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Project Number: 813884

Project Acronym: Lowcomote

Project title: Training the Next Generation of Experts in Scalable Low-Code Engineering Platforms

PROGRESS REPORT

Project GA: 813884

Project Acronym: Lowcomote

Project website: https://www.lowcomote.eu/

Project officer: Anna Starace

Work Package: WP1

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Version	**Publication date**	**Change**
0.1	12/12/2019	▪ Initial version
0.2	14/01/2020	▪ Review
1.0	17/01/2020	▪ Final version

Project Abstract

Low-code development platforms (LCPD) are software development platforms on the Cloud, provided through a Platform-as a-Service model, which allow users to build completely operational applications by interacting through dynamic graphical user interfaces, visual diagrams and declarative languages. They address the need of non-programmers to develop personalised software, and focus on their domain expertise instead of implementation requirements.

Lowcomote will train a generation of experts that will upgrade the current trend of LCPDs to a new paradigm, Low-code Engineering Platforms (LCEPs). LCEPs will be open, allowing to integrate heterogeneous engineering tools, interoperable, allowing for cross-platform engineering, scalable, supporting very large engineering models and social networks of developers, smart, simplifying the development for citizen developers by machine learning and recommendation techniques. This will be achieved by injecting in LCDPs the theoretical and technical framework defined by recent research in Model Driven Engineering (MDE), augmented with Cloud Computing and Machine Learning techniques. This is possible today thanks to recent breakthroughs in scalability of MDE performed in the EC FP7 research project MONDO, led by Lowcomote partners.

The 48-month Lowcomote project will train the first European generation of skilled professionals in LCEPs. The 15 future scientists will benefit from an original training and research programme merging competencies and knowledge from 5 highly recognised academic institutions and 9 large and small industries of several domains. Co-supervision from both sectors is a promising process to facilitate agility of our future professionals between the academic and industrial world.

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Introduction

The present document is a deliverable of the Lowcomote project (Grant Agreement n°813884), funded by the European Commission Research Executive Agency (REA), under the Innovative Training Networks Programme of the Marie Sklodowska Curie Actions (H2020-MSCA-ITN-2018).

The purpose of this document is to summarize major achievements of the project's first year (2019) as a discussion basis for Mid-Term check meeting (milestone 7) with the project officer from European Commission Research Executive Agency (REA) on 17th and 18th February 2020.

This deliverable contains an overview of the progress of the action, a summary of recruitment strategy & results, career development plans for each recruited researcher, management of the action, communication, and impact of the action.

Beneficiaries and Acronyms

1	Institut Mines-Telecom	IMT	France
2	University of York	UY	United-Kingdom
3	Universidad Autónoma de Madrid	UAM	Spain
4	Università degli Studi dell'Aquila	UDA	Italy
6	British Telecommunications Public Limited Company	BT	United-Kingdom
7	Intecs Solutions SPA	INT	Italy
8	Uground	UGD	Spain
9	CLMS (UK) Limited	CLMS	Greece
10	Incquery Labs Kutatasfejlesztesi KFT	INCQ	Hungary
11	Johannes Kepler University of Linz	JKUL	Austria

1. General progress of the action

Lowcomote training network has overall progressed according to Work Plan even if delay has occurred in recruitment process.

1.1. Deliverables and milestones

The majority of milestones and deliverable have been delivered in due time, except for Composition of Supervisory Board and Consortium Agreement which has been submitted following the Amendment to Grant Agreement Submission:

MS1: Kickoff meeting – Month 1, 17th & 18th January 2019
MS2: Recruitment completed – Month 12, 13 ESRs have been recruited by 1st January 2020. Remaining ESRs are in visa procedures.
D1.1: Consortium Agreement – Month 2, uploaded on 15/11/2019
D1.2: Supervisory Board of the Network – Month 2, uploaded on 23/05/2019
D1.3: Data Management Plan – Month 6, uploaded on 30/06/2019
D1.4: Progress report – Month 13, uploaded on 17/01/2020
D6.1: Network Web Presence – Month 6, uploaded on 26/06/2019
D6.2: Initial Dissemination and Exploitation Plan – Month 12, uploaded on 6/01/2020
D7.1: H - Requirement No. 1 – Month 12, uploaded on 06/01/2020
D7.2: POPD - Requirement No. 2 – Month 12, uploaded on 06/01/2020
D7.3: GEN - Requirement No. 3 – Month 12, uploaded on 06/01/2020

▷ **A Supervisory Board** (SB) was set-up, composed of representatives from each beneficiary and partner organizations, and had its first meeting on 18th January 2019 during the Kickoff meeting. The SB will also include 2 ESR representatives.

▷ **Ethics**. An Ethics Committee was appointed on 2nd December 2019.

▷ **Website**. www.lowcomote.eu was launched in February 2019, and updated regularly since then.

1.2. Scientific results

Lowcomote aims to train a generation of professionals in the design, development and operation of new Low-Code Development Platforms (LCDPs), that overcome their limitations, by being **scalable** (i.e., supporting the development of large-scale applications, and using artefacts coming from a large number of users), **open** (i.e., based on interoperable and exchangeable programming models and standards), and **heterogeneous** (i.e., able to integrate with models coming from different engineering disciplines). The ESRs will drive the upgrade of the current landscape of LCDPs to Low-Code Engineering Platforms (LCEPs). Consequently, the project integrates an interdisciplinary and intersectoral research program around three specific research objectives (RO):

- **RO1:** Enabling Low-code Engineering of Large-Scale Heterogeneous Systems, by smart development environments on the Cloud and precise integration of low-code languages with new domains. (Work package 3: ESR1, ESR2, ESR3, ESR4, ESR5)
- **RO2:** Developing a Large-scale Repository and Services for Low-Code Engineering, as a Cloud-based service able to handle a very large number of low-code artefacts, and automatically learn from them. (Work package 4: ESR6, ESR7, ESR8, ESR9, ESR10)
- **RO3:** Producing advancements in Scalable Low-Code Artefact Management, as new algorithms and reusable components. (Work package 5: ESR11, ESR12, ESR13, ESR14, ESR15)

It is too early to assess scientific work achieved so far with regards to delay in building up the network. So far ESRs have spent up to 4 months focusing on literature review and local training.

Year 2020 will be the occasion to launch the coordination of scientific work packages as agreed in Executive Board meeting on 2nd December 2019 and in accordance with Work Plan. First scientific deliverables will be submitted in November 2020.

1.3. Research trainings

Training programme activities (TPA) planned in September 2019 have been postponed to December 2019 so as to optimize the number of participating ESRs. Original Work Plan foresaw a first network event in September 2019 at IMT Atlantique, Nantes, which eventually took place from 2nd to 7th December 2019 with following elements:

- 1st Internal Research Meeting (1 day, including social activity for ESRs)
- TPA 2A: MDE Foundations and Tools Training (4 days), provided by UY and some contributions from CLMS and partner organization Metadev
- TPA 4A: Oral Presentations (0.5 day), provided by IMT

It is therefore too early to assess career developments achieved since trainings performed consisted in a first scientific & complementary skills session. Similarly, no secondment has started so far and their calendar is under rescheduling to preserve qualitative co-operations among ESRs when in secondment.

2. Recruitment strategy

The majority of ESRs' work contracts started between 01/09/2019 and 01/01/2020. At the time of writing of the report, 2 ESRs are still in the visa process before official hiring. All in all, the recruitment process has followed the planned calendar described in the grant agreement except for 3 ESRs who required a second round for applications. Any delay in official start of work contract is detailed later in the section.

2. 1. Recruitment overview

Preliminary Remark: Please note that the Researchers Declarations were submitted as soon as the information concerning the ESRs recruitment was made available to the Coordinator. As a result, the Fellow IDs and Researchers' order is not exactly chronological in comparison with their recruitment start dates.

Fellow ID	ESR#	Last Name	First Name	Last Country of residence	Recruiting beneficiary	Country of recruiting beneficiary	Academic / Non-academic	Recruitment Start date	Recruitment End date	Contract Type[1]	Family charges	PhD Enrolment
1	ESR14	PHILIPPE	Jolan	USA	IMT Atlantique	France	Academic	01/09/2019	31/08/2022	A	No	Yes
2	ESR15	SAHAY	Apurvanand	India	UDA	Italy	Academic	01/09/2019	31/08/2022	A	No	Yes
3	ESR12	ALI	Qurat Ul Ain	Pakistan	UY	UK	Academic	02/09/2019	01/09/2022	A	No	Yes
4	ESR11	JAHANBIN	Sorour	Iran	UY	UK	Academic	19/09/2019	18/09/2022	A	No	Yes
5	ESR10	KHORRAM	Faezeh	Iran	IMT Atlantique	France	Academic	01/10/2019	30/09/2022	A	Yes	Yes
6	ESR5	BRUNSCHWIG	Léa	France	UAM	Spain	Academic	24/09/2019	23/09/2022	A	No	Yes
7	ESR2	RANI	Fatima	Pakistan	UGD	Spain	Non-academic	08/10/2019	07/10/2022	A	Yes	Yes
8	ESR3	KOUROUKLIDIS	Panagiotis	Greece	BT	UK	Non-academic	01/10/2019	30/09/2022	A	No	Yes
9	ESR6	INDAMUTSA	Arsene	Rwanda	UDA	Italy	Academic	01/10/2019	30/09/2022	A	No	Yes
10	ESR1	ALMONTE GARCIA	Lissette	South Korea	UAM	Spain	Academic	15/10/2019	14/10/2022	A	No	Yes
11	ESR9	COLANTONI	Alessandro	Italy	JKUL	Austria	Academic	01/11/2019	31/10/2022	A	No	Yes
12	ESR4	IHIRWE	Jean Felicien	Rwanda	INT	Italy	Non-academic	16/12/2019	15/12/2022	A	No	Yes
13	ESR13	HORVÁTH	Benedek	Germany	INCQ	Hungary	Non-academic	01/01/2020	31/12/2022	A	No	Yes
-	ESR8	IBRAHIMI	Ilirian	Kosovo	CLMS	Greece	Non-academic	-	-	A	Yes	Yes
-	ESR7	KALWAR	Safia	Italy	JKUL	Austria	Academic	-	-	A	No	Yes

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[1] A: "employment contract" or B: "Fixed amount fellowship"

2.2. Organisation of the recruitment process

The recruitment process was centralized in order to enable the Coordination Team to better monitor the recruitment process through direct application reception, while not creating extra workload to beneficiaries' ordinary work. Beneficiaries were however asked to promote vacancies on their own institutional website and left free to make any additional promotion to find suitable candidates.

The recruitment process was coordinated insofar as the eligibility criteria for ESRs (Article 6 of Grant Agreement) were systematically monitored closely by the Coordinator (IMT). To that extent, the Project Manager at IMT pre-checked the eligibility of each application received when sharing them with beneficiaries concerned in a shared Google Drive folder. However, beneficiaries were reminded to double check the eligibility of them when having their interviews with applicants.

Applications Timeline
All positions' openings were **published between 13th February and 8th March 2019** (Month 2 / 3), shortly after the kick-off meeting (17th & 18th January 2019) where calendar for recruitment strategy was presented.

They were respectively **opened for a period of 8 weeks each and most of them were even extended until mid-May 2019** so as to maximize the number of applications received in preparation of the Supervisory Board meeting on 22nd May aiming at shortlisting them based on commonly agreed selection criteria, essentially related to academic profile. At this occasion, beneficiaries were reminded to organize their interviews in partnership with at least one consortium member from another country and sector so as to guaranty sectoral & geographical balance. They were also circulated a ranking and interview report templates with more specific criteria related to experience & skills (ex: previous experience, published papers, communication skills, team spirit, etc.).

In follow-up, the **majority of interviews took place between 23rd May and 21st June 2019**, where ranking and selection of 1st round applicants were approved by consortium members before official confirmation to candidates. 1st round interviews for ESR4, ESR6, ESR7, ESR9 and ESR15 were organized **between July and September 2019** and directly confirmed to the coordination team.

After official confirmation to candidates, 2nd round applications and interviews were necessary for ESR3, ESR9 and ESR13. Applications were re-opened accordingly **until end of August for ESR3**, **until end of September for ESR9**, and **until mid October for ESR13.** In each case, beneficiaries respected the sectoral / geographical balance for interviews and ranking of applicants was approved directly with the Coordination Team.

Advertisement

As agreed between all beneficiaries at the kick-off meeting, all positions were advertised on the project's website as main entry to application process (Google Form), on Euraxess and on each beneficiary's own website.

In addition, the Coordination Team advertised the vacancies on specialist, national-specific or broader job search websites such as www.findaphd.com, www.eclipse.org, www.jobs.ac.uk/, https://scholarshipdb.net, www.academicgates.com, www.science.hr, www.abg.asso.fr/fr/ , https://listserv.uni-heidelberg.de/science-jobs-de/sjd-e.html , http://muchong.com/, and on social medias: Twitter and LinkedIn.

Vacancies were also promoted to the following e-mailing lists (either by Coordinator by consortium members): gdr.gpl@imag.fr, planetmde@imag.fr, rsd-forum@cines.fr, gratra@upb.de, um@di.unito.it, distjisbd@lcc.uma.es, mdd-mda@ctima.uma.es, odp@lcc.uma.es, red-dsdm@lcc.uma.es, evol@lists.inf.unisi.ch, IR@jiscmail.ac.uk, CHI-ANNOUNCEMENTS@listserv.acm.org, ecoop-info@ecoop.org, http://www.cs.wisc.edu/dbworld/, mda-discussion@yahoogroups.com, SIGIR@listserv.acm.org, seworld@sigsoft.org, distjisbd@lcc.uma.es, wi-request@lists.kit.edu

Direct e-mailing to **76 Directors of Master Degrees** in Computer Science & Software Engineering in Europe was also performed by the Coordination Team.

A flyer was also made available to beneficiaries and an article about the project was written and presented by academic consortium members within the **Federated Conference STAF 2019 July 15 - 19, Eindhoven, The Netherlands.**

Each beneficiary also resorted to its own contacts, communication canals, e-mailing lists or direct flyer distribution to promote the vacancies.

Finally, additional communication campaigns for ESR3, ESR9 and ESR13 were made by resorting to e-mailing lists and advertisement websites used in first round campaign.

Applications received and Gender Assessment
209 candidates applied for the 15 positions that have been filled. Since the majority of candidates applied for several positions, the actual total cumulative number of applications ranks **710**. The majority of applications have been received through the dedicated GoogleForm.

Only the University of York has received directly applications for ESR11 & ESR12, because of internal rules from Human Resource department. A similar case also happened for ESR6 & ESR15, where Human Resource department from the University of L'Aquila required to receive applications directly so as to consider them officially. Shortlisted applicants were therefore informed to apply directly.

On average, a beneficiary received **47** applications for one position, ranging from **88** for ESR3 at BT and **8** for ESRs 11 & 12 at University of York.

In total, beneficiaries shortlisted **31** candidates for interviews (Among them some were shortlisted for different positions). On average, **2** candidates per position were selected.
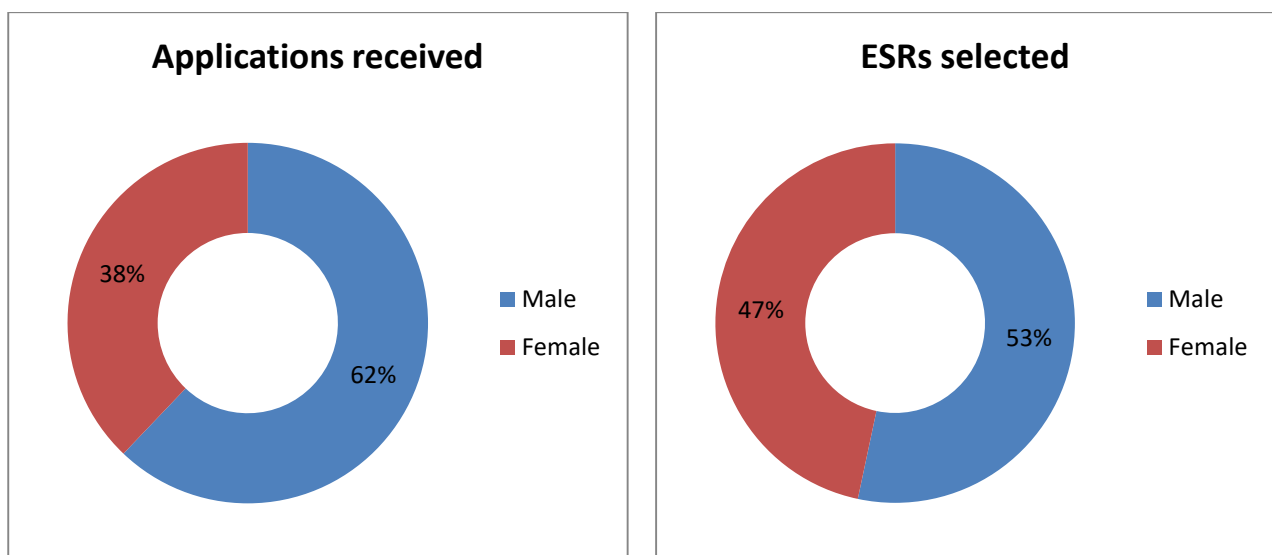
In a field (i.e. software engineering) that is highly dominated by men, the percentage of 38% women out of all applications was positive. Since the consortium recruited 7 women out of 15 ESRs so far, it has even increased the ratio to 47% and therefore matching equal gender balance. This figure is very encouraging especially as no affirmative action measure towards women has been put in place during advertisement of vacancies.

Applications received for each position (by gender)
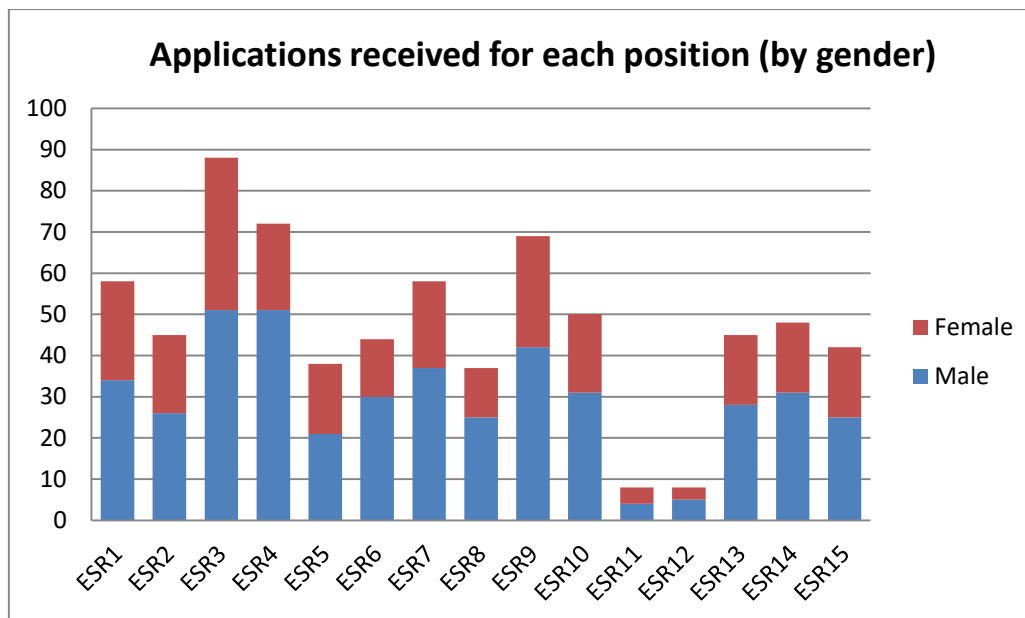
Implementation of the recruitment and working conditions obligations

In order to monitor compliance with the recruitment and working conditions obligations, the Coordinator has centralized as much as possible the process from application to follow-up. Major actions to guarantee compliance with Grant Agreement's provision related to recruitment can be summarized as follows:

a) A centralized GoogleForm enabled the Coordination team to check directly the eligibility of each application
b) Official EU's Information note about ITN projects has been published on the project's website to help applicants better understand the project
c) Harmonized selection criteria based an academic profile, experience and skills have been used to prevent any conflict of interest.
d) Acceptance & rejection e-mails have been sent to applicants by the Project Manager. The e-mails sent after interviews were inviting applicants to contact directly supervisors for any feedback for assessment.
e) Link to list of Euraxess center and National ITN contact points have been communicated to beneficiaries to provide them with experts able to inform them about implementation of ITN projects in their respective countries, and about formalities related to welcoming doctoral students (ex: visas, ect.)
f) A Career Development Plan (CDP) & Secondment Agreement Templates have been provided to beneficiaries. CDPs are signed between ESRs and supervisors.

2.3. Selected candidates

As demonstrated with the list below, the Lowcomote ESRs come from four continents and the two continents that are most represented are Europe and Asia,

Africa
ESR4: Félicien Ihirwe (Rwanda)
ESR6: Arsene Indamutsa (Rwanda)

Americas
ESR1: Lissette Almonte Garcia
       (Dominican Republic)

Asia
ESR2: Fatima Rani (Pakistan)
ESR7: Safia Kalwar (Pakistan)
ESR10: Faezeh Khorram (Iran)
ESR11: Sorour Jahanbin (Iran)
ESR12: Qurat Ul Ain Ali (Pakistan)
ESR15: Apurvanand Sahay (India)

Europe
ESR3: Panagiotis Kourouklidis (Greece)
ESR5: Léa Brunschwig (France)
ESR8: Ilirian Ibrahimi (Kosovo)
ESR9: Alessandro Colantoni (Italy)
ESR13: Benedek Horváth (Hungary)
ESR14: Jolan Philippe (France)

ESRs country of origin by continent

Map of the selected ESRs country of origin

2.4. Deviation from the work plan

As a result of undertaking visa applications for more than half of the ESRs, the consortium experienced delays, between appointing the selected candidate and their actual recruitment/start date due to visa process (a). Some internal factors linked to some beneficiaries' legal structure or national legislation delayed the recruitment (b). Finally, some cases have known delay because of 2nd round applications (c).

   a) *Cases where the start date of recruited ESRs was delayed due to visa and residence / work permit process*

ESR2 (UGD) Spain, ESR7 (JKUL) Austria, ESR 10 (IMT) France The recruitment was delayed by the need for the ESR's visa to be approved and residence / work permit to be delivered.

ESR 8 (CLMS) Greece, The recruitment was delayed because of an internal agreement needed about the PhD enrolment's place in order to waive tuition fees. Thus, he was eventually enrolled at JKUL (place of secondment) rather than UY. In addition, at the time of drafting this report, ESR8 is still waiting for work permit visa to settle in Greece.

b) *Cases where internal administrative rules or national legislation delayed the recruitment*

ESR6 (UDA) Italy, The ESR was selected in the 1st round phase. However, due to internal regulations of the HR Department of the University of L'Aquila, the interview had to be organized in compliance with them in July. Since the ESR had to apply for visa, it strengthened the delay in official starting date of work contract.

ESR4 (INT) Italy, Due to Italian national legislation, the recruitment of the ESR had to be organized in partnership with the HR department of the University of L'Aquila, which delayed the process. Visa application and issuing of residence permit prior to hiring at INT additionally added delay.

c) *Cases of 2nd round applications*

ESR3 (BT) UK, ESR9 (JKUL) Austria, ESR13 (INCQ) Hungary: all these ESRs were recruited in second round after either refusal of selected 1st applicants (ESR3 & 9) or unsuccessful site visit of 1st round selected applicant (ESR13). They did not experience any visa issue.

Overall, these delays have not impacted the consortium's work plan significantly, as most ESRs have been recruited within the first year, as planned.

Finally, due to delay in the recruitment, some beneficiaries requested to reschedule secondments so as to preserve the quality of ESRs' co-operations.

3. Career development plan for each recruited researcher

Supervision Agreements

Arrangements regarding the supervision of the ESRs have been left to the discretion of all partners and their institutions; as all beneficiaries' representatives are experienced supervisors. The ESRs nonetheless retain the opportunity to flag up any issue with the consortium via the ESR representatives and the annual (if not more frequent) reunions of the Supervisory Board.

Career Development Plans

Career Development Plans have been collected by the Coordinator after official presentation at first network event on 2nd December 2019 by ESRs. Such time was accommodated in order to ensure that the ESRs had enough time to reflect on their training, research and career plans as well as to discuss it with their supervisors, since not all ESR started at the same period. At the time of drafting this report, 3 career development plans are still under drafting because of delay in recruitment (ESR7, ESR8, ESR13).

A "*Career Development Plan Template*", agreed upon was provided by the Coordinator in parallel of researcher declarations to guide the supervisors and ESRs. However, freedom was left to the ESRs and supervisors with regards to the final format of the documents, to ensure that the plans could be adapted to each ESR and host institution's visions. The template is to be signed by both the ESR and the supervisor, and includes the following sections:

1. Long-term career objectives (over 5 years)
Including long term goals and research activities/training required to attain these goals

2. Short-term objectives (1-2 years)
Including anticipated research results (in terms of publications or events participation), research skills and techniques, plans for fellowship or funding applications, beyond-research professional skills training, and anticipated networking activities.

Compilation of the Career Development Plans' content

Long-term goals the ESRs set for themselves

- Become an expert in the challenges of data science model development, their deployment and life-cycle management
- Become a domain model expert in requirements and constraint specification for the data science domain
- Become a model transformation expert targeting deployment and management platforms for data science models
- Acquire skills needed empirical validation of research solutions in an industrial context
- Build an extensive free source low-code platform which are interoperable among different software and technologies such as MS flow, IFTTT, different low-code platforms that are runnable in several IDEs such as Visual Studio, Eclipse, etc.
- Have an extensive research in model-driven engineering, cloud computing and machine learning to be able to collaborate different concepts of these subjects such as model transformations, platform as a service, heuristic techniques, etc.
- Join the European companies which work on LCDPs
- Join a well-established University as a lecturer or postdoc
- Facilitate developers to understand artificial intelligence through model driven engineering to allow them to develop intelligent systems.
- Obtain a PhD

Skills the ESRs are expecting to acquire

General

- Gain major knowledge in the areas of Model-Driven Engineering, cloud computing and machine learning

Research skills

- Extend area of research by having collaboration with research scientists coming from various research institutes from different countries
- Attend project's Internal Workshops: Scalable Development of Low-Code Artefacts Workshop; Scalable Management of Low-Code Artefacts Workshop; Heterogeneous Low-Code Engineering in Industry Workshop
- Find out research methods to achieve an unkown goal
- Publication of the thesis results in conferences, journals
- Gain major knowledge in MDE, Mobile programming paradigm, Lowcode engineering
- Focus industrial research topics in industrial context and scale
- To gather non academic vendors and potential user

Communication skills

- Become experienced in paper, report and proposal writing
- Being able to make efficient and tailor-made oral presentations

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- Present an idea in a precise and accurate way
- Explain and teach a particular subject in an easy and enjoyable manner

Research results

- Acting as co-supervisor on MSc and undergraduate project related to research
- Have good publication records (high rankings journals and conferences IEEE TSE, Springer, SoSyMs, MoDELS, etc.)
- Understand and acquire skills on how to sell research work

Networking

- Attending conferences and workshops to present work and create research network
- Co-operate with Lowcomote's ESRs during secondments, hackathons and network events
- Gain more expertise in team management, collaboration and interpersonal skills
- Gain knowledge in industrial culture

4. Management of the action

4.1. Governance

Executive Board:

The Executive Board is the main decision-making body that gathers representatives from all beneficiaries. It is set to meet on average three times a year, by default during the network's Network Events. If deemed necessary, the Executive Board can also meet upon request for teleconference.

As detailed in the Consortium Agreement, the Executive Board is responsible for the successful performance of the project, the implementation of all objectives according to the project's timetable and for deciding about all management related issues, to ensure that they are aligned to the network goals, and that they are progressing towards milestone and deliverable targets. In addition, the Executive Board oversees finances, intellectual property rights as well as any change to the consortium.

Supervisory Board:

The Supervisory Board is the second decision-making body that gathers representatives from all beneficiaries, all partner organisations and two ESR representatives. It is set to meet at least once a year, by default at the occasion of a Network Meeting. If possible and deemed necessary, the Supervisory Board can also meet by teleconference.

As detailed in the Consortium Agreement, the Supervisory Board oversees the ongoing research efforts by ensuring that the complimentary strength of the network partners is optimally exploited. In doing so, they review and adjust the recruitment strategy, the network policies and the training programme. Most importantly, and because they include representatives from partner organisations and the ESRs, the Supervisory Board ensures an adequate balance between scientific/technological and transferable skills training , and that the skills acquired by researchers fulfill the needs of both academia and the non-academic sector.

Details on the meetings:

Executive Board. In the first year, the Management has met twice face-to-face, for a kick-off meeting, and at the occasion of the first Network Event in Nantes, France, and once by teleconference. Each time, all beneficiaries could be represented. The next Executive Board meeting is scheduled to take place during the 2nd network event in Madrid, from 17th to 21st February 2020 so as to match the period when further training sessions are organised at the Universidad Autónoma de Madrid.

▷ *Kick-off Meeting | 1st Executive Board meeting (Nantes,17 - 18th January 2019)*

This first meeting was an opportunity for all consortium members to meet and present their role in the project. A large part of the meeting was focused on planning the recruitment of ESRs, presenting the 2019 forecast of deliverables and confirming the EU MSCA rules.

▷ *2nd Executive Board meeting (Teleconference, 22nd May 2019)*

This second meeting offered the opportunity for the consortium to hear updates on deliverables, amendment procedure and the recruitment (then in the shortlisting phase), and the first suggestions of dates for the mid-term check meeting in February 2020.

▷ *First Network Event | 3rd Executive Board meeting (Nantes, 2nd December 2019)*

This third meeting offered the opportunity for the consortium to hear updates on deliverables, to have forecast for 2020 deliverables, to plan next Executive Board & Supervisory Board meetings, to validate Mid-Term Check Meeting agenda.

Supervisory Board. The Supervisory Board has met twice by teleconference, and twice on a face-to-face basis. All beneficiaries could be represented (no ESR as this was before any of them were recruited or the election took place). Concerning partner organizations, 3 out of 4 attended the first face-to-face meeting, 1 attended the second face-to-face meeting in December in Nantes, 2 out of 4 attended the third one related to ESR selections.

▷ *1st Supervisory Board meeting (Nantes, 17-18th January 2019)*

This first meeting was an opportunity for all members to meet and present their role in the project. The Coordinator presented the project and the network and the role of the partner organisations, especially in terms of their participation in the Supervisory Board. Since the meeting was part of the kick-off meeting, this was also the occasion to present the MSCA eligibility rules & discuss advertisement strategy.

▷ *2nd Supervisory Board meeting (Teleconference, 22nd May 2019)*

This second meeting was an opportunity for all members to discuss strategy to boost recruitment and to shortlist first round of applicants to organize interviews.

▷ *3rd Supervisory Board meeting (Teleconference, 21st June 2019)*

This third meeting consisted in the selection of applicants interviewed, and the presentation of the formalities of Declaration of Researcher, and Career Development Plans.

▷ *4th Supervisory Board meeting (Nantes, 2nd December 2019)*

This fourth meeting consisted in presentation of training calendar for 2020, internal organization per Work Packages, secondments, formalities for ESRs.

Involvement of researchers (ESRs):

Because of delay in recruitment of ESR8, ESR7, ESR13, the election of ERSs' representatives could not be organized at the occasion of the first network event held in Nantes from 2nd to 7th December 2019.

However, since at 17th January 2020 ESR7 & ESR8 were still not recruited, elections will be soon organized remotely through on-line poll before official recruitment of all ESRs. ESRs who attended the 1st network event also met informally on 2nd December in order to discuss possible applications & internal coordination of ESRs all along the project.

The ESR representatives act as a point of contact for the beneficiaries and supervisors to address all the ESRs. They maintain a contact list and an ESR-only mailing list and community via the Googlegroup application, in order to streamline communication between themselves. In 2020, a Slack group will be also created.

4.2. Risks

	Description and Proposed risk mitigation measure	Status
Risk 1 WP1, WP2	**Delay in recruitment / difficulty to recruit ESRs.** This risk is mitigated by wide diffusion of vacancy announcement, creation of reserve lists, and possible rescheduling of training programme (on-line material will help). In case a delayed recruitment impacts dependent tasks from other ESRs, his/her first tasks would be reaffected, in priority to ESRs whose work depends on those tasks or in the same WP.	The recruiting institutions have published vacancy announcements on the second month of the project with a wide diffusion. The Supervisory Board has constituted a reserve list in case of defections with applicants who presented interesting profiles. So far, only ESR7 & 8 have not been recruited. They will be able to access on-line material of the 1st network event held in Nantes in December 2019. After analyzing the dependencies among ESR tasks, we do not plan to re-affect the delayed tasks of ESR7 and 8.
Risk 2 WP1, WP2	**A supervisor leaves the consortium.** This risk is mitigated by the fact that ESRs won't only be supervised by the main and co-supervisor but by the network, represented by the Supervisory Board on this aspect. Several solutions to supervise the ESR will be considered in the order: another Lowcomote member of the same institution, or a new supervisor in the same institution, or another Lowcomote member of another institution.	Promotion of mobility in the research community is something well appreciated. Supervisor leaving risk is credible. However, for the moment no supervisor has left the consortium and adequate co-supervision of ESRs has been set up (1 main supervisor from hiring institution, 2 co-supervisors from institutions welcoming the ESR in secondment).
Risk 3 WP1, WP2,	**A partner withdraws from the project.**	So far, the partner organization Paralells Software Estonia OU has left the project. It had to provide a secondment for ESR 10 and a training about Cloud Computing and Virtualization

WP3, WP4, WP5, WP6, WP7	The affected events/secondments will be replanned if necessary and other members of the consortium that can provide comparable training and secondments will be identified and engaged. We will redistribute the contributions/deliverables of the leaving partner after EC consultation. Risk 2 measures will be used to supervise the ESR(s).	(TPA 2B). In replacement, secondment for ESR10 will be provided by Universidad Autónoma de Madrid (UAM) and the training will be provided by Amazon Web Services (AWS).
Risk 4 WP1	**Communication problems between participating organisations.** This risk is mitigated by Kick-off meeting held to establish personal contacts. Regular meetings will help maintain active communication channels between partners. Information will be shared online inside the consortium.	Kick-off meeting on 17th & 18th January 2019 helped creating personal contacts. Executive & Supervisory Board meetings organized in May, June & December 2019 have helped furthering active communication channels between partners and ESRs. Information is shared online through Google Drive & Google Groups. Finally, the Project Manager remains a contact point for both supervisors and ESRs all along the project.
Risk 5 WP1, WP2, WP3, WP4, WP5, WP6, WP7	**ESR withdraws.** During the first semester, we would try to hire another ESR, and apply Risk 1 measures. Later, his/her tasks would be reaffected to other ESRs, in priority to those whose work depends on those tasks or in the same WP.	So far, no ESR has expressed his/her willingness to quit. In such a case, we would resort to reserve lists created during the recruitment phase.
Risk 6 WP3, WP4, WP5	**ESR underperforms during the project.** In case on unsatisfactory performance, the Supervisory Board will be able to decide for specific additional training for the ESR(s) to help him (them) to reach level expected for the project. The regular meetings of the SB and the local supervision will ensure an early detection of such problems.	Because of delay in recruitment, it is too early to detect any underperformance of ESRs. Assessment of performance of ESRs will be deepened during year 2020.
Risk 7 WP3, WP4, WP5	**ESR(s) need(s) extra time to complete his/her research work.** The hosting institution will consider the possibility to extend the contract finding other sources of funding.	Not of actuality for the moment.
Risk 8	**Unforeseen evolution of the scientific fields.**	Not of actuality for the moment.

WP3, WP4, WP5	We will constantly check the state of the art and the LCDPs evolution. ESR personal project could be adapted after unexpected result, considering the implication on the ESRs collaborations.	
Risk 9 WP3	**Lack of realistic large and complex examples for applying Lowcomote lowcode technology.** Evaluate the techniques with case studies provided by industrial partners and open repositories hosted by academic partners.	Not of actuality for the moment.
Risk 10 WP4	**Inability to find appropriate and adequate datasets and models from different lowcode systems.** We will investigate the open public solutions for retrieving datasets to test the LCP application development as well as the enrichment of the graph repository with models from various low-code systems. We will adapt the Mutation Analysis and Fuzzyfication of dataset technique to LCEP to get scalable low-code artefacts.	Not of actuality for the moment.

4.3. Ethics

In follow-up to the Ethics Summary Report issued on 7th May 2019 by the European Commission, three Ethics Deliverables listed in the Grant Agreement (Annex 1 part A) are expected. All ethical issues will be addressed in the context of Early-Stage Researcher (ESR) 7 "Mining Interaction Processes in Low-Code Engineering Platforms", planning user studies to verify the efficiency of the developed interaction mining framework.

H – REQUIREMENT No.1:

This document contains:

- The procedures and criteria that will be used to identify/recruit research participants
- The informed consent procedures that will be implemented for the participation of humans
- Templates of the informed consent/assent forms and information sheets

POPD – REQUIREMENT No. 2:

This document contains:

- Appointment of a Data Protection Officer (DPO) and contact details of the DPO made available to all data subjects involved in the research.
- A description of the technical and organisational measures that will be implemented to safeguard the rights and freedoms of the data subjects/research participants
- Detailed information on the informed consent procedures in regard to data

GEN – REQUIREMENT No. 3:

This document contains:

- The composition of the Ethics Committee with a focus on data protection expertise.

4.4. Challenges

No specific challenge has been identified or faced during this first year. The only difficulties faced are related to recruitment and specific visa issues or implementation of national legislation which have generated some delay in recruitment (See section 2.4).

5. Communication activities

5.1 Dissemination activities

15th European Conference on Modelling Foundations and Applications (ECMFA'19 - STAF 2019), 15 - 19 July 2019, Eindhoven (The Netherlands)

Within the framework of recruitment process, Massimo Tisi, Coordinator of the project, has attended the STAF2019 conference where it was the occasion to present an article titled "Lowcomote: Training the Next Generation of Experts in Scalable Low-Code Engineering Platforms" promoting Lowcomote project. It was co-authored with other consortium members.

5.2 Public engagement activities

The communication activities performed so far are listed in deliverable D.6.2 "Initial Dissemination and Exploitation Plan" along with related communication strategy. Since the first year consisted essentially in recruitment of ESRs, organisation of Kick-Off meeting and first network event, the communication activities performed in 2019 are mainly related to these main events.

Recruitment:

Main communication tool for recruitment was the project website: www.lowcomote.eu.
More detailed information about its structure is provided in deliverable D6.1 "Network Web Presence". Another example of communication related to recruitment is the project flyer.

Kick-Off meeting & First Network Event:

Communication about the Kick-Off meeting has been made essentially on IMT Atlantique and Lowcomote's social networks and website:

IMT Atlantique ✔ @IMTAtlantique · 10 janv.

➡️Avis aux doctorants !⬅️

Le kick off meeting du projet européen Lowcomote en génie #logiciel aura lieu à l'Ecole à Nantes les 17 et 18 janvier.

On nous chuchote à l'oreillette que 15 places sont à prendre… 😉

@LaboLS2N @MSCActions

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IMT Atlantique ✔
@IMTAtlantique

Suivre

🇪🇺15 doctorants du programme européen @lowcomote s'installent une semaine à IMT Atlantique #Nantes pour se former à l'ingénierie logicielle avec Dimitris @kolovos de @UniOfYork ! bit.ly/34LKzSm
cc @massimotisi @UoY_CS #genielogiciel #low_code_engineering

Lowcomote : 1ère formation en ingénicie logicielle pour 15 doctorants
Lowcomote est un programme européen de formation en génie logiciel destiné à préparer une nouvelle génération d'experts de la construction d'applications basé…
imt-atlantique.fr

06:38 - 3 déc. 2019

4 Retweets 12 J'aime

💬   🔁 4   ♡ 12

6. Impact of the Action

6.1   Impact on the recruited researchers

We envisage a number of areas where the action will have a long-term impact on the fellows' career prospects including:

☐ **The training programme matches future software engineering market needs**. Having a network of academics as well as industrial experts allows to train the next generation of technology providers who will open the door to software for a larger community. We envision that LCEPs are going to radically transform the software construction landscape in the next few years, and will be the next step in the LCDP wave. LCEPs are giving access to non-programmers in building business-ready applications either for industrial or academic purposes. The capacity of LCEPs to transform domain experts (e.g. mechanical, civil, industrial engineers) into citizen developers makes them an active part of the ongoing digital transformation, instead of passive receivers. Lowcomote's ESRs will acquire the competences needed to construct new LCEPs, upgrade LCDPs to LCEPs or extend existing LCEPs to address new specific industrial domains. This will make them a precious resource in the future digital market.

☐ The **cross disciplinary nature** of the research will provide ESRs with skills for careers in a range of engineering domains. Each ESR will have specific competences that will raise its employability in a particular domain. For instance, ESR5 competences will advance the state-of-the-art in rapid development of mobile apps, ESR4 will address the central area of Smart Cities, ESR7 will be expert of measurement-based approaches for IT administration and operations in the DevOps paradigm. With Lowcomote project, ESRs will have the possibility to cooperate with strong academic and industrial

players and work on many relevant topics like Machine Learning, IoT, DevOps. They will be appropriately trained and positioned to manage the diversity of domains and the inherent focus of low-code systems to specific domains. They will then support citizen developers from various fields when developing on their own applications with minimum knowledge of programming languages, inducing a boom in entrepreneurial activities (e.g. startups) in this field.

☐ The action aims to develop a **solid scientific basis** with broad applications, in which the ESRs are given opportunities to interact with peer-researchers development technologies across a range of applications and levels. The employability of ESRs will be guaranteed by their unique combination of skills and competences:

- All ESRs will be expert in the development of domain-specific languages, by a common training in language engineering. This way they will be able to provide domain-specific low-code solution for heterogeneous engineering domains.

- All ESRs will be trained in Cloud computing, virtualisation, distributed computing, incremental algorithms and high performance persistence technologies. This will guarantee their awareness of the execution requirements of their low-code systems. Moreover this will provide them the capacity of developing innovative Cloud-based development environments.

- All ESRs will be taught the latest advancements in information retrieval and machine learning techniques. This knowledge will allow them to construct smart systems, necessary for the accessibility of LCEPs to citizen developers. As more and more data can be tracked in current and future systems, ESRs will be able to use these opportunities to understand how systems are actually used in comparison to the intention of the developers, and drive improvement.

☐ The **complementary skills programme** offered will prepare the fellows' senior positions and enable them to adapt and thrive in a variety of environments. Training events organised will provide the necessary soft skills to each ESR. At the end of the project, they all will be able to communicate easily towards various audiences, they will gain expertise on the different aspects of management, they will understand how to manage and how to plan their career perspectives, they will be able if interesting to launch a start up and will feel well-equipped to do so.

☐ The **active collaboration between the academic and industrial sectors** will allow ESRs to be in contact with various academic and industries and they will be able to extend their own networks benefiting from the large academic and industrial collaborations of each participating organisations. Dissemination events, such as the industrial workshop will ensure a high visibility of the network, of the ESRs, of their results and will open possible employment at the end of the project. In addition, the management structure of secondments will ensure a high degree of openness of each ESR to industrial and academic issues. Lowcomote will train a generation of scientists able to engage in an academic career or an industrial career. By spending a total of 6 months with other partners of the consortium, each ESR will benefit from various academic and industrial exposure making them able to pursue an academic and/or an industrial career.

6.2 Impact on the institutions involved

The ability of the partner institutions to attract ESRs of the highest calibre is of primary significance and provides the highest impact for those institutions involved.

The structure of the network, with detailed interaction between partners, both the academic institutions and the associate partners, is highly valuable. The ESRs will be a key vehicle to enable future collaborations and interactions.

6.3   Impact on the European Research Area

The action aims to provide a highly skilled workforce in a vital area of technologies development within Europe. This will have a significant impact on the partners and industry lasting well beyond the end of the project.

Thanks to Lowcomote, ESRs will be able to improve, increase, foster or contribute to a new generation of software engineering that will benefit to a large range of industries and reinforce the innovation capacity at the European level. ESRs will improve the performance of queries on heterogeneous low-code models which will in turn enable LCEPs to support larger and more complex systems. It will improve the development of new model management operations by reusing existing ones with a significant gain in quality and development time, making the process more cost efficient and ensuring a better performance.

In a general way, this project will foster the impact of low-code technologies in society. In the same way that WYSIWYG web builder tools have allowed the development of websites for any companies in the 2000s, and MDE impacted IT companies in the 2010s, LCE will allow in-house development of most of the company software in the 2020s. Explosion of the software in numbers and scalable treatments require this turn: manufactured products will soon be systematically sell associated to digital content: website, mobile apps, IoT (e.g. domotics) interactions, games. The innovation of Lowcomote will be to allow anyone to develop its software to customise its products reducing dependency on IT companies.

Society is evolving. We have switched from supply market to demand market. Citizens want personalization. Lowcomote will contribute to the continuous improvement of applications developed in LCEPs based on their usages. The first innovation will be to provide LCEPs helping citizen developers to build scalable software managing their data, without being dependent on GAFAM. This will foster the evolution and customization of applications, offering exactly the functionality to the users for a particular context, developed by themselves or open-source, craftsman/woman communities. Furthermore, the knowledge of how users interact with the platform should enable the platform developers and maintainers to build better tools for different target audiences.

Digitalization of the society and the complete industry is one of the key challenges of the EU in the upcoming decade to keep up with the growing competition with the BRICS nations and the USA. LCE is promising to solve the integration of non-expert developers into this new era by providing domain specific development capabilities built on top of LCEPs. By enhancing low-code technologies, we will be strengthening the position of EU software companies worldwide and improves Europe's competitiveness and growth. The more sophisticated, scalable technologies that we plan to develop will contribute to the faster realisation of innovative products with a more agile innovation process. ESRs of Lowcomote will also be prone to prevent citizen developers to develop low-code of low quality, which would be very valuable for companies helping them to keep their consumers in the time. ESRs will develop expertise to have the potential to be employed in several fields like energy, transport, etc. and will impact different sectors of industry. All of that will provide a clear competitive advantage for EU companies w.r.t. American ones.

Providing novel interfaces for the development of software systems is one of the main challenges for the digital transformation and Lowcomote will aim in contributing experts who can provide dedicated interfaces for domain experts. Lowcomote will train the generation of experts enabling the development of complex systems with low-code. The project may also impact the way industry such as mobile industry works: mobile app builders will become language engineers, and mobile app users will become modellers. Lowcomote non-academic members will train ESRs to help IT companies to develop LCEPs providing their clients (companies or final users) the possibility to use plainly their

products. In that sense, the contribution of the non-academic members in Lowcomote project is meaningful.

This will be a major advantage in a few years if we make EU scientifics of any discipline able to make their tools scale to the huge amount of data. Lowcomote will lead to the bridging of the gap between traditional data science and refining the resulting knowledge models into applications. A LCEP will enable data scientists to more easily develop and trial applications without the need for expensive manual redefinition and reimplementation.

The embedding in a European network of academic and industrial partners allows to further develop and mature existing research prototypes as well as connect our research with ongoing research efforts of international renowned experts. Structuring doctoral training level at the European level requires a set of common preliminary interest. With Lowcomote, all institutions, academic and non-academic, will be able to evaluate and disseminate their research results in new domains. It will increase the impact of the research performed and will open additional synergies that could be a leverage to launch new doctoral training programmes at the European level.

Lowcomote will train the first generation of LCDE experts, and they will be in Europe. They will themselves train LCE Engineers that will develop in IT European companies LCEPs to be used by citizen developers. Some of them will become researchers and/or academic teachers to promote LCEP and to train next generation of European developers.

7. Personnal career Development Plans

ESR1 PCDP: Lissette Almonte Garcia

lowcomote

Training the Next Generation of Experts in Scalable Low-Code Engineering Platforms

Personal Career Development Plan
○ Year 1 ✖ 2☐ 3☐

Name of ESR	Lissette Almonte Garcia
Host institution	Universidad Autónoma in Madrid
PhD title	Scaling Up Citizen Development with Recommender Chatbots.
Start date	October 2019
Name of academic Supervisor	Juan de Lara
Name of industrial Supervisor	
PhD enrolment	Doctorate Degree in Informatics and Telecommunication
Name of PhD Supervisor	Esther Guerra
Name of PhD Co-Supervisor	Ivan Cantador
Date	December 13th 2019

1. Brief overview of research project and major accomplishments expected

If this is your first PCDP, please provide your research plan and major accomplishments expected. If this is not your first PCDP, please provide an update of your research progress and major accomplishments achieved and expected (half page should be sufficient, about 300 words).

This research work aim to integrate model driven engineering, recommendation systems and information retrieval techniques in the concept of software development chatbots in order to support the citizen developers. The Citizen developers which are the users of the low-code development platforms tend to have low technical profile. To accomplish this chatbots will be addressed in natural language to issue queries on how to achieve some goals ("I want the application to do X, Y and Z"), or how to perform some task within the current project ("How do I make the app to send an e-mail to all registered customers?"). The chatbots will include a query answering component, and will provide example fragments and templates. Such fragments will be extracted from repositories of existing application descriptions, using information retrieval (IR) techniques. The chatbots will be proactive as well, suggesting artefacts specifically designed for LCEPs and IDEs. For this purpose, chatbots will use conversational recommendation techniques that will exploit preferences of the target user and like-minded users, artefact attributes, and contextual (action-based) data. This project will develop novel concepts to create systems that combine recommendation, information retrieval and query answering for specific domains and platforms. The systems will be able to scale for recommendations in repositories of millions of artefacts, and will be embeddable in platforms like Lowcomotive, and social networks like Slack or Telegram. We target at empowering citizen developers to create more complex apps, and in these scenarios, we will target at improvements in development times in the order of 30%. In order to achieve these goals this research will review all the literature available in the field of recommendation systems in the context of model driven engineer, evaluate the problem in concrete and develop the appropriate solution. Study the state of art of this research fields as well as design the theoretical and technical frameworks necessary to address this issue are the major accomplishments expected.

2. Long-term career objectives (over 5 years)

Clarify goals and further research activity or other training needed to attain these goals (if relevant, mention any adjustment to your long-term career development objectives as a result of the training received).
2.1 Goals
The main goals are first, review all the literature related to recommendation systems in the context of model driven engineering in order to develop the state of art in the field, second determinate the concrete problem to solve and finally, develop methods that address this issue.
2.2 What further research activity or other training is needed to attain these goals?
In other to attain these goals I need to gain major knowledge on the areas of recommendation systems, information retrieval and model driven engineering as well as attend to trainings and courses. Is necessary to attend to model driven engineer classes at Universidad Autonoma de Madrid as a listener, in addition to different training sessions ranging from model driven engineering, cloud computing and machine learning that will be provided by Lowcomote.

3. Short-term objectives (1-2 years):

3.1 Research and research management
Results: Publications; conference, workshop attendance, courses, and/or seminar presentations.
Skills and Techniques: Training in specific new areas, or technical expertise, etc.
Management: Fellowship or other funding applications (indicate name of award if known; include fellowships with entire funding periods, grants planed/applied/received, professional society presentation awards or travel awards, etc.).

Achieved objectives	Details	When

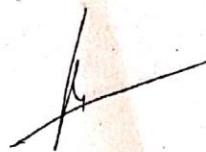| Expected objectives	What actions are required to achieved these objectives	By when
Gain major knowledge in the areas of model driven engineering, machine learning and cloud computing.	- Attend as a listener the master degree class of model driven software development.	Oct-Dec 2019
	- Participate in the different training sessions organized by Lowcomote in the areas of model driven engineering, cloud computing and machine learning.	Dec 2019 - Dec 2022
	- Collaborate in the University of L'Aquila with the ERS6 on aligning machine learning techniques with the structure of the repository.	Mar-May 2020
	- Collaborate in British Telecom with the ERS3 on applying recommendation techniques in the data science domain.	Dec 2020-Feb 2021
	- Attend to X conference/ Symposium.	----
Write an article describing the state of art of recommendation systems in the context of model driven engineer.	Examine all research work previously done in the field and create a comprehensive review on state of art of recommendation systems in the context of model driven engineering.	2-3 months

3.2 Personal and Professional Excellence

Communication skills: communication & presentation, leadership & interpersonal skills, self-management & career development.

Networking: Networking and collaboration opportunities, other activities with professional relevance (community, etc.).

Other professional training: teaching activity, mentoring, course work.

Innovation & Transferable Skills: Innovation process, IP management, business planning, commercialisation of research, policy development, etc.

Achieved objectives	Details	When

Expected objectives	What actions are required to achieved these objectives	By when
Gain more expertise in scientific writing, project and team management, and networking.	- Participate in the different training sessions organized by Lowcomote. These activities will help me to write better scientific research papers and reports, communicate with efficiency and relevance, and efficiently present my research work and results as well as others important technical and soft skills.	Dec 2019 - Dec 2022

Date & signatures of ESR, supervisors, co-supervisors, PhD director, PhD co-director

MADRID 5/12/2019

JUAN DE LARA
ESR SUPERVISOR

IVAN CANTADOR
PhD Co-SUPERVISOR

ESTHER GUERRA
PhD Co-SUPERVISOR
5/5

Lissette Almonte
ESR 1

ESR2 PCDP: Fatima Rani

lowcomote

Training the Next Generation of Experts in Scalable Low-Code Engineering Platforms

Personal Career Development Plan
- Year 1☐ 2☐ 3☐

Name of ESR	FATIMA RANI
Host institution	UGROUND GLOBAL, S.L
	Calle Guzmán el Bueno 133, Edificio Germania, 4ª Planta, Cuerpo Alto, 28003 Madrid, Spin
PhD title	SCALABLE CLOUD-BASED HETEROGENEOUS MODELLING
Start date	08/10/2019
Name of academic Supervisor	JUAN DE LARA JARAMILLO
Name of industrial Supervisor	PABLO DIEZ BURILLO
PhD enrolment	COMPUTER AND TELECOMMUNICATIONS ENGINEERING
Name of PhD Supervisor	JUAN DE LARA JARAMILLO
Name of PhD Co-Supervisor	ESTHER GUERRA SÁNCHEZ
Date	06/12/2019

1/5

1. Brief overview of research project and major accomplishments expected

If this is your first PCDP, please provide your research plan and major accomplishments expected. If this is not your first PCDP, please provide an update of your research progress and major accomplishments achieved and expected (half page should be sufficient, about 300 words).

This project is concerned with development and enhancement of Lowcode Engineering Platform. Lowcode Engineering Platforms can integrate heterogeneous engineering tools, they can implement interoperability in a system, even allow the cross-platform engineering. They also have the ability to add different resources to increase the scalability and support of very large engineering models with social networks of developers. They can develop smart applications and simplify the development for developers by means of machine learning and recommendation techniques. This can be achieved by research in Model Driven Engineering (MDE), amplified with Cloud Computing and Machine Learning techniques.

In Lowcode Development Platforms, we typically use the graphical notations for making the different aspect of the user application. But when the targeting application contains many metamodels and models, it is difficult to create, navigate and make the application if we don't have good platform or tool.

Creating the web based graphical editor is very hard and time consuming because the existing frameworks are not efficient enough. Even the existing frameworks are not enough to scalable more than the ten meta-models. For this purpose, there should be approach like "multi view cloud graphical editors". Hence the solution is that instead of low-level JavaScript graphical framework, all the aspects of the application should define through models for example syntax, semantics, interactions, definitions. For the heterogeneous cross modelling solution, we can integrate the front end and the back end of any application. This can be done by using the platform like UGROUND's ROSE, which works on "Recursive Ontology-Based Engineering". In it we can create the extensible libraries of different model. Its cloud-based environment provides us the ample computational power to work on the large models. By using the ROSE platform, we can even maintain the log for the millions of transactions the users are doing and working with.

ROSE can help to create the model like this which is heterogeneity scalable in modelling. The result of the project will be a framework to create Cloud-based modelling environments supporting abstraction, multi-view and heterogeneous modelling platforms.

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2. Long-term career objectives (over 5 years)

Clarify goals and further research activity or other training needed to attain these goals (if relevant, mention any adjustment to your long-term career development objectives as a result of the training received).

2.1 Goals

The results of the work done in this doctoral thesis will be published in prestigious international conferences, as well as in well-positioned journals in the rankings, such as:

- Conferences
  - Conferences in the field of MDE:
    - MODELS
    - ECMFA
    - ASE
    - ICSE
    - ICIHCC
- Journals
  - IEEE Transactions on Software Engineering
  - Journal of Systems and Software
  - Information and Software Technology
  - Automated Software Engineering
  - Software and Systems Modeling

2.2 What further research activity or other training is needed to attain these goals?

Training for the three main competences needed for developing future LCEPs:

- MDE, for domain analysis, language construction and code generation
- Cloud computing, for an efficient use of the Cloud infrastructure to manage many users and artefacts
- Machine learning, for building smart assistants for citizen developers
- Heterogeneous Modelling
- Object-Oriented Modelling

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3. Short-term objectives (1-2 years):

3.1 Research and research management
Results: Publications; conference, workshop attendance, courses, and/or seminar presentations.
Skills and Techniques: Training in specific new areas, or technical expertise, etc.
Management: Fellowship or other funding applications (indicate name of award if known; include fellowships with entire funding periods, grants planed/applied/received, professional society presentation awards or travel awards, etc.).

Achieved objectives	Details	When

Expected objectives	What actions are required to achieved these objectives	By when
➢ Expertise in Rose ➢ Survey of scalability in graphical modelling environment	• Learn & understand about different task in ROSE • Development of different Models in ROSE • Enhancement of Modelling Techniques in ROSE • Cloud computing in ROSE • In-depth reading around the topic in areas such as: ○ Model Driven Engineering ○ Cloud computing ○ Object Oriented Modelling ○ Scalability in heterogenous modelling ○ Comparative study of different MDE tools one by one	Couple of months

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4/5

3.2 Personal and Professional Excellence

Communication skills: communication & presentation, leadership & interpersonal skills, self-management & career development.

Networking: Networking and collaboration opportunities, other activities with professional relevance (community, etc.).

Other professional training: teaching activity, mentoring, course work.

Innovation & Transferable Skills: Innovation process, IP management, business planning, commercialisation of research, policy development, etc.

Achieved objectives	Details	When

Expected objectives	What actions are required to achieved these objectives	By when
➢ Networking with other ESR's ➢ Presentation Skills ➢ Technical writing skill ➢ Communication Skills ➢ Interpersonal Skills ➢ Problem Solving Skills	• Collaboration with other ESR's • Workshop on Presentation Skills • Workshop on Technical writing skill • Workshop on Communication Skills • Workshop on Interpersonal Skills • Workshop on Problem Solving Skills	On every workshop of Locomode Few days

Date & signatures of ESR, supervisors, co-supervisors, PhD director, PhD co-director

Dated:	06 Dec 2019			
ESR	**Supervisors**	**Co-Supervisor**	**PhD Director**	**PhD Co-Director**
Fatima Rani	Pablo Diez Burillo	Juan De Lara Jaramillo	Juan De Lara Jaramillo	Esther Guerra Sánchez

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Training the Next Generation of Experts in Scalable Low-Code Engineering Platforms

Personal Career Development Plan
- Year 1☐ 2☐ 3☐

Name of ESR	Panagiotis Kourouklidis
Host institution	BT PLC
PhD title	Deploying and Scaling Knowledge Models in Data Science
Start date	1-10-2019
Name of academic Supervisor	Dr. Dimitris Kolovos
	Dr. Nicholas Matragkas
Name of industrial Supervisor	Dr. Joost Noppen
PhD enrolment	University of York
Name of PhD Supervisor	Dr. Dimitris Kolovos
Name of PhD Co-Supervisor	Dr. Nicholas Matragkas
Date	22-11-2019

1. Brief overview of research project and major accomplishments expected

> If this is your first PCDP, please provide your research plan and major accomplishments expected. If this is not your first PCDP, please provide an update of your research progress and major accomplishments achieved and expected (half page should be sufficient, about 300 words).

Data science is playing an increasingly important role in industrial settings and in particular in large enterprises Managing workforce allocations, improving customer support and improved insight in fault rates are only a few areas in which large enterprises can leverage the significant amounts of data they collect A major challenge however lies in the development of applications that take advantage of these insights that offer acceptable performance, scalability and longevity

This challenge emerges from the conventional development practice that is employed in data science research and innovation The initial stages of a data science project is very much exploratory and research-oriented as at that point the exact potential and use of the available data is still unknown Using research-support tools and development environments a knowledge model is created that is typically suitable as a proof-of-concept but does not offer the required performance and scalability Therefore a second development stage is required, typically referred to as down-streaming, which focusses on reimplementing the knowledge model in a more suitable environment to ensure an application that is production-ready As this downstreaming stage is currently mostly manual there is a significant impact in time and to the adoption rate of knowledge models, which is further exacerbated by the fact that knowledge models require frequent updates due to changes in the environment and general trends in the data on which they are based

This project will investigate high-level abstraction languages for LCE knowledge models that are created in data science research and development, in order to help developers downstream such models into scalable, production-ready applications Developers should not have to deal with the repeated translation of knowledge models to more highly performant technology platforms, but rather focus on creating the infrastructure to accommodate the use of such models in real-world application

The first objective of the project is to develop a reference model for the transformation of knowledge models to specific target platforms A core focus of this model is to prevent regression, i e ensure functional behaviour, across transformations while facilitating highly scalable applications to be developed with the transformed model A second core focus of this model is the ability to ensure consistent API black-boxing, meaning that APIs for interaction with the knowledge models can be agreed as a contract This should make it possible to automate the replacement and deployment of an updated knowledge model inside a (running) application

We expect a significant reduction of the time required to downstream knowledge models into production applications, with development times potentially reduced 30-50% Further benefit will be achieved with the automated redeployment of updated knowledge models Currently due to the overhead involved this is not done, resulting in applications with deteriorating accuracy as time passes The ability to easily deploy updated models will significantly improve the relevance and accuracy of the applications over a longer period of time

2. Long-term career objectives (over 5 years)

Clarify goals and further research activity or other training needed to attain these goals (if relevant, mention any adjustment to your long-term career development objectives as a result of the training received).

2.1 Goals

- Become an expert in the challenges of data science model development, their deployment and life-cycle management
- Become a domain model expert in requirements and constraint specification for the data science domain
- Become a model transformation expert targeting deployment and management platforms for data science models
- Acquire skills needed for empirical validation of research solutions in an industrial context
- Become experienced in paper, report and proposal writing

2.2 What further research activity or other training is needed to attain these goals?

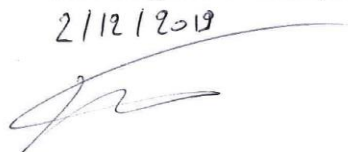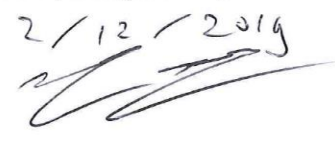- Introduction into data science (preparation, training, deployment, management)
- Training in principles of model-driven architecture and engineering
- Research into empirical validation of software engineering research in an industrial setting
- Paper and proposal writing training together with supervisory team
- In-depth training in best-practice deployment and management of software in industry

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3. Short-term objectives (1-2 years):

3.1 Research and research management

Results: Publications; conference, workshop attendance, courses, and/or seminar presentations

Skills and Techniques: Training in specific new areas, or technical expertise, etc.

Management: Fellowship or other funding applications (indicate name of award if known; include fellowships with entire funding periods, grants planed/applied/received, professional society presentation awards or travel awards, etc.).

Achieved objectives	Details	When
Introductory data science training	Attended data science week within BT	22-11-2019
Initial literature review	Compiled initial literature overview (ongoing effort)	22-11-2019
Define problem statement	Problem statement defined with long-term goals in accordance with research plan	22-11-2019

Expected objectives	What actions are required to achieved these objectives	By when
Progress Presentation	Progress presentation as part of University of York PhD track	15-1-2020
State-of-the-Art paper	Paper covering the current state of the art in the field (workshop, symposium)	31-3-2020
Initial Domain Model Concept	First concepts making up the requirements and constraints model for data science models	1-10-2020
Proof of Concept Transformation	Implementation of a PoC that can transform the initial domain model concepts to deployed data models	1-1-2021
Domain Model Paper	Paper based on the initial domain model and transformation results (symposium, conference)	1-3-2021

3.2 Personal and Professional Excellence

Communication skills: communication & presentation, leadership & interpersonal skills, self-management & career development.

Networking: Networking and collaboration opportunities, other activities with professional relevance (community, etc.).

Other professional training: teaching activity, mentoring, course work.

Innovation & Transferable Skills: Innovation process, IP management, business planning, commercialisation of research, policy development, etc.

Achieved objectives	Details	When
Mandatory training	Mandatory training on academic and industrial best practice	1-11-2019
Face-to-face with practitioners	Discussions with data science practitioners to discuss ways of working and concepts	22-11-2019
Lowcomote training week	Training week with introduction into Model-Driven Architecture and Engineering	8-12-2019

Expected objectives	What actions are required to achieved these objectives	By when
Data science standardisation body participation	Discussions and contribution towards standardisation efforts for data model deployments and management.	31-1-2020
Patent application	Involvement in patent applications based on PoC and research contributions	1-10-2020
Project supervision	Acting as co-supervisor on MSc and undergraduate projects related to research	1-4-2020
Conference attendance	Attending conferences and workshops to present work and create research network	1-9-2020

Date & signatures of ESR, supervisors, co-supervisors, PhD director, PhD co-director

2 / 12 / 2019   2 / 12 / 2019   2|12|2019.

5/5

ESR4 PCDP: Jean Félicien Ihirwe

Training the Next Generation of Experts in Scalable Low-Code Engineering Platforms

Personal Career Development Plan
- Year 1☒ 2☐ 3☐

Name of ESR	**Jean Felicien Ihirwe**
Host institution	Intecs Solutions S.p.a
	ITS Laboratory Via Umberto Forti 5 Montacchiello (Pisa) Italy
PhD title	ESR 4: Urban Area Management in Smart Cities
Start date	December 16th 2019
Name of academic Supervisor	Davide Di Ruscio
	Alfonso Pierantonio
Name of industrial Supervisor	Silvia Mazzini
	Pierluigi Pierini Giovanni Iovino
PhD enrolment	University of L'Aquilla
Name of PhD Supervisor	Davide Di Ruscio
Name of PhD Co-Supervisor	Alfonso Pierantonio
	Silvia Mazzini
Date	December 16th 2019

1. Brief overview of research project and major accomplishments expected

This is my first Personal Career Development Plan.

With the increase of population and devices in the cities around the globe where every activity generates data, technologies around the world needs efficient and user-centred pervasive functionalities to collect and process data seamlessly, enabling real-time monitoring and allowing the stakeholders' offer of enhanced services. This also goes with the design of systems in which it should be easy focusing from the high-level architecture to the more detailed design.

My plan for this research is mainly focusing on improving the IOT application design by incorporating the mode of using Model Driven Engineering methods. I plan to learn different technologies used for developing IoT systems on frameworks using Scalable LCEPs to model data-sources heterogeneity, standards and technologies involved in communications, interoperability with external systems, scalability and resilience.

In that regards Intecs Solutions Spa has different frameworks already established, like Data Management Framework (DMF). I plan to investigate how to extend its architectural design to meet Model Driven approach that can support system development on top of DMF. This will be one of the concrete products to show, at the end of the project, in terms of high complex heterogeneous systems implemented to meet Lowcomote concepts and technology. I will focus mainly on data acquisition and processing methods to meet higher standard design which supports easy integration with other IoT systems.

I'm new with Model Driven design technologies and tools but very enthusiastic to play a big role with my research. Currently I have a good practical experience with programming and Embedded system development in general in which I think that it will play a big part to push this project forward. One of the relevant metrics to evaluate the project results is the systems scalability, thus, throughout my PhD research I plan to emphasize the scalability principles and techniques related to IoT application and design. In this context, I will highlight the use of cloud computing and machine learning for user requirements analysis and response.

So far, I had been studying the foundations of Model Driven Engineering concepts and methods related to IoT context. In the coming months I will be part of the DMF2 project team, to design and implement a new and extended version of the framework. I expect to experience some new technologies in IoT application developments and the methods applied in industrial practice. I'm also learning on Eclipse CHESS platform which one of the main artefactual products I expect to incorporate in my research in terms of IoT modelling and design.

2. Long-term career objectives (over 5 years)

Clarify goals and further research activity or other training needed to attain these goals (if relevant, mention any adjustment to your long-term career development objectives as a result of the training received).

2.1 Goals

With the guide from my supervisors and coach, I aim to achieve a high-level merit PhD degree.

I aspire to become an expert in cloud based IoT application development focusing on smart cities application, by using Model Driven Engineering techniques and principles.

I plan to be a major playing part in Intecs Solutions Spa for all activities related to this research and I plan to learn large team management skills and report & paper writing skills. By the end of this research I aim to have played a significant part in the IoT community and Model Based Development in general by establishing new techniques and tools that will be used by citizen developers in building IoT intelligent systems using Model Driven approach.

To be specific, by the end of the project:
- I plan to gain an in-depth knowledge on Low code platforms development mainly applied for IoT systems development.
- I plan to acquire different skill sets to deal with scalability issues.
- I plan to develop an open source IoT modelling and design editor with extension from Intecs DMF as development side and CHESS on the Modelling side.
- I plan to publish at least 3 to 5 conference papers per year on my project domain in different International conferences related to IoT and Model Driven Engineering.

After my PhD, to strengthen my skills and deliver back to the community, I plan to look for some Postdoctoral opportunities in the fields related to research in MDE, Embedded systems and AI based smart systems or teaching.
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2.2 What further research activity or other training is needed to attain these goals?

To achieve the goals previously mentioned, I will need different training and workshops either provided by the fellowship, Intecs Solutions Spa, University of L'Aquila or any other institution.
- ❖ Secondments:
    - Collaboration with ESR10 to explore distributed verification of complex IoT systems under heterogeneous infrastructure constraints.
    - Collaboration with ESR2 to build editors for large IoT system models and log monitoring
- ❖ Trainings

  The project will provide more extensive trainings and workshops which will focus on 3 different aspects:
    - Model Driven Engineering, for domain analysis, language construction and code generation;
    - Cloud computing, for an efficient use of the Cloud infrastructure to manage many users and artefacts;
    - Machine learning, for building smart assistants for citizen developers.
- ❖ Project Management
    - As a PhD student I'm required to have an efficient way of communication, being a team player and an excellent writing and entrepreneurial skills.

3. Short-term objectives (1-2 years):

3.1 Research and research management		
Results: Publications; conference, workshop attendance, courses, and/or seminar presentations. Skills and Techniques: Training in specific new areas, or technical expertise, etc. Management: Fellowship or other funding applications (indicate name of award if known; include fellowships with entire funding periods, grants planed/applied/received, professional society presentation awards or travel awards, etc.).		
Achieved objectives	**Details**	**When**
MDE foundation skills	Training • MDE Foundations and Tools build on the top of Eclipse EMFcore.	Dec 2019
Research on already implemented modelling framework relating to IoT.	Tools include: • UML, SysMl, MARTE.	Jan 2020
Expected objectives	**What actions are required to achieve these objectives**	**By when**
Participate in the implementation of Intecs Data Managements Framework 2.	I plan to be involved in the whole development process to learn the new architectural and implemental design of the DMF.	April 2020
Learn PolarSys CHESS modelling framework to get the big picture of how IoT modelling tools are built.	Learn CHESS implementation mechanisms, design structure, technologies used. Take course tutorials on how to use CHESS in Modelling and Analysis of Real-Time and Embedded Systems profile.	June 2020
Explore the possible ways to improve the IoT modelling techniques which can be applied to CHESS.	CHESS modelling framework can support component definitions and analysis of different aspects, like performance and dependability, etc. This only applies on real time and embedded systems application. My focus will be to explore how possible to extend CHESS to cover also IoT system modeling aspects.	Nov 2020
	Explore the possible mechanism used for component verification process under the complex event scenario based on DMF/	Jan 2021
	I plan to add automation for the deployment and testing of IoT microservices implemented in DMF on being modelled in CHESS (scripts generations) as one of the strong links between DMF and CHESS. Explore cloud-based storage possibilities for CHESS modeling artifacts.	July 2021
		Nov 2021
Attends trainings	Training • Continuous industrial training on the job. • Cloud Computing and Virtualization Training • Scientific paper writing • Data Science and Machine Learning Training	Dec 2022 Feb. 2020 Feb. 2020 Jun. 2020

Attends workshops	Participate in internal workshops:	
	• ACM/IEEE MoDELS 2020 Research Workshop	Dec. 2019
	• Scalable Development of Low-Code artefacts Workshop	Dec. 2019
	• Scalable Management of Low-Code artefacts Workshop	Feb. 2020
	• Heterogeneous Low-Code Engineering in	Feb. 2020
	• Industry Workshop	Jun. 2020
Attends different IoT & MDE related conferences	Conferences includes:	
	• ACM / IEEE 23rd International Conference on Model Driven Engineering Languages and Systems (MODELS)	Oct. 2020
	• COINS: IEEE International Conference on Omni-layer Intelligent systems (Spain, Barcelona)	Jul. 2020
	• International Conference on Smart Cities and Smart Urban Technologies (ICSCSUT) - Paris, France	Dec 2020
	• International Conference on Intelligent Urban Systems and Smart Cities ICIUSSC (Istanbul, Turkey)	Jan. 2021
	• International Conference on Internet of Things and Cognitive Computing Systems (ICIOTCCS) - Barcelona, Spain	Aug. 2021

3.2 Personal and Professional Excellence

Communication skills: communication & presentation, leadership & interpersonal skills, self-management & career development.

Networking: Networking and collaboration opportunities, other activities with professional relevance (community, etc.).

Other professional training: teaching activity, mentoring, course work.

Innovation & Transferable Skills: Innovation process, IP management, business planning, commercialisation of research, policy development, etc.

Achieved objectives	Details	When
Oral presentation skills	Attended internal training on Oral presentation and on how to prepare a good presentation.	Dec 2019

Expected objectives	What actions are required to achieve these objectives	By when
Project Management	I plan to exercise my project management skills on some internal projects and improve my managerial skills to meet the need for the job	August 2021
Improve my presentation skills	Have a clear understanding and be able to present my project to the Intecs management and in conferences.	
Team working	Lease with my co-workers, integrate in the Intecs community to create a better working environment.	
Improve my writing skills	Focus on learning how to write a good research paper by collaborating on a weekly basis with my supervisors.	

Date & signatures of ESR, supervisors, co-supervisors, PhD director, PhD co-director

On 9th January 2020.

ESR:
Jean Felicien Ihirwe

Supervisors
Prof. Davide Di Ruscio   Prof. Alfonso Pierantonio   Silvia Mazzini

PhD Director
Prof. Vittorio Cortellessa

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Training the Next Generation of Experts in Scalable Low-Code Engineering Platforms

Personal Career Development Plan
- Year 1☒ 2☐ 3☐

Name of ESR	Léa Brunschwig
Host institution	Universidad Autónoma de Madrid
PhD title	Low-code Development of Rich Collaborative Mobile Apps using Active DSLs
Start date	23/09/2019
Name of academic Supervisor	Juan de Lara
Name of industrial Supervisor	-
PhD enrolment	Doctorate Degree in Informatics and Telecommunication
Name of PhD Supervisor	Juan de Lara
Name of PhD Co-Supervisor	Esther Guerra
Date	

11. Brief overview of research project and major accomplishments expected

> If this is your first PCDP, please provide your research plan and major accomplishments expected. If this is not your first PCDP, please provide an update of your research progress and major accomplishments achieved and expected (half page should be sufficient, about 300 words).

This research work aims at integrating model-driven engineering (MDE) in the process of mobile development by implementing low-code development platforms (LCDP) for mobile programming. Low-code development platforms are aimed at allowing non-programmers to build full applications by interacting through dynamic graphical user interfaces, visual diagrams and declarative languages. Some of them are focusing on mobile development and permit to create mobile apps that are typically mere CRUD applications that interact with a server exchanging data collected via forms.

The modelling and software engineering research group (MISO) proposes an approach to low-code development of rich collaborative mobile apps based on Language Engineering techniques and employs the novel notion of "Active DSL". A domain-specific model will be decorated with interaction mechanisms based on graphical diagramming, where elements may be geolocated on maps. It will also be able to incorporate information from open APIs to access services or to interact with social networks or smart things. It may be context sensitive which means it is able to adapt depending on context rules upon changing conditions like device position time or other conditions retrieved from APIs and external sensors. It will also be provided support for user roles and will enable collaboration. While the targeted apps are currently developed using traditional programming, this approach will reduce development time from months to days with zero programming and the deployment will be possible both on mobile devices and traditional computers.

In order to achieve these goals, this research will review all the literature available in the domain of MDE with mobile development and MDE for mobile apps development and also review the existing DSLs dealing with the notions of context, user interaction, user role and collaboration. This state of the art will permit to select the features to add to the DSL-comet app already implemented by MISO that is providing automation support to build mobile apps.

12. Long-term career objectives (over 5 years)

Clarify goals and further research activity or other training needed to attain these goals (if relevant, mention any adjustment to your long-term career development objectives as a result of the training received).

12.1	**Goals**

- State of the art of model-driven engineering applied to mobile development
- Improve automation support to build mobile apps provided by DSL-comet by adding for instance context sensitivity, customizable user interaction, …

12.2	**What further research activity or other training is needed to attain these goals?**

- Gain knowledge in the area of model-driven engineering by attending MDE class at UAM but also Lowcomote trainings.
- Improve mobile programming skills
- Attend Lowcomote training about writing scientific papers in order to publish scientific articles.

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13. Short-term objectives (1-2 years):

13.1 Research and research management

Results: Publications; conference, workshop attendance, courses, and/or seminar presentations.

Skills and Techniques: Training in specific new areas, or technical expertise, etc.

Management: Fellowship or other funding applications (indicate name of award if known; include fellowships with entire funding periods, grants planned/applied/received, professional society presentation awards or travel awards, etc.).

Achieved objectives	Details	When

Expected objectives	What actions are required to achieve these objectives	By when
State of the art	Read the literature about MDE and mobile development, write and publish an article	1st year
Design new DSL that are lacking or not complete	Improve the tools (DSL-comet, ...) and present it, evaluate it	
Gain major knowledge in MDE and Mobile programming paradigm	Read books, articles and attend training provided during Lowcomote project	

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13.2   Personal and Professional Excellence

Communication skills: communication & presentation, leadership & interpersonal skills, self-management & career development.

Networking: Networking and collaboration opportunities, other activities with professional relevance (community, etc.).

Other professional training: teaching activity, mentoring, course work.

Innovation & Transferable Skills: Innovation process, IP management, business planning, commercialisation of research, policy development, etc.

Achieved objectives	Details	When

Expected objectives	What actions are required to achieve these objectives	By when
Improve scientific writing skills	Training provided by Lowcomote projects and actually write papers.	
Improve oral presentation skills	Training provided by Lowcomote projects and practise by doing oral presentations.	
Extend my network	Lowcomote meetings and conferences	
Gain more expertise in team management and collaboration	Training session provided by Lowcomote and collaboration with ESR4 and ESR6 in their respective institution Intecs, Italy and University of L'Aquila, Italy but also ESR3 and ESR9 from British Telecom, United Kingdom and University of Linz, Austria	
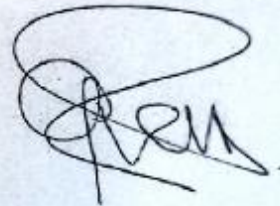
Date & signatures of ESR, supervisors, co-supervisors, PhD director, PhD co-director
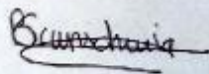
Madrid 5/12/2019

JUAN DE LARA

ESTHER GUERRA

Léa BRUNSCHWIG

ESR6 PCDP: Arsene Indamutsa

"This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 813884"

lowcomote

Training the Next Generation of Experts in Scalable Low-Code Engineering Platforms

Personal Career Development Plan
- Year 1☒ 2☐ 3☐

Name of ESR	Arsene INDAMUTSA
Host institution	Università degli Studi dell'Aquila
PhD title	Scalable and Extensible Cloud-based Low-Code Model Repository
Start date	October 1st, 2019
Name of academic Supervisor	Prof. Alfonso Pierantonio
	Prof. Davide Di Ruscio
Name of industrial Supervisor	
PhD enrolment	Information and Communication Technology
Name of PhD Supervisor	Prof. Dr. Davide Di Ruscio
Name of PhD Co-Supervisor	Prof. Dr. Alfonso Pierantonio
Date	October 26th, 2019

11. Brief overview of research project and major accomplishments expected

If this is your first PCDP, please provide your research plan and major accomplishments expected. If this is not your first PCDP, please provide an update of your research progress and major accomplishments achieved and expected (half page should be sufficient, about 300 words).

MDE technologies have been proposed for developing domain-specific modelling languages and for supporting a wide range of model management activities due to its ability to simplify and automate many steps of model-based development processes. However, empirical studies have shown some barriers that may hamper this progress. The major issue that obstructs the adoption of MDE is the limitation of the support for discovery and reuse of existing modelling artefacts. This causes irrelevant investments and compromise the productivity benefits of model-based processes due to model driven management tools and similar transformations that are unnecessary developed from scratch.

During the course of this project, we will develop several core services able to manage and store modelling artefacts and tools. These services will be extensible to facilitate the addition of new functionalities to the repository. We will expose these services by means of RESTful APIs to facilitate the adoption model management tools as Software-as-a-Service. Eventually, as we design the repository we bear in mind that we need it to support machine learning techniques in real-time in order to leverage on the power of analytics to facilitate knowledge discovery, predictive analytics and decision-support.

As a result, the project will produce a community-based model repository that can manage the persistence and reuse of heterogeneous modelling artefacts such as models, metamodels and model transformations. This repository is expected to handle advanced query mechanisms and be extensible to allow the addition of other functionalities such as remote calculation of model metrics, semantic model differencing, validation and composition of model transformations, and even automated clustering of the stored modelling artefacts. We expect to store thousands of real modelling artefacts (including model transformations, metamodels and models) which will be collected during the course of Lowcomote project development.

12. Long-term career objectives (over 5 years)

Clarify goals and further research activity or other training needed to attain these goals (if relevant, mention any adjustment to your long-term career development objectives as a result of the training received).

12.1 Goals

- My ultimate goal is to become a research professor in an interdisciplinary field, including model-driven engineering, cloud computing and machine learning
  - To achieve this I will need to successfully finish my PhD program with research publications that contribute to this area of expertise.
  - I will need to collaborate with other research scientists across other research institutes to always be at the edge of emerging technologies in this area.
  - Further trainings to gain exposure to various other IT engineering areas in order to understand how they can adopt model driven engineering in their daily life.
- After the PhD study, I am going to pursue post-doctoral research in the MDE area to deepen my understanding as well as to explore how model driven engineering can be applied during the development of artificial intelligence applications, and vice versa.
- Facilitate developers to understand artificial intelligence through model driven engineering to allow them to develop intelligent systems. As a result, we can considerably reduce the cost spent during the development phase.
- Publish at least 3 research papers before the end of my PhD program.

THE 5-YEAR PLAN
(2019-2024)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2019									Beginning of Ph.D.	Literature Survey on Low-Code Platforms and tools, learning how to use them, leveraging their organization and architecture to understand interoperability and integration among different platforms and external sources. Implementing a benchmark application Using different low code platforms		
												Going to IMT Atlantique, Nantes, France for MDE Foundations and Tools Training
2020	Take model-driven engineering course.					Data Science and Machine Learning Training at IncQuery Labs, Budapest, HU	Paper P1 review and Submission Start a Paper P2 about advanced query mechanism			Attend Scalable Development of Low-Code artefacts Workshop at Uground, Madrid, Spain	Paper P2 review	

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Year									
	Prepare the first draft of the above of the paper	Submit the paper P2			s on data repository by leveraging machine learning techniques				Start a Paper P3 on how on the state of the art on integration of artificial intelligence in low-code platforms
		Go to Universidad Autonoma de Madrid, Spain for Cloud Computing and Virtualization Training	Explore MDEForge repository and understand the organization, design and architectural patterns of this data repository. Implement RESTful Apis that will facilitate the adoption of model management tools as Software-as-a-Service		Investigating how machine learning techniques can be leverage to develop advanced query mechanisms that facilitate real-time and recommender systems and applications.	Design and Implement advanced query mechanisms on the data repository	Test the advanced queries developed and get the first draft of the paper ready		Carry out literature review on how artificial intelligence and model-driven can be easy merged
		Literature review and implementation of concepts on how to extend low code data repository and facilitating interoperability between different repositories							
2021	Implement ways machine learning and deep learning models can directly used from low-code. This will involve preparing the data and structuring the data from the low code platform to be consumed by the model embedded in the platform	Review and submission of P3	Start a paper P4 on automatic transformations of models in model driven engineering		Heterogeneous Low-Code Engineering in Industry Workshop at British Telecom, Ipswich (tbc), UK			Review and submission of the paper P4	ACM/IEEE MoDELS 2021 Research Workshop at University of York, UK
		Scalable Management of Low-Code artefacts Workshop at CLMS, Athens, GR		Literature review on automatic model transformations, define constraints and recommend standardizations needed to enable this feature	Implement automatic model transformation engine that can be used to automatically transform metamodels to another. For instance, cross platform transformation from ATL to JTL	Start collecting information and planning my thesis	Carry out an extensive literature review regarding my thesis		
						Start a Paper P5 Literature on the research question(Cloud computing, big data, machine learning and low code platforms)		Implementation of the proposed solution	Review and Submission a Paper P5.
2022	Start a paper P6	2nd Lowcomote Hackathon at Universität Linz		Review and submission of the Paper P6.	Industrial Workshop at Intecs, Pisa (tbc), IT		ACM/IEEE MoDELS 2022 Research and Future steps Workshop at University of L'Aquila, Italy	Fulfill my Ph.D. graduation requirements	
	Literature on the research question (Scalability, extensibility and maintenance of low code platforms that deal with big data)	Review and implement design and architectural patterns that can facilitate scalability, extensibility and maintenance of low code platforms that deal with big data		Start a Paper P7 (Traffic load, security and robustness of low code platforms)	Literature review (Traffic load, security and robustness of low code platforms)	Writing the Paper	Review and submission of the Paper P7		
	Start looking for post-doc opportunities through networks which will be established								
	Start writing the thesis				Have the first draft of	Work on reviews from Professors	Submit the final thesis		

12.2	What further research activity or other training is needed to attain these goals?

To attain the above goals,
- I have to attend trainings, workshops and conferences where new challenging ideas and edge cutting research ideas are discussed.
- Networking is essential to achieve these goals, thus I am going to seek collaborations with researchers coming from other engineering fields.
- Learn and investigate how model driven engineering can be adopted in other engineering fields, such as artificial intelligence, electronics, civil engineering, mechanical engineering and so on.
- Last but not least, I am going to improve my communication and presentation skills by attending online and on-site courses.

13. Short-term objectives (1-2 years):

13.1 Research and research management
Results: Publications; conference, workshop attendance, courses, and/or seminar presentations.
Skills and Techniques: Training in specific new areas, or technical expertise, etc.
Management: Fellowship or other funding applications (indicate name of award if known; include fellowships with entire funding periods, grants planned/applied/received, professional society presentation awards or travel awards, etc.).

Achieved objectives	Details	When
Surveying low-code tools, learning how to use them, leveraging their organization and architecture (In progress)	I am investigating low-code platforms and model driven engineering in general to understand how we can integrate low code platforms and enable interoperability across these platforms. Our goal is to save time and resources wasted by reinventing the wheel and to leverage already developed artefacts, techniques and proven design and architectural patterns.	June, 2020

Expected objectives	What actions are required to achieve these objectives	By when
• Investigating reusable artefacts in the MDEForge repository • Understanding interactions among components in the repository • Developing REST APIs to add new functionalities to the repository • Understanding how the repository can	• To reach these objectives, I am going to read related materials in model-driven engineering to understand the state-of-the-art and gain a broad view of the existing applications in the domain. • Furthermore, I am going to acquire technical skills and writing skills through attending workshops and conferences in software engineering domain, particularly in model-driven engineering.	June, 2020 June, 2020

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support advanced query mechanisms and be extensible in order to seamlessly add new functionalities • Having papers presented at doctoral symposiums • Having papers accepted at workshops, conferences, and journals		

13.2 Personal and Professional Excellence

Communication skills: communication & presentation, leadership & interpersonal skills, self-management & career development.

Networking: Networking and collaboration opportunities, other activities with professional relevance (community, etc.).

Other professional training: teaching activity, mentoring, course work.

Innovation & Transferable Skills: Innovation process, IP management, business planning, commercialisation of research, policy development, etc.

Achieved objectives	Details	When
Working on my communication skills	We are regularly holding meetings with our advisors where we are being trained on communicating our results in a convincing manner	
Expected objectives	**What actions are required to achieve these objectives**	**By when**

• Achieve excellent presentation skills • Attain teaching, mentoring and course planning skills • Understand and acquire skills on how to sell research work • Help the community grow in understanding this area and how it is important for them to adopt it.	• To achieve these goals, I need to stay updated on new technologies and techniques, new ideas and attain expertise needed to excel in this field. • Ask questions and feedback from the right people to clarify my assignments or theories as soon as possible. • Be an excellent team player. • I have to be willing to think out of the box, be flexible and accept feedback and criticism. • Learn from my advisors various skills, including professional, social and technical skills.	June, 2021

Date & signatures of ESR, supervisors, co-supervisors, PhD director, PhD co-director

Mr . Arsene Indamutsa
PhD Student
7/12/2019

Prof. Alfonso Pierantonio
PhD Supervisor
6/12/2019

Prof. Davide Di Ruscio
PhD co-supervisor
6/12/2019

12/11

ESR9 PCDP: Alessandro Colantoni

Training the Next Generation of Experts in Scalable Low-Code Engineering Platforms

Personal Career Development Plan
- Year 1☐ 2☐ 3☐

Name of ESR	Alessandro Colantoni
Host institution	Johannes Kepler University of Linz (Austria)
PhD title	DevOps Support for Low-Code Engineering Platforms
Start date	01/11/2019
Name of academic Supervisor	Prof. Manuel Wimmer
Name of industrial Supervisor	Dr. Ákos Horváth
PhD enrolment	On going
Name of PhD Supervisor	Prof. Manuel Wimmer
Name of PhD Co-Supervisor	Assoc. Prof. Juan De Lara
Date	09/12/2019

1. Brief overview of research project and major accomplishments expected

If this is your first PCDP, please provide your research plan and major accomplishments expected. If this is not your first PCDP, please provide an update of your research progress and major accomplishments achieved and expected (half page should be sufficient, about 300 words).

This research is **for** domain experts in different areas with long-living systems with frequent requirements changes, and areas where continuous service and technology innovation is needed, to take advantage of the new platforms offerings, to ensure that their economies, environment, and services are fit for the future, so being able to plug in new solutions in a changing era.

Examples of this business areas could be industry 4.0, smart grids and smart cities where, according to Navigation Research[1], requirements are still not clear, the pace of development is quickening, new business models are emerging, but it is not apparent what forms will be successful.

So this research is **for** domain experts **who** want to use their knowledge to build and rebuild their domain software applications directly from their models, easily and quickly, applying recursively revisions back to their models, on the basis of the actual outcomes and experiences generated by the executing applications themselves.

The *DevOps support for LCEP* **is a** collection of tools **that** allow to manage a large repository of low code artifacts, controlling their life cycle in all environments, to pick a set of them up to compose new ecosystems of applications that fit a domain expert needings, but not just to enable high level domain final services, but integrating them with other non functional systems like simulator, monitoring and evaluation, that allows domain experts to reason over the goodness of their models and restart, keeping aligned real applications with its models.

Unlike other DevOps *'products'* or existing Paas, **our DevOps Support project** allows domain experts to design its own DevOps, defining and linking its typical concepts (for example CI, VSC, Container System, Orchestration, Declarative Configuration, Rules and Constraints, Provisioning, KPI monitoring, Health Monitoring, Simulation, Discovery, Prototyping, Logging, Security etc.. etc..) in a custom abstract DevOps, independent from specific technologies, but having then the possibility to generate a concrete fully functional Devops specifying the actual technologies and platforms (for example use GIT as VSC, Jenkins as CI etc..).

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[1] https://www.navigantresearch.com/research-solutions/smart-cities

2 Long-term career objectives (over 5 years)

Clarify goals and further research activity or other training needed to attain these goals (if relevant, mention any adjustment to your long-term career development objectives as a result of the training received).

2.1 Goals

The main goal is to provide and research over standards, best practices, methodologies, tools, prototypes, poc, use cases, to manage the full life-cycle of software, from defining business strategic challenges, through design, develop, test, deploy orchestration, to real time data monitoring (BAM) and collecting and analyzing big data to create semantic value (BI) to feed back to initial strategic decisions and business requirements, to identify possible improvements in both software and business, implementing the virtuous circle based on learn, plan, develop evaluate.

Using MDE approach we will find out a know how to map outcome data from LCEP back to the design models, to update them and rerun automatically the whole process that lead to a modified application in production, to keep designs models and production data aligned.

2.2 What further research activity or other training is needed to attain these goals?

Self training

    Continuous integration

        (Jenkins, Bamboo, etc..)

    Orchestration tools self training

        (Docker, Docker Swarm, Kubernetes, Openshift, Cloudfoundry, Apache Mesos, Bluemix, Pivotal, etc...)

    Cloud service platform

        (Aws,Gcp)

    Bpm platform

        (Red hat PAM, Camunda, Appian, Mendix)

    MBaas platform

        (RHmap, Firebase, Xamarin, Ionic, Salesforce)

    IoT Platform

        EdgeXFoundry

    Monitoring systems

        (Splunk,ELK Stack)

    BAM and BI

    Other (Jhipster ....)

3. Short-term objectives (1-2 years):

3.1 Research and research management

Results: Publications; conference, workshop attendance, courses, and/or seminar presentations.

Skills and Techniques: Training in specific new areas, or technical expertise, etc.

Management: Fellowship or other funding applications (indicate name of award if known; include fellowships with entire funding periods, grants planned/applied/received, professional society presentation awards or travel awards, etc.).

Achieved objectives	Details	When

Expected objectives	What actions are required to achieve these objectives	By when
Research methodologies	Local and secondment Training: Development of Design Artifacts	06/2020
To practice with MoDELS	1st ACM/IEEEMoDELS 2020 Research Workshop 2nd ACM/IEEEMoDELS 2020 Research Workshop	10/2020 10/2021
Theories, SOTA, tools and technologies on specific topics of the research	MDE Foundations and Tools Training Cloud Computing and Virtualisation Training Data Science and Machine Learning Training	12/2019 02/2020 06/2020
Focus research topics in industrial context and scale	Scalable Development of Low-Code artefacts Workshop1 and Workshop2 Heterogeneous Low-Code Engineering in Industry Workshop	10/2020 02/2021 06/2021
To gather non academic vendors and potential user	Industrial Workshop	06/2022

3.2 Personal and Professional Excellence

Communication skills: communication & presentation, leadership & interpersonal skills, self-management & career development.

Networking: Networking and collaboration opportunities, other activities with professional relevance (community, etc.).

Other professional training: teaching activity, mentoring, course work.

Innovation & Transferable Skills: Innovation process, IP management, business planning, commercialisation of research, policy development, etc.

Achieved objectives	Details	When

Expected objectives	What actions are required to achieve these objectives	By when
Improving communication skills.	Oral Presentations Scientific paper writing Report writing Grant proposal writing Job interview and application	12/2019 02/2020 06/2020 02/2021 02/2021
Improve project management in tools methods and interpersonal skills.	Project self assessment Project management Team management IPR management	06/2021 10/2021 02/2022 06/2022
Learn how to do a PCDP	Career planning Industrial sector career Academic sector career Future steps	02/2022 06/2021 06/2002 08/2022
To reinforce entrepreneurship mindset to bring ideas into products	Start-up testimonies Opportunity recognition BusinessModelling and Development	10/2021 06/2022 09/2022
Integrate the products of the research in the Lowcomote platform	1st Lowcomote Hackathon 2nd Lowcomote Hackathon 10 Internal Research Meetings (approximately every 4 months)	10/2020 02/2022 09/2022

Manuel Wimmer   Juan De Lara   Ákos Horváth   Alessandro Colantoni

16/12/2019

ESR10 PCDP: Faezeh Khorram

lowcomote

Training the Next Generation of Experts in Scalable Low-Code Engineering Platforms

Personal Career Development Plan
- Year 1☐ 2☐ 3☐

Name of ESR	Faezeh Khorram
Host institution	IMT Atlantique
PhD title	Cloud-Based Testing Workbench for Low-Code Engineering
Start date	2019/10/01
Name of academic Supervisor	Dr. Jean-Marie Mottu
Name of industrial Supervisor	Dr. Yannis Zorgios
PhD enrolment	Faezeh Khorram
Name of PhD Supervisor	Dr. Gerson Sunye
Name of PhD Co-Supervisor	Dr. Jean-Marie Mottu
Date	2019/12/02

11. Brief overview of research project and major accomplishments expected

If this is your first PCDP, please provide your research plan and major accomplishments expected. If this is not your first PCDP, please provide an update of your research progress and major accomplishments achieved and expected (half page should be sufficient, about 300 words).

The research plan consists of several phases and the expected accomplishments are considered among them which are as follows:
- Investigating state of the art to acquire the background knowledge for the project. The main research directions define the borders of the thesis which for this project is the following areas individually or in combinations:
  - Functional Testing of Android applications and IoT systems
  - Model-Based Testing and its application on the generalization and automation of the test design and configuration
  - Large scale and distributed functional testing
  - Capabilities of existing low-code testing tools
- Attending the training sessions determined by the Lowcomote project plan
- Refining of the project objectives and specification of a precise definition for the problem
- Publishing the literature review results in a conference
- Proposing new solutions and implementing the most appropriate one
- Evaluating the proposed solution
- Communicating with the related secondments in different aspects of the thesis (ESR 1, 3, 4, 8) and probably publishing the results in conferences
- Finalizing the results and publishing them in a journal
- Successful defencing

12. Long-term career objectives (over 5 years)

Clarify goals and further research activity or other training needed to attain these goals (if relevant, mention any adjustment to your long-term career development objectives as a result of the training received).

12.1 Goals

- The foundation of my long term career would be defined based on the outcome of my PhD thesis. It is going to be a testing workbench for Low-Code engineering which is
  - extensible to be enriched by covering non-functional testing and also functional testing for other domains, in addition to mobile and IoT
  - scalable to be usable as the testing component of large scale LCDPs
  - contains a rich repository of reusable testing models
  - smart and provides recommendations to citizen developers for test design and configuration
- Publishing the intermediate results of the thesis in conferences during the next 3 years and after, pursuing as a postdoc to publish the late contributions made during thesis
- Joining the European companies which works on LCDPs such as the industrial partners of Lowcomote project to earn industrial experience
- Finally, I would like to join a well-established university as a lecturer, postdoc or hopefully faculty to continue my research interests

12.2 What further research activity or other training is needed to attain these goals?

The whole idea of my thesis is surrounded by Software Testing and I suppose that this would be helpful if I pass some technical courses in this area such as related Master classes provided by IMT or University of Nantes, or attending to some summer school.

For the rest of the required training, It is not clear-cut at the moment since it is two months from the project start date and there are several training sessions considered in the Lowcomote project in advance which is not held yet. Depends on the results of the network events and training sessions, I can decide whether further research activities are required or not.

13. Short-term objectives (1-2 years):

13.1 Research and research management

Results: Publications; conference, workshop attendance, courses, and/or seminar presentations.

Skills and Techniques: Training in specific new areas, or technical expertise, etc.

Management: Fellowship or other funding applications (indicate name of award if known; include fellowships with entire funding periods, grants planed/applied/received, professional society presentation awards or travel awards, etc.).

Achieved objectives	Details	When

Expected objectives	What actions are required to achieved these objectives	By when
Publication of the survey results	Comprehensive study on state of the art	2020
Publication of the secondments results	Efficient team work with other students and their supervisors	2020-2021
Publication of the intermediate results	Precise scheduling, following the research plan	2021-2022
Publication of the final results of the thesis in a high ranked journal	Performing high-quality research, on-time completion of the thesis	2022
Technical expertise in Low-code engineering, especially that of testing	Active and motivated attendance in training sessions of the Lowcomote project	2019-2022

13.2 Personal and Professional Excellence
Communication skills: communication & presentation, leadership & interpersonal skills, self-management & career development.
Networking: Networking and collaboration opportunities, other activities with professional relevance (community, etc.).
Other professional training: teaching activity, mentoring, course work.
Innovation & Transferable Skills: Innovation process, IP management, business planning, commercialisation of research, policy development, etc.

Achieved objectives	Details	When

Expected objectives	What actions are required to achieved these objectives	By when
French communication to get benefits from French academic events	Attending to the French courses	2019-2021
Expertise in English presentation skills	Self-study	2020
Improvement of teamwork skills	Efficient participation in secondments and training sessions	2019-2022

Date & signatures of ESR, supervisors, co-supervisors, PhD director, PhD co-director

02/12/2019

lowcomote

Training the Next Generation of Experts in Scalable Low-Code Engineering Platforms

Personal Career Development Plan
- Year 1☐ 2☐ 3☐

Name of ESR	Sorour Jahanbin
Host institution	University of York
PhD title	Intelligent Run-Time Partitioning of Low-code System Models
Start date	19 September 2019
Name of academic Supervisor	Prof. Dimitris Kolovos
Name of industrial Supervisor	
PhD enrolment	
Name of PhD Supervisor	Prof. Dimitris Kolovos
Name of PhD Co-Supervisor	Dr Simos Gerasimou
Date	16 December 2019

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11. Brief overview of research project and major accomplishments expected

> If this is your first PCDP, please provide your research plan and major accomplishments expected. If this is not your first PCDP, please provide an update of your research progress and major accomplishments achieved and expected (half page should be sufficient, about 300 words).

During the first year of my PhD, I have planned to do literature view to develop an overview of the problem and what other researchers do for solving this. For this purpose, I should read some articles from well-known journals which are more related to my thesis and try to work with tools that they developed.

In addition, I should identify the research question and specify the direction of my research. The direction of research means that I should have an idea for possible solutions and analyse them. In this way, I will find drawbacks and benefits of each solution, and according to this, I can compare existing solutions.

After this process, I will choose the best solution as my research approach. So, I will try to know more about this solution and analyse all aspects of this. I should justify the solution which I choose. It means that I should have strong reasons for choosing this way to solve my thesis problem. Therefore, I should know all the advantages of the approach and also, the limitations that we will have in our approach.

Finally, with my supervisors' assistance, I will try to publish one conference paper in the first year of my PhD.

My first secondment will be at CLMS in collaboration with ESR8 and I will spend 3 months in another workplace. It should be a very good experience as I will be in the industry and I can get familiar with real-world projects and gain knowledge about other parts of Lowcomote project.

From September to December, I worked on Static Analysis in Epsilon Framework. I tried to add some new features like compile-time errors in EOL in collaboration with ESR 12 at the University of York.

In addition, I started the literature view with reading some related articles about partial loading models, static analysis and scalable model persistence. According to the University of York PGR Handbook, my first milestone is a 25-minute literature review seminar, which we plan to have in January.

12. Long-term career objectives (over 5 years)

Clarify goals and further research activity or other training needed to attain these goals (if relevant, mention any adjustment to your long-term career development objectives as a result of the training received).

12.1 Goals

- Secure a postdoc position in a collaborative project between academic institutes and industry

- Pursue academic activities as a lecturer and professor

- Work in industrial projects

12.2 What further research activity or other training is needed to attain these goals?

- Contribute to lectures and practicals during my PhD

- Attend conferences for getting familiar with new topics and challenges in MDE and meet researchers who are working on these subjects

- Be in companies to be familiar with real-world projects

- Improve management skills by accepting responsibilities in projects

6/8

13. Short-term objectives (1-2 years):

13.1 Research and research management

Results: Publications; conference, workshop attendance, courses, and/or seminar presentations.

Skills and Techniques: Training in specific new areas, or technical expertise, etc.

Management: Fellowship or other funding applications (indicate name of award if known; include fellowships with entire funding periods, grants planed/applied/received, professional society presentation awards or travel awards, etc.).

Achieved objectives	Details	When
Work on Epsilon	Try to run Epsilon from source code and become familiar with some languages of Epsilon family	Sep - Oct 2019
Work on static analysis	Work on Epsilon source code and analyse it for adding new features like compile-time errors	Sep - Nov 2019
Literature review	Read articles about static analysis, partial loading, scalable model persistence	Dec 2019

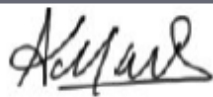| Expected objectives	What actions are required to achieve these objectives	By when
Publication	Publish at least 2 conference papers in highly-ranked international conferences like ICMT, MoDELS, ICSE and 1 journal paper	2020-2021
Management skills	Attend workshops and training courses related to project management, time management	2020-2021

13.2 Personal and Professional Excellence

Communication skills: communication & presentation, leadership & interpersonal skills, self-management & career development.

Networking: Networking and collaboration opportunities, other activities with professional relevance (community, etc.).

Other professional training: teaching activity, mentoring, course work.

Innovation & Transferable Skills: Innovation process, IP management, business planning, commercialisation of research, policy development, etc.

Achieved objectives	Details	When
Presentation	My presentation skills are improved due to group meetings and supervision meetings	Sep - Dec 2019
Workshop	Attended the workshop "Digital Wednesdays: Organise yourself! - Useful apps to help you keep on track", about time-management at the University of York	Nov 2019
Language class	I attended English classes to improve my speaking at the University of York	Nov 2019
Network event	Got familiar with other team members and learned about MDE	Dec 2019

Expected objectives	What actions are required to achieved these objectives	By when
Management skills	Attend workshops related to project management, time management	2020-2021
Teaching	Get teaching experience	
Interpersonal skills	Collaborate with other ESRs in host institute and secondments	2020-2021
Industry experience	Gain knowledge about real projects in secondments	2020-2022
Communication skills	Attend networking events and get familiar with other team members and know about other parts of Lowcomote project	2020-2022

Prof. Dimitris Kolovos   Dr Simos Gerasimou   Sorour Jahanbin

lowcomote

Training the Next Generation of Experts in Scalable Low-Code Engineering Platforms

Personal Career Development Plan
- Year 1 ☒ 2☐ 3☐

Name of ESR	Qurat ul ain Ali
Host institution	University of York
	United Kingdom
PhD title	Heterogeneous Low-Code Model Query Optimisation
Start date	2nd September, 2019
Name of academic Supervisor	Prof. Dimitris Kolovos
Name of industrial Supervisor	
PhD enrolment	University of York
Name of PhD Supervisor	Prof. Dimitris Kolovos
Name of PhD Co-Supervisor	Dr Konstantinos Barmpis
Date	16 Dec, 2019

11. Brief overview of research project and major accomplishments expected

> If this is your first PCDP, please provide your research plan and major accomplishments expected. If this is not your first PCDP, please provide an update of your research progress and major accomplishments achieved and expected (half page should be sufficient, about 300 words).

This year would be particularly focused on reviewing and analysing the work that has already been done in the field of Model Driven Engineering (MDE) particularly in terms of scalability issues. Identifying the performance issues that arise when models under consideration become very large and complex. Identifying the challenges that still exist for obtaining fast execution time while running model management queries. As the optimisation needs to be done for model management programs, knowledge of codebase of these model management languages would be required. Epsilon (eclipse.org/epsilon) would be primarily used for this purpose. Epsilon is a family of languages for model management tasks. EOL is the base language for Epsilon and all others are built on top of EOL. To optimise model management queries, all querying approaches need to be reviewed. Benefits and shortcomings should be analysed.

For developing novel compile-time query optimisation algorithms, I need to develop static analysis facilities for EOL programs.

Literature related to static analysis will be reviewed to apply state of the art static analysis approaches to the programs under consideration. Query optimisation is a very common work done in the field of databases, thus some of the approaches can be explored to use in the context of MDE as well.

Along with this particular research topic, I am looking forward to network events and training organised by Lowcomote. These will help me learn three major areas of Lowcode systems MDE, Cloud Computing & Machine Learning. I am expecting to learn how to be a good presenter/speaker. The oral presentations seminar of the first network training event will help me achieve this goal. I want to improve my technical writing skills to be able to write better technical reports & scientific articles. I am expecting that Lowcomote training will greatly help me learn how to work both as an individual and as part of a team.

5/5

12. Long-term career objectives (over 5 years)

Clarify goals and further research activity or other training needed to attain these goals (if relevant, mention any adjustment to your long-term career development objectives as a result of the training received).

12.1 Goals

- Secure a doctoral degree in the field of software engineering
- Secure a postdoctoral position in a project related to Model Driven Engineering, specifically focusing on scalability issues.
- Acquire industrial experience from the industries hosting secondments and also increase interdisciplinary network
- Developing skills to understand the industrial requirements & can use scientific knowledge for industrial setup.
- Publish the results in well-known international scientific conferences and journals.
- Develop a good research profile.
- Attend workshops and training seminar during the project course
- Attend A-rated conferences related to the subject
- Build international network from both industry and academia
- Acquire communication skills for both academia and industry.
- Enhance scientific writing skills

12.2 What further research activity or other training is needed to attain these goals?

- Training events for technical expertise in the field of:
  - Model Driven Engineering
  - Cloud Computing
  - Machine Learning
- Trainings for:
  - Oral Presentations
  - Scientific Writings
  - Being an effective researcher
  - Effective Teaching
  - Work/Life Balance & Wellbeing

6/5

13. Short-term objectives (1-2 years):

13.1 Research and research management

Results: Publications; conference, workshop attendance, courses, and/or seminar presentations.

Skills and Techniques: Training in specific new areas, or technical expertise, etc.

Management: Fellowship or other funding applications (indicate name of award if known; include fellowships with entire funding periods, grants planed/applied/received, professional society presentation awards or travel awards, etc.).

Achieved objectives	Details	When
Understanding of Epsilon Codebase	Worked on Epsilon's family EOL engine; interacted with different parts of the code base to produce static analysis facilities	Sep- Nov 19
Literature Review	Reviewed literature related to MDE and low-code systems, then specifically about scalability issues. Read articles for querying models and then how those queries are optimised	Nov- Dec 19
Some static analysis features in EOL	Wrote some static analysis functions for EOL programs, mainly including Assignment Type mismatch, Operations parameters, return types mismatch etc.	Sep- Dec 19

Expected objectives	What actions are required to achieved these objectives	By when
Research result management	Publications along with other members of the consortium to well-known international conferences and journals with particular focus on MODELS conference etc.	2020-2022
Increase technical expertise. Key skills in all scientific areas involved in "Low coding systems"	Attend trainings held by different institutes about three technical domains namely ("MDE Tools", "Machine Learning" & "Cloud computing") to increase technical expertise.	2019-2022
Collaboration with consortium of Lowcomote project	Secondments: • INCQ, Budapest, Hungary (M19-M21) • CLMS, Athens, Greece (M29-M31)	2020-2022

13.2 Personal and Professional Excellence

Communication skills: communication & presentation, leadership & interpersonal skills, self-management & career development.

Networking: Networking and collaboration opportunities, other activities with professional relevance (community, etc.).

Other professional training: teaching activity, mentoring, course work.

Innovation & Transferable Skills: Innovation process, IP management, business planning, commercialisation of research, policy development, etc.

Achieved objectives	Details	When
Collaboration and improvement in communication skills.	Collaborating with ESR11 for doing static analysis on Epsilon EOL	Sep-Nov 19
	Collaborating with ESR2 & ESR6 in MDE group project for developing a DSL, Model, Tree based & Graphic editor, M2T, M2M for a Sushi Restaurant	2-6 Dec 19

Expected objectives	What actions are required to achieved these objectives	By when
Good communication & presentation skills	Present at international conferences	2020-2022
Interpersonal skills & self-management-Networking	Collaborate with other team members both in the host country and other network fellows related to the Lowcomote project	2020-2022
Gain confidence and improve presentation skills	Contributing to labs lab or delivering guest lectures related to my course as advised by supervisor	2020-2022
Gain knowledge about industrial culture	Secondments	2020-2022

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Professor Dimitris Kolovos

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Dr. Kostantinos Barmpis

_____
Qurat ul ain Ali

8/5

lowcomote

Training the Next Generation of Experts in Scalable Low-Code Engineering Platforms

Personal Career Development Plan
- Year 1☐ 2☐ 3☐

Name of ESR	Jolan Philippe
Host institution	IMT Atlantique
PhD title	Multi-Paradigm Distribution for Model Management Operations
Start date	01/09/2019
Name of academic Supervisor	Dr. Massimo Tisi
Name of industrial Supervisor	Silvia Mazzini
PhD enrolment	Jolan Philippe
Name of PhD Supervisor	Dr. Gerson Sunye
Name of PhD Co-Supervisor	Dr. Massimo Tisi and Dr. Hélène Coullon
Date	2019/11/25

1/5

1. Brief overview of research project and major accomplishments expected

> If this is your first PCDP, please provide your research plan and major accomplishments expected. If this is not your first PCDP, please provide an update of your research progress and major accomplishments achieved and expected (half page should be sufficient, about 300 words).

Being assigned the task of model transformation optimization, a deep knowledge of what models are, and how they are handled is necessary. There exist many solutions for these problems: different used paradigms, representations, languages, etc. However, they are not all fit for all the problems and finding the most adapted solution constitutes the first line of research of my thesis. The structure of a model can be associated to a typed graph, and its topology may have a significant impact on performances during its handling. Additionally, other parameters, such as their configuration, must be considered in order to obtain the best possible performances. The first task is then to produce a state of the art. Ideally, the state of the art will be formal and published. At this point, the final solution is conceived as an algorithm taking as input a model transformation and returns a minimal-cost solution to operate this transformation. Several ideas come up for this objective. For instance, knowing all the possible solutions, first, remove all the ones that do not fit a particular type of transformation. Then, generate a cost estimation for each remaining solution, and select the minimum one. With this perspective, defining what the cost is, is not even trivial: it can be the financial cost (with machine leasing), operating time, energy consumption, and so on, or a mix of these criteria.

The granularity of the estimation also has to be discussed. Another idea is to base the predictability of performance on machine learning. Indeed, a large spectrum of previous experiments can give information about all the possible solutions cost.

2/5

1. Long-term career objectives (over 5 years)

Clarify goals and further research activity or other training needed to attain these goals (if relevant, mention any adjustment to your long-term career development objectives as a result of the training received).

1.1 Goals

Naturally, one of my personal goals is to obtain a Ph.D. This point is the main key for my future career.

For the next years, after completing the doctoral program, I envisage a postdoctoral position in a a foreign country to pursue additional research and teaching to open as much as possible opporunity for the future. I aim for the post of researcher and teacher in academia.

1.2 What further research activity or other training is needed to attain these goals?

Academics is known as a difficult position to obtain. Recruitement criterias are often based on the publications (the number, the quality of journals, and the quality of the related conferences) and on teaching experiences.

That is why, a postdoc, envisaged for several years, will be necessary. Moreover, additional training about teaching will be needed to get the required skills.
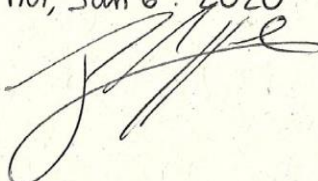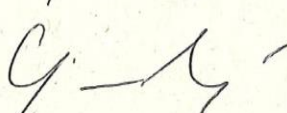
2. **Short-term objectives (1-2 years):**

1.3 Research and research management
Results: Publications; conference, workshop attendance, courses, and/or seminar presentations.
Skills and Techniques: Training in specific new areas, or technical expertise, etc.
Management: Fellowship or other funding applications (indicate name of award if known; include fellowships with entire funding periods, grants planed/applied/received, professional society presentation awards or travel awards, etc.).

Achieved objectives	Details	When

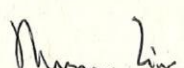| Expected objectives	What actions are required to achieved these objectives	By when
Technical expertise in: • Model engineering • Lowcode engineering	Attendance in Lowcomote trainings and courses at the University. Reading of tutorials, and technical report on research.	End of 2020
Publication of a State of the Art	Reading papers and articles related to me research axis, especially about the effort on model transformation over distributive paradigms	Summer 2020
Publication of secondments results	Teamwork with other ESRs, and the Lowcomote project members.	2021
Publication of intermediate results	Obtain signicative results by experimenting different approaches. Consulting experts.	2021-2022

1.4 Personal and Professional Excellence

Communication skills: communication & presentation, leadership & interpersonal skills, self-management & career development.

Networking: Networking and collaboration opportunities, other activities with professional relevance (community, etc.).

Other professional training: teaching activity, mentoring, course work.

Innovation & Transferable Skills: Innovation process, IP management, business planning, commercialisation of research, policy development, etc.

Achieved objectives	Details	When

Expected objectives	What actions are required to achieved these objectives	By when
Improve my presentation skills, especially in English	Conferenes attendances and presentations, and as many as possible presentations to other team members	2021
Teamwork skills	Work with other students during the training sessions and with potential collaborators during the other event of my doctoral program	2022
Improve my English writting	Submit publications as much as possible during the program, to get feedback.	2022

Date & signatures of ESR, supervisors, co-supervisors, PhD director, PhD co-director

Mon, Jan 6, 2020

Tue, Jan 7, 2020

TUE, JAN 7, 2020

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Training the Next Generation of Experts in Scalable Low-Code Engineering Platforms

Personal Career Development Plan
- Year 1☒ 2☐ 3☐

Name of ESR	APURVANAND SAHAY
Host institution	UNIVERSITY OF L'AQUILA
PhD title	o ESR 15: CLOUD-BASED LOW-CODE MODEL TRANSFORMATIONS COMPOSITION AND EXECUTION
Start date	SEPTEMBER 1ST, 2019
Name of academic Supervisor	PROF. DAVIDE DI RUSCIO
Name of industrial Supervisor	
PhD enrolment	INFORMATION AND COMMUNICATION TECHNOLOGIES
Name of PhD Supervisor	PROF. DAVIDE DI RUSCIO
Name of PhD Co-Supervisor	PROF. ALFONSO PIERANTONIO
Date	NOVEMBER 25TH, 2019

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1. Brief overview of research project and major accomplishments expected

If this is your first PCDP, please provide your research plan and major accomplishments expected. If this is not your first PCDP, please provide an update of your research progress and major accomplishments achieved and expected (half page should be sufficient, about 300 words).

Model Driven Engineering (MDE) is a wide area of research available to develop domain specific modelling languages and to handle various modelling activities in a complex system. Research has been done to simplify and automate many steps of model-based development processes. This can be done not only by structurally combining many steps of model driven approaches but also equating the logical steps of model based approaches in different model transformations. One of the primary issues with MDE is the support for discovery and reuse of existing modelling artefacts. The reuse of modelling artefacts will enable a faster, cheaper and simpler development of model.

One of the main tasks of the project is to transform one model to another and this would require a transformational domain specific language called Model Transformational Composition Language (MTCL) that will enable the complex transformation of models by reusing and composing simpler and smaller models. The specified properties can refer both syntactic and semantic characteristics that will drive the selection of intermediate transformations, which will be retrieved from a repository of existing model transformations.

The project's primary goal is to develop a model transformation and composition theory. It will also analyze the properties to preserve during and after the execution of model transformations. In order to determine model transformation compositions, a domain-specific language (MTCL) will be specified, i.e., the properties and constraints of the model which composed transformations must have been met. A main challenge in this regard would be to optimize and maintain semantics preservation of chained model transformations. A model transformation "orchestration engine" is built to execute the composition of many model transformations to achieve the desired model from the source model

Secondly, it is necessary to develop open source "generic" low-code platform which can be interoperable with external sources such as other low-code platforms, IFTTT, MS Flow, Zapier, etc. An efficient approach of making an application which is universally compatible in most of the systems would be a new model to live a "smart" life. All tools developed in this project has to be implemented as software-as-a-service, which enable their remote adoption and easy integration with external tools.

2. Long-term career objectives (over 5 years)

Clarify goals and further research activity or other training needed to attain these goals (if relevant, mention any adjustment to your long-term career development objectives as a result of the training received).

2.1 Goals

Over 5 years, I am going to work to reach the following objectives:

- The primary goal of my research is to build an extensive free source low-code platform which are interoperable among different software and technologies such as MS flow, IFTTT, different low-code platforms that are runnable in several IDEs such as Visual Studio, Eclipse, etc.
- I would like to have an extensive research in model-driven engineering, cloud computing and machine learning to be able to collaborate different concepts of these subjects such as model transformations, platform as a service, heuristic techniques, etc. for the further research in Lowcomote project along with different researcher in order to build an industrial grade product tentatively by April, 2022.
- I must have a good publication record of at least two journal papers in high ranking journals and conferences such as IEEE TSE, Springer SoSyM, MoDELS etc. tentatively by August, 2022.
- During my PhD, I want to extend my area of research by having collaboration with research scientists coming from various research institutes in Italy and other countries, including India tentatively by January, 2022.
- After my PhD, I will continue improving my expertise by pursuing post-doctoral research in the area of Model Driven Engineering along with different areas of study such as Cloud Computing and Artificial Intelligence tentatively by August, 2024.

2.2 What further research activity or other training is needed to attain these goals?

Understanding in-depth concepts of:

- Model Driven Engineering - Model transformation and reuse of models are essential components of Lowcomote project ESR-15.
- Cloud Computing - The project ESR-15 needs the product to be based on cloud. Therefore concepts of cloud computing need to be mastered. The end product is supposed to be supported cloud based so that it can be used remotely by different users at different locations.
- Machine Learning: Topics included Supervised Learning, Unsupervised Learning, Reinforcement Learning, Neural Network, Deep Learning, etc. must have been used for making an application futuristic so that it can be built with minimum human interference - In order to apply cognitive knowledge and understanding of creating an application autonomously would be a future ahead to research.
- Data Science, Artificial Intelligence: Leading to machine learning, huge data need to be assessed and consequently those data can be utilized in making an application in an autonomous or semi-autonomous way.

Doing research activities involving:

- Collaboration among different ESR team members to integrate various parts of the Lowcomote project so that an efficient and industrial usable wholesome product could be made.

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- Understanding the cohesiveness of the subjects including Model Driven Engineering, Cloud Computing and Machine Learning in order to build a "smart" low-code product which integrates different aspects of these subjects such as Model Transformation, Platform as a Service, Reinforcement Learning, etc.
- Maximizing the research community network in order to attain a fruitful and interdisciplinary achievements.

3. Short-term objectives (1-2 years):

3.1 Research and research management

Results: Publications; conference, workshop attendance, courses, and/or seminar presentations.

Skills and Techniques: Training in specific new areas, or technical expertise, etc.

Management: Fellowship or other funding applications (indicate name of award if known; include fellowships with entire funding periods, grants planned/applied/received, professional society presentation awards or travel awards, etc.).

Achieved objectives	Details	When
Literature Survey on Low-Code Platforms and comparative study of their features.	Documented details of different low-code platforms including:	Dec. 2019
Try out some of the low-code platforms for further understanding of the platform by using different application benchmarks.	OutSystems, Kony, Kinvey, Skyve Foundry, Kissflow, Appian, Zoho Creator, Microsoft PowerApps, Salesforce App Cloud, Caspio, Google App Maker, bpm'online studio enterprise DWKit, FileMaker, K2, WorkFlowWise, etc.	

Expected objectives	What actions are required to achieved these objectives	By when
Survey on interoperability among different low-code platforms	Informatica, MuleSoft, Dell Boomi, Workato, Jitterbit, SnapLogic, Microsoft, SAP, IBM, Software AG, Adaptris, TIBCO Software, etc.	Dec. 2019
Understanding MDE tools and techniques, Cloud Computing and Data science & Machine Learning. Their applications in the Lowcomote project which enable a good collaborations among different ESRs.	Training & Work on: • MDE Foundations and Tools Training • Oral Presentation • Cloud Computing and Virtualization Training • Scientific paper writing • Comparative analysis for implementation on low-code platforms applying on different application benchmarks • Data Science and Machine Learning Training • Report Writing	Dec. 2019 Dec. 2019 Feb. 2020 Feb. 2020 Apr. 2020 Jun. 2020 Jun. 2020

Having a survey paper submitted based on the complete comparative analysis of low-code platforms based on its features, application domain and pricing in MoDELS conference.	Documented manuscript of comparative analysis of different low-code platforms including: OutSystems, Mendix, Kissflow, Appian, Zoho Creator, Microsoft PowerApps, Salesforce App Cloud, Google App Maker, etc.	Jun. 2020
	Attending Internal Workshops such as:	
	• ACM/IEEE MoDELS 2020 Research Workshop	Oct. 2020
	• Scalable Development of Low-Code artefacts Workshop	Oct. 2020
	• Scalable Management of Low-Code artefacts Workshop	Feb. 2021
	• Heterogeneous Low-Code Engineering in Industry Workshop	June, 2021
Optimizing the execution of transformation chains.	Collaboration with ESR12 in University of York, UK	May, 2021
Build a model transformation "orchestration engine"	Integration of the transformation language developed by ESR13 with the orchestration engine in IncQuery Labs, Budapest, HU	Sept, 2021

3.2 Personal and Professional Excellence

Communication skills: communication & presentation, leadership & interpersonal skills, self-management & career development.

Networking: Networking and collaboration opportunities, other activities with professional relevance (community, etc.).
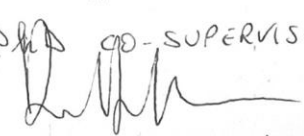
Other professional training: teaching activity, mentoring, course work.

Innovation & Transferable Skills: Innovation process, IP management, business planning, commercialisation of research, policy development, etc.

Achieved objectives	Details	When

Expected objectives	What actions are required to achieved these objectives	By when
To be able to present the idea in a precise and accurate way.	Aim to have clarity on all topics and different opportunities associated with it.	Apr, 2020
To be able to find out research methods to achieve an unknown goal.	Converse with the Professors and other research associates to be able to understand a generic approach to attain a research goal.	Dec, 2020
To be able to explain and teach a particular subject in an easy and enjoyable manner.	Read different approaches of understanding a particular topic in order to remember the topic for a longer period of time.	June, 2021

Date & signatures of ESR, supervisors, co-supervisors, PhD director, PhD co-director

Apurvanand Sahay
04/12/2019
(APURVANAND SAHAY)
ESR – 15 (Ph.D.)
DISIM, UNIVAQ

PROF. DAVIDS DI RUSCO
6/12/2019
(PhD CO-SUPERVISOR)

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THE 5-YEAR PLAN
(2019-2024)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2019									Beginning of Ph.D. on lowcomote project ESR 15			
									Literature Survey on Low-Code Platform and interoperability among different platforms and external sources by analyzing various features and applying different application benchmarks. Lowcomote First Internal Meeting in December, 2019			
2020	Start drafting the survey paper on Low-Code platforms	Lowcomote Second Internal Meeting	Comparative (implementation) analysis for low-code platforms for different application benchmarks. Improving on the draft of the survey paper iteratively.			Lowcomote Third Internal Meeting	Submitted survey paper on Low-Code tools in MoDELS conference, 2020			Lowcomote Fourth Internal Meeting	Start drafting the first journal paper P1 on various transformation composition of source metamodel to target metamodel	
	Learn and Practice the concepts of Model Driven Engineering and Cloud Computing to understand its usage in the project ESR-15											
	Learn and Practice the concepts of Data Science and Machine Learning to understand its long term usage during and after the Ph.D. program.											

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Year				
2021	Lowcomote Fifth Internal Meeting	Submission of First Journal Paper P1	Lowcomote Sixth Internal Meeting	Start writing Ph.D. thesis
				Start drafting the second journal paper P2 on integration of transformation on language using orchestration engine
			Lowcomote Seventh Internal Meeting	
		Collaboration with ESR12 for optimizing the execution of transformation chains in University of York, UK		Integration of the transformation language developed by ESR13 with the orchestration engine in IncQuery Labs, Budapest, HU
2022	Submission on Second Journal Paper P2	Lowcomote Eighth Internal Meeting	Lowcomote Ninth Internal Meeting	Lowcomote Tenth Internal Meeting
		Submission of Ph.D. thesis.		Beginning of Post-Doc program
		Look for Post-Doc opportunities in the areas of Model Driven Engineering	Low-Code platform product ready aimed in Lowcomote project comprising of model transformation composition and execution based on ESR-15.	
				Lowcomote Eleventh Internal Meeting

2023											
2024					End of Post-Doc Program						