



"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".



## **PhD Student Vacancy for Lowcomote Project**

### **Cloud-Based Testing Workbench for Low-Code Engineering**

IMT Atlantique is hiring a PhD Student for its Lowcomote Project in Nantes.

#### **The Lowcomote project**

The MSCA ITN 2018 project Lowcomote will train a generation of experts that will upgrade the current trend of Low-code development platforms (LCPDs) to a new paradigm, Lowcode 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.

The Lowcomote project will train the first European generation of skilled professionals in LCEPs. The 15 future Early Stage Researchers (ESRs) will benefit from an original training and research program merging competencies and knowledge from 5 highly recognised academic institutions and 8 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.

#### **Partners**

IMT Atlantique (FR), University of York (UK), Universidad Autónoma de Madrid (ES), University of L'Aquila (IT), JK University of Linz (AT), British Telecom (UK), Intecs (IT), Uground (ES), CLMS (UK), IncqueryLabs (HU), SparxSystems (AT), Metadev (ES), The Open Group (UK)

#### **Training activities**

The training program of Lowcomote aims at enabling the recruited ESRs to develop a broad range of scientific, technical and transferable skills that will prepare them for fruitful careers in academia and industry, namely thanks to training led by world experts in the field and timely and high quality feedback by all co-supervisors.

In particular, the network will provide 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 a large number of users and artefacts;
- Machine learning, for building smart assistants for citizen developers.

Other training activities will include communication, career development and plan, entrepreneurship.



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## PhD. research topic: Cloud-Based Testing Workbench for Low-Code Engineering

Within the context of the Lowcomote project, the PhD candidate will work to the following specific research subject.

**Objectives:** The benefits brought by low-code development, in terms of simplicity and maintainability could be annihilated if developed software is not correctly verified. A trap would be to consider that software with less code requires less test would be indeed the case for unit tests since the quality of the code is highly related to the quality of the code generators. However, functional tests are still mandatory and LCEP should provide methods and tools to manage their heterogeneity and distribution upon scalability. Lowcomote will provide a quality workbench for LCEP.

The first objective is to help on test configuration. To follow the LCDP principles, the tests should be written in the same language as the software, meaning that the users should only provide their expert knowledge and the test implementation should be up to the test workbench. Here, MDE techniques will be useful to transform the low-code tests into a test model that will be merged with the system and infrastructure models. Therefore, since model transformations will be used to generate executable platform dependent tests, their heterogeneity and distribution are the main issues for this task. While Cloud computing techniques may help for managing distributed tests, they also have quality issues. Distributed test data must be collected in different formats and to run dependent code which could be distributed and written in different languages. The second objective is to run the tests and get test results to be analysed for diagnostic. This objective requires to consider heterogeneity of the deployment platforms over the Cloud. Finally, dynamic modelling is still an issue which faces the scalability issue. Each test execution generates a trace that must be reified and linked to the global model, involving the generation of an important amount of data, which should be stored and queried effectively.

**Expected results:** The test workbench will firstly provide a set of distributed model transformations. To be effective they should consider two faces of the distribution: where they run, where the models they manipulate are stored. The result will be to provide transformations that will be divided into parts running as close as possible to their models and test data. The test workbench will secondly provide an assistance from chatbots to design tests and configure their execution on virtual machines under heterogeneous infrastructure constraints. Finally, the test workbench loads the dynamic results into a dynamic model, adding a dynamic dimension to the system and infrastructure models. The scalability of the dynamic models is a major issue since the number of test will highly increase the size of this model. A result will be to distribute the dynamic models where they have to be used. Extensions of this subject would be (i) to consider non-functional testing and in particular the performance of the low-code software depending of the deployment infrastructure, and (ii) to consider the code generators verification.

## Requirements

**Degree:** Master degree in Computer Science or equivalent providing access to PhD programs.

**Language:** English proficiency must be attested either through a previous English language diploma, or an internationally recognized proficiency test (at least C1 level of the Common European Framework of Reference for Languages i.e. IELTS, IBT, TOEFL or Cambridge).

**Career:** When starting their contract (September 2019), selected researchers should be within the first four years of their careers. This means being both within a four years window following their most recent graduation and not having been awarded a prior doctoral degree so far.



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**Mobility:** At the time of recruitment, the researcher must not have resided, or carried out his/her activity in France for more than 12 months in the 3 years prior to recruitment date.

**Employment conditions**

Full-time Equivalent Position

**Duration:** 36 months, including 2 secondments of 3 months each at other consortium members' premises (see Hosting institution section)

**Starting date:** 1<sup>st</sup> September 2019

**Remuneration:**

The monthly gross remuneration will amount €2,983 (if the researcher has no family) or €3,325 (if the researcher is married, in civil partnership or has dependent children).

**Research, Training and Networking costs:**

All relevant expenses linked to the research and training activities (travel, accommodation, etc.) will be covered by the project budget.

**Hosting institution**

IMT Atlantique, (result of a merger between the former Mines Nantes and Télécom Bretagne) is a new Elite Graduate School specialized in digital technology, energy and environment. Under the aegis of the Ministry of industry and the digital sector, IMT Atlantique aims to contribute to economic development through education, research and innovation. Research in IMT Atlantique is organized around 13 teaching and research departments. With more than 1000 publications each year (400 of these publications are A Rank), the research in IMT Atlantique is carried out by 110 researchers and/or professors.

The ESR will be hosted at the Automation, Production and Computer Sciences (DAPI), at the Laboratory LS2N in Nantes:

IMT Atlantique  
4 rue Alfred Kastler  
CS 20722  
44307 Nantes Cedex 3

The ESR will spend 2 secondments of 3 months at the premises of 2 project's members as detailed in the following table.

	Planned Secondments	Hosting Partner	Date
1	Collaboration with ESR8 on discovering reusable test models	CLMS (Greek branch)	M26-M28 (Feb. – April 2021)
2	Collaboration with ESR1 on designing and configuring lowcode tests with chatbot help	Universidad Autónoma de Madrid (ES)	M32-M34 (Sept. – Nov. 2021)



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## Supervisors

Gerson Sunyé, [gerson.sunye@ls2n.fr](mailto:gerson.sunye@ls2n.fr)  
Jean-Marie Mottu, [jean-marie.mottu@ls2n.fr](mailto:jean-marie.mottu@ls2n.fr)

## Application process

All applications shall be sent until 10<sup>th</sup> April 2019 by filling in the form on Lowcomote website: <https://www.lowcomote.eu/esr/10/> .

Applications are composed of the following documents in English (and when necessary a certified translation of official documents):

1. a complete CV with references to past research and training experiences;
2. a motivation letter highlighting the consistency between the candidate's profile and the chosen ESR position for which they are applying;
3. at least 2 reference contacts (could be substituted by a reference letter, which should be in English or in certified translation)
4. scan of the degree qualification.
5. proof of proficiency in English (either through a previous English language diploma, or an internationally recognized proficiency test - at least C1 level of the Common European Framework of Reference for Languages i.e. IELTS, IBT, TOEFL or Cambridge).