

Metamodeling the Requirements of Web Systems

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- Requirements Engineering (RE)
 - identification of user requirements
 - analysis, documentation, validation of requirements
 - processes that support these activities
 - relevance is underestimated
 - helps to reduce drawbacks in later phases
 - start point for a model-driven development approach

- Current Web systems development methods
 - centred on design models
 - analysis more from the system's viewpoint than the user's viewpoint

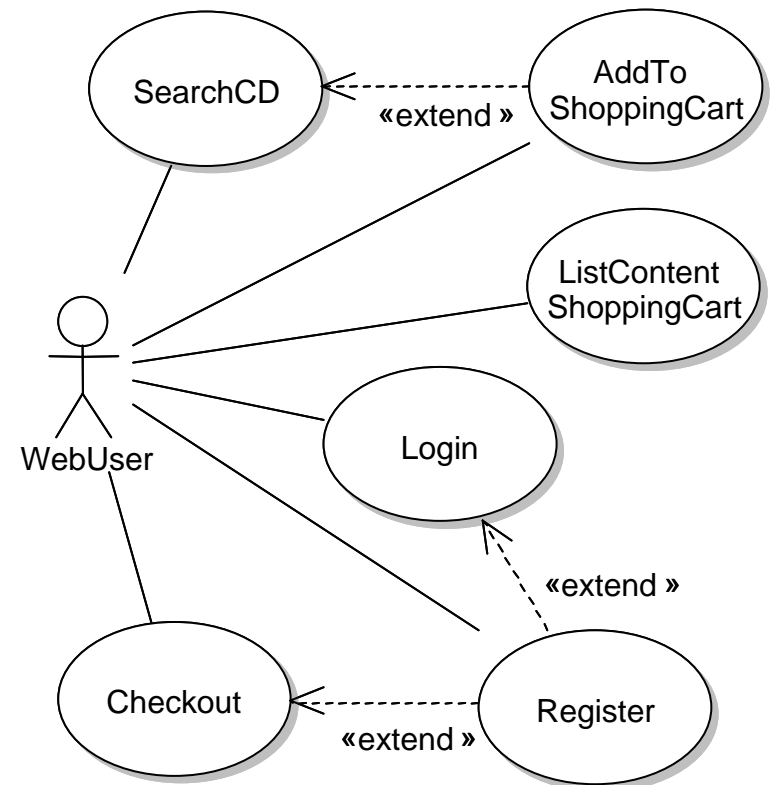
- Our focus
 - detailed specification of requirements of Web systems
 - a common strategy

- Requirements Engineering for Web Systems
- Different modeling approaches
- Metamodel for Web requirements
- Definition of an UML profile
- Conclusions
- Future work

- Elicitation
 - identification of
 - Web user groups
 - required content
 - navigation needs
 - business processes
 - presentation aspects, styles, corporate identity
 - Identification of non-functional requirements
- Specification
 - natural languages
 - templates
 - visual models, e.g. use cases
 - prototypes
 - formal languages
- Validation
 - inspection
 - review
 - model check

Different Modeling Approaches

- Navigation Development Techniques (NDT)
- Object-Oriented Hypermedia Design Method (OOHDM)
- UML-based Web Engineering (UWE)
- W2000
- based on use case modeling
- Example: CD e-shop
 - registration and login of users
 - searching mechanisms to find CDs
 - shopping cart management
 - checkout for buying CDs

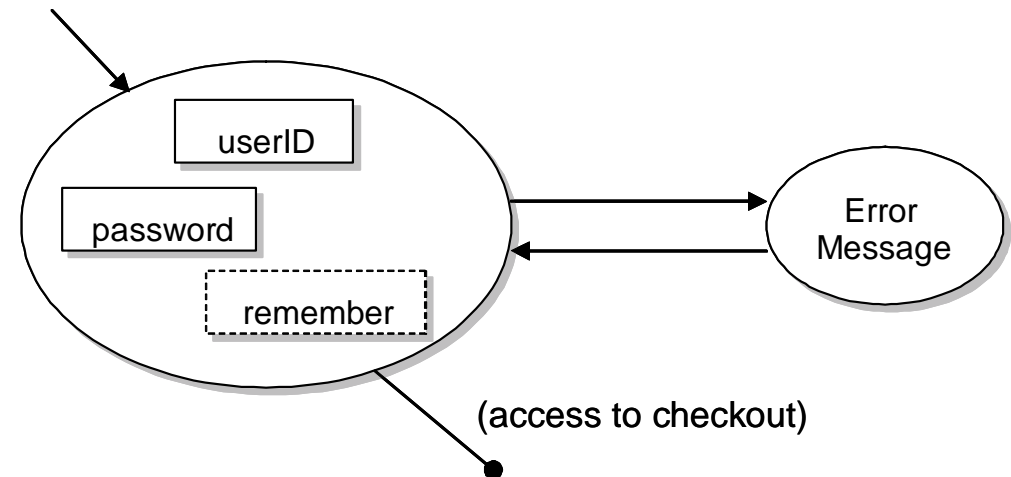


NDT: Navigation Development Techniques

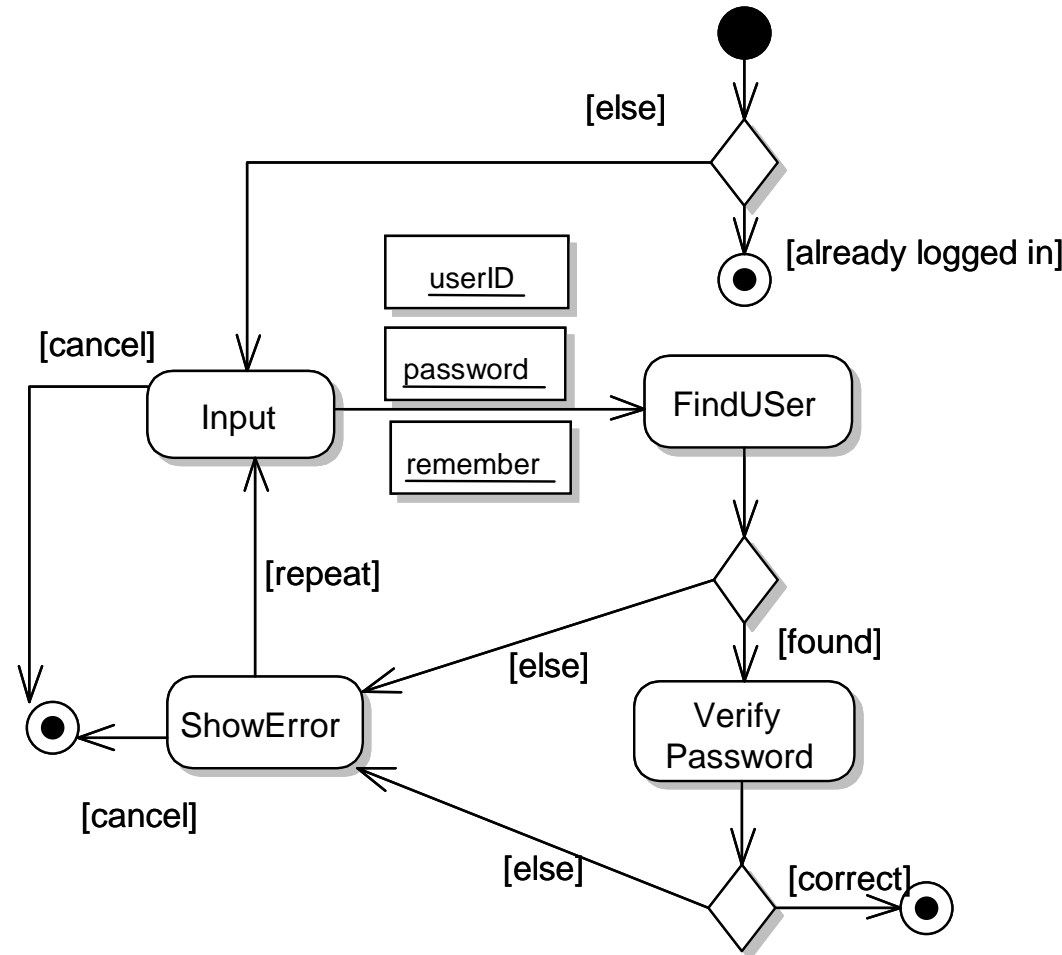
- Method with focus on requirements analysis (2003)
- Use cases supplemented by templates
 - storage information requirements
 - actor requirements
 - functional requirements
 - interaction requirements
 - non-functional requirements
- Characteristics
 - appropriated technique for customer-developer communication
 - lack of visual representation
 - requires specific tool support
 - NDT-Tool

FR-01		Login	
Description	Authentication to allow access to the checkout process		
Actors	Use case actor AC-01 Web User		
Normal sequence	Step	Action	
	1	System asks for userID, password and ability to remember both	
	2	Input of UserID and password	
	3	Check of both	
	4	Storage of UserID and password, if remember is true	
	5	Access to checkout allowed	
Exceptions	Step	Action	
	4	The user is not registered; the user executes FR-02	
	4	UserID or password not valid, continue with step 2	

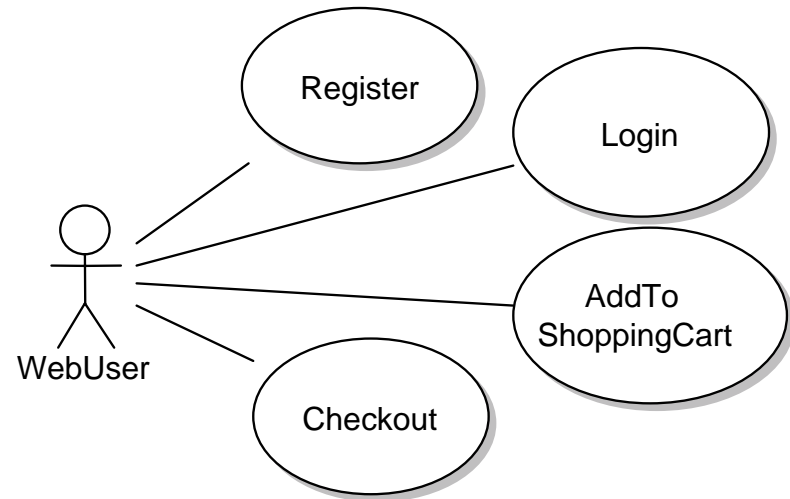
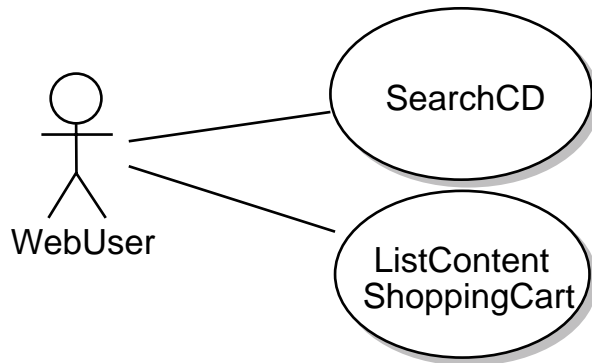
- First object-oriented method for the development of Web systems (1996)
- Separation of concern in design models
 - conceptual model
 - navigation structure model
 - abstract interface model
- Extension for requirements analysis (2000)
 - use cases model (standard UML)
 - user interaction diagram (UID)
- UIDs are built for each possible interaction user-Web system
 - Entry and exit points to UIDs
 - User input data
 - Communication to other UIDs
- Proprietary notation for UIDs visual representation



- Based on OMG standards (UML, MOF, OCL, ...) (2000)
- UML models for
 - requirements
 - use case diagrams
 - activity diagrams
 - content, navigation, presentation
 - business process
 - adaptation (aspect-oriented modeling)
- Uses extension mechanisms provided by UML
 - stereotypes
 - e.g. «navigation» use case
 - OCL constraints
- Tool support
 - UML CASE-tools
 - ArgoUWE



- UML-based approach (2000)
- Requirements analysis
 - only modeling in the large
 - separate models for each actor
- Use case diagrams
 - browsing activities
 - functional requirements



Requirements Specification: Summarizing

- Types of graphical representation (models)
 - functional overview model (modeling in the large)
 - detailed models (modeling in the small)
- Types of constructs (modeling elements)
 - actors
 - Web users of the system
 - behavioral elements
 - navigation functionality and business processes on the Web
 - browse and search activities
 - user transactions, e.g. credit card payment
 - structural elements
 - content: information provided by the Web system
 - node: requirements on application structure
 - Web user interface: presentation relevant aspects

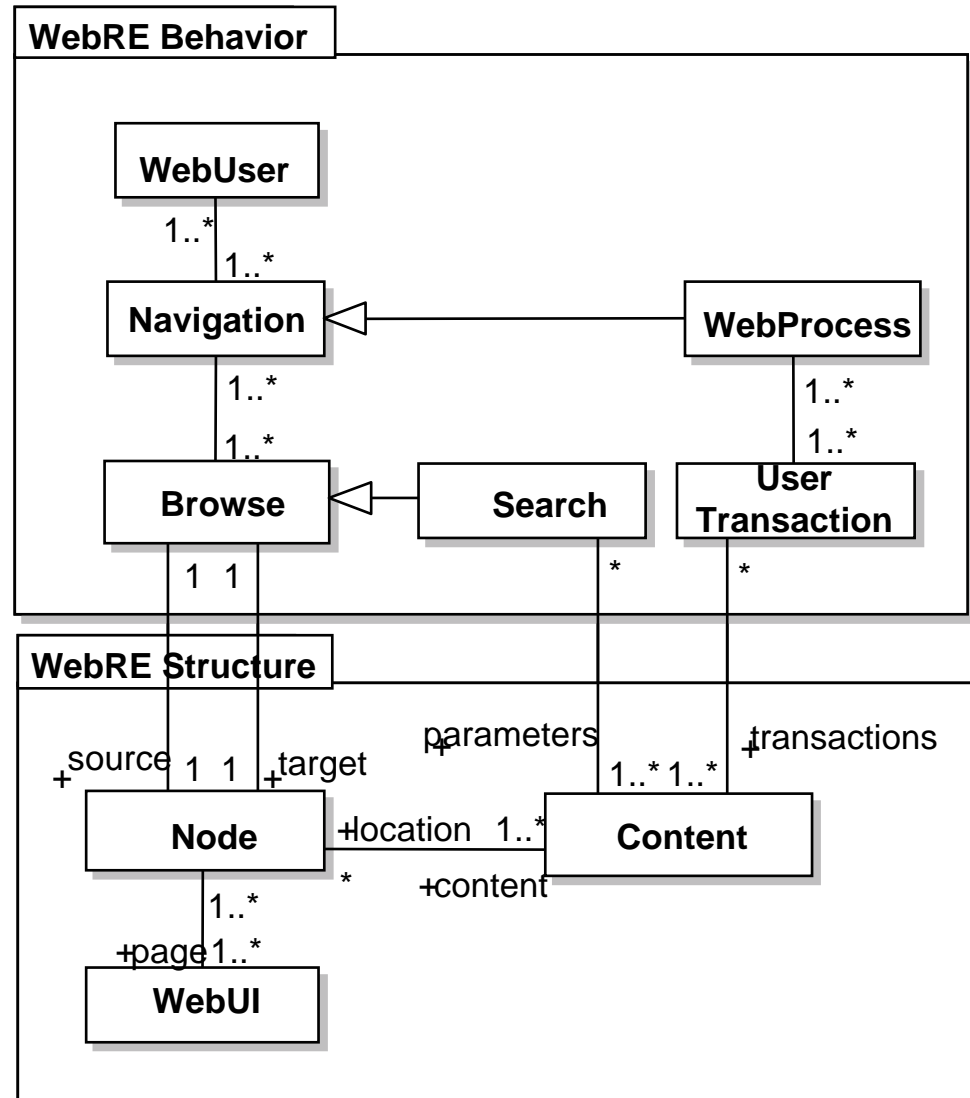
Mapping of Modeling Concepts

	Web Requirements	NDT	OOHDM	UWE	W2000
In the large	Web User	Actor	Actor	Actor	Actor
	Navigation	Visualization prototype	Use case	Navigation use case	Browse use case
	Web Process	Use case	Use case	Use case	Use case
In the small	Browse	Visualization prototype	Single choice	Activity	
	Search	Phrase	Data entry	Activity	
	User Transaction	Functional requirements	Application processing	Activity	
	Content	Storage requirement	Data entry	Class	
	Node	Visualization prototype			
	Web User Interface			Interaction	

- Representation of identified elements as MOF classes
- Grouping in packages
- Define relationships among elements
 - inheritance (e.g. search defined as an extended browse)
 - associations (e.g. a browse requires a source and a target node)
- Define invariants (OCL constraints)

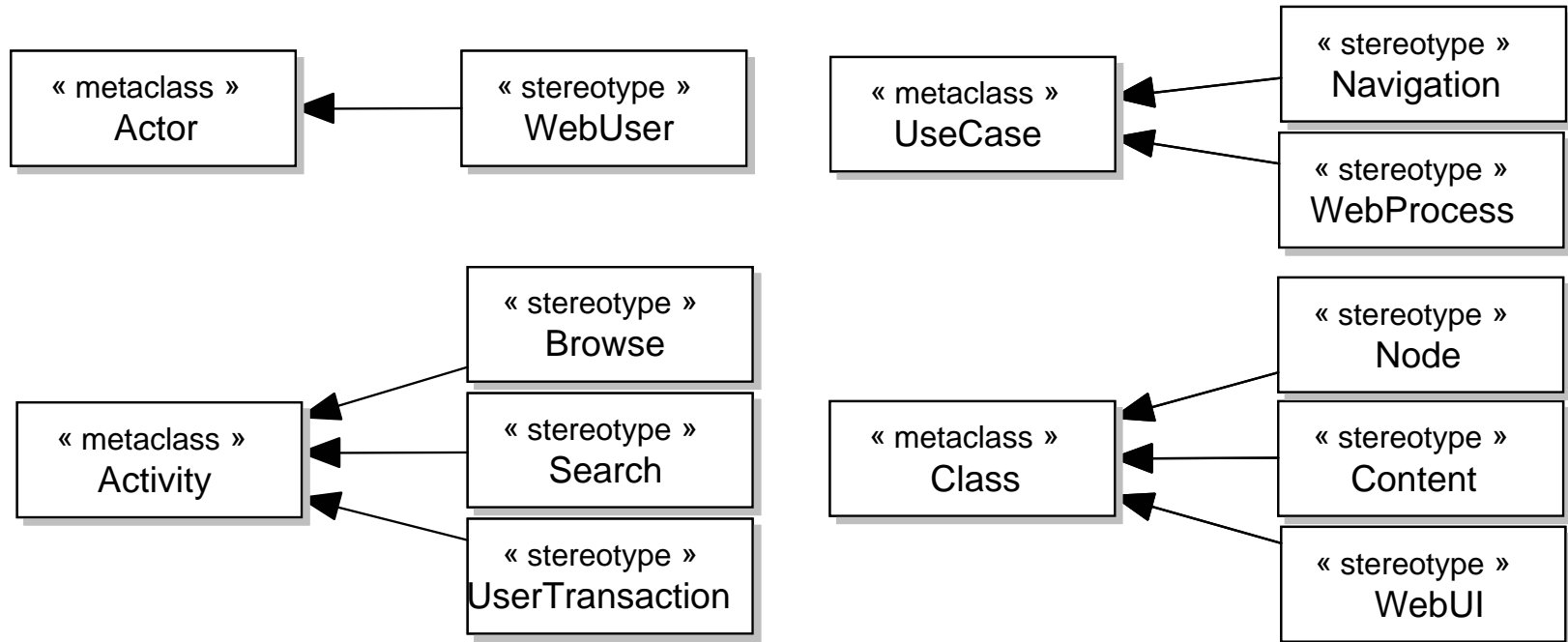
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context Browse
inv: self.oclIsKindOf(Search)
    implies
    self.parameters -> forAll
    (p | p.location ->
        includes
        (self.source))
    
```



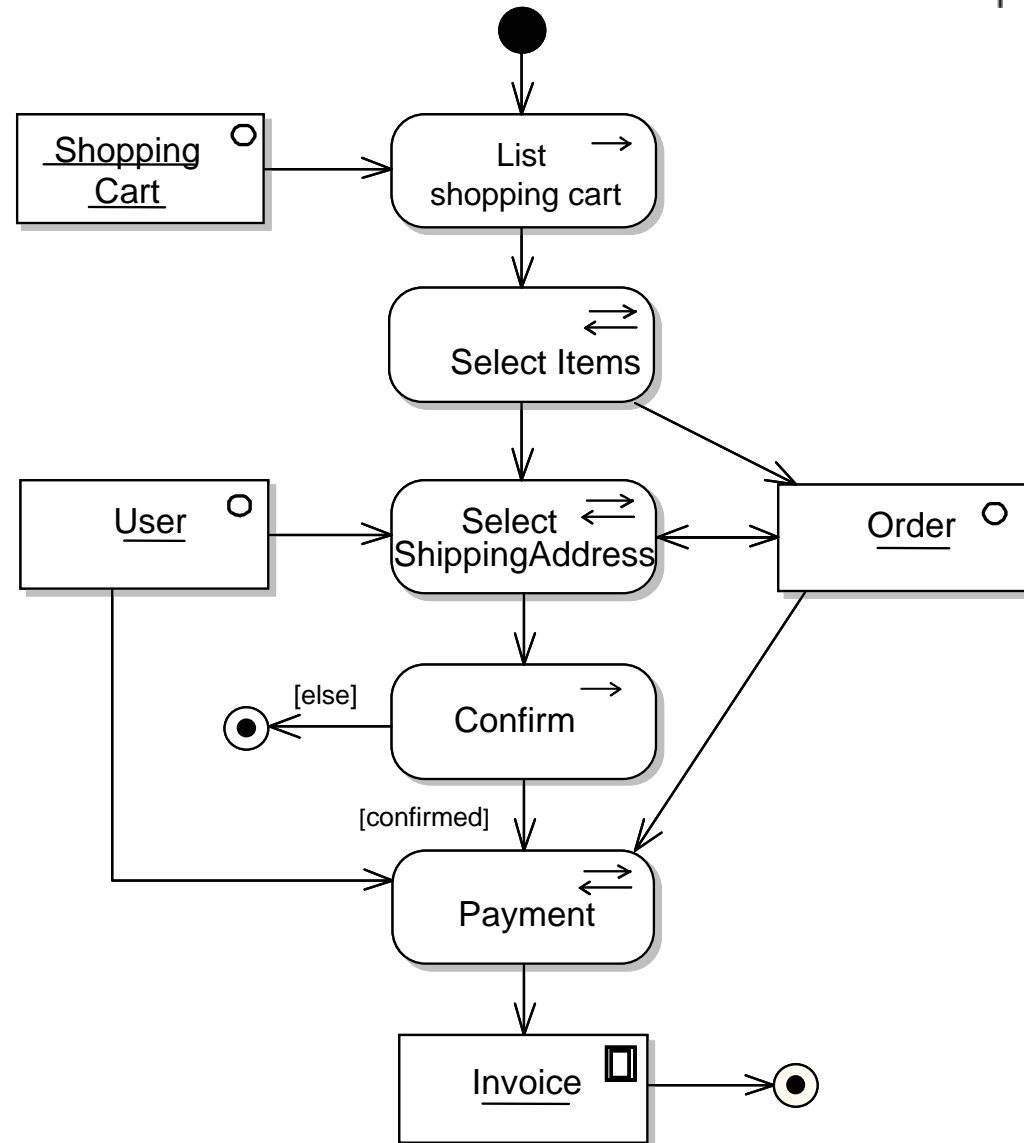
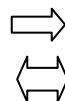
Definition of an UML Profile

- UML stereotype for each WebRE concept
- Extends relationship
- UML metaclass
- Advantages
 - no need to specify complete semantic of new modeling elements
 - use of all UML CASE-Tools



Notation for Activity Diagram Elements

WebRE Element	UML Metaclass	Icon
Browse	Activity	→
Search	Activity	?
User Transaction	Activity	↔
Content	Class	○
Node	Class	□
Web User Interface	Class	▭



- Definition of metamodel for Web requirements (WebRE)
 - model checking
 - model transformations
 - model-driven development
- Presentation of a modeling language
 - UML lightweight extension (UML profile)
 - UML CASE-tools

- Extension of existing approaches
 - provide UWE with WebRE modeling elements
 - add visual modeling features to NDT
- Mappings between models of different approaches
 - based on model transformations
 - defined at metamodel level
- Support of a model-driven development process
 - from requirements models to design models → ICWE 2006
 - QVT model transformations
- Tool support
 - extend NDT-Tool
 - transformations from NDT templates to visual models (WebRE profile)
 - extend ArgoUWE
 - transformations from WebRE models to UWE design models (content model, navigation model, ...)

Thank you for your attention!

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