

SAPERE Methodology

The complete process

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Modena, 20th February 2013



- 1 Work package 1 - Task 1.3
- 2 SAPERE Meta-model
- 3 SAPERE Process
 - The Requirements Analysis phase
 - The Analysis phase
 - The Architectural Design phase
 - The Detailed Design phase
 - The Implementation phase
- 4 SAPERE Methodology: next steps



Outline

- 1 Work package 1 - Task 1.3
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WP1

T1.3 from DoW

The focus of this task is on the development of a methodology for the design of the SAPERE services, namely methodological guidelines for the proposed computational models coupled with tools to support the development process



Methodology

Methodology [Ghezzi et al., 2002]

- A methodology is a collection of methods covering and connecting different stages in a process
- The purpose of a methodology is to prescribe a certain coherent approach to solving a problem in the context of a software process by preselecting and putting in relation a number of methods
- A methodology has two important components
 - one that describe the process elements of the approach: the **abstractions**
 - one that focuses on the steps that have to be done, the work products that have to be produced – and their documentation – ...: the **process**

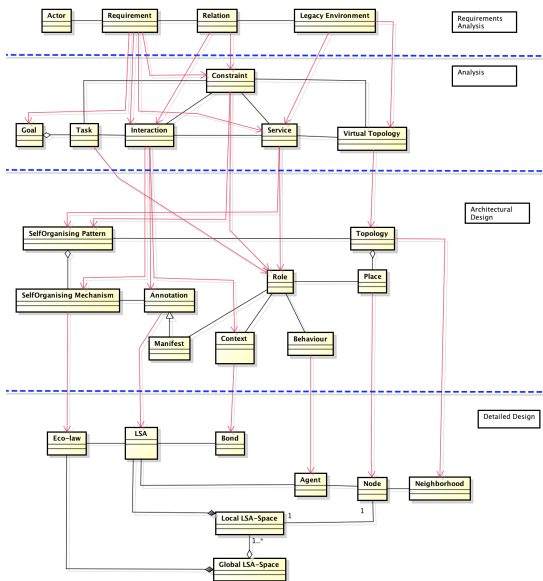


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The Abstractions Meta-model

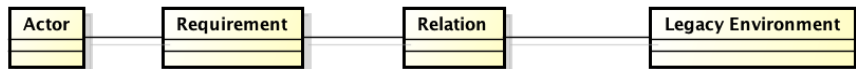


Abstractions Meta-model

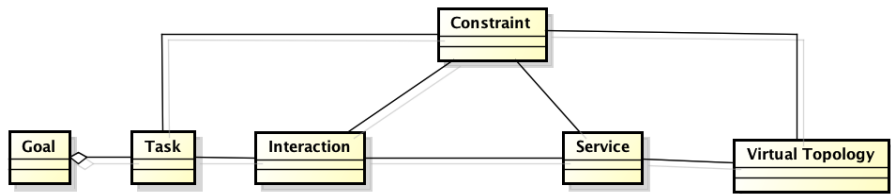
- Here we propose the abstractions meta-model where:
 - the abstractions of the Requirements Analysis and Analysis are inspired by the AOSE methodologies
 - the abstractions of the Architectural Design have different sources:
 - the abstract computational model (D1.1): *Annotation, Manifest, Context, Behaviour, Place, Topology*
 - the WP2 work (D2.1): *SelfOrganising Pattern*, and *SelfOrganising Mechanism*
 - the AOSE methodologies: *Role*
 - the abstractions of the Detailed Design coming from the abstract computational model presented in D1.1.



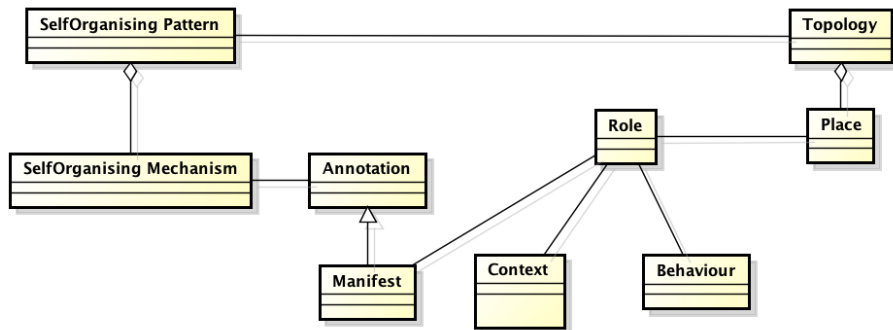
The Requirements Analysis Meta-model



The Analysis Meta-model



The Architectural Design Meta-model

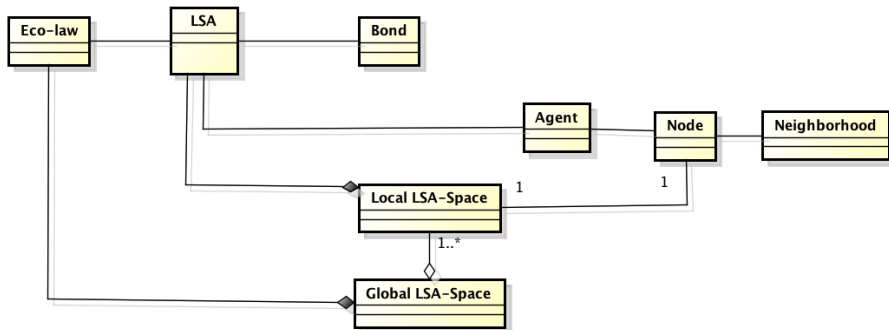


The Detailed Design Meta-model

- The creation of the process has lead to a refinement of the Detailed Design meta-model
 - introduction of the concept of *Global LSA-Space*: global chemical environment in the chemical metaphor. It works as the global environment abstraction containing all the LSAs and Eco-laws of a SAPERE (eco)system.
 - the previous concept *LSA-Space* has been renamed in *Local LSA-Space*: it is a subset of the Global LSA Space contained in a specific Node. It plays the role of the local chemical environment in the chemical metaphor



The Detailed Design Meta-model



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Methodology Documentation

- A new standard for the processes documentation [FIPA-DPDF, 2012] [Cossentino, 2009] [Molesini and Omicini, 2012] has been recently approved by IEEE-FIPA with number SC00097B.
- The Process Documentation Template:
 - has been conceived without considering any particular process or methodology → all processes can be documented using it
 - is neutral regarding the (MAS) meta-model and/or the modelling notation adopted in describing the process
 - has a simple structure resembling a tree, so documentation is made in a natural and progressive way:
 - addressing in first place the general description and meta-model definition which constitute the root elements of the process
 - detailing in a second step the branches which are the phases
 - is easy to use for a software engineer as it relies on few previous assumptions
 - suggests as notation the use of the OMG's standard SPEM [Object Management Group, 2008] with few extensions [Seidita et al., 2009]



Methodology Documentation in SAPERE

- Adoption of the Process Documentation Template for documenting the SAPERE methodology
 - documented in a standard way
 - comparable with other methodologies



The SPEM icons



Phase



Activity



Role Use



Task Use



Composite
WPKind



Free
WPKind



Structured
WPKind



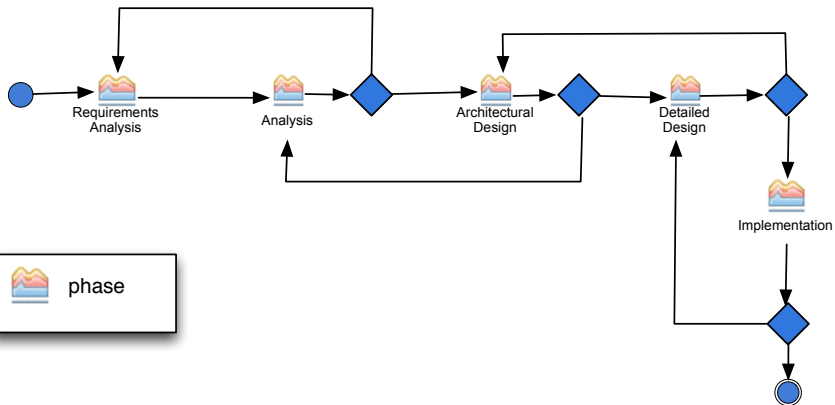
Structural
WPKind



Behavioral
WPKind



The SAPERE process lifecycle

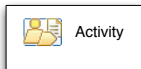
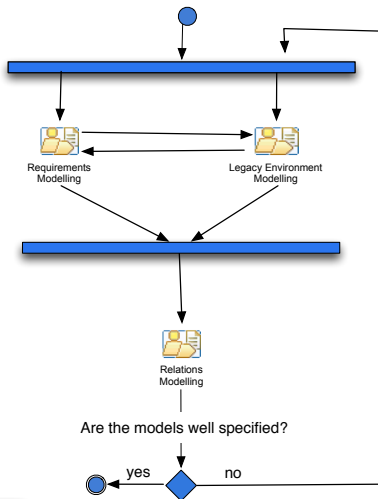


Outline

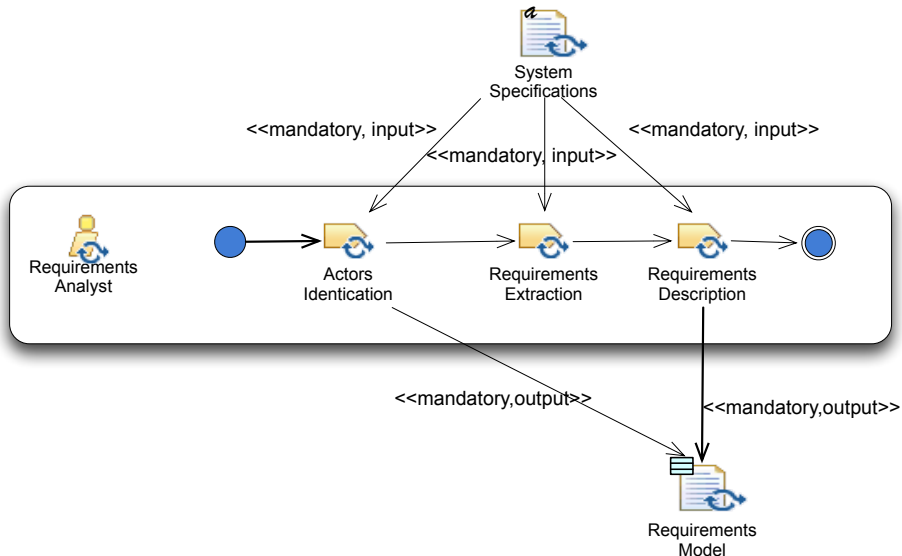
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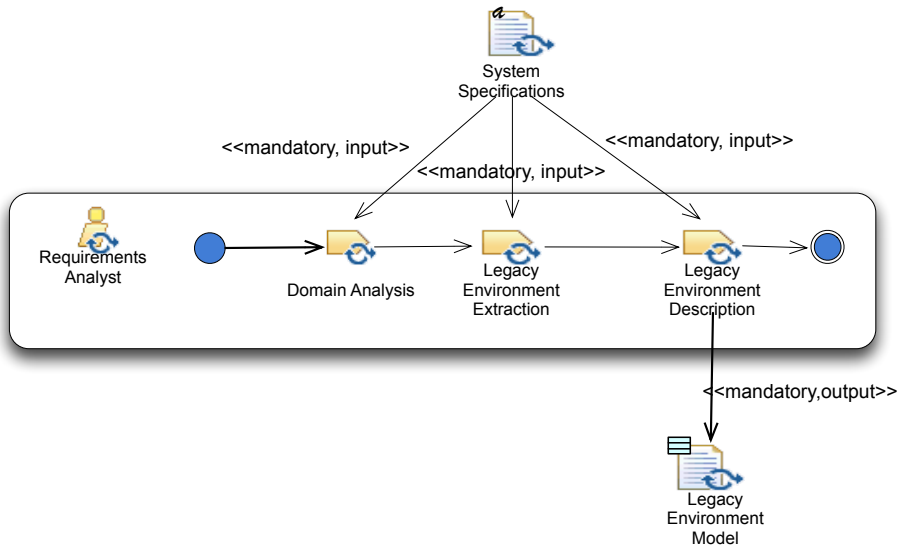
The Requirements Analysis process



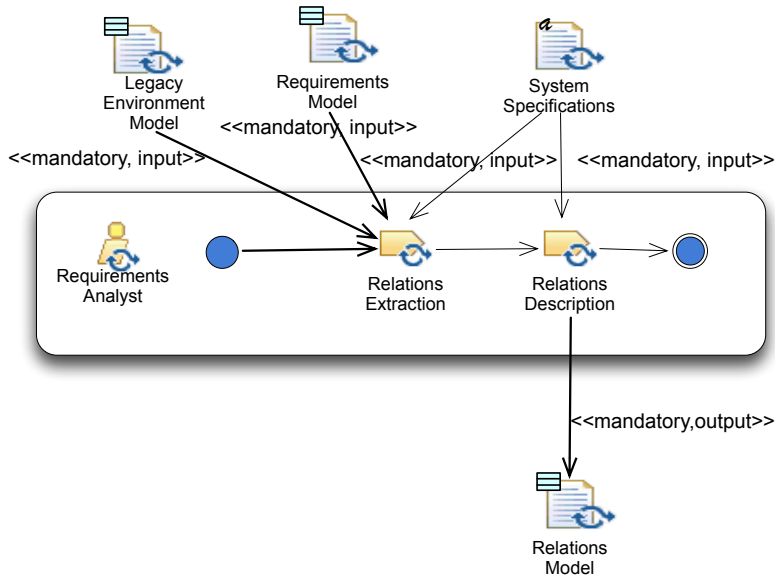
The Requirements Modelling activity



The Environment Modelling activity



The Relations Modelling activity



The Requirements Analysis work products

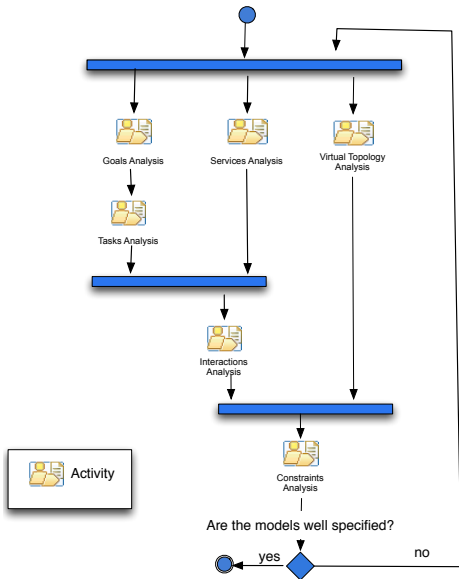
Name	Description	Work Product Kind
Requirements Specification	<i>A description of the problem to be solved</i>	Free Text
Requirements Model	<i>This document presents in a structured way the set of requirements providing for each of them the relation with the System Actor and an accurate description coming also from some actor interviews</i>	Structural
Legacy Environment Model	<i>This document presents in a structured way the set of legacy systems already presented in the environment providing for each of them an accurate description including the main technical characteristics coming both also from some actor interviews</i>	Structural
Relations Model	<i>This document presents in a structured way the set of relations between requirements and among requirements and legacy systems providing for each of them an accurate description</i>	Structural

Outline

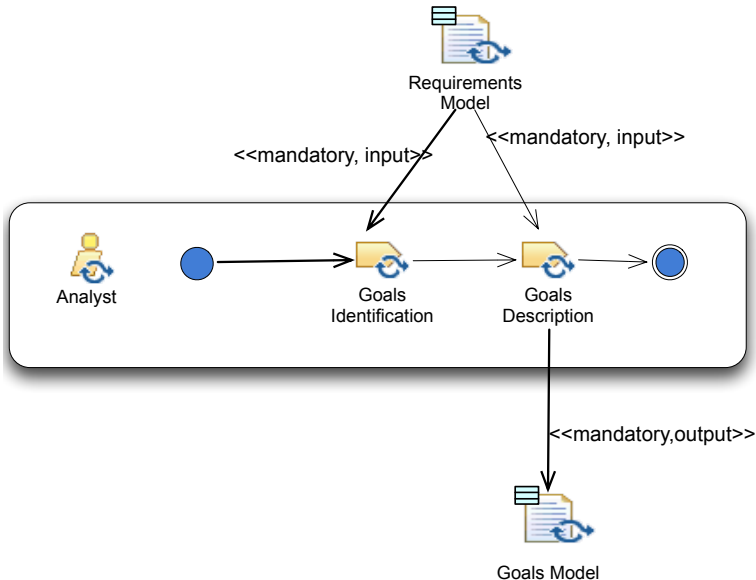
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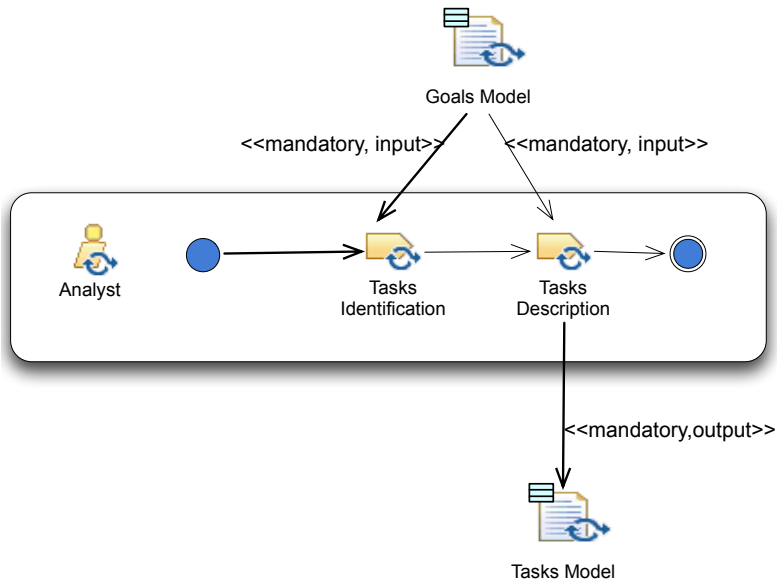
The Analysis process



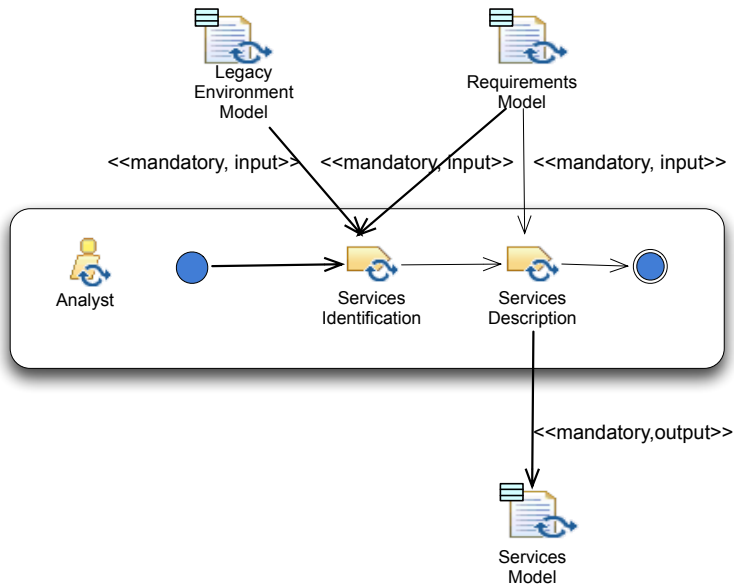
The Goals Analysis activity



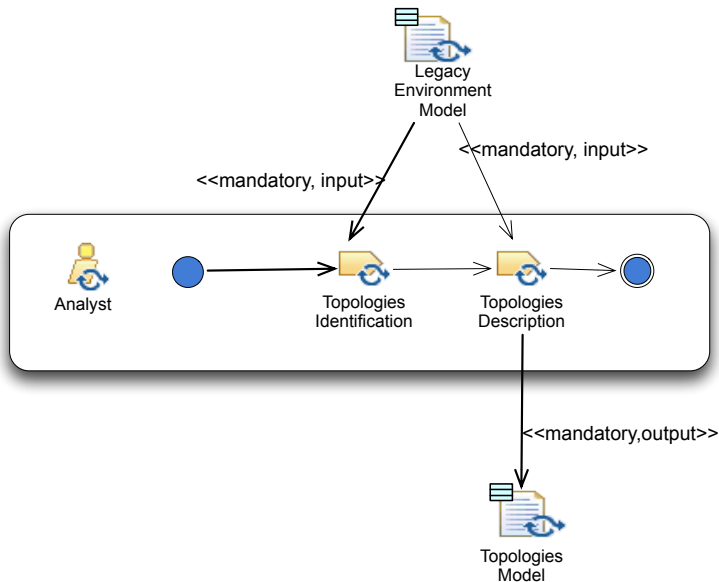
The Tasks Analysis activity



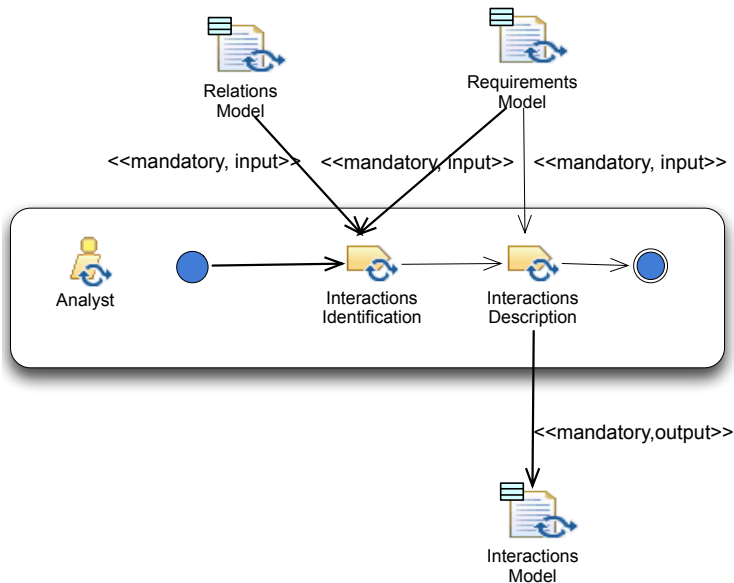
The Services Analysis activity



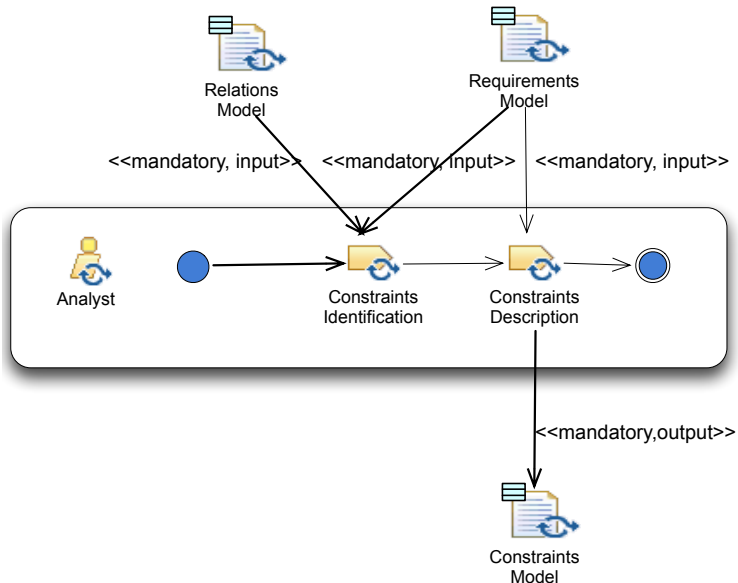
The Virtual Topology Analysis activity



The Interactions Analysis activity



The Constraints Analysis activity



The Analysis work products I

Name	Description	Work Product Kind
Goals Model	<i>This document presents the set of goals of the application. Each goal is related to the sourcing requirement and it is carefully described</i>	Structural
Tasks Model	<i>This document presents the set of tasks of the application. Each task is related to the sourcing goal and it is carefully described</i>	Structural
Services Model	<i>This document presents the set of services of the application. Each services is related to the sourcing requirement / legacy system and it is carefully described</i>	Structural
Interactions Model	<i>This document presents the set of interaction among system's entities of the application. Each interaction is related to the sourcing requirement / relation and it is carefully described</i>	Structural

The Analysis work products II

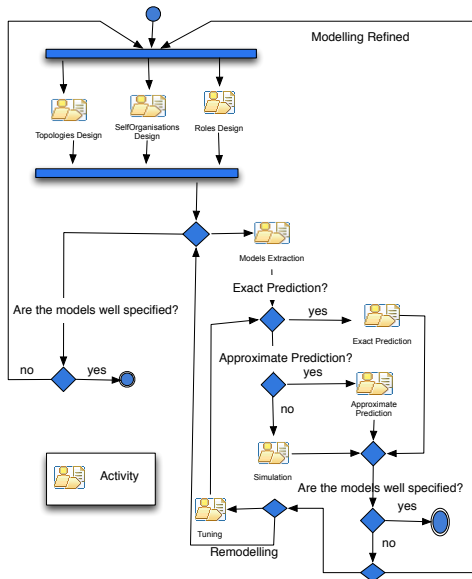
Name	Description	Work Product Kind
Topologies Model	<i>This document presents the spatial structure of the environment. Each topological aspect is related to the sourcing legacy system and it is carefully described</i>	Structural
Constraints Model	<i>This document presents the set of constraints over the application entities. Each constraint is related to the sourcing requirement /relation and it is carefully described</i>	Structural

Outline

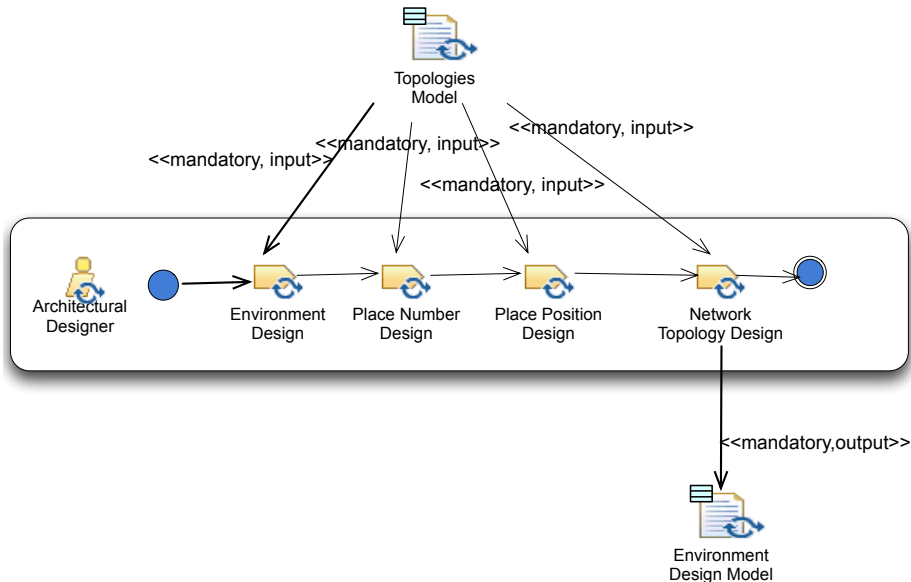
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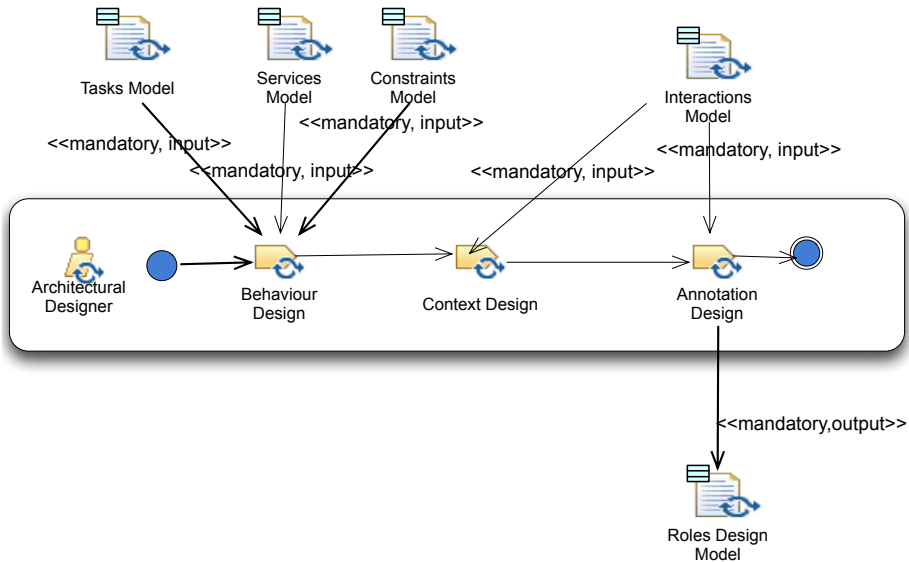
The Architectural Design process



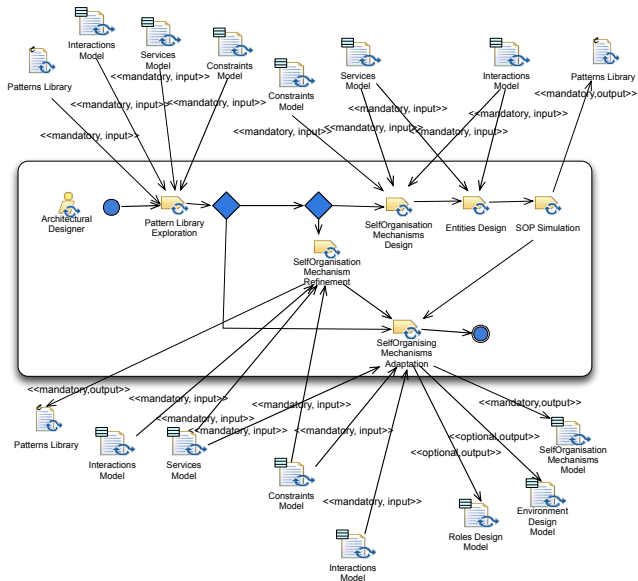
The Topologies Design activity



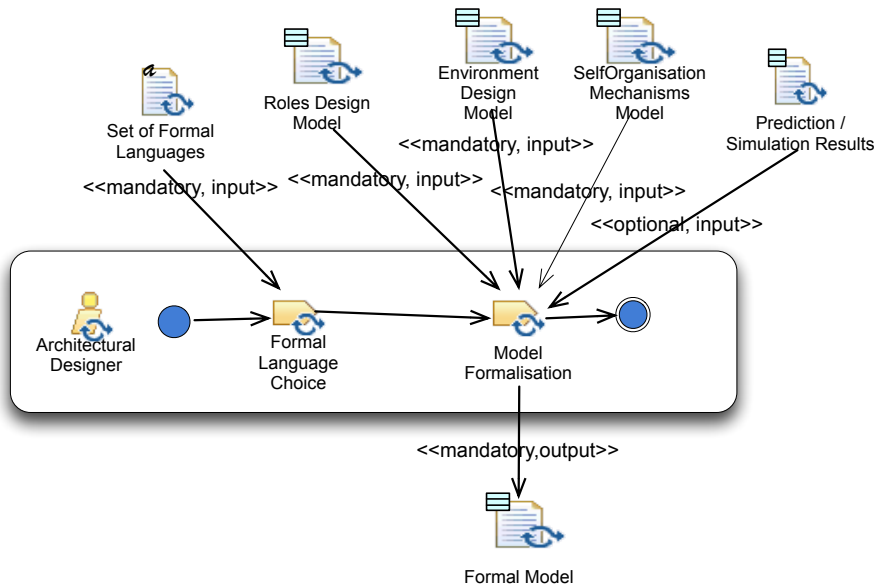
The Roles Design activity



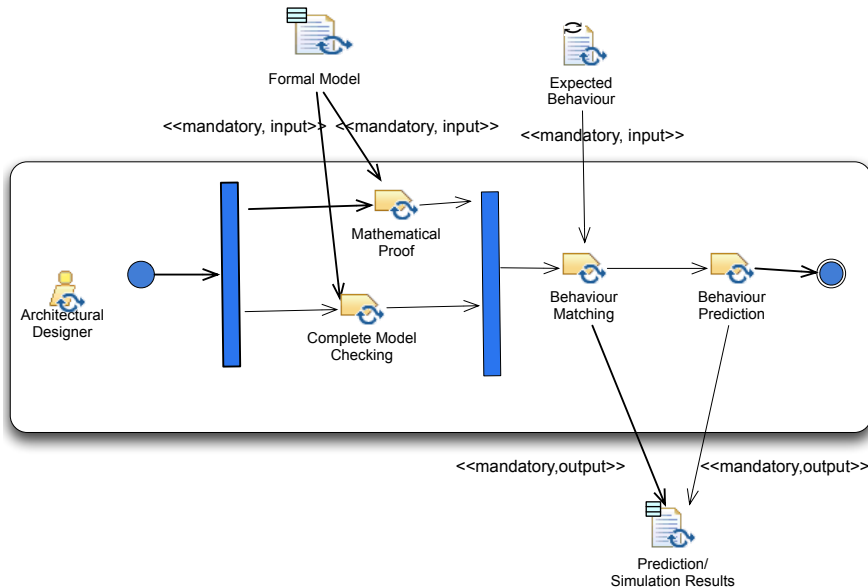
The SelfOrganisations Design activity



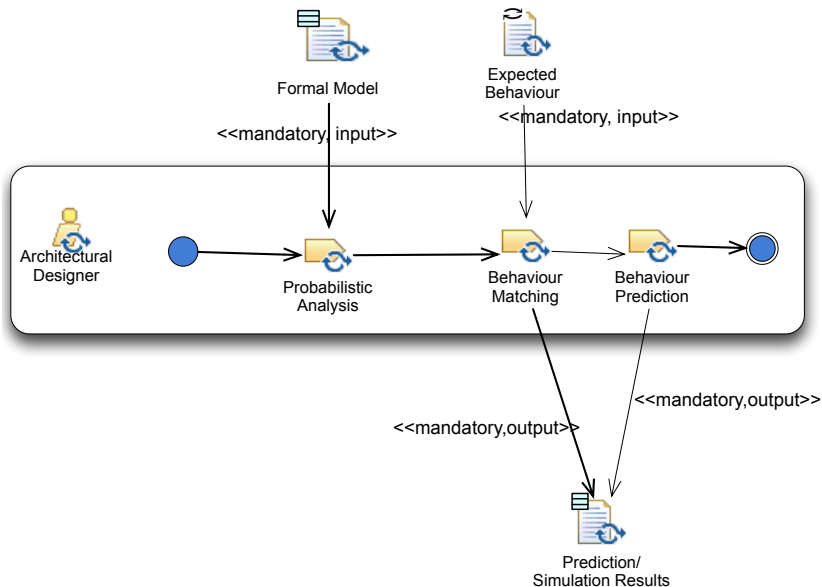
The Models Extraction activity



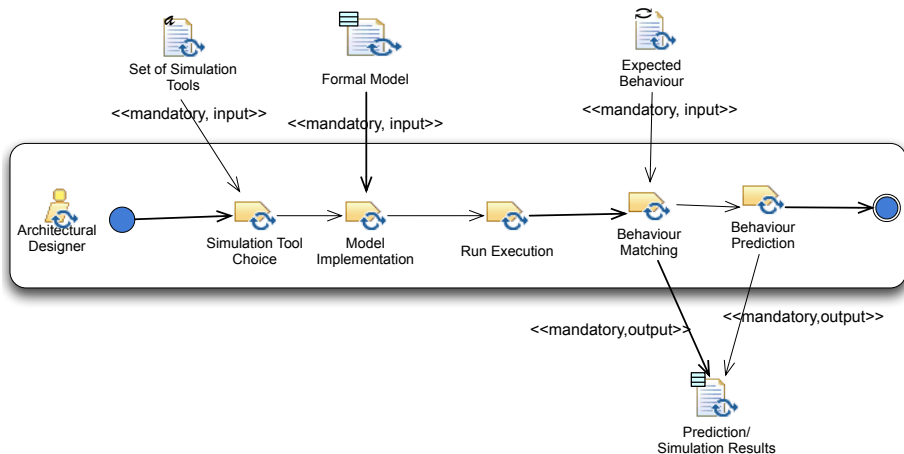
The Exact Prediction activity



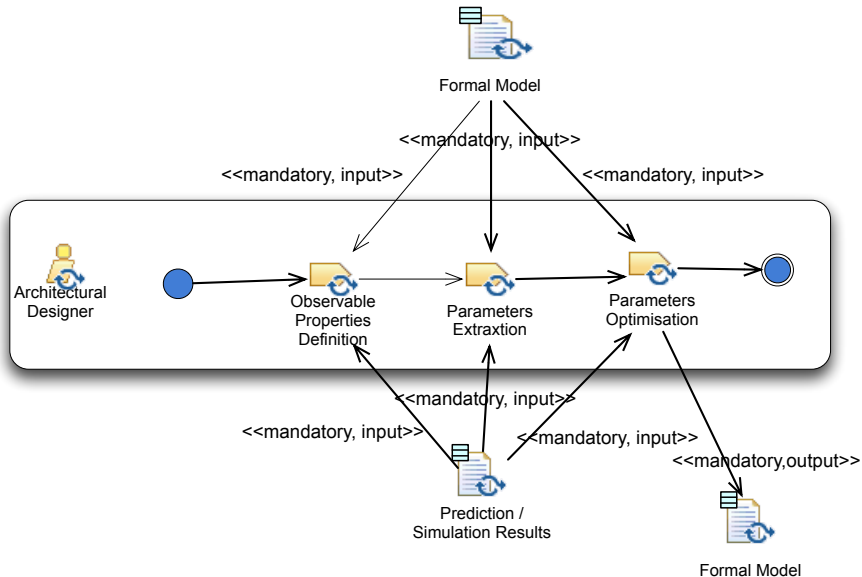
The Approximate Prediction activity



The Simulation activity



The Tuning activity



The Architectural Design work products I

Name	Description	Work Product Kind
Environment Design Model	<i>This document presents the design of the environment structure with particular regard to the number and the position of the places</i>	Structural
Roles Design Model	<i>This document presents the set of roles and their main characteristics (behaviour, annotation and context). This document is expressed according to a specific language</i>	Structural
SelfOrganisation Mechanisms Model	<i>This document presents the set of self-organisation mechanisms used during the architectural design and adapted to the specific problem to be solved. This document is expressed according to a specific language</i>	Structural

The Architectural Design work products II

Name	Description	Work Product Kind
Patterns Library	<i>This composite work product represent a catalogue of self-organisation patterns expressed according a specific standard. The designer can adopt a self-organising patter or create an its extension, or create a new pattern</i>	Composite (Structured)
Set of Formal Languages	<i>This document represents an input for the process, it provides a list of most known formal languages and their main features</i>	Free
Set of Simulation Tools	<i>This document represents an input for the process, it provides a list of most known simulation tools and their main features</i>	Free
Formal Model	<i>This document represent a simplified version of the system architecture expressed according to a specific formal language</i>	Structural

The Architectural Design work products III

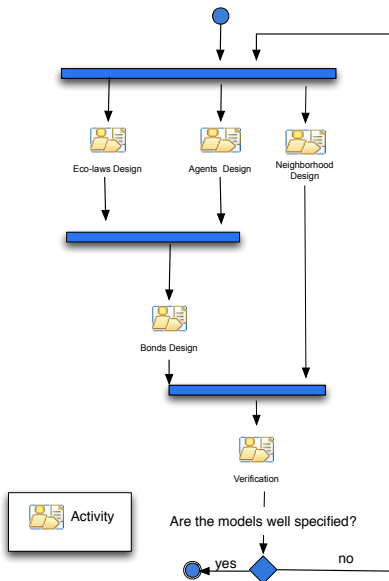
Name	Description	Work Product Kind
Prediction /Simulation Results	<i>This document presents the results of the predictions and simulation activities and highlights the presence of discordances between the expected behaviour and the prediction of the behaviour</i>	Structural
Expected Behaviour	<i>This document represents an input for the process and provides the system expected behaviour modeled according to a formal language</i>	Behavioural

Outline

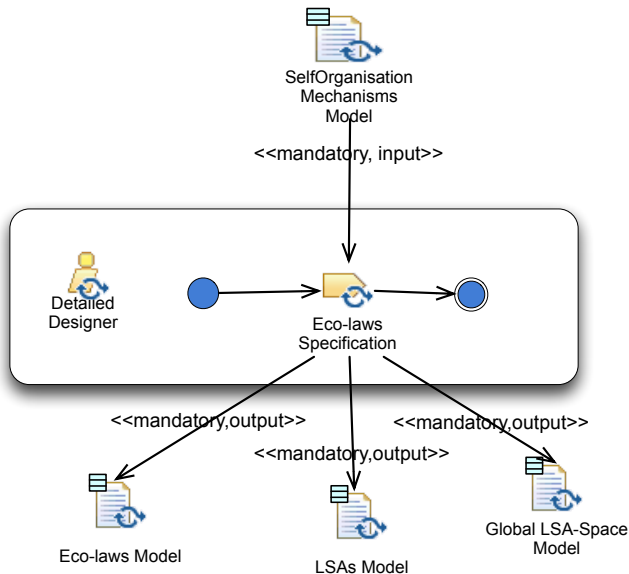
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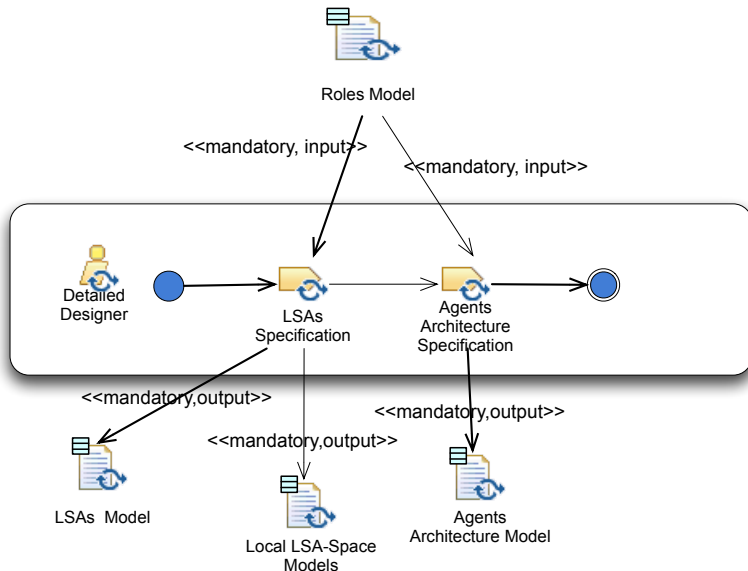
The Detailed Design process



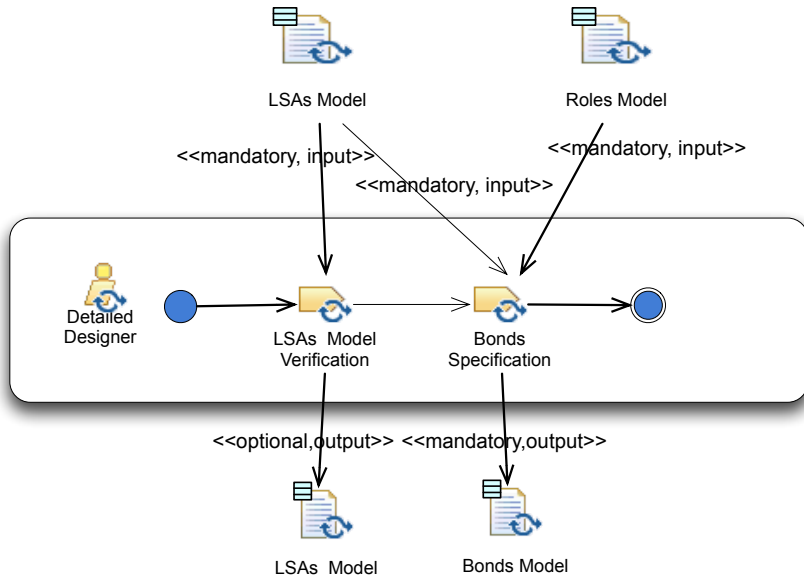
The Eco-laws Design activity



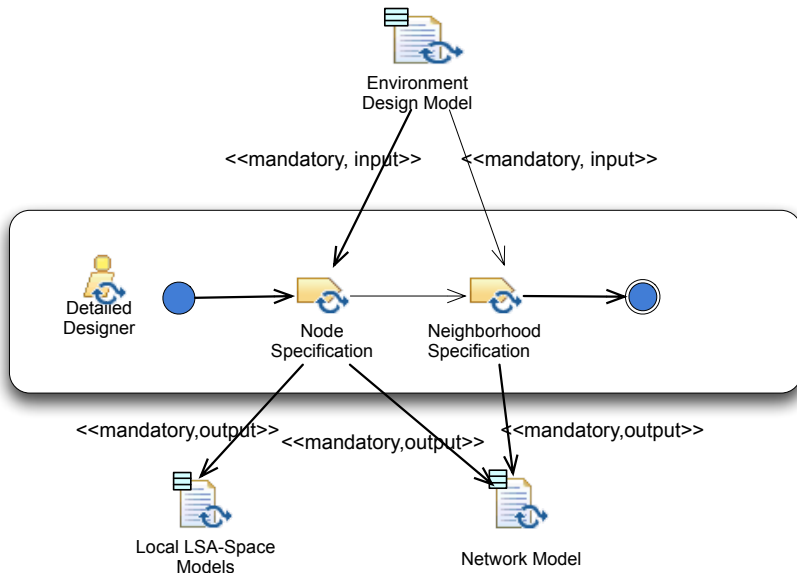
The Agents Design activity



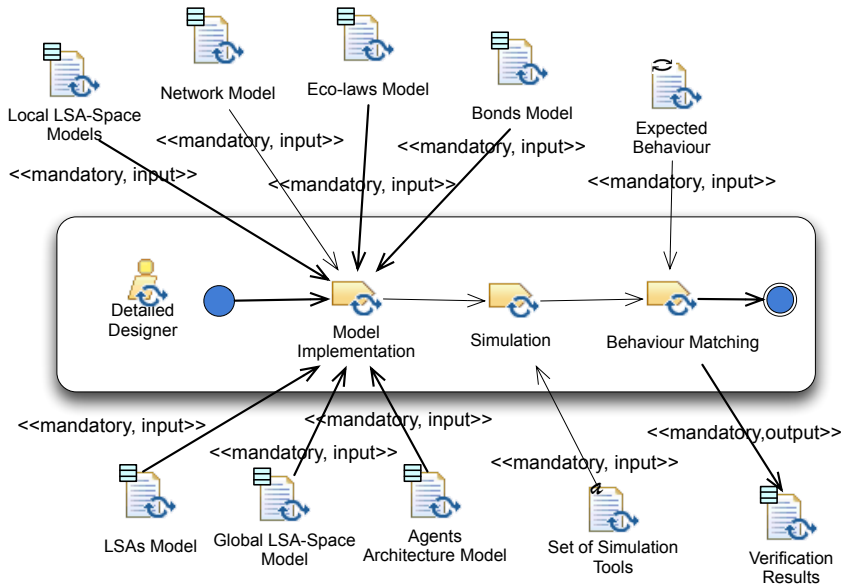
The Bonds Design activity



The Neighborhood Design activity



The Verification activity



The Detailed Design work products I

Name	Description	Work Product Kind
Eco-laws Model	<i>This document presents the set of Eco-laws expressed according to a specific formal language</i>	Structured
LSAs Model	<i>This document presents the set of LSAs expressed according to a specific formal language</i>	Structured
Agents Architecture Model	<i>This document provides for each agent its main architectural features and its expected behaviour</i>	Structured
Bonds Model	<i>This document presents the set of Bonds expressed according to a specific formal language</i>	Structured
Global LSA-Space Model	<i>This document provides the structure of the Global LSA-Space</i>	Structured



The Detailed Design work products II

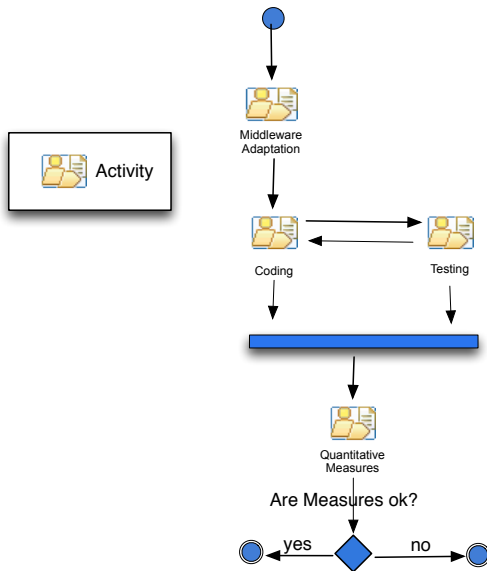
Name	Description	Work Product Kind
Local LSA-Space Models	<i>This document provides for each Node the set of its LSAs</i>	Structured
Network Model	<i>This document presents the design of the environment structure with particular regard to the nodes and their neighborhood relationships</i>	Structured
Set of Simulation Tools	<i>This document represents an input for the process, it provides a list of most known simulation tools and their main features</i>	Free
Verification Results	<i>This document presents the results of the verification activity and highlights the presence of discordances between the expected behaviour and the real behaviour</i>	Structured
Expected Behaviour	<i>This document represents an input for the process and provides the system expected behaviour modeled according to a formal language</i>	Behavioural

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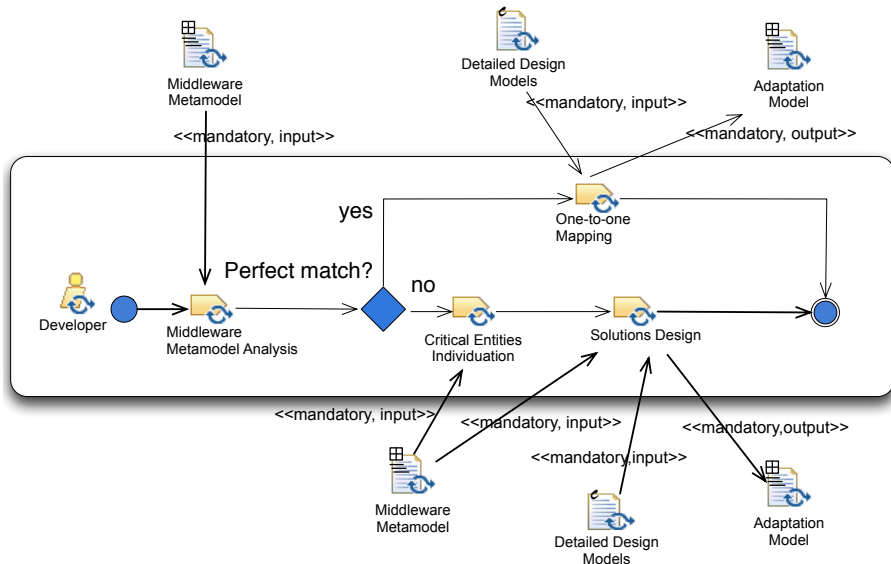
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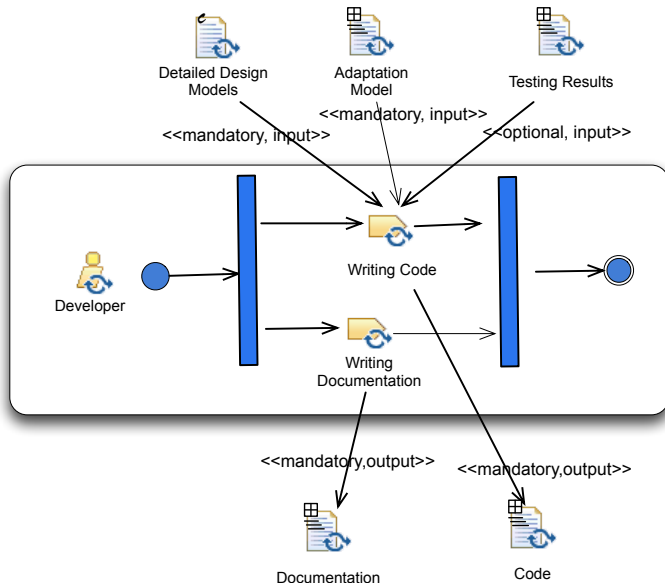
The Implementation process



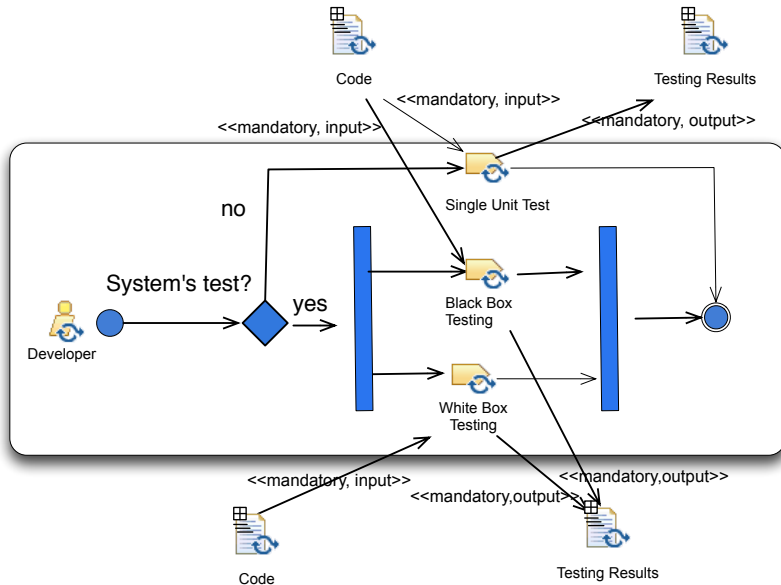
The Middleware Adaptation activity



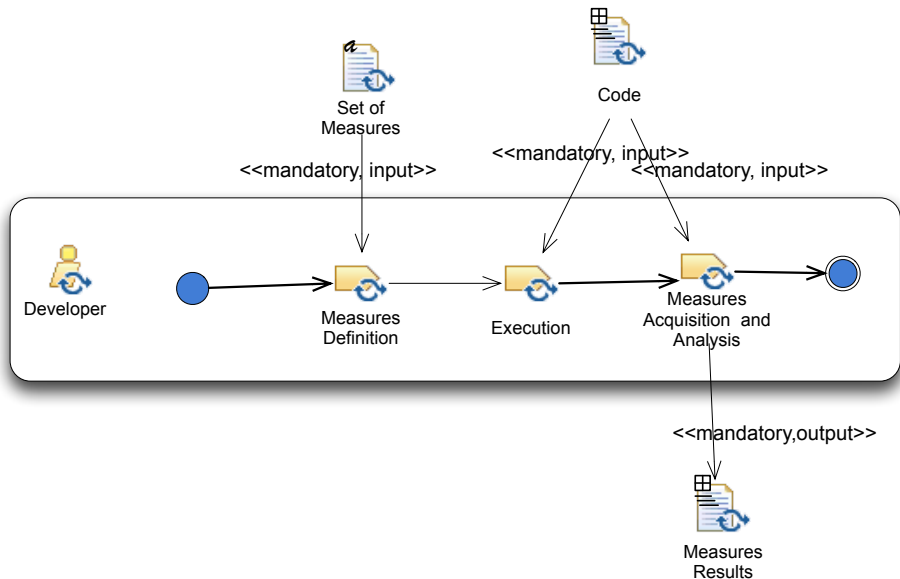
The Coding activity



The Testing activity



The Quantitative Measure activity



The Implementation work products I

Name	Description	Work Product Kind
Detailed Design Models	<i>This composite work product represents the collection of the all Detailed Design work products</i>	Composite
Adaptation Model	<i>This model provides the set of the mandatory modifications that have to be done in order to implement the result of the Detailed Design onto the chosen middleware</i>	Structured
Middleware Metamodel	<i>This document is only a input of the process and provide the metamodel of the middleware supported entities</i>	Structured
Code	<i>This is all the system application code</i>	Structured
Documentation	<i>This is the code documentation</i>	Structured

The Implementation work products II

Name	Description	Work Product Kind
Testing Results	<i>This document provides the results of the testing activity highlighting the failed test and the anomalous behaviours</i>	Structured
Measures Results	<i>This document presents the results of the quantitative measures and highlights the presence of discordances between the expected behaviour and the behaviour of the implemented system</i>	Structured
Set of Measures	<i>This document represents an input for the process, it provides a list of most known measures and their main features</i>	Free

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Abstractions Meta-model

- Next steps:
 - evaluation of the completeness of the meta-model
 - identification of the relationships among meta-model elements and methodology work products



Process

- Next steps:
 - evaluation of the completeness of the activities
 - evaluation of the completeness of the tasks and their detailed description
 - for each work product
 - identification of the structure
 - identification of the notational language



References I



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In Luck, M. and Gómez-Sanz, J. J., editors, *AOSE*, volume 5386 of *Lecture Notes in Computer Science*, pages 46–59. Springer.

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