

An Introduction to “Green Computing”

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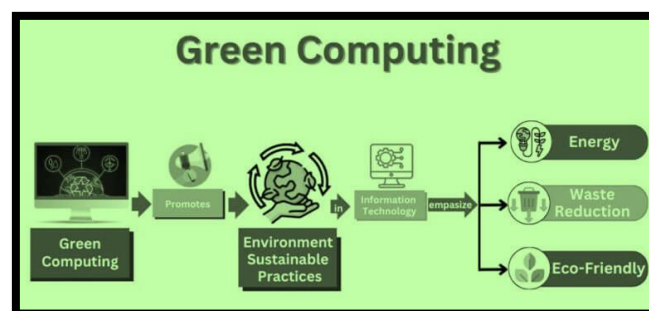
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ABSTRACT

Green computing, also known as sustainable computing, involves the design and optimization of computer chips, systems, networks, and software to maximize efficiency by reducing energy consumption and minimizing their environmental impact. The term “green computing” refers to practices that lessen the negative effects of technology on the environment. In today’s world, the focus of computing has shifted from prioritizing faster analysis, quicker calculations, and solving more complex problems to emphasizing energy efficiency, reducing electronic equipment consumption, minimizing e-waste, and using non-toxic materials in electronics manufacturing. The adoption of efficient computing practices is gaining significant momentum, with key goals including reducing hazardous material use, maximizing energy efficiency throughout a product’s lifespan, and promoting the recyclability or biodegradability of obsolete products and factory waste. This shift in perspective among developers has sparked a revolution in computing technology, commonly referred to as green computing. Due to the improvements in modern technology, various devices, mechanisms, and software have been developed, and lots of studies have been conducted to optimize and increase those technologies’ green computing abilities. Green computing involves the study and implementation of eco-friendly and efficient computing practices, helping organizations reduce their energy footprint while maintaining necessary computing performance. This paper explores the necessity of green computing.

INTRODUCTION:

Green computing, also known as environmentally sustainable computing, aims to optimize energy efficiency and reduce environmental impact in the development and use of computer systems and software. Its core mission focuses on lowering energy consumption in cloud servers to protect the environment.



The potential environmental benefits of green computing are substantial. The information and communication technology (ICT) sector accounts for 1.8% to 3.9% of global greenhouse gas emissions, while data centers alone represent 3% of total global energy consumption—doubling over the past decade.



ORIGIN OF GREEN COMPUTING:

In response to these challenges, programs like Energy Star, established by the U.S. Environmental Protection Agency in 1992, encourage energy savings in technology products such as displays and temperature control devices. Sleep mode functionality in commercial gadgets became widely adopted as a result. Additionally, TCO Advancement, a Swedish organization, launched the TCO Certification program, which focuses on reducing magnetoelectric emissions from CRT-based displays and later expanded to include requirements for energy use, comfort, and the avoidance of harmful materials.



Over time, authorities, businesses, and environmental organizations have introduced numerous initiatives to promote green computing, including hardware reuse, waste reduction, digitalization, cloud computing, energy efficiency, and green manufacturing. The IT industry continues to make strides toward implementing green computing practices across all areas.

A notable example is Intel's 2030 plan, which focuses on reducing water consumption, achieving 100% green energy usage, and eliminating waste sent to landfills across the company's global production operations. The plan's goals include enhancing safety and security through technology, improving digital readiness and accessibility, and combating climate change by creating carbon-neutral computers.

Need for Green Computing: The goals are to reduce the use of hazardous IT and computing products, make computing processes more eco-friendly, and enhance energy efficiency. This also involves minimizing travel needs, recycling computing waste, purchasing and utilizing green energy, and saving money through lower utility costs.

Green ICT and green computing are closely interconnected concepts with a shared objective of fostering environmental sustainability. Green ICT involves utilizing information and communication technology to enhance environmental sustainability, while green computing focuses on the environmentally responsible design, development, use, and disposal of computing systems. Both are essential for promoting sustainability in the digital age and complement each other in several ways. For instance, green ICT can enable the implementation of green computing solutions through technologies like remote access, virtualization, and cloud computing. In turn, green computing can improve the energy efficiency and sustainability of ICT infrastructure by optimizing hardware and software.

Both green ICT and green computing contribute to the creation of smart, sustainable cities by promoting energy-efficient buildings, transportation, and public services. A key tool in this effort is the green ICT taxonomy, a classification system that categorizes various aspects of environmental sustainability within ICT. This taxonomy



is vital for identifying the critical areas of focus necessary to advance sustainability in the digital age. Green ICT can be categorized into three main areas: data center-related sustainability, distributed ICT-related sustainability, and other ICT direct sustainability.

Data center-related sustainability focuses on energy-efficient technologies for cooling and power management to reduce environmental impact. Distributed ICT-related sustainability emphasizes the development of energy-efficient systems like cloud computing and virtualization to lower energy consumption. Lastly, other ICT direct sustainability includes practices such as sustainable software design and green procurement to minimize the environmental footprint of ICT systems. The green ICT taxonomy plays a crucial role in advancing environmental sustainability and supporting the growth of green computing.

Green computing differs from traditional IT systems in several key ways. While traditional IT systems prioritize performance and functionality, green computing focuses on environmental sustainability. Traditional systems often rely on energy-intensive hardware, consume large amounts of power, and produce significant e-waste. In contrast, green computing utilizes energy-efficient hardware, consumes less power, and minimizes electronic waste. Moreover, traditional IT systems may depend on non-renewable energy sources, such as fossil fuels, whereas green computing systems are powered by renewable energy.

Green computing is beneficial to the environment as it reduces carbon emissions, lowers electronic waste, and encourages the use of renewable energy sources. By adopting green computing practices, organizations can enhance their environmental sustainability, reduce their carbon footprint, and potentially save on energy costs. Additionally, green computing can improve energy efficiency and strengthen an organization's corporate social responsibility (CSR) profile.

Failure to adopt green computing could result in increased carbon emissions, more e-waste, and greater environmental degradation. Organizations may also face higher energy costs, regulatory penalties, and reputational damage. By embracing green computing, organizations can avoid these negative consequences while contributing to environmental sustainability.

The importance of green computing is amplified by the growing use of ICT across sectors such as healthcare, finance, education, and manufacturing. ICT already accounts for a significant portion of global energy consumption and carbon emissions, with usage expected to rise rapidly in the coming years. Therefore, adopting green computing practices is crucial to mitigating the environmental impact of ICT and fostering sustainable development.

Given the growing importance of green computing, numerous studies are currently being conducted in this area. To stay up-to-date, it is essential to continuously review research across different aspects of green computing. Future research may focus on identifying and addressing specific challenges and barriers within the field. Upcoming studies could also explore the interconnections between various green computing domains. Ultimately, achieving a sustainable and environmentally conscious future will require the adoption of eco-friendly alternatives and the implementation of awareness-raising initiatives.

ADVANTAGES OF GREEN COMPUTING:

- The reduction in energy consumption through green computing methods leads to lower carbon dioxide emissions by decreasing the reliance on fossil fuels in power plants and transportation.
- Resource conservation results in less energy needed for the production, use, and disposal of products.



- Saving energy and resources also leads to cost savings.
- Green computing extends to influencing government policies that promote recycling and encourage reduced energy usage by individuals and businesses.
- Additionally, it helps mitigate risks associated with harmful chemicals in laptops, such as those linked to cancer, nerve damage, and immune system reactions in humans.

DISADVANTAGES OF GREEN COMPUTING:

- Green computing can often be expensive.
- The process of making a computer environmentally friendly typically involves additional steps and technologies, which can result in higher costs once the computer is finished.
- Since green computing requires the use of advanced technologies, you may find yourself paying a premium for a more eco-friendly device.
- A prime example of this is the MacBook and MacBook Pro, which are among the most environmentally conscious computers available today—yet they are also some of the priciest on the market.

CONCLUSION

Green computing is a vital strategy for minimizing the environmental impact of IT. It promotes sustainability in technology by focusing on power consumption, reliability, efficient resource use, and waste reduction. Adopting green computing practices not only benefits the environment but also leads to cost savings and financial efficiency. Green technology offers numerous benefits that support a healthier planet and a more sustainable future. By reducing environmental impact, improving energy efficiency, utilizing renewable energy sources, and encouraging cost savings, green technology is driving progress toward a cleaner, greener world. Despite challenges like high initial costs and limited availability, the advantages of green technology far outweigh the drawbacks. By embracing these technologies, we can build a more sustainable and healthier world for future generations.

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