A Metamodel Approach to Model Driven Service Development

Yngve Lamo\textsuperscript{1}, Adrian Rutle\textsuperscript{2}

\textsuperscript{1}Faculty of Engineering, Bergen University College, Norway

\textsuperscript{2}St. Francis Xavier University, Canada

4 May 2012
AWOSS 2012, Halifax, Canada
Outline

Introduction and Motivation

Model Driven Service Generation

Summary and Future Work
• Name: Yngve Lamo
• Bergen University College, Norway
• James Chair, visiting professor at St. FX University, Antigonish, Canada
• Background in formal methods
• Currently working on foundations of model driven software engineering
Introduction

- Norwegian economy is based on:
  - Natural resources, oil and gas, fishing (fish farming), hydro electric power, ... 
  - Shipping: an important industry with long traditions in Norway
- Norwegian oil and gas production
  - Offshore production in heavy weather conditions
  - Supply and service industry: mainly done by Norwegian companies
- Safety is highly important
  - Need for training to handle extreme conditions
  - Use of offshore training simulators
Training simulators

• Offshore Simulator Centre (OSC): a Norwegian company which:
  • Delivers offshore simulators
  • Develops training concepts
  • Aims to increase safety for personnel involved in demanding offshore operations
  • See http://offsim.no

• MUMS project
  • Model Driven Development of Maritime Simulators
  • Incubation project founded by the Research Council of Norway
  • Cooperation between industry (OSC, RUnit), and University Colleges (HiALS, HiB)
Anchor handling

- The process of placing oil rigs in its right position
- Considered the most dangerous offshore operation
Problem Description

• Offshore simulators should be as realistic as possible, i.e. the crew should get the feeling of working on their own boat
• If a minor detail on a ship is changed the behavior of the ship may be completely different and
• The simulator code needs to be reimplemented
  • Repeated coding of low level details
  • Need to do language specific development (float, int, . . .)
• Our proposal is to use model driven engineering combined with service orientation to tackle the problem
Solution

1. Design domain specific language for the maritime domain
   - Simulator developers can work with domain concepts instead of programming language concepts

2. Components as services:
   - Loose coupling between components
   - Isolate components in specific services
   - SMODL language [http://smodl.org](http://smodl.org), language for model driven development of services

3. Code generation
   - Automate the development of simulator code
   - Challenge to automate code for physical behavior of the ship
     - Especially for the differential equation solvers
Outline

Introduction and Motivation

Model Driven Service Generation

Summary and Future Work
DSML and Metamodels

- Domain Specific (modelling) Languages (DSMLs) are (modelling) languages made for a specific domain
- DSMLs are specified by metamodels:
  - The domain specific types
  - Domain specific constraints that the models need to fulfill
- Diagram Predicate Framework (DPF) is a formal diagrammatic approach to MDE, http://dpf.hib.no
- DPF is used to construct a modeling hierarchy for part of the offshore domain
DSML for propulsor system
Approach
Deafult metamodel $\mathcal{G}_3$ in DPF

- DPF’s default metamodel $\mathcal{G}_3$ consisting of \textit{Node} and \textit{Arrow}
Propulsor metamodel $\mathcal{S}_2$ typed by $\mathcal{S}_3$
Propulsor model $S_1$ typed by $S_2$
Service model transformed from $\mathcal{S}_1$
Outline

Introduction and Motivation

Model Driven Service Generation

Summary and Future Work
Summary and Future Work

- We have presented a metamodel approach to model driven service development for an offshore simulator.
- The flow of this process is:
  1. Construct a DPF modelling hierarchy for the offshore domain.
  2. Transform domain models to internal DPF-SMODL models.
  3. Transform DPF-SMODL models to SMODL models.
  4. Generate services from the SMODL models.
  5. Run the services in the simulator.
- In the future we will:
  - Construct a complete DSML for the offshore simulation domain.
  - Automate services generation from domain specific models.
  - A major challenge will be to model and generate software for physical behavior (wind, sea, ...).
  - Improve the visual syntax of the model editor.
Thanks for your attention

Questions?