Process-oriented Worksheets for the Support of Teaching Projects

Dennis Schmitz and Lawrence Cabac

University of Hamburg, Department of Informatics
http://www.informatik.uni-hamburg.de/TGI/

Extended Abstract

Teaching students how to develop a single software application in a large team (e.g. with 25 people) is a challenging task. Especially if the software development process is distributed and concurrent, the participants have heterogeneous basic knowledge of software development and are not acquainted with the basics of the used software development approach.

We are teaching the Petri net-based, agent- and organisation-oriented software development approach (Paose) [2,3] in a period of one semester in the form of a project. The first six weeks cover the introduction phase. In this work we concentrate on this first phase only. The students are learning the basics of the Paose approach and how to apply it to develop multi-agent systems. In this context they get to know the corresponding methods, techniques and tools and have the opportunity to become familiar with these. The rest of the project the tutors and students cooperatively develop a multi-agent application.

From the previous projects, improvements to this approach emerged and the technical complexity of the environment increased. One example is the WebGateway [1], which enables the development and integration of web-based services for multi-agent systems. Due to the increased technical complexity, we experienced that the teaching complexity increased, too. Also, the large amount of new information can be confusing and frustrating for the students. We have observed, that in order to minimize this confusion and frustration it is important, to bring the information into a sensible order. This means, to provide the students with all necessary information in the adequate context. If the information is presented to early, the students could forget it until they need it. If the information is presented to late, the difficulty of the exercise unintentionally increases and this could lead to frustrated students.

In order to improve the structure of the existing worksheets, we analyzed these in regard of the inherent processes, which are necessary to solve the exercises [4]. As modeling technique we used workflow Petri nets [5]. We call these workflows *learnflows*. Based on these learnflow models, we restructured and augmented the worksheets. During this restructuring process it occurs, that we also extended the learnflow models. An interdependency of the refined texts and the

learnflow models emerged. This procedure leads to refined worksheets containing logically ordered and detailed instructions, which the students can follow step by step. The use of the workflow Petri nets helps the tutors, to rearrange the worksheet text in a better order. It shows them, which information appears in the wrong place (e.g. the information is necessary for an exercise on the current page, but appears only on the subsequent page). Also, it shows the tutors which information is missing and helpful for the students during processing the exercises.

In the latest teaching project we have already applied these worksheets and the workflow Petri net models as visual support along with the texts. We have noticed less frustration and confusion among the students. They are now able to process the worksheets faster and more independently. Therefore, the tutors are able to concentrate on teaching the actual objectives. Also the process-oriented worksheets support the communication between the tutors and the students. If a student needs some help, it is easy to identify which steps he has accomplished and to find out where precisely the challenge occurs.

On the poster we will present the old non-process-oriented and the new process-oriented version of an exercise of a worksheet of our teaching project. In the previous exercises the students already implemented a one-to-one message communication between agents. The objective of this exercise is, to extend this functionality to a one-to-all (broadcast) message communication between agents. For illustration we present the text and the corresponding visualized process model of both versions of the exercise. The visualization of the process of the non-process-oriented exercise did not exist before this work. We use it, to enable a visual comparison to make the differences obvious. These mentioned resources and also an extract of this text can be accessed on the PAOSE homepage [3] via `http://www.paose.net/wiki/ProcessOrientedWorksheets`.

The new worksheets represent the first stage of a process-oriented learning environment, which we are designing for teaching projects. The environment will provide a web-based support for the process-oriented creation and processing of worksheets, based on an agent-oriented workflow management system.

References

1. T. Betz et al. Integrating web services in Petri net-based agent applications. In D. Moldt and H. Rölke, editors, *Petri Nets and Software Engineering. International Workshop PNSE'13, Milano, Italia, June 2013. Proceedings*, volume 989 of *CEUR Workshop Proceedings*, pages 97–116, June 2013.
2. L. Cabac. *Modeling Petri Net-Based Multi-Agent Applications*, volume 5 of *Agent Technology – Theory and Applications*. Logos Verlag, Berlin, 2010.
3. PAOSE homepage. http://www.paose.net/. Last accessed on 31st May, 2015.
4. D. Schmitz. Unterstützung von Lehr- und Lernprozessen am Beispiel des PAOSE-Lehrprojekts. Master thesis, August 2015, University of Hamburg, Department of Informatics, 2015.
5. W. van der Aalst. Verification of workflow nets. In P. Azéma and G. Balbo, editors, *Application and Theory of Petri Nets 1997*, volume 1248 of *Lecture Notes in Computer Science*, pages 407–426. Springer Berlin Heidelberg, 1997.