

**Digital ecology:
How can you mitigate the carbon
footprint of websites?**

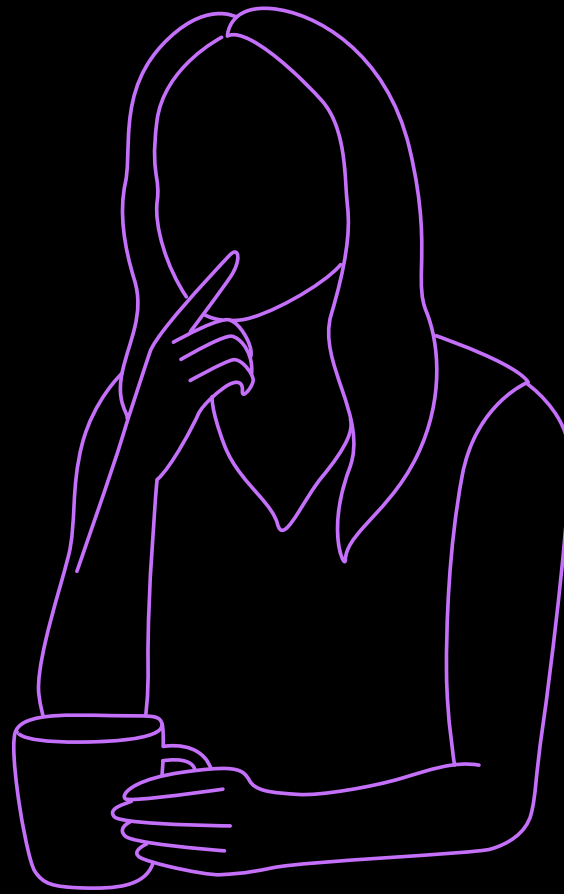
Katarzyna Wojdańska

Digital ecology is...

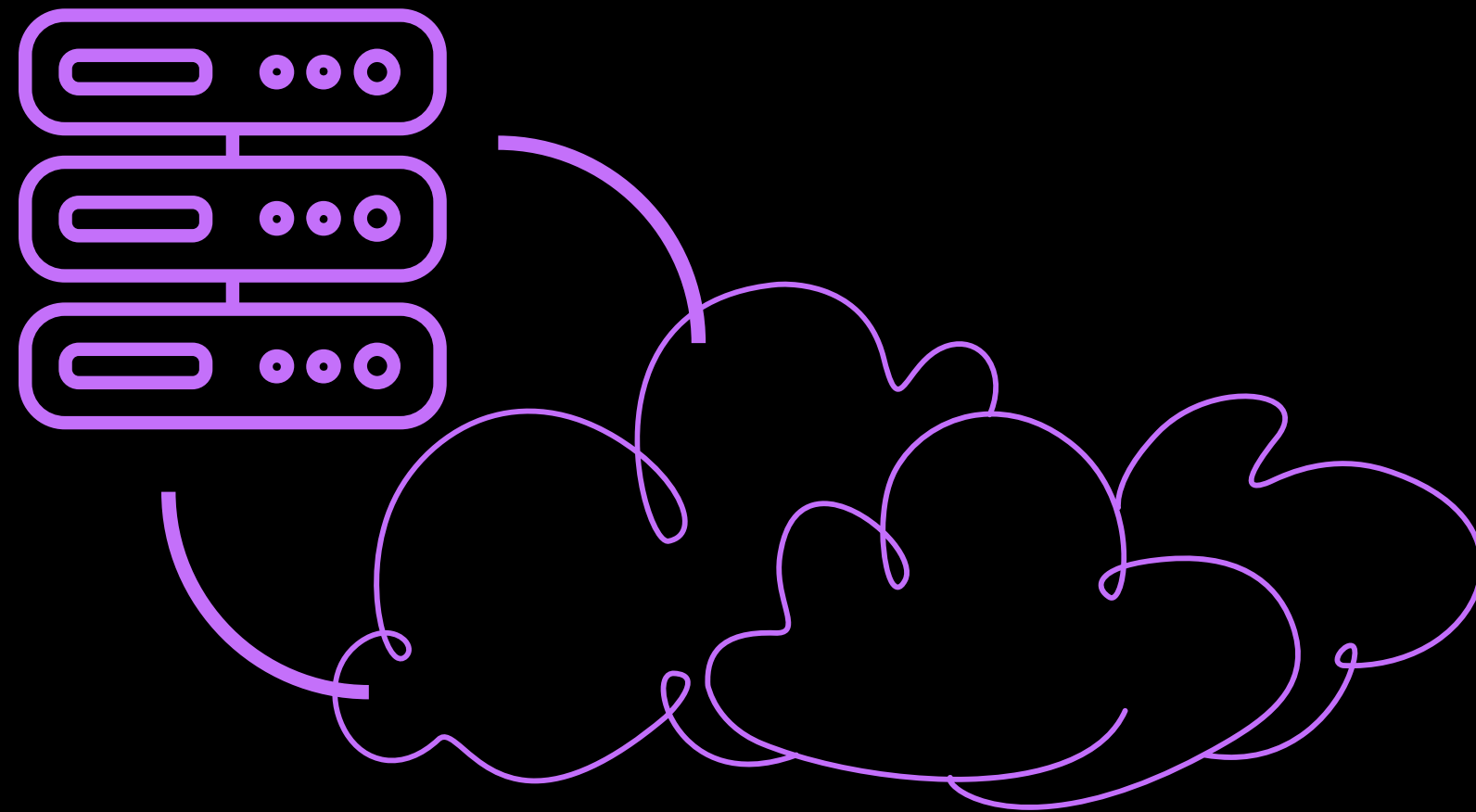
a field of study about the interdependence of digital systems and the natural environment

a branch of ecology that promotes green practices to make digital systems more sustainable.

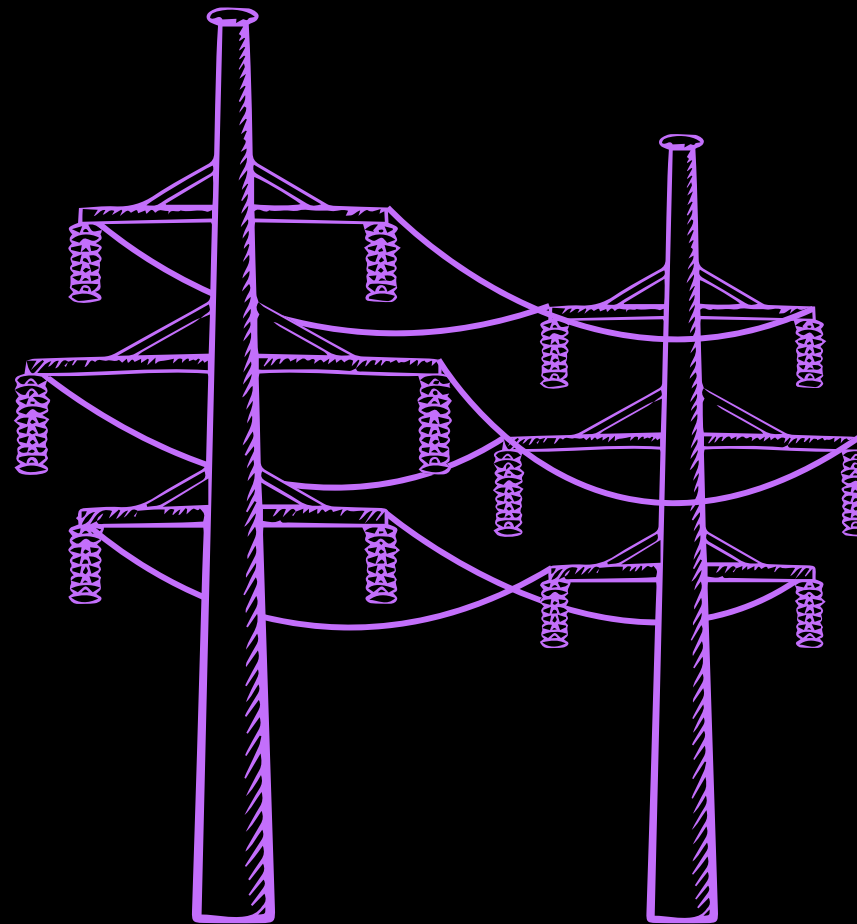
How does the Internet emit CO₂?



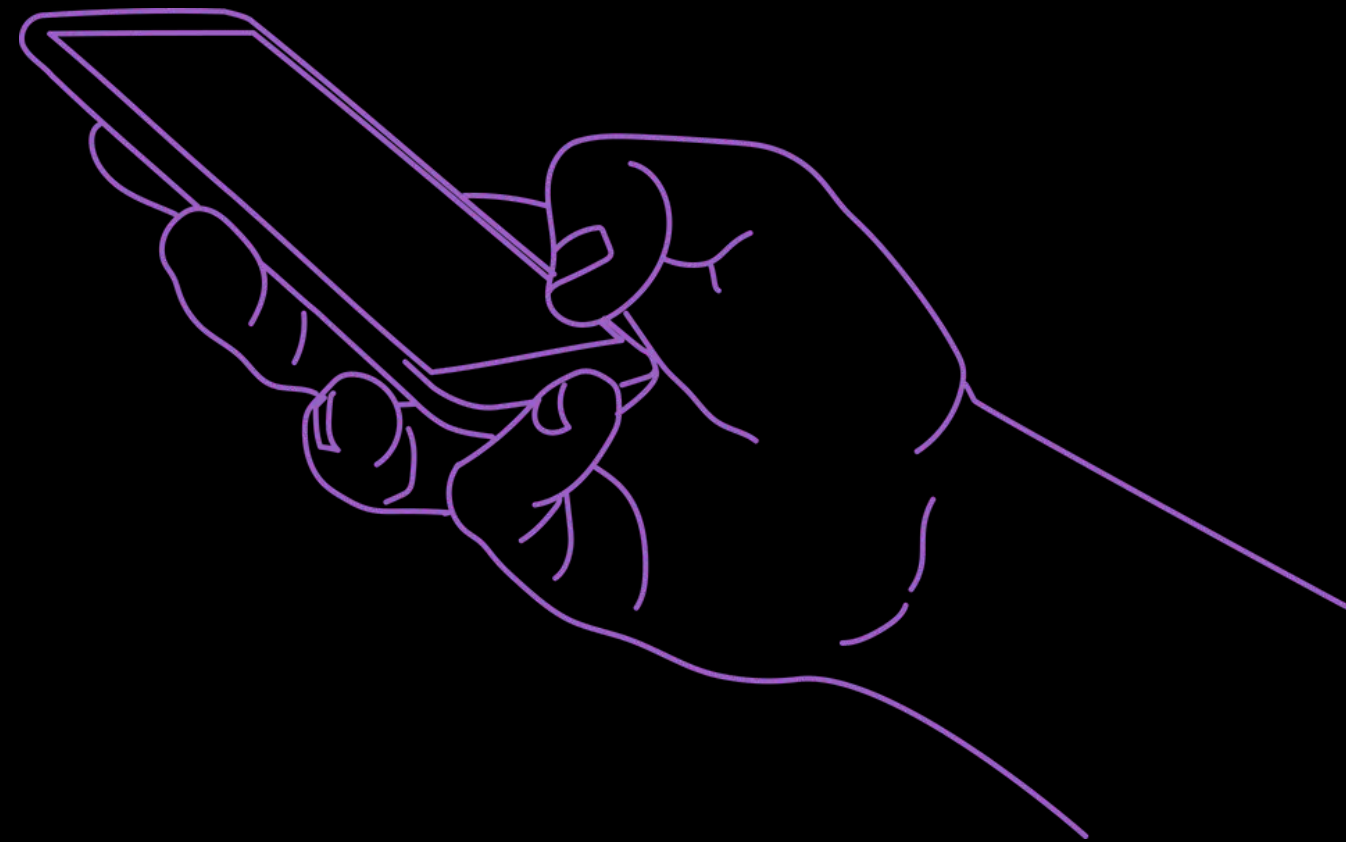
Servers / Data centres / Cloud



Data transfer and power lines



End devices



4%

of all greenhouse gases

*Cloud? 100 zettabytes by 2025 = 200 bln tons CO₂/year

What can we do about it?

We can make a **significant** impact with **insignificant** changes!

E-mails

1. Deleting emails
2. Other messaging tools
3. Spam
4. Size of e-mails



Browsing

1. Ecosia, Lilo, DuckDuckGo
2. Close tabs
3. Write addresses directly
4. Bookmarks
5. Keywords
6. Erase old media on social media platforms



Devices

1. Changing smartphones or computers less often

Replacement every 6th year instead of 4th:
190 kg of CO2 emissions per person less

2. Deleting mobile apps

3. Disabling mobile notifications

4. Unplugging a router

Websites

Every day **250 000** web pages are published.

Every view generates **1.8 g CO2**
what sums up to **216 kg CO2 annually.***

= driving 900 km by a gasoline car

*10 000 views monthly

How much CO₂ does **your website**
produce?

The original Website Carbon calculator

Estimate your web page carbon footprint:

Your web page address

By using this carbon calculator, you agree to the information that you submit being stored and published in our public database.

The formulas

Data transfer of an average visit

- Data transfer of the first visit (25%) = energy of the website
- Data transfer of the returning visit (75%) = energy of the website x 2%

Energy of the website

- Energy of the website = website size x end-user traffic
- End-user traffic = 0.81 kWh/GB

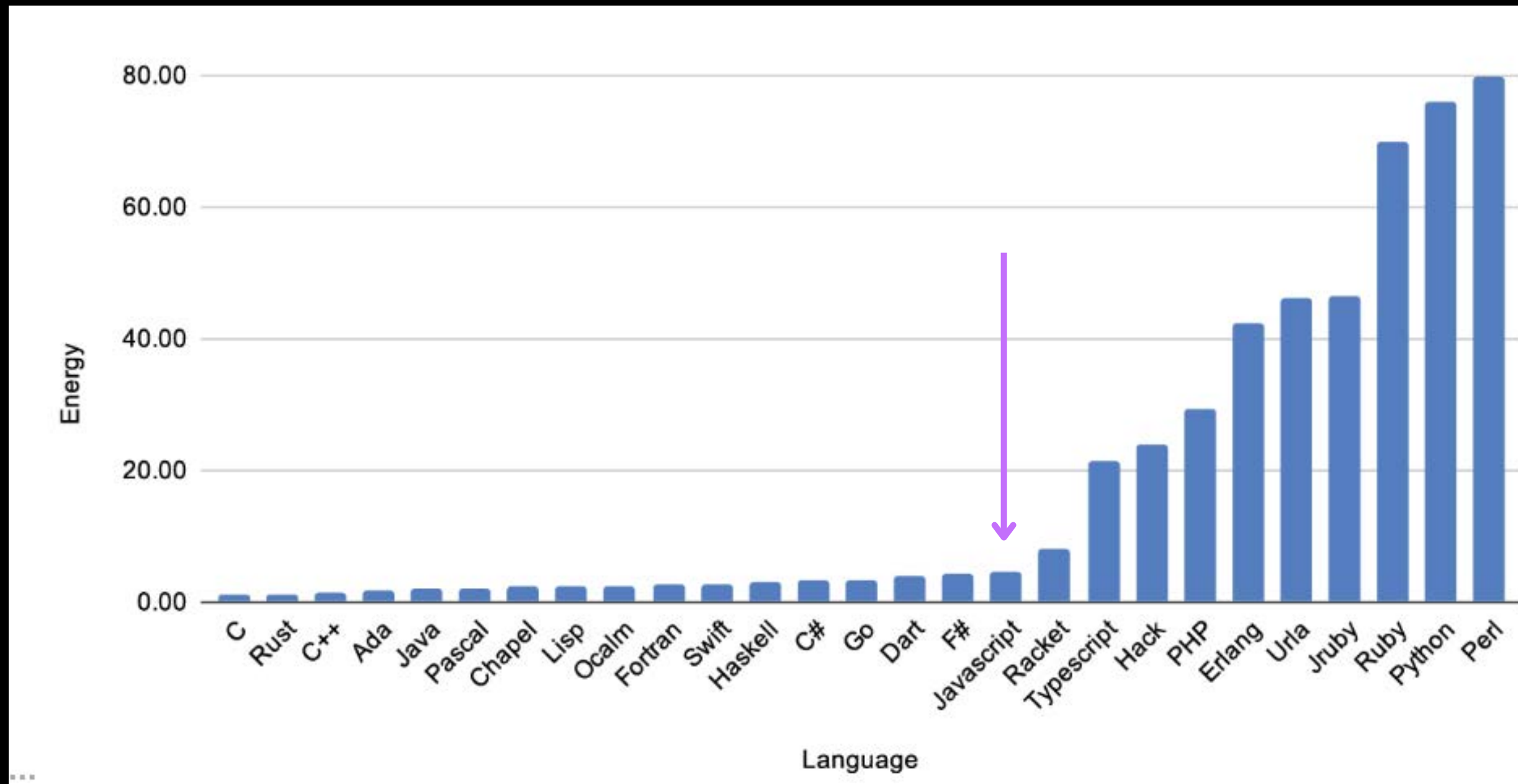
Emissions of CO2 per one visit

- Emissions of CO2 per one visit = data transfer of an average visit * energy emissions
- Energy emissions = 442 g/kWh

Emissions of CO2 per one visit = (75% * website size + 25% * 2% * website size) * end-user traffic * energy emissions

How can we create **more sustainable**
websites?

Programming language



Libraries

moment-js	4.23 MB	1.48 g CO2
lodash	1.41 MB	0.5 g CO2
jQuery	1.32 MB	0.47 g CO2
superagent	0.58 MB	0.21 g CO2
axios	0.44 MB	0.16 g CO2

Also: `needle`, `got`, `request`, `make-fetch-happen`,
`simple-get`

Calls to external APIs

- Reduce the number of calls
- Cache data
- Plain JS
- Lighter libraries

Resources

- Images
SVG, WebP



File format	File size	CO2 emission
SVG	126 KB	0.26 g
WebP	200 KB	0.57 g
JPG	503 KB	1.44 g
GIF	913 KB	2.61 g
PNG	2 111 KB	6.05 g
TIFF	6 329 KB	18.13 g
PSD	12 657 KB	36.25 g
PS	12 825 KB	36.73 g

Resources

- Videos

WebM

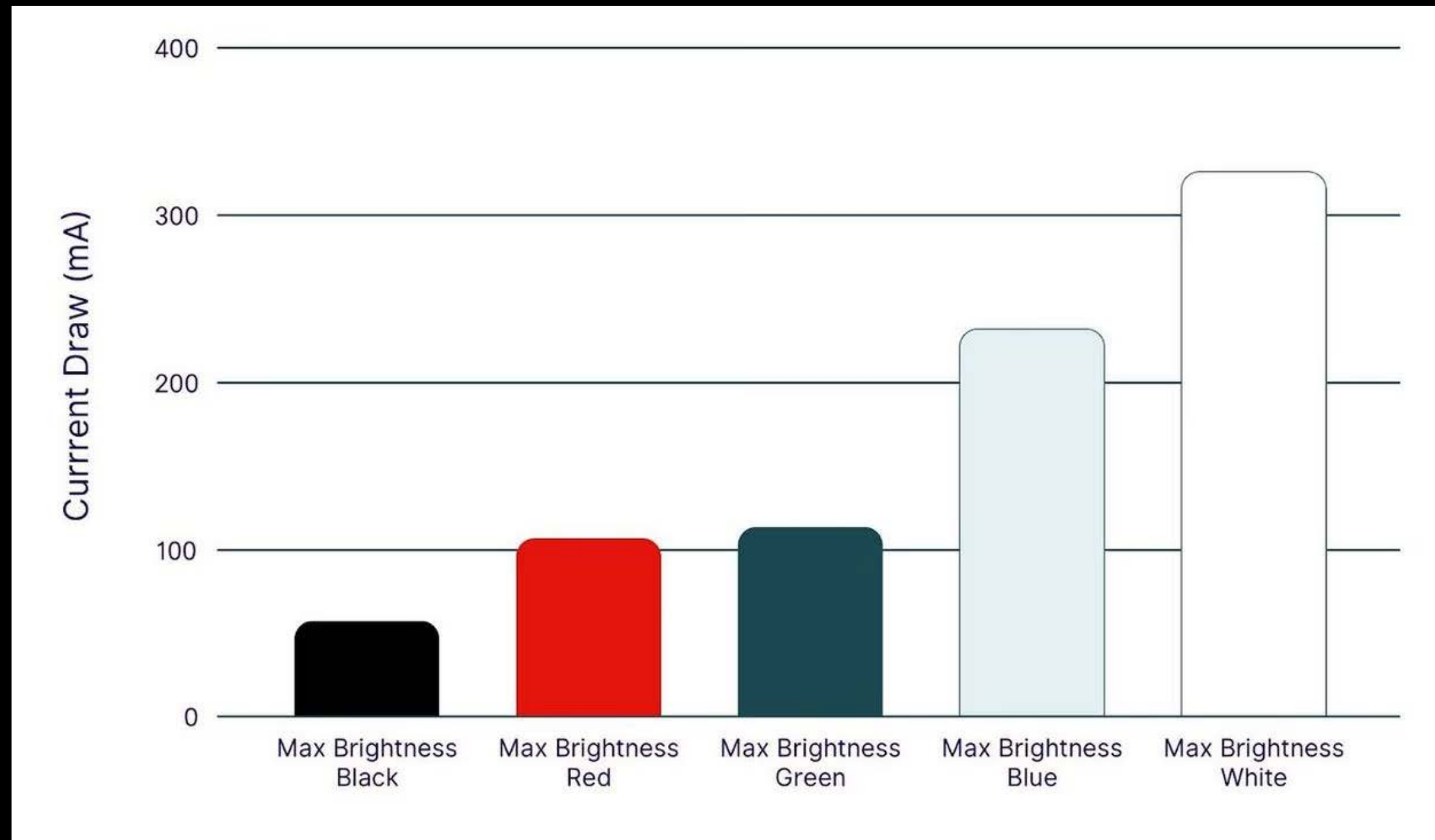
- Fonts

system > hosted online

WOFF2 > WOFF > TTF

	TTF	WOFF	WOFF2
Arial	1.03 g	0.50 g (-51%)	0.43 g (-58%)
Times New Roman	0.97 g	0.50 g (-48%)	0.45 g (-54%)
Helvetica	0.89 g	0.54 g (-39%)	0.35 g (-61%)
Roboto	0.47 g	0.26 g (-45%)	0.18 g (-62%)
Montserrat	0.55 g	0.27 g (-51%)	0.17 g (-69%)

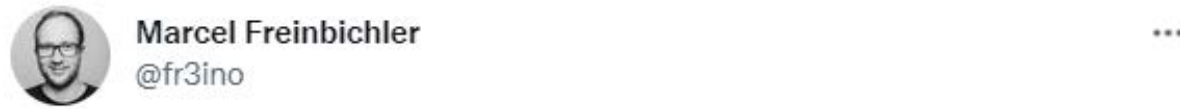
Colors



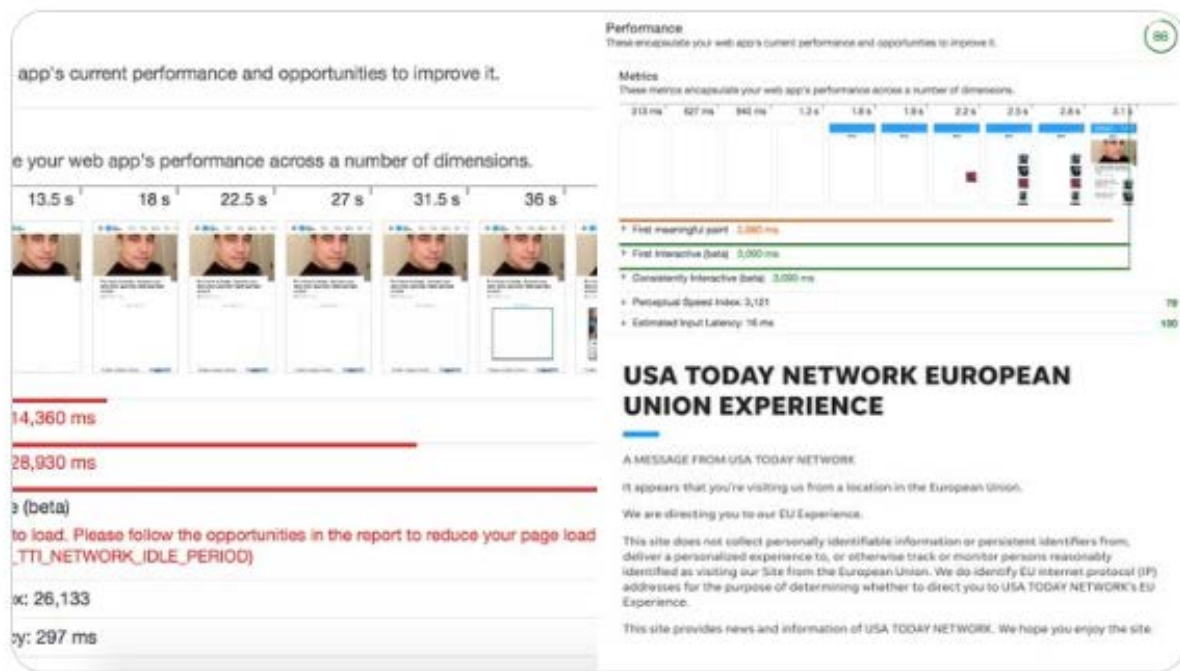
Hosting

- Power usage effectiveness (PUE)
- Renewable energy
- Planting trees, green employee behaviour policy
- The Green Web Foundation
- Seravo from Finland, S4 Hosting from Lithuania, Strato from Germany, Krystal Hosting from the UK

User data collection

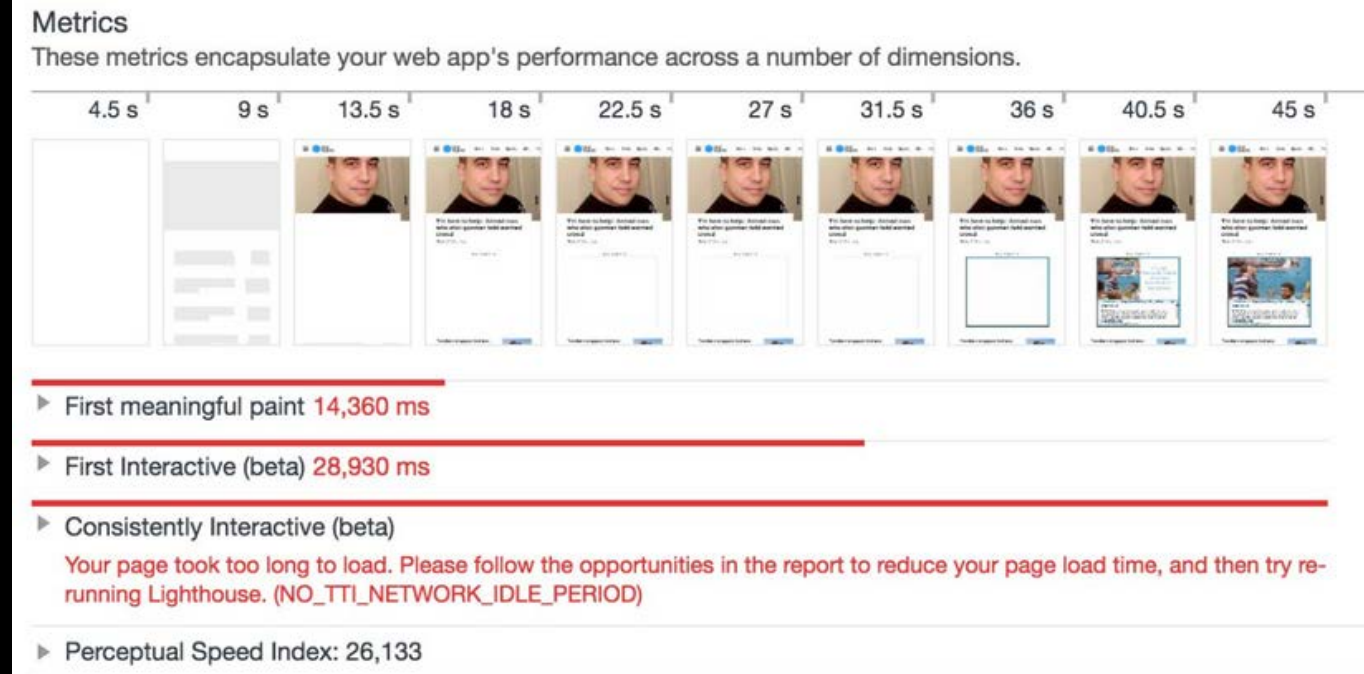


Because of #GDPR, USA Today decided to run a separate version of their website for EU users, which has all the tracking scripts and ads removed. The site seemed very fast, so I did a performance audit. How fast the internet could be without all the junk! 🙄
5.2MB → 500KB



2:05 AM · May 26, 2018 · Twitter Web Client

21.9K Retweets 1,901 Quote Tweets 32.9K Likes



Why?

1

carbon footprint
mitigation

2

electrical energy
savings

3

shorter loading
time

53%

of users can be lost if a website
loads longer than in 3 s

Why?

1

carbon footprint
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4

better SEO

ec0lint

- Linter
- Proposes possible code improvements to mitigate the carbon footprint of websites and make them more sustainable
- ec0lint (eslint) + ecolint-style (stylelint)

```
src/index.css
```

```
13:25 ✘ Format of image files can be changed to WebP or SVG. CO2 reduction:  
up to 99% of the image file. lighter-image-files
```

```
16:43 ✘ Format of the custom font can be changed to WOFF or WOFF2. CO2 redu  
ction: up to 80% of the font file. no-ttf-font-files
```

```
D:\repo\bitehack-2021\app\src\functions.js
```

```
1:1 error Do not import axios. Remove it from your app and use fetch inste  
ad (you can find examples on http://ec0lint.com/features). CO2 Reduction: up t  
o 0.21 g lighter-http
```

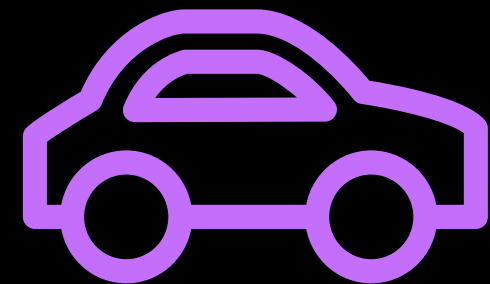
Features

- Replacement of heavy libraries functions
- Font format validation
- Font source validation
- Require font display
- Image format validation
- Video format validation
- Number of videos and images
- Video autoplay
- Lazy loading
- Color control
- Dark mode control
- CO2 module
- CI/CD report
- Angular plugin
- React plugin
- IDE plugins

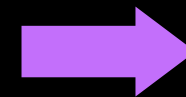
Environmental impact

for 250 000 websites:
54 mln kg CO₂

driving 220 mln km by a
gasoline car



220 mln km



-88%

driving 26 mln km by a
gasoline car



26 mln km

Get started

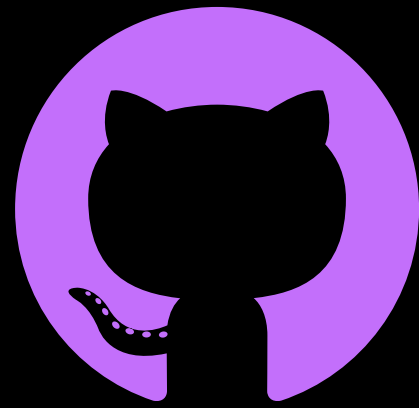
```
npm i eslint eslint-style eslint-style-config-recommended
```

```
npm init @eslint/config
```

```
npx eslint .
```

```
npx eslint-style "*/*.css"
```

Scaling



github.com/ec0lint

- Open-source tool
- Development with the help of community
- Everyone can contribute

References

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