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EXCELLERAT

Innovations

Innovation #1

"Data Exchange & Workflow Portal enabling a secure, fast and traceable online data transfer between data generators and HPC centeres".

SSC is developing a secure data exchange and transfer platform within the EXCELLERAT project to ease the use of High-Performance Computing (HPC) resources and make the data transfer more efficient. Nowadays, organisations and smaller industrial partners face various issues while dealing with HPC calculations, HPC in general or even the access to HPC resources. In many cases, calculations are too complex and potential users do not have the required expert knowledge to fully benefit from HPC technologies without support. This is the challenge that SSC has taken on. The developed Data Exchange & Workflow Portal will be able to simplify or even eliminate these obstacles. First activities with the High-Performance Computing Center Stuttgart (HLRS) have already started. With the help of the platform users are now enabled to easily access the two HLRS clusters, Hawk and Vulcan, from any authorised device and run their simulations remotely.

Status Quo: In cooperation with various pilot partners from the industry, the platform prototype is undergoing multiple tests regarding its suitability, starting with the German Federal Institute for Population Research as the first learning project with real productive use. All user requirements and feedback are incorporated into further development and optimisation so that we can offer the greatest possible added value for future users from different technical areas.

Owner of the innovation within the consortium:
SSC-Services GmbH

Key organisation(s) delivering this innovation, amongst the project partners:

1. Sicos BW GmbH
2. hydrograv GmbH
3. German Federal Institute for Population Research (Bundesinstitut für Bevölkerungsforschung, BiB)

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Innovations

Innovation #2

"AMR capability in Alya code to enable advanced simulation services for engineering"

Alya is a High-Performance Computational Mechanics code developed for the numerical solution of Engineering problems. Alya applications range from numerical simulation of combustion and pollutants emissions in engines to the simulation of structural problems such as aircraft fuselages, as well as Multiphysics couplings for the simulation of complete engineering systems. One of the key capabilities required by high-fidelity simulation codes to take advantage of leading-edge computing resources is the automation of the mesh generation or adaptation processes. Manual mesh generation or tuning is not conceivable in an Exascale simulation workflow. Adaptive Mesh Refinement (AMR) eliminates these bottlenecks providing higher efficiency and robustness to the codes.

One of the tasks of the EXCELLERAT project has been to develop massively parallel AMR implementations of the core engineering codes. Particularly, in Alya a fully parallel implementation has been developed based on an interface freezing approach to keep the mesh coherence between subdomains. Currently, we are in the process of attesting the performance on large scale simulations, solving associated complexities such as the load-imbalance or the results' postprocessing. Moreover, accurate error estimators are being tackled for the EXCELLERAT engineering uses cases.

Owner of the innovation within the consortium:
Barcelona Supercomputing Centre

Key organisation(s) delivering this innovation, amongst the project partners:
Barcelona Supercomputing Centre

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Innovations

Innovation #3

"Interactive in situ visualisation in VR"

Vistle is a software environment for scientific visualisation of large-scale data sets developed at HLRS. Vistle has a special focus on working in immersive virtual environments such as CAVEs and head-mounted displays. In order to enable visualisation of large-scale data sets in such environments, object and image based remote rendering can be configured within the visualisation workflows. This already capable tool has been extended with in situ interfaces within the EXCELLERAT project. Since Vistle is able to couple multiple clusters in a single post-processing pipeline, the new in situ capabilities cover everything in between direct in line visualisation on the simulation cluster with subsequent remote rendering to in transit visualisation sending the simulation data directly to a visualisation cluster. Since Vistle with its focus on VR is still quite rare, the in situ interfaces featured by Vistle are ones that are already used in some simulation codes. This way, interactive in situ visualisation in VR with Vistle works out of the box for these codes. The featured in situ interfaces of Vistle are the VTK-less LibSIm interface used by Vistle and the VTK-based interface of the SENSEI in situ framework.

Owner of the innovation within the consortium:
High-Performance Computing Center Stuttgart (HLRS) of the University of Stuttgart

Key organisation(s) delivering this innovation, amongst the project partners:
1. Royal Institute of Technology in Stockholm KTH
2. Barcelona Supercomputing Center (BSC)
3. Centre Européen de Recherche et de Formation Avancée en Calcul Scientifique (CERFACS)

Acknowledgements

Project Runtime: 2018-01-12 until 2021-30-11

These are only selected aspects of the EXCELLERAT project – learn more about the full portfolio on the website and service portal

Website: www.excellerat.eu
Service Portal: https://services.excellerat.eu

The EXCELLERAT project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No. 823691.

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