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Green Computing: Opportunities and Problems in the Perspective of Developing Countries

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Abstract **– Green computing is today considered as most important term, this is the study and practice of sustainable computing. This is also referred as energy efficient computing. This paper describes the general overview of green computing. We discuss the contemporary opportunities available from green computing model. We also discussed the pre-requisite and essentials to build up green environment in a company or industry. Green computing is the next important technological advancement in advance computing.**

Keywords: **Green Computing, Green Technology, Advance Computing, Energy Management, Power Management, Energy Management, Recycling, Green Industries**

I. Introduction

In simplified manner we can say that Green computing is actually nothing but the concept that deals with green aspects like green user, green disposal, green modeling, green designing, green manufacturing and related facet [03]. As sun Murugesan defines that 'it is a study and practice of desigining, manufacturing, using and disposing of computers, servers and associated sub system such as monitors, printers, storage devices and networking and communication systems efficiently and effectively with minimal or no impact on the environment'.

The green computing mainly gives importance in reducing and reusing as well as recycling of information technology system; ranging from hardware, software, application and systems[10,11,13].

II. Objectives

Some of the objective for which we conduct this research work are:

- To know basics about green computing and green technology;
- To know the benefits and advantages of green computing;
- To know main area of green computing;
- To learn the main approach of green computing and related field;
- To learn the organizational need of green computing for advance IT infrastructure;
- To learn the main challenges as well as opportunities of green computing;
- To learn about the probable need of green computing in information centre and related field;
- To learn about virtualization and use of green principle in virtualization;
- To learn about evolution of green computing as well as present scenario;
- To know about green computing movement and evolution through out the world.

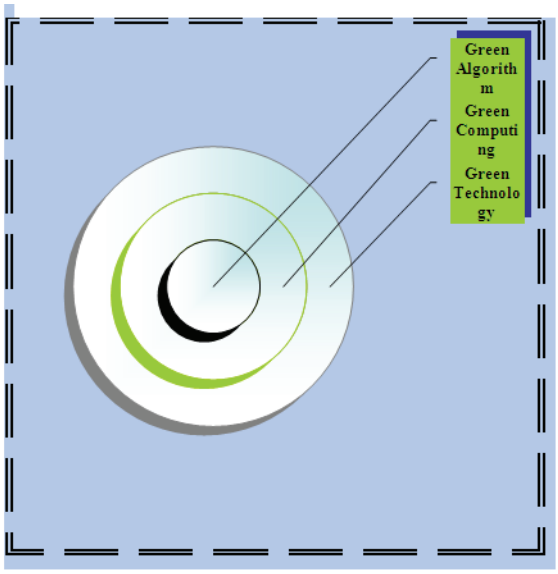

Fig. 1 From lower to higher green wor

III. Green Computing: Fundamentals

Some fundamentals issues related to Green Computing are:

Resource Allocation: Through the resource allocation mechanism it is possible to use route data to another data centre. The allocation algorithm basically helps to minimizing or reducing energy cost [06, 11].

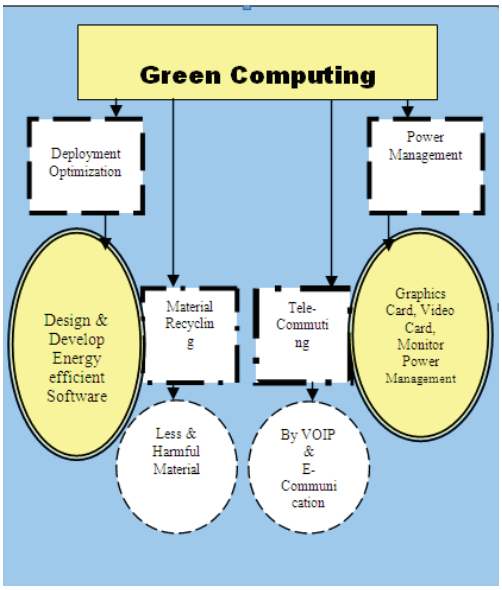

Fig. 2 Green computing approaches

Virtualization: Abstraction and virtualization are considered as equivalent as far as green technology is concerned. Virtualization is actually nothing but using one or some machine. Through the virtualization one single and powerful system may also help in cooling the system or simply reducing power.

Cloud Architecture: Cloud computing is today treated as most important and valuable term to save money, power and time.

IV. Green Computing: Evolution and Emerging Scenario

Green computing system is more or less similar with the term green chemistry. Here energy efficient computer as well as other technologies basically gets more priorities. The concept of green computing is actually not at all 'completely new'; this is actually a concept with new flavor and environment [10, 02]. Today green computing means the following aspects:

- Energy consumption;
- Material cycling;
- Power management;
- Ergonomics;
- Virtualization promotion;
- Using hazards free material and so on.

During 1980's many universities around the world create movement on green computing. In 1992 United States environmental protection agency a voluntary labeling programme was designed to promote energy efficient 'Energy Star', the first and still most popular logo or label for awareness of 'energy management' considered as first green computing initiatives [05,12]. Apart from this, TCO Certification is also launched by the Swedish organization. Earlier the products which used energy star labeling are

- Computer;
- Printer;
- Routers
- Servers;
- Switch and others.

Today awareness for green computing is increasing day-by-day. Apart from private companies and industries, government organizations and departments are using green computing models.

V. Green Computing: Advance Approaches

Today many facet and aspects are considered as green computing such as:

- Resource allocation;
- Virtualization;
- Terminal servers;
- Operating system supports;
- Storage;
- Material recycling;
- Telemedicine;
- Video card;
- Power supply;
- Data centre;
- Consortium
- Tele meeting or commuting and so on.

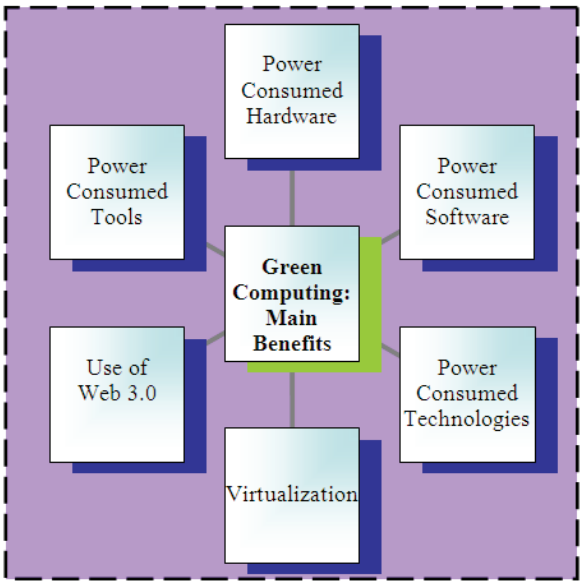

Fig. 3 Green computing benefit

During the evolution of green computing any algorithm and power management are consider as main facet but today the periphery of green computing is increasing. Fundamentally green computing approach refers to

- Deployment optimization;
- Power management;
- Material reusing;
- Tele commuting.

A. Deployment optimization: Energy efficient algorithm design and development as well as its proper use are mainly useful for reducing energy cost as much as possible. Many tool, computers, devices need higher energy and power, and for better green computing mechanism we need to use deployment optimization. Windows 7 may be a wonderful example for this. Practically windows 7 along with office 2010 package needs near about 70 times more RAM than that of office 2000 or earlier version like windows 98.

Resource Allocation: Resource allocation is another important name in green computing. Through the intelligent algorithm energy consumption is possible even in route direction. In this case data can reach its appropriate address with out consumption of time, the information networks and system can use this for resource allocation [13].

Virtualization: Virtualization is another important name for sharing of software, hardware or even other information technology infrastructure with the help of cloud based architecture. Today most of the organizations, industries, institutions even government are moving towards green computing. In virtualization or cloud model many computers or devices basically connects with central computers or nodes. This approach basically save 1/8 amount of energy than that of normal work station.

B.Power Management: Energy consumption is actually main aim of power management approach. This approach may be useful in data centre for less power usages. In computer or large computing system many areas can save power like- the centralized operating system can save money and energy. Graphical unit and voice card is an important area where power management is possible. In many computers in which video card and graphical card are installed basically are used in organizations and industries but as far as power management is concerned we don't need to use or buy this type of machine or need to uninstall theses cards. Liquid crystal display unit is far better than that of CRT Monitor in energy and space saving. Using LED monitor or Light Emitting diodes is far better than LCD.

C.Material Cycling: Material cycling is one of the emerging concepts of Green Computing and technology. Time by time we need material cycling because electronic garbage today is a big challenge to our environment as much harmful material like- lead, mercury, and chromium are released from this garbage. The new technology and discovery and development of computing devices increase the awareness about material cycling [02, 15].

D.Telecommuting: Telecommuting is an important way or mechanisms which are promoting the system of green computing. It saves energy, uses of many computers and devices and indirectly money. Teleconferencing with the help of web camera and advance VOIP (Voice over Internet Protocol) is an indirect energy saving. Indirectly it saves space, heat, lighting and so on. Today many organizations are moving towards teleconferencing for many purposes [16].

VI. Green Computing: Contemporary Advantages

Through the Green Computing so many advantages are possible. Today Green computing model or approach can be used in any type of foundation or services, even our own houses for computing [01]. Now let us check some of the computing benefits affiliated to Green Fragrance.

- Green computing and technology saves energy and money no doubt, because the virtualization, recycling, better algorithm designing can minimize energy and it ultimately saves money [12]. As per Microsoft awareness

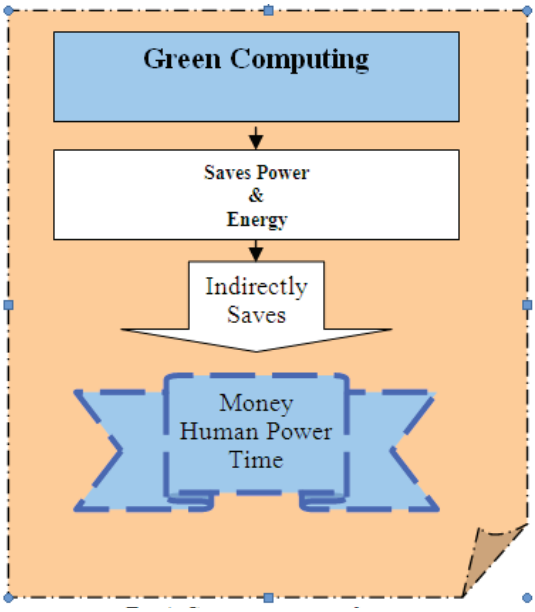

Fig.4 Green computing & saving

on Green Computing when one user turn off the machine every night , that time it can save $ 46 per computer, over the course of a year [17].

- Green information and computing infrastructure has so much cost effectiveness; when a company or institute use one computer or machine as a server and other machines as node at that time cost effectiveness is possible. The cloud computing model can save money indirectly through the wonderful virtualization techniques [13, 17].
- It helps to solve the main problems of unused computer with the help of recycling process.
- The time can also be saved by the green computing models.
- The centralization of information technology infrastructure is possible through the green computing.
- 'Minimum input and maximum output' this scientific management theory is possible through green computing.
- Through the green computing, the green environment movement can grow.
- It can save tax in many cases as far as MNC's are concerned.

VII. Green Computing: Need of Awareness

Green computing has so many advantages and benefits; we need awareness regarding green computing benefits and utilization as soon as possible. In 1992, the United States environment protection agency launched energy star, which can be treated as first initiatives of green computing [18]. However apart from these so many organizations are engaged in green IT movement such as:

- Client server computing initiatives;
- Electronic product environment assessment tool of green electronic council.
- So many organizations such as AMD, APC, DELL, HP, IBM, Intel, Microsoft, VMW have already created green grid consortium for improving green computing initiatives.

VIII. Findings

During this research work, we found the following aspects:

- In India initiative regarding green computing is lesser than other South Asian countries.
- Still awareness and structured look of green technology is not popularized.
- Information centres, systems, universities, governmental departments particularly in India are still not using green computing techniques and methods.

IX. Suggestion

- It is essential to include green projects in governmental departments, particularly in India.
- It is essential to implement Green computing in information foundations, such as information centre, systems, organization.
- It is essential to promote only those methods and techniques which are helpful for the organization- directly and indirectly.
- To include green computing as a full fledge papesr in the curriculum of computer & information science in Indian universities.

X. Conclusion

Green computing is no doubt a wonderful term for modernizing information and technological infrastructure in any country. Green computing can do many things from ecology and environment friendly society to energy and financial saving. Developing countries like- India needs several initiatives for green computing like- green computing awareness programme through advertisement, circulation of handbill, champanion, logo creation and so on. Using social networking site may also create healthy technological

infrastructure in India and other countries. Government needs to take proper planning as well as policy formulation for implementing green computing and technological aspects and proper output.

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