

Tools

Synergia 0.9 contains the following tools:

1. **Questionnaire Designer** is a pluggable rich client platform that enables modelers to visually create questionnaire models (.qml) which can be later imported into Quaestio. A diagram file (.qml_diagram) is created for each questionnaire model and synchronized with the latter. All the features of a questionnaire model can be specified. The tool also permits users to validate their models to spot undesired circular dependencies among facts or questions.
2. **Quaestio** is an interactive questionnaire tool which can be used by domain experts to configure the features of a given domain. The tool accepts an XML serialization (.qml) of a questionnaire model and generates a questionnaire that guides the configuration of the domain interactively. Questions are posed only if they are relevant, in an order consistent with the order dependencies defined in the model. Moreover, the tool prevents users from entering conflicting answers to subsequent questions, by dynamically checking the domain constraints defined over the answers that can be given (i.e. the answer to a given question may become constrained or irrelevant after answering another question). Questions can be answered explicitly or by using default values, and they can be rolled back if a decision needs to be reconsidered. Quaestio embodies a SAT solver based on Shared Binary Decision Diagrams (SBDDs) to handle the constraints dynamically. The answers given to a questionnaire can be exported as a domain configuration (.dcl). At any time during the answering of a questionnaire, one can decouple the underlying questionnaire model with a configurable process model (.epml or .yawl), through a c-mapping file (.cmap). By doing so, once the questionnaire has been completed, the corresponding configurable process model can be automatically configured and individualized, without the need of using **Process Configurator** and **Process Individualizer**.
3. **Process Merger** is a command-line based tool for merging (C-)EPC process models into a C-EPC process model. This tool accepts two or more models in the EPML format (.epml) and merges them by creating a configurable process model in C-EPC. Nodes that belong to all input models are only taken once, and reconnected to all other nodes that are not in common by means of configurable XOR connectors. It is possible to select the matching algorithm (Greedy or Hungarian) used to determine the mapping between the nodes of the two input models, and to customize the matching thresholds for functions/events and for connectors. To compute the similarity between each pair of input models, the Process Merger tool embeds the **Process Similarity** tool, which is also available for download separately. Moreover, this tool can compute the digest of a merged model. The digest is a projection of a configurable model where only the nodes that satisfy a given occurrence frequency appear, e.g. all nodes that occur in at least three of the five input models, or all nodes that are in common to all input models. Placeholder nodes may be added to avoid disconnections in the resulting digest.
4. **C-iEPC Designer** is a visual designer for EPC, C-EPC and C-iEPC process models. It is built on top of EPCTools - an open-source plug-in for the Eclipse IDE developed at the University of Paderborn. C-iEPC Designer supports the new EPC interchange format EPML 2.0, which allows users to capture resources and business objects in an iEPC model and to define variations thereof.
5. **C-YAWL Editor**. From release 2.1 beta, the YAWL Editor caters for the creation and configuration of C-YAWL models. It is possible to mark a task as configurable, and to configure its inflow, outflow ports, cancellation region and multiple instance parameters. Before applying a configuration, it is possible to preview the resulting individualized model by greying out those elements that will be removed from the model. Moreover, it includes a

component that instantaneously checks the correctness of any induced individualization given a configuration. This component is based on the open-source [Wendy](#) tool.

6. **C-Mapper** allows modelers to define c-mappings (.cmap) between questionnaire models (.qml) and configurable process models defined in C-EPC or C-YAWL. Upon saving the c-mapping file, the tool will store a link to the respective questionnaire model and configurable process model, so that when the c-mapping file is open again, these linked files will be automatically retrieved (provided they are in the same folder). With this tool one can also map more than one format of the same configurable process model to a single c-mapping file. For example, it is possible to link a process model that is represented in both C-EPC and C-YAWL to the same c-mapping file.
7. **Process Configurator** configures a process model according to the answers of a questionnaire. It accepts a domain configuration (.dcl) generated by Quaestio, the serialization of a process model in C-EPC (.epml) or C-YAWL (.yawl), and the c-mapping between the latter and the questionnaire model of the domain configuration. The tool uses the c-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 is an intermediate format representing a (partially) configured C-EPC or C-YAWL process model where (some) variation points are tagged as configured and assigned to one of their variants.
8. **Process Individualizer** implements an algorithm to generate an individualized process model from a (partially) configured process model, by transforming each configured variation point to the variant it has been assigned to, and removing those process fragments that are no longer required. The resulting model is guaranteed to be semantically correct (e.g. no deadlocks) provided the configurable process model is as such. In other words, the individualized process model is well-formed provided the input model is so. The tool currently generates EPC models from configured C-EPC models, and YAWL models from configured C-YAWL models.

The **bddc** folder within the Tools folder contains an SBDD calculator (<http://www-verimag.imag.fr/PEOPLE/Pascal.Raymond/tools/bddc-manual/bddc-manual-pages.html>) on which **Quaestio** and **Process Configurator** rely for constraints checking.

Known limitations

- While the original position of the configured elements is preserved, **Process Individualizer** does not automatically layout new YAWL tau tasks that are added during configuration.

Requirements

- Java Runtime Environment 6 or above.
- C-iEPC Designer (Eclipse plug-in):
 - platform independent
 - Eclipse v.3.4 or above
 - GEF v.3.4 or above
- Questionnaire Designer:
 - MS Windows, Mac OS X
- C-Mapper:
 - MS Windows, Mac OS X

- Quaestio:
 - platform independent
- Process Configurator:
 - platform independent
- Process Individualizer:
 - platform independent

Schemas

The **Schemas** folder contains the following XML schema files:

1. *QML.xsd*: describes the input files accepted by *Quaestio* (questionnaire models)
[\[http://www.processconfiguration.com/schemas/QML.xsd\]](http://www.processconfiguration.com/schemas/QML.xsd)
2. *DCL.xsd*: describes the output files exported by *Quaestio* (domain configurations of questionnaire models),
[\[http://www.processconfiguration.com/schemas/DCL.xsd\]](http://www.processconfiguration.com/schemas/DCL.xsd)
3. *CMAP.xsd*: describes the c-mapping files accepted by the Process Configurator (it supports mapping to C-EPC and C-YAWL notations)
[\[http://www.processconfiguration.com/schemas/CMAP.xsd\]](http://www.processconfiguration.com/schemas/CMAP.xsd)
4. *EPML_2.0.xsd*: describes (C-)EPC process models
[\[http://www.processconfiguration.com/schemas/EPML_2.0.xsd\]](http://www.processconfiguration.com/schemas/EPML_2.0.xsd)
5. *YAWL_Schema2.1.xsd*: describes (C-)YAWL process models
[\[http://www.yawlfoundation.org/yawlschema/YAWL_Schema2.1.xsd\]](http://www.yawlfoundation.org/yawlschema/YAWL_Schema2.1.xsd)

Examples

- The **Video Post-Production 0.8** folder contains the files related to the configuration of an example in the Video Post-Production domain. This example is captured as a configurable business process model in both the C-YAWL and C-EPC notations (Post_Production_YAWL.yawl, Post_Production_EPC.epml).

A questionnaire model (Post_Production.qml) and example domain configuration (Post-Production.dcl) are provided. The latter file has been used to configure (Post_Production_YAWL_configured.yawl, Post_Production_EPC_configured.epml) and individualize (Post_Production_YAWL_individualized.yawl, Post_Production_YAWL_individualized.epml) the two configurable process models. A mapping file is also provided (Post_Production.cmap for both and Post_Production_YAWL.epml and Post_Production_EPC.epml for each specific notation). This mapping links the configurable process models to the questionnaire model.

This example is described in details in:

M. La Rosa, J. Lux, S. Seidel, M. Dumas and A.H.M. ter Hofstede. [Questionnaire-driven Configuration of Reference Process Models](#). In Proceedings of the 19th International Conference on Advanced Information Systems Engineering (CAiSE'07), Trondheim, Norway. LNCS 4495, pp. 424–438, Springer, 2007.

M. La Rosa, F. Gottschalk, M. Dumas and W.M.P. van der Aalst. [Linking Domain Models and Process Models for Reference Model Configuration](#). In Proceedings of the 10th International Workshop on Reference Modeling (RM 07) at BPM 2007, Brisbane, Australia. LNCS 4928, pp. 417–430, Springer, 2008.

- The **Supply Chain** folder contains the files related to the configuration of an example process model in YAWL [note that this process model is rather high-level], inspired by the VICS standard (Voluntary Inter-industry Commerce Solutions, <http://www.vics.org>).

VICS_ProcessModel.pdf is a picture of the VICS process model in the YAWL notation, where domain facts have been mapped to process fragments. *VICS_ProcessModel_configured.xml* is a picture of the configured VICS process model in the YAWL notation, depicting only those process fragments corresponding to the domain facts set to true in the example configuration.

This example is described in details in: M. La Rosa, W.M.P. van der Aalst, M. Dumas and A.H.M. ter Hofstede. [Questionnaire-based Variability Modeling for System Configuration](#), *Software and Systems Modeling (SoSyM)*, Vol. 8 No. 2, 2009.

- Further examples of questionnaire models can be found in the folders **Audio Post-Production** and **Emergency Management**, which are described in details in:

M. La Rosa, M. Dumas, A.H.M. ter Hofstede and J. Mendling, [Configurable Multi-Perspective Business Process Models](#). In *Information Systems*, Vol. 36 No. 2, 2011.

M. La Rosa, M. Dumas, A.H.M. ter Hofstede, J. Mendling, F. Gottschalk, [Beyond Control-Flow: Extending Business Process Configuration to Roles and Objects](#). In Proceedings of the 27th International Conference on Conceptual Modeling (ER'08), Barcelona, Spain. LNCS 5231, pp. 199–215, Springer, 2008.

M. La Rosa, J. Mendling, [Domain-driven Process Adaptation in Emergency Scenarios](#) (Invited paper). In Proceedings of the 1st International Workshop on Process Management for Highly Dynamic and Pervasive Scenarios (PM4HDPS), Milan, Italy. LNBIP 17, pp. 280–287, Springer, 2009.

- The **Municipality** folder provides examples of questionnaire models, C-YAWL process models and their c-mappings for four Dutch municipality services: acknowledgement of unborn child, marriage, decease and birth. It also includes example domain configurations for some Dutch municipalities. These examples are described in:

Florian Gottschalk, Teun A.C. Wagemakers, Monique H. Jansen-Vullers, Wil M.P. van der Aalst and Marcello La Rosa, [Configurable Process Models: Experiences from a Municipality Case Study](#). In Proceedings of the 21th International Conference on Advanced Information Systems Engineering (CAiSE'09), Amsterdam, The Netherlands. LNCS 5565, pp. 486-500, Springer, 2009.

- Further examples of C-YAWL models can be found in the **C-YAWL models**.

A description of the Travel requisition example in C-YAWL is provided in:

W.M.P. van der Aalst, N. Lohmann, M. La Rosa and J. Xu. [Correctness Ensuring Process Configuration: An Approach Based on Partner Synthesis](#). In Proceedings of the 8th International Conference on Business Process Management, LNCS 6336, pp. 95-111, Springer, 2010.

A description of the Travel booking example in C-YAWL is provided in:

F. Gottschalk, W.M.P. van der Aalst, M.H. Jansen-Vullers and M. La Rosa. [Configurable Workflow Models](#), *International Journal of Cooperative Information Systems (IJCIS)*, Vol. 17 No. 2, June 2008.