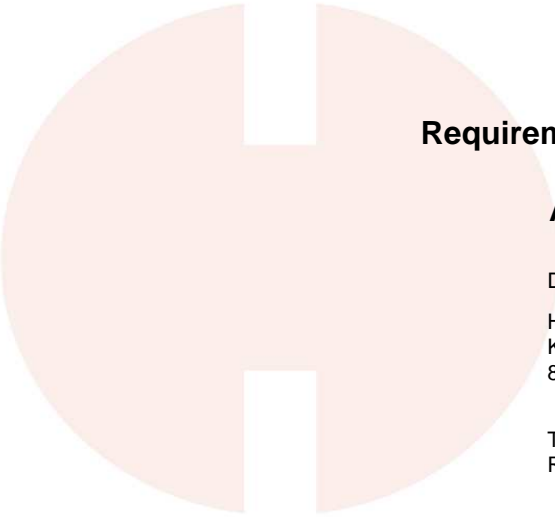


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## Requirements Management and Modelling: A Strong Team

Dr. Rudolf Hauber  
HOOD GmbH  
Keltenring 7  
82041 Oberhaching

Tel: +49 89 4512 53 0  
Rudolf.Hauber@HOOD-Group.com

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## Our Business


The usage of **Requirements Management & Engineering (RM&E)** and continuous **process improvement** initiatives like **CMMI** or **SPICE** are an essential part for big and world wide organisations to develop complex products, services and systems.



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## Our Customers


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- **Automotive Manufacturer**
  - Adam Opel GmbH
  - Audi AG
  - BMW AG
  - Daimler AG
  - Volkswagen AG
- **Automotive Supplier**
  - Hella KGaA Hueck & Co
  - Robert Bosch GmbH
  - TRW
- **Logistic**
  - Deutsche Bahn AG
  - Schenker Logistics
  - Siemens Mobility
  - Thales Group
- **IT/ Software Development**
  - BMW AG
  - Volkswagen AG
  - Deutsche Nationalbibliothek

- **Aerospace Industry**
  - EADS
  - Astrium
  - Airbus
- **Medical Industry**
  - Drägerwerk AG & Co. KGaA
  - Siemens Healthcare
  - CareFusion (Viasys Healthcare)
- **Telecommunication**
  - Alcatel Lucent
  - NetCologne Gesellschaft für Telekommunikation mbH
  - O2 Germany GmbH & Co. OHG
- **Banking and Insurance**
  - AXA Konzern AG
  - BMW Bank GmbH
  - Interpolis

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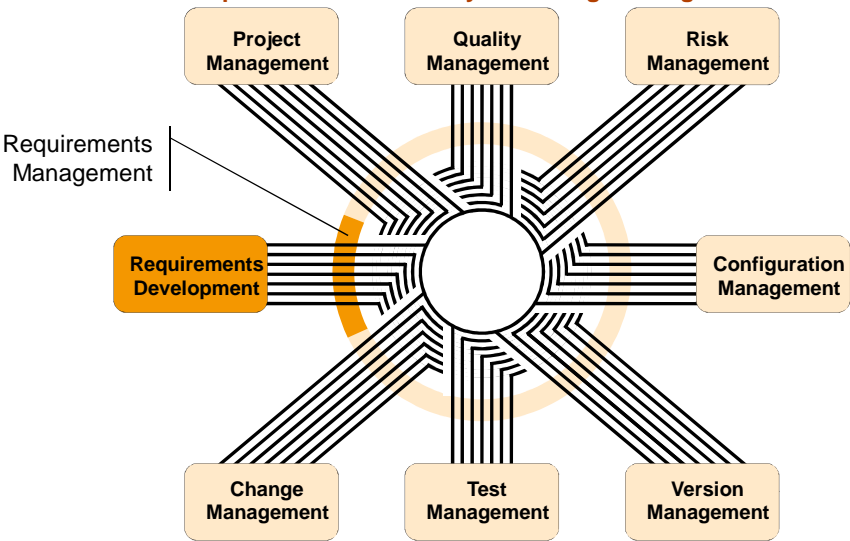
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## Our Expertise


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Requirements Management is the interface between Requirements Development and all other Systems Engineering Processes



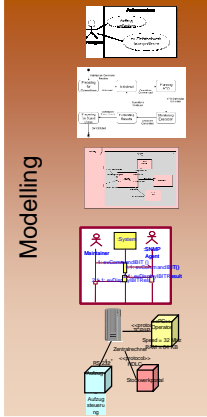
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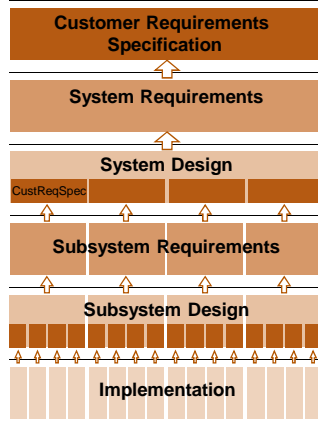


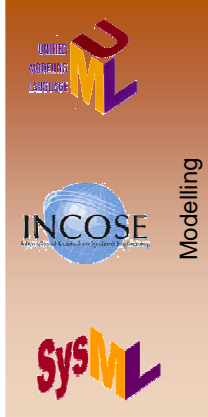
### Model Based Systems Engineering Expertise (MBSE)

- Modelling is a central element in the HOOD Requirements Specification Process and in the derivation of requirements
- HOOD actively works on INCOSE "Model Based System Engineering vision 2020"



Modelling






Modelling

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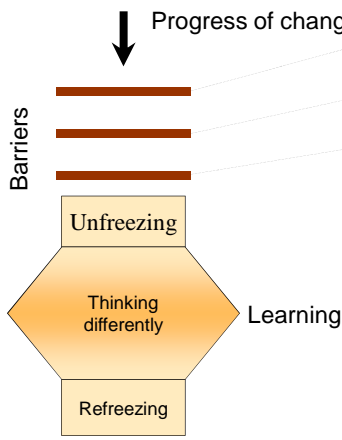
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### HOOD Guideline: Structure of Change

**Process Improvement is not just a technical challenge.**

Barriers



Learning

- Lack of discomfort/anxiety with present system
- Ignoring information that does not fit with the past
- Lack of psychological safety in the change, fear of loss of identity or integrity

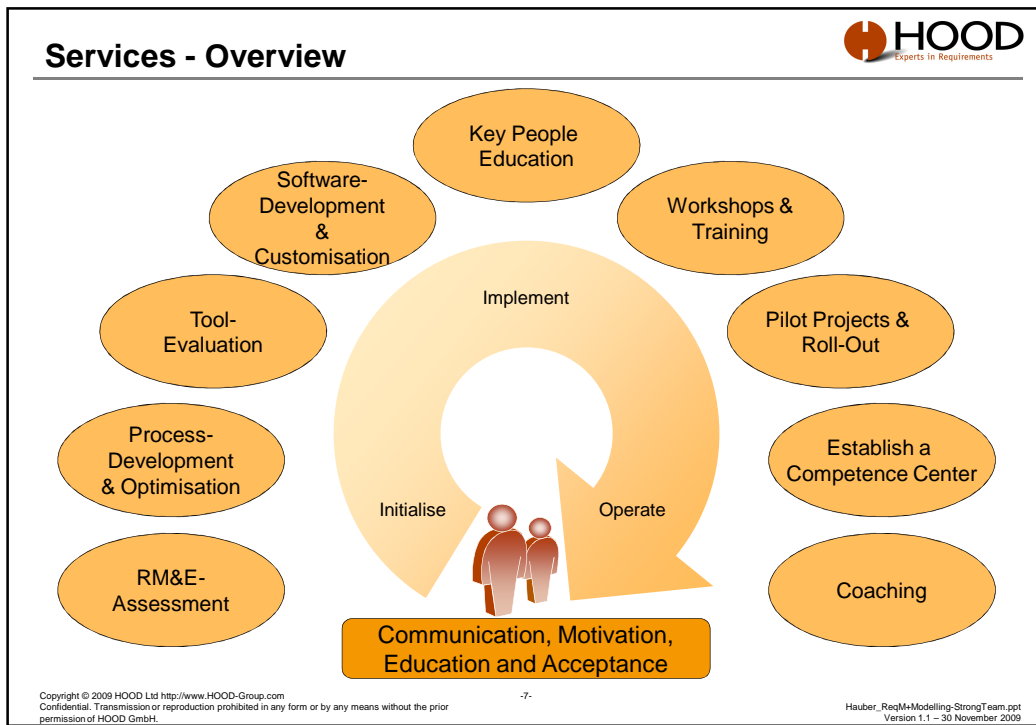
↓ ↓

Recognising the barriers to change and helping people to overcome their anxiety, is necessary for successful change

Source: Colin Hood 1997  
Model of change based on work by Lewin 1947 and Schein 1961-1965  
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### HOOD- Excellence in Requirements

This slide displays various logos and publications associated with HOOD's expertise in requirements engineering:

- HOOD DESIRE** (with a lightbulb icon)
- HOOD INSIDE** (with a gear icon)
- Anforderungsmanagement** (book cover)
- Requirements Management** (book cover)
- Requirements Management & Engineering** (book cover)
- ReConf** (conference logo: Requirements Engineering Today 2009)
- SubConf** (conference logo: Subsystem & Configuration Management Konferenz)
- INCOSE** (International Council on Systems Engineering)
- GfSE** (Gesellschaft für Systems Engineering e.V., German Chapter of INCOSE)
- Hochschule Rosenheim** (University of Applied Sciences)
- interequirements board international**


**HOOD**  
Experts in Requirements

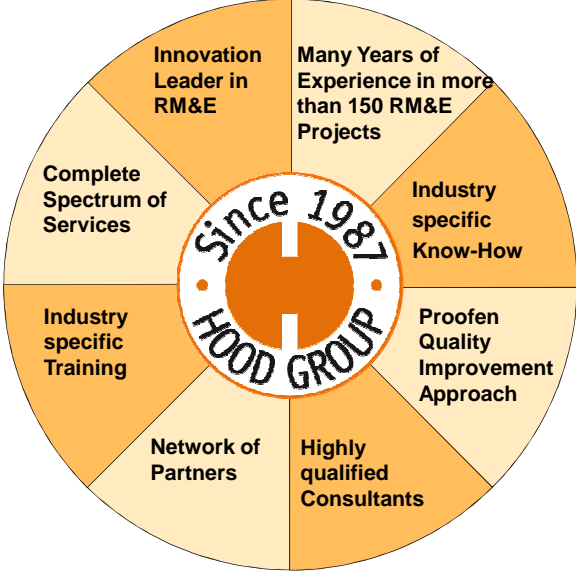
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## Your Advantage in Working with HOOD








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## HCMs – Requirements Management & Definition




### HOOD Capability Models

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## Agenda



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- 1 Requirements Engineering and Modelling - Motivation
- 2 From Business Process Modelling to Requirements
- 3 From Requirements to Software Modelling
- 4 Seamless Traceability
- 5 "Collateral Benefit"
- 6 Summary

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## Customer Language and Technical Language



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The difference between **Design** and **System** Requirements:

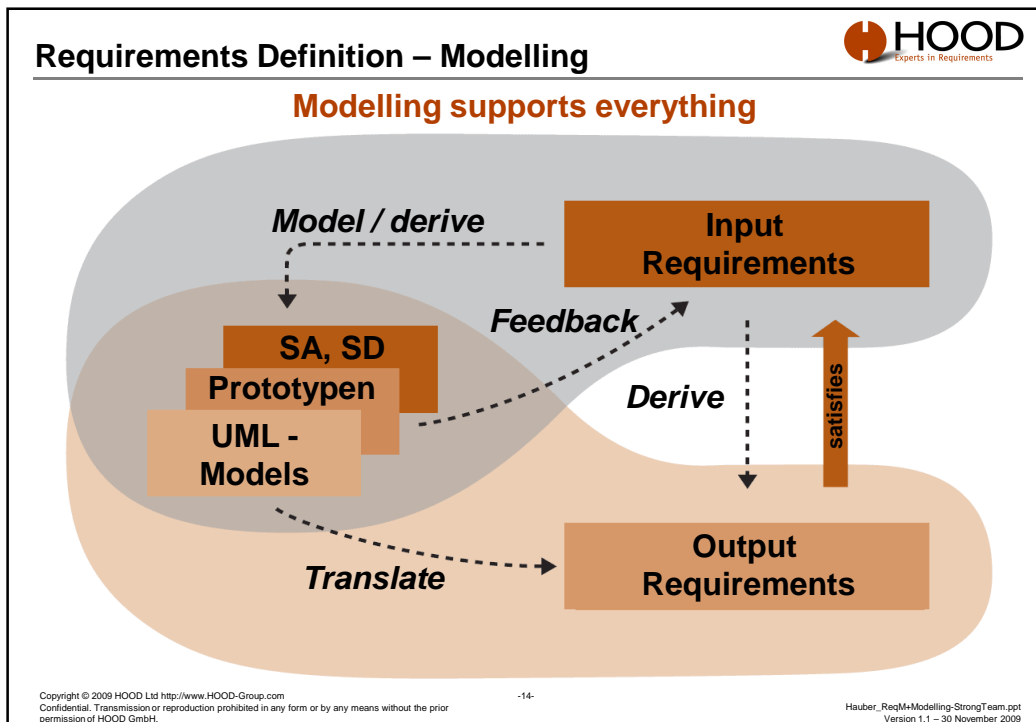
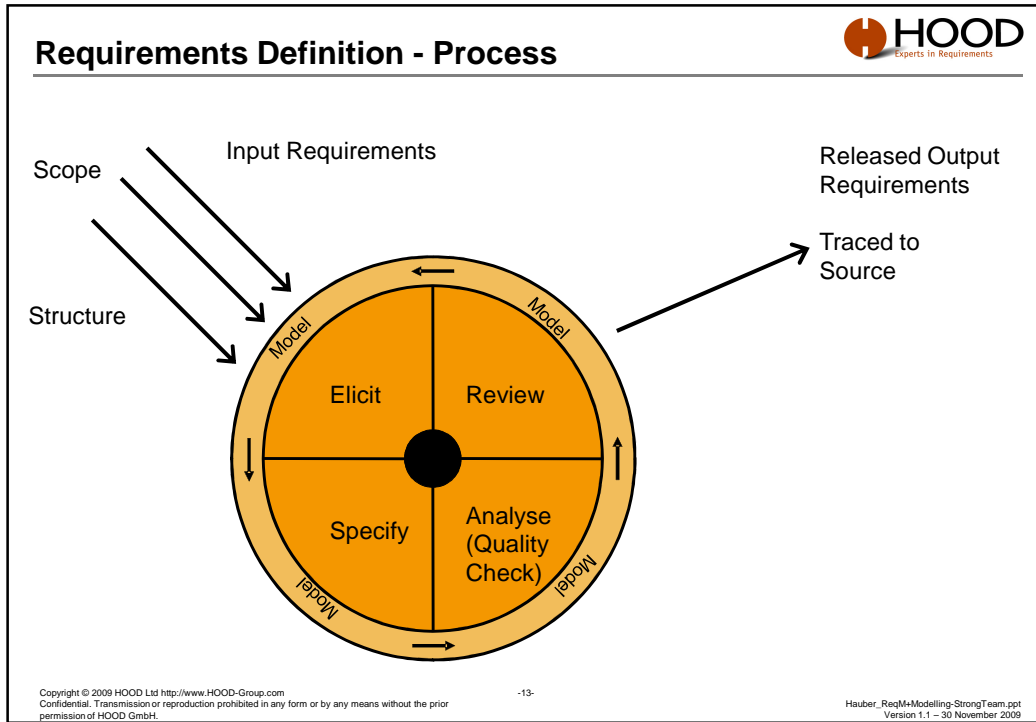
Customer Language


Technical Language

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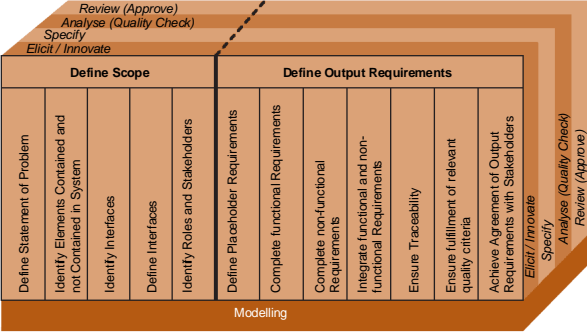


## Requirements Definition – Processactivities


Understand and Consolidate Input Requirements			
Understand Input Requirements	Prioritize Input Requirements	Consolidate Input Requirements	Achieve Agreement of Consolidated Input Requirements with Stakeholders
Modelling			

**Understanding Requirements**  
Before we can define the next level of requirements we have to understand the requirements we seek to fulfill

**Defining Requirements**  
The Requirements Definition Process is far more than just using a template



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## Benefits of Combining RM and Modelling

Different benefits for different stakeholders

- **Management**
  - Communicate vision of the business
  - Track goal orientation
- **Process Engineers**
  - Analyse and/or define processes and identify improvement potentials
- **Customer**
  - Understand business context, services and constraints
  - Define service access interfaces
- **Development**
  - Understand business and operational context
  - Derive project/system requirements
- **Supplier**
  - Understand business and products
  - Define service interfaces
- **Training**
  - Understand and learn business processes
- **Other stakeholders: financiers, ...**
  - Central means of communication

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## Views, models and diagrams

- Different types of diagrams show different aspects of the system
- Aspects complement and overlap one another
- Architecture frameworks guide the creation of models
- Consistency of the model must be established
- UML/BPMN supports consistency

Logical View

Physical View

Timing View

Behaviour View

Requirements View

Operational View

Security View

Data View

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## Zachmann Enterprise Framework

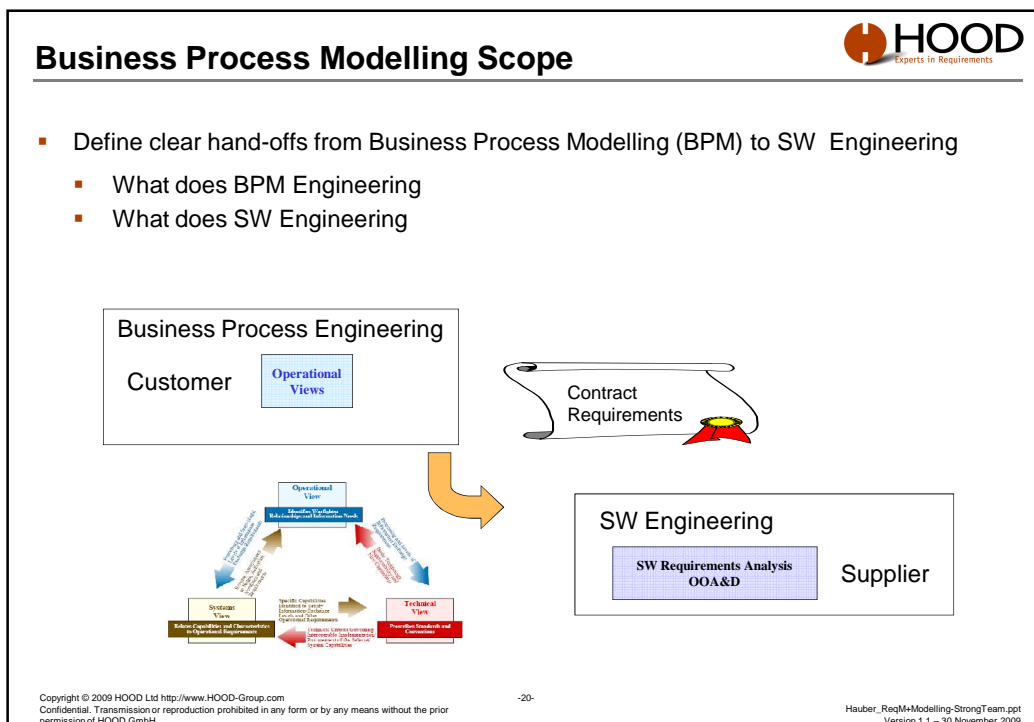
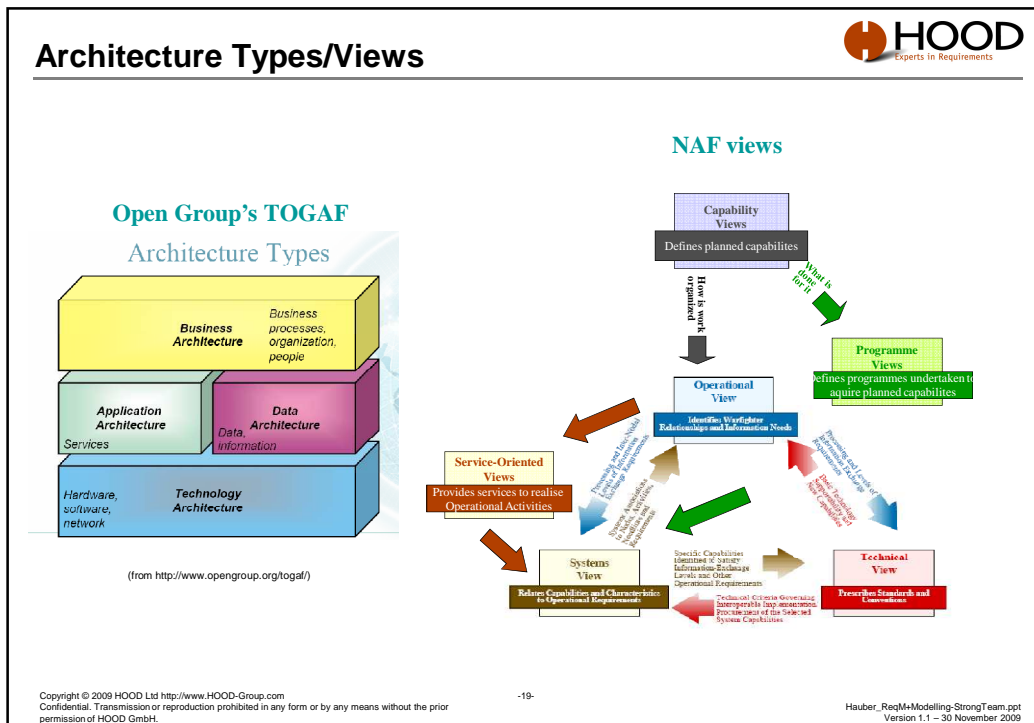
		Data	Function	Network	People	Time	Motivation		
		What	How	Where	Who	When	Why		
1	Contextual							Contextual	Objectives/ Scope
2	Conceptual							Conceptual	Business
3	Logical							Logical	System
4	Physical							Physical	Technology
5	As Built							As Built	Components
6	Functioning							Functioning	Operations
		What	How	Where	Who	When	Why		

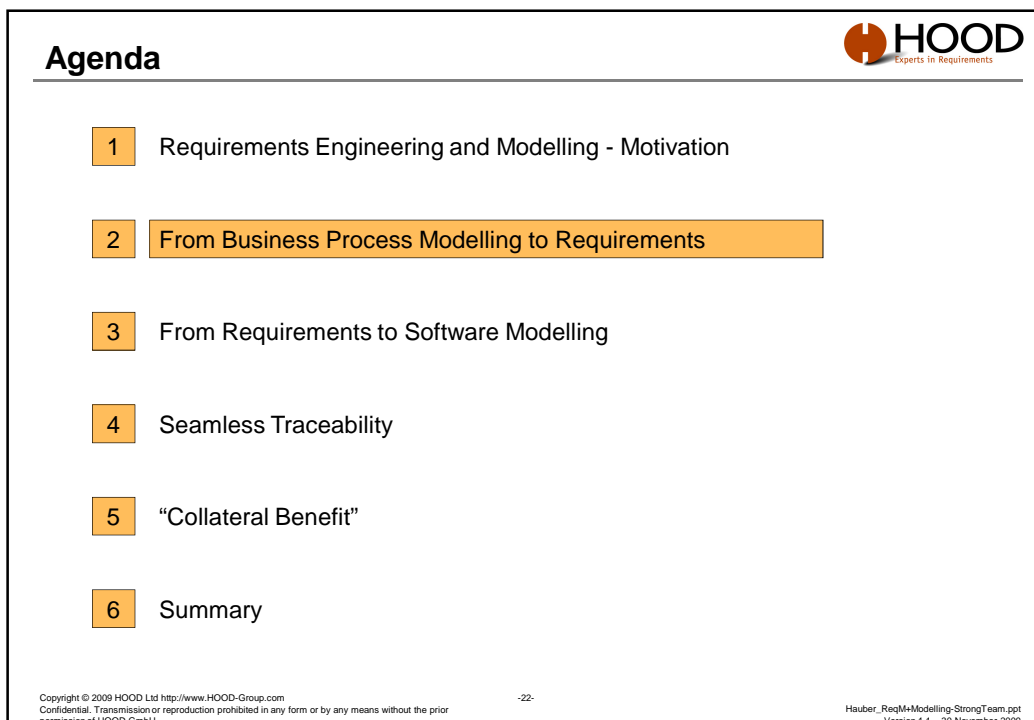
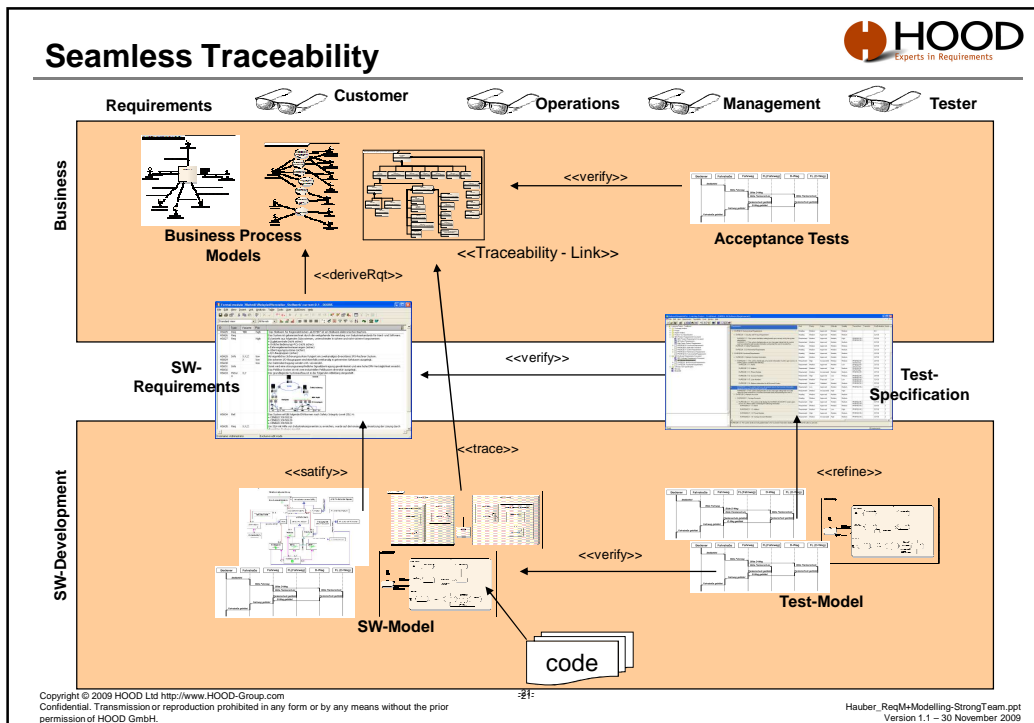
(from www.zachmanframeworkassociates.com/Standards)


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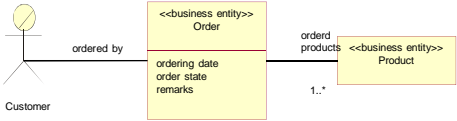






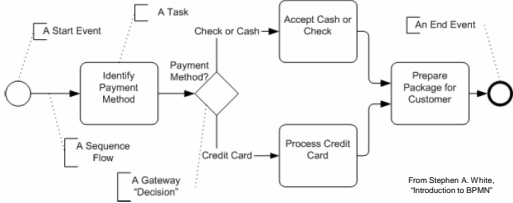
## Customer Requirements

- Capturing current business situation
  - Business Modelling can help to understand current business:
    - Applying techniques like scenarios, use cases, interviews,...
    - Using notations for business processes, workflows, roles, information, ...
    - However, notation must be easy to understand!



UML Business Modelling profile


BPMN as new standard  
(for BPEL as execution language)




From Stephen A. White, 'Introduction to BPMN'


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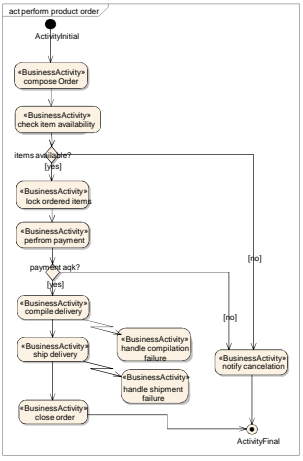
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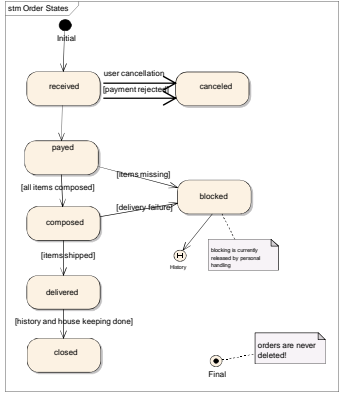


## Business Process Modelling Example



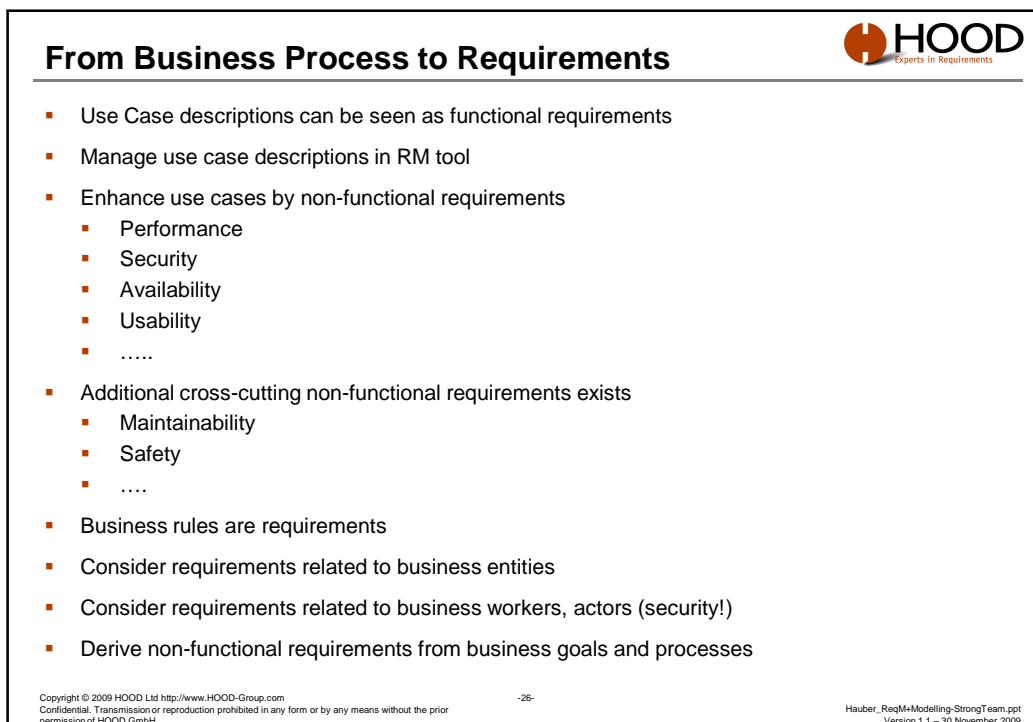
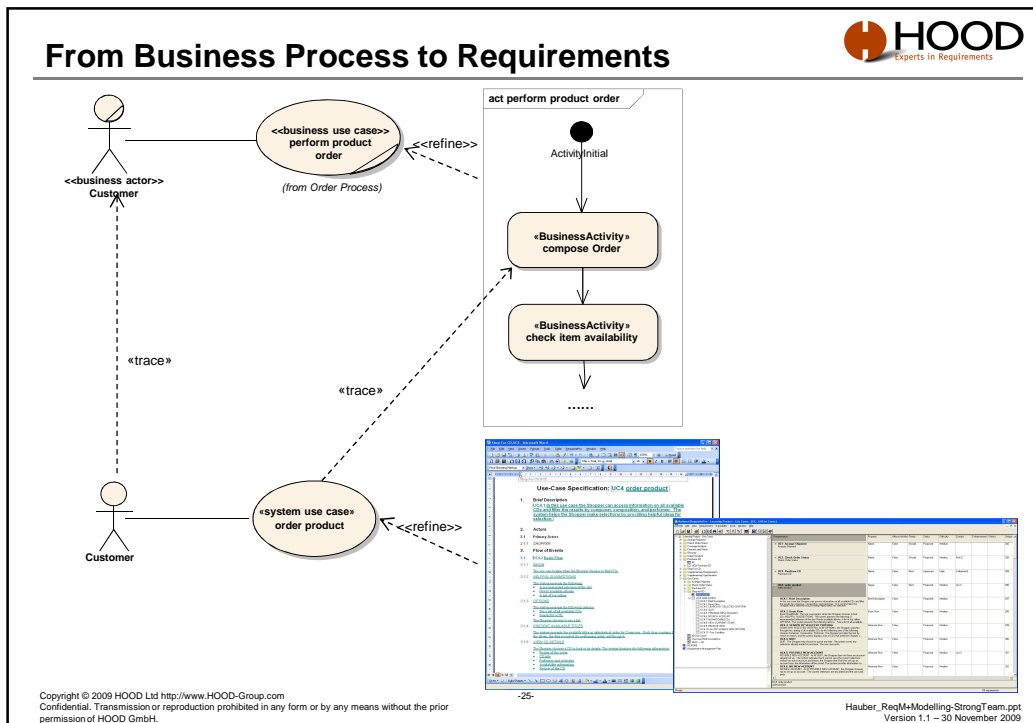






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## From Business Process to Requirements

- Derive requirements for business rules and constraints

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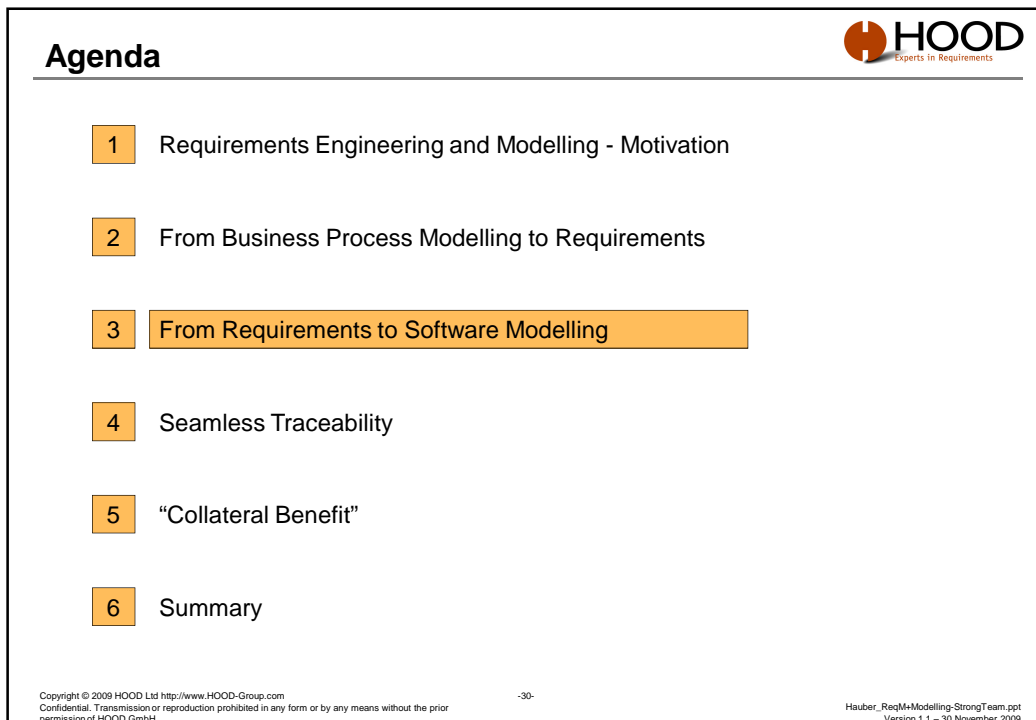
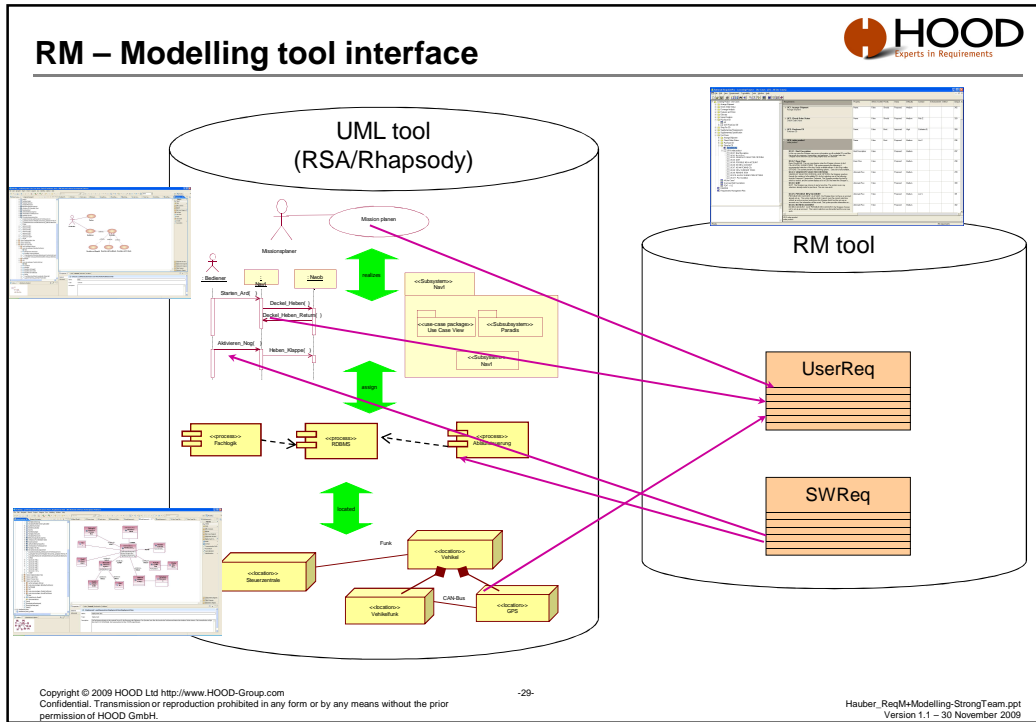
## SysML Requirements Traceability

- Example


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## From Requirements to Software Modelling




- Refine use case realizations from use case descriptions (functional requirements managed in RM tool)
- Consider impact of non-functional requirements on use case realizations
  - Performance
  - Security
  - Availability
  - Usability
  - .....
- Consider impact of cross-cutting non-functional requirements on architecture
  - Maintainability
  - Safety
  - ....
- Trace non-functional requirements to behavioural and structural elements

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## From Requirements to Software Modelling



**Alternative 1: Create SW Use Cases for (system –supported) Business Use Cases**

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## From Requirements to Software Modelling

### Alternative 2: Refine Business Use Case Activity to SW Use Case

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## From Requirements to Software Modelling

- Consider impact of non-functional requirements

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## Agenda


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- 1 Requirements Engineering and Modelling - Motivation
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- 4  Seamless Traceability
- 5 "Collateral Benefit"
- 6 Summary

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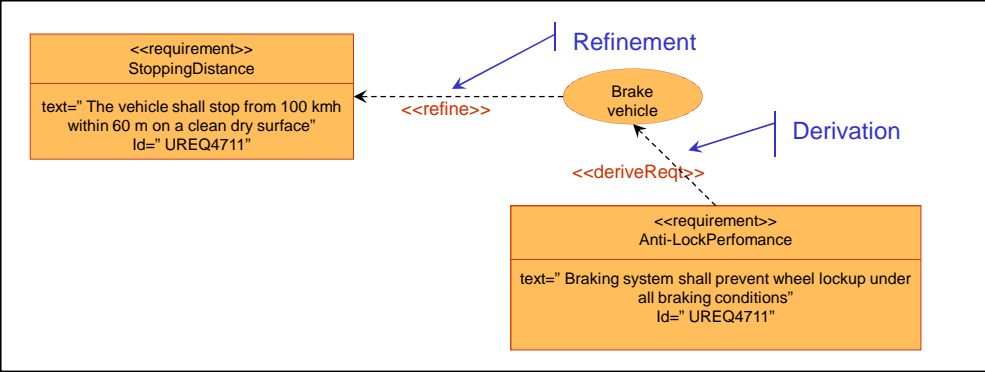
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## Tracing of non-functional Requirements

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- Until now there was no standard to integrate traceability to requirements into modeling
  - normally done by UML surrogates in RM&E tool
- SysML supports tracing in Requirements Diagram



The diagram illustrates the tracing of non-functional requirements in SysML. It features three main elements:

- Requirement 1 (Left):** A requirement box with the text: "The vehicle shall stop from 100 kmh within 60 m on a clean dry surface" and Id=" UREQ4711".
- Requirement 2 (Bottom):** A requirement box with the text: "Braking system shall prevent wheel lockup under all braking conditions" and Id=" UREQ4711".
- Use Case (Center):** An oval labeled "Brake vehicle".

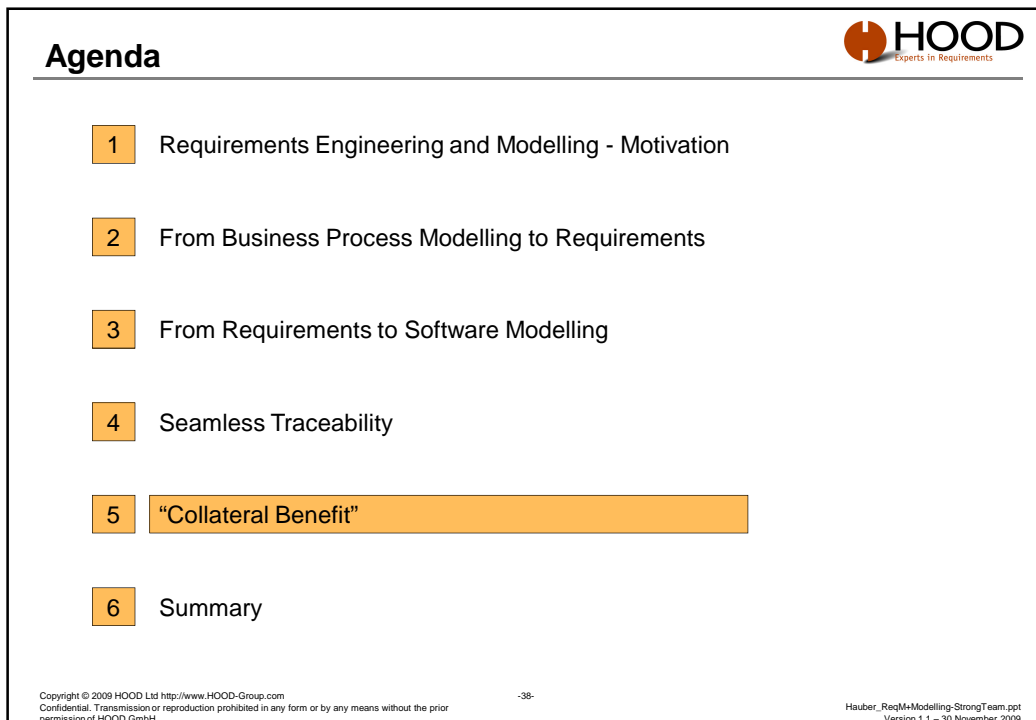
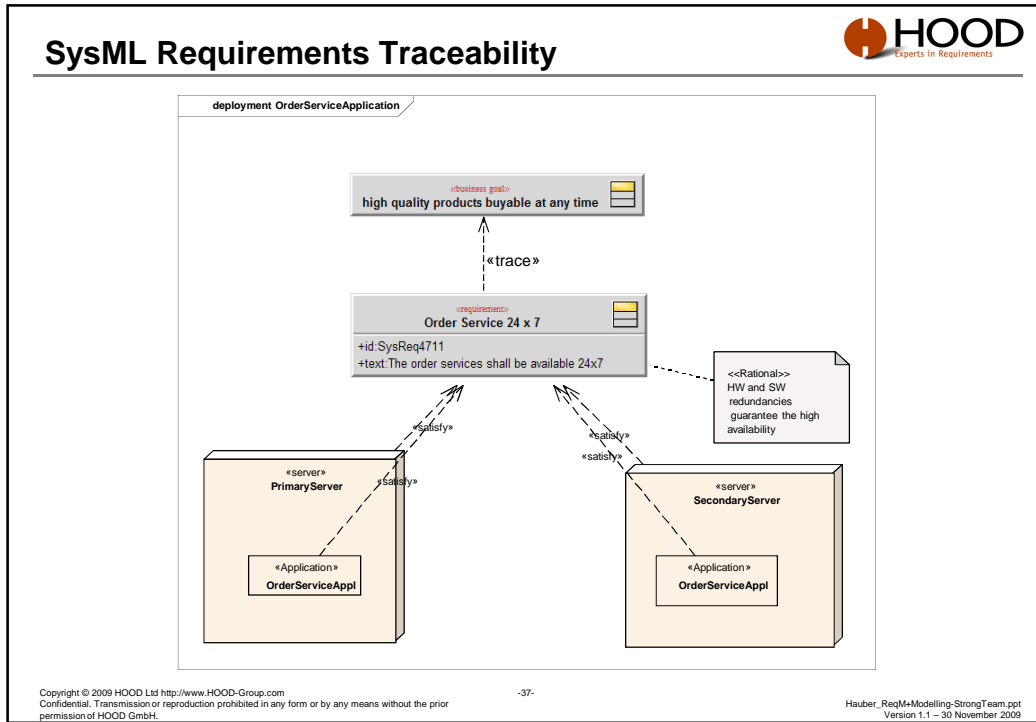
Tracing relationships are shown as follows:

- A solid blue arrow labeled "Refinement" points from the "Brake vehicle" use case to the top-left corner of the first requirement box.
- A dashed red arrow labeled "<<refine>>" points from the "Brake vehicle" use case to the text of the first requirement box.
- A solid blue arrow labeled "Derivation" points from the "Brake vehicle" use case to the top-right corner of the second requirement box.
- A dashed red arrow labeled "<<deriveReq>>" points from the "Brake vehicle" use case to the text of the second requirement box.

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**HOOD**  
Experts in Requirements

**“Collateral Benefit”**

**Seamless traceability from Business Processes to System Use Cases eases derivation of test cases**

The diagram illustrates the flow of information and verification between different stages of system development and testing. It is organized into three horizontal rows, each representing a different level of abstraction and testing:

- Top Row:** On the left, a stick figure actor is connected to a business process (represented by a circle with a line). A dashed arrow labeled <<verify>> points from this actor to another stick figure actor on the right. This second actor is connected to a system use case (circle with a line) and has a speech bubble containing <<test case>>. To the right of the use case is a document icon representing an acceptance test. A yellow box labeled "Acceptance Test" is positioned to the right of the document.
- Middle Row:** On the left, a stick figure actor is connected to a system use case. A dashed arrow labeled <<verify>> points from this actor to another stick figure actor on the right. This second actor has a speech bubble containing <<test case>>. To the right of the use case is a document icon representing a system test. A yellow box labeled "System Test" is positioned to the right of the document.
- Bottom Row:** On the left, a stick figure actor is connected to a system use case. A dashed arrow labeled <<verify>> points from this actor to another stick figure actor on the right. This second actor has a speech bubble containing <<test case>>. To the right of the use case is a document icon representing an integration test. A yellow box labeled "Integration Test" is positioned to the right of the document.

At the bottom left of the diagram, there is a sequence diagram showing interactions between components. At the bottom center, the number -39- is displayed. At the bottom right, the text "Hauber\_ReqM+Modelling-StrongTeam.ppt Version 1.1 – 30 November 2009" is present.

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**Agenda**

- 1 Requirements Engineering and Modelling - Motivation
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## Benefits of Integrating RM and Modelling



- Seamless traceability from business processes to software implementation
- Improved communication and understanding between all stakeholders
  - Business experts
  - Software analysts
  - Software developer
  - Project managers
  - Testers
  - ....
- Traceability of software architecture from requirements and business processes
  - reduces integration failures and efforts
  - improves maintainability
  - Improves extensibility and scalability of applications

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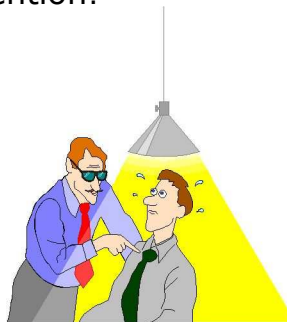
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## Discussion



Thanks for your attention!

Questions &  
Discussion



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