nature and creates natural disastrous. Many companies have come forward for these issues and make the efforts of green computing. Wasted computer system should be disposed in such a way to minimize the environment effects. To manage e-wastage of computer related hardware following optimization can be effective. Green computing will help to clean the earth for the next generation.

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C.Wasted computer hardware can be used to obtain thoroughly understanding of them in educational purposes.

D.Research should be initiated to utilize these wasted hardware in Nanotechnology that requires tiny parts. What the major benefit of it is to optimum utilization of damaged failure hardware that will make less harm to environment and on the other side the chances of new technology emerge that will help to the world.

E. Hardware wear out during the life span that is natural but optimizing using them may increase its life time.

IV. OPTIMIZE WASTAGE ELECTRICITY

According to physics thermodynamic rules it is not possible to take 100% work potential using any system. There exists wastage in some form of energy. Computer cannot take fully utilization of electricity that it receives. The wastage of energy in form of heat requires to be optimized. This is a problem associated with almost every electronic device. One solution to this problem is to minimize this wastage through heat energy by optimum usage. And second, theoretically energy is transformed from one form to another, so if we are able to absorb this emitted heat energy and utilize it to produce the electricity will solve both the problems of increasing the life cycle of devices by controlling the temperature and reproducing the electricity. This will also solve the economic issues of maintenance cost, hardware cost and power consumption cost.

V.OPTIMIZE COMPUTING POWER

Computer is a powerful tool for computation of any kind of complex calculation and processing. This power can only be obtained if we fully utilize it. This can be achieved through optimum architecture as well as by designing optimum algorithms. If we don't consider these issues the powerful computer with strong processor will be idle. For This reason number of solution are obtained for green computing that maximizes the potential power of computers.

Optimizing design architecture involves the organization of the computer systems used in parallel computing, cloud computing, network based applications. Optimizing algorithms involve efficient practice of solution.

A.Based on the architecture design number of virtualizations models are developed and maturity levels achieved. Here the term Virtualization related with sharing the content[3].

1. Level 0 is described using name local with dedicated applications and fixed infrastructure. It is intended for home usage of computers.

2. Level 1 is described using name logical with shared applications and fixed infrastructure. It is intended for departmental and organizational usage of computers.

3. Level 2 is described using name data center with shared applications and virtual infrastructure. It is intended for data storage centers.

4. Level 3 is described using name cloud with software as a service applications, virtual infrastructure and virtual ownership. It is intended for cloud computing.

Each level described here is for maximize the use of potential computer power in term of client, server or data stores.

B. Super computers involve parallel computing and if we do not utilize processing power of each computer then again results in loss of energy. Parraller computer architecture is suggeted when all the parrlelel computers are fully utilized.

C. Application design must be tested to support the system to enter into sleep mode when the application is idle. Todays software development not only incorporates analysis, desing and software engineering but also includes the greencomputing strategies. Also when computer leaves the sleep mode it must continue to operate successfully[3].

D. Applications should not continue to connect with network unnecessarily. When it is required to obtain service or sending information connection should be managed. If there is no communication with connected network for large amount time will result in loss of energy.

E. Software design should be optimum. Computer is power for processing doesn't mean to keep it continue with unnecessary processing continuolsly. Better algorithms should be designed to fully optimize the processing time. This issue is crucial and for that reason from multiple solution anoptimum solution should be obtained. This will not only fully utilize the computing hardware but also resultsin an efficient application.

F. Minimize the amount of data stored because each read write operation requires amount of power consumption. For large data stores this is an important issue for the optimization. It is necessary to design high-efficiency data storage.

G. Designing the client server applications with thin clients which utilizes the power of server and reduces the power consumption of clients.

H. Use of wireless sensor network for cooling data center for optimizing power management[4].

I. Check daily for switching off computer resources which will not be used for next two or three days. Many other issues are possible but the theme remains same as to maximize utilizing computing power with minimize power consumption and wastage.

VI. OPTIMIZE MISCELLENOUS COMMON IDEAS

It is also necessary to tune ourselves for effective implementation of green computing. Sometimes although

knowing we just ignore some of the actions. If little care is taken, results in supporting green computing.

A. Shut down the computer if not used for large amount time. Although screensaver is used for power optimization, excessive use of graphics yields more power consumption. Optimize power management for monitor and sleep mode for CPU.

B. Unplug the power cable if computer system is not used for few days. As little power is consumed when it is not switched on but plugged inpower cable. If all over the world this is followed then cumulatively electric power can be saved.

C. Take print out only when necessary otherwise complete the transaction through e-documents also supppors effective green computing. Keep printer switched off in idle state.

D. Use thin clients with keyboard, mouse and monitor and shared applications at server used by thin clients saving amount of power consumption[4].

E. Make efficient server usage by adopting virtulization techniques.

F. The simplest way for going green is to plant a tree that will add some value to green computing.

G. Make properly disposal and recycling of equipments. Many hardware companies promoting the recycle of equipments. Further upgrade the equipments when necessary instead of replacing entirely computer system.

VII. CONCLUSION

Green computing is recently the issue considered by most of the business, organization and manufacturing companies. Due to enormous usage of computers it is not only necessary but compulsory to think in the direction of green computing.

Hardware designers are also adopting the materials and chemical which is environmental friendly with tremendous capacity. The effective implementation for optimizing usage of computer systems can be achieved only if all the organizations, hardware manufacturers, employees, students and all the people in the world using computers are aware about green computing and then start implementing it at the moment after being aware. Today software designers are developing software keeping watch on green computing. Many other research projects are on the way on green computing. Operating systems, database management and many network based software are improved to fully utilize the computing power. Cloud computing the level 3 maturity virtualization model focuses on green computing by sharing the content available to everyone everywhere. The future is about green computing that will be involved in every aspect of computer usage.

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