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D7.4

Updated Dissemination, Communication, Collaboration, Community Building and Standardization Report

Workpackage:	WP7	Awareness, Impact Creation and Outreach	
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List of abbreviations

BoF   *Birds of a Feather*

CFD   *Computational Fluid Dynamics*

CoE   *Centre of Excellence*

CPU   *Central Processing Unit*

D   *Deliverable*

DLB   *Dynamic Load Balancing*

EU   *European Union*

F2F   *Face-to-face*

HPC   *High Performance Computing*

IG   *Interest Groups*

ISV   *Independent Software Vendor*

KPIs   *Key Performance Indicators*

MPI   *Message Passing Interface*

WP   *Work package*

Executive Summary

This meta-report will report yearly on all activities of Work Package (WP7) with subsections for performed actions and plans in the areas of dissemination, communication, collaboration, community building and standardisation. The WP7 tasks dealing with Community Building and Standardisation are now fully established and running with initial results and insights, which will be described in-depth in this deliverable. There will be an overview of the status of the KPIs and a more detailed description of the WP7 tasks.

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1 Introduction

The CoE for Engineering Applications EXCELLERAT aims to boost High Performance Computing (HPC) for engineering to Exascale and thus enable the engineering industry to use highly scalable codes leading to increased competitiveness. In order to help establish EXCELLERAT as a principal hub for industrial and academic players in the field of engineering with use of HPC, awareness about the services and expertise of EXCELLERAT has to be created among its stakeholders, which makes it necessary to approach communication and collaboration strategically.

In the first section of this document, the dissemination and communication strategy is addressing the questions of how information is exchanged within the project, what communication goals EXCELLERAT aims to reach, who the target group is and what message the project wants to deliver to each of them. In addition, communication and dissemination performance evaluation is outlined with the help of KPIs. This document explains the specific communication measures and tools the project uses in order to meet the strategy outlined in the prior section. The purpose of the EXCELLERAT portal specifically is only outlined very briefly, as this will be part of the deliverables D5.4 [1] and D5.5 [2] from WP5.

Additionally, this deliverable provides a comprehensive summary of the activities, which can be performed in cooperation with partners, projects, and other organisations beyond the EXCELLERAT Centre of Excellence (CoE).

Efficient collaboration on various levels is identified and continuously being extended, e.g., with other European CoEs or projects, with industry companies and with national projects/partners working on HPC-related fields.

Various standardisation tasks are undertaken, being implemented and further elaborated.

Finally, this document reports on the ongoing and planned activities contributing to community building as a tool to support the exploitation of the EXCELLERAT services more efficiently.

This document is a living document; it is the update of the initial version from M12 (see D7.3 [3]) and it will be updated and released as a final version in M36 of the project.

2 Dissemination and Communication

The Centre will act as a single access point to technology and expertise. Academia and industry can avoid overlapping investments by making use of the knowledge pool of EXCELLERAT. This will give all parties the chance to free up their own resources to thrive on niche innovations specific to a particular code.

2.1 Goals and tools of dissemination

In EXCELLERAT, both dissemination and communication are managed with a combined strategy. The two have similar timing and one could monitor for example social media for success (with KPIs). The identified target groups also define the level of interaction that is necessary through time from awareness over understanding up to action/collaboration. Dissemination is of importance for the academic/scientific communities as well as for the industrial players. The goal is that dissemination activities will transform into collaboration and finally exploitation activities towards the end of the project.

2.2 Progress with dissemination KPIs

Table 1 below shows the current values of the communication KPIs until M24 (November 2020) of the project. The goal is, amongst other things, to increase the traffic on our website in a way, that it is not about numbers, but that the visitors get aware of the added value of EXCELLERAT and thus enter in discussions with the consortium. The performance concerning the number released for Scientific Papers and Whitepapers as well as in the "Events" section has a mid-project target status, which means that there will be a continuous action towards these in order to achieve the targets set by the end of the project runtime. Especially with regards to events it is important to note that due to the situation caused by the COVID-19 pandemic, many events in 2020 were either postponed to 2021 or cancelled, therefore the project team has adapted to this challenge and is focussing on digital events.

For the second year of EXCELLERAT, the consortium has decided to focus on the further increase of awareness for the existence of the project and dissemination of first research results and success stories. The project is in a phase, in which mature results automatically lead to a higher number of publications. The long review process of some of the initial paper submissions is now finished and most of them have been accepted and published. The metrics (Table 1: KPIs Overview, Status: 24th November 2020) will further increase during M25-M36 of the project. Still despite setting the targets high, some of them are already achieved.

Tool	KPI	Status M24	Target M36
Publication	Released Scientific Papers	17	35
	Press Releases	2	4
	Released Whitepapers	0	5
Events	Project presentations conferences/events	20	25
	Significant presence at events (hosted, sponsorship and booths)	10	15
	No. of Workshops/Interest Groups meetings | no. of workshop participants	2 | Ø 14 participants per workshop/meeting	4 workshops Interest Groups meetings
	No. of conferences | No. of attendees	1 | 18	2 | Total 150
Social Media	No. of twitter postings, Followers, Engagement and Impressions	409 tweets 277 followers Ø 693 Impressions/tweet	Regular postings, 200 Follower p.a. & 500 impressions
	No. of LinkedIn postings, followers, engagement and impressions	214 followers, Ø 916 organic impressions	75 Followers p.a., 300 impressions
Reference in external media channels (on- & offline)	Press clippings	18	20
EXCELLERAT Website	Number of visits	Overall 23,500 (11/20)	7,000 p.a.
EXCELLERAT Portal	Number of subscribers	47	50
Newsletter	Number of subscribers	47	150

Table 1: KPIs Overview

2.2.1 Website

The EXCELLERAT website [4] architecture and analytics have been addressed in great detail in deliverable D7.1 "Website, Corporate Design and Templates" [5]. The most important statistics are the following:

- Site visits: 215/day, overall 6,454 in 30 days.
- Referring Domains: LinkedIn, Google, Twitter, ssc-services.de, bit.ly.
- Top languages: English, German.
- Search terms: codes, excellerat eu project, hlrs.
- Top visited pages: Events, Home, Blog, Our Goals

The website was re-designed and restructured with an improved design to achieve a better user experience. That makes it easier to integrate the service portal. The design is more reduced and cleaner than before, which makes the website more modern and easier for the user to get an overview. More clickable elements and simple visuals help the user to navigate and experience a more interactive user journey.

The website relaunch process was discussed in a working group between Work Packages 1, 5, 6, and 7 (Marketing and Business) and included feedback from the EXCELLERAT partners. The website will continuously be updated with new content and its style will be adapted, if necessary.

At this point, the service portal's design is being adapted to the website's design together with WP5.
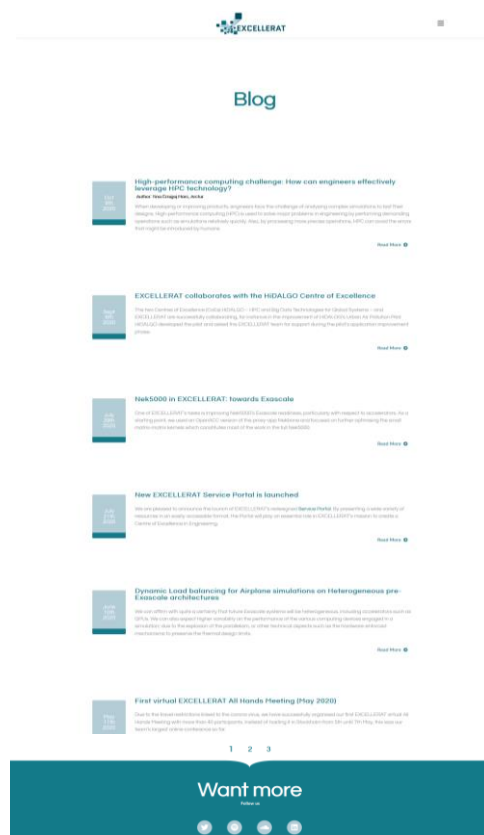
Figure 1: EXCELLERAT Website Home

Figure 2: EXCELLERAT Website Blog

2.2.2 Newsletter, Publications and White papers

The bi-monthly EXCELLERAT newsletter [6] was set up with the first issue being released in May 2020. The first issue was published as a PDF, as the updated website was not yet released at that point. From the second issue onwards and in line with the website redesign and relaunch, the newsletter is integrated into the website and being sent out via the WordPress plug-in MailPoet [7], which has been previously used by Focus CoE and other Centres of Excellence, like BioExcel and MaX CoE. This has several advantages, e.g. it increases the visibility via Google search, it is accessible via the smartphone, it is very easy to manage, you can keep track of the subscribers and manage the mailings in one single place, and, together with the according data policy form, it is in line with the GDPR regulation. In month 24 (M24), there have been three released issues and the fourth issue is under preparation to be released in December 2020. 47 persons have subscribed to the newsletter mailing list. The newsletter generally consists of various sections: An introduction by the Project Coordinator, a success stories section, a part that highlights one of EXCELLERAT's blog articles, as well as events and further news sections, which can include new podcast episodes, website updates or related news. The newsletter is sent out bi-monthly via e-mail to the list of subscribers, it is also embedded on the website in the news section [8], and it is regularly being promoted via Twitter and LinkedIn.

17 scientific papers (see Annex: EXCELLERAT Publications) have been published in research journals and conference proceedings, such as IEEE conference proceedings. This number will constantly increase with more scientific results, passing long review phases, and many conferences being postponed to 2021 due to the corona virus situation.

A white paper concept with a respective structure template has been developed within WP7 with several feedback loops (see Template in Annex, Figure 10 to Figure 12: EXCELLERAT White paper template). The concept includes a specific definition of white papers for EXCELLERAT and their purpose.

The definition and concept of white papers include:

- A technical, objectively/unbiased written document that elaborates innovations developed in EXCELLERAT with convincing (but not sales kind of) arguments, statistics/research results.
- This is written for an expert audience, like (research) software developers, ISVs, etc.
- The intro and outro are very important, as they are most likely to be remembered by the readers – this should catch the interest. The text shall be more thorough than a blog article but still interesting. Success stories can be very helpful for the story of a white paper.
- This document should have between five and ten pages and it shall be written in an accessible language.
- Reference links can be included, tags and key words are useful
- The white paper process shall include a review between a few EXCELLERAT members

The purpose of white papers for EXCELLERAT is:

- To promote a certain product/service/technology/methodology in a convincing way without marketing it, by factually presenting their benefits for potential stakeholders
- To influence decision making
- To generate leads
- Thought leadership
- To disseminate research results

The first white paper is being created by the standardisation task in WP7, which is helpful for testing and thus further improving the process and template. The layout for white papers to be included on the EXCELLERAT website is under development with the first paper being released in late 2020. Further potential topics are currently being identified.

2.2.3 Success Stories

In a working group between Task 7.1, Task 7.4, WP6 and WP1, a concept for success stories was created in May 2020. The concept includes three different types of success stories (collaboration with industrial (end) users, scientific achievements, collaboration with other CoEs, as described in Table 2) in order to reach all of EXCELLERAT's target audiences. The according process for the collection of success stories is described in Table 3.

The communication channels and formats for distribution of the success stories were chosen in accordance with the target groups. The EXCELLERAT website will serve as a content hub for all success stories. Distribution will be ensured via the following communication channels and formats:

- Newsletter: Highlighting the success stories as newsletter articles will generate further reach and target both industrial end users and academia.
- LinkedIn and Twitter: Sharing the success stories via LinkedIn for example to reach out to the Engineering community at large.
- Print material: Success stories in print version as hand-outs/flyers for conferences/trade fairs or other face-to-face (F2F) events. This will be created in a second step, as all F2F events in 2020 were either cancelled or postponed.
- Podcast: The success stories can be mentioned in podcast episodes with a linked topic. If qualified, partners who contributed to the success stories could be invited as interview partners for a podcast episode.
- Conference presentations: The success stories have been and will be further presented by experts from the consortium at conferences, e.g. at the digital Supercomputing 2020.
- Optional press articles: Several success stories might be adapted and rewritten for the press to be pitched to selected media contacts and being picked up as earned media articles.

Type of story Sections	Collaboration with industrial (end) users	Scientific achievements	Collaboration with other CoEs
Background information	Short presentation of the organisations involved (5%)		
Challenge	Technical/scientific challenge (15%)		Topic(s) of collaboration (15%)
Achievement	Solution (how the challenge has been solved) (30%)		Results of collaboration (50%)
Impact	Business impact (for the private company) (50%)	Scientific impact of the result (50%)	What did we manage to do together that we could not have done separately? (30%)
	Benefits for the company (bullet list)	Benefits for further research (bullet list)	
Highlights (in keyword style)	Main highlights (Keywords, ind. sector, key codes used)		

Illustrations	1-2 pictures describing the challenge and the solution

Table 2: Overview concept success stories

Action		In charge
1. Collect/identify topics for success stories	by (1) engaging in a dialogue with the experts in a proactive manner, and by (2) collecting the ideas coming from the experts	Teratec/USTUTT/Sicos BW
2. Validation and prioritisation	T7.1 partners present the pre-selected topics to the Project Management for prioritisation and approval (e.g. via joint telephone conferences)	USTUTT Project Management
3. Write the success stories	Collect elements from experts and partners and write the story	Teratec/USTUTT
	Refinement wording regarding the target group	USTUTT (T7.1)
	Validated by the experts for technical correctness	
4. Final validation		USTUTT Project Management
5. Dissemination	Via the appropriate dissemination channels	USTUTT (T7.1)

Table 3: Process for EXCELLERAT success stories

Three respective Word templates were created and the working group started with a first iteration and the goal to create three initial success stories. The first iteration was completed in October 2020 with the online publication of those three success stories [9], step by step. The second iteration was already initialised and the process will be continued and adapted from time to time, if necessary.

2.2.4 Podcasting

As EXCELLERAT still follows a multi-media approach to communication, some of the blog articles and themes can be enhanced by videos or podcasts. Used formats and formats envisioned for the future include the following:

- Podcast: An HPC Podcast powered by EXCELLERAT has been developed, with three episodes being published and the fourth one being under development. Episode #1 [10] was recorded with Sicos and dealt with an overall explanation of what HPC is; episode #2 [11] was released with Pipistrel, a Slovenian SME for lightweight aircrafts, speaking about the challenges of their product development, and episode #3 [12] was an interview with Ansys, the global leader in engineering simulation and a newer member of the EXCELLERAT Interest Groups.
- Recording of presentations (webinars): As more webinars are and will be taking place given the global situation, this will be increasingly enforced for future presentations.

- Interviews/Discussions/Workshops: Interviews with EXCELLERAT's or the Interest Groups' experts will be used for communication material, such as the podcast, but also blog articles and others.
- Explanatory video: The Explanatory video has the goal to introduce EXCELLERAT to every target group who visits the website. It should function as a simple and easy way to understand what the project is all about with a focus on the basics. This way it is easier for the viewer to get a feeling for the subject and after that they can deep-dive into more details about EXCELLERAT, which are presented through text on the website. The plan is to create a detailed storyboard and structure for the clip in the upcoming months and have it approved before the end of the year in order to get it done in the first quarter of 2021. The clip will be placed on the 'front page' of the website and it will automatically play muted as one is familiar from YouTube clips. Overall, this allows us to track the engagement of the video (view counts).

2.2.5 Social Media

EXCELLERAT is using social media for promoting content and connecting with the community. Within EXCELLERAT, social media is used to:

- increase traffic to the website – more than 19,000 visits in year one and two
- create a community interested in engineering HPC and Exascale technology
- promote the EXCELLERAT community, to achieve new subscribers to the EXCELLERAT Portal, to reach new users of EXCELLERAT services
- inform about upcoming events, news, newsletter issues, blog articles, new podcast episodes, and results regarding the project
- support the members, create another platform to interact & discuss topics directly
- engage and interact with the community with creative content, such as an HPC trivia quiz or #SimulationFriday, which also increases the engagement rate and probability of retweets

On Twitter and LinkedIn, EXCELLERAT tags the relevant partners' handles to posts in order to encourage engagement and to connect every partner with the community. Sharing news and scientific results, e.g. expressed through success stories, and the participation at events are highly important, too. Being close to the community and interact via social media, the website and personal contacts are key factors for the success of the dissemination of EXCELLERAT's results and achievements.

2.2.6 Media Relations & Events

It is one major goal to support the project's success with measures of both public relations and event presentations. EXCELLERAT will not only provide the HPC trade press with valuable content. A list of key media outlets has been identified in Table 4 and Table 5.

Magazine	Area	Language
HPCwire	HPC news	English
Primeurmagazine	Mainly HPC in Europe	English
The New Platform	HPC news	English
InsideHPC	HPC news	English
Scientific Computing World	HPC news	English
Golem	Technology news	German
Heise	Technology news	German
Eureka!	Engineering and design	English

Horizon Magazine	European funded research	English
Engineering	Technology, manufacturing, management	English
CFD online	Computational Fluid Dynamics (CFD) applications	English
INSiDE	HPC in Germany	English
Science Node	Applied HPC	English
Research & Development	Applied Science	English
Technology Review	Digital innovation	German
VDI-Nachrichten	Engineering news	German
Bild der Wissenschaft	Popular science news	German
Digital Engineering Magazin	Digital engineering applications	German
Automotive IT	IT in automotive industry	German
Data Center-Insider	Infrastructure/Hardware related news	German
Industrie 4.0 Magazin	Technology and work life	German

Table 4: Relevant magazines for press outreach

The success of the EXCELLERAT media relations is measured in pickups by the press ("clippings"). The list below with all clippings generated so far will be updated regularly.

Source	Release Date	Channel	Link
Produktdaten journal	Feb 18	Online	http://prostep.epaper.pro/journal-2018-02/de/#36
Primeurmagazine	15 Oct 2018	Online/ Video	http://primeurmagazine.com/weekly/AE-PR-11-18-85.html
GCSnews	October 2018	Online	https://www.gauss-centre.eu/fileadmin/user_upload/PR_News/2018/Publications/GCSnews20/GCSnews_20_2018_final_sm.pdf#page=2
HPC Wire	12 Dec 2018	Online	https://www.hpcwire.com/off-the-wire/EXCELLERAT-to-bring-hpc-applications-to-engineering-industry/
INSiDE	Dec 2018	Online / Print	https://www.hlrs.de/fileadmin/user_upload/InSiDE_16-2_ES_web.pdf#page=7
IDW	Dec 3, 2018	Online	https://nachrichten.idw-online.de/2018/12/03/expert-panel-on-the-future-of-hpc-in-engineering/
Innovations Report	Dec 3, 2018	Online	https://www.innovations-report.de/html/berichte/veranstaltungen/live-chat-zur-zukunft-von-supercomputing-im-engineering.html

Innovations Report	January 30, 2019	Online	https://www.innovations-report.com/html/reports/information-technology/new-analysis-methods-facilitate-the-evaluation-of-complex-engineering-data.html
InsideHPC	March 21, 2019	Online	https://insidehpc.com/2019/03/european-commission-funds-10-centers-of-excellence-for-hpc/
insideHPC	January 29, 2020	Online	https://insidehpc.com/2020/04/video-competence-centres-in-hpc-their-role-in-european-innovation/
datacenter-insider.de	February 25, 2020	Online	https://www.datacenter-insider.de/deutschlands-schnellster-supercomputer-werkelt-nun-in-stuttgart-a-907780/
HPC Wire	July 6, 2020	Online	https://www.hpcwire.com/2020/07/06/qa-hlrss-bastian-koller-tackles-hpc-and-industry-in-germany-and-europe/
PRACE News	July 14, 2020	Online	https://prace-ri.eu/scientists-provide-the-first-full-view-into-an-aircraft-engine/
EPCC Newsletter	August 5, 2020	Online	https://www.epcc.ed.ac.uk/sites/default/files/EPCC%20News%2087%20summer%202020.pdf
HLRS News	August 6, 2020	Online	https://www.hlrs.de/news/detail-view/2020-08-06/
Sicos-bw.de	August 10, 2020	Online	https://www.sicos-bw.de/news-events/news-detail/sommerinterview-nicole-prange/
HPC Wire	August 31, 2020	Online	https://www.hpcwire.com/off-the-wire/european-commission-approves-two-bsc-led-high-performance-computing-centers-of-excellence/
Sicos-bw.de	September 2, 2020	Online	https://www.sicos-bw.de/news-events/news-detail/sommerinterview-anne-bernard-bedouet/

Table 5: List of pickups in the media

3 Collaboration

3.1 Introduction

An efficient use of EU funding resources and a customer-oriented development of HPC services for the field of engineering requires a well-planned and continuously maintained collaboration network. EXCELLERAT closely cooperates with other partners involved in European and national research projects and initiatives to identify common issues in the field of HPC and to avoid investments into redundant activities.

A large number of new collaboration activities were initiated in the first year of EXCELLERAT and an intensive and successful exchange of tools, services, and experience took place in the second year, leading to mutual benefits for all collaboration parties. To monitor the achievements, success stories summarising the efforts and results of the collaborations have been created, which are shown exemplarily for some project partners in the next section. These

success stories contribute considerably to monitoring on-going and motivate additional collaborations. Besides the existing collaboration activities outlined in Deliverable D7.3 [3], a number of new collaborations have been established and added to the collaboration network. In total, the EXCELLERAT partners are collaborating in 41 projects which are summarised in Table 6 and are described in more detail in the annex (Table 13 to Table 24).

As part of the FocusCoE [13] platform, EXCELLERAT already intensively collaborates with FocusCoE, EoCoE [14], POP2 CoE [15], Max CoE [16], ChEESE CoE [17], HiDALGO CoE [18] and CompBioMed CoE [19] to synergistically define strategies for extreme scale applications in the EU HPC Ecosystem. Besides the activities within the FocusCoE project, the EXCELLERAT project partners have a large number of existing and newly acquired collaborations with European and national projects, companies and dedicated research groups.

Project Partner	Collaboration Project
USTUTT	FocusCoE, HiDALGO CoE, CATALYST, CRESATA, bwWisu, bwWisu2
UEDIN	CompBioMed CoE, CompBioMed2 CoE
CINECA	MAX2 COE, ETP4HPC, I4MS ICT, Prace Preparatory Access, ChEESE CoE, Hi-Fi Turb
SICOS BW	RECOM SERVICES, OPTIMA PHARMA
KTH	EPiGRAM-HS, RIKEN, Scania, SeRC, FLOW
ARCTUR	DIH HPC5
CERFACS	MMG, AVBP, CVT, EPEEC, POP2 CoE, EPI
BSC	POP2 CoE, EoCoE
FRAUNHOFER	ViPriA, VMAP, MADESI
TERATEC	POP2 CoE, FocusCoE
RWTH	SFB TRR40, ENODISE, INVENTOR, POP2 CoE
SSC	HLRS pilot project, hydrograv

Table 6: Overview of the projects collaborating with EXCELLERAT

To further extend the collaboration network, future potential partners will be identified and the EXCELLERAT partners are encouraged to establish new cooperation activities. To attract potential industrial customers and collaboration partners, information about the EXCELLERAT services has been disseminated in close collaboration with Task 7.1 (Dissemination and Communication).

3.2 Success Stories

In this section, an exemplary selection of the success stories summarising the efforts and results of the completed and ongoing collaborations is given. The success stories serve, first of all, as an internal monitoring system to regularly track the status of the collaborations' achievements. In addition, the internal success stories serve to identify projects that offer services, which can potentially attract new stakeholders. For these projects, more comprehensive, publicly available success stories, as described in section 2.2.3, are created in order to disseminate the services offered by EXCELLERAT, e.g. via the website or social media channels.

3.2.1 BSC – POP2 CoE

Partner:	**Name of the Collaboration Project:**
BSC (CASE Department)	POP2 CoE (EU Horizon 2020)

Collaboration Partner:	**Related WP:**	**Time Frame:**
BSC (Computer Science Department)	WP3	May 2019 - now

Objectives:

Optimisation of the code efficiency by Dynamic load balancing (DLB) at node level using DLB library for the integration of chemical source terms in detailed chemistry calculations.

Most Important Results:

In the figure presented below, we can see the elapsed time on the integration loop with and without using DLB. In the x axis, we see different configurations of MPI processes and OmpSs threads. On the left-hand side in Figure 3 (a) the results when solving the detailed chemistry and using a grain size of 1 are shown. We observe that the DLB run can improve the pure MPI and the hybrid version in all the cases. The runs with DLB are more than two times faster than the pure MPI. The best configuration is using 6 MPI processes and 8 OmpSs threads. But the most interesting fact is that the difference between the different configurations when using DLB is almost negligible. Looking at Figure 3 (b), we can see the results when solving the reduced chemistry problem and using a grain size of 32. We can see that in this case DLB can also improve the performance in all the cases. When comparing with the pure MPI run, DLB is 7 times faster. The DLB execution is faster than all the hybrid configurations and shows a flat trend when changing the number of MPI processes and OmpSs threads. Further analyses are now taking place on a large-scale case using detailed and reduced chemistry descriptions.
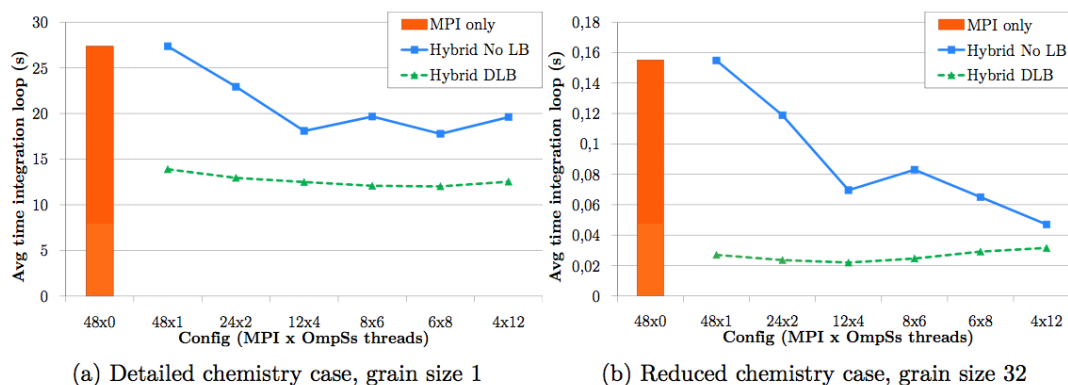

(a) Detailed chemistry case, grain size 1   (b) Reduced chemistry case, grain size 32

Figure 3: DLB time step timing comparison

3.2.2 CERFACS - MESHLES

Partner:	**Name of the Collaboration Project:**		
CERFACS	MESHLES: MESH refinement for Large Eddy Simulation		

Collaboration Partner:	**Related WP:**	**Time Frame:**
MMG consortium (INRIA), CORIA CNES, CERFACS, EM2C Centrale Supélec CNRS	WP2, WP3, WP4	2019-2021

Objectives:

One of the key components towards Exascale simulations in CFD is a better generation and handling of meshes. With this in mind within EXCELLERAT, CERFACS introduces automatic mesh refinement (AMR) within the Large Eddy Simulation (LES) framework to handle heavily transient flows.

AMR is not a new field however implementing an efficient highly parallel and intuitive mesh adaptation workflow suited for Exascale computing requires efficient remeshing techniques, highly parallel domain decomposition and rebalancing and interpolation techniques.

Most Important Results:

CERFACS has previously collaborated with the MMG consortium (represented by INRIA) and CORIA CNRS towards sequential refinement techniques for static meshing. Building upon this collaboration and work performed within the EU project EPEEC, we have setup two parallel workflows for AMR:

- The first one uses YALES2 from CORIA CNRS within the AVBP code to handle on-the-flight mesh adaptation. This workflow has been applied to the first use case for AVBP within EXCELLERAT, the MARSI explosion simulation [20] with success and obtained a 2x speed-up compared to static mesh simulations (see Figure 4).
- The second workflow, called Treeadapt [21], is an opensource framework built upon the Treepart library [22] to perform parallel mesh adaptation. Treeadapt has been successfully applied to meshes within the PRACE Project Rockdyn (PI: EM2C Centrale Supélec) on 8192 AMD Epyc 2 cores; adapting a 100 million element mesh to 1 Billion elements in less than 30 min (see Figure 5). This is a 140x plus speed up compared to the 72 hours required generate the 1 Billion element mesh using standard meshing software.

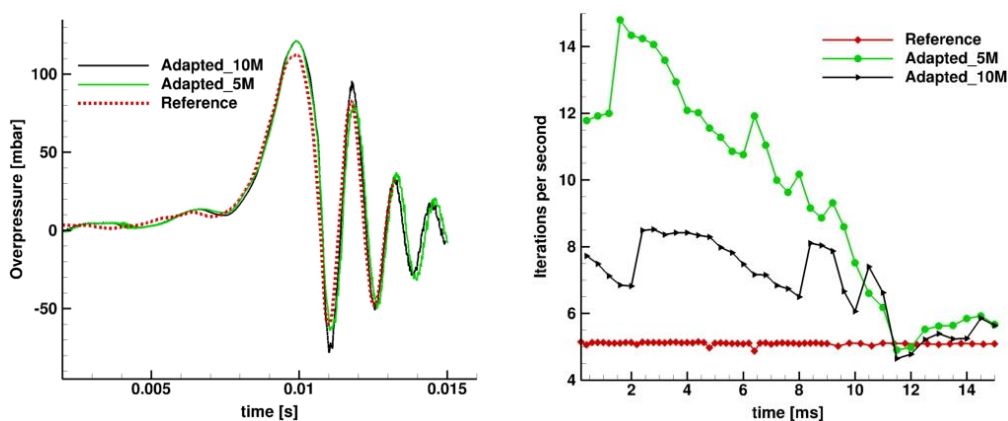Both workflows use the MMG open source remeshing library [23].

Figure 4: Overpressure versus time (left). Iterations per second over time (right)
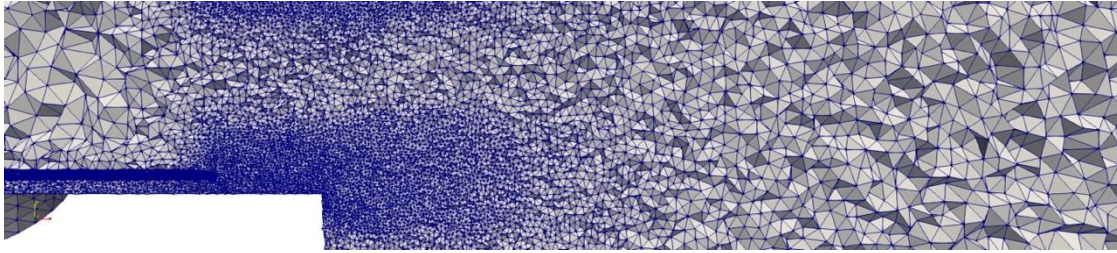
Figure 5: Adapted mesh detail from the PRACE Rockdyn simulation (T. Schmitt EM2C)

3.2.3 CERFACS – ADOPT

Partner:	**Name of the Collaboration Project:**	
CERFACS	ADOPT: portAbility anD OPTimisation	

Collaboration Partner:	**Related WP:**	**Time Frame:**
Cellule de Veille technologique GENCI (CVT) / ARM / EPI project / AMD / Atos / EPCC	WP3, WP4	2020

Objectives:

Preparing the core codes for Exascale requires extensive technology watch. In order to prepare the AVBP code to architectures that were not available at the start of the project, CERFACS has teamed up with the CVT from GENCI, ARM, AMD and the EPI project to port, benchmark and (when possible) optimise the AVBP code to ARM and AMD architectures.

This collaboration ensures an early access to these new architectures and prime information to prepare our codes for the wide spread availability of systems equipped with these processors.

Most Important Results:

The collaboration ensured access to the AVBP developers to the IRENE AMD system of PRACE at TGCC with support from AMD and Atos. This allows to characterise the application on this architecture and create a predictive model on how the different features of the processor (frequency, bandwidth) can affect the performance of the code. Also, strong and weak scaling measurements up to 128k cores were performed and 32k cores respectively preparing the code for the 20th and 21st PRACE call for projects, which saw 4 projects with AVBP awarded with more than 100 million CPU hours in total.

Beside AMD processors, the EPI project and the CVT of GENCI as well as EPCC provided access to ARM equipped processors, Thunder X2 and Hi1616 (early silicon from Huawei). This access provided important feedback on code portability using the ARM and gcc compilers, single processor and strong scaling performance on ARM.

Results from this collaboration have been included on the ARM community blog [24]. A white paper on this collaboration is underway with GENCI and CORIA CNRS.
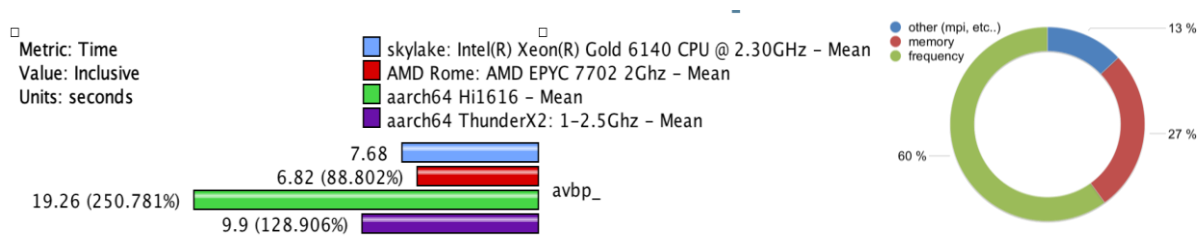
Figure 6: Single core performance for a Karman street simulation measures via gprof

Figure 7: Code characterisation on AMD Epyc 2 for AVBP

3.2.4 FRAUNHOFER – MADESI

Partner:	Name of the Collaboration Project:
FRAUNHOFER	MADESI (IKT 2020 - Forschung für Innovationen)

Collaboration Partner:	Related WP:	Time Frame:
TU Darmstadt, Weidmüller Monitoring Systems, ZF Friedrichshafen	WP4	Jan 2019 - now

Objectives:

Collaborations aim at scientific discussions and exchange of results about data analytics methods for time series data. Both, wind energy sensor data (MADESI) and highly resolved CFD simulations (EXCELLERAT) are of similar chaotic nature. Thus, similar analysis techniques are applied in both projects and compared with the goal of anomaly detection and simulation monitoring.

Most Important Results:

Regular exchange between both projects has taken place on a scientific level to identify similarities in the character of the data and requirements for data analytics. Although the formal dimension of the data differs in both cases, many similarities can be found in the chaotic nature that results from the underlying non-linear dynamic systems. As an example, the sensor data from wind energy systems is strongly influenced by the turbulent properties of the wind hitting the blades. This kind of flow can also be found in the highly resolved CFD simulations of EXCELLERAT use-cases.

Consequently, similar data analysis techniques, in particular variational auto-encoders (VAE) and modal decompositions (DMD), have been discussed and applied in both projects to find intrinsic, low-dimensional structures in the data. In MADESI they have proven successful to build a health monitoring system for wind turbines, i.e. to detect ice accumulation on the blades. In EXCELLERAT similar approaches can be used for a simulation monitoring in order to find early trends and cluster flow behaviour during run-time of the CFD simulation.

4 Community Building

4.1 Approach

As a reminder, the goal of this activity is twofold: first, to ensure that EXCELLERAT is recognised by developers and users of engineering application codes as a new key player in their ecosystem for Exascale codes in engineering, and second to link EXCELLERAT and its activities to the communities of academics, industrial users, ISVs and code developers, who are potential customers of EXCELLERAT's services.

Following the discussions during the EXCELLERAT AHM in Bologna (November 2019) among other interactions, and to better see the evolution of the Community Building, it was decided to monitor the EXCELLERAT community building efforts at three main levels: the first level is the initial core of the community (i.e. the EXCELLERAT consortium partners), the second level is constituted by the communities around the reference applications or the satellite codes which are hosted by the project (this is mainly the HPC community), and finally the third level combines all of the associated partners (mainly via the Interest Groups) and all the industrial partners, the potential users/clients, the other CoEs and the general public.

4.2 Implementation
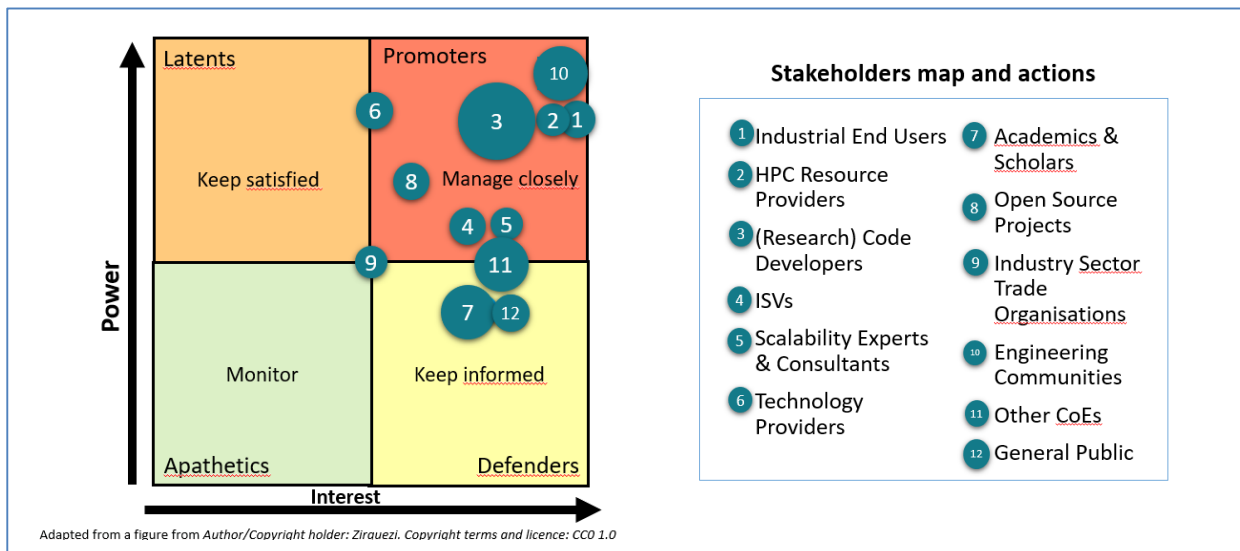
Figure 8: EXCELLERAT stakeholders map and actions. (The size of the circles on the map is proportional to the number of planned/underway/done actions)

To visualise the different types of stakeholders concerned by EXCELLERAT and the community building actions, the map in Figure 8 places the types of stakeholders with their importance on a grid scaled with power/interest.

The map in Figure 8 allows EXCELLERAT to target the most important stakeholders to ensure community building with them. All stakeholders are taken into account. The activities reaching out to potential clients, especially in the industry (for instance for the Industrial End Users and the HPC Resource Providers) have already started but they will gain more importance in the rest of the project, once the service portfolio and the service offerings are finalised.

Table 7 below provides details on the initially planned activities for the second year of the project that contribute to the Community Building task. Unfortunately, due to the COVID-19 outbreak, several events went digital or were postponed, therefore, the current status regarding these activities planned during the two first years of EXCELLERAT was also specified.

Community activities [content/title, date, main organiser/manager, partner]	Targeted stakeholders	Status following the COVID-19 outbreak
Networking with industrial end users during Teratec Forum 2019, June 2019, Teratec	Industrial End Users and ISVs	Done before the pandemic outbreak
Interest Group, 1st webinar in November 2019, USTUTT	Industrial End Users and ISVs	Done before the pandemic outbreak
School on "Numerical methods for parallel CFD" December 2019, CINECA	(Research) Code Developers and Academics & Scholars	Done before the pandemic outbreak
Workshop during the CFD school with ChEEse, December 2019, CINECA	(Research) Code Developers and other CoEs	Done before the pandemic outbreak
Webinar Verificarlo, 10 March 2020, CERFACS & ECR	(Research) Code Developers	Done online before the pandemic outbreak
EXCELLERAT WP3 - Workshop: "Porting to accelerators and new architectures." May 2020, BSC and Teratec	(Research) Code Developers	Digital workshop held before the digital EXCELLERAT- AHM in May 2020
OpenFOAM Thematic work group, Jour Fixe 2019-2020, SICOS and USTUTT	(Research) Code Developers and Open Source Projects	Jour Fixe regularly done (online)
Podcasts 1, 2 and 3 done in February – October 2020, USTUTT and Newsletters by USTUTT (new episodes/issues underway)	General public, Engineering Communities	Done online
NAFEMS DACH Conference, 14 October 2020, USTUTT	Engineering Communities, (Research) Code Developers	Online conference
Birds of a Feather (BoF) or similar event at SC20 in November 2020 on the project overall, UQ, and the Alya success story, KTH, BSC, and USTUTT	(Research) Code Developers and Industrial End Users	Side session now planned to happen online organised by WP7, WP1, and WP4 around SC20
Mini-symposium on load balancing at PASC 2020 [25] accepted (Initially planned for June 2020), KTH	(Research) Code Developers	Event postponed to June 2021

Table 7: Implementation status

The next actions currently planned by EXCELLERAT are listed in Table 8.

Community activities [content/title, date, main organizer/manager partner]	Targeted stakeholders
School on "Numerical methods for parallel CFD" December 2020, CINECA	(Research) Code Developers and Academics & Scholars
OpenFOAM Thematic work group, Jour Fixe 2019-2020, Sicos and USTUTT (currently in discussion for possible evolution of the frame through the future ExaFOAM project)	(Research) Code Developers and Open Source Projects
International CAE Conference and Exhibition 2020, December 2020, USTUTT & CINECA	Engineering Communities
iHURT, 1 December 2020, SICOS	Industrial End Users and ISVs
Individual meeting with a new IG member to discuss the progress and the overall cooperation, November 2020, USTUTT	Industrial End Users and ISVs
By-monthly newsletter issues and podcast episodes	General public
HiPEAC 2021 Conference (Joint CoEs workshop), USTUTT & Focus CoE	Other CoEs and (Research) Code Developers
CoEs workshop (technical joint workshop) with ChEESE and HiDALGO, January 2021, USTUTT, CINECA & Teratec	Other CoEs and (Research) Code Developers
NAFEMS DACH Salzburg, June 2021, USTUTT & BSC	Engineering Communities

Table 8: Next planned activities regarding Community Building

Several other potential topics for community building activities are also currently under consideration but they still need to be refined before being confirmed and before starting their planning and organisation, according to the market needs and EXCELLERAT's service offering and following this, the overall dissemination strategy. Therefore, they are not listed for the moment in the previous tables.

Finally, the outbreak of the COVID-19 pandemic (still active in November 2020) has strongly affected Community Building activities as all events were postponed, cancelled or went digital starting from March 2020 and for an undefined period. Therefore, in response to this global evolution, it has been decided to target in priority online events and to plan online sessions or workshops and webinars as physical events are not possible.

4.3 Work Involvement of the Interest Groups

EXCELLERAT has decided to establish the so-called Interest Groups [26], with their main objectives being the communication, monitoring and validation of the project's overall goal as well as, the industrial, and technological relevance for the user communities. The Interest Groups are structured in such a way that allows providing the viewpoints of the different actors of the Centre's value chain: Code Developers/ISVs, Industrial End Users, Scientific Experts and Technology Providers.

The first webinar for the Interest Groups was done and recorded at the beginning of November 2019. The agenda for this webinar is presented in Table 9 below.

Topic
Introduction
Role of the Interest Groups in EXCELLERAT
Presentation of the Project (Overview of EXCELLERAT)
Presenting our new HPC data exchange platform
Video + Work plan for Vistle (Visualisation)
Presentation of the BigWhoop compression library
First Preview of the Service Portal
Questions and Advice
Summary

Table 9: IG Webinar Agenda

The purpose of this webinar was to give the IG an overview about the recent results of EXCELLERAT and the project as well as integrating them into the process. Different Interest Groups were considered, including the following:

- ISVs (offering software and service in the domain of civil engineering)
- Software developers (in academia and in industry), who contribute to the development of the EXCELLERAT application codes (or similar applications)
- Users (from academia and industry), who are interested in making sure that the future applications development's take their requirements into account
- Trade unions, who may act as an interface between the application developers and the end users, as for example.

Thanks to the IG Webinar, it is easier to communicate with the IG members, since they now understand the purpose and the use of EXCELLERAT even better. The members will be notified, if events within the project would be interesting for them. That might provide the ability to even meet in person, discuss the further steps and get some feedback.

Furthermore, we keep the IG members updated for example via our podcasts and newsletters. We are looking to corporate with even more members, since the interest in EXCELLERAT is growing. As soon as we have new success stories, we are always keen to share those with this group to get their input. In this way, we are able to implement the feedback provided into the project's progress and create a better product/service portfolio in the end.

As a result of the IG, EXCELLERAT will be able to grow and adapt according to the important counselling from the Groups. Furthermore, all of the EXCELLERAT members are able to collect more helpful information to provide the best possible services in the end.

5 Standardisation

5.1 Identification

The last report introduced three axes, where standardisation could bring added value: crashes, performances, and sustainability. As EXCELLERAT is focusing on the engineering usage, we should precise the domain of investigation.

The Chasm
from *Crossing the Chasm* by Geoffrey A. Moore
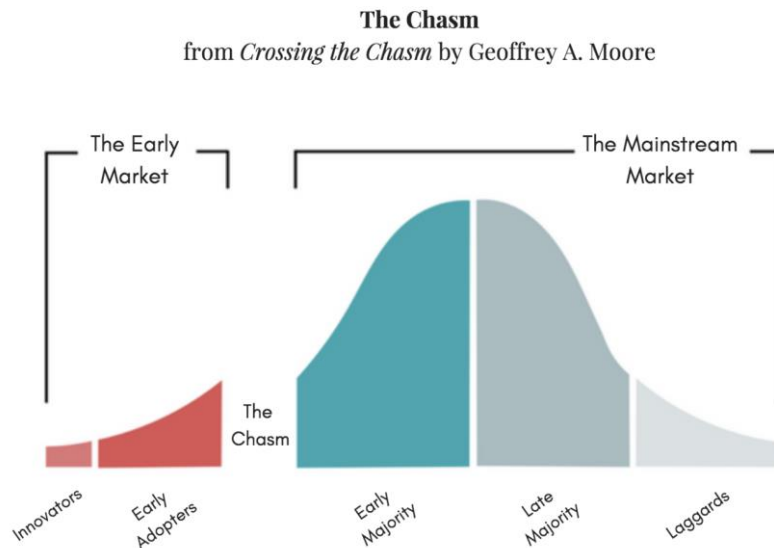
Figure 9: The "crossing the chasm" point of view

From a "crossing the chasm" point of view, the large HPC usage for the engineer is, nowadays, laying around the chasm. Some bleeding edge research applications are done by the Early Adopters, usually through a PhD contract or a small bilateral contract. Many laboratories also have "industrialisation" programs to cross the chasm. A little part of their applications has already overcome the chasm with large scale usage by the Early Majority of engineers. However, the situations, in which the HPC is a validated and accepted part of the design process are still very rare for now.

The following discussion will focus on this Early Majority context. Indeed, the challenges particular to HPC, namely Crashes, Performances and Sustainability, are the three potential showstoppers on the road to acceptance. This is where the danger comes from when moving from tens to thousands HPC runs per year.

This is the topic of the first white paper of EXCELLERAT. This document proposes an in-depth analysis of what can be done at the end of a design simulation campaign on HPC resources at an industrial scale.

The task 7.2 "Standardization" is working on elaborating sustainable practices. At the same time, some tools are developed to enforce these practices.

5.2 Elaboration

Concerning sustainability, the Fortran Standard for a human-friendly coding of large HPC codes is evolving. Indeed, core codes such as AVBP or NEK5000 were started more than 25 years ago and gather 500 000+ lines from different generations of programmers. In the EXCELLERAT frame, the open source lightweight linter "Flinter" [27] successfully tested the same standard version on these two codes. It seems that, even if the code communities were

totally separated, similar trends were found. Further work needs to be done to select the pertinent features of a final standard with evidence coming from the other core codes of EXCELLERAT.

At the same time, an investigation on crashes and performances was conducted on a realistic simulation campaign done with AVBP over 2.5 years. The resulting *a posteriori* datamining went through several data science diagnostics. It showed unexpectedly that, for this campaign, the crashes were essentially input fails at the start up, and almost never simulations errors at runtime: the inputs need more documentation. It also identified a set of runs with exceptionally bad performances, which are now under investigation. This illustrates the potential insights one company could gain from such a process. The method and tools are now under cleaning before a release toward the other partners of EXCELLERAT.

5.3 Diffusion

As stated before, the efforts done within the standardisation team are or will be released to the other partners. Indeed, HPC experts are bound to continuously move on the very latest emerging technology. In this context; discussing a standard without a concrete example would be meaningless.

Concerning the contribution of EXCELLERAT to International standards. Both research and industry have shown very little interest in developing and enforcing standards on HPC so far. With such little interest, even supposing a good and practical standard is existing, people would not be willing to pay for reading the content yet.

Therefore, in order to get active standards in the field, we need to make sure these are, at the very least, freely accessible. Open Standards organisations exists, as shown in this project review [28].

According to our research, one of the most adapted organisations would be OASIS [29]. First, because even if the scientific computing/HPC category is still missing, some existing categories are close to our field (Big data, Cloud). Second, because various levels of memberships are possible, from a personal to an organisation-wide membership, giving room for different approaches (individual-based or organisation-based).

We plan to propose to one of the Open standards organisations some of the EXCELLERAT standardisation task's outcomes, starting with the simple json-SCHEMA standard. This ubiquitous internet standard can be used to structure the inputs of our Exascale software, easing dramatically their implementation in, for example, simulations of on-demand platforms. A short technical explanation can be found in [30].

Other ideas that are already under development in EXCELLERAT could follow, the most mature being:

- a linting standard for the Fortran Language, inspired by the Colostate suggestion [31] with addition specific to Exascale computing with legacy codes.
- a baseline recursive job on an HPC cluster, easing the creation of simulation on-demand services.
- the structure of the database a HPC software provider should provide to explore and justify the past year worth of production on a specific cluster. This would allow the monitoring of *a posteriori* performances on past simulation campaigns.

The potential blockers are the poor amount of registered HPC users in the OASIS group, since it takes several unrelated contributors to build a valid standard. We will investigate if our industrial partners already have some links to Open standards organisations, which would give us a substantial head start on the standard submission completion.

6 Conclusion

Deliverable 7.4 summarises the results so far regarding, amongst other things, Dissemination and Collaboration. These will be the driving forces in EXCELLERAT, even more in the last third of the project. It is also important for the development of getting the needed expertise and consulting. Overall, for EXCELLERAT, there is a clear need for community building, which is a vital part of the project now and has already grown thanks to the Interest Groups and many other activities. The clear benefit for EXCELLERAT is that the CoE will be more visible, understandable, and that it increases its stakeholders' awareness to be recognised as a strong partner. This will also be in line and constantly evaluated and updated with EXCELLERAT's overall brand strategy and the project's innovation management. These are the bases for the communication and dissemination plans.

This deliverable outlined the project's work and next steps for WP7 to assist and to support EXCELLERAT overall. The selection of these concrete approaches is based on present requirements as well as the constraints of the project. If some requirements change, it will be adapted accordingly. The final progress and details will be presented in the last deliverable for WP7 – D7.5 in M36.

The project is still in progress therefore the data from this document will be changed and updated for the final report. In the third phase of WP7, there will be a great focus on dissemination and collaboration, especially with the Interest Groups members. The approach towards community building will be continued as planned, with future activities being described and reported in more detail in deliverable D7.5 "Final Dissemination, Communication, Collaboration, Community Building and Standardization Report" (Table 10).

Number	Title	Due	Status
D7.1	Website, Corporate Design and Template	PM 2	Submitted
D7.2	Initial Dissemination and Collaboration Plan	PM 3	Submitted
D7.3	Dissemination, Communication, Collaboration, Community Building and Standardization Report	PM 12	Submitted
D7.4	Updated Dissemination, Communication, Collaboration, Community Building and Standardization Report	PM 24	Submitted
D7.5	Final Updated Dissemination, Communication, Collaboration, Community Building and Standardization Report	PM 36	To be submitted

Table 10: Deliverables

The first milestone (Table 11) to be reached in EXCELLERAT with the help of Work Package 7 was the project kick off. This work package has supported this. The second milestone: MS6 will not be due until the project closes.

Number	Title	Due	Status
MS1	Project Kick Off	PM 1	Done
MS6	Final Reports of all project outcomes and project close	PM 36	To be done

Table 11: Milestones

7 References

[1] EXCELLERAT project, D5.4 "Updated Portal Release"

[2] EXCELLERAT project, D5.5 "Updated Services, Training and Portal Report"

[3] EXCELLERAT project, D7.3 "Dissemination, Communication, Collaboration, Community Building and Standardization Report"

[4] EXCELLERAT project, https://www.excellerat.eu

[5] EXCELLERAT project, D7.1 "Website, Corporate Design and Templates"

[6] EXCELLERAT Newsletter, https://www.excellerat.eu/newsletter/

[7] MailPoet Plugin for WordPress, https://www.mailpoet.com/

[8] EXCELLERAT News section, https://www.excellerat.eu/news/

[9] EXCELLERAT Success stories, https://www.excellerat.eu/success-stories

[10] EXCELLERAT Podcast Episode #1, https://soundcloud.com/user-61965686/hpc-podcast-powered-by-excellerat-e01-whats-hpc

[11] EXCELLERAT Podcast Episode #2, https://soundcloud.com/user-61965686/hpc-podcast-powered-by-excellerat-e02-why-do-aeronautics-benefit-from-hpc-simulations

[12] EXCELLERAT Podcast Episode #3, https://soundcloud.com/user-61965686/hpc-podcast-e03-how-to-improve-autonomous-vehicles-with-supercomputer-simulations

[13] FocusCoE project, https://www.hpccoe.eu/

[14] EoCoE project, https://www.eocoe.eu/

[15] POP2 CoE project, https://pop-coe.eu/

[16] MaX CoE project, http://www.max-centre.eu/

[17] ChEESE CoE project, https://cheese-coe.eu/

[18] HiDALGO CoE project, https://hidalgo-project.eu/

[19] CompBioMed CoE project, https://www.compbiomed.eu/

[20] Vermorel, Olivier, Pierre Quillatre, and Thierry Poinsot. "LES of explosions in venting chamber: A test case for premixed turbulent combustion models." *Combustion and Flame* 183 (2017): 207-223.

[21] EXCELLERAT project, https://www.excellerat.eu/success-story-enabling-parallel-mesh-adaptation-with-treeadapt

[22] Treepart library, https://arxiv.org/pdf/2008.00832.pdf

[23] MMG open source remeshing library, https://www.mmgtools.org/

[24] ARM community blog, https://community.arm.com/developer/tools-software/hpc/b/hpc-blog/posts/genci-journey-of-optimizing-applications-on-arm-platforms

[25] PASC20 conference, https://pasc20.pasc-conference.org/

[26] EXCELLERAT Interest Groups, https://www.excellerat.eu/interest-groups

[27] Flinter, https://pypi.org/project/flinter/

[28] Open standards organisations, https://opensource.com/resources/what-are-open-standards

[29] OASIS, https://www.oasis-open.org/

[30] CERFACS JSON Schema, https://cerfacs.fr/coop/json-schema-for-sci-apps

[31] Colostate, https://alm.engr.colostate.edu/cb/wiki/16983

Annex 1: EXCELLERAT Publications

Title	Authors	Title of the Journal/Proc./Book	DOI	Repository Link
Parallel SFC-based mesh partitioning and load balancing	Ricard Borrell, Guillermo Oyarzun, Damien Dosimont, Guillaume Houzeaux	2019 IEEE/ACM 10th Workshop on Latest Advances in Scalable Algorithms for Large-Scale Systems (ScalA)	10.1109/scala49573.2019.00014	https://arxiv.org/abs/2007.03518
Heterogeneous CPU/GPU co-execution of CFD simulations on the POWER9 architecture: Application to airplane aerodynamics	R. Borrell, D. Dosimont, M. Garcia-Gasulla, G. Houzeaux, O. Lehmkuhl, V. Mehta, H. Owen, M. Vázquez, G. Oyarzun	Future Generation Computer Systems	10.1016/j.future.2020.01.045	https://arxiv.org/abs/2005.05899
Performance Analysis of Complex Engineering Frameworks	Wagner, Michael und Jägersküpper, Jens und Molka, Daniel und Gerhold, Thomas	Tools for High Performance Computing 2019		https://elib.dlr.de/132767/
Improving Strong Scalability Limits of Finite Element Based Solvers	Niclas Jansson	Kyoto, The 48th International Conference on Parallel Processing (ICPP 2019)		https://www.hpcs.cs.tsukuba.ac.jp/icpp2019/data/posters/Poster7-abst.pdf
EXCELLERAT: il centro di eccellenza europeo per le applicazioni di ingegneria	R.ponzini, F. Salvadore, C. Arlandini	Analisi e calcolo		
Abstract: Quantifying Uncertainties in high-fidelity Scale-Resolving Simulations of Wall Turbulence	Philipp Schlatter, Saleh Rezaeiravesh, Ricardo Vinuesa	72nd Annual Meeting of the APS Division of Fluid Dynamics		
Active flow control for external aerodynamics: from micro air vehicles to a full aircraft in stall	Oriol Lehmkuhl, Adrian Lozano-Duran, Ivette Rodriguez	Conference: Fourth Madrid Turbulence Summer Workshop, 2019		

Exploring the Acceleration of the Met Office NERC Cloud Model Using FPGAs	Nick Brown	High Performance Computing - ISC High Performance 2019 International Workshops, Frankfurt, Germany, June 16-20, 2019, Revised Selected Papers	10.1007/ 978-3- 030- 34356- 9_43	
Mastering Exascale Challenges for Engineering Applications	Bastian Koller, Ralf Schneider, Andreas Ruopp, Dimitris Liparas	Sustained Simulation Performance 2018 and 2019 - Proceedings of the Joint Workshops on Sustained Simulation Performance, University of Stuttgart (HLRS) and Tohoku University, 2018 and 2019	10.1007/ 978-3- 030- 39181- 2_2	
High Performance Computing und Datenmanagement für Ingenieursanwendungen in Forschung, Mittelstand und Industrie	Bastian Koller, Ralf Luithardt	ProduktDatenJournal		
Effect of the Actuation on the Boundary Layer of an Airfoil at Moderate Reynolds Number	O. Lehmkuhl, I. Rodriguez, R. Borrell	Direct and Large Eddy Simulation XII	10.1007/ 978-3- 030- 42822- 8_41	
Effects of the Actuation on the Boundary Layer of an Airfoil at Reynolds Number Re = 60000	Ivette Rodriguez, Oriol Lehmkuhl, Ricard Borrell	Flow, Turbulence and Combustion	10.1007/ s10494- 020- 00160-y	
Active flow control for external aerodynamics: from micro air vehicles to a full aircraft in stall	Oriol Lehmkuhl, Adrián Lozano-Durán, Ivette Rodriguez	Journal of Physics: Conference Series	10.1088/ 1742- 6596/152 2/1/0120 17	http://hdl. handle.ne t/2117/19 1718
Weighing up the new kid on the block: Impressions of using Vitis for HPC software development	Nicholas Brown	Field Programmable Logic		https://arx iv.org/abs /2010.002 89
A Hybrid MPI+PGAS	Niclas Jansson	IEEE Cluster 2020	10.1109/ CLUSTE	https://iee explore-

Approach to Improve Strong Scalability Limits of Finite Element Solvers			R49012. 2020.000 41	ieee-org.focus.lib.kth.se/document/9229577
Investigating applications on the A64FX	Jackson, A. Weiland, M. Brown, N. Turner, A.	Embracing Arm: a journey of porting and optimization to the latest Arm-based processors		https://arxiv.org/abs/2009.11806
Exploring the acceleration of Nekbone on reconfigurable architectures	Nicholas Brown	Sixth International Workshop on Heterogeneous High-performance Reconfigurable Computing (H2RC'20)		

Table 12: EXCELLERAT Publications

Annex 2: EXCELLERAT White paper template

EXCELLERAT

EXCELLERAT Template – White Paper

The EXCELLERAT project is a single point of access for expertise on how data management, data analytics, visualisation, simulation-driven design and Co-design with high-performance computing (HPC) can benefit engineering, especially in the aeronautics, automotive, energy and manufacturing sectors. The goal of EXCELLERAT is to enable the European engineering industry to advance towards Exascale technologies and to create a single entry point to services and knowledge for all stakeholders of HPC for engineering.

Definition of white paper in EXCELLERAT:

The EXCELLERAT white paper target is a technical, objectively/unbiased written document that elaborates new inventions/solutions with convincing arguments, statistics/research results. This document should and be written in an accessible language (avoid marketing and flashy language). Finally, it should include references if and where necessary.

CAUTION: This is NOT THE DEFINITIVE VERSION. The present definition is a draft under construction. This definition might change in the future, and is available here for testing. Pay attention to any updates.

1. **Headline, key words and tags:**
   - Headline (journalistic style, max. 8 words):
   - Keywords:
   - Topic/Industry sector (e.g. aeronautics, automotive):
   - Target audience:
   - Key codes/use cases involved:
   - Organisations involved:
   - Contact for further questions:

   2-4 Images:

   - Statistics
   - Further images
   - Thumbnail image ("emotional")

   Min 1500px width/height, 300 dpi resolution

2. **Introduction**

   Teaser/Lead paragraph that describes the content of the white paper and its relevance for the reader, should be written interestingly (journalistic style). By the end of it, the reader should know if he/she can relate to the problem addressed or not.

   Min: 1,500 characters
   Max: 3,000 characters

3. **Related work and references**

   Please include related work and your references at the end of the white paper.

EXCELLERAT – T7.1 – White Paper Template   October 2020

Figure 10: EXCELLERAT White paper template page 1

EXCELLERAT

Large audience pitch

Exact Scope

Teaser/Lead paragraph that describes the content of the white paper and its relevance for the reader, should be written interestingly (journalistic style). By the end of it the reader should know if he/she can relate to the problem addressed or not.

Min. 1,500 characters
Max. 3,000 characters

(Visionary) New angle

This should be complementary to the introduction (interesting, journalistic style). It should answer questions raised in the beginning and sum up the content of the white paper. It can be written in a more personal style.

Min. 1,500 characters
Max. 3,000 characters

(Visionary) Outlook

This should be in echo to both Intro and Angle (interesting, journalistic style). It should have a short visionary outlook, which shows the potential impact of the solution/methodology for future research or other fields. It can be written in a more personal style. It should be something a reader would remember after reading.

Min. 1,500 characters
Max. 3,000 characters

Expert audience pitch

Introducing the worked example

Lead paragraph that describes the worked example, why it is pertinent to the "exact scope", why the "angle" is missing right now.

Min. 1,500 characters
Max. 3,000 characters

Main section 1, focus on WHAT is the worked example

Extension of the lead paragraph, gives the reader some more details on the question "WHAT". Can be clustered in several paragraphs. In this part, you should go into depth. It's possible to use sub-headlines in order for the reader to decide, which sections he/she would like to continue reading. Explain your subject objectively.

Min. 3,000 characters
Max. 5,000 characters

EXCELLERAT – T7.1 – White Paper Template   October 2020

Figure 11: EXCELLERAT White paper template page 2

EXCELLERAT

Main section 2, focus on HOW the worked example is working

Extension of the lead paragraph, gives the reader some more details on the question "HOW". Can be clustered in several paragraphs. In this part, you should go into depth. It's possible to use sub-headlines in order for the reader to decide, which sections he/she would like to continue reading. Show a methodology/solutions.

Min. 3,000 characters
Max. 5,000 characters

Main section 3 (optional)

A third main section could be useful, in particular if the Expert audience can be divided into two groups of interest (End Users and Code Developers).

Min. 3,000 characters
Max. 5,000 characters

How to reproduce (optional)

This should describe precisely how one could reproduce the worked examples, what tools are compulsory and what can be replaced, what skills are required.

Min. 3,000 characters
Max. 5,000 characters

What did we learn?

This should be a discussion on the facts found in this worked example. It should declare explicitly the limits of the present approach (e.g. this is of no interest on a resource with less than 10,000 cores, this is pertinent only beyond 2 Billion degrees of freedom, etc.). It should finish with a perspective, explaining in particular what insights are specific to the worked examples, and what conclusions are presumably the same for other cases.

Min: 1,500 characters
Max: 3,000 characters

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Figure 12: EXCELLERAT White paper template page 3

Annex 3: Detailed Collaboration of the EXCELLERAT Partners

In the following, an overview of the existing and newly acquired collaboration of the EXCELLERAT partners is provided (Table 13 – Table 24).

Institution	Collaboration Project	Collab. Partner	Related WP/Task	Time Frame
USTUTT	CRESTA, bwWisu, beWisu2	HLRS	WP4/T4.2	Ongoing - 2021
	Description: Development of the visualization tool Vistle (the VISualization Testing Laboratory for Exascale computing, is an extensible software environment that integrates simulations on supercomputers, post-processing and parallel interactive visualization).			
	FocusCoE	SCAPOS AG	All	Nov 2019 - Nov 2021
	Description: Representation of EXCELLERAT in the FocusCoE Activities, participation in the FocusCoE project board.			
	HIDALGO	ARH, ATOS, BUL, DIALOGIK, ECMWF, HLRS, ICCS, Know-Center, MOONSTAR, MK, PLUS, PSNC, SZE	WP3, WP4	Nov 2019 - Nov 2021
	Description: Evaluation and optimization of the HIDALGO CFD codes. Definition of optimal simulation parameters. Examination and improvement of the parallelization. Optimization of pre-processing, geometry preparation and mesh generation.			
	CATALYST	SCAPOS AG	WP4	Nov 2019 - Nov 2021
	Description: Exploration of Synergies in the area of Data Management, Data Analytics.			
	No name	ENCI, CEA, Airbus	All	Ongoing
	Description: Identify potential R&D Success stories with Airbus and Onera and work on prototypes to show the successful application of HPC to industry.			

Table 13: Detailed Collaboration USTUTT

Institution	Collaboration Project	Collab. Partner	Related WP/Task	Time Frame
UEDIN	CompBioMed CoE	UEDIN, UCL, BSC, UvA, SURFsara, Uni of Oxford, Uni of Geneve, Uni of Sheffield, CBK,	All	Oct 2016 – Sep 2019

	UPF, LifeTec Group, Acellera, Evotec UK Ltd, Bull (Atos), Janssen			
	Description: WP Leader for Sustainability and Innovation, Porting Applications and general User Support on local HPC systems, Co-author of two "HPC for Medics" courses.			
	CompBioMed2 CoE	UCL, BSC, UvA, SURFsara, Uni of Oxford, Uni of Geneve, Uni of Sheffield, CBK, UPF, Acellera, Evotec UK Ltd, Bull (Atos), Janssen, LRZ, Argonne and Rutgers	All	Oct 2019 – Sep 2023
	Description: Porting Applications and general User Support on local HPC systems, bringing in new Software Solutions, running webinar series in collaboration with VPH.			

Table 14: Detailed Collaboration UEDIN

Institution	Collaboration Project	Collab. Partner	Related WP/Task	Time Frame
CINECA	MAX2 COE	CNR, SISSA, ICN2, E4, JULICH, EPFL, BSC, ETHZ, KTH, UNESCO (Fr), Cloudweavers	WP2, WP4, WP6, WP7	Dec 2018 - Nov 2021
	Description: Adaptability and Auto-tuning: Making performance available to end users. Exascaling and co-design technologies: Identify and address the gaps towards the pre- and Exascale. High level domain-specific support.			
	Prace Preparatory Access	ESI, Intel	WP3	Ongoing
	Description: HPC Performance Improvement for OpenFOAM linear solvers, creating an interface to external solver libraries such as PETSc/Hypre thus providing to the users a greater choice and flexibility when solving their cases. Increase the performances, in term of execution time, for very large test-cases (at least 50 M of cells) running on massively parallel cluster (order of thousands of cores).			
	ChEESE CoE	BSC, INGV, IMO, ETH, HLRS, CINECA, TUM, LMU, university Malaga, NGI, IPGP, CNRS, ATOS	WP3	2019 - 2022
	Description: Improve performance of linear solver algebra for simulation of solid earth. Optimization of ASHEE (Multiphase fluid dynamic model conceived for compressible mixtures composed of gaseous components			

	and solid particle phases, based on OpenFOAM), bringing in new Software Solutions, running webinar series in collaboration with VPH.			
	Hi-Fi Turb	NUMECA, ERCOFTAC, DLR, Cenaero, CERFACS, Imperial College London, ONERA, ANSYS, DASSAULT AVIATION, UCLouvain, CINECA, UNIBG, BSC, Safran, TSAGI	WP3	2019 - 2022
	Description: Improving the capabilities of models for complex fluid flows, offers the potential of reducing energy consumption of aircraft, cars, and ships, with consequent reduction in emissions and noise of combustion based engines.			

Table 15: Detailed Collaboration CINECA

Institution	Collaboration Project	Collab. Partner	Related WP/Task	Time Frame
SICOS BW	RECOM SERVICES	HLRS	WP4/T4.2	2019
	Description: With the help of the 3D simulation software RECOM-AIOLOS, specially designed by RECOM for industrial furnaces, the combustion and pollutant formation processes of the plant process can be mapped in virtual reality without any effects on the running operation time, for very large test-cases (at least 50 M of cells) running on massively parallel cluster (order of thousands of cores).			
	OPTIMA PHARMA	HLRS	WP4/T4.2	2018
	Description: By using simulation and visualization technologies, OPTIMA pharma visualizes the air flows in clean room systems as an essential quality factor. The medium-sized company thus minimizes the risk of planning errors, accelerates the planning process and achieves cost savings.			

Table 16: Detailed Collaboration SICOS BW

Institution	Collaboration Project	Collab. Partner	Related WP/Task	Time Frame
KTH	EPiGRAM-HS	EPCC, ETH, FRAUNHOFER, CRAY, ECMWF	WP2, WP3	2018 - 2019

	Description: Modernization/refactoring of Nek5000, targeting heterogeneous systems.			
	RIKEN	RIKEN	T3.2, T4.2	2016 - 2021
	Description: Methods for extreme-scale industrial CFD, including in-situ techniques, dynamic load balancing methods and adaptive mesh refinement.			
	Scania	Scania	N/A	2015 - 2021
	Description: Optimization of industrial CFD use cases using ISV codes; benchmarking of various hardware options.			
	SeRC	KTH	WP2, WP3	on-going
	Description: National large-scale e-Science initiative and national project dedicated to improve important e-science software on future HPC platforms, including Nek5000.			
	FLOW	KTH	WP2	on-going
	Description: KTH is home of the internationally recognised Linné FLOW Centre which focuses on fundamental aspects of fluid dynamics.			

Table 17: Detailed Collaboration KTH

Institution	Collaboration Project	Collab. Partner	Related WP/Task	Time Frame
ARCTUR	DIH HPC5	eXact Lab, Info.era, Sontius, Spin, Vahta, Xlab	WP6	Sep 2017 on-going
	Description: HPC5 stimulates and sustains a business growth system in technologically oriented vertical niches focusing in the Slovenia-Italy cross-border region.			

Table 18: Detailed Collaboration ARCTUR

Institution	Collaboration Project	Collab. Partner	Related WP/Task	Time Frame
CERFACS	MMG	INRIA	WP2	On-going
	Description: Use case C3U1 relies on mesh adaptation techniques developed for sequential execution by INRIA on the open source library MMG. The collaboration with INRIA dates back to 4 years as we evaluate and develop new metric methods to use MMG on complex physical cases.			
	AVBP	CORIA	WP2	2019 - 2020

	Description: CERFACS and CORIA have a long history of collaboration for CFD applications. They have worked in the past on parallel mesh adaptation techniques for incompressible flows. The current collaboration focuses on extending methods developed by CORIA to compressible flows and introducing them to AVBP.			
	CVT	GENCI	WP3	2019
	Description: CERFACS is part of the technology watch group of GENCI, the tier1 and PRACE systems manager for France. Within the CVT collaboration access and support is provided to CERFACS to port and optimize the code on new architectures. Within EXCELLERAT this concerns for now the ARM thunderx2 architecture and will be extended in 2020 to AMD Roma. This work is included in the WP3 node level and system level optimization tasks.			
	EPEEC	CERFACS	WP2, WP3	2019 - 2021
	Description: In the H2020 project, EPEEC, CERFACS developed a parallel hierarchical mesh partitioner for optimized load balancing in many core systems. Within EXCELLERAT we have extended it for load rebalancing and support for int64 required for mesh adaptation (WP2: use case C3U1). Also this partitioner is required for massively many core systems and is use in the WP3 system level optimization task.			
	POP 2 COE	BSC/UVSQ	WP2, WP3	Jan 2020 - Dec 2020
	Description: Evaluation of the performance of AVBP code on the uses cases using POP2 methods and tools. Identify bottlenecks and potential improvements.			
	EPI	GENCI/JSC	WP3	Jan 2020 - Dec 2020
	Description: Port and Benchmark core code in ARM technologies			

Table 19: Detailed Collaboration CERFACS

Institution	Collaboration Project	Collab. Partner	Related WP/Task	Time Frame
BSC	POP	/	WP3, T3.1	May 2019 - ongoing
	Description: Apply load balancing strategies for chemical reactions in detailed chemistry			
	EoCoE	BSC-INFIRA	WP2	2019
	Description: Using a better solver for the Poisson equation in replacement of GMRES and Conjugate Gradient			

Table 20: Detailed Collaboration BSC

Institution	Collaboration Project	Collab. Partner	Related WP/Task	Time Frame
FRAUNH OFER	ViPriA	SCALE, SIDACT, AUDI, Porsche, Volkswagen	WP4, T4.3	Oct 2019-Sep2022
	Description: The goal of the project ViPriA is the development of intelligent assistance systems based on artificial intelligence and machine learning approaches to support engineers in simulation-based, virtual product development.			
	VMAP	29 partners from 6 countries	WP4, T4.3	Sep 2017 – Aug 2020
	Description: The VMAP project will create new concepts for a universal material exchange interface for virtual engineering workflows. These concepts will be concretized in an open software standard.			
	MADESI	TU Darmstadt, Weidmüller Monitoring Systems, ZF Friedrichshafen	WP4, T4.3	Oct 2018 – Sep 2022
	Description: The analysis of sensor data of machines, plants or buildings makes it possible to detect anomalous states early and thus to avoid further damage. For this purpose, the monitoring data is searched for anomalies. By means of machine learning, anomaly detection can already be partially automated.			

Table 21: Detailed Collaboration FRAUNHOFER

Institution	Collaboration Project	Collab. Partner	Related WP/Task	Time Frame
RWTH	SFB TRR40	TU Braunschweig, UniBw Munich	WP4, T4.3	Jul 2019 – Jun 2020
	Description: Apply dynamic mode decomposition of experimental and numerical data provided by TU Braunschweig and UniBw Munich to analyse the unsteady dynamics in the base flow field of space launchers.			
	ENODISE	VKI, TU DELFT	T4.3	June 2020 - May 2023
	Description: Apply DMD to simulation results for the analysis of acoustic ources in turbulent flow around porous material.			
	INVENTOR	ONERA, VKI	T4.3	June 2020 - May 2023
	Description: Use DMD to identify acoustic source mechanisms in aerospace applications			
	POP COE		WP2, WP3	2020

	Description: Evaluation of the performance of ZFS code using POP methods and tools. Identify bottlenecks and potential improvements.

Table 22: Detailed Collaboration RWTH

Institution	Collaboration Project	Collab. Partner	Related WP/Task	Time Frame
TERATEC	FocusCoE,	CEA, KTH, HLRS, BSC, UCL, ENEA, PRACE, ICHEC	WP3, WP5	Dec 2019 – Nov. 2021
	Description: Coordination and implementation of activities supporting the CoEs in connecting to the industrial ecosystem in helping in promoting their services to potential clients			
	POP CoE	BSC, USTUTT, IT4I, FZ Juelich, NAG, RWTH, UVSQ	WP2, WP3	Dec 2019 – Nov. 2021
	Description: Business Development and Sustainability, assessment of the experiments and customer advocacy			

Table 23: Detailed Collaboration TERATEC

Institution	Collaboration Project	Collab. Partner	Related WP/Task	Time Frame
SSC	HLRS pilot project	HLRS Stuttgart, Federal Institute for Population Research	WP3, WP4	July 2020 -
	Description: Testing the SSC platform and its feasibility with different pilot partners and incorporating user feedback into the platform. This collaboration deals with calculations from the health care sector.			
	hydrograv GmbH	hydrograv GmbH	WP3, WP4	October 2020 -
	Description: Testing the SSC platform and its feasibility with different pilot partners and incorporating user feedback into the platform. This collaboration deals with flow simulations for the optimization of wastewater treatment plant components.			

Table 24: Detailed Collaboration SSC