OpenOME distilled

@ Early Requirements Seminar, 2005

Presented by Yijun Yu

A Tool for Goal/Agent/Aspect-oriented Requirements Engineering

http://sourceforge.net/projects/openome

http://www.cs.toronto.edu/~yijun/OpenOME.html

Abstract

- OpenOME is a goal/agent/aspect-oriented requirements engineering tool. In this talk, we explain the current development of the OpenOME, as a result of reengineering the legacy OME tool. We explain the unique features of OpenOME and the improvements on usability, extensibility and interoperability. Currently OpenOME supports some advanced research topics such as goal modeling and analysis, ontology queries, requirements knowledge reuse. In the near future, it will support Web-service based editing, weaving of requirements goal aspects, discovery and application of requirements patterns, viewpoint extraction and applications through ontology queries, etc. OpenOME is 100% open-source and all contributions are welcome. At the end, we show how you can contribute.

Agenda

1. Motivations
2. What have been done since we started?
3. Some research topics
4. A tool *of you, by you and for you*:
   Any suggestions, contributions are extremely welcome!
5. How can you contribute?

1. Motivations: Reengineer OME

- *OME* = *Organizational Modeling Environment*.
  http://www.cs.toronto.edu/km/ome
  It was part of the *Tropos* project to support goal-oriented and agent-oriented requirements engineering methodologies
  (>5 years of development, >10 man-year efforts)
- J OME has been used by more than 130 users across the globe
- L Every OME user must sign an agreement with *Techne* because the core *Telos* knowledge base is a binary module protected by the license
- To enlarge the user-base and make it fully-extensible, we decide to open-source it last year … *OpenOME*
  - Replace the *Telos* DLL module with an open-source module
  - Reengineer the code base to pure Java
  - Reshape the plug-in architecture
  - Integrate with other modules
- Some quality improvements
  - Usability, Scalability, Extensibility, Reusability, etc.

What is OpenOME good for?

- OpenOME is a general graph editor, supporting conceptual modeling for Entity Relationships (ER), goal models (NFR, i*, GRL), etc.
- It is designed to support requirements engineering
  - Goal-oriented: goal reasoning through label propagation (GRL, i* strategic rationale, NFR)
  - Agent-oriented: group goals into agents (i* strategic dependency)
  - Aspect-oriented: group NFR in the "v"-graphs into aspects
- It can interoperate with other graph editors
  - ConceptBase (OTelos) …………………… ..already in OME
  - Stanford Protégé………..Ontology Editors….. (OWL)
  - AT&T Graphviz…………Graph Layouts……. (DOT)
  - Microsoft Visio..…………Scalability…………..(XSLT)
  - Rational unified process….Model-driven…… (EMF/XMI)

Acknowledgement
OpenOME is a forged effort

Progress until now …

- Eclipse development
- Copy/Paste support (with Zhifeng Liu)
- Interact with Protégé
  (Cascon’04 demo, with Eric, Jennifer, Frank, Jane, …)
- Load Visio model (with Jorge and Marcel)
- Layout through graphviz (with Xiaoxue)
- Load/Save Telos Knowledge Base without jtelos.dll (with Xiaoxue)
- Reengineering to the MVC pattern
- Q7 representations (with Julio)

How to begin with …

- Download the recent SDK at
  - http://sourceforge.net/projects/openome
  - http://www.cs.toronto.edu/~yijun/OpenOME.html
- Follow the instructions at
  - http://www.cs.toronto.edu/~yijun/OpenOME.html/preparation.html
- You can start OpenOME in various ways:
  - Command line: “run” versus “run_protege”
  - “Run” menu inside Eclipse
  - Windows: Associate file extensions “.tel”, “.q7”, “vdx” to “run.bat” under the OpenOME project directory

Input and Output Formats

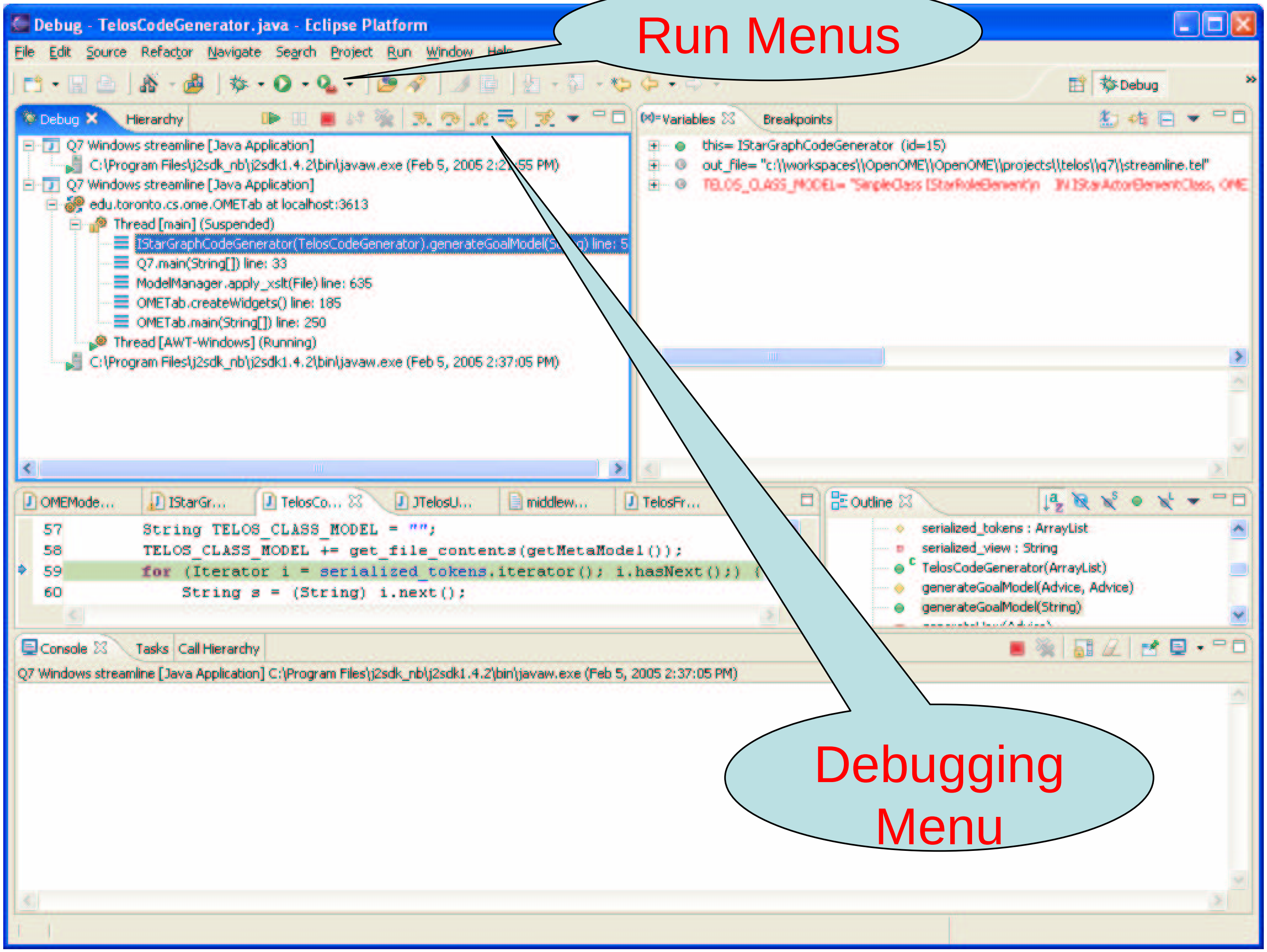
- run.bat projects/telos/q7/streamline.q7
- An input file can be in one of the following formats:
  - Telos
  - XML (E.g. Visio) provided there is an XSLT to convert it into Telos
  - Any programming language as long as you can create a parser using JavaCC
    (E.g., Telos, Q7)
  - DOT layout file, later …
  - Java/EMF/XMI model, later …
- An output file of OpenOME can be any of the following:
  - Telos, the de facto format
  - OTelos (SML), to communicating with ConceptBase
  - Any output format supported through Protégé (E.g., OWL)
  - PNG, the model can be saved into (File/Extract …) a high-quality picture
  - DOT, the graph description format for Graphviz is saved when you do “File/Layout…”

2. What we have done?

1. Eclipse development
2. Copy/Paste support (with Zhifeng Liu)
3. Interact with Protégé
4. Load Visio model (with Jorge and Marcel)
5. Layout through graphviz (with Xiaoxue)
6. Load/Save Telos Knowledge Base without jtelos.dll (with Xiaoxue)
7. Q7 representations (with Julio)

2.1 Eclipse development

Double Click Here



```
Q7 Windows streamline [Java Application]
    C:\Program Files\j2sdk_nb\j2sdk1.4.2\bin\javaw.exe (Feb 5, 2005 2:2 55 PM)
Q7 Windows streamline [Java Application]
    edu.toronto.cs.ome.OMETab at localhost:3613
        Thread [main] (Suspended)
            IStarGraphCodeGenerator(TelosCodeGenerator).generateGoalModel(S   g) line: 5
            Q7.main(String[]) line: 33
            ModelManager.apply_xslt(File) line: 635
            OMETab.createWidgets() line: 185
            OMETab.main(String[]) line: 250
        Thread [AWT-Windows] (Running)
    C:\Program Files\j2sdk_nb\j2sdk1.4.2\bin\javaw.exe (Feb 5, 2005 2:37:05 PM)
```

```
this= IStarGraphCodeGenerator  (id=15)
out_file= "c:\\workspaces\\OpenOME\\OpenOME\\projects\\telos\\q7\\streamline.tel"
TELOS_CLASS_MODEL= "SingleClass IStarRoleElementKin   IN IStarActorElementClass, OME
```

```
    String TELOS_CLASS_MODEL = "";
    TELOS_CLASS_MODEL += get_file_contents(getMetaModel());
    for (Iterator i = serialized_tokens.iterator(); i.hasNext();) {
        String s = (String) i.next();
```

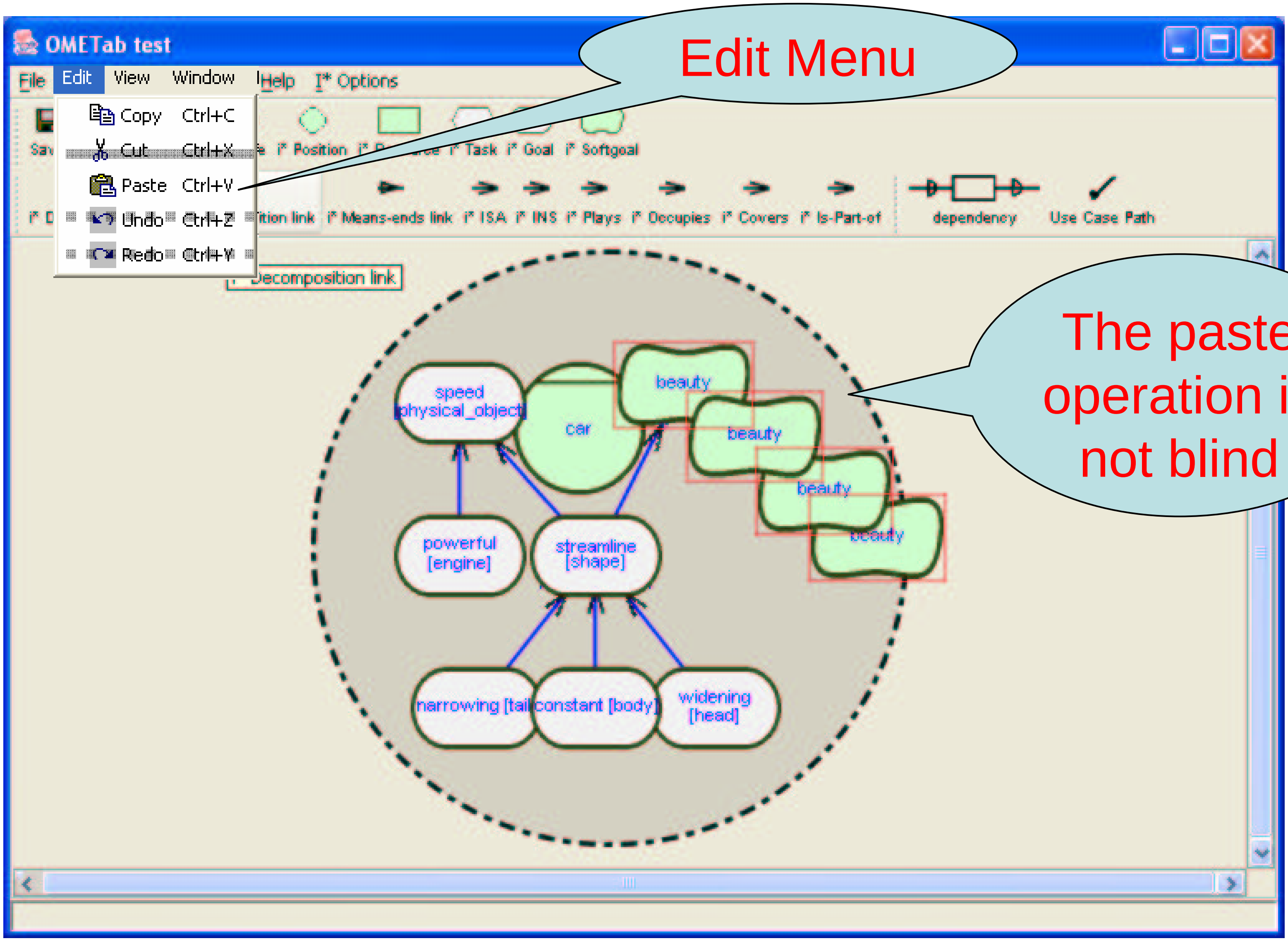
```
serialized_tokens : ArrayList
serialized_view : String
TelosCodeGenerator(ArrayList)
generateGoalModel(Advice, Advice)
generateGoalModel(String)
```

```
Q7 Windows streamline [Java Application] C:\Program Files\j2sdk_nb\j2sdk1.4.2\bin\javaw.exe (Feb 5, 2005 2:37:05 PM)
```

Run Menus

Debugging Menu

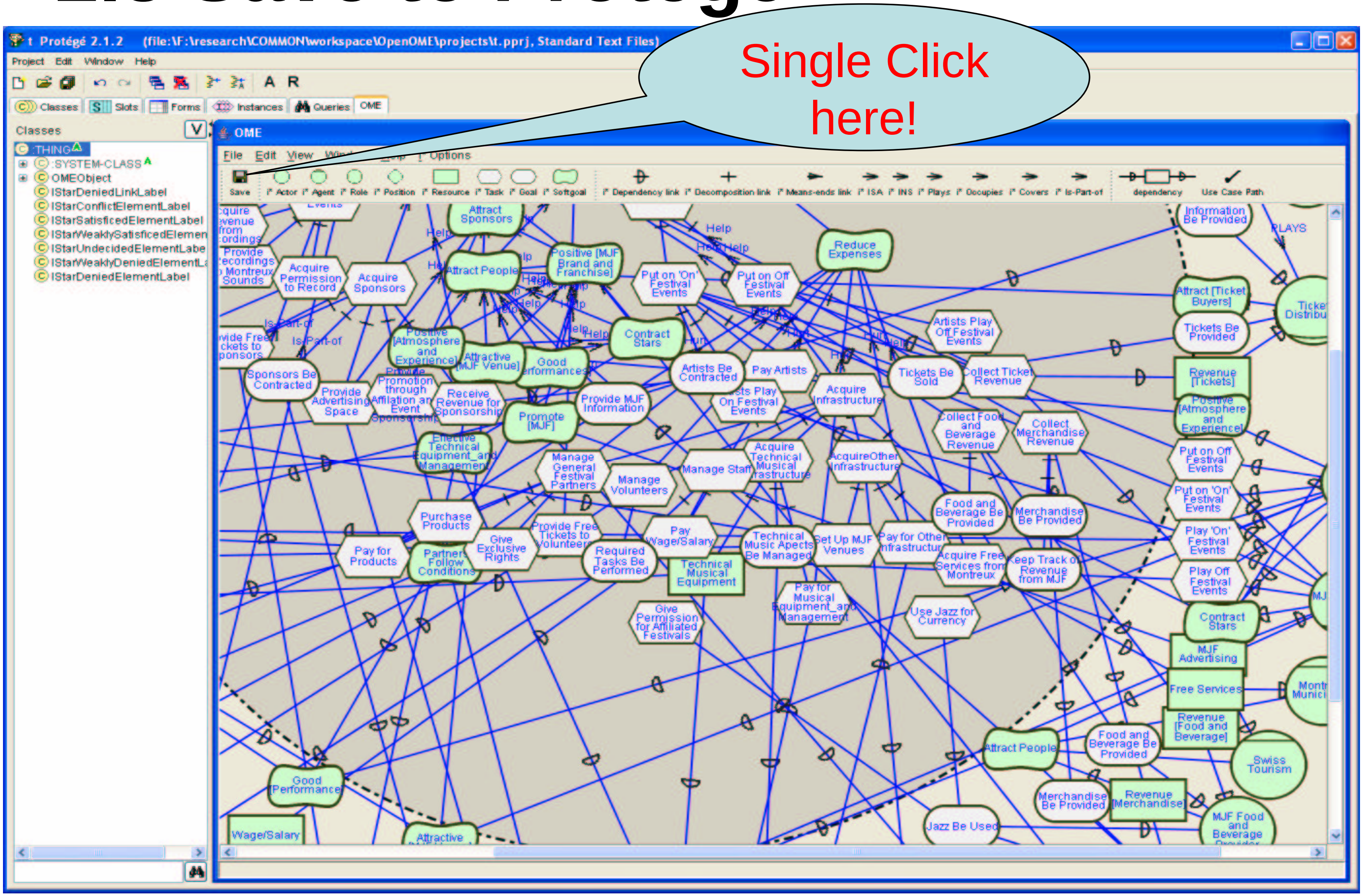
2.2 Copy and paste



Edit Menu

The paste operation is not blind

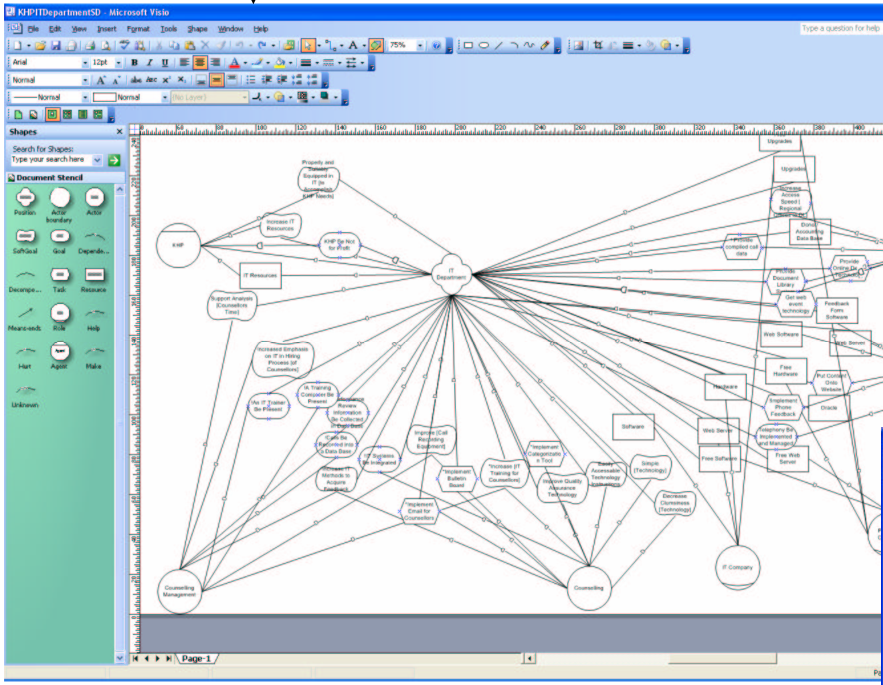
2.3 Save to Protégé

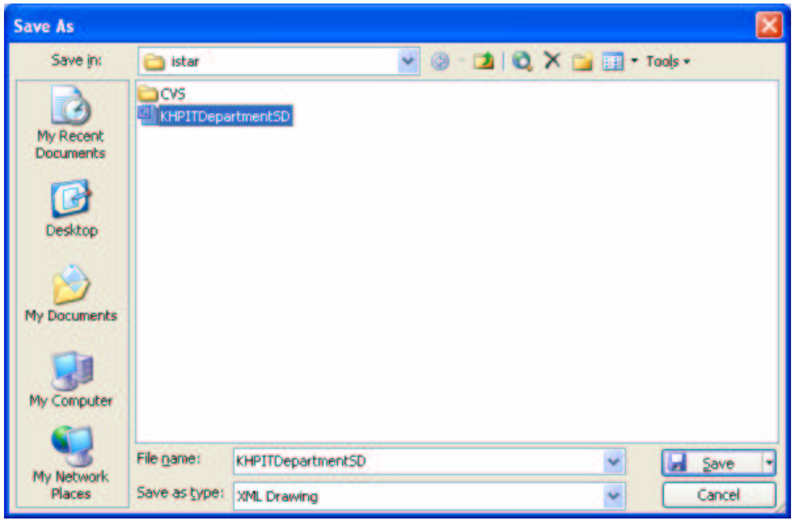

t Protégé 2.1.2 (file:\F:\research\COMMON\workspace\OpenOME\projects\t.pprj, Standard Text Files)
Project Edit Window Help
Classes Slots Forms Instances Queries OME
Classes
:THING
:SYSTEM-CLASS
OMEObject
IStarDeniedLinkLabel
IStarConflictElementLabel
IStarSatisficedElementLabel
IStarWeaklySatisficedElemen
IStarUndecidedElementLabe
IStarWeaklyDeniedElementL
IStarDeniedElementLabel
OME
File Edit View Options
Save
Actor Agent Role Position Resource Task Goal Softgoal
Dependency link Decomposition link Means-ends link ISA INS Plays Occupies Covers Is-Part-of
dependency Use Case Path
Attract Sponsors
Acquire Permission to Record
Acquire Sponsors
Attract People
Positive [MJF Brand and Franchise]
Put on 'On' Festival Events
Put on Off Festival Events
Reduce Expenses
Information Be Provided
PLAYS
Attract [Ticket Buyers]
Tickets Be Provided
Ticket Distribu
Artists Play Off Festival Events
Contract Stars
Positive [Atmosphere and Experience]
Attractive [MJF Venue]
Good Performances
Sponsors Be Contracted
Provide Advertising Space
Promotion through Affiliation and Event Sponsorship
Receive Revenue for Sponsorship
Artists Be Contracted
Pay Artists
Artists Play On Festival Events
Acquire Infrastructure
Tickets Be Sold
Collect Ticket Revenue
Revenue [Tickets]
Provide MJF Information
Promote [MJF]
Effective Technical Equipment and Management
Collect Food and Beverage Revenue
Collect Merchandise Revenue
Manage General Festival Partners
Manage Volunteers
Manage Staff
Acquire Technical Musical Infrastructure
AcquireOther Infrastructure
Put on Off Festival Events
Put on 'On' Festival Events
Purchase Products
Food and Beverage Be Provided
Merchandise Be Provided
Play 'On' Festival Events
Play Off Festival Events
Pay for Products
Partners Follow Conditions
Give Exclusive Rights
Provide Free Tickets to Volunteers
Required Tasks Be Performed
Pay Wage/Salary
Technical Music Apects Be Managed
Set Up MJF Venues
Pay for Other Infrastructure
Acquire Free Services from Montreux
Keep Track of Revenue from MJF
Technical Musical Equipment
Pay for Musical Equipment and Management
Give Permission for Affiliated Festivals
Use Jazz for Currency
Contract Stars
MJF Advertising
Free Services
Revenue [Food and Beverage]
Food and Beverage Be Provided
Attract People
Swiss Tourism
Good Performance
Merchandise Be Provided
Revenue [Merchandise]
MJF Food and Beverage
Jazz Be Used
Wage/Salary
Attractive
Help
Is-Part-of

Single Click here!

- i* in Visio

2.4 Visio

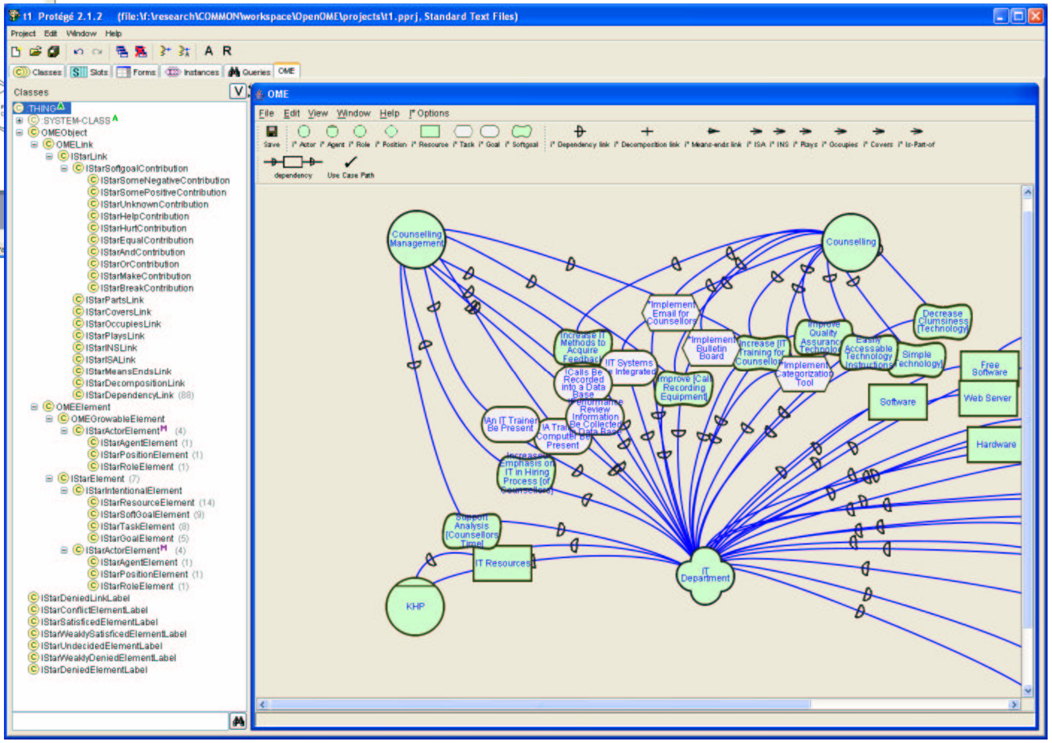




File name: KHPITDepartmentSD

Save as type: XML Drawing

- The Visio graph loaded into OpenOME

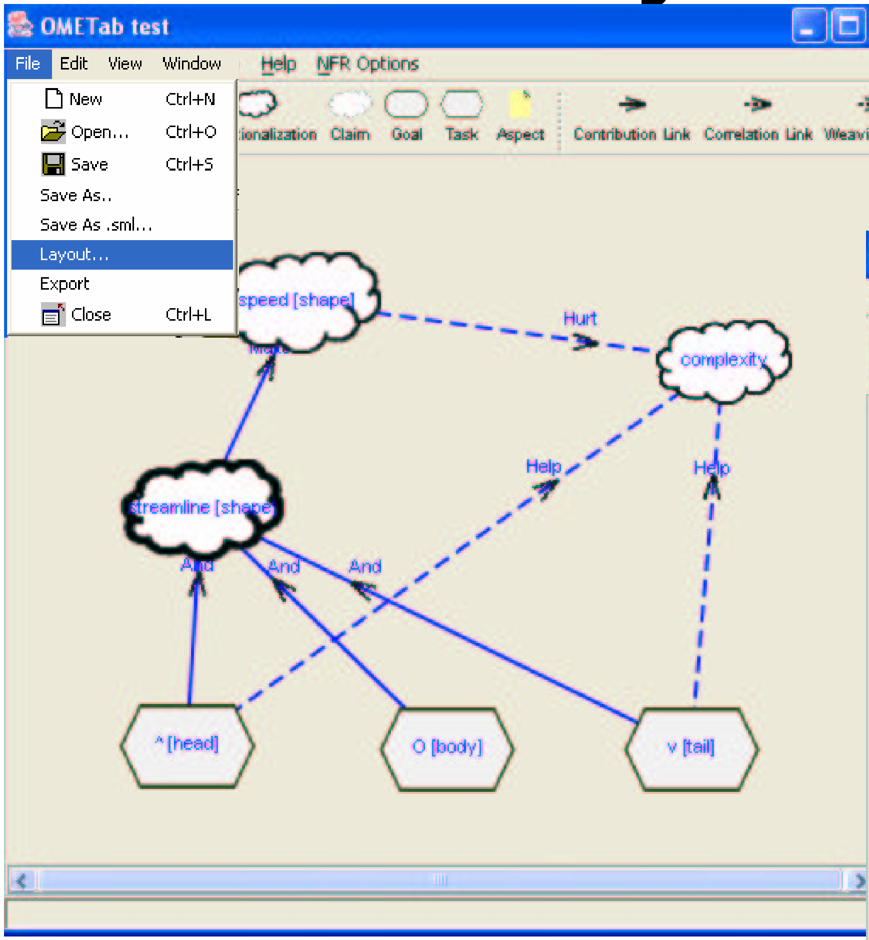


t1 Protégé 2.1.2 (file:\f:\research\COMMON\workspace\OpenOME\projects\t1.pprj, Standard Text Files)

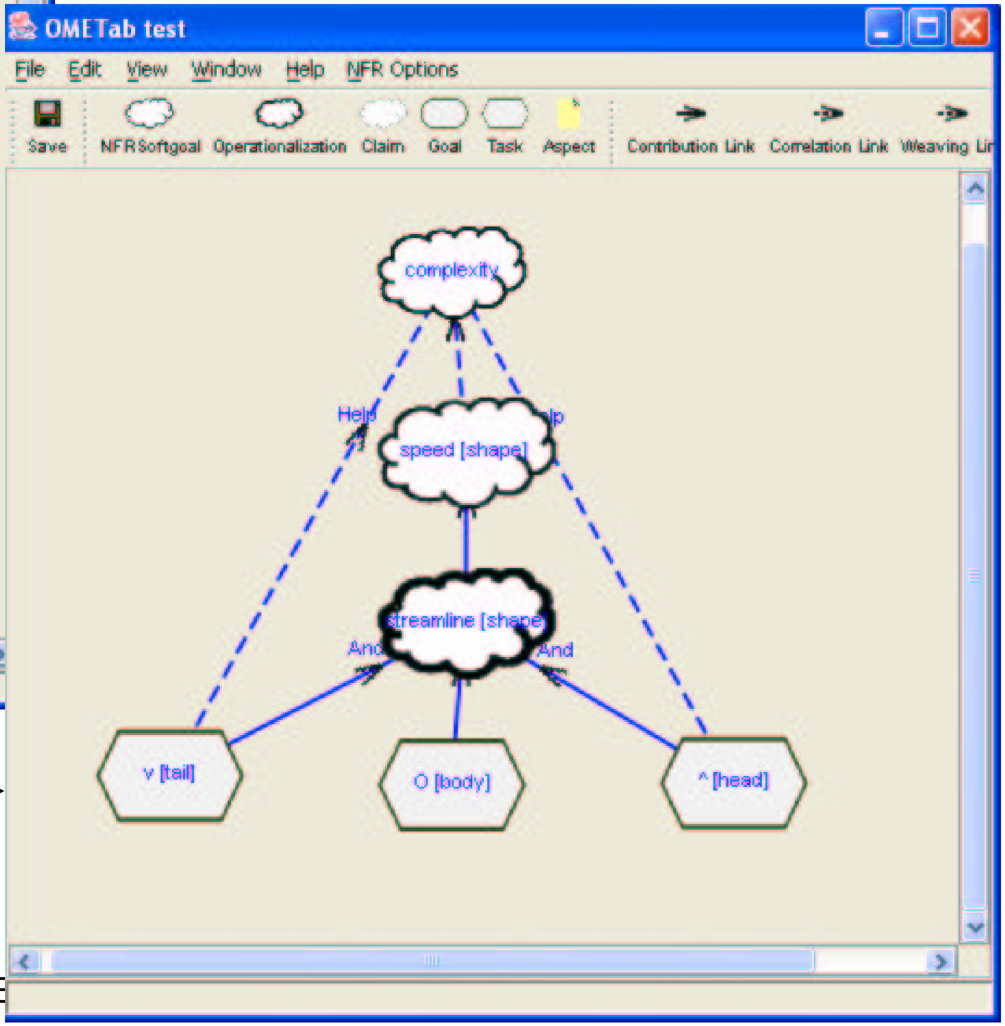
Classes

```
:THING
  :SYSTEM-CLASS
  OMEObject
    OMELink
      IStarLink
        IStarSoftgoalContribution
          IStarSomeNegativeContribution
          IStarSomePositiveContribution
          IStarUnknownContribution
          IStarHelpContribution
          IStarHurtContribution
          IStarEqualContribution
          IStarAndContribution
          IStarOrContribution
          IStarMakeContribution
          IStarBreakContribution
        IStarPartsLink
        IStarCoversLink
        IStarOccupiesLink
        IStarPlaysLink
        IStarINSLink
        IStarISALink
        IStarMeansEndsLink
        IStarDecompositionLink
        IStarDependencyLink (88)
    OMEElement
      OMEGrowableElement
        IStarActorElement (4)
          IStarAgentElement (1)
          IStarPositionElement (1)
          IStarRoleElement (1)
      IStarElement (7)
        IStarIntentionalElement
          IStarResourceElement (14)
          IStarSoftGoalElement (9)
          IStarTaskElement (8)
          IStarGoalElement (5)
        IStarActorElement (4)
          IStarAgentElement (1)
          IStarPositionElement (1)
          IStarRoleElement (1)
  IStarDeniedLinkLabel
  IStarConflictElementLabel
  IStarSatisficedElementLabel
  IStarWeaklySatisficedElementLabel
  IStarUndecidedElementLabel
  IStarWeaklyDeniedElementLabel
  IStarDeniedElementLabel
```

2.5 Auto layout

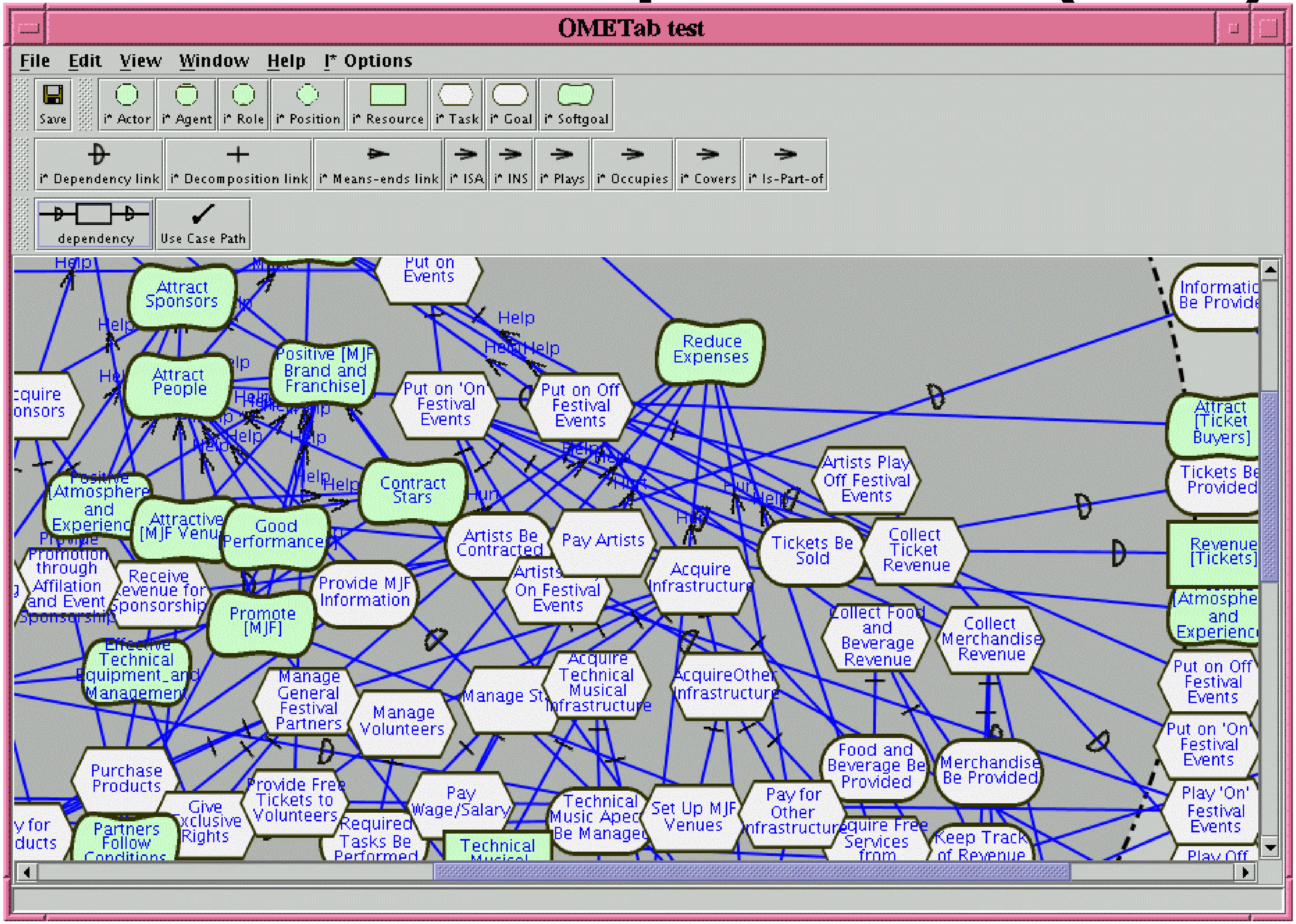


Before



After

2.6 Platform independence (MJF)



2.7 Q7 support
What is Q7?

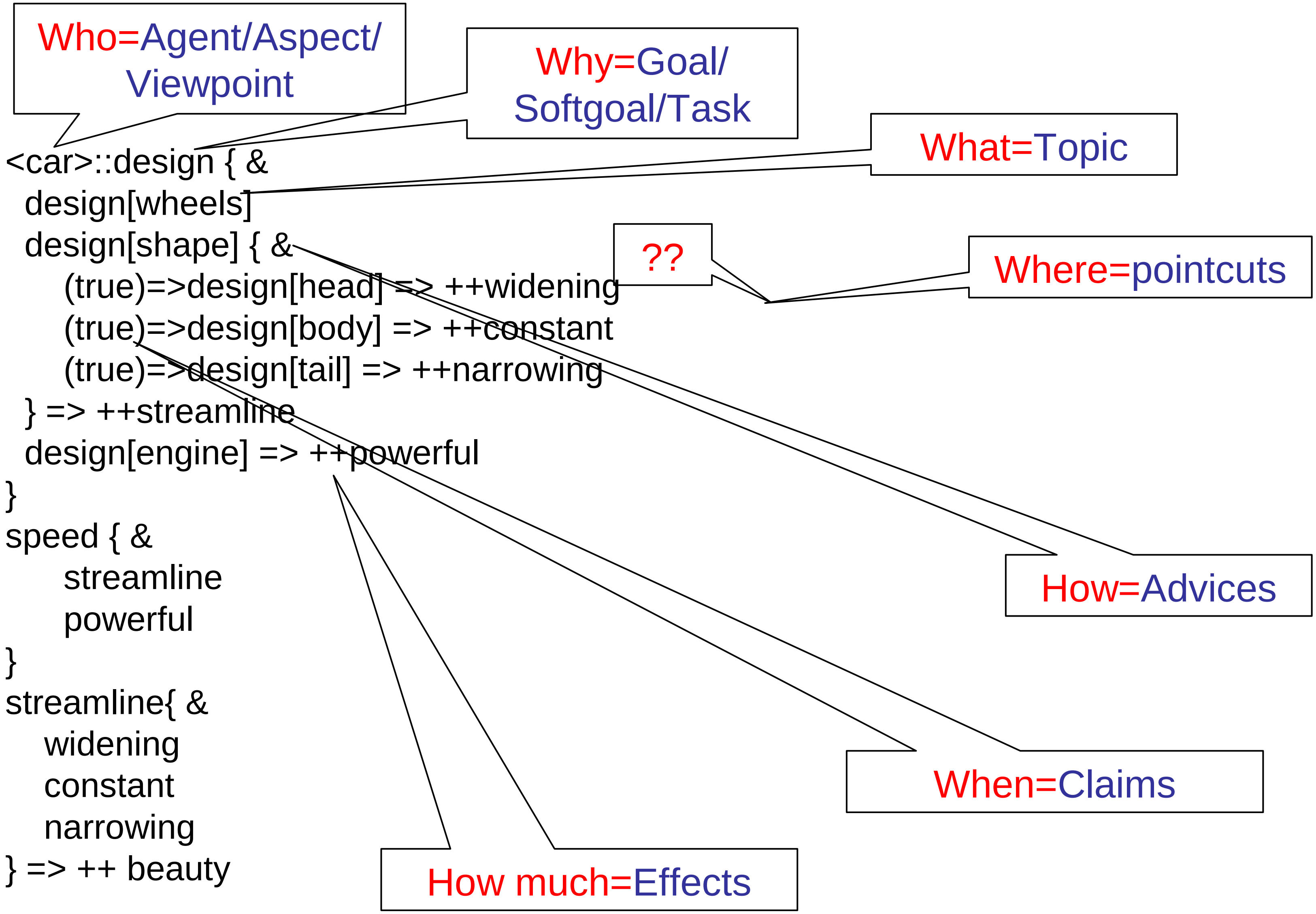
Q7 = 5W2H, an abstract language to classify NFR/i* knowledge for reuse

When	context-oriented
Who	agent-oriented
Why	goal-oriented
What	object-oriented
Where	aspect-oriented
How	system/function-oriented
How much	metric-oriented

3. Some research topics

1. Q7, supporting the quality-based software reuse using aspect-oriented technology
   It also supports checklist requested by the KHP group J
2. *Ontology and Viewpoints:*
   find errors
   actor class view
   Future work: PAL (Protégé Axiom Language) Queries
   Future work: Front-end for Homomorphism Views Merging
3. *Reasoning with Goal Models through label propagation*
   Future work
   No time to expand the following topics:
4. Requirements and other SE phases
   1. Forward Engineering:
      From Stakeholder Goals to High-variability Software Designs
   2. Reverse Engineering:
      Refactoring Source Code into Goal Models
   3. *Conceptual modeling*: EclipseUML ó Ontology ó Telos
5. OmniGraphEditor + OpenOME: Web-service oriented implementation of the group editing of the requirements goal models (course project of ECE450)

3.1 Q7 language for aspect reuse



```
<car>::design { &
  design[wheels]
  design[shape] { &
      (true)=>design[head] => ++widening
      (true)=>design[body] => ++constant
      (true)=>design[tail] => ++narrowing
  } => ++streamline
  design[engine] => ++powerful
}
speed { &
      streamline
      powerful
}
streamline{ &
    widening
    constant
    narrowing
} => ++ beauty
```

Who=Agent/Aspect/Viewpoint

Why=Goal/Softgoal/Task

What=Topic

??

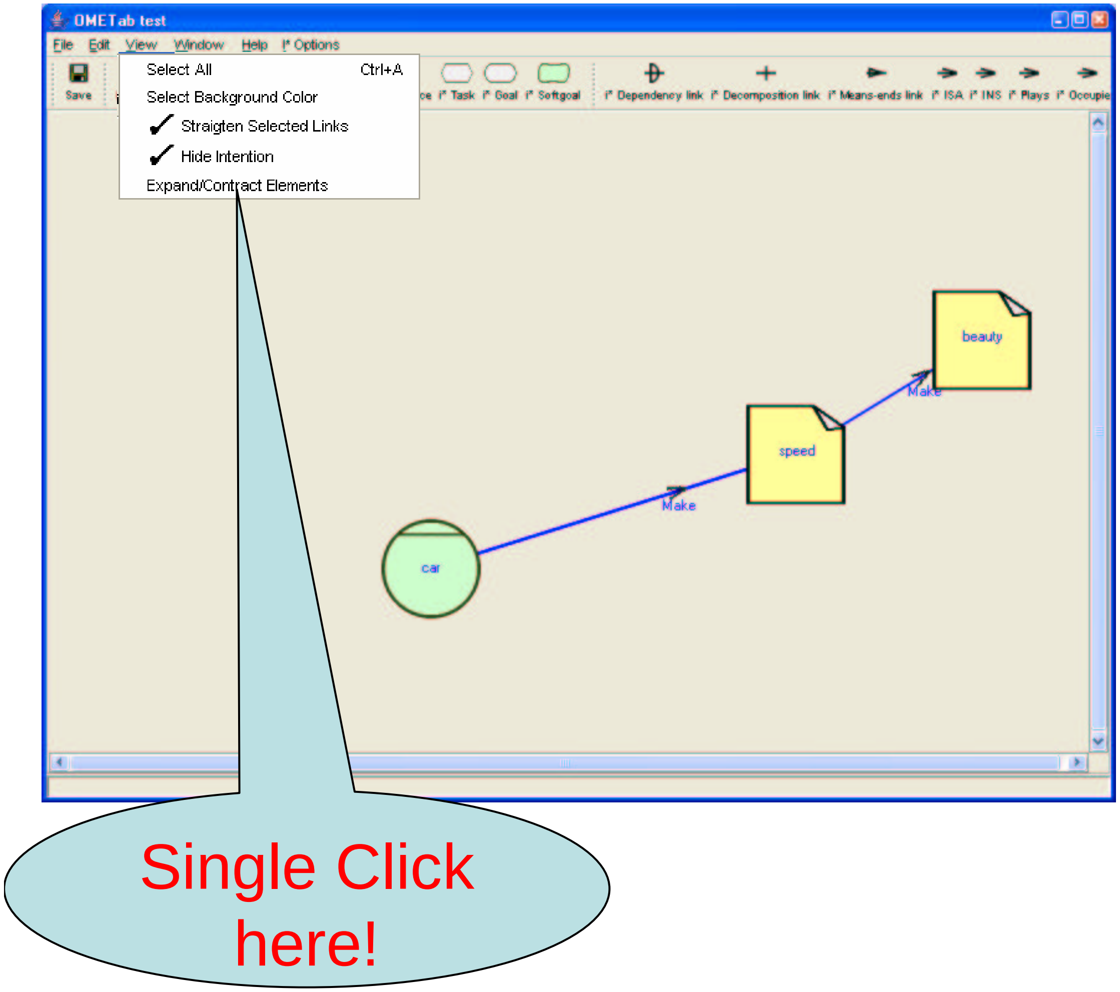
Where=pointcuts

How=Advices

When=Claims

How much=Effects

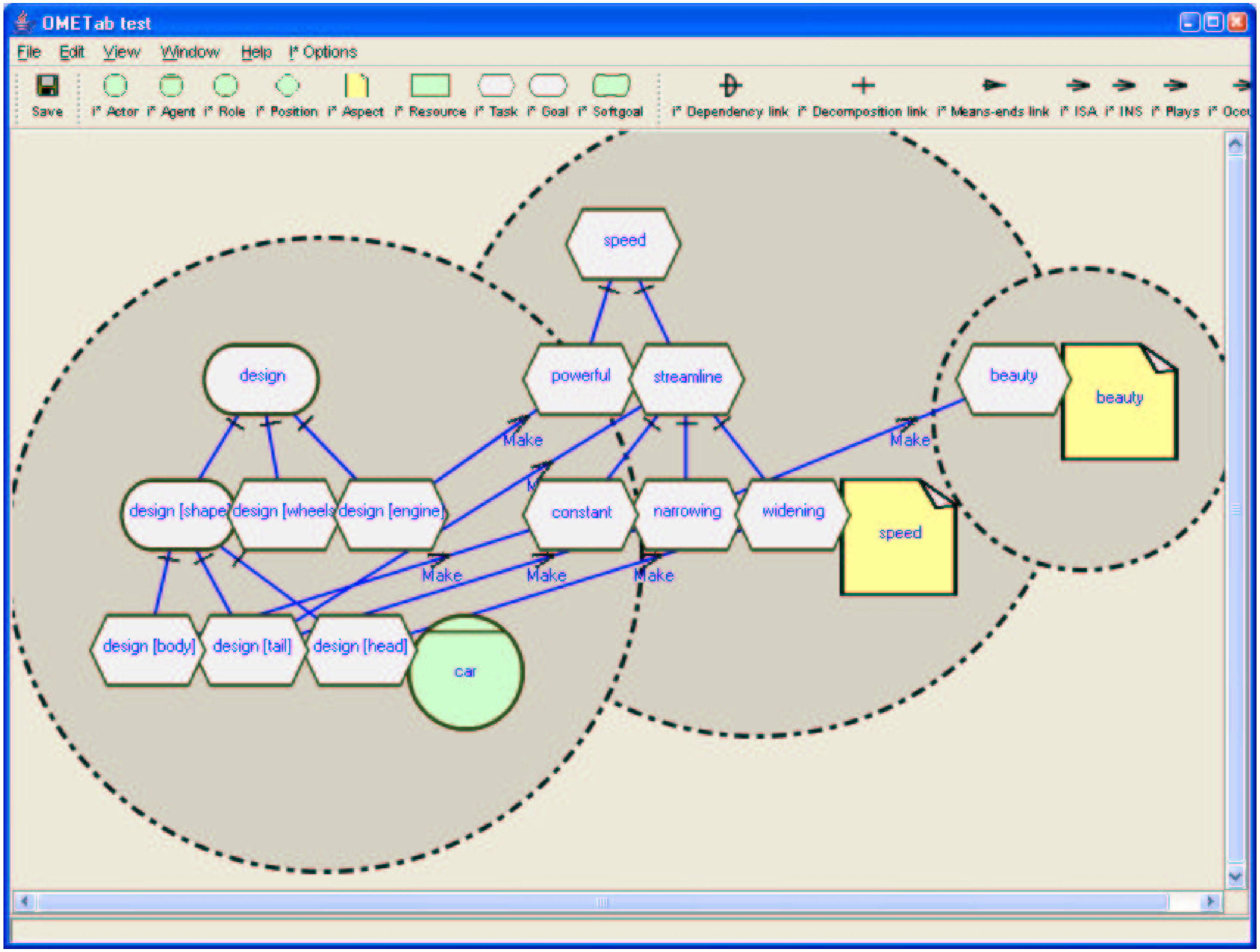
Q7 loaded in OpenOME


OMETab test
File Edit View Window Help i* Options
Save
Select All Ctrl+A
Select Background Color
✓ Straigten Selected Links
✓ Hide Intention
Expand/Contract Elements
i* Task i* Goal i* Softgoal
i* Dependency link i* Decomposition link i* Means-ends link i* ISA i* INS i* Plays i* Occupie
beauty
Make
speed
Make
car

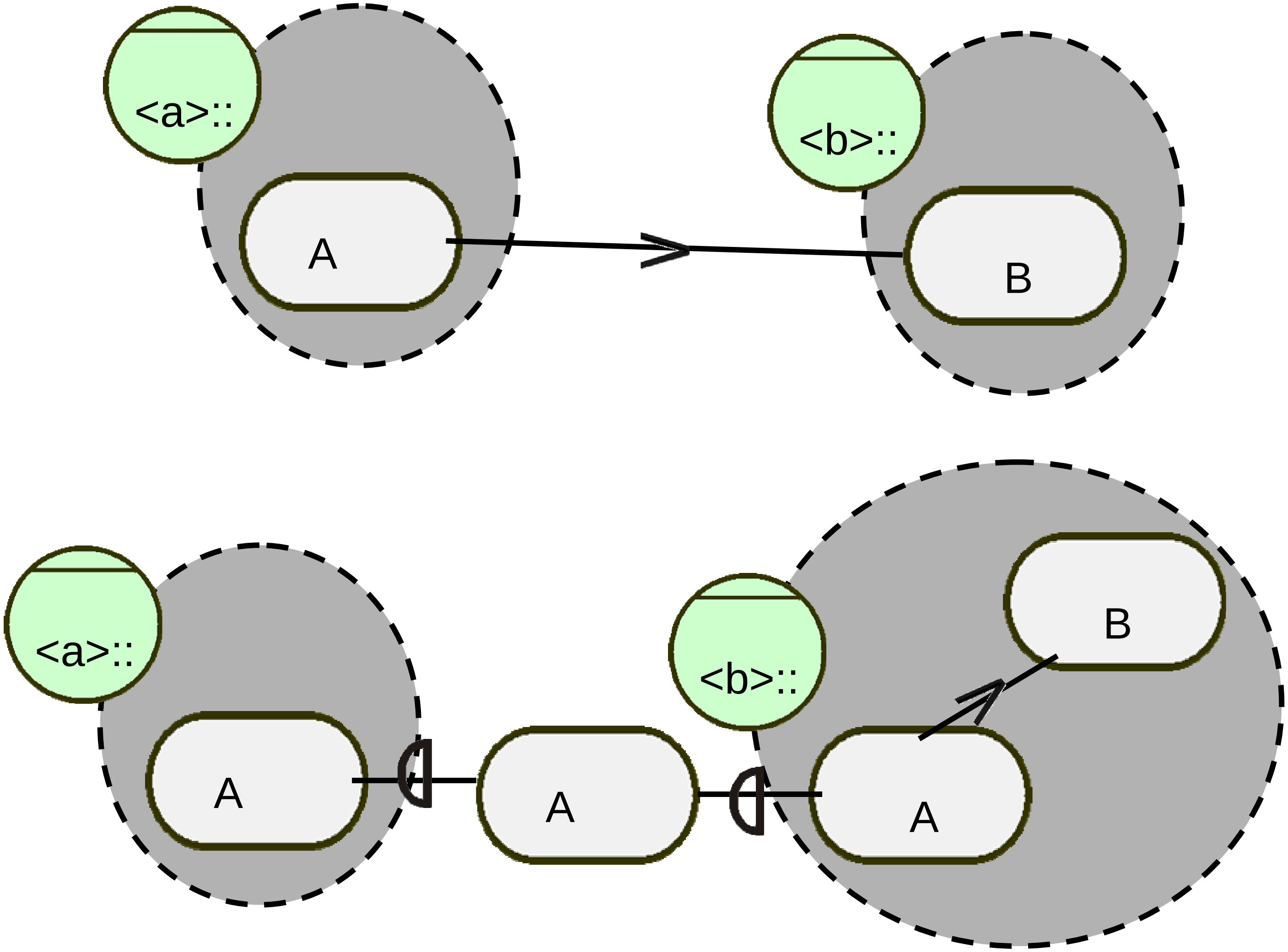
Single Click here!

- Initially, the agents are compacted
- You can expand them into the Strategic Rationale view

Result i* SR model



A pattern to create strategic dependencies (not done yet)

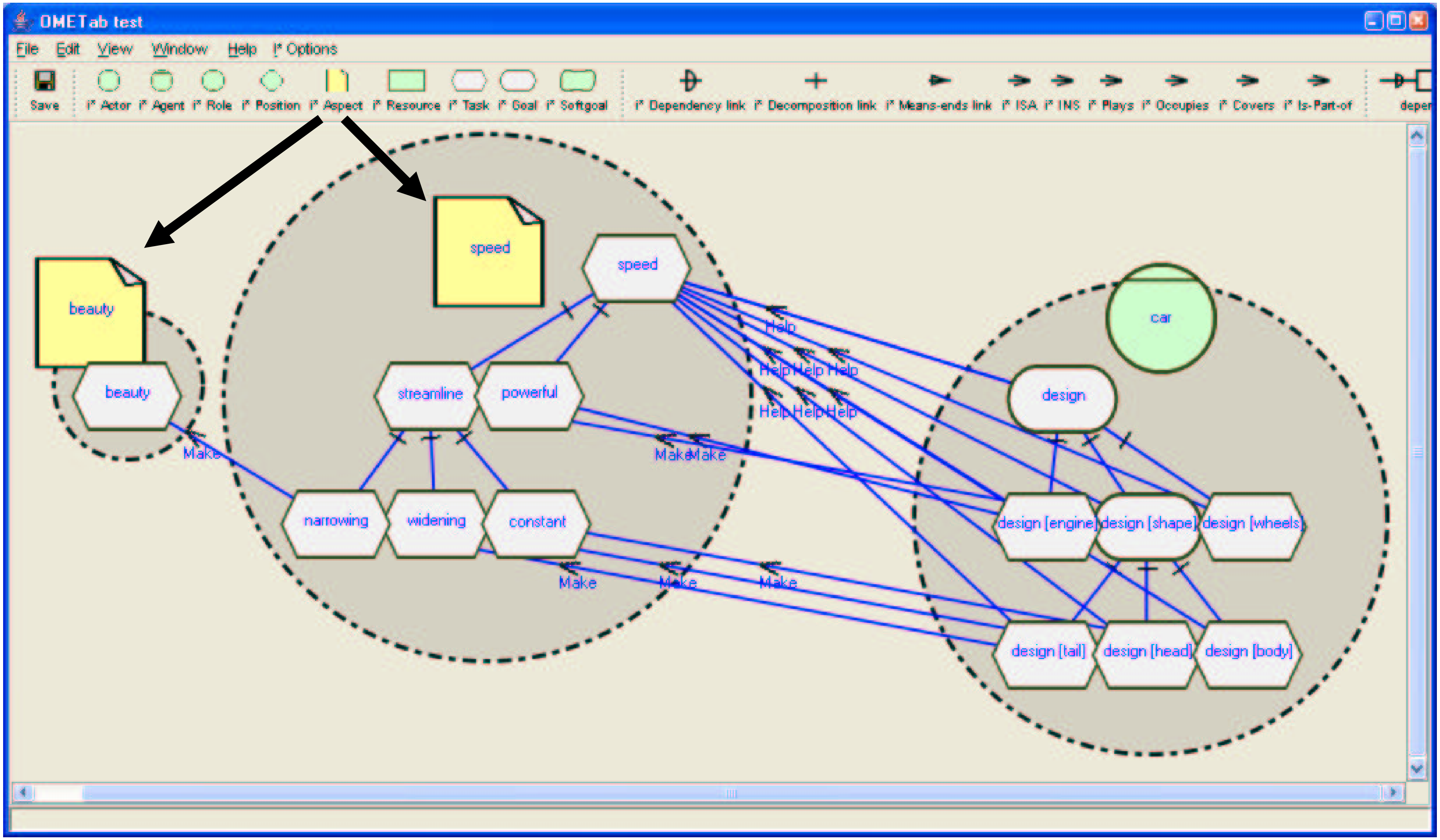


Where are the aspects?

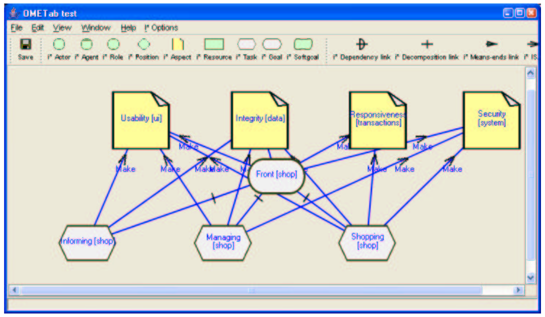
```
<car>::design { &
  design[wheels]
  design[shape] { &
      (true)=>design[head] => ++widening
      (true)=>design[body] => ++constant
      (true)=>design[tail] => ++narrowing
  } => ++streamline
  design[engine] => ++powerful
}
speed { &
      streamline
      powerful
}
streamline{ &
    widening
    constant
    narrowing
} => ++ beauty
```

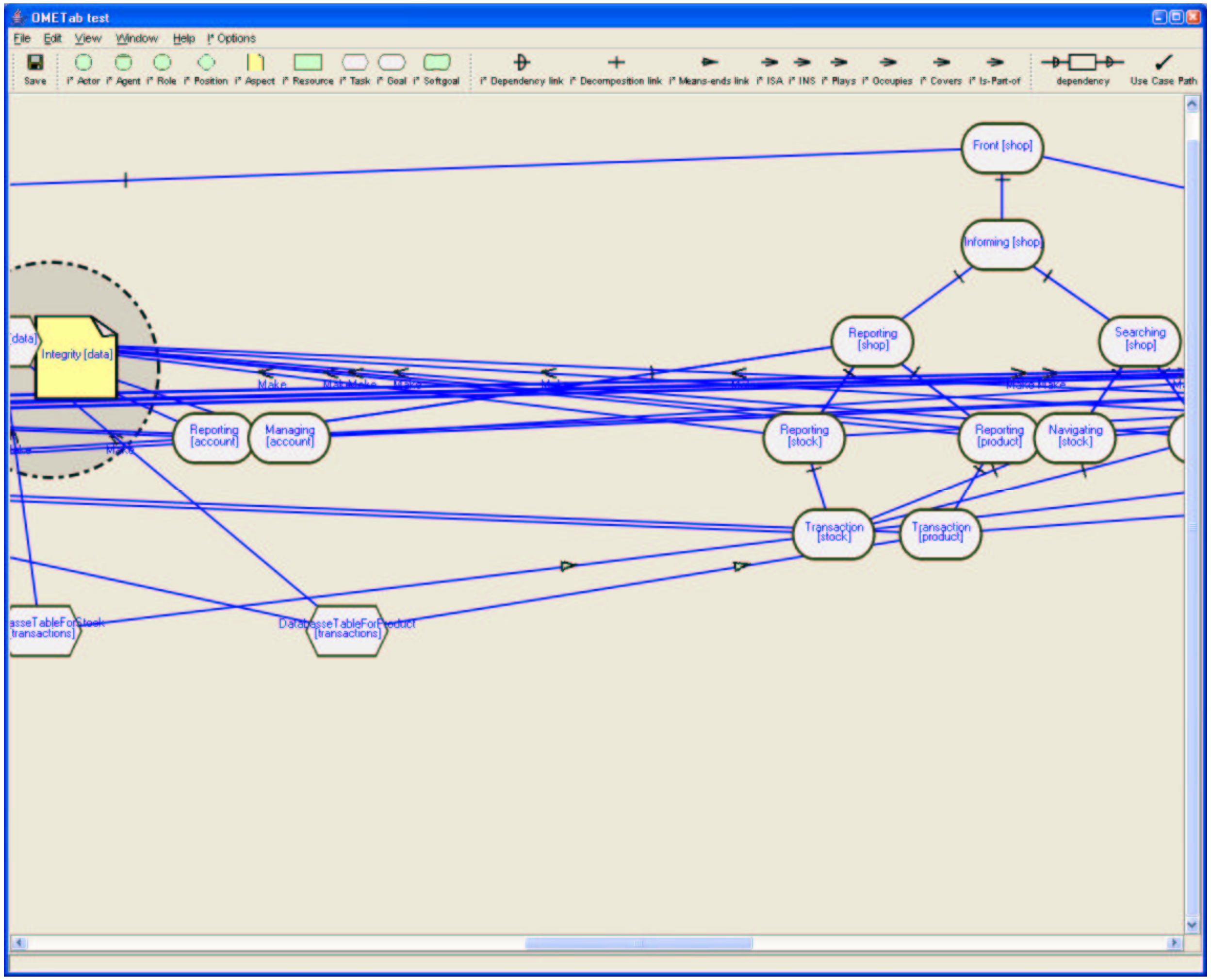
```
<car>::design { &
  design[wheels]
  design[shape] { &
         (true)=> design[head]
         (true)=> design[body]
         (true)=> design[tail]
  }
  design[engine]
}
<speed>::speed { &
      streamline<=++*[shape]
      powerful<=++*[engine]
}
<beauty>:: beauty {&
      streamline<=++*[shape]
}
streamline { &
    widening <=++*[head]
    constant  <=++*[body]
    narrowing<=++*[tail]
}
```

Automatically woven

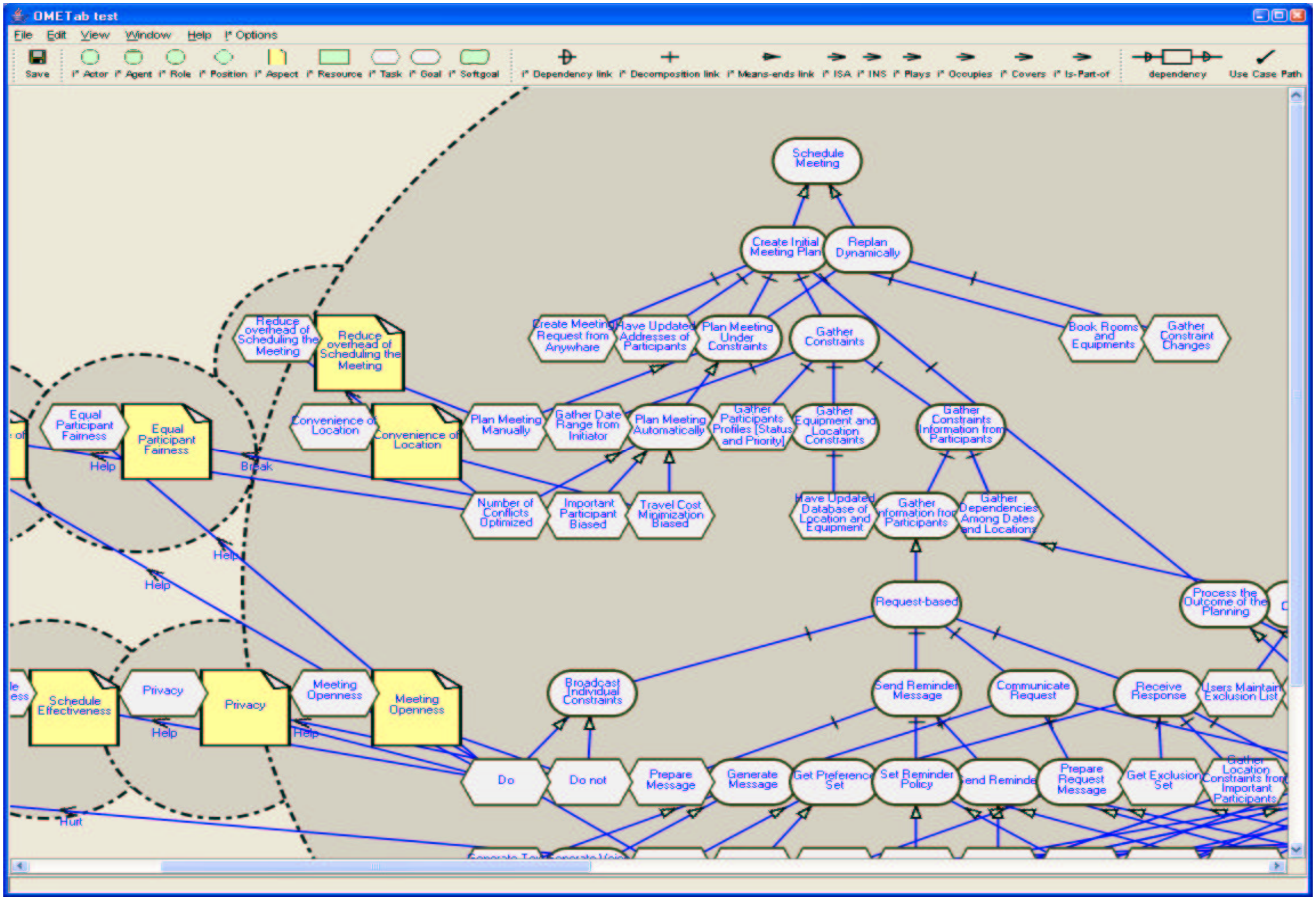


Example 1. Media Shop

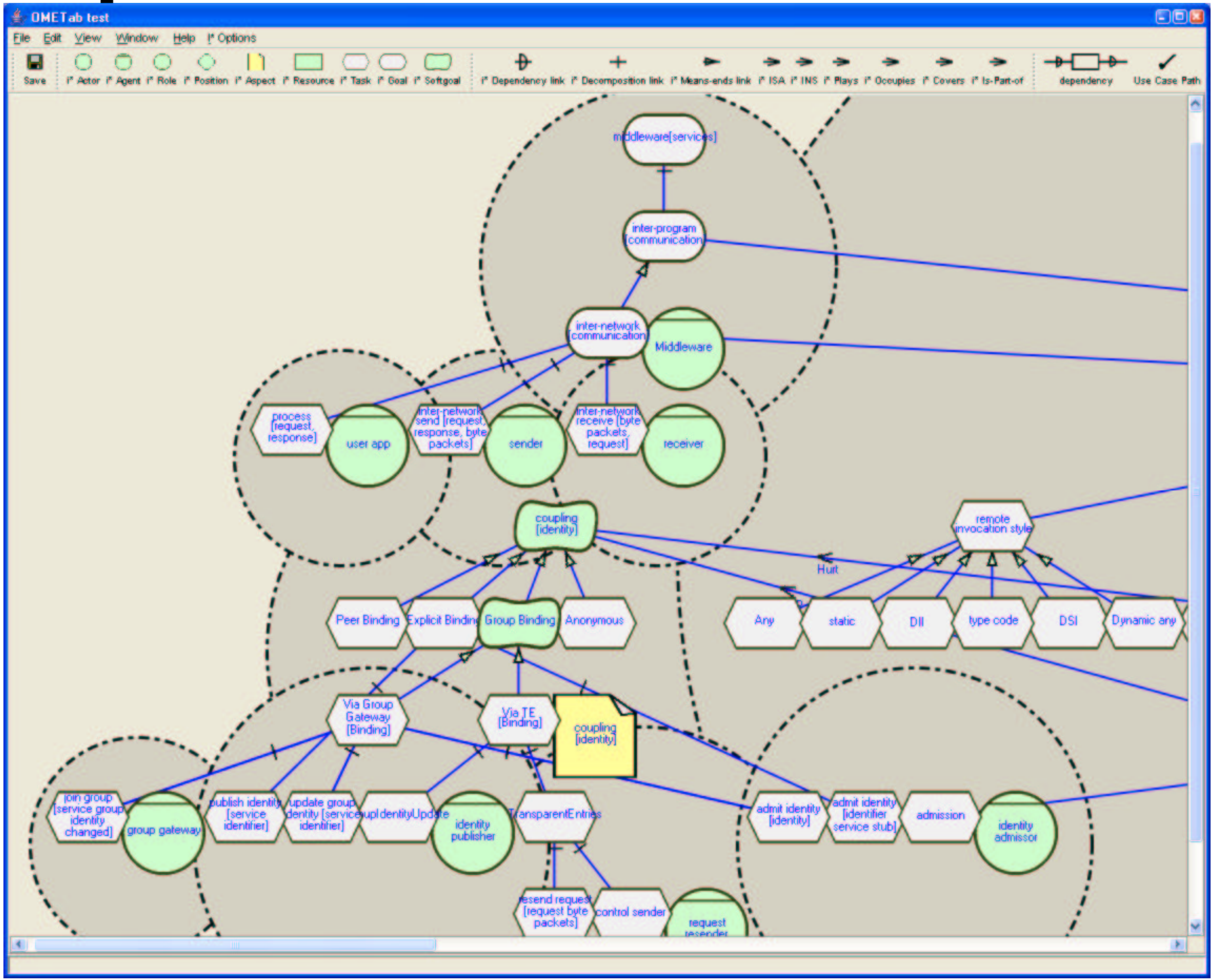




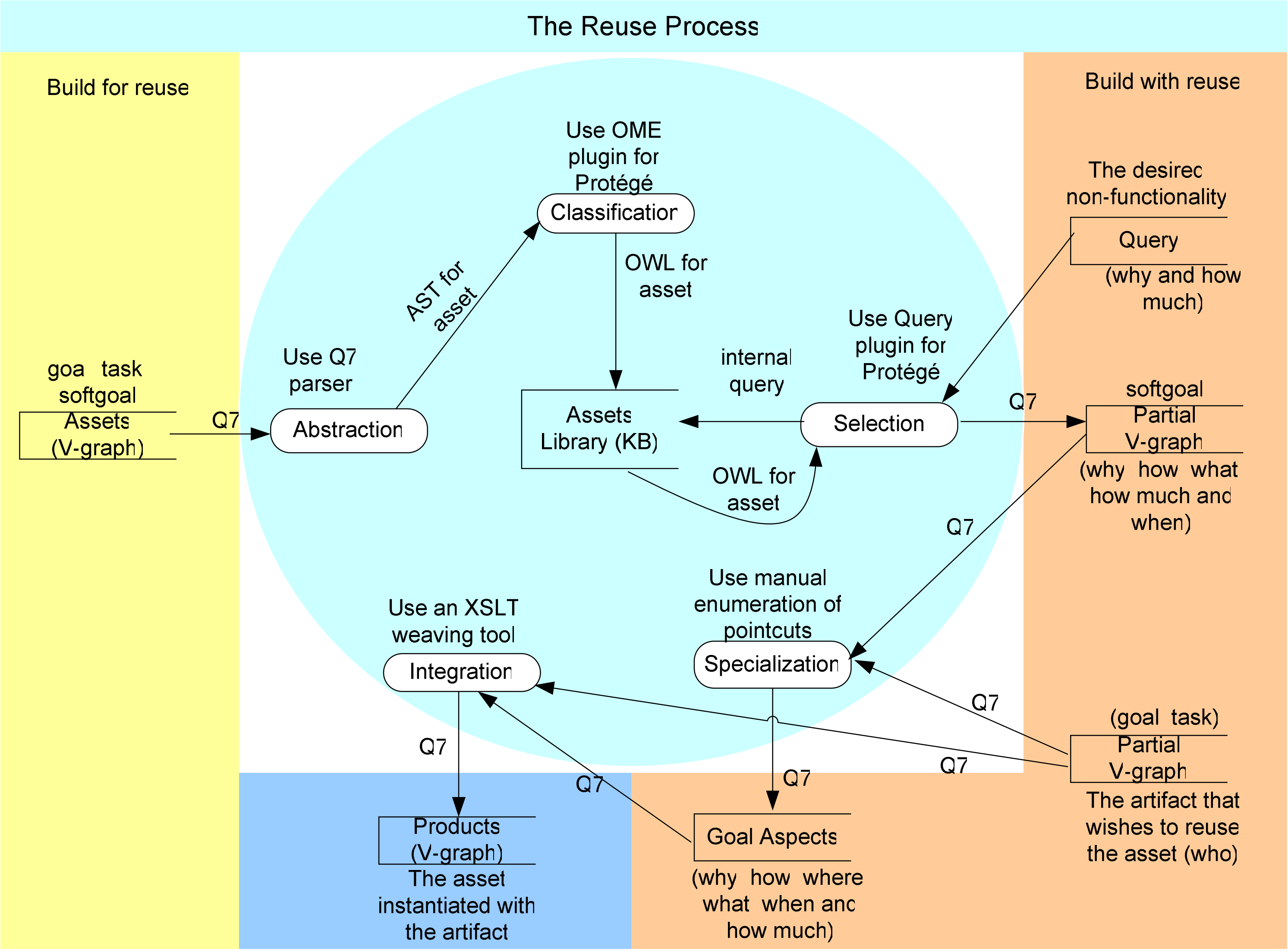
Example 2. MeetingScheduler


OMETab test
File
Edit
View
Window
Help
I* Options
Save
i* Actor
i* Agent
i* Role
i* Position
i* Aspect
i* Resource
i* Task
i* Goal
i* Softgoal
i* Dependency link
i* Decomposition link
i* Means-ends link
i* ISA
i* INS
i* Plays
i* Occupies
i* Covers
i* Is-Part-of
dependency
Use Case Path
Schedule Meeting
Create Initial Meeting Plan
Replan Dynamically
Create Meeting Request from Anywhere
Have Updated Addresses of Participants
Plan Meeting Under Constraints
Gather Constraints
Book Rooms and Equipments
Gather Constraint Changes
Reduce overhead of Scheduling the Meeting
Reduce overhead of Scheduling the Meeting
Equal Participant Fairness
Equal Participant Fairness
Convenience of Location
Convenience of Location
Plan Meeting Manually
Gather Date Range from Initiator
Plan Meeting Automatically
Gather Participants Profiles [Status and Priority]
Gather Equipment and Location Constraints
Gather Constraints Information from Participants
Help
Break
Number of Conflicts Optimized
Important Participant Biased
Travel Cost Minimization Biased
Have Updated Database of Location and Equipment
Gather Information from Participants
Gather Dependencies Among Dates and Locations
Help
Help
Request-based
Process the Outcome of the Planning
Schedule Effectiveness
Privacy
Privacy
Meeting Openness
Meeting Openness
Help
Help
Broadcast Individual Constraints
Send Reminder Message
Communicate Request
Receive Response
Users Maintain Exclusion List
Do
Do not
Prepare Message
Generate Message
Get Preference Set
Set Reminder Policy
Send Reminder
Prepare Request Message
Get Exclusion Set
Gather Location Constraints from Important Participants
Hurt
Generate Text
Generate Voice

Example 3. Middleware: CORBA



Q7 is a key to reuse NFR



The Reuse Process

Build for reuse

goa task
softgoal
Assets
(V-graph)

Q7

Use Q7
parser

Abstraction

AST for
asset

Use OME
plugin for
Protégé

Classificatior

OWL for
asset

Assets
Library (KB)

internal
query

OWL for
asset

Use Query
plugin for
Protégé

Selection

Q7

Build with reuse

The desirec
non-functionality

Query

(why and how
much)

softgoal
Partial
V-graph

(why how what
how much and
when)

Q7

Use manual
enumeration of
pointcuts

Specialization

Use an XSLT
weaving tool

Integration

Q7

Q7

Q7

Q7

Q7

Products
(V-graph)

The asset
instantiated with
the artifact

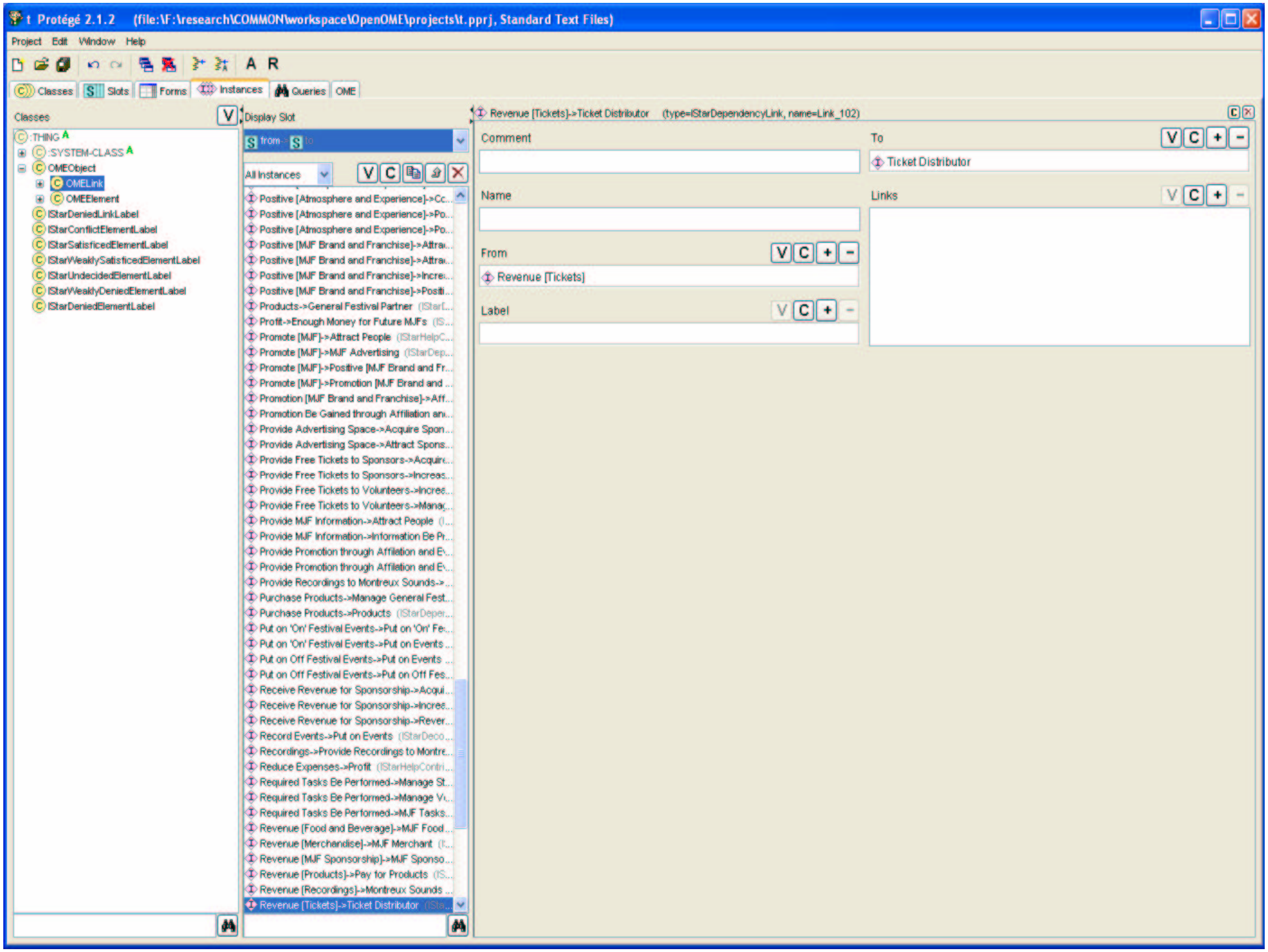
Goal Aspects

(why how where
what when anc
how much)

(goal task)
Partial
V-graph

The artifact that
wishes to reuse
the asset (who)

3.2 Ontology saved (MJF)



t Protégé 2.1.2 (file:\F:\research\COMMON\workspace\OpenOME\projects\t.pprj, Standard Text Files)

Classes

- :THING
- :SYSTEM-CLASS
- OMEObject
  - OMELink
  - OMEElement
- IStarDeniedLinkLabel
- IStarConflictElementLabel
- IStarSatisficedElementLabel
- IStarWeaklySatisficedElementLabel
- IStarUndecidedElementLabel
- IStarWeaklyDeniedElementLabel
- IStarDeniedElementLabel

Display Slot: from-> to

All Instances

- Positive [Atmosphere and Experience]->Cc...
- Positive [Atmosphere and Experience]->Po...
- Positive [Atmosphere and Experience]->Po...
- Positive [MJF Brand and Franchise]->Attra...
- Positive [MJF Brand and Franchise]->Attra...
- Positive [MJF Brand and Franchise]->Incre...
- Positive [MJF Brand and Franchise]->Positi...
- Products->General Festival Partner (IStarI...
- Profit->Enough Money for Future MJFs (IS...
- Promote [MJF]->Attract People (IStarHelpC...
- Promote [MJF]->MJF Advertising (IStarDep...
- Promote [MJF]->Positive [MJF Brand and Fr...
- Promote [MJF]->Promotion [MJF Brand and ...
- Promotion [MJF Brand and Franchise]->Aff...
- Promotion Be Gained through Affiliation an...
- Provide Advertising Space->Acquire Spon...
- Provide Advertising Space->Attract Spons...
- Provide Free Tickets to Sponsors->Acquire...
- Provide Free Tickets to Sponsors->Increas...
- Provide Free Tickets to Volunteers->Increa...
- Provide Free Tickets to Volunteers->Manag...
- Provide MJF Information->Attract People (I...
- Provide MJF Information->Information Be Pr...
- Provide Promotion through Affilation and E...
- Provide Promotion through Affilation and E...
- Provide Recordings to Montreux Sounds-> ...
- Purchase Products->Manage General Fest...
- Purchase Products->Products (IStarDeper...
- Put on 'On' Festival Events->Put on 'On' Fe...
- Put on 'On' Festival Events->Put on Events ...
- Put on Off Festival Events->Put on Events ...
- Put on Off Festival Events->Put on Off Fes...
- Receive Revenue for Sponsorship->Acqui...
- Receive Revenue for Sponsorship->Increa...
- Receive Revenue for Sponsorship->Rever...
- Record Events->Put on Events (IStarDeco...
- Recordings->Provide Recordings to Montre...
- Reduce Expenses->Profit (IStarHelpContri...
- Required Tasks Be Performed->Manage St...
- Required Tasks Be Performed->Manage V...
- Required Tasks Be Performed->MJF Tasks...
- Revenue [Food and Beverage]->MJF Food ...
- Revenue [Merchandise]->MJF Merchant (I...
- Revenue [MJF Sponsorship]->MJF Sponso...
- Revenue [Products]->Pay for Products (IS...
- Revenue [Recordings]->Montreux Sounds ...
- Revenue [Tickets]->Ticket Distributor (ISta...

Revenue [Tickets]->Ticket Distributor (type=IStarDependencyLink, name=Link_102)

Comment:

Name:

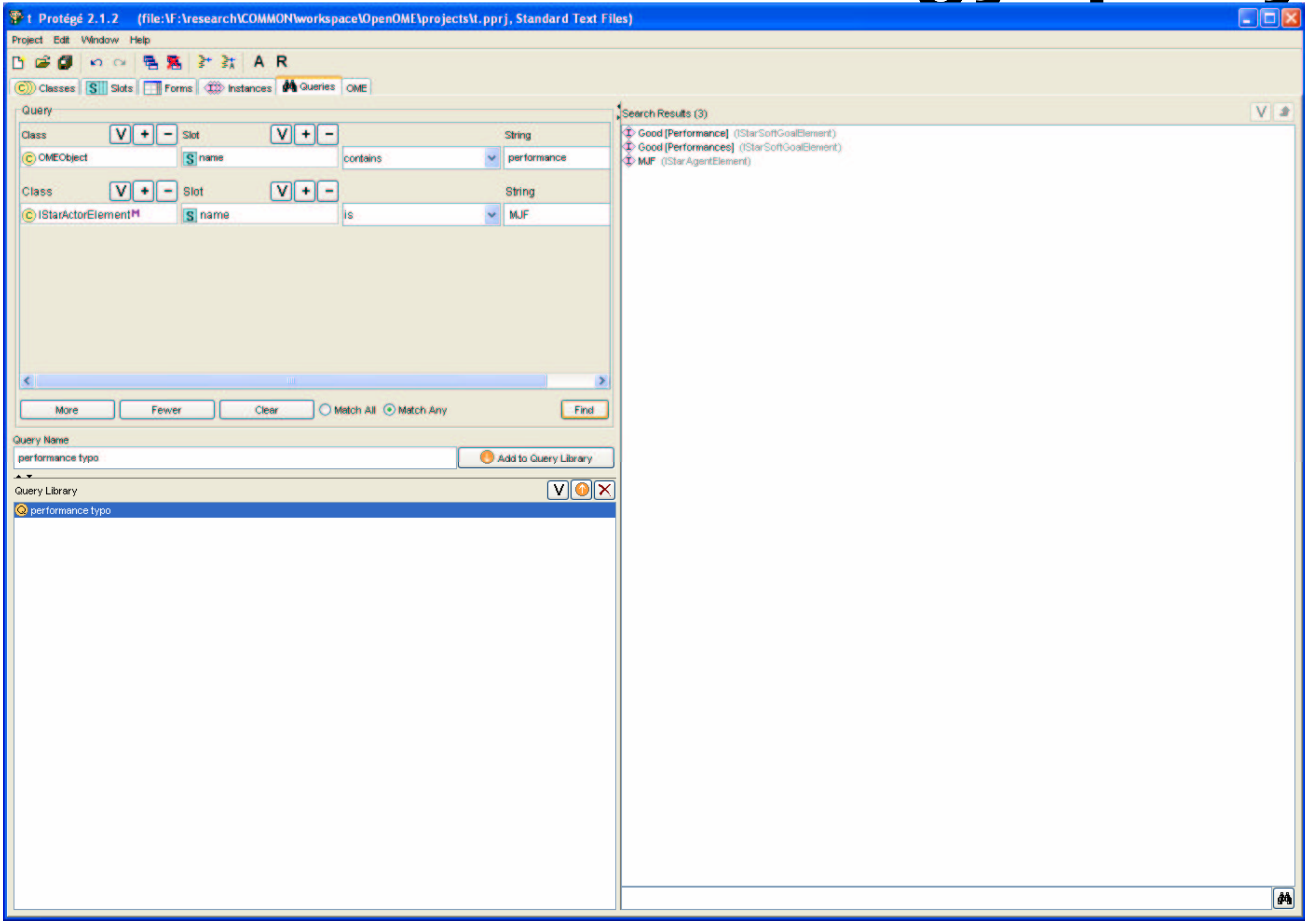
From: Revenue [Tickets]

Label:

To: Ticket Distributor

Links:

Construct an Ontology query



t Protégé 2.1.2 (file:\F:\research\COMMON\workspace\OpenOME\projects\t.pprj, Standard Text Files)

Query

Class	Slot		String
OMEObject	name	contains	performance
IStarActorElement	name	is	MJF

○ Match All ● Match Any

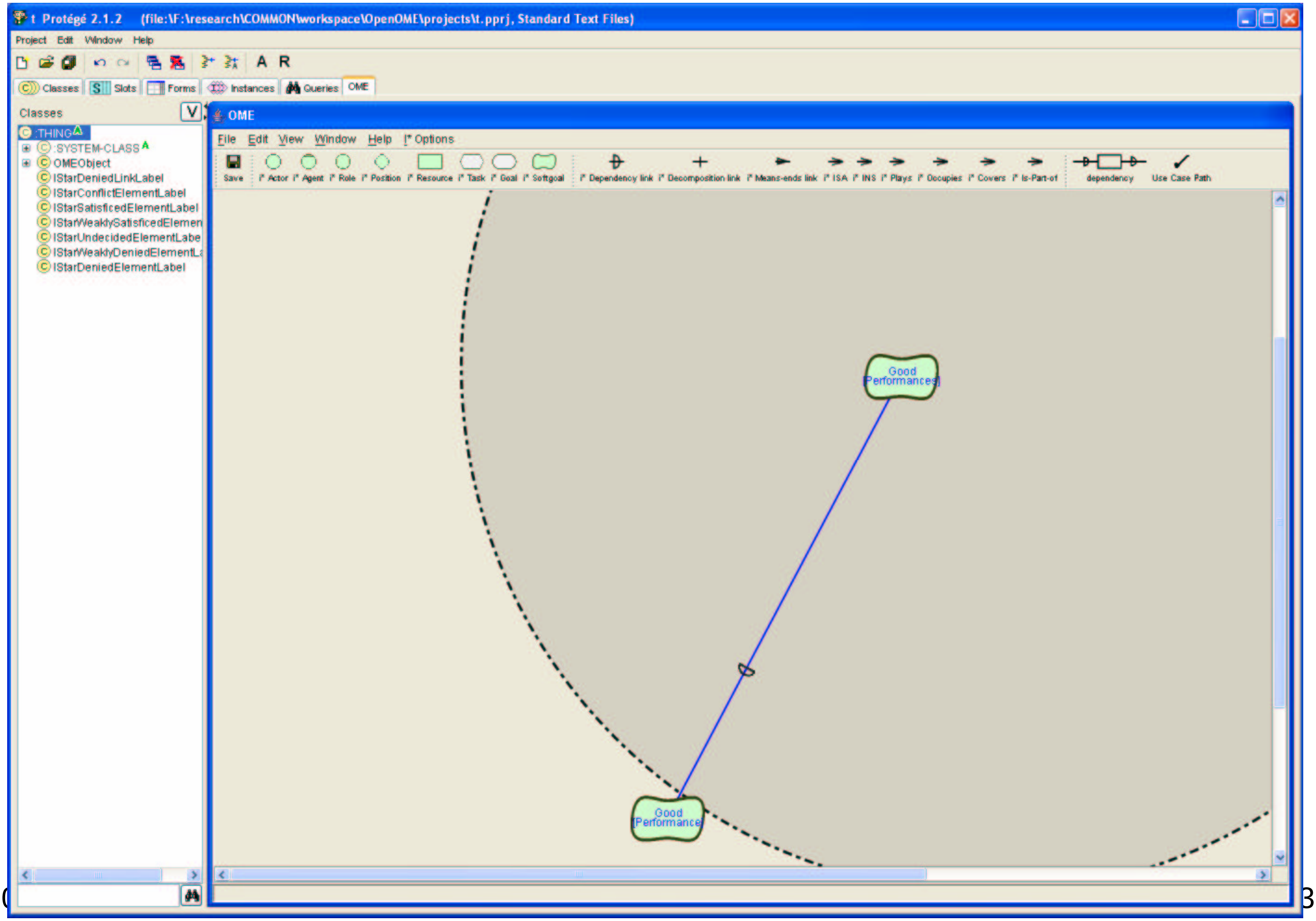
Query Name: performance typo

Query Library: performance typo

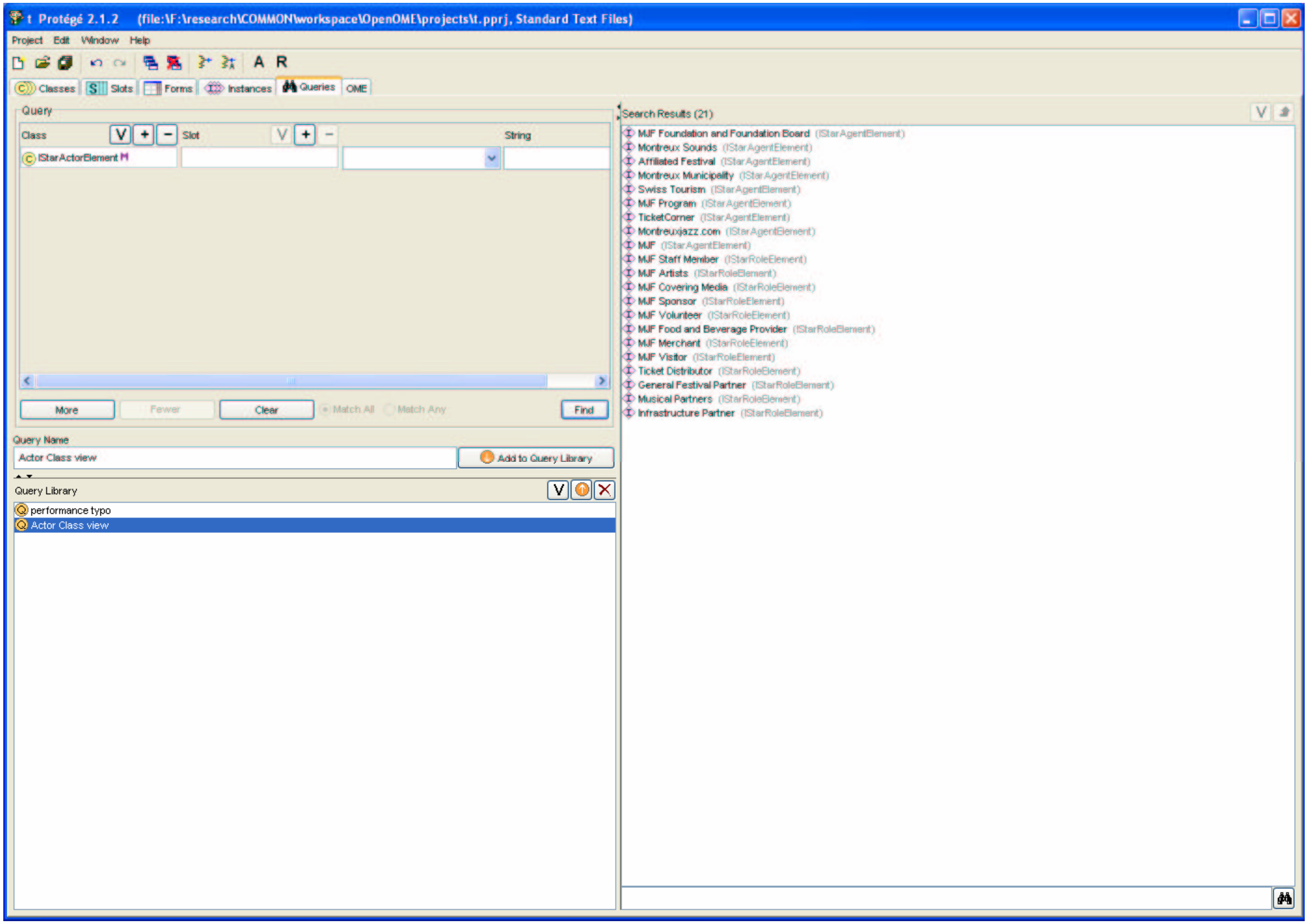
Search Results (3)

- Good [Performance] (IStarSoftGoalElement)
- Good [Performances] (IStarSoftGoalElement)
- MJF (IStarAgentElement)

Results 1 Errors highlighted



Create another query



t Protégé 2.1.2 (file:\F:\research\COMMON\workspace\OpenOME\projects\t.pprj, Standard Text Files)

Class: IStarActorElement

Slot:

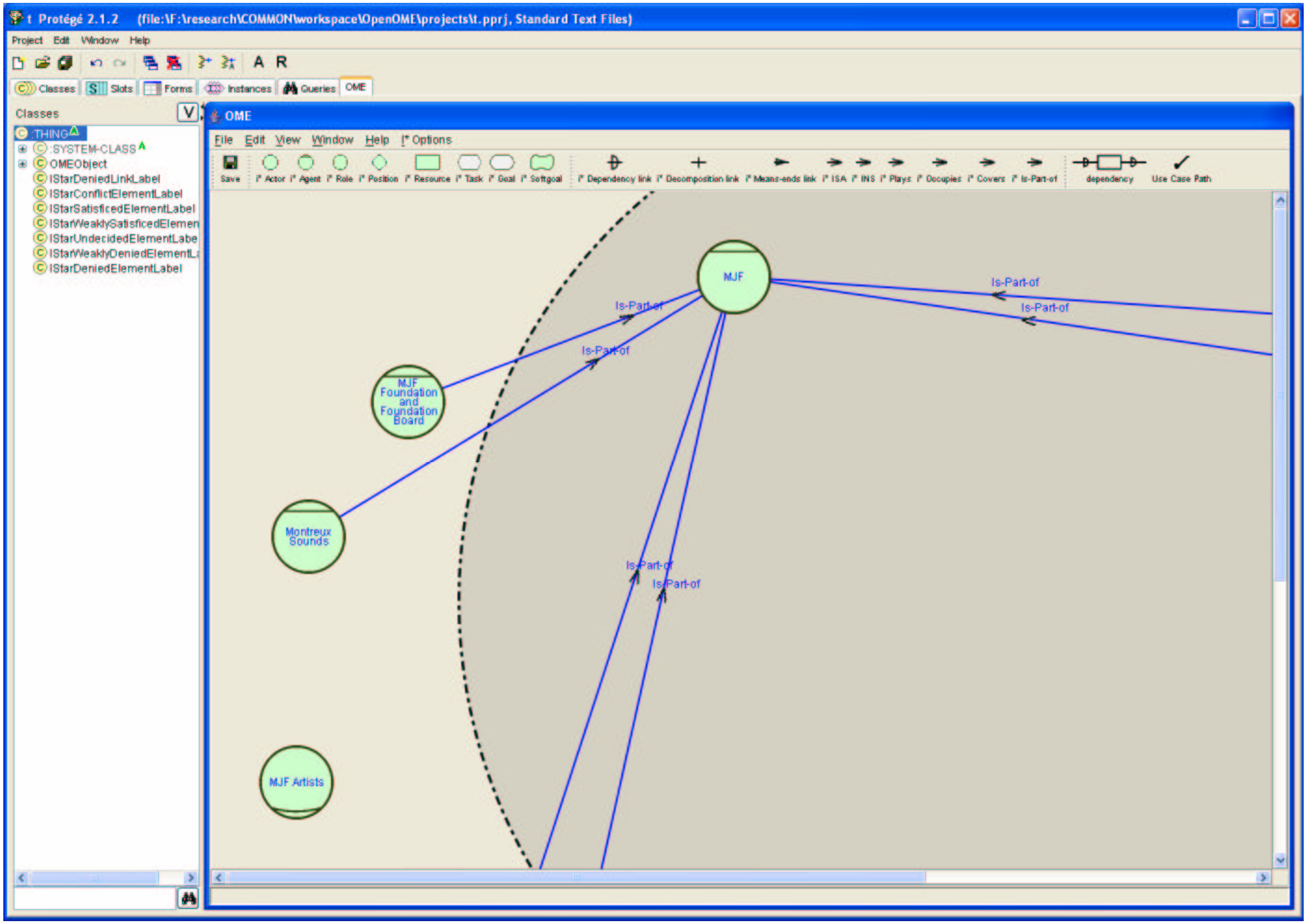
String:

Query Name: Actor Class view

Query Library
- performance typo
- Actor Class view

Search Results (21)
- MJF Foundation and Foundation Board (IStarAgentElement)
- Montreux Sounds (IStarAgentElement)
- Affiliated Festival (IStarAgentElement)
- Montreux Municipality (IStarAgentElement)
- Swiss Tourism (IStarAgentElement)
- MJF Program (IStarAgentElement)
- TicketCorner (IStarAgentElement)
- Montreuxjazz.com (IStarAgentElement)
- MJF (IStarAgentElement)
- MJF Staff Member (IStarRoleElement)
- MJF Artists (IStarRoleElement)
- MJF Covering Media (IStarRoleElement)
- MJF Sponsor (IStarRoleElement)
- MJF Volunteer (IStarRoleElement)
- MJF Food and Beverage Provider (IStarRoleElement)
- MJF Merchant (IStarRoleElement)
- MJF Visitor (IStarRoleElement)
- Ticket Distributor (IStarRoleElement)
- General Festival Partner (IStarRoleElement)
- Musical Partners (IStarRoleElement)
- Infrastructure Partner (IStarRoleElement)

Results 2: Actor class view

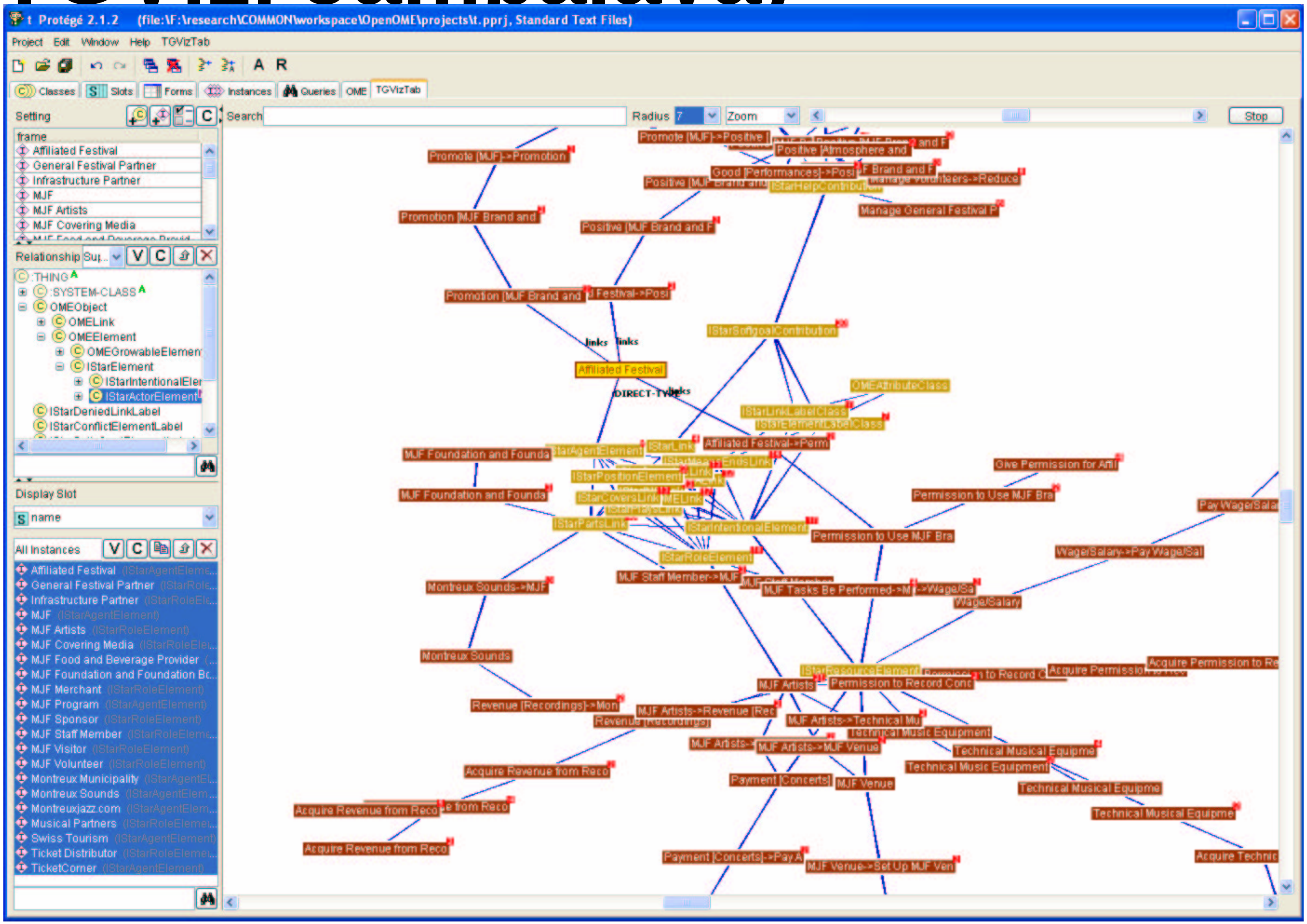


t Protégé 2.1.2 (file:\F:\research\COMMON\workspace\OpenOME\projects\t.pprj, Standard Text Files)

Classes

- :THING
  - :SYSTEM-CLASS
  - OMEObject
  - IStarDeniedLinkLabel
  - IStarConflictElementLabel
  - IStarSatisficedElementLabel
  - IStarWeaklySatisficedElemen
  - IStarUndecidedElementLabe
  - IStarWeaklyDeniedElementL
  - IStarDeniedElementLabel

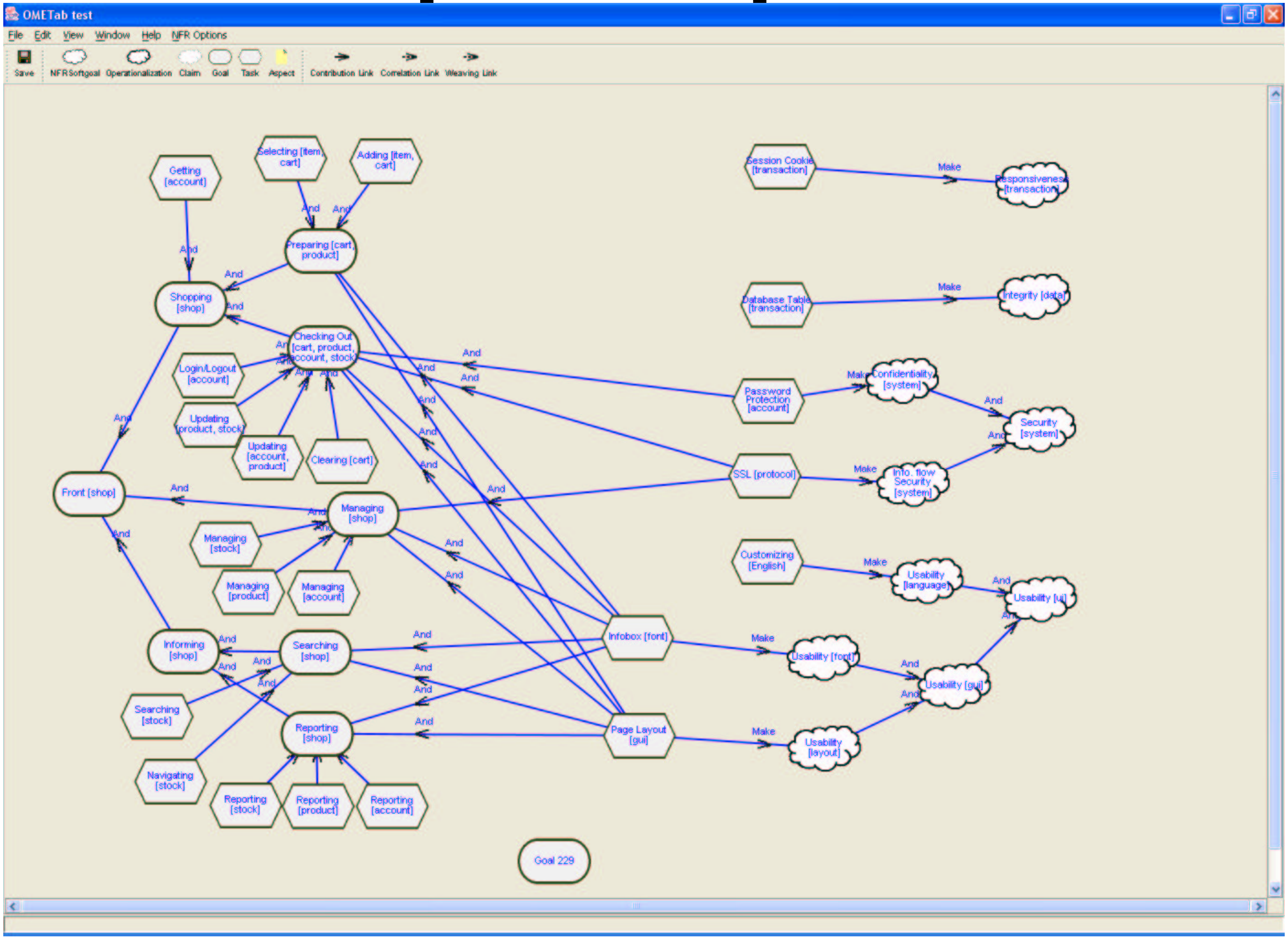
Work with other visual plugins (TGViz, Jambalaya)


t Protégé 2.1.2 (file:\F:\research\COMMON\workspace\OpenOME\projects\t.pprj, Standard Text Files)
Project Edit Window Help TGVizTab
Classes Slots Forms Instances Queries OME TGVizTab
Setting
Search
Radius 7
Zoom
Stop
frame
Affiliated Festival
General Festival Partner
Infrastructure Partner
MJF
MJF Artists
MJF Covering Media
Relationship Sup...
:THING
:SYSTEM-CLASS
OMEObject
OMELink
OMEElement
OMEGrowableElement
IStarElement
IStarIntentionalElement
IStarActorElement
IStarDeniedLinkLabel
IStarConflictElementLabel
Display Slot
name
All Instances
Affiliated Festival (IStarAgentElement)
General Festival Partner (IStarRoleElement)
Infrastructure Partner (IStarRoleElement)
MJF (IStarAgentElement)
MJF Artists (IStarRoleElement)
MJF Covering Media (IStarRoleElement)
MJF Food and Beverage Provider
MJF Foundation and Foundation Board
MJF Merchant (IStarRoleElement)
MJF Program (IStarAgentElement)
MJF Sponsor (IStarRoleElement)
MJF Staff Member (IStarRoleElement)
MJF Visitor (IStarRoleElement)
MJF Volunteer (IStarRoleElement)
Montreux Municipality (IStarAgentElement)
Montreux Sounds (IStarAgentElement)
Montreuxjazz.com (IStarAgentElement)
Musical Partners (IStarRoleElement)
Swiss Tourism (IStarAgentElement)
Ticket Distributor (IStarRoleElement)
TicketCorner (IStarAgentElement)
Promote (MJF)->Promotion
Promote (MJF)->Positive
Positive (Atmosphere and
Good (Performances)->Posi
Manage Volunteers->Reduce
IStarHelpContribution
Manage General Festival P
Promotion (MJF Brand and
Positive (MJF Brand and F
Promotion (MJF Brand and
Festival->Posi
IStarSoftgoalContribution
links
Affiliated Festival
DIRECT-TYPE
OMEAttributeClass
IStarLinkLabelClass
IStarElementLabelClass
MJF Foundation and Founda
IStarAgentElement
IStarLink
Affiliated Festival->Perm
IStarPositionElement
IStarCoversLink
OMELink
IStarPartsLink
IStarIntentionalElement
IStarRoleElement
Give Permission for Arti
Permission to Use MJF Bra
Pay Wage/Salary
Wage/Salary->Pay Wage/Sal
Montreux Sounds->MJF
MJF Staff Member->MJF
MJF Tasks Be Performed->M
->Wage/Sa
Wage/Salary
Montreux Sounds
IStarResourceElement
Acquire Permission to Re
MJF Artists
Permission to Record Conc
Revenue (Recordings)->Mon
MJF Artists->Revenue (Rec
Revenue (Recordings)
MJF Artists->Technical Mu
Technical Music Equipment
MJF Artists->MJF Venue
Technical Musical Equipme
Acquire Revenue from Reco
Payment (Concerts)
MJF Venue
Payment (Concerts)->Pay A
MJF Venue->Set Up MJF Ven
Acquire Technic

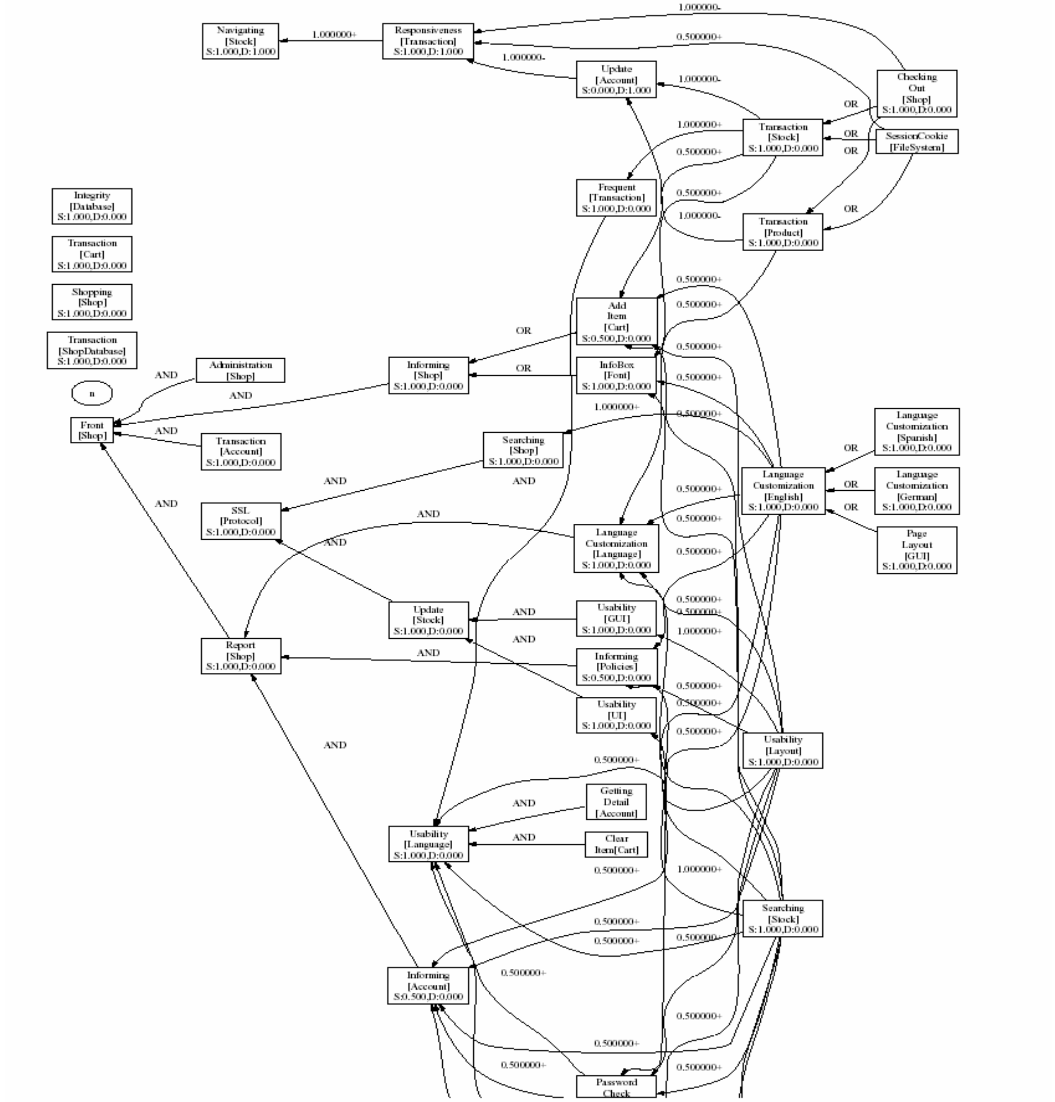
3.3 Quantitative label propagation

- Telos parser to convert the NFR goal model into an input file for the goal reasoning tool developed in Trento
- The result can be saved into DOT and visualized in GraphViz
- Example, Media shop

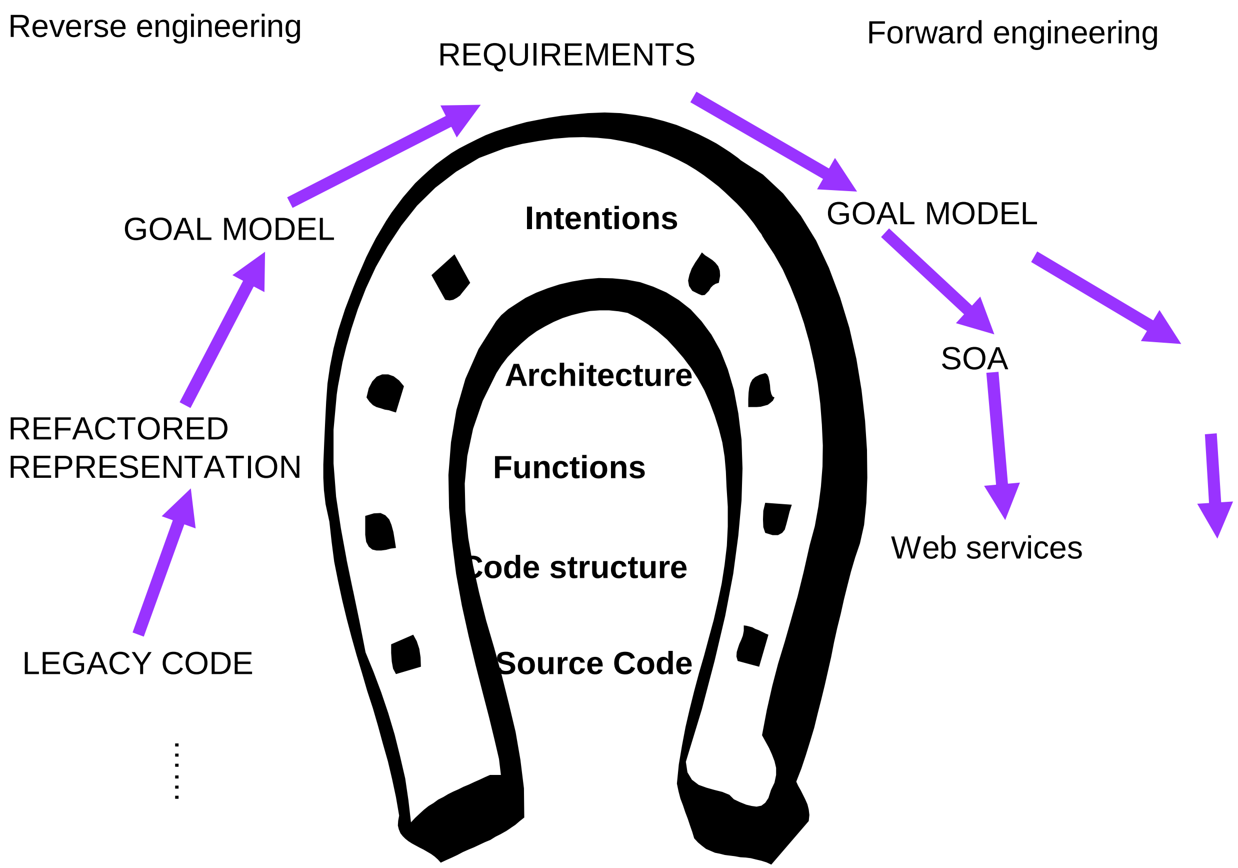
Media Shop example



Result of the label propagation


Navigating [Stock] S:1.000,D:1.000
1.000000+
Responsiveness [Transaction] S:1.000,D:1.000
1.000000-
0.500000+
1.000000-
Update [Account] S:0.000,D:1.000
1.000000-
Checking Out [Shop] S:1.000,D:0.000
OR
Transaction [Stock] S:1.000,D:0.000
OR
SessionCookie [FileSystem]
OR
1.000000+
0.500000+
Frequent [Transaction] S:1.000,D:0.000
0.500000+
1.000000-
Transaction [Product] S:1.000,D:0.000
OR
Integrity [Database] S:1.000,D:0.000
Transaction [Cart] S:1.000,D:0.000
Shopping [Shop] S:1.000,D:0.000
Transaction [ShopDatabase] S:1.000,D:0.000
n
Front [Shop]
AND
Administration [Shop]
AND
Informing [Shop] S:1.000,D:0.000
OR
Add Item [Cart] S:0.500,D:0.000
OR
InfoBox [Font] S:1.000,D:0.000
AND
Transaction [Account] S:1.000,D:0.000
1.000000+
Searching [Shop] S:1.000,D:0.000
AND
AND
SSL [Protocol] S:1.000,D:0.000
AND
AND
Language Customization [Spanish] S:1.000,D:0.000
OR
Language Customization [English] S:1.000,D:0.000
OR
Language Customization [German] S:1.000,D:0.000
OR
Page Layout [GUI] S:1.000,D:0.000
Language Customization [Language] S:1.000,D:0.000
AND
Update [Stock] S:1.000,D:0.000
AND
Usability [GUI] S:1.000,D:0.000
AND
Report [Shop] S:1.000,D:0.000
AND
Informing [Policies] S:0.500,D:0.000
Usability [UI] S:1.000,D:0.000
Usability [Layout] S:1.000,D:0.000
AND
AND
Getting Detail [Account]
Usability [Language] S:1.000,D:0.000
AND
Clear Item[Cart]
Searching [Stock] S:1.000,D:0.000
Informing [Account] S:0.500,D:0.000
Password Check
0.500000+
1.000000+

3.4 Not just requirements



Reverse engineering

REQUIREMENTS

Forward engineering

GOAL MODEL

Intentions

GOAL MODEL

SOA

Architecture

REFACTORED
REPRESENTATION

Functions

Web services

Code structure

LEGACY CODE

Source Code

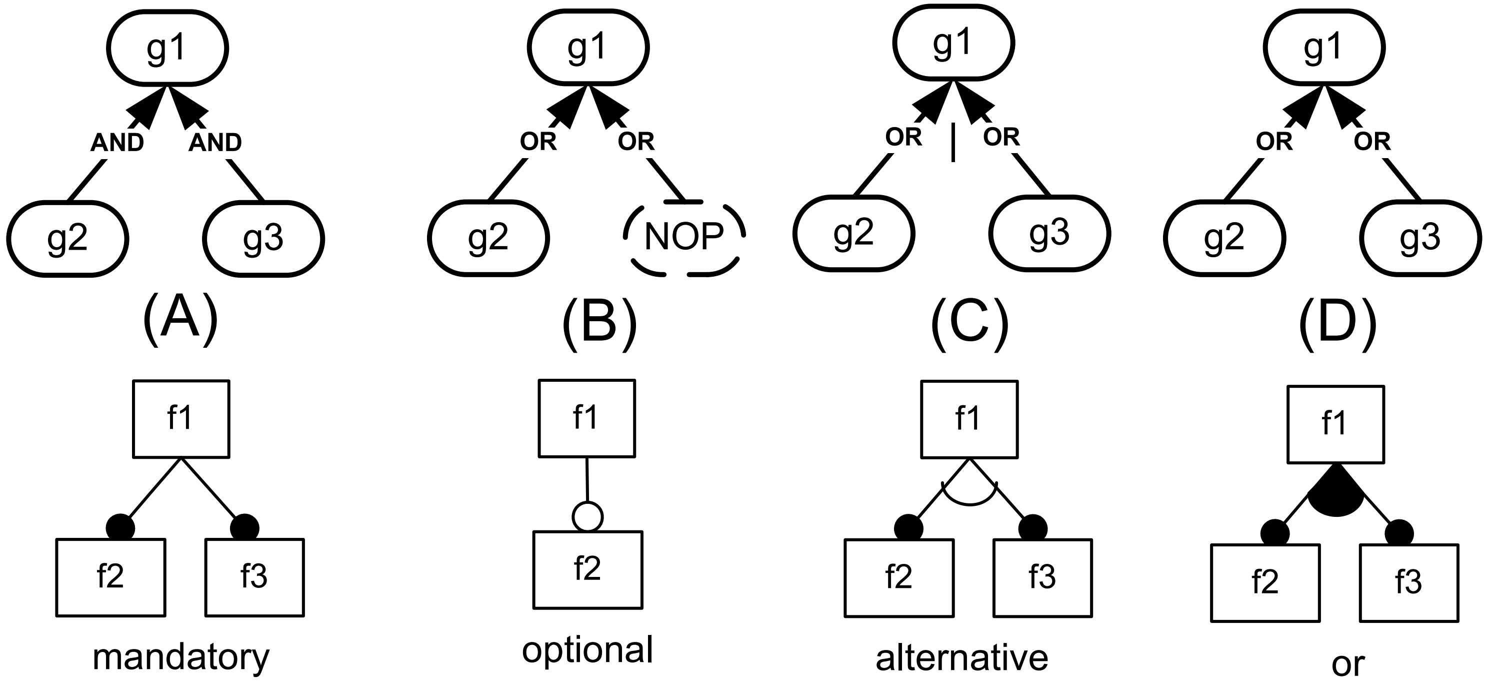
……

3.4.1 Generating High-variability designs from Goal Models

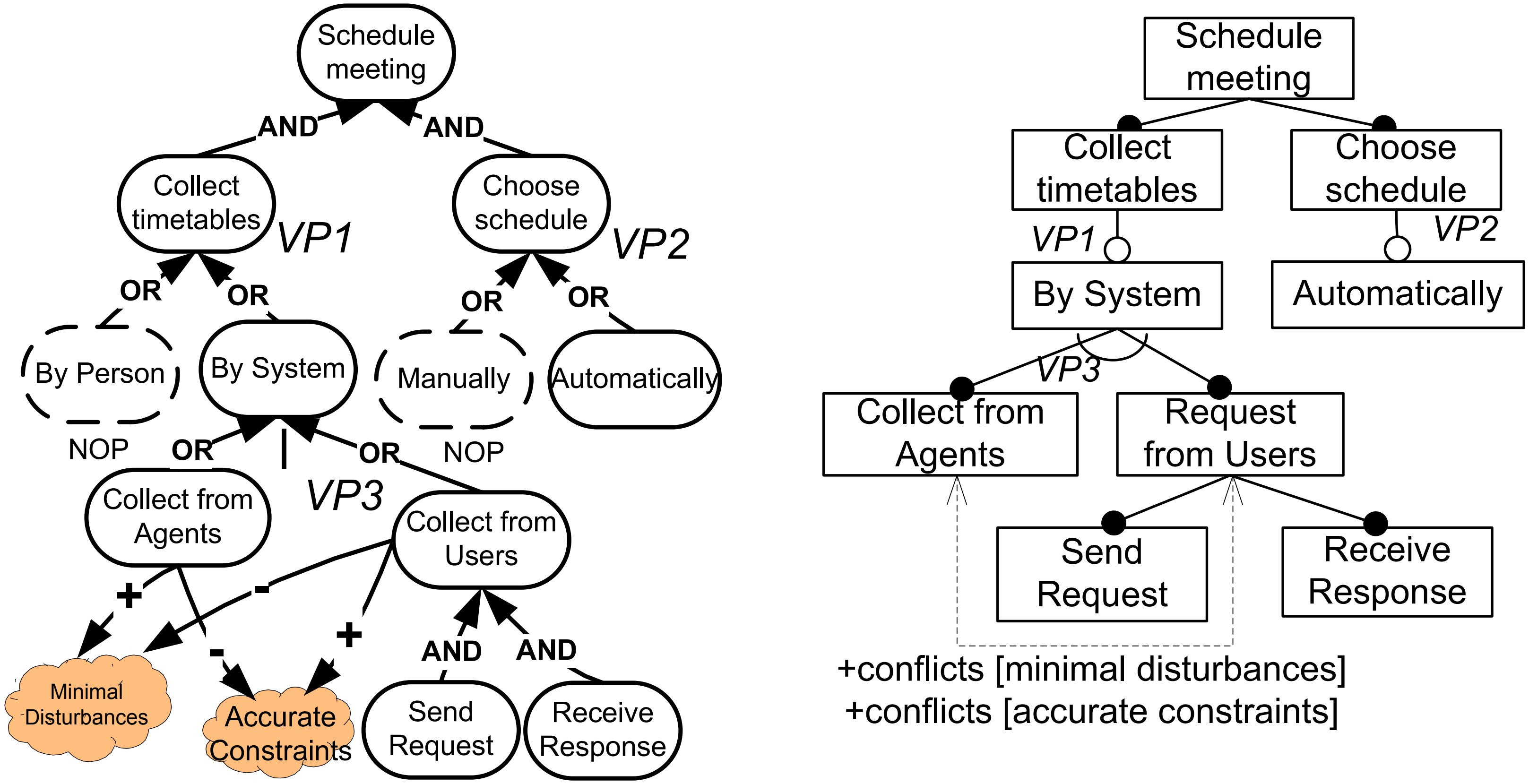
Annotate the goal model with light-weight design information to derive the following high-variability views

- Feature models
- Statecharts
- Component-connector models
- Aspects
- Web services (BPEL)

Feature model generation



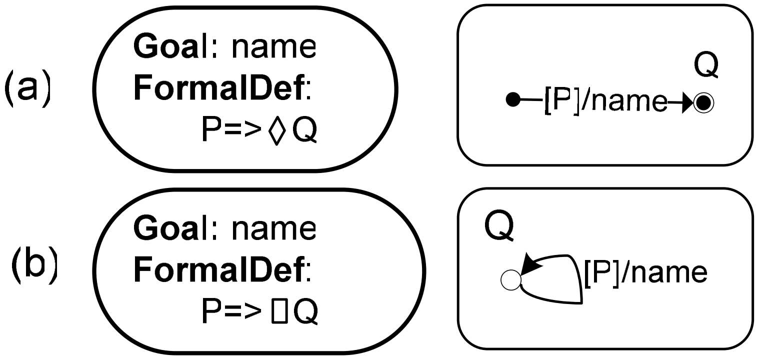
Example

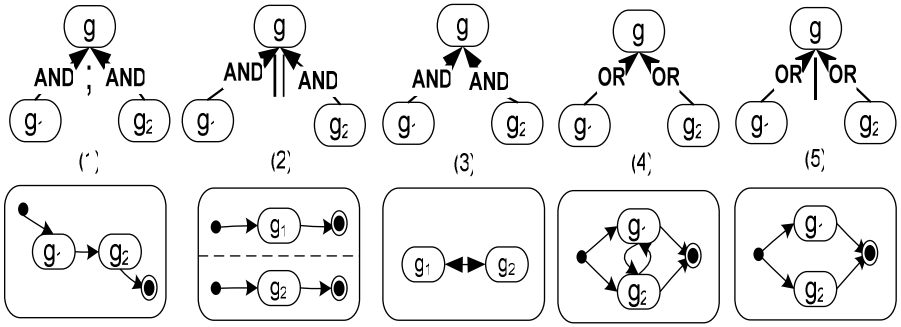

Schedule meeting
AND
AND
Collect timetables
Choose schedule
VP1
VP2
OR
OR
OR
OR
By Person
By System
Manually
Automatically
NOP
OR
OR
NOP
VP3
Collect from Agents
Collect from Users
+
-
-
+
AND
AND
Minimal Disturbances
Accurate Constraints
Send Request
Receive Response
Schedule meeting
Collect timetables
Choose schedule
VP1
VP2
By System
Automatically
VP3
Collect from Agents
Request from Users
Send Request
Receive Response
+conflicts [minimal disturbances]
+conflicts [accurate constraints]

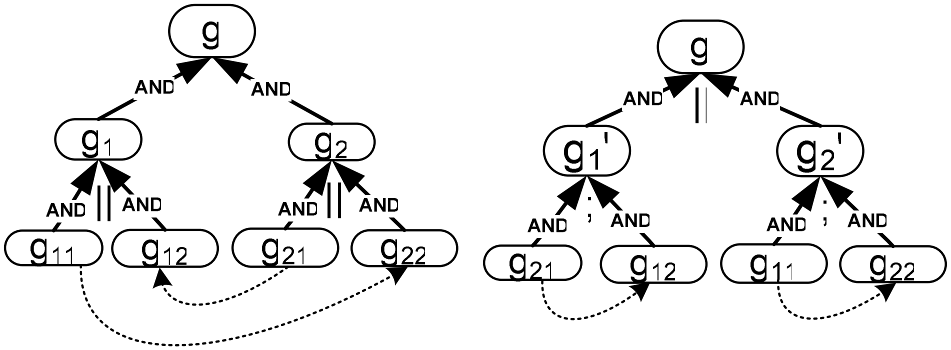
(a)

(b)

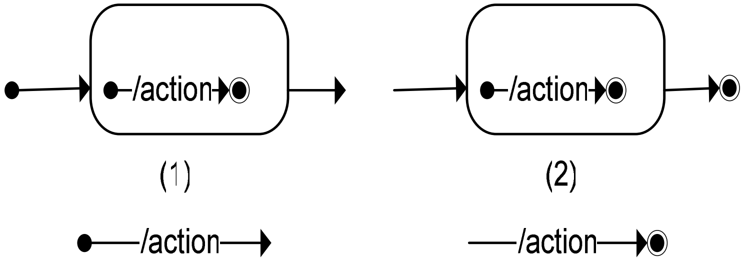
Statecharts generation



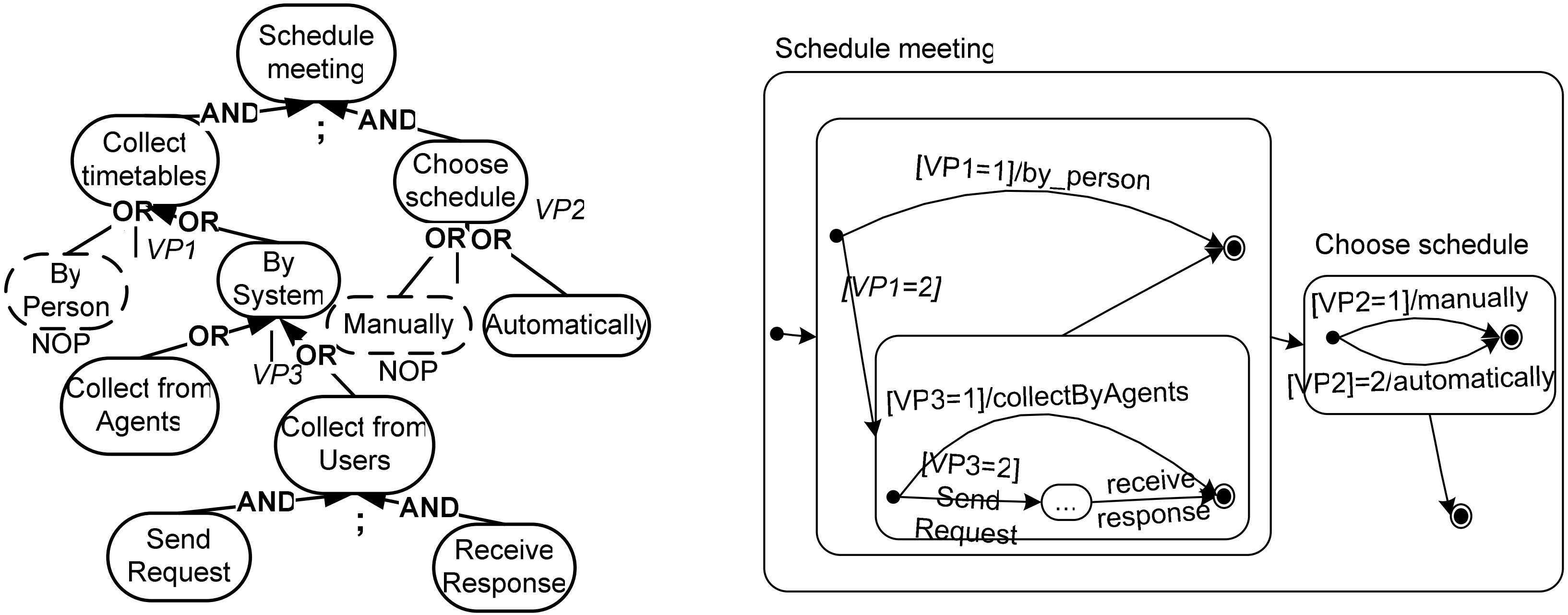




(1) (2)



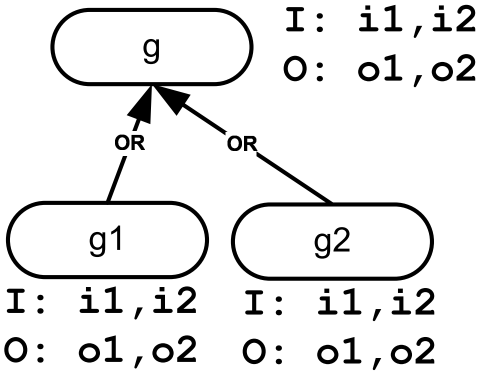
Example

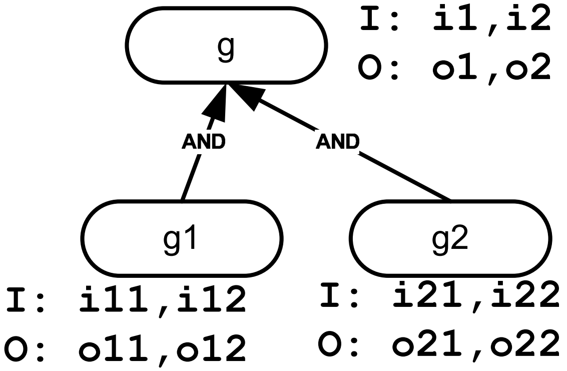

Schedule meeting
AND
;
AND
Collect timetables
Choose schedule
VP2
OR
OR
VP1
OR OR
By Person
NOP
By System
Manually
NOP
Automatically
OR
OR
VP3
Collect from Agents
Collect from Users
AND
;
AND
Send Request
Receive Response
Schedule meeting
[VP1=1]/by_person
[VP1=2]
[VP3=1]/collectByAgents
[VP3=2]
Send Request
...
receive response
Choose schedule
[VP2=1]/manually
[VP2]=2/automatically

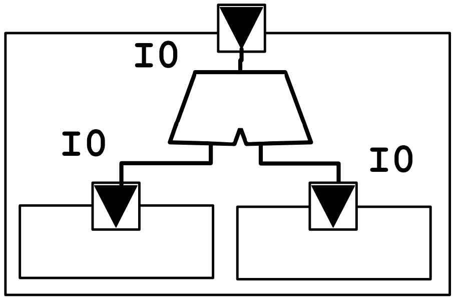
(a)

(b)

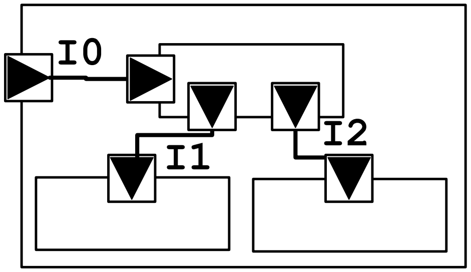
Component-connector view





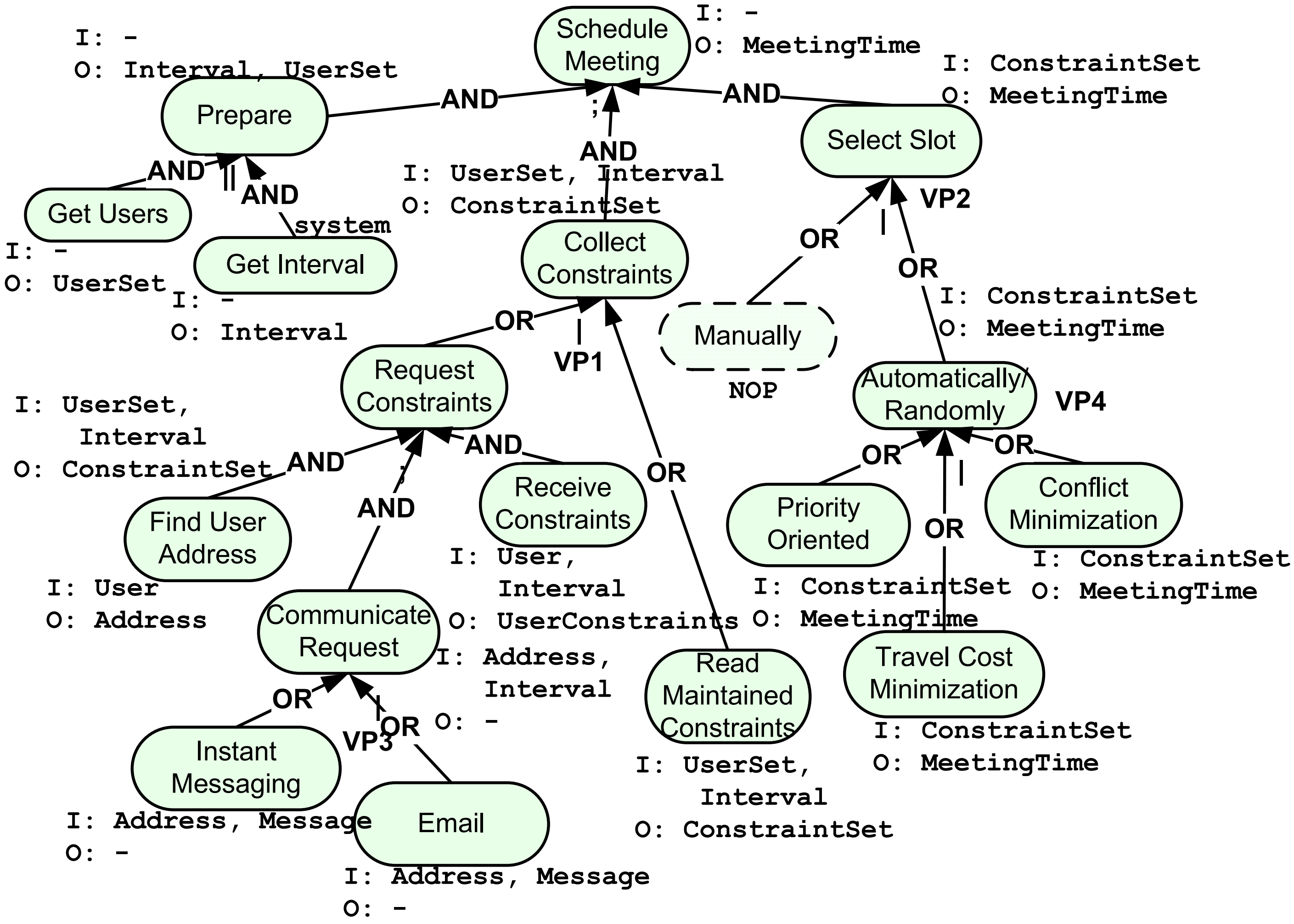


```
interface type I0{
G(IN i1, IN i2
   OUT o1, OUT o2);
}
```

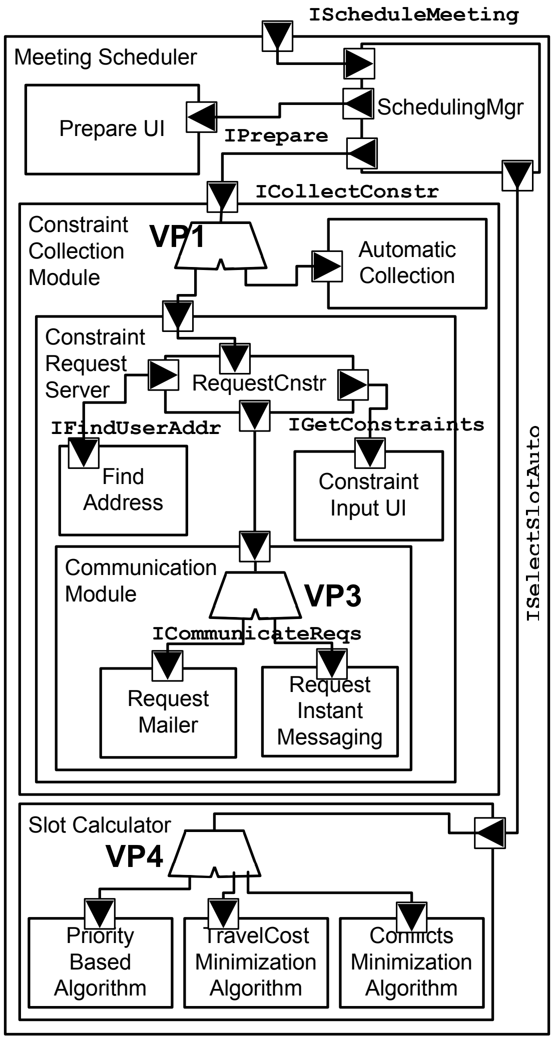


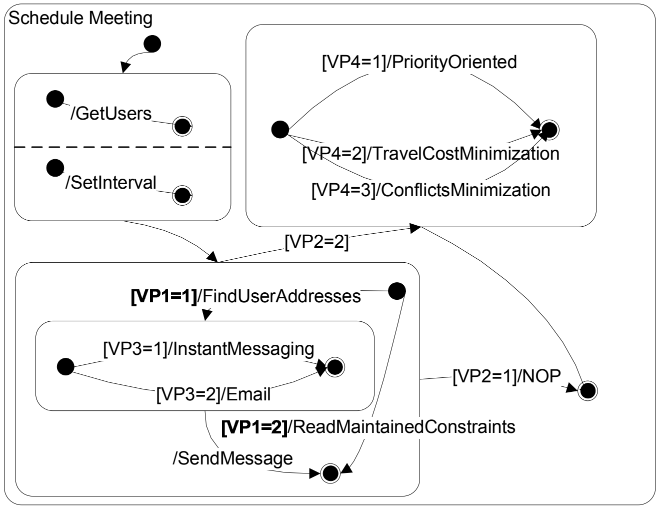
```
interface type I0{
 G(IN i1, IN i2, OUT o1, OUT o2);
}
Interface type I1 {
 G1(IN i11, IN i12, OUT o11, OUT o12);
}
Interface type I2 {
 G2(IN i21, IN i22, OUT o21, OUT o22);
}
```

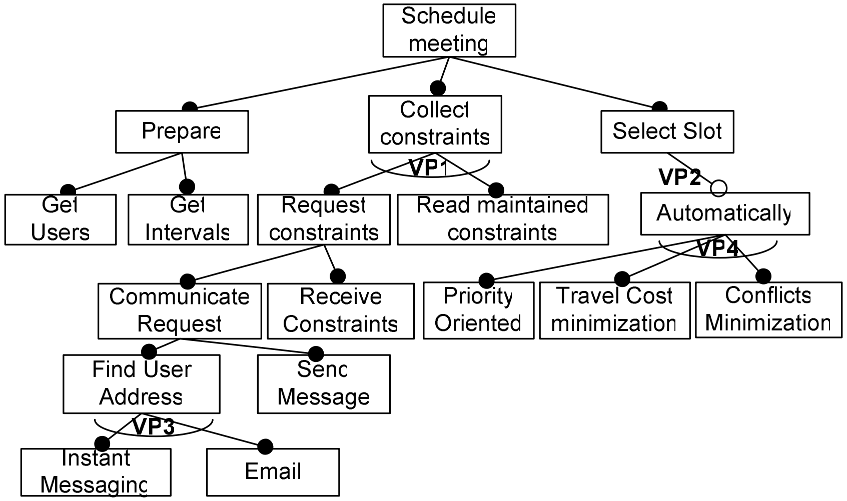
Example.


Schedule Meeting
I: -
O: MeetingTime
I: -
O: Interval, UserSet
Prepare
AND
;
AND
AND
I: ConstraintSet
O: MeetingTime
Select Slot
AND
||
AND
system
Get Users
I: -
O: UserSet
Get Interval
I: -
O: Interval
I: UserSet, Interval
O: ConstraintSet
Collect Constraints
OR
|
VP1
OR
|
VP2
OR
Manually
NOP
I: ConstraintSet
O: MeetingTime
Automatically/ Randomly
VP4
Request Constraints
I: UserSet, Interval
O: ConstraintSet
AND
AND
;
AND
Find User Address
I: User
O: Address
Receive Constraints
I: User, Interval
O: UserConstraints
OR
Read Maintained Constraints
I: UserSet, Interval
O: ConstraintSet
OR
OR
|
OR
Priority Oriented
I: ConstraintSet
O: MeetingTime
Conflict Minimization
I: ConstraintSet
O: MeetingTime
Travel Cost Minimization
I: ConstraintSet
O: MeetingTime
Communicate Request
I: Address, Interval
O: -
OR
|
OR
VP3
Instant Messaging
I: Address, Message
O: -
Email
I: Address, Message
O: -

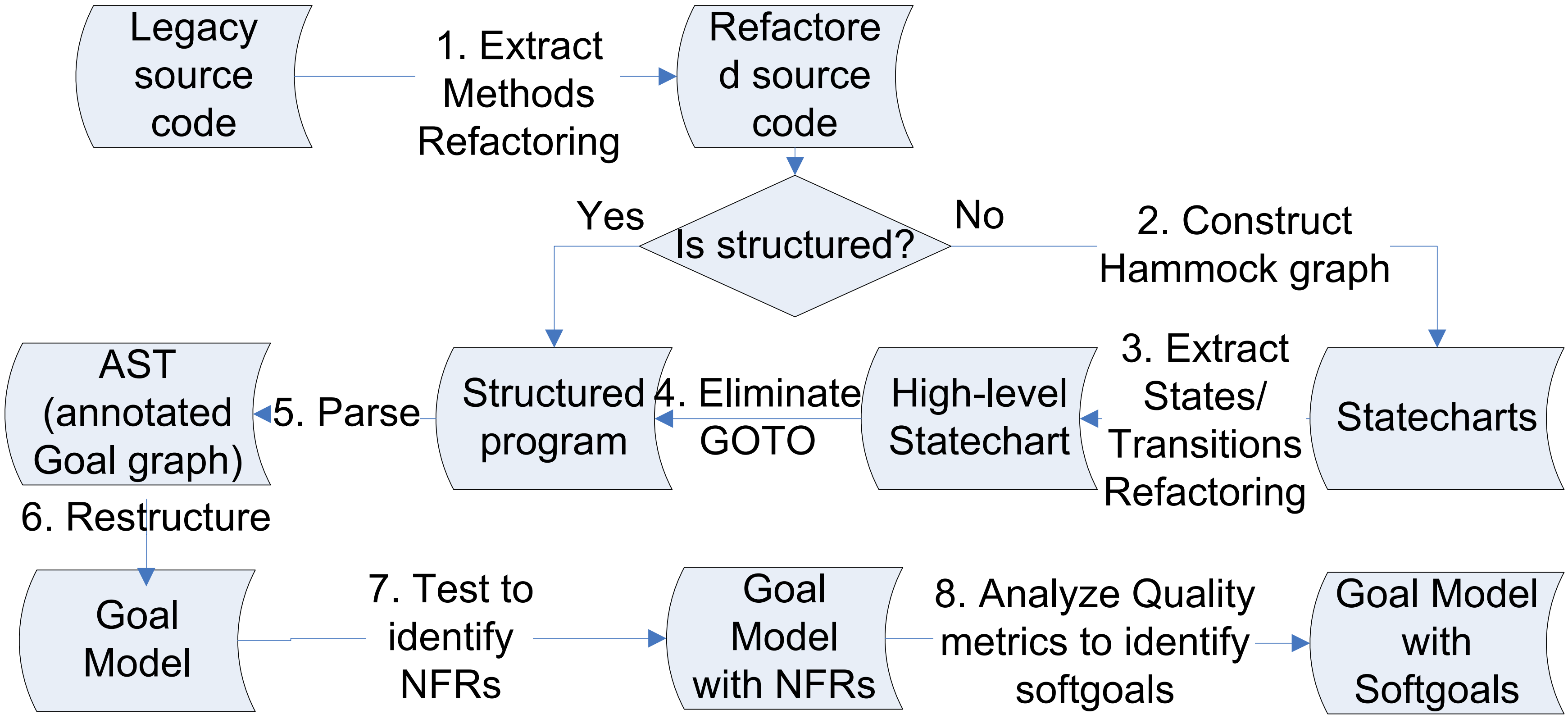
Generated views







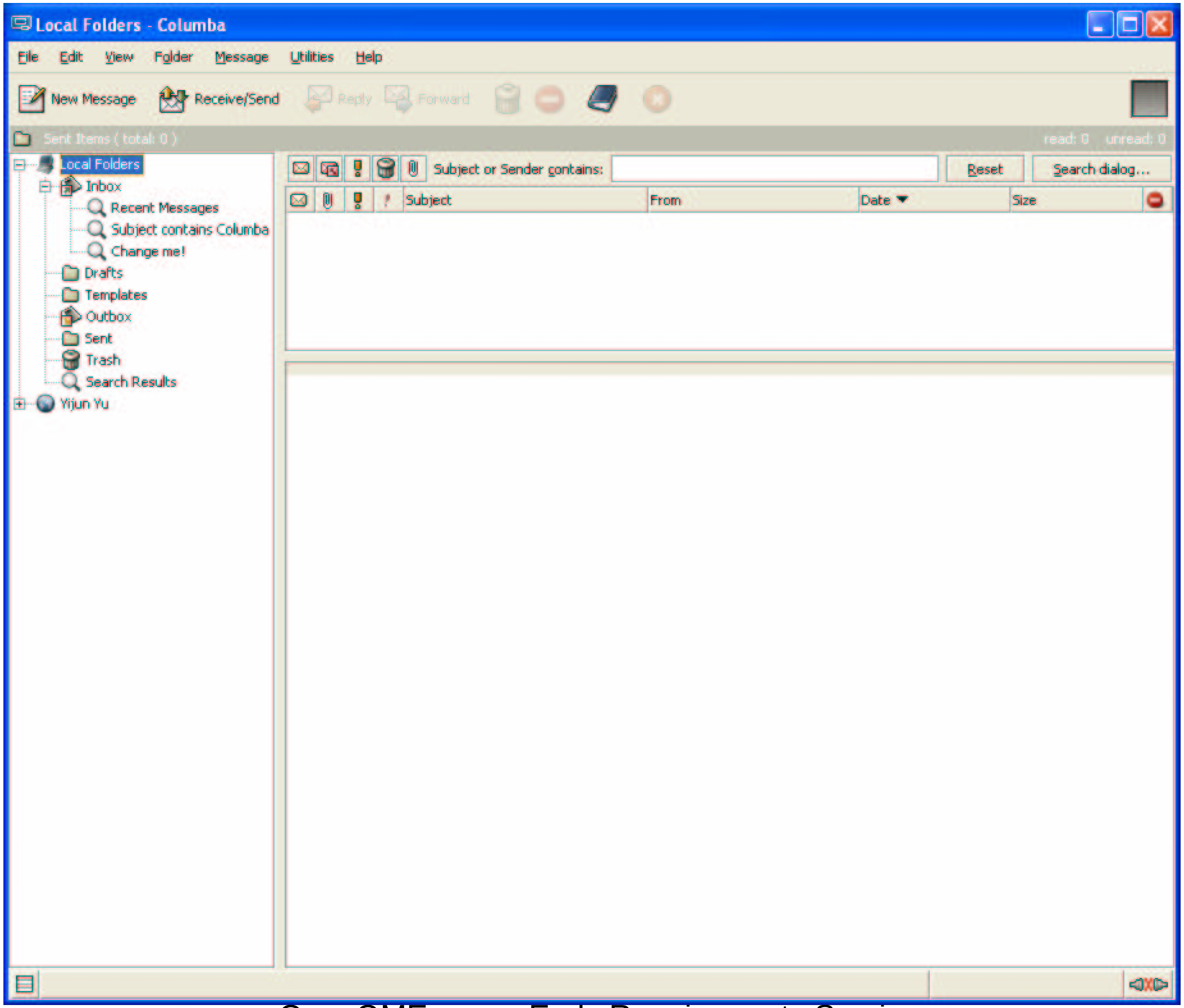
3.4.2 Reverse engineering goal models from legacy code



Example. Columba Refactoring

- Search “Java email client” in Google, you will find this software
- It is open-source
- It has 140 KLOC in Java
- It also has plug-in patterns
- First thing, we modify the code base to fit Eclipse development (moving packages, i.e., move all “src” subdirectories including plug-in projects under the same “src” directory)

A screenshot



Where to look at first?

- Secondly, we look for the main routine
  from the manifest in the JAR file

```
Manifest-Version: 1.0
Ant-Version: Apache Ant 1.6.2
Created-By: 1.4.2_06-b03 (Sun Microsystems Inc.)
Main-Class: org.columba.core.main.Main
Sealed: false
Class-Path:  lib/usermanual.jar lib/junit.jar lib/lucene-1.3-final.jar
  lib/commons-cli-1.0.jar lib/jwizz-0.1.2.jar lib/plastic-1.2.0.jar li
 b/jhall.jar lib/forms-1.0.4.jar lib/ristretto-1.0_RC2.jar lib/jscf-0.
 2.jar lib/macchiato-1.0pre1.jar lib/frapuccino-1.0pre1.jar lib/winpac
 k.jar lib/jniwrap-2.4.jar lib/jdom.jar lib/jpim.jar lib/je.jar ${lib.
 jdic}
```

The Main routine

```
public static void main(String[] args) {
    Main.getInstance().run(args);
}
```

Thus we look at “run” routine, which has 81 lines of code

The Run routine

```
public void run(String args[]) {
    ColumbaLogger.createDefaultHandler();
    registerCommandLineArguments();
    // handle commandline parameters
    if (handleCoreCommandLineParameters(args)) {
       System.exit(0);
    }
    // prompt user for profile
    Profile profile = ProfileManager.getInstance().getProfile(path);
    // initialize configuration with selected profile
      new Config(profile.getLocation());
      // if user doesn't overwrite logger settings with commandline arguments
     // just initialize default logging

      ColumbaLogger.createDefaultHandler();
      ColumbaLogger.createDefaultFileHandler();

      for ( int i=0; i<args.length; i++) {
         LOG.info("arg["+i+"]="+args[i]);
      }
     …
```

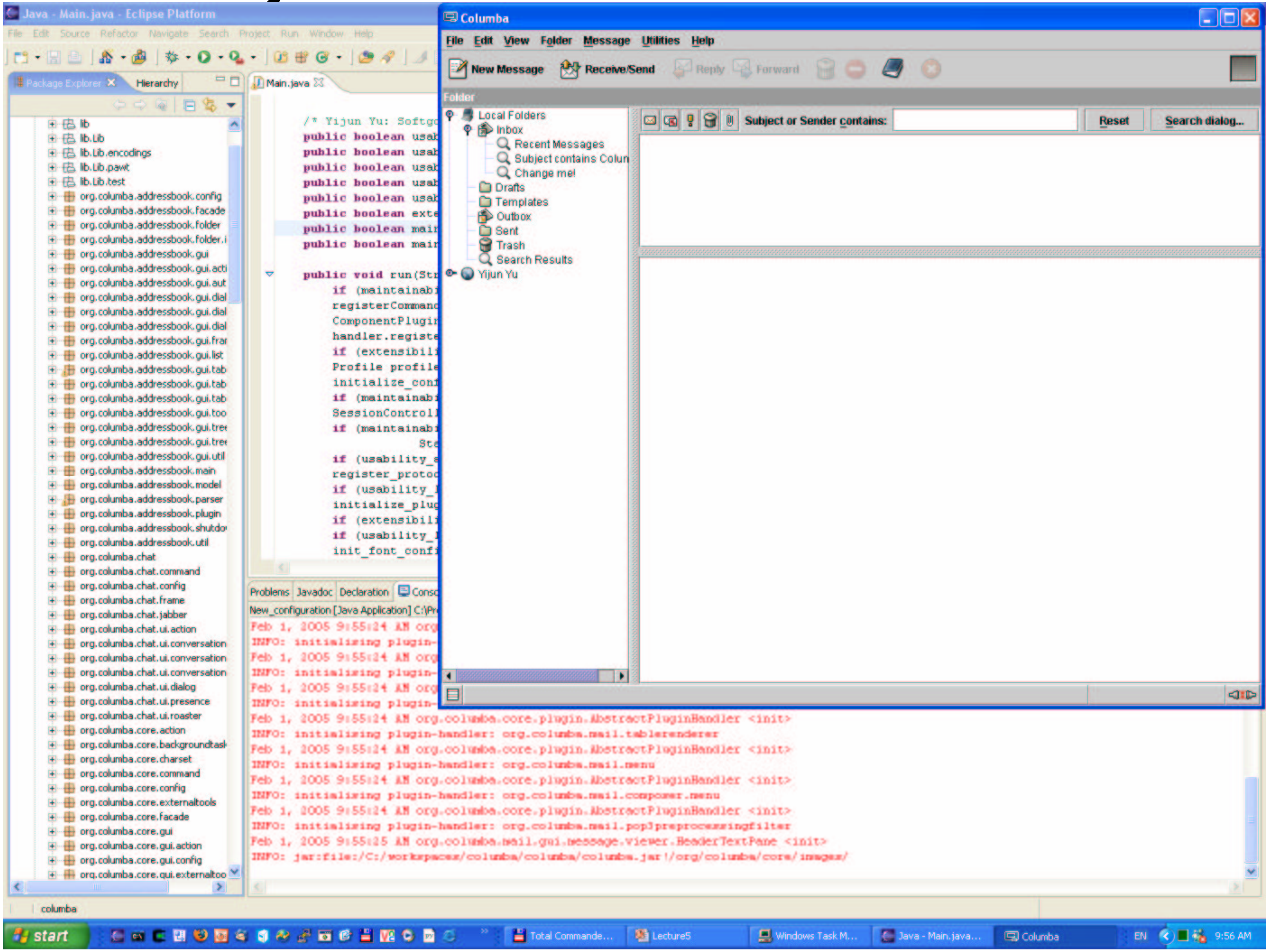
The Run routine refactored

```
public void run(String args[]) {
      ColumbaLogger.createDefaultHandler();
       registerCommandLineArguments();
       ComponentPluginHandler handler = register_plugins();
       handler.registerCommandLineArguments();
       handle_commandline_parameters(args);
       Profile profile = prompt_user_for_profile();
       initialize_configuration_with_selected_profile(profile);
       initialize_default_logging(args);
       SessionController.passToRunningSessionAndExit(args);
       enable_debugging_repaint_manager_for_swing_gui_access();
       StartUpFrame frame = show_splash_screen();
       register_protocol_handler();
       load_user_customized_language_pack();
       initialize_plugins(handler);
       load_plugins();
       set_look_and_feel();
       init_font_configurations();
       set_application_wide_font();
       hide_splash_screen(frame);
       handle_commandline_arguments_of_the_modules(handler);
       restore_frames_of_last_session();
       ensure_native_libraries_initialized();
       post_startup_of_the_modules(handler);
  }
```

Identify NFR and introducing softgoals

```
public boolean usability = false;
public boolean usability_language_customization = false;
public boolean usability_assured_progress = false;
public boolean usability_look_and_feel = false;
public boolean usability_font_configuration = false;
public boolean extensibility = false;
public boolean maintainability_debugging = false;
public boolean maintainability_logging = false;
public void run(String args[]) {
  if (maintainability_logging) ColumbaLogger.createDefaultHandler();
  registerCommandLineArguments();
  ComponentPluginHandler handler = register_plugins();
   handler.registerCommandLineArguments();
  if (extensibility) handle_commandline_parameters(args);
  Profile profile = prompt_user_for_profile();
  initialize_configuration_with_selected_profile(profile);
  if (maintainability_logging) initialize_default_logging(args);
  SessionController.passToRunningSessionAndExit(args);
  if (maintainability_debugging) enable_debugging_repaint_manager_for_swing_gui_access();
        StartUpFrame frame = null;
  if (usability_assured_progress) { frame = show_splash_screen(); }
  register_protocol_handler();
  if (usability_language_customization) load_user_customized_language_pack();
  initialize_plugins(handler);
  if (extensibility) load_plugins();
  if (usability_look_and_feel) set_look_and_feel();
  init_font_configurations();
  if (usability_font_configuration) set_application_wide_font();
  if (usability_assured_progress) hide_splash_screen(frame);
  if (extensibility) handle_commandline_arguments_of_the_modules(handler);
  restore_frames_of_last_session();
  if (extensibility) ensure_native_libraries_initialized();
  if (extensibility) post_startup_of_the_modules(handler);
}
```

The system without the NFRs

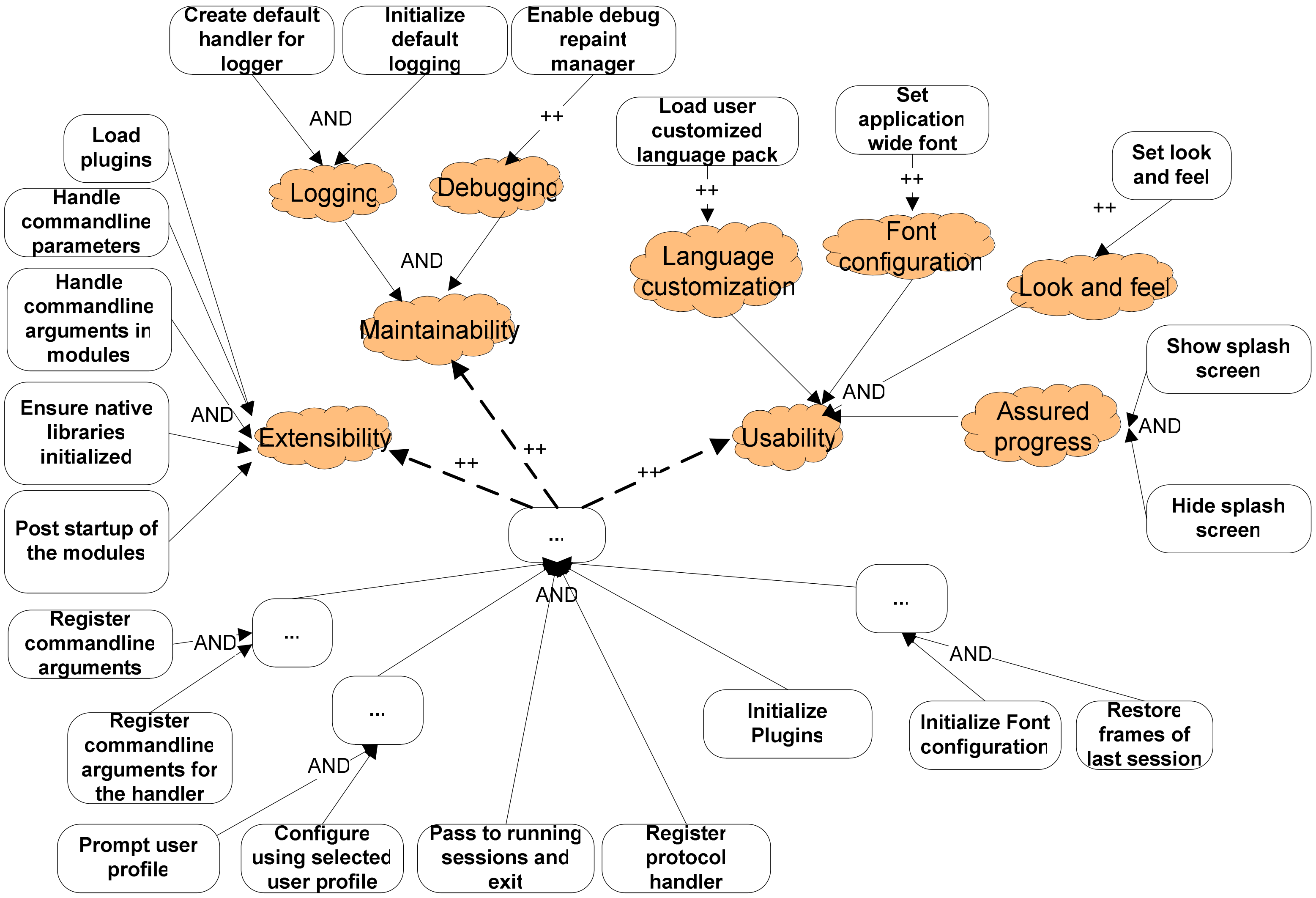


Java - Main.java - Eclipse Platform
File Edit Source Refactor Navigate Search Project Run Window Help
Package Explorer
Hierarchy
lib
lib.Lib
lib.Lib.encodings
lib.Lib.pawt
lib.Lib.test
org.columba.addressbook.config
org.columba.addressbook.facade
org.columba.addressbook.folder
org.columba.addressbook.folder.i
org.columba.addressbook.gui
org.columba.addressbook.gui.acti
org.columba.addressbook.gui.aut
org.columba.addressbook.gui.dial
org.columba.addressbook.gui.dial
org.columba.addressbook.gui.dial
org.columba.addressbook.gui.frar
org.columba.addressbook.gui.list
org.columba.addressbook.gui.tab
org.columba.addressbook.gui.tab
org.columba.addressbook.gui.tab
org.columba.addressbook.gui.too
org.columba.addressbook.gui.tree
org.columba.addressbook.gui.tree
org.columba.addressbook.gui.util
org.columba.addressbook.main
org.columba.addressbook.model
org.columba.addressbook.parser
org.columba.addressbook.plugin
org.columba.addressbook.shutdo
org.columba.addressbook.util
org.columba.chat
org.columba.chat.command
org.columba.chat.config
org.columba.chat.frame
org.columba.chat.jabber
org.columba.chat.ui.action
org.columba.chat.ui.conversation
org.columba.chat.ui.conversation
org.columba.chat.ui.conversation
org.columba.chat.ui.dialog
org.columba.chat.ui.presence
org.columba.chat.ui.roaster
org.columba.core.action
org.columba.core.backgroundtask
org.columba.core.charset
org.columba.core.command
org.columba.core.config
org.columba.core.externaltools
org.columba.core.facade
org.columba.core.gui
org.columba.core.gui.action
org.columba.core.gui.config
org.columba.core.gui.externaltoo
columba
Main.java
Problems
Javadoc
Declaration
Conso
Columba
File Edit View Folder Message Utilities Help
New Message
Receive/Send
Reply
Forward
Folder
Local Folders
Inbox
Recent Messages
Subject contains Colun
Change me!
Drafts
Templates
Outbox
Sent
Trash
Search Results
Yijun Yu
Subject or Sender contains:
Reset
Search dialog...
start
Total Commande...
Lecture5
Windows Task M...
Java - Main.java...
Columba
EN
9:56 AM

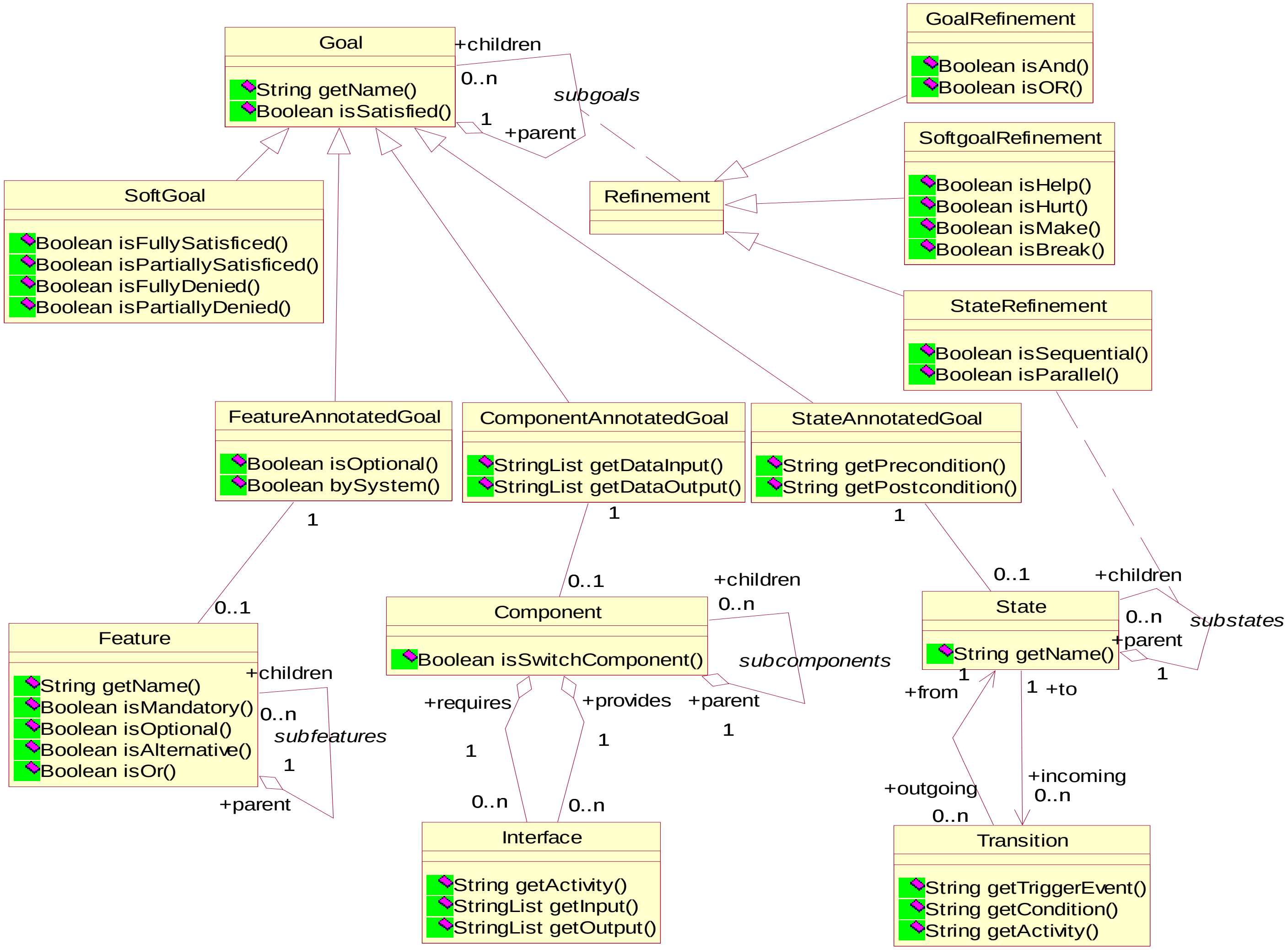
```
    /* Yijun Yu: Softgo
    public boolean usab
    public boolean usab
    public boolean usab
    public boolean usab
    public boolean usab
    public boolean exte
    public boolean main
    public boolean main

    public void run(Str
        if (maintainabi
        registerCommand
        ComponentPlugin
        handler.registe
        if (extensibili
        Profile profile
        initialize_conf
        if (maintainabi
        SessionControll
        if (maintainabi
                    Sta
        if (usability_a
        register_protoc
        if (usability_l
        initialize_plug
        if (extensibili
        if (usability_l
        init_font_confi
```

```
New_configuration [Java Application] C:\Pr
Feb 1, 2005 9:55:24 AM org
INFO: initializing plugin-
Feb 1, 2005 9:55:24 AM org
INFO: initializing plugin-
Feb 1, 2005 9:55:24 AM org
INFO: initializing plugin-
Feb 1, 2005 9:55:24 AM org.columba.core.plugin.AbstractPluginHandler <init>
INFO: initializing plugin-handler: org.columba.mail.tablerenderer
Feb 1, 2005 9:55:24 AM org.columba.core.plugin.AbstractPluginHandler <init>
INFO: initializing plugin-handler: org.columba.mail.menu
Feb 1, 2005 9:55:24 AM org.columba.core.plugin.AbstractPluginHandler <init>
INFO: initializing plugin-handler: org.columba.mail.composer.menu
Feb 1, 2005 9:55:24 AM org.columba.core.plugin.AbstractPluginHandler <init>
INFO: initializing plugin-handler: org.columba.mail.pop3preprocessingfilter
Feb 1, 2005 9:55:25 AM org.columba.mail.gui.message.viewer.HeaderTextPane <init>
INFO: jar:file:/C:/workspaces/columba/columba/columba.jar!/org/columba/core/images/
```

The goal model


Create default handler for logger
Initialize default logging
Enable debug repaint manager
AND
++
Logging
Debugging
Load user customized language pack
Set application wide font
Set look and feel
++
++
++
Load plugins
Handle commandline parameters
Handle commandline arguments in modules
Ensure native libraries initialized
Post startup of the modules
AND
Maintainability
Language customization
Font configuration
Look and feel
AND
Extensibility
++
++
++
Usability
AND
Assured progress
Show splash screen
AND
Hide splash screen
...
AND
Register commandline arguments
AND
...
Register commandline arguments for the handler
...
AND
Prompt user profile
Configure using selected user profile
Pass to running sessions and exit
Register protocol handler
Initialize Plugins
...
AND
Initialize Font configuration
Restore frames of last session

3.4.3 meta model implementation



Goal
- String getName()
- Boolean isSatisfied()

GoalRefinement
- Boolean isAnd()
- Boolean isOR()

SoftgoalRefinement
- Boolean isHelp()
- Boolean isHurt()
- Boolean isMake()
- Boolean isBreak()

Refinement

StateRefinement
- Boolean isSequential()
- Boolean isParallel()

SoftGoal
- Boolean isFullySatisficed()
- Boolean isPartiallySatisficed()
- Boolean isFullyDenied()
- Boolean isPartiallyDenied()

FeatureAnnotatedGoal
- Boolean isOptional()
- Boolean bySystem()

ComponentAnnotatedGoal
- StringList getDataInput()
- StringList getDataOutput()

StateAnnotatedGoal
- String getPrecondition()
- String getPostcondition()

Feature
- String getName()
- Boolean isMandatory()
- Boolean isOptional()
- Boolean isAlternative()
- Boolean isOr()

Component
- Boolean isSwitchComponent()

State
- String getName()

Interface
- String getActivity()
- StringList getInput()
- StringList getOutput()

Transition
- String getTriggerEvent()
- String getCondition()
- String getActivity()

3.5 Web service-based OpenOME

- OmniGraphEditor is a web service that keeps shared channels
- OpenOME communicates to the Web service, open-up cooperative requirements engineering possibilities
- Client/Server versus Peer-to-Peer
- Let’s hope the ECE450 students can deliver something at the end of the course

4. Relation to your research

1. This is a tool *of you, by you and for you*
2. Any suggestions, contributions are extremely welcome!

5. How can you contribute?

http://sourceforge.net/projects/openome

To contribute:

1. Apply a developer account at source forge
   http://sourceforge.net/account/newuser_emailverify.php
2. Send me email, I will add your account to the developer member list
3. Commit the source code into CVS

   CVS -d:ext:*developername*@cvs.sourceforge.net:/cvsroot/openome
4. Feature request
   http://sourceforge.net/tracker/?group_id=110573&atid=656743
5. Bug report
   http://sourceforge.net/tracker/?group_id=110573&atid=656742