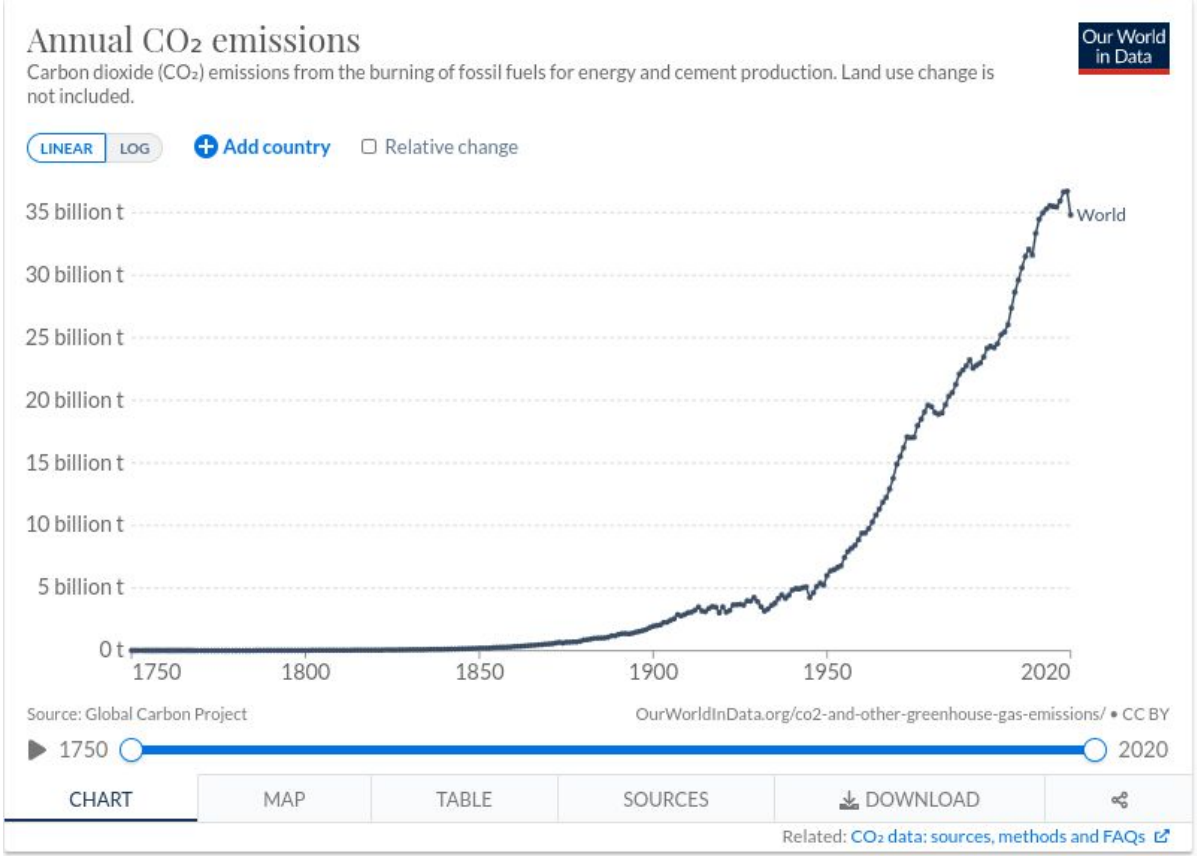
¿Green Software? ¿Esto de qué va?

https://tysmagazine.com/sabes-lo-que-tiras-a-la-basura/

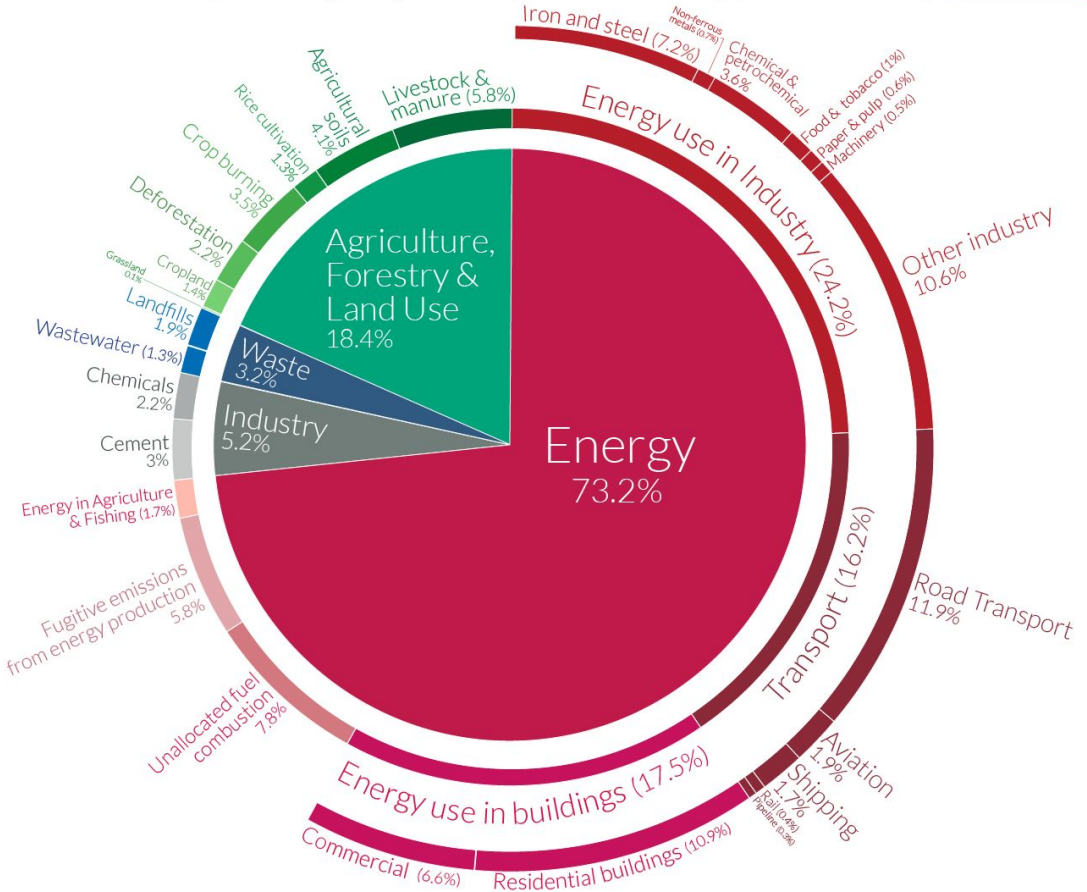


https://ourworldindata.org/co2-emissions

Global greenhouse gas emissions by sector

This is shown for the year 2016 – global greenhouse gas emissions were 49.4 billion tonnes CO_2eq.

Our World in Data



OurWorldinData.org – Research and data to make progress against the world's largest problems.

Source: Climate Watch, the World Resources Institute (2020).

SIZING UP THE INTERNET'S CARBON EMISSIONS

CARBON FOOTPRINT

4 BILLION+

Over 4 billion people are active internet users.

3.7%

The carbon footprint of our gadgets, the internet and the systems supporting them accounts for 3.7% of global greenhouse emissions, similar to the airline industry. These emissions are predicted to double by 2025.[1]

NO.3

Global IT sector electricity demand ranks behind only two countries in the world – China and the US.[2]

1: https://www.bbc.com/future/article/20200305-why-your-internet-habits-are-not-as-clean-as-you-think
2: Green Peace Click Clean report 2017, p16

THE INTERNET USES A HUGE AMOUNT OF ENERGY. THIS IS DUE TO TWO KEY FACTORS:

MANUFACTURING AND SHIPPING

Technology companies must manufacture and ship the internet's hardware including:

POWERING AND COOLING

Computers and smartphones must be powered and cooled, drawing electricity from local grids.

This power is generated in different ways with varying emissions.[1]

https://www.climateimpact.com/news-insights/insights/infographic-carbon-footprint-internet/

Green Software Engineering

@uritau

2022

Green software is software that is responsible for emitting **fewer greenhouse gases**.

How?

Using less physical resources

Increasing life expectancy, sharing physical resources and optimizing its usage

Using less energy

Reducing the wasted energy, improving efficiency or in any way that could help

Using energy more intelligently

Consuming lower-carbon sources of energy or consuming electricity in a way that helps accelerate the energy transition

"If you can't measure it, you can't improve it."

Peter Drucker

Software Carbon Intensity (SCI)

The Software Carbon Intensity (SCI) specification gives an approach to developers to **measure the carbon impact** of their systems.

SCI

Amount of **C**arbon the software is emitting per **R**esource (API call, extra user, SaaS, microservice, ML Training system...)

SCI

$$SCI = C * R$$

SCI

- Amount of **C**arbon the software is emitting per **R**esource (API call, extra user, SaaS, microservice, ML Training system...)
- The amount of Carbon is the sum of Operational emissions plus the embodied emissions

SCI

$$SCI = (O + M) * R$$

SCI

- Amount of **C**arbon the software is emitting per **R**esource (API call, extra user, SaaS, microservice, ML Training system...)
- The amount of Carbon is the sum of Operational emissions plus the embodied emissions
- The operational emission is the location-based marginal carbon emission generated per the energy consumed by a software system

SCI

$$SCI = ((E * I) + M) * R$$

Green Software Foundation


13 Oct - 10 Nov
Carbon Hack 22
by
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Articles
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GREEN SOFTWARE
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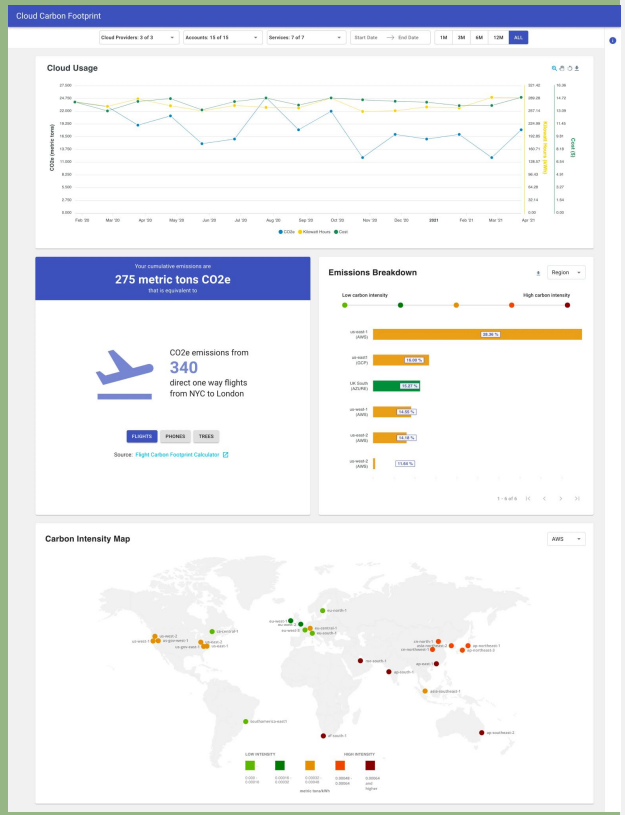
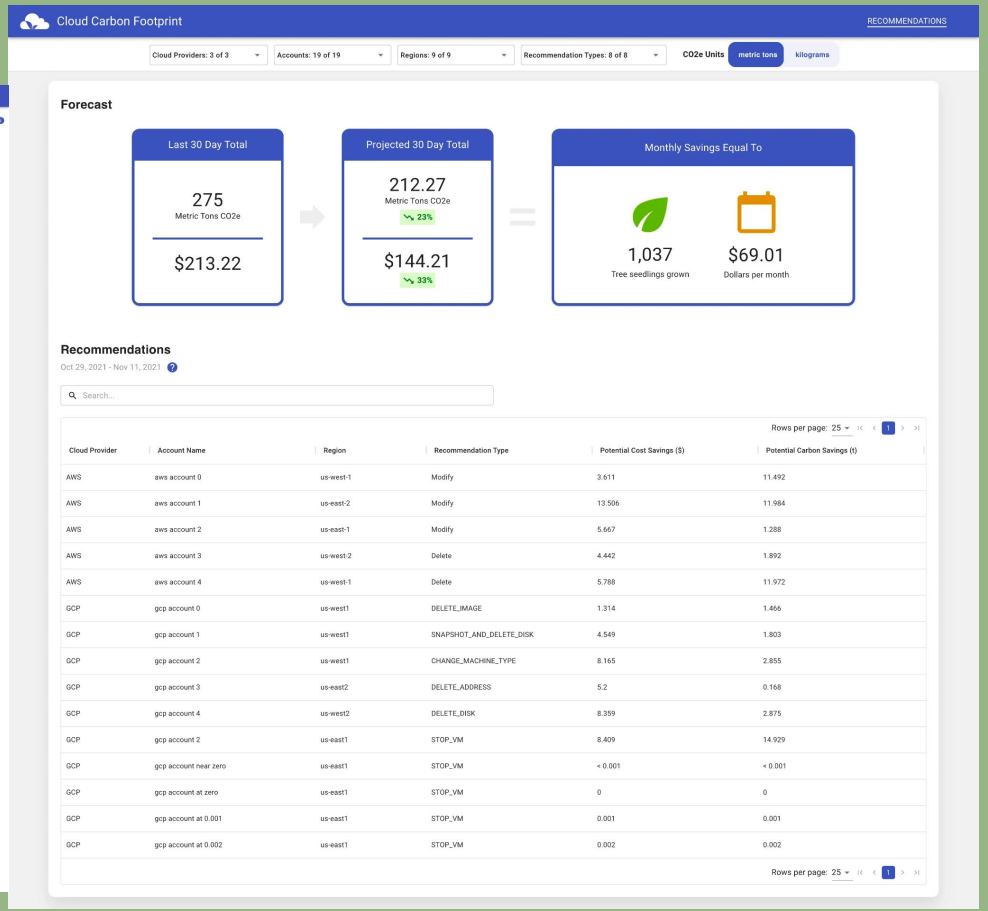
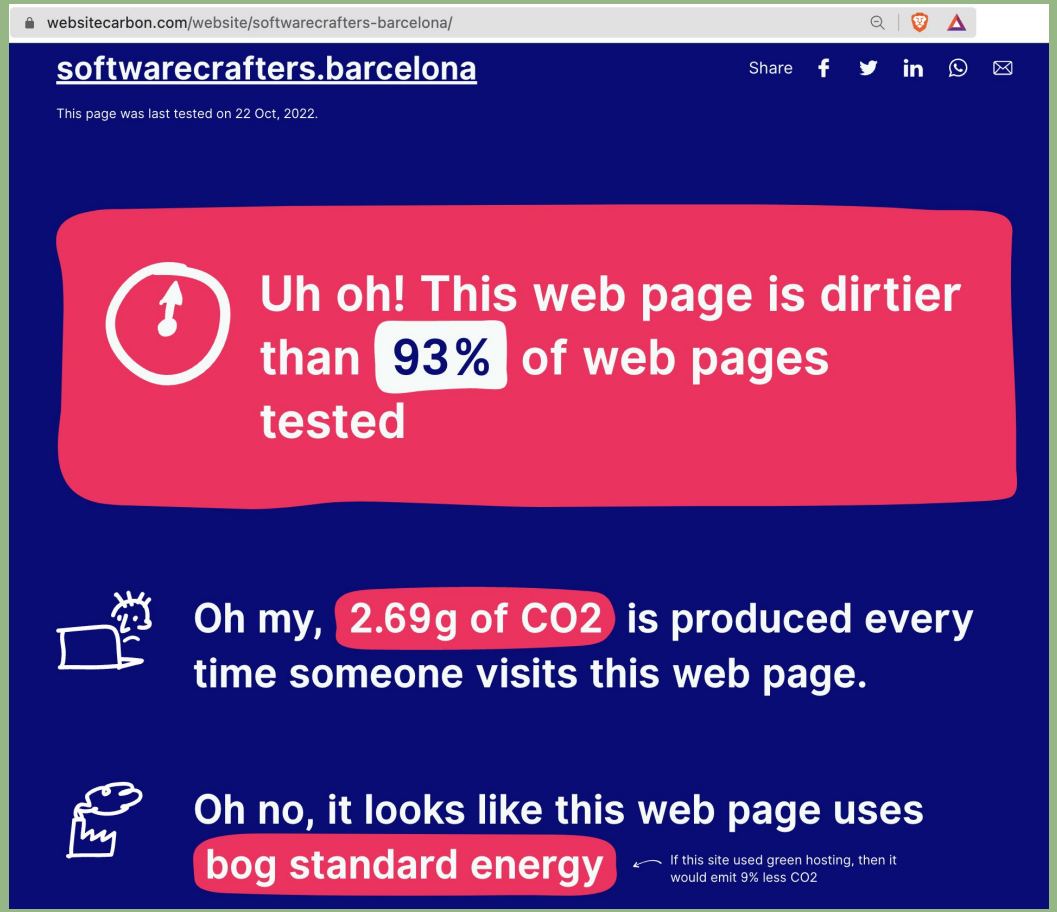
Sign up





Cloud Provider	Account Name	Region	Recommendation Type	Potential Cost Savings ($)	Potential Carbon Savings (t)
AWS	aws account 0	us-west-1	Modify	3.611	11.492
AWS	aws account 1	us-east-2	Modify	13.506	11.984
AWS	aws account 2	us-east-1	Modify	5.667	1.288
AWS	aws account 3	us-west-2	Delete	4.442	1.892
AWS	aws account 4	us-west-1	Delete	5.788	11.972
GCP	gcp account 0	us-west1	DELETE_IMAGE	1.314	1.466
GCP	gcp account 1	us-west1	SNAPSHOT_AND_DELETE_DISK	4.549	1.803
GCP	gcp account 2	us-west1	CHANGE_MACHINE_TYPE	8.165	2.855
GCP	gcp account 3	us-east2	DELETE_ADDRESS	5.2	0.168
GCP	gcp account 4	us-west2	DELETE_DISK	8.359	2.875
GCP	gcp account 2	us-east1	STOP_VM	8.409	14.929
GCP	gcp account near zero	us-east1	STOP_VM	< 0.001	< 0.001
GCP	gcp account at zero	us-east1	STOP_VM	0	0
GCP	gcp account at 0.001	us-east1	STOP_VM	0.001	0.001
GCP	gcp account at 0.002	us-east1	STOP_VM	0.002	0.002

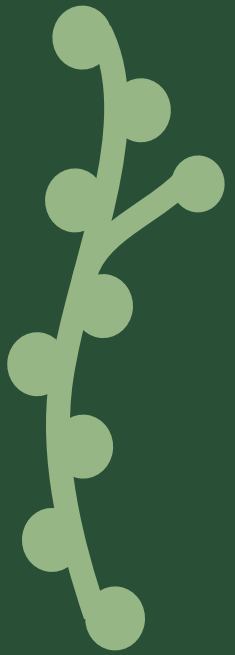

websitecarbon.com/website/softwarecrafters-barcelona/
softwarecrafters.barcelona
Share
This page was last tested on 22 Oct, 2022.
Uh oh! This web page is dirtier than 93% of web pages tested
Oh my, 2.69g of CO2 is produced every time someone visits this web page.
Oh no, it looks like this web page uses bog standard energy
If this site used green hosting, then it would emit 9% less CO2


UN GRAN PODER
CONLLEVA UNA GRAN RESPONSABILIDAD
memegen.com

3 main responsibilities

Consumers

- Choose “green” services
- Reduce unnecessary tech usage
- Limit transfer
- Communication good practices
- Long life devices
- Green energy



3 main roles

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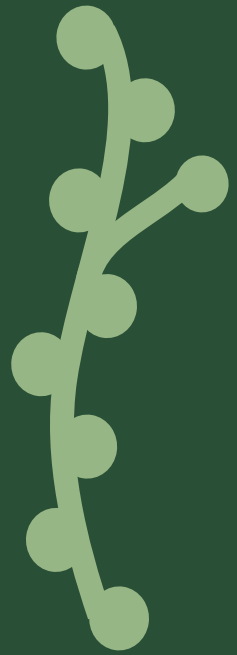
“Experts”

- No tech by tech
- Conscious choices
- Evangelize
- Critical opinions
- Add “SCI” into decisions
- 5g, crypto, FullHD



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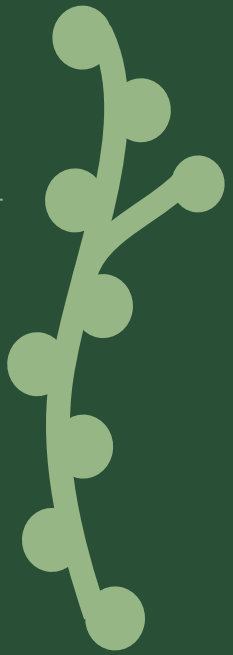
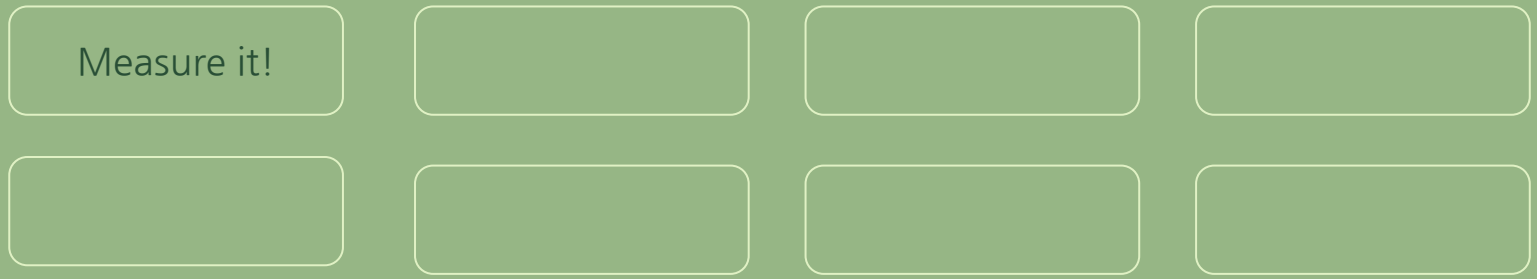
Devs

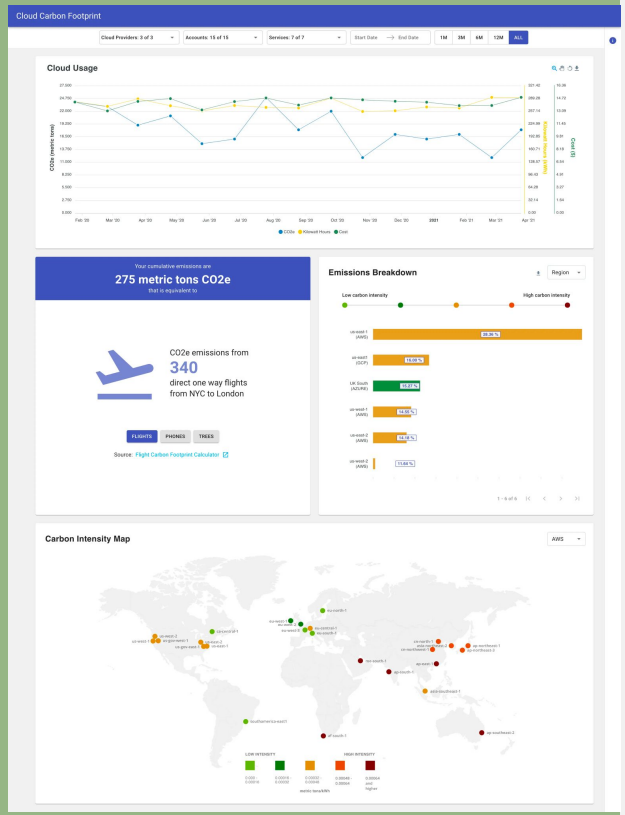
- **What else?!!**

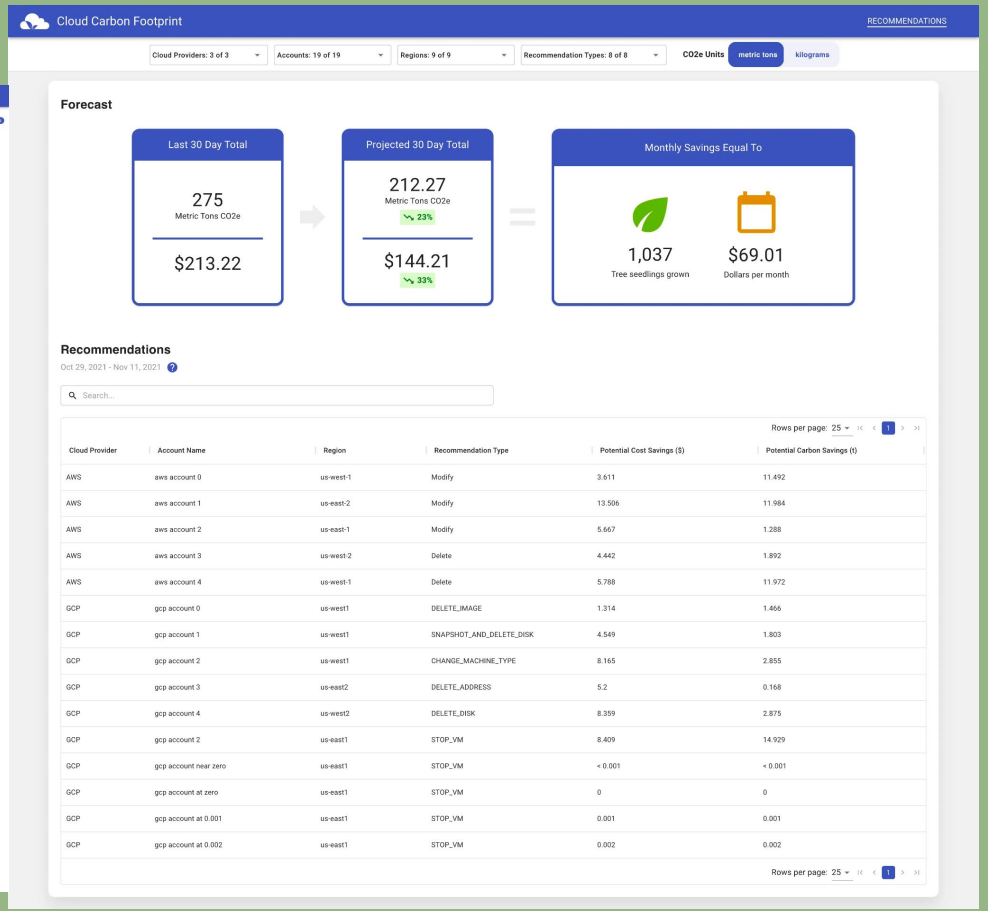


Green Software Engineering

Conscious infrastructure choses


Measure it!





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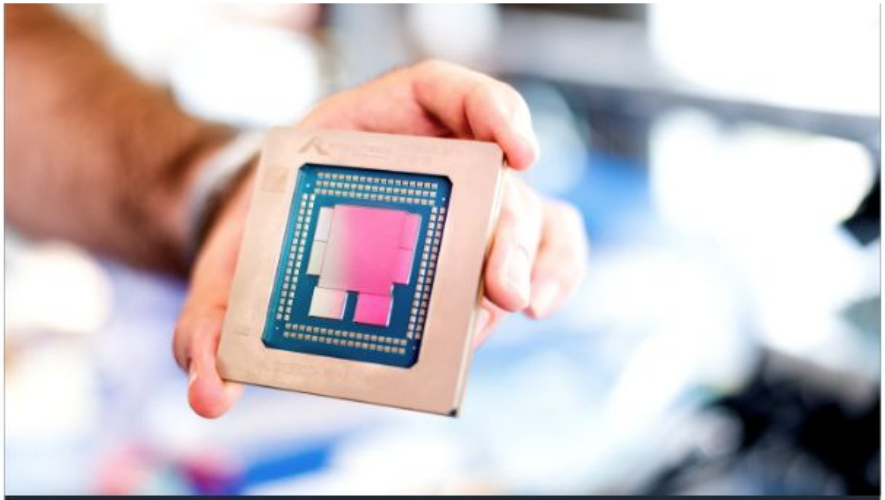
Power Efficiency Cooling Efficiency Tracking Performance



ENERGY EFFICIENCY

Power Efficiency

ENERGY EFFICIENCY

Cooling Efficiency

Measure it!

Efficient families

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Efficient families

FinOps

FinOps

https://adastraglobal.co/google-cloud-finops-on-gcp/

Beneficios del cambio:

Reducimos Costes: $44,64 Month without stop [Parece poco, si ....]

Reducimos CO2: NoStop 78.790,8 gCO2eq 40 arboles? no se com es mira les equivalencies xd [***Esto ya parece más atractivo para el cambio no?*** 😛] 🚀 🎉

https://adastraglobal.co/google-cloud-finops-on-gcp/

FinOps

Green Software

Measure it!

Efficient families

Elastic scaling

Serverless

“No todo vale” to scale

Stop it if it’s not being used

Location	Carbon intensity (gCO2/kWh)	
Scotland	3	
South Wales	378	x 126 larger
London	213	x 71 larger
South England	281	x 94 larger
East Midlands	220	x 73 larger
East England	137	x 46 larger
Yorkshire	98	x 33 larger

https://www.nationalgrid.com/

SCI

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

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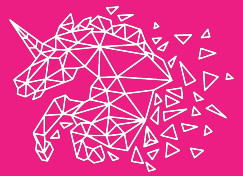
Choose zones & times wisely

Software Crafters Barcelona

#SCBCN22 ✦ IX EDITION



PREMIUM

autentia

elastic

LIFULL CONNECT

trainline

wallbox

DIVERSITY

CODE SHERPAS

BASIC

Adevinta Spain

audiense

codely

540

holaluz

seQura

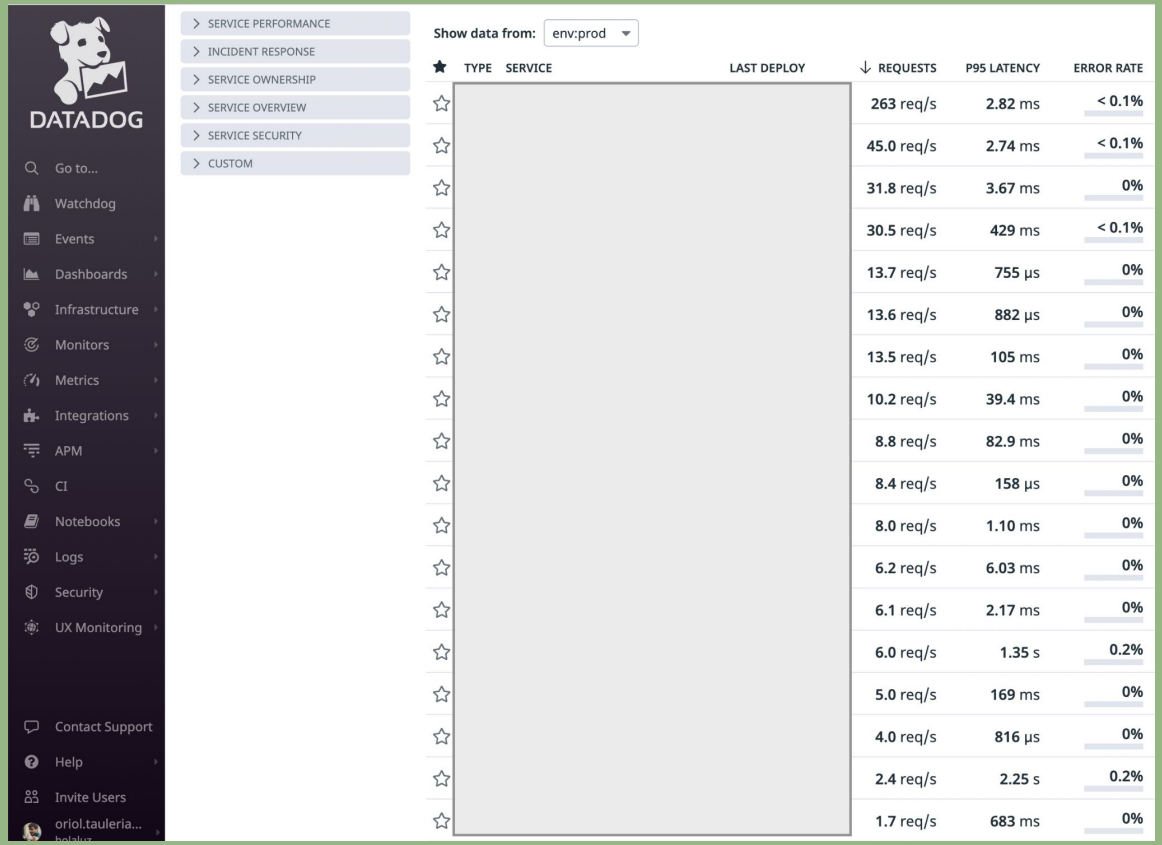
stepaniuk

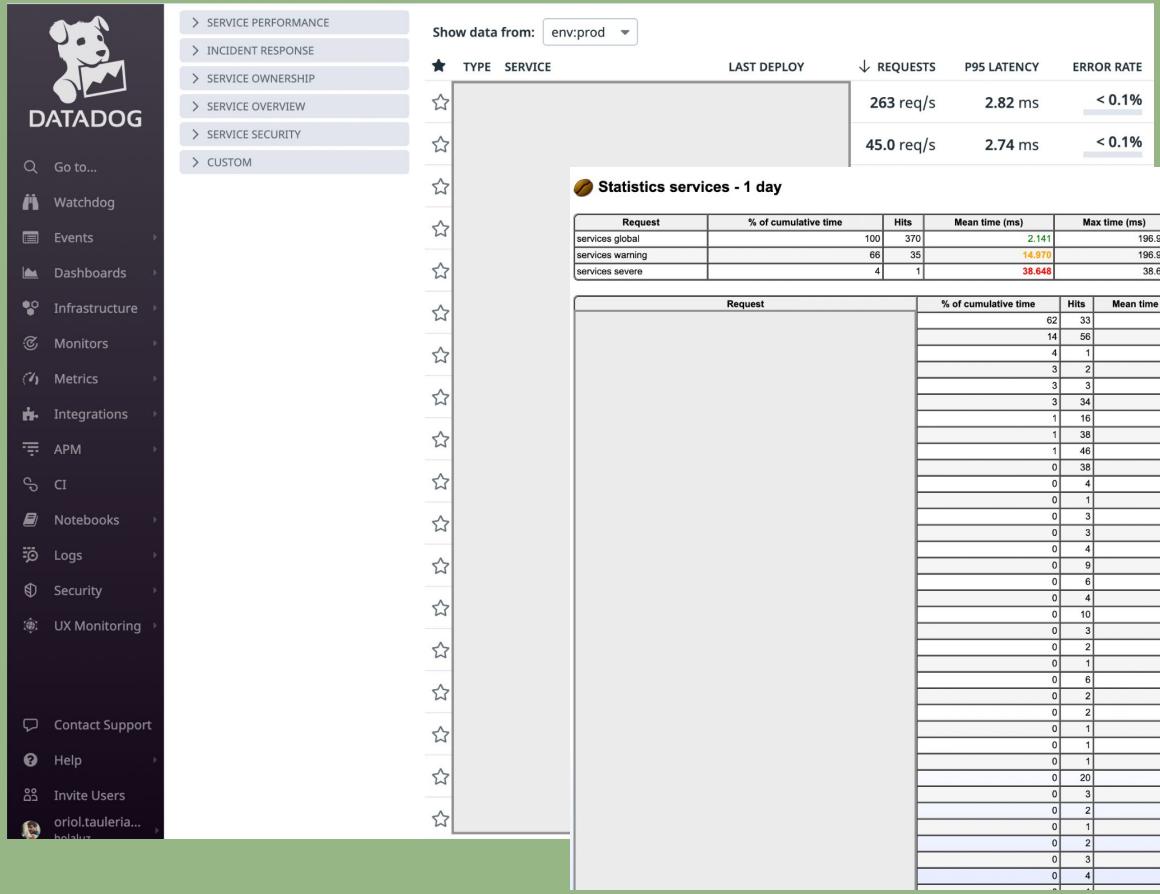
voxel

SUPPORTERS

Agile-Spain

Backend aware loads


DATADOG
Go to...
Watchdog
Events
Dashboards
Infrastructure
Monitors
Metrics
Integrations
APM
CI
Notebooks
Logs
Security
UX Monitoring
Contact Support
Help
Invite Users
oriol.tauleria...
SERVICE PERFORMANCE
INCIDENT RESPONSE
SERVICE OWNERSHIP
SERVICE OVERVIEW
SERVICE SECURITY
CUSTOM
Show data from: env:prod
TYPE SERVICE LAST DEPLOY REQUESTS P95 LATENCY ERROR RATE
263 req/s 2.82 ms < 0.1%
45.0 req/s 2.74 ms < 0.1%
31.8 req/s 3.67 ms 0%
30.5 req/s 429 ms < 0.1%
13.7 req/s 755 µs 0%
13.6 req/s 882 µs 0%
13.5 req/s 105 ms 0%
10.2 req/s 39.4 ms 0%
8.8 req/s 82.9 ms 0%
8.4 req/s 158 µs 0%
8.0 req/s 1.10 ms 0%
6.2 req/s 6.03 ms 0%
6.1 req/s 2.17 ms 0%
6.0 req/s 1.35 s 0.2%
5.0 req/s 169 ms 0%
4.0 req/s 816 µs 0%
2.4 req/s 2.25 s 0.2%
1.7 req/s 683 ms 0%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Show data from: env:prod
TYPE SERVICE LAST DEPLOY REQUESTS P95 LATENCY ERROR RATE
263 req/s 2.82 ms < 0.1%
45.0 req/s 2.74 ms < 0.1%
Statistics services - 1 day
Request % of cumulative time Hits Mean time (ms) Max time (ms) Standard deviation % of cumulative cpu time Mean cpu time (ms) % of system error
services global 100 370 2.141 196.988 12.397 100 70 0,0
services warning 66 35 14.970 196.988 36.492 62 468 0,0
services severe 4 1 38.648 38.648 0 1 421 0,0
0 hits/min on 40 requests Summary by class Dependencies Details
Request % of cumulative time Hits Mean time (ms) Max time (ms) Standard deviation % of cumulative cpu time Mean cpu time (ms) % of system error
62 33 14.931 196.988 37.605 51 407 0,0
14 56 2.020 56.610 7.473 5 25 0,0
4 1 38.648 38.648 0 1 421 0,0
3 2 15.612 19.108 4.944 11 1.476 0,0
3 3 8.536 9.323 821 4 359 0,0
3 34 740 11.119 1.842 2 18 0,0
1 16 591 4.451 2.208 0 5 0,0
1 38 233 1.246 204 9 66 0,0
1 46 179 516 59 1 10 0,0
0 38 187 2.359 567 2 18 0,0
0 4 1.295 1.729 771 0 7 0,0
0 1 4.397 4.397 0 0 15 0,0
0 3 1.083 1.622 590 0 41 0,0
0 3 1.061 1.502 765 0 10 0,0
0 4 584 1.559 650 0 3 0,0
0 9 223 254 58 2 72 0,0
0 6 311 362 47 0 38 0,0
0 4 373 448 58 0 42 0,0
0 10 133 484 174 0 16 0,0
0 3 409 437 92 0 46 0,0
0 2 499 814 444 0 54 0,0
0 1 866 866 0 0 31 0,0
0 6 140 219 50 0 41 0,0
0 2 278 311 46 0 7 0,0
0 2 238 256 24 0 70 0,0
0 1 432 432 0 0 31 0,0
0 1 302 302 0 0 46 0,0
0 1 224 224 0 0 31 0,0
0 20 9 30 5 0 0 0,0
0 3 55 108 47 0 0 0,0
0 2 81 142 85 0 7 0,0
0 1 160 160 0 0 31 0,0
0 2 66 67 1 0 7 0,0
0 3 33 50 18 0 10 0,0
0 4 21 39 11 0 0 0,0

Measure it!

Efficient families

“No todo vale”

Digital Diogenes

Choose zones wisely

If you don’t use it, stop it.

Architecture patterns

Measure it!

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Efficient families

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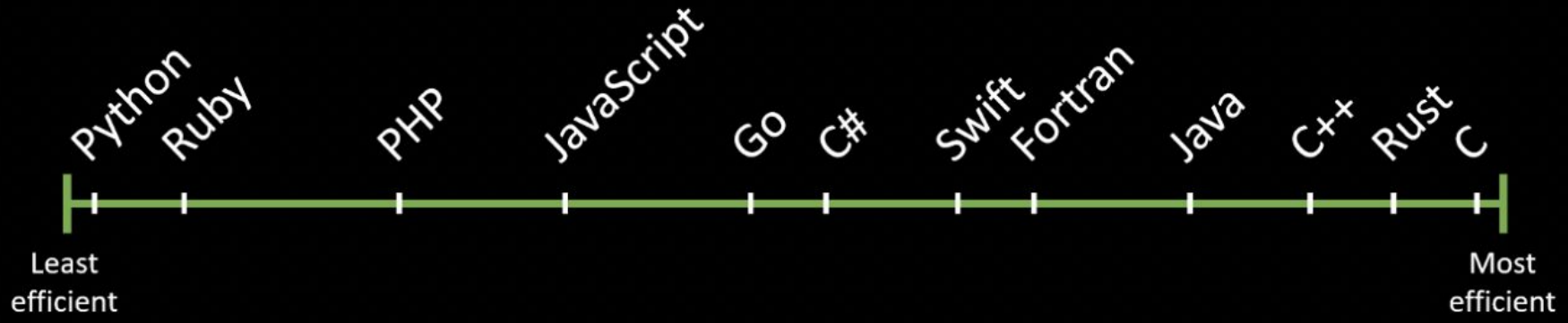
Languages selection

Energy efficiency of programming languages



https://kaspergroesludvigsen.medium.com/the-10-most-energy-efficient-programming-languages-6a4165126670

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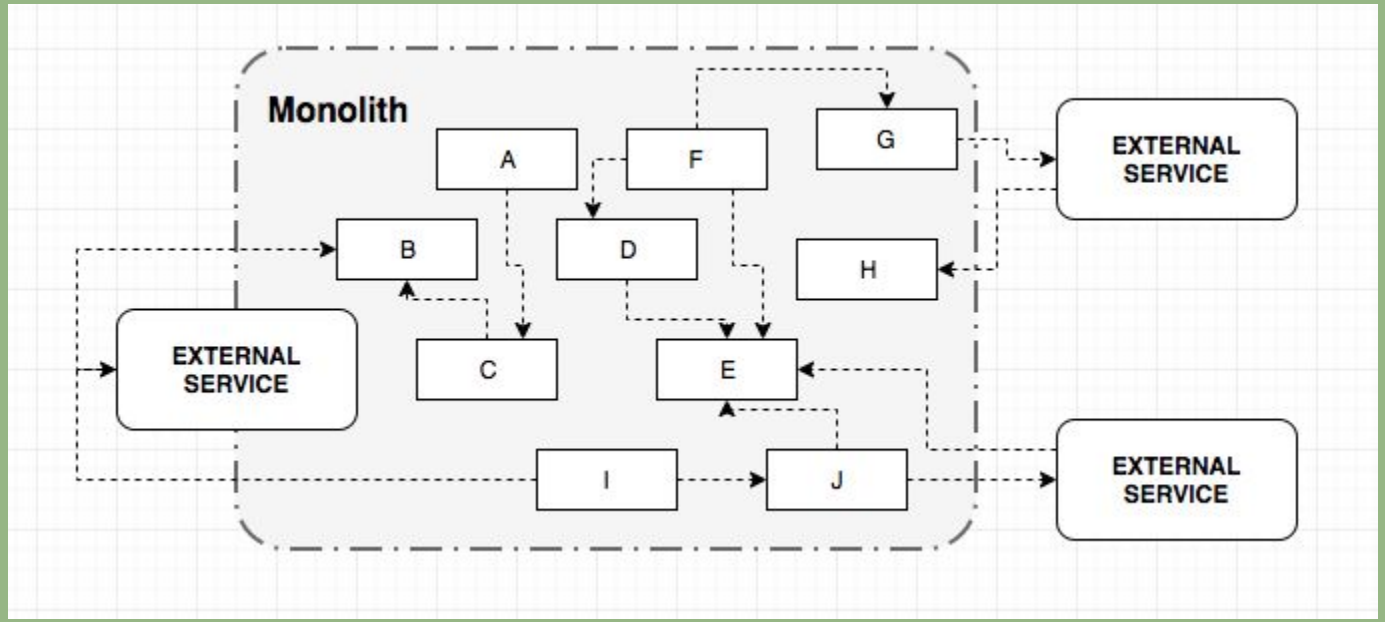
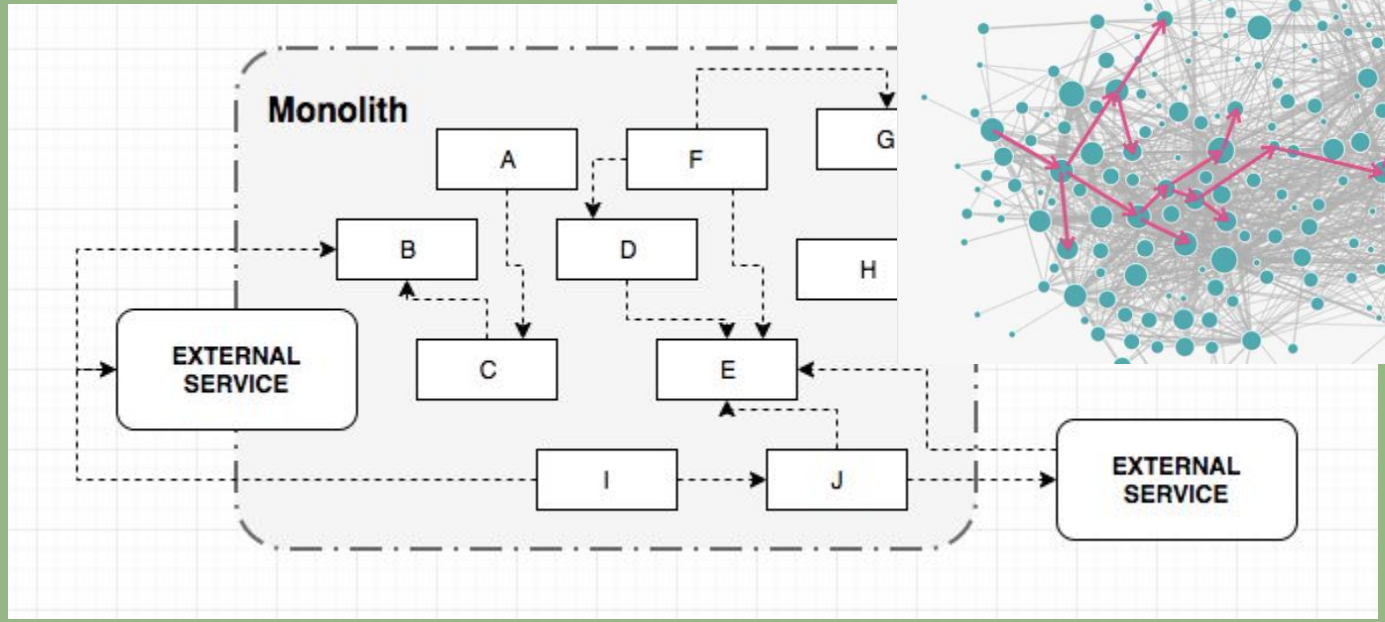
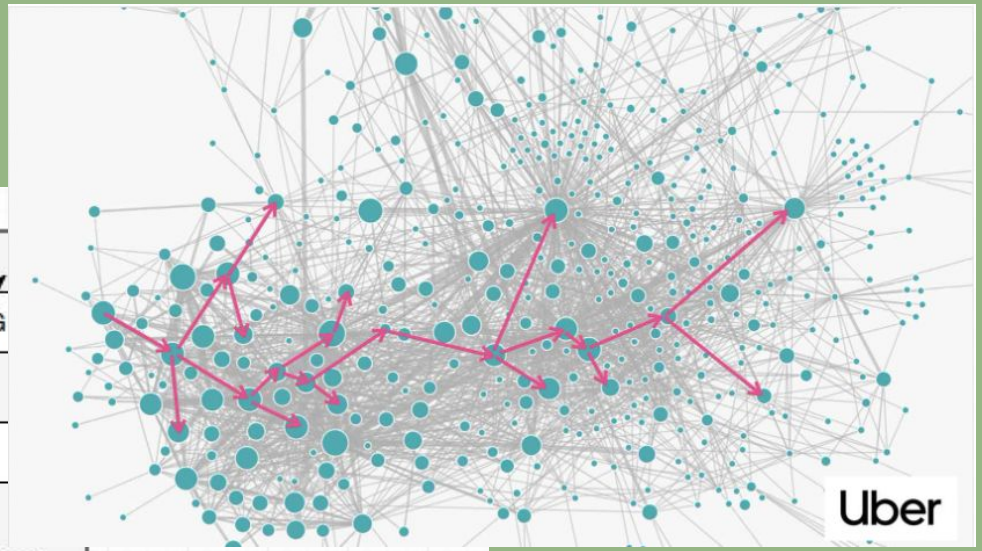


https://medium.com/@juanhurtado10/domain-driven-design-for-monoliths-1f386e125d35

https://kaspergroesludvigsen.medium.com/the-10-most-energy-efficient-programming-languages-6a4165126670





https://medium.com/@juanhurtado10/domain-driven-design-for-monoliths-1f386e125d35

https://www.infoq.com/presentations/uber-microservices-distributed-tracing/

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Compiler tunning

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Algorithms

(Stand-up maths) https://www.youtube.com/watch?v=c33AZBnRHks

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Choose the best time to execute

DBs design

On user-side aware loads

Measure it!

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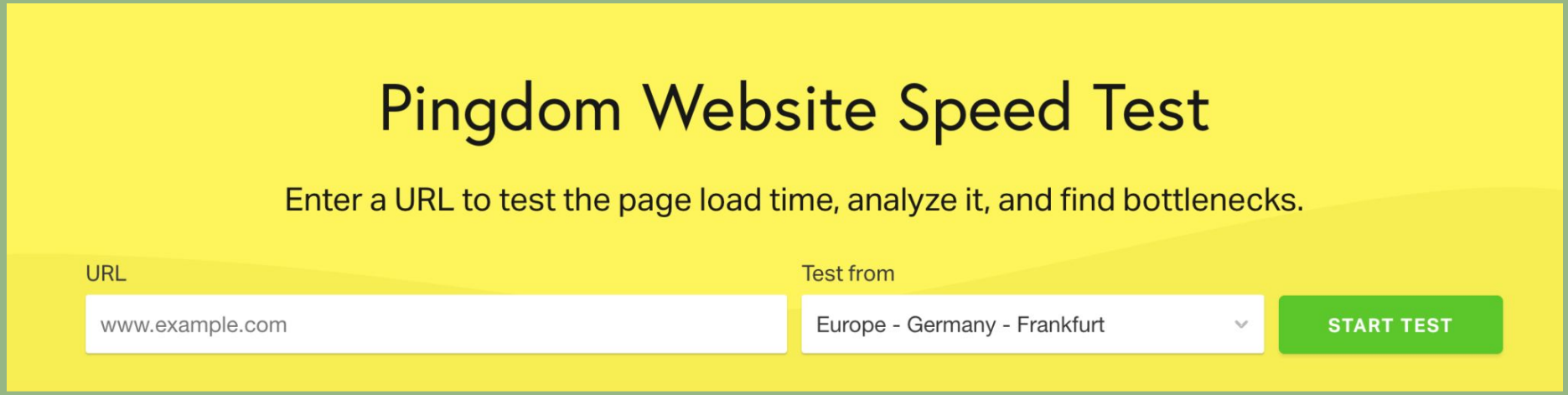
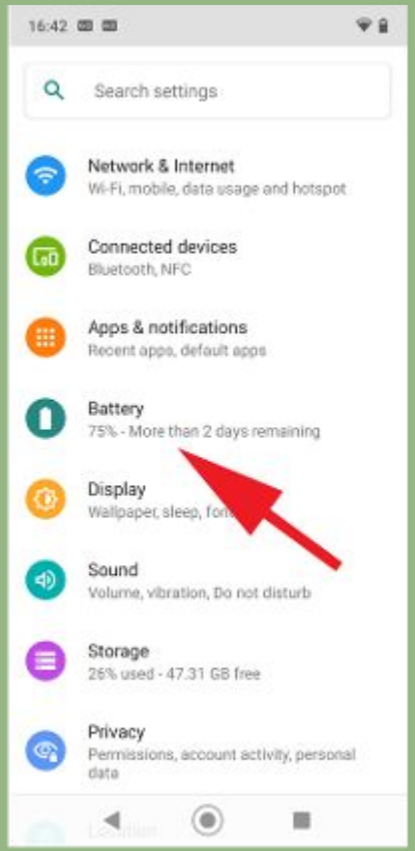
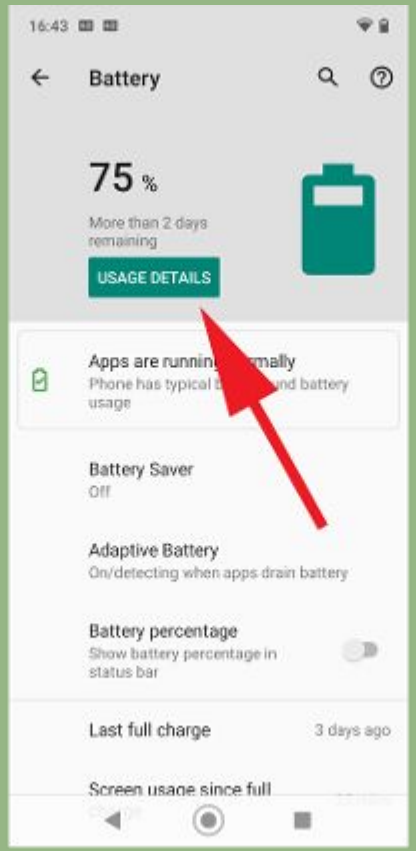


https://tools.pingdom.com/





https://www.techadvisor.com/article/739921/how-to-see-whats-using-your-battery-on-android.html

Measure it!

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DBs design

Measure it!

Dark mode

Measure it!

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DBs design

Measure it!

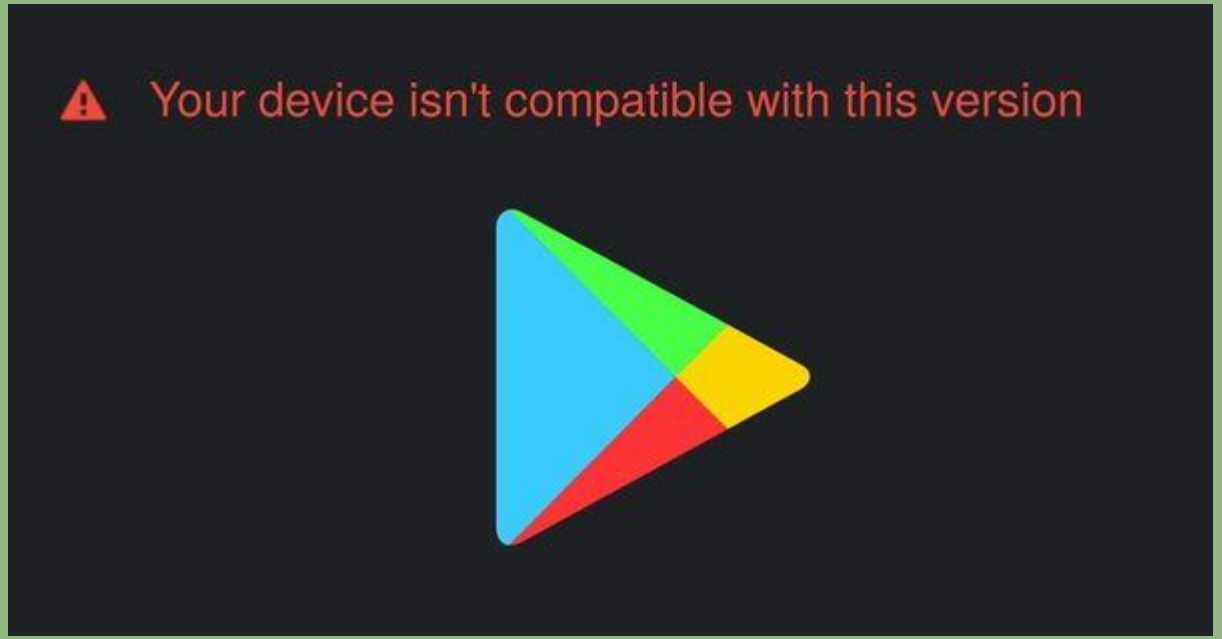
Dark mode

3rd party libraries

Conscious Networking

One size for all?

Support old devices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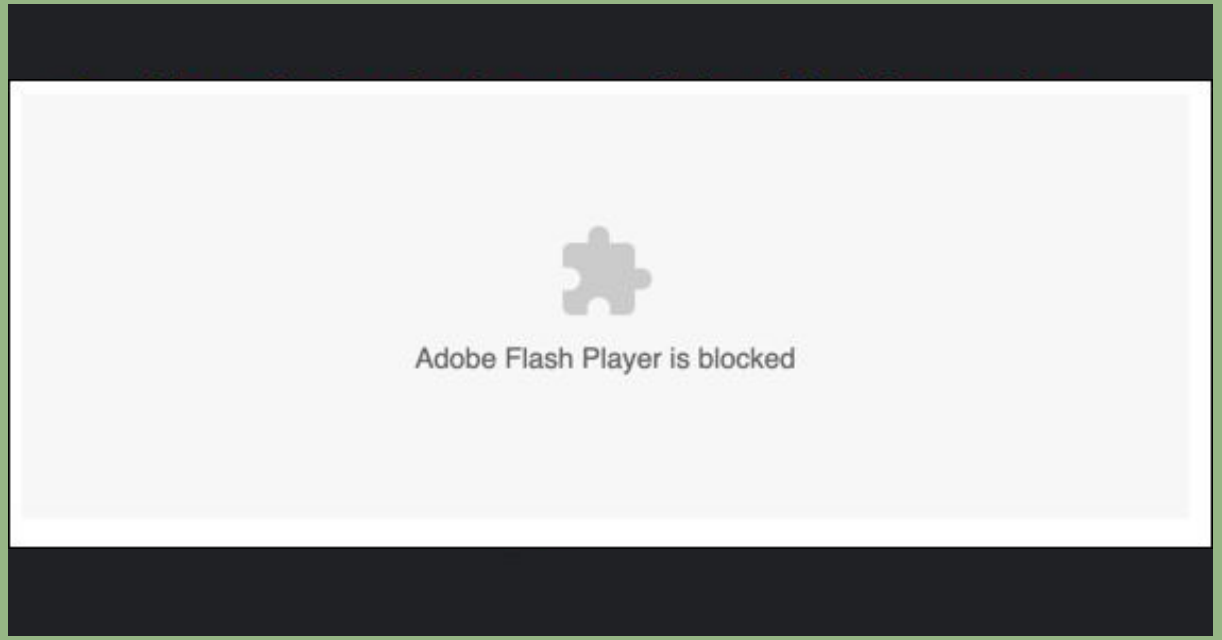
Adobe Flash Player is blocked

Measure it!	Efficient families	“No todo vale”	Digital Diogenes
Choose zones wisely	If you don’t use it, stop it.	Architecture patterns	
Measure it!	Languages selection	Compiler tuning	Architecture patterns
Algorithms	Choose the best time to execute	DBs design	
Measure it!	Dark mode	One size for all?	Conscious Networking
Libraries & components	Support old devices	Updated versions	

UX

Green Software

Over the past year, the Vue team has been working on the next major version of Vue.js, which has been released in the second half of 2020. According to the Vue core team, there are two key considerations that led to the new release and rewriting of Vue: first being the general availability of new JavaScript language features in mainstream browsers, and second, being design and architectural issues in the current codebase that had been exposed over time. The rewrite gave the opportunity to rethink the code organization with these things in mind. Upgrades to many aspects of the framework have resulted in speed improvements. Users report that Vue 3 is about **55 percent** faster, memory usage is down to **54 percent** and updates are up to **133 percent** faster. This is achieved by completely rewriting the DOM implementation using TypeScript.

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Measure it!	Efficient families	“No todo vale”	Digital Diogenes
Choose zones wisely	If you don’t use it, stop it.	Architecture patterns	
Measure it!	Languages selection	Compiler tuning	Architecture patterns
Algorithms	Choose the best time to execute	DBs design	
Measure it!	Dark mode	One size for all?	Conscious Networking
Libraries & components	Support old devices	Updated versions	

Keep Software impact in mind

Recap

What is SCI?

Software carbon intensity. MEASURE IT!

Responsibility

As users, experts and creators we have a great power.

Let’s do something

Keep in mind, it’s easy to improve our day to day.

https://wellwo.es/aprender-a-reciclar-que-va-en-cada-contenedor/

Thanks!

To Read more:
Github Green Software Foundation
Green Software & Telco agenda
Green principles
Green Software foundation

Q&A

Q&A (extended)

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Engineering Director at **Holaluz**