

**OPEN
SOURCE
EXPERIENCE**



Bienvenue à la Green Software Foundation

Julien Landuré

@jlandure



Julien Landuré



CTO Zenika



Google Cloud 4x certified

Official Trainer

GDE Cloud

GDG & DevFest Nantes Organizer



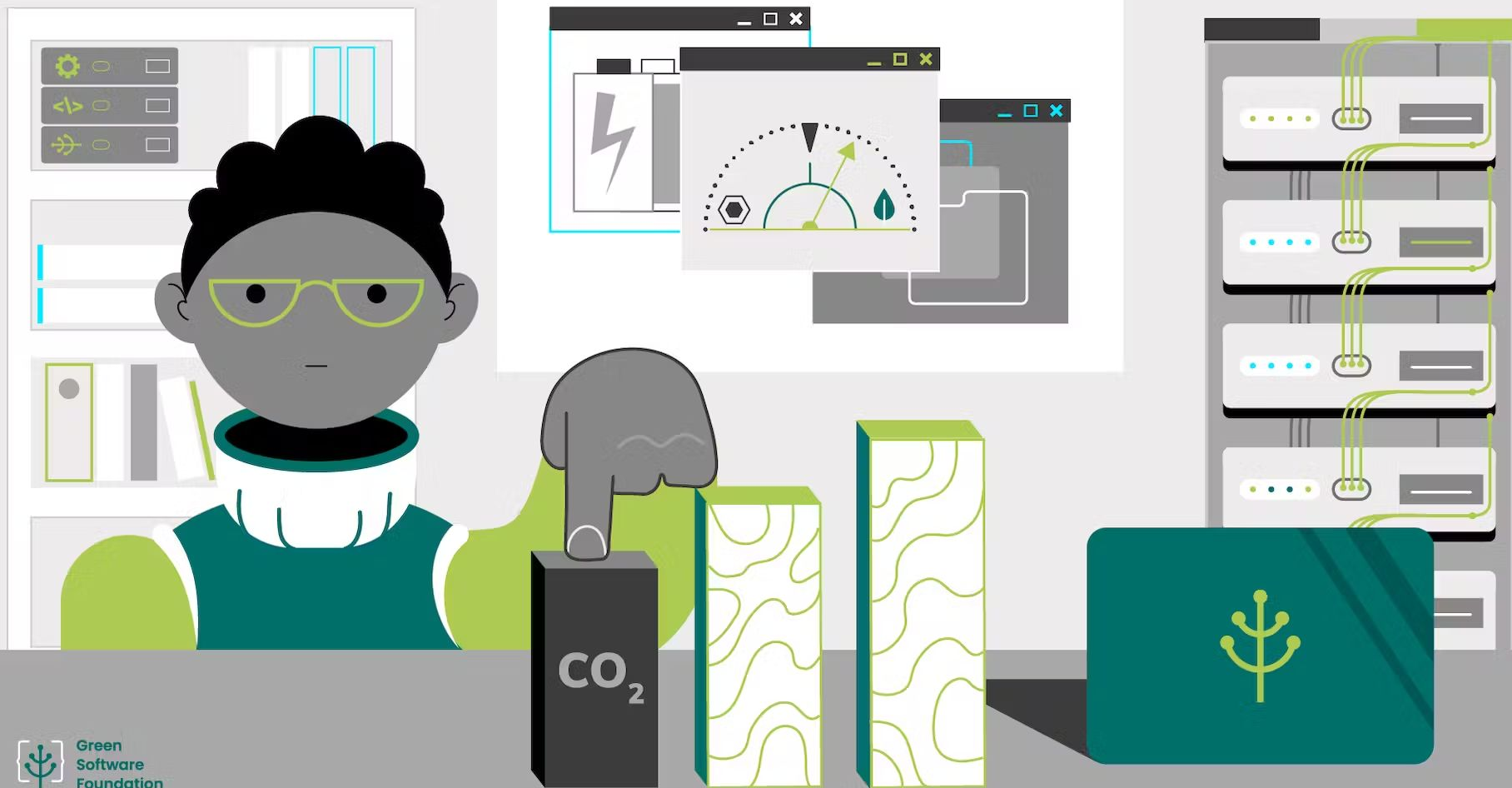
@jlandure | jlandure.dev

Merci à OSX de m'accueillir 🎉





**Green
Software
Foundation**



Green
Software
Foundation

greensoftware.foundation



★ Introduction





Principles

a core set of competencies needed to define, run and build green software



Patterns

a catalog of how to apply green software principles in a vendor agnostic way



Practices

a catalog of how to apply green software patterns in a vendor specific way



Green Software Principles



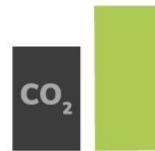
Energy Efficiency

Consume the least amount of electricity possible



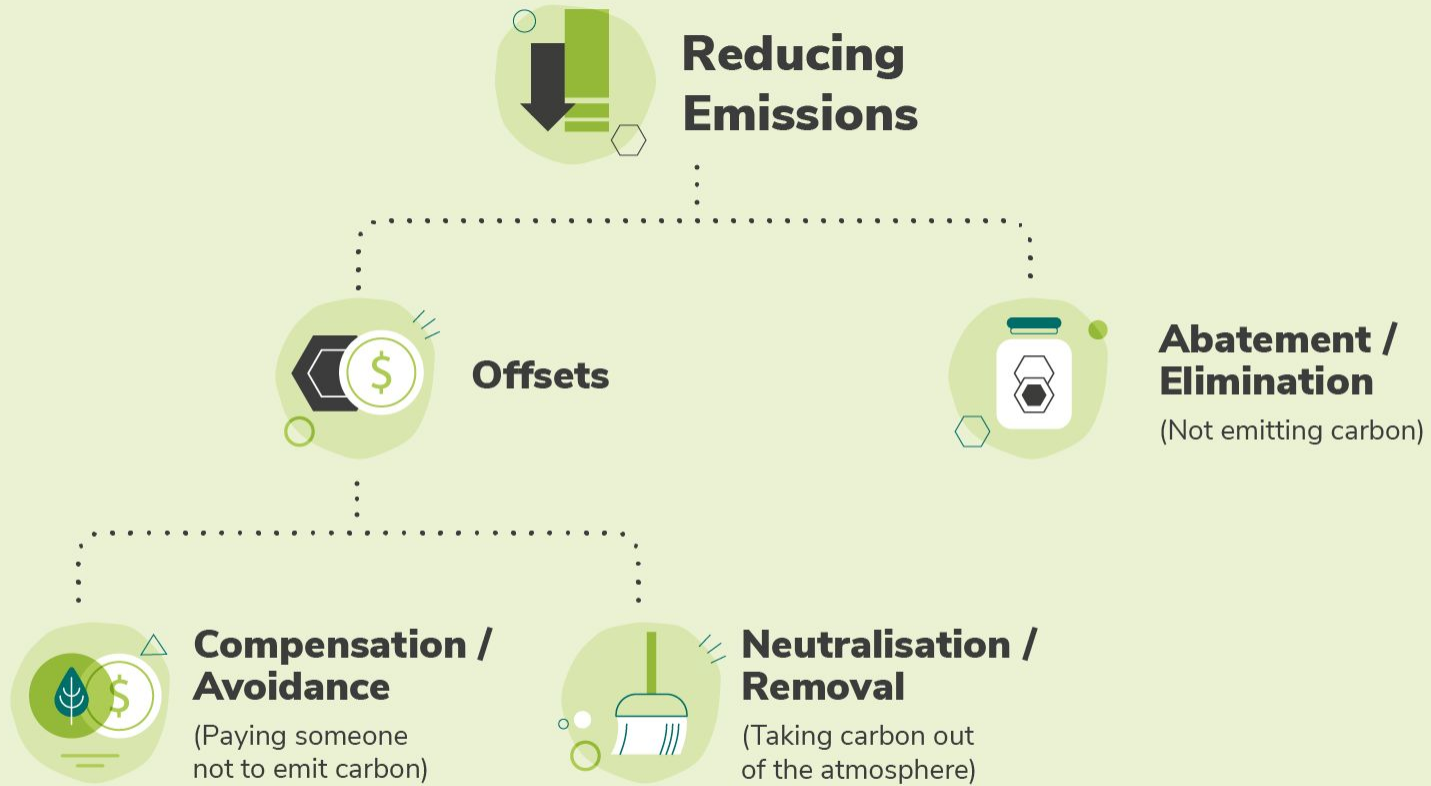
Hardware Efficiency

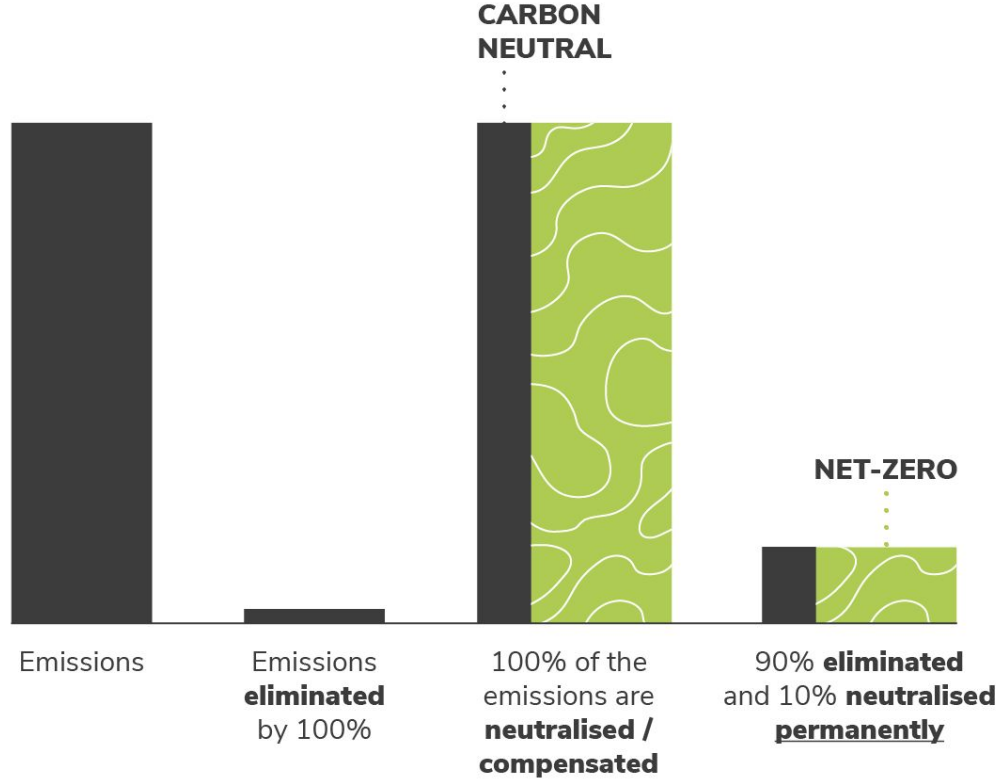
Use the least amount of embodied carbon possible



Carbon Awareness

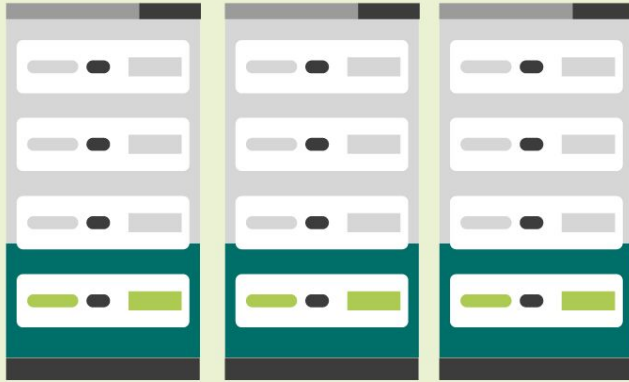
Do more when the electricity is clean and less when it's dirty





PRIVATE CLOUD

33%
utilisation



spare capacity - 67%

PUBLIC CLOUD

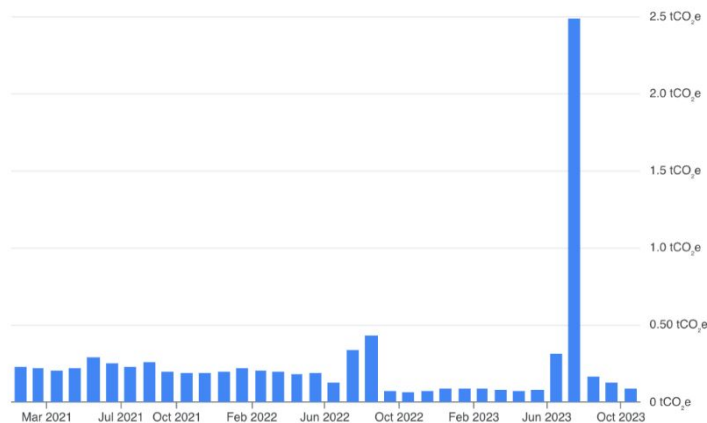
100%
utilisation



spare capacity - ∞

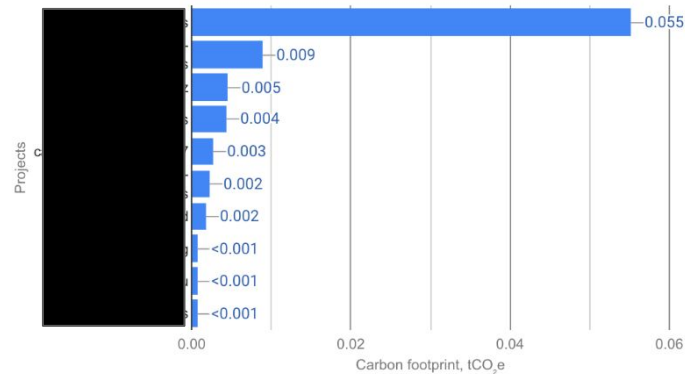


Location-based monthly carbon footprint estimate



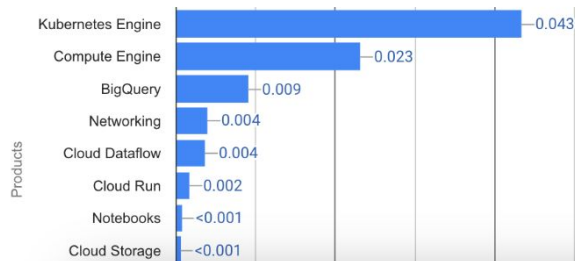
Location-based carbon footprint estimate by project in October 2023

Chart view ▾



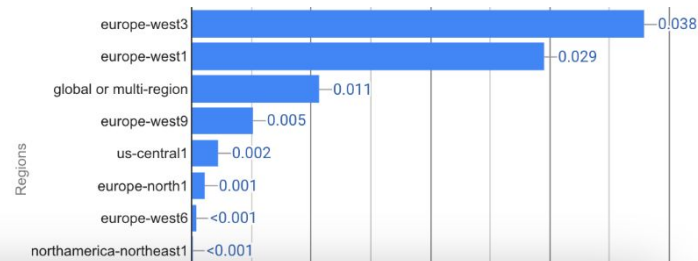
Location-based carbon footprint estimate by product in October 2023

Chart view ▾



Location-based carbon footprint estimate by region in October 2023

Chart view ▾



Carbon emitted per kWh
of energy, gCO2/kWh

Carbon emitted through
the hardware that the
software is running on

$$SCI = ((E * I) + M) \text{ per } R$$

Energy consumed by
software in kWh

Functional Unit; this is how
software scales, for example
per user or per device

“

Calculating software-driven emissions using the GHG protocol is possible but can be difficult for open-source software. – Green Software Foundation



open source



Green
Software
Foundation

The Linux Foundation hereby certifies that

Julien Landuré

has successfully completed

Green Software for Practitioners (LFC131)

TIMOTHY SEREWICZ,
TRAINING PROGRAM DIRECTOR

December 03, 2023

DATE OF COMPLETION

LF-y9lwlrzdoi

CERTIFICATE ID NUMBER

OUR STEERING MEMBERS

 **accenture**

 **avanade**

BCG 

GitHub

Globant 

intel®

 Microsoft

NTT DATA

SIEMENS

 **thoughtworks**

 **UBS**



Projects





Software Carbon Intensity (SCI) Specification

The Software Carbon Intensity (SCI) Specification defines a methodology for calculating the rate of carbon emissions for a software system. The purpose is to help users and developers make informed choices about which tools, approaches, architectures, and services they use in the future. It is a score rather than a total; lower numbers are better than higher numbers, and reaching 0 is impossible.

- > .github
- > .vscode
- ✓ Software_Carbon_Intensity
 - > images
 - Appendix_A_Further_Informatio...
 - License.md
 - Software_Carbon_Intensity_Spe...
 - case_study_template.md
 - index.yaml
 - > case-studies
 - CITATION.cff
 - README.md

Introduction

"If you can't measure it, you can't improve it." - Peter Drucker

Software systems cause emissions through the hardware that they operate on, both through the energy that the physical hardware consumes and the emissions associated with manufacturing the hardware. This specification defines a methodology for calculating the rate of carbon emissions for a software system. The purpose is to help users and developers make informed choices about which tools, approaches, architectures, and services they use in the future. It is a score rather than a total; lower numbers are better than higher numbers, and reaching 0 is impossible. This specification is focused on helping users and developers understand how to improve software to reduce or avoid the creation of emissions.

Reducing an SCI score is only possible through the elimination of emissions. That can be achieved by modifying a software system to use less physical hardware, less energy, or consume lower-carbon energy sources. Neutralization or avoidance offsets do not reduce an SCI score ([see exclusions section](#)). This makes the SCI an ideal strategy that organizations can adopt to meet climate targets focused on eliminating emissions, such as those specified by [1].

The SCI is for everyone. It is possible to calculate an SCI score for any software application, from a large, distributed cloud system to a small monolithic open source library, any on-premise application, or even a serverless function. The environment the product or service is running in can also vary; from personal computers, private data centers or a hyperscale cloud.

Software practitioners have a significant role to play in collectively reducing the SCI score during the design, development, and delivery of software applications. The following list provides some strategies that can be used to do this across different software roles:

- For a software programmer, this implies writing energy efficient code.
- For an AI/ML developer, it implies model optimization, using pre-trained models or leveraging optimized hardware for training.
- For a database engineer, this comprises choices like schema design, choice of storage, and query optimizations.
- For a DevOps practitioner, this requires creating a carbon-aware pipeline and considering when to schedule builds and leverage clean energy.
- For QA engineers, it involves creating energy efficient test automation and performance testing scripts across browsers and devices.
- For an architect, this implies choices like serverless or event driven architectures, infrastructure optimization, and design for carbon-aware systems.

Carbon emitted per kWh
of energy, gCO₂/kWh

Carbon emitted through
the hardware that the
software is running on

$$SCI = ((E * I) + M) \text{ per } R$$

Energy consumed by
software in kWh

Functional Unit; this is how
software scales, for example
per user or per device



Green Software Maturity Matrix

The Green Software Maturity Matrix is a self-assessment tool. It helps organisations understand the extent to which they have implemented green principles, patterns, and processes for building and operating their software systems.



green-software-maturity-matrix

Public

Watch

4



Fork

1



Star

15



dev



3 branches



0 tags

Go to file

Add file

Code



russelltrow Merge pull request #16 from russelltrow/dev ...



0f49bf6 last week



33 commits



.github/workflows

Update deploy.yml

last month



docs

Added GSMM visual

last week



src/css

Final content corrections before merging into main re...

3 weeks ago

About

A green technology self-assessment tool for organisations



[maturity-matrix.greensoftware.founda...](#)

sustainability

climate

sustainable-software

green-computing

maturity-model

<https://github.com/Green-Software-Foundation/green-software-maturity-matrix>

	ASPIRING	AWARE	ACTING	AWESOME	INSPIRING
 commitments	none	carbon neutral	carbon zero with offsets	10% (offset)	1% (offset)
 footprint	unknown	know scope 1&2	reducing per unit	reducing absolutely	~zero
 metrics	none	report scope 1&2	daily scope 1&2&3	realtime	predicted
 carbon ops	none	manual	lightswitch ops	auto-rightsizing	carbon SRE
 energy	none	green hosting	dynamic management	demand shaping	24/7 Carbon Free Electricity
 devices	none	some targets	10y/90%	10y/100%	rolling repair
 utilization	none	some multi-tenant	all multi-tenant	max orchestration	edge integration
 products	none	carbon awareness	demand shaping	feature tracking	feature carbon error budgets
 training	ad hoc	basic/champions	advanced	you are the trainer	you are the leader



Awesome Green Software

Research, tools, code, libraries and training for building applications that emit less carbon into our atmosphere. An awesome list created and managed by the Innovation Working Group in the Green Software Foundation.



awesome-green-software

Public

Watch 29

Fork 64

Star 387

main

5 branches

0 tags

Go to file

Add file

Code



Sophietn Merge pull request #163 from Green-Software-Foundation/Sophietn-pa... 5ec2b43 last week 102 commits



.gitattributes

Initial Commit

2 years ago



code-of-conduct.md

Initial Commit

2 years ago



contributing.md

Fixes title casing url in contributing.md

last year



license

Adds MIT license file

2 years ago



readme.md

Update readme.md

last week



readme.md

[!important] Incubation Project This project is an incubation project being run inside the Green Software Foundation; as such, we **DON'T** recommend using it in any critical use case. Incubation projects are experimental, offer no support guarantee, have minimal governance and process, and may be retired at any moment. This project may one day Graduate, in which case this disclaimer will be removed.

About

No description or website provided.

sustainability

climate

awesome-list

hacktoberfest

sustainable-software

green-computing

green-ai

green-software

sustainable-ai

Readme

View license

Code of conduct

Activity

387 stars

29 watching

64 forks

Report repository

Contributors 24

<https://github.com/Green-Software-Foundation/awesome-green-software>



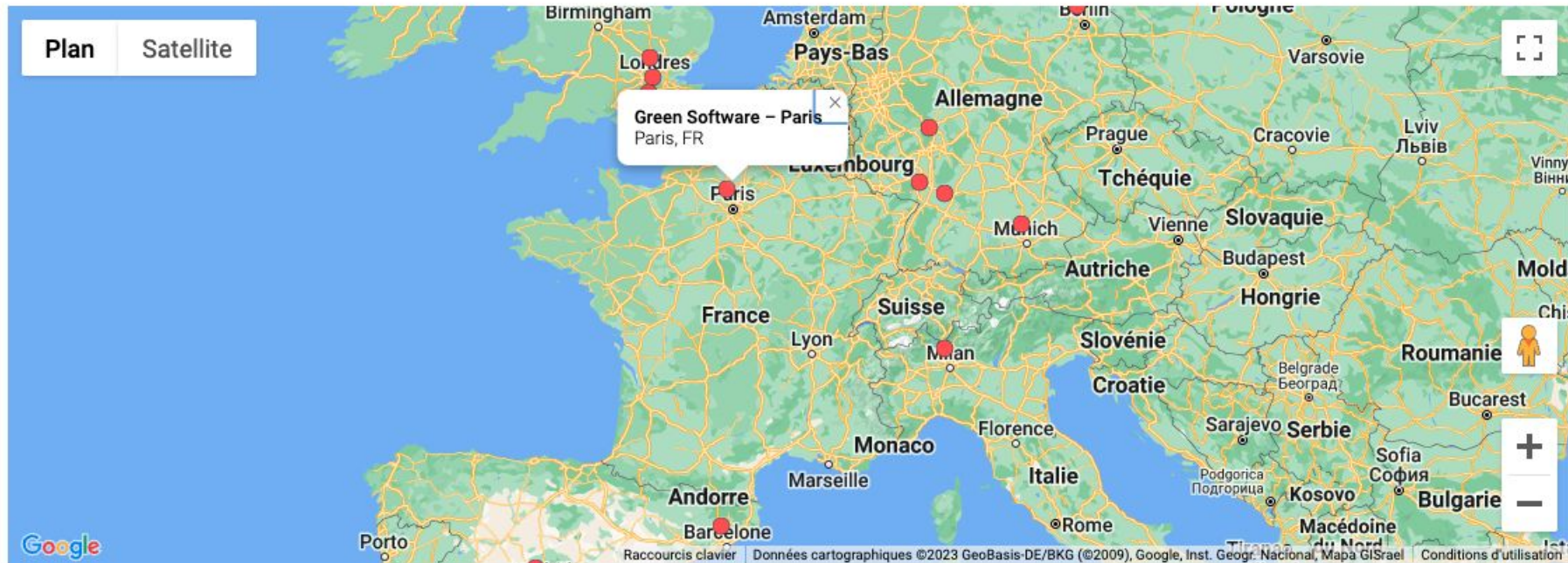
Community Impact





Green
Software
Foundation

GLOBAL



Green Software Foundation Community

Members
6,914

Groups
36

Countries
16

<https://www.meetup.com/fr-FR/gsf-global/>

JEU. 7 DÉC. 2023, 11:00 UTC+1

Online Session 🌲 Festive Introduction to Green Software

🔗 Lien visible pour les participants



Join us for this live introduction to Green Software session as part of the community-organised [Festive Tech Calendar](#) - surely the best way to kick off your holiday season!...

Participer

<https://www.meetup.com/gsf-paris/events/297775625/>

BOARD / TEAM

STEERING COMMITTEE

The steering committee is made up of primary and alternative representatives from each of our steering member organizations. They decide how the money is spent, review the outputs from the working groups before publication and collaborate on strategy to help the GSF meet its mission.

<https://greensoftware.foundation/team>





Other communities





MEETUP
GREENOPS



Empreinte environnementale de
l'IA dans le Cloud : une approche
pratique

GreenOps & FinOps : quels
parallèles et quelles divergences ?



alygne

 **Boavizta**

 **ManoMano**

ASSOCIATION
green ft

<https://www.meetup.com/fr-FR/finops-france-sig/>

Pour un numérique innovant et engagé pour l'environnement.

GreenTech Forum est le rendez-vous professionnel Numérique et Environnement

21 & 22 novembre 2023
Beffroi de Montrouge, Paris

Programme des conférences

Inscription

<https://www.greentech-forum.com/>



awesome-greenit

Public

Edit Pins

Watch 4

Fork 3

Star 4

main

1 branch

0 tags

Go to file

Add file

Code

About



jeanphibaconnais ✨🚀 Badge Zenika + issues created on october (#16)

b6368af on Oct 13

8 commits



LICENSE

Initial commit

last year



README.md

✨🚀 Badge Zenika + issues created on october (#16)

2 months ago

README.md



Awesome Green-IT



awesome

🤓🇬🇧 A collaborative list of great resources about Green-IT. Feel free to contribute to this on-going list. Inspired by <https://github.com/geojis/awesome-green-it>

🤓🇫🇷 Liste collaborative de liens utiles d'éco-conception et du numérique responsable. N'hésitez pas à contribuer à cette liste. Inspiré par <https://github.com/geojis/awesome-green-it>

🤓 Awesome list about green-it 🇬🇧 / Liens utiles d'éco-conception et du numérique responsable 🇫🇷

green

ecology

hacktoberfest

greenit

Readme

Apache-2.0 license

Activity

4 stars

4 watching

3 forks

Report repository

<https://github.com/zenika-open-source/awesome-greenit/>

ECO-CONCEPTION DE SERVICE NUMÉRIQUE



WEB ET LOGICIEL

70% théorie, 30% pratique



(4.3)

213 évaluations de janvier 2019 à ce jour

Durée 2.5 jours • 17.5 heures



Officielle



Certifiante



Nouveauté



Présentiel



À distance

Prochaine formatrice ou formateur
Raphaël LEMAIRE

Spécialiste Innovation, GreenIT

<https://training.zenika.com/fr-fr/training/greenit-ecoconception/>



⚡ One more thing...





Welcome to LFC131



Sign In/Register To Access

In order to access the course content, you must be signed in to the Linux Foundation Learner Dashboard.

- If you already have a Linux Foundation Account, click the "Sign In" link on the right to begin.

ENROLL TODAY

Register now to gain access to this course.

[Register Now](#)

 Already Enrolled? Sign In

[Check out other courses](#)

Merci ! 🙌🙌

👋 Bienvenue à la Green Software Foundation

Julien Landuré
@jlandure



THE FRUGAL ARCHITECT

Simple laws for building cost-aware, sustainable, and modern architectures.

