Evolizer

A Platform for Software Evolution Analysis and Research

Michael Würsch, Harald C. Gall

University of Zurich
Department of Informatics

s.e.a.l.
software evolution & architecture lab

The Release History Database Approach

Populating a Release History Database from Version Control and Bug Tracking Systems

Michael Fischer, Martin Pinzger, and Harald C. Gall, Proceedings of the International Conference on Software Maintenance, 2003, Pages: 23-32

Why is a VCS not enough?

CVS, Subversion, git, etc were never designed for software evolution analysis

- Tracking the Evolution of large software systems and their particular products
- No linking of detailed modification reports and classification of changes
- Links to bug reports have to be added manually as free text

Joining VCS and Bug Report Databases

Logical couplings

Error prone classes

Estimation of code maturity

Evolizer; can you eat it?

Evolizer is our software evolution analysis platform in Eclipse

- Automates the data harvesting process
- Provides a convenient way to access the harvested data
- Simplifies prototyping of software evolution analysis tools

Key publications with Evolizer and related tools

- IEEE Transactions on Software Engineering 2007
- IEEE Software 2009
- Software Quality Journal, Springer 2009
- ICSE 2010

- ICPC 2006, WCRE 2007, ICSM 2008, ASE 2008

Theses in the Evolizer Ecosystem I

Developing a Meta Model for Release History Systems
Dane Marjanovic, Diploma Thesis, University of Zurich, 2006, Pages: 82

Detecting Design Violations and Code Smells by Bug-Impact Analysis
Dominik Schaffhauser, Diploma Thesis, University of Zurich, May 2006, Pages: 58

Evolving Code Clones - An Approach towards a Fine-Grained Analysis of Code Clone Changes and Change Couplings
Emanuel Giger, Diploma Thesis, University of Zurich, July 2006, Pages: 88

Kiviat Navigator: Navigation of Source Code Data using Kiviat-Graphs
Roman Flueckiger, Diploma Thesis, University of Zurich, October 2006, Pages: 48

Assessing Software Quality Attributes with Source Code Metrics
Andreas Jetter, University of Zurich, October 2006, Pages: 56

A Visual Evolution Explorer: Visualize a Release History Database
Daniel Zuberbuehler, University of Zurich, October 2006, Pages: 66

Improving Abstract Syntax Tree based Source Code Change Detection
Michael Würsch, Diploma Thesis, University of Zurich, October 2006, Pages: 92

Data Mining with Eclipse
Julio Gonnet, Diploma Thesis, University of Zurich, January 2007

Visualizing Dynamic Social Network Structures
Barbara Schwarz, Diploma Thesis, University of Zurich, May 2007

Adaptation of Source Comments and API Documentation when Source Code changes
Eduardo Beutler, Diploma Thesis, University of Zurich, May 2007

Theses in the Evolizer Ecosystem II

Investigating Change Patterns that Fix Bugs
Marco Jakob, Diploma Thesis, University of Zurich, 2007

Analyzing and Detecting Design Flaws using Source Code Change Information
Raoul Schmidiger, Diploma Thesis, University of Zurich, 2007

Visual Analysis of Java Class Dependencies
Katja Graefenhain, Master's Thesis, University of Zurich, 2007

Visualizing Metrics using Tree Maps and Evolizer
Anil Kandrical, Master's Thesis, University of Zurich, 2007

DA4Java
Mark Odermatt, Bachelor's Thesis, University of Zurich, 2008

Change Prism: A Java Visualization for Software Changes
Sebastian Müller, Bachelor's Thesis, University of Zurich, 2009

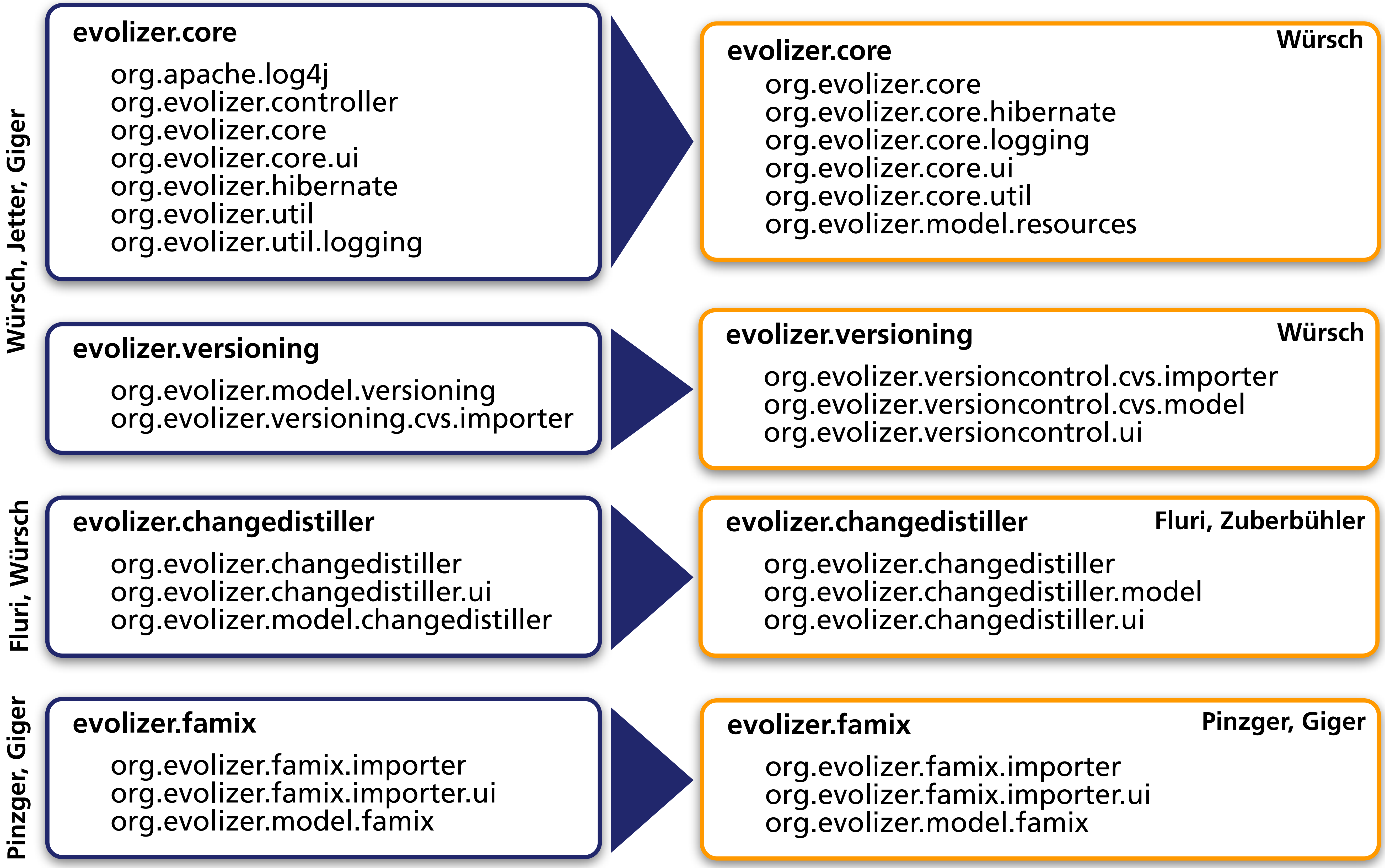
Coupling in ChangePrism: Enhancing ChangePrism with Coupling
Michael Küchler, Bachelor's Thesis, University of Zurich, 2009

Evolizer Metrics
Reto Zenger, Bachelor's Thesis, University of Zurich, 2009

Refactorizer: Detecting Refactorings with Evolizer
Jef Van Loon, Master's Thesis, University of Zurich, 2009

Implementation of EvoSpaces2 in Java
Dustin Wüest, Master's Thesis, University of Zurich, 2009

Evolizer 1.0 to 2.0



Würsch, Jetter, Giger

evolizer.core

- org.apache.log4j
- org.evolizer.controller
- org.evolizer.core
- org.evolizer.core.ui
- org.evolizer.hibernate
- org.evolizer.util
- org.evolizer.util.logging

evolizer.core — Würsch

- org.evolizer.core
- org.evolizer.core.hibernate
- org.evolizer.core.logging
- org.evolizer.core.ui
- org.evolizer.core.util
- org.evolizer.model.resources

evolizer.versioning

- org.evolizer.model.versioning
- org.evolizer.versioning.cvs.importer

evolizer.versioning — Würsch

- org.evolizer.versioncontrol.cvs.importer
- org.evolizer.versioncontrol.cvs.model
- org.evolizer.versioncontrol.ui

Fluri, Würsch

evolizer.changedistiller

- org.evolizer.changedistiller
- org.evolizer.changedistiller.ui
- org.evolizer.model.changedistiller

evolizer.changedistiller — Fluri, Zuberbühler

- org.evolizer.changedistiller
- org.evolizer.changedistiller.model
- org.evolizer.changedistiller.ui

Pinzger, Giger

evolizer.famix

- org.evolizer.famix.importer
- org.evolizer.famix.importer.ui
- org.evolizer.model.famix

evolizer.famix — Pinzger, Giger

- org.evolizer.famix.importer
- org.evolizer.famix.importer.ui
- org.evolizer.model.famix

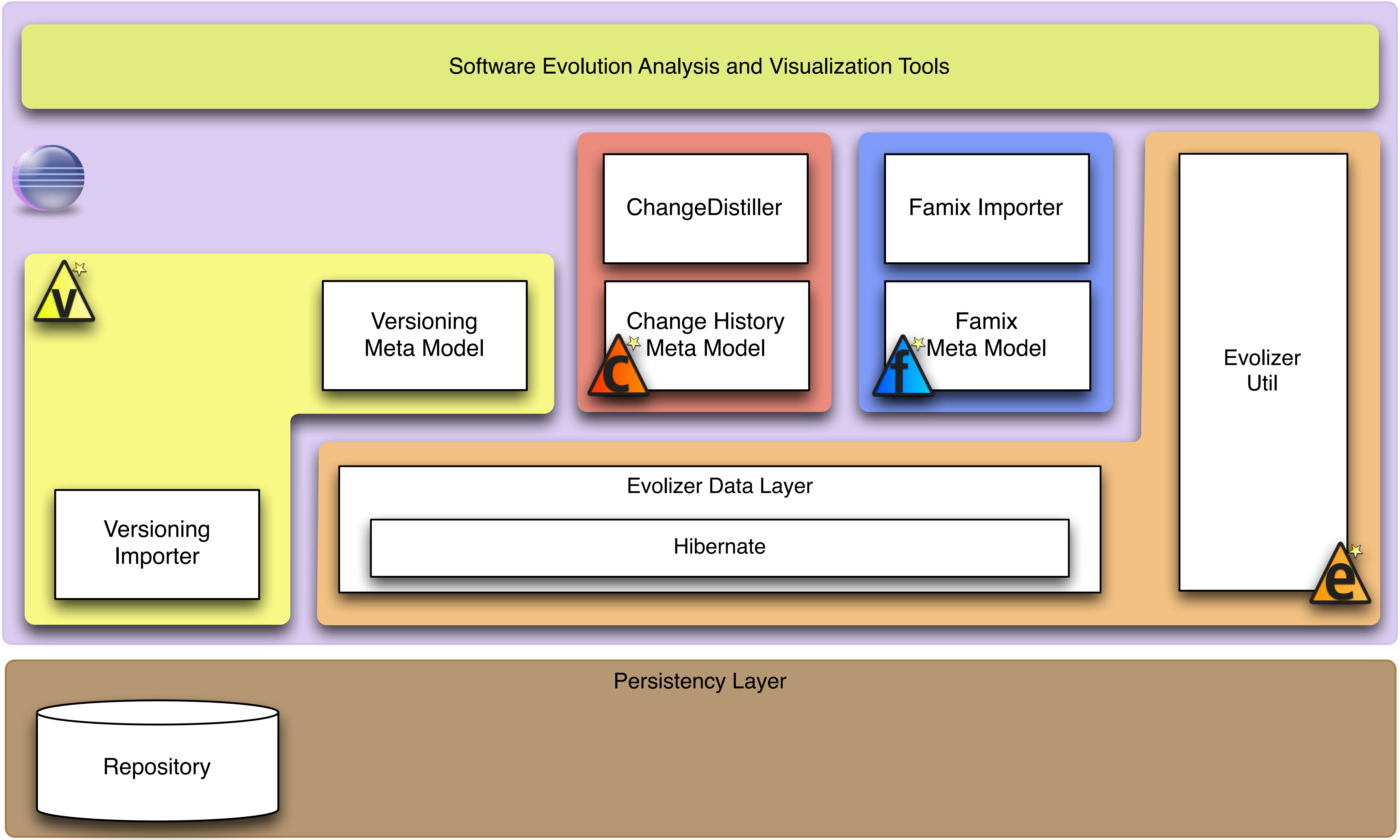
The Architecture of Evolizer

Plug-in architecture

Layered architecture

- Repositories
- Data importers
- Data integrators
- Data providers
- Data consumers

Evolizer 2.0 architecture



Data Models in Evolizer

Data models provide an interface to the information harvested from a repository

- One model per repository
- Models can integrate other models

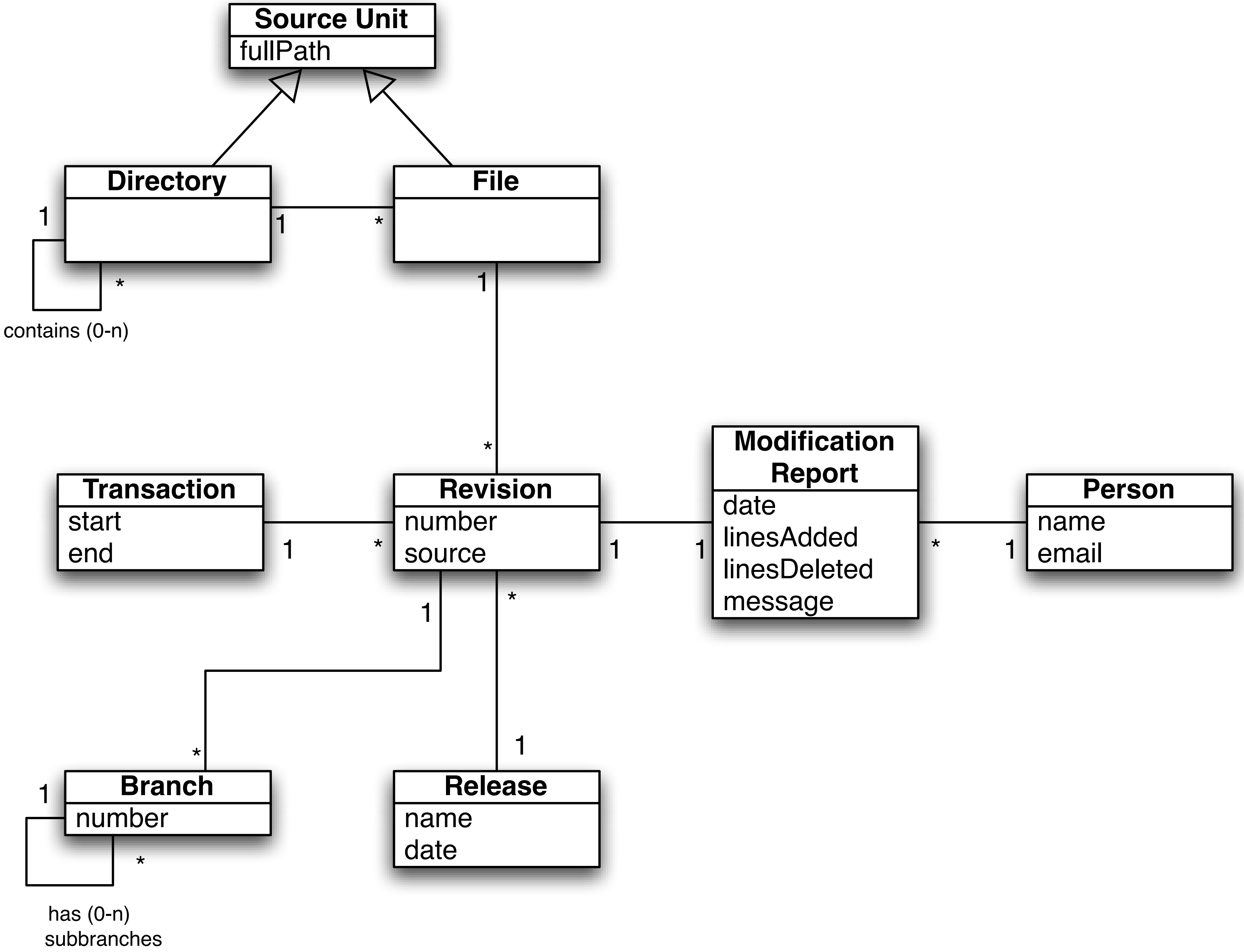
Models are Eclipse plug-ins

- EJB 3.0 annotated
- Add/integrate a new model without changing a single line of code

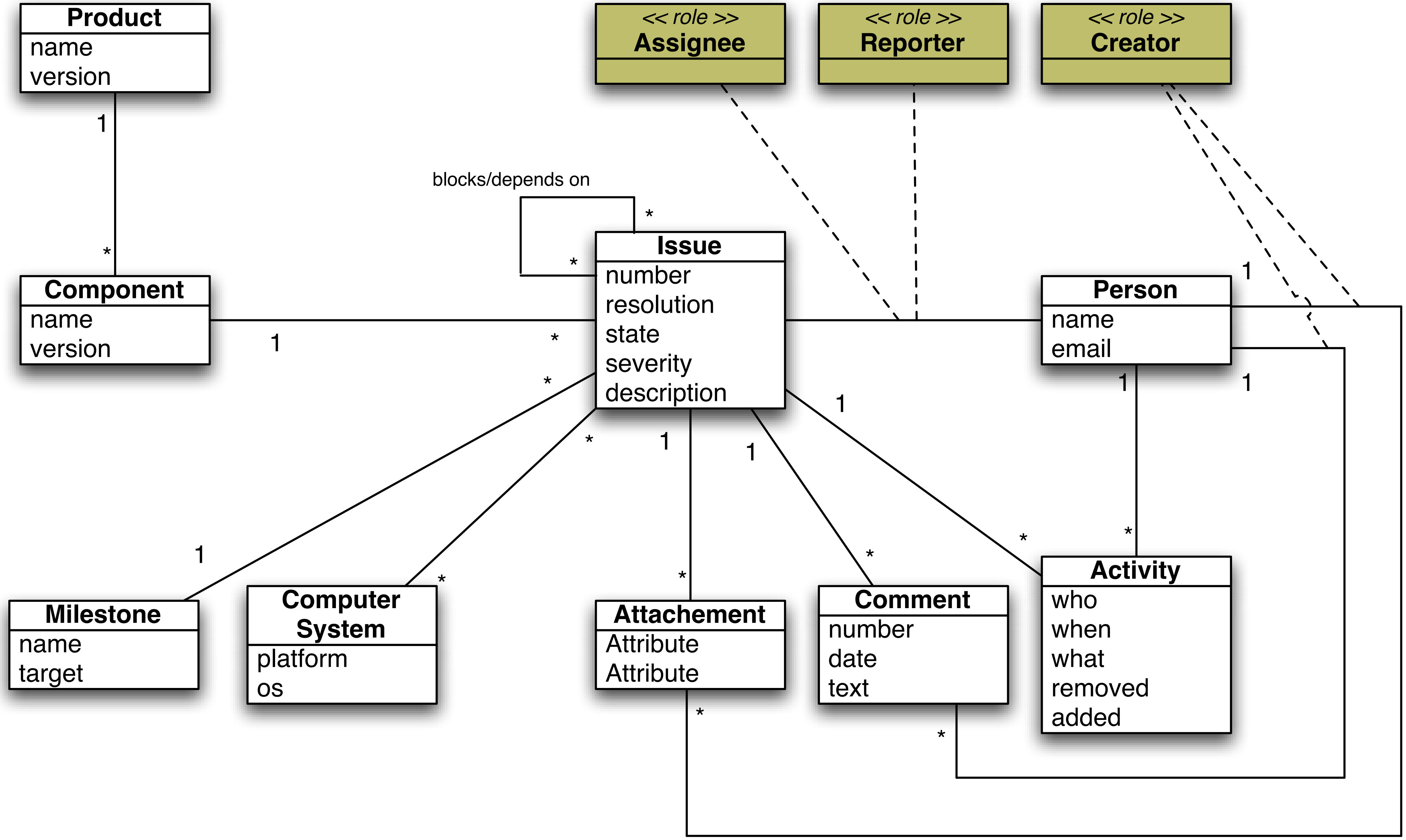
Models are easy to query

- Hibernate Query Language (HQL)
- Guided input natural language (Ginseng)

Version Control Model



Bug Tracking Model



Product
name
version

Component
name
version

blocks/depends on

Issue
number
resolution
state
severity
description

<< role >>
Assignee

<< role >>
Reporter

<< role >>
Creator

Person
name
email

Milestone
name
target

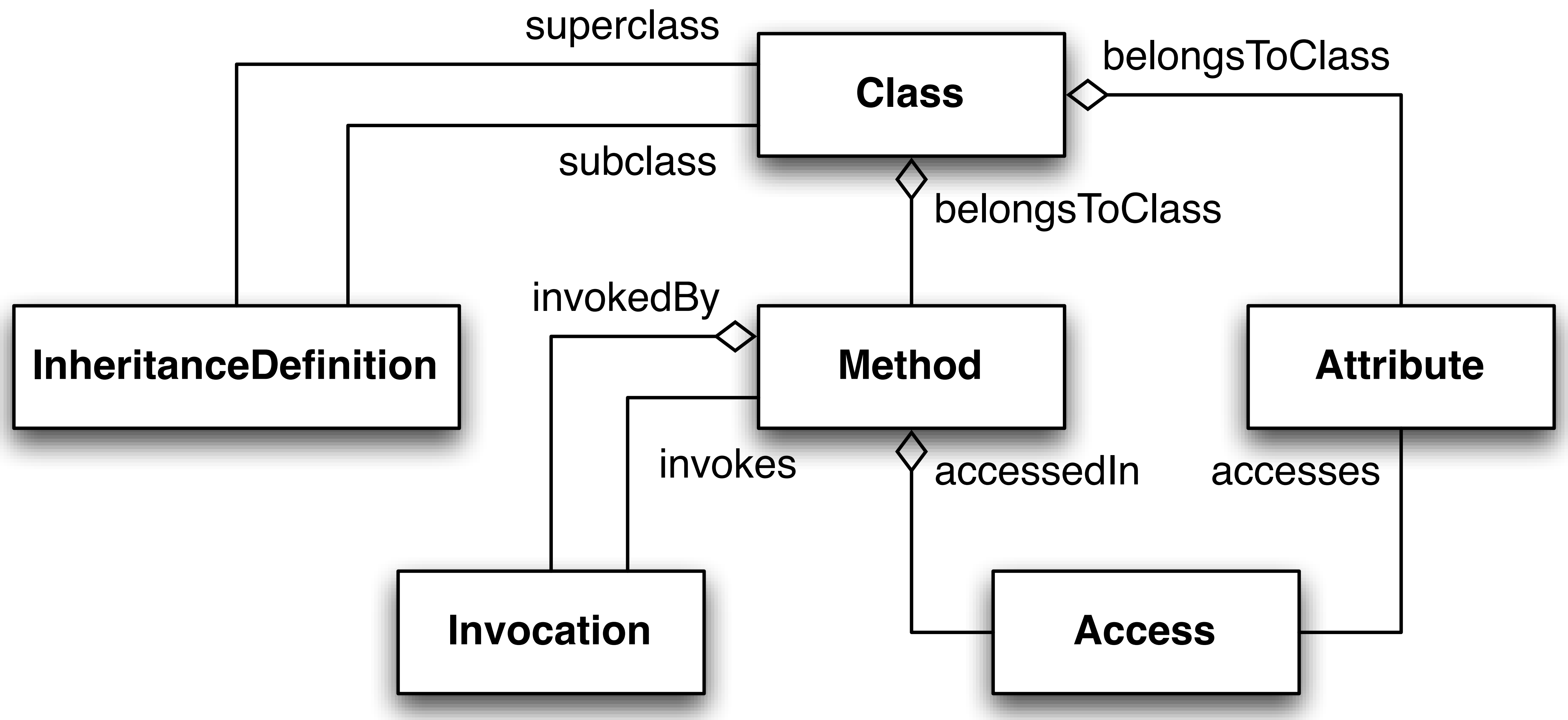
Computer System
platform
os

Attachement
Attribute
Attribute

Comment
number
date
text

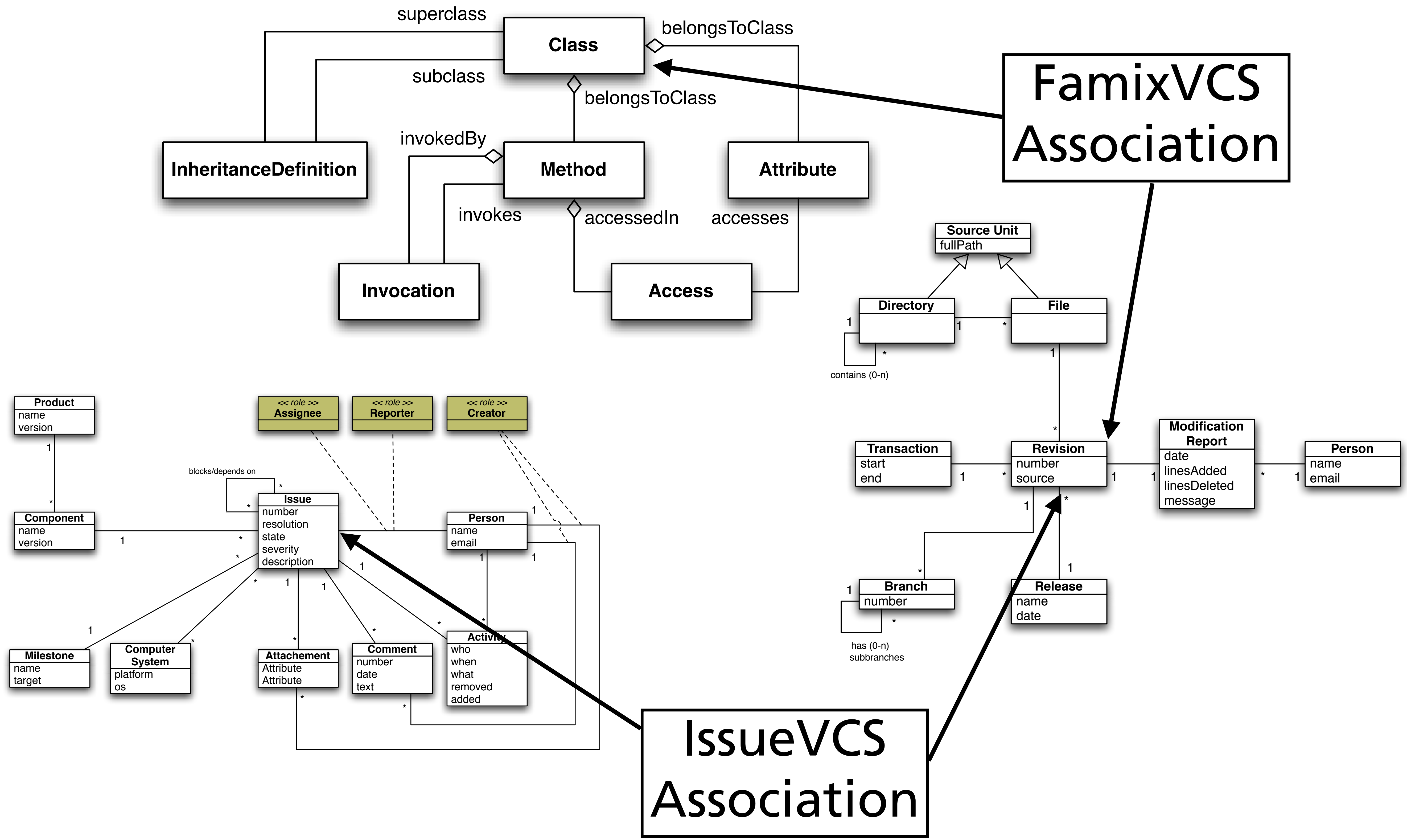
Activity
who
when
what
removed
added

FAMIX* - Source Code Model



*S. Tichelaar, S. Ducasse, and S. Demeyer. Famix and Xmi. WCRE '00

Model Integration



FamixVCS Association

IssueVCS Association

EJB 3.0 Annotations

```
import javax.persistence.Entity;
import javax.persistence.GeneratedValue;
import javax.persistence.GenerationType;
import javax.persistence.Id;

@Entity
public class BusinessEntity {
            private Long id;
            private String aString;

            public String getAString() {
                        return aString;
            }

            public void setAString(String string) {
                        aString = string;
            }

            @Id @GeneratedValue(strategy = GenerationType.AUTO)
            public Long getId() {
                        return id;
            }

            public void setId(Long id) {
                        this.id = id;
            }

}
```

@Entity

@Id

Querying the RHDB

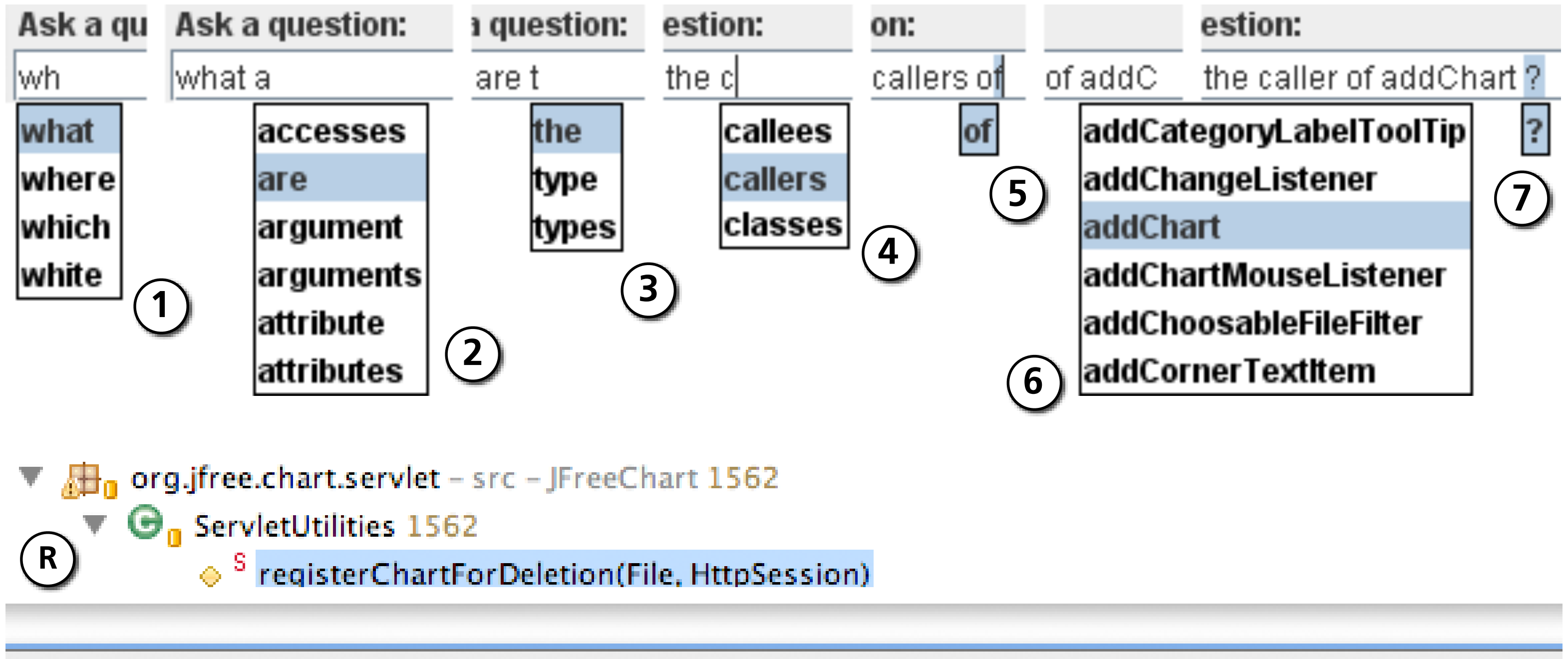
SQL

Not recommended ☺

HQL

```
from Invocation as invocation
     join invocation.callee as callee
where
     callee.name=‘main’;
```

Guided Natural Language Input



Ask a qu: wh

Ask a question: what a

a question: are t

estion: the c

on: callers of

of addC

estion: the caller of addChart ?

Applications using Evolizer

ChangeDistiller

Extracts fine-grained source code changes between subsequent revisions of Java classes.

ArchView

Visualizes metrics.

Dependency Analysis for Java (DA4Java)

Visualizes Java source code with nested graphs.

http://swerl.tudelft.nl/bin/view/MartinPinzger/MartinPinzgerDA4Java

CocoViz

Visualizes software with cognitive shapes.

EvoSpaces2

Uses a urban metaphor to visualize software

Sofas - Software Analysis as a Service

Distributed and Collaborative Software Analysis platform.

Detecting Changes with UNIX diff

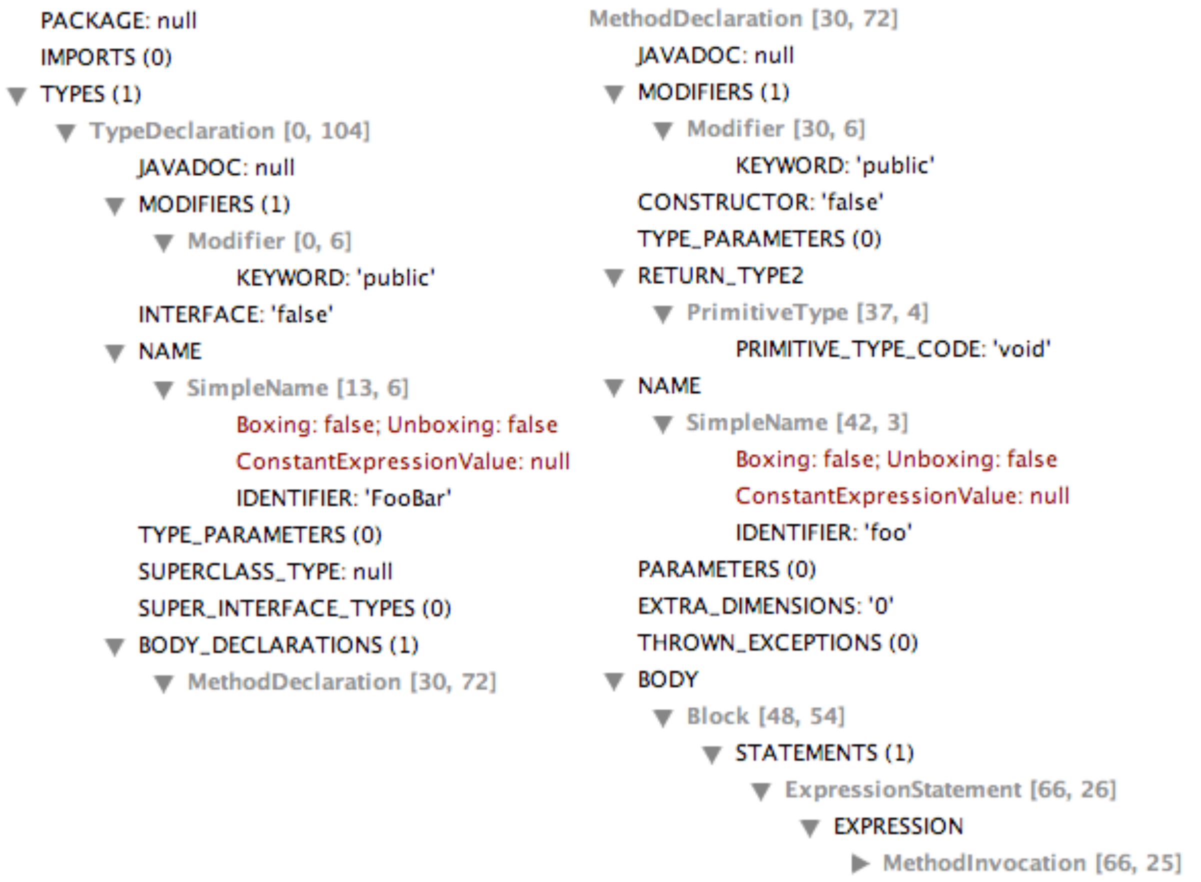
```
//original version:
public class HelloWorld {
 private HelloWorld theInstance = new HelloWorld();

 public static void main(String[] args){ }
}

//modified version:
public class NewHelloWorld {
 public static void main(String[] args){
  System.out.println("Hello World");
 }
}
```

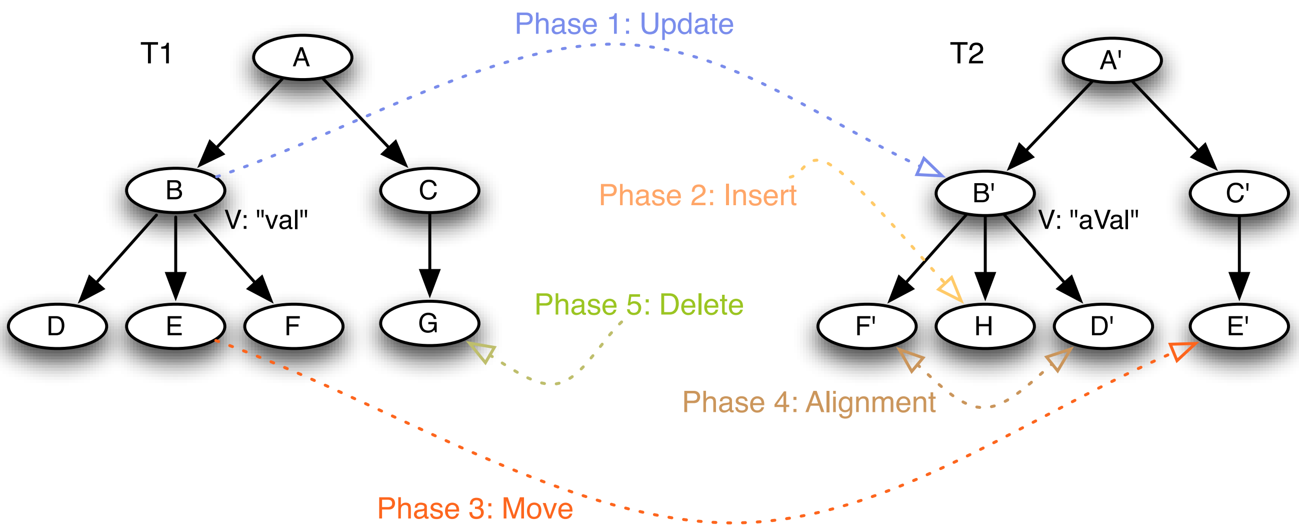
```
unix-machine:~/$ diff -b HelloWorld.java NewHelloWorld.java
1,2c1
< public class HelloWorld {
< private HelloWorld theInstance = new HelloWorld();
---
> public class NewHelloWorld {
3a3
> System.out.println("Hello World");
```

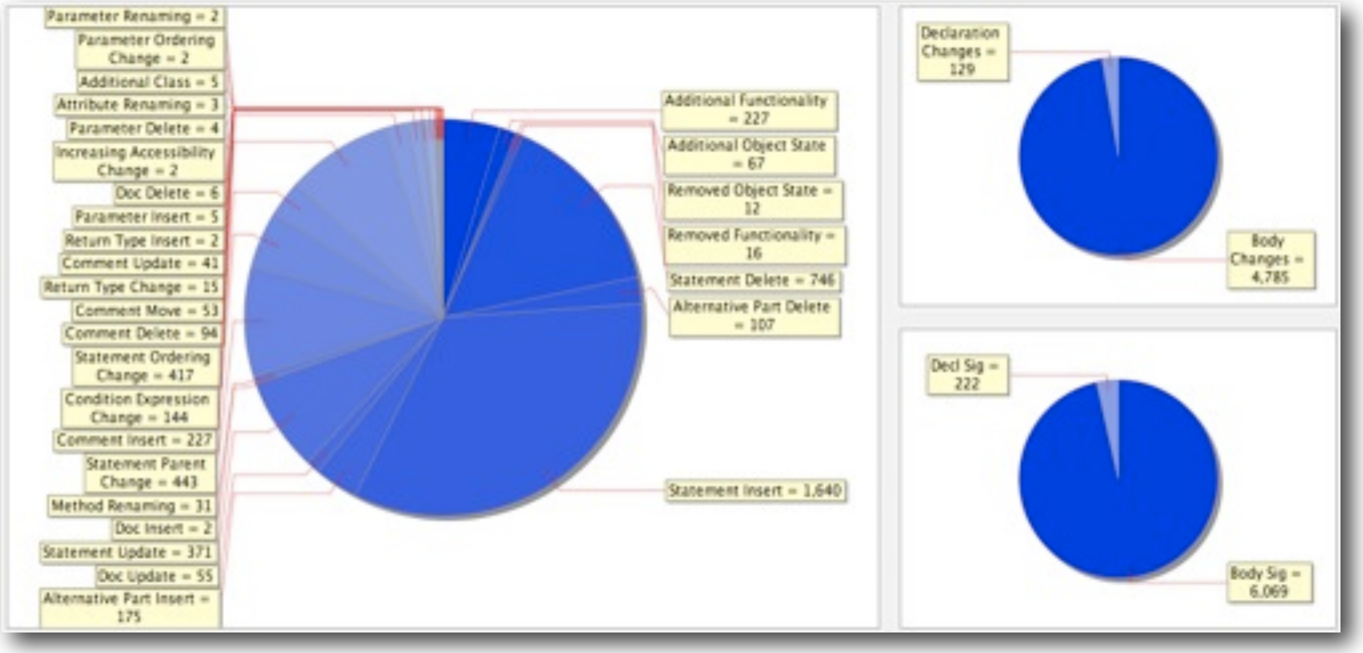
ChangeDistiller

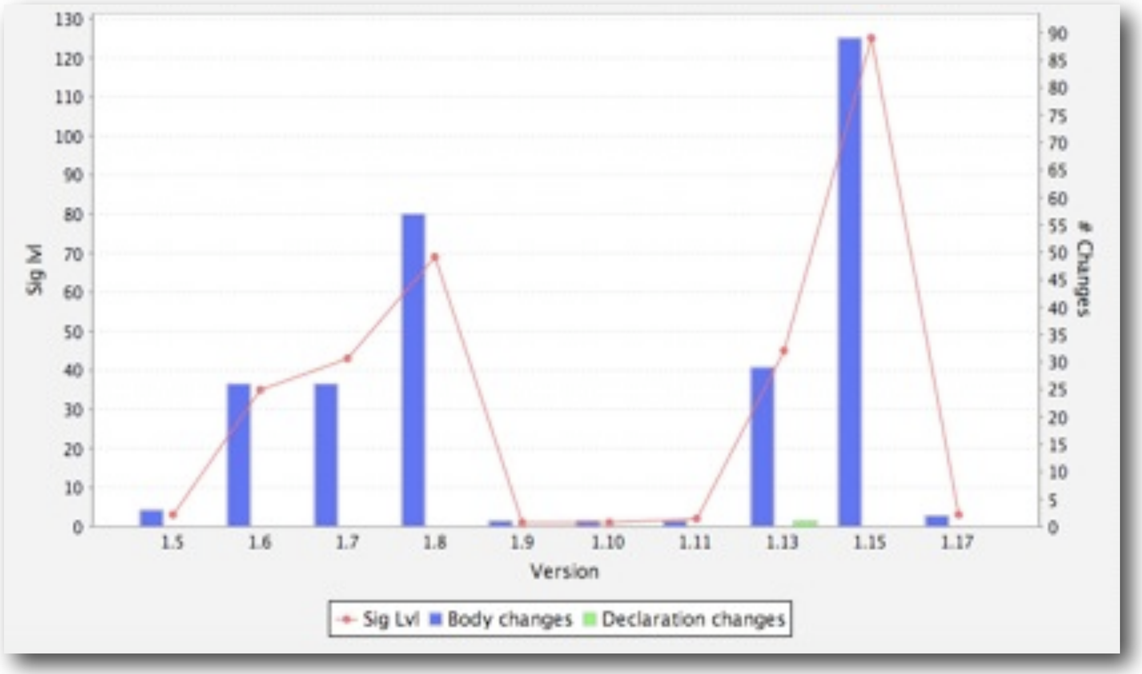


```
    PACKAGE: null
    IMPORTS (0)
▼   TYPES (1)
  ▼   TypeDeclaration [0, 104]
          JAVADOC: null
      ▼   MODIFIERS (1)
        ▼   Modifier [0, 6]
              KEYWORD: 'public'
          INTERFACE: 'false'
      ▼   NAME
        ▼   SimpleName [13, 6]
              Boxing: false; Unboxing: false
              ConstantExpressionValue: null
              IDENTIFIER: 'FooBar'
          TYPE_PARAMETERS (0)
          SUPERCLASS_TYPE: null
          SUPER_INTERFACE_TYPES (0)
      ▼   BODY_DECLARATIONS (1)
        ▼   MethodDeclaration [30, 72]
```

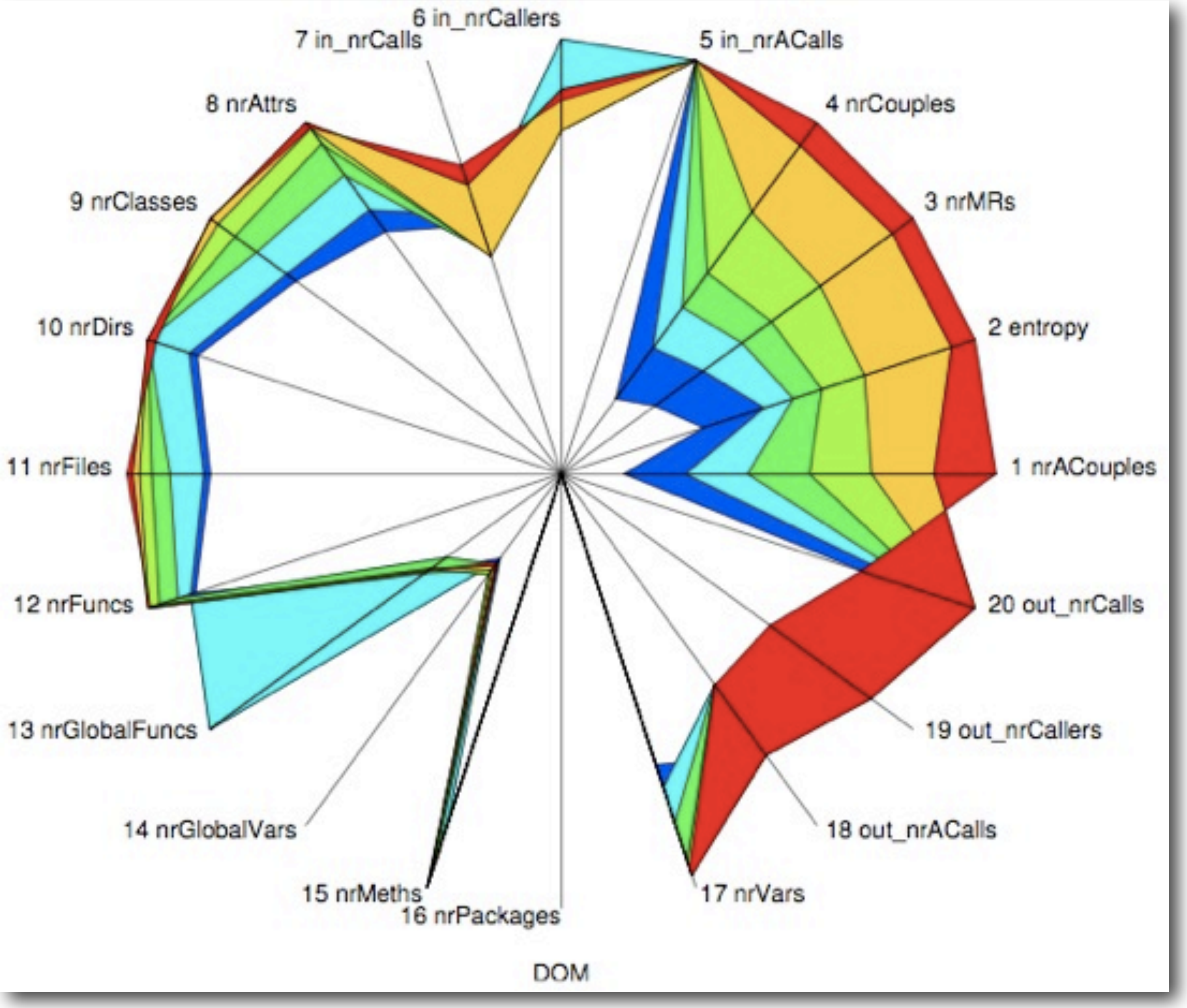
```
MethodDeclaration [30, 72]
    JAVADOC: null
▼   MODIFIERS (1)
  ▼   Modifier [30, 6]
          KEYWORD: 'public'
    CONSTRUCTOR: 'false'
    TYPE_PARAMETERS (0)
▼   RETURN_TYPE2
  ▼   PrimitiveType [37, 4]
          PRIMITIVE_TYPE_CODE: 'void'
▼   NAME
  ▼   SimpleName [42, 3]
          Boxing: false; Unboxing: false
          ConstantExpressionValue: null
          IDENTIFIER: 'foo'
    PARAMETERS (0)
    EXTRA_DIMENSIONS: '0'
    THROWN_EXCEPTIONS (0)
▼   BODY
  ▼   Block [48, 54]
    ▼   STATEMENTS (1)
      ▼   ExpressionStatement [66, 26]
        ▼   EXPRESSION
          ▶   MethodInvocation [66, 25]
```





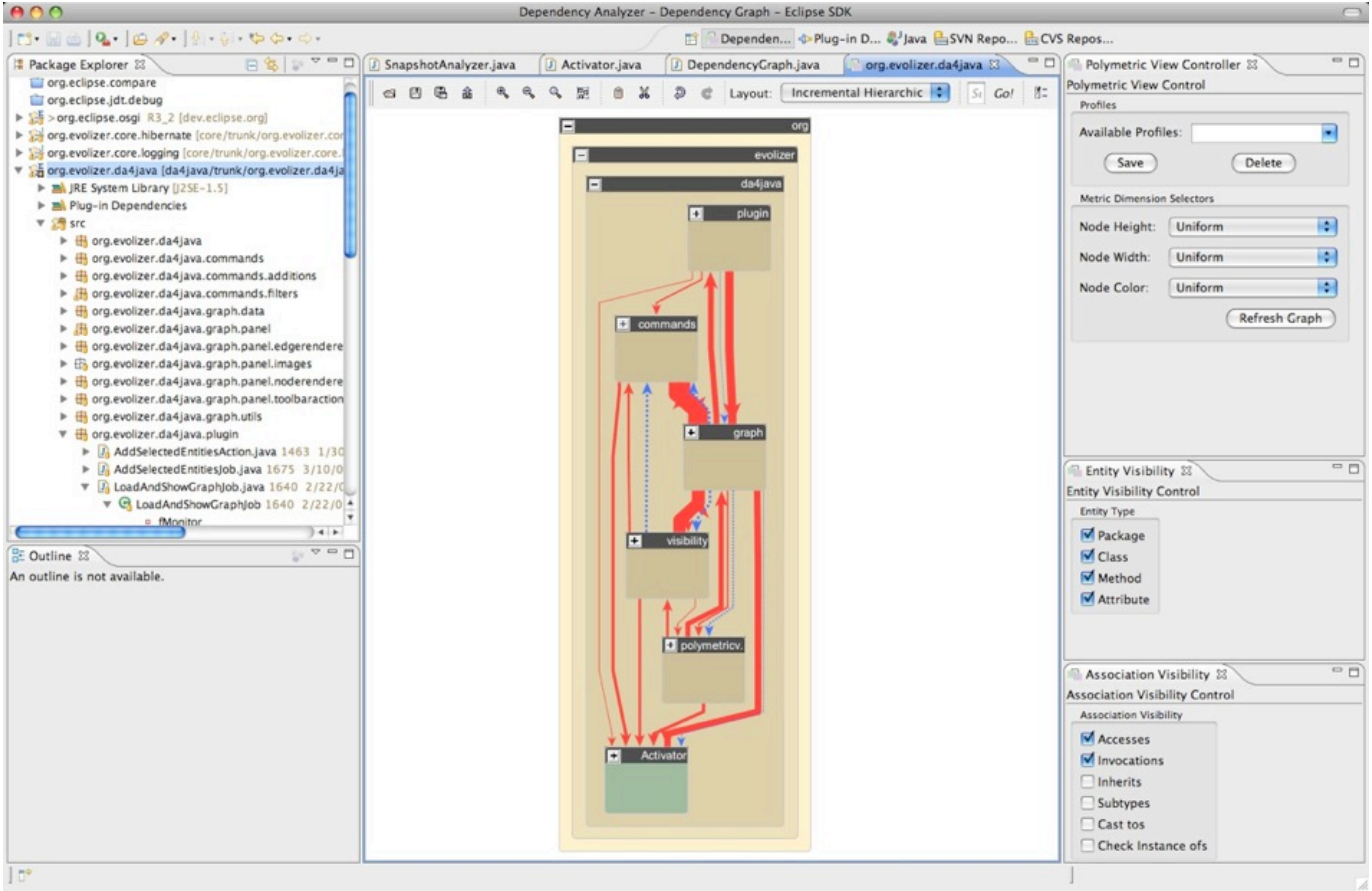


ArchView



Visualizing Multiple Evolution Metrics
Martin Pinzger, Harald C. Gall, Michael Fischer, and Michele Lanza,
Proceedings of the ACM Symposium on Software Visualization, 2005, Pages: 67-75

DA4Java



Dependency Analyzer – Dependency Graph – Eclipse SDK

Package Explorer

- org.eclipse.compare
- org.eclipse.jdt.debug
- >org.eclipse.osgi R3_2 [dev.eclipse.org]
- org.evolizer.core.hibernate [core/trunk/org.evolizer.cor
- org.evolizer.core.logging [core/trunk/org.evolizer.core.
- org.evolizer.da4java [da4java/trunk/org.evolizer.da4ja
  - JRE System Library [J2SE-1.5]
  - Plug-in Dependencies
  - src
    - org.evolizer.da4java
    - org.evolizer.da4java.commands
    - org.evolizer.da4java.commands.additions
    - org.evolizer.da4java.commands.filters
    - org.evolizer.da4java.graph.data
    - org.evolizer.da4java.graph.panel
    - org.evolizer.da4java.graph.panel.edgerendere
    - org.evolizer.da4java.graph.panel.images
    - org.evolizer.da4java.graph.panel.noderendere
    - org.evolizer.da4java.graph.panel.toolbaraction
    - org.evolizer.da4java.graph.utils
    - org.evolizer.da4java.plugin
      - AddSelectedEntitiesAction.java 1463 1/30
      - AddSelectedEntitiesJob.java 1675 3/10/0
      - LoadAndShowGraphJob.java 1640 2/22/0
        - LoadAndShowGraphJob 1640 2/22/0
          - fMonitor

Outline

An outline is not available.

Layout: Incremental Hierarchic

Polymetric View Control

Profiles

Available Profiles:

Metric Dimension Selectors

Node Height: Uniform

Node Width: Uniform

Node Color: Uniform

Entity Visibility Control

Entity Type

- ☑ Package
- ☑ Class
- ☑ Method
- ☑ Attribute

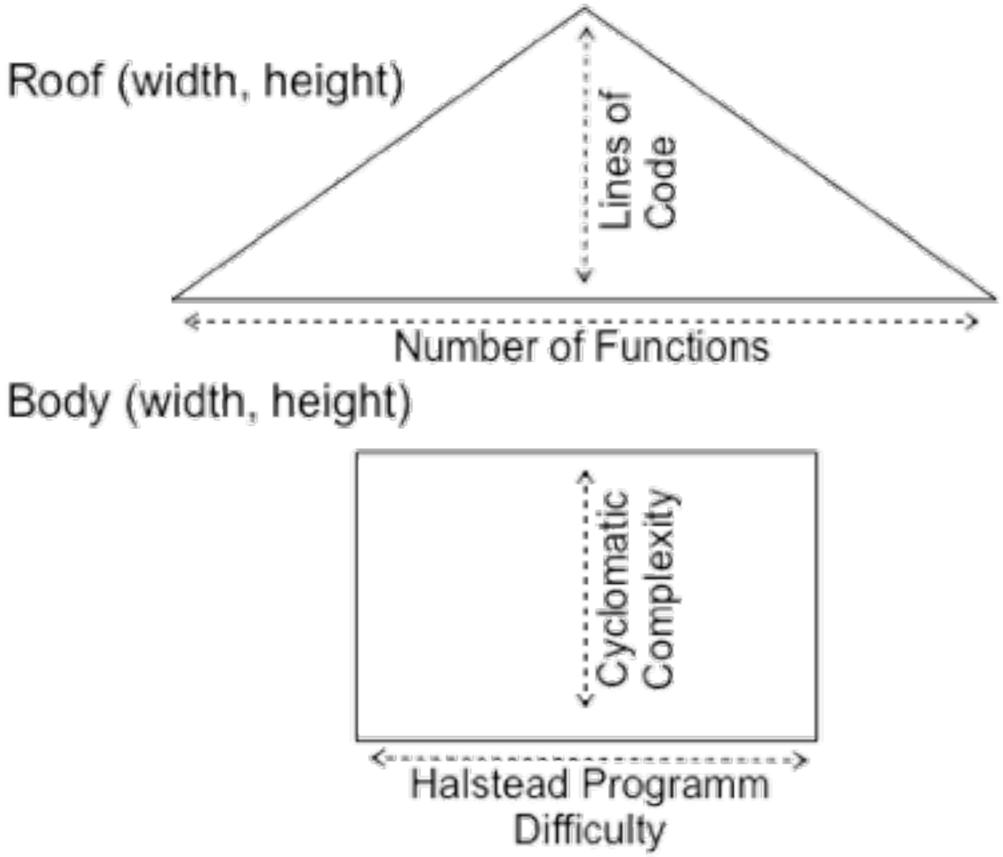
Association Visibility Control

Association Visibility

- ☑ Accesses
- ☑ Invocations
- ☐ Inherits
- ☐ Subtypes
- ☐ Cast tos
- ☐ Check Instance ofs

CocoViz - Where would you rather live in?

CocoViz - Metrics Mapping



Roof (width, height)

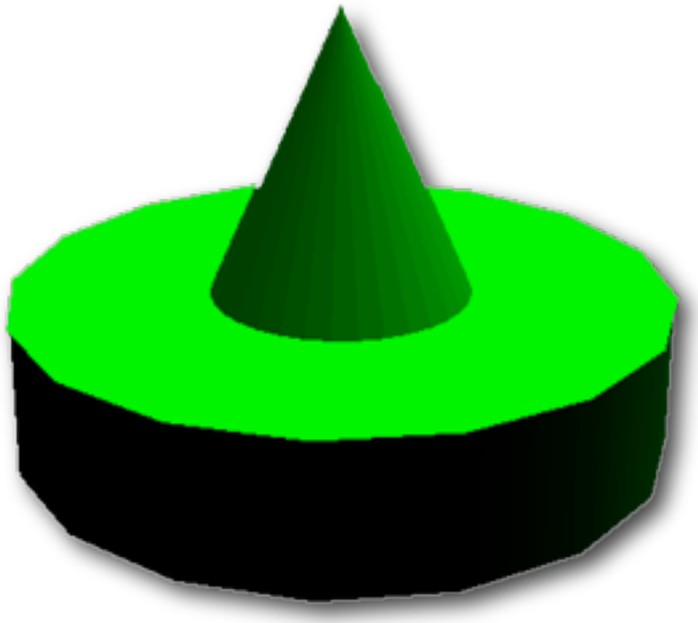
Lines of Code

Number of Functions

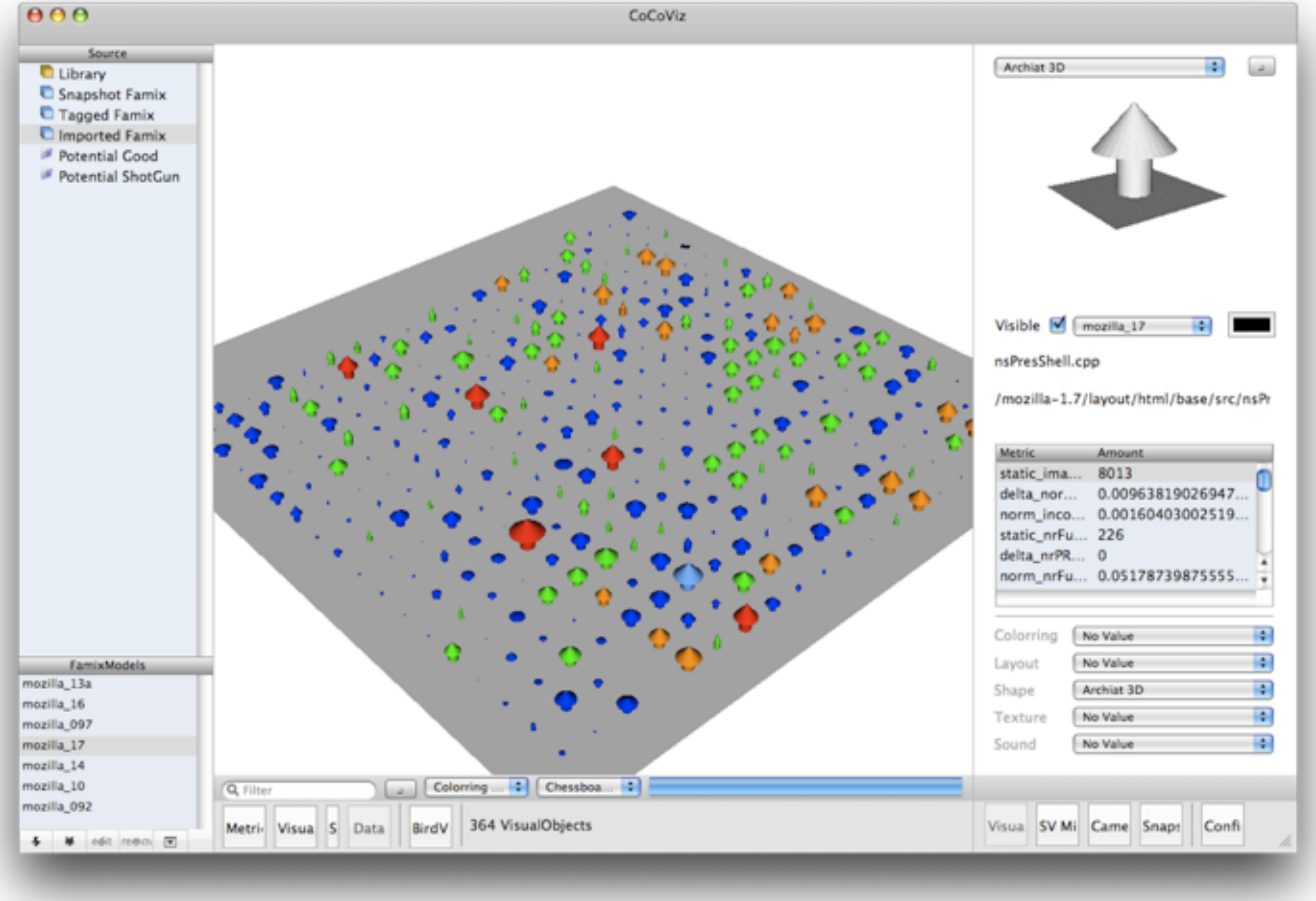
Body (width, height)

Cyclomatic Complexity

Halstead Programm Difficulty



CocoViz - Tool



Visible ☑ mozilla_17

nsPresShell.cpp

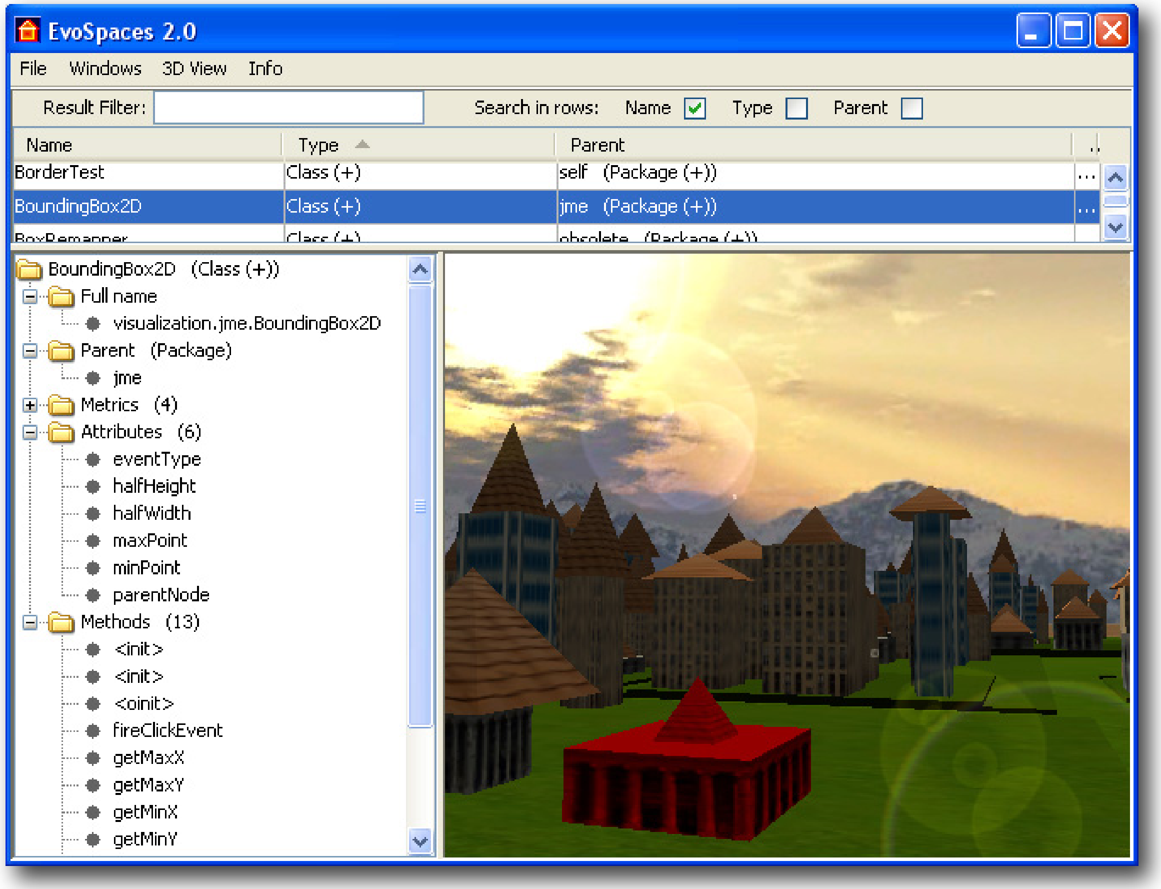
/mozilla-1.7/layout/html/base/src/nsPr

Metric	Amount
static_ima...	8013
delta_nor...	0.00963819026947...
norm_inco...	0.00160403002519...
static_nrFu...	226
delta_nrPR...	0
norm_nrFu...	0.05178739875555...

Colorring	No Value
Layout	No Value
Shape	Archiat 3D
Texture	No Value
Sound	No Value

364 VisualObjects

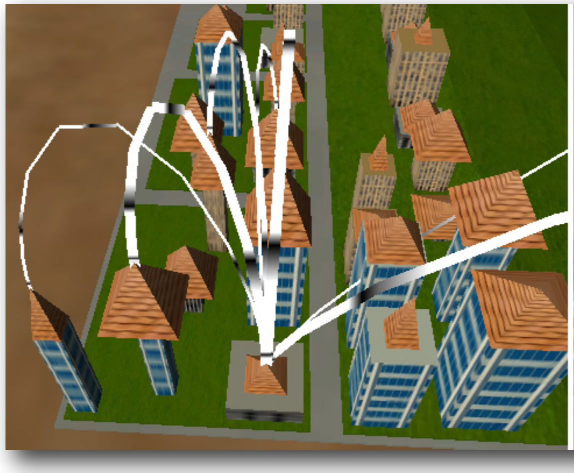
EvoSpaces2

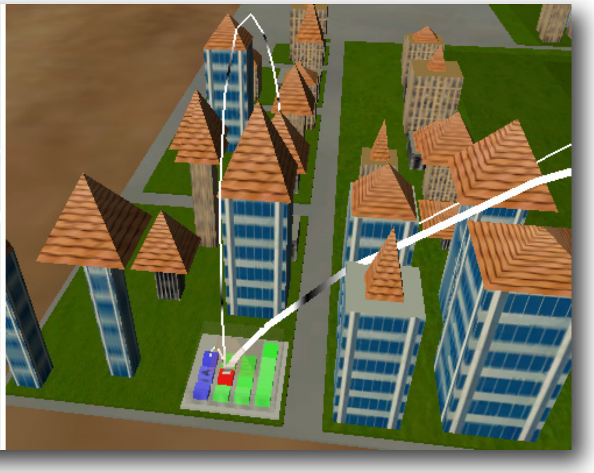


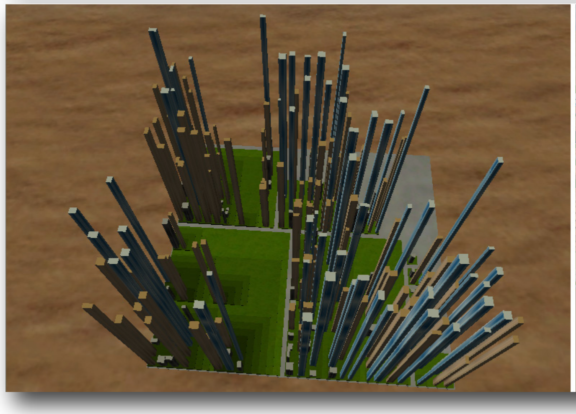
Result Filter:

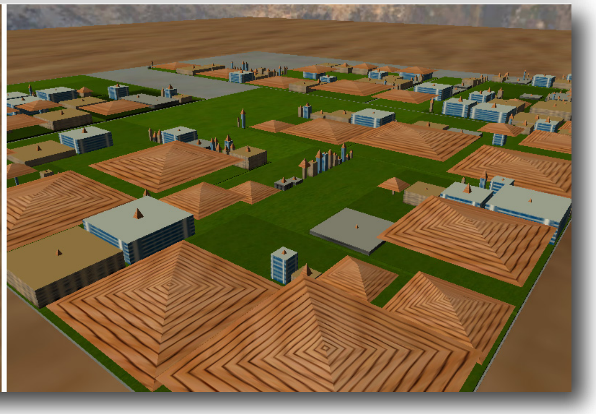
Name	Type	Parent
BorderTest	Class (+)	self (Package (+))
BoundingBox2D	Class (+)	jme (Package (+))
BoxRemapper	Class (+)	obsolete (Package (+))

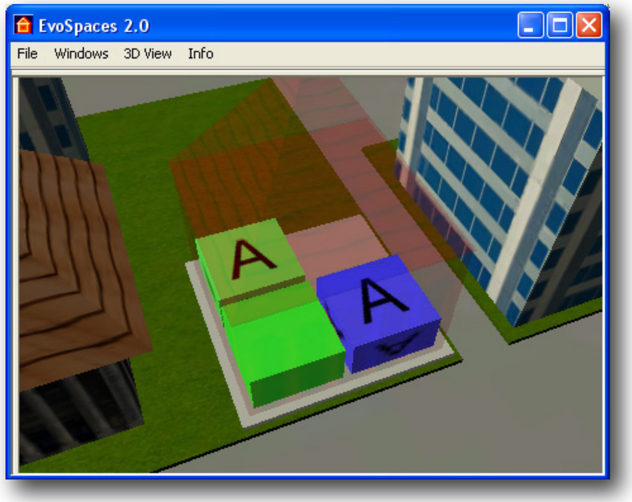
- BoundingBox2D (Class (+))
  - Full name
    - visualization.jme.BoundingBox2D
  - Parent (Package)
    - jme
  - Metrics (4)
  - Attributes (6)
    - eventType
    - halfHeight
    - halfWidth
    - maxPoint
    - minPoint
    - parentNode
  - Methods (13)
    - <init>
    - <init>
    - <oinit>
    - fireClickEvent
    - getMaxX
    - getMaxY
    - getMinX
    - getMinY

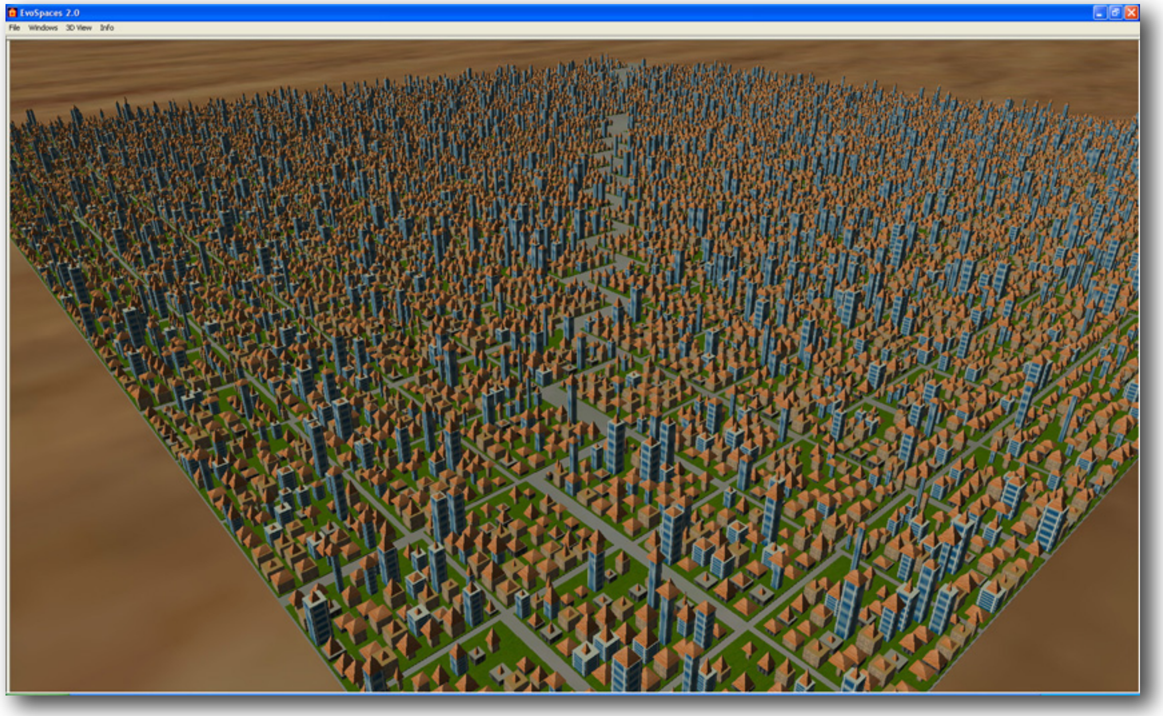




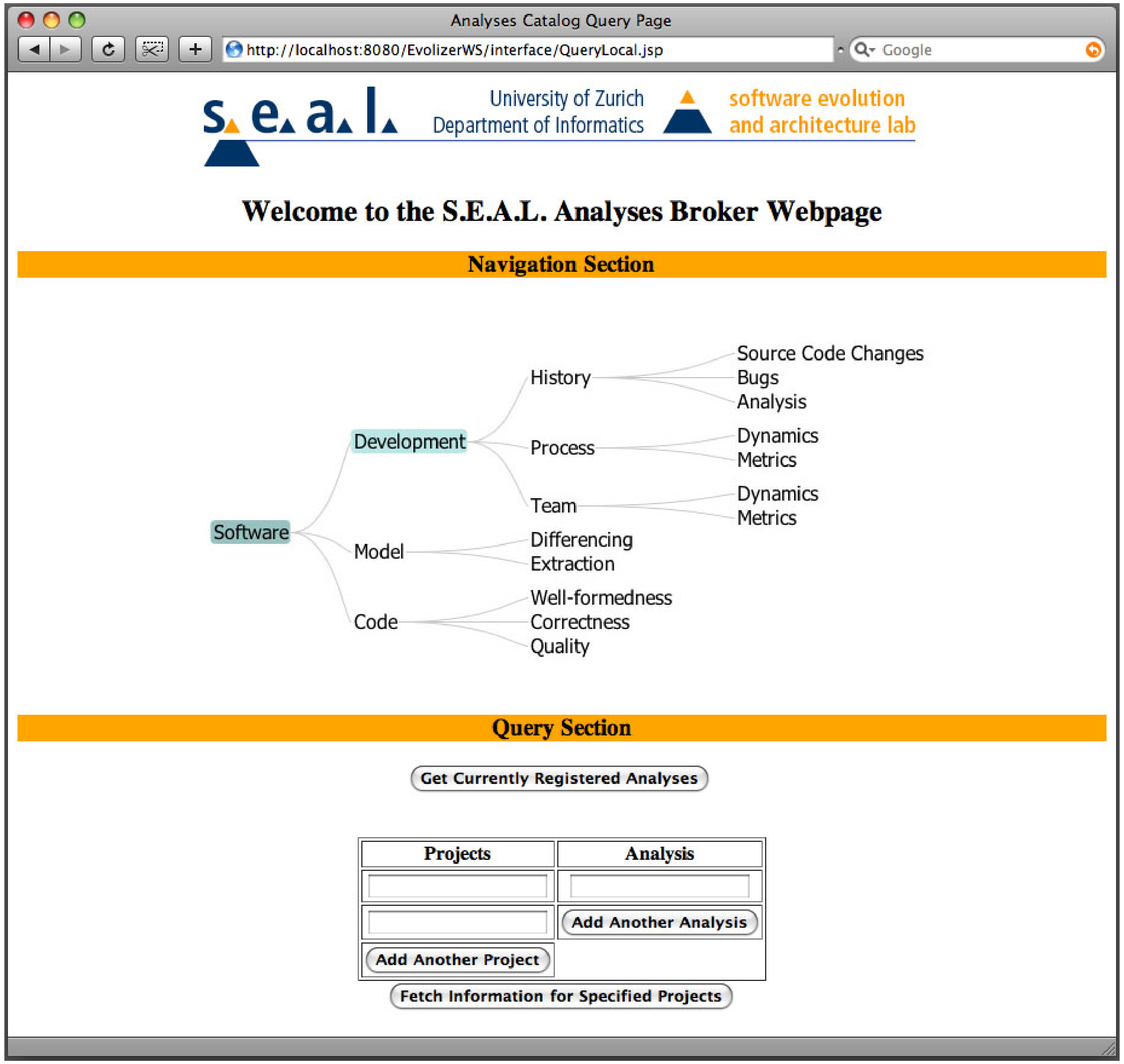








Sofas



Analyses Catalog Query Page

http://localhost:8080/EvolizerWS/interface/QueryLocal.jsp

s.e.a.l. University of Zurich Department of Informatics software evolution and architecture lab

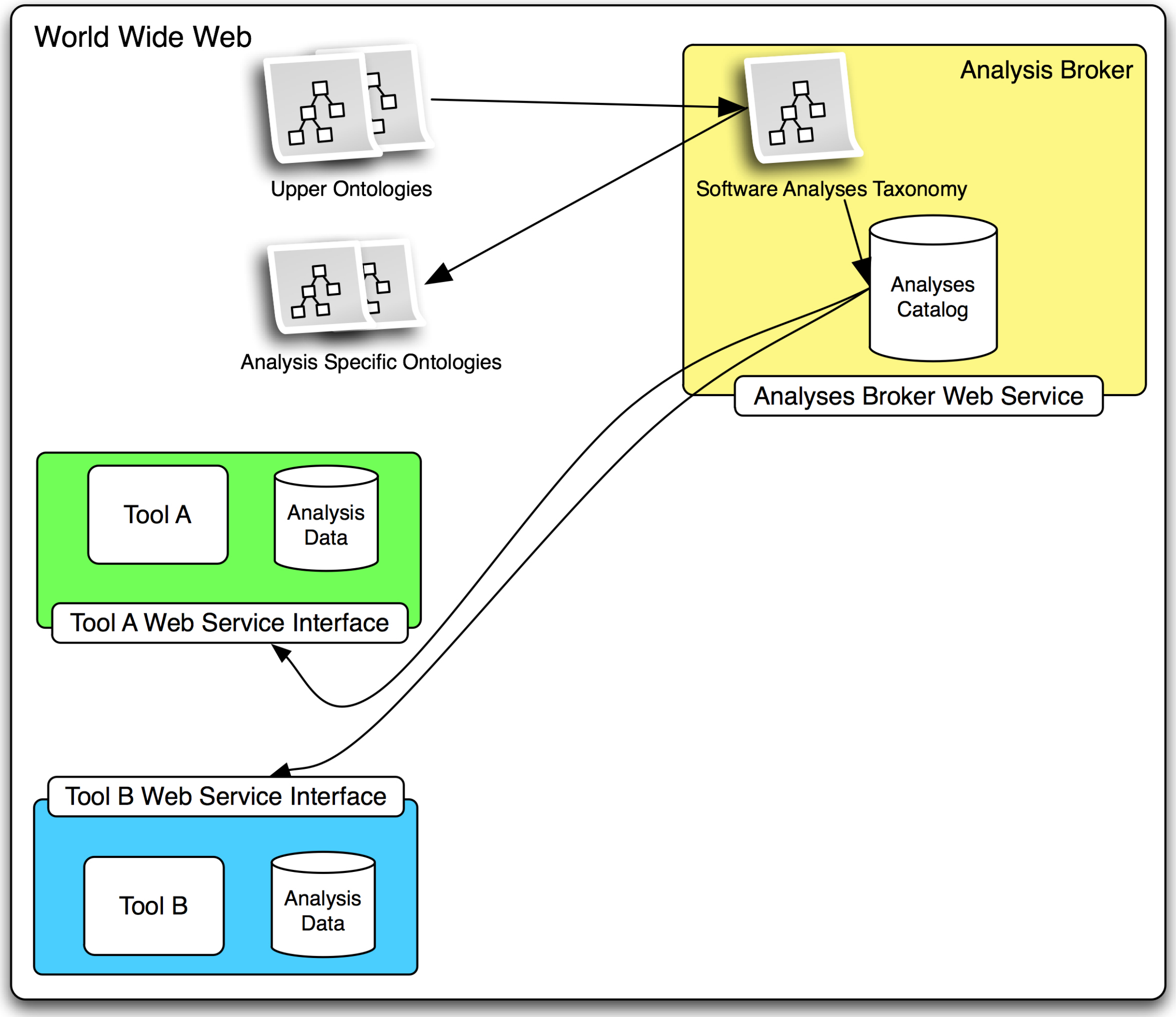
Welcome to the S.E.A.L. Analyses Broker Webpage

Navigation Section

Query Section

Get Currently Registered Analyses
Add Another Analysis
Add Another Project
Fetch Information for Specified Projects
Google

Projects	Analysis



World Wide Web
Upper Ontologies
Analysis Specific Ontologies
Analysis Broker
Software Analyses Taxonomy
Analyses Catalog
Analyses Broker Web Service
Tool A
Analysis Data
Tool A Web Service Interface
Tool B Web Service Interface
Tool B
Analysis Data

Contributors

Martin Pinzger

Beat Fluri

Michael Würsch

Jonas Zuberbühler

Emanuel Giger

Harald Gall

www.evolizer.org

REGISTER
NOW