# Chapter 3
Static Testing

Static Testing Basics

Static Analysis

- Static analysis is important for safety-critical computer systems, but static analysis has also become important and common in other settings.

- static analysis is an important part of **security testing**

- Static analysis can be applied efficiently to any work product with a formal structure (typically code or models) for which an appropriate static analysis tool exists

- Static analysis can even be applied with tools that evaluate work products **written in natural language** such as requirements (e.g., checking for spelling, grammar, and readability).

Benefits of Static Testing

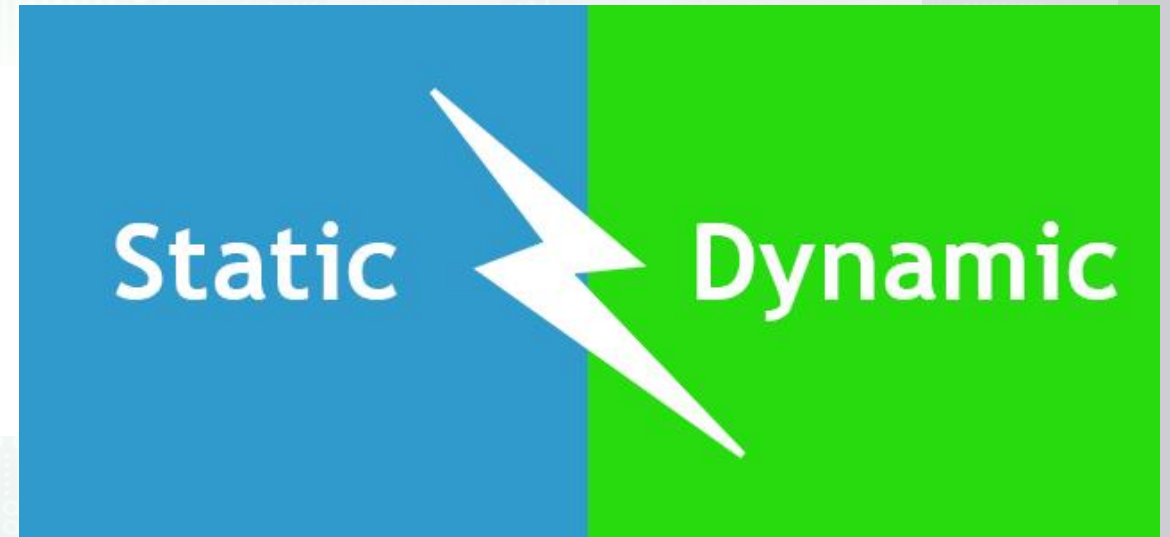THE RELATIVE COST OF FIXING DEFECTS
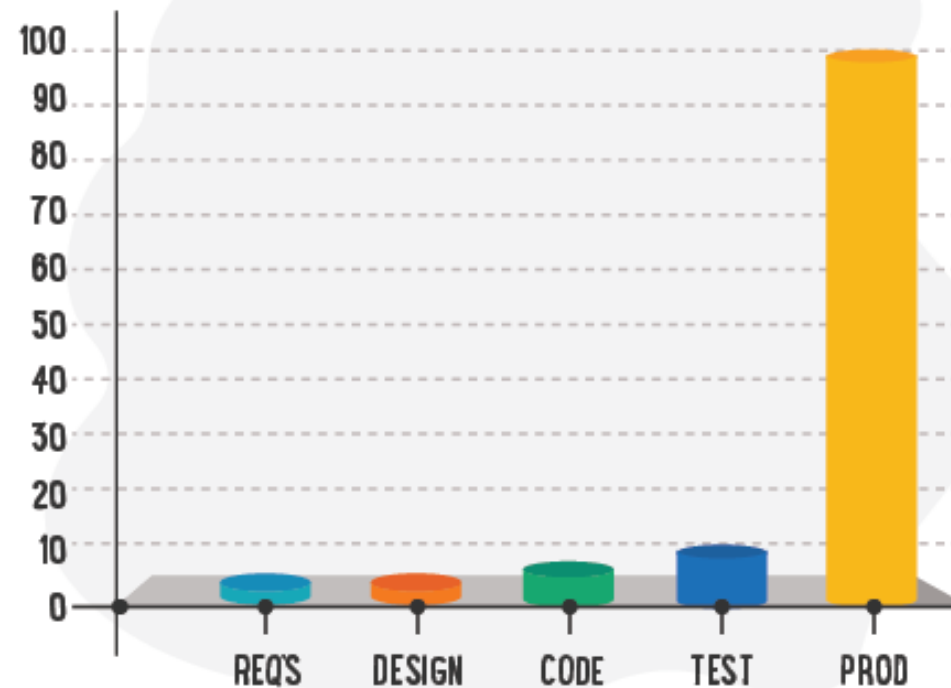
ILLUSTRATED BY SEGUE TECHNOLOGIES

Defects that are easier to find and fix in Static Testing

1. Requirements defects
2. Design defects
3. Coding defects
4. Deviations from standards
5. Incorrect interface specifications
6. Security vulnerabilities
7. Gaps or inaccuracies in test basis traceability or coverage
8. Maintainability Defects

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Quiz Time

Quiz Time

- **Which TWO of the following statements about static testing are MOST true?**

A. A cheap way to detect and remove defects

B. It makes dynamic testing less challenging

C. Early validation of user requirements

D. It makes it possible to find run-time problems early in the lifecycle

E. When testing safety-critical system, static testing has less value because dynamic testing finds the defects better

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Quiz Time

- **Which testing technique would be most effective in determining and improving the maintainability of the code (assuming developers fix what is found)?**

A. Peer reviews
B. Static analysis
C. Dynamic analysis
D. Unit testing

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Quiz Time

- **Which of the following techniques is a form of static testing?**

A. Error guessing

B. Automated regression testing

C. Providing inputs and examining the resulting outputs

D. Code review

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Quiz Time

- **Which of the following is a benefit of static analysis?**

A. Defects can be identified that might not be caught by dynamic testing
B. Early defect identification requires less documentation
C. Early execution of the code provides a gauge of code quality
D. Tools are not needed because reviews are used instead of executing code

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Quiz Time

- **What is the main difference between static and dynamic testing?**

A. Static testing is performed by developers; dynamic testing is performed by testers

B. Manual test cases are used for dynamic testing; automated tests are used for static testing

C. Static testing must be executed before dynamic testing

D. Dynamic testing requires executing the software; the software is not executed during static testing

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Review Process

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Review Process:
-Planning
-Initial review
-Individual review
-Issue communication and analysis
-Fixing and reporting (author)

Review Types:
-Informal Review (buddy)
-Walkthrough (Author)
-Technical Review
-Inspection

Review Roles:
-Management
-Reviewers
-Author
-Facilitator (moderator)*
-Review Leader

Review Techniques:
-Checklist based
-Ad hoc (no planning)
-Scenario & dry run
-Role-based
-Perspective based

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Review Process

Planning

Initial Review

Individual Review

Issue Communication & Analysis

Fixing & Reporting

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1-Planning

- **Defining the scope**

- **Estimating effort**

- **Identifying review characteristics (types, roles, activities, and checklists)**

- **Selecting the people to participate in the review and allocating roles**

- **Defining the entry and exit criteria**

- **Checking that entry criteria are met**

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2-Initial Review

- **Distributing the work product**

- **Explaining the scope, objectives, process, roles, and work products to the participants**

- **Answering any questions that participants may have about the review**

3-Individual Review (i.e., individual preparation)

- **Reviewing all or part of the work product**

- **Noting potential defects, recommendations, and questions**

4-Issue Communication & Analysis

- **Communicating identified potential defects (e.g., in a review meeting)**

- **Analyzing potential defects, assigning ownership and status to them**

- **Evaluating and documenting quality characteristics**

- **Evaluating the review findings against the exit criteria to make a review decision**

5-Fixing & Reporting

- **Creating defect reports**

- **Fixing defects found**

- **Communicating defects to the appropriate person or team**

- **Recording updated status of defects**

- **Gathering metrics**

- **Checking that exit criteria are met**

- **Accepting the work product when the exit criteria are reached**

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Roles & Responsibilities in a formal review

1-Author

✓ **Creates the work product under review**

✓ **Fixes defects in the work product under review (if necessary)**

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2-Management

- **Is responsible for review planning**

- **Executes control decisions in the event of inadequate outcomes**

- **Decides on the execution of reviews**

- **Assigns staff, budget, and time**

- **Monitors ongoing cost-effectiveness**

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3-Facilitator (Often called Moderator)

- **Ensures effective running of review meetings (when held)**

- **Mediates, if necessary, between the various points of view**

- **Is often the person upon whom the success of the review depends**

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4-Review Leader

✓ **Takes overall responsibility for the review**

✓ **Decides who will be involved and organizes when and where it will take place**

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5-Reviewers

- **May be subject matter experts, persons working on the project, stakeholders with an interest in the work product, and/or individuals with specific technical or business backgrounds**

- **Identify potential defects in the work product under review**

- **May represent different perspectives**

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Review Types

Types of Reviews

Inspection

Technical Review

Walkthrough

Informal Review

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Informal review (e.g., buddy check, pairing, pair review)

- **Main purpose: detecting potential defects**

- **Possible additional purposes:**
  - ✓ **generating new ideas or solutions**
  - ✓ **Quickly solving minor problems**

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Informal review (e.g., buddy check, pairing, pair review)

- **Optional characteristics:**
    - **Results documentation**
    - **Checklists**

- **May be performed by a colleague of the author (buddy check) or by more people**

- **Not based on a formal (documented) process**

- **May not involve a review meeting**

- **Varies in usefulness depending on the reviewers**

- **Very commonly used in Agile development**

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Walkthrough

- **Main purposes: find defects, improve the software product, consider alternative implementations, evaluate conformance to standards and specifications**

- **Possible additional purposes:**

    - ✓ **Exchanging ideas about techniques or style variations**
    - ✓ **Training of participants**
    - ✓ **Achieving consensus**

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Walkthrough

- **Optional characteristics:**
  - **Individual preparation**
  - **Checklists**
  - **Defect logs & review reports**

- **Mandatory characteristics:**
  - **Scribe**

- **Review meeting is typically led by the author of the work product**

- **May take the form of scenarios, dry runs, or simulations**

- **May vary in practice from quite informal to very formal**

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Technical Review

- **Main purposes: gaining consensus, detecting potential defects**

- **Possible further purposes:**
  - ✓ **evaluating quality and building confidence in the work product**
  - ✓ **generating new ideas**
  - ✓ **motivating and enabling authors to improve future work products**
  - ✓ **considering alternative implementations**

Technical Review

- **Optional characteristics:**
  - **Review Meeting (Led by a trained moderator, not the author)**
  - **Checklists**
  - **Defect logs & Review reports**

- **Mandatory characteristics:**
  - **Individual preparation**
  - **Scribe (not the author)**

- **Reviewers should be technical peers of the author, and technical experts in the same or other disciplines**

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Inspection

- **Main purposes: detecting potential defects, evaluating quality and building confidence in the work product, preventing future similar defects through author learning and root cause analysis**

- **Possible further purposes:**
  - ✓ **Motivating and enabling authors to improve future work products and the software development process**
  - ✓ **Achieving consensus**

Inspection

- **Mandatory characteristics:**
  - **Defined process**
  - **Checklists**
  - **Clearly defined roles**
  - **Individual preparation**
  - **Entry & Exit criteria**
  - **Scribe**
  - **Gathering metrics**
  - **Defect logs & Review report**

- **May include a dedicated reader (who reads the work product aloud during the review meeting)**

- **Reviewers are either peers of the author or experts in other disciplines that are relevant to the work product**

- **Review meeting is led by a trained facilitator (not the author)**

- **Author cannot act as the review leader, reader, or scribe**

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Peer Review

The types of reviews described above can be done as peer reviews, i.e., done by colleagues at a similar approximate organizational level

Review Techniques

Ad hoc

- In an ad hoc review, reviewers are provided with little or no guidance on how this task should be performed.

- Reviewers often read the work product sequentially, identifying and documenting issues as they encounter them.

- Ad hoc reviewing is a **commonly used** technique needing little preparation.

- This technique is highly dependent on reviewer skills and may lead to many **duplicate issues** being reported by different reviewers

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Checklist-based

- A checklist-based review is a systematic technique, whereby the reviewers detect issues based on checklists that are **distributed at review initiation** (e.g., by the facilitator).

- A review checklist consists of a **set of questions** based on potential defects, which may be derived from experience.

- The main advantage of the checklist-based technique is a **systematic coverage of typical defect types.**

- Reviewer should also look for defects outside the checklist

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Scenario and Dry Runs

- In a scenario-based review, reviewers are provided with structured guidelines on how to read through the work product.

- A scenario-based approach supports reviewers in performing "dry runs" on the work product based on expected usage of the work product (if the work product is documented in a suitable format such as use cases).

- These scenarios provide reviewers with better guidelines on how to identify specific defect types than simple checklist entries.

- Reviewers should not be constrained to the documented scenarios

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Role-based

- A role-based review is a technique in which the reviewers evaluate the work product from the perspective of individual stakeholder roles.

- Typical roles include specific end user types (experienced, inexperienced, senior, child, etc.), and specific roles in the organization (user administrator, system administrator, performance tester, etc.)

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Perspective-based

- In perspective-based reading, similar to a role-based review, reviewers take on different stakeholder viewpoints in individual reviewing.

- Typical stakeholder viewpoints include end user, marketing, designer, tester, or operations.

- Using different stakeholder viewpoints leads to more depth in individual reviewing with less duplication of issues across reviewers

- Empirical studies have shown perspective-based reading to be the most effective general technique for reviewing requirements and technical work products.

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Organizational Success Factors for Reviews

1. Each review has clear objectives, defined during review planning, and used as measurable exit criteria

2. Review types are applied which are suitable to achieve the objectives

3. Suitable review techniques are used

4. Any checklists used address the main risks and are up to date

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Organizational Success Factors for Reviews

5. **Large documents are written and reviewed in small chunks, to provide early and frequent feedback**

6. **Participants have adequate time to prepare**

7. **Reviews are scheduled with adequate notice**

8. **Management supports the review process**

People-related Success Factors for Reviews

1. The right people are involved to meet the review objectives

2. Testers are seen as valued reviewers

3. Participants dedicate adequate time and attention to detail

4. Reviews are conducted on small chunks, so that reviewers do not lose concentration during individual review and/or the review meeting

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People-related Success Factors for Reviews

5. Defects found are acknowledged, appreciated, and handled objectively

6. The meeting is well-managed

7. The review is conducted in an atmosphere of trust

8. Participants avoid negative body language or behaviors

9. Adequate training is provided, especially for more formal review types

10. A culture of learning and process improvement is promoted

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Quiz Time

Quiz Time

- **Which of the following options are roles in a formal review?**

A. Developer, Moderator, Review leader, Reviewer, Tester

B. Author, Moderator, Manager, Reviewer, Developer

C. Author, Manager, Review leader, Reviewer, Designer

D. Author, Moderator, Review leader, Reviewer, Scribe

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Quiz Time

- **Which of the following describes the main activities of a formal review?**

A. Initiation, backtracking, individual review, issue communication and analysis rework, follow-up

B. Planning, individual review, issue communication and analysis, rework, closure, follow-up

C. Planning, initiate review, individual review, issue communication and analysis, fixing and reporting

D. Individual review, issue communication and analysis, rework, closure, follow-up, root cause analysis

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Quiz Time

- **Which of the review types below is the BEST option to choose when the review must follow a formal process based on rules and checklists?**

A. Informal Review

B. Technical Review

C. Inspection

D. Walkthrough

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Quiz Time

- **You are participating in a role-based review session. Your assigned role is that of a senior citizen. The product is an online banking application that is targeted for use on smart phones. You are currently reviewing the user interface of the product with a prototype that works on iPhones. Which of the following is an area that you should review?**

A. The speed of response from the banking backend
B. The attractiveness of the application
C. The size and clarity of the instruction text
D. The reliability of the application when the connection is dropped

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- The design of a newspaper subscriptions system is being reviewed. The expected system users are:

    - Subscribers

    - Technical support team

    - Billing department

    - Database administrator

Each type of user logs into the system through a different login interface (e.g. subscribers login via a web page; technical support via an application).

Different reviewers were requested to review the system's login flow from the perspective of the above user categories.

Which of the following review comments is MOST LIKELY to have been made by all reviewers?

A.   The login page on the web is cluttered with too much advertisement space. As a result, it is hard to find the "forgot password?" link
B.   The login to access the billing information should also allow access to subscribers' information and not force a second login session
C.   After logging-in to the database application, there is no log-out function
D.   The log in flow is un-intuitive since it requires entering the password first, before the user name can be keyed-in

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Quiz Time

- **What is checklist-based testing?**

A. A test technique in which tests are derived based on the tester's knowledge of past failures, or general knowledge of failure modes

B. Procedure to derive and/or select test cases based on an analysis of the specification, either functional or non-functional, of a component or system without reference to its internal structure

C. An experience-based test technique whereby the experienced tester uses a high-level list of items to be noted, checked, or remembered, or a set of rules or criteria against which a product has to be verified

D. An approach to testing where the tester dynamically designs and executes tests based on their knowledge, exploration of the test item and the results of previous tests

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Quiz Time

- **In a formal review, which role is normally responsible for documenting all the open issues?**

A. The facilitator

B. The author

C. The scribe

D. The manager

Quiz Time

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B. The author
C. **The scribe**
D. The manager

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Quiz Time

- **For a formal review, at what point in the process are the entry and exit criteria defined?**

A. Planning

B. Review initiation

C. Individual review

D. Fixing and reporting

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Quiz Time

- If the author of the code is leading a code review for other developers and testers, what type of review is it?

A. An informal development review
B. A walkthrough
C. An inspection
D. An audit

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Quiz Time

- If a review session is led by the author of the work product, what type of review is it?

A. Ad hoc
B. Walkthrough
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Quiz Time

- You are preparing for a review of a mobile application that will allow users to transfer money between bank accounts from different banks. Security is a concern with this application and the previous version of this application had numerous security vulnerabilities (some of which were found by hackers). It is very important that this doesn't happen again.

- Given this information, what type of review technique would be most appropriate?

A. Ad hoc
B. Role-based
C. Checklist-based
D. Scenario

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Chapter 3 In the Exam

Remember (1 Question)	Understand (3 Questions)	Apply (1 Questions)
• Work products that can be examined by Static Testing • Roles in Formal Review	• Static Testing Benefits • Difference between Static & Dynamic Testing • Review Process • Review Types • Success factors for reviews	• Review Techniques

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