Large-scale EXecution for Industry & Society

Deliverable D9.12

Open Call Framework and Stakeholders Engagement on Targeted Large-Scale Pilots – Final Report

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GLOSSARY

ACRONYM	DESCRIPTION
OC	LEXIS Open Call
SME	Small and Medium Enterprises
EU	European Union
H2020	Horizon 2020

TABLE OF PARTNERS

ACRONYM	PARTNER
Avio Aero	GE AVIO SRL
Atos	BULL SAS
AWI	ALFRED WEGENER INSTITUT HELMHOLTZ ZENTRUM FUR POLAR UND MEERESFORSCHUNG
BLABS	BAYNCORE LABS LIMITED
CEA	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES
CIMA	CENTRO INTERNAZIONALE IN MONITORAGGIO AMBIENTALE - FONDAZIONE CIMA
CYC	CYCLOPS LABS GMBH
ECMWF	EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS
EURAXENT	MARC DERQUENNES
GFZ	HELMHOLTZ ZENTRUM POTSDAM DEUTSCHESGEOFORSCHUNGSZENTRUM GFZ
ICHEC	NATIONAL UNIVERSITY OF IRELAND GALWAY / Irish Centre for High-End Computing
IT4I	VYSOKA SKOLA BANSKA - TECHNICKA UNIVERZITA OSTRAVA / IT4Innovations National Supercomputing Centre
ITHACA	ASSOCIAZIONE ITHACA
LINKS	FONDAZIONE LINKS / ISTITUTO SUPERIORE MARIO BOELLA ISMB
LRZ	BAYERISCHE AKADEMIE DER WISSENSCHAFTEN / Leibniz Rechenzentrum der BAdW
NUM	NUMTECH
O24	OUTPOST 24 FRANCE
TESEO	TESEO SPA TECNOLOGIE E SISTEMI ELETTRONICI ED OTTICI

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EXECUTIVE SUMMARY

This document contains the last updates and description of the LEXIS Open Call (OC) implementation. At the beginning the selection process is described, including external factors and targeted sectors. A list of selected applicants from public and academia, as well as from companies is followed by a description of their applications. Feedback obtained from the selected participants, that allowed to improve the LEXIS Platform, is also discussed. The last part of the document is dedicated to presentation of the propagation efforts made to attract other potential applicants, including SMEs.

Position of the deliverable in the whole project context

In the previous Deliverable D9.4 [1], the preparation and the launch of the OC was detailed, before the execution of this framework. Following the up said initial launch, earlier this year, the consortium now has the elements to present the achievements reached.

This deliverable aims at reporting the final status of the OC framework at the conclusion of the Project. We will report herein the way the OC achieved its goals and how it contributed to the success of the whole LEXIS Project, because the OC was the place where the LEXIS Platform was first tested by entities that well represent future potential users.

Description of the deliverable

Deliverable D9.12 is structured as follows:

- Reminder of the initial objectives of the OC,
- The selection of Applicants,
- The implementation of the selected application experiments,
- Main outcomes of the OC,
- Conclusion.

1 OBJECTIVES OF THE LEXIS OPEN CALL

The consortium has developed a demonstrator with a significant Open Source dimension including validation, test, and documentation. It was validated in three pilots - in the industrial and scientific sectors (Aeronautics, Earthquake and Tsunami, Weather and Climate).

On top of these 3 pilots´ validation, the consortium intended to add another level of validation through the opening of the LEXIS Platform to various types of projects in the OC framework which is in detail discussed in Deliverable 9.4 [1].

The objective is the validation of the key aspects of the LEXIS Platform:

- Technologies developed and deployed,
- Usability according to various computing scenarios,
- Usability of workflows,
- Usability of data sets, data transfer and data management solutions.

The main focus of the OC is the collection of qualitative and quantitative experiences with the usage of the Platform from players outside the Consortium and in the collection of their feedback all along the course of OC in order to refine and improve the LEXIS Platform in the perspective of its final delivery at end of the project. But mostly, in the view of making it a mature market-ready tool that fulfils what the industry, academic and scientific worlds expect.

The Validation process is going hand in hand with the evaluation of the likely impact of:

- Initial on-boarding of the applications,
- Ongoing monitoring and support of the participants during the life of the OC duration.

For these purposes, the plan was to support minimum of 5 different application experiments selected by the OC process

2 SELECTION OF APPLICANTS

2.1 THE COVID IMPACT ON THE SELECTION PROCESS

At the time of the LEXIS Project kick-off, nobody could foresee the COVID-19 pandemic and its implications. As a result, the development of the project and its components, among them the OC, were not structured nor budgeted to take in account the fundamental changes derived from such a global disease. The Consortium had to adapt the work organisation, the planning, and in the specific case of the OC, it was necessary to rethink entirely the processes initially developed for the recruitment of the candidates. In a normal situation, the action plan would have been to develop a series of events to inform and attract candidates via conferences, participation to Supercomputing (SC) and ISC High Performance and other major events, with the possibilities for face-to-face interactions with a large number of professionals from various targeted sectors: large companies, SMEs and Start-ups from industry, services and agriculture, research, other EU funded projects (H2020). As an example, the participation to an event like SC in Denver in 2019 provided, just for the booth of LEXIS, hundreds of contacts physically met on site, hence an ambition to reach out a very large number of targets.

Having the COVID crisis driven to the cancellation to all face-to-face events 2 years in a row, from a marketing point of view it was a game changing disaster and a drastic reduction of our potential to reach out a large number of targets. By comparison with SC previously mentioned, a similar event, TERATEC, where LEXIS had a virtual booth, collected just a few relevant contacts, that is hundreds of time less! With a very pragmatic approach, the only levers remaining in the Consortium's hands were:

- Using personal networks and contacts within the members of the Consortium,
- Social networks & digital marketing,
- Organising some digital events for promoting and informing possible applicants about the platform potential and capabilities with the target to involve some of them in the OC.

All of this meant that every member of the consortium had to commit much more than foreseen and to make efforts that were not originally planned to compensate the lack of traditional field of action in informing and attracting organisations to the LEXIS Platform and OC.

The final consequence on the selection process was that the Consortium had to switch from a process based on very large spread of applicants to a process with far smaller numbers of applicants but much more qualitative and still having the same high level of selection criteria.

2.2 TIMETABLE & CHRONOLOGY

Knowing that the LEXIS Platform would have been technically ready to welcome the OC participants (from operational point of view) starting from summer 2021; it was decided to start the recruitment of the applicants as early as January 2021.

We had 2 categories of applicants:

- Invited applicants: potential candidates, involved projects particularly interesting for the need of LEXIS and its OC, have been identified and subsequently directly contacted to invite them to join the OC framework.
- Applicants selected after a competitive process: several applications have been received from numerous candidates and a three steps process has been proposed to get the final selection:
    - Step 1: pre-selection based on a self-administered questionnaire, fulfilled by candidates,
    - Step 2: promising candidates were invited by the OC Board to a technical discussion allowing to have a better understanding of the application experiment proposed and goals,
    - Step 3: final selection by the OC Board.

As a consequence, the time table has been stretched between January 2021 and July 2021 to complete the selection process and be ready to set up the experiments from September 2021 to November 2021.

It is to be noted that some selected applicants have already expressed their wish to collaborate beyond the end of the OC. Such wish is an additional challenge for the Consortium to enhance the Platform's potential, improve its readiness to the market and make it attractive to the widest audience of users.

2.3 TARGETED SECTORS & SELECTION RESULTS

As explained in the previous Deliverable D9.4 [1], our targeted sectors were:

- Research organisations (Public, private, Academic),
- Industry (big players),
- SMEs, Start-ups, and in general profit-making companies,
- Other EU funded projects (H2020/EuroHPC), when possible and relevant.

The LEXIS Project did encourage candidates to use workflows and datasets proposed and developed in the frame of the 3 LEXIS Pilots, but has also encouraged candidates to propose their owns in order to be able to test different scenarios in terms of workflows and computing, incoming from sectors not previously targeted.

Having initially defined a target of minimum of 5 application experiments to be listed for the OC, we report herein that we selected 10 application experiments, covering various sectors and types of applicants, despite the very difficult context of COVID 19.

2.3.1 Academic & Public Sector

Among the various projects subjected to discussion, the following 3 have been selected:

- 1 project on Distributed Algorithms for Virtual Screening in Drug Discovery proposed by Politecnico di Milano (POLIMI) based in Italy,
- 1 project from Germany, proposed by the Technical University of Munich (TUM), about GHG emissions in the Munich region,
- 1 international project named APOCAWLIPSEA, in which research laboratories from Germany, Thailand, Indonesia are collaborating together on calculations for pollution from wildfires in the Pacific South East Asia Region.

These projects are presented in more details later in this document, in Section 3.4.

It should be noted that one of the main difficulties due to the COVID impact was to find projects which timeline could be compatible with the OC timeline.

2.3.2 Start-ups & SMEs

Selected projects represent various application domains: engineering, medical/healthcare, computer fluid simulation, drug discovery and design for pharmaceutical industry, data networks for cyber-defense, etc.

One of the main difficulties was that many companies working on projects in the HPC/HPDA/AI domain are adopting a perspective of deployment for production (commercial usage), and this is not possible in the OC framework. However, the collaboration on the OC may be the seed for a future commercial exploitation of the LEXIS Platform that leverages on the knowledge gained and on the investment made by the companies participating to the OC.

Another relevant point is that for this OC, many projects were at the moment not mature enough for their implementation, mostly because the companies involved are facing a shortage of highly qualified engineers needed for these developments.

Finally, 6 projects have been selected from various countries in Europe, from SMEs and Start-ups (more details are provided in Section 3.4):

- *Belgium*: the OPEN ENGINEERING company has presented a project of RF Solver for HPC (electromagnetic wave propagation),
- *Italy*: the ORBYTA company proposed a project where AI is used to facilitate communication with deaf and hearing impaired without knowledge of sign languages,
- *Italy*: the I-SEE COMPUTING company has presented a project to evaluate cells damage with different types of radiations, part of a full treatment planning for patients using Monte Carlo simulations,
- *Spain*: the PHARMACELERA company (Start-up) has presented an application for virtual screening for drug discovery,
- *France*: the ALTRNATIV company (Start-up) has presented an application experiment about Data Networks for Cyber Defence,
- *The Czech Republic*: the AIRMOBIS company has presented a CFD application for intensive multi-phase simulations.

2.3.3 Other EU funded projects

The LEXIS Consortium has been in touch with numerous other EU funded projects (H2020/EuroHPC) and many of them did express an interest in the LEXIS Platform. In the discussions held prior to invite one or many to participate, the main issue was the lack of alignment between the timelines of each project with the one of LEXIS.

We finally selected and invited the project CompBioMed2 (H2020). This will be presented more in details in Section 3.4.

It is to be noted that the discussions carried out with other EU funded projects have demonstrated not only the existence of a real interest in the LEXIS Platform, but also revealed numerous potential collaborations post end of the LEXIS Project.

3 IMPLEMENTATION OF SELECTED APPLICATION EXPERIMENTS

3.1 LEXIS OPEN CALL PROJECTS GOVERNANCE

The LEXIS Consortium, as detailed in the previous Deliverable D9.4 [1], has set-up an OC Board to monitor the execution of the selection of applicants and then the implementation phase.

During the selection phase, the OC Board organised monthly meetings to review candidatures, decided which ones will be processed on the next stage and finally, after technical meetings with applicants, concluded the final selection.

The OC Board is also the place where everything around the OC, including communication, was discussed, reviewed, validated. Accent has been put on using the OC as a whole to prepare future exploitation of the LEXIS Platform. Finally, the OC Board contributed to all articles published on social media and in the LEXIS Newsletter about the OC.

3.2 LEXIS OPEN CALL ON-BOARDING PROCESS

The on-boarding process, for applicants, is mostly 2 sided. It is designed to be simple and straightforward.

- **Technical on-boarding:** as described in the Deliverable D2.5 [2], the on-boarding is made with the support of each Project Manager for each selected applicant: preparation of the application experiment, deployment, registrations and account creation/management for representatives of each applicant, security rules.
- **Administrative on-boarding:** we have implemented a straight forward and simple process for the users (selected applicants in this case). Each LEXIS Project Manager had to check the compliance of each applicant with the LEXIS Open Call rules. This included signing of Acceptable Use Policy (AUP) documents by each selected applicant's organisation, for being allowed to access the LEXIS Platform and the related infrastructures, in total compliance with the specific rules of each of them. Then, a careful process to register every user, on behalf of each organisation, with the correct role and attributes, and the adapted rights and security protocols was managed and double-checked. A legal expert on LEXIS side was also in charge of checking the forms and the compliance.

At the end of this formality, each selected applicant (participant in the following text) and its respective users were tooled to start working on the LEXIS Platform.

Comments, feedback and lessons learned were collected all along this on-boarding. This topic is also described in the Lessons Learned in Deliverable D2.5, Section 2.2.2 [2] and in Deliverable D2.6 [3], Section 3.3.

3.3 LEXIS PROJECT MANAGERS

In order to arrive efficiently to the implementation phase and to support the selected applicants (OC participants), the OC Board has appointed 8 dedicated Project Managers, all of them part of the consortium teams.

They were the main points of contact with the participants and were in charge of coordinating the various resources of the consortium to assist participants at the different stages of the implementation, from training, on-boarding to deployment.

In addition, the Project Managers were in charge to collect feedback and lessons learned, that were essential for the consortium to validate the platform, identify the improvements, address refinements to be made and help us to tune the development of training programs, technical documentation and support.

3.4 PRESENTATION OF SELECTED APPLICATION EXPERIMENTS FOR THE LEXIS OPEN CALL

3.4.1 Academic & Research – Distributed Algorithms for Virtual Screening in Drug Discovery – POLIMI

Politecnico di Milano (POLIMI) is one the largest technical universities in Italy. The university offers undergraduate, graduate and higher education courses in engineering, architecture, and design. Founded in 1863, it is the oldest university in Milan.

In the scope of the LEXIS project, POLIMI's aim was to produce and analyse data coming from a virtual screening campaign. The data sets were first produced by the execution of a parallel version of a molecular docking tool, and then the binding affinity results with COVID proteins have been analysed using artificial neural networks (Self Organizating Map, SOM).

The two main expectations of the LEXIS Platform were: (i) the possibility to safely and easily execute various simulations with data protection and (ii) the possibility to execute the different steps of the workflow without having physical access to the HPC infrastructure. Indeed, the workflow consists of three parts: score extraction (data-generation and pre-processing), SOM simulation execution, and remote visualization on the Cloud (post-process).

3.4.2 Academic & Research – APOCAWLIPSEA

The Accelerating POllutoin CAlculations for WildLand fires In the Pacific South-East Asia (APOCAWLIPSEA) is a collaboration project carried out by researchers, interdisciplinary experts in the field of Hydro-, Geo-informatics, Forestry from SEA universities, and the Upper ASEAN Wildland Fire Special Research Unit (WFSRU).

APOCAWLIPSEA workflow applies data from the Global Fire Assimilation System (GFAS) of ECMWF to predict the distribution of pollutants caused by wildland fires on the daily or monthly basis. The predicted quantities of pollutants, e.g. PM2.5, CO_2, are then fed to the Fire Emissions in Upper ASEAN website[1] for public information provision. Such up-to-date information is a key building block for further initiatives in the region e.g. direct smoke and haze monitoring, forest fire risk prediction, Operative Fire Danger Rating System, and is valuable not only for general public but also the decision makers and governmental bodies.

In the context of the OC, APOCAWLIPSEA aimed to test its workflow in a large-scale computing environment (multi-processor Cloud Computing or HPC) to improve its efficiency in providing timely information (daily), more precise simulation results, increasing simulation time steps for the extended areas of interest. Further test scenarios included exploration of regular scheduling of the simulations as well as triggering based on certain fire intensities. The workflow steps are: download input data from GFAS, simulation of smoke propagation, visualisation of results and delivering results to the destination website.

3.4.3 Academic & Research – TUM

The Environmental Sensing and Modelling group (ESM) at the TUM Department of Electrical and Computer Engineering used LEXIS within a project dubbed QuicGHGSim (QUantifying the ImpaCt of urban GHG emissions with WRF SIMulations).

The mesoscale Weather Research and Forecasting model version 3.9.1.1 coupled with Greenhouse Gas modules (WRF-GHG) is applied in QuicGHGSim to provide a better quantification of GHG emissions in urban areas and to

[1] Fire Emissions in Upper ASEAN website: http://wildlandfire.thairen.net.th/

provide guidance for local authorities for emission reduction. Workflows within the project consisted of three main parts: pre-processing, HPC WRF run and post-processing with Matlab, R and python.

Up to now, the computational workflow has been executed manually without sophisticated solutions for orchestration and federated data management. Due to long simulation time span, the workflow usually involves several partial HPC runs with restarts of the code in between. By participating in the OC, the research team aimed to test its workflow in the automated and orchestrated LEXIS Cloud-HPC environment in order to improve the workflow efficiency (processing time reduction) and automation. On the high-performance infrastructures connected with LEXIS Platform, it was expected the improvement of resolution as well as flexible consideration of different input data. On the LEXIS Distributed Data Infrastructure (based on iRODS and EUDAT-B2SAFE), data can be stored in a standardized way and can be conveniently made available to public at the later time, complying to the Open Science and FAIR principles. As the basic workflow scheme (i.e. “preprocessing (WPS) - WRF runs – post-processing”) is similar to the one used in the Weather and Climate Large-Scale Pilot (WP7), QuicGHGSim could directly leverage knowledge and experience gathered by this LEXIS Pilot.

3.4.4 SMEs & Start-ups – AIRMOBIS

AIRMOBIS is an engineering company specialised in aerodynamics, hydrodynamics and thermal analyses. The company offers its applications mainly in the transportation domain (aircraft, boats, cars).

IMPS is an application for Computational Fluid Dynamics (CFD) simulation of the multi-phase system (air and water, air and solid) and thermal analysis, which was planned to be tested on LEXIS. AIRMOBIS team was interested to use High Performance Computing resources through LEXIS Platform in achieving higher result accuracy as well as making complex analyses with HPC requirements possible. In addition, possibility for using Paraview (remote visualisation functionality) to display model status during the computation was explored.

3.4.5 SMEs & Start-ups – ORBYTA LIS2S

Orbyta is a group of highly specialized companies that support leading industrial groups in developing business cases, in optimising and integrating processes with the aid of new technologies and paradigms such as Artificial Intelligence, Big Data, Cloud Computing, Analytics and Social Networking.

LIS is the Italian sign language and Orbyta has developed an application that translates the sign language into spoken sentences.

LIS2S uses GRU recurrent neural networks and data augmentation, hyper-parameter tuning, feature extraction, K-fold cross validation, text mining, multivariate data analysis and early stopping techniques. LIS2S was successfully executed on the Barbora Cluster where the LEXIS Platform is used as a computational platform for ML training, video processing and data augmentation. Besides being a back-end for automated workflows, LEXIS provided LIS2S for structured and unstructured data storage.

The contribution of LIS2S to the LEXIS Platform validation is somehow strategic for LEXIS, because it demonstrates the readiness of the infrastructure in providing scalable and continuous computing resources.

3.4.6 SMEs & Start-ups – OPEN ENGINEERING

Open Engineering has developed and validated an electromagnetic wave propagation coupled with temperature solver for radio-frequency micro- electromechanical system (RF MEMS) applications. Its core algorithm is based on the Finite-Difference Time-Domain (FDTD) method.

Two versions of the application exist, written in C++ and CUDA (CPU & multi- GPU). Open Engineering aimed to investigate software scalability using LEXIS capabilities and to explore technical and economic feasibility of the provision of RF solver in HPC environments to end users.

3.4.7 SMEs & Start-ups – I-SEE

I-SEE is a Start-up born as a spin-off of the Univerity of Turin and the INFN (National Institute of Nuclear Physics) with the goal of providing ad-hoc solution and hardware optimization for clients in the field of proton therapy for oncology, through specific simulations which allow for accurate radiation effects prediction.

These simulations are performed using Monte Carlo methods, which is based upon the principle of stochasticity and randomness, therefore providing a powerful means for simulating the physics involved in this type of therapeutic technique. However, for the same reasons, a very large statistic is required for accurate predictions, which, in turn, requires large amounts of computational power.

The highly parallel and independent nature of these simulations, as well as the need for post-processing and visualization of the results, make this application a good fit for the LEXIS Platform, as it helps improve simulation accuracy and efficiency thanks to HPC resource access and to workflow automation.

3.4.8 SMEs & Start-ups – ALTRNATIV

ALTRNATIV is an operator and software publisher specialising in cyber defence, cybersecurity system and individual protection.

ALTRNATIV Data Networks, ADN, a data fusion platform solution, enables users in integrating, managing and securing all types of data. ALTRNATIV intended to rely on LEXIS computing power to test, train and improve its solution, which has been developed based on Artificial Intelligence methodology.

3.4.9 SMEs & Start-ups – PHARMACELERA

PHARMACELERA has developed a software to help pharmaceutical companies in their R&D efforts. The tool that will be used in this experiment, PharmScreen is capable of analysing large libraries of millions of compounds to look for promising drug candidates in the preclinical stages of a drug discovery project.

PHARMACELERA goals when using the LEXIS Platform were to study the scalability of the software in large computing systems, to learn how to integrate its software in other environments and to test easy access to large computing systems through the LEXIS portal.

3.4.10 EU Funded Project – COMPBIOMED 2

CompBioMed2 is a proposal for the second phase of the Computational Biomedicine Centre of Excellence (CoE)[2]. It has established itself as a hub for practitioners in the field, successfully nucleating a substantial body of research, education, training, innovation and outreach within the nascent field of Computational Biomedicine. It seeks to combine the application of HPC-based Computational Biomedicine with the large, heterogeneous data sets from medical records and from the experimental laboratory to underpin clinical decision support systems.

The goals of CompBioMed2 aligned with those of LEXIS and from there, the collaboration on different technical aspects including Data management and automated workflow executions started.

Data management

During the first phase of the CompBioMed project, an iRODS-EUDAT B2SAFE federation has been tested between SURF, Barcelona Supercomputing Centre (BSC), and Edinburgh Parallel Computing Centre (EPCC). The setup allows for data replication and curation within the project. LEXIS has implemented a similar setup between LRZ, IT4I, and ICHEC. As a first step, a federation between SURF and LRZ was established thereby connecting LEXIS and

[2] CompBioMed 2: https://cordis.europa.eu/project/id/823712

CompBioMed2 data infrastructure together. Figure 1 shows the established federation between LEXIS and CompBioMed2.

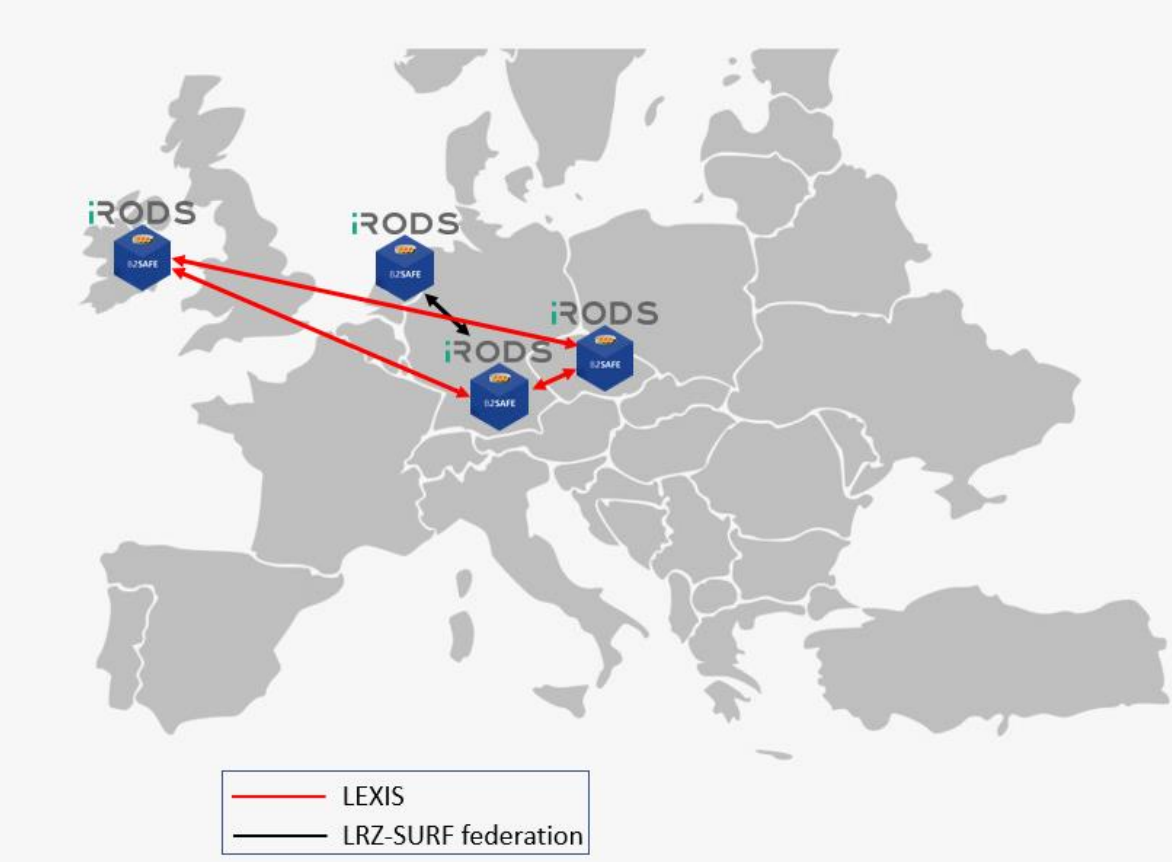

Figure 1 iRODS-B2SAFE federation between LEXIS and CompBioMed2

Resilient HPC workflow

The LEXIS partners are working with CompBioMed2 to create a Resilient HPC Workflow. The workflow scenario starts with a simulation on one of the LEXIS HPC platforms. As soon as the restart files are available the files are staged and replicated to the available data nodes (LRZ, IT4I, and SURF). As the simulation progresses, an MPI task aborts the simulation triggering the LEXIS Dynamic Allocation Module (DAM) to choose another available HPC platform (LRZ, IT4I, or EPCC). The LEXIS Orchestrator will use the restart files to resume the simulation on the chosen platform.

The CompBioMed2 Resilient HPC Workflow, currently under development, employs a blood flow simulation to provide live guidance to a surgeon. The associated operation is on a stroke victim, where a flow divertor is inserted into a blood vessel in the brain and, once inserted, this divertor cannot be moved. Hence this time- and safety-critical simulation requires such a resilient workflow.

4 LEXIS OPEN CALL - OUTCOMES

4.1 IMPACT ON EXPLOITATION

Running the OC allowed to the LEXIS project to gather directly from the field:

- Feedback from end-users about the platform functionalities and improvements to be done,
- Expressions of interest in continuing to use the platform after the project end.

Apart of all technical topics related to the LEXIS Platform, the major feedback we had from the OC experience was to continue the exploitation of LEXIS well after the project end.

In this regard, the execution of the OC brought the confirmation that this is possible because of the platform potential, functionalities and future extensions.

4.2 LESSONS LEARNED & FEEDBACK

The OC activity was the best way to perform in-depth testing and validation of the platform and to get a view of the work that has been done from an external angle. As such, a large number of feedbacks and Lessons Learned has been gathered during both the preliminary activities and the applications' deployment phase. These are very important sources of information on what should be improved both technically and on the organizational level, as well as providing an indication on the possible impact of the LEXIS Platform on the European industrial and scientific environments.

During the whole activity's period, applicants provided feedback and Lessons Learned which concerned the overall usage experience and technical aspects. These are listed below:

- Several applicants provided very useful notes related to usability of the LEXIS Portal which resulted in many improvements in the LEXIS UI, where several changes were made mainly in the flow of the tasks users must perform, to select an input data set, execute a workflow, and view the results.
- The applicants also pointed out that dataset management should be improved by showing more information in the listing table mainly related to the origin of the dataset (i.e. uploaded input data, replicated or result of a workflow),
- Many applicants expressed their interest in deploying their containerized applications. Several improvements have been made in this area, mainly adding a support for Singularity containers and implementing a generic Cloud template which allows to launch a container on a Cloud with an arbitrary image and specifying all required parameters (exposed ports, bind mounts, etc.),
- As the LEXIS Platform focuses mainly on execution of workflows, the applicants also stated that they needed to run a long-term service, essentially using the LEXIS orchestration feature as a deployment tool. This is useful for deploying self-contained data analytic applications (i.e. Shiny) or classical services such as SQL database server, specialised API and so on. Several changes were implemented in the UI as well as in the back-end to allow smooth deployment of a long-term running services.
- Instantiating a specialised Generic HPC workflow template via the LEXIS Portal requires to manually insert a lot of parameters, some of which are not easy to retrieve for the end user, like DDI location, project-ID, etc. Based on this Lesson Learned, the additional functionality for usage of the information available in the back-end will be implemented to automatically define default values for most of the input parameters during new instantiations of Generic workflows template, increasing by this way the "quality of life" for the end user.

4.3 IMPACT ON COMMUNICATION & DISSEMINATION

The OC has had a crucial role for the LEXIS Project because it allowed to gather feedback from the field on the platform functionalities and workflows execution and above all, gather from external users important feedback for improvements.

To be sure to properly communicate and disseminate the project's OC for attracting various applicants, several dissemination and communication activities have been carried out:

1. Dedicated section on website and continuous maintenance,
2. Dedicated events organised for promoting the OC,
3. Dedicated space inside the LEXIS newsletter,
4. Dedicated posts on LEXIS social media channels and joint social media campaigns made with OC applicants.

As the website has been used as a first communication tool with external audience, we created and improved a dedicated section about the OC with some subsections explaining all the technical and administrative aspects of the OC in order to properly follow OC applicants and communicate any kind of activities and achievements related the OC.

To create further interest and spread the OC, TESEO and LINKS organised two webinars with two of the most important technology hubs in Piedmont (Italy), MESAP Innovation Cluster and Torino Wireless, to explain the OC and attract possible applicants and in particular SMEs.

The two organised events could be found in the links below:

1. MESAP Innovation Cluster: https://www.mesap.it/event/takeaway-lexis-teseo/
2. Torino Wireless: https://www.torinowireless.it/evento/open-call-lexis-hpc-big-data-e-cloud-per-il-testing/

A dedicated section in the LEXIS newsletter (Figure 2) has been used to actively communicate about the OC activities. Our goals here were to create awareness about the OC among LEXIS potential users (industry and society) and to attract them with this unique opportunity to test the advanced LEXIS Platform. In the course of the project, we have communicated about the OC, application process, selected application experiments from SMEs as well as introducing a specific application with variety of short and long articles.

Figure 2 Dedicated section in the LEXIS newsletter about the Open Call

Also, social media accounts played an important role in communicating around the OC, and the approach used by the LEXIS consortium was twofold:

- Directly by the WP9 leader and other Consortium members,
- With joint social media campaigns with some of the OC applicants as Orbyta, CompBioMed2 and the one done with Eiffage Energie Systemes (Branch of the Eiffage Group).

Figure 3hows some examples of posts made in this regard.

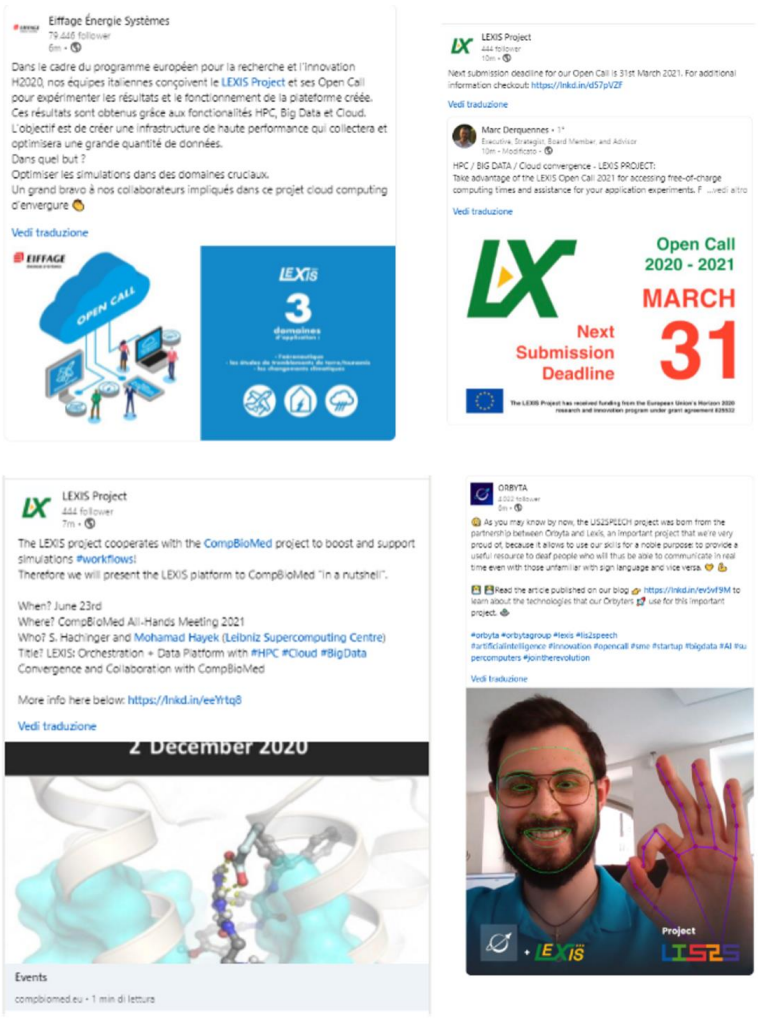

Figure 3 Examples of OC related social media posts

5 CONCLUSION

The OC paved a way for future exploitation of the LEXIS Platform. Valuable feedback from the participants has been collected, which led to many improvements and provided us with a great way to test the results of the LEXIS Project on the real-world scenarios.

The LEXIS Platform reached TRL near to 8 and the outcomes from the OC have been crucial in allowing the Consortium to identify the next tunings, updates and developments to be made for being fully market ready (TRL 9).

In addition, this real-life test confirmed:

- The LEXIS Platform is relevant to the market for not only research (academic, public or private) but also production and commercial usage for private companies of all sizes,
- There is a significant potential for the platform when commercialised,
- The offer of technical assistance, scientific support and related services is both a differentiator and a factor of success for the LEXIS Platform.

The relationships established during the OC with the applicants can lead to future commercial exploitation of the platform, thus attracting more users and infrastructure providers.

The Consortium will be able to capitalise on the OC outcomes to build and refine its exploitation plans post-end of project, thus maximising the impact on economy and society.

REFERENCES

[1] LEXIS Deliverable, *D9.4 Open Call Framework and Stakeholders Engagement on Targeted Large-Scale Pilots - first report.*

[2] LEXIS Deliverable, *D2.5 Final Assessment of the Co-Designed LEXIS Architecture.*

[3] LEXIS Deliverable, *D2.6 Infrastructure Validation and Assessment Report.*