

# Report on the outcomes of a Short-Term Scientific Mission<sup>1</sup>

Action number: CA20111

Grantee name: Violet Ka I Pun

## **Details of the STSM**

Title: Developing a graded type system for a resource-aware workflow modelling language

Start and end date: 16/02/2025 to 22/02/2025

## **Description of the work carried out during the STSM**

Description of the activities carried out during the STSM. Any deviations from the initial working plan shall also be described in this section.

The plan of this STSM is to concretise the research idea of developing a workflow modelling framework based on type theory. The purpose of such a framework is to ensure correct use of consumable resources that take part in business process workflows. We plan to exploit the earlier work [1,2] by the host which uses the graded model type theory to ensure resource-aware soundness for a lambda calculus.

The activities carried out during the STSM are as follows:

- We first defined a core, actor-based modelling language, which is resource sensitive, thus allowing resource acquisition and release. We then formalised the operational semantics of the language to capture the behaviour of the model with respect to resource acquisition. The core language also supports cooperative scheduling enabling the active thread of an actor to yield control and go to suspension.
- We have developed a graded type system to check if the resources in the modelled workflow are used properly, e.g., if the specified amount of resources are enough for the execution of the workflow model.
- Finally, we started to look at the correctness of the type system in terms of showing the property of subject reduction

## **References**

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<sup>1</sup>This report is submitted by the grantee to the Action MC for approval and for claiming payment of the awarded grant. The Grant Awarding Coordinator coordinates the evaluation of this report on behalf of the Action MC and instructs the GH for payment of the Grant.

- [1] Riccardo Bianchini, Francesco Dagnino, Paola Giannini, Elena Zucca: Multi-Graded Featherweight Java. ECOOP 2023: 3:1-3:27. <https://doi.org/10.4230/LIPIcs.ECOOP.2023.3>
- [2] Riccardo Bianchini, Francesco Dagnino, Paola Giannini, Elena Zucca: Resource-Aware Soundness for Big-Step Semantics. Proc. ACM Program. Lang. 7(OOPSLA2): 1281-1309 (2023). <https://doi.org/10.1145/3622843>

### **Description of the STSM main achievements and planned follow-up activities**

Description and assessment of whether the STSM achieved its planned goals and expected outcomes, including specific contribution to Action objective and deliverables, or publications resulting from the STSM. Agreed plans for future follow-up collaborations shall also be described in this section.

Together with a PhD student of the grantee, who is doing his research stay, and the collaborators at the host institution, the STSM has partially achieved the planned goals:

- A core, resource sensitive language for modelling business process workflow with futures and cooperative scheduling incorporating grades for consumable resources and its operational semantics.
- A graded type system which ensures precise resource consumption and fair termination, with the property of subject reduction, whose proof is at the moment work in progress.

We plan to submit and present this preliminary research work as an extended abstract to TYPES 2025 to get feedback on the idea. Meanwhile, the PhD student continues to physically work together with the collaborators at the host institute, while the grantee continues the collaboration remotely and meet for discussion when necessary.



Elena Zucca  
Associate Professor, DIBRIS  
Host of the STSM