

Green Computing: The Value Added Gap Perspective

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Abstract- *Green computing is enduring computing for environment. It is the use of computers and their resources. With the advancement in variety of applications and user demands the infrastructure and resources are increasing exponentially. Designing manufacturing and decomposing the parts of computer in that way so that it does not affect the environment. In past few years, computer industries have realized the importance of going green, both in terms of environmental issues and minimizing costs which has led to remarkable drift in strategies and policies of computer industry. The development of environmentally sustainable production of particles, energy efficient computers and better disposing of recycling products. Growing energy use has increased computer costs. The goal of green computing is to diminish down the use of dangerous materials, maximize energy efficiency and biodegradability or recyclability of outdated products and factory waste of the computer factory*

Keywords- Green Computing, Energy cost, Data centers, green initiatives

Green IT Principles

Moreover, states that such an approach should be along the following 4 corresponding paths: green design, green manufacturing, green use, and green disposal. The combined goal of these paths, is to achieve total environmental sustainability from the IT side and make IT greener throughout its whole life cycle. Due to the broadness of IT, many different approaches have emerged already for, or in support of, the awareness of Green IT principles. Examples of such approaches are, amongst others: terminal servers combined with low power thin-clients, recycling of computing equipment, and the process of making large data centers more energy efficient. Especially the latter gained a lot of attention due to the ongoing growth of services provided through the WWW together with the increasing demand for more and better data centers. This attention resulted in several broad and efficient actions for greening data centers, such as modern Eco-friendly designs, alternative methods for conserving energy, and virtualization of servers.

I. INTRODUCTION

Green Computing is the future technology which is responsible for the manufacturing and use of computer devices by consuming less carbon. The main goals are to decrease the use of hazardous materials like cadmium, mercury and other poisonous substances, maximizing energy efficiency during the product's lifetime, and promote recyclability of obsolete products and factory waste. This means creating eco-friendly products, reducing pollution, proposing alternative technologies, and creating a center of economic activity around technologies that benefit the environment. A green computer will also take into account how it impacts the environment during its life. Scientists are conducting many studies in order to reduce the negative impact of computer technology on our natural resources. A central point of research is using nontoxic materials in the products' manufacturing process. The idea is to make computers without nontoxic materials. The Technical processes adopted by the industries create challenges in the waste management. "Green computing" represents environmentally responsible way to reduce power and environmental e-waste. Green computing technologies are Virtualization, Green Data Centre, Cloud computing, grid computing, Power optimization.

Further, most approaches regarding the realization of Green IT principles have a preference to follow the green use path, and, moreover, most of them have been directed on hardware-related aspects. In addition, states that a key green purpose in using computer systems and operating data centers is to reduce their energy utilization, thereby minimizing the greenhouse gas emissions and we can appreciably reduce energy consumption by making small changes to the ways we use computers. For instance, we can enable power management features; frequently turn off a system when it is not in use, and use more energy-efficient systems.

Focusing on Green Software

The previous section argues that, in contrast to the increased interest for the use of greener hardware, there are still barely any approaches that aim to achieve SD solely through the software by incorporating it in its design. According to this is partially caused by a lack of models, descriptions, and realizations in the particular area. However, some positive changes are noticeable as recently different research works have been devoted to methods for measuring the energy consumption as well as the efficiency of software and models for making the software engineering process more

sustainable. For instance, Figure 3.2 shows a recent version of the GREENSOFT Model, which originates from. This model can be used as a theoretical reference model, which helps to organize and classify research results, actions, frame- work, process models, etc. Furthermore, it includes a cradle-to-grave product life cycle model for software products, sustainability metrics and criteria for software, software engineering extensions for sustainably sound software design and development, as well as appropriate guidance.

Also introduced a definition for the concept of Green Software, i.e. software of which the direct and indirect negative impacts on economy, society, human being, and the environment resulting from development, deployment, and usage of the software is minimal. Following this definition, states that Green Software is required to full the following three concrete green factors: (1) how resource efficient is it to develop, maintain, and discontinue the software, (2) how resource efficient is the software during its execution, and (3) to what extend does it support sustainable development in general. Examples of resources required during the development and execution of software are, amongst others, raw material, human resources, or energy consumption. The latter resource is an important factor during the usage phase of software, since current systems often need to run over long periods of time, process large amounts of data, and/or have many users that execute the software. Subsequently, these aspects lead to more intensive and longer use of computer hardware. This, in turn, increases the direct operational costs of the system and, also, more energy is required for cooling the hardware since more heat is being produced. Therefore, we can argue that in particular cases even small improvements with respect to the energy efficiency of software during its execution can lead to a significant decrease of the energy consumption of its related system. However, according to, making existing software more energy e_cient or designing new green and sustainable software can be complex tasks.

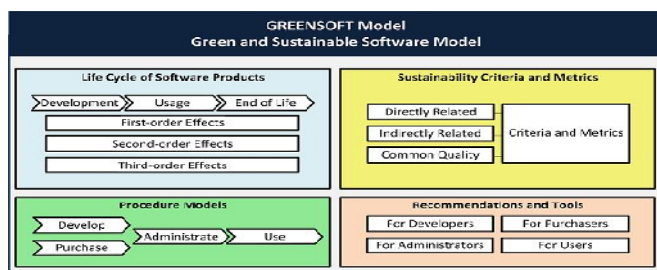


Figure 3.2: The GREENSOFT model by

II. GREEN INITIATIVES AND CERTIFICATIONS

Green technology and other Eco-friendly products are still a new concept to many. Technology has made quicker

advancements as time goes on, but many have not stopped to think about the effects it could have on the environment. It was not until 1992 when Energy star was launched by EPA (Environmental Protection Agency) in the United States of America. They created a voluntary program that helps organizations to save money while also reducing their emissions when they successfully identify products that have superior energy efficiency. These products generally use 20–30% less energy than required by federal standards. The list below are some major green initiatives. There are plenty more, but these are the most well-known:

- Climate Savers Computing Initiative (CSCI) an effort to reduce electric power consumption of all PCs in active/inactive states. (Schnitt 2007, cited 12.1.2017).
- The Electronic Product Environmental Assessment Tool (EPEAT) can assist in buying greener computing systems. A Council evaluates computing equipment on 51 criteria – 23 required and 28 optional, measuring a product's efficiency and sustainability. Products are rated Gold, Silver, or Bronze. (Case 2010, cited 12.1.2017).
- The Green Grid is a global association dedicated to advancing energy efficiency in data centers and business computing ecosystems. Companies such as AMD, APC,Dell, HP, IBM, Intel, Microsoft are responsible for its founding. (The green grid 2017, cited 12.2.2017).
- Energy star is an association started by the Environmental Protection Agency (EPA) in 1992 which labels products that use 20–30% less energy than required by federal standards. As of 2006, more than 40 000 energy star products are available. (Energy Star 2017, cited 3.3.2017).
- TCO certification promotes sustainably designed IT products. Certified products meet a broad criteria scope including requirements for socially responsible manufacturing, environment as well as health and safety throughout the products life cycle. (TCO development 2017, cited 4.4.2017).

The potential future

Technology has existed for such a long time, that many of us have not thought about the bad effects it has on the environment. Many people simply buy technology out of boredom or simply because they want the newest edition. As mentioned in the earlier sections, technology has for the most part severely polluted our world. Global warming was discovered, as well as the hole in our ozone layer. The scary thing is that some of the things that we were warned about if we did not change our ways are already starting to happen. (WWF 2016, cited 1.1.2017). If you want to know what is going on in the world, you simply turn on the news. You may be shocked at all the bad news, increasing amounts of droughts, floods, hurricanes, glaciers shrinking, intense heat

waves, and sea levels rising. Scientists have been warning us about these effects of global warming for decades, but it is a different story now that they have started occurring. It is not certain how the future will be like, but it will get worse if we do not change our ways. The global temperature will increase 2.5 to 10 degrees Fahrenheit in the next century. (NASA 2007, cited 15.1.2017). This may be good for some regions, but bad for many. Rainfall will both increase and decrease in regions, leading to some areas to be flooded whereas other areas will go through severe droughts. Heat waves will be stronger, and will last longer, and hurricanes will be more frequent as well as more severe. Winters will be colder and will last longer. These facts are all quite scary, but out of all of them, this may be the most devastating of them all; that by 2100 the sea level will rise 1-4 feet, putting some cities completely underwater. This is a result of the polar ice caps melting, maybe even to the point of depletion. (NASA 2007, cited 15.1.2017.) Over the years, it will only get worse, if the previous ones were not scary enough. No one knows for sure what will happen, but it will eventually lead to mass extinctions and probably the end of all life on earth.

III. GREEN SOLUTIONS

From the previous sections, one could assume that our world certainly is headed towards a bad direction, if people simply do not change the way that they behave. This includes many things, the main ones are consumer buying habits and how we live our day-to-day lives. Easy changes can make a great difference, for example if every UK office worker used one less staple a day, we would be saving 120 tons of steel.

Every year, more than 14 billion pounds (6 billion kilograms) of garbage is dumped into the world's ocean. Most of it is plastic, and is toxic to marine life (Rinkesh 2009, cited 1.11.2016). The declining health of our environment is a direct result of millions of decisions made without considering the effect on the world. Many are to blame such as poor governance, policies with narrow-minded focuses on economic growth. Businesses concentrate on short-term profits and do not account for long-term costs. There are always better choices to be made, even if they aren't necessarily the easy ones. These facts are definitely quite shocking, but people have the power to make a difference in the world, after all about 75% of the content in landfills is actually recyclable. (Do something, cited 1.1.2017). The next sections in this thesis will hopefully equip the reader with solutions on how to live a greener life, as well as hopefully getting others to change their ways as well. Many underestimate the power of the individual, especially the power that many of them have when they agree on issues that

are important to them. The consumers are the only ones that have the power to truly change the world, even though it may not seem that way, basically consumer's control how companies operate.

Green Technology:

- Turn off technology and/or appliances when not in use
- Use power bricks that enable you to make sure many things are off
- Recycle, sell or give away old devices/ components
- Buy LED, CFL (compact fluorescent bulbs) or other long lasting bulbs
- Try to repurpose old technology
- Have heating and air conditioning on when needed; make sure it's not going non-stop
- Go paperless
- Virtualization and cloud computing
- Invest in rechargeable batteries
- Do more things electronically (ex: voting, filing taxes, and various tickets, and meetings)
- Ask boss about possibility of distant working
- Get rid of screen savers and allow products to go into sleep mode
- Order things online or walk / bike, instead of using up fuel
- Install a meter app on your phone to monitor power usage and habits

More involved:

- Try to repair technology instead of replacing it entirely
- Buy a hybrid / electric car
- Use booster apps (closes open apps) to make phone batteries last longer
- Use power saving modes for maximum efficiency on all devices
- Check certifications for product purchases

IV. CONCLUSION

Green technology is an important concept that every individual should be well acquainted with. Understanding the past of technology in addition to green technology is crucial to understand the potential future of green technology. The direct results of our consumer lifestyle are often hidden from the public eye because it is not a pleasant topic to think about, but it is important to get the truth to enable solutions to pollution, planned obsolescence, and e-waste and sweatshop labor. Since these things are often swept

Under the rug, the public may not know much information about these topics until it is too late to fix, with irreversible damage. Modular technology offers a solution that would make both sides happy. Manufacturers save money by

specializing in certain parts, instead of being responsible for creating whole units. The other side, the consumer gets the savings passed on to them. Modular technology offers customizable and even replaceable components that can easily be replaced. Although modular technology is not a complete solution because it still creates more e-waste, it is a major step in the right direction. Modular technology is a stepping stone to other solutions that can be even better. For example, technology can be biodegradable after 5-10 years, depending on the appliance. One of the greatest aspects of green technology is that it enables individuals to live their lives, but in a greener way that is not harmful to the environment. Since green technology covers a variety of appliances, making it within reach to be more green in everyday life.

REFERENCES

- [1] Adharanand, F. 2008. Big green ideas for the workplace. Cited 20.12.2016
- [2] <https://www.theguardian.com/environment/2008/jan/29/corporatesocialresponsibility.ethicallivig>
- [3] Baroudi, C, Jeffrey Hill, Arnold Reinhold, Jhana Senxian. 2009. Green IT for dummies. USA. IDG
- [4] BBC news. 2005. Apple deal for iPod battery cases.
- [5] <http://news.bbc.co.uk/2/hi/technology/4606481.stm>
- [6] <http://www.sheknows.com/home-and-gardening/articles/807479/52-cheap-ways-to-go-green>
- [7] Cartridge World. 2016. Cartridge world's fight against 350 million printer cartridges ending up in landfills <https://www.cartridgeworld.com/fight-against-350-million-printer-cartridges-ending-up-in-landfills/>