German Research School
for Simulation Sciences

Interactive Exploration of Fine-Grained Scalability Models



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Overview

- Arising exascale machines require highly scalable applications
- Early scalability analysis saves time & money
- The Catwalk project aims at simplifying scalability analysis
  - Automated generation of performance models
  - Visual exploration of performance models
- Catwalk is part of SPPEXA
  (German Priority Programme 1648 Software for Exascale Computing)

Performance model generator

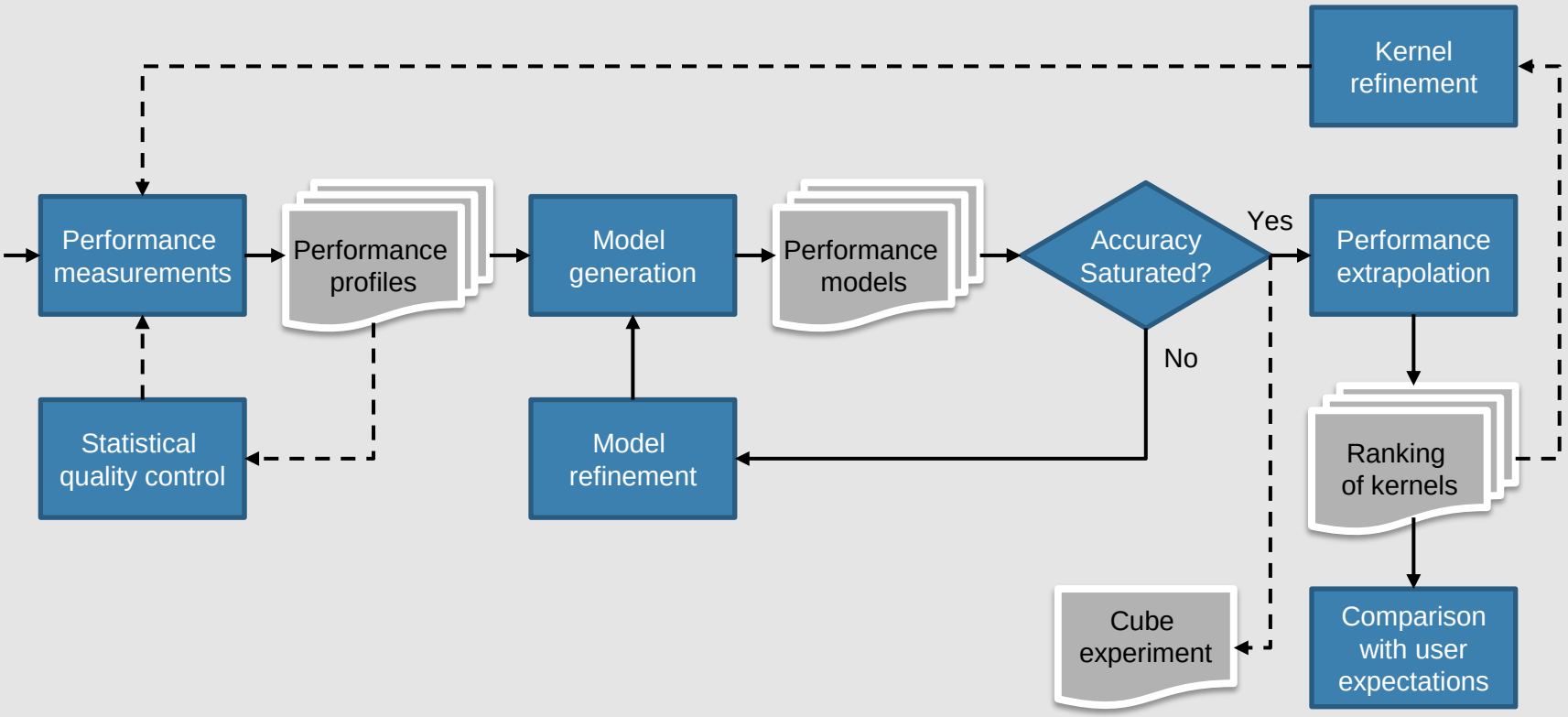
- Input: Performance measurements for different process counts
- Output: Performance models f for every measured function

$$f(x) = \sum_{k=1}^{n} c_k \cdot x^{i_k} \cdot \log_2(x)^{j_k} \qquad | \; c_k, i_k, j_k \in \mathbb{Q}; n \in \mathbb{N}$$

- Above form is called Performance Model Normal Form (PMNF)
- Model generation is completely automated

[Calotoiu, Alexandru, et al. "Using automated performance modeling to find scalability bugs in complex codes." Proceedings of SC13: International Conference for High Performance Computing, Networking, Storage and Analysis. ACM, 2013.]

Extended workflow of model generation



Comparison of performance modeling

- Earlier: analytical models handcrafted only for a few selected functions
  - Handcrafting is time consuming and laborious
  - No guarantee to select right functions for modeling
- Now: automated mass production of performance models
  - Covers all application's functions
  - Efficient due to automation
  - Challenging analysis and exploration of huge quantity of models

Visual exploration of performance model

- Goal: Efficient analysis of huge performance model compounds
- Our tool comprises two essential components:
  - Performance model generator
  - Cube (interactive browser for performance measurements)
- Approach: Extend Cube to handle performance models

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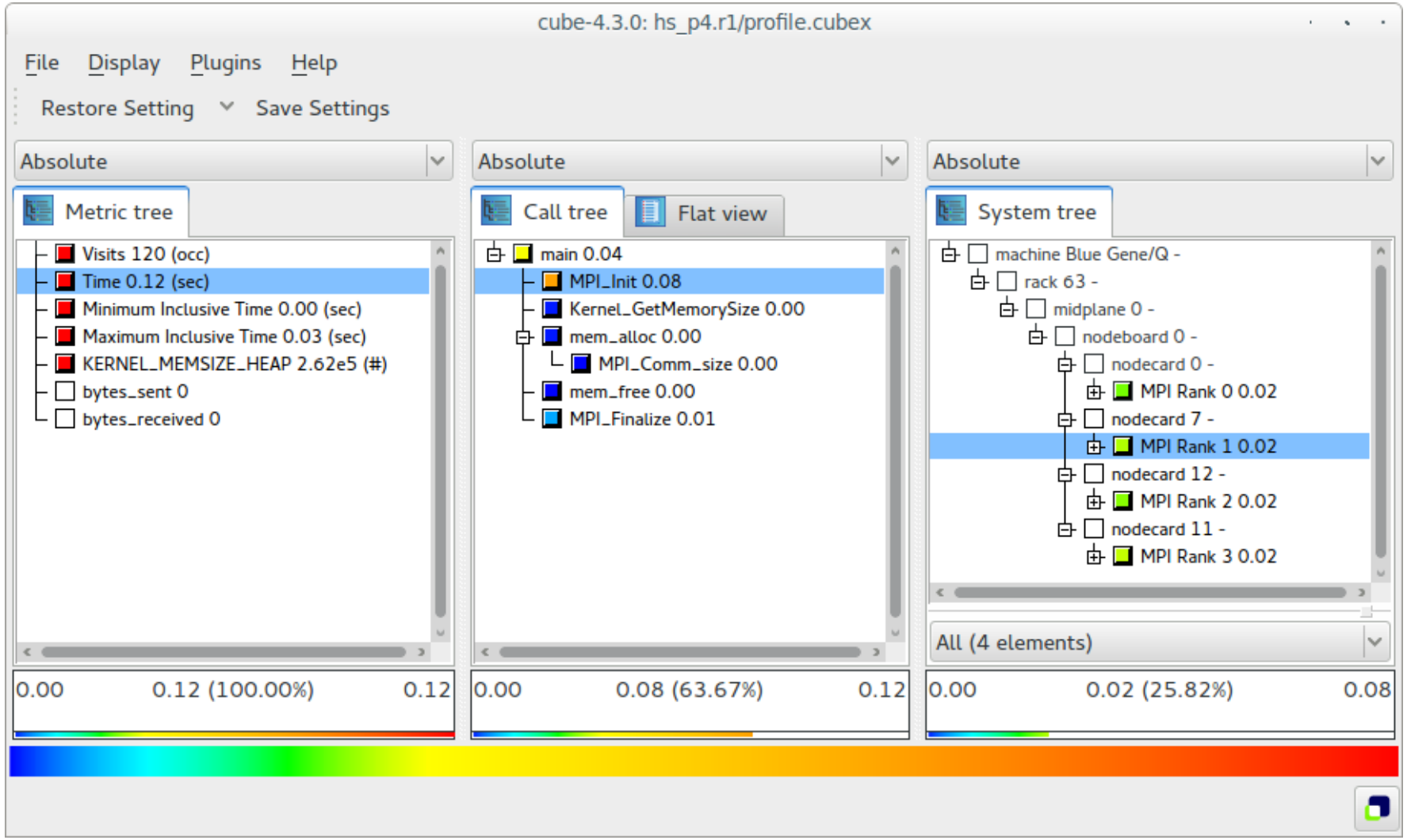

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