

ICT and environmental sustainability

Computer life cycle and role of open source in
reducing e-waste

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OSWC2008 Malaga 22 October 2008

Sustainable development

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

It contains within it two key concepts:

– the concept of needs, in particular the essential needs of the world’s poor, to which overriding priority should be given

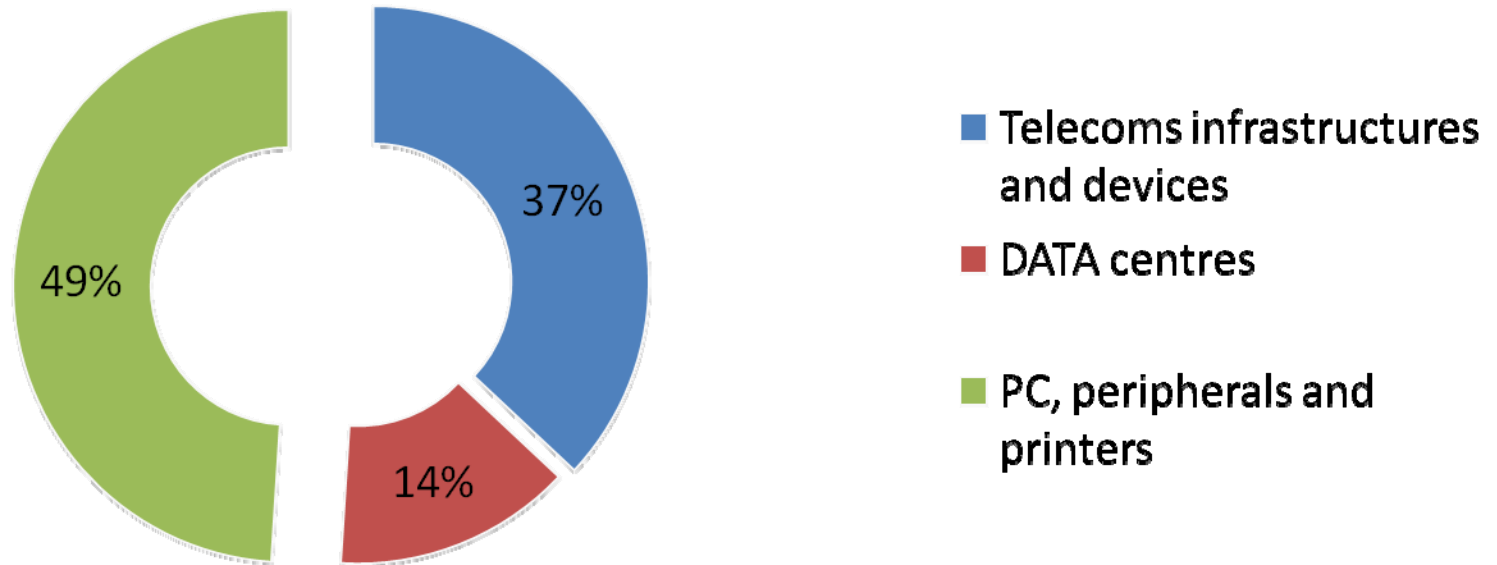
and

– the idea of limitations imposed by the state of technology an social organization on the environment’s ability to meet present and future needs”

In 2007, the **total footprint of the ICT sector** – including personal computers (PCs) and peripherals, telecoms networks and devices and data centers – was 830 MtCO₂ emission, about **2% of the estimated total emissions** from human activity released that year (*a figure equivalent to aviation*).

ICT footprint by sectors - 2007

% of 830 MtCO₂ emissions



e-work e-government

e-health

e-elearning e-commerce

ICT

e-democracy e-business

e-inclusion e-procurement

e-work e-government

e-health

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ICT

e-democracy e-business

e-inclusion e-procurement

e-waste

PCs environmental footprint

- **High tech complexity** implies that the production of PCs and their components is **energy and material intensive**
- Energy used to operate computers is also relevant
- The disposal (storage, landfill and recycling) of end-of-life equipment plays an important role in the **direct environmental impact**
- The **hazardous chemicals** in e-waste mean that electronics can **harm workers** in the recycling yards, as well as their neighbouring communities and the **environment**

THE E-WASTE PROBLEM



The amount of **electronic** products **discarded** globally has skyrocketed recently, with **20-50 million tons** generated **every year**.

If such a huge figure is hard to imagine, think of it like this - if the estimated amount of e-waste generated every year would be put into containers on a train it would go once around the world!

The e-waste problem – some figures

- E-waste is now the fastest growing component of the municipal solid waste stream: mobile phones and computers are causing the biggest problem because they are replaced most often
- In Europe e-waste is increasing at 3%-5% a year, almost **three times faster** than the **total waste stream**
- Developing countries are also expected to triple their e-waste production over the next five years
- 183 million computers were sold worldwide in 2004 -**11.6 % more** than in 2003
- By 2010, there will be 716 million new computers in use. There will be 178 million new computer users in China, 80 million new users in India

E-waste “hidden flow”

- The fate of large quantities of e-waste is unknown. This “hidden flow” is the e-waste that escapes responsible collection, reuse and recycling and as such is unaccounted for.
- While some might be found stored in garages or disposed, thousands more are exported, often illegally, for dumping in Africa or for rudimentary recovery by Asian informal recyclers.
- No precise data are available on what happens to this waste, whether is stored, disposed or exported, to be either reused, recycled or disposed of in Asian countries such as India and China as well as Africa.



Toxic Tech:
Not in Our Backyard
Uncovering the Hidden Flows of e-Waste

GREENPEACE

Creating a Toxic-Free Future

FULL REPORT
FEBRUARY 2008

greenpeace.org

Life Cycle Analysis

- Continued, rapid technological progress in the IT industry has contributed to short lifespans that are well below the functional limits of computers.
- A short lifespan exacerbates environmental impact, requiring production of more new machines and increasing the numbers heading for landfills or recycling centers
- The average **lifespan** of computers in developed countries has dropped from **six years** in 1997 to just two years in 2005
- Software bloat: Software Induced Hardware Obsolescence (SIHO)

Reduce, Reuse, Recycle

- **Reduce**
- The term **reuse** means the equipment is still working and the “life” of the product can continue
- The term **recycling** means the equipment is *disassembled* and the components - such as plastic, glass and metals - are recovered and used to manufacture new products (raw materials)

Reuse vs recycle

- Many of the machines are either still usable creating a real challenge for end-of-life processing
- When a computer no longer satisfies the needs of its user, she or he can sell or donate it to another user who has lower demands on performance
- While collection systems and recycling technologies are clearly needed, the common wisdom of waste management is that, **reducing and reusing** are often very **effective** and economical approaches **compared to recycling**

Obsolete PC

Potential E-waste

Or Reuse



What makes the
difference?

Free Software, people and ideas...

Thin clients

Virtualisation

LTSP (Linux Terminal Server Project)
www.ltsp.org

Linux Ubuntu



The mantra of "**Reduce, Reuse, Recycle**" (3Rs)

here becomes

"Reduce, Reuse, Recycle, Rethink" (4Rs)

An example

- A national agreement between the Ministries of Transport and Education gave Italian schools a few thousand old PCs, managed on a regional basis
- In Genoa: GROSS (Genoa Reuse with Open Source at School), a pilot project to create a **general framework for reuse computers at school**
- Genoa PCs stock: ~200 Pcs

GROSS - project

- A technical software solution suitable for the schools
old PCs are used as Thin clients
- **Desktop virtualization**
- **Application virtualization**

LTSP (Linux Terminal Server Project)

- A Guideline for donation to schools with procedural and practical suggestions for donors and criteria to evaluate the feasibility and sustainability of a donation program

Example of criteria:

- *A large number of obsolete but homogeneous PCs allows easy replication*
- *Substitute all old CRT monitors with LCD*

Strengths

- No client administration/management
- Only terminal server administration/management
- **Zero software licence costs**
- Scalability
- **Full reuse (direct reuse)** of potential e-waste

Weaknesses

- Know how: professional skills for feasibility study, cost/benefit analysis and prototyping
- **Man/Months of work**
- Data clean-up
- (Physical) storage
- Transportation of old equipment

Recommendations

For all (individuals, organizations..)

Extend the service life of your ICT hardware to an extreme

Each month or year of additional service saves considerable amounts of energy and scarce materials

Use thin client solutions

They may save 50% of the energy in the use phase

Virtualize resources

Recommendations

For software developers

Avoid software induced hardware obsolescence (SIHO)

As a software developer you should be aware that relying on the availability of cheap hardware capacity on the user's side is ecologically expensive, because it boots hardware flow.

Avoid unmastered complexity (E.W.Dijkstra)

If software functionality were presented in an "axiomatic style" instead of an "additive" style, its complexity would be masterable.

Disposal - Recommendations

For Public Administrations and Organizations

- *If new computers are acquired, Public Administrations should take into account the option of donating it for reuse when they will need to be upgraded or changed*
- *The Public administration have to simplify the donation procedures*
- *The procedures have to take into consideration the data cleanup*

- *It can be useful to have work teams composed by donors and receiving subjects (i.e. schools)*
- *It's important to **donate** end-of-life computers **immediately instead of keeping them in storage for months or years***

Higher energy efficiency with new product vs. ecological footprint of new material

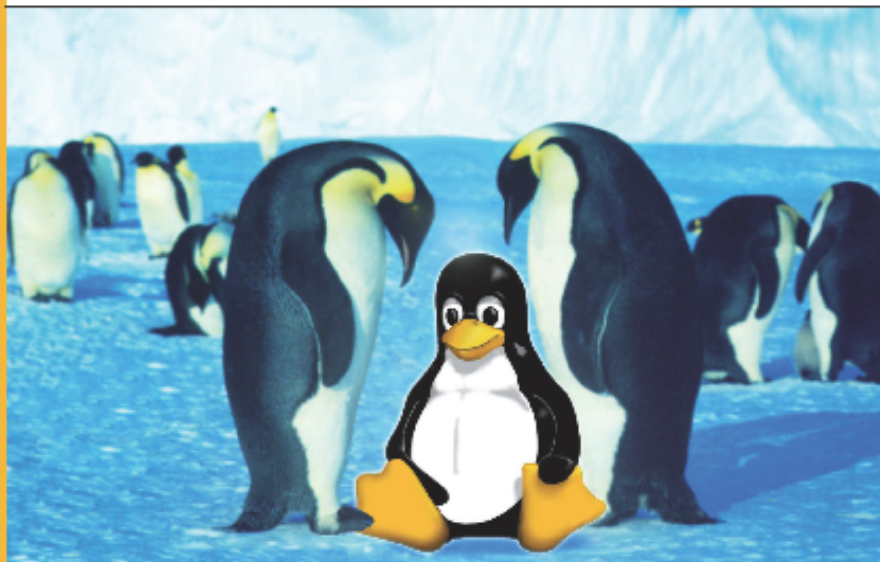
The Challenge is to find a “sustainable balance!”

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GIOVANNA SISSA

IL COMPUTER SOSTENIBILE

RIDUZIONE DEI RIFIUTI ELETTRONICI
RIUSO DEI PC E OPEN SOURCE



Prefazione di *Giulio Occhini* e *Angelo Raffaele Meo*



FrancoAngeli



E-waste art

Thanks for your attention!

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