Working Conference on **Reverse Engineering 2009**

Proceedings

Sixteenth Working Conference on

Reverse Engineering

13-16 October 2009
Lille, France

Sponsored by
Reengineering Forum

Technical co-sponsor
IEEE Computer Society Technical Council on Software Engineering (TCSE)

IEEE computer society

IEEE

Edited by
Andy Zaidman
Giuliano Antoniol
Stéphane Ducasse

Published by the IEEE Computer Society
10662 Los Vaqueros Circle
P.O. Box 3014
Los Alamitos, CA 90720-1314

IEEE Computer Society Order Number P3867
BMS Part Number: CFP09090-PRT
ISSN Number 1095-1350
ISBN 978-0-7695-3867-9

ISBN 978-0-7695-3867-9
90000
9 780769 538679

Computer Society Press

Proceedings

16th Working Conference

on Reverse Engineering (WCRE 2009)

Proceedings

16th Working Conference on Reverse Engineering (WCRE 2009)

13th – 16th October 2009 – Lille, France

Edited by

Andy Zaidman, Giuliano Antoniol and Stéphane Ducasee

Sponsored by

Reengineering Forum

Technical Co-sponsor

IEEE-CS Technical Council on Software Engineering

In cooperation with

INRIA Lille-Nord Europe

Los Alamitos, California

Washington • Tokyo

IEEE Computer Society Order Number P3867
BMS Part Number CFP09090-PRT
ISBN 978-0-7695-3867-9
ISSN Number 1095-1350

Additional copies may be ordered from:

IEEE Computer Society
Customer Service Center
10662 Los Vaqueros Circle
P.O. Box 3014
Los Alamitos, CA 90720-1314
Tel: + 1 800 272 6657
Fax: + 1 714 821 4641
http://computer.org/cspress
csbooks@computer.org

IEEE Service Center
445 Hoes Lane
P.O. Box 1331
Piscataway, NJ 08855-1331
Tel: + 1 732 981 0060
Fax: + 1 732 981 9667
http://shop.ieee.org/store/
customer-service@ieee.org

IEEE Computer Society
Asia/Pacific Office
Watanabe Bldg., 1-4-2
Minami-Aoyama
Minato-ku, Tokyo 107-0062
JAPAN
Tel: + 81 3 3408 3118
Fax: + 81 3 3408 3553
tokyo.ofc@computer.org

Individual paper REPRINTS may be ordered at: <reprints@computer.org>

Editorial production by Bob Werner
Cover art production by Joe Daigle/Studio Productions
Printed in the United States of America by The Printing House

IEEE Computer Society
***Conference Publishing Services* (CPS)**
http://www.computer.org/cps

2009 16th Working Conference on Reverse Engineering

WCRE 2009

Table of Contents

Session II – Dynamic Analysis

Session III – Empirical Software Engineering

Session IV – Remodularization and Reengineering

Session V - Change and Defect Proneness

Session VI – Static Analysis and Security

Session VII – Traceability

Session VIII - Program Comprehension

Session IX – Static Analysis

PhD Forum

Tool Demonstrations

Workshops

PRECISO: A Reverse Engineering Tool to Discover Web Services from Relational Databases

Ricardo Pérez-Castillo, Ignacio García-Rodríguez de Guzmán, Ismael Caballero, Macario Polo and Mario Piattini
Alarcos Research Group, University of Castilla-La Mancha
Paseo de la Universidad, 4 13071, Ciudad Real, Spain
{Ricardo.PdelCastillo, Ignacio.GRodriguez, Ismael.Caballero, Mario.Piattini}@uclm.es

Abstract—***There is a real need for SOA principles, such as those offering software as services, in the software industry. In this effort, databases (one of the most important artefacts in Information Systems) can be also seen as a set of services offering access to the stored information. This paper presents PRECISO, a reverse engineering tool to discover and generate Web Services automatically from relational databases. PRECISO makes it possible to modernize legacy databases by introducing them in an SOA context by means of the generated services. This tool was used in a real-life case study in the context of a software company.***

Keywords: Database Reverse Engineering, Web Services, MDA, SOA and Pattern Matching.

I. INTRODUCTION

Today, organizations are increasingly forced to share more and more information as part of the basic activity in their daily operations. However, the heterogeneity of Information Systems (IS) is growing every day due to the appearance of new technological paradigms, standards, and environments, making it more and more difficult to share information [3]. Due to these facts and in order to keep their competitiveness level throughout their IS, organizations must be involved in a process of continuous renewal. Therefore, IS developers must constantly and quickly develop and maintain their products in order to meet market requirements [3]. Among all the artefacts that compose information systems, databases are possibly one of the most important elements since they contain all the organizational information and form the basis of decision-making.

This paper presents PRECISO [1], a tool for database re-engineering following the MDA (*Model-Driven Architecture*) principles [5] to extract Web Services (WS) that show the database as a set of services, offering easy access to the information. PRECISO offers several benefits: (i) it minimizes heterogeneity problems since databases can be integrated in SOA environments; (ii) it advocates the reuse of legacy databases, thus extending the lifecycle of databases; and (iii) it shortens development time because the WS generation is automatic and instantaneous.

II. THE RECOVERY PROCESS

Figure 1 depicts the database re-engineering process, which consists of three main activities broken down into several tasks. *DMR* is the first activity to create a PSM (*Platform-Specific Model*) which represents the input relational database. The *DMR-1* task recovers metadata from the database and builds the PSM according to an SQL-92 metamodel based on [2]. The *DMR-2* task simultaneously discovers the potential services by means of pattern matching [4]. Figure 2 shows the patterns recognized in the database schema and the associated service templates.

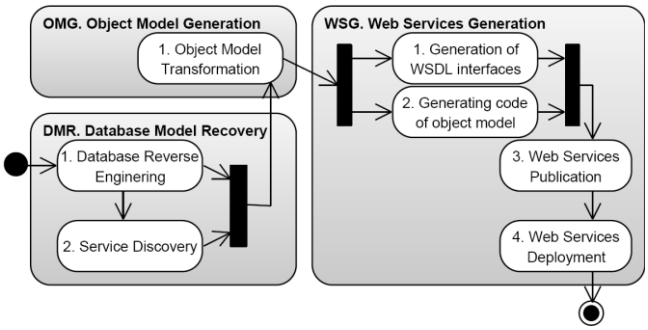

Figure 1. The Web Services recovery process

The second activity is *OMG*, which generates an object model from the previous database schema model. Thus, the *OMG-1* task transforms the PSM into a PIM (*Platform-Independent Model*) according to the UML2 metamodel [6]. Finally, the third activity is *WSG*, which generates the WS to manage the input database. The *WSG-1* task builds the service interfaces in WSDL (*Web Services Description Language*) from services discovered in *DMR-2*. This set of interfaces is the target PSM since it represents the WS platform. At the same time, *WSG-2* generates the source code related to the object model. This code supports the business layer of WS. Then *WSG-3* writes out the source code of the WS. After that, *WSG-4* carries out the Web Services deployment. Finally, the WS are ready to be used.

1095-1350/09 $26.00 © 2009 IEEE
DOI 10.1109/WCRE.2009.21

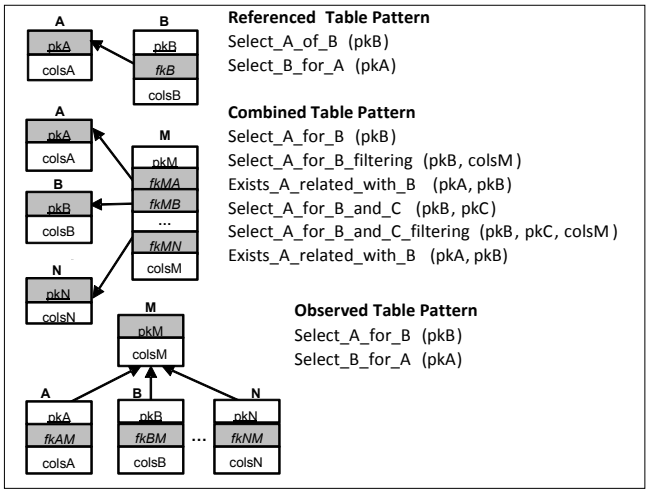

Figure 2. Service patterns in database schema

III. THE ARCHITECTURE

The PRECISO tool automates several tasks in the proposed recovery process (see Figure 1); but it also addresses other necessary issues such as remote database connection, connections to databases from different vendors, project management, graphic display of involved models, testing, reporting, and so on. The proposed architecture, taking into account the previous challenges, is shown in Figure 3.

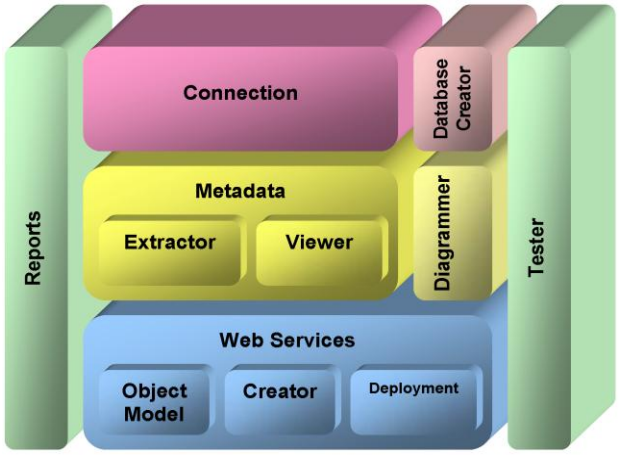

Figure 3. Architecture of PRECISO

The most important features of PRECISO are: (i) *'project-oriented nature'* because it manages a repository with all recovery information; (ii) *'partitioned and ordered process generation'* since PRECISO generates WS by means of individual, but complementary modules; (iii) *'usage of standards'* such as SQL-92, XMI (*XML Metadata Interchange*) and WSDL. (Therefore, PRECISO can be integrated with other reverse engineering tools in the market); and (iv) '*high development process coverage'* since it supports metadata extraction, model generation, graphic visualization of models, model transformations, editing and publication of WS, deployment, testing, reporting, and so on.

IV. CONCLUSIONS

This paper has presented PRECISO, a tool that carries out a re-engineering process following the MDA standard to discover and generate WS from relational databases. PRECISO presents three key advantages: (i) it integrates relational databases into SOA environments; (ii) it extends the lifecycle of legacy databases; and (iii) it accelerates Web developments. In addition, PRECISO has been validated through a case study since it was used in an industry project to develop a corporate Web portal from a legacy database. The tool selectively published and deployed of the generated WS. The percentage of services that was published to support the functionalities of the Web portal was 30%. This percentage represents 73 services out of 245 candidate services in total. The WS supports all the information needs of the portal in an SOA context, and thus the staff could put all of their effort into the development of the Web interface.

The future extensions of this work will make more in-depth analysis to establish more patterns in database schemes in order to define more service templates.

ACKNOWLEDGMENTS

This work has been supported by the *FPU Spanish Program*; by the R+D projects funded by *JCCM*: ALTAMIRA (PII2I09-0106-2463), INGENIO (PAC08-0154-9262) and PRALIN (PAC08-0121-1374); and MITOS (TC20091098) funded by the *University of Castilla-La Mancha*.

REFERENCES

[1] Alarcos, R.G. PRECISO. A Reverse Engineering Tool to Discover Web Services from Relational Databases. 2008 [cited 7/30/2009]; Available from: http://alarcos.esi.uclm.es/per/rpdelcastillo/PRECISO/PRECISO.html.

[2] Calero, C., "An Ontological Approach To Describe the SQL:2003 Object-Relational Features". Journal of Computer Standards and Interfaces, 2006. 28(6): p. 695-713.

[3] Di Lucca, G.A., A.R. Fasolino, and P. Tramontana, "Reverse engineering Web applications: the WARE approach". Journal of Software Maintenance and Evolution: Research and Practice, 2004. 16(1-2): p. 71 - 101.

[4] García, I., M. Polo, and M. Piattini, "Using Model-Driven Pattern Matching to derive functionalities in Models", in 9h International Conference on Software Engineering and Knowledge Engineering. 2007: Boston, USA. p. 529-534.

[5] Miller, J. and J. Mukerji, "MDA Guide" Version 1.0.1. 2003: OMG.

[6] OMG. UML (Unified Modeling Language). Superstructure specification. Version 2.2. 2009 02-02-2009 [cited 24-06-2009]; Available from: http://www.omg.org/spec/UML/2.2/Superstructure/PDF/.