Requirement Engineering

Lecture 10: Requirements Validation

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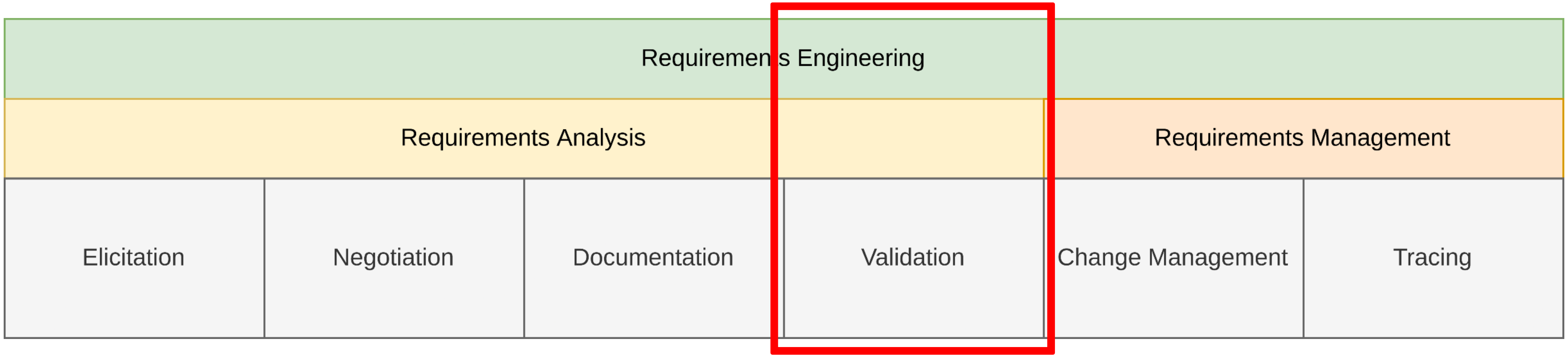
General Requirements Engineering Process

Overview



Requirements Engineering

Requirements Analysis

Requirements Management

Elicitation

Negotiation

Documentation

Validation

Change Management

Tracing

Lecture 10: Requirements Validation

Content

1. Requirements Validation in General
2. Principles of Requirements Validation
3. Requirements Validation Techniques

REQUIREMENTS VALIDATION IN GENERAL

Requirements Validation in General

Why?

- Review of the requirements
  - Should uncover errors in requirements
- Present requirements to stakeholders
  - Identify deviations between requirements and actual wishes
- Quality of requirements is evaluated
  - Decision is made if quality is sufficient
  - Leads to approval of requirements
  - Should use predefined criteria

Requirements Validation in General

Quality Aspects of Requirements

Three major goals of validation:

- Content
  - Are all relevant requirements elicited and documented?
  - Is the level of detail appropriate?
- Documentation
  - Is the documentation according to predefined guidelines and specifications?
- Agreement
  - Do all stakeholders concur with the documented requirements

Requirements Validation in General

Quality Aspects – Content

- Refers to the content of the document
  - The requirements themselves
  - The completeness of the requirements

Requirements Validation in General

Quality Aspects – Documentation

- Validates the documentation of the requirements
  - Flaws in the documentation
  - Violation of documentation guidelines
    - Project specific
    - Organization specific
  - Understandability of document formats
  - Structure of the documents

Requirements Validation in General

Quality Aspects – Documentation (Guideline Violation Risks)

- Impairment of development activities
  - Development activities may require certain document formats
  - For example, consider the Rational Unified Process (RUP)
    - Later stages refine models created during the requirements engineering
    - If models have not been created, refinement is not possible
- Misunderstandings
  - The target audience may not understand or misinterpret requirements in certain document formats
  - Requirements may become unusable

Requirements Validation in General

Quality Aspects – Documentation (Guideline Violation Risks)

- Incompleteness
  - Relevant information may be missing from the document
  - Must not necessarily be the requirements themselves
    - Stakeholders involved
    - Persons responsible
- Overlooking requirements
  - Requirements documented at the wrong place → Not missing!
  - May be overlooked in later activities → Example: Developer wants to implement the persistence features of a system. Checks section “4.3 Persistence requirements” and implements all documented features. Additional persistence requirements hiding in other sections

Requirements Validation in General

Quality Aspects – Documentation (Test Criteria)

- Conformation to documentation format and rules
  - Are all documents in the predetermined documentation format?
  - Have modeling languages been used properly?
- Conformity to documentation structures
  - Has the structure of the document been maintained?
  - Is everything where it belongs?
- Understandability
  - Is the documentation understandable in the given context?
  - Is the glossary sufficient?

Requirements Validation in General

Quality Aspects – Agreement

- Stakeholders gain additional knowledge during the course of requirements engineering
  - May lead to changes between the begin of the elicitation and the end of the documentation
  - Validation offers a last opportunity for changes without impacting later phases
- Test criteria
  - Agreed → Is every requirement agreed upon with all relevant stakeholders?
  - Agreed after changes → Is every requirement agreed upon with all relevant stakeholders after it has been changed?
  - Conflicts resolved → Have all known conflicts with regard to the requirements been resolved?

PRINCIPLES OF REQUIREMENTS VALIDATION

Principles of Requirements Validation

Overview

- 6 principles of requirements validation

Principles of Requirements Validation

Overview

1. Involvement of the correct stakeholders

- Independence of the author
  - Author should not be the one validate a requirement
  - Has prior knowledge which influences the validation
- Internal auditors
  - Stakeholders that are members of the developing organization
  - Easy to organize
- External auditors
  - Higher effort
  - Have to become familiar with the document
  - Independent perspective

Principles of Requirements Validation

Overview

2. Separating the identification and the correction of errors

- Identify flaw
- Document flaw
- Fix flaw
- Separation allows concentration on identification → Better separation of resources

3. Validation from different views

- Different people → Different perspectives

Principles of Requirements Validation

Overview

4. Adequate change of documentation type

- Check if usage of different documentation types balances out weaknesses
- Natural language → Very expressive
- Conceptual models → Abstraction and complex behavior

5. Construction of development artifacts

- Creation of artifacts reveals ambiguities
- Example:
  - Creation of a test case to validate the requirement
  - Problems during the test creation

Principles of Requirements Validation

Overview

6. Repeated validation

- Positive validation at one point does not guarantee that a requirement is still valid at a later point in time
- Should be repeated in the following cases
  - Lots of innovative ideas and technologies
  - Significant gain of knowledge
  - Long-lasting projects
  - Very early previous validation
  - Unknown domain
  - Reuse of requirements

VALIDATION TECHNIQUES

Validation Techniques

Overview

- 6 validation techniques in this lecture

- Three types of reviews
  - Commenting
  - Inspections
  - Walk-throughs
- Three supporting techniques
  - Perspective-based reading
  - Prototypes
  - Checklists

Validation Techniques

Commenting

- Author gives requirements to another person
  - Usually a co-worker
- Receive expert opinion of the other person
  - Marks flaws in the document
  - Briefly discusses the flaws with the author
- Informal and cheap

Validation Techniques

Inspection

Systematic check development artifacts for errors

- Consists of 4 phases
  - Planning
    - Object and goals of the inspection are determined
    - Roles and participants are selected
  - Overview
    - Author explains the requirements to the inspection team → Common understanding
  - Error detection
    - Inspectors analyze the requirements for flaws
      → Individually or in teams
  - Error collection and consolidation
    - Results are collected and consolidated
    - Duplicate errors removed
    - Check if each finding is indeed an error

Validation Techniques

Inspection – Roles

- Organizer
  - Plans and supervises the inspection process
- Moderator
  - Leads collection and consolidation session
  - Neutral
- Author
  - Explains the requirements
  - Responsible for error correction
- Reader
  - Introduces the requirements to be inspected
  - Neutral (usually the moderator)

Validation Techniques

Inspection – Roles

- Inspectors / Reviewers
  - Responsible for the flaw detection
  - Communicate findings to members of the project team
- Minute-taker / Recorder
  - Takes minutes of the results during the collection and consolidation session
  - Writes protocol of the inspection results

Validation Techniques

Walk-Through

- “Lightweight” inspection
  - Less strict
  - Roles not strongly differentiated
- Step-by-step “walk-through” of the requirements during the review session
  - Author introduces the requirements
    - Can use the opportunity to give additional details about the requirements
    - For example, rationale for a decision

Validation Techniques

Perspective-based Reading

- Validate the requirements from a certain perspective
- Examples:
  - User/customer perspective → Do the requirements meat the expectations and desired functions of a user?
  - Software architect perspective → Do the requirements contain all information required for the architectural design?
  - Tester perspective → Do the requirements contain all information necessary to derive test cases?
  - Content / documentation / agreement perspective

Validation Techniques

Prototypes

- Implement something to try out
  - Not everything, but a subset of the requirements
- Throw-away prototypes
  - Use once, throw away
- Evolutionary prototypes
  - Develop further after prototypical use
    - Additional prototypes
    - Development artifact

Validation Techniques

Prototypes

- Validation with prototypes requires
  - Manuals / Instructions → Information necessary to apply the prototype
  - Validation scenarios
    - Scenarios to perform with the prototype
    - Encompasses data and user interactions
  - Checklist with validation criteria → Define how users of the prototype validate the requirements
- Results:
  - Protocol of the auditor → Experiences with the prototype of the auditor
  - Observation protocol (optional) → “Second person” writes protocol of how the auditor interacted with the prototype

Validation Techniques

Checklists

- Set of questions and/or statements about a certain circumstance
  - Make sure no aspect is omitted
  - Should not be longer than a single page
- Can be used in combination with all previously introduced techniques
  - Provide a guideline
  - Automatically structure review results

Validation Techniques

Checklists

- Sources for checklist entries
  - The three quality aspects of requirements
  - Principles of requirements validation
  - Criteria for good requirements (Lecture 06, Part 2, Section 1)
  - Characteristics for good requirements documents (Lecture 06, Part 3, Section 1)
  - Experience from prior projects
  - Error statistics

Validation Techniques

(Software-) Reviews – Its Complicated

- 90% of all companies choose testing as their only quality assurance measure
- Test requires executable code → Bugs are discovered late
- Failures are discovered not the bugs themselves
  - Isolation of the error requires additional effort
- Not all errors are found with testing
  - No proof of correctness
- Test effort ("debugging") often more than 50% of the development effort

Validation Techniques

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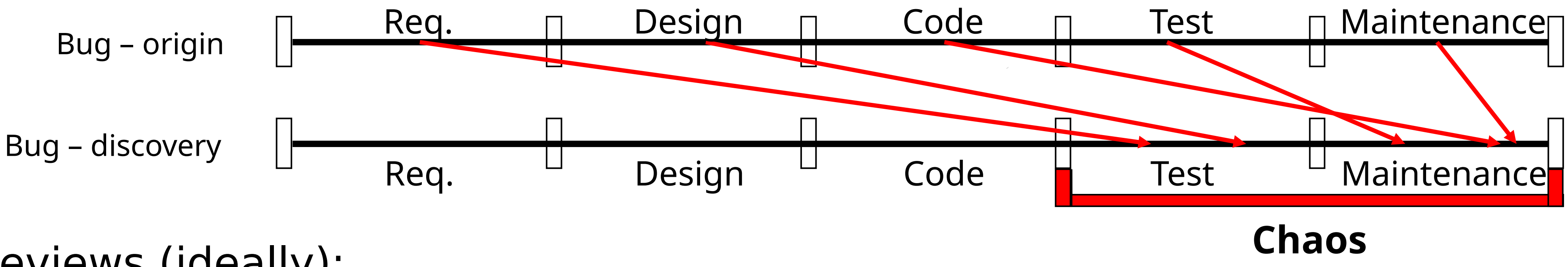
- → Do not use “reviews” as your only validation technique

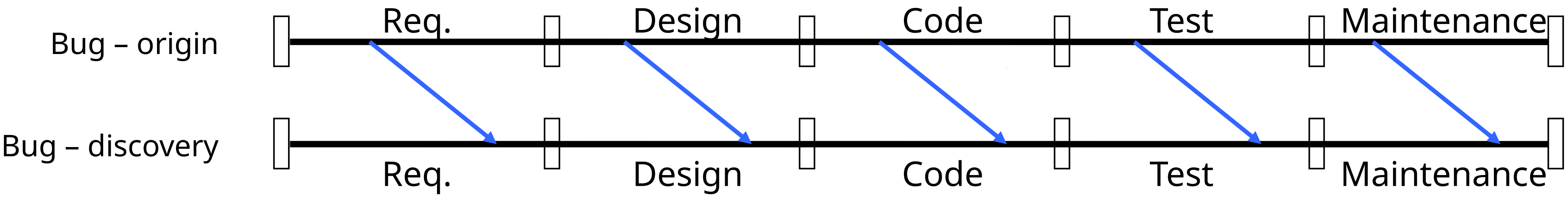
Validation Techniques

(Software-) Reviews – Overview

Without reviews

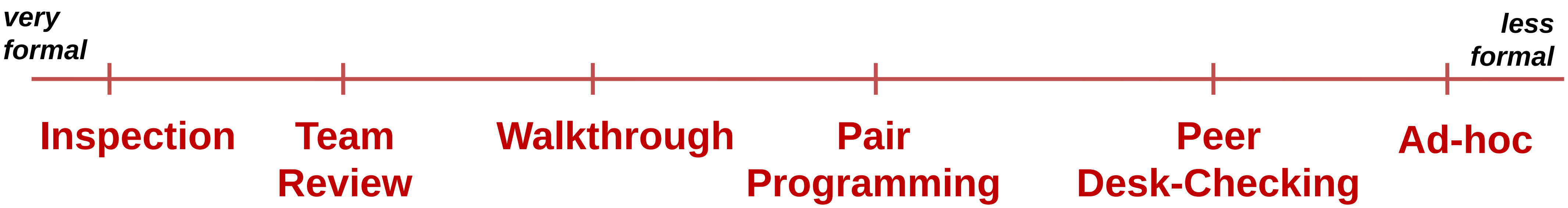


With reviews (ideally):



Validation Techniques

Review Techniques – Overview


very formal
less formal
Inspection
Team Review
Walkthrough
Pair Programming
Peer Desk-Checking
Ad-hoc

- Inspections as the most reliable review technique
  - Empirical studies
  - Inspections find 50% more defects than walkthroughs
  - Inspections find up to 6x more defects than ad-hoc reviews

Validation Techniques

Review Techniques

- Ad-hoc Review
  - If you cannot solve a problem, you spontaneously ask an employee for help
  - Result depends entirely on the experience of one employee
- Peer Desk-Checking
  - Similar to ad-hoc review
  - The employee "executes the product to be checked on paper" (mostly code)

Validation Techniques

Review Techniques

- Pair Programming
  - Two developers share a PC workstation. While one operates the keyboard, the other checks the input.
  - One of the practices of eXtreme Programming.

- Walkthrough
  - The author of a document presents it to collaborators to gain a general understanding and improve the quality of the document.
  - No predefined process and no guidance on how to find errors.
  - Risk: The author easily forgets to focus on the essential parts of the document during the presentation.

Validation Techniques

Review Techniques

- Team-Review
  - Similar to the inspection technique but less formal
  - Several employees inspect a product individually
  - The results are discussed in a meeting with the author

SUMMARY

Summary

- Validation ensures quality of the requirements
- Makes sure all stakeholders are on the same page
  - Also offers last chance for changes without negative impact on later phases
- Different aspects of quality
  - Content, documentation, agreement
- Should abide by the six principles of validation
  - Increases the quality of validation results
- Different techniques available for validation
  - Usually some flavor of a review
  - Checklists are helpful

Questions?

References

- Additional literature on reviews and software inspection
  - Karl E. Wiegers (2002) – Peer Reviews in Software – A practical Guide.
  - T. Gilb, D. Graham (1993) – Software Inspection.