Towards Software Resource Efficiency Benchmarking
Or: How to Get to a Resource Efficiency Classification of Software?

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https://se.informatik.uni-wuerzburg.de

Motivation

- ➢ More services are placed in the cloud

- ➢ Datacenters are increasing in number and size

- ➢ Prediction: Data centers need more than 1PWh annually by 2030 [1]

Motivation

➤ Cloud data centers can be made more efficient

- ▪ Intelligently placing or consolidating services
- ▪ Minimize resources through auto-scaling while satisfying performance demand

➤ Hardware can be made more efficient

- ▪ DVFS
- ▪ Different C-States

➤ Software controls the hardware and different, but functionally identical software can have a different energy efficiency while the performance does not change [2]

➡ Large impact of implementation

➡ Performance and efficiency: not the same!

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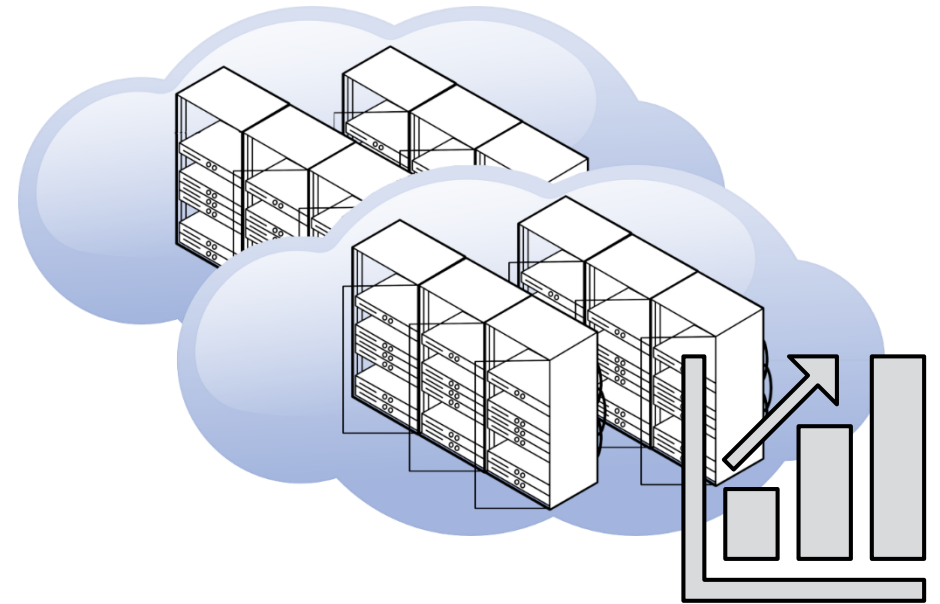
Problem

➢ Not much consideration for energy efficiency in software development [3]

▪ Knowledge gap: How to achieve better energy efficiency [4]

▪ Incentive gap: *Why should I bother?*

➢ **Hardware benchmarks:** incentivized development of efficient products

▪ SPECpower_ssj 2008

▪ SERT® 2 suite

Contribution
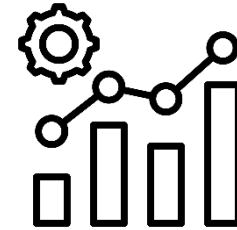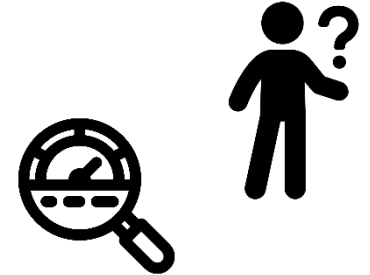
➤ **Our vision**:

- Software Efficiency Benchmark

- Assess resource demands

- Comparison of resource usage of standard application types

  - ERP, CRM, …

- Resource efficiency entails energy efficiency

➤ Easy-to-use means to describe and assess the resource demand of software

- Resource-efficiency metric for classification of and comparison between the resource efficiency of software

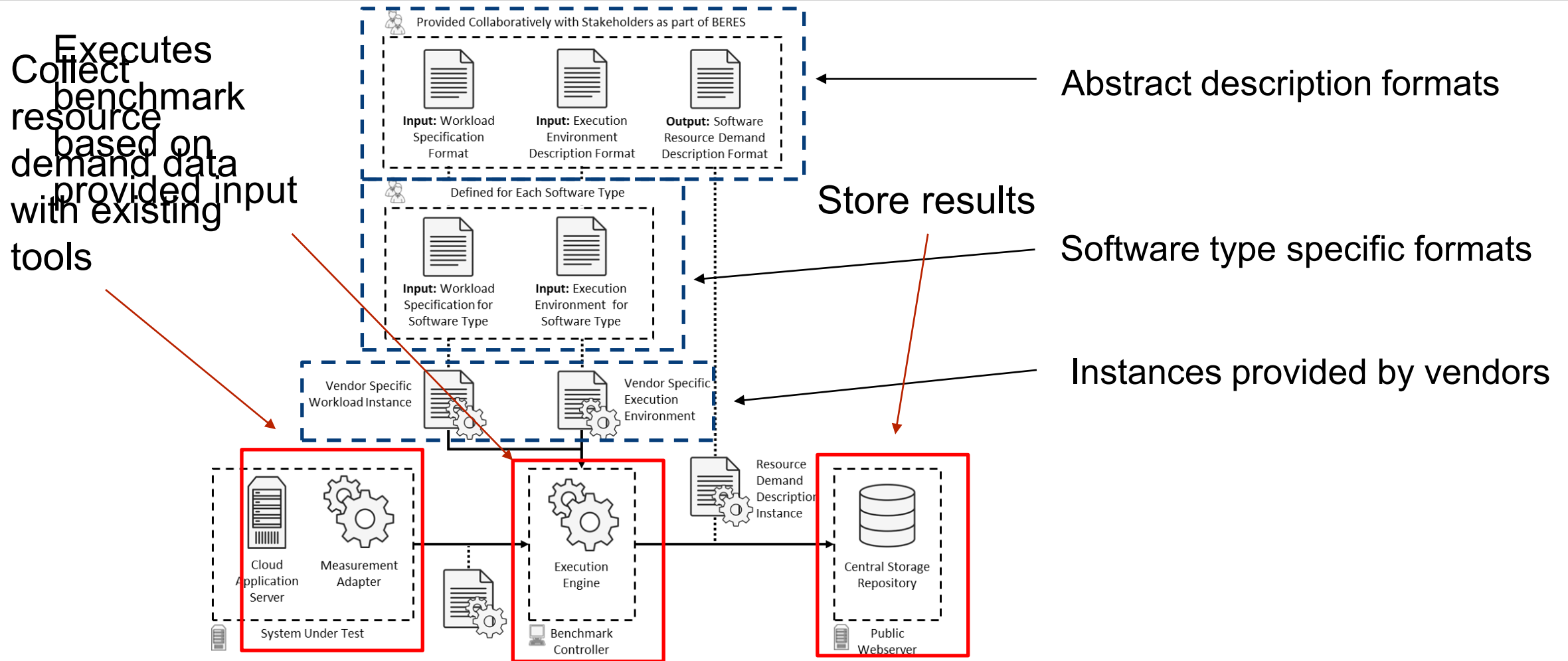| Make resource usage transparent | Enable comparability | Incentivize resource efficient implementation | Spark competition |

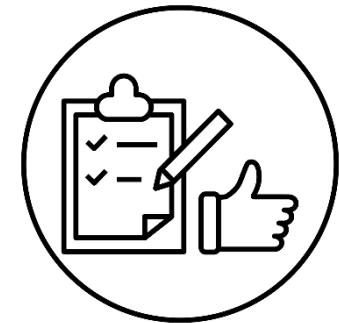# TOWARDS SOFTWARE RESOURCE EFFICIENCY BENCHMARKING

Challenges

How to describe the resource demand?

How to specify & standardize workloads?

How can we make results comparable?

How to achieve awareness and acceptance?

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Benchmark-Framework[5]

Provided Collaboratively with Stakeholders as part of BERES

Input: Workload Specification Format

Input: Execution Environment Description Format

Output: Software Resource Demand Description Format

Abstract description formats

Defined for Each Software Type

Input: Workload Specification for Software Type

Input: Execution Environment for Software Type

Store results

Software type specific formats

Vendor Specific Workload Instance

Vendor Specific Execution Environment

Instances provided by vendors

Cloud Application Server

Measurement Adapter

Execution Engine

Resource Demand Description Instance

Central Storage Repository

System Under Test

Benchmark Controller

Public Webserver

Executes benchmark based on provided input

Collect resource demand data with existing tools

Possible Incentives to Increase Awareness and Acceptance?

➢ Awareness and acceptance of stakeholders

➡ socio-technical problem

➢ Adapt approaches from similar incentive-based mechanisms

▪ Labels: Energy Star, Blauer Engel

▪ SPECpower_ssj 2008

➢ Propose our ideas, input and output format

➢ Get Feedback

▪ Publications, questionnaires, workshops

▪ Scientific community

▪ Software developers

▪ End-users

Conclusion

➢ **Vision**: Resource efficiency benchmark for software

- Enable comparability

- Increase awareness

- Spark competition

➢ Incentivize resource efficiency as a non-functional requirement

➢ Next steps

- Present work-in progress at scientific conferences

- Get feedback

- Implement prototype

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Thank You!

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