Model-Driven Software Migration towards Service-Oriented Architectures

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SOAMIG Consortium

pro et con GmbH, Chemnitz
SMB (small to medium sized business)
Software Reengineering and Migration

- Language front ends, COBOL-to-Java transformations,
code generators, analysis tools, service implementation

Amadeus Germany, Bad Homburg
Global provider of IT solutions for tourism & travel industry
Experience in large scale migration project

- RailClient system developers, domain experts,
evaluation of process and tools

Institute for Software Technology, University of Koblenz
Research on Software Engineering, Reverse/Re-Engineering,

- TGraph repository technology, transformation and
  analysis tools, process development

OFFIS Institute for Information Technology, Univ. of Oldenburg
Research on Software Engineering,
Knowledge transfer from research to economy,

- Target architecture, implementation, and process development
Project Goals

- Define a reference process for migration into SOA - the SOAMIG Process
- Achieve a high degree of automatic code migration
- Provide prototypic tools and technologies for legacy analysis and transformation based migration
- Explore different migration scenarios
  - Language Migration
  - Architecture Migration
Industrial Case Studies

- **LCOBOL**
  - Language migration
  - COBOL to Java

- **RailClient**
  - Architecture migration
  - Monolithic Java to Java SOA
LCOBOL Case Study

- Language Migration from COBOL server to Java Web Services
- Main challenges:
  - Semantics-preserving automatic language migration
  - Quality and maintainability of target code
  - Technology mapping
    Tuxedo transaction monitor to JAX-WS

Translator chain

Cobol Code → CobolFE → Cobol2Java → JGen → JFormat → Java Code

Cobol model → Java model

Transformation rules
RailClient Case Study

- Architecture migration
- Java fat client to SOA based Web Application
RailClient Case Study

- DB Ticket solution for travel agents
- Schedules, reservation, booking, ticketing
- Additional services, hotels, cars, public transportation...
RailClient numbers

- Java code: ~450 files
  ~266,000 LOC
- ~7,000 messages
  ~30,300 attributes
- Model size: 2.5 million elements
- Flat data model, ~1,900 MVC variables
- Traces for use case „TMF“
  Request: 276,708 calls
  Booking: 1,548,891 calls

Non-Java Model Elements (12,854)

- Workflow DFAs (53 major UI states)
- Source file information
- 11 BP models
- Traceability links for 1 use case
Dynamic Analysis

- Static analysis alone not sufficient
- Dynamic analysis used for...
  - Mapping of business processes to code
  - Identifying service candidates
  - Narrowing down static over-estimates
  - Detecting relevant data model parts for service interfaces
Tools & Technologies
Tools & Technologies

Legacy system:
- Java Code
- Cobol code
- State machines
- Message repository
- Business processes

Extractor tools:
- JavaFE
- CobolFE
- DSL parsers

Transformation tools:
- SOAMIG Extractor
- GRoTL
- DataModel Generator
- Cobol2Java

Code generation tools:
- JFormat
- JGen

Code generation:
- Migrated system

Analysis tools:
- FGM
- Dynamic Analysis Toolset
- GRoQL

Java, Cobol, UML and DSL Metamodels

SOAMIG Repository

Java model
SOAMIG Repository

- Initial program understanding supported by FGM (Flow Graph Manipulator)
- Explorative program analysis
- Metrics
- Redocumentation
- Repository grows as you analyze more
SOAMIG Repository

- Analysis and transformation repository based on JGraLab
- High performance TGraph API
  - Graph UML (grUML) modeling
  - Querying
  - Transformations
- In SOAMIG: Integrated model for
  - Source code
  - Other legacy system descriptions
  - Business processes
  - Target architecture
  - Traceability
Tools & Technologies

Legacy system
- Java Code
- Cobol code
- State machines
- Message repository
- Business processes

Extractor tools
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- CobolFE
- DSL parsers

Transformation tools
- SOAMIG Extractor
- GR(4)TL
- DataModel Generator
- Cobol2Java

SOAMIG Repository

Analysis tools
- FGM
- Dynamic Analysis Toolset
- GR(4)QL

Code generation tools
- JFormat
- JGen

Migrated system

Java, Cobol, UML and DSL Metamodels

Ready to use „industrial strength“ tools
Easily Reusable (minor project specific extensions)
Completely project specific
SOAMIG @ CSMR

- This Talk 😊
- People: J. Ebert, A. Fuhr, A. Winter, V. Riediger, W. Teppe, C. Zillmann,
- Poster Session (stands are two-sided!)
- EU Track (Thursday)

The SOAMIG Process Model in Industrial Applications
Model Driven Migration ??

- Metamodels
- Models
- Business Processes
- Architecture
- Evolution
- Evolution
- Human communication
- Technology Selection
- Transformations
- PIM
- CIM
- Views/Viewpoints
- ROI
- Querying
- Redocumentation
- Services
- PSM
- Testing
- Tool integration
- Renovation
- Reverse Engineering