Software Quality Engineering

Lecture 12:
Inspection

Lecture Overview

- Basic Concept and Generic Process
- Fagan Inspection
- Other Inspection and Related Activities
- Other Issues

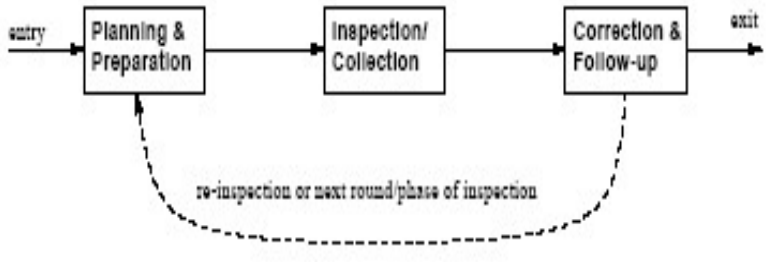
QA Alternatives

- Defect and QA:
  - Defect: error/fault/failure.
  - Defect prevention/removal/containment.
  - Map to major QA activities
- Defect prevention:
  Error blocking and error source removal.
- Defect removal:
  - Inspection: this chapter.
  - Testing, etc.
- Defect containment: Fault tolerance and failure containment (safety assurance).

Inspection as Part of QA

- Throughout the software process
  - Coding phase: code inspection
  - Design phase: design inspection
  - Inspection in other phases and at transitions from one phase to another
- Many different software artifacts:
  - program code, typically
  - requirement/design/other documents
  - charts/models/diagrams/tables/etc.
- Other characteristics:
  - People focus.
  - Not waiting for implemented system.
  - Complementary to other QA activities.

Generic Inspection Process



CFG Example

- Generic process/steps: Fig 14.1 (p.238)
  1. Planning and preparation (individual)
  2. Collection (group/meeting)
  3. Repair (followup)

Inspection Process Variations

- Overall planning:
  - who? team organization/size/roles/etc.
  - what? inspection objects
  - objectives?
  - number/coordination of multiple sessions?
- Technique
  - for preparation (individual inspection)
  - for collection
- What to do with defects?
  - always: detect and confirm defects
  - classify/analyze defects for feedback?
  - Use of post-collection feedback?

Fagan Inspection

- General description
  - Earliest, Fagan at IBM
  - Led to other variations
  - Generic process and steps
- Six steps of Fagan inspection:

1. Planning
2. Overview (1 author-to-n inspectorsmeeting)
3. Preparation (individual inspection)
4. Inspection (n-to-n meeting)
5. Rework (by author)
6. Follow-up

Fagan Inspection

1. Planning
   - what to inspect
   - Team size: about 4 persons
   - Developers/testers from similar projects
2. Overview
   - Author-inspectors meeting
   - General background information
     - functional/structural/info., intentions
   - Assign individual tasks:
     - coverage of important areas
     - moderate overlap

Fagan Inspection

3. Preparation or individual inspection
   - Independent analysis/examination
   - Code as well as other document
   - Individual results:
     - questions/guesses
     - potential defects
4. Inspection (generic: collection)
   - Meeting to collect/consolidate individual inspection results
   - Team leader/meeting moderator (1)
   - Reader/presenter: summarize/paraphrase for individual pieces (assignment)
   - Defect identification, but not solutions, to ensure inspection effectiveness
   - No more than 2 hours
   - Inspection report

Fagan Inspection

5. Rework
   - Author's response
   - Defect fixing (solutions)
6. Follow-up
   - Closing the inspection process by final validation

- Fagan inspection in practice
  - Widely used in industry
  - Evaluation studies
  - Variations and other inspections

Fagan Inspection: Findings

- Importance of preparation:
  - Most defect detected
  - Meetings to consolidate defects
    - alternatives focusing on preparation.
- Other important findings:
  - Team size and #sessions tailored to env.
  - Prefer systematic detection techniques to ad-hoc ones
  - More use of inspection feedback/analysis

Other Inspection Methods

- Variations to Fagan inspection:
  size/scope and formality variations.
- Alternative inspection techniques/processes:
  - Two-person inspection
  - Meetingless inspections
  - Gilb inspection
  - Phased inspections
  - Informal check/review/walkthrough
  - Code reading
  - Code reading with stepwise abstraction
  - Active design reviews
  - Inspection for program correctness

Reduced Size/Scope Inspection

- Two-person inspection
  - Fagan inspection simplified
  - Author-inspector pair
    - reciprocal: mutually beneficial
  - Smaller scale program
- Meetingless inspections
  - Importance of preparation (indiv. insp.)
    (most defects found during preparation)
  - Empirical evidence
  - 1-on-1 instead of team meetings
    (or other feedback mechanisms)

Gilb Inspection (Expanded Fagan)

- Key: A “process brainstorming” meeting right after the inspection meeting
  - root cause analysis
  - parallel to edit (rework)
  - aim at preventive actions/improvement

Gilb Inspection (Expanded Fagan)

- Other characteristics
  - Clearly identified input,
    checklists/rules extensively used
  - Output include change request and suggested process improvement, in addition to inspected documents.
  - Team size: 4-6 people.
  - More emphasis on feedback loop:
    more closely resemble our SQE process (Fig 5.1, p.54)

Other Expanded Fagan Inspections

- Phased inspections
- Overall inspection is divided into multiple phases with each focusing on a specific area
  - Expand Fagan inspection
  - Multiple phases/meetings
  - Each on a specific area/problem-type
  - Dynamic team make-up

Informal Inspection

- Desk check (self conducted):
  - Should focus on conceptual problems
  - Use tools for problems with syntax/spelling/format/etc.
- Informal review (by others):
  - Similar to desk check, but by others
  - Benefit from independent views
  - Group reviews for phase transitions
- Walkthroughs:
  - More organized, but still informal
  - Leading role of author/moderator
  - Less preparation by other participants than in inspection

Formal Inspection: Code Reading

- Code reading
  - focus on code
  - optional meetings
- Code reading by stepwise abstraction
  - basis: program comprehension studies
  - variation to code reading
    - formalized code reading technique
  - top-down decomposition and bottom-up abstraction
  - recent evidence of effectiveness

Formal Inspection: ADR & Correctness

- Active design reviews (ADR)
  - Another formal inspection, for designs
  - Inspector active vs. passive
  - Author prepares questionnaires
  - More than one meeting
  - Scenario based (questionnaires)
  - Overall ADR divided into small ones
  - 2-4 persons (for each smaller ADR)
- Inspection for program correctness
  - Correctness (vs. questionnaire) of:
    - topology (decomposition, hierarchy)
    - invariance (variable relations)
    - robustness (error handling)
  - Close to formal verification

Systematic Inspection Techniques

- Ad-hoc vs. systematic ones below:
  checklist-/scenario-/abstraction-based.
- Checklist-based inspection:
  - Similar to testing checklists
  - Basic types: artifact-/property-based.
- Scenario-based inspection:
  - Similar to usage-based testing.
  - Scenarios ties multiple components.
  - More a usage/external view.
  - Suitable for OOS.
- Abstraction-based inspection:
  - Similar to code reading with stepwise abstraction.

Implementation and Effectiveness

- Implementation support:
  - Process and communication support
  - Repository management tools
  - Defect tracking and analysis as followup
  - Still human intensive
- Effectiveness studies
  - Defect detection technique important
  - Inspector skills/expertise also important
  - Other factors, less than unanimous
  - Many individual variations

Summary

- Key advantages:
  - Wide applicability and early availability
  - Complementary to testing/other QA
  - Many techniques/process to follow/adapt
  - Effective under many circumstances
- Key limitations:
  - Human intensive
  - Dynamic/complex problems and interactions: Hard to track/analyze.
  - Hard to automate.