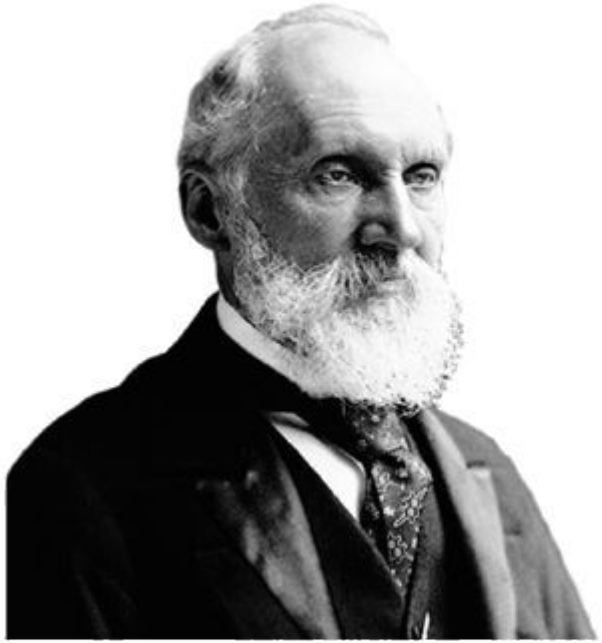


To measure
is to know.
If you can not
measure it,
you can not
improve it.
– Lord Kelvin

DENERGIUM

Digital Energy Optimum

Hervé MATHIEU - CEO

09/2023

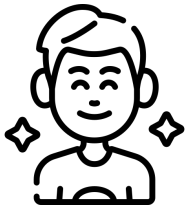
DENERGIUM history

2023

Financial

Regulation

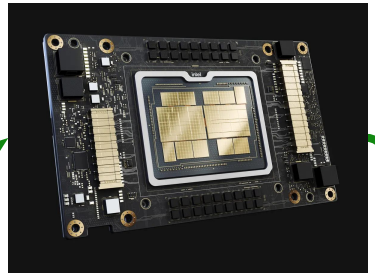
Impact



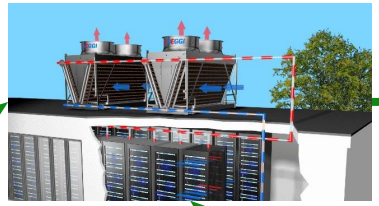
The energy chain of datacenters

Users

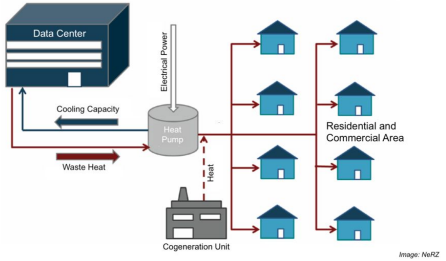
Servers / Processors

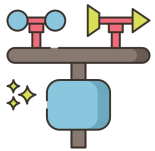


Cooling system

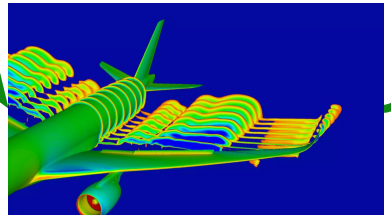


Fatal waste heat





Weather conditions



Applications (software)

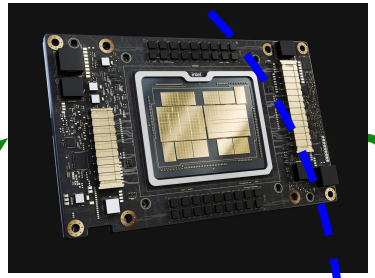
Servers cabinet

On Premise energy production

The energy chain of datacenters

Users

Servers / Processors



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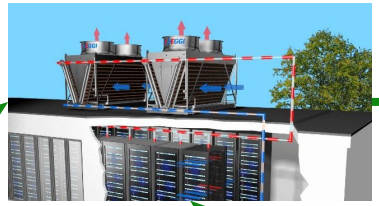

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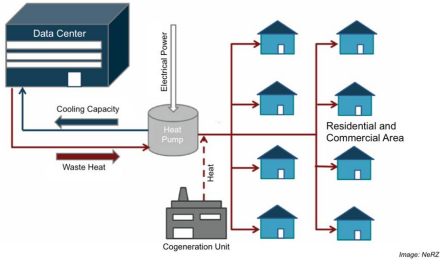
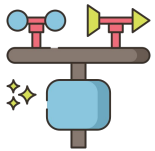
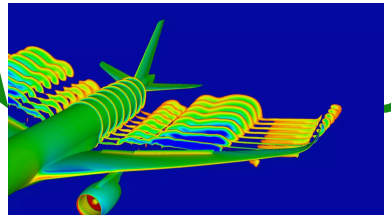




Weather conditions

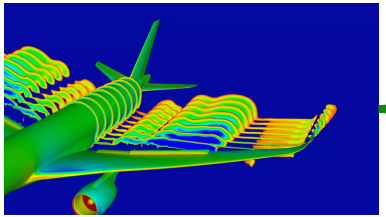


Applications (software)

Servers cabinet

On Premise energy production

How to measure?



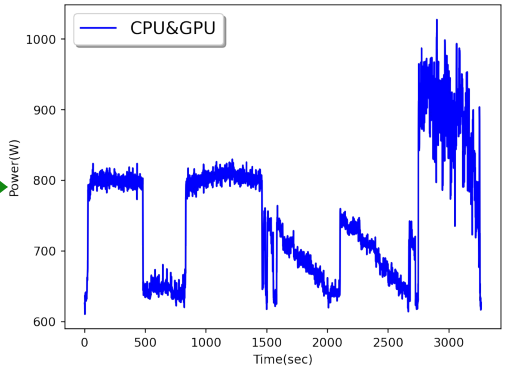
less intrusive

Power Distribution Unit (PDU) Watt meter

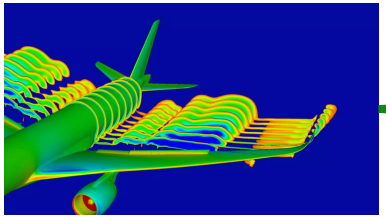
BMC / IPMI

Internal Registers

Finer grain



How to measure?



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Power Distribution Unit (PDU) Watt meter

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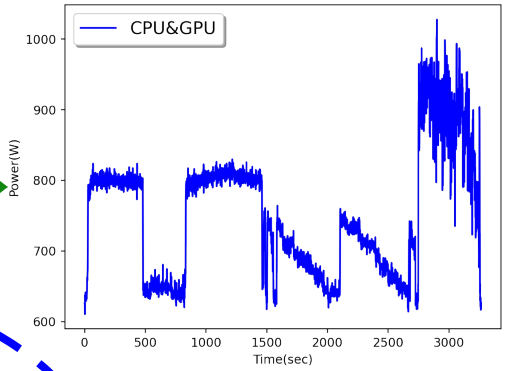
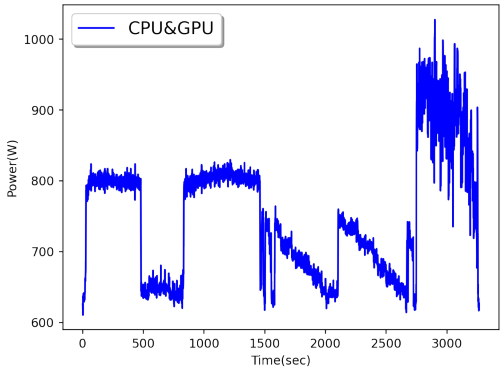


The energy signal acquisition

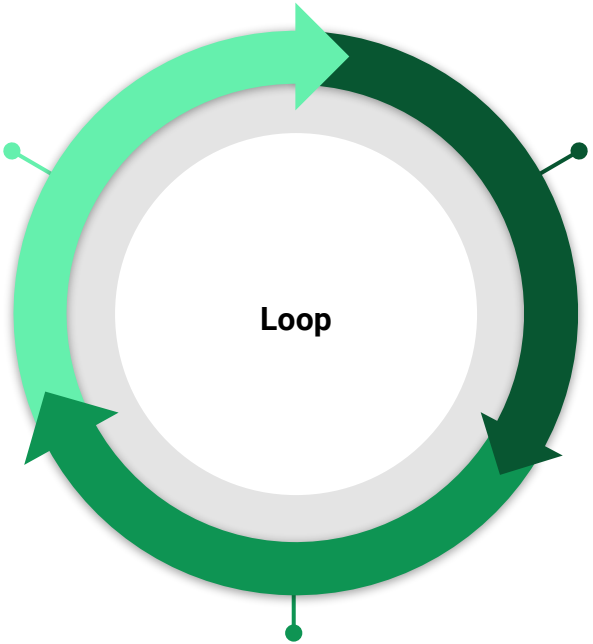
- Frequency: 1 kHz - 1 Hz - 0.1 Hz
- Quantification: 1 joule (1 W.s)
- Amount of data for 1000 servers / Year @1 Hz: ~8 TeraB

Why is it not so easy?

- Measure perimeters between processors & GPU are not the same
- Core data can be temperature for Intel, Joule for AMD, none for GPU



The Energy-To-Solution Optimization Loop



Data acquisition
reliable, without overhead…

Modelisation
From processor measure to applications, to global consumption…

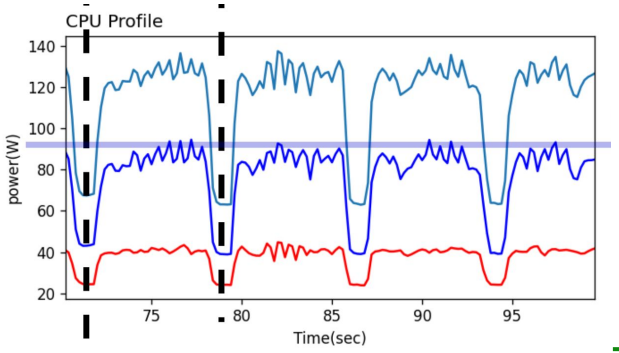
End user point of view

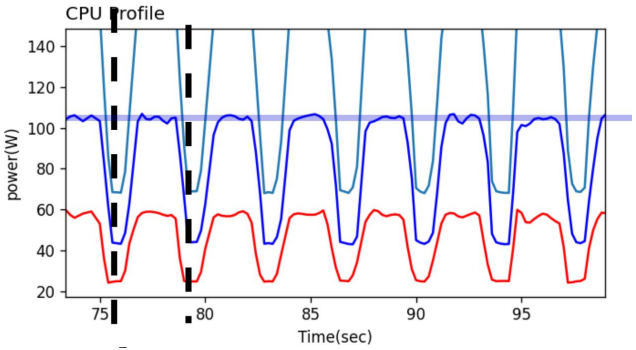
Server owner point of view

Action
Monitoring, Application Profiling, Power capping, Servers configuration, Alert…

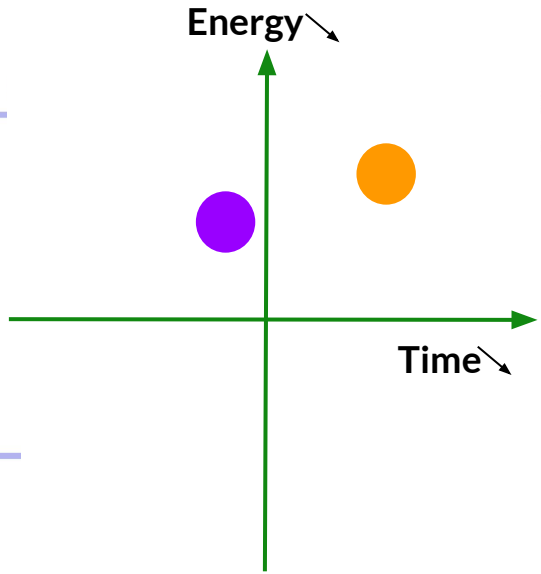
Energy-To-Solution

Same application result
Above without AVX-512
Below with AVX-512
Duration (/ 2), Energy (-40%)

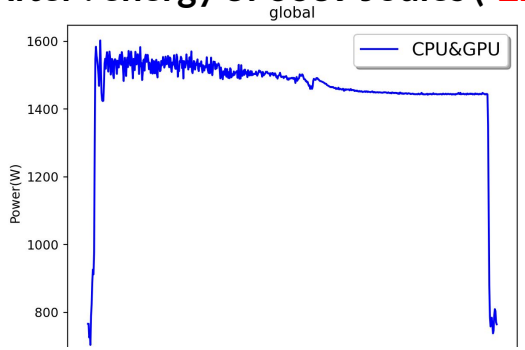


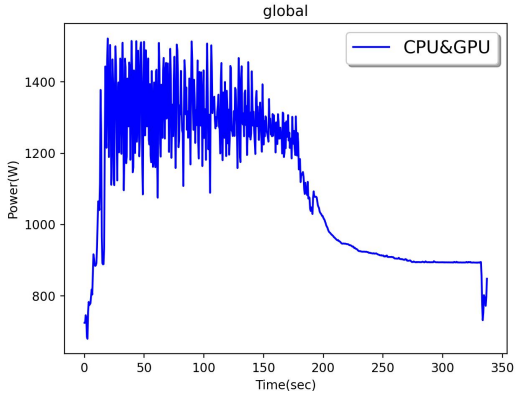


GAIN

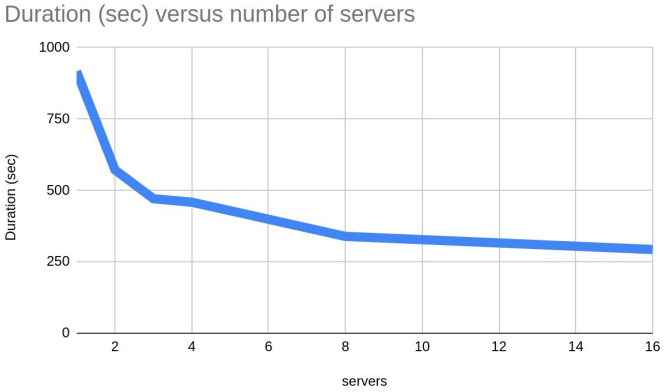


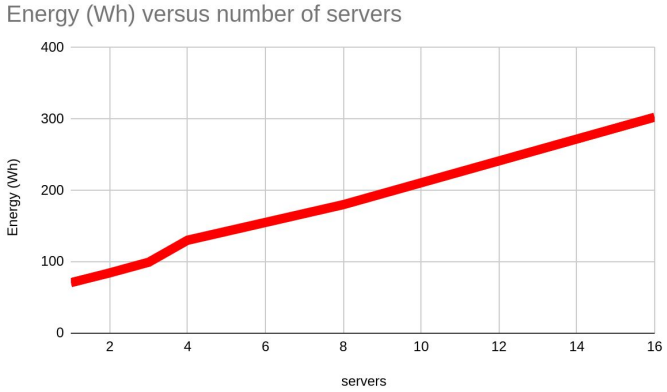
Same application result
Almost same duration (+2%)
Before : energy 485795 Joules
After : energy 376639 Joules (-22%)

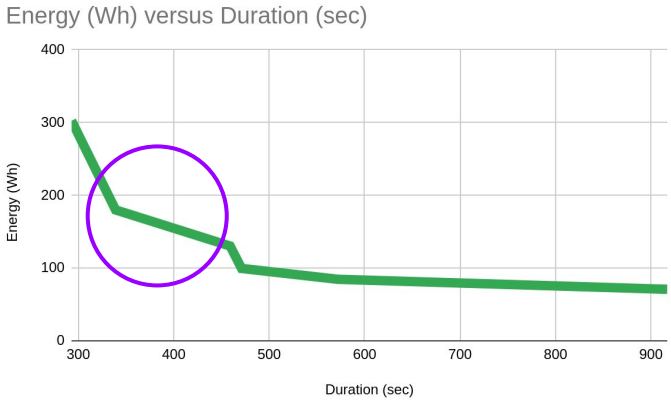




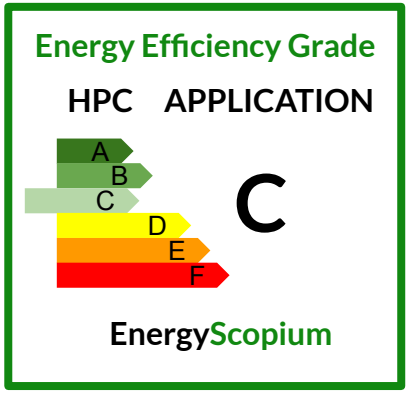
What is the energy cost to win 100 seconds by adding servers?

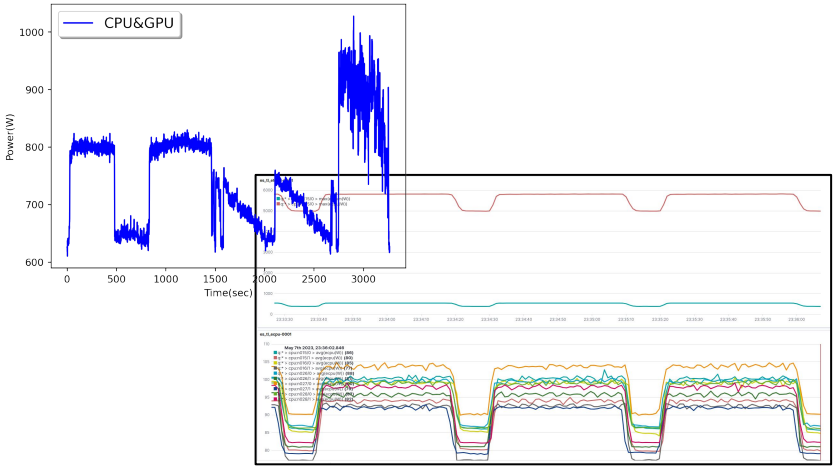






The EnergyScopium software suite (meli melo)



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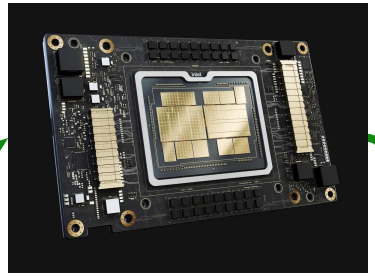
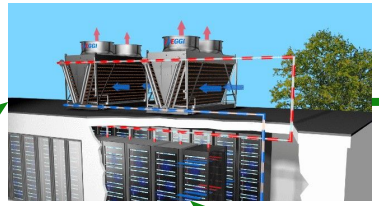
The energy chain of datacenters

Users

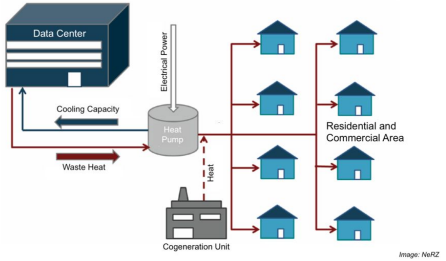
Servers / Processors

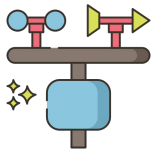


Cooling system

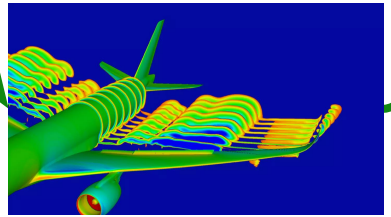


Fatal waste heat





Weather conditions

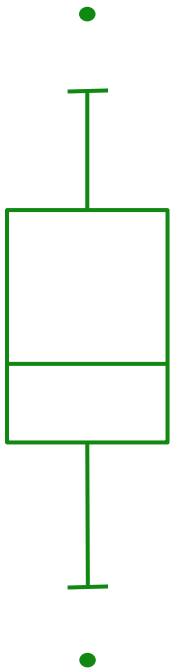


Applications (software)

Servers cabinet

On Premise energy production

The Box-Plot representation



Outliers

Maximum

Q3 third quartile

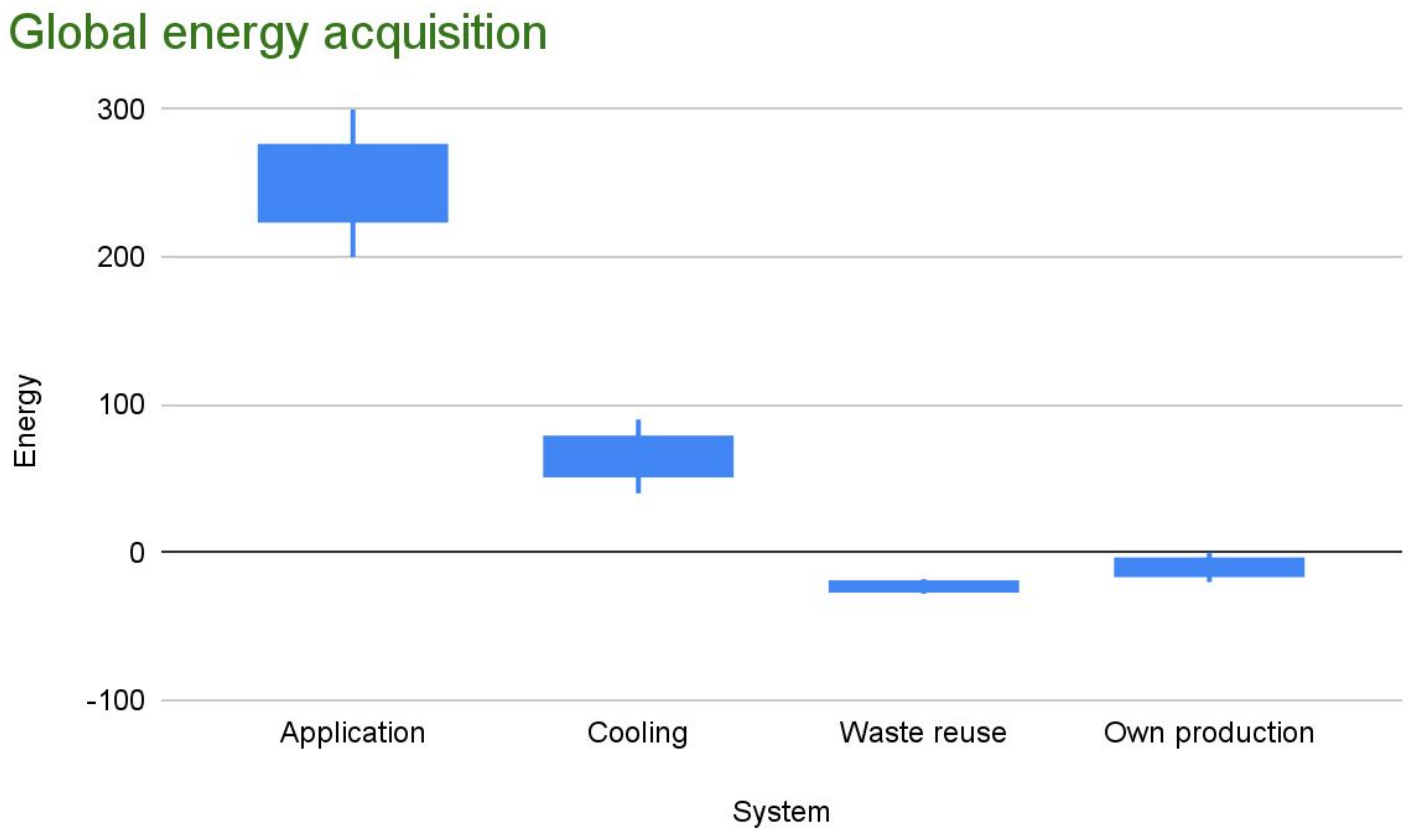
Median

Q1 first quartile

Minimum

Outliers

The energy acquisition



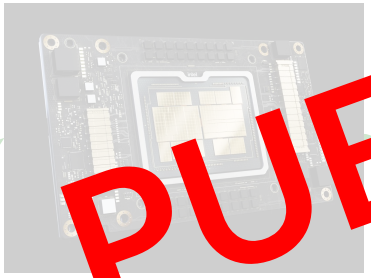
What is next?

Servers / Processors

Cooling system

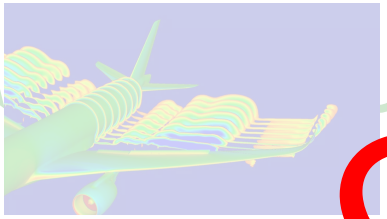
Fatal waste heat

Users



PUE = f(t)

Global Optimization



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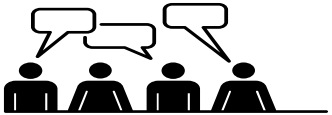

Thanks for your attention

- Credits (icons): Freepik, SyafriStudio - Flaticon
- Kelvin: https://www.incrementalhealthcare.com/qtvideo/smart-technology-for-nutrition-tracking/
- Users: Guiicons.com
- Application (Sofware): cfd : airbus.com
- Servers / Processors: Ponte Vecchio : PHOTO-ILLUSTRATION: INTEL CORP.
- Servers cabinet: https://mediatheque.inria.fr/Mediatheque/media/38324
- Cooling system: https://www.filiere-3e.fr/2021/11/15/dossier-refroidir-efficacement-les-datacenters/
- Weather station https://www.flaticon.com/free-icons/meteorology (Meteorology icons created by Flat Icons)
- Fatal waste heat: https://international.eco.de/topics/datacenter/white-paper-utilization-of-waste-heat-in-the-data-center/
- On Premise energy production: https://fr.123rf.com/photo_13007600_panneaux-solaires-et-%C3%A9olienne.html

Together, let's consume digital better!

Hervé Mathieu

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