EMBRACING GREEN COMPUTING FOR A SUSTAINABLE TECH FUTURE

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Abstract. *Going green is the emerging IT trend in the context of human-induced natural calamities like global warming. With Green Computing still in its infancy, some prevalent obstacles hinder progress: most hardware components do not meet environmental standards yet, the greenhouse gas emissions generated by electronic waste are expected to persist and the demand for electricity to power data centers is projected to double by 2030. The scope of this paper is to emphasize influential green practices in the IT industry. To reinforce these ideas, the data was collected from international journals, relevant websites, and organizations. Analysis reveals that one operational computer emits approximately a ton of carbon dioxide annually. Therefore, one can reduce energy consumption by regularly powering off the inactive PC given the hard drive's durability. Another viable alternative is adopting eco-friendly hardware based on a circular economy since it reduces electronic waste and its dire consequences, including illegal waste disposal in developing countries. Additionally, embracing the Cloud enables one to use virtual servers instead of physical ones, which cuts down the need for hardware. Finally, this study highlights that ecological catastrophes act as a catalyst for sustainable practices in the IT sector.*

Keywords: *carbon footprint, circular economy, cloud computing, efficiency, e-waste.*

Introduction

As the development of technology reaches new heights, our quality of life is expected to increase substantially. But at what cost? Despite our revolutionizing achievements, the brittle ecosystem is prone to degradation - a dreadful process exacerbated by the large amount of waste. Electronic waste (E-waste) may be toxic as well as not biodegradable, hence, it poses a serious threat to the environment. Although it is utterly impossible to eradicate pollution, it is our responsibility to mitigate its impact on the environment by implementing measures like using computers efficiently, adopting eco-friendly hardware, and investing in cloud computing.

The Advent of Green Computing

It is hardly surprising that data centers began to grow exponentially both in size and energy consumption between 1960 and 1970 [1]. However, there was no incentive to tackle this matter back then since no one could foresee its profound impact afterward. By 1990, more efficient, compact, and convenient systems had appeared but the term "Green Computing" was coined as late as 1992, when the U.S. Environmental Protection Agency founded the Energy Star program to determine an IT product's environmental footprint in terms of efficiency [2].

Key Benefits of Sustainable Technology

Adopting an eco-friendly approach in the IT sector is associated with a myriad of benefits (Fig. 1). For instance, reduced waste and emissions would contribute to a healthier environment, which implies an enhanced overall public health, intact ecosystems, less natural disasters and so forth. According to the United Nations, we are forced to diminish greenhouse gas emissions by

7.6% each year until 2030 to cope with global warming [3]. By spurring innovative solutions to ecological issues, companies raise green awareness and hereby instill into others the mindset of prioritizing environmental concerns.
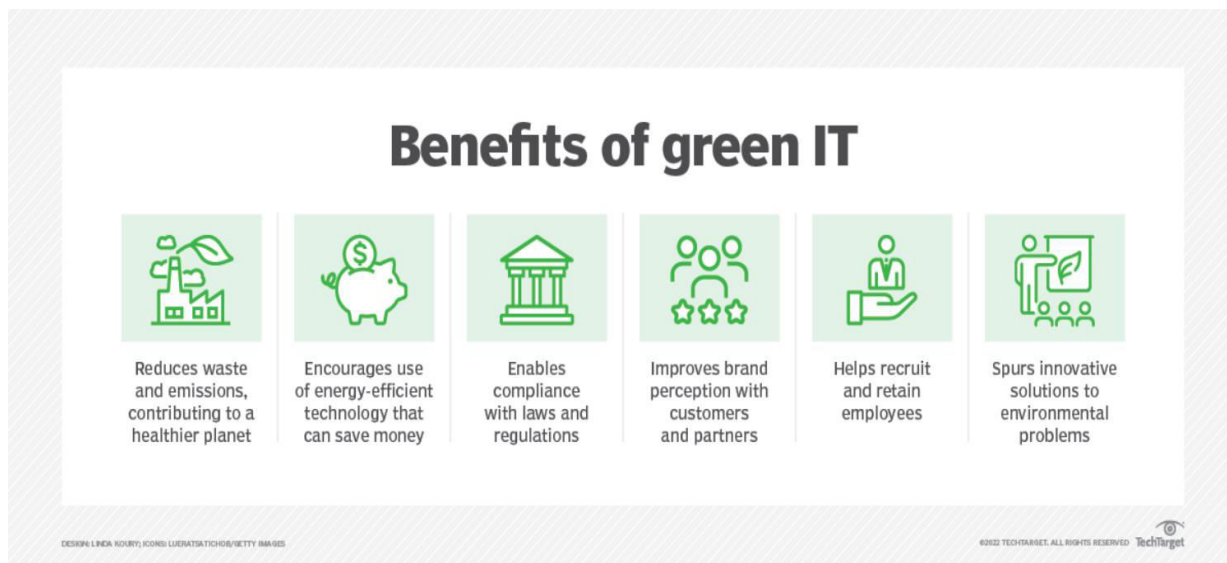

Figure 1. Advantages of sustainable IT [4]

Moreover, by implementing sustainable practices, businesses considerably improve their reputation and earn the loyalty of their customers and employees. Saving lots of money by conserving energy and complying with environmental laws are some other significant benefits [4].

Reducing Energy Consumption

The IT sector requires more electricity as it continues to expand and advance significantly. Schneider Electric – a French company renowned for energy management – released in 2021 a report outlining that electricity demand is bound to grow twice by 2030 [5]. One relevant practice would be the Sleep Mode option which enables temporary shutdown at specific times for specific systems, namely when some slow down or are no longer needed to function. Turning the device on and off repeatedly is also a viable alternative because modern hard drives can withstand constant switching [6]. As for massive IT companies, it is highly recommended to use modern energy-efficient equipment, to limit the cooling of computers by optimizing heat dissipation, and ultimately, to regularly monitor and improve their green practices.

Shifting to Sustainable Hardware

The mounting concern about climate change has increased green awareness in the last few years. Since the greenhouse effect is the main factor behind global warming, the carbon footprint of electronic waste ought to be curbed as soon as possible. It is estimated that a single active PC produces nearly a ton of carbon dioxide each year [6]. For instance, the most impactful solution would be focusing on circular economy, which implies prolonging the life span of the product. In this way, designing hardware components for circular use contributes to conserving raw materials, reusing as well as diminishing waste (Fig. 2).

Furthermore, it minimizes problematic waste management taking into consideration its toxic components coupled with the possibility of improper disposal in landfills and incinerators. An even more alarming fact is that developed countries send to developing countries some of their E-waste for recycling, exposing the poorer nations to harmful chemicals [8].

Figure 2. Circular economy [7]

Green Cloud Computing

Cloud computing enables one to access servers globally rather than locally via the Internet. These servers, including their respective applications and databases, are available from almost anywhere in the world. Moreover, using the Cloud is a convenient alternative as there is no need to handle physical servers. The greener version of this practice is called "Green Cloud Computing". As its name suggests, it aims to combine efficiency with functionality by lessening IT resource consumption along with its environmental consequences. Therefore, relying on Cloud Computing is based on the following compelling arguments:

- Virtualization can be defined as the cornerstone of the Cloud since it enables the successful imitation of hardware units. In this way, one physical server comprises many other virtual servers. Less physical servers, reduced maintenance costs, and consistent performance are some key benefits [9].
- Multitenancy serves as a shared environment where one Cloud instance is used either by everyone within a company (Private Cloud) or by manifold organizations on a larger scale (Public Cloud) [9]. This method is not only secure but also convenient for all in terms of cost.
- Introducing fees may be a controversial approach since it implies paying for using remote computing resources. However, it prompts users to adjust their needs correspondingly.

Conclusions

To sum up, green computing is crucial for shaping a sustainable future. Taking precautions like saving energy, using sustainable equipment and virtualization can alleviate the damaging consequences of pollution. Although ecological disaster cannot be reversed, it is possible to prevent it or to lessen its risks at the least. Therefore, it is pivotal to encourage advancements in technology if they do not neglect environmental concerns. The next disruptive technologies should adhere to environmental regulations before employing them because no technological paradise is worth the ecological degradation.

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