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# Static Testing

# Learning Objectives

- Static Testing Techniques
- Review Process
  - Activities of a Formal Review
  - Roles and Responsibilities
  - Types of Reviews
  - Success Factors for Reviews
- Static Analysis by Tools

# Static Testing Techniques

## Static Testing

- Testing of a component or system at specification or implementation level without execution of that software, e.g. reviews or static analysis.
- **There are two types of static testing techniques.**
  - Review
  - Static Analysis

## Review

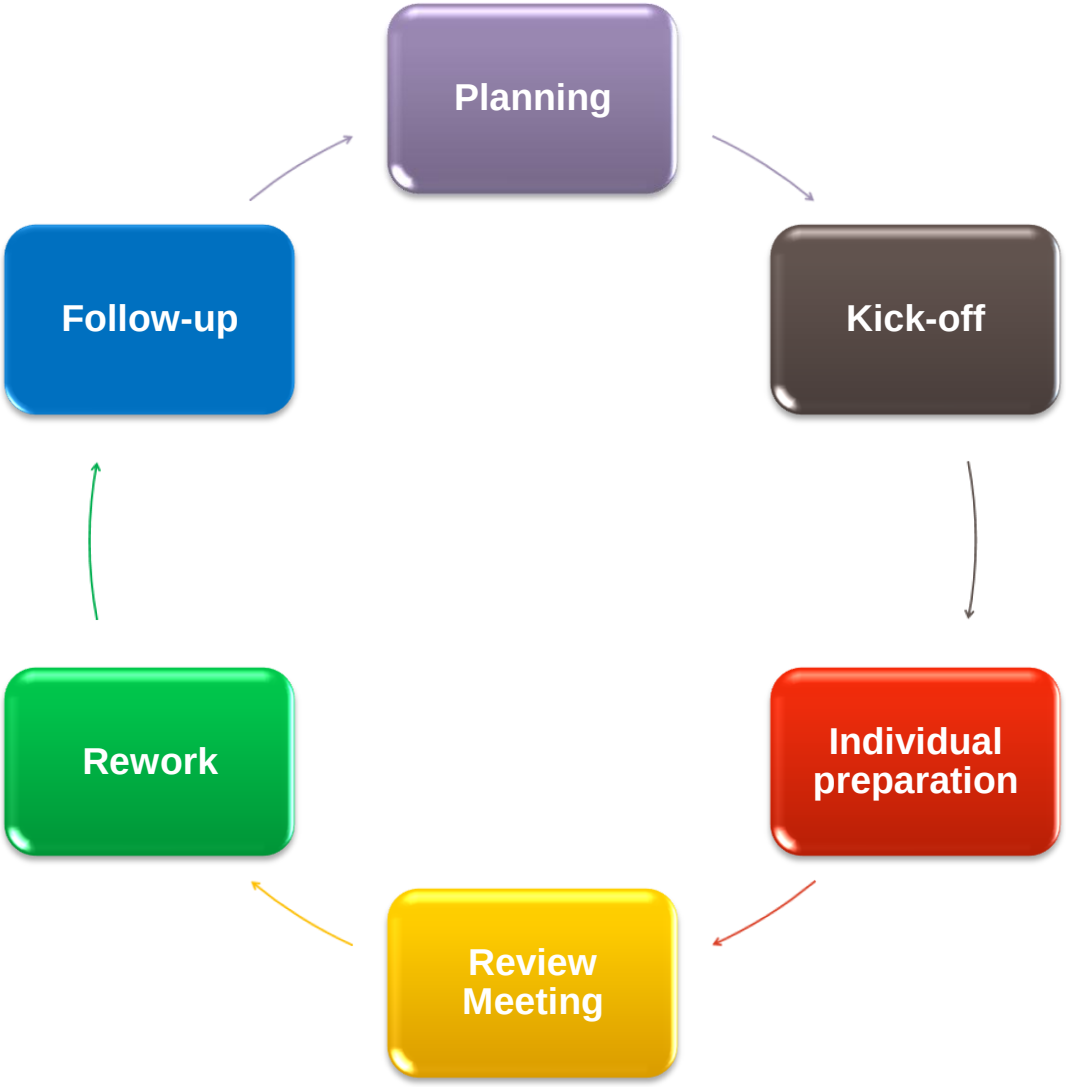
- An evaluation of a product or project status to ascertain discrepancies from planned results and to recommend improvements. [After IEEE 1028]
- Examples: management review, informal review, technical review, inspection, and walkthrough.

## Static Analysis

- Analysis of software artifacts, e.g. requirements or code, carried out without execution of these software development artifacts.
- Static analysis is usually carried out by means of a supporting tool.

# Review Process: Activities of a Formal Review:

**A typical formal review has the following main activities:**



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## Planning

- Defining the review criteria
- Selecting the personnel
- Allocating roles
- Defining the entry and exit criteria
- Selecting which parts of documents to review
- Checking entry criteria

## Kick-off

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

## Individual preparation

- Preparing for the review meeting by reviewing the documents
- Noting potential defects, questions and comments

# Contd..

## Examination/ evaluation/ recording of results (Review Meeting)

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

## Rework

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

## Follow-up

- Checking that defects have been addressed
- Gathering metrics
- Checking on exit criteria

# Roles and Responsibilities

## Manager

- Decides on the execution of reviews.
- Allocates time in project schedules and determines if the review objectives have been met.

## Moderator

- Sometimes known as the Review Leader.
- This person leads the review of the document or set of documents, including planning the review, running the meeting, and follow-ups after the meeting.
- He also makes the final decision whether to release an updated document.

## Author

- The writer or person with chief responsibility for the document(s) to be reviewed.
- In most instances he takes responsibility for fixing any agreed defects.

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## Reviewers

- These are the individuals with a specific technical or business background (also called checkers or inspectors) 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 and take part in any review meetings.

## Scribe (or recorder)

- Documents all of the issues, problems and open points that were identified during the meeting.

# Types of Reviews

## Informal Review

- A review not based on a formal (documented) procedure.
- 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.

## Walkthrough

- A step-by-step presentation by the author of a document in order to gather information and to establish a common understanding of its content.
- 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
- **Main purpose:** learning, gaining understanding, finding defects

# Contd..

## Technical Review

- A peer group discussion activity that focuses on achieving consensus on the technical approach to be taken.
- Documented, defined defect-detection process that includes peers and technical experts with optional management participation.
- May be performed as a peer review without management participation.
- Ideally led by trained moderator (not the author).
- Pre-meeting preparation by reviewers.
- Optional use of checklists.
- Preparation of a review report which includes the list of findings, the verdict whether the software product meets its requirements and, where appropriate, recommendations related to findings.
- May vary in practice from quite informal to very formal.
- **Main Purpose:** discussing, making decisions, evaluating alternatives, finding defects, solving technical problems and checking conformation to specifications, plans, regulations, and standards.

# Contd..

## Inspection

- A type of peer review that relies on visual examination of documents to detect defects, e.g. violations of development standards and non-conformance to higher level documentation.
- The most formal review technique and therefore always based on a documented procedure.
- 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 of the software product.
- Pre-meeting preparation.
- Inspection report including list of findings.
- Formal follow-up process.
- Optional reader.
- **Main Purpose:** finding defects.

# Contd..

## 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.
- Examples are inspection, technical review and walkthrough.

## Key benefits of Reviews

- Makes defects cheaper and easier to remove.
- Can prevent defects from appearing in test execution.
- Development productivity can be improved and time-scales reduced.
- Testing costs and time can be reduced.
- Reductions in lifetime costs can be achieved because fewer defects in the final software ensure that ongoing support costs will be lower.

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- **Types of defects -found in Reviews**
  - ✓ Deviations from standards (either internally or regulatory/ legally).
  - ✓ Requirements defects.
    - Example: the requirements are ambiguous, or there are missing elements.
  - ✓ Design defects.
    - Example: the design does not match the requirements.
  - ✓ Insufficient maintainability.
    - Example: the code is too complex to maintain.
  - ✓ Incorrect interface specifications.
    - Example: the interface specification does not match the design or the receiving or sending interface.

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## Success Factors for Reviews

- ✓ Each review has clear predefined objectives.
- ✓ The right people for the review objectives are involved.
- ✓ Testers are valued reviewers who contribute to the review and also learn about the product which enables them to prepare tests earlier.
- ✓ Any 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).
- ✓ The review is conducted in an atmosphere of trust; the outcome will not be used for the evaluation of the participants.
- ✓ Review techniques are applied that are suitable to achieve the objectives.
- ✓ Checklists or roles are used if appropriate to increase effectiveness of defect identification.
- ✓ Training is given in review techniques, especially the more formal techniques such as Inspection.
- ✓ Management support is essential for a good review process (e.g., incorporating adequate time for review activities in project schedules)
- ✓ There should be an emphasis on learning and process improvement.

# 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.
- Static analysis can locate defects that are hard to find in dynamic testing.
- As with reviews, static analysis finds defects rather than failures.
- Static analysis tools analyze program code (control flow and data flow), as well as generated output such as HTML and XML.
- **The value of static analysis is:**
  - ✓ Early detection of defects prior to test execution.
  - ✓ Early warning about suspicious aspects of the code or design.
  - ✓ 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.

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- Static analysis tools are typically used by developers before and during component and integration testing or when checking-in code to configuration management tools, and by designers during software modeling.
- **Typical defects discovered by static analysis tools**
  - ✓ Referencing a variable with an undefined value.
    - e.g. using a variable as part of a calculation before the variable has been given a value.
  - ✓ Inconsistent interface between modules and components,
    - e.g. module **X** requests three values from module **Y**, which has only two outputs.
  - ✓ Variables that are not used or are improperly declared.
  - ✓ Unreachable (dead) code.
  - ✓ Missing and erroneous logic (potentially infinite loops)
  - ✓ Overly complicated constructs.
  - ✓ Programming standards violations
  - ✓ Security vulnerabilities
  - ✓ Syntax violations of code and software models.

# Thank you

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