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Green ICT Sustainability and It's Impacts-Next Wave in Computing

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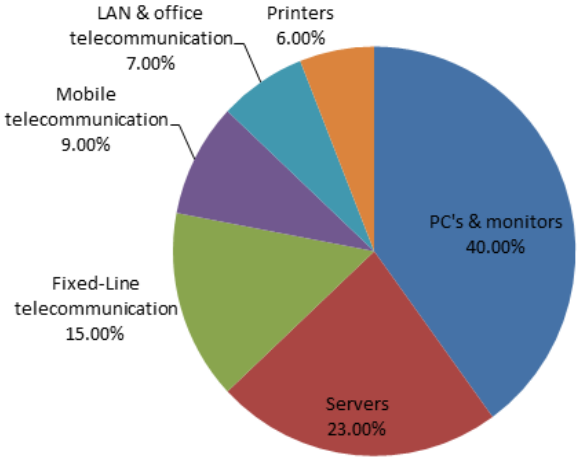
Abstract: ***The term "Green Computing" was probably coined shortly after the 'Energy Star'[1] program began way back in 1992. One of the first results of green computing was the"Sleep mode" function of computer monitors. As the concept developed, green computing began to encompass thin client solutions, energy cost, accounting, virtualization practices, e-Waste etc.***

Keywords: Green Computing, Energy Star, Sleep Mode, Virtualization, energy efficiency, recyclability

1. ICT Sustainability

- Green computing or green IT, refers to environmentally sustainable computing or IT.
- It is "the study and practice of Designing, Manufacturing, Using, and Disposing of computers, servers, and associated subsystems efficiently and effectively with minimal or no impact on the environment"[2].



CO2 emission caused by it field
SOURCE: Conceptualizing "Green IT" & data center power and cooling issues, Gartner
Research paper No G00150322

How computing harms environment

- By electronic appliances.
- Desktop requires 85 watts just to idle (Monitor switched-off)
- Left on 24 hrs/day-1500 pounds of CO2 per year.
- A tree absorbs between 3 and 15 pounds of CO2 each year.
- Hazardous materials inside computers.
- These contain are:
- Cadmium-damage kidneys
- Mercury-neurological damage
- Lead-disrupt brain neurotransmitters

2. History

Green computing is the environmentally responsible and eco-friendly use of computing systems and their resources. In broader terms, it is also defined as the study of designing, manufacturing and engineering, using and disposing of computing devices in a way that reduces their environmental impact. The goals of green computing are similar to green chemistry: reduce the use of hazardous materials, maximize energy efficiency during the product's lifetime3, the recyclability or biodegradability of defunct products and factory waste. Green computing is important for all classes of systems, ranging from handheld systems to large-scale data canters.

Many corporate IT departments have green computing initiatives to reduce the environmental effect of their IT operations[4]

- The term "Green Computing" was probably coined shortly after the 'Energy Star' program began way back in 1992.
- One of the first results of green computing was the **"Sleep mode"** function of computer monitors.
- As the concept developed, green computing began to encompass thin client solutions, energy cost, accounting, virtualization practices, e-Waste[5] etc.

Objectives of Green Computing

- Reduce climate change
- Savings
- Reliability of Power
- Reduce the use of hazardous materials

Climate Change

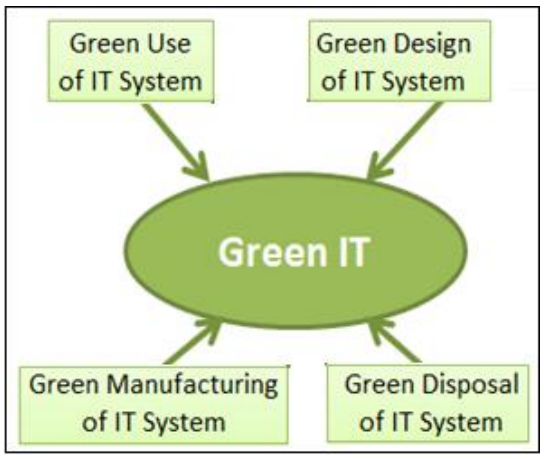
- First and foremost, conclusive research shows that CO2 and other emissions are causing global climate and environmental damage.
- Preserving the planet is a valid goal because it aims to preserve life. Planets like ours, that supports life, are very rare.
- **SAVINGS:** Green computing can lead to serious **cost savings** overtime. Reductions in energy costs from servers, cooling, and lighting are generating serious savings for many corporations.
- Maximize energy efficiency during the product's lifetime

- Promote the recyclability or biodegradability of defunct products and factory waste.

Materials Recycling

- Parts from outdated systems may be salvaged and recycled through certain retail outlets and municipal or private recycling.
- Many organizations including some manufacturers themselves, are willing to take equipment back and recycle the components into new products.
- Limiting printing and recycling papers.
- A course management system where faculty can share electronic documents with students.
- A community space for document sharing and collaboration with unlimited storage via Google Drive[6].

3. Pathways to Green Computing

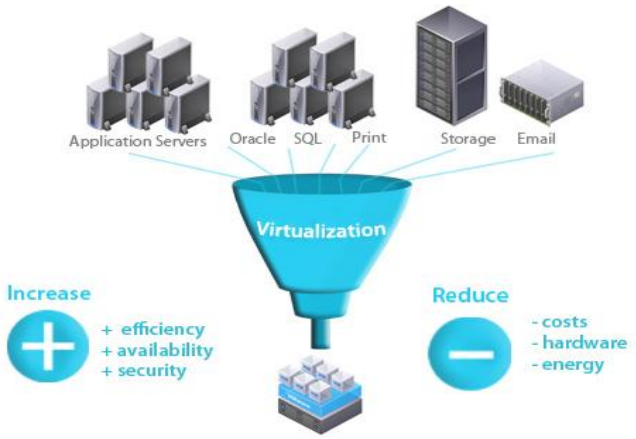


Design, manufacture, use and dispose of electronic components, computers, and other associated subsystems with minimal impact on the environment.

3.1 Approaches to Green Computing

1) Virtualization:

Computer virtualization is the process of running two or more logical computer systems on one set of physical hardware.



2) Power Management

- Advance configuration and common interface (ACPI) allows an operating system to directly control the power saving aspects of its underlying hardware.
- Prolong battery life for portable and embedded systems.
- Reduce cooling requirements.
- Reduce noise.
- Reduce operating costs for energy and cooling
- Setting of consumer products at effective status of no-wastage energy label[7].

Simple tasks we can do

- Buy and use a lowpower desktop or a laptop computer (40-90 watts) rather a higher power desktop (e.g. 300 watts).
- Buy hardware from manufacturers that have a hardware recycling scheme, and recycle your old computer equipment rather than sending it to landfill.
- Replace your CRT screen with an LCD screen.
- Turn your computer and monitor off when you are not using it.
- Enable hibernation using the power management settings. Standby does not save as much power.
- Use Linux (such as Ubuntu), which requires less resources than many other operating systems.

- **Look for the "*Energy Star*"**
  Consider energy efficiency when shopping for new equipment by looking for products with an ***energy star***.

- **Turn off your monitor**
  Your monitor uses a lot of power, so put it in standby or turn it switch off when not in use.

- **Adjust the brightness**
  The brightest setting on a monitor consumes twice the power used by the dimmest setting.

- **Don't use a screen saver**
  Screen savers consume power and are unnecessary. Instead set your monitor to go blank or dim when not in use.

- **Turn off peripherals**
  When you don't need your speakers, scanner and other add-ons, turn them switch off.

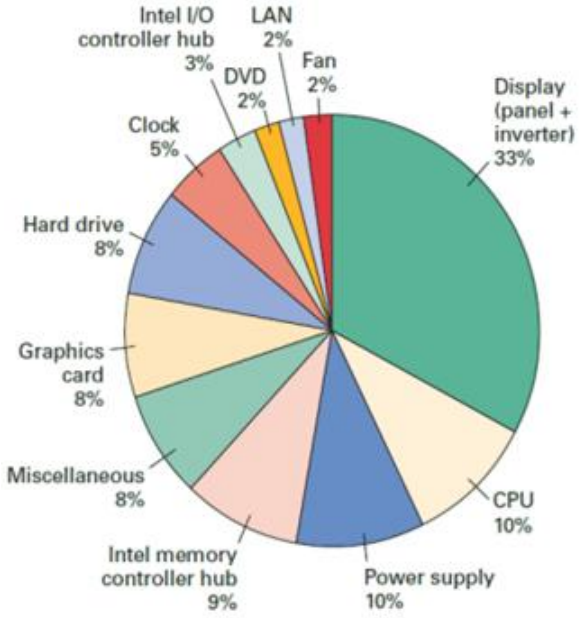
- **Leave your printer off**
  A printer draws a lot of power, so leave it off until you need it. Also make sure its power settings include a standby mode that consumes less energy when switched on.

- **Preview before you print**
  Select and print only the content you need. Omit unneeded pages from the printing job.

- **Print on both sides**
  Another way to reduce the amount of paper used, by printing multiple pages on a single sheet.

- **Don't Print**
  Ask yourself if printing is necessary[8]. Do you really need a hard copy or can you just read the e-mail, document or Web page on screen?

3) Power Consumption in an Average Laptop



4) Display needs the maximum power consumption in a laptop

Steps taken by Apple

- Mac Book keyboards are made from one single piece of aluminum.
- Mac Book pro notebooks have long lasting batteries where as a normal notebook uses three batteries.
- A Mac Book will only use one throughout its life time.

Steps taken by Dell

- Their free world-wide product recycling program allows user to properly dispose their product safely.
- Their ***"Plant a tree for me"*** project can offset a customer's carbon emissions for only three dollars[9].

Advantages

- Energy saving.
- Environmentally Friendly.
- Cost-effective (pays over time).
- Save more money per year.

Disadvantages

- High start up cost.
- Not readily available.
- Still in experimental stages.
- Sacrifices performance for battery life.
- Not for everyone[10].

4. Future of Green Computing

- The plan towards green IT should include new electronic products and services with optimum efficiency and all possible options towards energy savings.
- That is enterprise wise companies are laying emphasis on moving towards Eco Friendly Components in Computers, the use of eco-friendly sustainable components will become the norm rather than the exception in future11.

5. Conclusion

- So far, consumers haven't cared about ecological impact when buying computers, they've cared only about speed and price.
- Green computing can lead to a lot of energy savings; reduction in emission of CO_2& CFC's which leads to environmental protection.
- It also leads to serious cost savings overtime.
- The features of a green computer of tomorrow would be like: efficiency, manufacturing and materials, recyclability, server model, self-powering and other trends.

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