Software Reviews

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Analysis of Software Artifacts

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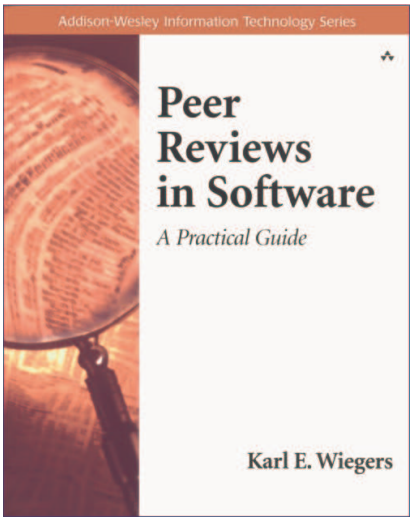
Resources

My primary source:

- Peer Reviews in Software: A Practical Guide. Karl E. Wiegers.
  - Well-written, gives choices and rationale
  - Many other sources available



Benefits of Software Reviews

- Get another perspective
  - Finding defects can be easier for someone who hasn't seen the artifact before and doesn't have preconceived ideas about its correctness
- Transfer of knowledge
  - About the software artifact, and about defect detection
- Find errors early
  - Can dramatically reduce cost of fixing them
- Reduce rework and testing effort
  - Can reduce overall development effort

Reviews vs. Testing

- Can evaluate properties testing can't
  - Maintainability, evolvability, reusability
  - Other properties tough to test
    - Scalability, efficiency
    - Security, integrity
    - Robustness, reliability, exception handling
- Can evaluate artifacts earlier
  - Requirements, design documents
  - Code before test harness is built, or when a fault prevents running a test

Statistics

- Raytheon
  - Reduced "rework" from 41% of cost to 20% of cost
  - Reduced effort to fix integration problems by 80%
- Paulk et al.: cost to fix a defect in space shuttle software
  - $1 if found in inspection
  - $13 during system test
  - $92 after delivery
- IBM
  - 1 hour of inspection saved 20 hours of testing
  - Saved 82 hours of rework if defects in released product
- IBM Santa Teresa Lab
  - 3.5 hours to find bug with inspection, 15-25 through testing
- C. Jones
  - Design/code inspections remove 50-70% of defects
  - Testing removes 35%
- R. Grady, efficiency data from HP
  - System use 0.21 defects/hour
  - Black box 0.282 defects/hour
  - White box 0.322 defects/hour
  - Reading/inspect. 1.057 defects/hour
- Your mileage may vary
  - Studies give different answers
  - These results show what is possible

Inspections / Formal Technical Reviews

- Advance preparation by participants
  - Typically based on checklists
- Formal meeting to discuss artifact
  - Led by moderator, not author
  - Documented process followed
- Formal follow-up process
  - Written deliverable from review
  - Appraise product

Walkthroughs

- No advance preparation
- Author leads discussion in meeting
- No formal follow-up
- Low cost, valuable for education

Other Forms of Review

- Passaround
  - Just the preparation part of an inspection
- Peer deskcheck
  - Examination by a single reviewer
- Ad-hoc
  - Informal feedback from a team member
- Feel free to find your own variant
  - But understand the tradeoffs between techniques
  - Formal technical reviews will find more bugs, but also cost more
    - Ford: 50% more bugs with formal process

Review Roles: Moderator

- Organizes review
  - Keeps discussion on track
  - Ensures follow-up happens
- Key characteristics
  - Good facilitator
  - Knowledgable
  - Impartial and respected
  - Can hold participants accountable and correct inappropriate behavior

Review Roles: Reader

- Presents material (different from author)
  - Provides point of comparison for author and other team members
    - Differences in interpretation provoke discussion
    - Reveals ambiguities vs. if author were to present
      - Wiegers, p. 48
- Alternative
  - Get comments section by section
  - Faster, but does not capture differing perspectives as effectively

Review Roles: Recorder

- Writes down issues

Review Roles: Author

- Not moderator or reader
  - Hard for author to be objective when presenting work or moderating discussion
  - Other inspectors can raise issues more comfortably
- Not recorder
  - Temptation to not write down issues the author disagrees with
- Significant benefits to attending
  - Gain insight from others' perspectives
  - Can answer questions
  - Can contribute to discussion based on knowledge of artifact; others' discussion may stimulate ideas
  - Only downside: meeting is more confrontational

Process: Planning

- Determine objectives
- Choose moderator
- Identify inspectors
  - Good to involve people with connection to artifact
    - e.g. depends on, interfaces with
- Schedule meeting(s)
  - General guideline: 150-200 SLOC/hour, or 3-4 pages/hour
- Prepare and distribute inspection package
  - Deliverable, supporting docs, checklists
  - Cross-reference specs, standards

Process: Overview Meeting

- Informal meeting
- Goal: go over features, assumptions, background, context
- Optional stage
  - May be able to use paper overview or shared context

Process: Preparation

- Inspectors examine deliverable
  - Defects: cause an error in the product
  - Non-defects: improvements, clarification, style, questions
    - May want to list typos/spelling/format/style separately and not discuss during the meeting
  - Conformance to standards & spec
  - Often use checklist
- General guideline
  - prep time ~ meeting time

Process: Meeting

- Reader describes one piece at a time
  - Inspectors respond: defects, questions, suggestions
- Recorder writes down each defect, suggestion, issue
  - This is the primary deliverable
- Moderator
  - Avoid problem solving, inappropriate behavior, lack of participation
- Appraisal of product
  - Accepted (minor changes, no follow up)
  - Accepted conditionally (minor changes, verification)
  - Reinspect following rework (major changes)
  - Inspection not completed
- Gather input on improving inspection process
- Moderator prepares report with appraisal and data
- Variant: reviewers make comments on electronic bulletin board
  - Cost is lower
  - Lose benefits of real meeting
    - Synergy - new bugs found (4%? 25%?)
    - Learning by participants
    - Communication about product

Process: Rework and Follow-up

- Author addresses each item
  - Ensure understands issue
    - Judge whether or not it is a defect
  - Fixes defects and makes improvements
    - Any uncorrected/unverified defects go into defect tracking system
- Deliverables
  - Corrected work product
  - Response to each issue and rationale for action
- Moderator (or verifier) meets with author
  - Check resolution of issues
  - Examine corrected deliverable
- Author checks in code

Process: Analysis

- Casual analysis
  - Analyze root causes of defects
- Make improvements to development and QA processes
  - Add issue to checklist
  - Change testing approach
  - Develop or purchase new static analysis
- Measuring effectiveness
  - % of bugs found during inspection
    - vs. found in inspection and afterwards (test, customer)
- Measuring efficiency
  - Defects per hour
  - Will decrease as your process improves

What to Inspect

- Requirements, design documents
  - hard to validate in other ways
  - especially important to get right
    - cheaper to fix earlier on in process
  - many different views are helpful
- Critical or uncertain pieces of code
- Initial work in large work segment
  - catches mistakes early, when easy to fix
  - allows rest of system to be built with knowledge gained
- Samples of larger body of work

Review Guidelines

- Build reviews into your schedule
  - Otherwise viewed as intrusion
  - Recognize that reviews can accelerate schedule by reducing other V&V activities
- Keep review team small
  - General guidelines: 3-7 participants
    - 3 is minimum for formal process to work
    - Below 3 you don't get enough perspectives besides author
    - Above 7, work goes more slowly, scheduling is difficult, moderating is hard
  - Smaller groups for code, larger groups for other documents
    - Knowledge is spread around more, more stakeholders
- Find problems, but don't try to solve them
  - Typically less expensive to address 1-on-1
  - Guideline: halt solution discussion after 1 minute
- Limit meetings to 2 hours maximum
  - Attention span gets lost beyond this
- Require advance preparation
  - Provides much of the value of a (formal) review

Checklists

- Benefits
  - Focus on likely sources of error
  - Form quality standard that aids preparers
  - Can bring up issues specific to a product
- Should be short
  - Rule of 7 : can only keep about 7 things in the head at once
  - If more than that, group and do multiple passes
- Focus
  - Most important issues
  - Issues unlikely to be found other ways
  - Historical problems
  - Issues specific to the document
- Start with checklist from well-known source
  - Refine based on experience

Social Aspects of Reviews

- Reviews are challenging
  - Authors invest self-worth in product
  - Encourages you to avoid letting others find errors
- For Authors
  - Recognize value of feedback
  - Place value in making code easy to understand
  - Don’t take criticism of code personally
- For reviewers
  - Don’t show off how much better you are
  - Be sensitive to colleagues
    - Bad: "you didn't initialize this variable“
    - Good: "I didn't see where this variable was initialized"

Review Pitfalls

- Letting reviewers be in charge of quality
  - Attitude: “why fix this, the reviewers will find it“
  - Rresponsibility for quality is with author, not reviewers
  - reviewers help in that goal
- Insisting on perfection before review
  - Makes harder to accept suggestions for change
- Using review statistics for evaluation
  - Real world example: manager decides "finding more than 5 bugs during an inspection would count against the author”
    - Weigers '02
  - Negative effects
    - Avoid submitting for inspection
    - Submit small pieces at a time
    - Avoid pointing out defects in reviews (thus missing them)
    - Holding "pre-reviews" that waste time and skews metrics