SiA
Nationaal Regieorgaan Praktijkgericht Onderzoek
RAAK MKB

The impact of Green Software

Greening the Cloud Experiment results

GREENING
THE CLOUD

Giuseppe Procaccianti

VU UNIVERSITY AMSTERDAM

Presentations are in order

- Dr. Giuseppe Procaccianti
- Postdoc, Software and Services
- Contact me:
  - g.procaccianti@vu.nl

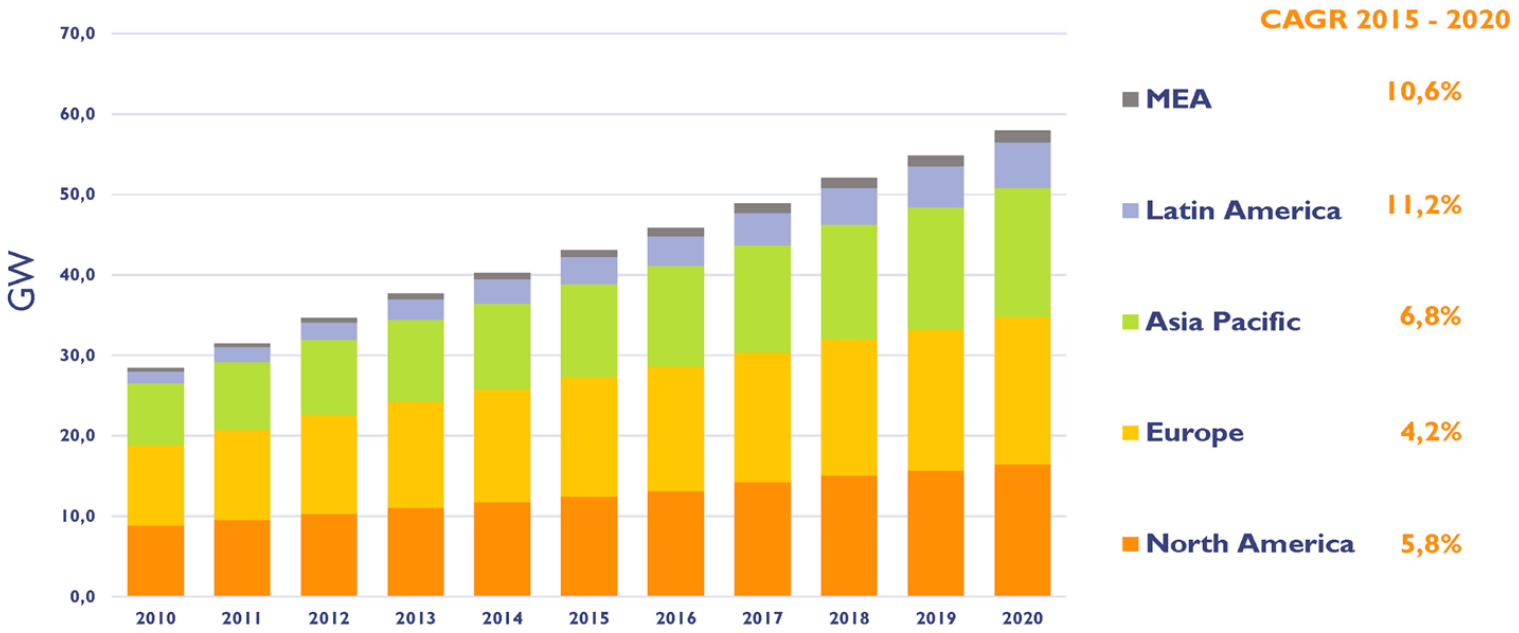
Agenda

- Software is wasting energy
- The Greening the Cloud project
- The Green Lab
- The impact of Green Software
- Final remarks

Datacenters are energy-hungry

WORLDWIDE DATA CENTER FACILITIES – POWER NEEDS IN GW

(Source: New Technologies and Architectures for Efficient Data Center report, *July 2015, Yole Développement)*



With no slowdown in new facility construction, data centers worldwide will have an increasing need for power.

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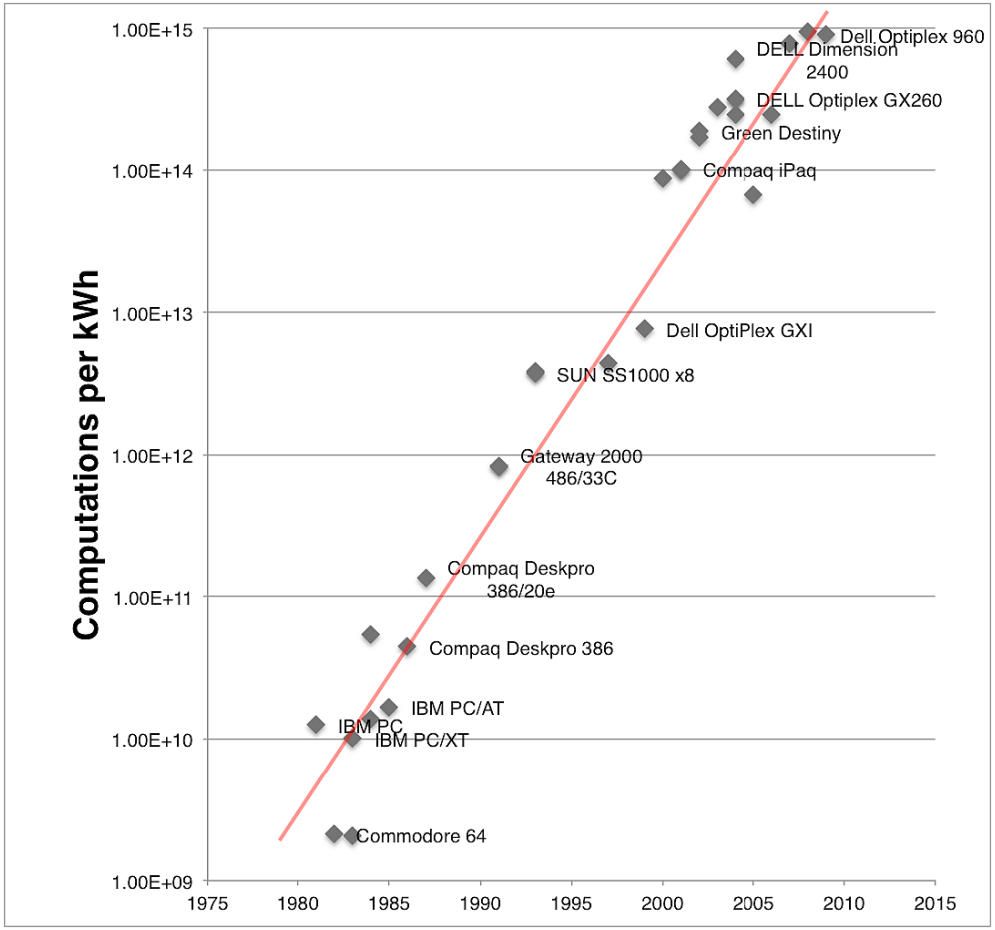

"The energy efficiency of hardware doubles every 1.5 years."

(Koomey's law)

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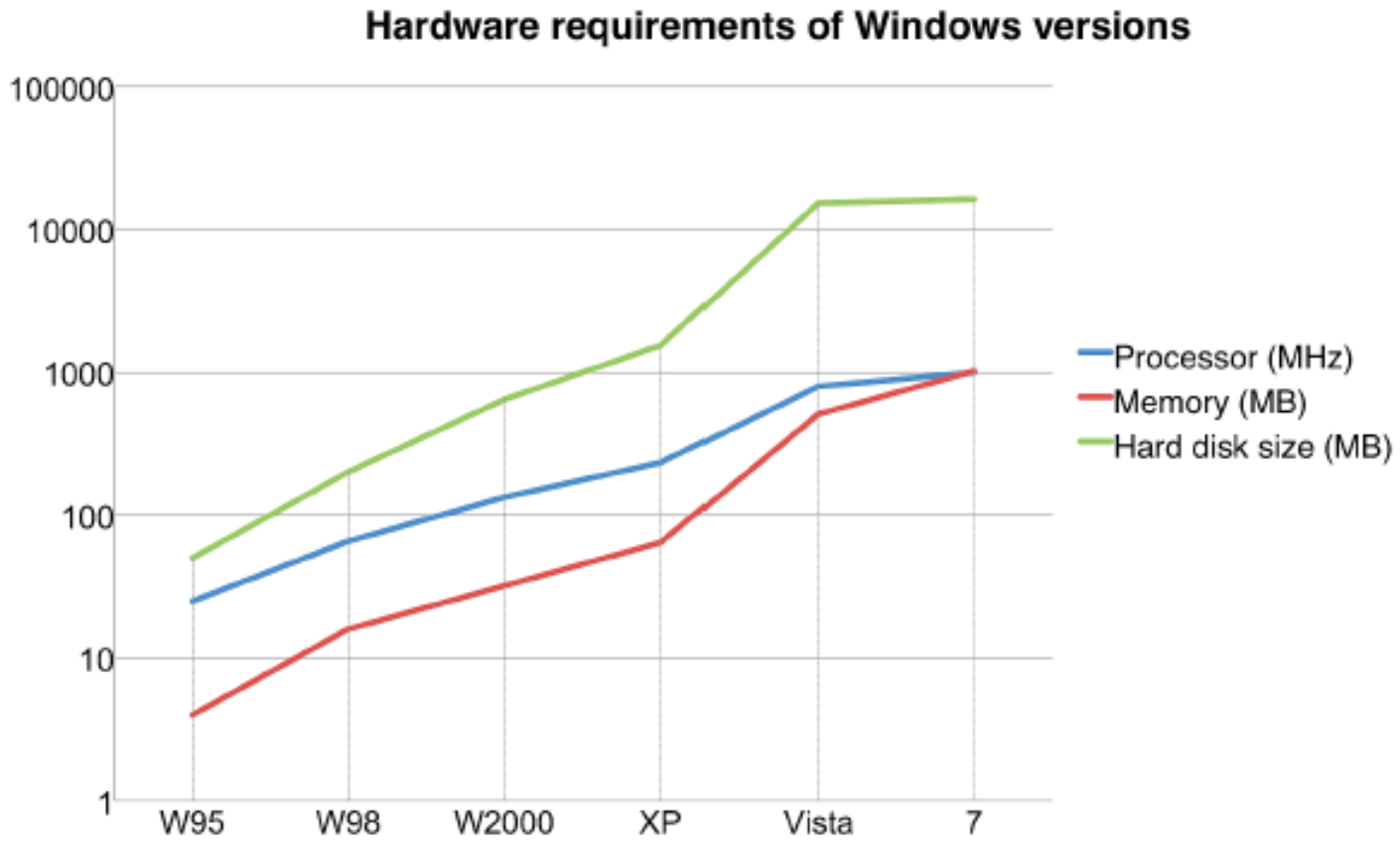
"Software gets slower more rapidly than hardware gets faster."

(Wirth's law)

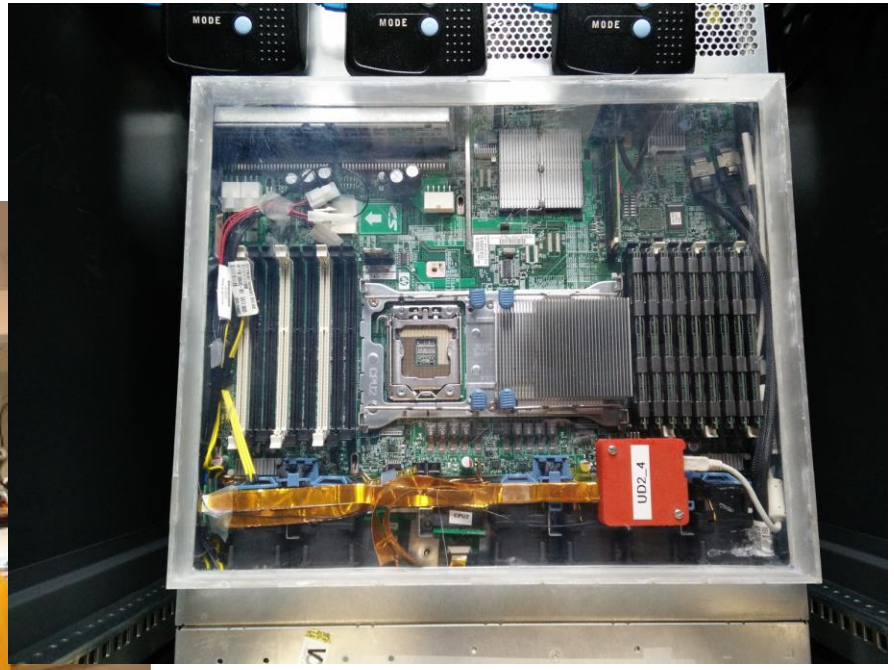


RAAK Project Greening the cloud

Objective: Support (i) cloud providers and (ii) cloud software developers to increase software energy efficiency.

Partners:

SEFLab measurement servers



The Green Lab

- Our platform for researching energy-efficient software
- We measure real software solutions
- Powered by SEFLab

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Efficient Database queries:

-25%

Efficient multi-threading:

-8%

Efficient ORM strategies:

-60%

Efficient Web pages:

-46%

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Efficient Database queries [1]


```
select SQL_NO_CACHE a.old_id from text a, revision b
where a.old_id = b.rev_text_id
order by a.old_id;
```

[1] Procaccianti G., Fernandez H., Lago P. *"Empirical Evaluation of Two Best-Practices for Energy-Efficient Software Development"*. *Journal of System and Software*, 2016. Pre-print available on: http://dare.ubvu.vu.nl/handle/1871/54184

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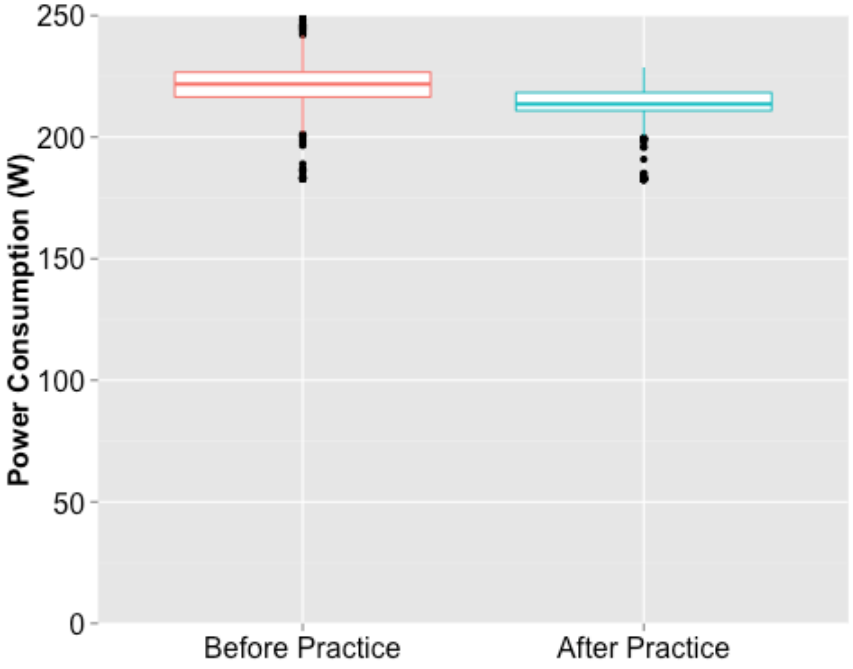
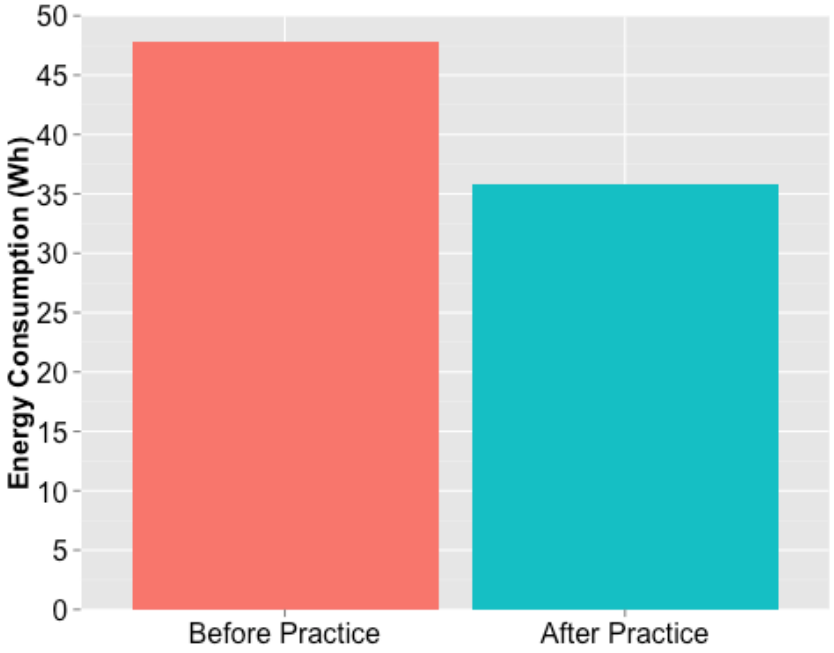
Efficient Database queries [1]



3% Power savings



25% Energy savings

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Efficient Multithreading [1]


```
     * might get lost.
     */
    apr_sleep(TASK_SWITCH_SLEEP);
    apr_pool_destroy(process->pool); /* and destroy all descendent pools */
    apr_terminate();
    exit(process_exit_value);
}

static process_rec *init_process(int *argc, const char * const * *argv)
{
```

[1] Procaccianti G., Fernandez H., Lago P. *"Empirical Evaluation of Two Best-Practices for Energy-Efficient Software Development"*. *Journal of System and Software*, 2016. Pre-print available on: http://dare.ubvu.vu.nl/handle/1871/54184

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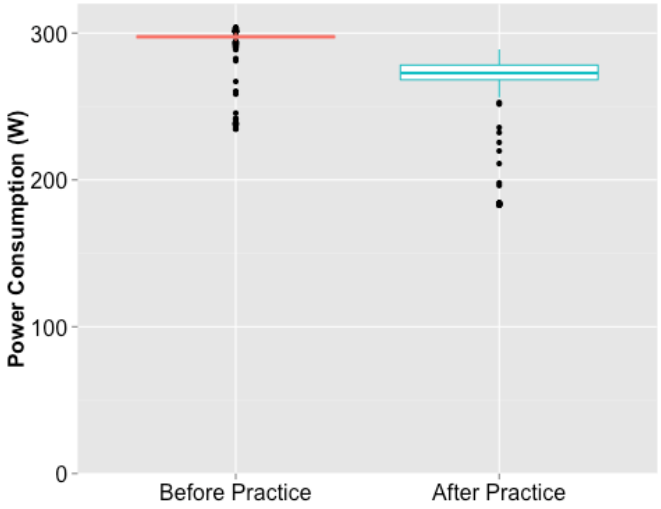

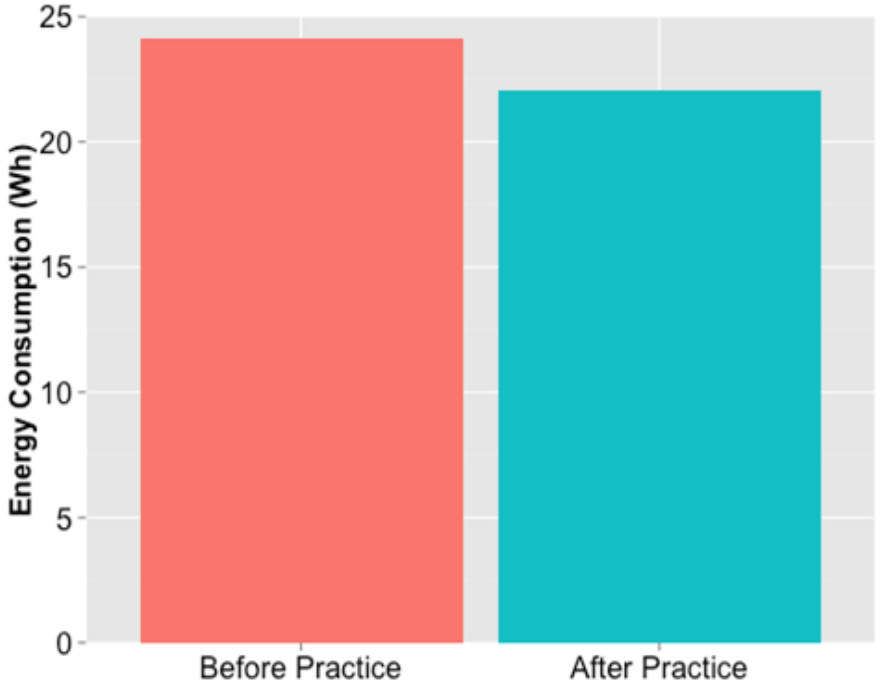

8.2% Power savings

8.4% Energy savings

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Efficient ORM Strategies [2]

- ORM vs. no-ORM (Diesveld Query Technologies)

[2] Procaccianti, G., Lago, P., & Diesveld, W. (2016). Energy Efficiency of ORM Approaches: an Empirical Evaluation. In Proceedings of the 10th International Symposium on Empirical Software Engineering and Measurement (ESEM 2016). Ciudad Real, Spain: IEEE. Available on: http://hdl.handle.net/1871/54530

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Efficient ORM Strategies [2]

- Propel framework significantly slower

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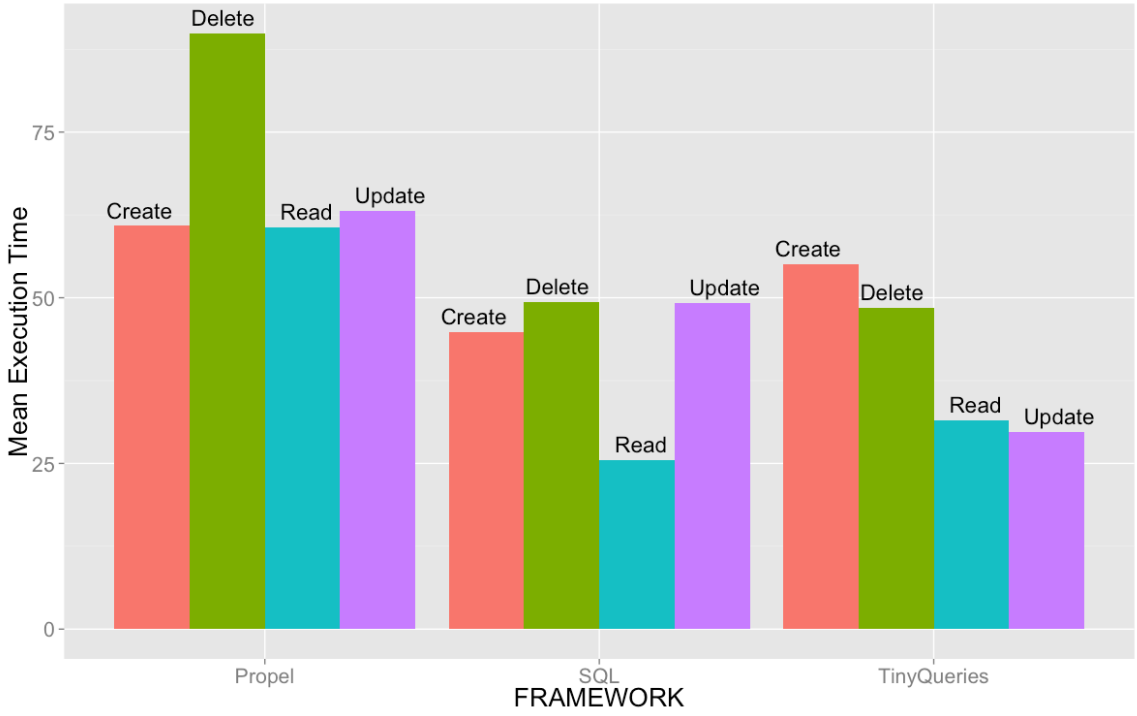

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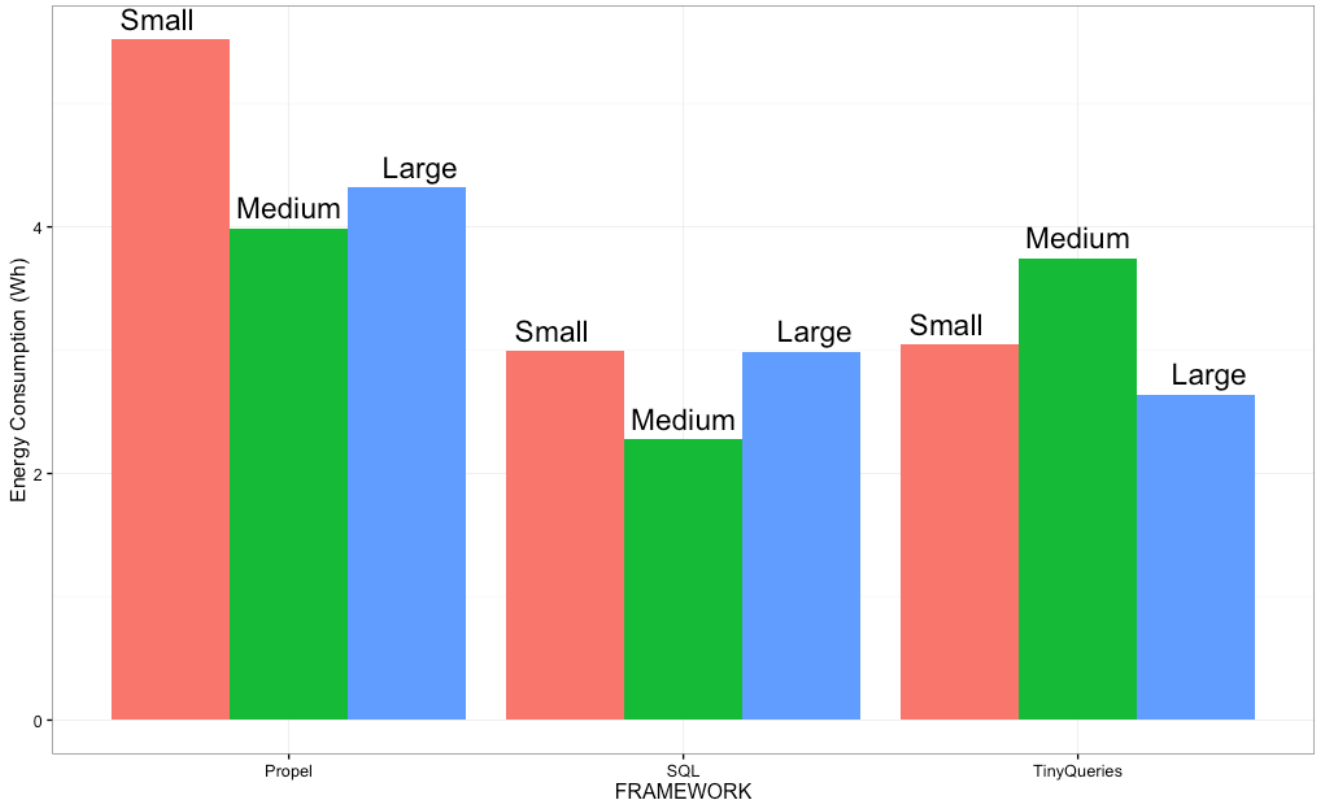

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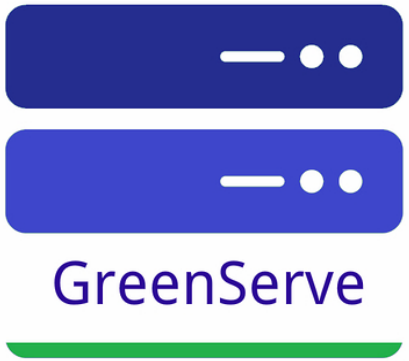
GreenServe

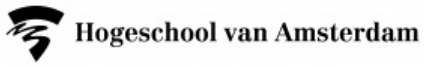

Certios


Software
Improvement
Group


Rijksdienst voor Ondernemend
Nederland


GreenServe


Greenit
amsterdam region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Efficient Web Pages

- Evaluate energy impact of Content Management Systems
  - E.g. Wordpress vs. Static web pages

- Experiment: compare 2 different VMs
  - different software stack
  - Same content

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Efficient Web Pages

cobra

This is our blog

Where we write about stuff

Example Article

May 31

cobra

This is our blog

Where we write about stuff...

Example Article

Jan 1

cobra SYSTEMS

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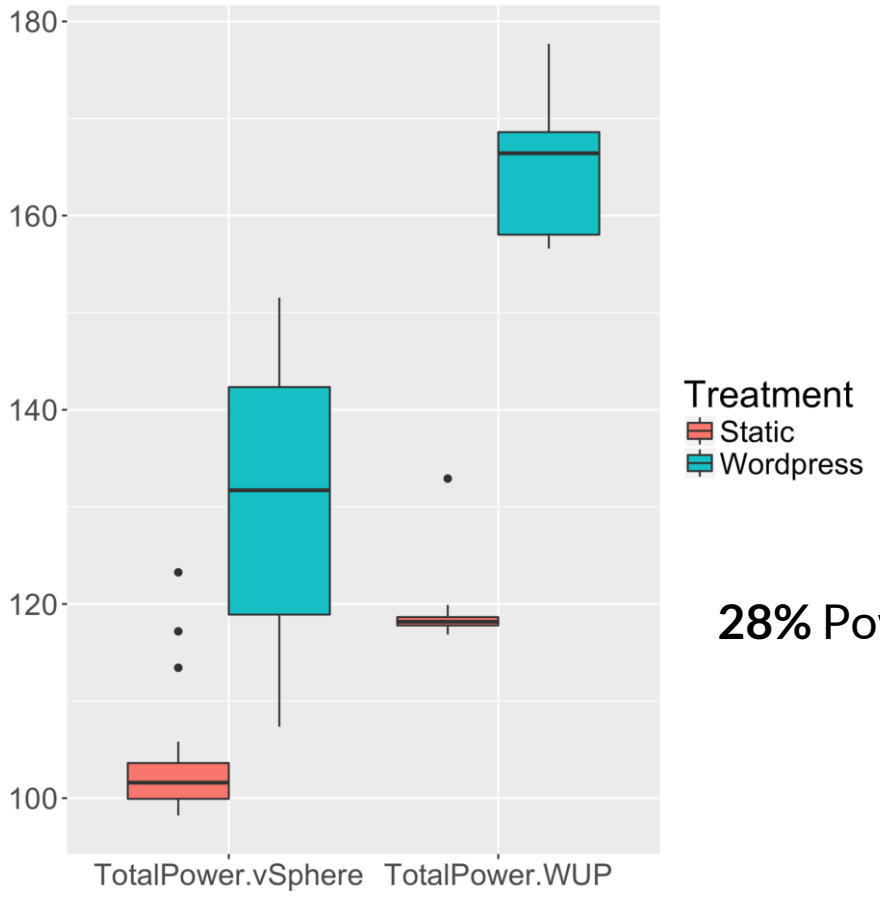
Efficient Web Pages



28% Power savings

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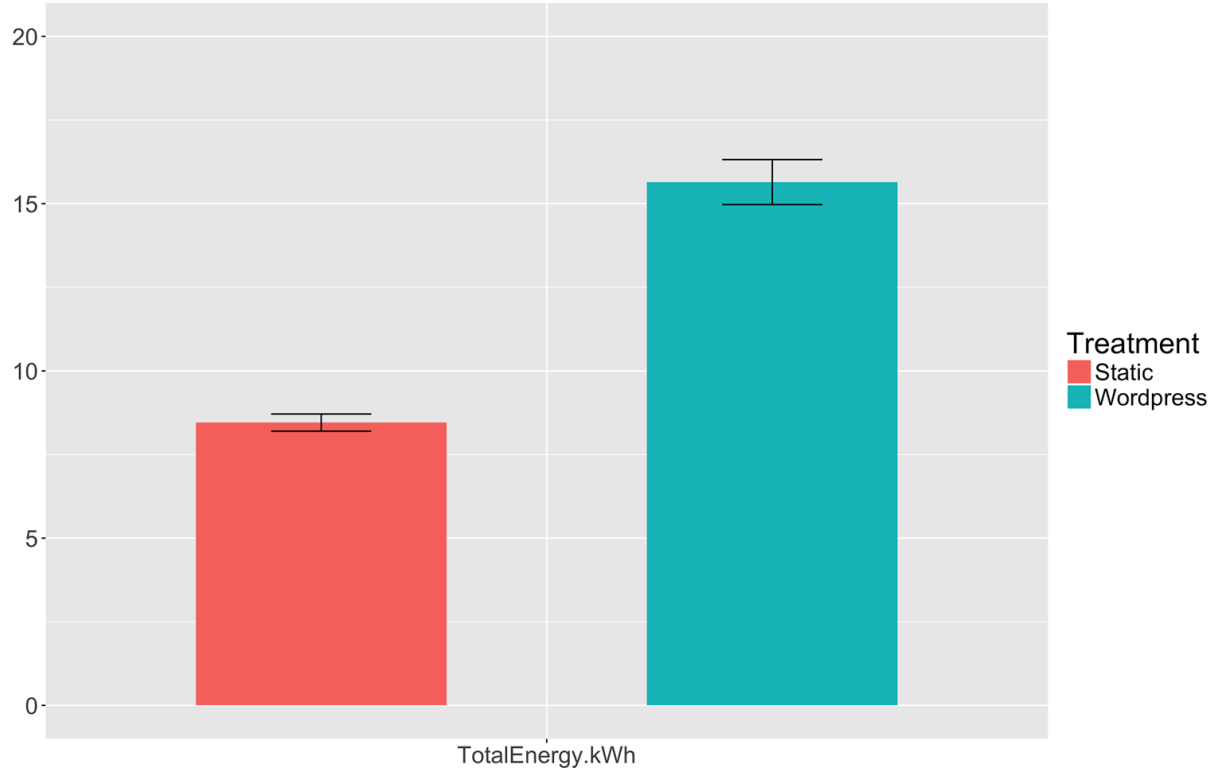
Efficient Web Pages



46% Energy savings

Impact of Green Software

Efficient Database queries:

-25%

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Static Web Pages:

-46%

EE is Software Quality

- Being Energy-Efficient implies trade-off decisions

- Data from energy measurements helps decision-making

Conclusions

- Green Software matters!
- Validated Best Practices
- ...looking for case studies!

GreenServe

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