Influence of ICT on Green Computing

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Abstract: Green Computing is the emerging technologies and practice of using computing resources in an eco-friendly manner to enhance the green environments by using the computing applications and services. Also, the applications of green computing are used to enhance the decent, smart and green environment by using computing technology as the tools. In study, green computing for the green environments focus on using the IT and its services effectively by making your environments, working offices, day to activities is very strongly connected with technologies. In generally, the green computing is one proposed solution for global climate changes.

Keywords: Cloud Computing, Environments, Green computing, ICT

I. INTRODUCTION

The global information and communications technology (ICT) industry accounts for approximately 2 percent of global carbon dioxide (CO2) emissions, a figure equivalent to aviation, according to a estimate by Gartner, Inc. Despite the overall environmental value of IT, Gartner believes this is unsustainable.(Brodkin, 2008) As we know that the IT industry has long been a significant contributor to global warming, but green computing is a strong and growing trend that seeks to reverse that impact. Green computing is the utmost requirement to protect environment and save energy along with operational expenses in today's increasingly competitive world.

It is becoming widely understood that the way in which we are behaving as a society is environmentally unsustainable causing irreparable damage to our planet. Global warming and environmental changes have become problematic issues with governments, corporations and therefore all are seeking out new ways to green up.

“Green” has become a popular term for describing things that are good for the environment, generally healthful and, more recently, economically sensible (Jain et al., 2013). Environmental and Energy conservation issues are now the talk of the day in the global business arena in recent years.

The goals of green computing is to reduce the use of hazardous materials, maximize energy efficiency during the product's lifetime, and promote recyclability or biodegradability of defunct products and factory waste(Hooper, 2008). Also, it strives to achieve economic viability and improved system performance and use, while abiding by our social and ethical responsibilities. As mentioned on Figure 1, computers and its application are used to make green environment and convenient for human life.

Benefits of Green computing:

(1) Reduced Energy usage

(2) Conserving Resources
(3) Saves time, energy and labour works
(4) Minimizing Organizational bureaucracy
(5) Minimizing deforestations for paper works.
(6) Making conducive working environments
(7) Enhancing the digital worlds.

Challenges of Green Computing: (Wang, 2008)

(1) Users skill gap to implement and access
(2) Rapid IT Technology changes
(3) Boosts jobless in developing countries related with labour works
(4) Platform shortages
(5) Infrastructure capacity like ISP or telecom industry
(6) Security issues

Figure 1: Green Computing [Gustman, 2000].

Methods to implement Green computing

Proposing the methods which uses instead man-power computer systems, and instead of organizations infrastructures by using the cloud computing. The advantages of IT systems are to saves the times, cost and energy from the manpower. Hence IT is tools for social life's, business, politics, and day-to-day activities. Therefore, by using these tools I am proposing the following solutions and findings.

II. IMPLEMENTATIONS OF GREEN COMPUTING TECHNOLOGIES

1) Paperless Environment

Most of the offices and small-to- Macro enterprises are printing day to day activities, tasks, reports and notices. Those methods yield the carbon dioxide to the environments and disturb the environmental atmospheric conditions and quality. Social Media Communications instead of the Newspaper: Paperless office means efficiently utilized green computing applications

Benefits of paperless Environment

Saves Time: Time spent filing, organizing, and searching for paper documents is time that could be spent on more productive tasks. Digitized documents are stored in a central repository, which is basically a well-organized digital filing cabinet where all of your documents live.(Suresh, 2020),(Orantes-Jimenez et al., 2015),(CDIA, 2013),(Ohsaki and Tsuda, 2006),(Gates and Urquhart, 2007)

Saves Space: Paper takes up a lot of space as do file cabinets and space to store those filing cabinets. Books and bookshelves are bulky, too. What's worse, paper keeps piling up, oftentimes accumulating more quickly than it can be sorted and organized. This is particularly true of industries that have long mandatory retention periods for paperwork like the financial industry.

Digitizing files allows you to store all documents either on an on-premises server or in the cloud. Digital file folders in a repository require much less space than a physical records archive.

Saves Money: Going digital improves process efficiency, saving you money. Paperless offices can process a much larger volume of paperwork compared to traditional offices in the same amount of time. Further, digitization reduces money spent on paper, printers, ink, postage, office space for files and employee time to manage paperwork. The savings on employee time become especially valuable in regard to regulatory audits and repetitive, high-volume tasks like expense reimbursements.

Eases Transfer of Information

Document management software offers a simple process for saving documents. The software easily compiles digital documents using scanners, mobile capture using a camera on a phone or tablet or importing any file type (.docx, .pdf, image files). Many commonly used applications, like Microsoft Office and Adobe Acrobat, integrate with document management systems and have native plugins which allow you to file your document into your content management system with just one click(Suresh, 2020),(Orantes-Jimenez et al., 2015),(CDIA, 2013),(Ohsaki and Tsuda, 2006),(Gates and Urquhart, 2007)

Promotes the Environment: Manufacturing paper products produce greenhouse gases, causing deforestation and global warming. Recycling can offset some of the environmental impact, but not by much. Most paper eventually ends up in a landfill. Further, ink and toners contain volatile compounds and non-renewable substances which are damaging to the environment. It is much more sustainable to simply reduce paper use altogether by switching to a paperless office.

Boosts Security: A physical documents are hard to track – reams of paper can get lost, misfiled or destroyed without anyone noticing. It can also be difficult to monitor the access, printing and copying of sensitive files.

Currently, peoples in developing countries are using different printed medias to get and access the information's. But there are a lot of opportunities like social medias. As I mentioned in Figure 2, to print this much of newspapers the environment lost dozens of tree and energy. Therefore, the computing applications like green computing is the critical for the solution.

Figure 2: Newspaper collections (Src: Wolaita Sodo University)

2) Using cloud computing

Cloud computing provides a variety of computing resources, from servers and storage to enterprise applications such as email, security, backup/DR, voice, all delivered over the Internet. The Cloud delivers a hosting environment that is immediate, flexible, scalable, secure, and available – while saving corporations money, time and resources. The services of cloud Computing is as mentioned in figure 3.

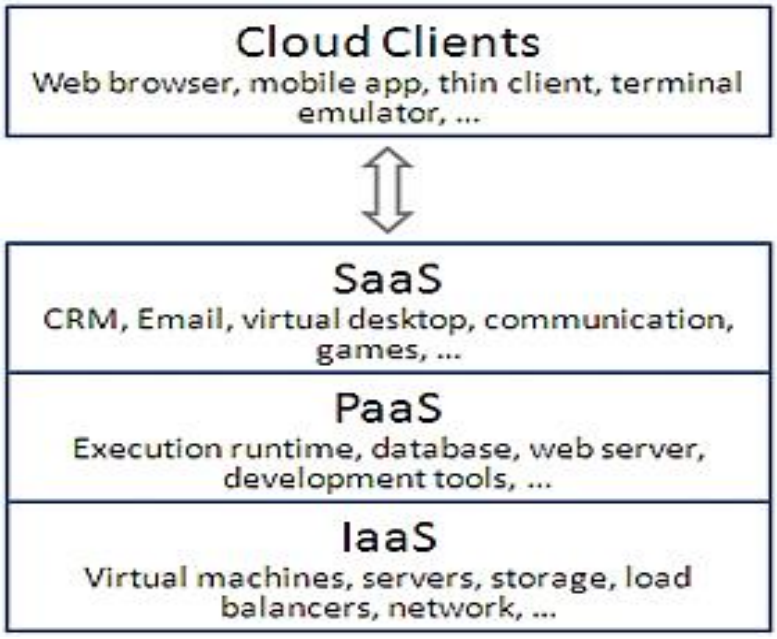

Figure 3: The services of cloud Computing (Rani and Ranjan, 2014),(Kavis, 2014)

Software as a Service/SaaS

Software as a Service, also known as cloud application, services, represents the most commonly utilized option for businesses in the cloud market. SaaS utilizes the internet to deliver applications, which are managed by a third-party vendor, to its users. A majority of SaaS applications run directly through your web browser, which means they do not require any downloads or installations on the client side.(Paraiso et al., 2012), (Jamsa, 2012)

SaaS have the following basic characteristics in real world

(1) Managed from a central location
(2) Hosted on a remote server
(3) Accessible over the internet
(4) Users not responsible for hardware or software updates

Examples of SaaS are Google GSuite (Apps), Dropbox, Salesforce, Cisco WebEx, SAP Concur, GoToMeeting.

Platform as a Service /PaaS/

Cloud platform services, also known as Platform as a Service (PaaS), provide cloud components to certain software while being used mainly for applications. PaaS delivers a framework for developers that they can build upon and use to create customized applications. All servers, storage, and networking can be managed by the enterprise or a third-party provider while the developers can maintain management of the applications (Jamsa, 2012).

Characteristics of PaaS:

(1) Builds on virtualization technology, so resources can easily be scaled up or down as your business changes
(2) Provides a variety of services to assist with the development, testing, and deployment of apps
(3) Accessible to numerous users via the same development application
(4) Integrates web services and databases

Examples of PaaS services are AWS Elastic Beanstalk, Windows Azure, Heroku, Force.com, Google App Engine and OpenShift.

Infrastructure as a Service /IaaS

Cloud infrastructure services, known as Infrastructure as a Service (IaaS), are made of highly scalable and automated compute resources. IaaS is fully self-service for accessing and monitoring computers, networking, storage, and other services. IaaS allows businesses to purchase resources on-demand and as-needed instead of having to buy hardware outright.

Characteristics of IaaS in real world:

(1) Resources are available as a service
(2) Cost varies depending on consumption
(3) Services are highly scalable
(4) Multiple users on a single piece of hardware

(5) Organization retain complete control of the infrastructure
(6) Dynamic and flexible

Examples of IaaS are DigitalOcean, Linode, Rackspace, Amazon Web Services (AWS), Cisco Metacloud, Microsoft Azure and Google Compute Engine (GCE).

Hence, to make fully functioning services of ICT is center requires much amount of money and energy, to minimize the energy consumptions in data centers the preferable ways is implementing the cloud computing instead of the local services(Kansal and Chana, 2012).

In cloud computing we can assure to find the following services:

- ✓ The platform provides on demand services that are always on, anywhere, anytime and anyplace.
- ✓ Pay for use and as needed, elastic by scale up and down in capacity and functionalities
- ✓ The hardware and software services are available to public, enterprises, corporations and businesses markets

In principle, cloud computing is energy-efficient technology for ICT provided that it‘s potential for significant energy savings that have so far focused on only hardware aspects, can be fully explored with respect to system operation and networking aspects also. Cloud Computing results in better resource utilization, which is good for the sustainability movement for green technology.

3) Digital Libraries instead condensed printed collections

The digital library is a collection of documents in organized electronic form, available on the Internet or on CD-ROM (compact-disk read-only memory) disks. Depending on the specific library, a user may be able to access magazine articles, books, papers, images, sound files, and videos.(Gustman, 2000)

On the Internet, the use of a digital library is enhanced by a broadband connection such as cable modem or DSL. Dial-up connections can be used to access plain-text documents and some documents containing images, but for complex files and those with animated video content, a downstream data speed of at least several hundred kilobits per second (KBPS) can make the user's experience less tedious, as well as more informative. Internet-based digital libraries can be updated on a daily basis. This is one of the greatest assets of the green computing applications (Baldonado et al., 1997)

Printing books and different collections consumes much amount of paper-works. As I mentioned on Figure 4, below which contains printed book in libraries, and which uses the amount of paper works to duplicate the books. Therefore, proposing the digital libraries instead of Printed collection is best solutions to empower green environment.

Figure 4: Libraries Printed Collections (Src: WSU Libraries)

4) E-Commerce

The impact of green Computing to create green and sustainable world is by making selling and buying through internet. The governments lost much amount of money to print the notes of money for the direct transactions. Buying, selling, marketing, and servicing products, services, and information over computer networks makes the life for peoples smart and modernize. As I mentioned in Figure 5, buying and selling online is one of key indicator of green computing.

Figure 5: Selling and buying Online

5) Email communications:

As we know the most known advantages of electronic world is to save time, cost and energy or labour works. But, in developing countries we are using printed letters to office to office. To disseminate, manage, print, and access those files from file cabinets: we are losing much amount of papers, energy consumptions and labour workers. In figure 6, mentioned are some of office files managing systems. Therefore, making green world, making culture as email communication instead of printed letters.

Figure 6: File cabinets

6) Enterprise resource planning (ERP)

By developing and designing different ERP software for inventory, health sectors, Human resource management systems, student's information systems, and others business process in governmental, public and private sectors. In short, ERP (Enterprise Resource Planning) is a set of software used by companies to manage daily business activities, such as financial management, procurement, production, projects, human resources, etc. In addition, usually, ERP systems have the ability to provide real-time and accurate information, so the company/organization can make good decisions based on the generated data. Also, an Enterprise resource planning system is a fully integrated business management system covering functional areas of an enterprise like stokes, Logistics, Production, Finance, Accounting and Human Resources. It organizes and integrates operation processes and information flows to make optimum use of resources such as men, material, money and machine. An ERP system is an attempt to integrate all functions across a company to a single computer system that can serve all those functions' specific needs (Barton, 2001),(Jacobs, 2007),(Moon, 2007).

- ✓ It may also integrate key customers and suppliers as part of the enterprise's operation.
- ✓ It provides integrated database and custom-designed report systems.
- ✓ It adopts a set of "best practices" for carrying out all business processes.

Enterprise resource planning (ERP) promises the following (Han, 2004):

- ✓ one database
- ✓ one application
- ✓ one user interface

By developing and designing different ERP software for inventory, health sectors, Human resource management systems, student's information systems, and others business process in governmental,

public and private sectors. It is also packaged software system that utilizes a centralized database that contains all the necessary data in one location as it mentioned on Figure 7.

Figure 7: Enterprise resource planning (ERP) (Markus et al., 2000)

III. CONCLUSION

In generally, green computing is towards efficient utilization of resources in electronic and digital world. Energy is considered as the main resource and the carbon footprints are considered the major threads to environment. Therefore, by using the applications of Computing technologies and changing the old existing systems into new systems will enhancing the green environments, reduces deforestations, reduces environmental pollutions, and minimizes greenhouse in world.

Conflict of interest: I declared in this research on date Oct 27. 2020 GC. 'INFLUENCE OF ICT ON GREEN COMPUTING' have no conflict of interest.

Ethical Statement: I declared that this research has conducted by Desta Dana Data, Wolaita Sodo University, Ethiopia in 2020 GC.by sole publication. The contents written in this document is my own works and some of the others works cited on the reference part of research.

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