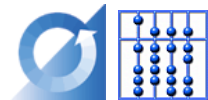

Interdisciplinary Requirements Analysis Using the Model-based RM Tool AutoRAID

Eva Geisberger, Johannes Grünbauer, Bernhard Schätz

AURE'06 Workshop
Minneapolis, November 11, 2006

Lehrstuhl für Software & Systems Engineering
Institut für Informatik
Technische Universität München



Model-based Requirements Analysis with AutoRAID Content

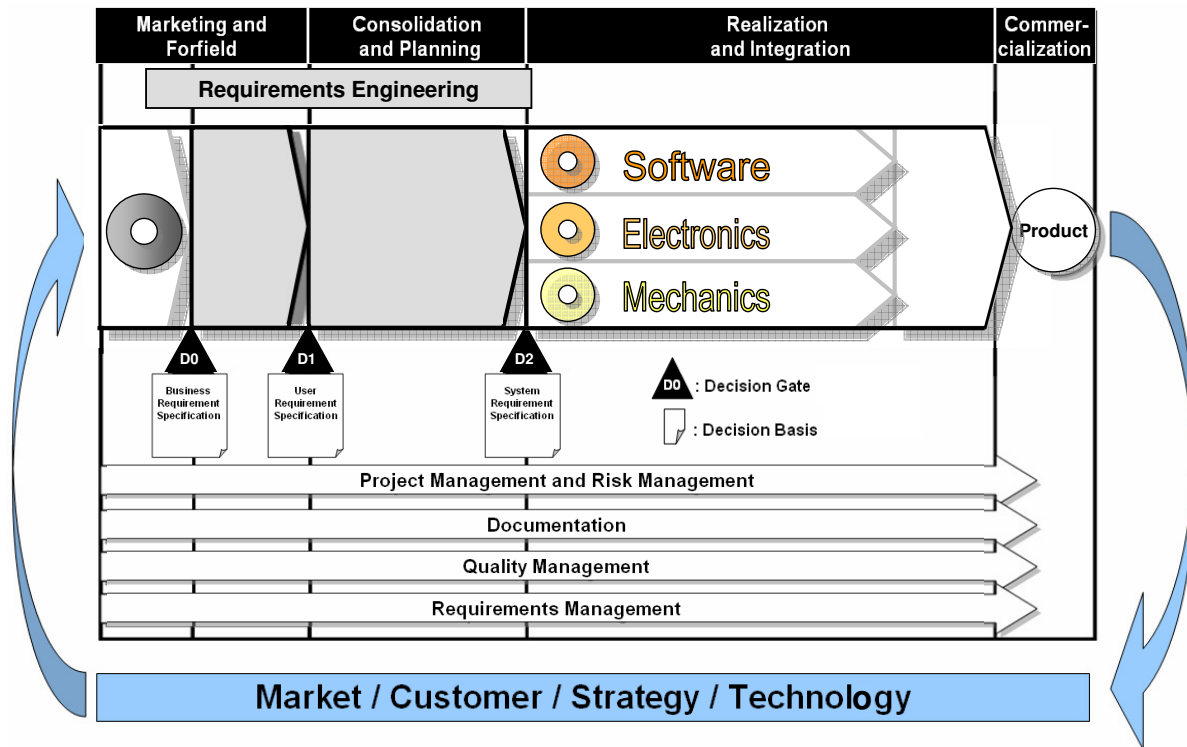


- **Motivation**
- **Modelbased RE – basic concepts**
 - Requirements Engineering Product Model
 - Basic iterative process cycle
 - Specification/validation/verification by core modeling rules and consistency constraints
- **Prototypic realization in AutoRAID/AutoFocus**
- **Summary and outlook**



Model-based Requirements Analysis with AutoRAID

Role of RE in product life cycle management

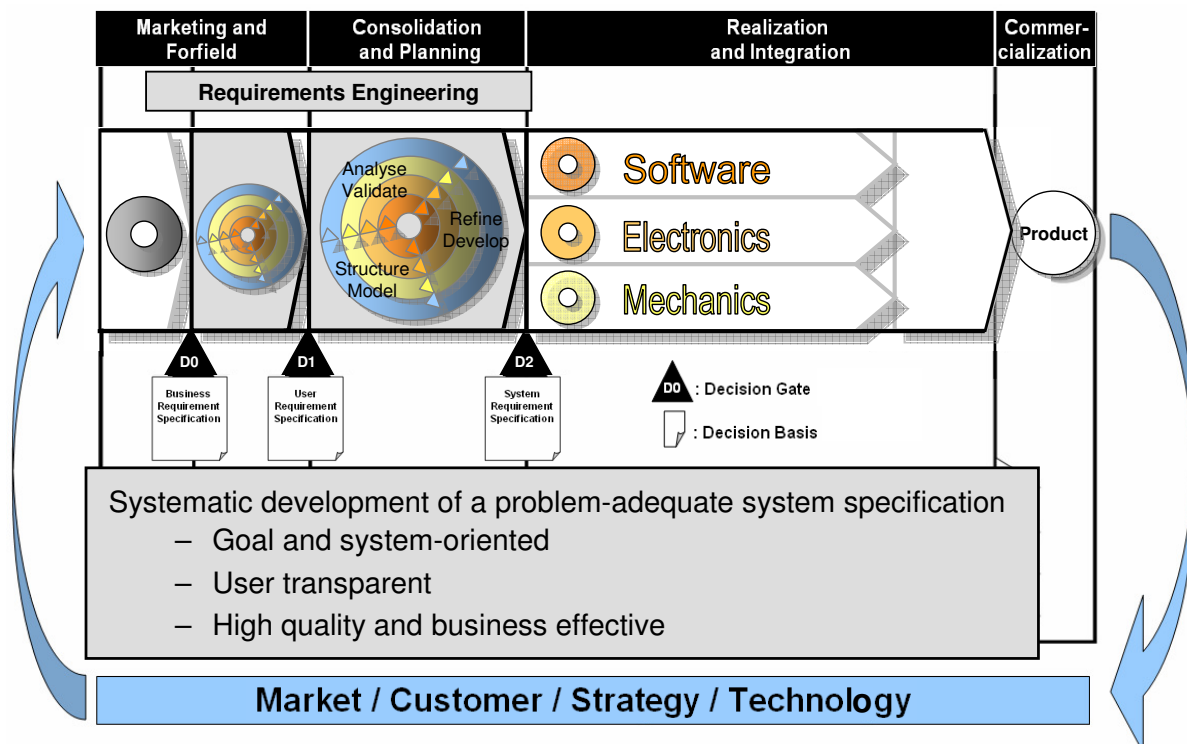


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Model-based Requirements Analysis with AutoRAID

Role of RE in product life cycle management



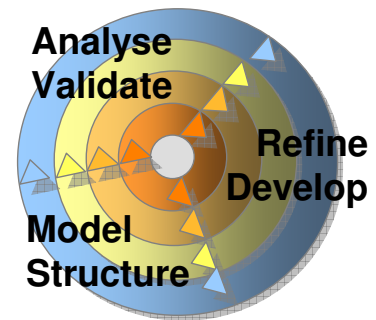
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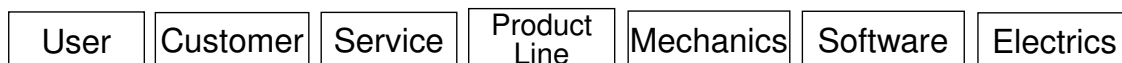
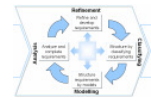
Communication and consolidation of:

- Functional user requirements
- Integration into heterogeneous distributed system environment and interface definitions
- General conditions and constraints from
 - strategic and long-term requirements
 - integration into product-lines and system families
- Business goals, feasibility and economic efficiency



Major challenges:

Interdisciplinary communication, model building and system design



Model-based Requirements Engineering – core concepts:

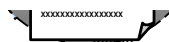
Orientation on a Requirements Engineering Product Model

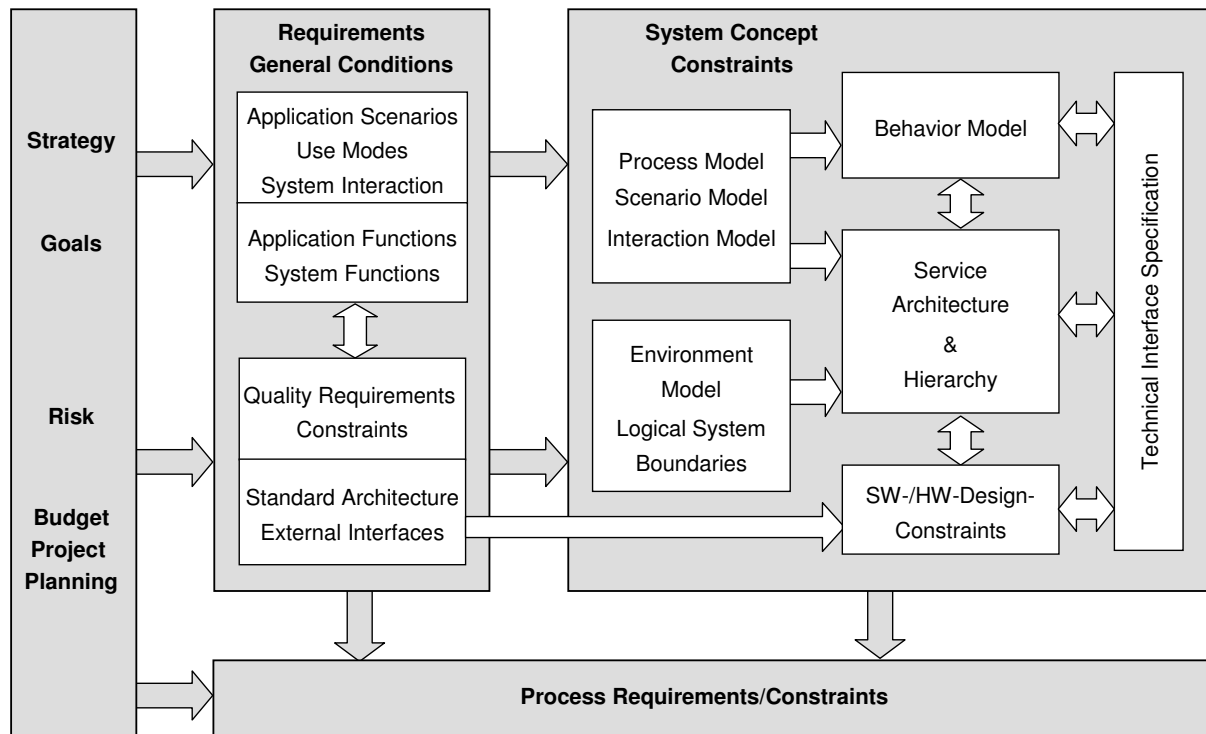
- Problem-solving-oriented classification of requirements
- Basic system concept and functional modeling views
- Model relations → consistency constraints
 - Guide for requirements development and modeling
 - Communication basis for verification and validation
 - Ruler for quality and progress control of specifications

Use of intuitive logical description techniques

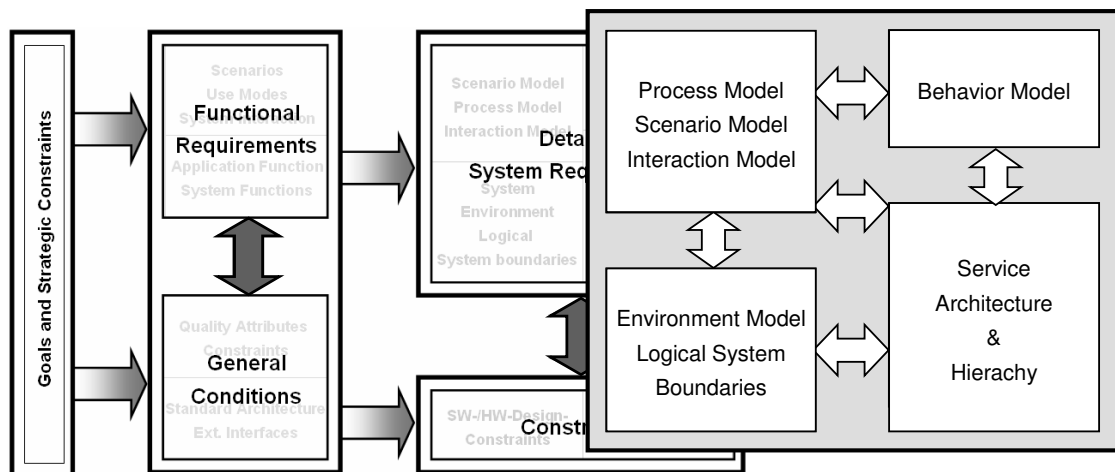
Basic iterative process model and feedback-loop

Consistent specification of the desired system





- Problem solving REQ classification: Refinement (→) Design Relation (↕)
- System modeling concepts: Relation between system views (↔)

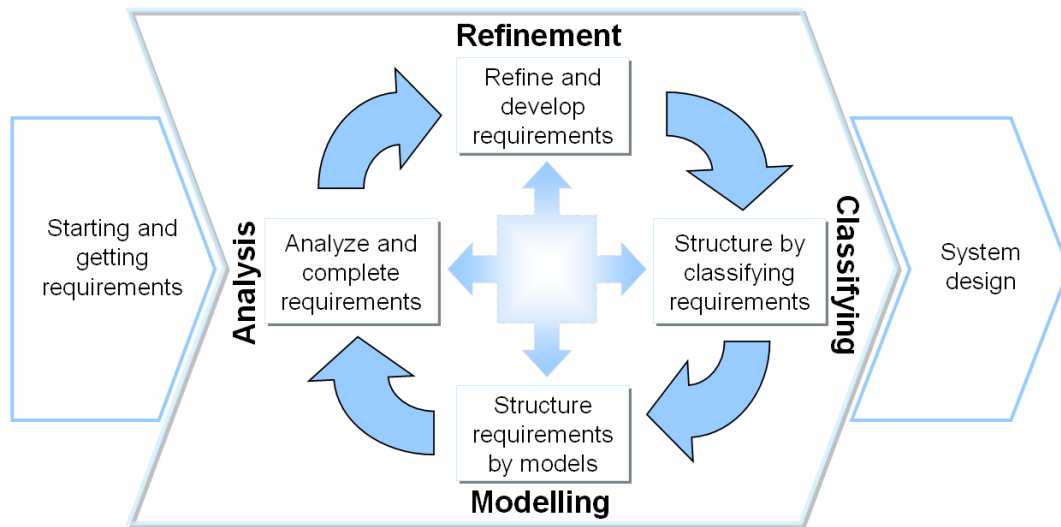


Model relations → consistency constraints: validation & verification



Model-based Requirements Analysis with AutoRAID

Iterative steps of REQ analysis and system construction



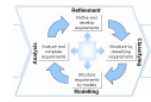
Basic RE Cycle in AutoRAID

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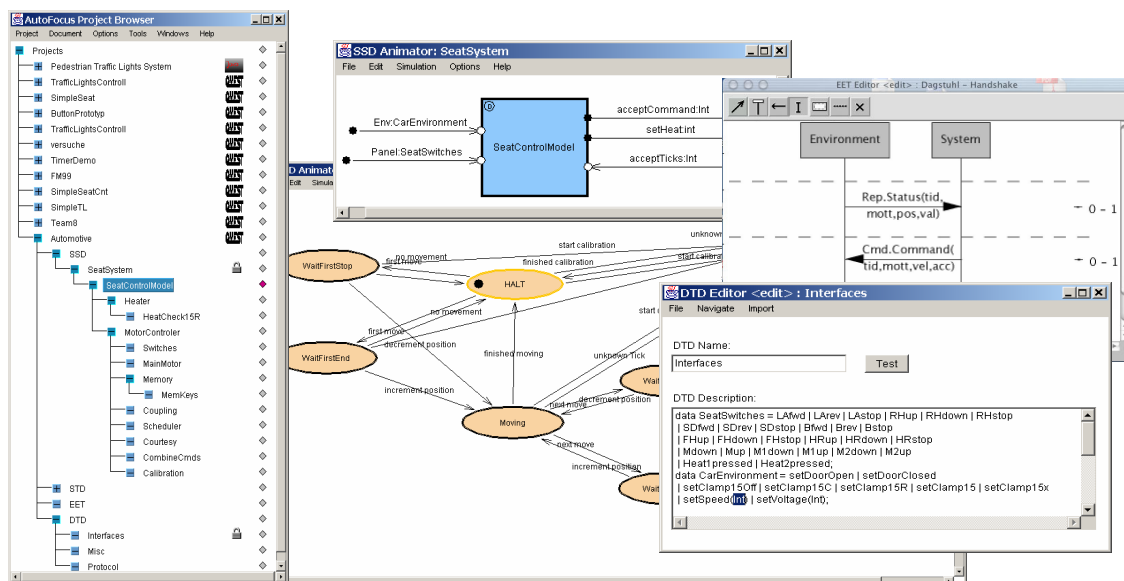
Model-based Requirements Analysis with AutoRAID

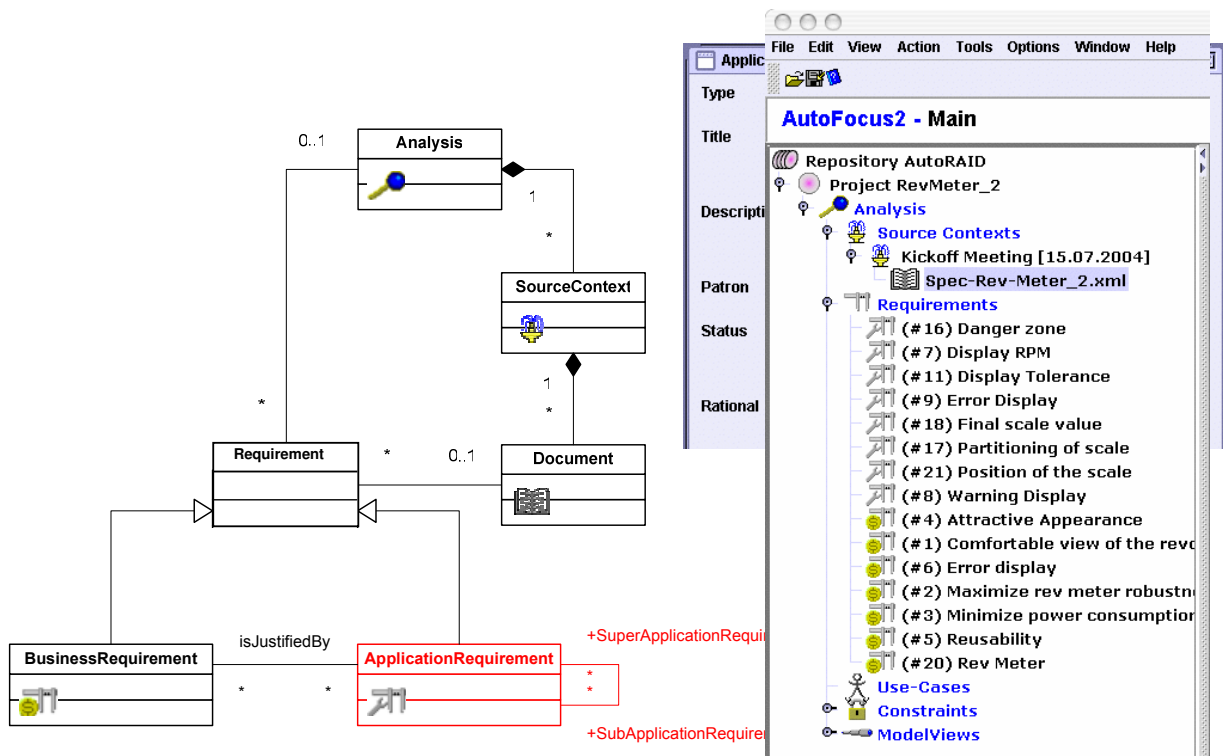
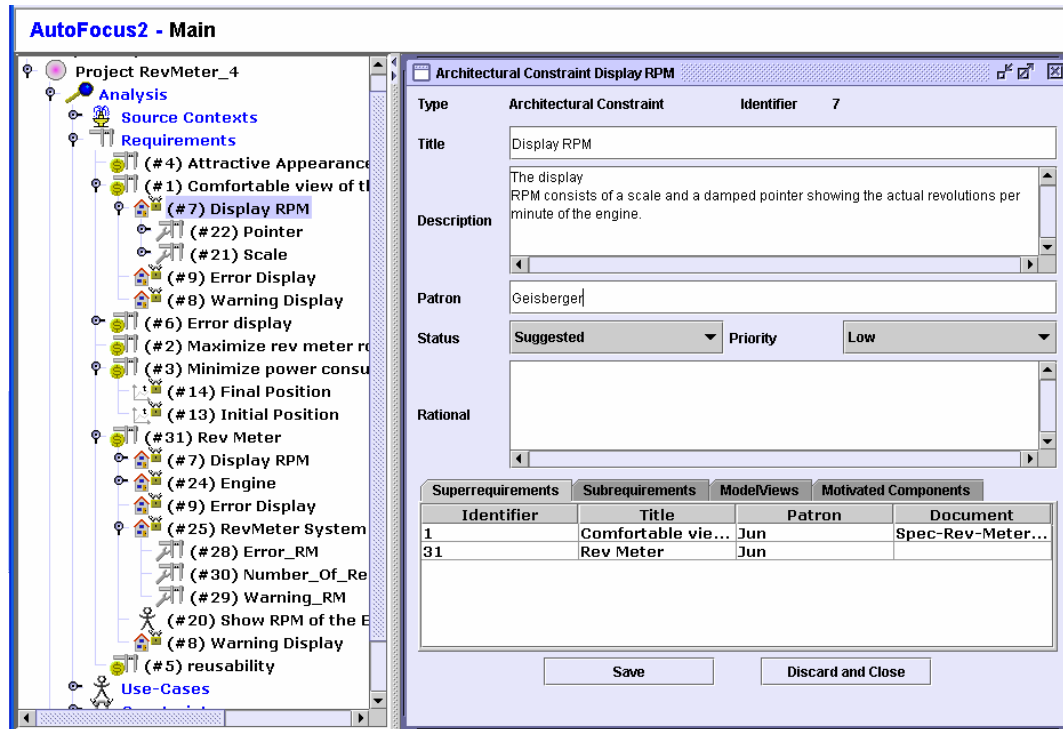
Integrated with system modeling tool AutoFocus



Mathematically well-founded system specification and development tool

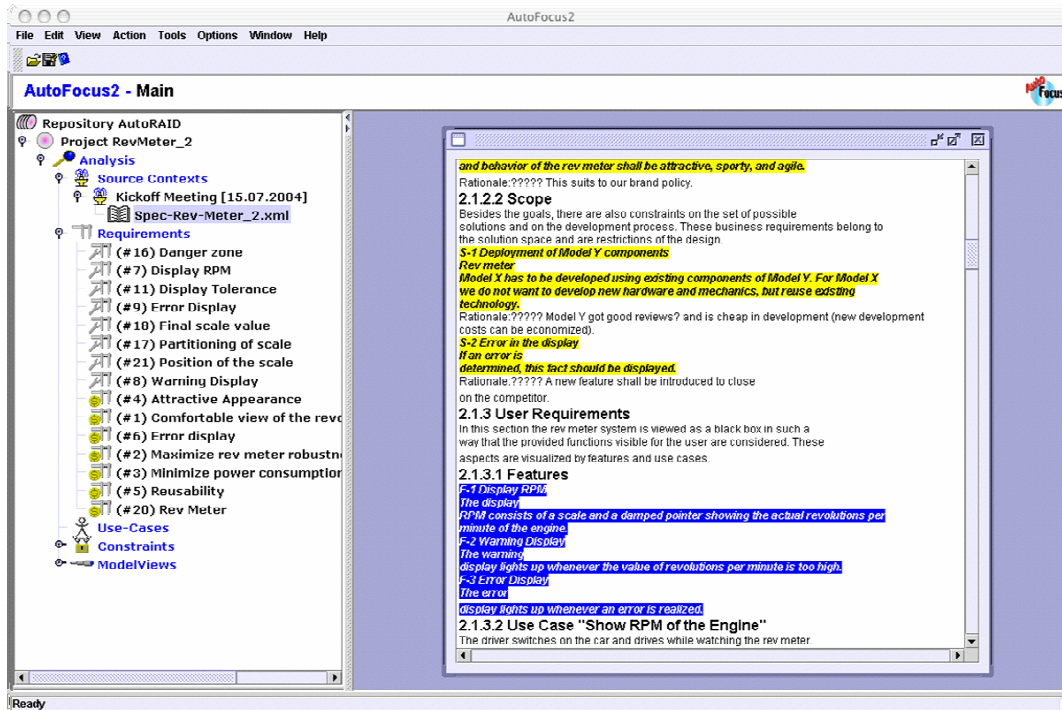
- System concept with functional system views and graph. description techniques
- Test case & code generation, simulation and verification of components





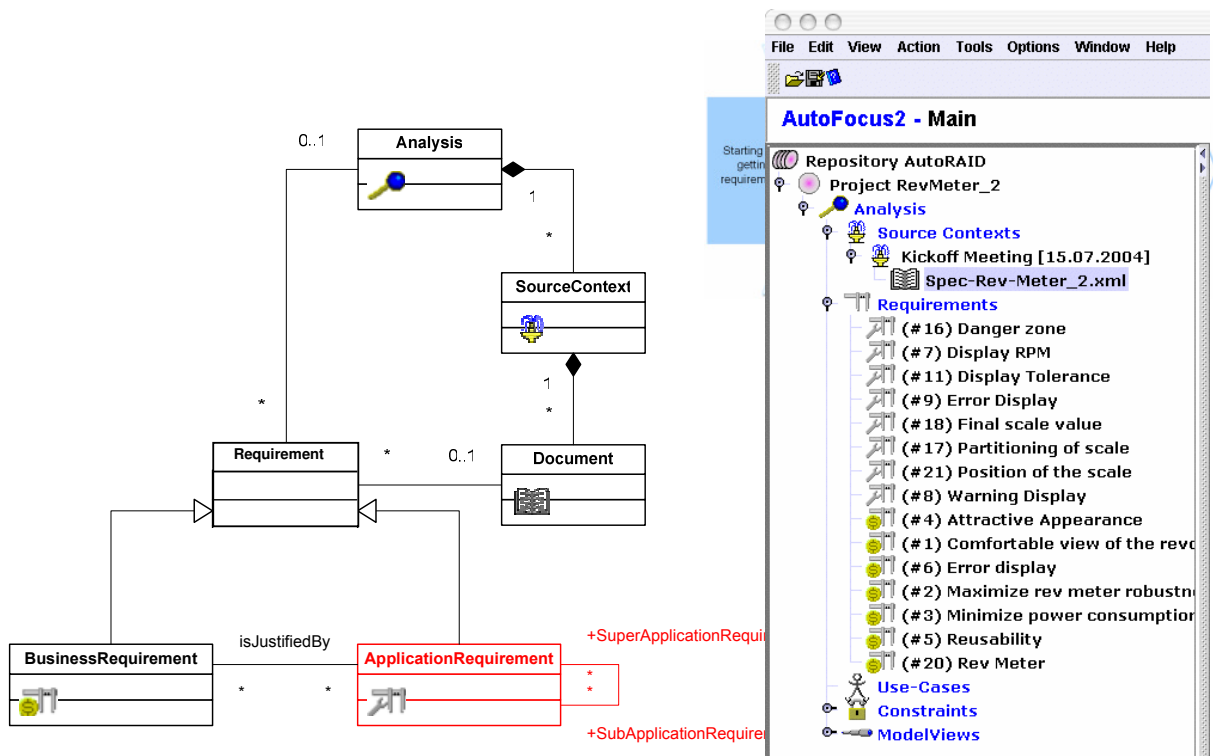
Model-based Requirements Analysis with AutoRAID

Identifying and capturing of requirements (2)



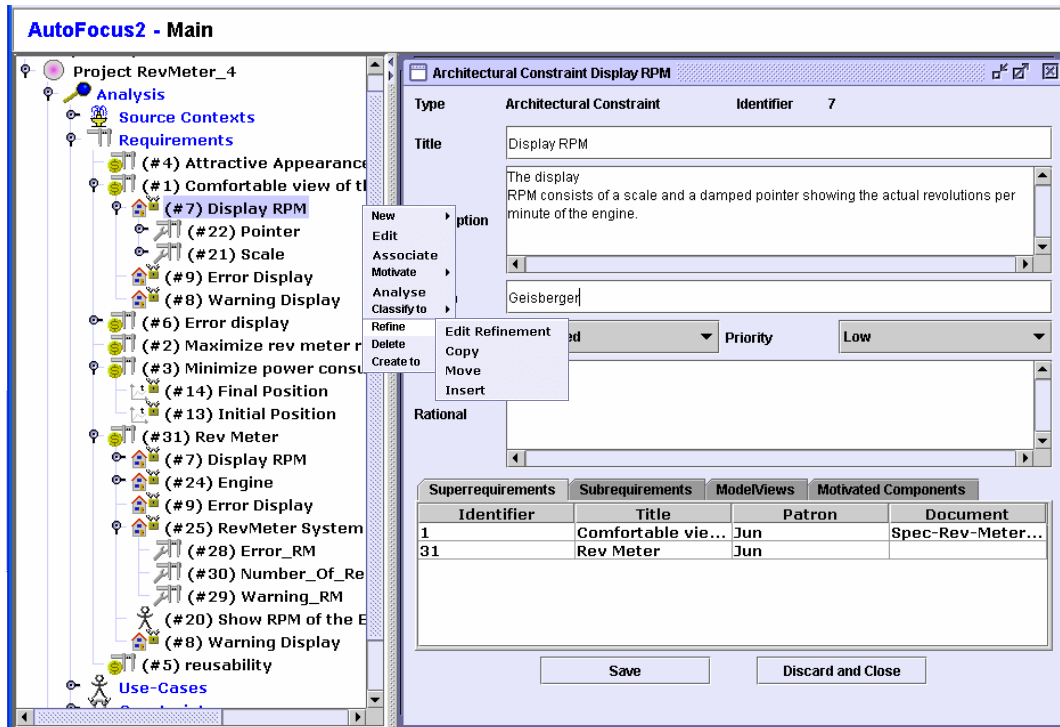
Model-based Requirements Analysis with AutoRAID

Refining and goal-oriented structuring of requirements (1)



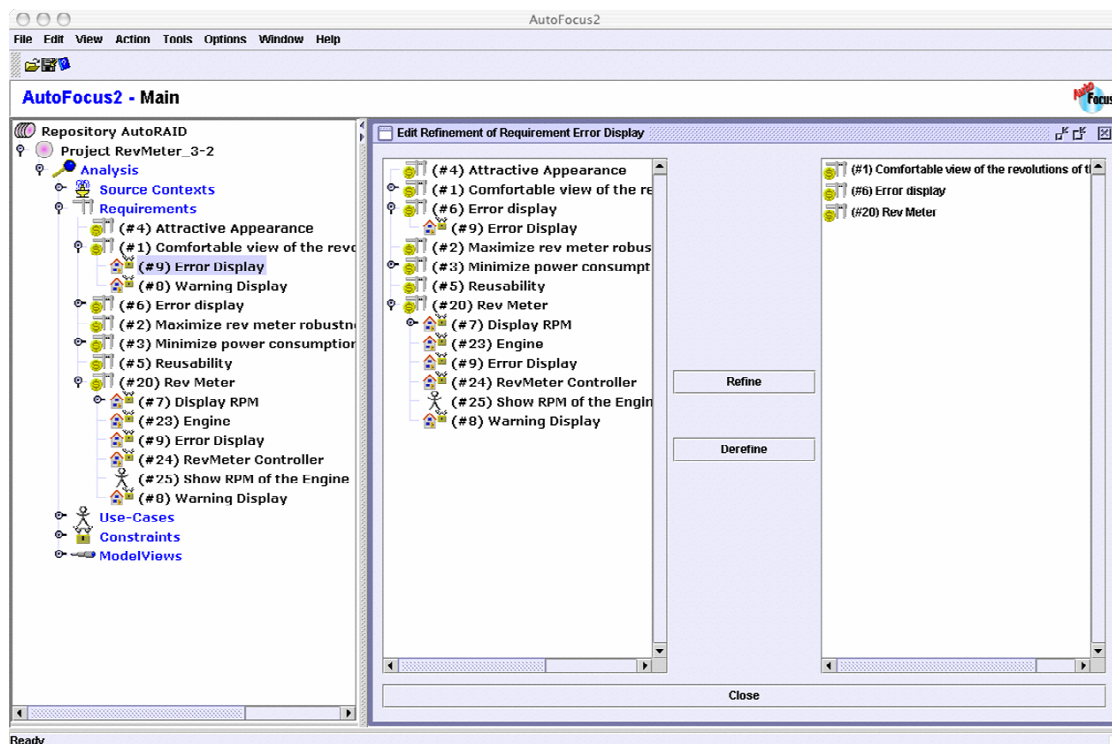
Model-based Requirements Analysis with AutoRAID

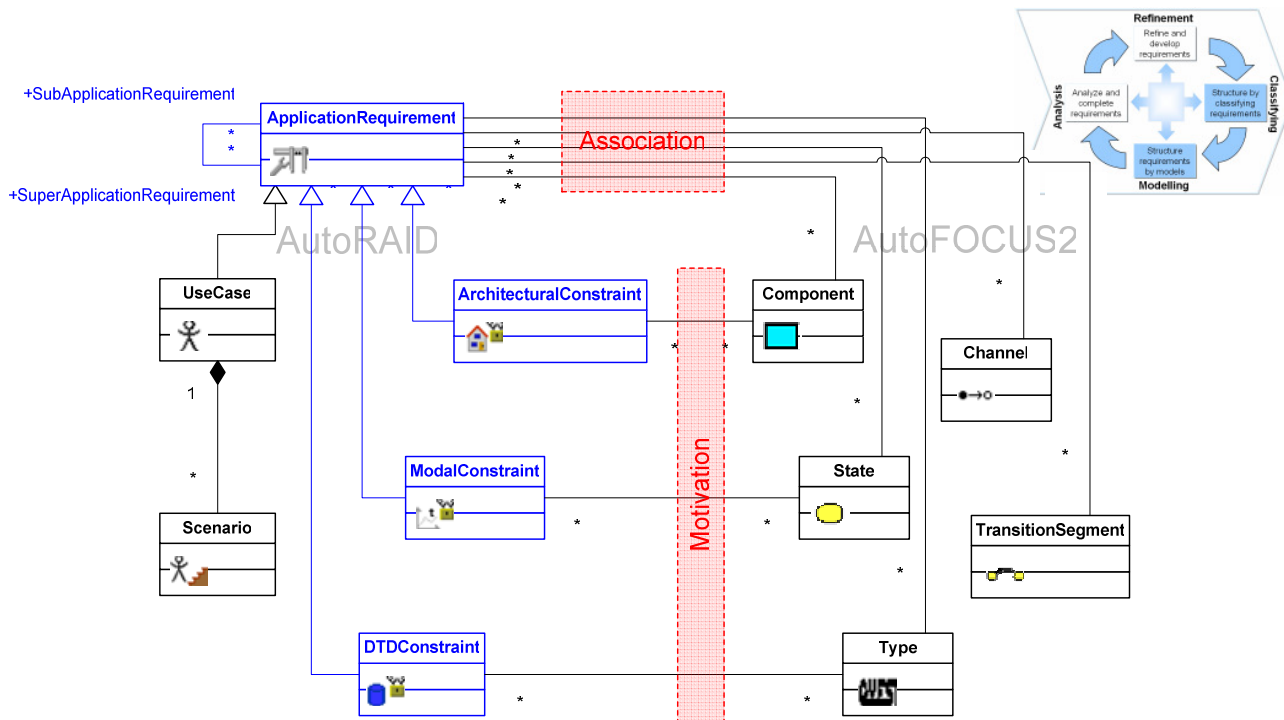
Refining and goal-oriented structuring of requirements (2)



Model-based Requirements Analysis with AutoRAID

Refining and goal-oriented structuring of requirements (3)





AutoFocus2 - Main

Repository AutoRAID

- Project RevMeter_4
 - Analysis
 - Source Contexts
 - Requirements
 - (#4) Attractive Appearance
 - (#1) Comfortable view of the revolution...
 - (#7) Display RPM
 - New
 - Edit
 - Associate
 - Motivate
 - Analyse
 - Classify to
 - Refine
 - Delete
 - Create to
 - (#9) Error Display
 - (#8) Warning Display
 - (#6) Error display
 - (#2) Maximize rev n...
 - (#3) Minimize power
 - (#31) Rev Meter
 - (#5) reusability
 - Use-Cases
 - Constraints
 - Architectural
 - Modal
 - DTD
 - ModelViews

Architectural Constraint Display RPM

Type: Architectural Constraint Identifier: 7

Title: Display RPM

Description: The display RPM consists of a scale and a damped pointer showing the actual revolutions per minute of the engine.

Patron: Geisberger

Status: Suggested Priority: Low

Identifier	Title	Patron	Document
1	Comfortable vi...	Jun	Spec-Rev-Mete...
31	Rev Meter	Jun	

Buttons: Save, Discard and Close





AutoFocus2 - Main

Repository AutoRAID
Project RevMeter_4
Analysis
Source Contexts
Requirements
(#4) Attractive Appearance
(#1) Comfortable view of the revolutions of the...
(#7) Display RPM
(#9) Error Display
(#8) Warning Display
(#6) Error display
(#2) Maximize rev n...
(#3) Minimize power...
(#31) Rev Meter
(#5) reusability
Use-Cases
Constraints
Architectural
Modal
DTD
ModelViews
Architectural
Component Car /* */
Component Analog Display /* */
Component Digital Display /* */
Component Engine /* */
Component RevMeter Controller /* */
Modal
DTD
Component Car /* */
Ports /* */
LocVariables /* */
Channels /* */
Component Digital Display /* */
Component Analog Display /* */

Architectural Constraint Display RPM

Type: Digital Display
Title: Name: Digital Display
Desc: Comment:
Associated Relations
Motivations Associations Channels
Identifier Title Description
9 Error Display The error display lights up...
8 Warning Display The warning display lights up...
Save Close

Superrequirements Subrequirements ModelViews Motivated Components
Identifier Title Patron Document
1 Comfortable view o... Jun Spec-Rev-Meter_3...
31 Rev Meter Jun



AutoFocus2 - Main

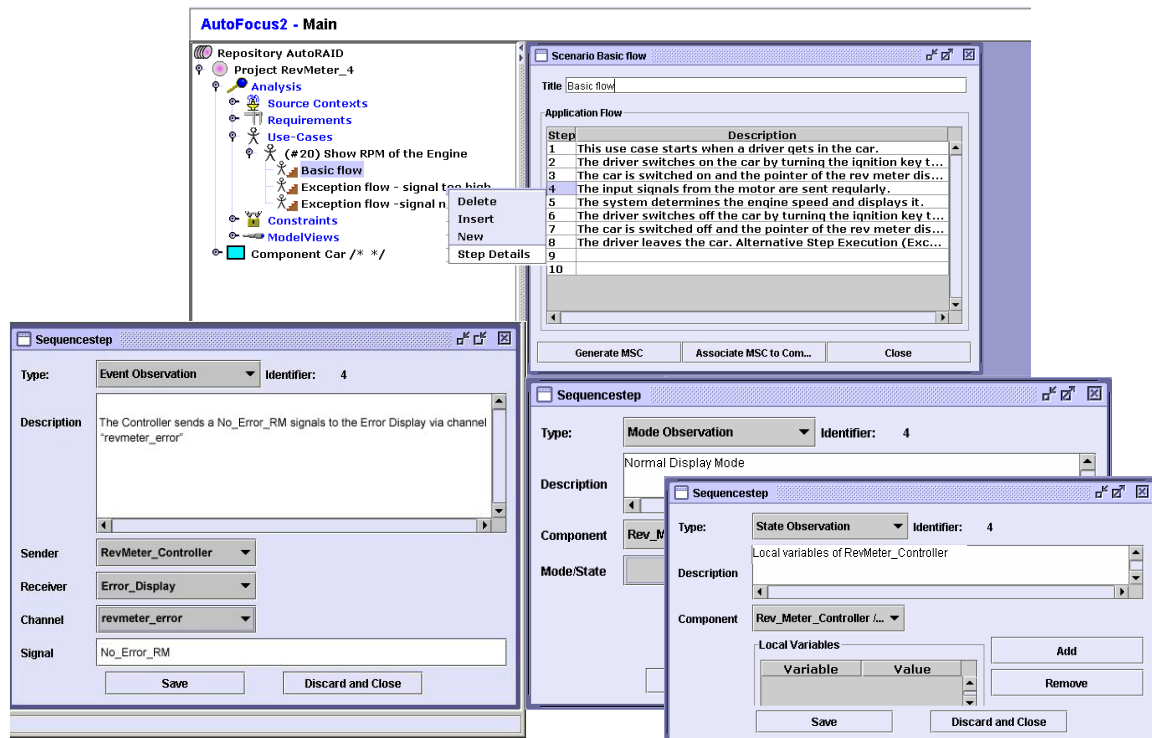
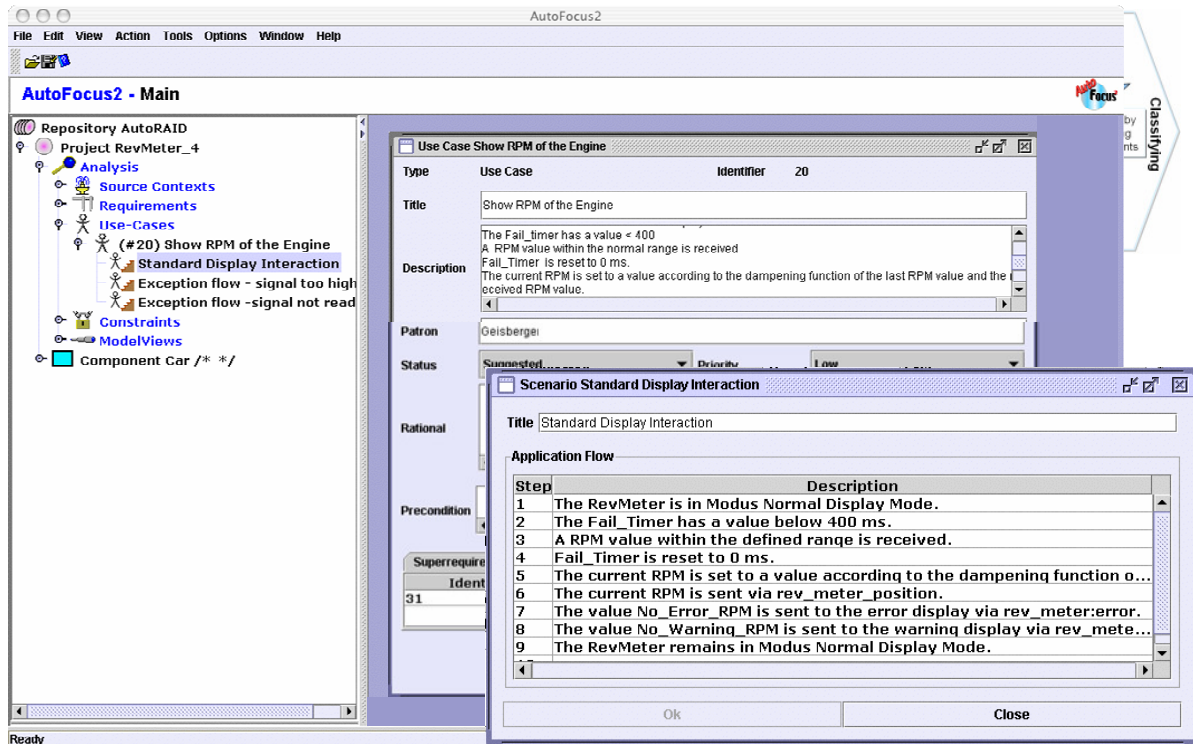
Repository AutoRAID
Project RevMeter_4
Analysis
Source Contexts
Requirements
(#4) Attractive Appearance
(#1) Comfortable view of the revolutions of the...
(#7) Display RPM
(#9) Error Display
(#8) Warning Display
(#6) Error display
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(#3) Minimize power...
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Use-Cases
Constraints
Architectural
Modal
DTD
ModelViews
Architectural
Component Car /* */
Component Analog Display /* */
Component Digital Display /* */
Component Engine /* */
Component RevMeter Controller /* */
Modal
DTD
Component Car /* */
Ports /* */
LocVariables /* */
Channels /* */
Component Digital Display /* */
Component Analog Display /* */

Edit Associations of Component Digital Display /* */

Associate
Dissociate
Close

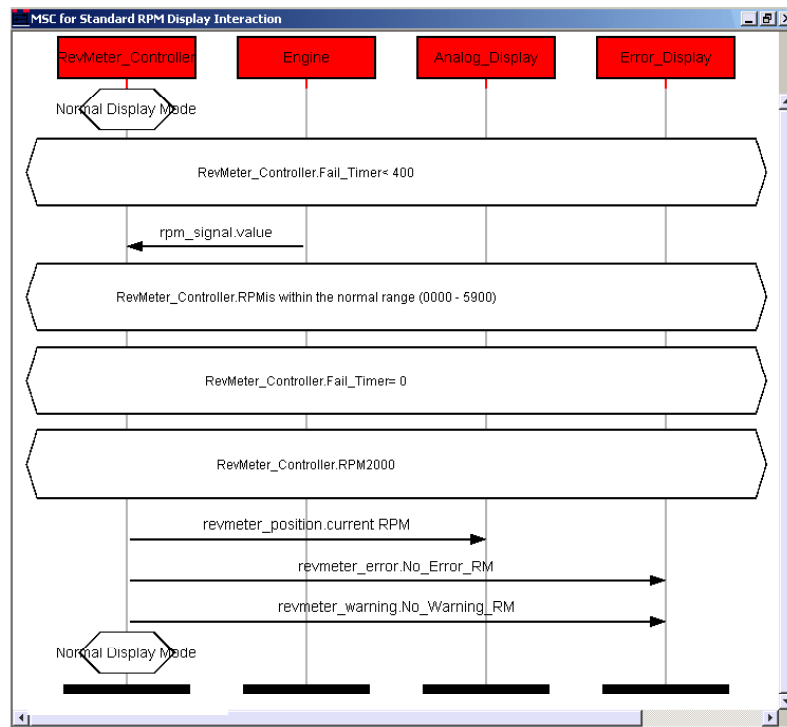
Engine
Analog Display
RevMeter Controller
Digital Display





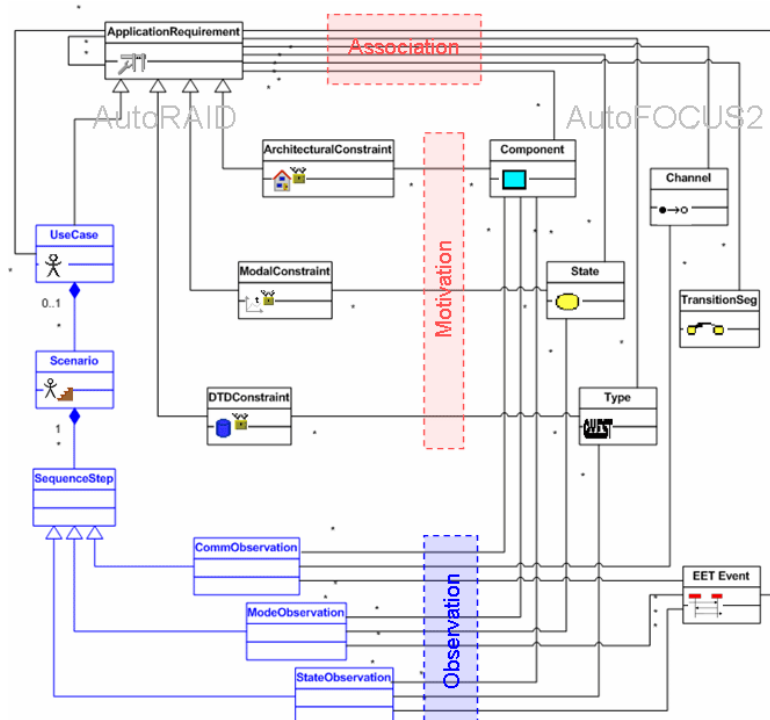
Model-based Requirements Analysis with AutoRAID

Analyzing and modeling scenario steps by observations (2)



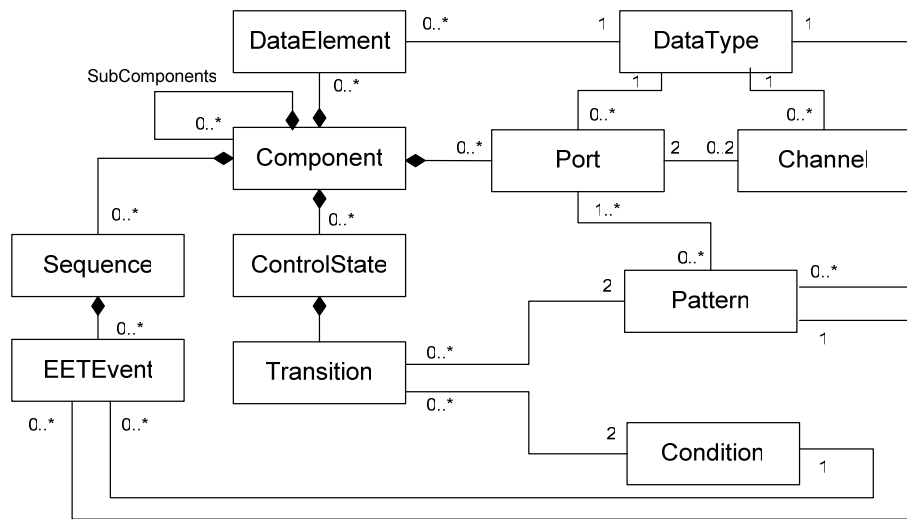
Model-based Requirements Analysis with AutoRAID

Analyzing and modeling requirements by system views





System model-relations in AutoFocus



Model-based Requirements Analysis with AutoRAID

Summary and outlook



Model-based RE with AutoRAID/AutoFocus:

- Common core model of RE work products: RE Product Model
- Goal-oriented refinement and consolidation of requirements
- Basic functional system concept and views
 - Model relations define construction and consistency rules
 - Guide analysis, development and completion of requirements
- Integrated requirements analysis and functional system design
- Interdisciplinary communication and appropriate decision making
- Supports measurable quality and progress control

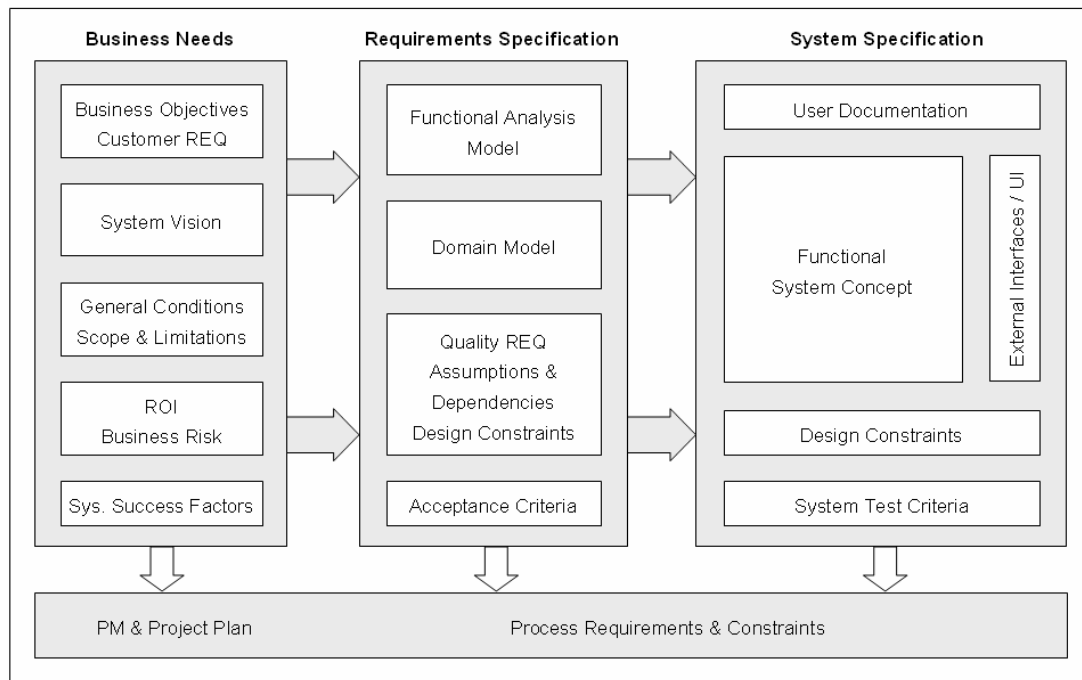
Requirements Engineering Reference Model (REM):

- Testing and advancing a comprehensive RE approach
 - REM: common core model of RE work products
 - tailoring concept and tool support





Model of Specification Products – RE Product Model

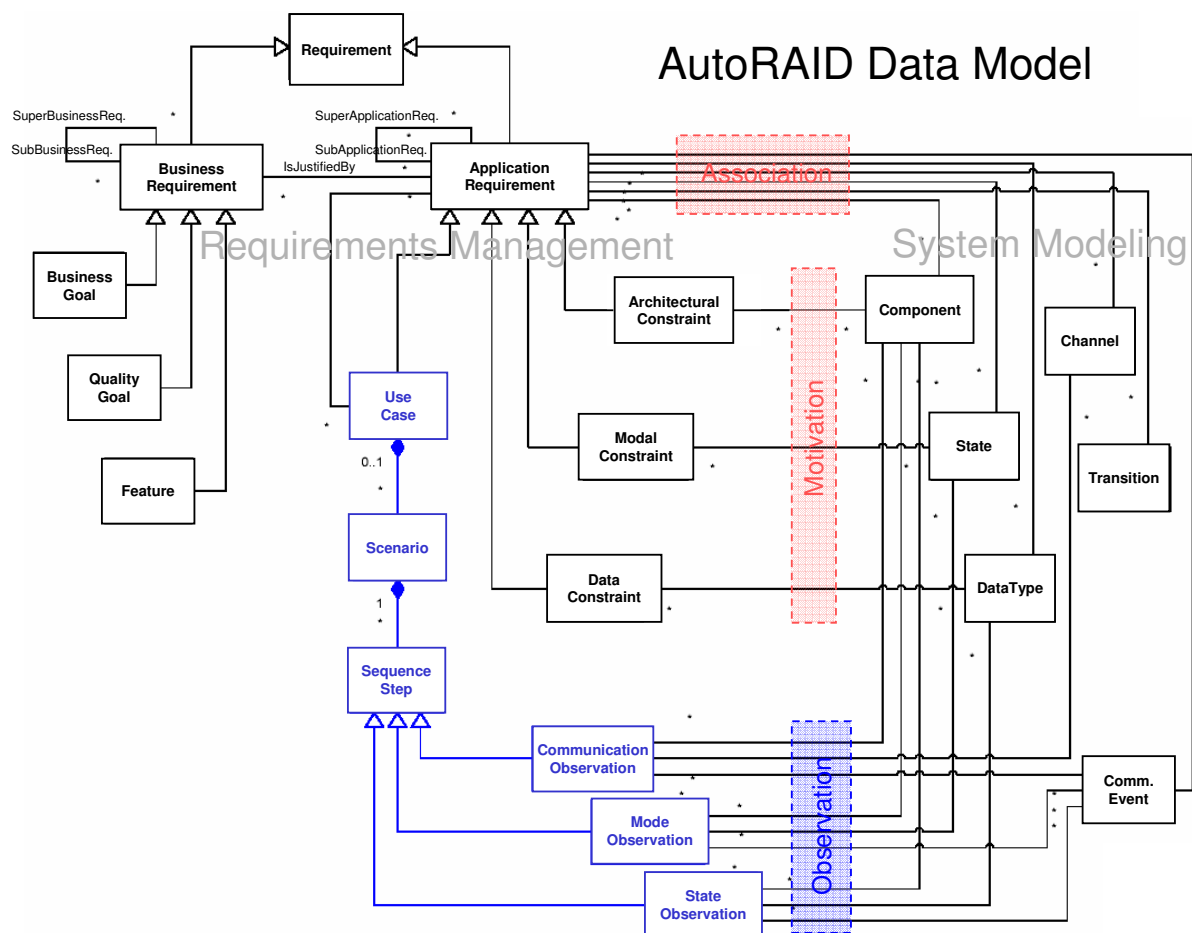


Contact: www4.in.tum.de/~autoraaid





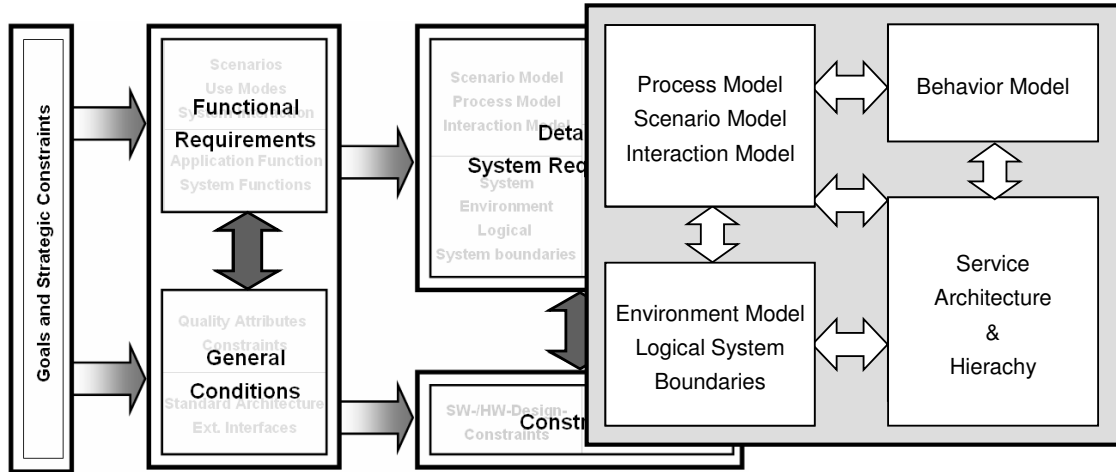
back up



Structure of RE Product Model

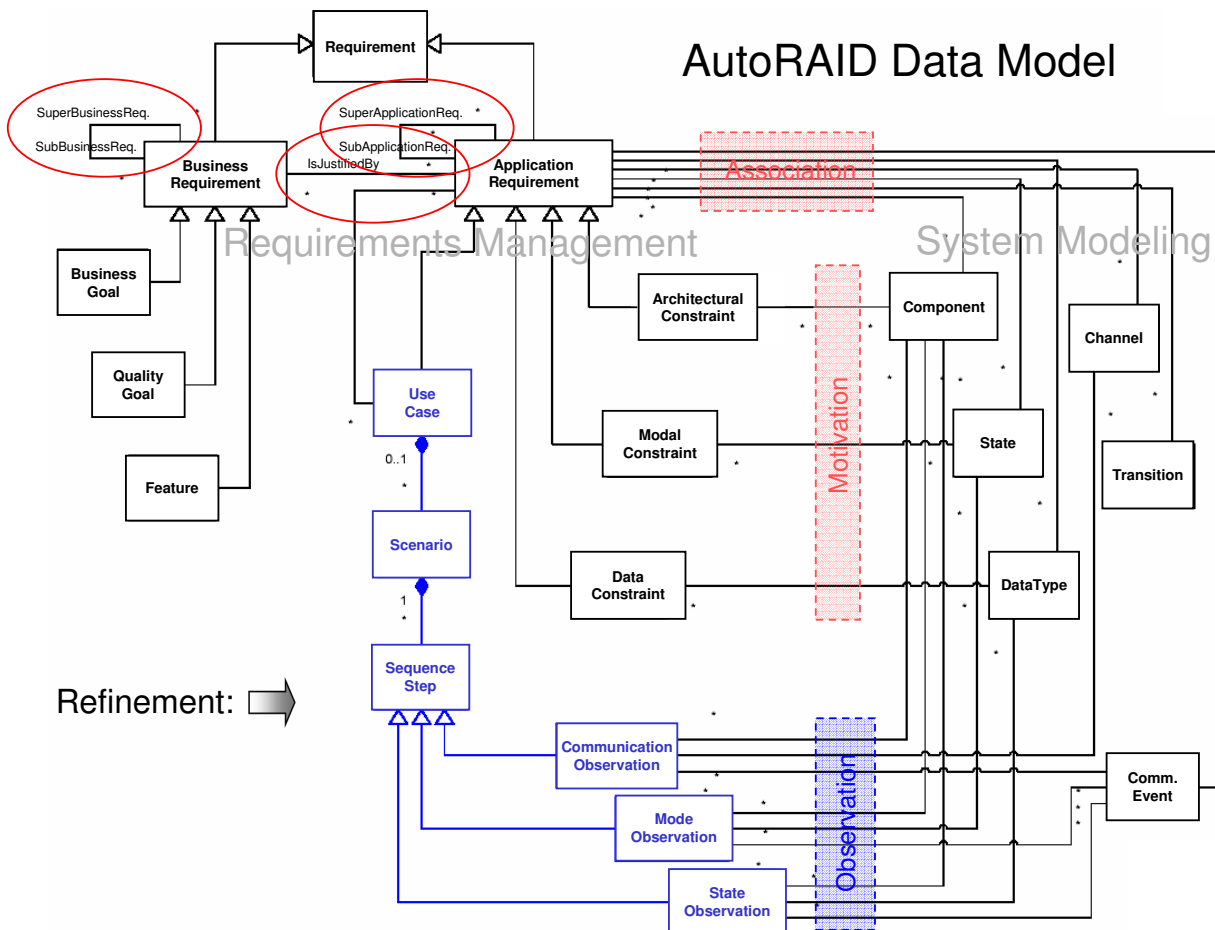


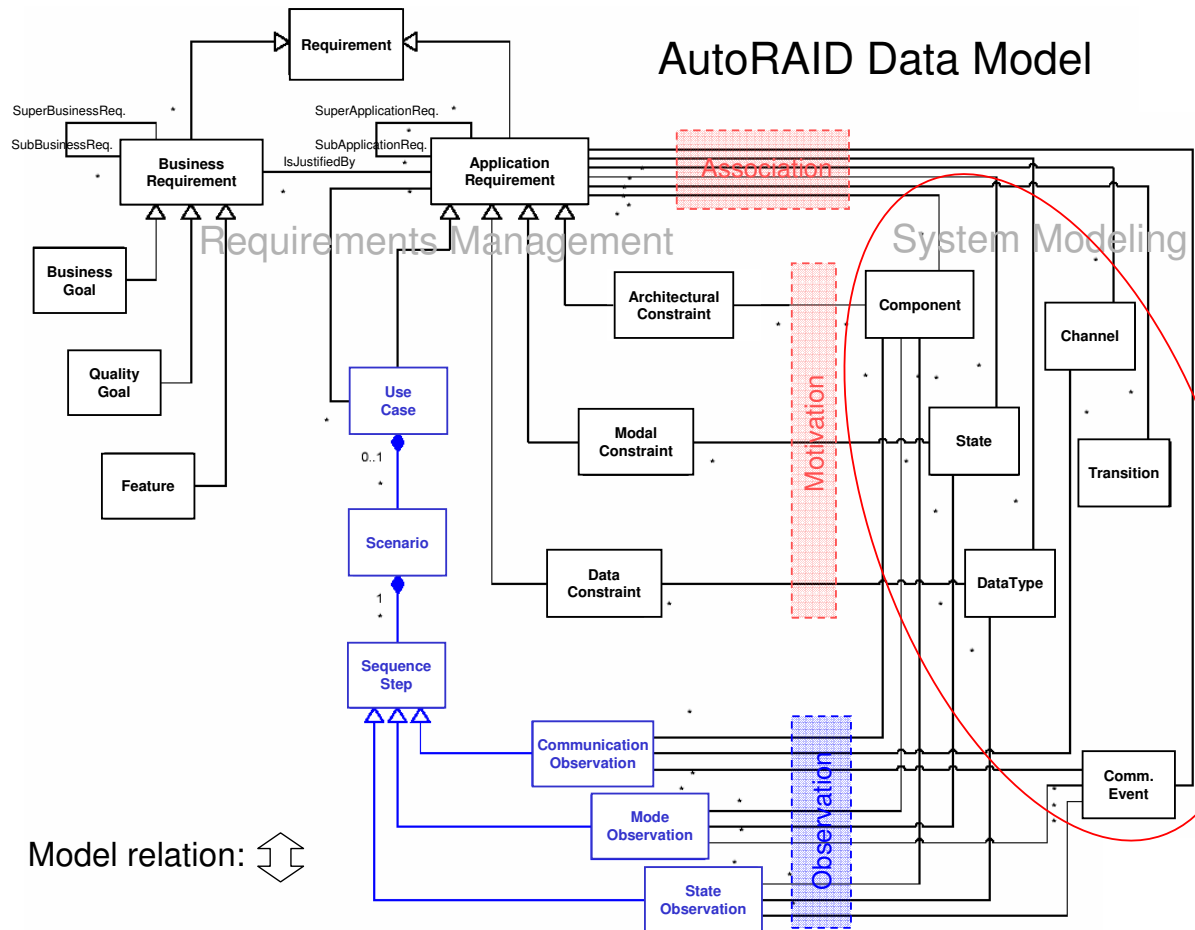
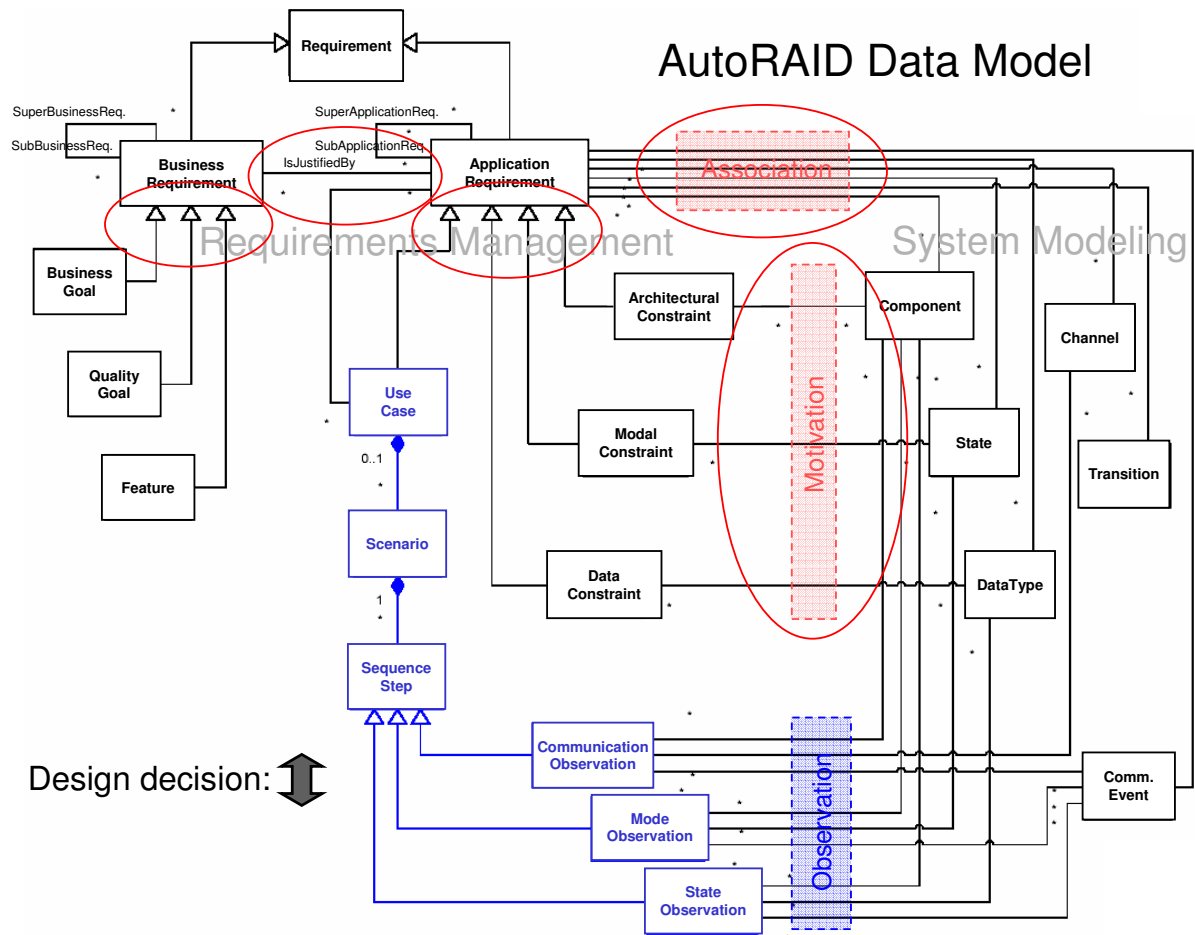
- Problem solving REQ classification: Refinement (⇒)
Design Relation (⇕)
- System modelling concepts: Relation between system views (⇕)

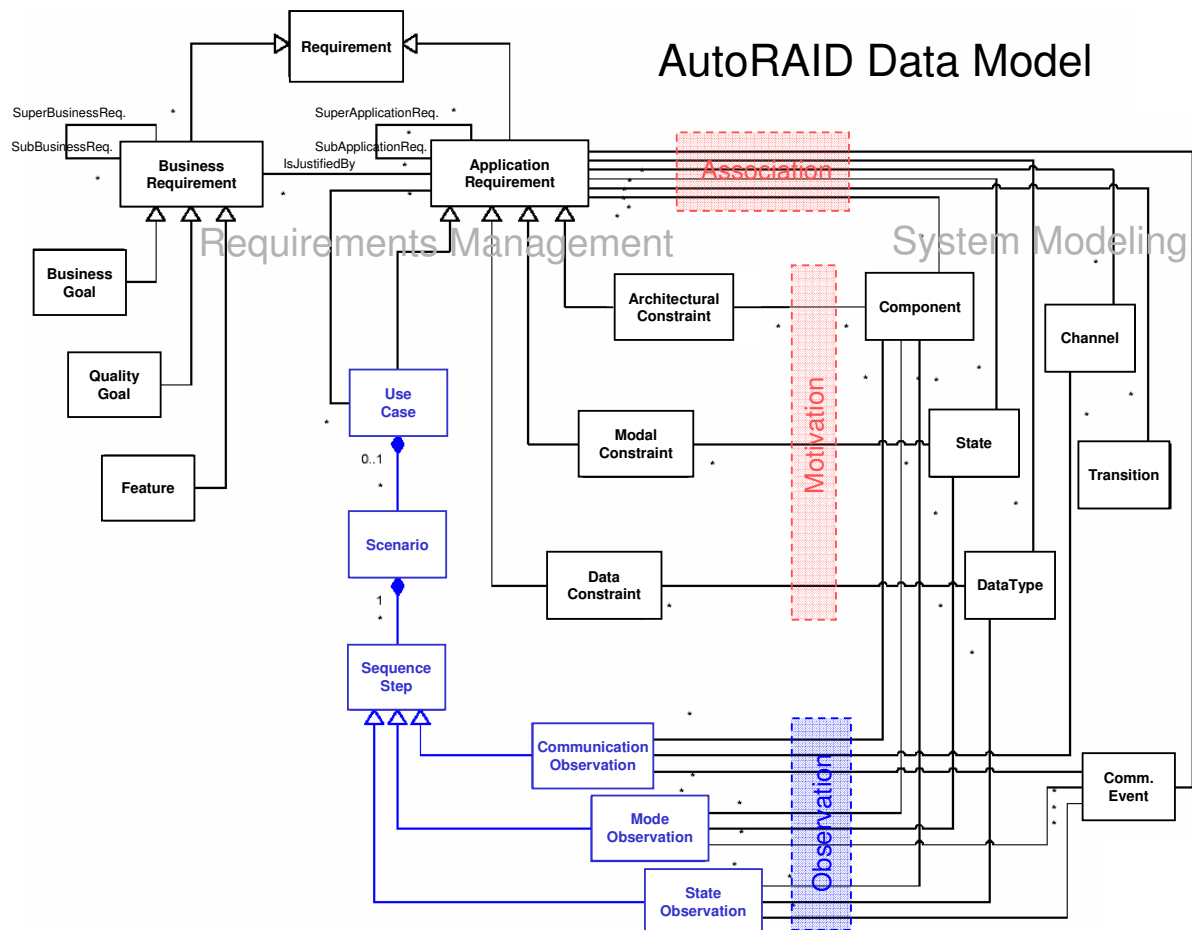
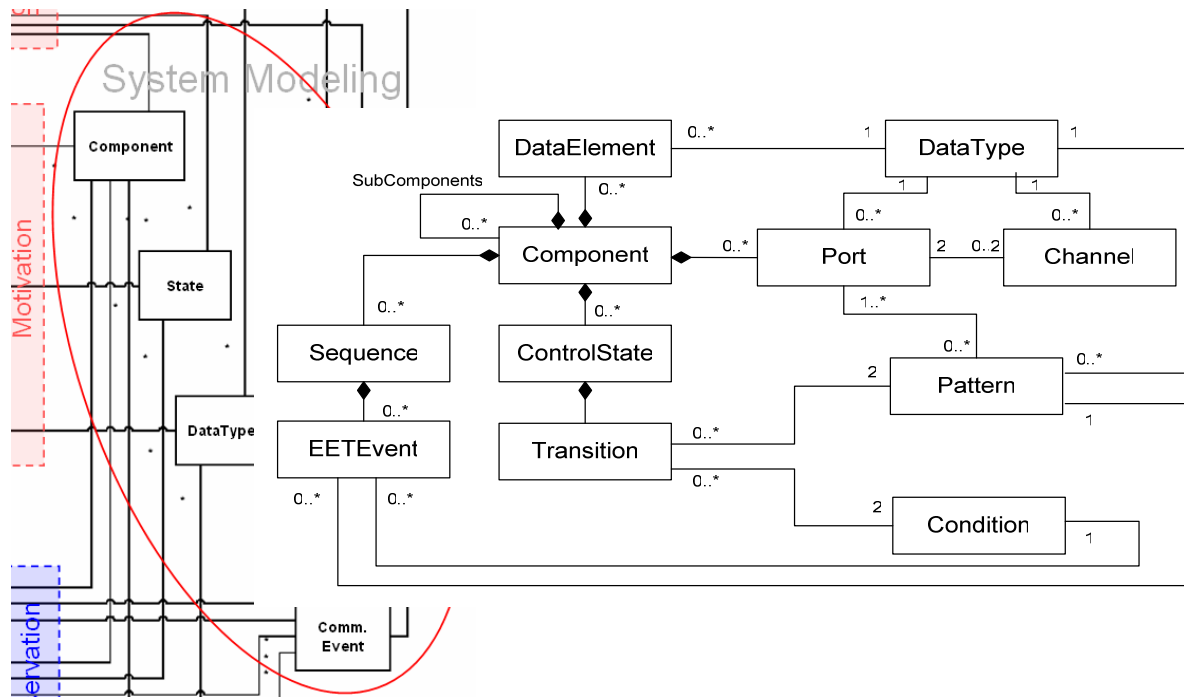


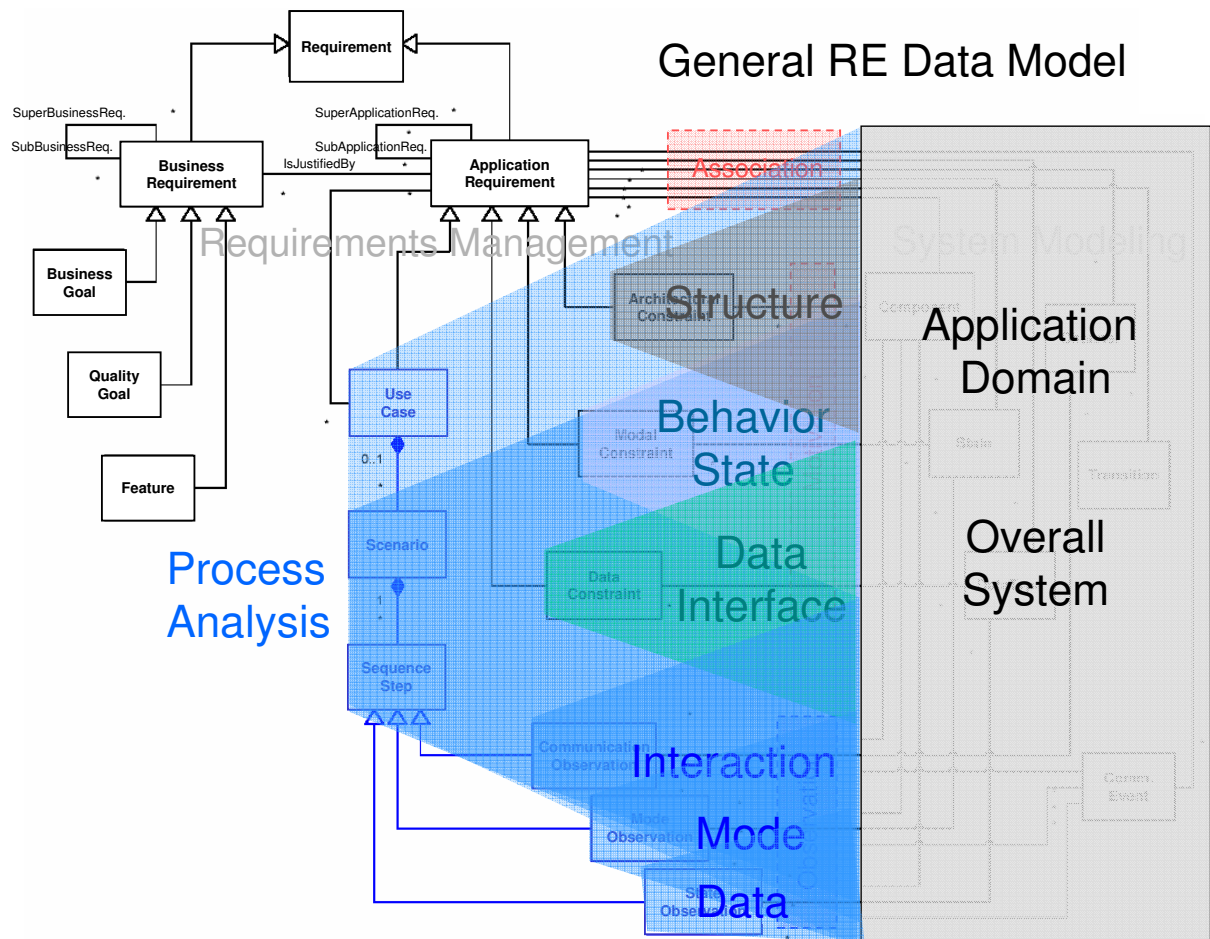
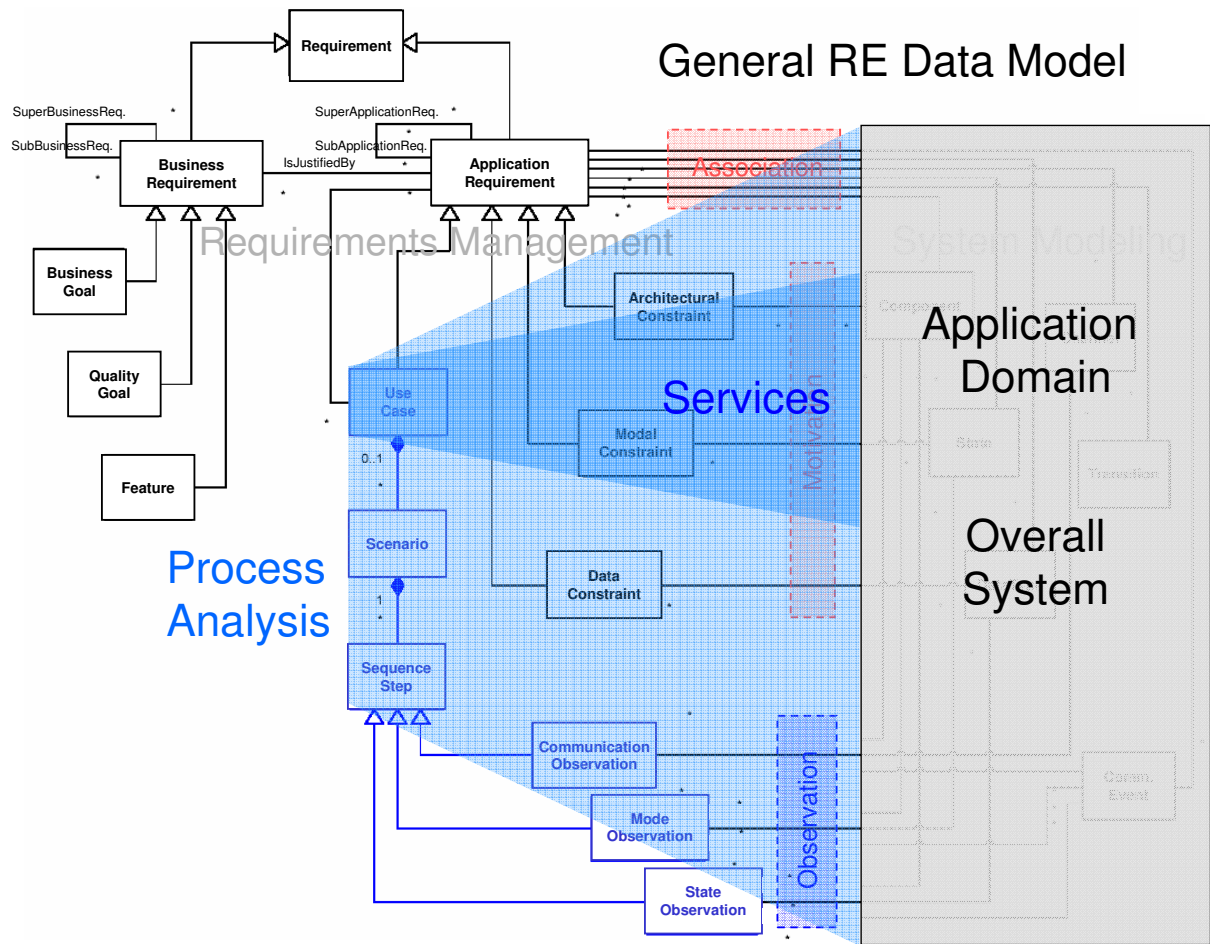
Model relations → consistency constraints: validation & verification

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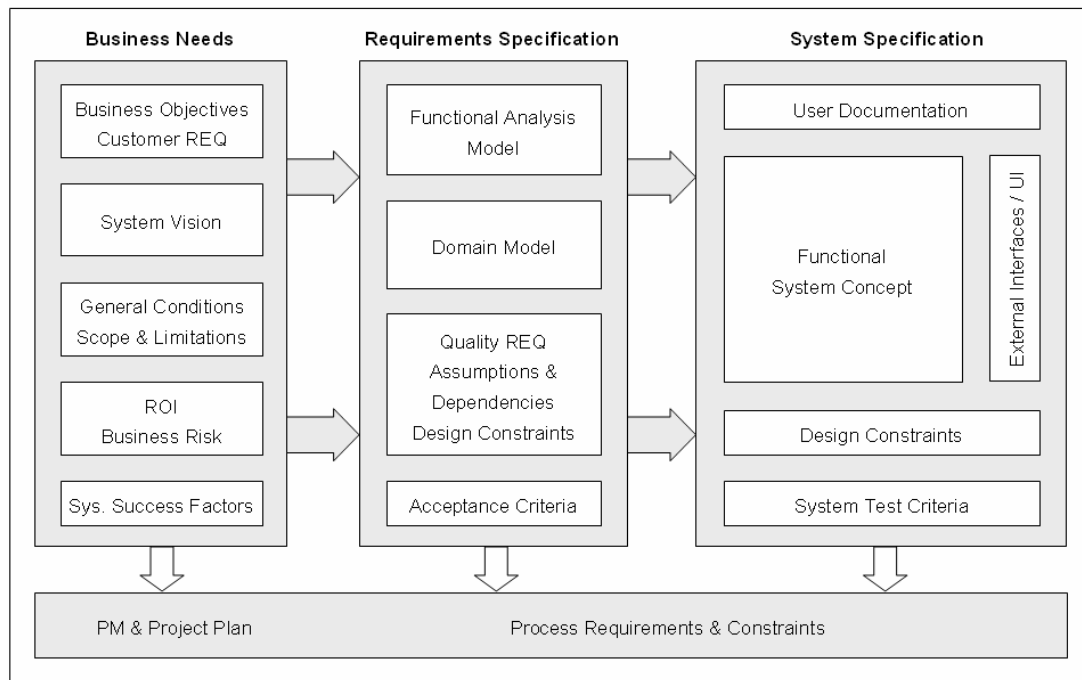








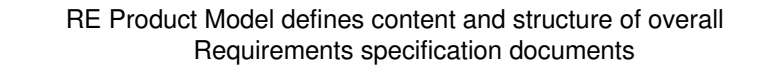
Model of Specification Products – RE Product Model



Structured into groups of work products

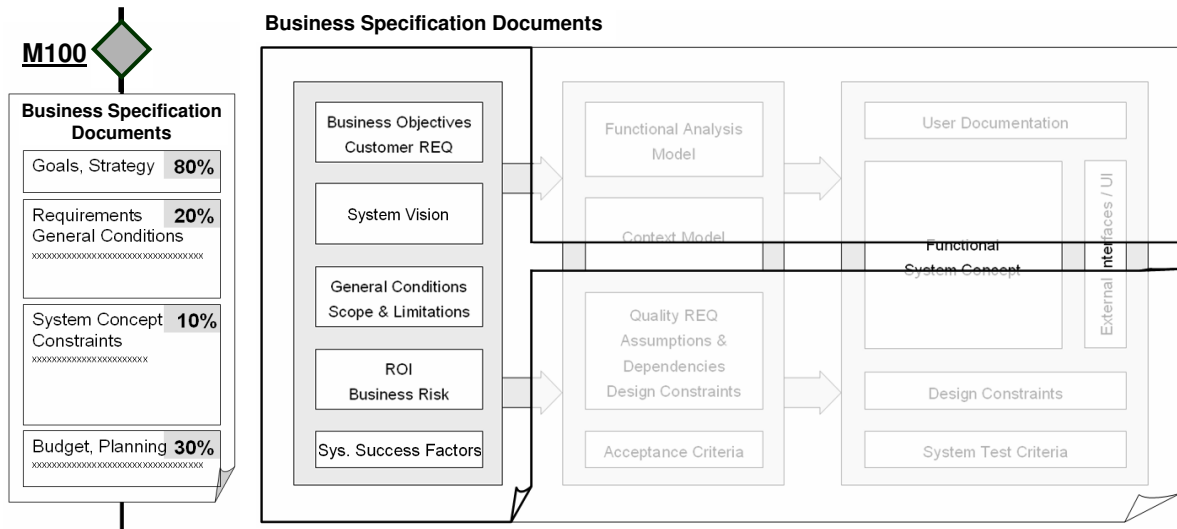
- Business Needs
- Requirements Specification
- System Specification
- Products and product items
- Systematically described by:
 - Overview/purpose of product group
 - Product-wise:
 - Role assignment (contributing, responsible)
 - Description
 - Purpose in RE
 - » Communication support
 - » Refinement relation
 - » Design relation
 - » Model relation
 - Example/reference/templates





Model-based Requirements Analysis with AutoRAID

Specification Progress Level on Decision Gate D0 (M 100)

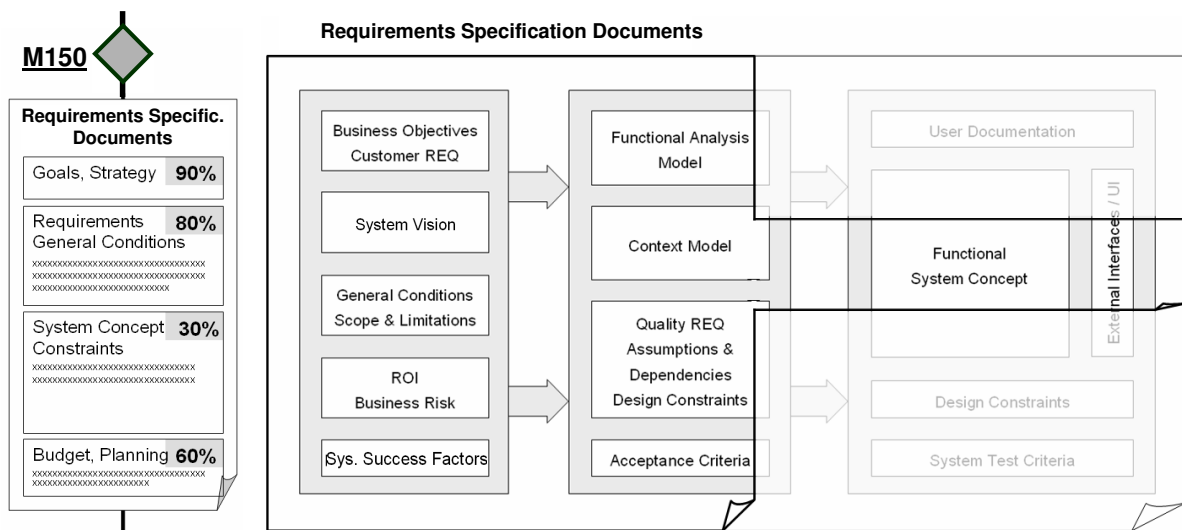


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Model-based Requirements Analysis with AutoRAID

Specification Progress Level on Decision Gate D1 (M 150)

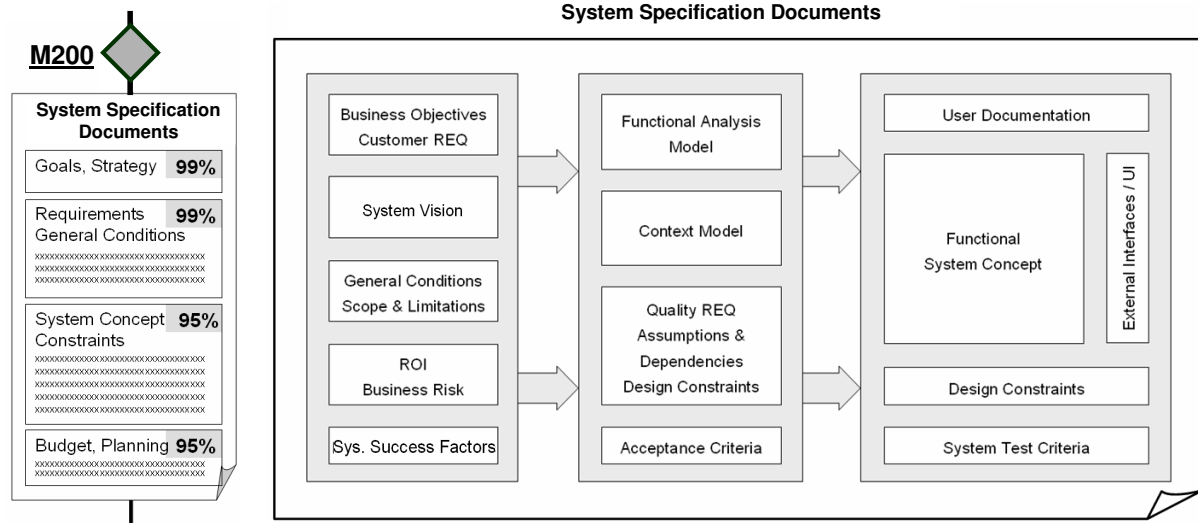


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Model-based Requirements Analysis with AutoRAID

Specification Progress Level on Decision Gate D2 (M 200)

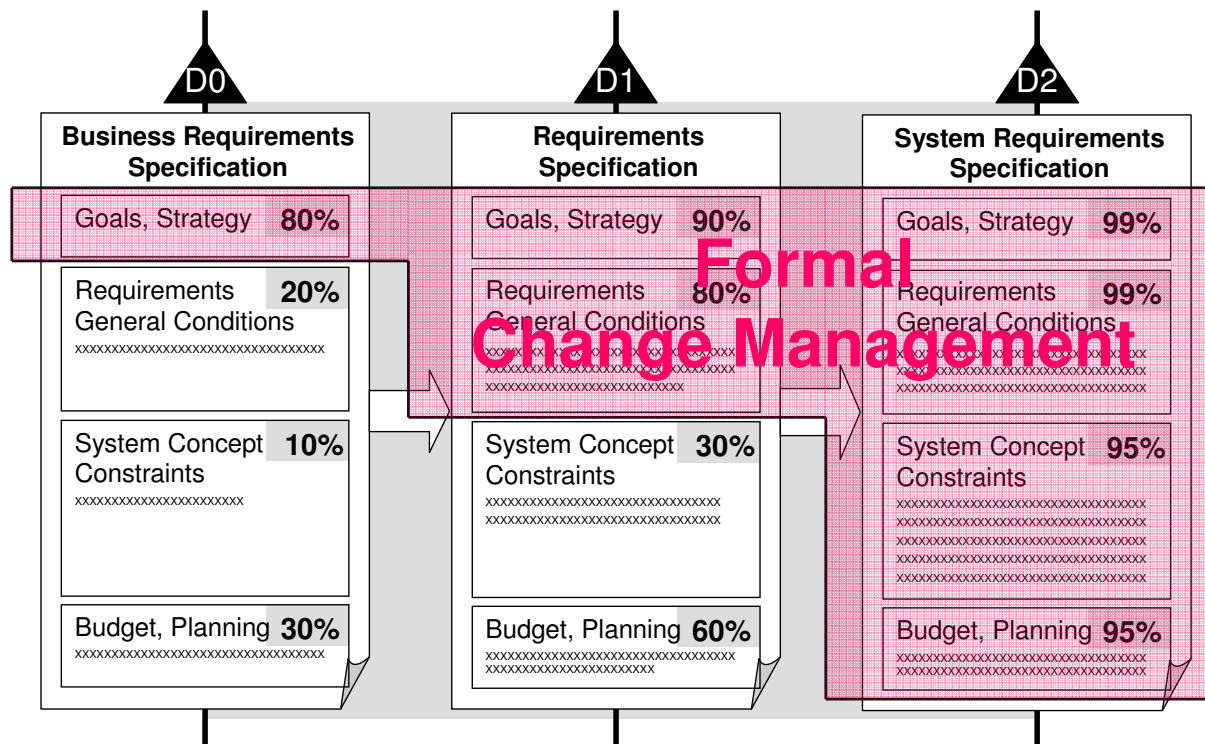
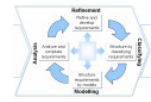


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Model-based Requirements Analysis with AutoRAID

Progress control and change management



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