

**PANEL DISCUSSION:
CURRENT AND FUTURE NEEDS OF THE CFD
COMMUNITY IN THE ERA OF EXASCALE COMPUTING**

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Abstract. Science and industry face rapid and accelerating developments in hardware and software when it comes to, e.g., numerical simulations, analytics of huge amounts of data, or the application of novel AI technologies in the era of heterogeneous and/or federated exascale HPC. The observed evolution of the scientific and economic landscape makes pervasive intertwining of classical simulation and data methods with AI unmissable, resulting in increasing complexity that necessitate workflow orchestration on and across modular HPC systems. The broad spectrum of opportunities and, at the same time, impediments challenges software developers and hardware providers alike. The EuroHPC Joint Undertaking drives the development of the HPC landscape in Europe and provides exascale HPC resources and instruments, such as AI Factories, the European Federation Platform (EFP), or – in the future – the AI Gigafactories to user communities. It becomes clear that there exist several strategic pathways that can be followed to address future compute and data needs for solving societal challenges.

In this regard, the CFD community is not an exception. Developers are urged to port simulation codes to GPUs – when not with low-precision hardware – for more energy-reduced and performance-efficient computations. They need to show scalability at exascale, while not seldomly struggling with the conversion of complex legacy codes to data- and compute-efficient algorithmic implementations, and at the same time keeping functionality. Scalable mesh adaptivity and solution methods, hybrid parallelization, or hardware-agnostic programming are pressing challenges. Applications, such as in combustion, aerospace, or energy systems deal with multi-scale and multi-physics phenomena that increase code complexity and including less-efficient coupling setups. More recently, the need to rethink algorithms to cope with modern accelerator architectures offering less floating point precision while maintaining the accuracy required by classical simulation sciences brings an additional challenge.

On the contrary, such hardware is ideally suited for AI training at scale and model inference. However, taking the hurdle of first implementing and training sufficiently accurate AI models, and then finding efficient embeddings in CFD solvers or workflows using state-of-the-art hardware, possibly including agentic AI, is a challenge in itself. This is complemented by sometimes difficult-to-oversee interplays between various EU projects, infrastructures, or services. To tackle all these challenges highly skilled interdisciplinary teams equipped with knowledge in modern and future compute technologies, AI and big data analytics, domain science, and software development, are absolutely mandatory.

As a community-representing entity, it is PRACE's highest interest to collect independent feedback from the HPC users and to provide guidance to stakeholders and funding agencies in the improvement of the European HPC ecosystem throughout the range of users and computing sites. This panel invites representatives from each of the various ParCFD 2026 mini-symposia on stage to discuss – together with the audience – current and future challenges of individual CFD sub-communities. Needs from a compute, data, infrastructure interplay, and skill point of view in the era of exascale are elaborated. PRACE intends to compile the discussion outcome to an EU CFD strategy paper for distribution to decision authorities.

Short bio of the organizers



Dr. Andreas Lintermann is the leader of the Simulation and Data Lab "Fluids & Solids Engineering" at the Jülich Supercomputing Centre (JSC), Forschungszentrum Jülich. He is holding the Chair of the Council of the Partnership for Advanced Computing in Europe (PRACE). Lintermann was coordinating the European CoE RAISE and leads/co-leads JSC's activities in various national and international projects, e.g., in EuroCC3, SPECTRUM, HANAMI, RI-SCALE, AIRIS, TwinRISE, or nxAIM. His research focuses on HPC, modular supercomputing, AI, bio-fluidmechanis, lattice-Boltzmann methods, high-scaling meshing methods, and efficient multi-physics coupling strategies.



Serge Bogaerts is Managing Director of PRACE aisbl. He graduated in 1992 as Mechanical and Electrical Engineer of the Free University of Brussels (ULB). Researcher in numerical fluid mechanics at the von Karman Institute, then study engineer in nuclear safety at Tractebel Engineering and, in 2003, researcher in CFD-Multiphysics at Cenaero, Serge knows the challenges of numerical simulation. He managed the operations of Cenaero supercomputers from 2006 which allowed him to build up a confirmed experience in leading projects of procurement and operation of HPC infrastructures. In October 2012, he was appointed Belgian Delegate to the PRACE Council in which he also served as Council Secretary from October 2015 on. He left Cenaero to start as PRACE Chair of the Board of Director and Managing Director on 1 February 2017.