



Tools and adopting of green computing in computer industry

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Abstract

Today, the world stands in the middle of the era of digital transformation, with all sectors ranging from healthcare, energy and education to digital technologies through advances in information technology. The current time of digital transformation is not only limited to significant progress in production and quality, which we see, but also has a significant impact on the environment. There are many tools and electronic applications that contribute to protecting the environment, reducing energy consumption and Noise prevention. Therefore, the current research has been prepared to identify the tools and adoption of green computing in computer industry. To achieve the objectives of this research was used descriptive approach. The results showed that the Green computing in the computer industry refers to maintaining economic feasibility so that it is environmentally friendly without compromising the effective and optimized use of computing resources.

Keywords: Green Computing, Tools, Information Technology (IT), Computer, Industry, Energy.



1. Introduction

As greenhouse gas emissions increase and major factors contribute to global warming, many institutions, governments and communities have sought to develop a new agenda that focuses on addressing Environmental matters and work on a clean and healthy environment. These practices include the greening of Information Technology products, applications and services. Carbon dioxide emissions are caused by increased energy consumption caused by computer use. Information communications Technology (ICT) has changed our way of life, our work, our learning; this affects the environment in many ways. Many jobs have been created around the world, where computer literacy has become something we cannot do without in all sectors. Therefore, an increasing number of Information Technology users, manufacturers and vendors are moving towards green Information Technology, helping to build a green society and economy. Green economy means all economic activities related to reducing fuel use, reducing pollution, emitting gases, increasing energy efficiency, recycling materials and developing new sources of energy [8].

Green computing has been spreading for some time now. Today's people are racing to meet the requirements of Technology Information Green and know green information technology or green computing as environmentally stable information technology. As attention stems from economic requirements, the costs of energy for the global IT industry are showing a growing trend. Green computing means manufacture of electronic components and computers that are energy saving and have less impact on the environment and interested in disposal of these components when the completion of use



or obsolete and recycled to other electronic components [7].

Green computing is environmentally friendly computing. The optimal use of computer resources leads to green computing; from reducing resource, lack of consumption and better disposal of e-waste (e-waste) although experimental information systems (IS). We need to know the tools that action the adoption of green technologies, most, if not all, published research on Information System, Green Information Technology, or Green Information System is characterized by a call to action by the Information System community and a definition of the Green Research Agenda Information System [1].

Green computing is becoming widespread these days. Today people are racing to meet the requirements of this technology. Green IT is defined as green IT or green computing as an environmentally stable information technology. As economic requirements have become the most important energy saving, the energy costs of the global IT industry are showing an increasing trend in this area that we cannot keep away. Since green computing means for everyone the manufacture of electronic components and computers with energy efficiency first and last, which have less impact on the environment, which is concerned with the disposal of these components when they are finished and recycled to other electronic components to preserve the environment well. It was necessary to focus on the design of advanced devices and small in size, consume a little energy, and preserve the environment, as described in this published paper [14].

Problem



Today, electronic devices and computers cannot be dispensed with in our daily life, work and study and many other areas. They are of great importance in making life easier and simpler, but it is necessary to acknowledge the existence of damage to these technologies. The greater our use of technology, the higher the rate of energy consumption and the more heat generated by electronic devices, which means harmful emissions such as carbon dioxide negatively affect the environment. Therefore, it is necessary to search for environmentally friendly technologies (green computing) that reduce energy consumption and greenhouse gas emissions. Industries have recently adopted the green concept of focusing on environmental issues [5].

However, many are unaware of the concept of green computing and tools and their adoption in the computer industry, so this research was prepared to know the concept of green computing and its importance and tools and adoption in the computer industry.

Questions

The rapid development of network technology has led many organizations to make their applications available for use on the Internet in what is known as Green computing. The current research has been prepared to answer the following main question:

What are the tools and adoption of green computing in the computer industry?

A number of sub-questions emerge from the main question, as follows:

- What is the concept of green computing?
- What is the importance of applying green computing in the computer industry?



- What are the ways and steps of applying green computing in the computer industry?
- What is the Techniques of Green Computing?

Objectives

The ability of the computer to store large amounts of data and retrieve them quickly, easily and inexpensively has led to widespread use in the management of many functions, and has been used in many industries using green computing tools. The current research has been prepared to identify the tools of green computing and to achieve the following

Objectives

- Determine the tools and adoption of green computing in the computer industry.
- Identify the concept of green computing.
- Highlight the importance of applying green computing in the computer industry.
- Highlight the ways and steps of applying green computing in the computer industry.
- Determine is the techniques of green computing.

Methodology

Green computing is important for all system categories, from mobile systems to large-scale data centers. In order to achieve the objectives of the research which is to identify the concept of green computing and to highlight the tools and adoption of green computing in the computer industry, the descriptive method was used by examining the facts and literature and previous studies and analysis of the results related to the subject of the current research.

2. The general concept of green computing



A number of concepts have emerged in the communications, IT and IS such as green computing. Green computing has many other names such as green technology / green smart computing / technology engineering, environment-friendly technology, computing of green information systems, and finally environmentally sustainable information technology. Raza et al see that However, the debate about green computing for information technology remains one of the issues to be discussed [8].

According to Ishrath, the Green computing is a trend towards the design, construction and operation of the use of energy is less in the use of computers and the proper destruction of electronic trash. It is the design, manufacture, use, disposal of computers and their efficiently with smaller or no effect [13].

Harmon and Auseklis discuss that the term Good use of electronic computing resources leads to green computing. It also requires the integration of green computing resources such as energy and virtualization, improved refrigeration technologies, recycling, e-waste disposal and improved Information Technology infrastructure to meet sustainability requirements [6].

The disposal of electronic devices with minimal damage to the environment gives computing excellent vegetables. One of the most important technologies to help adopt green computing is "cloud computing" as it helps greatly reduce hardware and thus reduce consumption that is what we are seeking. A number of challenges companies face when adopting cloud computing. Although the cloud provides excellent and economical



features within the reach of the average user, several challenges arise: Internet dependency, line speed, security and privacy, as all data will be stored in the crawlers' devices [11].

3. The importance of green computing

According to current facts, the greatest use of green technology is in Europe and North America, as these regions and their governments have realized for decades the importance of this type of technology and its long-term effects on future generations. Using the computer, reduce the time and effort. However, it increases energy consumption and increases heat. This leads to carbon dioxide emissions [9].

Green computing objectives to energy management, and the process of so-called recycling of materials to benefit from products.

There are many reasons why we think about switching to green computing:

- Traditional electronic devices consume a lot of energy and environmental pollution in water, air and land.
- Most electronic devices generate the heat responsible for carbon dioxide emissions.
- Disposal of old computers generates hazardous waste and metals such as lead, mercury and cadmium.

Green computing offers good economic solutions to preserve the environment. There are many trends that affect as such as data, centers, servers, and desktops to increase the adoption of green computing practices which we seek to achieve. In the following there are some of these trends: [8].



- Rapid growth of Internet and ICT usage.
- Increased need for refrigeration equipment requirements.
- The increasing need for equipment density.
- High energy costs.
- Restrictions on access to energy supplies.
- Server usage rates are low.
- Increase awareness of the impact of information technology.

4. The Techniques of green computing

Green computing aims to take down shorthand the energy consumed by computers and electronic devices, reduce the dangerous radiation emitted from them, and increase the profits of enterprises. In the following will explain the techniques that are used by green computing to achieve the above objectives: [10].

4.1 Software and Development Optimization.

Since the cost of hardware and the cost of designing utility programs are expensive and drain resources for computers and power. We are looking for small-scale devices that connect to central servers that reduce power consumption and support more than one user at the same time [14].

The cost of electronic devices continues to decline as a result of the great competition in the computer industry and its components, but the cost of implementing programs and algorithms that are written is still large and consumes the resources of computers and



energy. One of the most important solutions is the use of a central server, which reduces the energy consumed because it supports more than one user at the same time [8].

4.2 Virtualization.

Virtualization is a new technology that has emerged recently. It designed to reduce power and costs; it helps increase reliability and is the foundation of fuzzy computing. Fuzzy computing is a way to share computing resources over the Internet. Fuzzy computing allows a group of users to share the same physical device by dividing it into virtual machines [10].

This technology helps reduce the amount of greenhouse gases emitted because a large number of devices are replaced by one physical device. It also reduces the cost to users; the user pays only for the resources he or she uses. The user is no longer worried about maintenance. Fuzzy computing has helped to save the environment. While the technology suffers from many challenges such as its ability to meet all the services it receives in the absence of virtual machines [12].

4.3 Power Management.

There are several ways to save energy, most notably shutting down the devices when they are finished. In addition, most devices and operating systems currently offer many features and ways to save energy. Green computing maximizes energy efficiency during



product life, recyclability or biodegradation of waste products and plant waste [3].

4.4 Powering off Computing Devices.

Many corporate Information Technology Departments have to adopt green computing to reduce environmental impact. Such as the user must be responsible for energy conservation, so the devices must be turned off when done. In addition, do not run computers continuously unless they are in use continuously [4].

The Important guidelines for computing consumption in an environmentally friendly way:

Government agencies and private companies have adopted green computing as progress in sustainable development, as green technology is gaining significant importance as energy consumption increases, leading to increased environmental awareness of computing. In the following, there are many guidelines for computing consumption in an environmentally friendly way: [12].

1. Products with the Star Energy logo are used for such products taking into account the green environment and optimal energy consumption.
2. Put the computer into sleep mode when do not need to use it for a short time. Sleep mode uses the least energy possible if we want to return quickly to the system after a short rest such as lunch break. When using the computer for an hour, we consume about 200 watts, but when using the sleep mode, the consumption is reduced to about 2 watts.
3. Using a screen saver such as images and texts consumes a certain amount of energy so



it is best to stay away from it, just to sleep or to use hibernation. It consumes a fraction of the power but may be slower than sleep when returning to open programs.

4. It is best to replace desktops with laptops that consume up to 80% less power from the office.

One way to preserve the environment is to reuse existing equipment within the organization or to donate it to beneficiaries outside the organization. Of critical issues in activating green computing in institutions is training employees and committing them to the optimal consumption of electronic products such as computers, printers, etc. [11].

5. Objectives of the green computing in the computer industry

While green Information Technology is expected to reduce costs and the company's effect on the environment, there was little interest in understanding the many benefits of sustainable strategies Information Technology services in terms of customer value creation, business value and community value. In the following are some of the most important goals of green computing in the industry [6].

- Reduce energy use, which reduces the cost of manufacturing the product and achieves the highest economic return on the manufacturer.
- Reduce water use as a key factor in manufacturing to address the increasing water shortage in Egypt and to reduce the cost of the product.
- Reduce the use of raw materials in the manufacture and the full utilization of secondary products and reduce waste to reduce the cost of final treatment of all waste.



- Maintain the health of workers in industry.
- Preserving the environment surrounding the industry.
- Avoid fines resulting from pollution of the environment of industrial region.
- Ensuring that all manufacturing inputs are present in a continuous manner so as to ensure the sustainability of production and achieve the greatest economic return to the owners of capital and the state and not to lose job opportunities due to the interruption of industry.
- Save time and effort within the work environment.
- Reducing environmental degradation resulting from manufacturing and affecting the health of the community, ensuring the presence of a qualified and capable workforce in all sectors of development [2].

6. The solution of Green Computing

6.1 Recycle and Reuse.

Safely disposed, recycled, or donated to non-profit organizations.

6.2 Develop sustainable green-computing plans.

Through the active participation of all persons associated with industries from the highest to the lowest levels. Regulatory policies and checklists need to be developed, with mandatory guidelines, government policies, "green recommendations" and a list of recyclable and non-recyclable materials. Best practices and strategies should include recycling, disposing of the equipment used, and ensuring the purchase of green devices, and objective to decrease the use of non-traditional resources, by decrease the use of

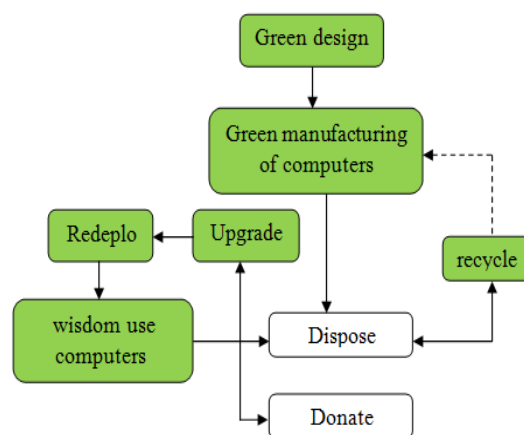


paper and recycling old devices and systems for the elimination of e-waste from organizations.

6.3 Conservation of energy.

All electronic instruments show energy consumption from non-renewable sources of energy. Therefore, appropriate tactics and techniques are adopted to conserve energy so that they can be used in times of actual need.

Figure (1):
green model"



"proposed

7. Conclusion

In order to
economic

maintain the
viability and

upgrade it to become environmentally friendly we must make better use of computing resources. The benefits of green technology are many, including: Do not contaminate the



environment or the nuisance. Thus preserving them, and meeting the need of the society and the consumer without exhausting the natural environmental resources especially the poor or non-renewable ones, Protect the environment, preserve it and its resources for future generations, Saving and minimizing the raw materials needed in manufacturing, thereby reducing the cost of manufacturing, Saving in energy needs whether in manufacturing, using the product or disposing of the product, thus saving the cost of energy in manufacturing or use by consumers, In addition to recycling materials and waste, which reduces the need for new sources and raw materials.

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