

Master M2 internship: *"A top down co-evolution in modern model-based software generation"* (**possible follow-up with a PHD**)

Location: Rennes, IRISA Lab, DiverSE team : <http://www.diverse-team.fr>

It can be done remotely as well due to Covid-19.

Duration: 6 months.

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Context and Problem.

Nowadays, a plethora of techniques exists to ease the development task of software, in particular, by generating part of the software to speed up its development. Indeed, in many scenarios source code can be generated under the form of application skeleton (e.g., interface), minimal running application (e.g., website), etc. Some examples of such techniques are: EMF, jHipster, and Swagger (OpenAPI), etc.

However, this code generation does not stem from nothing, but must consume as an input a model to drive the code generation. Depending on the used technique, this model can come in various formats.

Ultimately, this generated code is meant to be enriched with new functionalities, hence, with additional code.

As software inevitably evolves, the model can evolve as well, for various reasons, such as fixing bugs/security vulnerabilities, adding/removing/modifying features. As a result, the source code can be impacted, which then has to be co-evolved accordingly. Otherwise, it may cause build failures in the CI pipeline and slow down the development. Therefore, it is essential to support co-evolution.

Objectives.

This internship proposes to first investigate the challenge of model and code co-evolution on the scenarios of jHipster and Swagger (OpenAPI). You will leverage on the already investigated case of EMF [5]. The second goal is to lay the foundations of a co-evolution mechanism that can cope with different scenarios (EMF, jHipster, and Swagger), thus, specifying and prototyping a technical solution.

This internship can follow up with a PhD thesis on the continuation of this work, depending on the obtained results, demonstrated dedication and hard work of the candidate. This internship as well as the PhD will be in the context of an ANR project.

We will provide the necessary supervision and technical infrastructure to carry out this ambitious project. The choice of technologies to work on are Java, Spoon [1], GitHub, Maven, and tools to detect changes in the code, such as [2].

Required skills.

- Being (highly) autonomous, a problem solver, and desire to work in a team environment.
- Strong technical skills in (object-oriented) programming.
- Very good level of written and spoken English.
- Experience in the development of IDE components will be a plus

To apply, please, send me the following documents:

- CV.
- Grades for your bachelor degree and Master degree (in computer science and software engineering).
- Motivation letter explaining why you want to work on this topic.

Below we provide some references (not exhaustive!). [3] and [4] are for understanding the challenge of co-evolution in general. Finally, [5] is our recent approach that handles the model/code co-evolution in the usecase of EMF.

References:

[1] Spoon. <http://spoon.gforge.inria.fr>

[2] Nikolaos Tsantalis, Matin Mansouri, Laleh Eshkevari, Davood Mazinanian, and Danny Dig: Accurate and Efficient Refactoring Detection in Commit History. *ICSE 2018*. <https://github.com/tsantalis/RefactoringMiner>

[3] Djamel E. Khelladi, Roland Kretschmer, Alexander Egyed: Change Propagation-based and Composition-based Co-evolution of Transformations with Evolving Metamodels. *MODELS 2018*.

[4] Djamel E. Khelladi, Reda Bendraou, Regina Hebig, Marie-Pierre Gervais: A semi-automatic maintenance and co-evolution of OCL constraints with (meta)model evolution. *JSS 2017*.

[5] Khelladi, D. E., Combemale B., Mathieu A., Barais O., Jézéquel J-M. Co-Evolving Code with Evolving Metamodels. IEEE/ACM 42th International Conference on Software Engineering, ICSE 2020, <http://people.irisa.fr/Djamel-Eddine.Khelladi/papers/ICSE-2020.pdf>.