Involving Users in the Design of Energy-Aware Cloud Computing Systems

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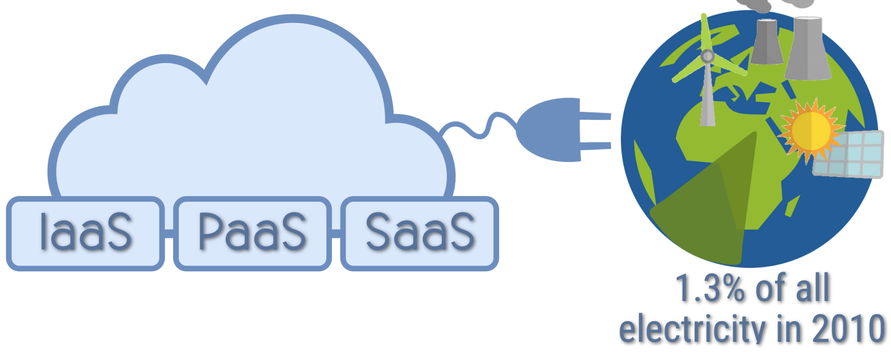
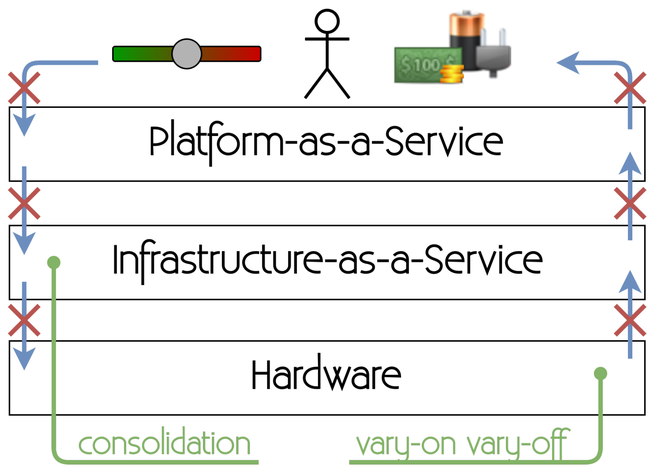


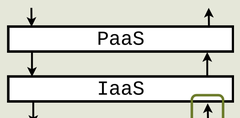
Jonathan Koomey (2011) Growth in data center electricity use 2005 to 2010



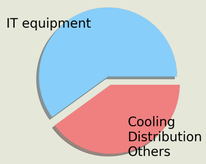
Current energy optimizations are not sufficient

Including users could help to achieve higher energy savings

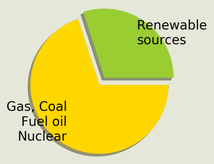
Issue: no easy way to express energy efficiency of Cloud datacenters



$$PUE = \frac{E_{total}}{E_{ITtotal}}$$



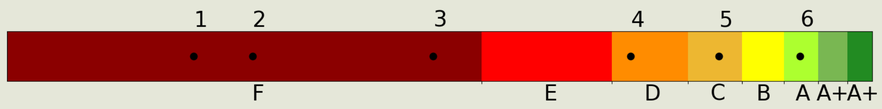
$$GEC = \frac{E_{green}}{E_{total}}$$



$$GLENDA = \frac{E_{ITdynamic}}{E_{ITtotal} \times PUE} \times GEC$$

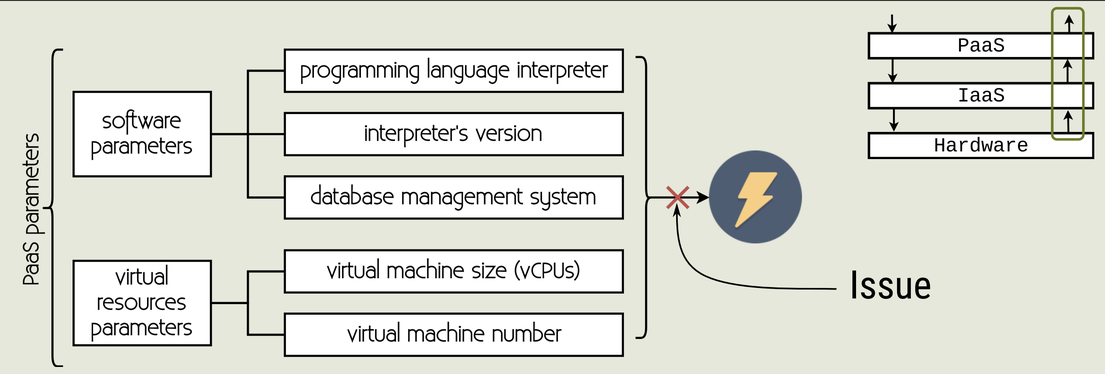
Validation: a real workload and different scenarios

baseline: typical datacenter usage
PP: energy-proportional IT equipments
Pmax: utilization rate at its maximum

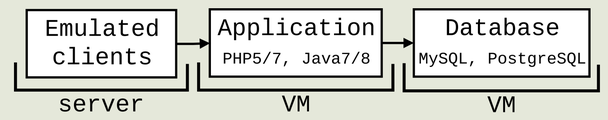


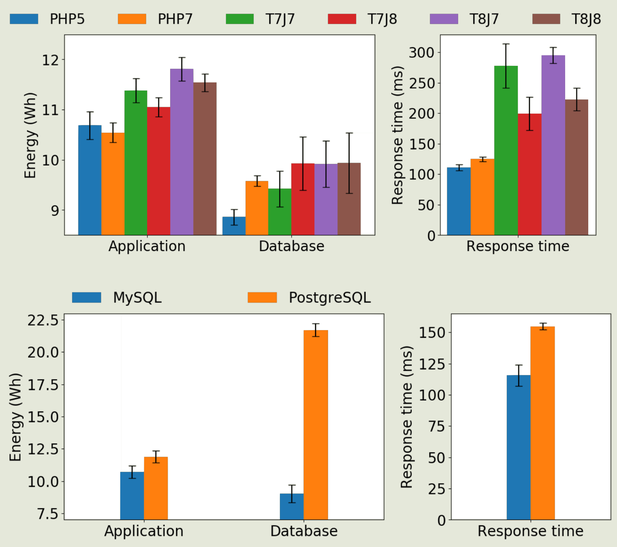
	scenario	PUE	GEC		scenario	PUE	GEC
1	baseline	1.53	0.14	4	PP	1.53	0.50
2	baseline	1.12	0.14	5	PP	1.53	0.80
3	baseline	1.53	0.50	6	PP + P_{max}	1.12	0.80

Guyon et al., GLENDA: Green Label towards Energy proportioNality for IaaS DAta centers, e-Energy workshop 2017, Hong Kong



Proposition: evaluate impact of PaaS parameters on energy

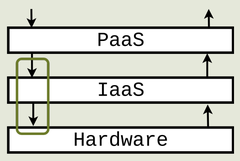




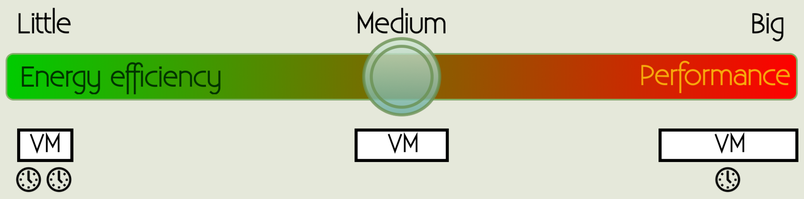
PHP consumes **7.27%** less energy than Java

PostgreSQL consumes **141%** more than MySQL

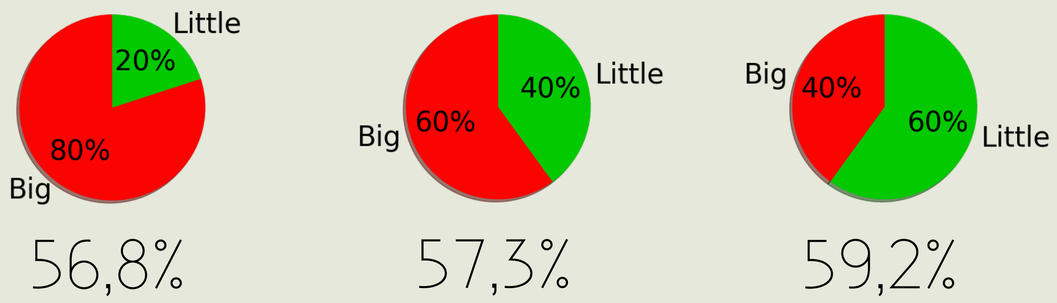
Issue: difficult for IaaS users to participate in energy optimizations



Proposition: easy-to-use parameter over the size of VMs

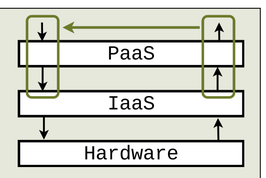


Little mode: smaller VMs, increased execution time
Big mode: larger VMs, reduced execution time



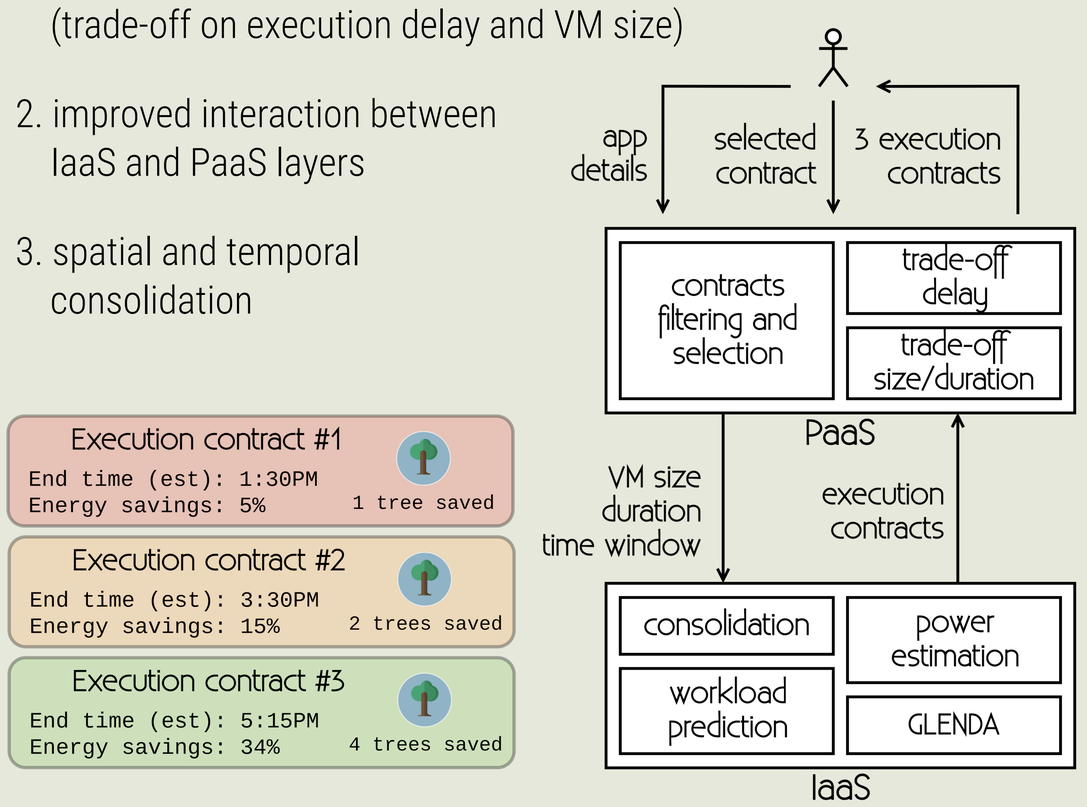
Guyon et al., Energy-efficient User-oriented Cloud Elasticity for Data-driven Applications, GreenCom 2015, Sydney
Guyon et al., How Much Energy can Green HPC Cloud Users Save?, PDP 2017, St. Petersburg

Issue: no energy-related parameter and missing link between IaaS and PaaS layers



Proposition:

1. take PaaS user into account (trade-off on execution delay and VM size)
2. improved interaction between IaaS and PaaS layers
3. spatial and temporal consolidation



Feedback

Actions

IaaS oriented

PaaS oriented