



Performance Optimization and Productivity

EU H2020 Center of Excellence (CoE)



1 October 2015 – 31 March 2018 (30 months)



- **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 code(s) !**



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 and the 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



Tools used

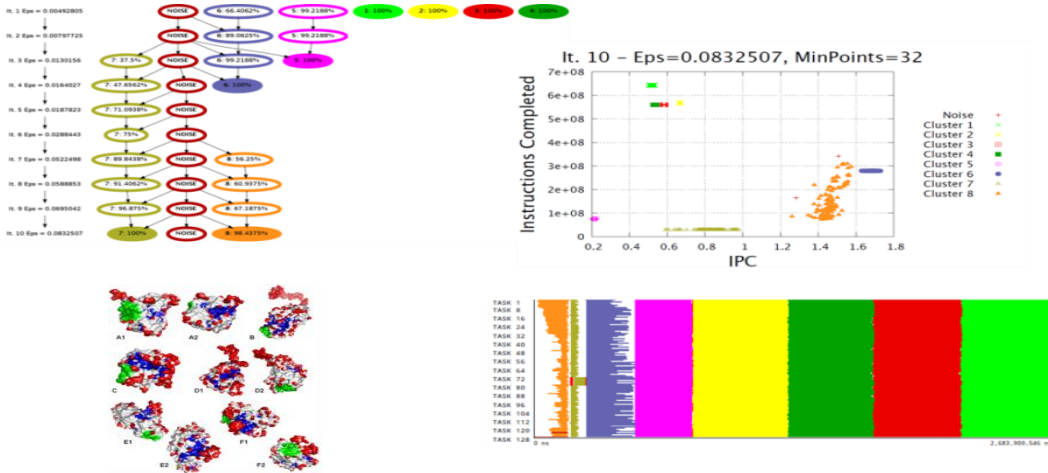


- **Open-source toolsets**
 - Extrae + Paraver
 - Score-P + Scalasca/TAU/Vampir + Cube
 - Dimemas, Extra-P
- **Commercial toolsets** (if available at customer site)
 - Intel tools
 - Cray tools
 - Allinea tools

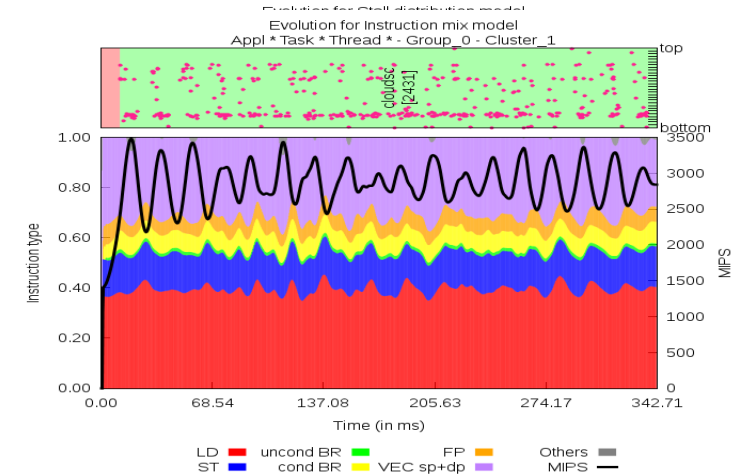


BSC Performance tools

Advanced clustering algorithms



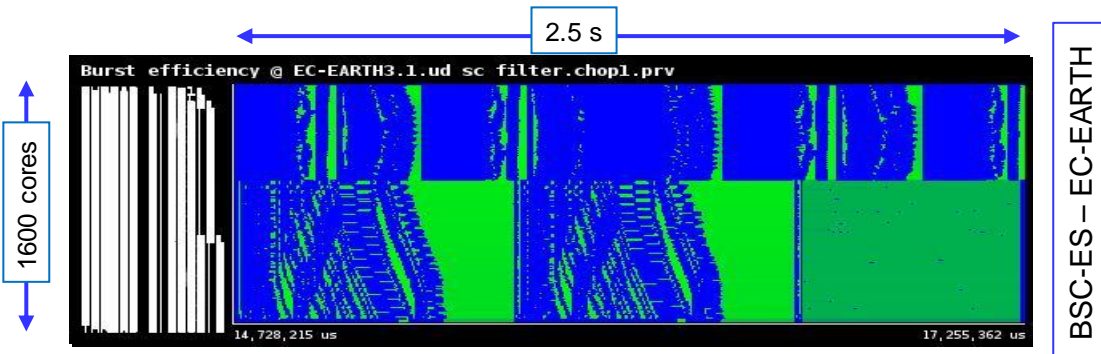
Instantaneous metrics for ALL hardware counters at "no" cost



Code line

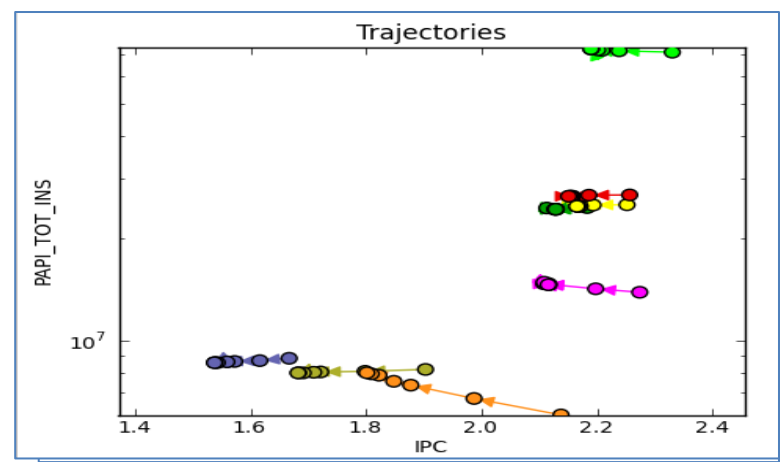
BSC-ES - EC-EARTH

Adaptive burst mode tracing



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

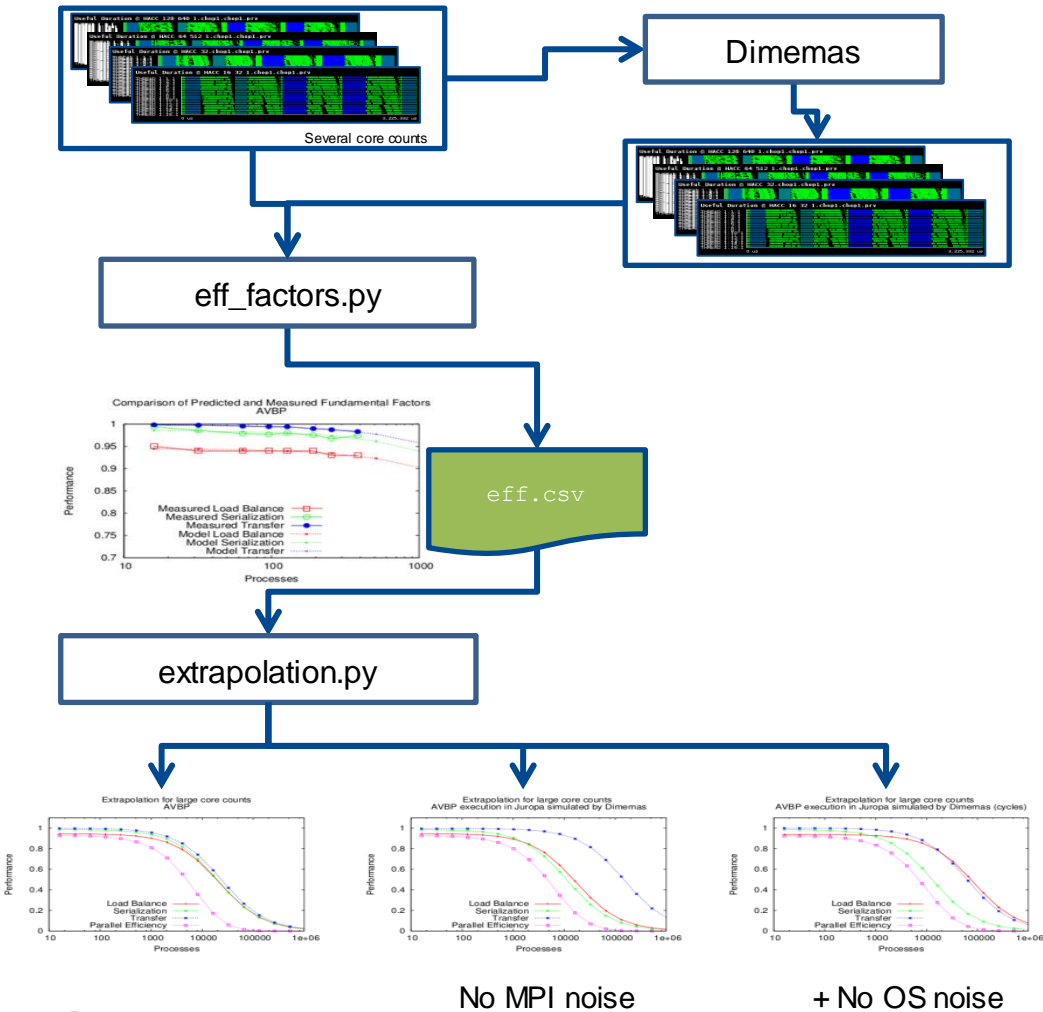
Tracking performance evolution



AMG2013

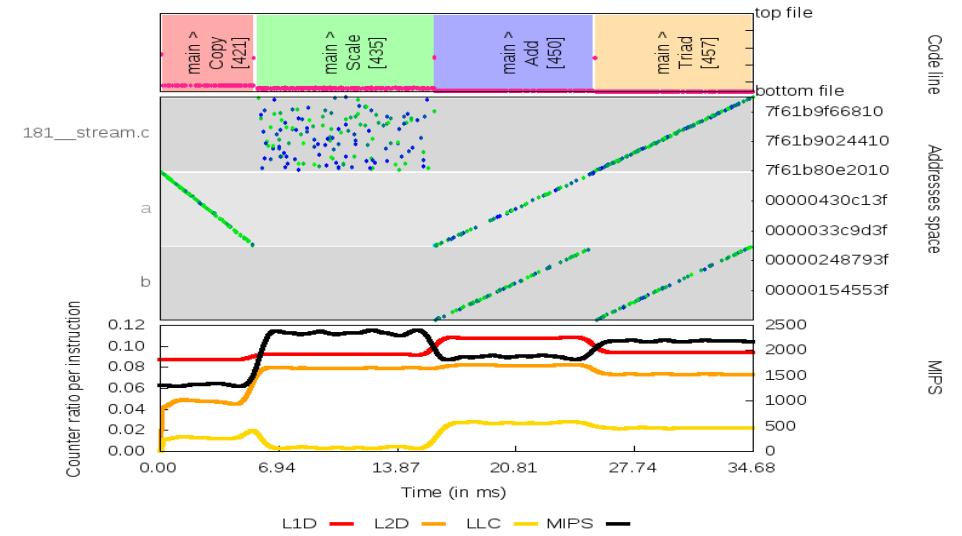
BSC Performance Tools

Models and Projection

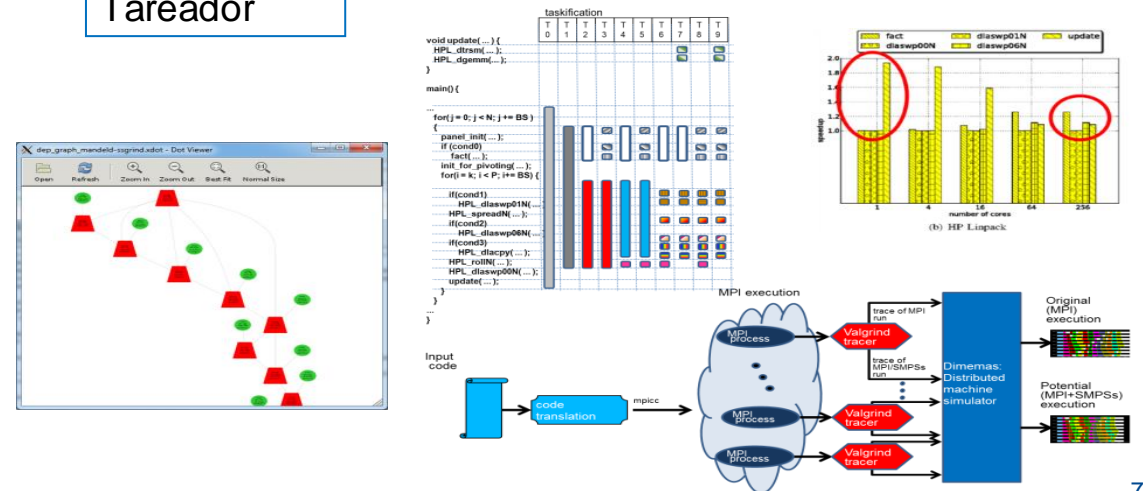


Intel -BSC Exascale Lab

Data access patterns



Tareador



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 process

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

Interactively: Gather data → Analysis → Report



3 levels of services



? 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 service
- Identifies the root causes of the issues found and qualifies and quantifies approaches to address the issues
- 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



Other activities



- **Customer advocacy**

- Gather customers feedback, ensure satisfaction, steer activities

- **Training**

- Best practices on the use of the tools and programming models (MPI + OpenMP)



Contact us !!



- If you have the feeling you are not getting the performance you expected
- If you are not sure whether it is a problem of your application, the system, ...
- If you want an external view and recommendations on suggested refactoring efforts
- If you would like some help on how to best restructure your code

POP Coordination

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