Call for Contributions – SCALABLE Abstract

Abstract

Lattice Boltzmann methods (LBM) have already evolved to become trustworthy alternatives to conventional CFD. In several engineering applications, they are shown to be roughly an order of magnitude faster than Navier-Stokes approaches in a fair comparison and in comparable scenarios. In the context of EuroHPC, LBM is especially well suited to exploit advanced supercomputer architectures through vectorization, accelerators, and massive parallelization.

In the public domain research code waLBerla, superb performance and outstanding scalability has been demonstrated, reaching more than a trillion (1012) lattice cells already on Petascale systems. WaLBerla performance excels because of its uncompromising unique, architecture-specific automatic generation of optimized compute kernels, together with carefully designed parallel data structures. However, is not compliant with industrial applications due to lack of a geometry engine and user friendliness for non-HPC experts.

On the other hand, the industrial CFD software LaBS already has such industrial capabilities at a proven high level of maturity, but it still has performance worthy of improvement.

In SCALABLE, 8 partners both from industry and academia team up to improve the performance, scalability, and energy efficiency of LBM-based computational fluid dynamics (CFD) softwares.

In particular, the project will:

- Assess the differences between LaBS and waLBerla solvers and to understand the key drivers for optimal performance, while preserving the industrial needs as a “best solution” industrial solver
- Unleash the full CPU performance, identify and remove bottlenecks in the path towards industrial extreme scale computing
- Produce dedicated code generation for the LBM accounting for runtime specificities to enable better versatility and performance for the next generations of HPC hardware
- Increase the ease-of-use and use of high-scalable HPC systems for industrial applications

SCALABLE started in January 2021 and is co-funded by EuroHPC JU through the Horizon 2020 research and innovation program, as well as Czech, French and German funding agencies.

Our presentation will focus on the results already obtained by SCALABLE that include an extensive benchmark produced for both softwares on standard test cases and related ways of

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improvement towards an “exascale-ready” version which could be of interest for the entire European HPC Community at large.

Our speaker is Jérôme TEXIER, director of LaBS at CS GROUP and SCALABLE’s project coordinator.