Application of SHAPE Technologies in Production and Process Optimization

IESA 2010 Workshop
Use of MDI/SOA concepts in Industry

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Presentation Outline

- SHAPE FP7 Project
  - Solution Overview
  - SoaML
  - Solution Matrix
  - Methodology Framework
- Statoil Case Study
  - Business Context
  - Use Case Challenges
- Application of SHAPE Technologies
- Questions
SHAPE FP7 Project

- Project acronym
  - SHAPE

- Project full title
  - Semantically-enabled Heterogeneous Service Architecture and Platforms Engineering

- Grant agreement number
  - ICT-2007-216408

- Website
  - http://www.shape-project.eu/

- Duration
  - 30 months
  - Dec 2008 – June 2010

- Objective
  - Develop an infrastructure for model-driven engineering for service-oriented landscapes with support for various technology platforms and extensions for advanced service provision and consumption techniques.

- Partners
  - SINTEF (Norway)
  - ESI (Spain)
  - SAP AG (Germany)
  - SOFTEAM (France)
  - UIBK (Austria)
  - DFKI (Germany)
  - Statoil (Norway)
  - Saarstahl (Germany)
SHAPE Solution Overview

- The technologies developed in the project are centred around SoaML
  - Metamodel for describing service-oriented landscapes that is standardized in OMG.
- SoaML is extended with metamodels for
  - other technology platforms
  - advanced service engineering techniques
- The project provides
  - integrated tool suite that supports the modelling
  - encompasses the necessary model transformations
  - methodology framework that provides role-specific guided procedures for creating all model types and supports the creation of customized methodologies for individual engineering projects
SoaML

- Service oriented architecture Modeling Language (SoaML)
  - Extensions to UML2.1 to support service concepts.
  - SoaML focuses on the basic service modelling concepts.
  - A foundation for further extensions both related to integration with other OMG metamodels like BPMN 2.0, SBVR, OSM, ODM and others.

- Website:
  - http://www.soaml.org

- Capabilities:
  - identifying services
  - specifying services
  - defining service consumers and providers
  - policies for using and providing services.
  - defining classification schemes
  - defining service and service usage requirements and linking them to related OMG metamodels, such as the BMM and BPMN 2.0.
# SHAPE Solution Matrix

## Flexibile Business Modelling
- **Models**: BPMN, EPC, Data, Org., Rules, BMM, Ontologies
- **Transformations**: CIM->CIM (mult.), CIM->PIM (mult.)
- **SHAPE Tool Suite**: CIMFlex Modelio
- **SHAPE Methodology**: CIMFlex Modeling BPMN + UML Ontology Engin.

## Service & SOA Modelling
- **Models**: SoaML
- **Transformations**: SoaML -> WS, SoaML -> JEE
- **SHAPE Tool Suite**: Modelio Composition Studio
- **SHAPE Methodology**: SoaML & WS Modelling

## Integration of Agent Technology
- **Models**: SHAML – Agent Extension
- **Transformations**: SoaML -> PIM4Agents, Plm4Agents -> PSM
- **SHAPE Tool Suite**: PIM4Agents
- **SHAPE Methodology**: Agent Modelling (PIM -> PIM2PSM -> PSM)

## Integration of SWS Technologies
- **Models**: SHAML – SWS Extension
- **Transformations**: SoaML-> SWSPim, SWSPim -> WSMO
- **SHAPE Tool Suite**: WSMT
- **SHAPE Methodology**: SWS Modelling (PIM -> PIM2PSM -> PSM)

## Service Customization
- **Models**: Service Variability Metamodel
- **Transformations**: SoaML-> SV-Spec. SV-Res. -> Soaml
- **SHAPE Tool Suite**: Service Variability Tools
- **SHAPE Methodology**: Service Variability Modelling & Variant Creation

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**Technological Innovations**

**MDE Infrastructure**

**SHAPE Methodology**

**SHAPE Tool Suite**

**Model Transformations**

**Meta-Models**

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**SHAPE**

**SHAPE Tool Suite**

**SHAPE Methodology**

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**SINTEF**
SHAPE Methodology Framework

- Methods provide structured guidance.
- A matrix structure for organizing the methodology content.
- Partial processes that define suitable engineering procedures.
- Use and extend the Eclipse Process Framework (EPF).
Business Context

- Statoil is an integrated technology-based international energy company primarily focused on upstream oil and gas operations.
  - The oil and gas industry need to improve operational efficiency.
- The Norwegian Oil Industry Association (OLF) has defined the term Integrated Operations (IO) as “real time data onshore from offshore fields and new integrated work processes”.
  - increased exchange of information across geographical and organizational boundaries, internally and externally.
  - drive for new IT solutions
- For this information exchange to be successful, good interoperable IT solutions and standards are needed.
  - With Integrated Operations the need for standards are revitalized and changed.

- The focus now is implementation of IO generation 1 solutions and strategic planning of IO generation 2 solutions.
- Generation 1 activities focus on integration across onshore and offshore, while generation 2 activities focus on integration across companies.
Use Case Challenges

- **Production and Process Optimization (PPO)**
  - Use case within Integrated Operations

- **Business and SoaML Modelling**
  1. Enable integrated and comprehensive modelling of the business processes.
  2. Design services for enabling the consistent and automated information exchange among the various IT systems.

- **Service Variability**
  3. Enable system integration via central services using simplified variants that allow an easy usage and integration.

- **Semantic Web Services**
  4. Handle the integration of the often incompatible information and data structures used within the various production systems.

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**Diagram:***

- **Workflow Automation (WFA)**
  - Filtered data
  - Alarms & events

- **IMS**
  - Measurements
  - Choke positions

- **Process Control AWR**
  - Actions

- **Model Repository**
  - Analysis (FPA/APS)
  - Appropriate Simulation & Optimization Tools (IAI)

- **Subsurface Production System & Facility**
  - WFA: Workflow automation
  - DPO: Detailed production optimisation
  - FPA: Fluid performance analyser
  - APS: Avocet production surveillance
  - IAM: Integrated asset modeller
  - AWR: Automatic wells and reservoirs

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**SINTEF ICT**
Application of SHAPE Technologies

1. Define the business architecture for PPO
2. Specify the service-oriented architecture for PPO
3. Define service variability (4) and semantic web service (5) for PRODML subset

Define the methodology for the use case

Method Engineer

Business Architect

System Architect

System Developer

SHAPE Methodology Tool
Define Methodology

- Business challenge
  - Methodological support for service and system engineering
  - Provide guidance for the various roles
  - Adaptable to individual scenarios

- Role
  - Method Engineer

- SHAPE technologies
  - SHAPE Methodology Customization Tool

- Tool suite steps
  - Methodology configuration wizard
  - Custom delivery process
  - Publish methodology website
1 Business Modelling

- **Business challenge**
  - Enable integrated and comprehensive modelling of the business processes.
  - Derive and specify IT requirements/services that aligns with the business models

- **Role**
  - Business Architect

- **SHAPE technologies**
  - CIMFlex
  - Modelio

- **Tool suite steps**
  - **BMM modelling**
    - Improved reservoir management
    - Optimize intelligent wells
    - Optimize reservoir performance
    - Production optimization
    - Optimize process facilities
    - Optimize production network

  - **BPMN modelling**
Service Modelling (1/2)

- **Business challenge**
  - Specify and design new services for PPO
  - Modernise/wrap existing services using standards such as PRODML

- **Tool suite steps**
  - Services Architecture
    - Network of participant roles providing and consuming services to fulfil a purpose.

- **Role**
  - System Architect

- **SHAPE technologies**
  - SoaML
  - Modelio
2 Service Modelling (2/2)

- Tool suite steps (cont.)
  - Service contracts/interfaces
    - Defines the terms, conditions, interfaces and choreography.

- Participants
  - Represent organizational units or system components.

- Operation signatures
- Message types

![Diagram](image-url)
3 Define service variability

- **Business challenge**
  - Exists legacy systems with complex interfaces.
  - Want to integrate these using simplified service variants.
  - Want to make use of industry standards (complex).
  - Only want to use suitable subset of standards.

- **Role**
  - System Developer

- **SHAPE technologies**
  - Service Variability Tool
  - Modelio

- **Tool suite steps**
  - Import the SoaML model
  - Specify the service variant
  - Specify the service resolution
  - Export the service variant

  ![Diagram]

- Import into Modelio
- Generate the WSDL
4 Define Semantic Web Services

- Business challenge
  - Dynamic service request (based on goals)
  - Information mapping between different data formats and structures
  - EC legacy system with approved Well Test data
  - IFM legacy system with estimated Well Test data
  - Use PRODML WellTest subset

- Role
  - System Developer

- SHAPE technologies
  - Modelio with SoaML4SWS
  - WSMT
  - WSMX

- Tool suite steps
  - Define ontologies
  - Transform to WSML
  - Refine WSML
Evaluation of Results

In the progress of writing up the final validation report.
- Statoil participates in research projects such as SHAPE as part of a technology feasibility study in order to experiment with and evaluate new technology and methodological approaches.
- The evaluation will provide an input to future strategic decision regarding technology and methodology choices.

Initial conclusions
- The SHAPE results (languages, tools and methods) do provide the main concepts and support for constructing business and service models.
  - Business and SoaML modelling
  - Service Variability
  - Semantic Web Services

Methodology improvement areas
- Too "technology-driven" (CIM, PIM, and PSM) – should be more focused on users (roles and tasks)
- Improve methodology website/navigation structure for users
- Some guidelines need revision (BPMN 2.0, aligned with latest changes of SoaML)
- Further illustrative examples.

Tool suite improvement areas
- Usability issues
- Integration issues
Thanks for your attention!

Questions?