

Implementing complex graphical editors with model-driven technologies



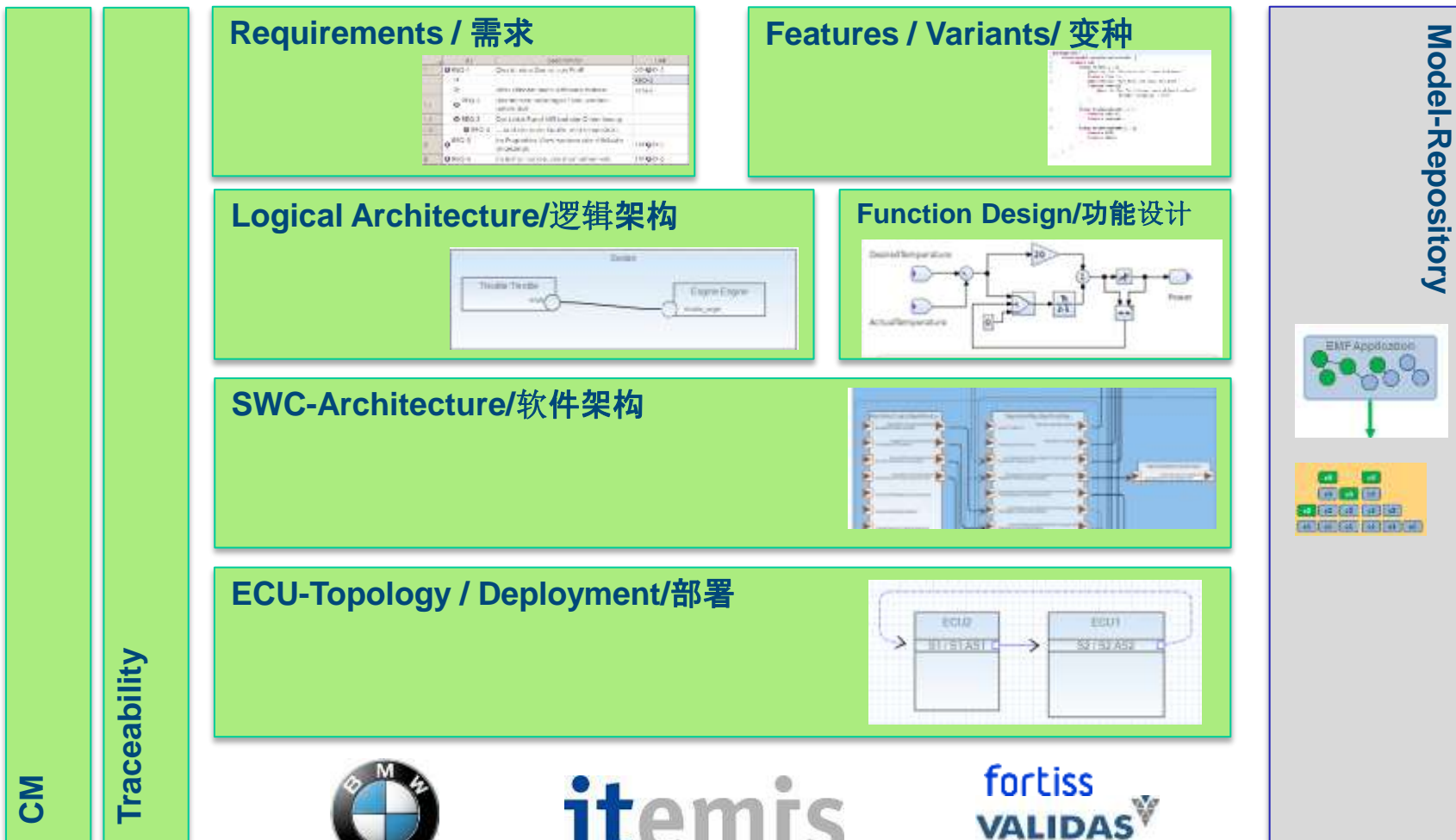
使用模型驱动技术实现图形编辑器
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IMES Research project – Tooling for Function oriented development

IMES研究项目：面向功开发的工具





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IMES研究项目：面向功开发的工具



Graphiti Framework (eclipse.org/graphiti)



Graphiti - a Graphical Tooling Infrastructure

Eclipse provides a modeling infrastructure evolving around the Eclipse Modeling Framework (EMF) for which offering graphical representations and editing possibilities is essential.

Graphiti is an Eclipse-based graphics framework that enables rapid development of state-of-the-art diagram editors for domain models. Graphiti can use EMF-based domain models very easily but can deal with any Java-based objects on the domain side as well.

The objectives of the Graphiti project are the following:

Provide an easy to use and well structured plain Java API for building graphical tools

Provide documentation and tutorials for doing so

Limit the dependencies of the framework to an absolute minimum to support RCP-like scenarios

Provide optional components beyond the RCP use case to ease e.g. IDE integration

Provide the ability to use any existing layout algorithms for auto laying out a diagram

Graphiti: Lessons Learned



Developing a Graphiti Application: 使用Graphiti的应用开发

Manual Code / 手工代码

Domain Model Element: 域模型元素		Graphiti classes to be implemented (more than 7 per domain element): Graphiti Java类; 个域模型元素要七多Java类
Composition Type		Add
Application Type		Create
SRInterface		Move
Port	X	Update
Component Prototype		Direct Editing
Delegating Connector		Custom
Assembly Connector		Resize

Feature

Diagram Model

Graphiti diagram .ecore is fixed

Domain Model

```

AUTOSAR [AUTOSAR]
├── ARRoot [ARPackage]
│   ├── AS1 [ApplicationSwComponentType]
│   ├── AS2 [ApplicationSwComponentType]
│   ├── AS3 [ApplicationSwComponentType]
│   ├── AS4 [ApplicationSwComponentType]
│   └── CompositionSwComponentType1 [CompositionSwComponentType]
│       ├── ass [AssemblySwConnector]
│       ├── ass2 [AssemblySwConnector]
│       ├── ass3 [AssemblySwConnector]
│       ├── dgc [DelegationSwConnector]
│       ├── in1 [RPortPrototype]
│       ├── in2 [RPortPrototype]
│       ├── out2 [PPortPrototype]
│       ├── S1 [SwComponentPrototype]
│       ├── S2 [SwComponentPrototype]
│       ├── S3 [SwComponentPrototype]
│       └── S4 [SwComponentPrototype]
    
```

使用模型驱动技术实现图形编辑器

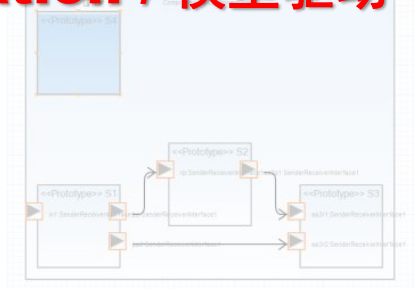


Developing a Graphiti Application: 使用Graphiti的应用开发

Manual Work / 手工代码 →
Model Driven - Code Generation / 模型驱动 - 代码生成

Composition Type	X	Add	Feature
Application Type		Create	
SRInterface		Move	
Port		Update	
Component Prototype		Direct Editing	
Delegating Connector		Custom	
Assembly Connector		Resize	
...			

Diagram Model



Fixed Graphiti diagram .ecore

Domain Model

```

AUTOSAR [AUTOSAR]
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│       ├── ass3 [AssemblySwConnector]
│       ├── dgc [DelegationSwConnector]
│       ├── in1 [RPortPrototype]
│       ├── in2 [RPortPrototype]
│       ├── out2 [PPortPrototype]
│       ├── S1 [SwComponentPrototype]
│       ├── S2 [SwComponentPrototype]
│       └── S3 [SwComponentPrototype]
    
```

使用模型驱动技术实现图形编辑器



Developing a Graphiti Application: 使用Graphiti的应用开发



Manual Work / 手工代码 →

Model Driven - Code Generation / 模型驱动 - 代码生成

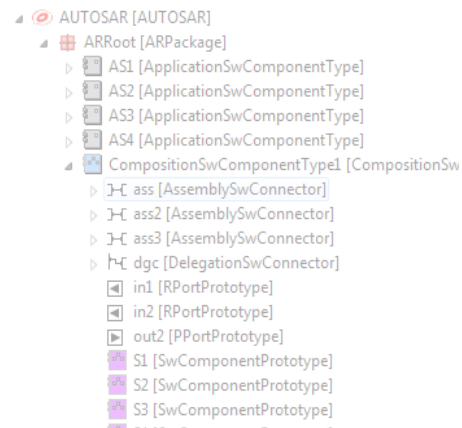
Composition Type		Add	Diagram Model
Application Type		Create	
SRInterface		Move	
Port		Update	
Component Prototype		Direct Editing	
Delegating Connector	X	Custom	Feature
Assembly Connector		Resize	
...			

MDD 模型驱动 == UML?



Fixed Graphiti diagram .ecore

Domain Model



使用模型驱动技术实现图形编辑器



Developing a Graphiti Application: 使用Graphiti的应用开发

Manual Work / 手工代码 →
Model Driven - Code Generation / 模型驱动 - 代码生成

Diagram Model

Fixed Graphiti diagram .ecore

MDD 模型驱动 == UML?

Domain Specific Languages / 领域特定语言

Domain Model

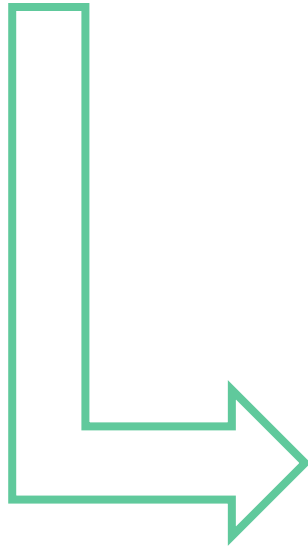
使用模型驱动技术实现图形编辑器



Domain Specific Language / 领域特定语言

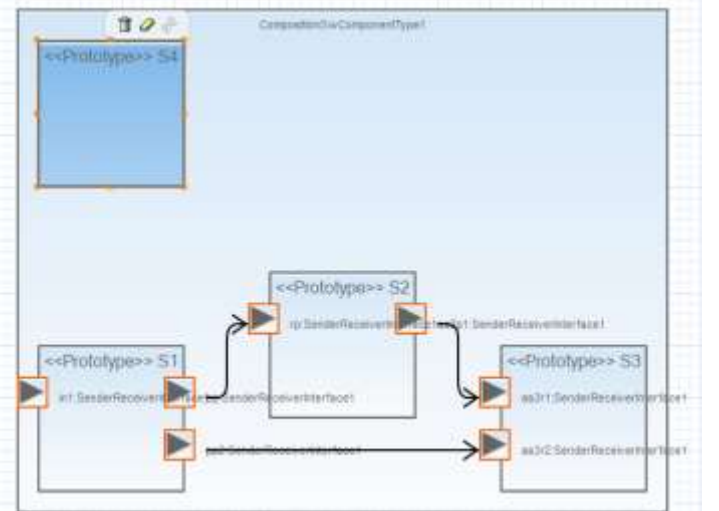
Domain Specific Language / 领域特定语言

```
node NCompositionSwComponentType CompositionSwComponentType {  
  label { attribute shortName }  
  icon "composition"  
  shape conceptalsymbols.autosar.symbolsautosar.SmartShapeAutosarComponent  
  defaultSize 100 50  
  description "A CompositionSwComponentType is a subsystem consisting of connect  
  context diagram { attr { ctx.elements} }  
  update NCRPortPrototype NCPPortPrototype  
}
```



Code Generation / 代码生成

Diagram Editor / 图形编辑器



使用模型驱动技术实现图形编辑器



How to Develop a DSL / 如何开发一个DSL with Xtext (eclipse.org/xtext)

Xtext DSL 语法

```
Node:  
'node' name=ID (element=JvmTypeReference)? (aliasOnly?='aliasOnly')?  
((labelSpec=LabelSpec)? &  
 (typedElementSpec=TypedElementSpec)? &  
 (.xtextEditor='.xtextEditor' '{'  
   (  
     ('domainObject' doExpr=XBlockExpression) &
```



DSL
开发人员

Domain Specific Language / 领域特定语言工具

```
node NCompositionSwComponentType CompositionSwComponentType {  
  label { attribute shortName }  
  icon "composition"  
  shape conceptalsymbols.autosar.symbolsautosar.SmartShapeAutosarComponent  
  defaultSize 100 50  
  description "A CompositionSwComponentType is a subsystem consisting of connect  
context diagram { attr { ctx.elements} }  
update NCRPortPrototype NCPPortPrototype
```



图形编辑器
开发人员



汽车
开发人员

使用模型驱动技术实现图形编辑器

功能强大的DSL编辑器. 领域特定语言工具



A Selection Of Supported Features

```
module Arithmetics
def boxVolume(l,w,h) : l*w*h;
boxVolume(1,2,3);
// = 6
```

Syntax Coloring

语法着色

```
datatype:
'datatype' name=ID;
Entity:
'entity' name=ID
(features+=fea...
```

Content Assist

内容辅助

```
module Arithmetics
def boxVolume(l,w,h) : l*w*h;
def LUE : 20+22;
boxVolume(...
```

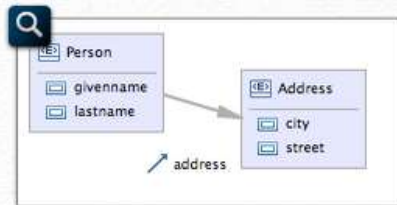
Validation and Quick Fixes

验证

```
entity Person {
name : String
firstName : String
age : Integer
friends : Set<Person>
}
```

Advanced Java Integration

Java积分



Integration with other Eclipse

Eclipse积分

```
Domainmodel.xtext (5 matches)
24: 'datatype' name=ID;
27: 'entity' name=ID ('extends'
32: name=ID ':' type=TypeRef;
38: ID ('ID');
```

More IDE Features

Xtext's advanced Eclipse integration goes far beyond the editor. You will not feel any difference between your language and Java.

使用模型驱动技术实现图形编辑器



Efficiency /效率

DSL 开发(手工LOC)

Xtext Grammar / 语法	300
Code Generator /代码生成器	4800
Editor Definition (DSL):编辑器定义	2700
Total / 总数	7800

生成的代码(LOC)

10 graphical editors	28000
Expected 15 editors	42000

使用模型驱动技术实现图形编辑器

Other benefits /其它优点

DSL 开发(手工LOC)

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Total / 总数	7800

生成的代码(LOC)

10 graphical editors	28000
Expected 15 editors	42000

- Easy Refactoring**
重构
- Use of new frameworks** - 新框架
- Fast Bugfixing**
- View on the domain** - 抽象模型
- ...-等等

Core Competencies:

- Model based Software Development
 - Textual, graphical and hybrid
 - Eclipse based tool chains
 - Product Line Engineering
- Systems Engineering
- Software- and System Architecture
- Test Automation
- Continuous Integration and Build Verification
- Project Management (PMI, SCRUM)
- Agile Methods

Services:

- Coaching and Consulting
 - High qualified Software Experts, Project Leaders, Software Architects, MDSO and Eclipse Experts
 - Java/.NET Developer
- Tool Development
 - Editors, Generators
 - Transformations
 - Simulation tools
- Enterprise Application Development
- Service and Support

Open Source offered by itemis



ReqIF Implementation,
as basis RE/RM Tools



Statecharts and
Block Diagrams



AUTOSAR
Tool Platform



Workbench Infrastructure



MDS and DSL Tools



Core of Eclipse Modeling