Master Project Software Engineering: Team-based Development WS 2010/11

Requirements Engineering Tutorial, September 28th 2011

Digital Scrum Board

Anne Groß

Anne.Gross@informatik.uni-kl.de

Tel.: 0631 6800 2104

JOHN DEERE

AG·SE

Fraunhofer IESE

The goal of this tutorial is to …

- … provide you with an overview about requirements engineering („best practices“)
- … provide a baseline / guidance for requirements engineering activities to be followed within the project
  (depending on requirements in project)

Agenda

- „TORE / Satisfy“ – A Task-Oriented Requirements Engineering Approach
  - Decisions in Requirements Engineering
  - How to specify these Decisions
- Tipps / Methods and Guidelines
- Task Assignment

--- TORE / Satisfy ---

TORE Requirements Decisions from Problem to Solution

Task-Oriented Requirements Engineering

- Stakeholders (customers, end users) have Goals
- Goals are operationalized by Tasks
- Tasks are supported by Systems

System development should be driven by (goals and) tasks

- Every system functionality can be motivated by goals & tasks
- Fulfillment of goals can be assured

JOHN DEERE AG·SE Fraunhofer IESE

Satisfy Phases

- Engineering Method supporting early development phases of information / interactive systems
- Application of TORE in concrete project settings (Experience of Experts)
- Detailed descriptions of phases / activities → Guideline for requirements engineers

JOHN DEERE AG·SE Fraunhofer IESE

TORE Goal- & Task-Level

Focus on stakeholder, their goals & tasks

- Which stakeholders will be supported by the system?
- What are the goals of these stakeholders?
- What are the tasks and responsibilities of these stakeholders?

Activity Analyze Stakeholder (1/3)

Goal

Elicit and analyze detailed information about stakeholders that are to be supported by a (software-) system to be developed

Stakeholders can be

- Persons / group of persons
- Organizations / Organization Units

Techniques

- Interviews / focus groups with stakeholders
- Interviews / focus groups with surrogate-user (marketing, sales, hotlines, trainer)
- Analysis of available documentation

Activity Analyze Stakeholder (3/3)

Role Description

"A user role is an abstract summary of needs, interests, **expectations**, behavior, and responsibilities which is characteristic for prospective system user". [Constantine/Lockwood99]

ID	Role_1
Role	Department Head
Responsibility	management of a department and its employees
Success Criteria	incoming orders, department revenues, employee satisfaction
Typical Tasks	acquisition, personnel management and development, staffing, project planning, strategic planning, budget administration
Communication Partner	division head, staff, secretary

Activity Analyze Goals (1/4)

Goal

Elicit & analyze stakeholder goals

Techniques

- Interviews / focus groups with stakeholders
- Interviews / focus groups with Surrogate-User (marketing, sales, hotlines, trainer)
- Goal Analysis:
  - Identify hierarchies (refinement)
  - Prioritization techniques

Activity Analyze Goals (2/4)

Information

- Project goals
- Business goals
- Individual stakeholder goals
- „Current“ goals
  (that should further be kept)
- Goals that are currently not fulfilled
- Relations between goals
  (Refinements, conflicts)
- Supported Stakeholder
- Priorities
- Rationale

Documentation

- Goal descriptions
- Goal models (And-Or-Trees)

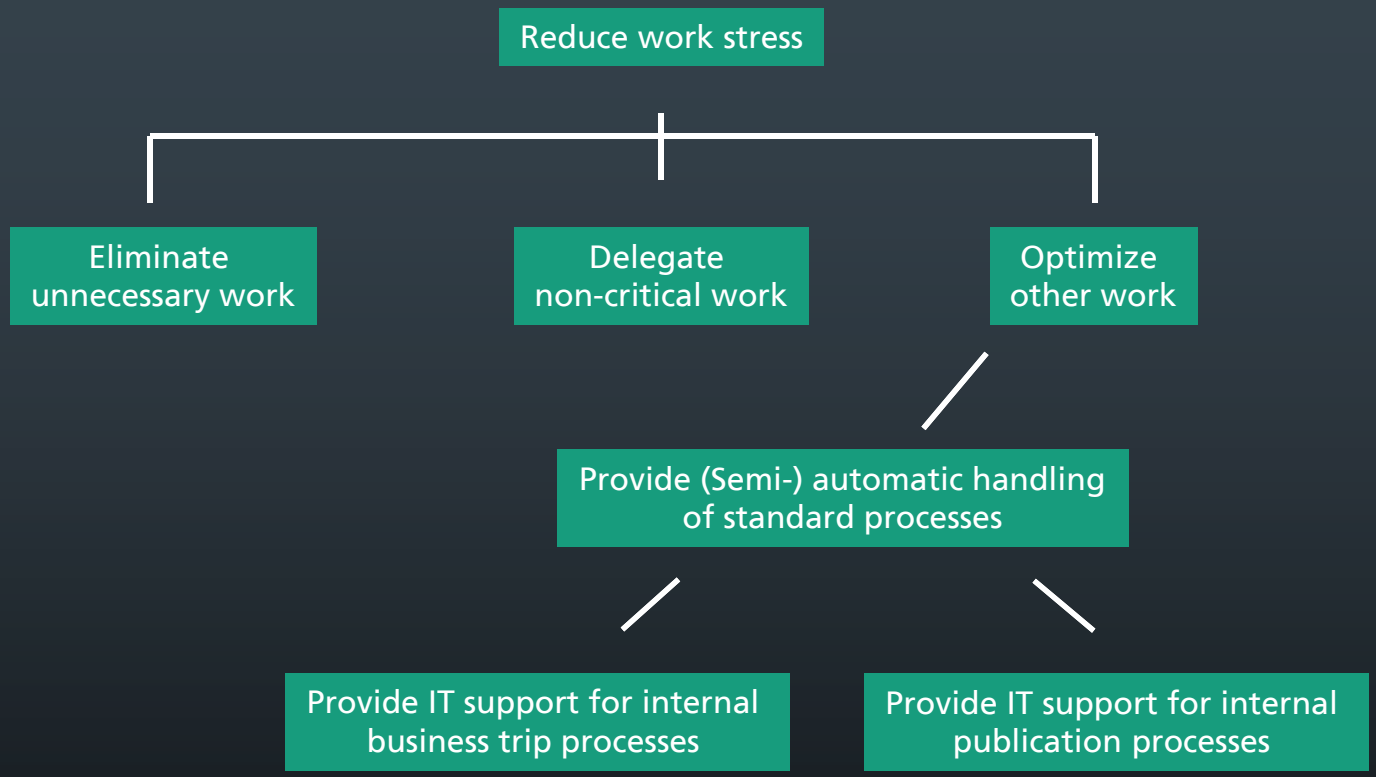
Activity Analyze Goals (3/4)

Goal Description

ID	Goal_3-5
Name	Provide IT-Support for internal business trip processes
Priority	High
Supported Stakeholders	Department head, employees, secretary, travel management, administration
Description	The current manual (paper-based) business trip process should be supported by IT
Superior Goal(s)	Goal_3: Provide (Semi-) automatic handling of standard processes
Sub-Goal(s)	Goal_3-5-1 Provide IT-Support for business trip planning Goal_3-5-2 Provide IT-Support for business trip accounting
Conflicting goals	Goal_5: Low costs

Activity Analyze Goals (4/4)

Goal Model (And-Or-Tree)



- allow hierarchical decomposition of goals
- thus allow systematic derivation of a system's core features from the actual goals of the stakeholders

Activity Analyze Tasks (1/3)

Goal

Identify and analyze stakeholder tasks

Tasks

- Tasks describe a Sequential set of activities to achieve a specific goal under specific preconditions
- Tasks should be contained within themselves and their granularity should not be too fine
  - Good example: book hotel, settle travel expenses
  - Bad example: enter destination

JOHN DEERE AG·SE Fraunhofer IESE

Activity Analyze Tasks (2/3)

Techniques

- Interviews / focus groups with end users
- Interviews / focus groups with Surrogate-User (marketing, sales, hotlines, trainer)
- Observations
- Analysis of available documentation

Information

- Goal(s) of the tasks
- Role
- Execution Profile (Frequency, Complexity)
- Reason(s) / Motive(s)
- Preconditions
- Required Information (i.e., Input)
- (Intermediate) Results (i.e., Output)
- Priority
- Ressources (e.g., external Systems, further involved roles)
- Quality Requirements / NFR

Activity Analyze Tasks (3/3)

Task Description

Abstract summary of **why** the task is being performed (goals, reasons, priority) and **which impact** this has on the environment (precondition, input, output, resources)

ID	Task_01
Name	Perform Business Trip
Goal	Attend business appointment in different location
Role	Department Head
Reasons / Motives	Meeting with business partner, presentation, rendering of a service
Priority	High
Execution Profile	Frequent, interruptions not common
Precondition	Travel date known
Input	Travel Date
Output	Reimbursement of travel expenses
Resources	Business trip management system, department head, secretary, employees, financial settlement, etc.
Quality Requirements / NFR	N/A

TORE Domain-Level

Focus on processes / activities, system responsibilities and data

- How do current processes / activities look like?
- How will processes / activities be executed with the system to be developed?
- What are particular system responsibilities?
- What data is important on the domain level?

JOHN DEERE

AG·SE

Fraunhofer IESE

Activity Analyze As-Is Activities (1/3)

Goal

Elicit and analyze current processes / activities ("As-Is Activities") including problems

Techniques

- Interviews / focus groups with stakeholders
- Interviews / focus groups with surrogate-user (marketing, sales, hotlines, trainer)
- Observations
- Analysis of available documentation

JOHN DEERE

AG·SE

Fraunhofer IESE

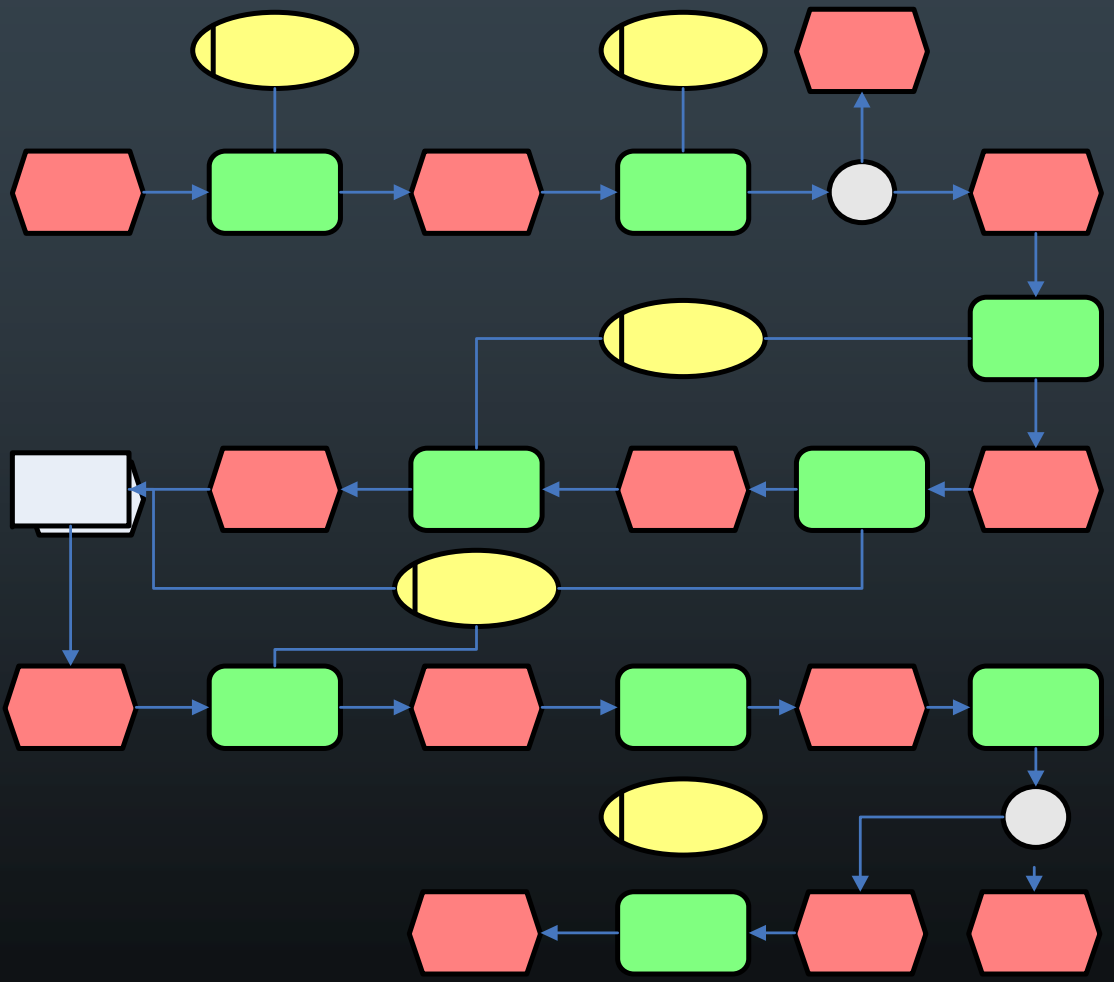
Activity Analyze As-Is Activities (2/3)

Information

- Goals
- Is-Activities
- Role(s)
- Ressources
- Documents / Data (Input)
- Documents / Data (Output)
- Preconditions
- Postconditions
- (Business-) Rules
- Quality Requirements / NFR
- Current Problems
- Solution Ideas

Documentation

- Free-text description
- Structured text (bullets)
- Graphical representation through
  - UML activity diagrams
  - EPCs (event-controlled process chains)



Activity Specify Interactions (1/2)

Goal

Specify system-supported activities in form of detailed interaction descriptions

Informationen

- Goal(s)
- Actor(s)
- Preconditions
- Interaction (Flow of events)
- Exceptions
- Alternatives
- (Business-) Rules
- Quality Requirements / NFR
- Data
- System Functions
- Preconditions

JOHN DEERE AG·SE Fraunhofer IESE

Activity Specify Interactions (2/2)

Documentation

- Use Case Descriptions
- Use Case Diagrams
- Free-text description
- Structured text (bullets)
- Graphical representation through
  - UML activity diagrams
  - EPCs

ID	UC1
Name	Submit travel application
Goal	An official application for a business trip exists
Actor	Employee
Precondition	A date and a location for the trip are known
Description	1. The actor logs onto the business trip management system using his personal access data 2. The system shows him the personalized business trip overview [incorrect user data]. 3. The actor initiates a new business trip. 4. The system shows him the form for recording the travel application. 5. The actor fills in the application form. 6. The system saves the travel application.
Exceptions	[incorrect user data] 2a. The system informs the user about incorrect data und asks the user to submit his data. 3a. The actor initiates a new business trip.
(Business) Rules	The employee has to submit a travel application two days before the travel at the very latest.
Quality Requirements	**Usability**: the form for recording the travel application should distinguish required from optional data. **Efficiency**: the system should display the business trip overview within 2 seconds.
Data	Employee data, travel application data
System Functions	SF1. Display business trip overview SF2. Display input mask SF3. Save travel application
Post-Conditions	A travel application has been created and saved in the system.

Activity Specify System Functions (1/2)

Goal

Specify system activities in form of detailed system function descriptions.

Information

- Required Input
- Preconditions
- Descriptions
- Exceptions
- Alternatives
- (Business-) Rules
- Quality Requirements / NFR
- Output
- Postconditions

Activity Specify System Functions (2/2)

Documentation

- System function descriptions
- textual descriptions (industry)

ID	SF3
Name	Save travel application
Input Data	Employee data, travel application data
Precondition	All travel application data are available
Description	1. The system creates a logical connection between employee data and travel application data. 2. The system saves the travel application data. 3. The system identifies the department head of the employee submitting the application. 4. The system creates an email notification concerning the travel application received. 5. The system sends the email notification it has created to the department head it has identified [Out-Of-Office Reply]
Exceptions	[Out-Of-Office Reply] 6. In case that the system receives an Out-Of-Office Reply the system identifies the responsible division head 7. The system creates an email notification concerning the travel application received. 8 The system sends the email notification to the division head it has identified
(Business) Rules	Email notifications are first sent to the department head. Only in case that the department head is out of office, the notifications are sent to the division head.
Quality Requirements	*Efficiency: The Email notification has to be sent to the department head within 1 minute after the system has saved the application data*
Output Data	Email notification
Post-Conditions	A new business trip has been created in the system. The responsible department head has been informed.

Activity Analyze Interaction Data (1/2)

Goal

Identify and analyze relevant interaction data (exchanged between the user and the system) including attributes and relations.

Technique

- Supplement the domain data model with interaction data (classes / attributes)
- Identify additional data information
  - Format (zB. *@*.*)
  - Length / size
  - Types (Integer, String, boolean…)

Activity Analyze Interaction Data (2/2)

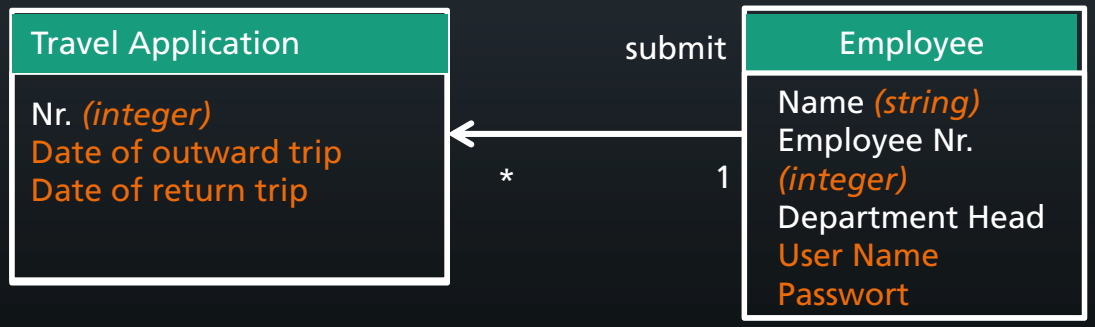
A **travel application** has a number. Each travel application consists of the date of the outward trip and return trip. It can be submitted by no more than one employee. Each employee can submit several travel applications

Information

- Concepts / Terms
- Attributes
- Relations

Documentation

- Class diagrams
- Object diagrams
- ER diagrams
- Glossary



Activity Define UI Structure (1/2)

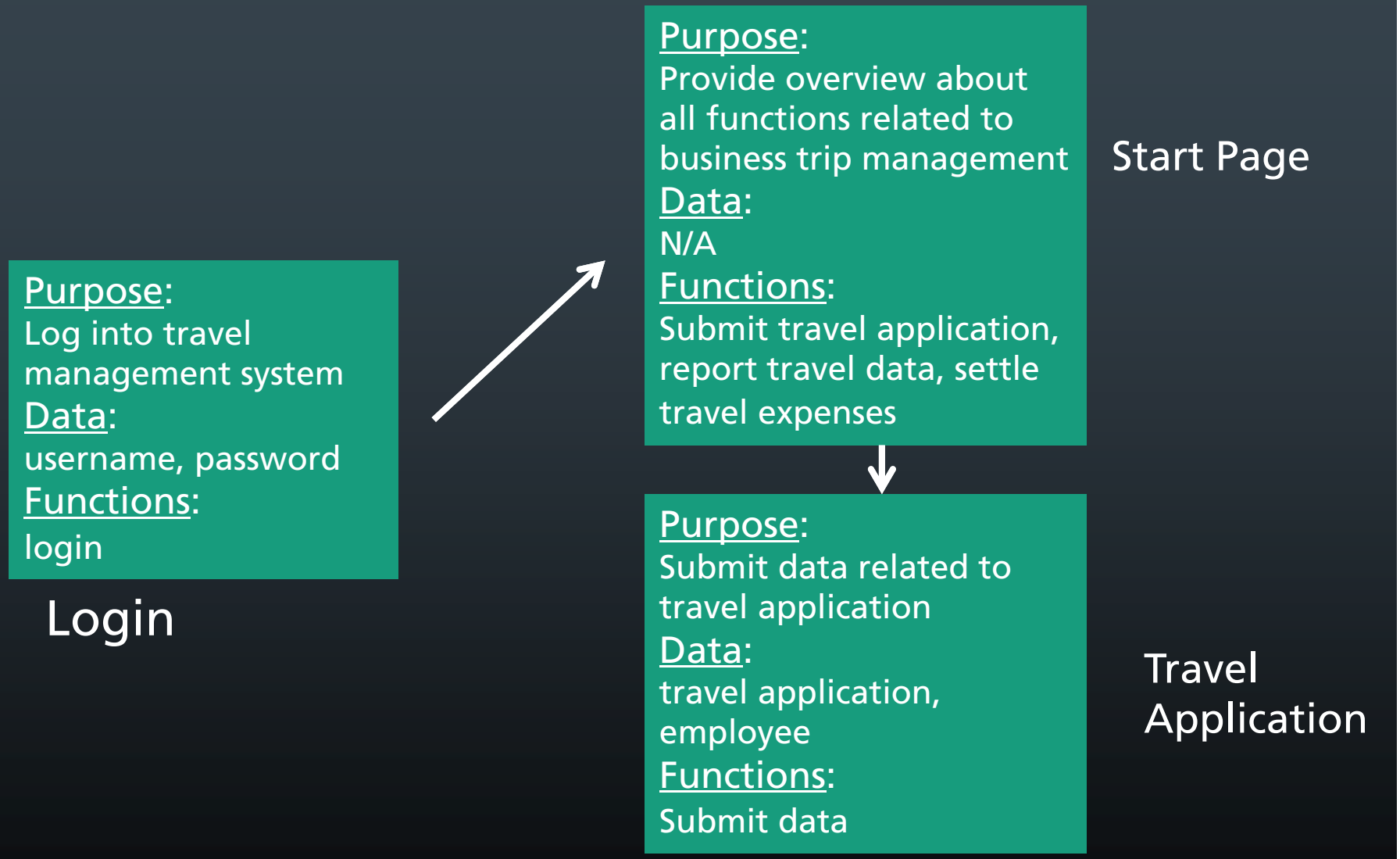
Goal

Group logically related functionalities (use cases, system functions) and data into workspaces

Techniques

- 1st Step: For each system responsibility create a workspace that shows which data the user wants to see and which functions the user can execute
- 2nd Step: group logically related workspaces together

Aktivität UI Strukturen definieren (2/2)



--- Tipps / Guidelines ---

Requirements Specification

Requirements specification seen as activity is a

- **consistent**
- **complete**
- **unique / unambiguous**
- **correct**
- **revisable**
- **traceable**

documentation of requirements for a system in a notation stakeholders are able to understand

Consistency

Requirements specifications are consistent if there are no conflicts between requirements / if requirements do not contradict each other

- Examples of inconsistencies:
  - „user enters travel location“, „user enters destination“ (usage of different terms for the same objects)
  - Req A: „Data must always be specified via keypad“ Req B: „Data must always be specified via voice input“ (conflicts)
- Tipps:
  - Usage of Glossary
  - Avoid Synonyms (Customer number ←→ Customer ID)
  - Avoid Homonyms („Bank“)

Completeness

Requirements specifications are complete if every requirement is completely specified and if all relevant requirements are contained in the document

- Tipps:
  - Usage of standard contents / reference structures
  - Systematic derivation / refinement of requirments (goals → system functions)

Completeness

IEEE-830 Template (1/3)

1. Introduction

1.1 Purpose

1.2 Scope (Name, General System Description, Benefits)

1.3 Definitions, acronyms, and abbreviations

1.4 References

1.5 Overview

JOHN DEERE

Fraunhofer IESE

IEEE-830 Template (2/3)

2. Overall description

2.1 Product perspective: System interfaces, user interfaces, HW interfaces, SW interfaces, Communications Interfaces Memory constraints

2.2 Product functions

2.3 User characteristics

2.4 Constraints

2.5 Assumptions and dependencies

Completeness

IEEE-830 Template (3/3)

3. Specific requirements

- 3.1 External interfaces
- 3.2 Functions
- 3.3 Performance requirements
- 3.4 Logical database requirements
- 3.5 Design constraints
- 3.6 Standards compliance
- 3.7 Software system attributes
  - Reliability
  - Availability
  - Security
  - Maintainability
  - Portability

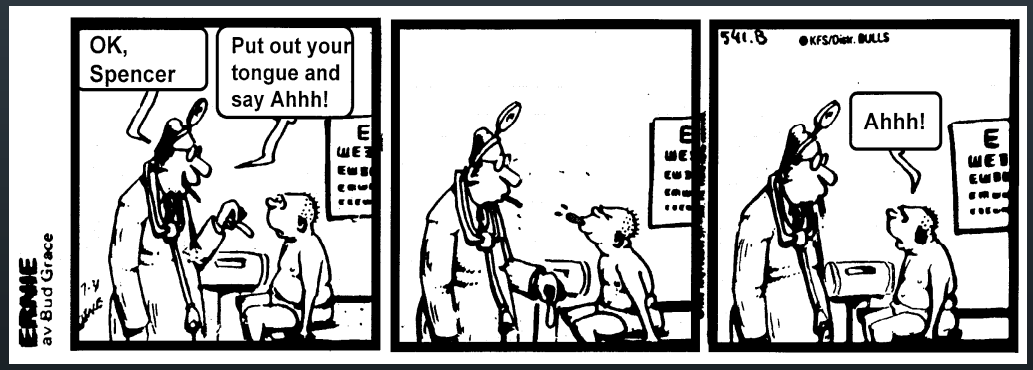
Appendixes

JOHN DEERE

Fraunhofer IESE

Uniqueness / Unambiguousness

A requirement is unique (unambiguous) if it is specified in such a way that it can only be interpreted in a single way



Uniqueness / Unambiguousness

- Examples of ambigiousness:
  - “The driver authenticates himself by using an electronic card and a PIN. In case that it is invalid, the engine can not be started.“
    - PIN or card invalid?
    - Better: in case that the PIN is invalid….
- Tipps:
  - Avoid usage of passive formulation (use active)
    - Bad: “The data is verified” (by whom? By User? By System?)
    - Good: “The system verifies the data”
  - Avoid weakwords (frequently, if possible, eventually, …)

Traceability

Requirements are traceable if they can be traced from to their origin (source) to their realization

Traceability supports

- Change Management
- Verifiability
- ....

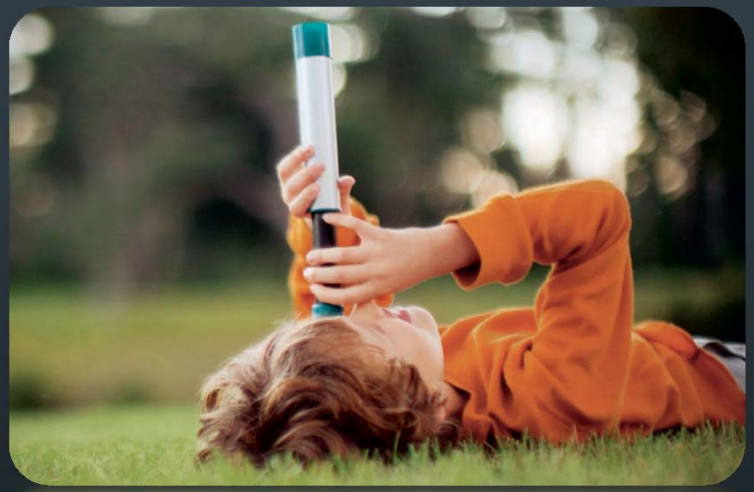
- Tipps:
  - Usage of unique Identifiers
  - Usage of Traceability Matrices / Graphs
  - Usage of references

JOHN DEERE

Fraunhofer IESE

-- Your task... --

Your next tasks (Requirements Engineers)



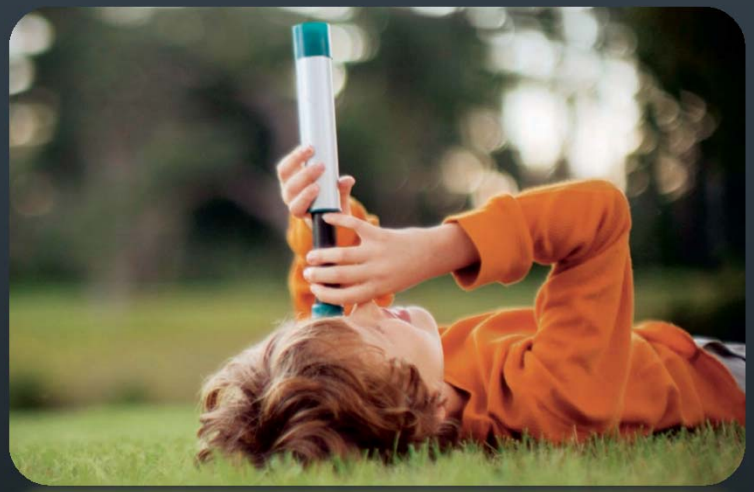
- ✓ How to apply TORE / Satisfy in this project?
  - ✓ What activities are relevant?
  - ✓ What information is relevant?
- ✓ Prepare requirements specification templates
- ✓ Prepare elicitation guideline
- ✓ Elicit & specify requirements for 1st iteration
  - ✓ Prepare templates to specify requirements

JOHN DEERE

AG·SE

Fraunhofer IESE

Your next tasks (Requirements Engineers)



Meet me@Thursday
afternoon or Friday morning?

- ✓ How to apply TORE / Satisfy in this project?
  - ✓ What activities are relevant?
  - ✓ What information is relevant?
- ✓ Prepare requirements specification templates
- ✓ Prepare elicitation guideline
- ✓ Elicit & specify requirements for 1st iteration
  - ✓ Prepare templates to specify requirements