VM Performance Evaluation with Functional Models

An Optimist's Outlook

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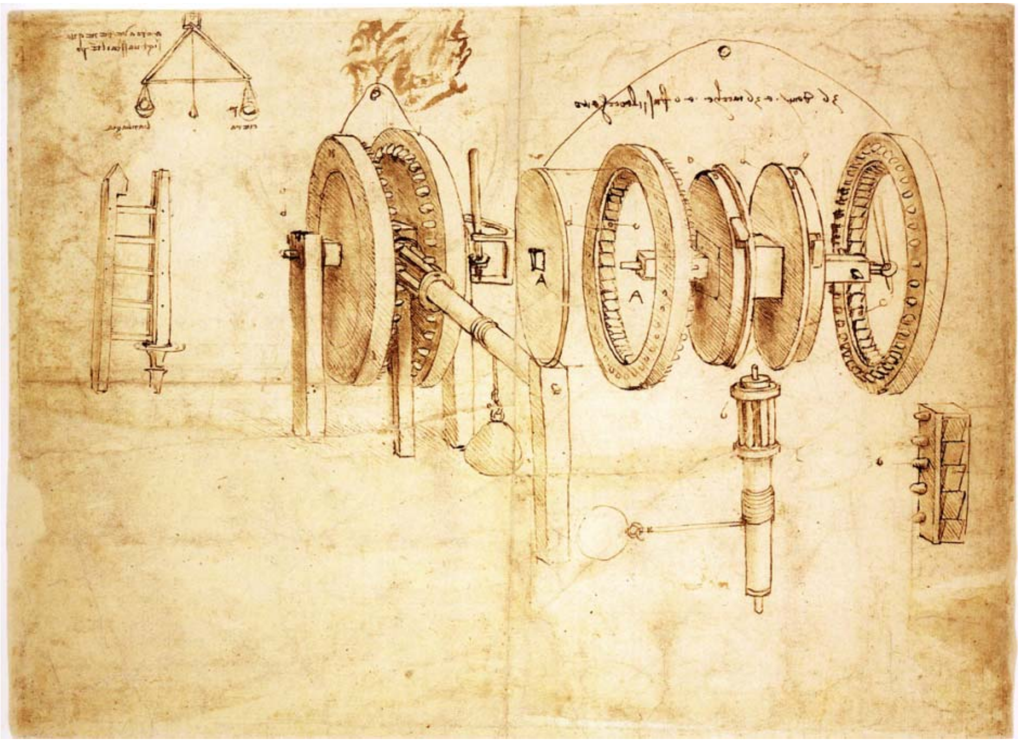
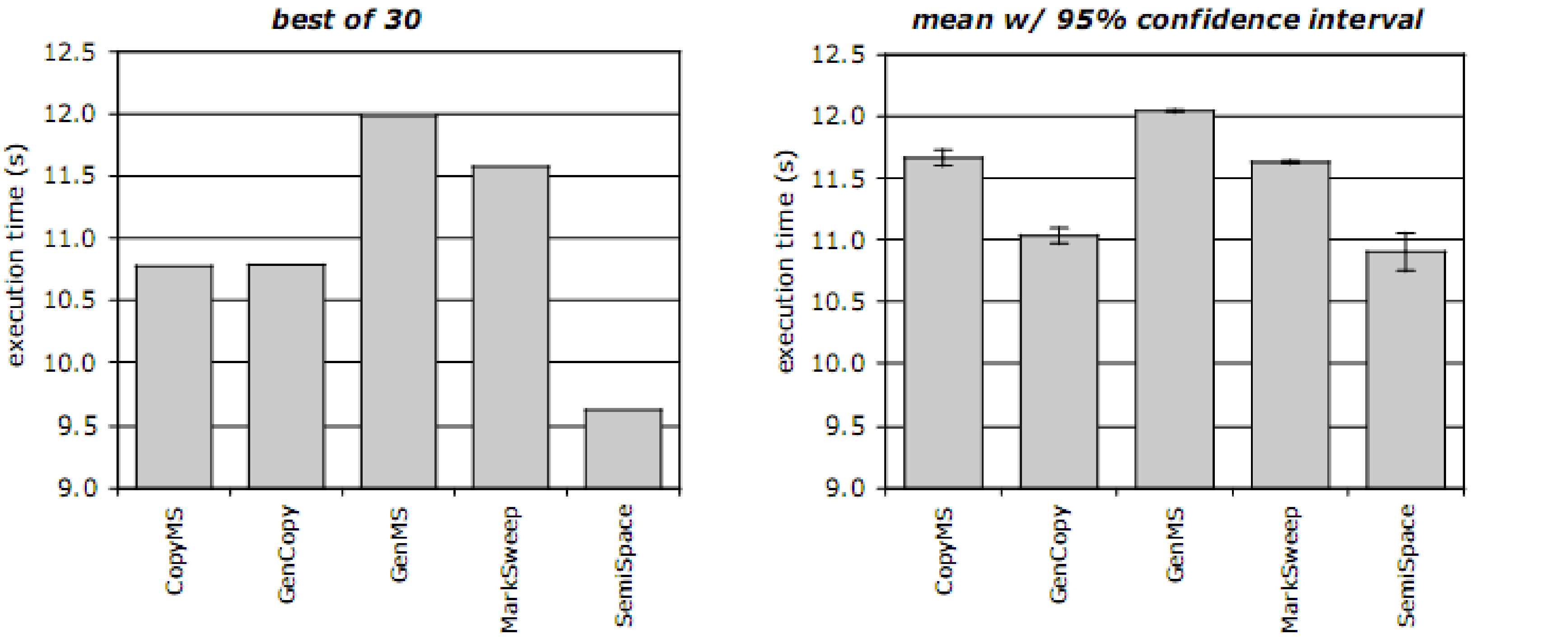
The Status of VM Performance Assessment



- Cascading effects
- Chaotic Behaviour

- Some nondeterminism is accepted
  - Noise
  - ...which is where bias hides

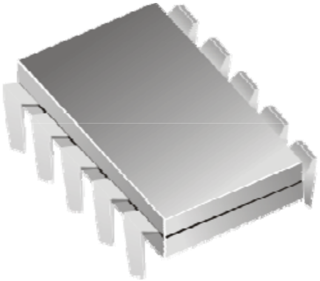
"Statistically Rigorous Java Performance Analysis"



“Wake up and smell the coffee”

- Advocates diverse Benchmarks

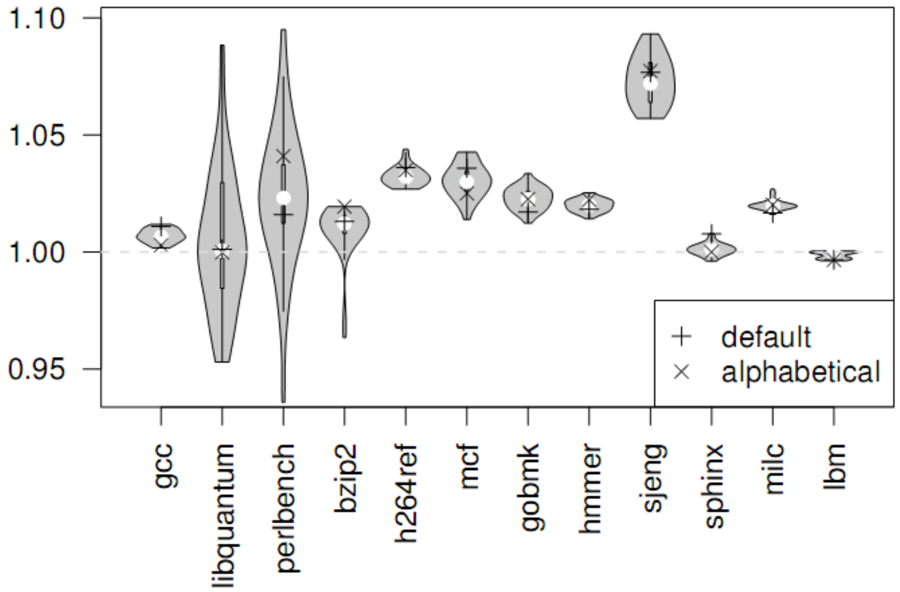
the DaCapo benchmark suite



- Proposes ways to control nondeterminism

- Demands meaningful baseline and publishing the implementation

„Producing Wrong Data Without Doing Anything Obviously Wrong“

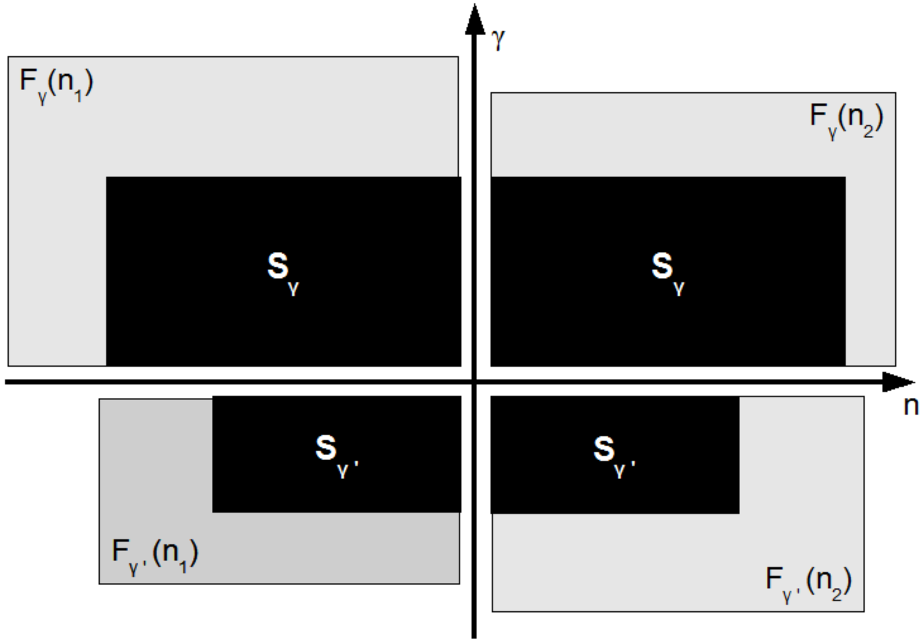


Suggestions for dealing with bias

- Setup randomization
- Causal analysis of an intervention

Functional Performance Models

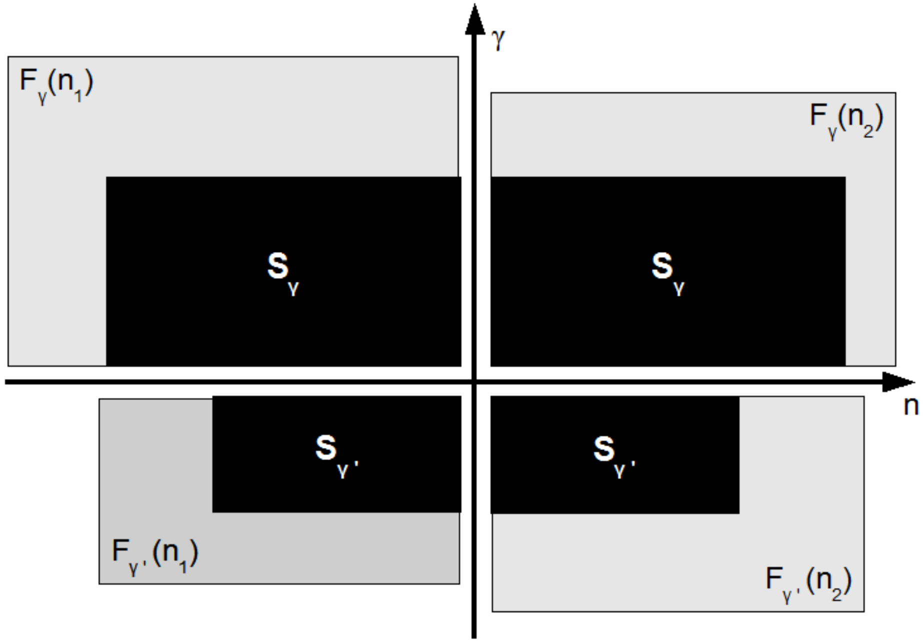
$$P_\gamma(n) = S_\gamma + F_\gamma(n)$$



Functional Performance Models

$$P_\gamma(n) = S_\gamma + F_\gamma(n)$$

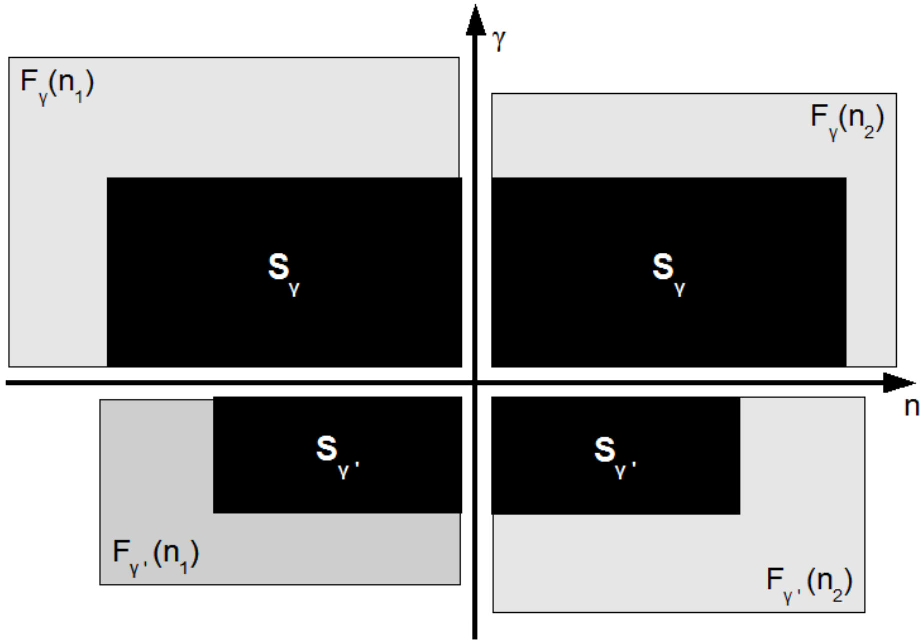
Mean Value



Functional Performance Models

$$P_\gamma(n) = S_\gamma + F_\gamma(n)$$

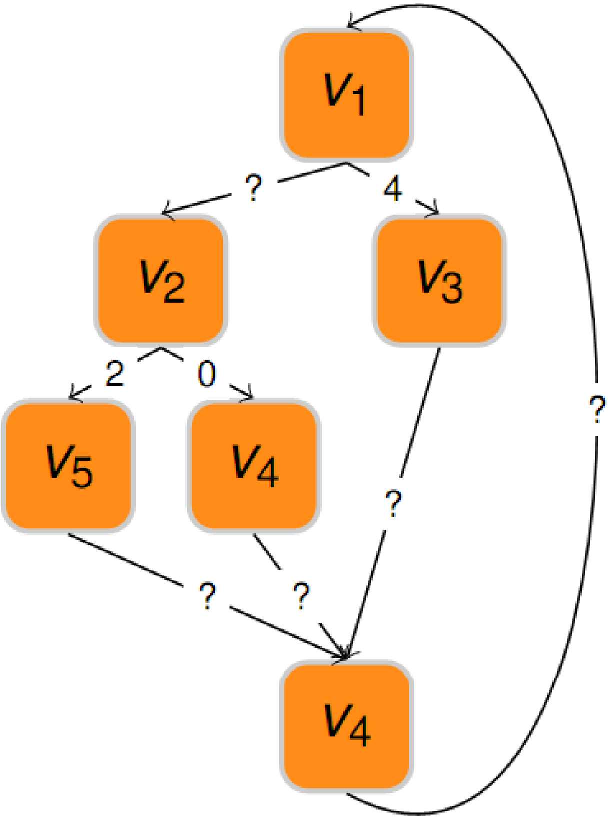
Confidence Interval



A Case Study Proposal

Scenario: Edge Profiling in Jikes VM

- Some counters are redundant
  - JIT compilation could lessen it
  - Values can be reconstructed afterwards
- This might we worthwhile
  - But it would cause overhead
  - We want to determine what strategy to use for overhead reduction

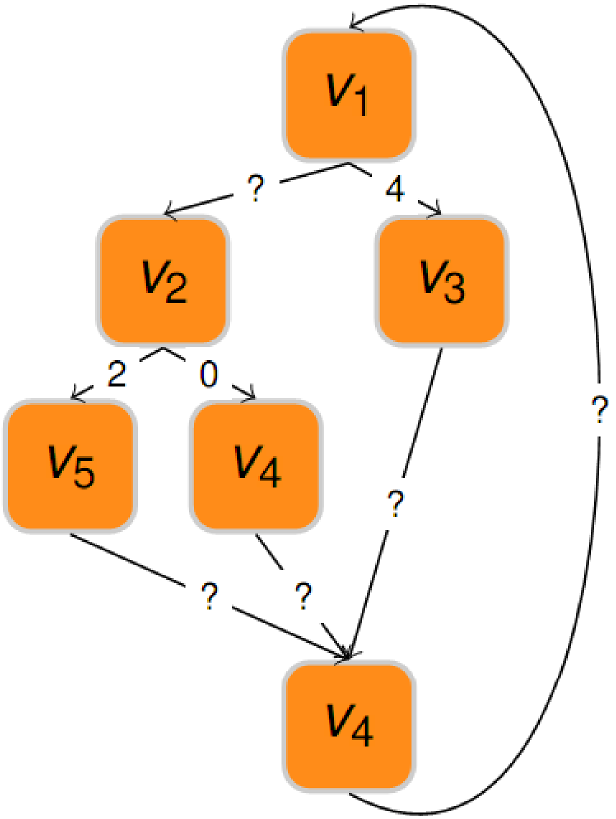


The Model for Counter Cost

- What to model
  - Counters necessary and safeable
  - Their respective performance contributions

- Specific Model:
  - Cost of counters in baseline code (γ)
  - Counter frequency (m_i)

$$P(n) = P(0) + \gamma \sum_{i \in n} placed?_i * m_i$$



A More Realistic Model

- Put counters into a broader model context
  - Based on recompilation plans, with r_0 opt-compiling nothing

$$P_{steady}(r,n) = P_{steady}(r_0,n_0) - \gamma \sum_{i \in n} m_i$$

  - The approach works as part of a rigorous recompilation setup

- Benefits to expect
  - Increased confidence in evaluation
  - Knowledge about the behaviour of profiling counters and the benchmarks
    - Helps to predict what optimization can pay off

What are Feasible Applications?

- Code Instrumentation
- Security Label Checking
- Execution Sampling
- GC Barrier Instrumentation

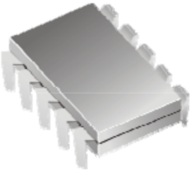
- Adaptive Compilation
- Pretenuring
- Thread Interactions
- Inlining

Summary

- Functional Models geared towards transferable research results

$$P(n) = P(0) + \gamma \sum_{i \in n} placed_i * m_i$$

- The discovery of bias still depends on the variety in the benchmarking environment



- Scope needs to be explored

- Applies to new functionality as well

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