



Large-scale EXecution for Industry & Society

Deliverable D9.6

Report on IPR Management



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GLOSSARY

ACRONYM	DESCRIPTION
CA	Consortium Agreement
CAE	Computer Aided Engineering
CFD	Computational Fluid Dynamics
CPS	Cyber-Physical System
DDI	Distributed Data Infrastructure
EC	European Commission
GA	Grant Agreement
HPC	High Performance Computing
IM	Innovation Manager
IoT	Internet of Things
IP	Intellectual Property
IPR	Intellectual Property Rights
OC	LEXIS Open Call for platform validation
SW	Software
WPs	Work Packages

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

Deliverable D9.6 is an update of deliverable D9.2 - IPR and Data Management Approach [1] and has the purpose to update and align the initial strategy for the project intellectual property rights (IPR) based on the project latest developments.

It clarifies the LEXIS project Open Source results or contributions to existing Open Source software (hereinafter referred to as Open Source results) which are embedded in the platform and focus on the innovations presented by the Consortium during the project interim review in M18 that has been finally selected by the Innovation Radar of the European Commission (EC).

The Consortium uses an Open Call (OC) [2] as a very first test of the whole platform in real life environment and LEXIS will be able to gather a first feedback about the functionalities of the whole platform, including applications and Pilots' results.

Position of the deliverable in the whole project context

The position of this document is an update of the IPR strategy of the project focussing on the Open Source results of the LEXIS Platform and how the Consortium will let third parties to access project's results during the OC execution managing the intellectual property rights (IP) related issues and how the first validation on field of the technology used within LEXIS could be used for future joint exploitation initiatives between the partners.

Consolidated information has been gathered individually from the LEXIS partners.

Description of the deliverable

This deliverable focuses on the IPR strategy updates including IPR ownership, access rights to background and results, the management of the obtained results and their transfer in regard of the IP and IPR.

Another important part of the document is the list of Open Source results. The Consortium has the chance to test on the field the whole platform, including Pilots' use cases and applications. From the point of view of the Open Source results, in this deliverable are excluded the Pilots which will have a specific section on this topic inside dedicated deliverables.

1 INTRODUCTION

In this document, we are updating deliverable D9.2 [1] delivered in M6. It has the major objective to update the project IPR strategy based on project achievements and provides a full visibility to the initial results at this stage of the project lifetime.

As anticipated in deliverable D9.2 [1], the main purpose of this update is to adjust the initial IPR strategy by better detailing the Open Source results used in the LEXIS project.

For completeness, all current Open Source results are listed and detailed in this document. We have also included Pilots for validation of the LEXIS platform, but they are not mentioned in terms of IPR perspective because it was agreed to insert this part in their dedicated deliverables issued in M36.

All the information about pilots will be stated inside the deliverables D9.7 [3], D9.8 [4] and D9.9 [5].

2 INTELLECTUAL PROPERTY RIGHTS

The main goal of this chapter is to give an updated vision in relation to the IPR strategy at this phase of the project and to draw the basis for the last part of its execution by concentrating on project results, innovations and how the Consortium is transferring and will transfer, disseminate, and exploit project's results.

2.1 IP OWNERSHIP

IP ownership is an important outcome of the project and due to the cooperation between partners and WPs any kind of Joint Agreement in the execution of the LEXIS project is guaranteed by the Innovation manager (IM) in respect of the IPR policies in order to enforce and underline project results.

The Consortium, by signing the Consortium Agreement (CA), accepted the shared IPR policies as drafted in Section 8 of the CA, which defines the management of the results ownership consistently to EC guidelines including joint results.

We report for the sake of clarity an abstract of the CA, Section 8:

Each joint owner shall have a share in the Joint Result's IPR accordingly to their respective inventive contribution, material and financial contribution and human resource contributions.

Unless otherwise agreed:

- 1. each of the joint owners shall be entitled to use their jointly owned Results for non-commercial research activities on a royalty-free basis, and without requiring the prior consent of the other joint owner(s), and*
- 2. each of the joint owners shall be entitled to otherwise Exploit the jointly owned Results and to grant non-exclusive licenses to third parties (without any right to sub-license), if the other joint owners are given:*
 - a. at least 45 calendar days advance notice; and*
 - b. Fair and Reasonable compensation.*

Each joint owner of Intellectual Property Rights protecting such jointly owned Result shall have the right to bring an action for infringement of any such jointly owned Intellectual Property Rights only with the consent of the other joint owner(s). Such consent may only be withheld by another joint owner who demonstrates that the proposed infringement action would be prejudicial to its legitimate interests.

The joint owners shall agree on all protection measures and the division of related costs in advance of any such protection measures being undertaken by any of the joint owners. In this regard, the IM is continuously monitoring this aspect to properly report and manage joint outputs.

2.2 ACCESS RIGHTS TO BACKGROUND AND RESULTS

The Access Rights to background and results are managed accordingly to sections 8 and 9 of the CA. Results will be a subject to IPR agreement before the end of the project and IM is in charge of continuous monitoring of this process.

The OC execution is one of the opportunities for partners to gather feedback from the field of the whole platform, applications and pilots and, maybe to increase the possibility to plan possible exploitation for joint initiatives between partners beyond the project ends.

The Consortium transparently reports on the innovations identified during the project life-cycle which is one of the key objectives of LEXIS project.

We believe that LEXIS project is delivering relevant innovations; some of them were already raised up at Interim Review and a first evidence of LEXIS project innovation degree comes from the EC which selected seven innovations through its Innovation Radar¹.

Selected innovations are reported in the following Table 1:

IDENTIFIER	INNOVATION	INNOVATION DESCRIPTION	OBJECTIVE WITH OPEN CALL
IR1	Data Infrastructure based on iRODS/EUDAT-B2SAFE & REST APIs	In LEXIS, a secure and reliable Distributed Data Infrastructure (DDI), federating IT4I, LRZ and prospectively further data centres has been developed on the basis of iRODS and EUDAT-B2SAFE. We provide installation recipes for our redundant iRODS set-up, for future members to join the LEXIS DDI or also for third parties to build similar data infrastructures. Data on the DDI is managed via HTTP REST APIs, facilitating e.g. data up-and download, listing (including metadata search), staging and rights management. The code for these APIs, based on open-source tool-kits, is provided as well.	Platform validation
IR2	Improving Orchestration in distributed HPC infrastructures for HPC/Cloud/Big Data workflow management	LEXIS orchestration service is a key technological element enabling the full exploitation of the distributed HPC and Cloud resources (IT4I and LRZ, potentially including other future centres). To this end, the orchestrator has been developed around a set of technologies (YSTIA ² , HEAppE ³ , OpenStack), whose integration allows to seamlessly execute users' workflows on the distributed resources, taking advantage of the DDI. Furthermore, LEXIS orchestrator, in its final form, will leverage on a dynamic mechanism to select the most suitable resources for the execution of the workflow tasks.	Platform validation
IR3	LEXIS Platform for SMEs, Industry & Society	Specialized platform aimed at lowering the entry barriers to the worlds of supercomputing, cloud, and Big Data without sacrificing the execution performance is being created. Platform includes dynamic data-aware orchestration of complex workflows, data sharing between Cloud and HPC resources and distributed data management with an appropriate data back-end to the orchestration solutions, access to HPC/Big	Platform validation

¹ Innovation Radar: <https://www.innoradar.eu/resultbykeyword/lexis>

² YSTIA is a TOSCA based orchestration suite, composed of the orchestrator itself (Yorc), and a studio (Alien4Cloud) to design TOSCA applications and to handle a catalogue of TOSCA components: <https://ystia.github.io/>

³ HEAppE: <http://heappe.eu>

		<p>Data/Cloud resources for SMEs and Industry, and control of workflows and data through a web interface with remote visualization services.</p>	
<p>IR4</p>	<p>Smart-gateway with embed data processing/validation features before cloud transfer</p>	<p>Smart-gateways are growing with a speed close to IoT sensors, they need to be Low Power, energy autonomous, capable to connect into resilient sensors network, and to perform decentralised computing moving towards deep edge capability. LEXIS will contribute to solve this challenge embedding native connectivity with twitting sensors, having on-board pre-processing and data validation before cloud transfer based around innovative low power chips leveraging on low-level firmware management for Low Power features optimisation. It is then designed with a multiplatform cloud protocol interpreter.</p>	<p>Depending on the project that will be presented by the OC applicant, TESEO will provide a smart-gateway that implements native interface to the LEXIS platform through dedicated broker and DDI. TESEO will eventually support the OC applicant in the design of its own edge node(s).</p>
<p>IR5</p>	<p>Accounting and billing engine for HPC centers</p>	<p>Adaptation of the CYC flexible billing engine for use in HPC context, including providing support to the HPC resource approval process, support for credits management, converged invoicing of HPC + Cloud resources in an on-demand continuous manner.</p>	<p>CYC will use the OC to test the correctness and validity of the embedded pricing plan, the correctness of the periodic usage and cost data aggregation logic and the information shown to the users of the LEXIS platform</p>
<p>IR6</p>	<p>Novel CFD numerical solver for design/analysis of Turbomachinery operating in Aeronautical engines</p>	<p>Nowadays, thanks to GPUs introduction, SW application evolution is opening again to a new family of solvers with predictive capabilities more attractive for the aeronautical products. LEXIS is porting the CFD solver "TRAF" from a solely CPU-based to a more innovative GPU-enabled one. Research steps: adaptation/modification of data structures, and re-writing of subroutines/functions, profiling aimed at identifying application bottlenecks, optimization of CPU-GPU data exchange/communication.</p>	<p>The application solver and the turbomachinery simulation data used in the newly developed application workflow here mentioned are subject to IP constraints and cannot be public released, so for the specific OpenCall purposes, a "twin" application workflow without IP constraints will be deployed based on open data and OpenFOAM application solver.</p>
<p>IR7</p>	<p>Real-time model of computation for high performance computational workflows under real-time deadlines</p>	<p>In the context of answering to emergency situation, computation and simulation results have to be provided according to strict real-time deadlines to be of use for urgent decision making. The innovation is then to bring to the HPC/Cloud orchestration domain a model of computation with an ability to express and verify deadlines, while maintaining a view of</p>	<p>Depending on the project submitted by the OC applicant, the model of computation will be applied to study the constraints and the deadlines associated to the workflow of the project and applied to derive the orchestration implementation.</p>

		a computational flow. This opens the ability to use such systems as a component of a Cyber-Physical System (CPS) and hence offers a strong potential as an innovation.	
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Table 1 - LEXIS innovations selected by the Innovation Radar and use within the project Open Call

The main objective of the OC is twofold:

1. Accelerate testing by SMEs and institutions,
2. Prove and improve the effectiveness of the technology.

As the process of innovation detection is an important aspect of the LEXIS project, any other kind of innovation will be investigated in the period of the project and duly reported continuously in an “Undisclosed Annex” of this deliverable.

2.3 IPR RESULTS MANAGEMENT

IPR results management is one of the important aspects of the LEXIS IPR process; this process is led by the IM that has the role to continuously investigate the innovation coming out of the project.

In the first half of the project, a list of already completed innovations has been already presented to the EU and some of them have already been selected by the Innovation Radar of the EC, as presented in the previous section.

The IM will continue to monitor and report during the last months of the project execution the innovations coming out from the project and will ensure that all the new possible innovations will respect the IPR policies.

As already declared, to ensure a high qualitative level of the IPR documentation, the Quality manager will check adequately all the documentation coming out and related to IPR, as final validation.

2.4 TRANSFER OF RESULTS

Validation of the LEXIS technologies through LEXIS OC is crucial to the project success and to understanding the possible impact of the whole platform on final users and fosters joint exploitation initiatives between the partners beyond the project.

During the OC execution, the Consortium allows the use of the LEXIS platform to OC participants outside the Consortium for validation of the LEXIS platform. OC will provide the feedback in terms of platform effectiveness and impact, gathering direct feedback from potential “final users” as OC participants are.

From a Consortium perspective, IPR management in the OC will apply the rules set by the LEXIS project Description of the action, the CA and the Grant Agreement. Due to commercial considerations of some industrial partners, some restrictions may apply in the OC. The IM will be in charge to coordinate all the activities regarding IPR issues in the OC.

The OC applicants have to identify and commit in writing on the background IP during the submission of the OC proposal. ‘Background’ means any data, know-how or information — whatever its form or nature (tangible or intangible), including any rights such as IPR that the OC applicant would be using during the OC.

2.5 OPEN SOURCE

The use of Open Source technology, as introduced in deliverable D9.2 [1], is a natural element of LEXIS, and increases the potential adoption of the platform by a larger group of end-users. Deliverable D9.2 [1] presented the first list of Open Source technology components used within LEXIS and their associated licenses.

In Table 2, we provide the first set of identified Open Source results and a description of their use within LEXIS (without LEXIS Pilots, as stated in Section 1). Table 2 also contains the LEXIS project partners who are contributing to the relevant results and indicates how these results are connected with the LEXIS project innovations identified by the Innovation Radar of the EC. The table is not final at the time of this deliverable submission and will be updated until the end of the project (and reported in deliverable D9.10 [6]).

TECHNOLOGY NAME	LEXIS RESULT	CONTRIBUTING CONSORTIUM MEMBERS	NOTE ON USE WITHIN LEXIS	INNOVATION RADAR
WCDA To be included in D9.10	Yes	ECMWF	APIs for curated weather and climate data and metadata	IR1, IR3
DDI SERVICE & APIs To be included in D9.10	Yes	IT4I LRZ Atos O24	Staging API between iRODS and different computing systems	IR1, IR3
Yorc https://github.com/ystia/yorc/	Partial	Atos	Yorc is the orchestration engine used as the basis for deploying workload to the federated cluster	IR2, IR3
Yorc Plugins (DDI/HEAppE) https://github.com/lexis-project/yorc-heappe-plugin https://github.com/lexis-project/yorc-ddi-plugin	Yes	Atos	Yorc plugin developed so that Yorc can use the DDI API to manage Data transfers and the HEAppE API to manage HPC resources	IR2, IR3
HEAppE Middleware https://github.com/It4innovations/HEAppE	Partial	IT4I	HEAppE will be used as secure layer between Ystia/Yorc and HPC/Cloud infrastructure for the managing of computational task	IR2, IR3
Dynamic Allocation Module To be included in D9.10	Yes	LINKS	Module which dynamic job allocation is delegated to	IR2, IR3
Orchestration Service APIs To be included in D9.10	Yes	Atos ICHEC IT4I LINKS	APIs exposed to the portal to interact with orchestrator	IR2, IR3
Cyclops and extensions (HPC) https://github.com/Cyclops-Labs/cyclops	Yes	CYC	Cyclops forms the core of the LEXIS accounting and billing solution and has been extended further within LEXIS	IR5, IR3

Cyclops Usage Collectors (HPC/Cloud) https://github.com/Cyclops-Labs/cyclops	Yes	CYC IT4I	Resource usage collectors for Billing system	IR5, IR3
LEXIS Portal To be included in D9.10	Yes	CYC IT4I ICHEC LRZ	LEXIS Front-end which allows for easy user interaction with the platform	IR3
LEXIS Back-end service To be included in D9.10	Yes	CYC	Go Module to serve the Portal Front-end and keep up part of the interaction with the users	IR3
3D Remote Visualisation: XRV and noVNC To be included in D9.10	Partial	Atos	XRV and noVNC are streaming middleware that allow remote and interactive use of 3D graphical applications and avoid moving data back to client workstations.	IR3
Monitoring To be included in D9.10	Partial	IT4I LRZ	System and resource monitoring is taken care of by this collection of standard frameworks together with custom-programmed installation recipes and test scripts.	IR3
AAI Service Module To be included in D9.10	Yes	O24	Authentication and Authorization system components, including connectors to specific modules	IR3

Table 2 - Selected LEXIS Open Source results and their use within LEXIS (without LEXIS Pilots)

The LEXIS Consortium has not identified so far any conflict between pre-existing licences of partners, so no mitigation action is required at the moment.

The OC is also expected to provide additional feedback in order to guide the first draft of the commercialization agenda of partners and the positioning of the LEXIS project on the market which will be included in the deliverable D9.11 - Updated market analysis of converged HPC, Big Data and Cloud Ecosystems in Europe and positioning of the LEXIS platform [7].

The final list of the LEXIS project Open Source results or LEXIS project contribution to existing Open Source software will be a part of the deliverable D9.10 - Impact KPI and metrics achievement report and plan final version [6].

3 CONCLUSION

This report on IPR Management is an update of the intermediate outcomes at this stage of the project. Based on the initial IPR plans and strategy, the Consortium has achieved significant milestones in term of IPR. We have detailed these achievements in the present document keeping in mind this is still a work in progress with many expected evolutions to come between now and the project's end.

So far IPR management outcomes and progression have been aligned with the Consortium plans for the LEXIS project. In the next coming months, until the end of the project, the Consortium is expecting to deliver as per initial expectations and plans, and we do not foresee at this stage any obstacle for such an achievement.

REFERENCES

- [1] LEXIS Deliverable, *D9.2 IPR and Data Management Approach*.
- [2] LEXIS Deliverable, *D9.4 Open Call Framework and Stakeholders Engagement on Targeted Large-Scale Pilots - first report*.
- [3] LEXIS Deliverable, *D9.7 Impact on Productivity and Business Process Improvement in Aeronautics*.
- [4] LEXIS Deliverable, *D9.8 Impact on Productivity and Business Process Improvement for Earth*.
- [5] LEXIS Deliverable, *D9.9 Impact on Productivity and Business Process Improvement for Weather & Climate*.
- [6] LEXIS Deliverable, *D9.10 Impact KPI and Metrics Achievements Report and Plan - final version*.
- [7] LEXIS Deliverable, *D9.11 Updated Market Analysis of Converged HPC, Big Data and Cloud Ecosystems in Europe and Positioning of the LEXIS Platform*.