IT Quality and Software Test

Lesson 4
Static Testing
V1.0

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  - Static Techniques and the Test Process
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Static Techniques and the Test Process

- Dynamic testing techniques
  ⇨ requires the execution of software
- Static testing techniques
  ⇨ without execution of software
  ⇨ early test activity
  - Reviews
    Manual examination of the code or other project documentation (tool support possible)
  - Static analysis
    Automated analysis of the code

Static Techniques and the Test Process

- The main review manual activity is to examine a work product and make comments about it, e.g.
  - Requirements specifications,
  - Design specifications,
  - Code,
  - Test plans,
  - Test specifications,
  - Test cases,
  - Test scripts,
  - User guides,
  - Web pages.

Static Techniques and the Test Process

- Benefits of reviews include
  - early defect detection and correction,
  - development productivity improvements,
  - reduced development timescales,
  - reduced testing cost and time,
  - lifetime cost reductions,
  - fewer defects and improved communication.
- Reviews can find missing items, for example, in requirements, which are unlikely to be found in dynamic testing.

Static Techniques and the Test Process

- Reviews, static analysis and dynamic testing have the same objective – identifying defects.
- They are complementary
  Different techniques can find different types of defects effectively and efficiently.
- Compared to dynamic testing, static techniques find causes of failures (defects) rather than the failures themselves.

Static Techniques and the Test Process

- Typical defects that are easier to find in reviews than in dynamic testing include:
  - deviations from standards,
  - requirement defects,
  - design defects,
  - insufficient maintainability and
  - incorrect interface specifications.

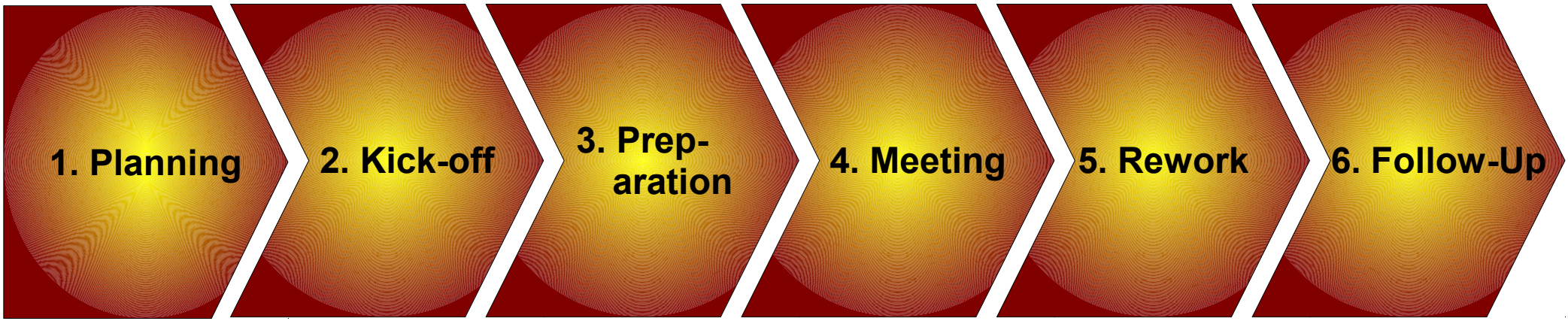
Review Process

- The different types of reviews vary from
  - informal,
    characterized by no written instructions for reviewers,
  - to systematic,
    characterized by team participation, documented results of the review, and documented procedures for conducting the review.
- The formality of a review process is related to
  - maturity of the development process,
  - any legal or regulatory requirements or
  - the need for an audit trail.

Review Process

- The way a review is carried out depends on the agreed objectives of the review, for example
  - find defects,
  - gain understanding,
  - educate testers and new team members,
  - discussion and decision by consensus.

Review Process
Activities of a Formal Review



Review Process
Activities of a Formal Review

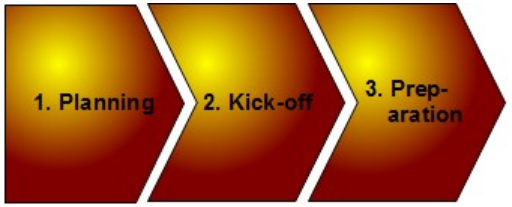
1. Planning

- Defining the review criteria
- Selecting the personnel
- Allocating roles
- Defining the entry and exit criteria for more formal review types (e.g., inspections)
- Selecting which parts of documents to review
- Checking entry criteria (for more formal review types)

Review Process
Activities of a Formal Review

2. Kick-off
   - Distributing documents
   - Explaining the objectives, process and documents to the participants

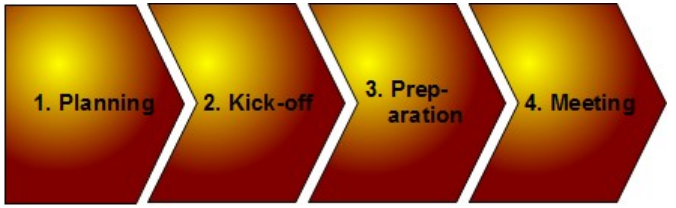
Review Process
Activities of a Formal Review



3. Individual preparation

- Preparing for the review meeting by reviewing the document(s)
- Noting potential defects, questions and comments

Review Process
Activities of a Formal Review

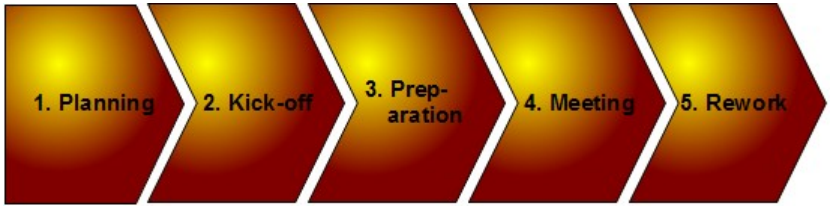


4. Review meeting

   … to examine / evaluate / record results

- Discussing or logging, with documented results or minutes (for more formal review types)
- Noting defects, making recommendations regarding handling the defects, making decisions about the defects
- Examining/evaluating and recording issues during any physical meetings or tracking any group electronic communications

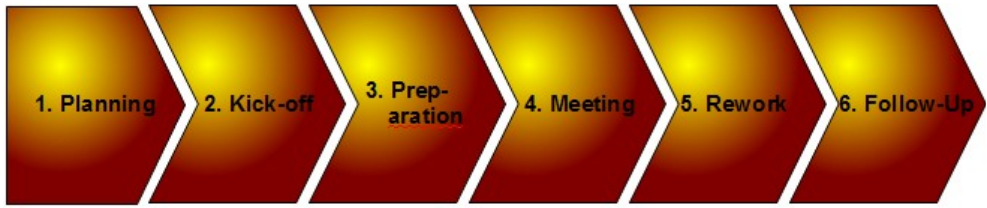
Review Process
Activities of a Formal Review



5. Rework

- Fixing defects found (typically done by the author)
- Recording updated status of defects (in formal reviews)

Review Process
Activities of a Formal Review



6. Follow-up
   - Checking that defects have been addressed
   - Gathering metrics
   - Checking on exit criteria (for more formal review types)

Review Process
Roles and Responsibilities

Overview

- Manager
- Moderator
- Author
- Reviewers (or checkers, or inspectors)
- Scribe (or recorder)

Review Process
Roles and Responsibilities

Manager

- decides on the execution of reviews,
- allocates time in project schedules and
- determines if the review objectives have been met.

Review Process
Roles and Responsibilities

Moderator

- the person who leads the review of the document or set of documents, including
  - planning the review,
  - running the meeting, and
  - following-up after the meeting.
- If necessary, the moderator may mediate between the various points of view and is often the person upon whom the success of the review rests.

Review Process
Roles and Responsibilities

Author

- the writer or person with chief responsibility for the document(s) to be reviewed

Review Process
Roles and Responsibilities

Reviewers (or checkers, or inspectors)

- Individuals with a specific technical or business background who, after the necessary preparation, identify and describe findings (e.g., defects) in the product under review.
- Reviewers should
  - be chosen to represent different perspectives and roles in the review process,
  - take part in any review meetings.

Review Process
Roles and Responsibilities

Scribe (or recorder)

- documents all the items identified during the meeting like
  - issues,
  - problems, and
  - open points

Review Process
Types of Reviews

- Informal Review
- Walkthrough
- Technical Review
- Inspection

- “Peer Review”
  A review of a software work product by colleagues of the producer of the product for the purpose of identifying defects and improvements. Walkthroughs, technical reviews and inspections can be performed

Review Process
Types of Reviews

- A single software product or related work product may be the subject of more than one review.
- If more than one type of review is used, the order may vary, examples:
  - Informal review before a technical review,
  - Inspection on a requirements specification before a walkthrough with customers.

Review Process
Informal Review

- No formal process
- May take the form of pair programming or a technical lead reviewing designs and code
- Results may be documented
- Varies in usefulness depending on the reviewers
- Main purpose: inexpensive way to get some benefit

Review Process Walkthrough (1/2)

- Meeting led by author
- May take the form of scenarios, dry runs, peer group participation
- Open-ended sessions
  - Optional pre-meeting preparation of reviewers
  - Optional preparation of a review report including list of findings
- Optional scribe (who is not the author)
- May vary in practice from quite informal to very formal

Review Process Walkthrough (2/2)

- Main purposes:
  - learning,
  - gaining understanding,
  - finding defects

Review Process
Technical Review (1/3)

- Documented, defined defect-detection process that includes peers and technical experts with optional management participation
- Ideally led by trained moderator (not the author)
- Pre-meeting preparation by reviewers

Review Process
Technical Review (2/3)

- Optional use of checklists
- Preparation of a review report could include
  - list of findings,
  - verdict whether the software product meets its requirements
  - recommendations related to findings
- May vary in practice from quite informal to very formal

Review Process
Technical Review (3/3)

- Main purposes:
  - discussing,
  - making decisions,
  - evaluating alternatives,
  - finding defects,
  - solving technical problems and
  - checking conformance to
    - specifications,
    - plans,
    - regulations, and
    - standards

Review Process Inspection (1/2)

- Led by trained moderator (not the author)
- Usually conducted as a peer examination
- Defined roles
- Includes metrics gathering
- Formal process based on rules and checklists
- Specified entry and exit criteria for acceptance

Review Process Inspection (2/2)

- Pre-meeting preparation
- Inspection report including list of findings
- Formal follow-up process (with optional process improvement components)
- Optional reader
- Main purpose: Finding defects

Review Process Success factors (1/3)

- Checklists, for example
  - based on various perspectives such as user, maintainer, tester or operations,
  - typical requirements problems.
- Attitudes
  - Emphasis on learning and process improvement.
  - Defects found are welcomed and expressed objectively.
  - People issues and psychological aspects are dealt with (e.g., making it a positive experience for the author).
  - Atmosphere of trust: The outcome will not be used for the evaluation of the participants

Review Process
Success factors (2/3)

- Each review has clear predefined objectives.
- Right people for the review objectives are involved.
- Testers are valued reviewers who
  - contribute to the review
  - learn about the product which enables them to prepare tests earlier.

Review Process
Success factors (3/3)

- Training is given in review techniques, especially the more formal techniques such as inspection
- Management supports a good review process (e.g., by incorporating adequate time for review activities in project schedules)

Static Analysis by Tools

- The objective of static analysis is to find defects in software source code and software models.
- Static analysis is performed without actually executing the software being examined by the tool; dynamic testing does execute the software code.
- Static analysis tools analyze program code (e.g., control flow and data flow), as well as generated output such as HTML and XML.

Static Analysis by Tools Value

- Early detection of defects prior to test execution
- Early warning about suspicious aspects of the code or design by the calculation of metrics, such as a high complexity measure
- Identification of defects not easily found by dynamic testing
- Detecting dependencies and inconsistencies in software models such as links
- Improved maintainability of code and design
- Prevention of defects,
  if lessons are learned in development

Static Analysis by Tools
Typical defects discovered (1/2)

- Referencing a variable with an undefined value
- Inconsistent interfaces between modules and components
- Variables that are not used or are improperly declared
- Unreachable (dead) code
- Missing and erroneous logic (potentially infinite loops)

Static Analysis by Tools
Typical defects discovered (2/2)

- Overly complicated constructs
- Programming standards violations
- Security vulnerabilities
- Syntax violations of code and software models

Static Analysis by Tools Usage

- Static analysis tools are typically used
  - by developers (checking against predefined rules or programming standards)
    - before and during component and integration testing,
    - when checking-in code to configuration management tools.
  - by designers during software modeling.
- Compilers may offer some support for static analysis, including the calculation of metrics.

Sources

- International Software Testing Qualifications Board: Certified Tester Foundation Level Syllabus, Released Version 2011, http://istqb.org/display/ISTQB/Foundation+Level+Documents