The POP Project

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6th AICS Symposium

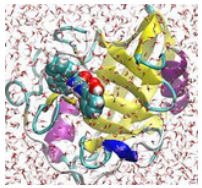
Kobe, Feb 23rd, 2016

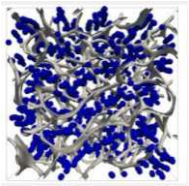
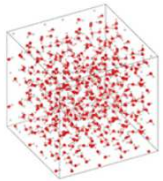
EU HPC Ecosystem

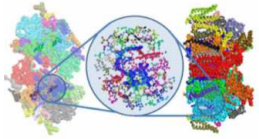
PRACE

ETP 4 HPC

THE EUROPEAN TECHNOLOGY PLATFORM FOR HIGH PERFORMANCE COMPUTING





Centres of Excellence in **HPC applications**

POP CoE

- A **Center of Excellence**
  - On **Performance Optimization and Productivity**
  - Promoting **best practices in parallel programming**
- Providing **Services**
  - Precise understanding of application and system behavior
  - Suggestion/support on how to refactor code in the most productive way
- **Horizontal**
  - Transversal across application areas, platforms, scales
- **For academic AND industrial codes and users !**

Motivation

Why?

- Complexity of machines and codes
  → Frequent lack of quantified understanding of actual behavior
  → Not clear most productive direction of code refactoring
- Important to maximize
  - Efficiency (performance, power) of compute intensive applications
  - Productivity of the development efforts

Partners

- **Who?**
  - BSC (coordinator), ES
  - HLRS, DE
  - JSC, DE
  - NAG, UK
  - RWTH Aachen, IT Center, DE
  - TERATEC, FR

A team with

- Excellence in performance tools and tuning
- Excellence in programming models and practices
- Research and development background AND
  proven commitment in application to real academic and industrial use cases

Services provided by the CoE

? Application Performance Audit

- Primary service
- Identify performance issues of customer code (at customer site)
- Small effort (< 1 month)

! Application Performance Plan

- Follow-up on the audit service
- Identifies the root causes of the issues found and qualifies and quantifies approaches to address them
- Longer effort (1-3 months)

✓ Proof-of-Concept

- Experiments and mock-up tests for customer codes
- Kernel extraction, parallelization, mini-apps experiments to show effect of proposed optimizations
- 6 months effort

Target customers

- **Code developers**
  - Assessment of detailed actual behavior
  - Suggestion of most productive directions to refactor code
- **Users**
  - Assessment of achieved performance in specific production conditions
  - Possible improvements modifying environment setup
  - Evidence to interact with code provider
- **Infrastructure operators**
  - Assessment of achieved performance in production conditions
  - Possible improvements from modifying environment setup
  - Information for computer time allocation processes
  - Training of support staff
- **Vendors**
  - Benchmarking
  - Customer support
  - System dimensioning/design

The process …

When?

October 2015 – March 2018

How?

Apply: pop@bsc.es; http://www.pop-coe.eu

Small questionnaire describing application and needs

Selection/assignment of analysts team

Install tools @ your production machine (local, PRACE, …)

Interactively: Gather data → Analysis → Report

About methodologies

Target and approach

- Real production codes and operation conditions
- Install tools @ customer production machine (local, PRACE, …)
- Interactively: Gather data → Analysis → Report

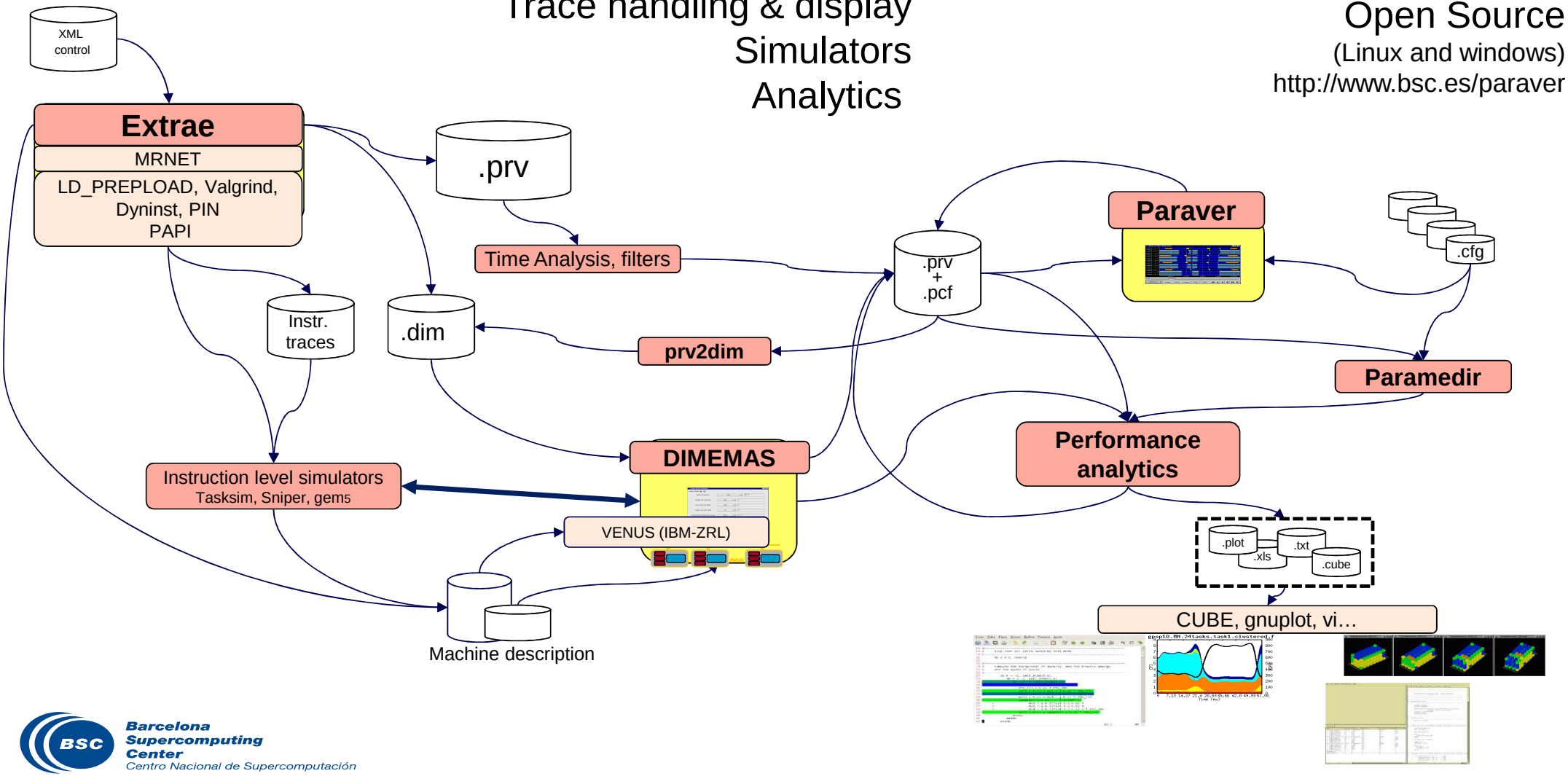
Challenge

- Integration of methodologies
  - How to look at performance in a hierarchical/structured way
  - Tools to validate/reject hypotheses and help generate new ones
- Duration of studies?

BSC – tools framework

Trace handling & display
Simulators
Analytics

Open Source
(Linux and windows)
http://www.bsc.es/paraver



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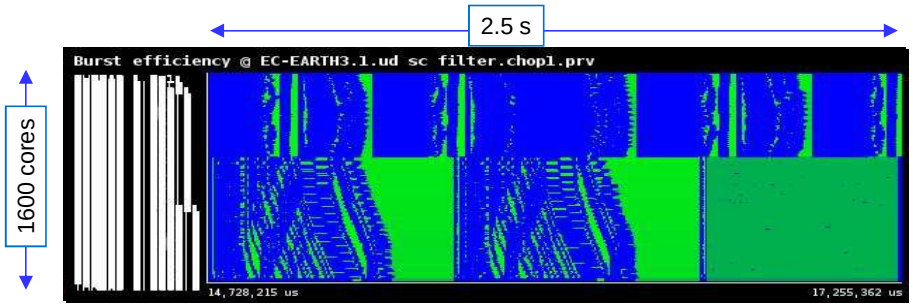
BSC Performance Tools

Flexible trace visualization and analysis

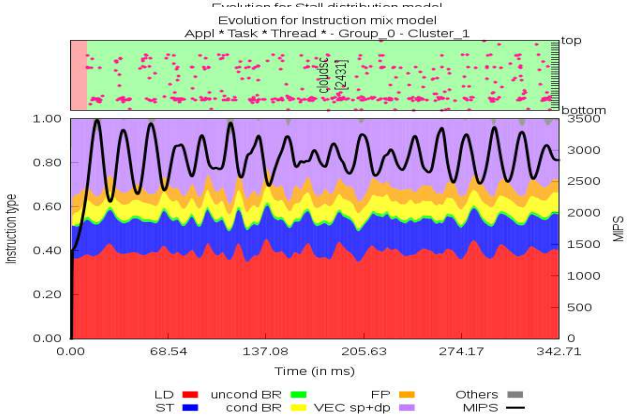
Adaptive burst mode tracing



BSC-ES – EC-EARTH

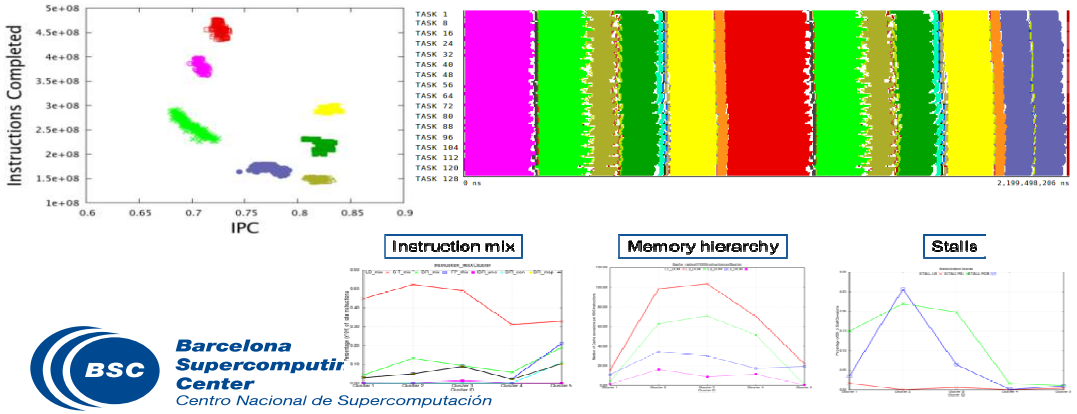
26.7MB trace
Eff: 0.43; LB: 0.52; Comm:0.81

Instantaneous metrics for ALL hardware counters at “no” cost

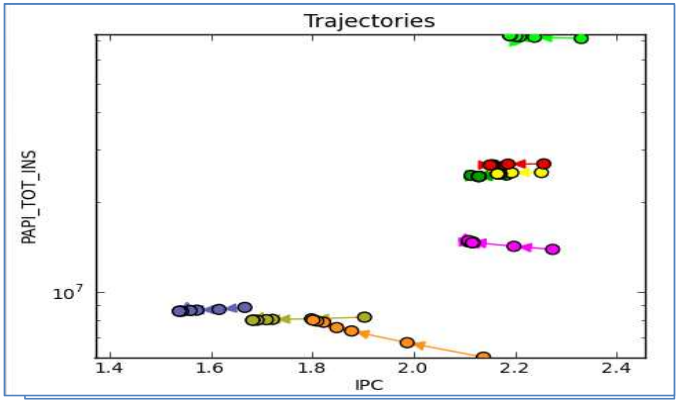


BSC-ES – EC-EARTH

Advanced clustering algorithms



Tracking performance evolution



AMG2013

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BSC Performance Tools

What if

ideal

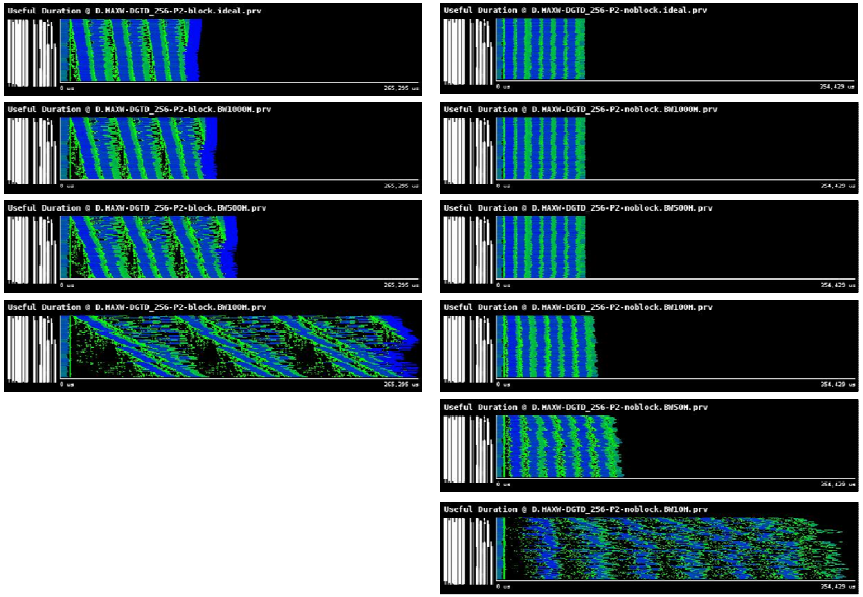
1000 MB/s

500 MB/s

100 MB/s

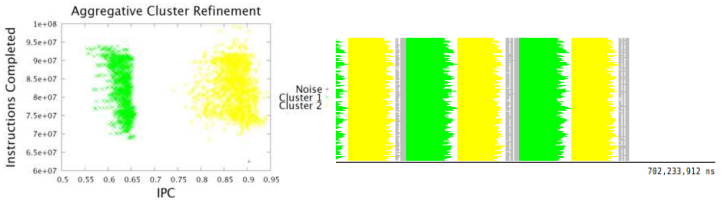
50 MB/s

10 MB/s

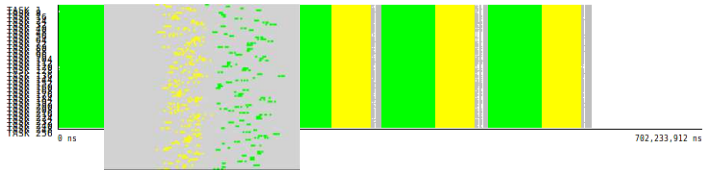


What if …

… we increase the IPC of Cluster1?

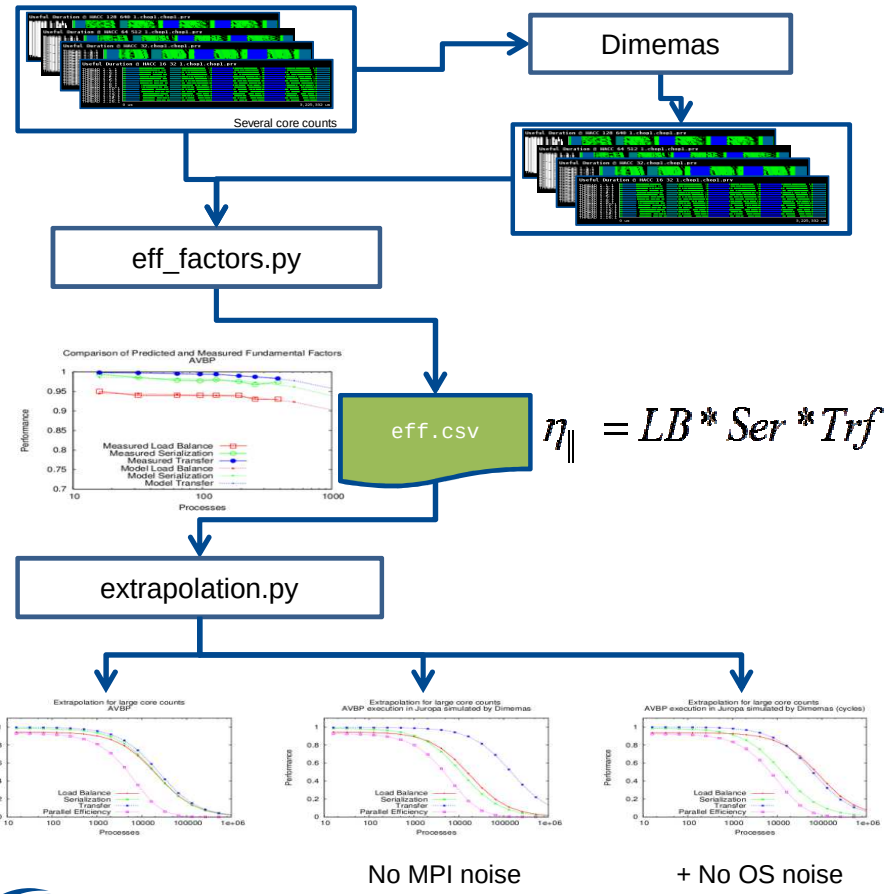


… we balance Clusters 1 & 2?



BSC Performance Tools

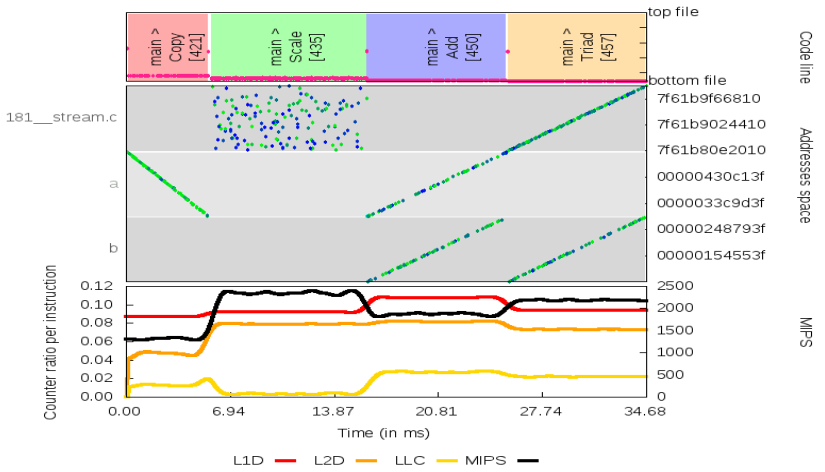
Models and Projection



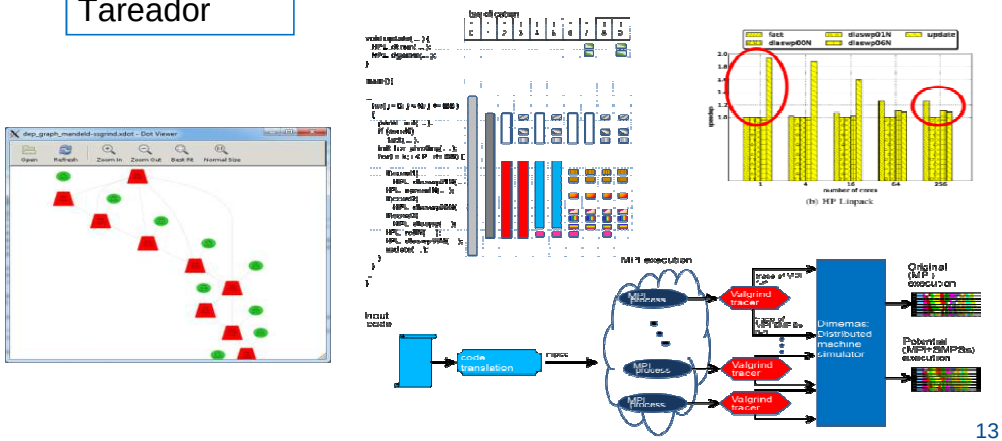
"Scalability prediction for fundamental performance factors " J. Labarta et al. SuperFRI 2014

Intel –BSC Exascale Lab

Data access patterns



Tareador



Summary …

Apply : www.pop-coe.eu

Download: www.bsc.es/paraver/downloads