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GREEN COMPUTING – AN APPROACH TOWARDS ENVIRONMENTALLY SUSTAINABLE COMPUTING

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Abstract
In recent years there has been a substantial rise in the usage of computing devices throughout the world, rise in data centers has also been noticed for the same. Increasing data centers has resulted in rise to carbon and other harmful gases also more and more consumption of power can be seen due to increasing use of computing devices and data centers worldwide. Green computing, Green IT, or information & communication technologies (ICT) sustainability, is basically an approach taken forward to build up devices and components that are environment friendly which would help save our environment from the hazardous effects of harmful gases and will little impact our environment. Sustainable approach towards green computing will be helpful in designing and development of computing resources without affecting the environment. This paper draws an insight overview towards the importance of green computing in this demanding world of technology and explains how essential it is to protect our environment from green house gas emission caused due to computing devices. Appropriate usage and disposal of devices are can play an important step to sustain the environment.
Keywords: *Green Computing, Data Centers, Sustainable, Environment, disposal, Energy, Hazardous.*

1 Introduction to Green Computing

The word 'Green Computing' is a study or practice of designing, manufacturing, using and disposing of computing devices or resources with no or minimum I pact on environment. Computing resources are used efficiently in a environment friendly way and with responsibility. We know that in order to use computing resources many natural resources are used, like to manufacturing , to run computers it needs electricity, to dispose we need natural power using all these resources badly impact the environment. So it is required to efficiently and effectively utilize computing resources' so that the environment is minimal effected. The main object of green computing is to reduce the use of hazardous material which will reduce the impact on environment, to maximize energy efficiency, to properly recycle E-wastage or to promote biodegradable material. In order to implement green computing we can adopt cloud computing as many organization together consume same resources with the help of which resources can be efficiently and effectively used, proper disposal e-wastage this can be done with the help ogf manufacturing and designing of devices such that it reduces e-wastage, reduced paper consumption is another approach of Green computing where we can use email instead of paper in short to use more electronic ways for document sharing instead of papers, Use of LCD/LED as compared to CRT , to replace Notebook with desktop computer to save power consumption. To replace old machine with new this will lower the heat consumption, increase processing speed, lower power consumption.

Impact of Information Technology upon Environment:

Over the same period of time the rise in the use of computers have increased manifold. The combined effect of the energy needed to run these devices and the electricity required to maintain the cooling infrastructure for these devices have an impact on the environment. This is an area of serious concern and is drawing people for research in the field of Green Computing which is about using computer in an eco friendly way. Green Information Technology: Green computing should address environmental sustainability primarily by focusing on design, manufacture, use and disposal of computer and other related devices in an eco friendly way. [3]

2 Sustainable Computing Advantages and Disadvantages

- **Advantages Of Green Computing**
  - Green computing will benefit by saving cost in electricity consumption as products would consume less energy and hence low cooling requirements.
  - It causes reduction in the quantity of heat generated by devices which will result into less carbon dioxide release and low green gas emission.
  - Green computing works on the concept of reuse and recycle this will help to lower the electronic waste worldwide.
  - As green computing involves usage of non-toxic material for product design and manufacturing it will benefit the environment by reducing environmental pollution cause by toxic material.
  - Sustainable approach in green computing will help to utilize maximum natural resources.

- **Disadvantages Of Green Computing**
  - Green computing implementation could be quite costly at individual level.
  - Lacks general public awareness
  - Green computers may slow down the process over a network.
  - Small business entrepreneurs may find green implementation costly
  - Due to frequent change in technology only fewer implementations or change could be possible with green computing.

3 Green Computing approaches for Sustainable Environment

- **Green Design**
  - This one of the most important requirement for green computing, there is a need to design and implement energy efficient and environment friendly computing system.
- **Green Manufacturing**
  - Usage of green manufacturing for IT components that causes minimal or no impact on environment.
- **Green usage**
  - Green usage can be achieved by implementing energy saving IT systems which can help to save overall power consumption and saving cost.
- **Green Disposal**
  - Proper recycling or disposal of IT products is necessary to reduce environmental pollution caused due to improper recycling methods. Green disposal will help to reduce the amount of e-waste too, as it works on the concept of reusability.
- **Green Standards**
  - Green standards can help to create benchmarks for products adoption and comparison.
- **Green Awareness**
  - Green approach helps to encourage environmental awareness in society.

4 Origin of Green Computing

The term Green computing came into existence in the year 1992 by U.S environmental protection agency with the launch of Energy Star program by U.S environmental protection agency. One of the first approaches towards green computing was sleep mode function in computers. Shortly after this the term "Green Computing" was coined.

Soon after that that "The Swedish organization TCO development launch the TCO certification program to promote a low magnetic and electrical mission from Cathode Ray Tube (CRT) based computer display.

Figure 1: Energy Star Logo
(sources:https://bharatgogreen.com/greencomputing/#
What_is_the_Importance_of_Sustainable_Computing)

5 Need of Green Computing

Green computing is one of the most essential requirements for planet earth. As we all know that with growing years there has been an increase demand in terms of computer usage. As computers and related resources are electricity dependent, it has been noted with rise in demand there is a significant rise in devices and also the power consumption ratio has drastically, so with power consumption there is a increase in carbon and heat generation has increased too and heat released increases CO2 in environment. There are toxic chemicals used in computers manufacturing and inappropriate device disposal causes air, water and land pollution which is harmful for the environment. In order to decrease the impact of pollution cause by computing devices the concept of green computing as it will help to save our environment from the hazardous impact caused through such devices. We need green computing to limit the environmental damage caused by the electronics industry and the IT sector. With current technologies, the production of a single computer involves the emission of 227-270 kilos of carbon dioxide. The consumption of water and the amount of waste from the electronics industry are also considerable: according to The Guardian, in the first three months of 2021 the Intel plant in Ocotillo had already produced 15 thousand tons of waste, of which 60% dangerous and consumed more than 4 million liters of water and 561 thousand kilowatt-hours of electricity [1].

6 Implementation of Green Computing:

Green computing has been getting popular day by day because of raising environment concern. Many environmentalist and NGOS are working and conducting on several awareness programs to create worldwide awareness amongst individuals and enterprises too. It can be observed that many technical organizations has shifted towards Green Computing. Green Computing has become a necessity for environmental sustainability today.

- Adopting cloud services for data storage and backup.
- Purchasing and using green energy products, generally those with the Energy Star mark.
- Purchasing quality devices, that last longer.
- Repairing or adapting non-functioning or underperforming devices.
- When the time comes to dispose of your electronic equipment, arranging for it to be reused.
- Putting computers to sleep mode or hibernating them when taking a break or Turning the equipments off when not in use.

- Replacing desktop with laptops and tablets, since they consume less energy.
- Taking advantage of digital technology to avoid polluting emissions, for example: working remotely and meeting online to avoid travelling, not printing unless it is essential thus saving paper.

7 Challenges and Barriers

Due to growing adoption in environmental awareness amongst people, more and more adoption towards green computing can be seen. Although the adoption ration is still very low in terms of total globe population. There are certain perceived as well as real barriers towards green computing. In order to make green computing successful it is necessary to identify the real barrier. One of the major hurdles towards green is cost, In order to migrate from traditional system to ecofriendly system capital investment is necessary. As greener IT means re-engineering the products i.e. replacing hardware and software with greener IT , however practically replacing traditional system with green totally will take time as investment is a major concern and not favorable to all. “Even though IT decision makers clearly recognize the importance of green IT solutions such as virtualization and server consolidation, there are always going to be growing pains involved with making a significant change to an organization," said Mark Gambill, CDW vice president. "If going green means replacing servers that are already delivering reliable IT to an organization, then widespread adoption may take some time."[2]

According to the CDW survey, the biggest barrier to implementing green initiatives is cost, which is the same result found in another survey of IT decision makers about green IT practices In the CDW survey, the IT decision makers were asked to identify the biggest barriers to going green. The findings reveal that:

- 51% perceive the costs of implementing and maintaining green IT as a big barrier
- 25% perceive the complexity of implementing and maintaining green IT as a big barrier
- 23% perceive the lack of appropriate expertise within the organization as a big barrier
- 22% perceive the disruption to current IT systems and the resulting negative impact on productivity as a big barrier
- 21% perceive the lack of IT initiatives that truly have a positive environmental impact as a big barrier
- 14% perceive management's lack of support or its resistance as a big barrier
- 12% perceive the employees' lack of support or their resistance as a big barrier
- Notably, 12 percent said there were no barriers. [4]

8 Conclusion

From the above research study it can be said that Green computing is an environmental change that current world demands for environmental betterment. Many governments worldwide have initiated energy-management programs, such as Energy Star, an international standard for energy-efficient electronic equipment that was created by the United States Environmental Protection Agency in 1992 and has now been adopted by several other countries. However due to various barriers progress in its adoption and implementation in green computing can be found slow. There are various approaches adopted to create awareness for green computing also techniques such as virtualization, power management, consolidated data centers, reuse and recycle are applied and implemented to conserve environment. Various entrepreneurs and IT organizations have already migrated towards green computing and many are expected to adopt in coming future. Thus, it can be safely concluded that in order to have a healthy and clean environment government, private organizations as well as individuals must adopt and share knowledge, awareness and work collaboratively. It can be further concluded that

by adopting green computing we can live in a better environment. To conclude with everyone need to identify the importance of green computing and steps to adopt must be taken now or a plan for parallel or future implemented must be adopted.

9 References

1. https://www.babyloncloud.com/en/2021/10/green-computing/
2. https://www.itprotoday.com/windows-8/biggest-barriers-going-green
3. Murugesan, San. "Harnessing green IT: Principles and practices." IT professional 10.1 (2008).
4. https://www.itprotoday.com/windows-8/biggest-barriers-going-green