Using the PR*i*M method to Evaluate Requirements Models with COSMIC-FFP

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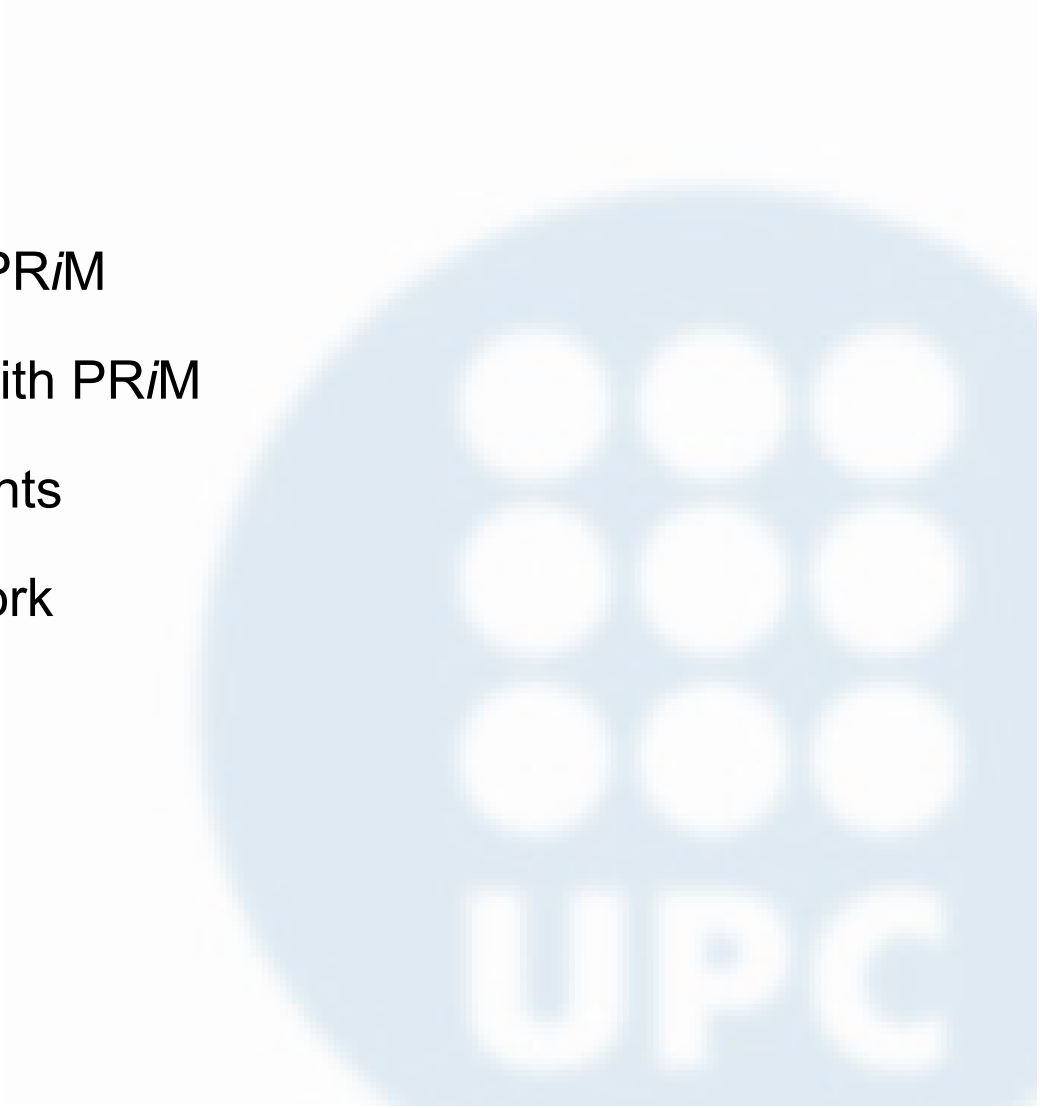
Agenda

- Motivation
- The *i** Framework
- Mapping COSMIC-FFP to PR*i*M
- Measuring COSMIC-FFP with PR*i*M
- Non-functional Measurements
- Conclusions and Future Work



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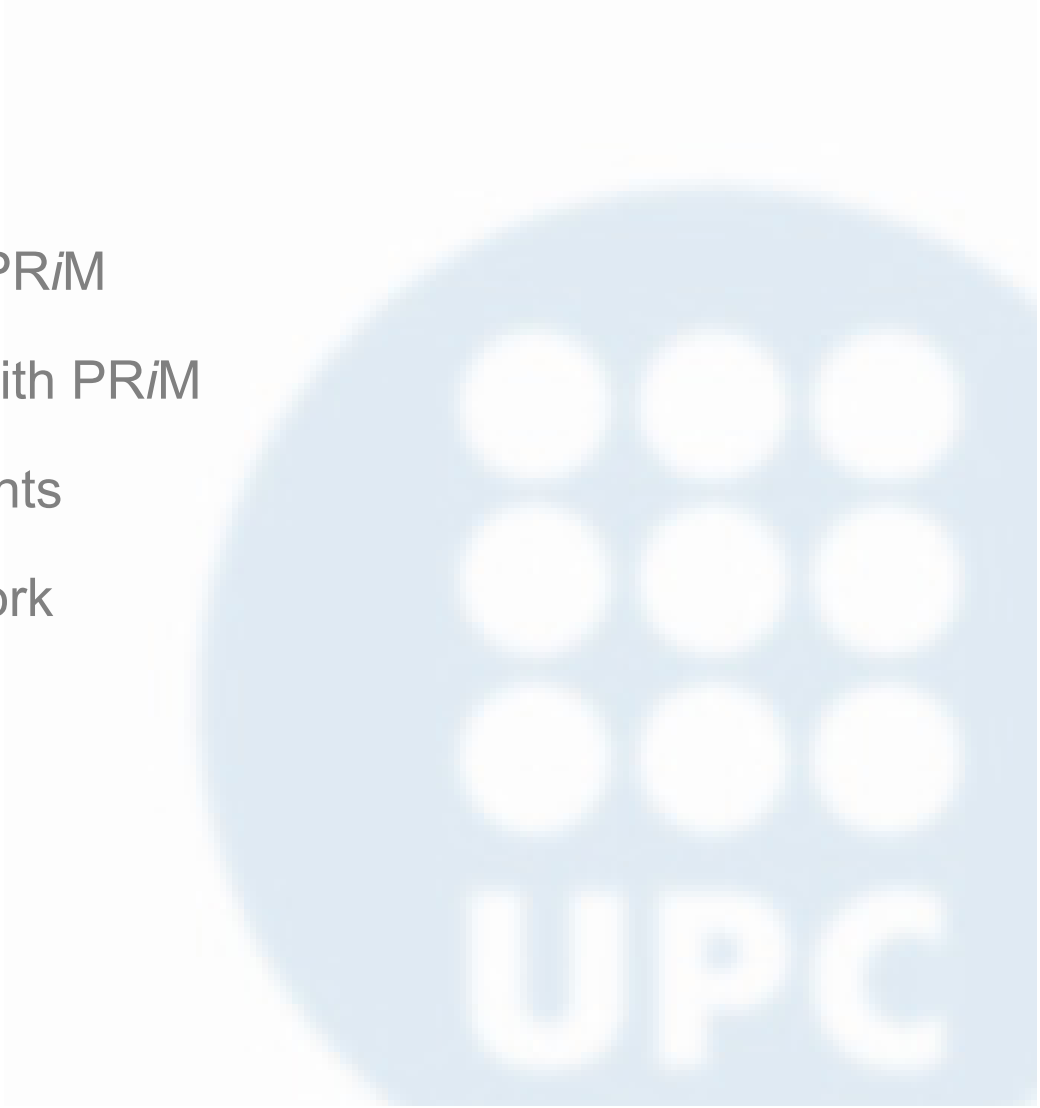


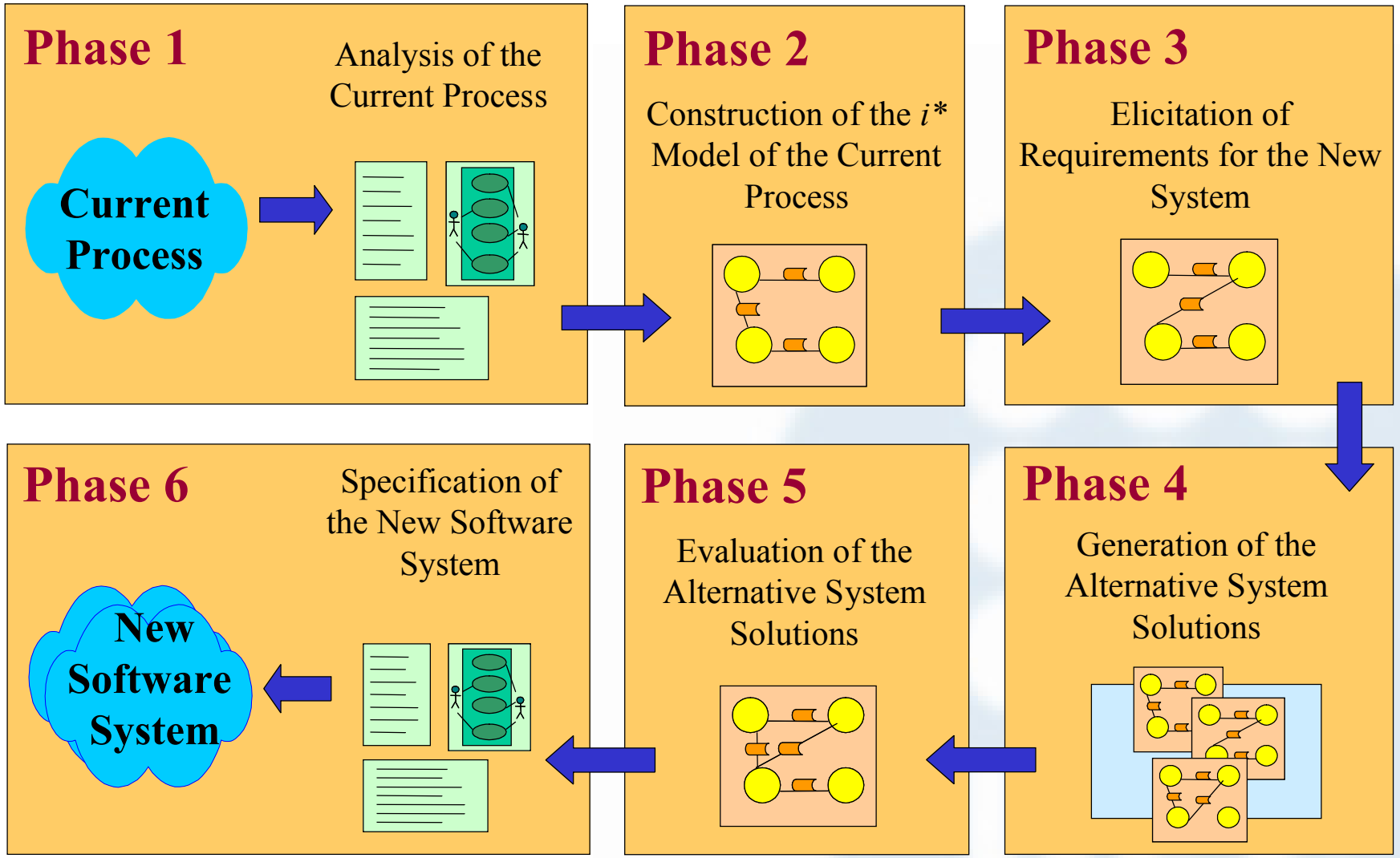
Motivation

- **In the latest projects where you have been involved, did you use the current system as an starting point?**
  - We did
  - We used the current system as an starting point
    - Maintain most of the existing functionality
    - Improve some non-functional requirements
    - Fulfil new organizational goals
- **Use of Business Process Reengineering practices**
  - We defined PR*i*M, a Process Reengineering *i** Method
- **Development of software systems can be viewed as an exercise of reengineering**

Motivation

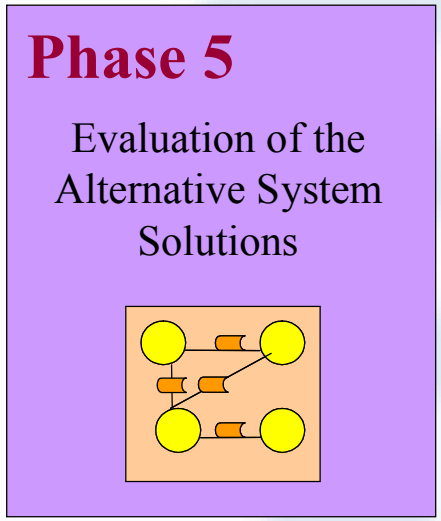
- **Traditional reengineering activities**
  - Model an the existing system
  - Generate solutions
  - Evaluate solutions
- **Some existing methods**
  - Support some of the reengineering activities
  - Mention/Not mention the term “reengineering”
- **PR*i*M: A Process Reengineering *i** Method**
  - Works during the requirements stage
  - Uses the *i** Framework to represent requirements

PR*i*M: a Process Reengineering *i** Method



PR*i*M: a Process Reengineering *i** Method

- **Evaluation of Alternatives**
  - **Structural Metrics**
  - **Non-functional requirements**
  - **How to measure the functional size?**
    - **COSMIC-FFP**



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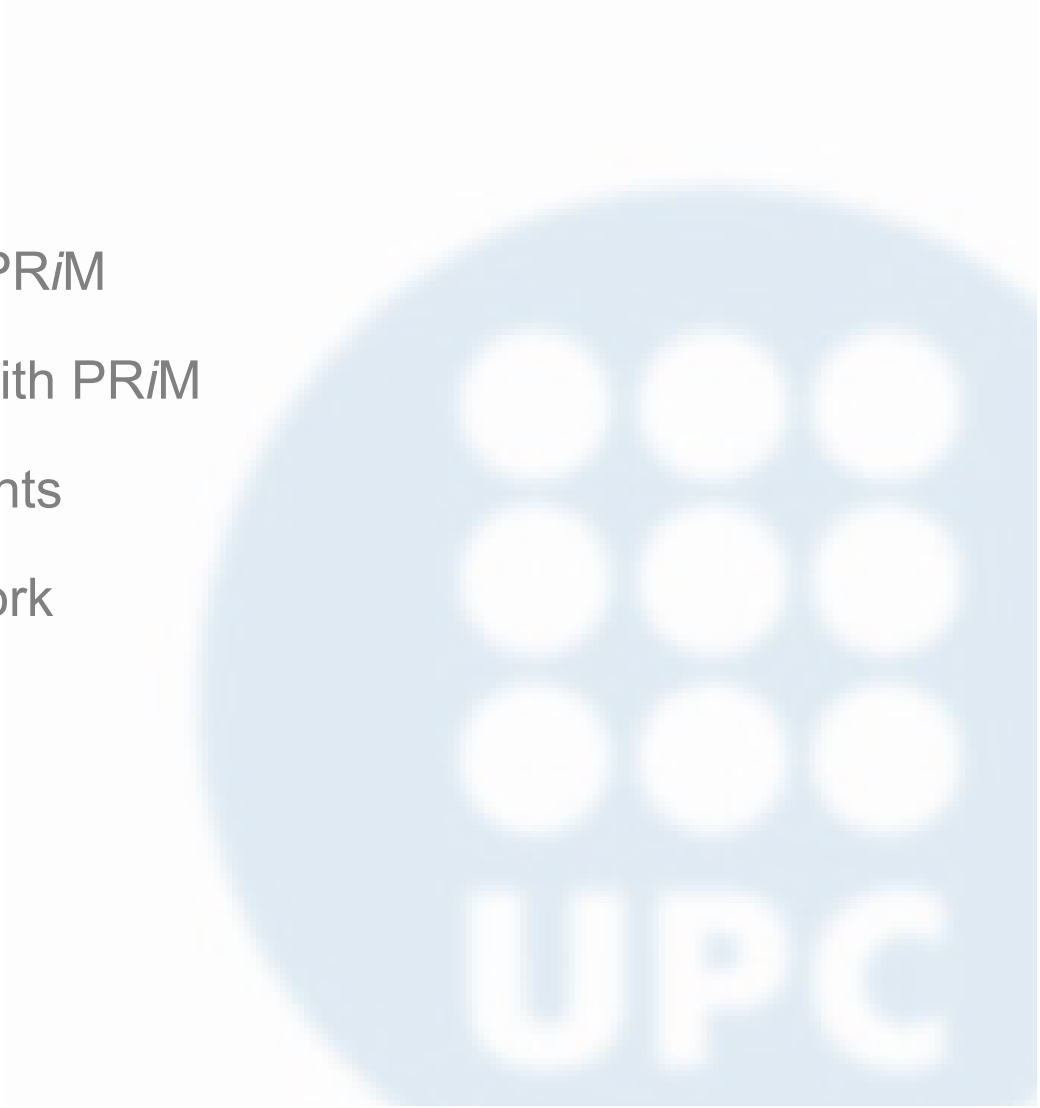

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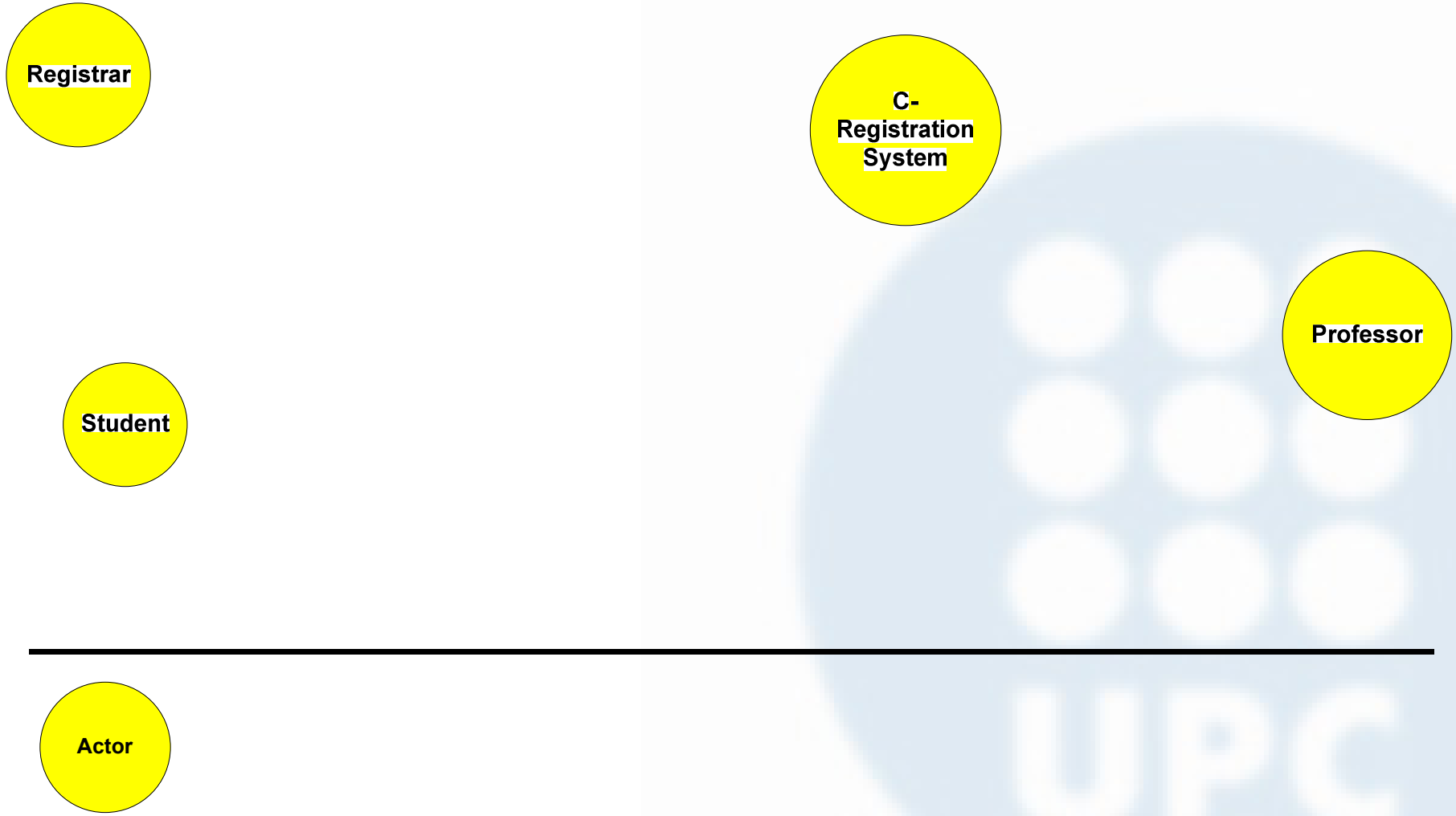

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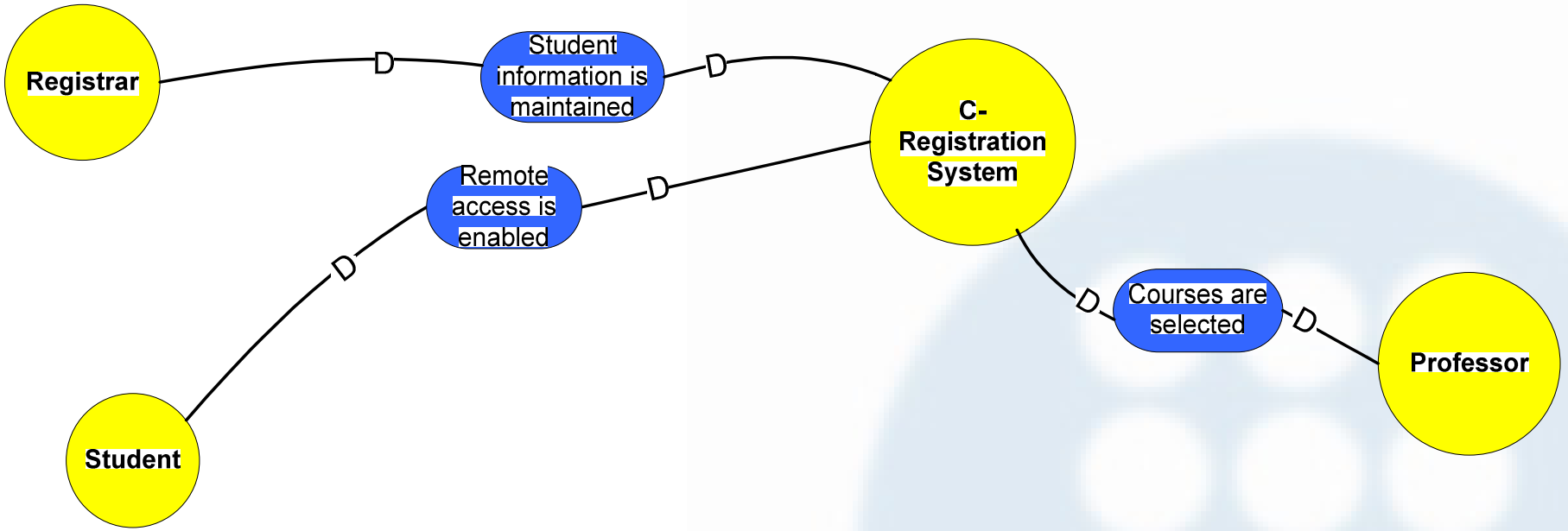

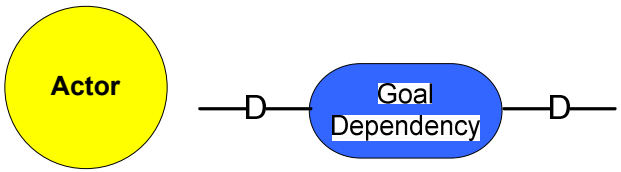

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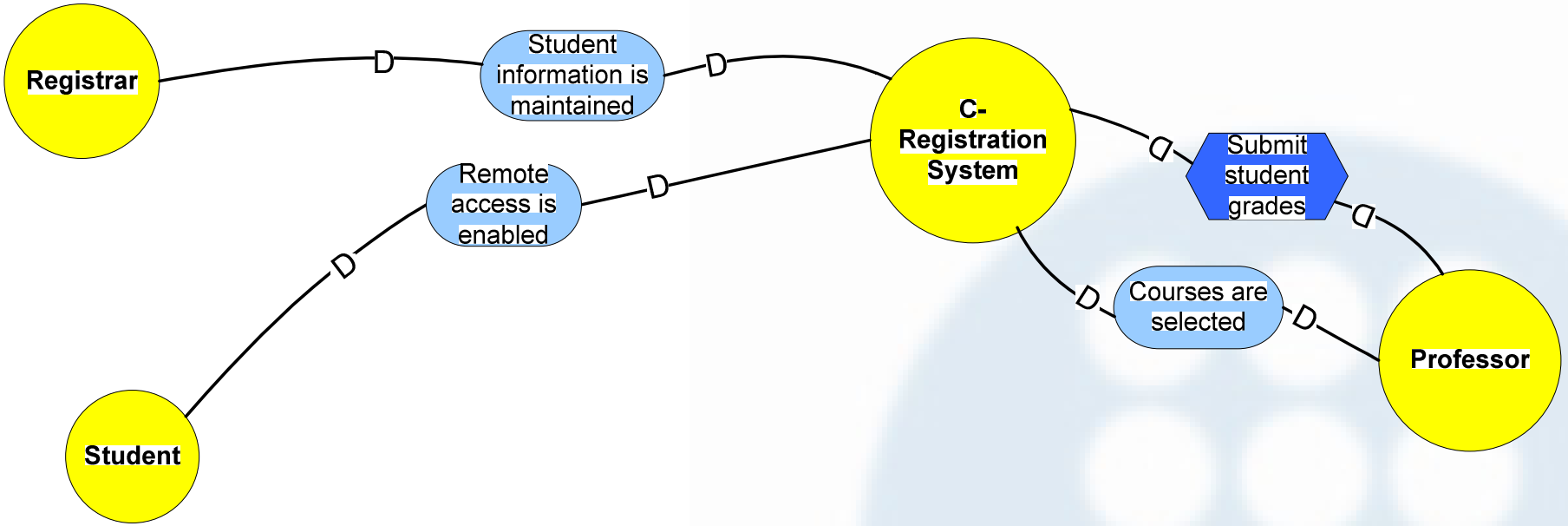

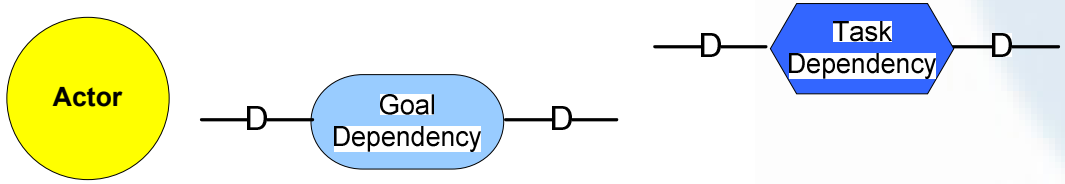

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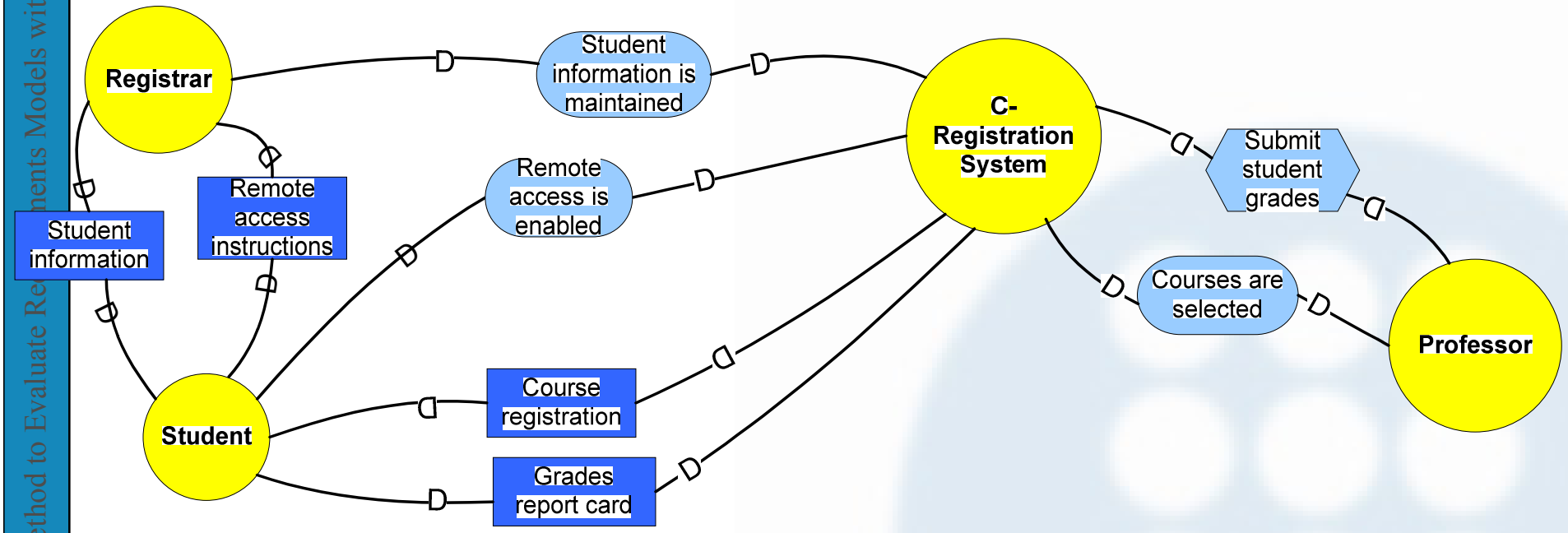

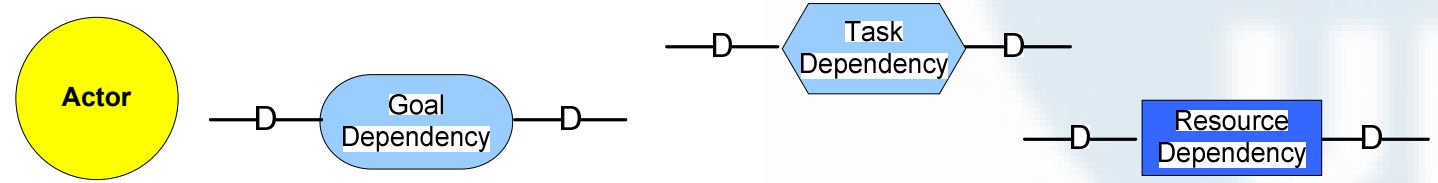

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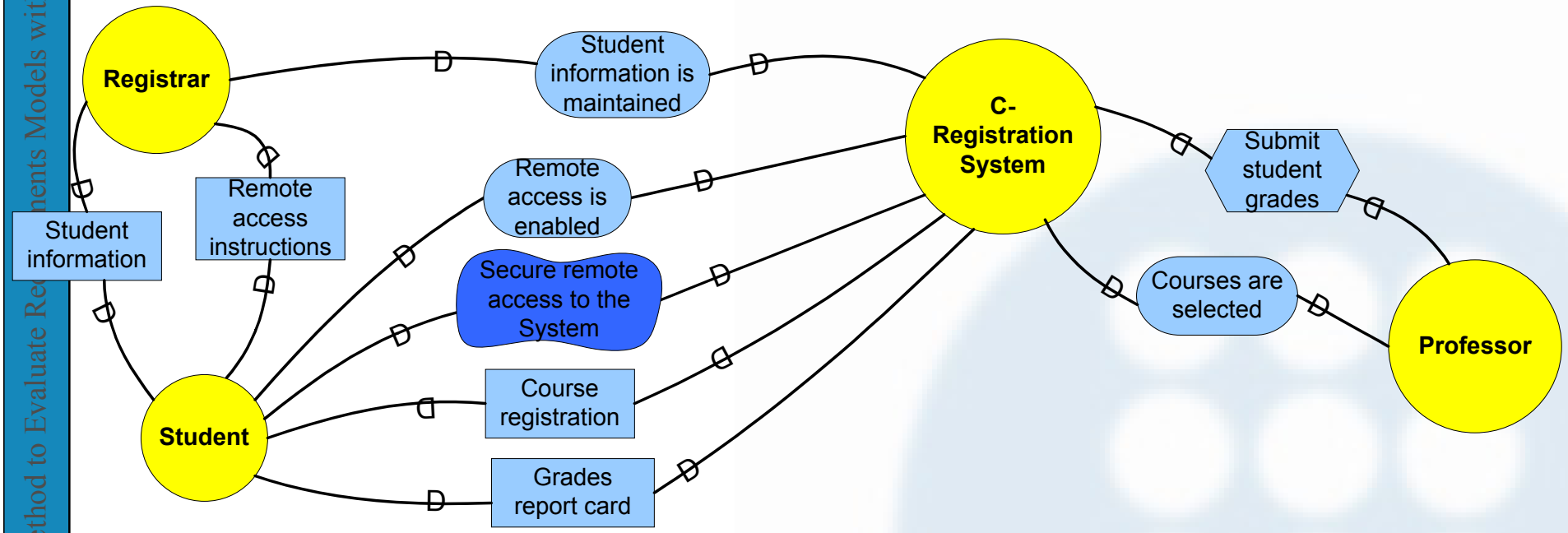

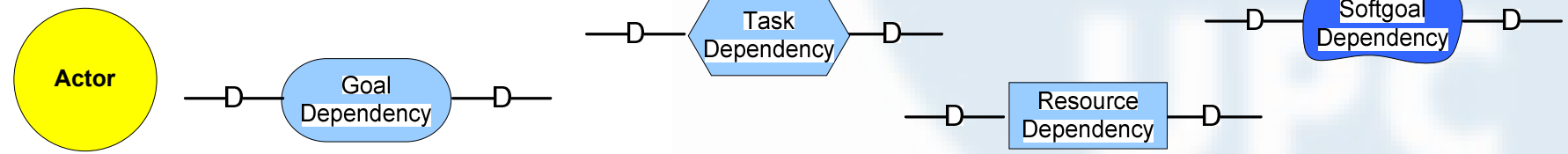

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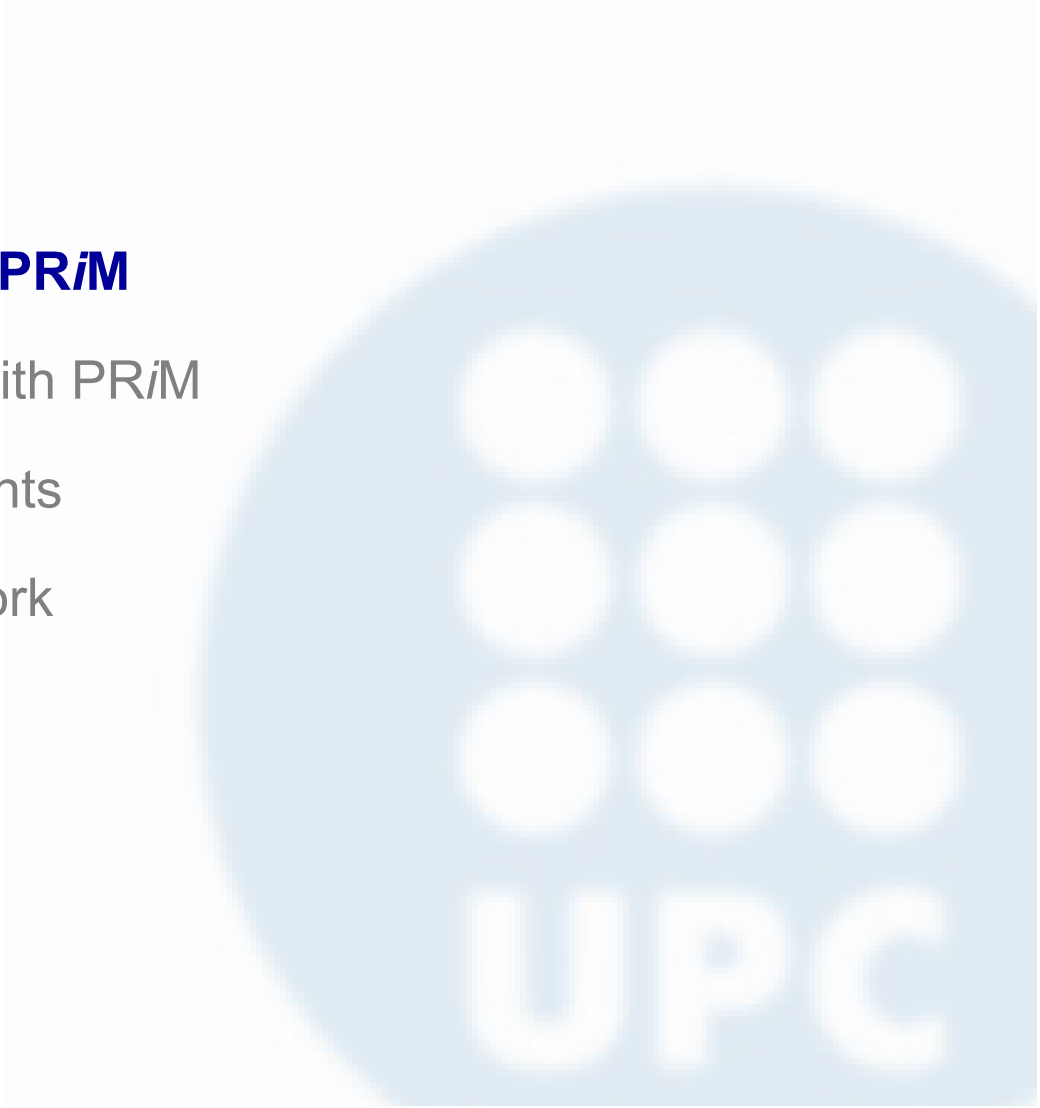
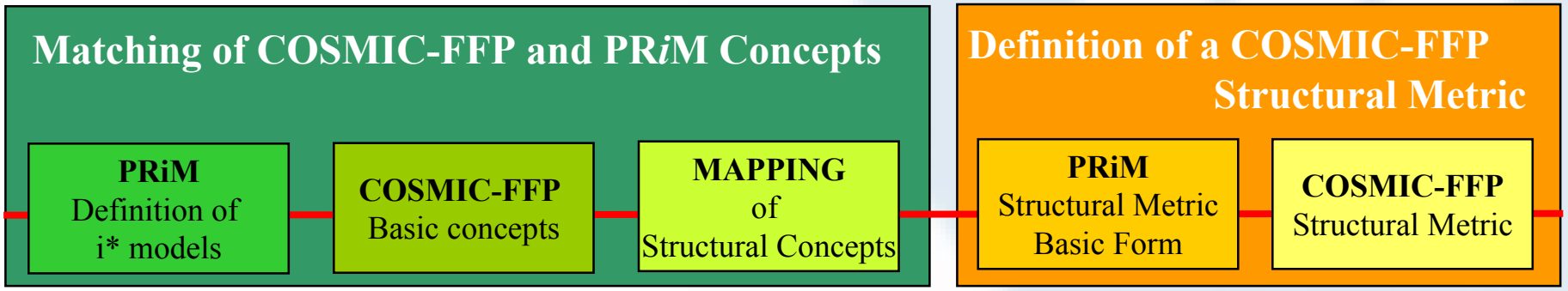
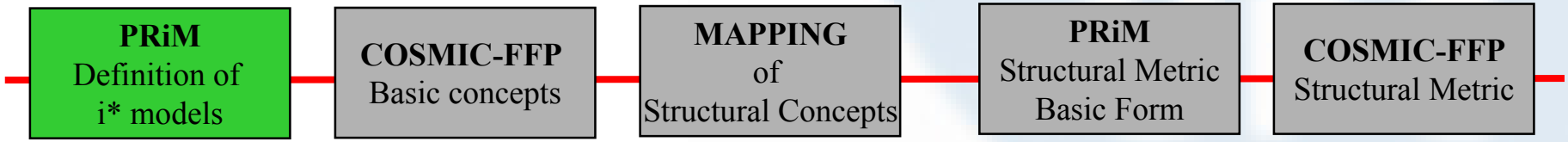


Mapping COSMIC-FFP to PR*i*M



Defining *i** Models with PR*i*M

- **Objective:**
  - Build the i* Model of the Current Process
    - Social or Socio-Technical
- **Strategy:**
  - Analyse the Current Process
  - Document the Current Process into DIS
  - Building the Operational *i** Model:
    - Descriptive goals
    - Obtained by applying rules over the DIS tables
    - Resources and Tasks
  - Building the intentional *i** model
    - Prescriptive goals
    - Obtained from the organization needs and expectations
    - Goals and Softgoals



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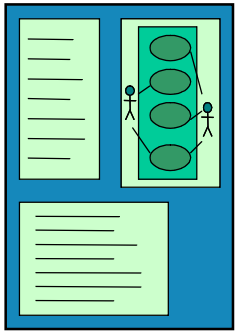
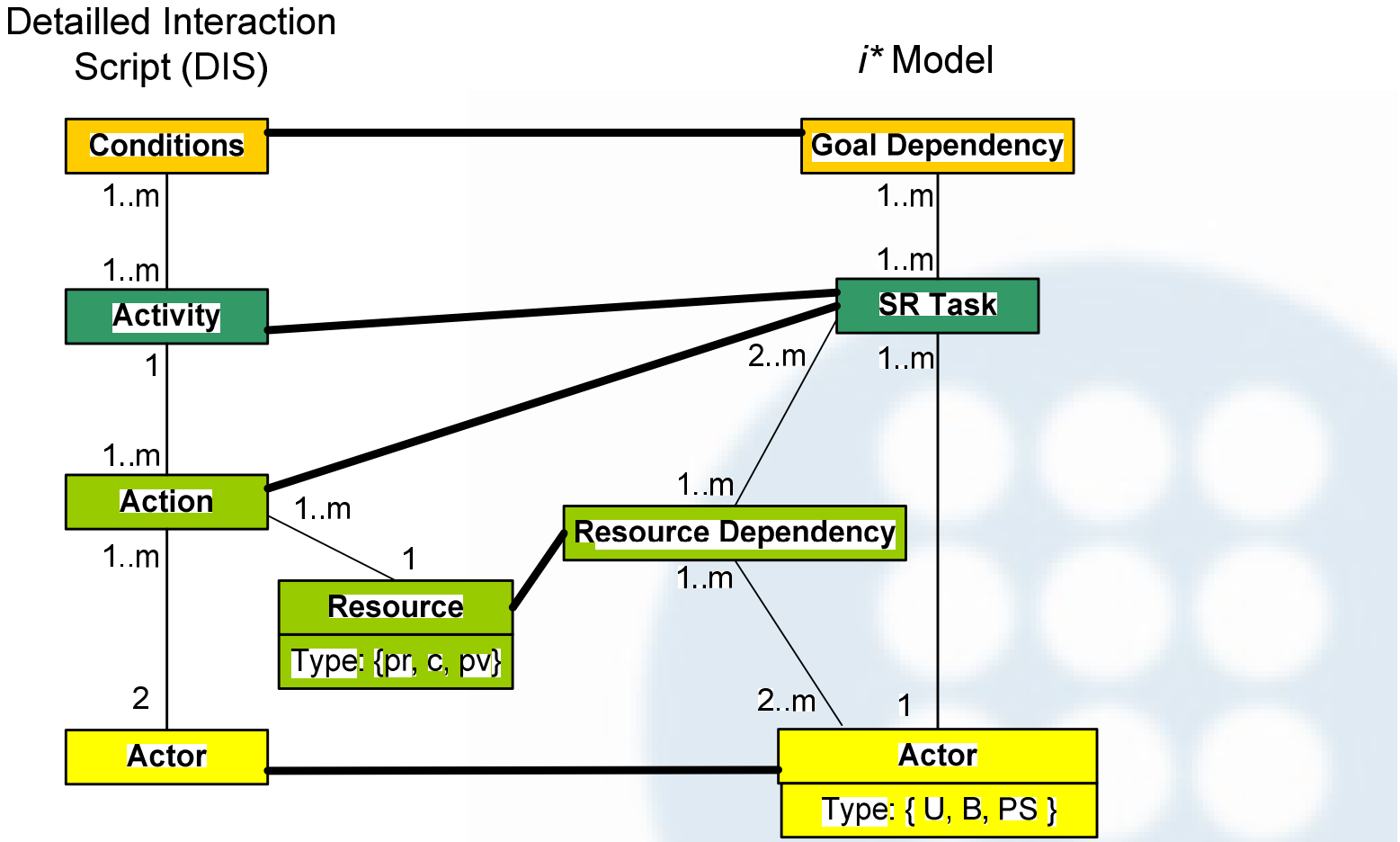


- **Detailed Interaction Script (DIS)**
  - Scenario-based notation for documenting the Current Process
  - One DIS for each activity

	DIS_3: Modify a Professor					
Source:	The C-Registration Case Study with ISO 19761 (2003)					
Actors:	Registrar, C-Registration System, Database					
Precondition:	-					
Triggering event:	Registrar selects the 'modify a professor'					
Actions:						
	Actor Initiator	**Action**	**Consumed Resource**	**Produced Resource**	**Provided Resource**	**Action Addressee**
1	Registrar	Registrar enters Professor ID			Professor ID	C-Registration System
2	C-Registration System	The system retrieves the professor information	Professor data			Database
3	C-Registration System	The system displays the professor information			Professor data	Registrar
4	Registrar	The registrar enters the modified professor data		Professor data		C-Registration System
5	Registrar	When changes are complete, the Registrar selects 'save'	C-Registration System			
6	C-Registration System	The system updates the Professor information		Professor data		Database
7	C-Registration System	Display error message		Error message		Registrar
Postcondition:	The Registrar has modified the professor data					

PRiM Definition of i* models → **COSMIC-FFP** Basic concepts → **MAPPING** of Structural Concepts → **PRiM** Structural Metric Basic Form → **COSMIC-FFP** Structural Metric

Transformation Guidelines: from DIS to *i**



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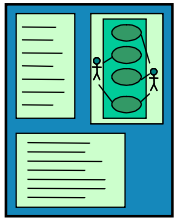

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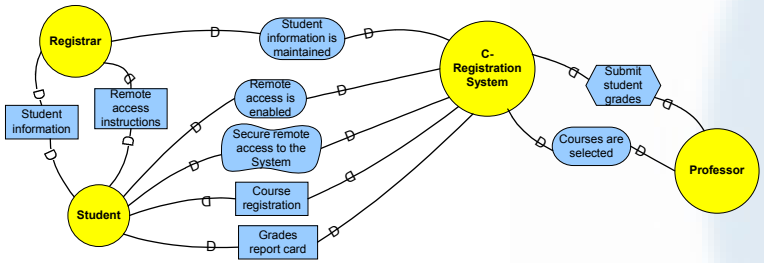
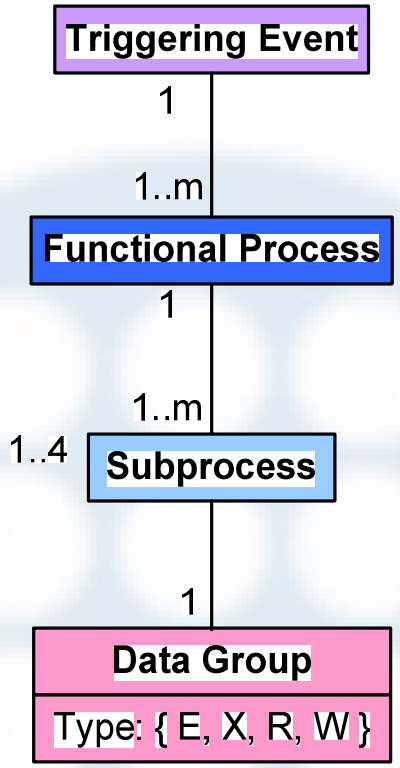


PRiM Definition of i* models → **COSMIC-FFP** Basic concepts → **MAPPING** of Structural Concepts → **PRiM** Structural Metric Basic Form → **COSMIC-FFP** Structural Metric

COSMIC-FFP

- Analyses the functional processes
- Considers three kinds of actors:
  - Users or Engineered Devices
  - System Boundary
  - Persistent Storage
- Identifies the data movements implied:
  - Entry
  - eXit
  - Read
  - Write

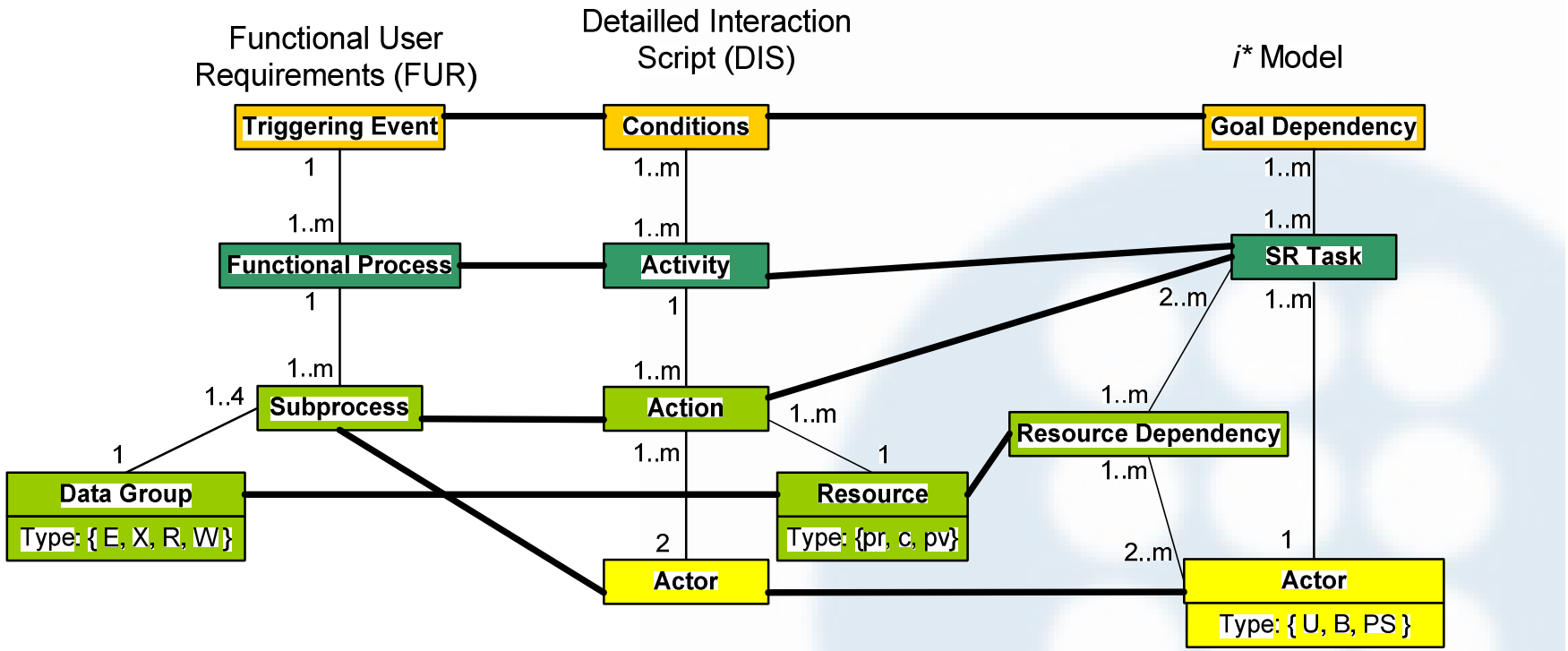
Functional User Requirements (FUR)



COSMIC-FFP

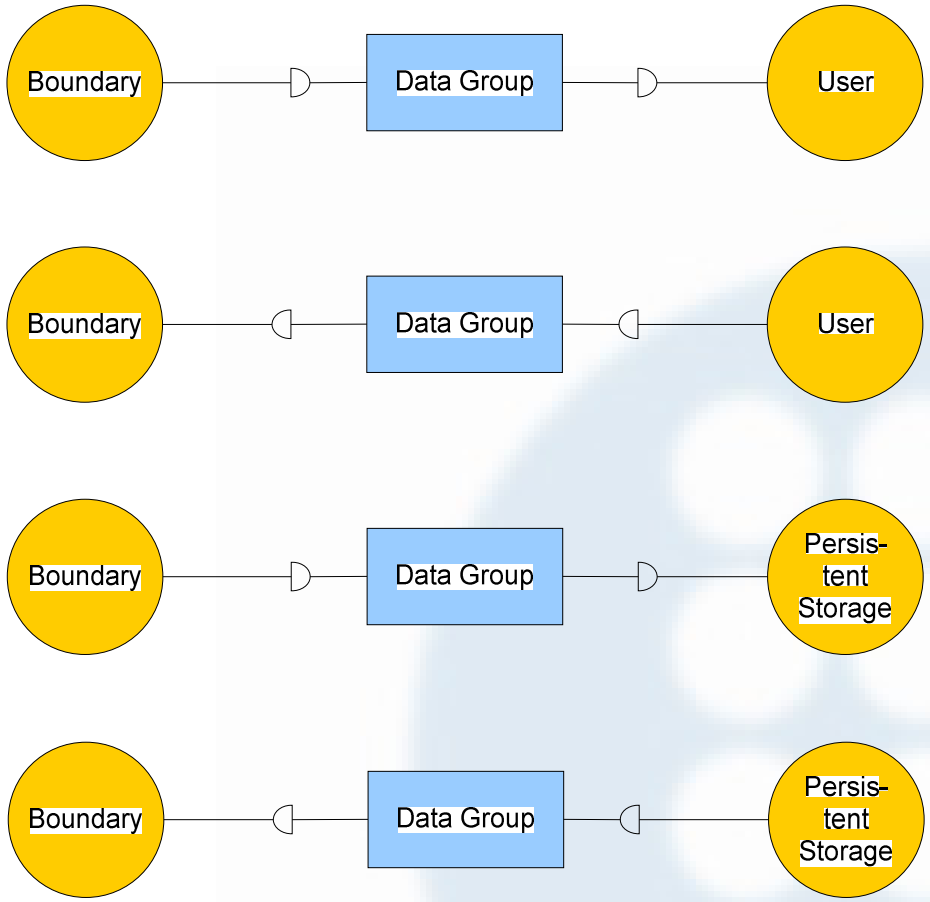
No	ID. of Requirements	Process descriptions	Triggering event	Sub-process Description	Data Group	Data movement Type	Cfsu	ΣCfsu
3	2.2.2.1	Modify a professor	Registrar selects the "modify a Professor" activity	Registrar enters Professor ID	Professor ID	E	1	
	2.2.2.4			The system retrieves the Professor information	Professor data	R	1	
				The system displays the Professor information	Professor data	X	1	
				The Registrar enters the modified Professor data	Professor data	E	1	
				When changes are complete, the Registrar selects 'Save'	This is not a distinct data movement. It only indicates that the Entry of the data (see above) is completed	This will be omitted from now on in all other use cases	0	
				The system updates the Professor information	Professor data	W	1	
				Display error message	Message	X	1	
								6

Mapping of Structural Concepts



Mapping of Structural Concepts

- **E**ntry
- e**X**it
- **R**ead
- **W**rite



PRiM: Structural Metrics

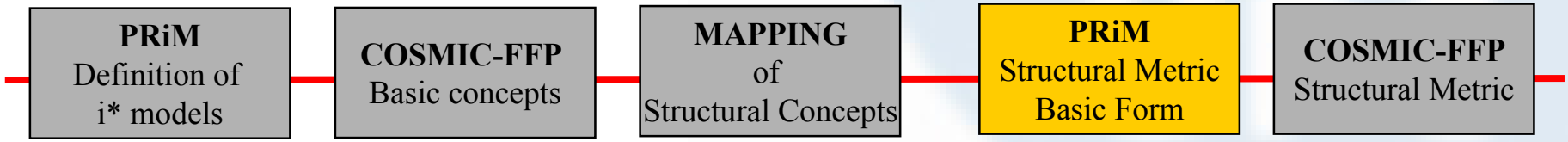
- **Objective:**
  - Evaluate non-functional properties of the models
- **Technique:**
  - Actor-based metrics and Dependency-based metrics

$$P(M) = \frac{\Sigma d:\, d \in D:\, (\text{filter}_M(d) \times \text{correctionFactor}_M(a,b))}{\text{limit}p(\text{D})}$$

filter$_M$: $D \rightarrow$ [0, 1] a function that assigns a weight to the every dependency

correctionFactor$_M$: $A \rightarrow$ [0, 1] a function that corrects the weight of the dependency considering its depender and the dependee.

limit$p$(D) $\rightarrow$ [1..||A||] a function that normalizes the result obtained (if needed)



COSMIC-FFP: Structural Metric

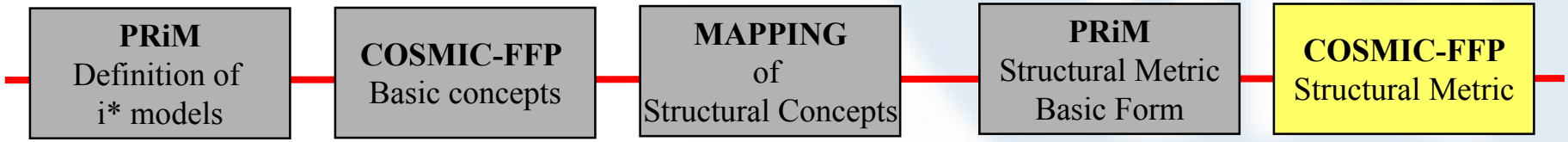
Functional Size (M) = $\Sigma d: d \in D:$ functional_size(d) / $limit_P(D)$

functional_size(d) = filterM(d) x correctionFactor(d)

$$filter_M(d) = \begin{cases} 1, \text{ if } d \in \text{Resource} \\ 0, \text{ otherwise} \end{cases}$$

$$correctionFactor_M(a,b) = \begin{cases} 1, \text{ if } a \in \text{Boundary and } b \in \text{User} \\ 1, \text{ if } a \in \text{User and } b \in \text{Software} \\ 1, \text{ if } a \in \text{Boundary and } b \in \text{Persistent Storage} \\ 1, \text{ if } a \in \text{Persistent Storage and } b \in \text{Boundary} \\ 0, \text{ otherwise} \end{cases}$$

$$limit_P(D) = 1$$



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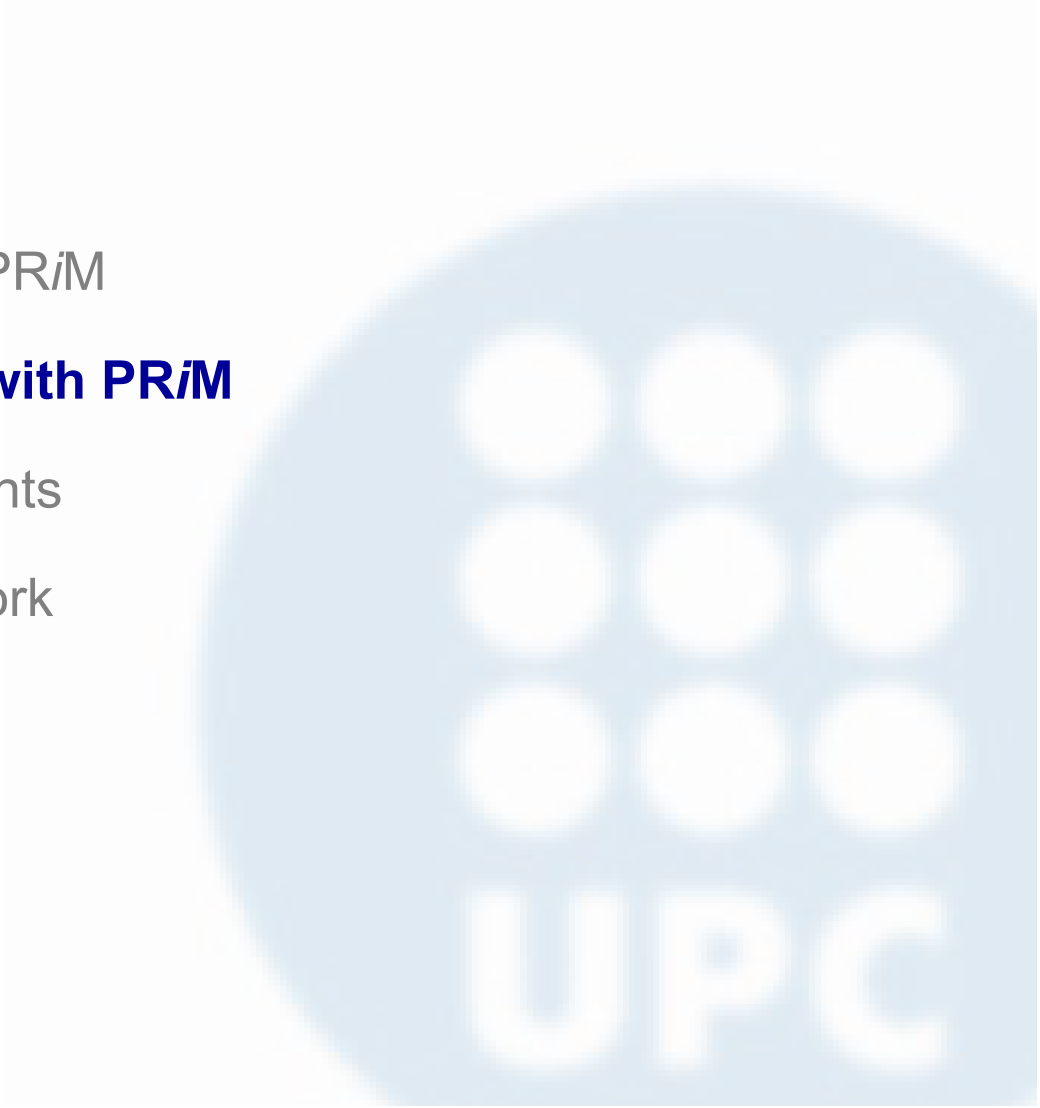

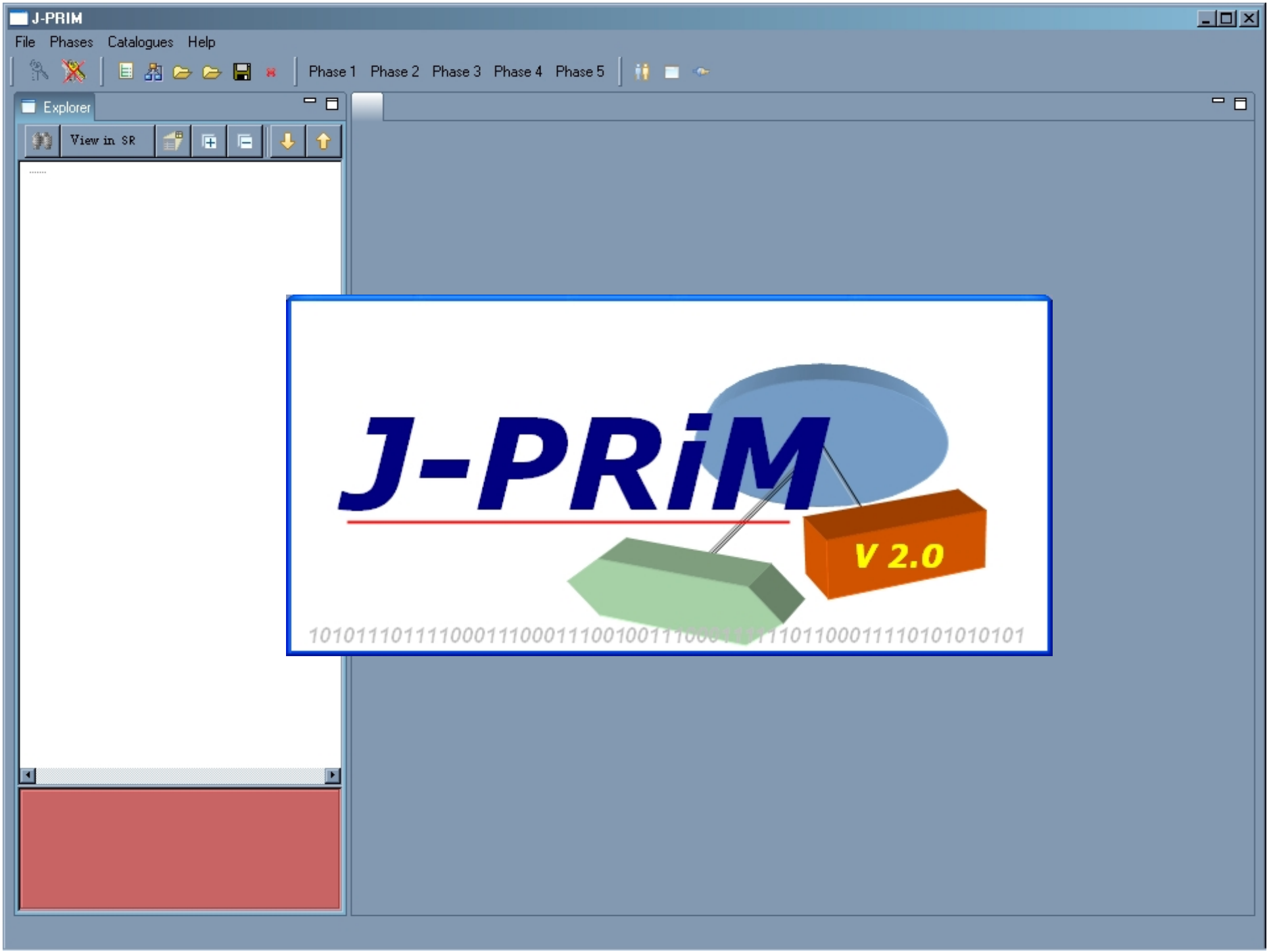
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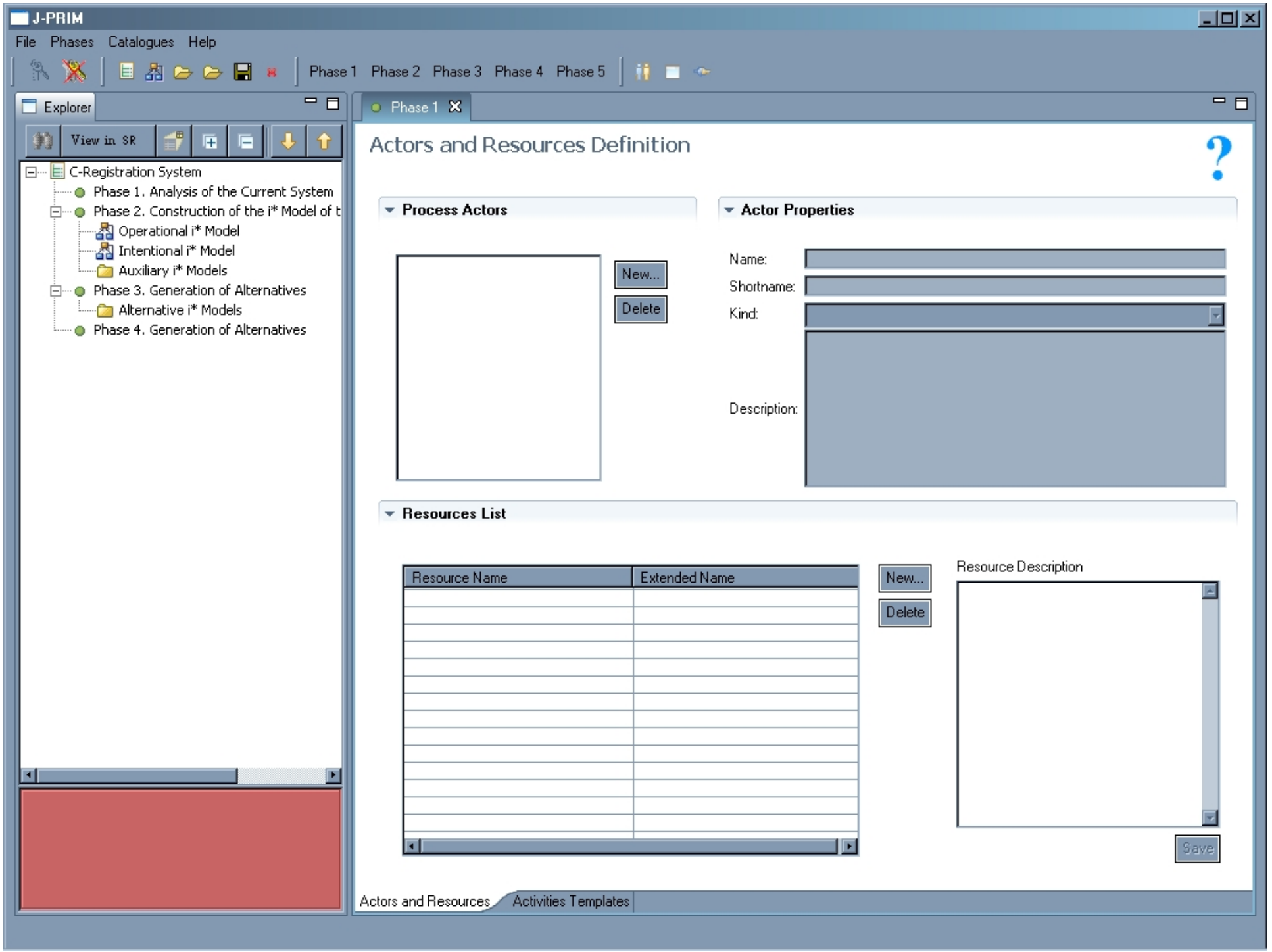
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Delete
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Shortname:
Kind:
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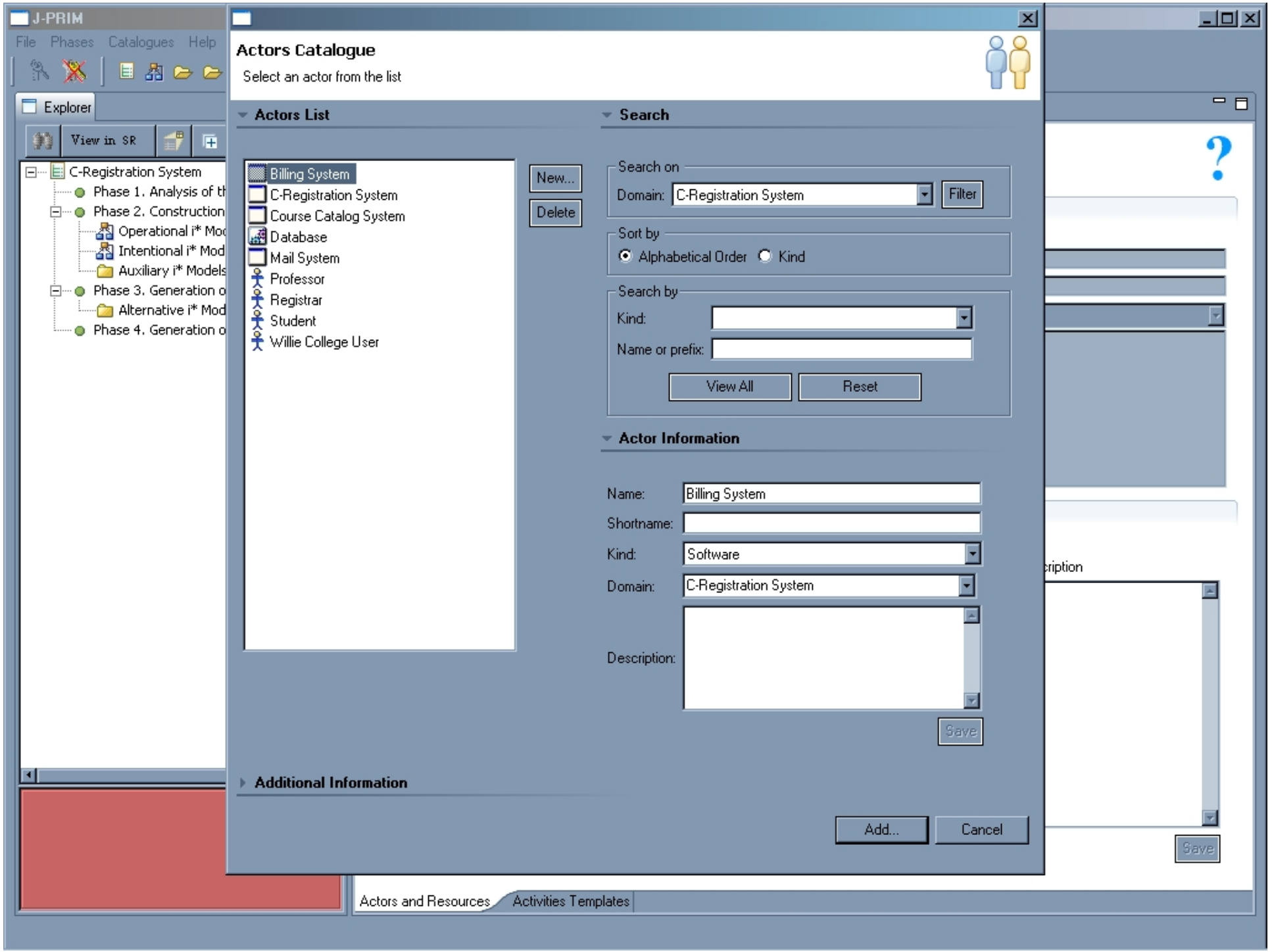
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Name or prefix:
View All
Reset
Actor Information
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Shortname:
Kind: Software
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Additional Information
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Cancel
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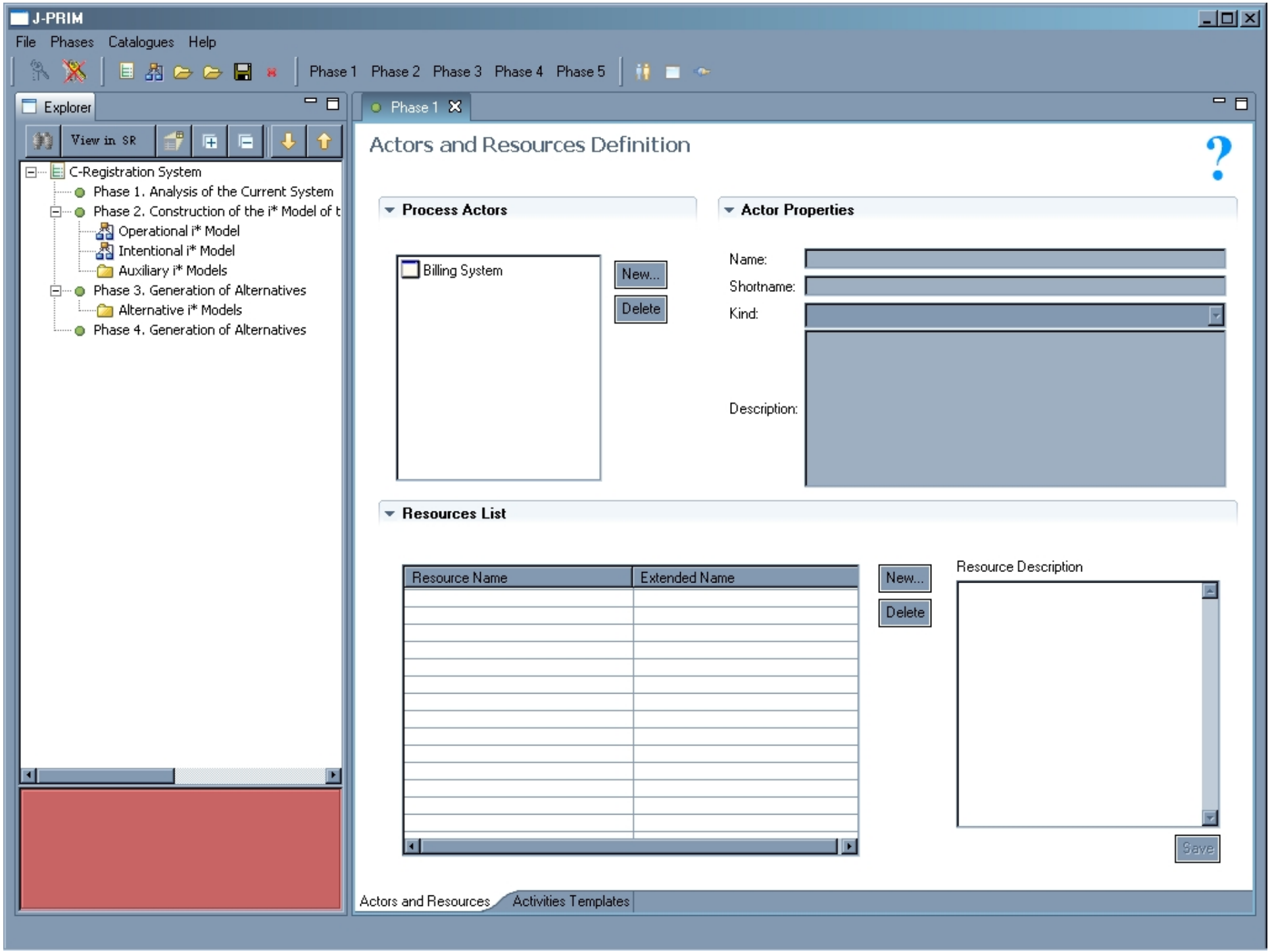
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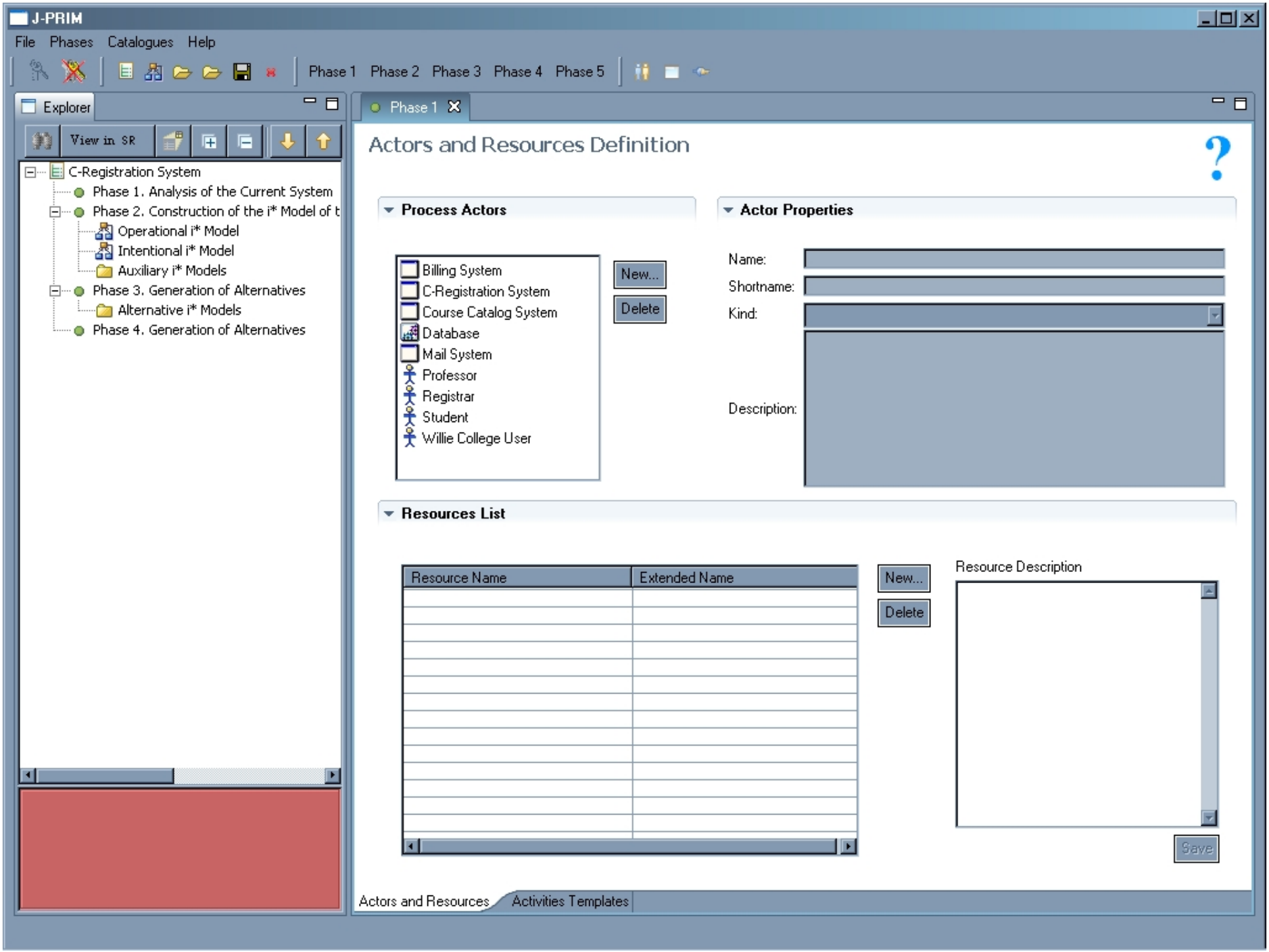
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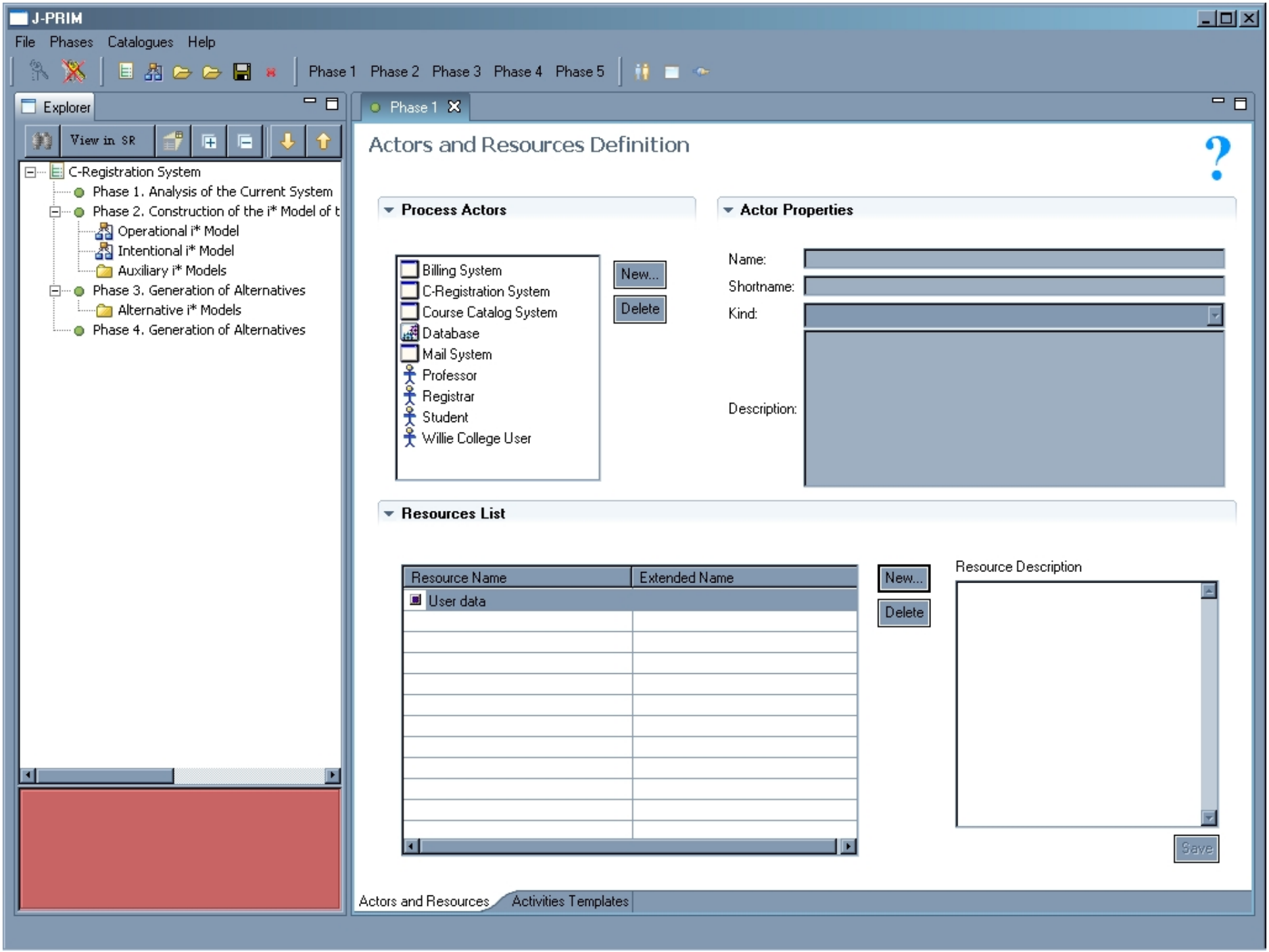
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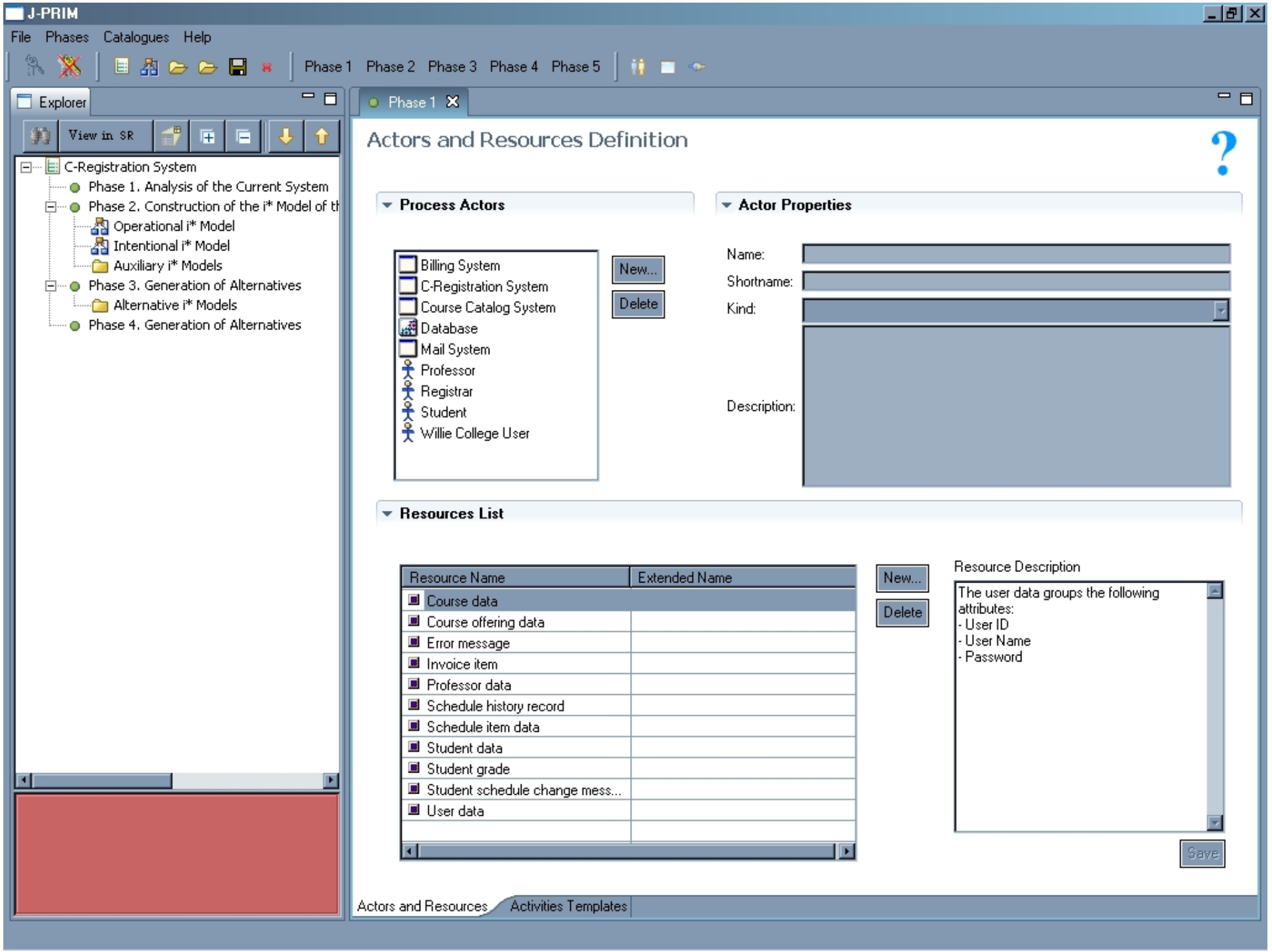
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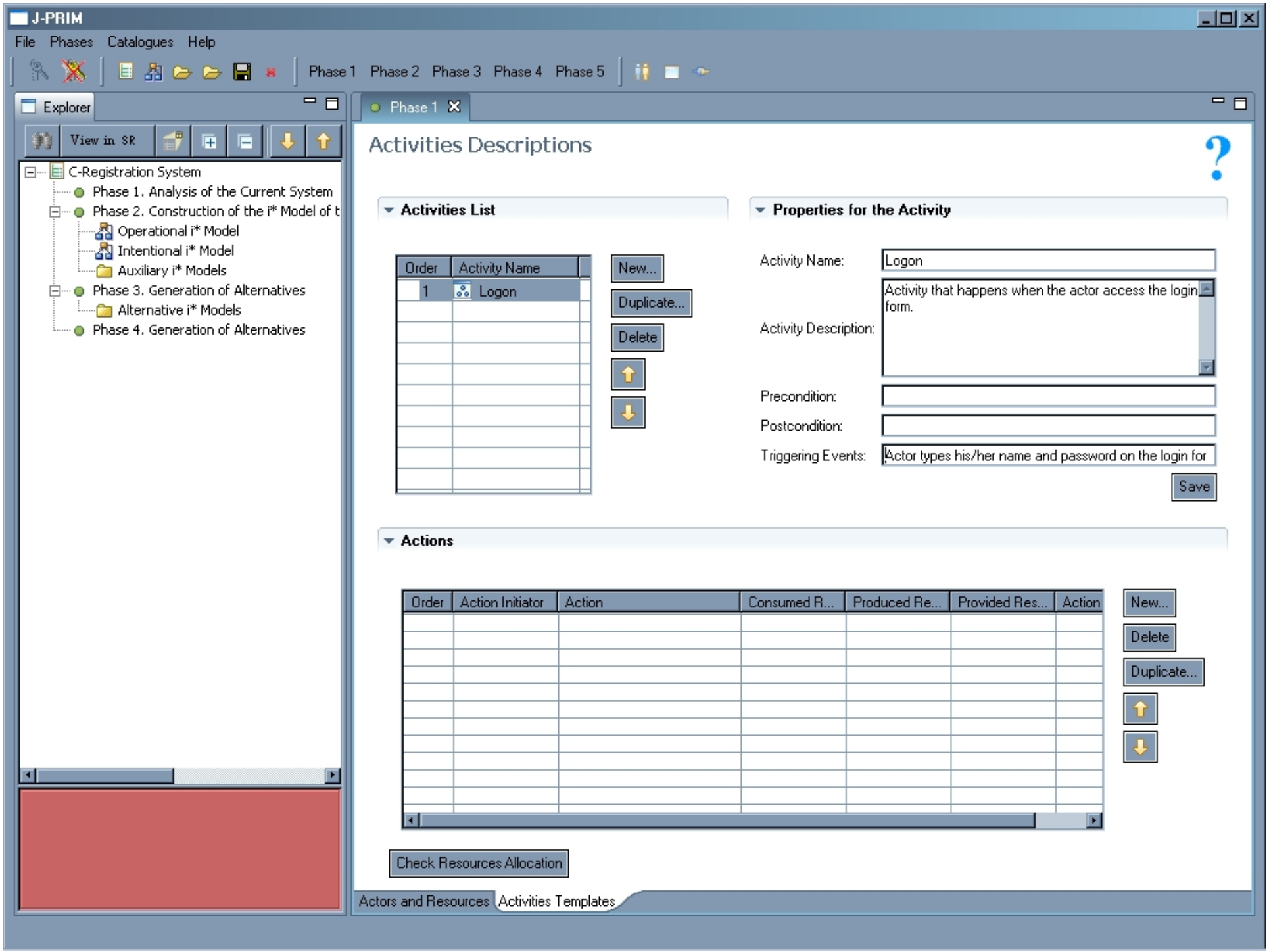
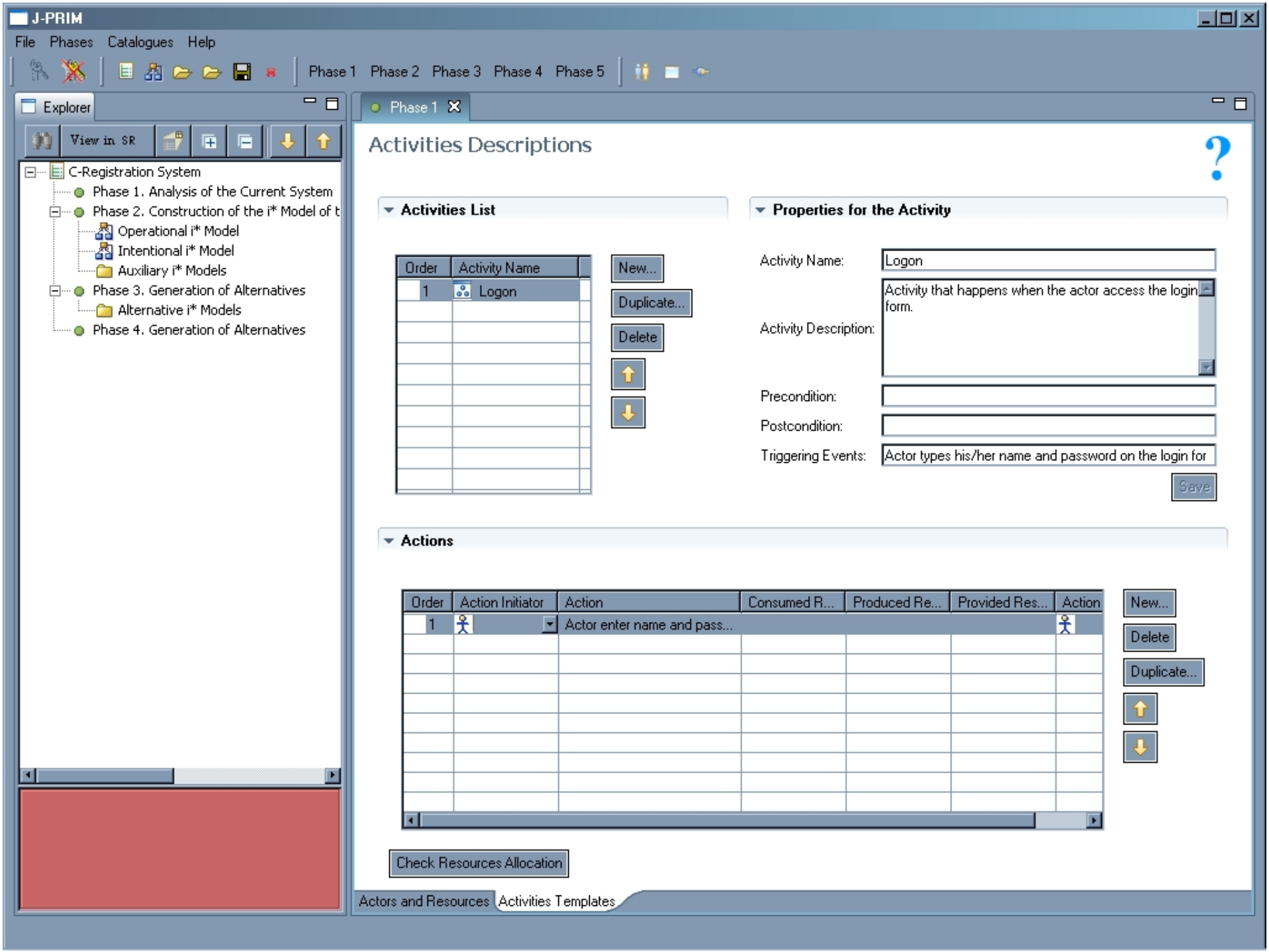
Resources List
Resource Name
Extended Name
Course data
Course offering data
Error message
Invoice item
Professor data
Schedule history record
Schedule item data
Student data
Student grade
Student schedule change mess...
User data
New...
Delete
Resource Description
The user data groups the following attributes:
- User ID
- User Name
- Password
Save
Actors and Resources
Activities Templates


J-PRIM
File Phases Catalogues Help
Phase 1 Phase 2 Phase 3 Phase 4 Phase 5
Explorer
View in SR
C-Registration System
Phase 1. Analysis of the Current System
Phase 2. Construction of the i* Model of t
Operational i* Model
Intentional i* Model
Auxiliary i* Models
Phase 3. Generation of Alternatives
Alternative i* Models
Phase 4. Generation of Alternatives
Phase 1
Activities Descriptions
Activities List
Order
Activity Name
1
Logon
New...
Duplicate...
Delete
Properties for the Activity
Activity Name:
Logon
Activity Description:
Activity that happens when the actor access the login form.
Precondition:
Postcondition:
Triggering Events:
Actor types his/her name and password on the login for
Save
Actions
Order
Action Initiator
Action
Consumed R...
Produced Re...
Provided Res...
Action
New...
Delete
Duplicate...
Check Resources Allocation
Actors and Resources
Activities Templates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C-Registration System
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Activities List
Order
Activity Name
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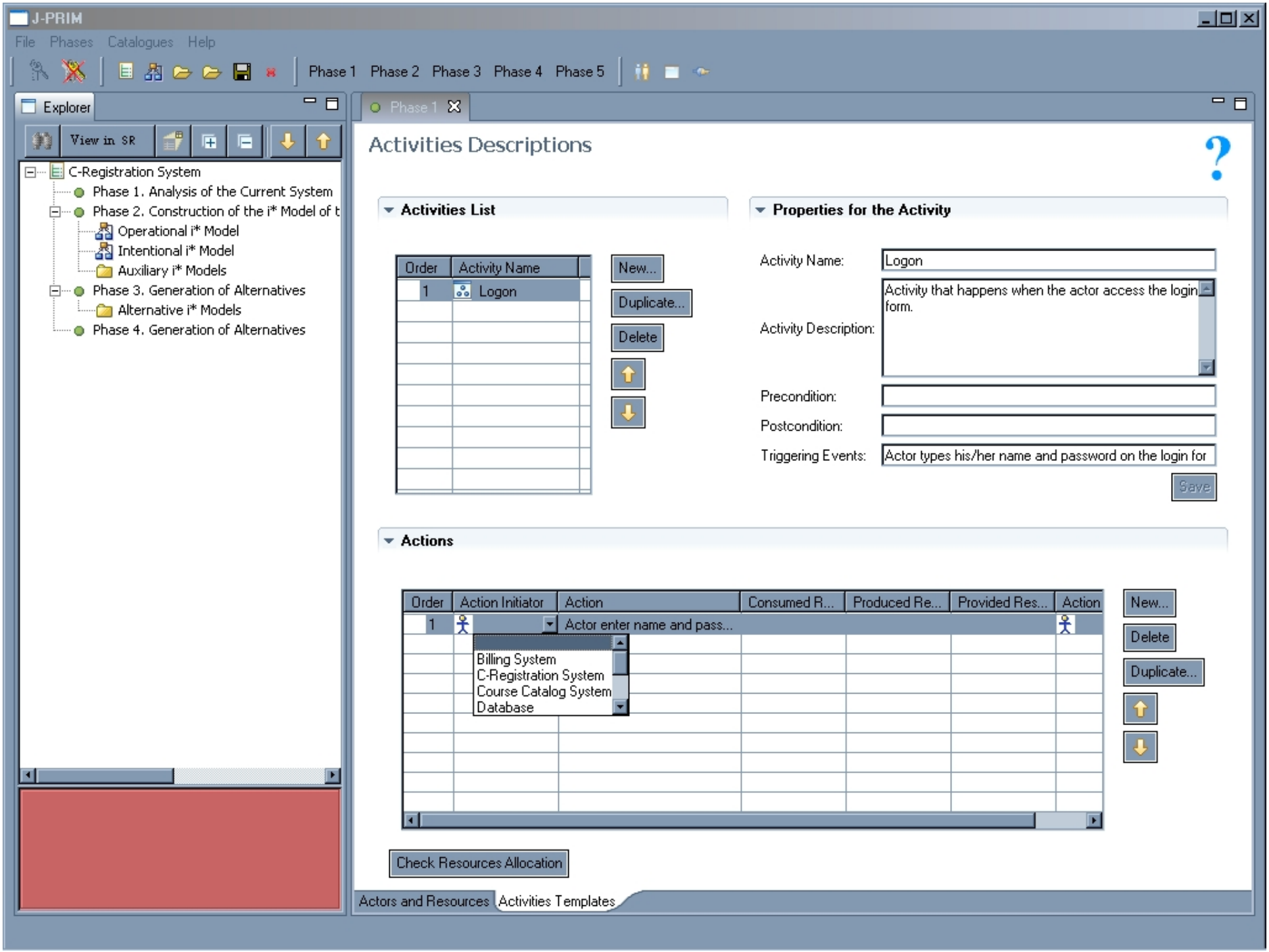
Logon
New...
Duplicate...
Delete
Properties for the Activity
Activity Name:
Logon
Activity Description:
Activity that happens when the actor access the login form.
Precondition:
Postcondition:
Triggering Events:
Actor types his/her name and password on the login for
Save
Actions
Order
Action Initiator
Action
Consumed R...
Produced Re...
Provided Res...
Action
1
Actor enter name and pass...
New...
Delete
Duplicate...
Check Resources Allocation
Actors and Resources
Activities Templates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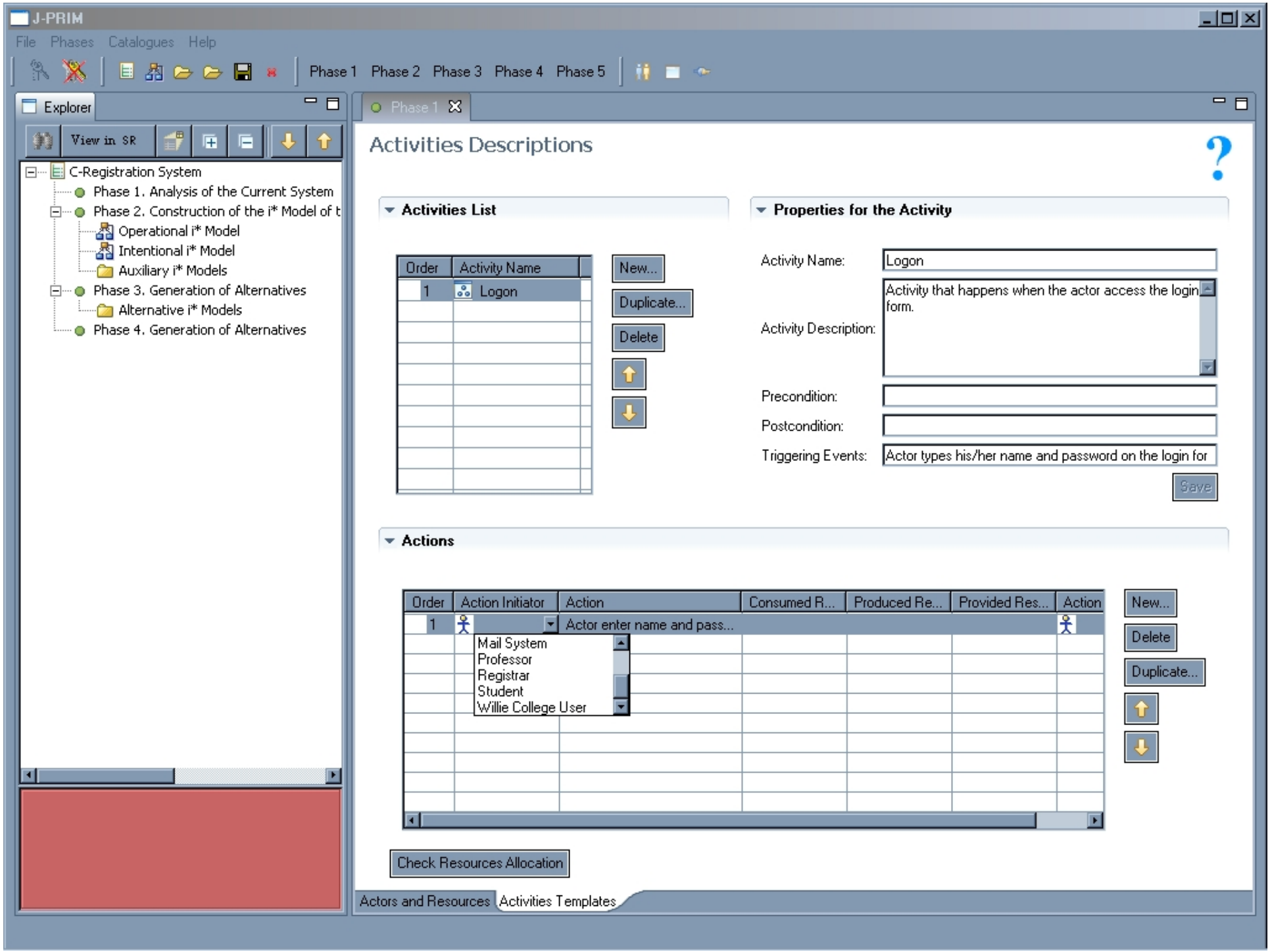
Activities Descriptions
Activities List
Order
Activity Name
1
Logon
New...
Duplicate...
Delete
Properties for the Activity
Activity Name:
Logon
Activity Description:
Activity that happens when the actor access the login form.
Precondition:
Postcondition:
Triggering Events:
Actor types his/her name and password on the login for
Save
Actions
Order
Action Initiator
Action
Consumed R...
Produced Re...
Provided Res...
Action
1
Actor enter name and pass...
Billing System
C-Registration System
Course Catalog System
Database
New...
Delete
Duplicate...
Check Resources Allocation
Actors and Resources
Activities Templates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Phase 1 Phase 2 Phase 3 Phase 4 Phase 5
Explorer
View in SR
C-Registration System
Phase 1. Analysis of the Current System
Phase 2. Construction of the i* Model of t
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Intentional i* Model
Auxiliary i* Models
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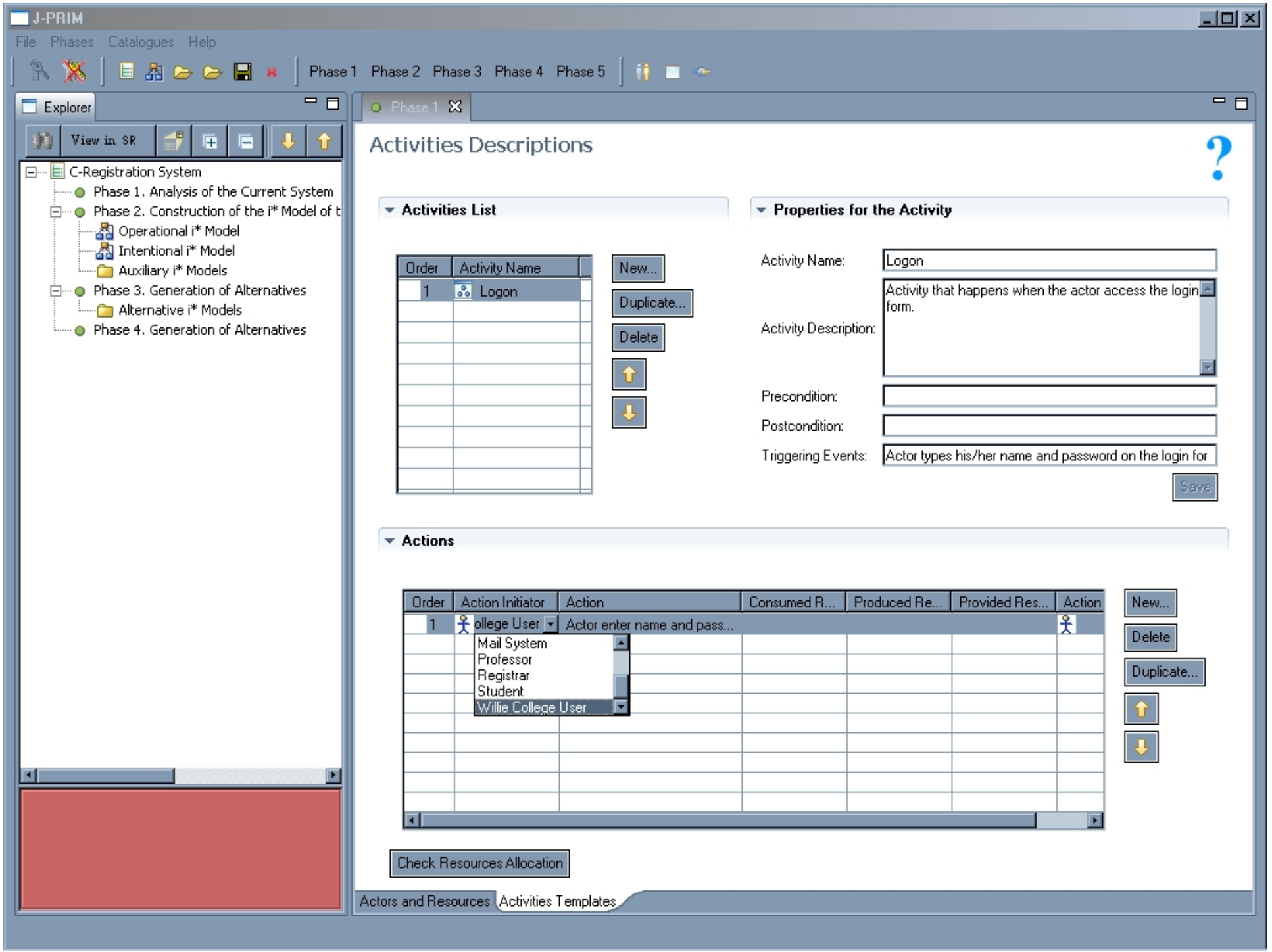
Alternative i* Models
Phase 4. Generation of Alternatives
Phase 1
Activities Descriptions
Activities List
Order
Activity Name
1
Logon
New...
Duplicate...
Delete
Properties for the Activity
Activity Name:
Logon
Activity Description:
Activity that happens when the actor access the login form.
Precondition:
Postcondition:
Triggering Events:
Actor types his/her name and password on the login for
Save
Actions
Order
Action Initiator
Action
Consumed R...
Produced Re...
Provided Res...
Action
1
Actor enter name and pass...
Mail System
Professor
Registrar
Student
Willie College User
New...
Delete
Duplicate...
Check Resources Allocation
Actors and Resources
Activities Templates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Activities List
Order
Activity Name
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Logon
New...
Duplicate...
Delete
Properties for the Activity
Activity Name:
Logon
Activity Description:
Activity that happens when the actor access the login form.
Precondition:
Postcondition:
Triggering Events:
Actor types his/her name and password on the login for
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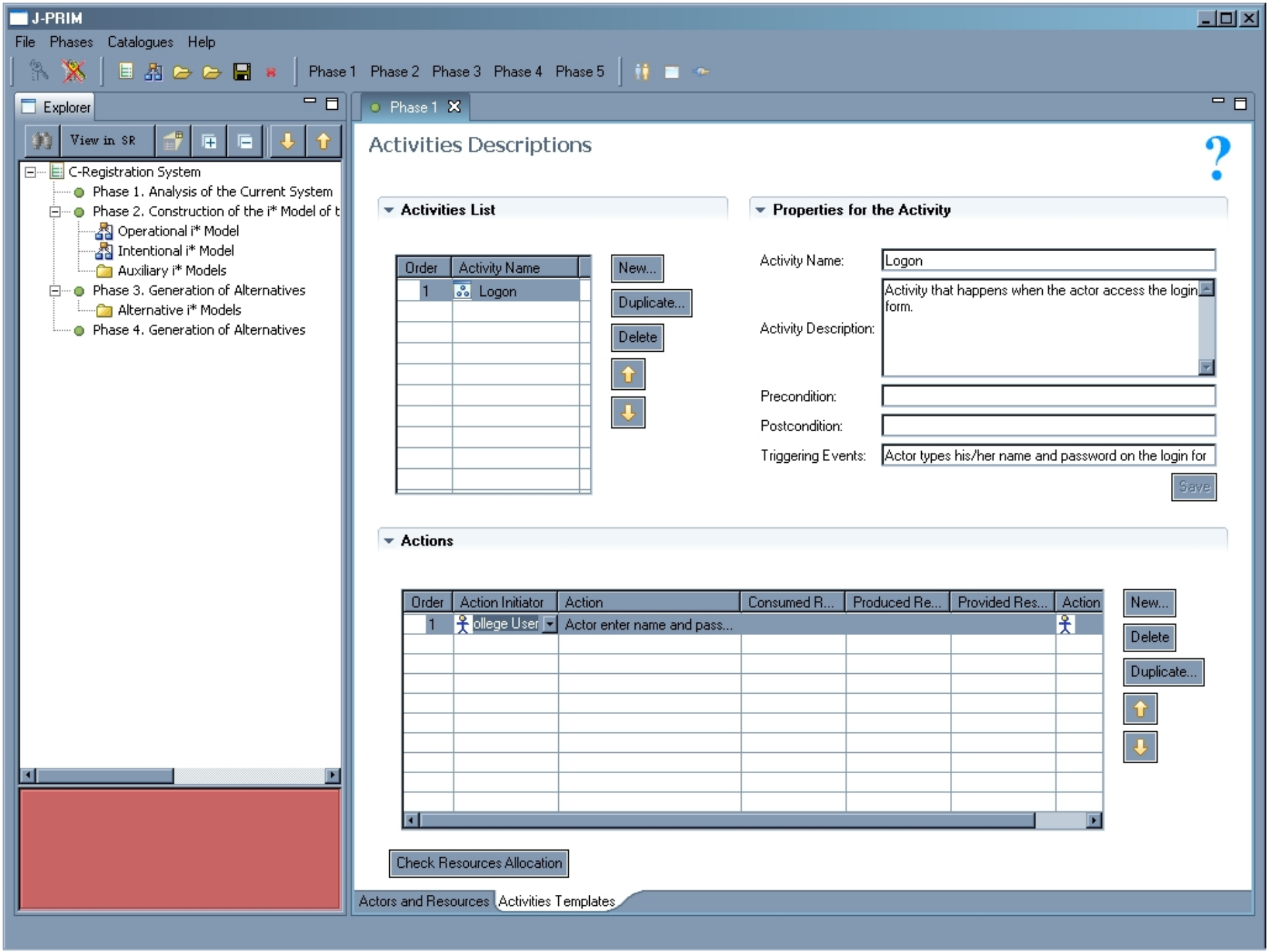
Actions
Order
Action Initiator
Action
Consumed R...
Produced Re...
Provided Res...
Action
1
ollege User
Actor enter name and pass...
Mail System
Professor
Registrar
Student
Willie College User
New...
Delete
Duplicate...
Check Resources Allocation
Actors and Resources
Activities Templates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Explorer
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Intentional i* Model
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Phase 3. Generation of Alternatives
Alternative i* Models
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Phase 1
Activities Descriptions
Activities List
Order
Activity Name
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Logon
New...
Duplicate...
Delete
Properties for the Activity
Activity Name:
Logon
Activity Description:
Activity that happens when the actor access the login form.
Precondition:
Postcondition:
Triggering Events:
Actor types his/her name and password on the login for
Save
Actions
Order
Action Initiator
Action
Consumed R...
Produced Re...
Provided Res...
Action
1
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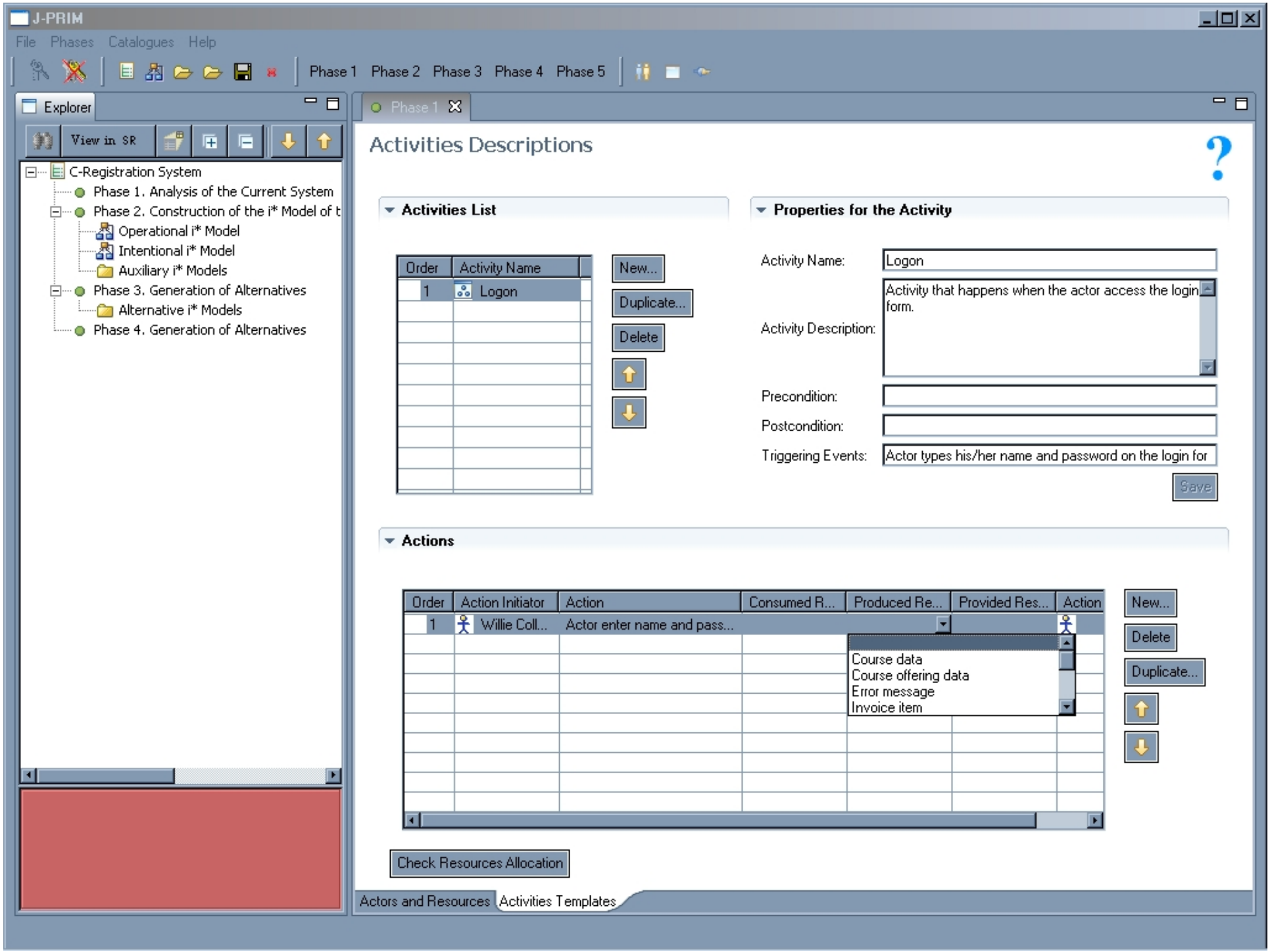
Actor enter name and pass...
New...
Delete
Duplicate...
Check Resources Allocation
Actors and Resources
Activities Templates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Activities List
Order
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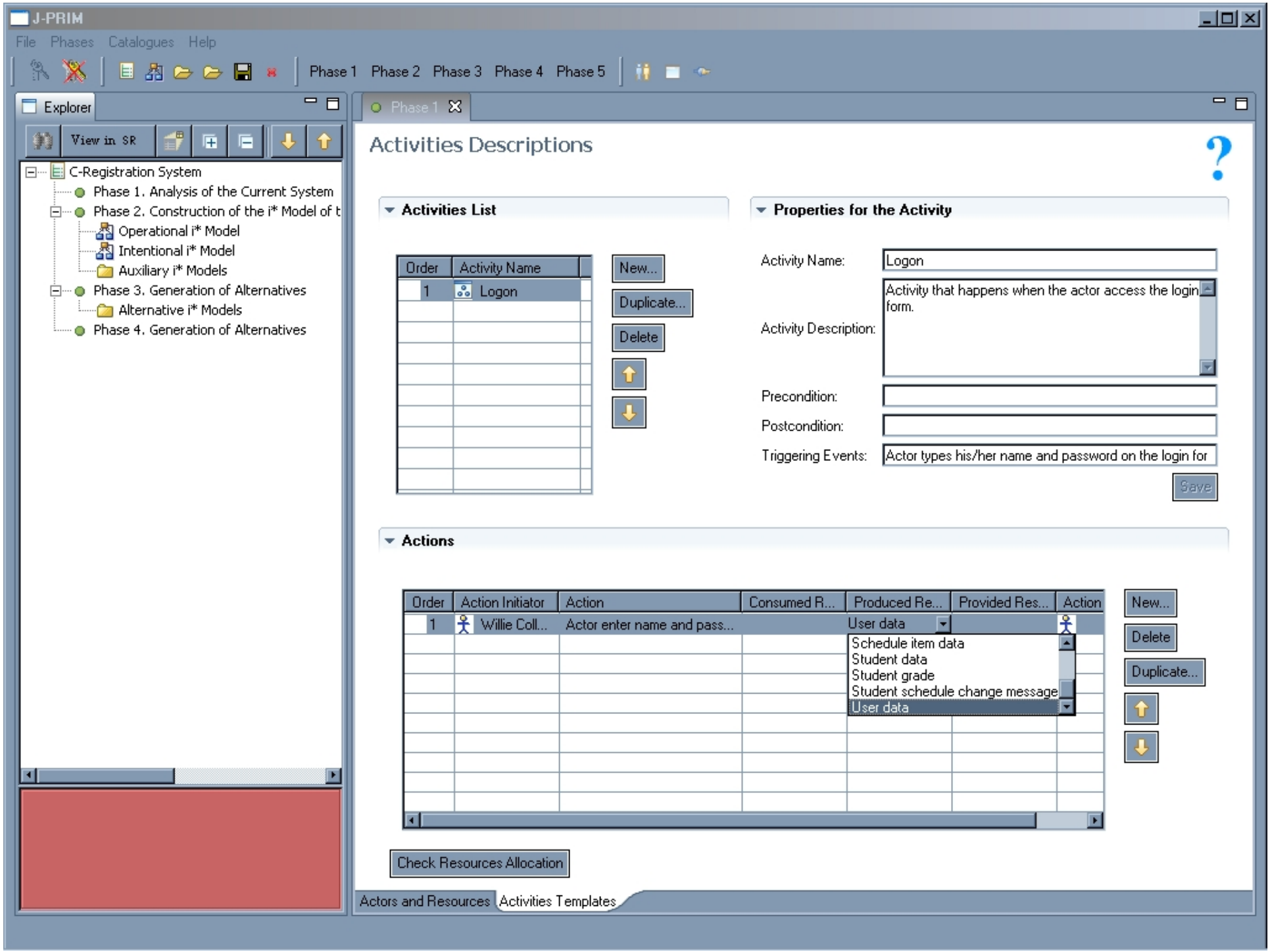
1
Logon
New...
Duplicate...
Delete
Properties for the Activity
Activity Name:
Logon
Activity Description:
Activity that happens when the actor access the login form.
Precondition:
Postcondition:
Triggering Events:
Actor types his/her name and password on the login for
Save
Actions
Order
Action Initiator
Action
Consumed R...
Produced Re...
Provided Res...
Action
1
Willie Coll...
Actor enter name and pass...
Course data
Course offering data
Error message
Invoice item
New...
Delete
Duplicate...
Check Resources Allocation
Actors and Resources
Activities Templates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Phase 1 Phase 2 Phase 3 Phase 4 Phase 5
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Activities List
Order
Activity Name
1
Logon
New...
Duplicate...
Delete
Properties for the Activity
Activity Name:
Logon
Activity Description:
Activity that happens when the actor access the login form.
Precondition:
Postcondition:
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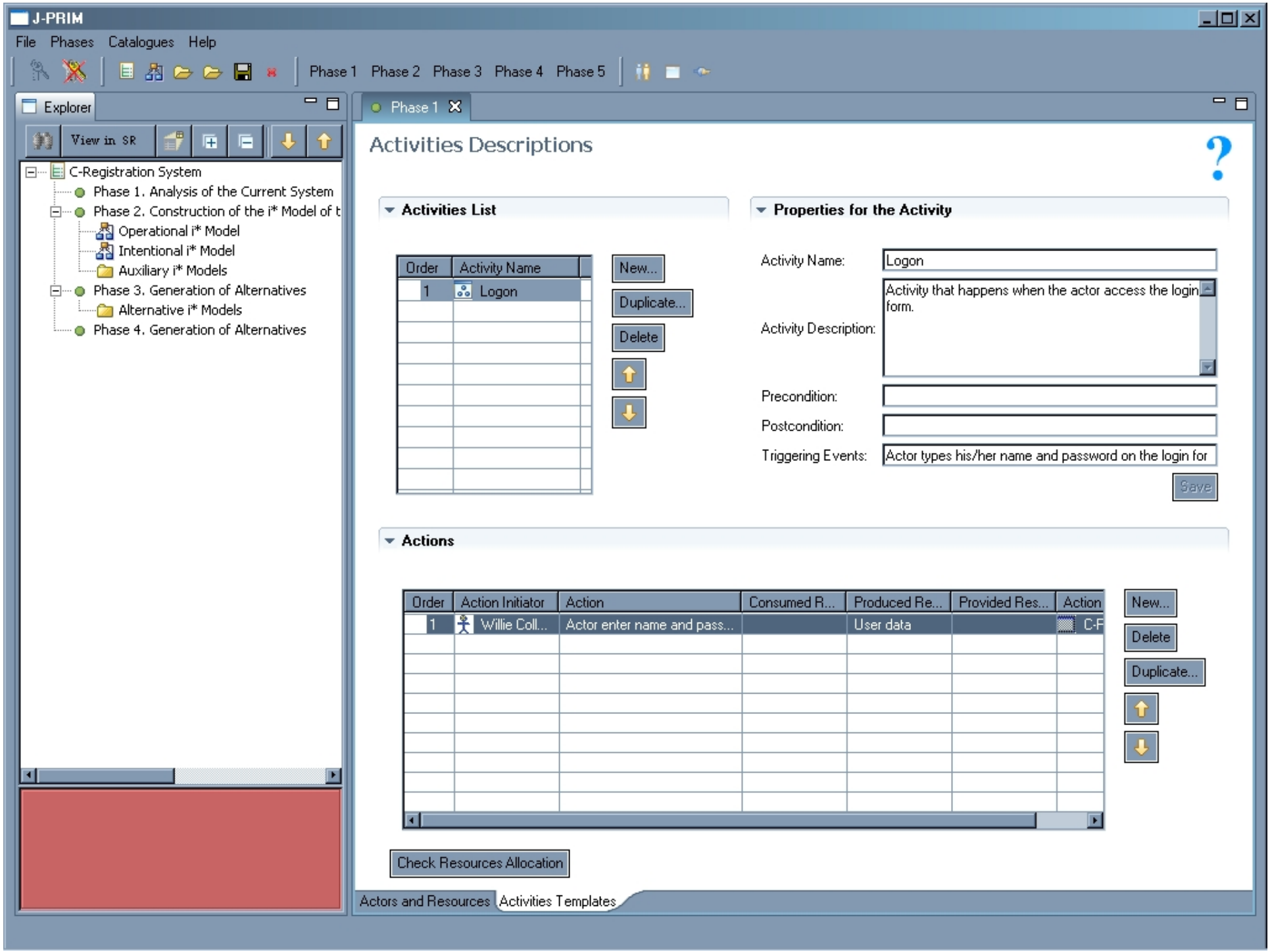
Actor types his/her name and password on the login for
Save
Actions
Order
Action Initiator
Action
Consumed R...
Produced Re...
Provided Res...
Action
1
Willie Coll...
Actor enter name and pass...
User data
Schedule item data
Student data
Student grade
Student schedule change message
User data
New...
Delete
Duplicate...
Check Resources Allocation
Actors and Resources
Activities Templates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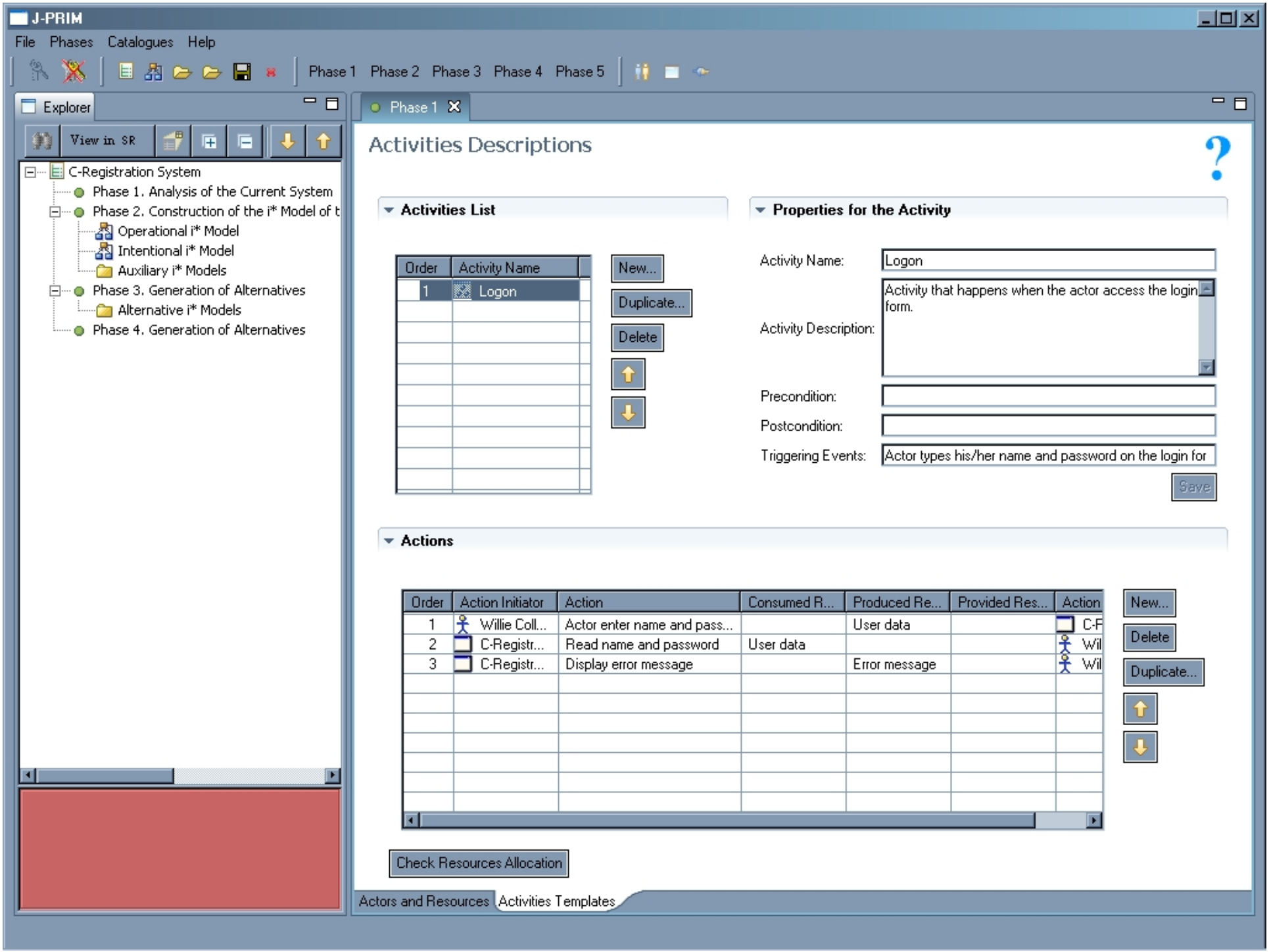
Phase 1
Activities Descriptions
Activities List
Order
Activity Name
1
Logon
New...
Duplicate...
Delete
Properties for the Activity
Activity Name:
Logon
Activity Description:
Activity that happens when the actor access the login form.
Precondition:
Postcondition:
Triggering Events:
Actor types his/her name and password on the login for
Save
Actions
Order
Action Initiator
Action
Consumed R...
Produced Re...
Provided Res...
Action
1
Willie Coll...
Actor enter name and pass...
User data
C-F
New...
Delete
Duplicate...
Check Resources Allocation
Actors and Resources
Activities Templates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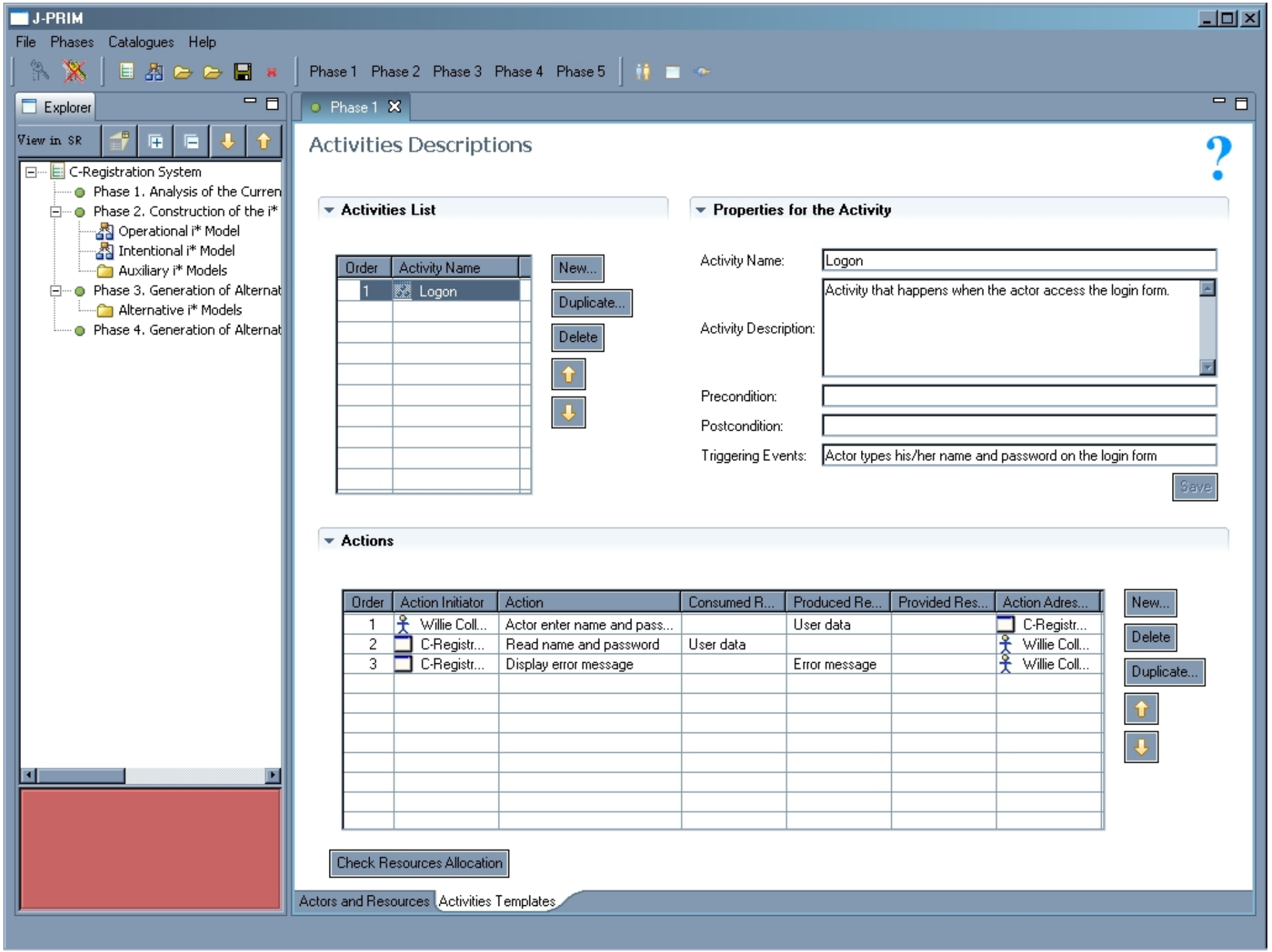
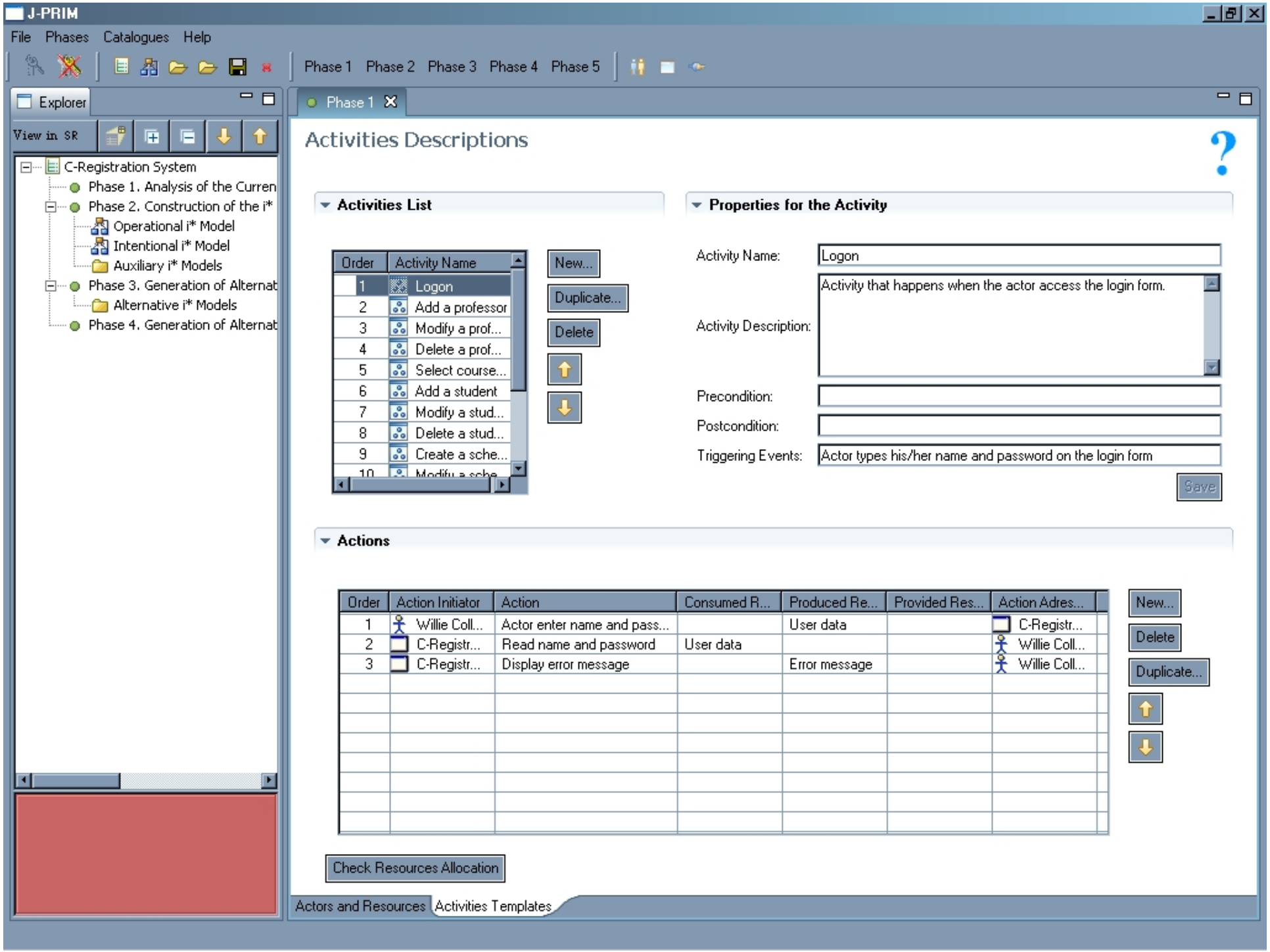
Activities List
Order
Activity Name
1
Logon
New...
Duplicate...
Delete
Properties for the Activity
Activity Name:
Logon
Activity Description:
Activity that happens when the actor access the login form.
Precondition:
Postcondition:
Triggering Events:
Actor types his/her name and password on the login for
Save
Actions
Order
Action Initiator
Action
Consumed R...
Produced Re...
Provided Res...
Action
1
Willie Coll...
Actor enter name and pass...
User data
2
C-Registr...
Read name and password
User data
3
C-Registr...
Display error message
Error message
New...
Delete
Duplicate...
Check Resources Allocation
Actors and Resources
Activities Templates


J-PRIM
File Phases Catalogues Help
Phase 1 Phase 2 Phase 3 Phase 4 Phase 5
Explorer
View in SR
C-Registration System
Phase 1. Analysis of the Curren
Phase 2. Construction of the i*
Operational i* Model
Intentional i* Model
Auxiliary i* Models
Phase 3. Generation of Alternat
Alternative i* Models
Phase 4. Generation of Alternat
Phase 1
Activities Descriptions
Activities List
Order
Activity Name
1
Logon
New...
Duplicate...
Delete
Properties for the Activity
Activity Name:
Logon
Activity Description:
Activity that happens when the actor access the login form.
Precondition:
Postcondition:
Triggering Events:
Actor types his/her name and password on the login form
Save
Actions
Order
Action Initiator
Action
Consumed R...
Produced Re...
Provided Res...
Action Adres...
1
Willie Coll...
Actor enter name and pass...
User data
C-Registr...
2
C-Registr...
Read name and password
User data
Willie Coll...
3
C-Registr...
Display error message
Error message
Willie Coll...
New...
Delete
Duplicate...
Check Resources Allocation
Actors and Resources
Activities Templates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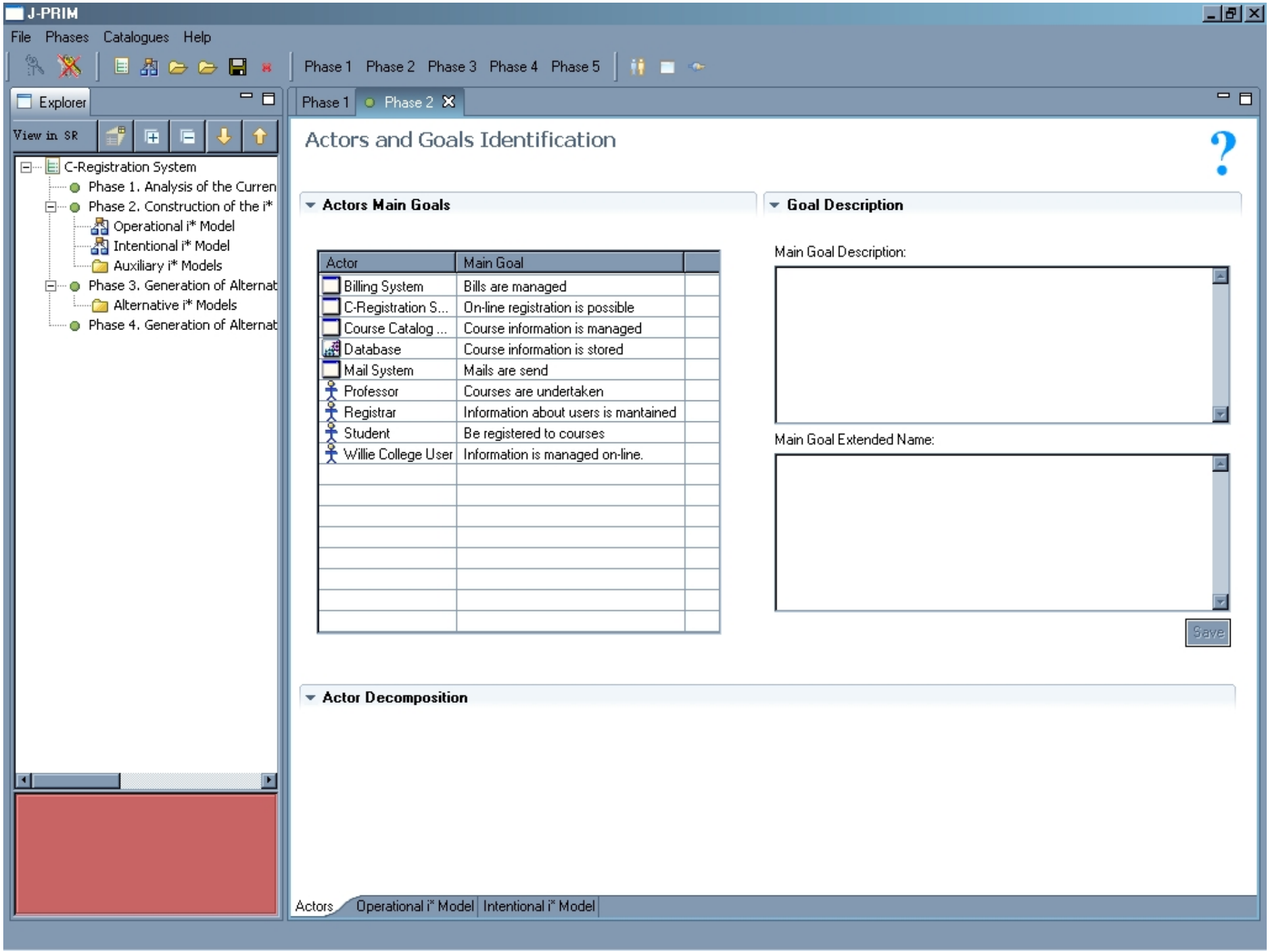
File Phases Catalogues Help
Phase 1 Phase 2 Phase 3 Phase 4 Phase 5
Explorer
View in SR
C-Registration System
Phase 1. Analysis of the Curren
Phase 2. Construction of the i*
Operational i* Model
Intentional i* Model
Auxiliary i* Models
Phase 3. Generation of Alternat
Alternative i* Models
Phase 4. Generation of Alternat
Phase 1
Activities Descriptions
Activities List
Order Activity Name
1 Logon
2 Add a professor
3 Modify a prof...
4 Delete a prof...
5 Select course...
6 Add a student
7 Modify a stud...
8 Delete a stud...
9 Create a sche...
New...
Duplicate...
Delete
Properties for the Activity
Activity Name: Logon
Activity Description: Activity that happens when the actor access the login form.
Precondition:
Postcondition:
Triggering Events: Actor types his/her name and password on the login form
Save
Actions
Order Action Initiator Action Consumed R... Produced Re... Provided Res... Action Adres...
1 Willie Coll... Actor enter name and pass... User data C-Registr...
2 C-Registr... Read name and password User data Willie Coll...
3 C-Registr... Display error message Error message Willie Coll...
New...
Delete
Duplicate...
Check Resources Allocation
Actors and Resources
Activities Templates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Explorer
View in SR
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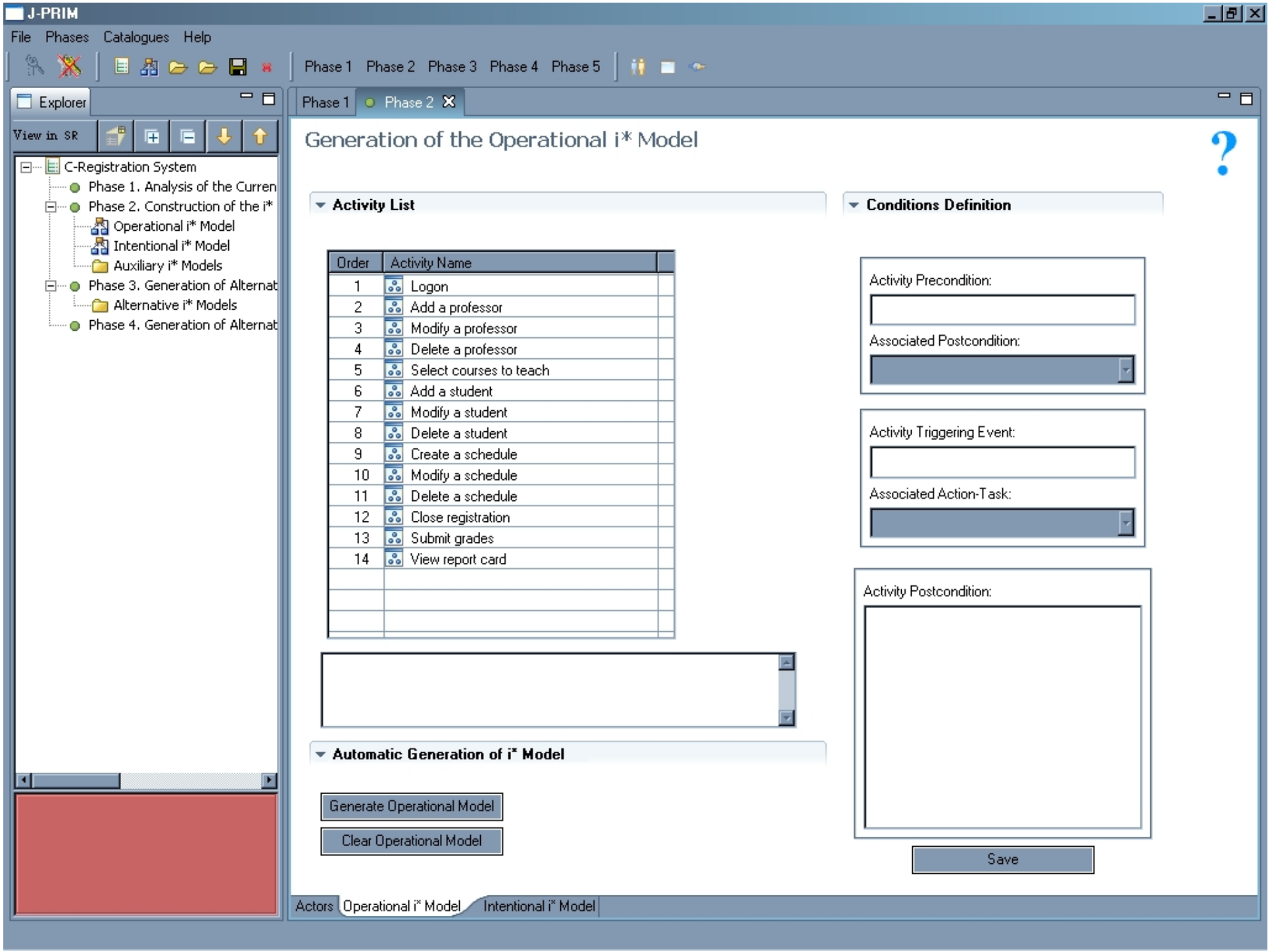
Phase 1. Analysis of the Curren
Phase 2. Construction of the i*
Operational i* Model
Intentional i* Model
Auxiliary i* Models
Phase 3. Generation of Alternat
Alternative i* Models
Phase 4. Generation of Alternat
Phase 1
Phase 2
Actors and Goals Identification
Actors Main Goals
Goal Description
Actor
Main Goal
Billing System
Bills are managed
C-Registration S...
On-line registration is possible
Course Catalog ...
Course information is managed
Database
Course information is stored
Mail System
Mails are send
Professor
Courses are undertaken
Registrar
Information about users is mantained
Student
Be registered to courses
Willie College User
Information is managed on-line.
Main Goal Description:
Main Goal Extended Name:
Save
Actor Decomposition
Actors
Operational i* Model
Intentional i* Model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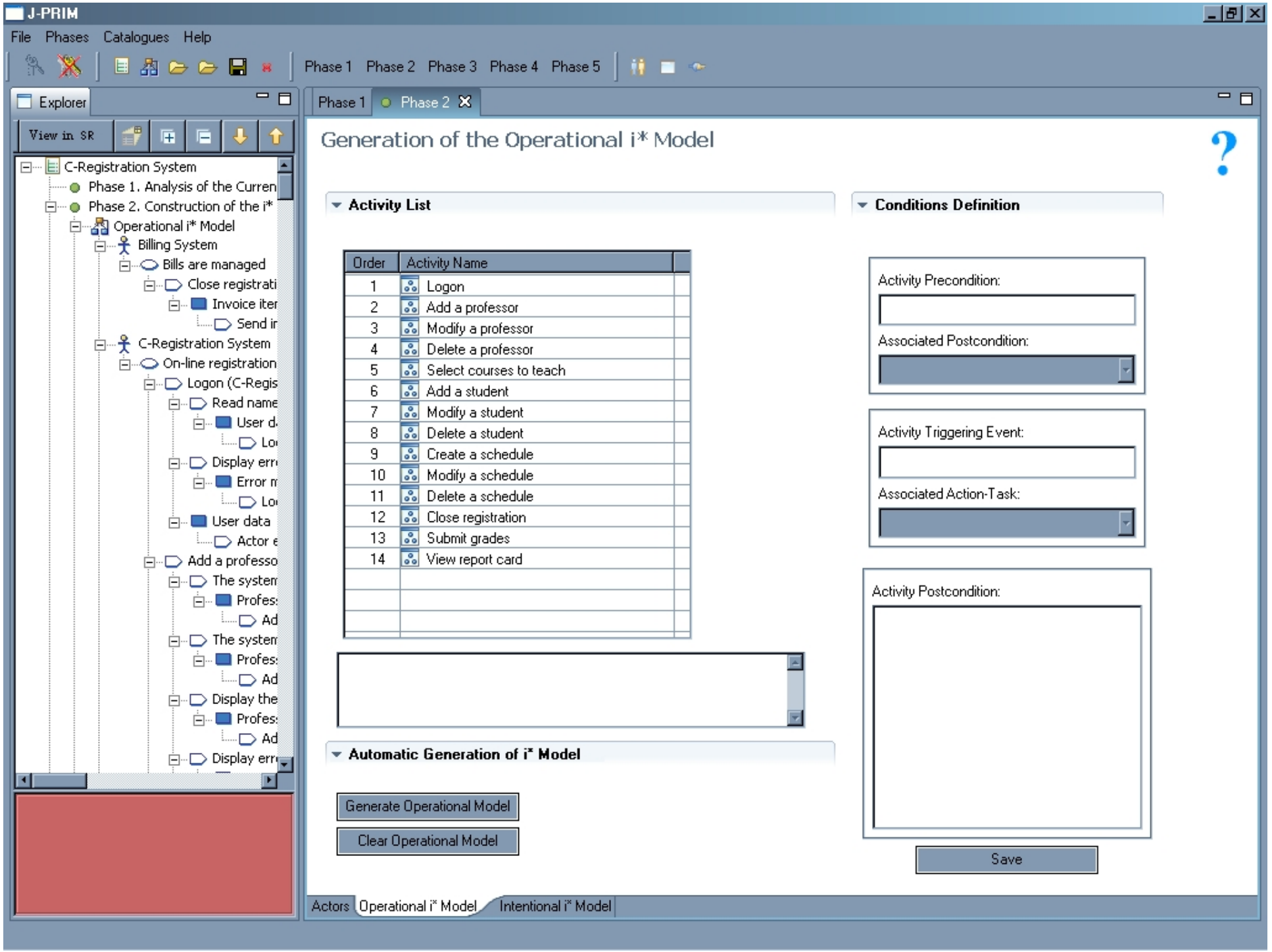
Phase 1. Analysis of the Curren
Phase 2. Construction of the i*
Operational i* Model
Intentional i* Model
Auxiliary i* Models
Phase 3. Generation of Alternat
Alternative i* Models
Phase 4. Generation of Alternat
Phase 1
Phase 2
Generation of the Operational i* Model
Activity List
Order
Activity Name
1 Logon
2 Add a professor
3 Modify a professor
4 Delete a professor
5 Select courses to teach
6 Add a student
7 Modify a student
8 Delete a student
9 Create a schedule
10 Modify a schedule
11 Delete a schedule
12 Close registration
13 Submit grades
14 View report card
Automatic Generation of i* Model
Generate Operational Model
Clear Operational Model
Conditions Definition
Activity Precondition:
Associated Postcondition:
Activity Triggering Event:
Associated Action-Task:
Activity Postcondition:
Save
Actors
Operational i* Model
Intentional i* Model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File Phases Catalogues Help
Phase 1 Phase 2 Phase 3 Phase 4 Phase 5
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C-Registration System
Phase 1. Analysis of the Curren
Phase 2. Construction of the i*
Operational i* Model
Billing System
Bills are managed
Close registrati
Invoice iter
Send ir
C-Registration System
On-line registration
Logon (C-Regis
Read name
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Display err
Error m
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User data
Actor e
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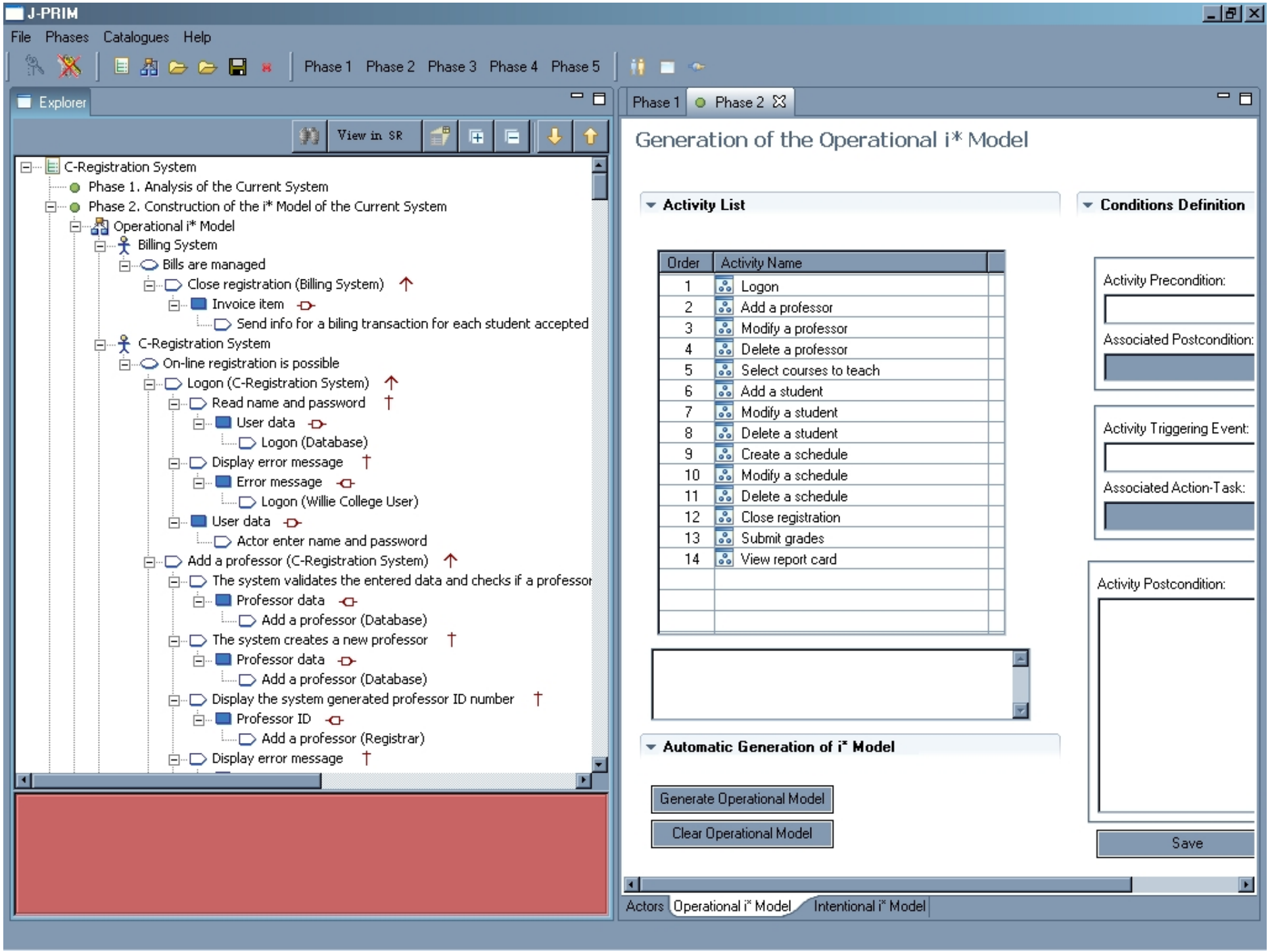
Profes:
Ad
The systen
Profes:
Ad
Display the
Profes:
Ad
Display err
Phase 1
Phase 2
Generation of the Operational i* Model
Activity List
Order
Activity Name
1 Logon
2 Add a professor
3 Modify a professor
4 Delete a professor
5 Select courses to teach
6 Add a student
7 Modify a student
8 Delete a student
9 Create a schedule
10 Modify a schedule
11 Delete a schedule
12 Close registration
13 Submit grades
14 View report card
Automatic Generation of i* Model
Generate Operational Model
Clear Operational Model
Conditions Definition
Activity Precondition:
Associated Postcondition:
Activity Triggering Event:
Associated Action-Task:
Activity Postcondition:
Save
Actors
Operational i* Model
Intentional i* Model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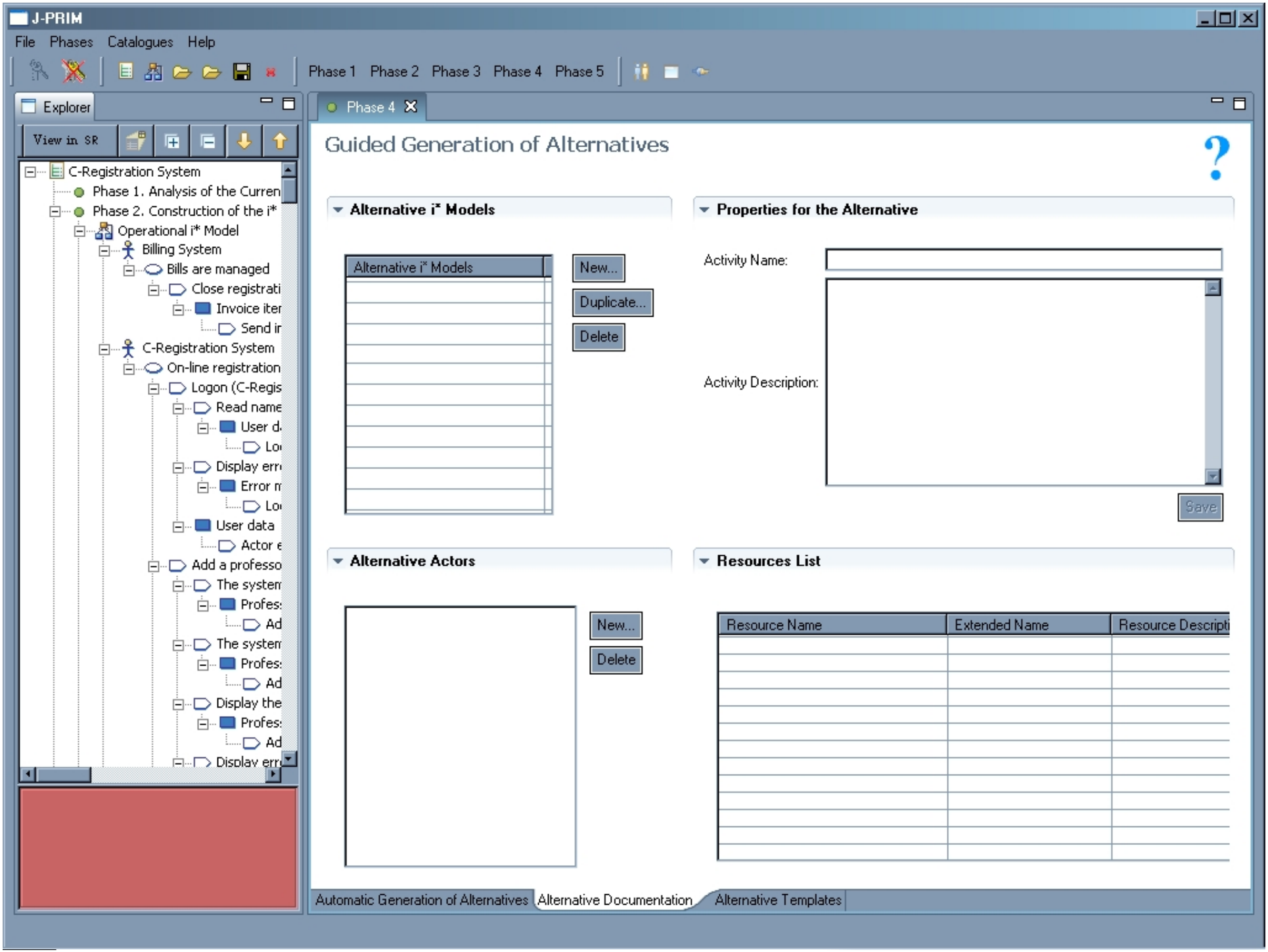
Phase 1. Analysis of the Current System
Phase 2. Construction of the i* Model of the Current System
Operational i* Model
Billing System
Bills are managed
Close registration (Billing System)
Invoice item
Send info for a biling transaction for each student accepted
C-Registration System
On-line registration is possible
Logon (C-Registration System)
Read name and password
User data
Logon (Database)
Display error message
Error message
Logon (Willie College User)
User data
Actor enter name and password
Add a professor (C-Registration System)
The system validates the entered data and checks if a professor
Professor data
Add a professor (Database)
The system creates a new professor
Professor data
Add a professor (Database)
Display the system generated professor ID number
Professor ID
Add a professor (Registrar)
Display error message
Phase 1
Phase 2
Generation of the Operational i* Model
Activity List
Conditions Definition
Order
Activity Name
1 Logon
2 Add a professor
3 Modify a professor
4 Delete a professor
5 Select courses to teach
6 Add a student
7 Modify a student
8 Delete a student
9 Create a schedule
10 Modify a schedule
11 Delete a schedule
12 Close registration
13 Submit grades
14 View report card
Activity Precondition:
Associated Postcondition:
Activity Triggering Event:
Associated Action-Task:
Activity Postcondition:
Automatic Generation of i* Model
Generate Operational Model
Clear Operational Model
Save
Actors
Operational i* Model
Intentional i* Model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Catalogues
Help
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Phase 3
Phase 4
Phase 5
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Phase 1. Analysis of the Curren
Phase 2. Construction of the i*
Operational i* Model
Billing System
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Close registrati
Invoice iter
Send ir
C-Registration System
On-line registration
Logon (C-Regis
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Display err
Error m
Lo
User data
Actor e
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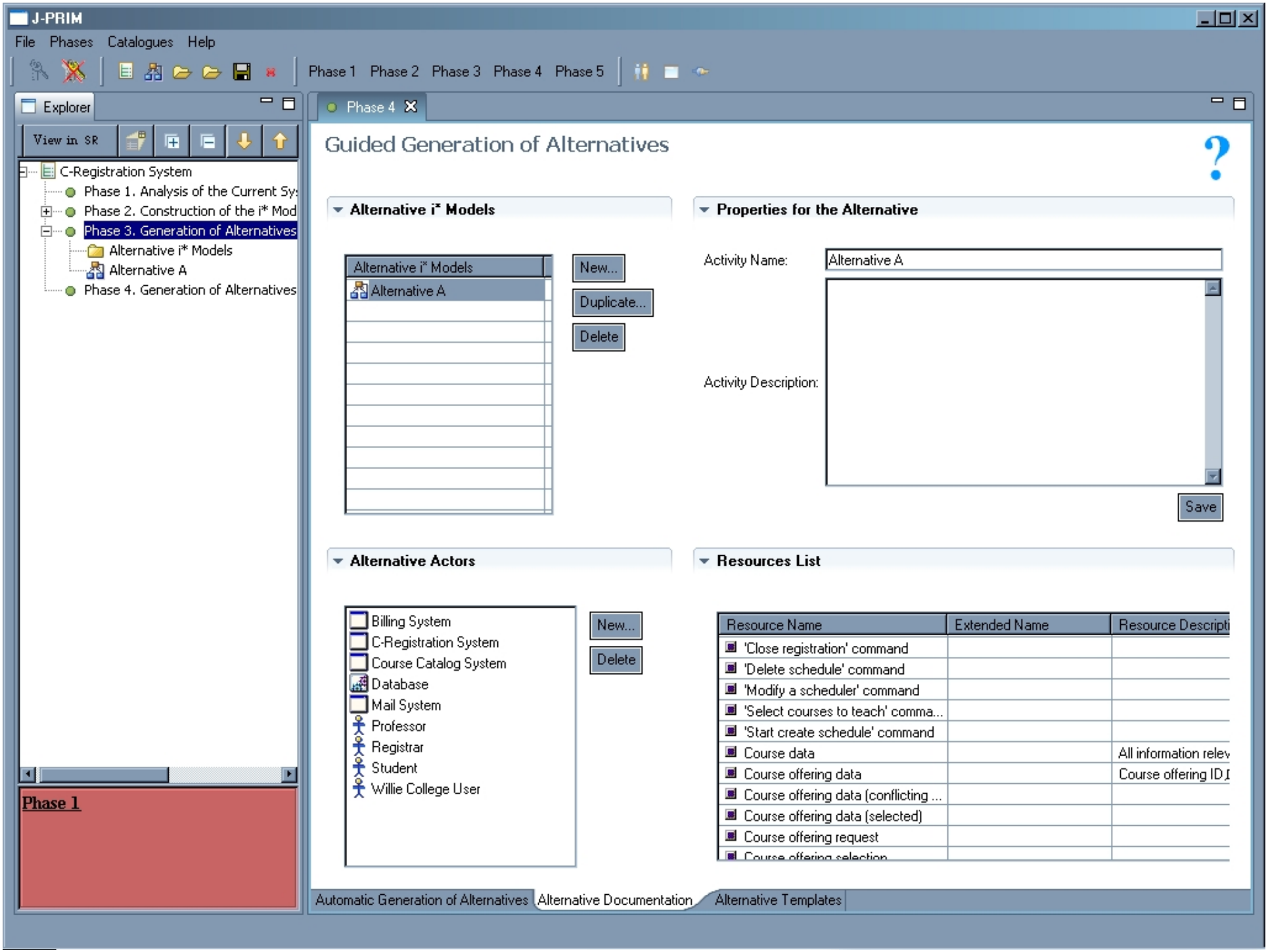
Profes
Ad
The system
Profes
Ad
Display the
Profes
Ad
Display err
Phase 4
Guided Generation of Alternatives
Alternative i* Models
Alternative i* Models
New...
Duplicate...
Delete
Properties for the Alternative
Activity Name:
Activity Description:
Save
Alternative Actors
New...
Delete
Resources List
Resource Name
Extended Name
Resource Descripti
Automatic Generation of Alternatives
Alternative Documentation
Alternative Templates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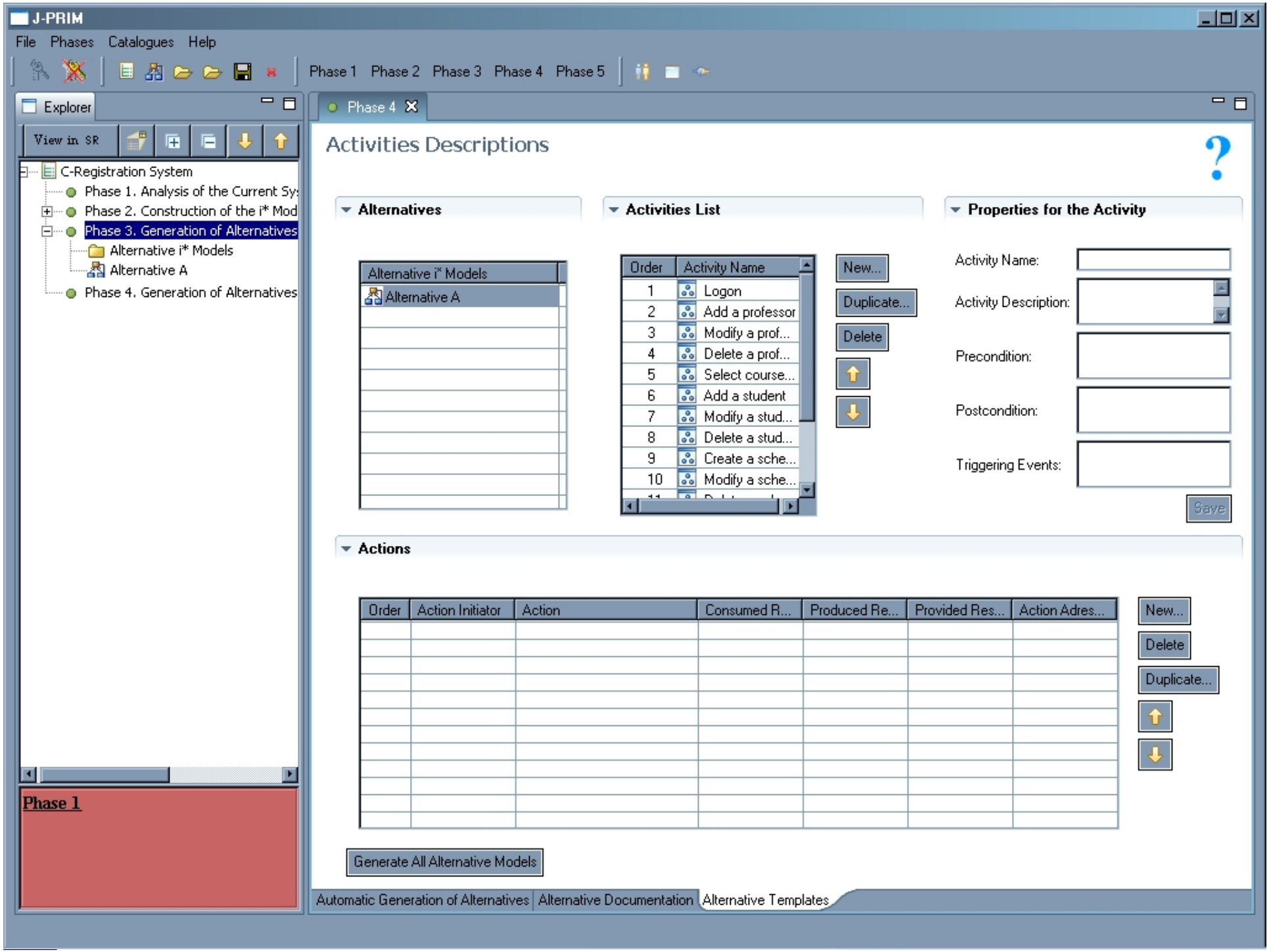
File Phases Catalogues Help
Phase 1 Phase 2 Phase 3 Phase 4 Phase 5
Explorer
View in SR
C-Registration System
Phase 1. Analysis of the Current Sy
Phase 2. Construction of the i* Mod
Phase 3. Generation of Alternatives
Alternative i* Models
Alternative A
Phase 4. Generation of Alternatives
Phase 1
Phase 4
Guided Generation of Alternatives
Alternative i* Models
Alternative i* Models
Alternative A
New...
Duplicate...
Delete
Properties for the Alternative
Activity Name:
Alternative A
Activity Description:
Save
Alternative Actors
Billing System
C-Registration System
Course Catalog System
Database
Mail System
Professor
Registrar
Student
Willie College User
New...
Delete
Resources List
Resource Name
Extended Name
Resource Descripti
'Close registration' command
'Delete schedule' command
'Modify a scheduler' command
'Select courses to teach' comma...
'Start create schedule' command
Course data
All information relev
Course offering data
Course offering ID,I
Course offering data (conflicting ...
Course offering data (selected)
Course offering request
Automatic Generation of Alternatives
Alternative Documentation
Alternative Templates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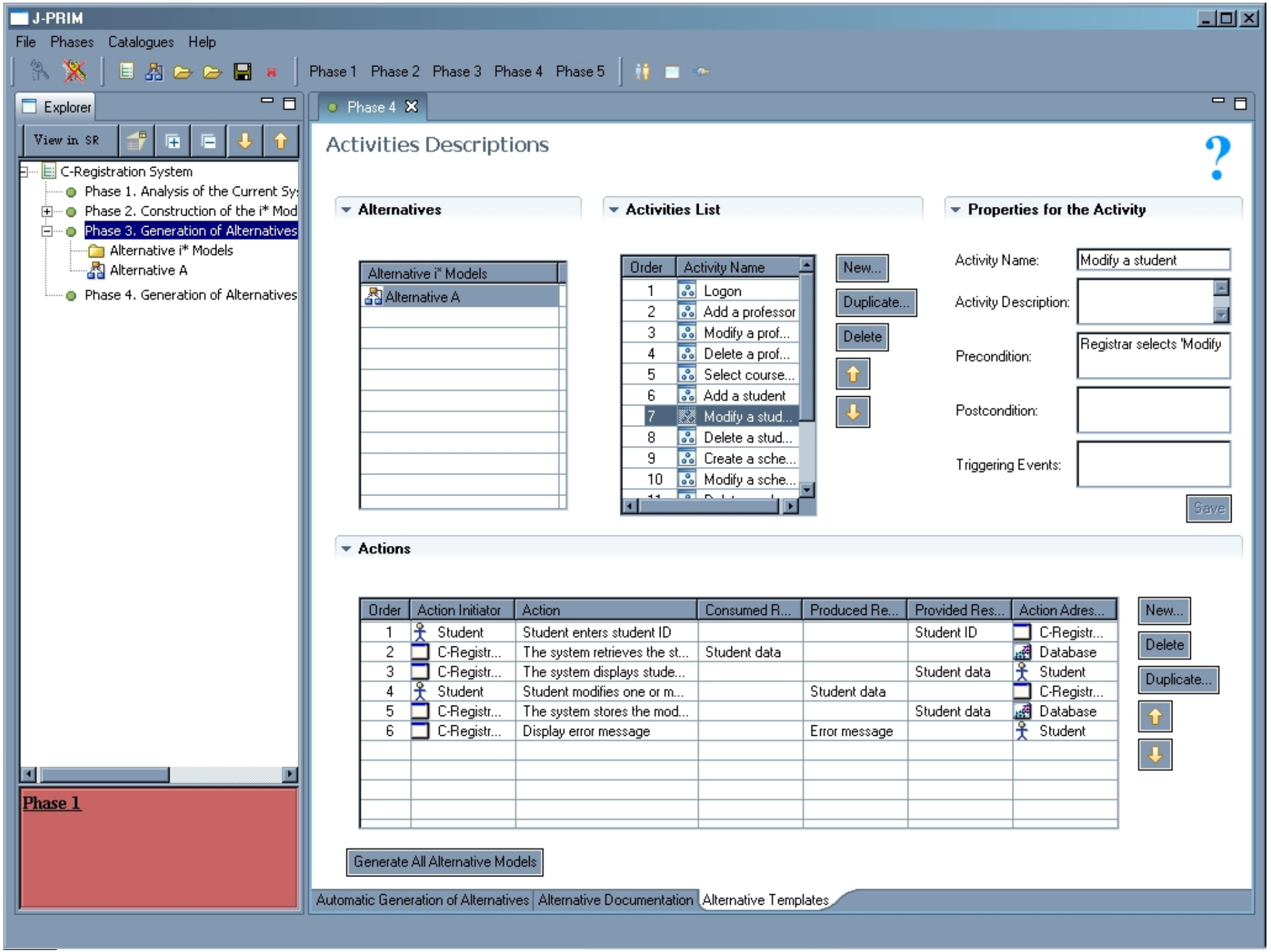
File Phases Catalogues Help
Phase 1 Phase 2 Phase 3 Phase 4 Phase 5
Explorer
View in SR
C-Registration System
Phase 1. Analysis of the Current Sy
Phase 2. Construction of the i* Mod
Phase 3. Generation of Alternatives
Alternative i* Models
Alternative A
Phase 4. Generation of Alternatives
Phase 1
Phase 4
Activities Descriptions
Alternatives
Alternative i* Models
Alternative A
Activities List
Order
Activity Name
1 Logon
2 Add a professor
3 Modify a prof...
4 Delete a prof...
5 Select course...
6 Add a student
7 Modify a stud...
8 Delete a stud...
9 Create a sche...
10 Modify a sche...
New...
Duplicate...
Delete
Properties for the Activity
Activity Name:
Activity Description:
Precondition:
Postcondition:
Triggering Events:
Save
Actions
Order
Action Initiator
Action
Consumed R...
Produced Re...
Provided Res...
Action Adres...
New...
Delete
Duplicate...
Generate All Alternative Models
Automatic Generation of Alternatives
Alternative Documentation
Alternative Templates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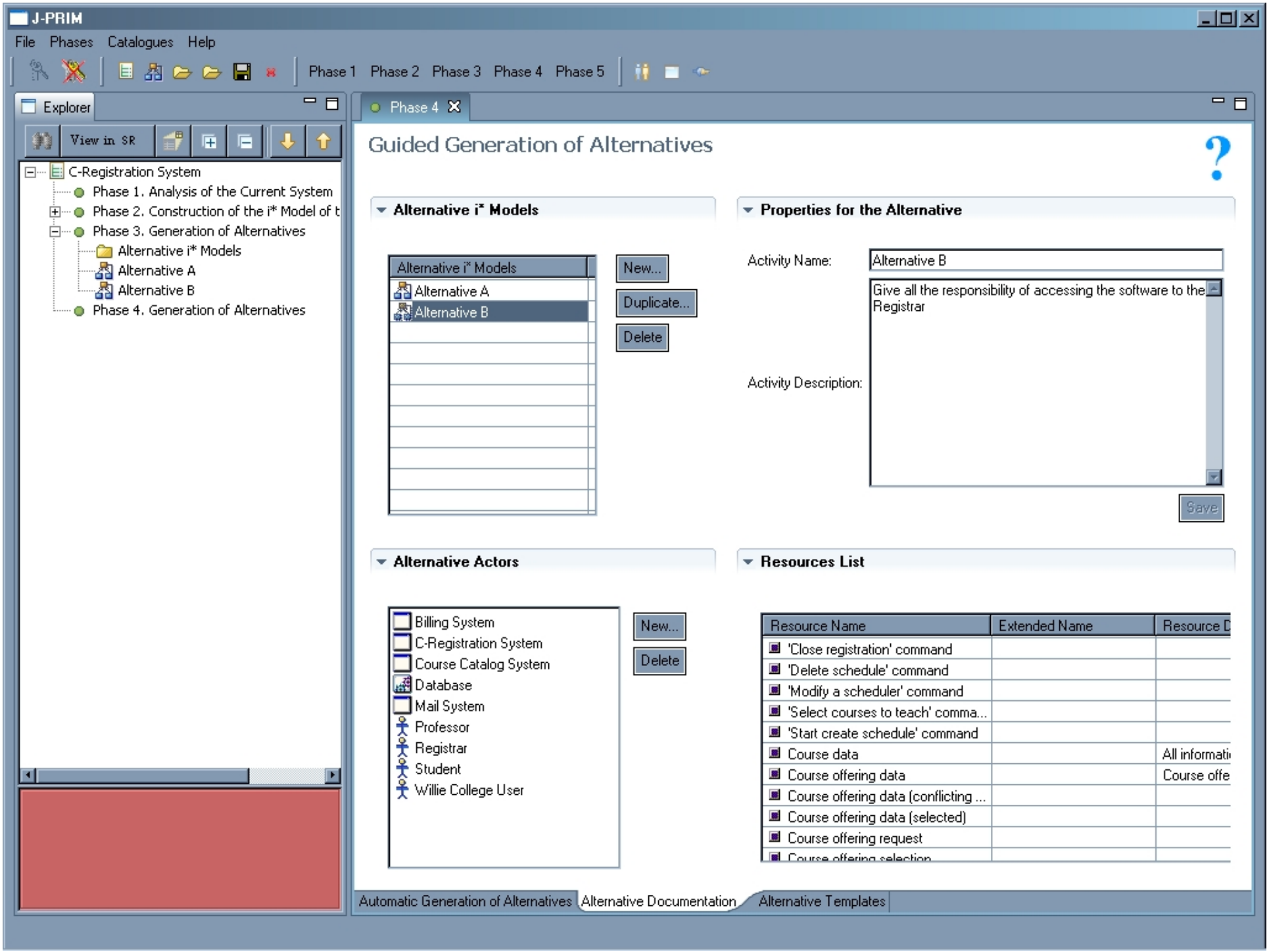
Phase 4
Activities Descriptions
Alternatives
Alternative i* Models
Alternative A
Activities List
Order
Activity Name
1 Logon
2 Add a professor
3 Modify a prof...
4 Delete a prof...
5 Select course...
6 Add a student
7 Modify a stud...
8 Delete a stud...
9 Create a sche...
10 Modify a sche...
New...
Duplicate...
Delete
Properties for the Activity
Activity Name: Modify a student
Activity Description:
Precondition: Registrar selects 'Modify
Postcondition:
Triggering Events:
Save
Actions
Order
Action Initiator
Action
Consumed R...
Produced Re...
Provided Res...
Action Adres...
1 Student Student enters student ID Student ID C-Registr...
2 C-Registr... The system retrieves the st... Student data Database
3 C-Registr... The system displays stude... Student data Student
4 Student Student modifies one or m... Student data C-Registr...
5 C-Registr... The system stores the mod... Student data Database
6 C-Registr... Display error message Error message Student
New...
Delete
Duplicate...
Generate All Alternative Models
Automatic Generation of Alternatives
Alternative Documentation
Alternative Templates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View in SR
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Phase 1. Analysis of the Current System
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Phase 3. Generation of Alternatives
Alternative i* Models
Alternative A
Alternative B
Phase 4. Generation of Alternatives
Phase 4
Guided Generation of Alternatives
Alternative i* Models
Alternative i* Models
Alternative A
Alternative B
New...
Duplicate...
Delete
Properties for the Alternative
Activity Name:
Alternative B
Activity Description:
Give all the responsibility of accessing the software to the Registrar
Save
Alternative Actors
Billing System
C-Registration System
Course Catalog System
Database
Mail System
Professor
Registrar
Student
Willie College User
New...
Delete
Resources List
Resource Name
Extended Name
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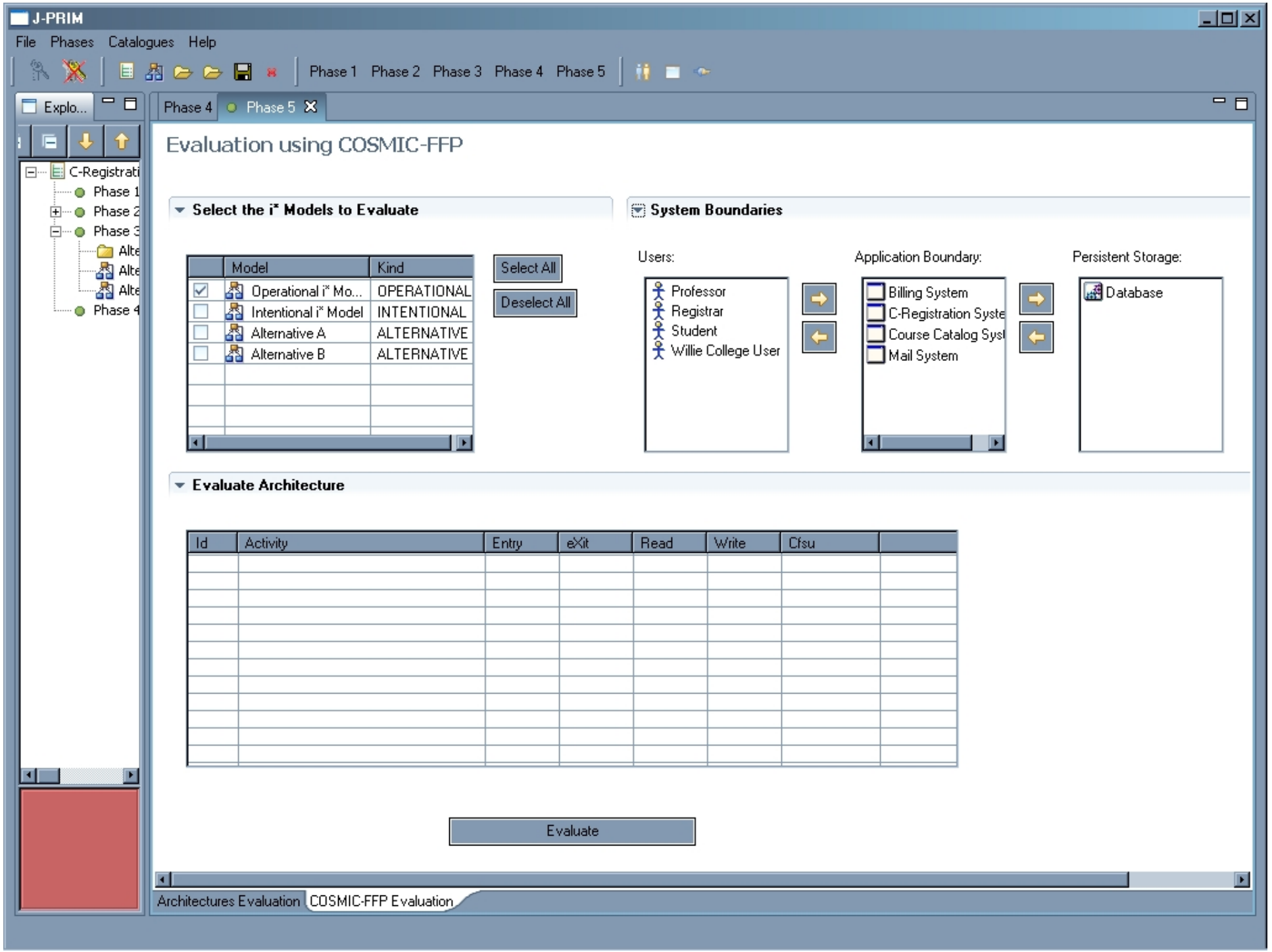
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Evaluation using COSMIC-FFP
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Alternative A
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ALTERNATIVE
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Registrar
Student
Willie College User
Application Boundary:
Billing System
C-Registration Syste
Course Catalog Syst
Mail System
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Activity
Entry
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Read
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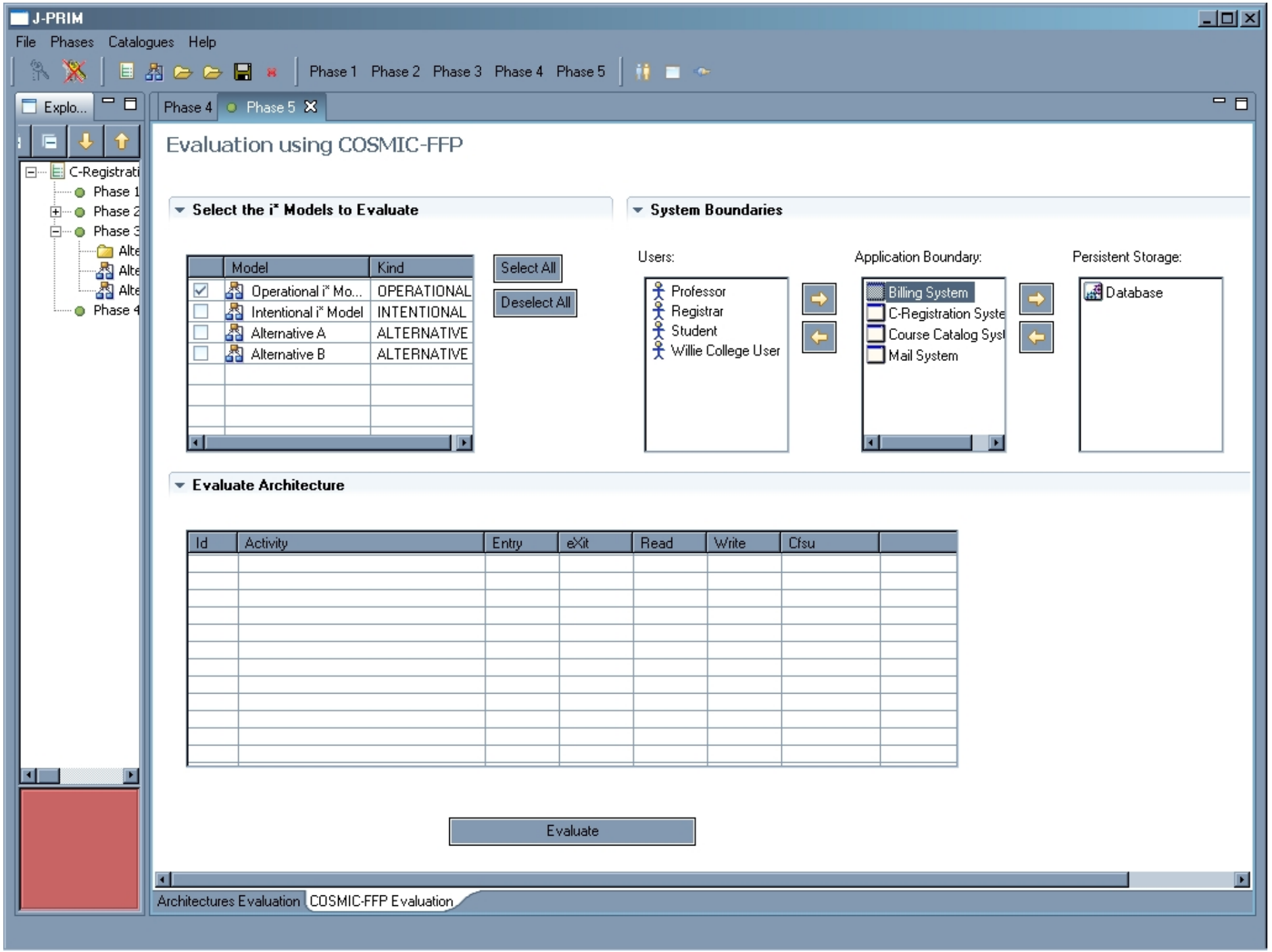
Cfsu
Evaluate
Architectures Evaluation
COSMIC-FFP Evaluation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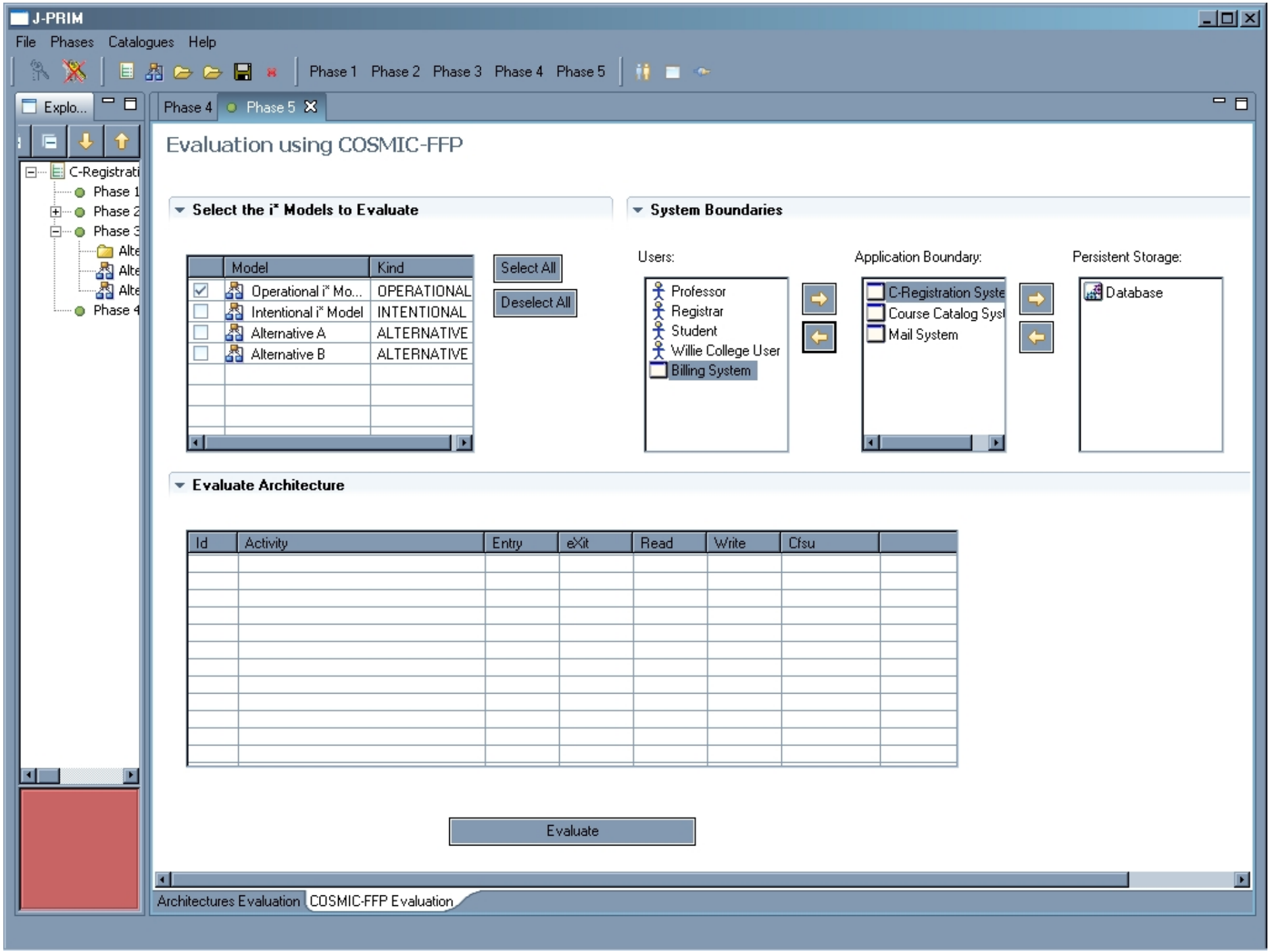
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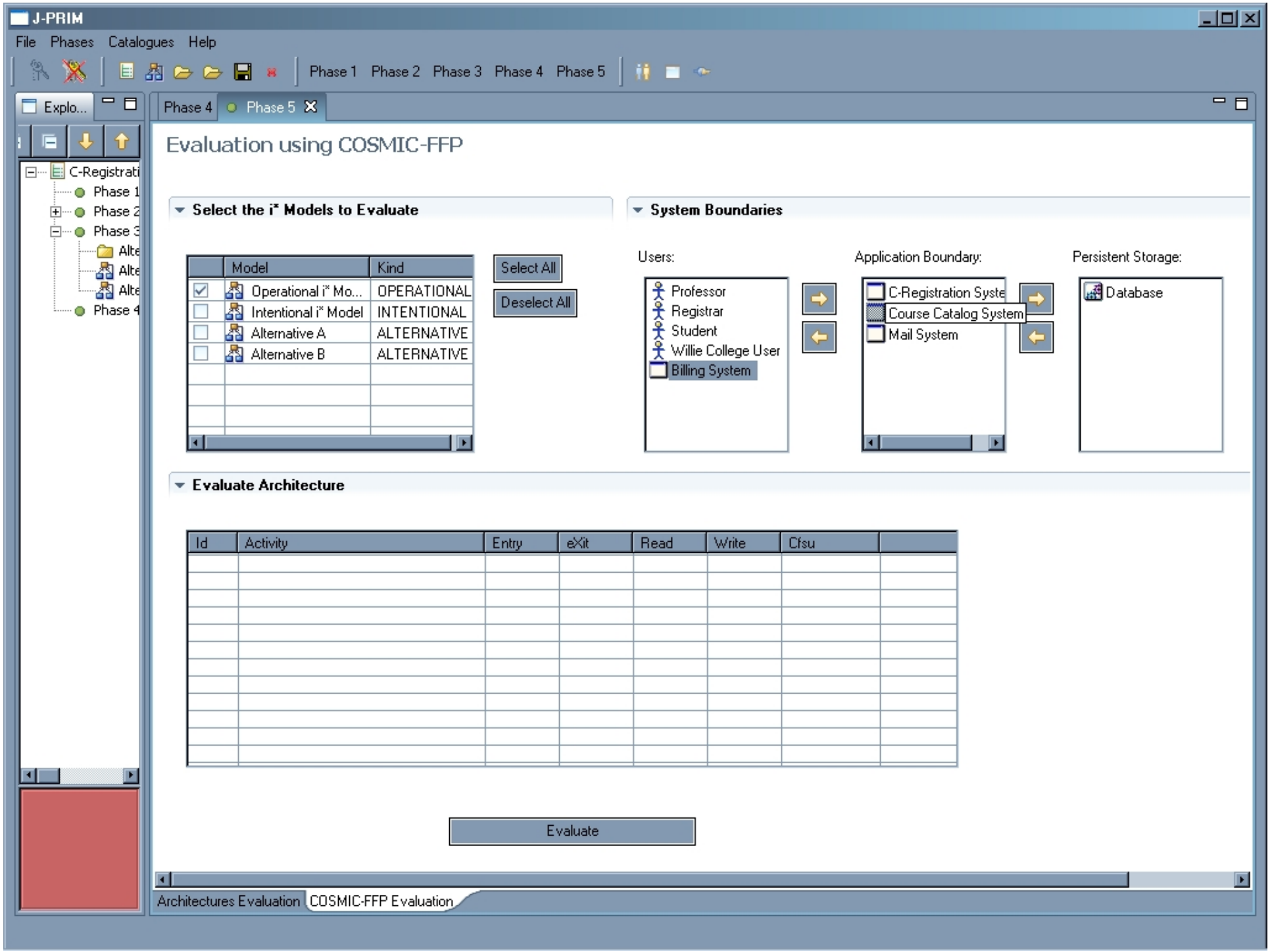
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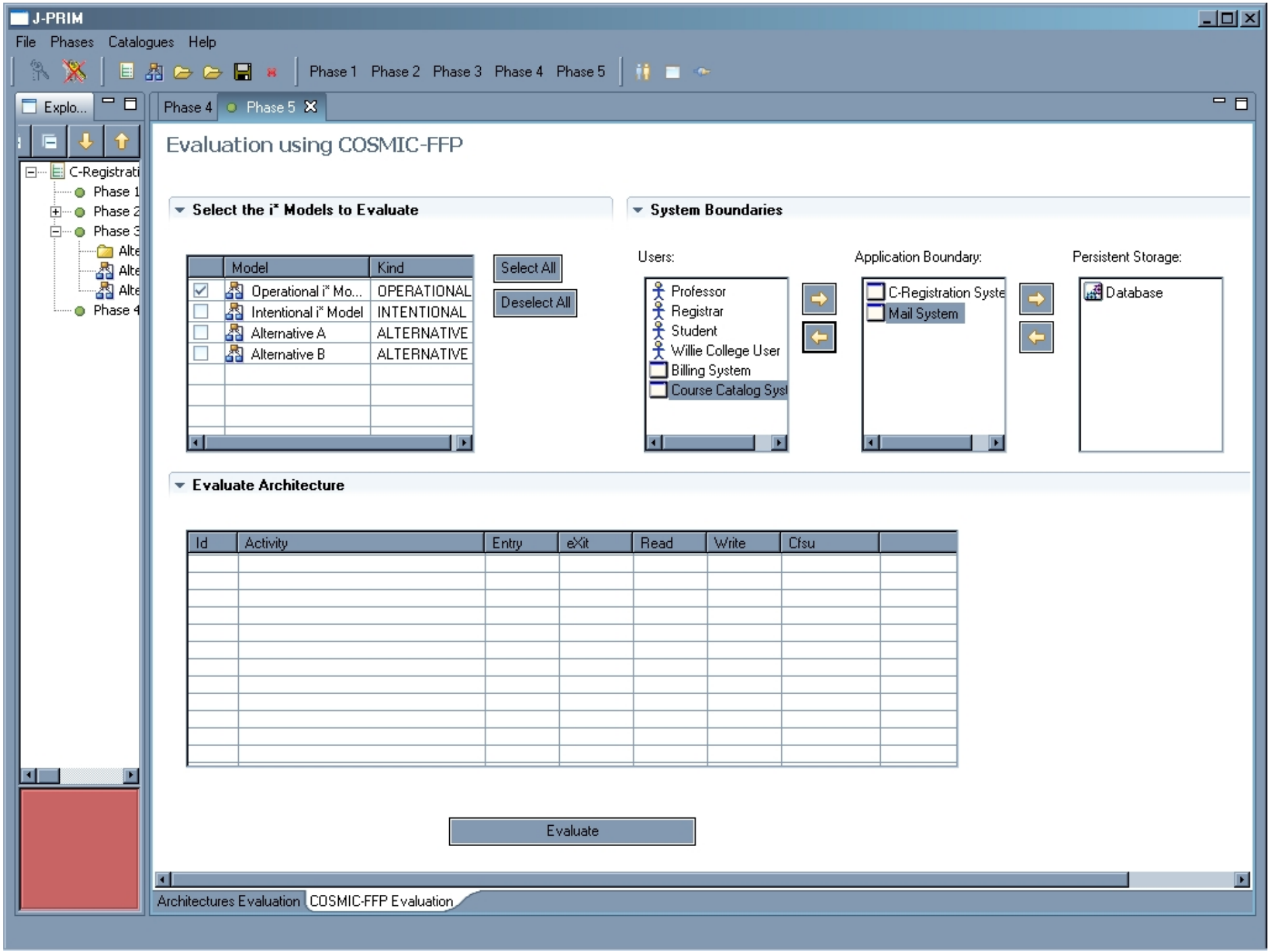
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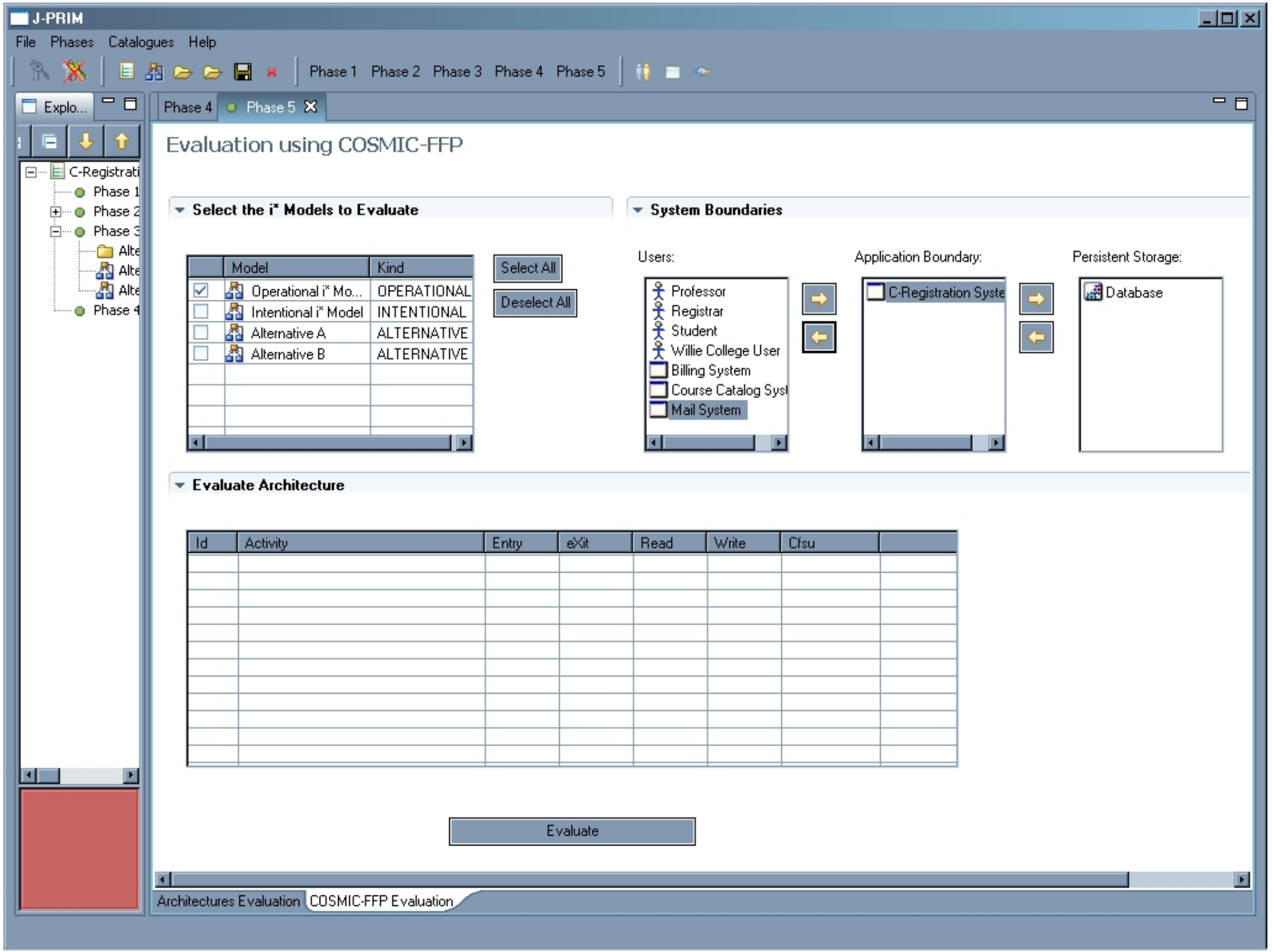
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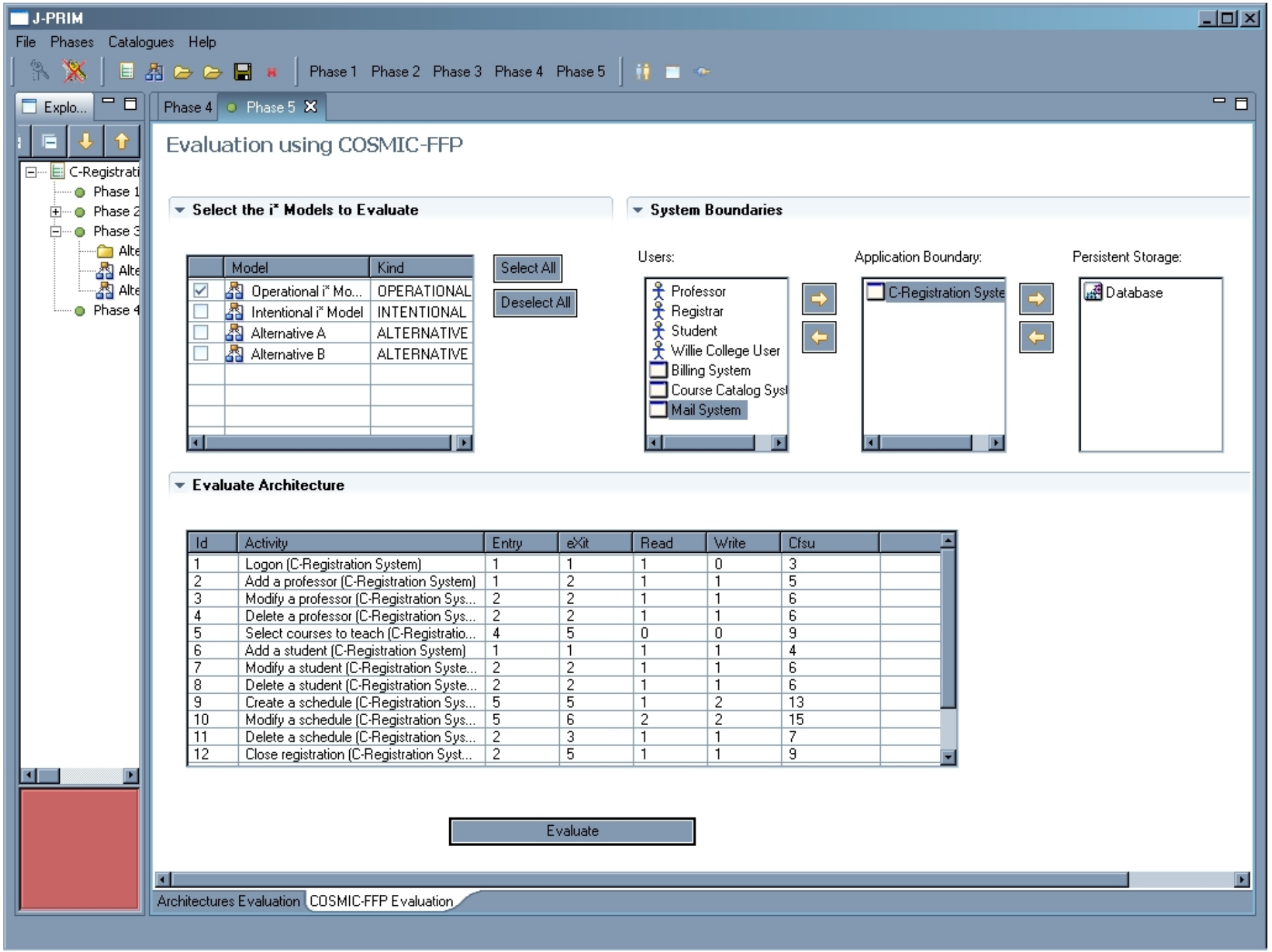
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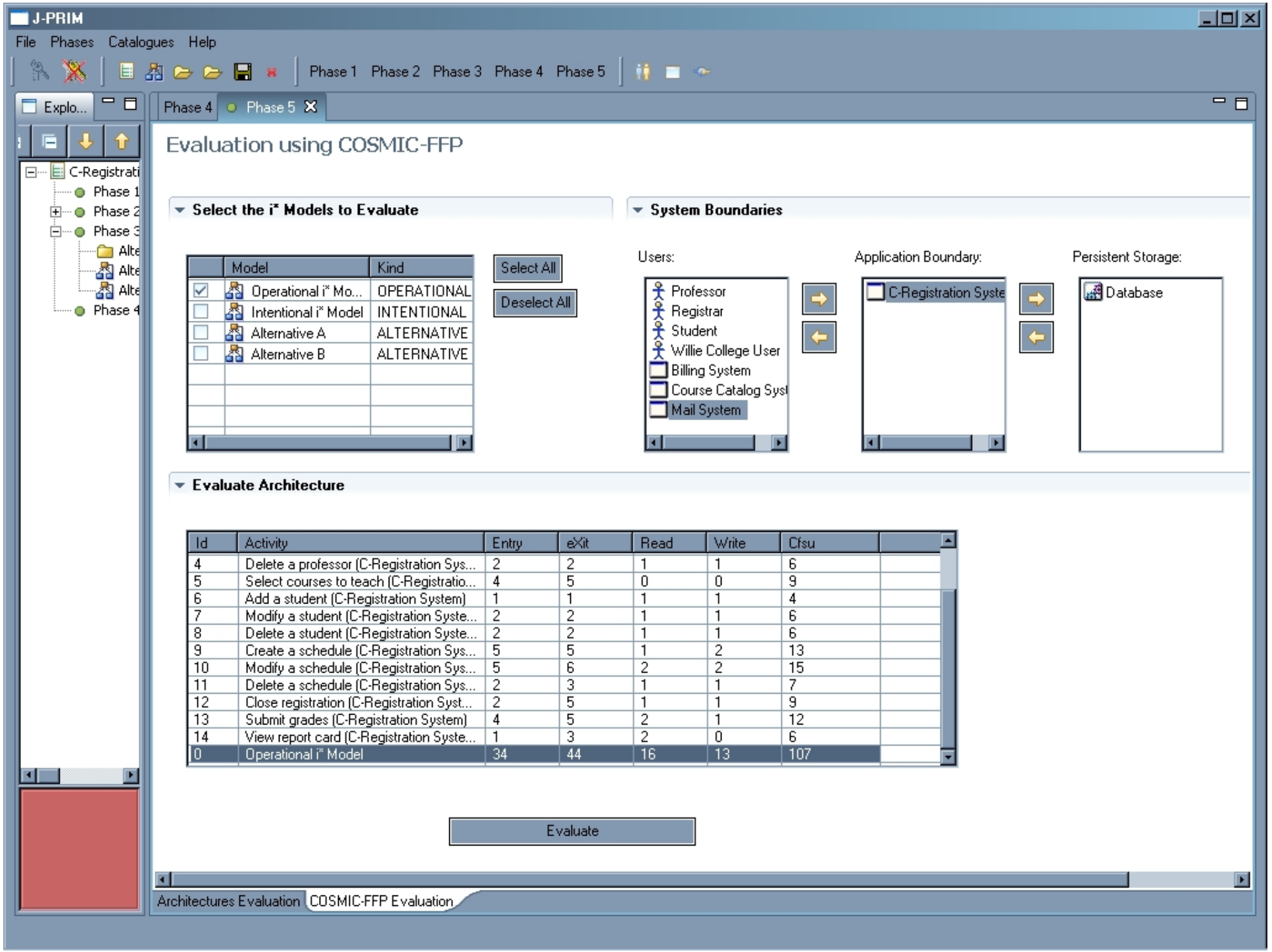
Registrar
Student
Willie College User
Billing System
Course Catalog Syst
Mail System
Application Boundary:
C-Registration Syste
Persistent Storage:
Database
Evaluate Architecture
Id
Activity
Entry
eXit
Read
Write
Cfsu
1 Logon (C-Registration System) 1 1 1 0 3
2 Add a professor (C-Registration System) 1 2 1 1 5
3 Modify a professor (C-Registration Sys... 2 2 1 1 6
4 Delete a professor (C-Registration Sys... 2 2 1 1 6
5 Select courses to teach (C-Registratio... 4 5 0 0 9
6 Add a student (C-Registration System) 1 1 1 1 4
7 Modify a student (C-Registration Syste... 2 2 1 1 6
8 Delete a student (C-Registration Syste... 2 2 1 1 6
9 Create a schedule (C-Registration Sys... 5 5 1 2 13
10 Modify a schedule (C-Registration Sys... 5 6 2 2 15
11 Delete a schedule (C-Registration Sys... 2 3 1 1 7
12 Close registration (C-Registration Syst... 2 5 1 1 9
Evaluate
Architectures Evaluation
COSMIC-FFP Evaluation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4 Delete a professor (C-Registration Sys... 2 2 1 1 6
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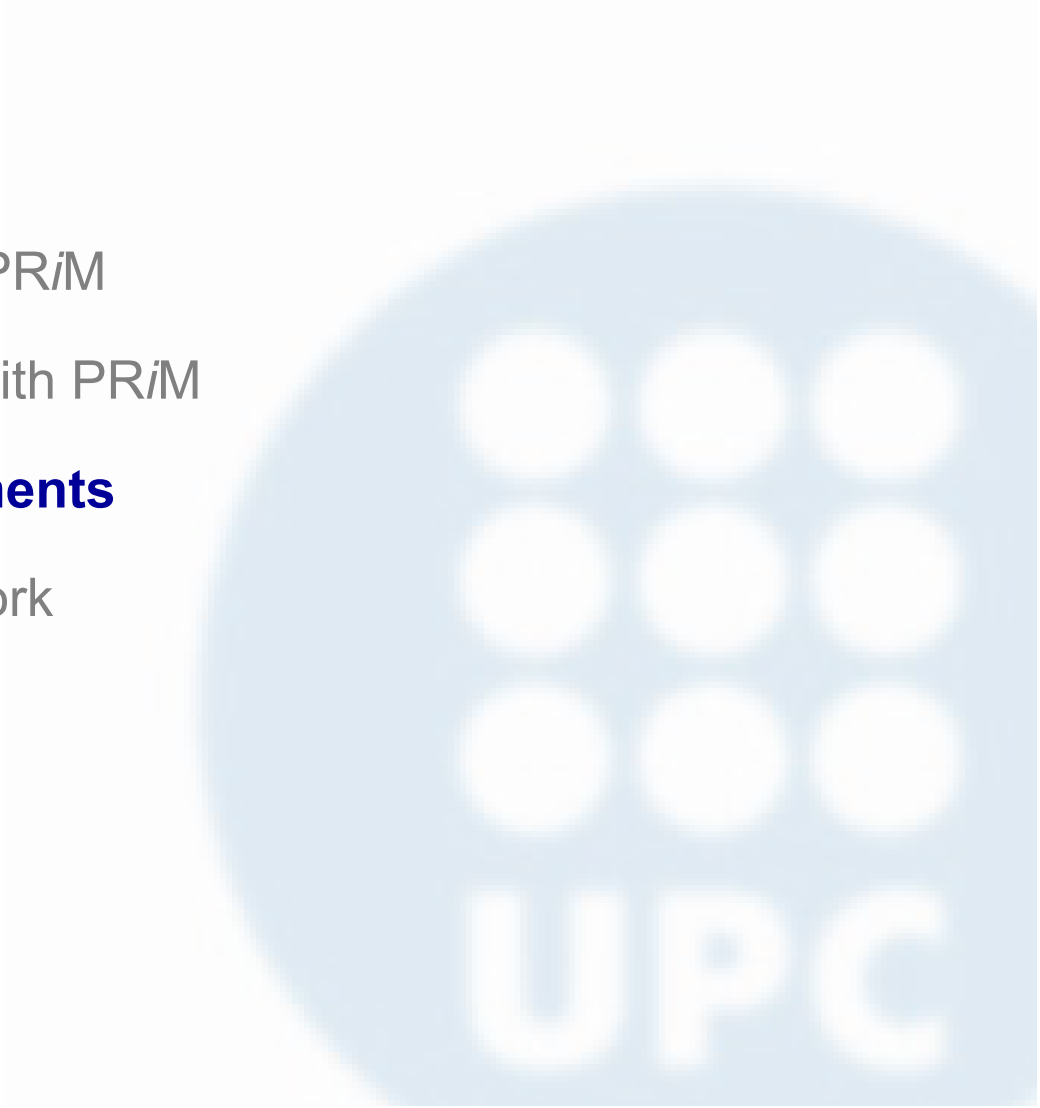
8 Delete a student (C-Registration Syste... 2 2 1 1 6
9 Create a schedule (C-Registration Sys... 5 5 1 2 13
10 Modify a schedule (C-Registration Sys... 5 6 2 2 15
11 Delete a schedule (C-Registration Sys... 2 3 1 1 7
12 Close registration (C-Registration Syst... 2 5 1 1 9
13 Submit grades (C-Registration System) 4 5 2 1 12
14 View report card (C-Registration Syste... 1 3 2 0 6
0 Operational i* Model 34 44 16 13 107
Evaluate
Architectures Evaluation
COSMIC-FFP Evaluation

Agenda

- Motivation
- The *i** Framework
- Mapping COSMIC-FFP to PR*i*M
- Measuring COSMIC-FFP with PR*i*M
- **Non-functional Measurements**
- Conclusions and Future Work



Non-functional Measurements

- **Operational *i** Model:**
  - The Registrar maintains Student Data
  - The Registrar maintains the Professor Data
  - The Student and the Professor access the System for other purposes
- **Alternative A:**
  - The Student modifies the Student Data
  - The Professor modifies the Professor Data
- **Alternative B:**
  - The Registrar is the only actor that access the System
  - The Student and the Professor request the Registrar

Evaluation of the Alternatives

Alternative	Cfsu	Ease of Communication	Process Agility
Operational *i** Model	107	0.2824	0.7903
Alternative A	107	0.2796	0.8040
Alternative B	107	0.3761	0.6351

Agenda

- Motivation
- The *i** Framework
- Mapping COSMIC-FFP to PR*i*M
- Measuring COSMIC-FFP with PR*i*M
- Non-functional Measurements
- **Conclusions and Future Work**

Conclusions

- Our Proposal:
  - Adapting the COSMIC-FFP measurement process model to PR*i*M
  - Validation of the results:
    - COSMIC-FFP results by replicating case studies
    - Non-functional properties by generating alternatives
- COSMIC-FFP enriches PR*i*M:
  - It is a standardized measurement process for evaluating the functional size
  - It provides knowledge and experience:
    - Questions for validated COSMIC-FFP functional processes
    - Guidelines for the identification of the data movements types

Conclusions

- PR*i*M enriches COSMIC-FFP:
  - Use of a unique i* requirements model for representing functional and non-functional requirements
  - Guidelines for generating alternatives
  - Guidelines for defining structural metrics for evaluating non-functional properties
- *i** actors types provide implicit identification of the Data Groups
  - **E**ntry = depender (human) and dependee (software)
  - e**X**it = depender (software) and dependee (human)
  - **R**ead = depender (software) and dependee (database)
  - **W**rite = depender (database) and dependee (software)
- Tool support available: J-PR*i*M

Future Work

- Address other metrics based on the functional size
  - Software Product Lines
- Further specification facilities
  - Study how to get the class diagrams in addition to the use cases from *i**-PR*i*M

Thank You

Contact me at: ggrau@lsi.upc.edu

Everything about *i** is at: http://istar.rwth-aachen.de/