Synergia – Comprehensive Tool Support for Configurable Process Models

Marcello La Rosa[1] and Florian Gottschalk[2]

[1] Queensland University of Technology, Australia
m.larosa@qut.edu.au
[2] Eindhoven University of Technology, Netherlands
f.gottschalk@tm.tue.nl

1 Introduction

Process configuration deals with the problem of managing families of business process models, i.e. business process models that are similar to one another in many ways, yet differ in some other ways from one organization or industry to another. For example this problem arises in the context of multinational companies that need to localize their business processes to different legislations or quality requirements. It also manifests itself in the context of acquisition projects, where a company needs to merge their own processes with the ones of the acquired organization. Re-designing business process models every time from scratch is often not a viable option, due the high costs involved.

Process configuration proposes to address this problem by merging similar "best-practice" process models in a single configurable process model, where variation points are explicitly captured. Business analysts can then configure this model to their needs by choosing the proper process variant for each variation point and removing those variants (i.e. process fragments) that are irrelevant.

This paper presents Synergia, the first toolset providing comprehensive support for configurable process models. The approach underpinning Synergia is outlined in Section 2. Next, the toolset's main features are described in Section 3 while its maturity is discussed in Section 4. An outlook to future developments concludes the paper.

2 Overview of Synergia

Synergia provides end-to-end support for process model configuration. Its innovation lies on the use of an *incremental*, *questionnaire-driven* approach for configuring process models [2]. Accordingly, individualized process models are obtained incrementally by combining a set of configuration steps, until all the required variation points in the configurable process model have been configured. A configuration step is accepted only if it satisfies a set of correctness requirements that are automatically inferred from the configurable process model before starting the configuration. In this way Synergia guarantees that any individualized process model is semantically correct.

The user's input needed to determine the various configuration steps is obtained through the use of a questionnaire-based interface. This interface supports business analysts in deciding how a configurable process model should be individualized to meet their specific requirements. Questionnaires are described in questionnaire models and

linked to the variation points in the configurable process model, such that the latter are configured based on the answers given to the questionnaire. A questionnaire model contains questions, their possible answers, order dependencies and domain constraints. Order dependencies are used to constrain the order in which questions have to be posed to users, while domain constraints capture the business rules of the domain in terms of relationships between possible answers.

Through the use of questionnaires, Synergia permits users to achieve abstraction from the specific process modeling notation adopted (e.g., C-EPC). This can make the configuration of (complex) process models more accessible to a non-skilled audience. In fact, while it is normal to assume that the modelers who design process models are familiar with the notation in question, it is less realistic to assume that those who provide input for configuring these models (e.g. a domain expert) are sufficiently proficient with the process modeling notation being adopted.

3 Synergia Applications

Synergia comprises six interrelated applications developed in Java, each responsible for a specific task in the configuration process. Currently, three configurable process modeling notations are supported: C-EPC [4], C-iEPC [3] and C-YAWL [1]. Figure 1 shows how the various applications interact with each other.

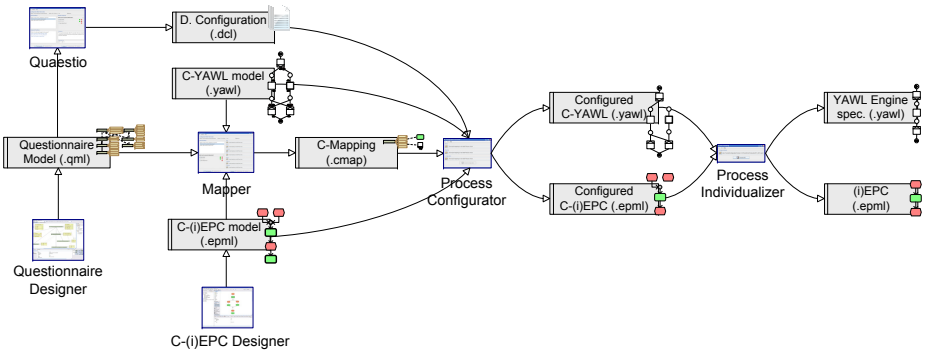

Fig. 1. Tools interaction map in Synergia.

Questionnaire Designer is a pluggable application that enables modelers to visually create questionnaire models. A diagram file is created for each questionnaire model and synchronized with the latter. The tool also allows users to validate their models in order to spot undesired circular dependencies among questions. Questionnaire Designer is distributed as a Rich Client Application (RCA) and as an Eclipse plug-in.

Quaestio generates interactive questionnaires from questionnaire models and then guides users through answering these questionnaires. The tool poses questions in an order consistent with the order dependencies defined in the questionnaire model, and prevents users from entering conflicting answers to subsequent questions by dynamically checking the domain constraints. Questions can be answered explicitly or by using default values, and they can be rolled back if a decision needs to be reconsidered.

Answers can be exported as a domain configuration. Quaestio is distributed as a RCA and embodies a sophisticated SAT solver based on Shared Binary Decision Diagrams to handle the domain constraints dynamically.

C-iEPC Designer is a visual designer for C-(i)EPC configurable process models which extends EPCTools.[1] C-iEPC Designer supports the new EPC interchange format EPML 2.0, which allows one to capture variations in the resources and business objects participating in a process model. This tool is distributed as an Eclipse plug-in.

Mapper is a tool to create and validate mappings between a questionnaire model and the variation points of a configurable process models. It implements an algorithm to automatically infer correctness requirements from configurable process models, which need to be satisfied during the configuration process to ensure the correctness of the individualized process models. The Mapper is distributed as a RCA.

Process Configurator accepts a domain configuration generated by Quaestio, the serialization of a process model (e.g. the one produced by the C-iEPC Designer), and the mapping between the latter and the questionnaire model produced by the Mapper. The tool uses the mapping to configure those variation points in the process model that are affected by the domain configuration. Since it is possible to export a partial domain configuration from Quaestio, not all the variation points in the process model might be impacted by this domain configuration. In this case the result will be a partial process configuration. The output of this tool is an intermediate format representing a (partially) configured process model where the variation points (or a subset thereof) are tagged as configured and assigned to one of their variants. This tool is distributed as a RCA.

Process Individualizer is the last application of the chain and is used to individualize a configured process model by removing those model fragments that no longer relevant. This is achieved through an individualization algorithm that cleans up the configured process model according to the notation being used, while ensuring the preservation of the model's correctness. This tool is distributed as a RCA.

4 Toolset Maturity

To date, Synergia has been tested in four case studies drawn from different industry domains. For each scenario, a configurable process model and a questionnaire model were built. One such scenario is related to screen post-production. This study was conducted in collaboration with domain experts from the Australian Film Television & Radio School over a one-year period. The C-EPC and C-iEPC notations were used to capture the post-production processes. The configurable process model consists of 792 process elements, of which 183 are variation points (23% of the total), each allowing a number of process variants for a total of around 310,000 valid individualizations, while the complete questionnaire model consists of a total of 53 questions. The screen industry was deemed suitable to evaluate the toolset since post-production processes are not fixed, but vary from one project to another depending on a range of factors, e.g. creativity and budget, and the involved stakeholders have little modeling expertise, hence the need for using questionnaire-based interfaces. Another scenario was inspired by the VICS[2] (Voluntary Inter-Industry Commerce Standards) reference model for order man-

[1] `wwwcs.uni-paderborn.de/cs/kindler/research/EPCTools`

[2] `www.vics.org`

agement and modeled in C-YAWL. VICS is an industry standard endorsed by a number of large organizations, which describes a variety of options for interacting with suppliers and logistics providers. A third scenario was drawn from the municipal domain. It provided insights on the use of C-YAWL and questionnaire models to capture variability across executable processes that run at different Dutch municipalities. Finally, a fourth scenario was drawn from the emergency management domain and modeled in C-EPC. In this domain there is a need for simple and self-explanatory support for process configuration, given the lack of modeling expertise of the people involved in recovery actions. These experiences showed that the toolset is able to cope with practical variability scenarios involving numerous domain choices, constraints and process variation points. Meanwhile, performance measurements showed that the toolset is stable and can efficiently scale with complex configuration scenarios.

Synergia is open-source and its applications are released under the GPL v3 and EPL v1.0 licences. It can be freely downloaded from `www.processconfiguration.com`. In this web-site users can also find toolset documentation (including the case studies and the details of the performance measurements) as well as examples, schemas for input/output formats, source code and javadocs.

5 Outlook

This paper presented Synergia – the first comprehensive toolset to support the configuration of process models – and described the case studies through which the toolset was evaluated. Future developments include the integration of Quaestio, Process Configurator and Process Individualizer in a single application able to show a configurable process model being individualized while users answer the respective questionnaire. This can facilitate understanding of how business decisions taken through a questionnaire impact on the process model. Finally, the C-iEPC designer can be extended to support the creation of configurable process models from the merge of multiple similar process models.

An open research question in this area is how to facilitate the incremental adaptation of a questionnaire model as a result of changes to the corresponding configurable process model (e.g. due to updates). A possible starting point is to exploit the mapping between questionnaire models and configurable process models. For this purpose, the Mapper tool can be extended to provide a synchronized view on both the models once the mapping has been established.

References

1. F. Gottschalk, W.M.P. van der Aalst, M.H. Jansen-Vullers, and M. La Rosa. Configurable Workflow Models. *Int. Journal of Cooperative Information Systems*, 17(2):177–221, 2008.
2. M. La Rosa. *Managing Variability in Process-Aware Information Systems*. PhD thesis, Queensland University of Technology, April 2009.
3. M. La Rosa, M. Dumas, A.H.M. ter Hofstede, J. Mendling, and F. Gottschalk. Beyond Control-Flow: Extending Business Process Configuration to Roles and Objects. In *Proceedings of the 27th Int. Conference on Conceptual Modeling (ER'08)*, volume 5231 of *Lecture Notes in Computer Science*, pages 199–215. Springer, 2008.
4. M. Rosemann and W. M. P van der Aalst. A Configurable Reference Modelling Language. *Information Systems*, 32(1):1–23, 2007.