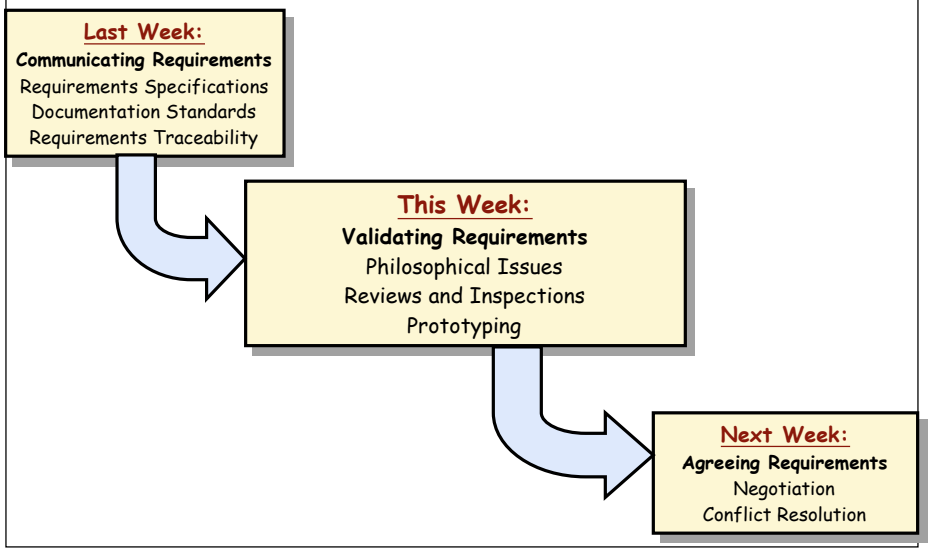
Lecture 10: Validating Requirements



Overview

→ Two key problems for getting agreement:
- 1) the problem of validation
  - What is "truth" and what is "knowable"?
- 2) the problem of negotiation
  - How do you reconcile conflicting goals in a complex socio-cognitive setting?

→ Validating Requirements
- Inspections and Reviews
- Prototyping

→ Negotiating Requirements (next week)
- Conflict and Conflict Resolution
- Requirements Negotiation Techniques
  - Argumentation approaches
  - Knowledge-based approaches
- Requirements Prioritization

The problem of validation

→ logical positivist view:
- "there is an objective world that can be modeled by building a consistent body of knowledge grounded in empirical observation"

↳ In RE, assumes there is an objective problem that exists in the world
- Build a consistent model; make sufficient empirical observations to check validity
- Use tools that test consistency and completeness of the model
- Use reviews, prototyping, etc to demonstrate the model is "valid"

→ Popper's modification to logical positivism:
- "theories can't be proven correct, they can only be refuted by finding exceptions"

↳ In RE, design your requirements models to be refutable
- Look for evidence that the model is wrong
- E.g. collect scenarios and check the model supports them

→ post-modernist view:
- "there is no privileged viewpoint; all observation is value-laden; scientific investigation is culturally embedded"
- E.g. Kuhn: science moves through paradigms
- E.g. Toulmin: scientific theories are judged with respect to a *weltanschauung*

↳ In RE, validation is always subjective and contextualised
- Use stakeholder involvement so that they 'own' the requirements models
- Use ethnographic techniques to understand the weltanschauungen

Reviews, Inspections, Walkthroughs…

Source: *Adapted from Blum, 1992, pp369-373*

→ Note: these terms are not widely agreed

↳ formality
- informal: from meetings over coffee, to team get-togethers
- formal: scheduled meetings, prepared participants, defined agenda, specific format, documented output

↳ "Management reviews"
- E.g. preliminary design review (PDR), critical design review (CDR), …
- Used to provide confidence that the design is sound
- Attended by management and sponsors (customers)
- Usually a "dog-and-pony show"

↳ "Walkthroughs"
- developer technique (usually informal)
- used by development teams to improve quality of product
- focus is on finding defects

↳ "(Fagan) Inspections"
- a process management tool (always formal)
- used to improve quality of the development process
- collect defect data to analyze the quality of the process
- written output is important
- major role in training junior staff and transferring expertise

Benefits of formal inspection

Source: Adapted from Blum, 1992, pp369-373 & Freedman and Weinberg, 1990.

- Formal inspection works well for programming:
  - For applications programming:
    - more effective than testing
    - most reviewed programs run correctly first time
    - compare: 10-50 attempts for test/debug approach
  - Data from large projects
    - error reduction by a factor of 5; (10 in some reported cases)
    - improvement in productivity: 14% to 25%
    - percentage of errors found by inspection: 58% to 82%
    - cost reduction of 50%-80% for V&V (even including cost of inspection)
  - Effects on staff competence:
    - increased morale, reduced turnover
    - better estimation and scheduling (more knowledge about defect profiles)
    - better management recognition of staff ability
- These benefits also apply to requirements inspections
  - E.g. See study by Porter et. al.

Inspection Constraints

Source: Adapted from Blum, 1992, pp369-373 & Freedman and Weinberg, 1990.

- Size
  - "enough people so that all the relevant expertise is available"
  - min: 3 (4 if author is present)
  - max: 7 (less if leader is inexperienced)
- Duration
  - never more than 2 hours
    - concentration will flag if longer
- Outputs
  - all reviewers must agree on the result
    - accept; re-work; re-inspect;
  - all findings should be documented
    - summary report (for management)
    - detailed list of issues
- Scope
  - focus on small part of a design, not the whole thing
- Timing
  - Examines a product once its author has finished it
  - not too soon
    - product not ready - find problems the author is already aware of
  - not too late
    - product in use - errors are now very costly to fix
- Purpose
  - Remember the biggest gains come from fixing the process
    - collect data to help you not to make the same errors next time

Inspection Guidelines

Source: Adapted from Freedman and Weinberg, 1990.

→ Prior to the review

- schedule Formal Reviews into the project planning
- train all reviewers
- ensure all attendees prepare in advance

→ During the review

- review the product, not its author
  - keep comments constructive, professional and task-focussed
- stick to the agenda
  - leader must prevent drift
- limit debate and rebuttal
  - record issues for later discussion/resolution
- identify problems but don't try to solve them
- take written notes

→ After the review

- review the review process

Choosing Reviewers

Source: Adapted from Freedman and Weinberg, 1990.

→ Possibilities

- specialists in reviewing (e.g. QA people)
- people from the same team as the author
- people invited for specialist expertise
- people with an interest in the product
- visitors who have something to contribute
- people from other parts of the organization

→ Exclude

- anyone responsible for reviewing the author
  - i.e. line manager, appraiser, etc.
- anyone with known personality clashes with other reviewers
- anyone who is not qualified to contribute
- all management
- anyone whose presence creates a conflict of interest

Structuring the inspection

Source: Adapted from Porter, Votta and Basili, 1995

- Can structure the review in different ways
  - Ad-hoc
    - Rely on expertise of the reviewers
  - Checklist
    - uses a checklist of questions/issues
    - checklists tailored to the kind of document (Porter et. al. have examples)
  - active reviews (perspective based reading)
    - each reviewer reads for a specific purpose, using specialized questionnaires
    - effectively different reviewers take different perspectives
- The differences may matter
  - E.g. Porter et. al. study indicates that:
    - active reviews find more faults than ad hoc or checklist methods
    - no effective different between ad hoc and checklist methods
    - the inspection meeting might be superfluous!

Prototyping

- Definitions
  - "A software prototype is a partial implementation constructed primarily to enable customers, users, or developers to learn more about a problem or its solution." [Davis 1990]
  - "Prototyping is the process of building a working model of the system" [Agresti 1986]
- Approaches to prototyping
  - Explanatory
    - explain, demonstrate and inform – then throw away
    - e.g. a 'presentation prototype used at the initiation of the project
  - Exploratory
    - used to determine problems, elicit needs, clarify goals, compare design options
    - informal, unstructured and thrown away.
  - Experimental
    - evaluate technical issues and model behaviour; test suitability of a technology
    - detailed, throw away (or possibly) enhance as product.
  - Evolutionary (e.g. "operational prototypes", "pilot systems"):
    - development seen as continuous process of adapting the system
    - prototype is an early deliverable, to be continually improved.

Throwaway or Evolve?

→ Throwaway Prototyping

- **Purpose:**
  - to learn more about the problem or its solution…
  - hence discard after the desired knowledge is gained.
- **Use:**
  - early or late
- **Approach:**
  - horizontal - build only one layer (e.g. UI)
  - "quick and dirty"
- **Advantages:**
  - Learning medium for better convergence
  - Early delivery □ early testing □ less cost
  - Successful even if it fails!
- **Disadvantages:**
  - Wasted effort if requirements change rapidly
  - Often replaces proper documentation of the requirements
  - May set customers' expectations too high
  - Can get developed into final product

→ Evolutionary Prototyping

- **Purpose**
  - to learn more about the problem or its solution…
  - …and to reduce risk by building parts of the system early
- **Use:**
  - incremental; evolutionary
- **Approach:**
  - vertical - partial implementation of all layers;
  - designed to be extended/adapted
- **Advantages:**
  - Requirements not frozen
  - Return to last increment if error is found
  - Flexible(?)
- **Disadvantages:**
  - Can end up with complex, unstructured system which is hard to maintain
  - early architectural choice may be poor
  - Optimal solutions not guaranteed
  - Lacks control and direction

Brooks: "Plan to throw one away - you will anyway!"