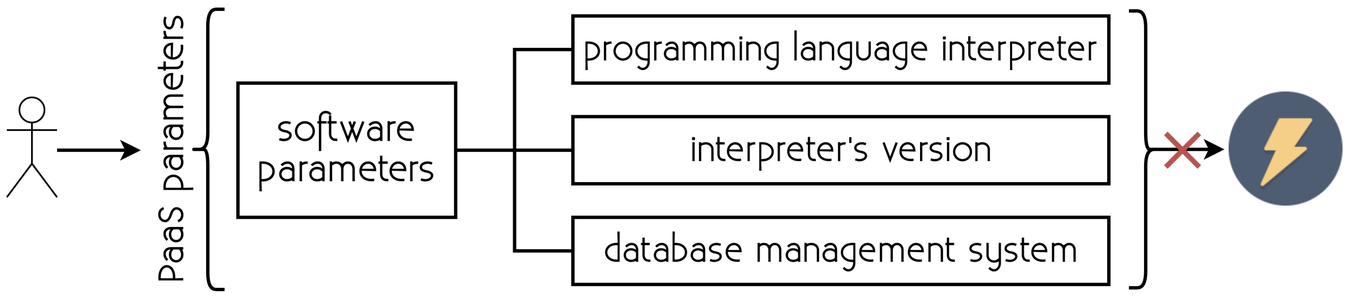
An Experimental Analysis of PaaS Users Parameters on Application Energy Consumption

David Guyon, Anne-Cécile Orgerie and Christine Morin
Univ Rennes, Inria, CNRS, IRISA



- PaaS parameters are available to users
- distance between PaaS parameters and energy consuming devices is important
- difficult for PaaS users to understand the link between parameters and their applications energy consumption

How important is the impact on applications energy consumption of varying PaaS parameters' value?

Experimental analysis

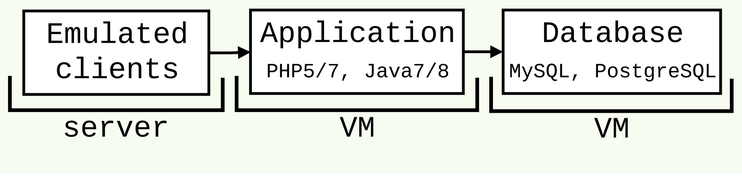
- deployment of a typical PaaS application in real VMs
- execute the application in different configurations
- for each execution, measure application dynamic energy consumption
- compare measurements between configurations

Considered parameters

- programing language
- version of interpreter
- database technology

Considered benchmark

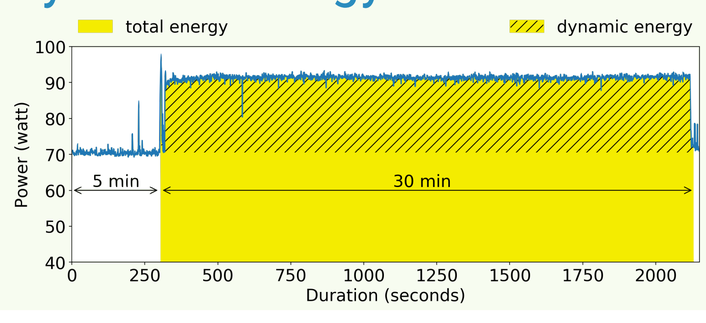
- multi-tier web application (RUBiS)
  - each tier execute in a separate VM
  - each VM has a fixed size (2 vCPUs, 2GB of RAM)
  - a different VM image for each version of RUBiS



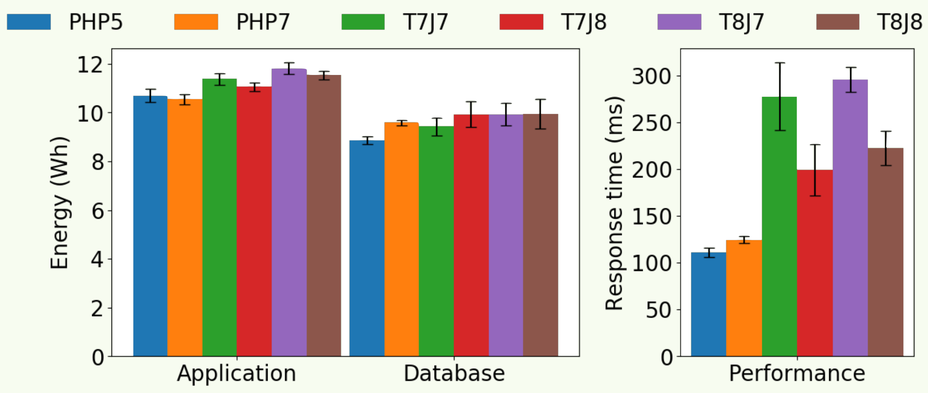
Hardware configuration

- experiments deployed on Grid'5000
  - servers with 16 CPU cores and 32GB of RAM
  - equipped with **fine-grained wattmeters**
- virtual resource configuration
  - KVM hypervisor
  - each VM execute in a separate server

Dynamic energy measurements

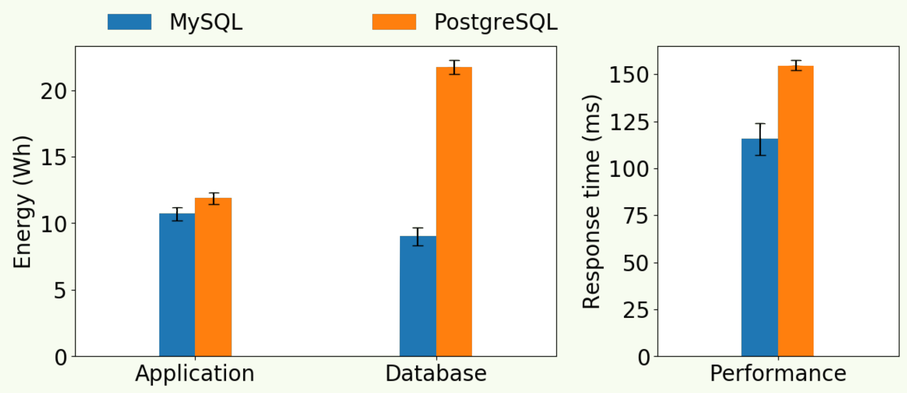


Experiment 1: Varying application tier



- comparison between PHP and Java
  - on average, PHP consumes 7.27% less than Java
  - PHP responds faster than Java (no Tomcat server)
- comparison between Java versions
  - 2.6% energy increase when migrating from Java 7 to Java 8
  - 4% energy increase when migrating from Tomcat 7 to Tomcat 8
  - Java 8 has a better performance than Java 7

Experiment 2: Varying database tier



- App tiers consume approximately the same amount of energy
  - PHP 7 source code slightly change
- large energy difference between MySQL and PostgreSQL
  - 141% energy consumption increase between database tiers
- increased response time when using MySQL
  - optimized for simple SQL requests

Conclusion

- PaaS parameters have an effect on energy consumption
- Java always consume more than PHP versions
- database technologies can have significant energy differences
- PaaS users can reduce their impact on energy consumption
  - but an energy-related feedback is required

Future directions

- extend our approach to consider virtual resource parameters
  - size and number of VM instances
- design a model for PaaS providers to deliver an energy-related metric to their users according to the available parameters

UNIVERSITÉ DE RENNES 1 · Inria inventors for the digital world · cnrs · UMR IRISA