We are the "Performance" in HPC

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HORIZON-EUROHPC-JU-2023-COE

EuroHPC Joint Undertaking

1 January 2024– 31 December 2026

Grant Agreement No 101143931

POP CoE

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

Partners

- **Who?**
  - BSC, ES (coordinator)
  - HLRS, DE
  - INESC-ID, PT
  - IT4I, CZ
  - JSC, DE
  - RWTH Aachen, IT Center, DE
  - TERATEC, FR
  - UVSQ, FR

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

HLRS
High-Performance Computing Center Stuttgart

IT4I

JÜLICH Forschungszentrum
JÜLICH SUPERCOMPUTING CENTRE

inesc id lisboa

RWTH AACHEN UNIVERSITY

Teratec

UNIVERSITÉ DE VERSAILLES ST-QUENTIN-EN-YVELINES

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

Motivation

Why?

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

What?

- Parallel programs, mainly MPI/OpenMP
  - Although also CUDA, OpenCL, OpenACC, Python, …

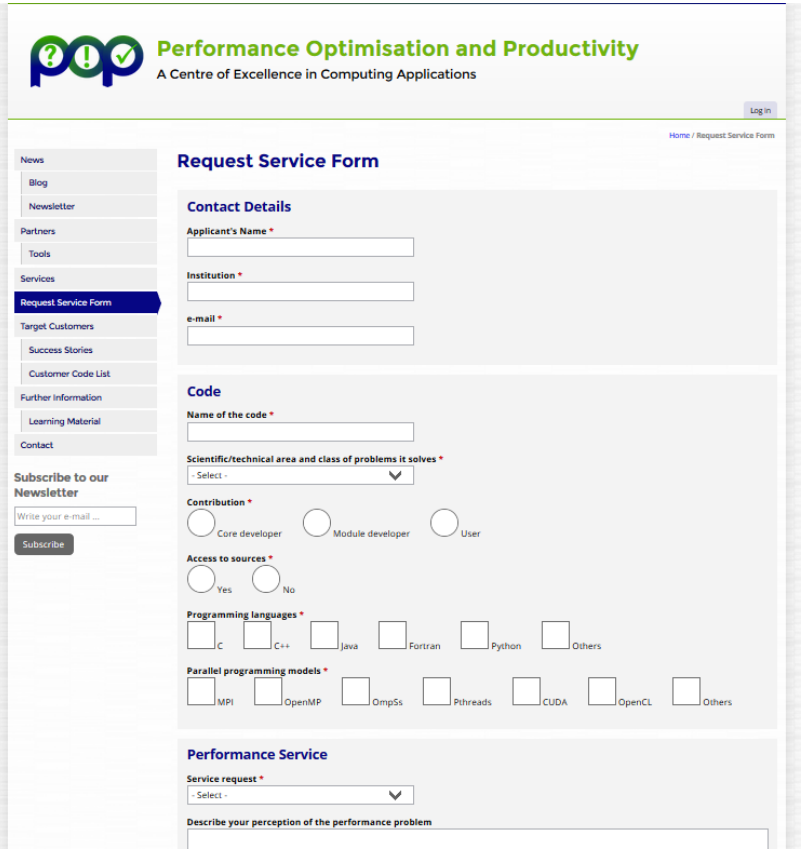
The Service Process …

When?

Januar 2024 – December 2026

How?

- Apply
  - Fill in small questionnaire describing application and needs https://pop-coe.eu/request-service-form
  - Questions? Ask pop@bsc.es
- Selection/assignment process
- Install tools @ your production machine (local, PRACE, …)
- Interactively: Gather data → Analysis → Report



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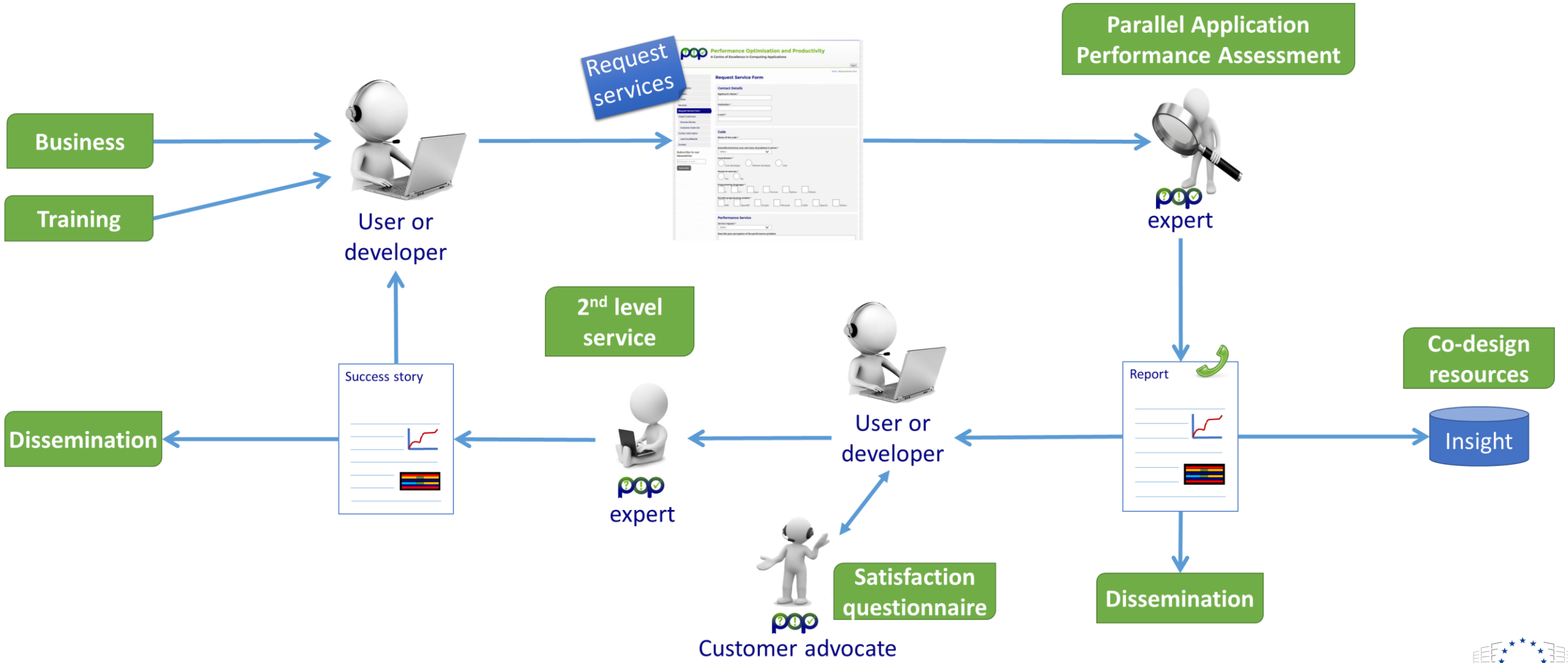
FREE Services provided by the CoE

- **Parallel Application Performance Assessment**
  - Primary service
  - Initial analysis measuring a range of performance metrics to assess quality of performance and identify the issues affecting performance (at customer site)
  - If needed, undertakes further performance evaluations to identify the root causes of the issues found and qualify and quantify approaches to address them (recommendations)
- **Second Level Services**
  - Second level services may follow after conclusion of an initial performance assessment:
    - **Proof-of-concept**: explore the potential benefit of proposed optimisations by applying them to selected regions of the applications
    - **Correctness-check**: evaluate the correctness of hybrid MPI + OpenMP applications
    - **Energy-efficiency study**: investigate improvements of energy consumption or efficiency
    - **Advisory study**: ongoing consultancy for customers that choose to implement proposed optimisations on their own
- Note: Effort shared between our experts and customer!

The Service Process …

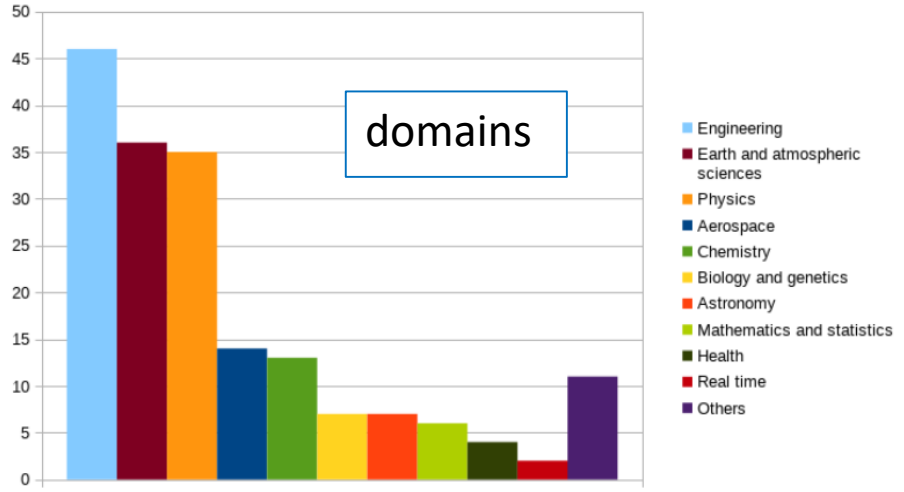


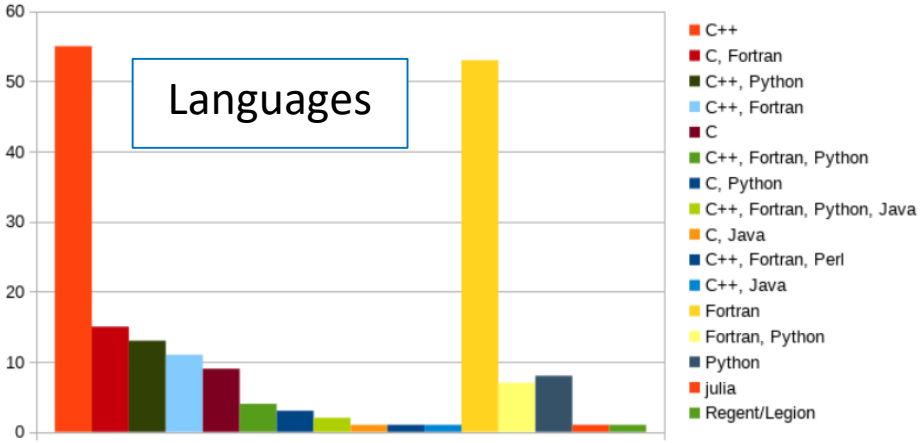
Past POP Assessments

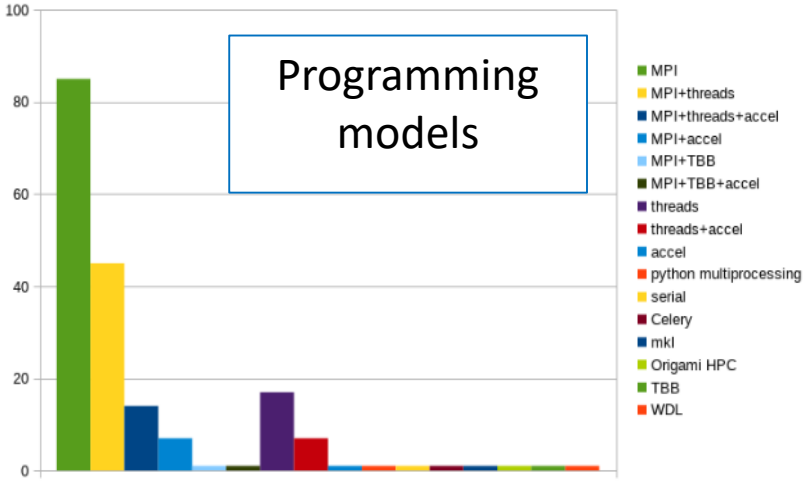
- Large number of services

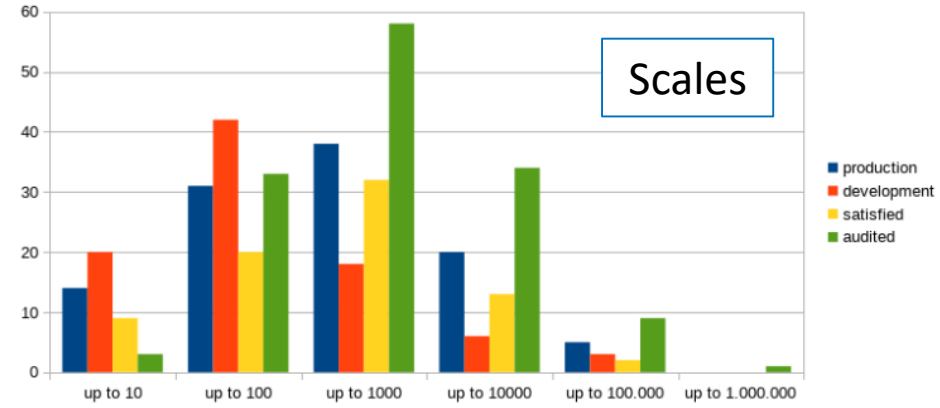
POP1 & POP2 each
- > 140 Assessments
- > 25 Proof of Concept

customer
- ~80% Research
- ~20% Industry



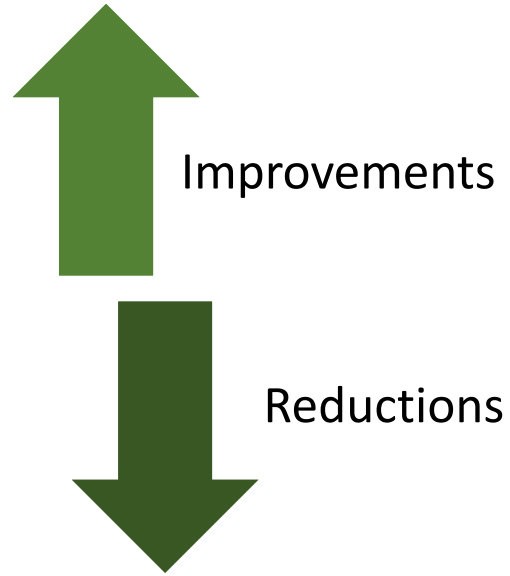






Some PoC Success Stories

- See ⇨ https://pop-coe.eu/blog/tags/success-stories



- Performance Improvements for SCM's ADF Modeling Suite
- **3x Speed Improvement** for zCFD Computational Fluid Dynamics Solver
- **25% Faster time-to-solution** for Urban Microclimate Simulations
- **2x performance improvement** for SCM ADF code
- Proof of Concept for BPMF leads to around **40% runtime reduction**
- POP audit helps developers **double their code performance**
- **10-fold scalability improvement** from POP services
- POP performance study improves performance **up to a factor 6**
- POP Proof-of-Concept study leads to **nearly 50% higher performance**
- POP Proof-of-Concept study leads to **10X performance improvement** for customer

ROI Examples

Application Savings after POP Proof-of-Concept

- POP PoC resulted in 72% faster-time-to-solution
- Production runs on ARCHER (UK national academic supercomputer)
- Improved code saves €15.58 per run
- Yearly savings of around €56,000 (from monthly usage data)

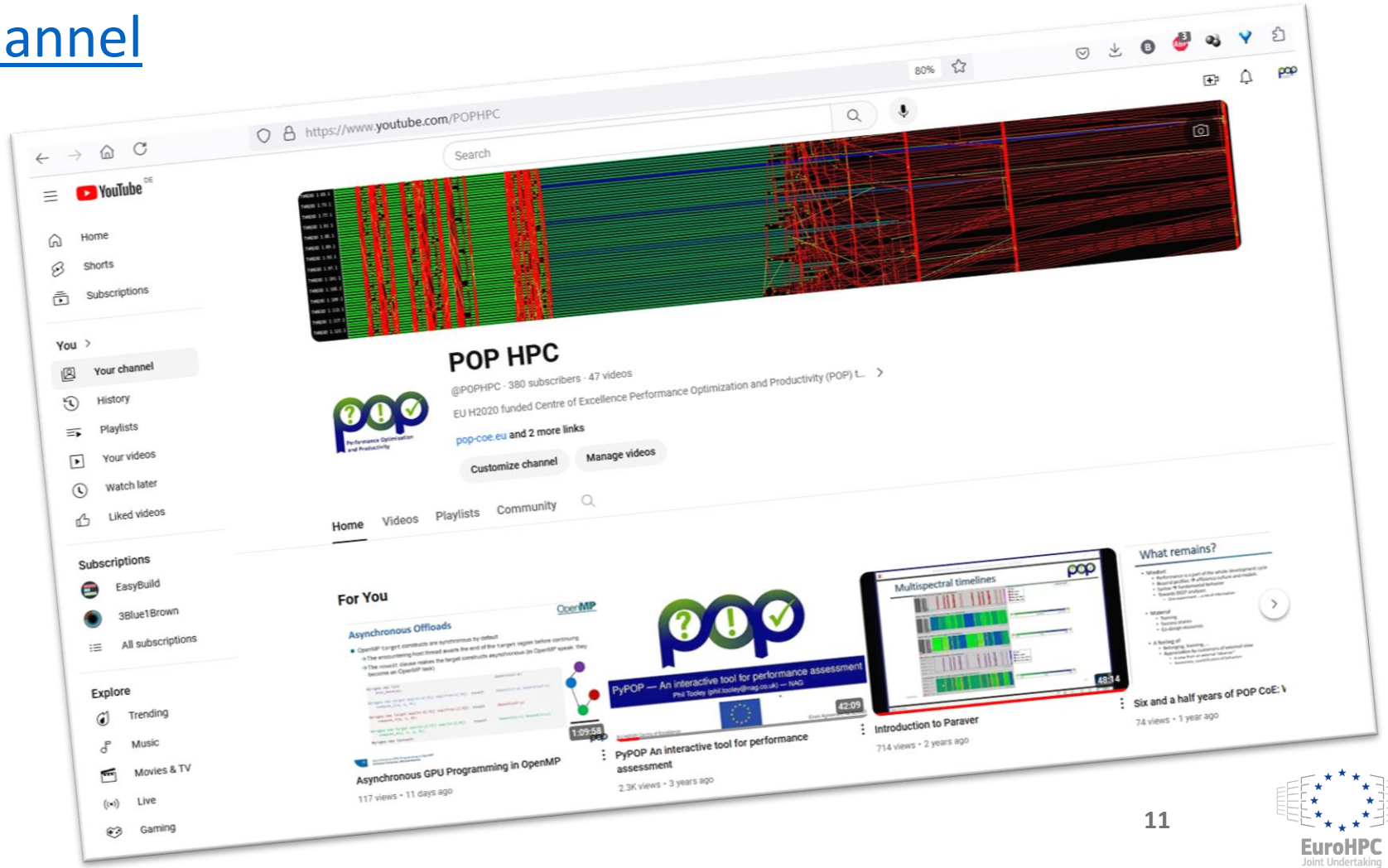
Application Savings after POP Performance Plan

- Cost for customer implementing POP recommendations: €2,000
- Achieved improvement of 62%
- €20,000 yearly operating cost
- Resulted in yearly saving of €12,400 in compute costs ⇨ ROI of 620%

Webinars / YouTube

- See ⇨ https://pop-coe.eu/blog/tags/webinar
- Or YouTube Channel

- Recordings of 26 webinars already available!



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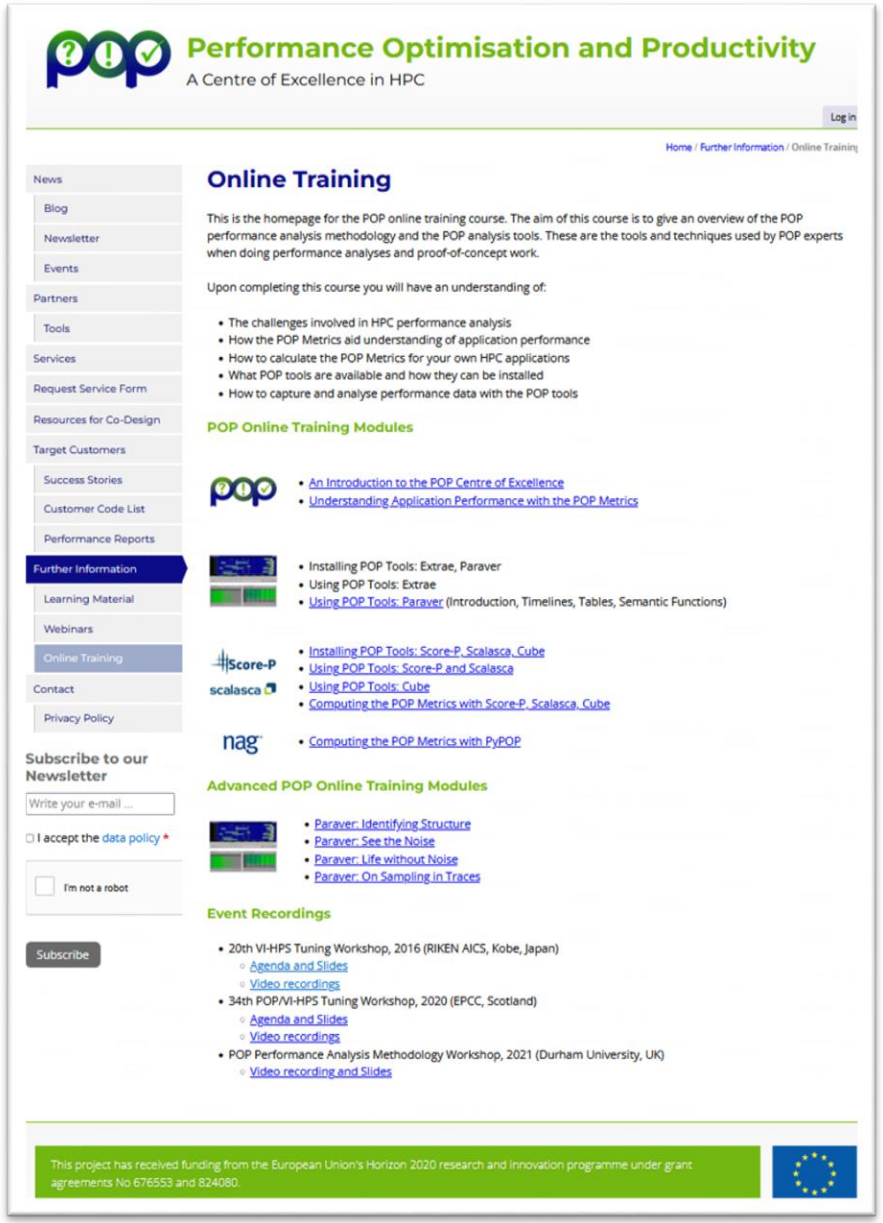
Online Training Modules



- 8 basic topics modules
- 4 advanced topics modules
- 3 (+1) Tool Talks in coop with HPC.NRW

- Modules / video recordings from other events

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Performance Optimisation and Productivity 3

A Centre of Excellence in HPC

Contact:

- https://www.pop-coe.eu
- pop@bsc.es
- @POP_HPC
- youtube.com/POPHPC

This project has received funding from the European High-Performance Computing Joint Undertaking (JU) under grant agreement No 101143931. The JU receives support from the European Union's Horizon Europe research and innovation programme and Spain, Germany, France, Portugal and the Czech Republic.