A Tool to Convert a PIM model into a CORBA IDL Specification

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TUPI

Transformation one-to-one PIM-IDL
Software Architecture

Requirements Engineering

Software Architecture

Implementation

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Software Architecture

Component - functional entity

Connector - communication entity

Port - interaction point

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MDA

Model-Driven Architecture

- Architectural Description Technique
- Based on UML
- Deals with Architectural Models

UML, XMI, MOF

OMG Standard

Middleware Platforms

Essential Services

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MDA Models

Platform Independent Model (PIM)

Model that express the rules of an application

Transformation between the models using conversion rules

“Tupi”

Platform Specific Model (PSM)

Model that represents the features of an application realized in a certain platform

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**PIM**

**UML profile for EDOC**
- Component Integration
- Description of process, application structure, component composition

<table>
<thead>
<tr>
<th>Component</th>
<th>Description UML</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProcessComponent</td>
<td>component</td>
</tr>
<tr>
<td>Property Definition</td>
<td>component properties related with the component</td>
</tr>
<tr>
<td>Port</td>
<td>port</td>
</tr>
<tr>
<td>FlowPort</td>
<td>port that sends only one flow</td>
</tr>
<tr>
<td>MultiPort</td>
<td>port that glue a set of Flow Port</td>
</tr>
<tr>
<td>OperationPort</td>
<td>port that represents a call/return of an operation</td>
</tr>
<tr>
<td>ProtocolPort</td>
<td>port connected to a protocol</td>
</tr>
<tr>
<td>Protocol</td>
<td>communication protocol related with the protocol</td>
</tr>
<tr>
<td>InitiatingRole / RespondingRole</td>
<td>role of a component in a protocol</td>
</tr>
</tbody>
</table>

**Descrição UML**

- component
- component properties related with the component
- port
- port that sends only one flow
- port that glue a set of Flow Port
- port that represents a call/return of an operation
- port connected to a protocol
- communication protocol related with the protocol
- role of a component in a protocol

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CORBA

- Interoperability in distributed and heterogeneous environments
- Interaction between objects via ORB
- Separation between object interface and object implementation (IDL - *Interface Definition Language*)

<table>
<thead>
<tr>
<th>interface</th>
<th>object description</th>
</tr>
</thead>
<tbody>
<tr>
<td>attribute</td>
<td>attribute</td>
</tr>
<tr>
<td>operation</td>
<td>operation</td>
</tr>
<tr>
<td>module</td>
<td>set of elements</td>
</tr>
<tr>
<td>struct, enum</td>
<td>data type</td>
</tr>
<tr>
<td>typedef</td>
<td>named typed</td>
</tr>
<tr>
<td>exception</td>
<td>exception</td>
</tr>
</tbody>
</table>
### PIM-PSM Mapping

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProcessComponent</td>
<td>interface with an attribute for each property and for each port</td>
</tr>
<tr>
<td>Port</td>
<td>----</td>
</tr>
<tr>
<td>FlowPort</td>
<td>interface with a method that indicates the direction of the port</td>
</tr>
<tr>
<td>MultiPort</td>
<td>interface with an attribute for each subport</td>
</tr>
<tr>
<td>OperationPort</td>
<td>operation in the interface of the component</td>
</tr>
<tr>
<td>Protocol</td>
<td>interface</td>
</tr>
<tr>
<td>ProtocolPort</td>
<td>interface with an attribute that represents the protocol</td>
</tr>
<tr>
<td>InitiatingRole /</td>
<td>class with an attribute to each protocol port</td>
</tr>
<tr>
<td>RespondingRole</td>
<td></td>
</tr>
</tbody>
</table>

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Tupi

• ArgoUML
• Syntax follows the UML profile for EDOC

• ArgoUML
• Produces the XMI file

• ArgoUML
• Produces the IDL interfaces

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Conversion PIM-IDL

- XML Document (well-formed)
- Represents a textual form of an UML model

PIM Metamodel (in XML)

Conversion Rules (in XSLT)

Conversion

PSM Model (IDL File)

- XML Document (well-formed)
- Represents actions to be executed when a certain entity is found in the metamodel

- Uses an JAXP API (allows to process the XML using DOM, SAX and XSLT)
Example

Creating the PIM model

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Example²

Producing the PIM Metamodel
Example³

PIM Metamodel

```xml
<Foundation.Core.Class xmi.id="xmi.9" xmi.uuid="10-3--128--9-78efd8:f2ae1e7096:-7ffe">
  <Foundation.Core.ModelElement.name>Comprador</Foundation.Core.ModelElement.name>
</Foundation.Core.Class>

<Foundation.Core.Attribute xmi.id="xmi.14">
  <Foundation.Core.ModelElement.name>pedido</Foundation.Core.ModelElement.name>
</Foundation.Core.Attribute>

<Foundation.Core.StructuralFeature.type>
  <Foundation.Core.Classifier xmi.idref="xmi.16"/>
</Foundation.Core.StructuralFeature.type>
```

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Example

Conversion of the metamodel into IDL

```java
C:\Raquel\relatorio\xml>java ConversorIDL ./pin.xmi

interface Protocolo{
};
interface Compra{
    attribute Protocolo atributo1;
};
interface Comprador : Pessoa{
    attribute int pedido;
    attribute Compra atributo1;
};
interface Pessoa{
    attribute String nome;
};
```

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Conclusions

Difficulties:

• References about MDA.
• The lack of tools that implements MDA.
• The gap between PIM syntax and IDL syntax

Future Works

• An extension to TUPI to convert PSM in IDL of CORBA CCM (*CORBA Component Model*)