"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".

IMT Atlantique
Bretagne-Pays de la Loire
École Mines-Télécom

PhD Student Vacancy for the Lowcomote Project

Multi-Paradigm Distribution for Model Management Operations

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, and entrepreneurship.

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Phd. research topic: Multi-Paradigm Distribution for Model Management Operations

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

Objectives: Declarative model query and transformation languages (MTL) are primary candidates for expressing operations on artefacts in LCEPs, e.g. for translation, analysis or code generation. They allow for a concise executable description of the operation semantics, which is highly readable and understandable, thus ideally suitable for citizen developers. Research on the implicit distribution of such languages is an active area of research, with the purpose of combining development efficiency with high scalability, needed for the very large models in LCE. Current approaches focus on mapping the declarative MTL to an existing distributed programming model. The choice of the underlying programming model among the plethora of available ones is based on affinity with the execution semantics of the MTL and on the desired efficiency properties. For instance, the ATL language has been mapped to MapReduce, Linda, Reactive Programming. Experimentation in these works has shown that the choice of most efficient programming model is strongly dependent on the particular transformation. In this project we want to develop static and dynamic analysis techniques for declarative MTL code, in order to automatically select the most efficient programming model for a given transformation. Moreover, within a transformation it may be possible to identify sub-computations that are more efficiently distributed using a different programming model w.r.t. the rest of the transformation. Hence, we want to be able to automatically decompose the transformation (e.g., through graph partitioning techniques) and independently select a programming model for each one of the sub-transformations according to some static or dynamic constraints. Such an approach will require an orchestration mechanism among different transformation engines with synchronization points based on recent research on model coordination, and sharing of intermediate data. The final orchestrator will also be able to integrate natively distributed transformation engines like the one developed in ESR13. Such an orchestrator could also take advantage of component models to statically or dynamically create an assembly (i.e., a composition) of a set of sub-transformations. Finally, such a set of sub-transformation using heterogeneous programming models should be easy to deploy onto the underlying distributed infrastructure. Component models could also help in this task.

Expected results: The first project contribution will be a meta-modeling of the space of distributed programming models, i.e. a unified representation of the existing programming models within the same formalism. Afterwards the project will propose a set of formal mappings between the class of relational MTLs (i.e., languages like QVT, ATL, ETL) and several programming models, in the form of higher-order transformations. In a second phase, given a transformation and set of programming models, the project will provide cost models to predict the performance of that transformation on each programming model. Finally, a decomposition mechanism for transformation will be defined, in order to minimize the cost of the global execution. The project will produce a concrete component for the Lowcomotive platform, in the form of an orchestrator for model transformations over a set of distributed engines.

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.

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: 1st September 2019

Remuneration:
The monthly gross remuneration will amount €3,020 (if the researcher has no family) or €3,350 (if the researcher is married or in civil partnership).

Research, Training and Networking costs:
All relevant expenses linked to the research and training activities (travel, accommodation, etc.) will be paid 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.

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	Planned Secondments	Hosting Partner	Start – End Date
1	Collaboration with ESR4 in deriving industrial use cases for large scale model management operations.	Intecs (Italy)	M19-M21 (July – September 2020)
2	Collaboration with ESR11 on implicit data distribution by model partitioning.	University of York (UK)	M26-M28 (February – April 2021)

Supervisors

Gerson Sunyé, gerson.sunye@imt-atlantique.fr
Massimo Tisi, massimo.tisi@imt-atlantique.fr
Hélène Coullon, helene.coullon@imt-atlantique.fr

Application process

All applications shall be sent before 10th April 2019 by filling in the form on the Lowcomote website: https://www.lowcomote.eu/esr/14/ .

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. scanned copy of valid identification document (identity card or passport)
6. 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).