Sustainable Software

The case for transparency in software energy consumption

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Standard-Slide to start with :)

Short-Info - Arne Tarara / Green Coding Berlin

- Software-dev 16+ years
- Founder & CEO **Green Coding Berlin GmbH**
  - We help companies and devs to measure and optimize CO2/energy of their digital infrastructure

KDE Eco - Contributor

Green Software Design - Community Leader

SDIA - Member

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Software uses energy

To make software more sustainable we need to make its consumption visible.

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... so what tools do already exist?

Easy starter: Scaphandre - Hubblo

open-source RAPL based command line tool

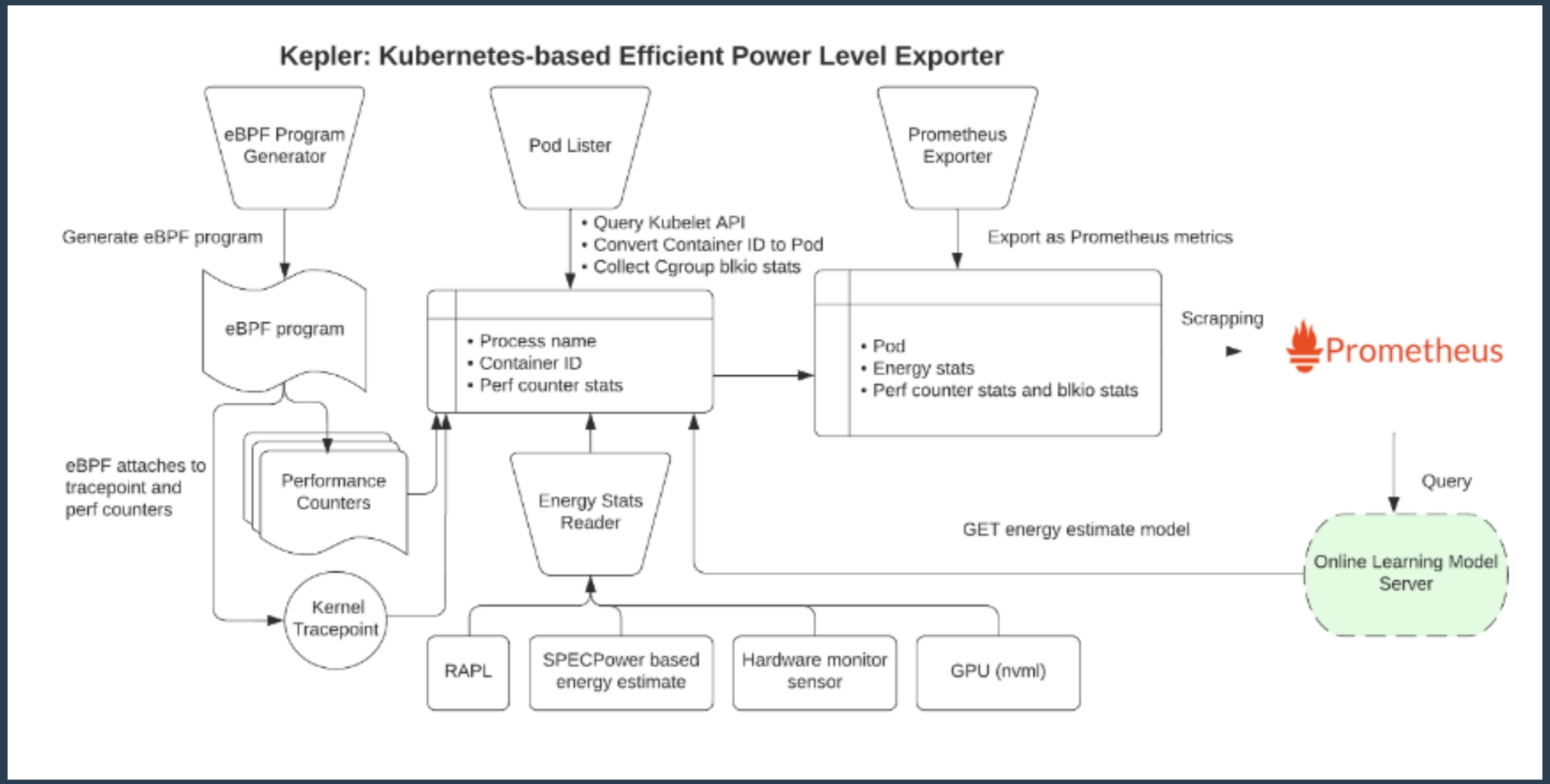
- Neat feature: Can split by process

```
Host:   13.1463 W
        package         core            dram            uncore
Socket0 13.1463 W |     10.879847 W     0.748591 W      0.071402 W

Top 5 consumers:
Power           PID     Exe
10.400553 W     16621   "stress"
2.08011 W       16610   "scaphandre"
0.166408 W      2786    "gnome-shell"
0.083204 W      3915    "Xwayland"
0.041602 W      4621    "guake"
----------------------------------------------------------------
```

Distributed Environments / Clusters

Introducing Kepler

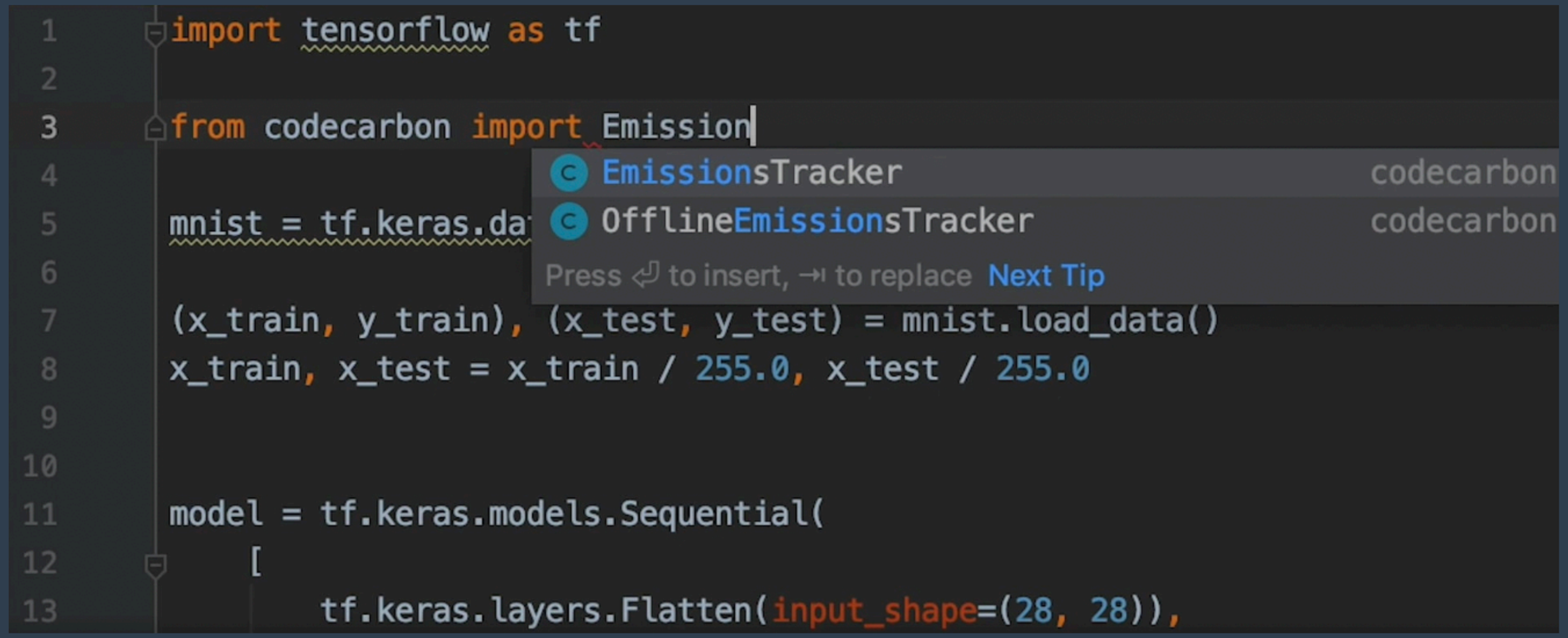


http://sustainable-computing.io

Ready to use tools

codecarbon.io

- Python
- RAPL-based
- NVIDIA GPU support



Weitere Tools ...

for questions regarding a specific tool, please ask in the Q&A!

- powertop
- powermetrics
- Cloud Carbon Footprint
- turbostat
- powerJoularX
- PAPI
- ...

These are nice tools

So why do we need another one?

USPs of Eco-CI and Green Metrics Tool (GMT)

Increasing transparency & reproducibility

- GMT is designed to compare applications (standard usage scenarios)
- GMT is designed to publicise data
- GMT is designed to compare architectures
- GMT is an all-in-one solution: Frontend, Measurement, API & Statistics
- GMT enforces best practices to make measurements reproducible

- Eco-CI works in CI/CD pipelines where a lot of energy is consumed

Demo Time

Introducing Eco-CI and Green Metrics Tool

-

https://www.green-coding.berlin/#projects

Thank you & time for Q&A

Want to support the project or more details?

- Website / Blog / Newsletter: https://www.green-coding.berlin
- Demo Open Data Repository: https://metrics.green-coding.berlin

- Our projects: https://www.green-coding.berlin/#projects
- Our Case-Studies: https://www.green-coding.berlin/case-studies

- Meetup Group (Berlin): https://www.meetup.com/green-coding

- https://www.linkedin.com/in/arne-tarara / arne@green-coding.berlin

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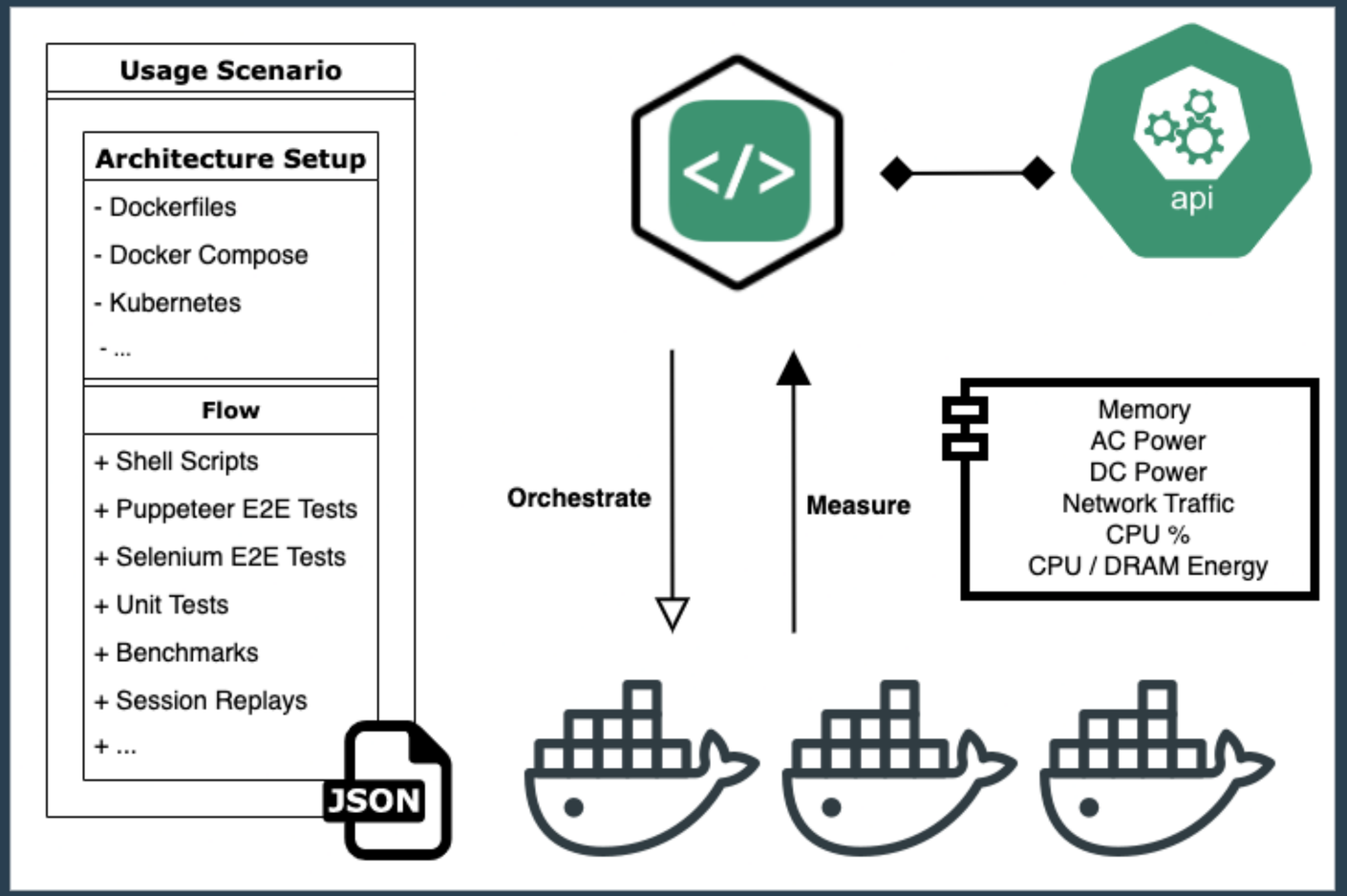
Backup

Green Metrics Tool

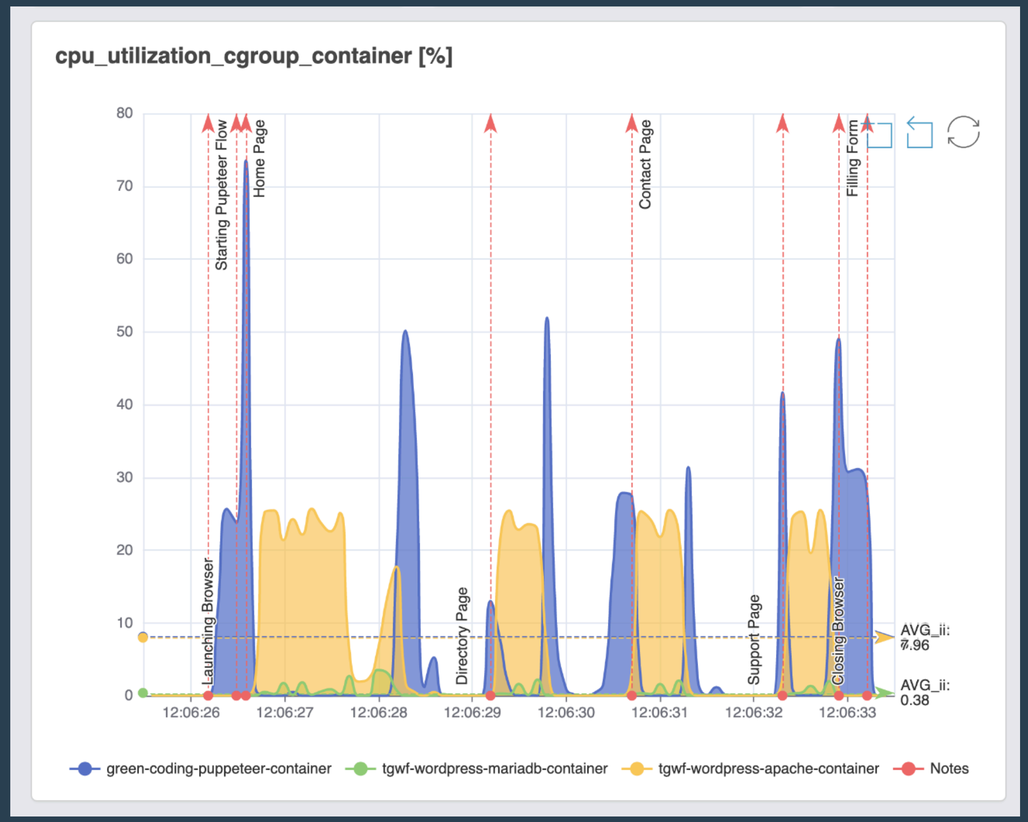
Ingesting standard infrastructure files. Output as POSIX stream

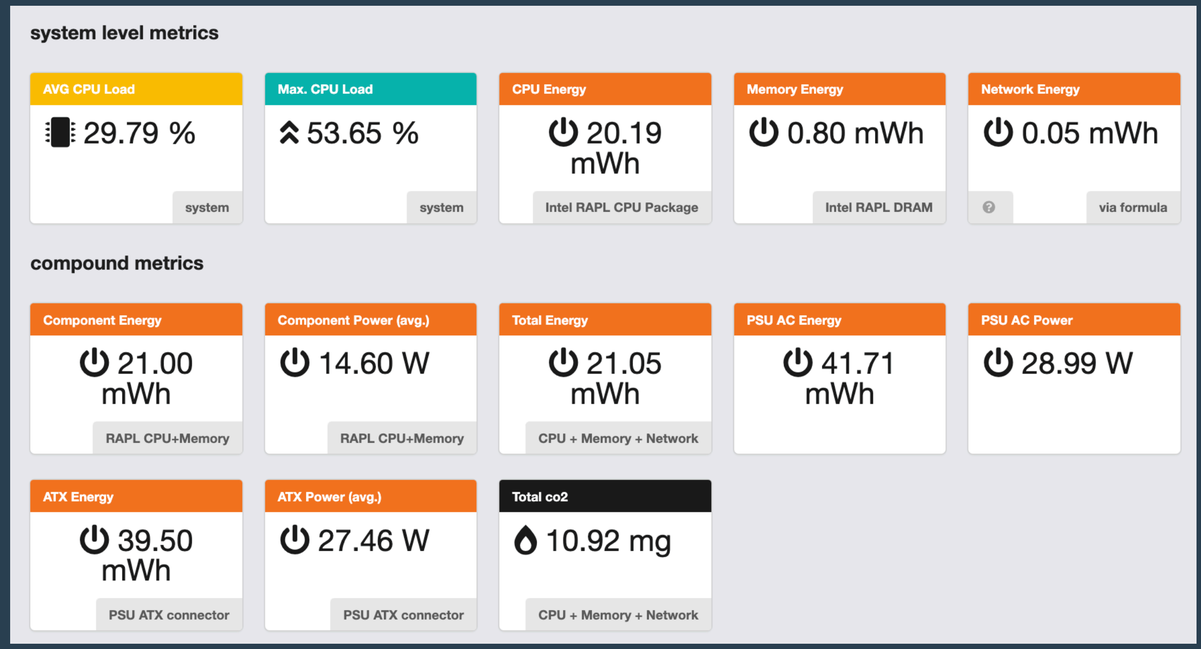


Potentiale von Infrastrukturen

Identifizierung der Auslagerungsfähigen Komponenten

- Isolierte Messungen der Energie und Auslastung von Microservices





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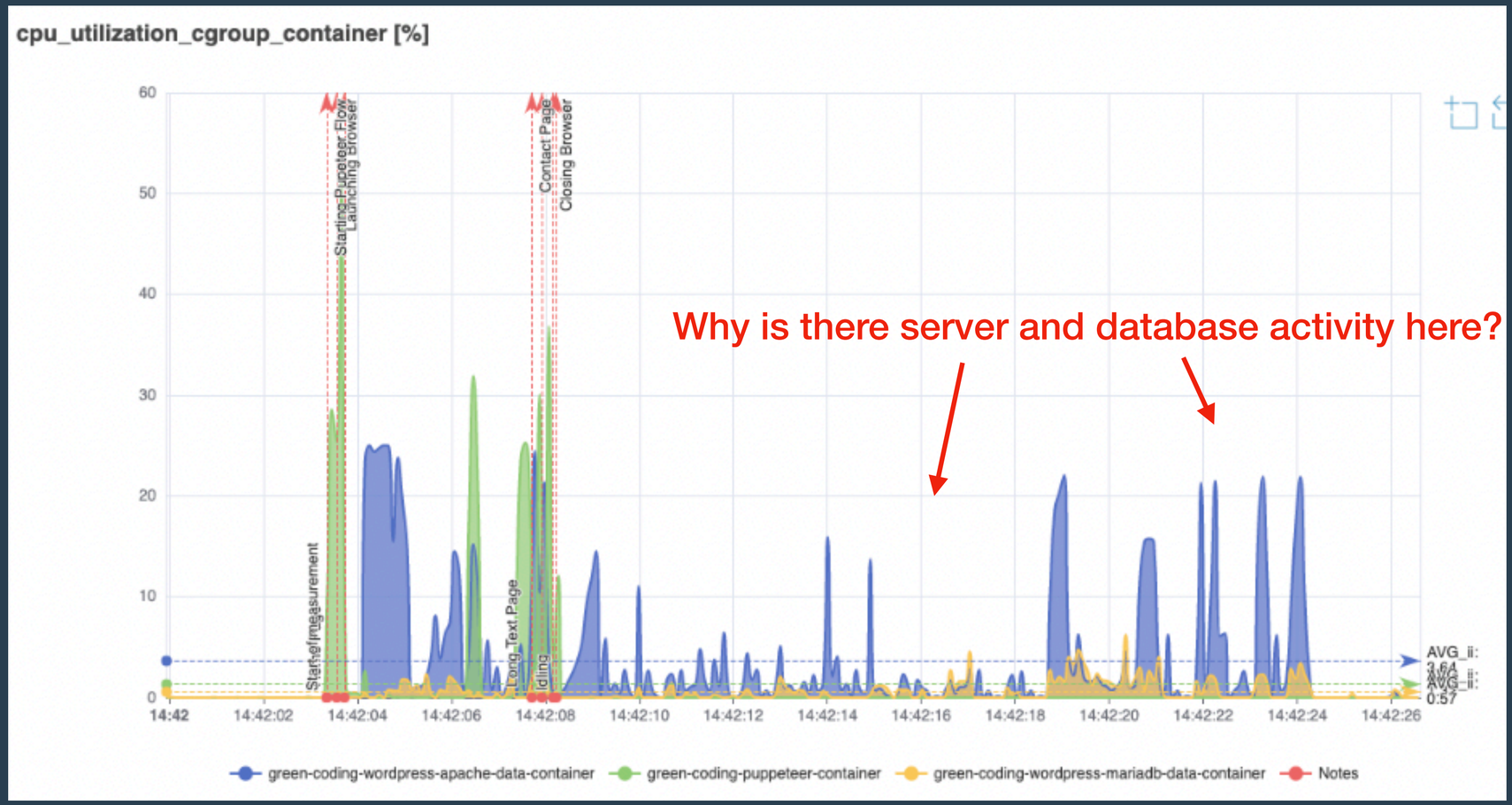
Potentiale in Web-Applikationen

Idle-Time Optimierungen / Energy-Bugs



Use-Case mit Wordpress / Django Community

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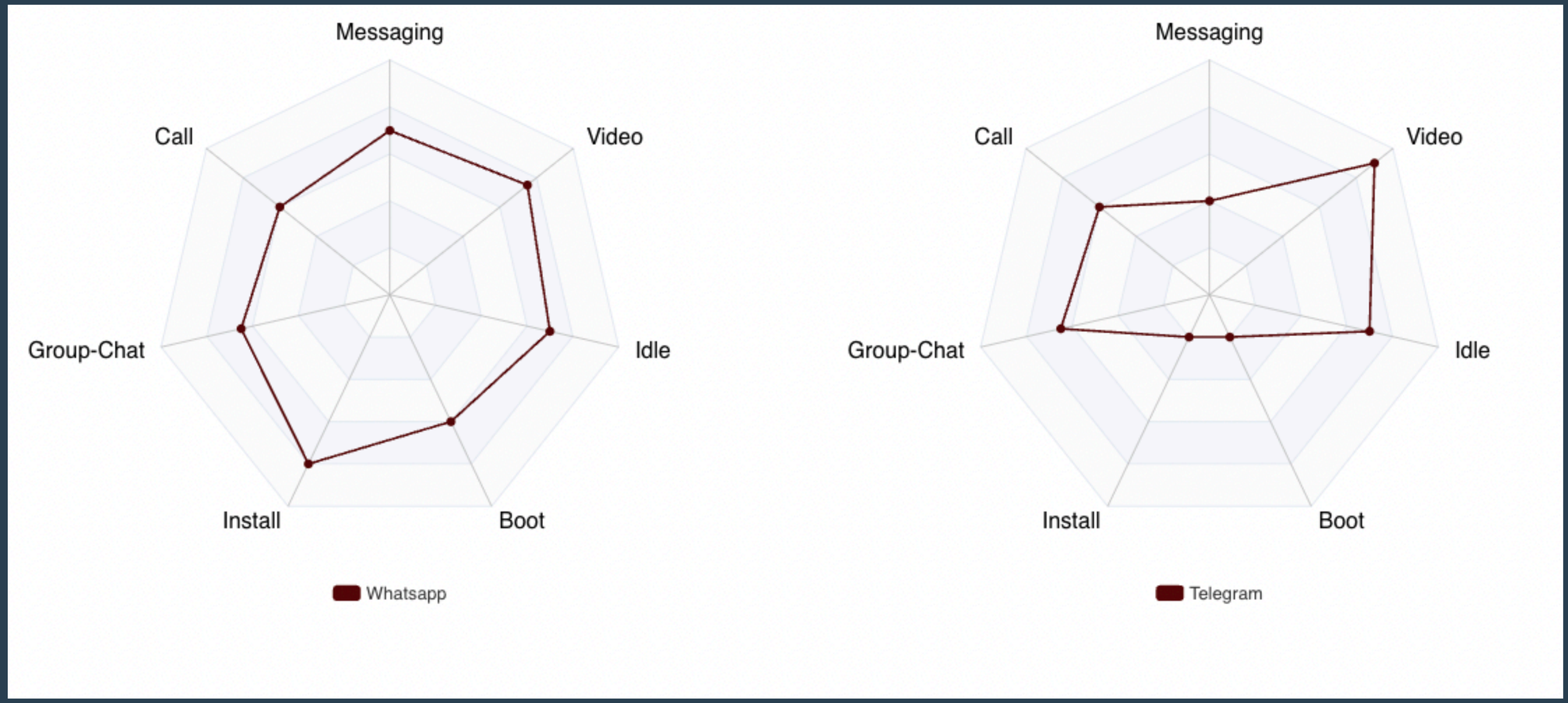
Stellen wir uns eine Welt vor ...

In der der Anwender Software einfach vergleichen kann

No actual data! Concept picture!



Energy consumption of Whatsapp vs. Telegram - per usage scenario

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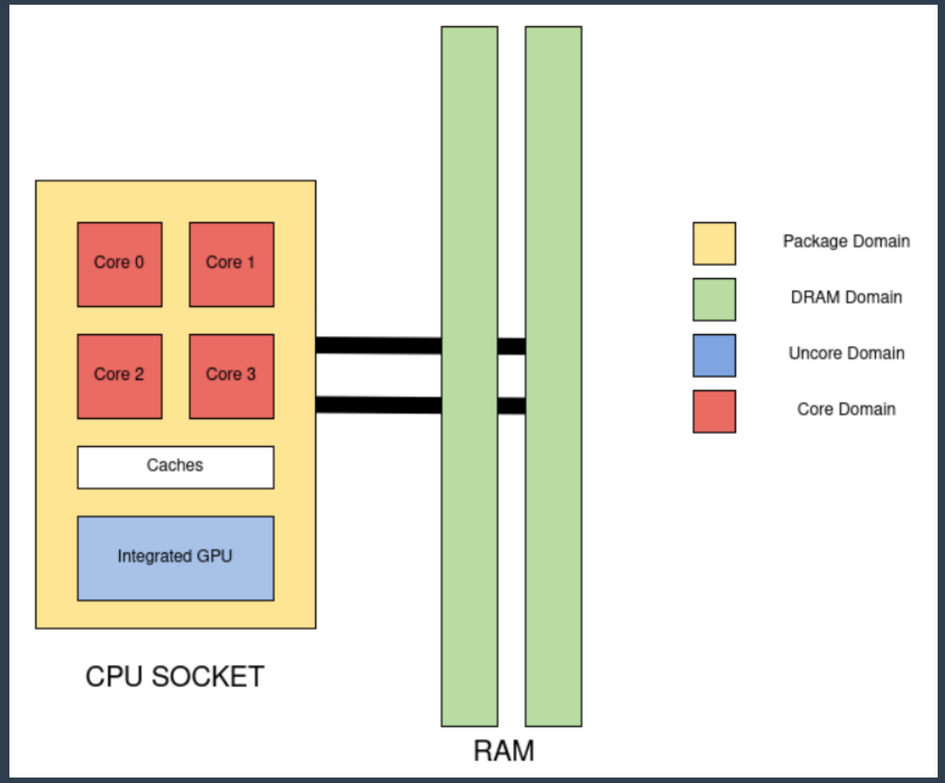
Details on RAPL

The most used technology atm

- Energy measurement capabilities on most modern Intel/AMD processors
- Measure:
  - CPU Energy per Core / Package
  - RAM
  - Integrated GPU
- Software model of capacitor readings on mainboard
  - Resolution 1ms / 15.3 microJoules
- Exposed in Linux kernel through device



Source: https://pyjoules.readthedocs.io/en/stable/devices/intel_cpu.html

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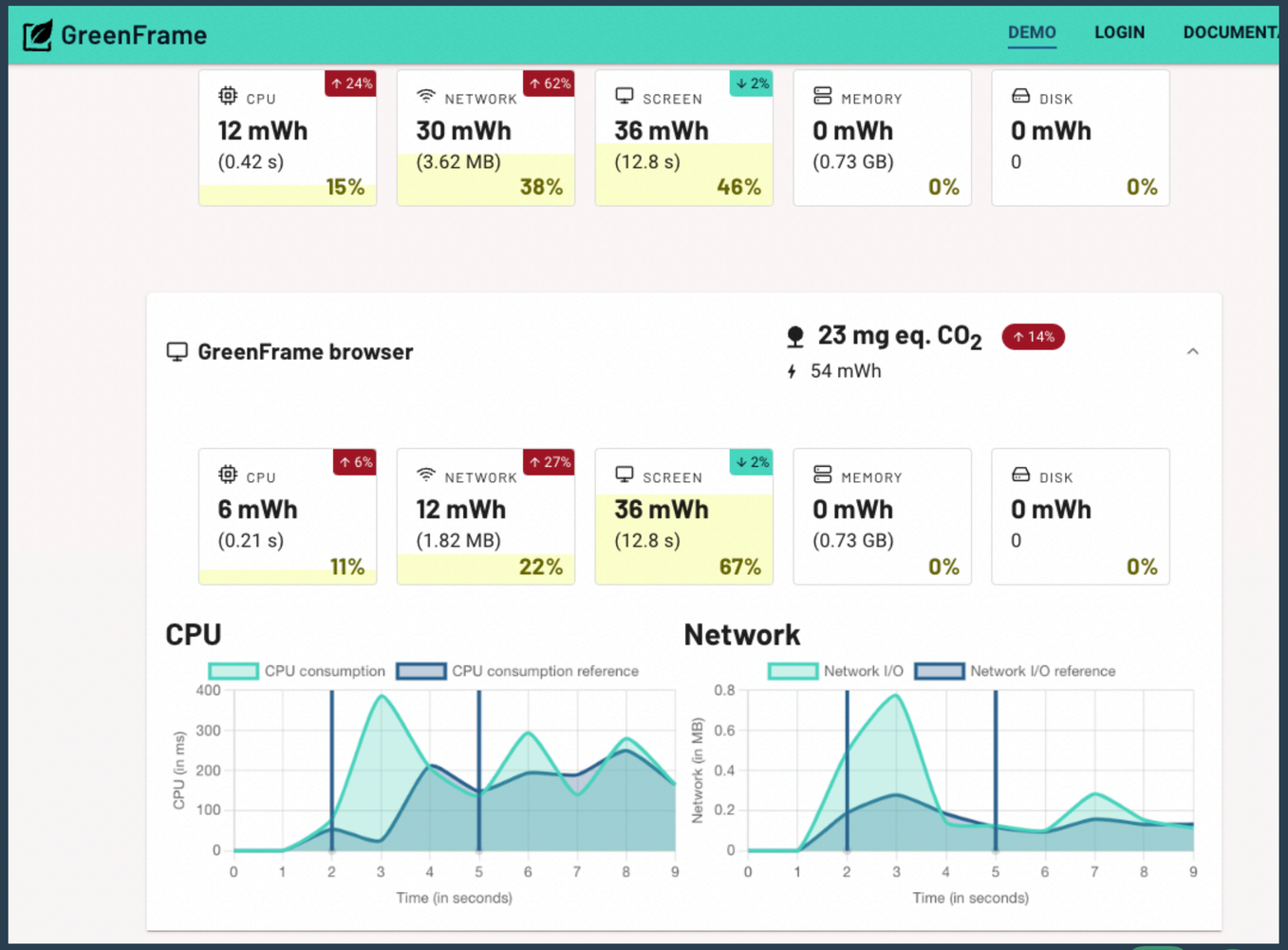
Greenframe.io

centralized but non-open measurement service



Why not upstream to greenframe.io

We wanted to!

- At the time of starting the Green Metrics Tool greenframe.io was not open source
- We contacted the company if they open-source it, but got no response
- Now the Green Metrics Tool is more advanced and STILL more open than greenframe.io
  - greenframe.io only estimates. no measurement
  - Server code is not on Github

Static Site Potentiale

Caching and pre-rendering

- Wordpress vs. Cloudflare [HUGO]
  - 5-fache Ersparnis pro Anfrage
  - Netto-Gewinn schon ab der ersten Anfrage
  - Das komplette Rendern der statischen Seite kostet so viel wie eine dynamische Anfrage bei Wordpress

https://www.green-coding.berlin/case-studies/wordpress-vs-hugo-cloudflare/

- Durch Mögllchkeit des Serverless Hosting kann sich der Server zwischen den Anfragen ausschalten

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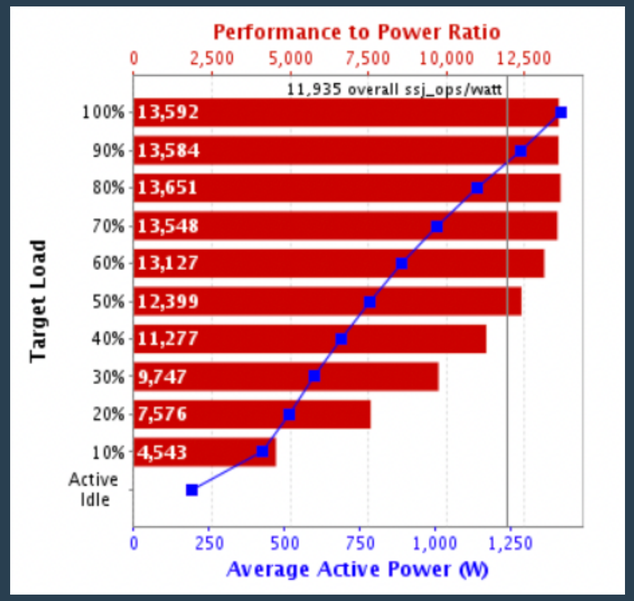
Zusammenspiel von Hardware und Software

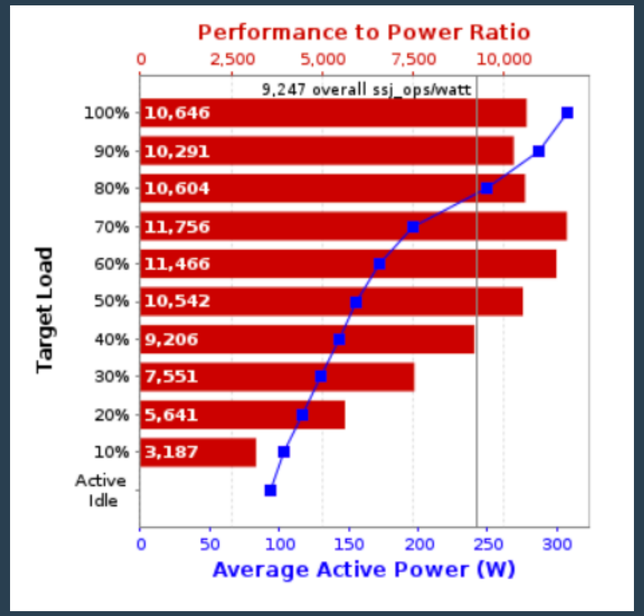
Datenbanken für Energiekennlinien durch Hardware und Konfiguration

High Idle, but almost linear



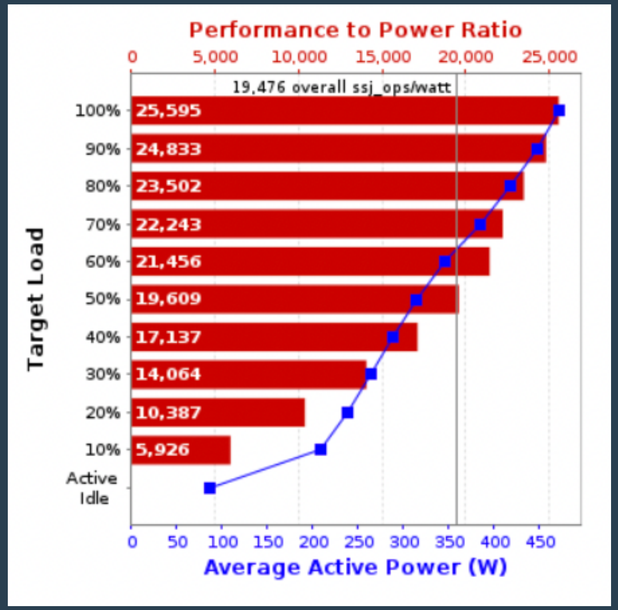
ASUSTeK Computer Inc. RS720Q-E9-RS8 (2019)

50% Power increase at 70% uttilization



Hewlett Packard Enterprise ProLiant DL110 Gen10 Plus

Idle optimized



QuantaGrid D43K-1U (2022)