

Sustainable Software Engineering

Seminar Software Engineering FS22
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Content

01. Research Questions
02. Sustainability in Software Engineering
03. Tools and Methodologies

Research Questions

original

RQ 1: What do developers understand by the term “Sustainable Software documentation” and what steps do they take to achieve it?

RQ 2: To what extent do current tools (measuring carbon footprints or energy consumptions) consider software documentation?

updated

RQ 3: What do developers understand by the term “Sustainable Software”?

RQ 4: What research topics are being addressed?

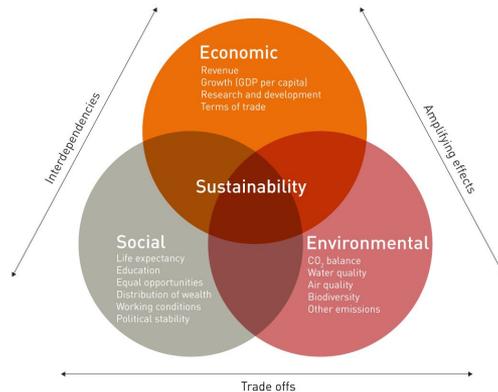
RQ5: What tools and methodologies currently exist to measure sustainability in software?

Sustainability ?

Sustainability

Def: “Sustainability means meeting our own needs without compromising the ability of future generations to meet their own needs.” (McGill University, 2013)

The three dimensions of sustainability and a selection of indicators



Source: own presentation, based on Passet (1979)
www.economiesuisse.ch

<https://www.economiesuisse.ch/en/dossier-politics/sustainable-development-includes-several-dimensions>, 28.5.22

Sustainability in Software Engineering

Software Sustainability SOS

Goal: to achieve sustainability in software

- Social Sustainability
- Economic Sustainability
- Environmental Sustainability

Software as Part of Sustainability SAPOS

Considers software as a new dimension of sustainability.

- Individual Sustainability
- Social Sustainability
- Economic Sustainability
- Environmental Sustainability
- Technical Sustainability

(Calero et al, 2022)

Tools and Methodologies

- Green Software Model
- GREENTRACKER

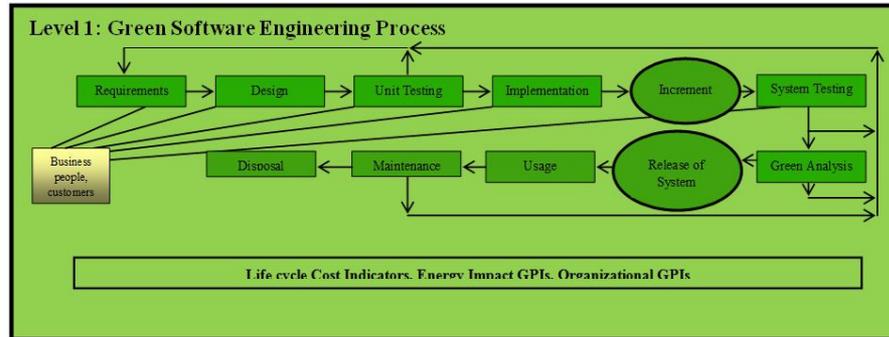
Green Software Model (1)

Two-level green software model:

- complete list of metrics to measure the 'greenness' of each stage
- categorization of tools to aid in green computing by monitoring resources

Level 1:

- Considered stages: Requirements, Design, Implementation, Testing, Usage, Maintenance and Disposal.



(Mahmoud et al, 2013)

Green Software Model (2)

Green Performance Indicators (GPIs):

- Lifecycle Cost Indicators
- Energy Impact GPIs
- Organizational GPIs

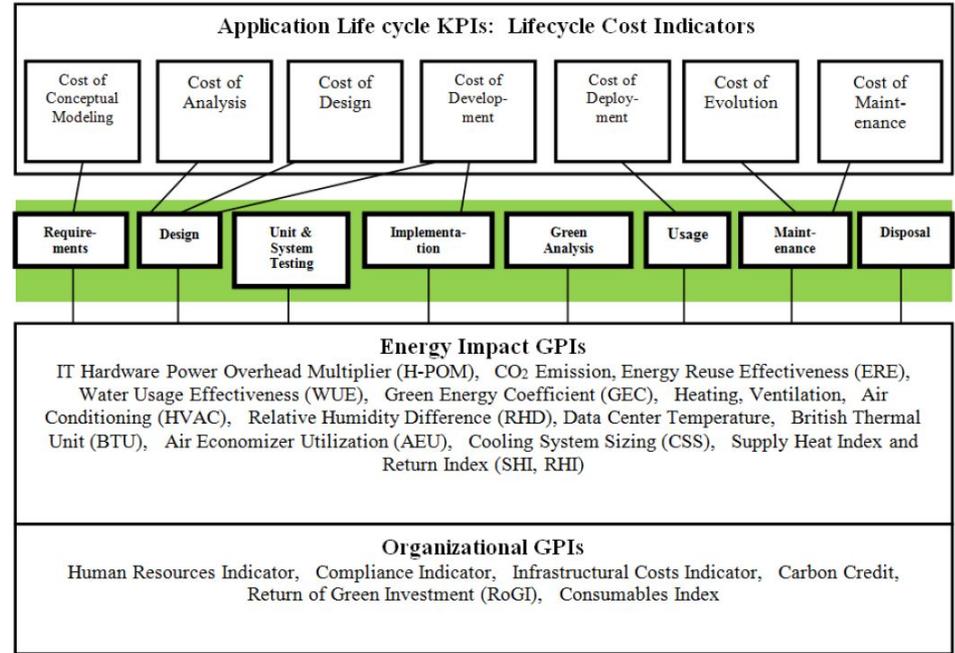


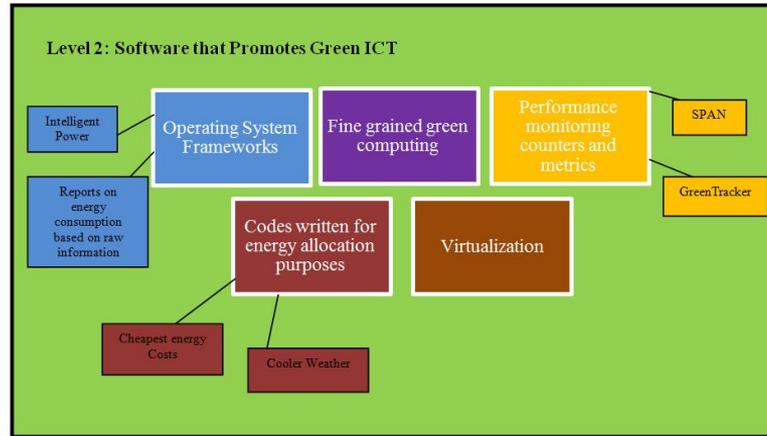
Figure 7. Metrics that Measure First Impact of ICT

(Mahmoud et al, 2013)

Green Software Model (3)

Level 2:

Indicates 5 categories of software tools and concepts, which can play a major role in having energy efficient use of software applications.



(Mahmoud et al, 2013)

GREENTRACKER (1)

- Definition: Tool, which measures the energy consumption of software
- Motivation: Survey on Sustainability
 - “I thought about environmental sustainability when I last upgraded my software.”
 - Reasons for upgrading or not updating software?

(Amsel et al, 2011)

GREENTRACKER (2)

Software classes tested:

- Audio (iTunes and Windows Media Player)
- Internet browsers (Internet Explorer, Mozilla Firefox, and Google Chrome)
- Word processing software (Microsoft Word and Open Office Writer)

(Amsel et al, 2011)

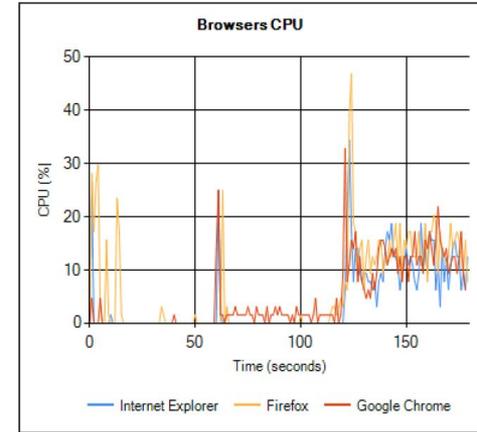
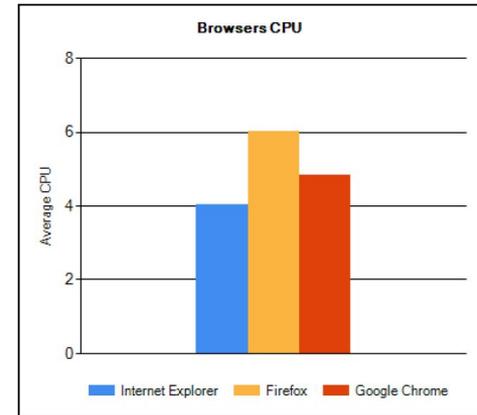


Figure 1. Graph of browsers' CPU usage over time.



Most efficient: Internet Explorer

Figure 2. Graph of browsers' average CPU usage.

Thank you!

Questions?

Sources

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