From Models to Components

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TECHNOLOGIES AG

Rapid Service Creation with

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Evolutions in Software Construction

- Model Driven Architectures
- Meta Object Facility and UML
- Shared Metadata Environments (.NET, CWM, JMI)

- CORBA
- Java RMI
- EJB
- Distributed objects technology

- C++
- Java
- Smalltalk
- Object composition paradigm

- C
- Pascal
- Modula
- Step-wise procedural refinement paradigm

Increasing Need for Tools

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The Challenge

  - 64% of enterprises under study are using or plan to use object-oriented analysis and design
  - 80% of such enterprises are using or plan to use component architectures (EJB, CORBA, COM)

- The challenge is to integrate object oriented design and component manufacturing in a model centric approach
The Approach

- **Application of dedicated development techniques**
  - Object oriented modeling for analysis and design
    - Stable, infrastructure independent design models
  - Application of component architectures for integration, test and production
    - Component architectures provide support for component integration: communication, packaging, deployment,
  - Generation of software components from design models
    - Definition of code generation rules -> Design models to components

- **But:**
  - MANY notations/languages for design and manufacturing
    - CORBA Components IDL, ITU-ODL, DCL, SDL
Separation of Concerns

- Define concepts and relations for object oriented analysis and design

- Define/refine notations suitable for the presentation of models

- Use/reuse component architectures to specify the software infrastructure

- Define code generation rules that map from the concepts of the conceptual foundation onto the software infrastructure
Dynamic Metadata Integration Architecture

MOF
Meta Meta Model Implementation

A Meta Model of a Business or Business Processes

develop the meta model with UML

generate

Meta Data Repository

generate

code to automate the business process

Business Process Model
An Instance of the Meta Model
Concepts in enago m2c

structural concepts
structural aspects of functional decomposition
e.g. CO type, interface, interaction element, data types

configuration concepts
aspects of the configuration of software components
e.g. port, provided port, used port

deployment concepts
aspects of manufacturing and integration of software components,
e.g. component, assembly, realize

interaction concepts
case based description of interaction policies
e.g. binding, contract type and contract

enago m2c concepts enabled with DynMEDIA

implementation concepts
aspects of the implementation of software components
e.g. artifact, implementation element, state attribute
Notations for the enago m2c Concepts

- Notations are secondary
  - enago m2c defines modeling concepts and semantical foundations
  - Notations define the presentation of enago m2c concepts

- Notations depend on developers preferences
  - graphical vs. textual model presentation
  - compact vs. descriptive model presentation

- Frequent changes to notations

- Based on the concepts of enago m2c, different notations can be integrated
  - enago m2c defines currently two notations
Notations for the Concept Space

Example 1: Definition of a graphical notation – enago m2c UML Profile
- UML is a standardized, wide spread set of graphical notations
- Applicable in different software development processes and different development phases
- Built-in extension mechanism
- The enago m2c UML Profile can be integrated with different UML CASE tools
Notations for the Concept Space –

- **Example 1:** Definition of a graphical notation
  - **UML** is a standardized, widely spread set of graphical notations.
  - Applicable in different software development processes and different development phases.
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Notations for the Concept Space –

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- **Example 2: Definition of a textual notation – enago m2c eODL – based on ITU-ODL and CORBA IDL**
  - CORBA-IDL allows for the definition of interfaces, datatypes, ...
  - Interfaces are defined independent of the programming language chosen for the implementation
Notations for the Concept Space

CORBA 3 and ITU-ODL Specifications

enago m2c UML Specifications

enago m2c dynamic meta data integration architecture

DynMEDIA
The System Construction Paradigm: Model Transformations

MOF Meta Meta Model

Source Meta Model
e.g. Business Meta Model

Define Formal Transformation Rules

Target Meta Model
e.g. Platform Meta Model

Source Model
e.g. Business Model

Apply Transformation Rules

Target Model
e.g. Platform Specific Software Components

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The enago m2c Component Support Platform

- system specific components
  - use
  - generic components
    - e.g. components of a service platform
      - based on
        - development, deployment and execution support
          - component support platform
            - uses
              - object interaction support
                - object middleware
The enago m2c Component Support Platform

- Component platforms realize the software infrastructure for the integration of components
  - CORBA, .net, EJB, ...

- Telecommunication domain implies specific requirements
  - Scaleability of software systems
  - Manageability (esp. configuration) of the system components
  - Platform support for different interaction kinds

- enago m2c provides a component support platform
Code Generation Aspects: CORBA Technologies used

- Operational interactions realized by plain CORBA
- Signal interactions realized by CORBA Event Service/Notification Service
  - CORBA Event/Notification Service specific interfaces for signal consumption and production
- Continuous media interactions realized by proprietary media delivery platform
  - Platform specific interfaces for media management and delivery
- Support for CO Factory Finder mechanism
  - Realized by CORBA naming service
- Container implementation for generic run-time support
Code Generation Aspects: Port- and Interaction Management

O Composition

I Composition (supply-case)

J Composition (use-case)

CO Servant

servant for operational interaction

servant for signal and streams

servant for signal and streams

Interface I

Interface J

Inherits (on type level)
deleates

implements

provides

uses
Code Generation Aspects: Artifactmanagement

Artifact Factory B₂ creates Artifact B₂ (supply-case)
Artifact Factory B₁ creates Artifact B₁ (supply-case)
Artifact Factory A creates Artifact A (use-case)

O Composition
I Composition (supply-case)
J Composition (use-case)

Interface I provides Interface J uses
Code Generation Aspects
The enago m2c System Configurator
Execution of the System
enago m2c @ work

define/refine the system with enago m2c UML profile

apply the enago m2c model transformators to generate components

execute the resulting system

configure the system with enago m2c system configurator
Conclusions

- OMG's Model Driven Architecture @ Work ☺ ☺ ☺
- MOF compliant meta-models enable flexibility of the approach
  - DynMEDIA is MOF 1.4 compliant
  - Model exchange format(s) come for free
  - Notations are easy to define/integrate
  - First set up the conceptual foundation, afterwards define a concrete syntax
  - Code generation rules can be defined based on the meta-model definitions (i.e. independent of a concrete notation)
- The component support platform behind the scene is an extension of the CORBA Component Model
  - ... and it's implemented ☺
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IKV++ Technologies AG offers:
- products,
- solutions
development,
- consultancy
for the implementation
of (mobile) service
ports

Enago platform suite is:
an open service
platform enabling the
implementation of
(mobile) service
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**enago platform suite**  
*flexible IT-infrastructure for Service Portals*

- **enago OSP (Open Service Platform)**
  - enables integration of heterogeneous third party services  
  - dynamic service subscription  
  - flexible profile handling

- **enago Mobile**
  - enables complex workflow applications  
  - dynamic Service Client software installation  
  - active portal implementation within the endsystem  
  - incorporates personal mobility and Smart Phones

- **enago MediaGate**
  - provides for state of the art Unified Messaging capabilities
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