

The state of Green Washing - or how to build sustainable systems with Kubernetes

Max Körbächer | Liquid Reply

Max Körbächer - Co-Founder @



My work is all about

Kubernetes Consultancy & Cloud Native Advisory

CNCF TAG Environmental Sustainability Co-Chair,
CNCF Ambassador, LF Europe Advisory Board,
Contributed 3y to the Kubernetes release team



 maxkoerbaecher

 mkoerbi



The Challenges



Global Data Centers

Consuming around **2%** of the global energy.

Expected to grow within the next couple of years by **additional 2%**.

Some forecast assume a peak of **12%** of the consumed energy by 2024

*treat this numbers with care, studies to this are old



Data, Distribution and Digitalization

The explosion of **data generation, connecting everything and the digital opening** of not yet well connected countries will lead to an **exponential growth**.

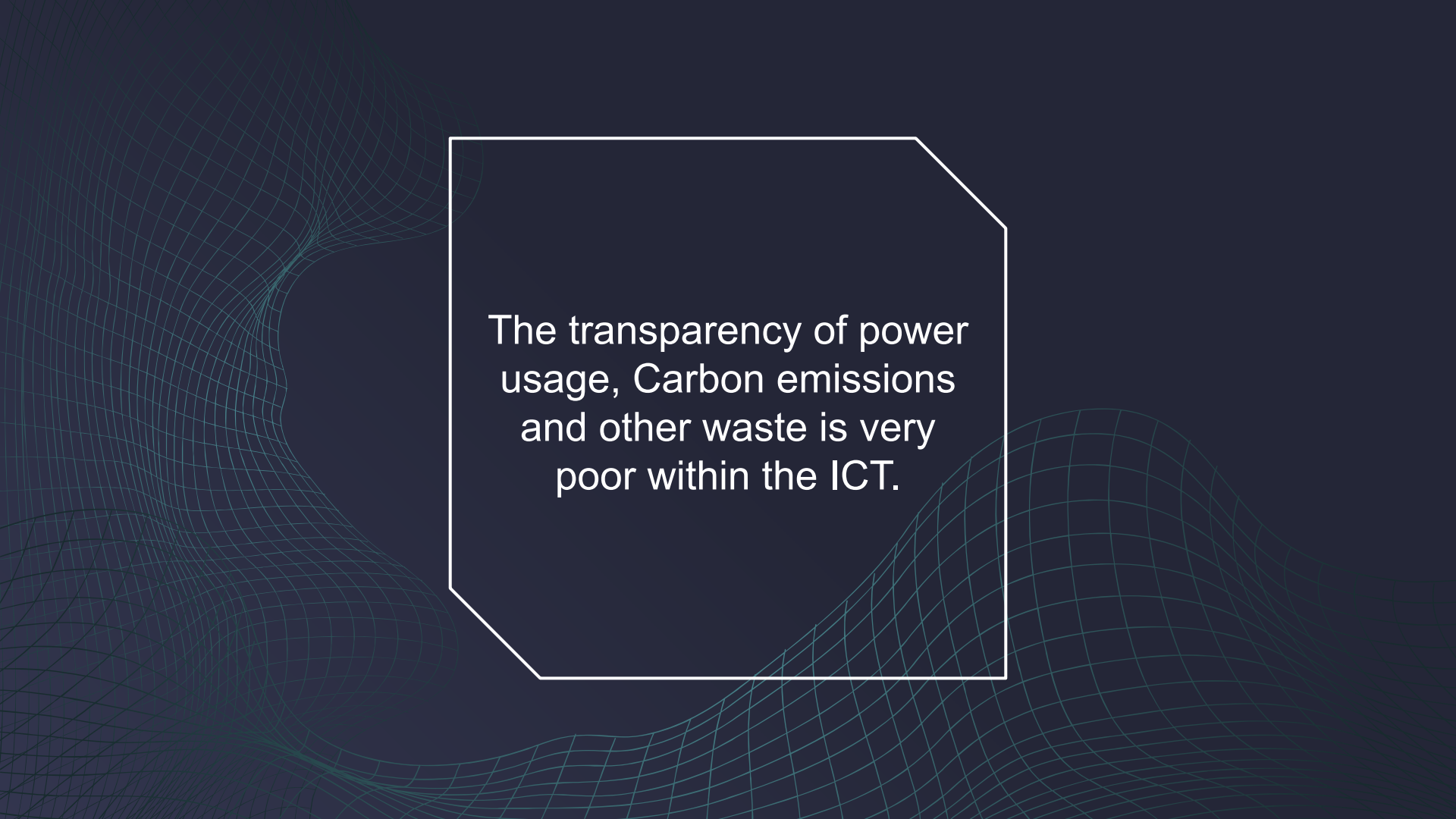
Old systems and hardware as well as data center are not very efficient.



Carbon emissions are everywhere

Carbon emissions are caused in **any step of the production** of products and services.

This also counts for IT. The **major part** of carbon emissions are caused by the production of chips, server and other hardware components.



The transparency of power usage, Carbon emissions and other waste is very poor within the ICT.

A missing link:

Data about energy
consumption

TO

Data on caused CO₂
emissions per kWh



Kubernetes provides a unified approach to integrate various solutions and to make them act on each other.*

*yes, we still need better data at the node level, beyond this, only the creativity is a limit

What to consider

Time to act! You don't have to be an ESG expert, to do the right things ;)

The Cloud Native “Can and have to”

Can do*

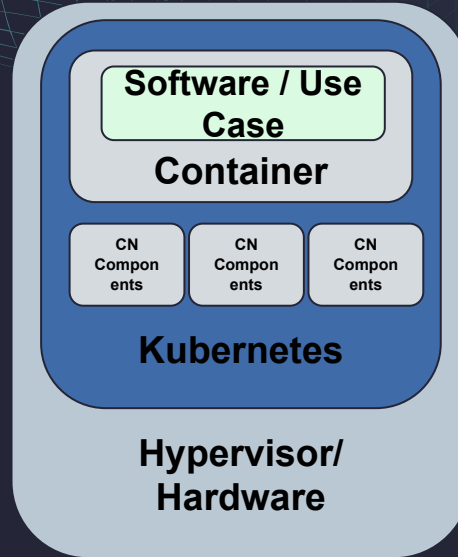
Optimize Container Images

Schedule containers for high density

Scale containers to zero

Scale clusters to zero

Optimize nodes, HW (e.g. ARM based) and OS



Have to*

A future without container?

Schedule based on carbon data

Scale based on carbon data

Design architectures for sustainability

Improve power management

*selection of topics that are obvious



Scale, reduce & rightsize



Change hardware or compute architecture



Adjust systems architecture



Optimize Software



Scale, reduce & rightsize

Approach

Measure resource consumption.
Identify what you eliminate entirely.
Implement event, time or metrics based scaling.

Solutions

- Autoscaling Groups
- Karpenter
- kube-green
- KEDA
- kepler
- scaphandre

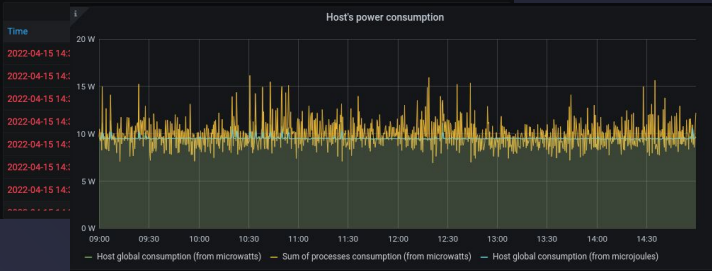
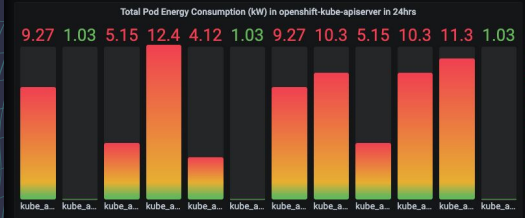
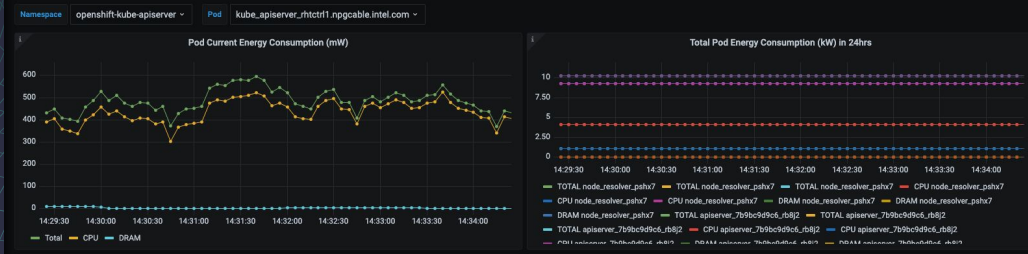
Impact

Drastic consumption reduction.
Easy to achieve, potential for further improvement over time.

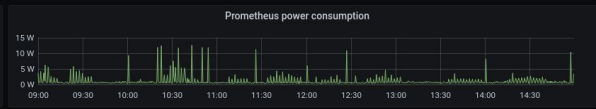
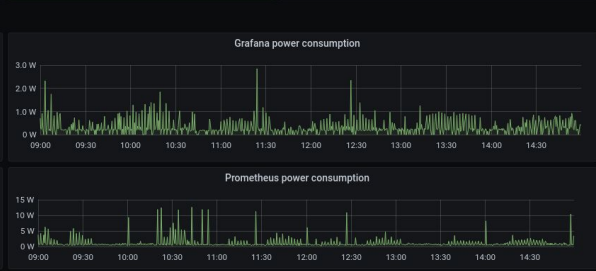


Scale, reduce & rightsize

monitoring / Kepler Exporter Dashboard



Top consumers		
awx-manage	grafana-server	redis-server
3.6	3.1	0.89
Scaphandre version		Welcome!
0.11		Hubblo's CI/CD energy dashboard
This dashboard's metrics are provided by scaphandre . Contributions and feedbacks are more than welcome!		





Change hardware or compute architecture

Approach

Switch to more efficient CPU, Memory & Storage. Utilize event driven or serverless solutions.

Solutions

- AWS Graviton
- (just the latest instance type)
- Fermion Spin
- OpenFaas
- “Green” Regions

Impact

Reduce required runtime & energy. Depending on effort invested, can have similar good impact as scaling & reduction.



Adjust systems architecture

Approach

Change system configuration, HA, used middleware solutions, data formats, storage options and so on.

Solutions

- Stateless
- Reduce transmitted data
- Implement more lightweight tools

Impact

Complicated approach that requires a well thought through plan.
Minimal to large reduction of energy demand.



Optimize Software

Approach

Rewrite software with more efficient algorithms, libraries or “better” programming languages.

Solutions

← ???

And change the whole solution design, as mentioned before.

Impact

High effort to implement those changes, except software is already highly modular and can be adjusted.


MYTHBUSTERS

Good ideas but not calculated till the end

- I. **Time-shifted jobs** - 0 benefits for you, most likely even the CSP doesn't recognize the impact
- II. **Relocation or follow the sun** - might save you some coins, but is it green to shift data?
- III. **Optimize for costs will optimize for CO2e reduction** - possible, but optimize for CO2e reduction can be even most costly

WHOA!

As you saw, you don't have to be an
ESG expert to do the right things ;)



**It's a movement and
need all of you to
cause a change**

To drive this change we have
founded the CNCF TAG
Environmental Sustainability



TAG ENVIRONMENTAL
SUSTAINABILITY



Talk with us on the
CNCF Slack, find a team
to work with or show us
your ideas!

[#tag-environmental-sustainability](#)



Find us on the CNCF
GitHub, discuss current
working artifacts and
review our deliverables.

<https://github.com/cncf/tag-env-sustainability>



Join our mailing list
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THANKS!

Does anyone have any questions?

Max Körbächer



maxkoerbaecher



mkoerbi