Introduction

The Performance Optimisation and Productivity Centre of Excellence in Computing Applications (POP) has received funding from the European Commission to uncover inefficiencies and their causes in HPC applications.

From its start date in October 2015, POP aims to analyse 150 HPC codes in its first 2.5 years and provide €3M worth of savings through improved performance.

This is achieved through free of charge performance investigations.

Results

To date POP has achieved 55 Audits completed or reporting to customer and 4 completed Proof-of-Concepts, and is working on a further 29 studies. A wide range of application areas and languages have been covered:

Figure 2: a) Application areas b) Application languages.

Figure 3 examines the main cause of inefficiency identified in the Audits conducted so far. We see that no single type of inefficiency is the most prevalent.

Figure 3: Leading cause of inefficiency found by Audits.

Highlights: Ateles

The Institute for Simulation Techniques and Scientific Computing of the University of Siegen develops a CFD code called Ateles. POP identified potential optimisations:

- Inlining of very short functions with high call rates
- Reduction of expensive CPU operations such as division

We measured a performance increase of nearly 50% on the provided test case and the user confirmed a substantial performance improvement for production runs.

Highlights: GraGLeS2D

The Institute of Physical Metallurgy and Metal Physics of RWTH Aachen University develops a microstructure materials simulation code called GraGLeS2D.

Figure 4: Initial (l) vs. optimised (r) work/data distribution

We implemented a number of optimisations, including reordering the work distribution to match data locality. The hotspot’s runtime improved by more than 10X.

Conclusion and Impact

POP has made a great start towards its goals and is on target to analyse the desired number of applications.

POP shows that there is great scope for gains in application performance. Such gains can lead to reduced simulation time, the ability to run larger problems, and an improved competitive advantage.

POP investigations are available free of charge for EU based organisations.