Static Testing Techniques

JAN 2026

expleo

Contents

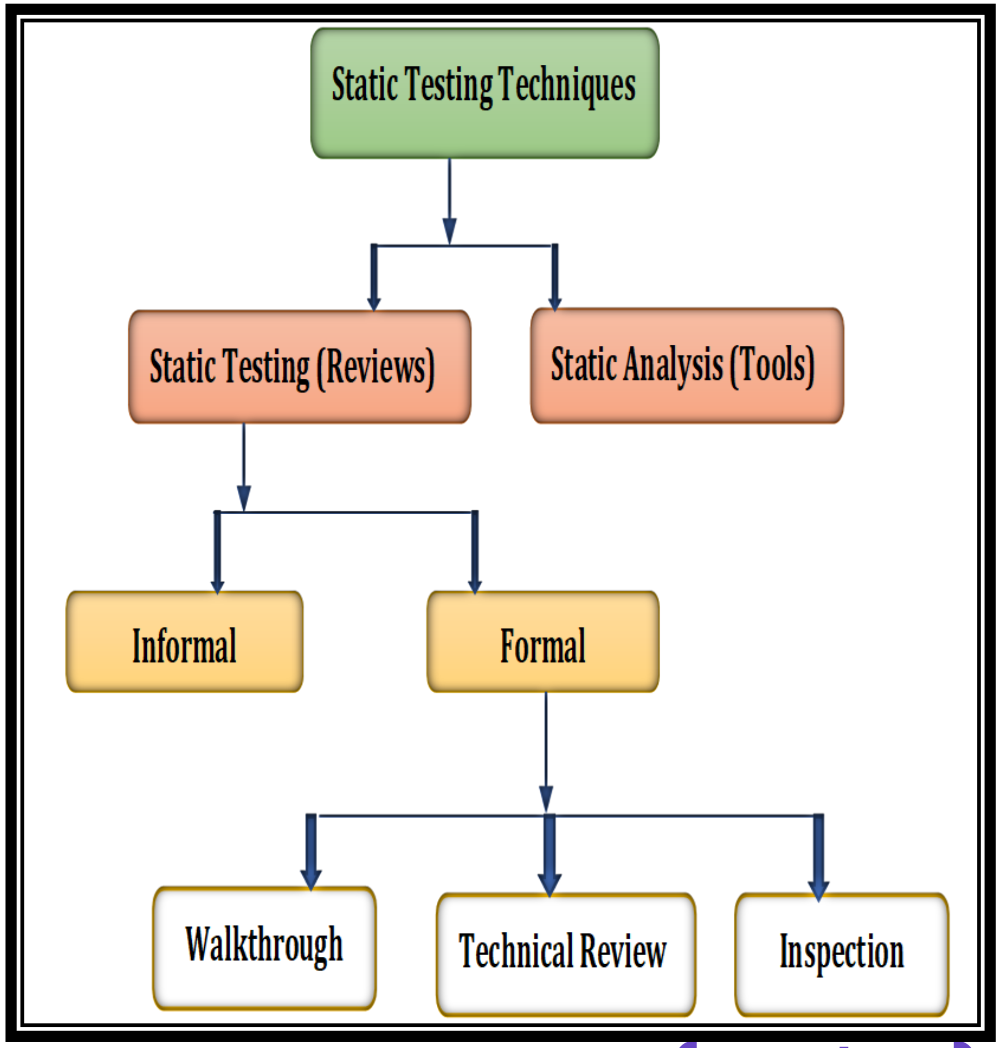
Static Testing Basics

Static techniques and the test process

- **Static testing** relies on the **manual examination** of work products (i.e., reviews) or **tool-driven evaluation of the code** or other work products (i.e., static analysis).
- **Static analysis** is important for **safety-critical computer** systems (e.g., aviation, medical, or nuclear software), but static analysis has also become important and common in other settings.

Under Static Design Techniques, we have:

- **Static techniques and the test process**
- **Review process**
- **Static analysis by tools**



Static techniques and the test process

- Any software work product can be reviewed, including **requirements specifications, design specifications, code, test plans, test specifications, test cases, test scripts, user guides** or **web pages.**
- Compared to dynamic testing, **static techniques find causes of failures (defects) rather than the failures** themselves. Static analysis is an important part of **security testing**.
- So, basically static testing deals with **Quality Assurance**, involving **reviewing and auditing of code** and **other design documents**.

The various static test design techniques can be further divided into two parts :

- Static testing performed manually
- Static testing using tools.

Benefits of Static Testing

- Static testing enables the early detection of defects before dynamic testing is performed.
- Defects found early are often much cheaper to remove than defects found later in the lifecycle.
- Identifying defects which are not easily found by dynamic testing .
- Increasing development productivity (e.g., due to improved design, more maintainable code)
- Reducing development and testing cost and time .
- Improving communication between team members while participating in reviews.
- Finding and fixing defects during static testing is much cheaper than using dynamic testing to find defects and then fix them.

Work Products that Can Be Examined by Static Testing

- Specifications, including business requirements, functional requirements, and security requirements .
- Epics, user stories, and acceptance criteria.
- Architecture and design specifications .
- Code.
- Test ware, including test plans, test cases, test procedures, and automated test scripts.
- User guides.
- Web pages.
- Contracts, project plans, schedules, and budget planning .
- Configuration set up and infrastructure set up .

Static Testing vs Dynamic Testing

Aspect	Static Testing	Dynamic Testing
Basic Meaning	Testing without executing the code	Testing by executing the code
Primary Objective	Detect defects early in work products	Detect failures during execution
Execution Required	✗ No	☑ Yes
How Defects are Found	Defects are found **directly**	Failures are observed and defects are identified through analysis
Type of Work Products Tested	Non-executable work products (requirements, design, code, test cases)	Executable work products (software, system, application)
Stage of SDLC	Early stages (requirements, design, coding)	Later stages (integration, system, acceptance testing)

Static Testing vs Dynamic Testing

Aspect	Static Testing	Dynamic Testing
Defect Visibility	Can find defects in rarely executed or hard-to-reach code paths	Finds defects only in executed paths
Quality Characteristics Measured	Maintainability, readability, compliance, consistency	Performance efficiency, reliability, functional behavior
Examples of Techniques	Reviews, walkthroughs, inspections, static code analysis	Unit testing, system testing, regression testing
Cost of Defect Detection	Generally **cheaper**	Generally **more expensive**
Tools Used	Review checklists, static analysis tools	Test automation tools, execution frameworks
Output	Defect reports, review comments	Test results, failure logs

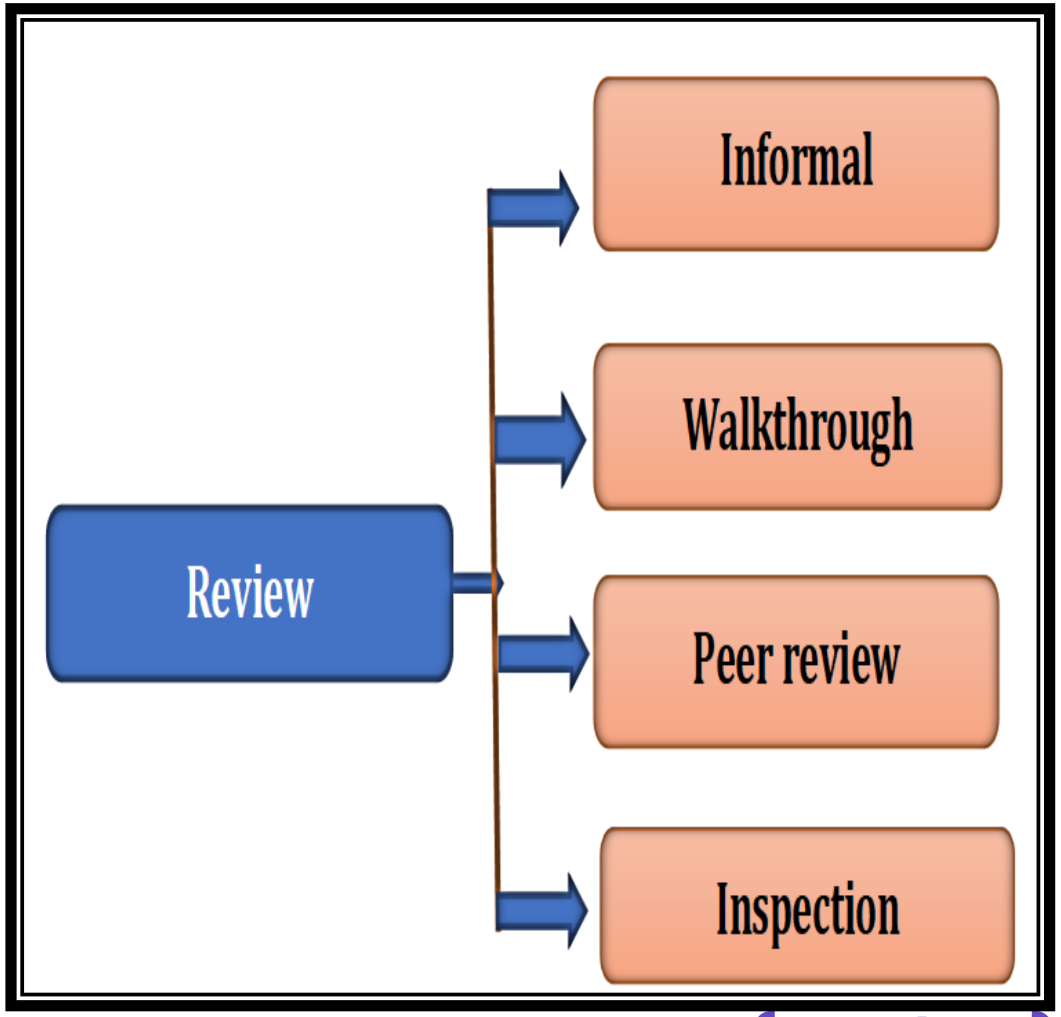
Review Process

Manual Static Design Techniques/Review Process

- Reviews are done in order to find the defects, issues, and ambiguities in the documents like requirements, design, etc.
- Reviews play an important role in static testing as it is better to find the cause of failure in the starting rather than failures at the end.
- As most of the issues arose after the development of software regarding the requirements, design not fixed in the starting or any ambiguity found in the documents.
- Reviews can be formal/informal depending on the stage of software testing.

Manual Static Design Techniques/Review Process

- **Informal reviews** are characterized by not following a **defined process and not having formal documented output**.
- **Formal reviews** are characterized by **team participation, documented results of the review, and documented procedures** for conducting the review.
- The focus of a review depends on the agreed objectives of the review (e.g**., finding defects, gaining understanding, educating participants such as testers and new team members, or discussing** and deciding by consensus).



Work Product Review Process

The review process comprises the following main activities:

Planning:

- Defining the scope, which includes the purpose of the review, what documents or parts of documents to review, and the quality characteristics to be evaluated.
- Estimating effort and timeframe .
- Identifying review characteristics such as the review type with roles, activities, and checklists .
- Selecting the people to participate in the review and allocating roles.
- Defining the entry and exit criteria for more formal review types (e.g., inspections)
- Checking that entry criteria are met (for more formal review types).

Work Product Review Process

Initiate review:

• Distributing the work product (physically or by electronic means) and other material, such as issue log forms, checklists, and related work products .

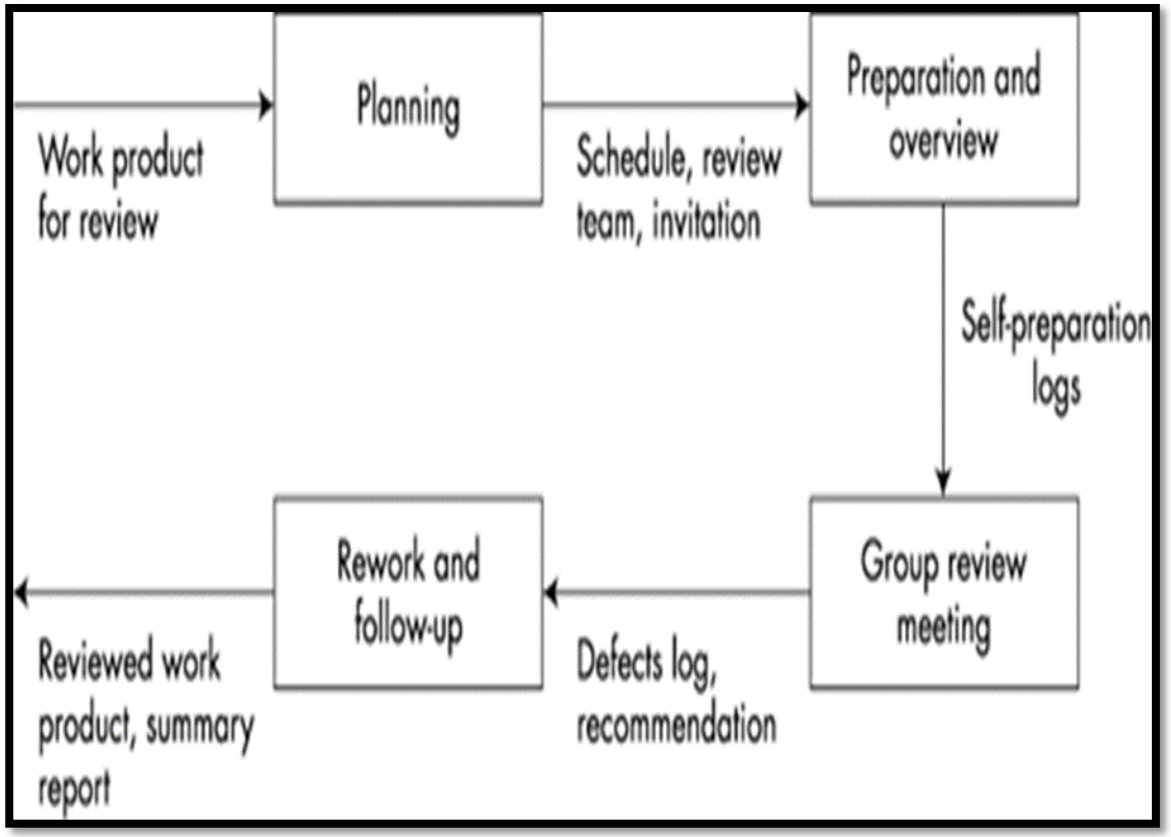
• Explaining the scope, objectives, process, roles, and work products to the participants.

• Answering any questions that participants may have about the review

Individual review or preparation:

• Reviewing all or part of the work product.

• Noting potential defects, recommendations, and questions.



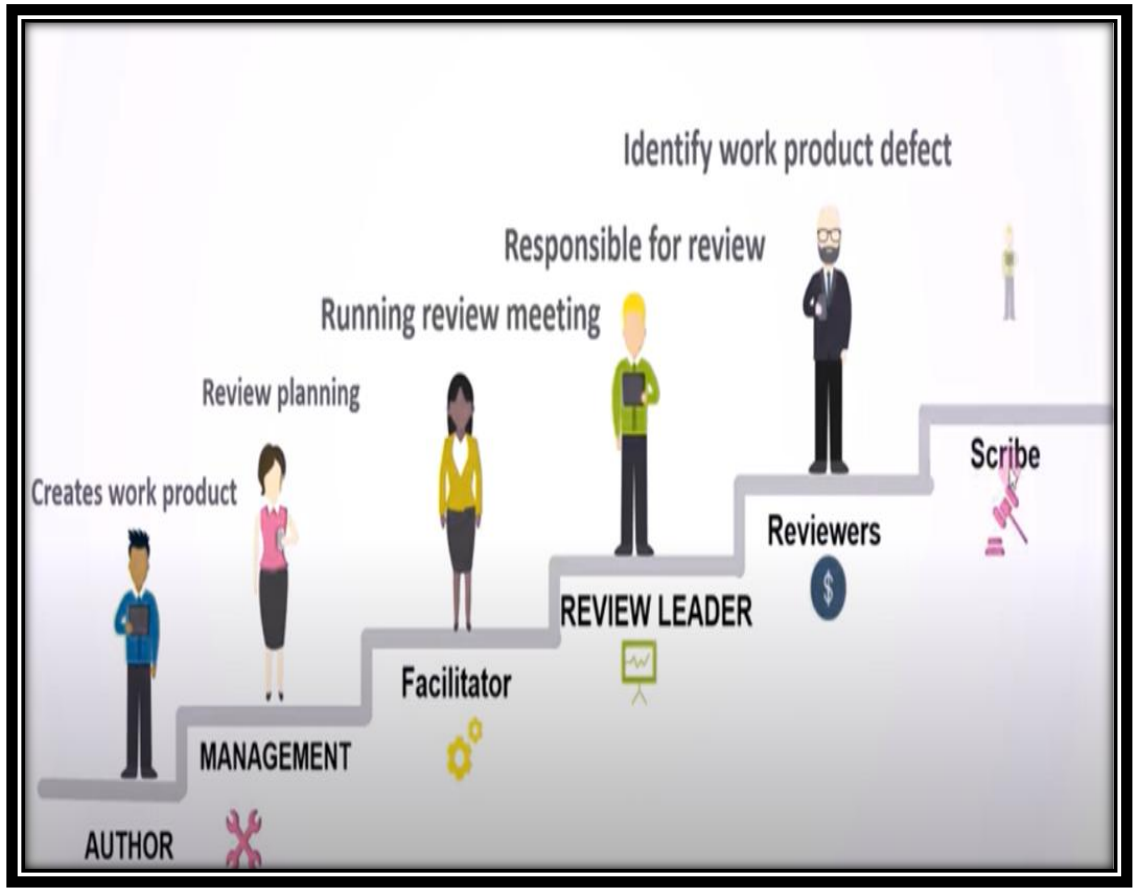
Work Product Review Process

Issue communication and 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 (reject; major changes needed; accept, possibly with minor changes)

Fixing and reporting:

- Creating defect reports for those findings that require changes to a work product
- Fixing defects found (typically done by the author) in the work product reviewed
- Communicating defects to the appropriate person or team.



Roles and responsibilities in a Formal review

Author :

• Creates the work product under review.

• Fixes defects in the work product under review (if necessary).

Management:

• Is responsible for review planning.

• Decides on the execution of reviews.

• Assigns staff, budget, and time.

• Monitors ongoing cost-effectiveness.

• Executes control decisions in the event of inadequate outcomes.

Roles and responsibilities in a Formal review

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.

Review leader:

- Takes overall responsibility for the review .
- Decides who will be involved and organizes when and where it will take place.

Roles and responsibilities in a Formal review

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.

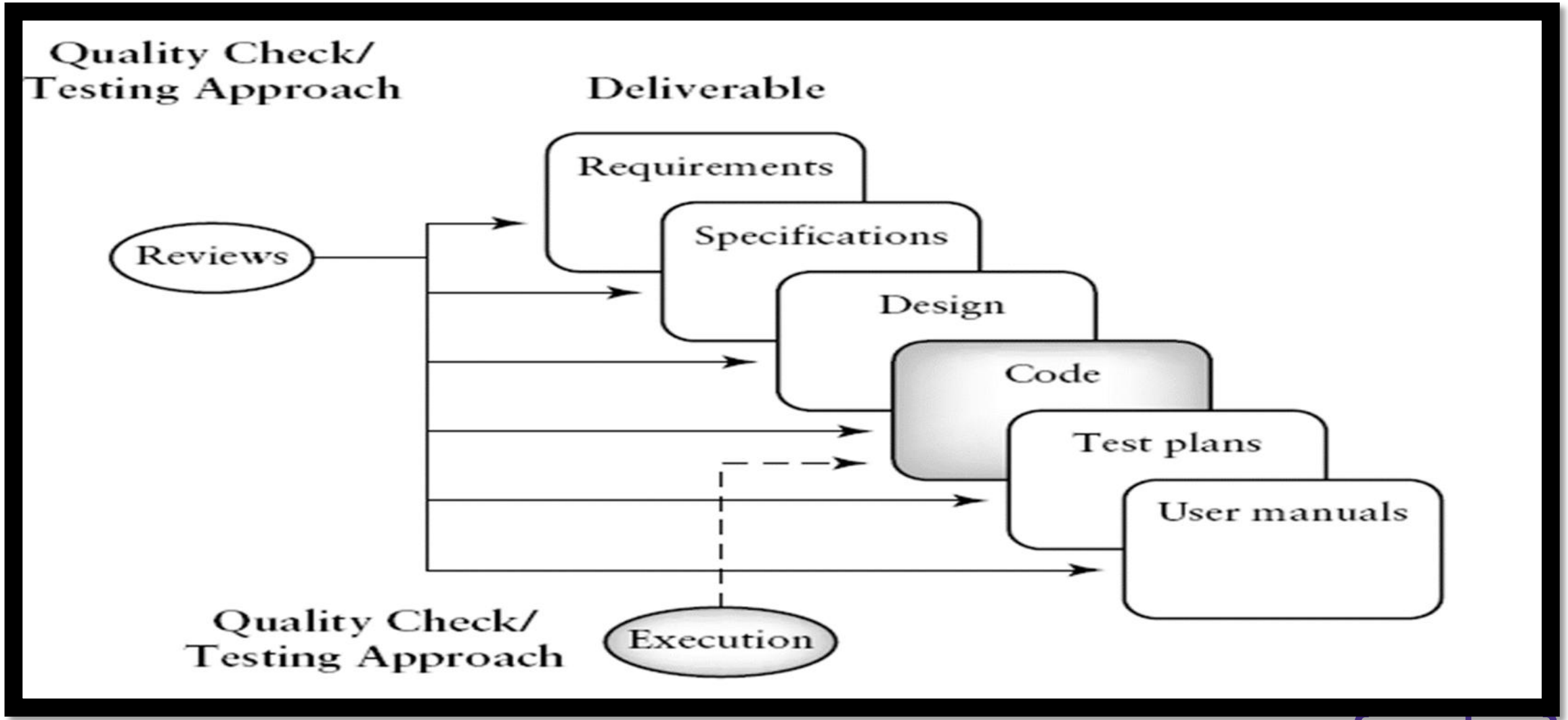
• May represent different perspectives (e.g., tester, developer, user, operator, business analyst, usability expert, etc.)

Scribe (or recorder):

• Collates potential defects found during the individual review activity.

• Records new potential defects, open points, and decisions from the review meeting (when held) .

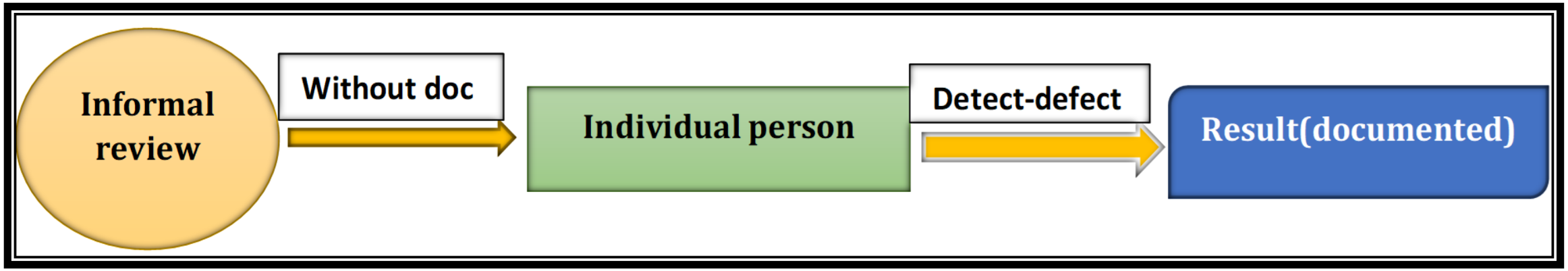
Roles and responsibilities in a Formal review



Review Types:

Informal Reviews

- As the name suggests, an informal review done by an individual without any process or documentation.
- Main purpose: detecting potential defects.
- Not based on a formal (documented) process.
- May not involve a review meeting.
- Results may be documented.



Review Types:

Walkthrough

- A Walk-through is a step-by-step presentation of different requirements and design documents by their authors.
- This is done with the intent of finding defects or any missing pieces in the documents.
- Main purposes: find defects, improve the software product, consider alternative implementations, evaluate conformance to standards and specifications.
- Review meeting is typically led by the author of the work product.
- Scribe is mandatory .
- Potential defect logs and review reports are produced.

Review Types:

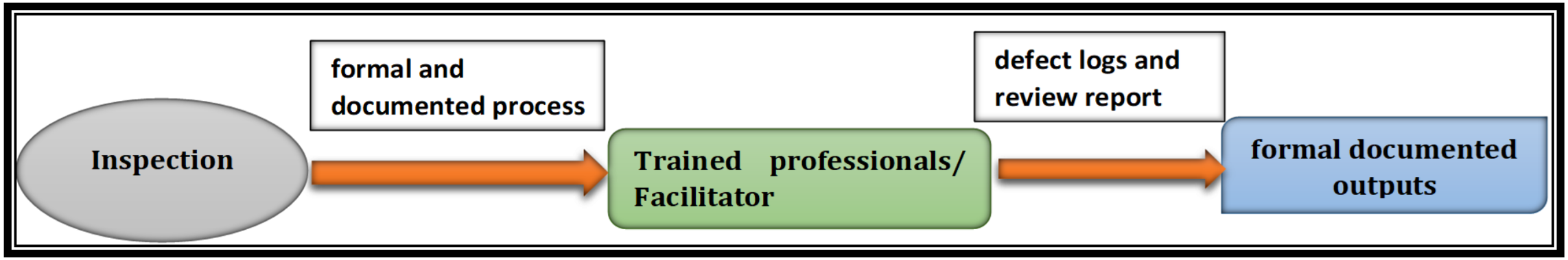
Technical Review

- A technical review involves reviewing the technical approach used during the development process.
- Main purposes: gaining consensus, detecting potential defects.
- Individual preparation before the review meeting is required.
- Scribe is mandatory, ideally not the author .
- Reviewers should be technical peers of the author, and technical experts in the same or other disciplines

Review Types:

Inspection

- An inspection is a formal and documented process of reviewing the different documents by experts or trained professionals.
- Main purposes: detecting potential defects.
- Follows a defined process with formal documented outputs, based on rules and checklists.
- Scribe is mandatory
- Review meeting is led by a trained facilitator.
- Potential defect logs and review report are produced.



Success Factors for Reviews

There are several factors that determine the success of reviews, which include:

- Defining clear objectives and measurable exit criteria. Evaluation of participants should never be an objective
- Choosing the appropriate review type to achieve the given objectives, and to suit the type of work product, the review participants, the project needs and context
- Performing reviews on small chunks, so that reviewers do not lose concentration during an individual review and/or the review meeting (when held)
- Providing feedback from reviews to stakeholders and authors so they can improve the product and their activities.

Success Factors for Reviews

There are several factors that determine the success of reviews, which include:

- Providing adequate time to participants to prepare for the review
- Support from management for the review process
- Making reviews part of the organization’s culture, to promote learning and process improvement
- Providing adequate training for all participants so they know how to fulfil their role
- Facilitating meetings

Quiz

1.Which of the following statements CORRECTLY reflects the value of static testing?

A . By introducing reviews, we have found that both the quality of specifications and the time required for development and testing have increased.

B. Using static testing means we have better control and cheaper defect management due to the ease of detecting defects later in the lifecycle.

C. Now that we require the use of static analysis, missed requirements have decreased and communication between testers and developers has improved

D. Since we started using static analysis, we find coding defects that might have not been found by performing only dynamic testing

Option : D

Quiz

2. Which of the following statements on the use of checklists in a formal review is CORRECT?

A . As part of the review planning, the reviewers create the checklists needed for the review

B. As part of the issue communication, the reviewers fill in the checklists provided for the review

C. As part of the review meeting, the reviewers create defect reports based on the checklists

provided for the review

D. As part of the review initiation, the reviewers receive the checklists needed for the review

Option : D

Quiz

3. Which of the following CORRECTLY matches the roles and responsibilities in a formal review?

A . Manager – Decides on the execution of reviews

B. Review Leader - Ensures effective running of review meetings

C. Scribe – Fixes defects in the work product under review

D. Moderator – Monitors ongoing cost-effectiveness

Option : A

Quiz

4. In a formal review, what is the role name for the participant who runs an inspection meeting?

A . Facilitator

B. Programmer

C. Author

D. Project manager

Option : D

Quiz

5.You are reading a user story in the product backlog to prepare for a meeting with the product owner and a developer, noting potential defects as you go. Which of the following statements is true about this activity?

A . It is not a static test, because static testing involves execution of the test object.

B. It is not a static test, because static testing is always performed using a tool.

C. It is a static test, because any defects you find could be found cheaper during dynamic testing.

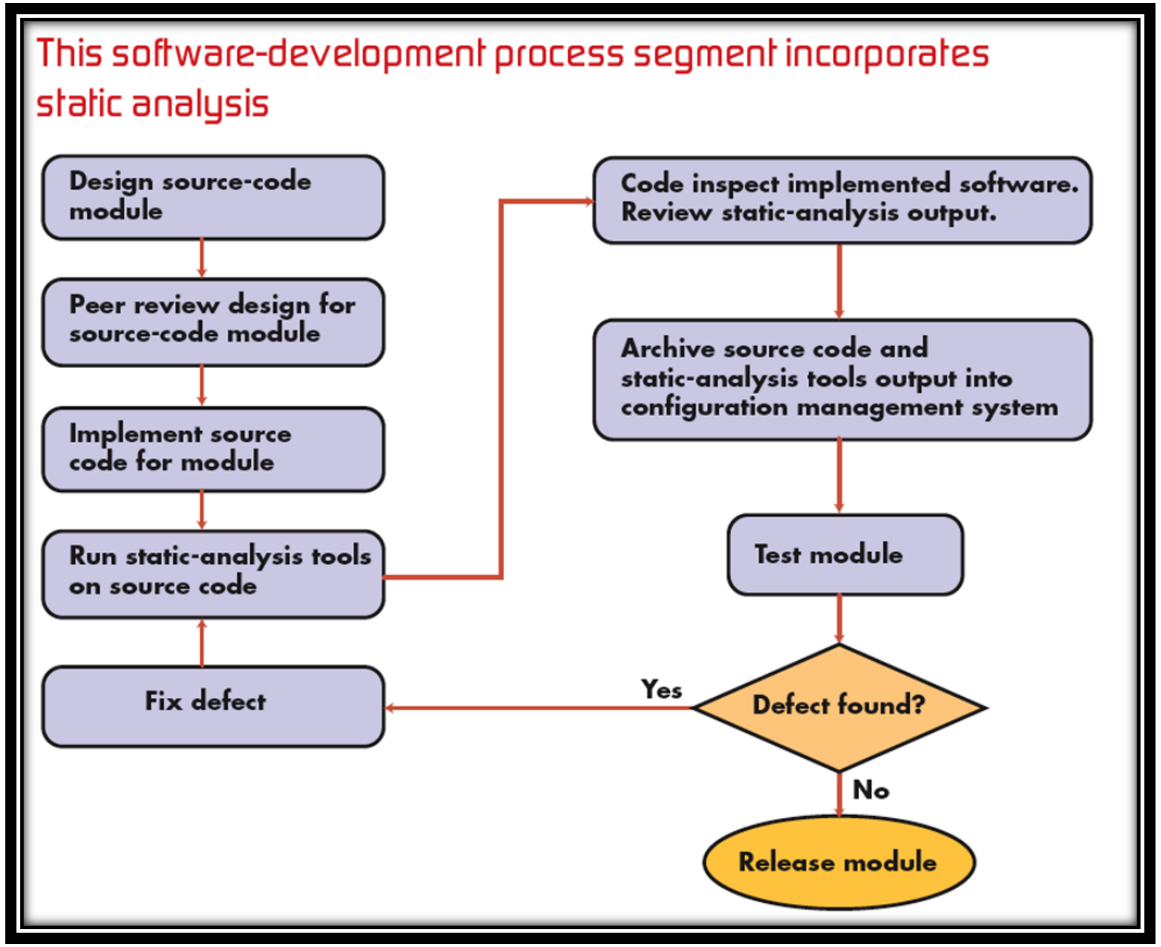
D. It is a static test, because static testing does not involve execution of the test object.

Option : D

Static Analysis by Tools

About Static analysis by tools

- The objective of static analysis is to find defects in software source code and software models.
- Static analysis can locate defects that are hard to find in testing. As with reviews, static analysis finds defects rather than failures.
- Static analysis tools analyze program code (e.g., control flow and data flow), as well as generated output such as HTML and XML.



Static Design Techniques Using Tools

The static analysis techniques for the source code evaluation using tools are:

- **Control flow analysis** – The control flow analysis requires analysis of all possible control flows or paths in the code.
- **Data flow analysis** – The data flow analysis requires the analysis of data in the application and its different states
- **Compliance with coding standards** – This evaluates the compliance of the code with the different coding standards.
- **Analysis of code metrics** – The tool used for static analysis is required to evaluate the different metrics like lines of code, complexity, code coverage, etc.

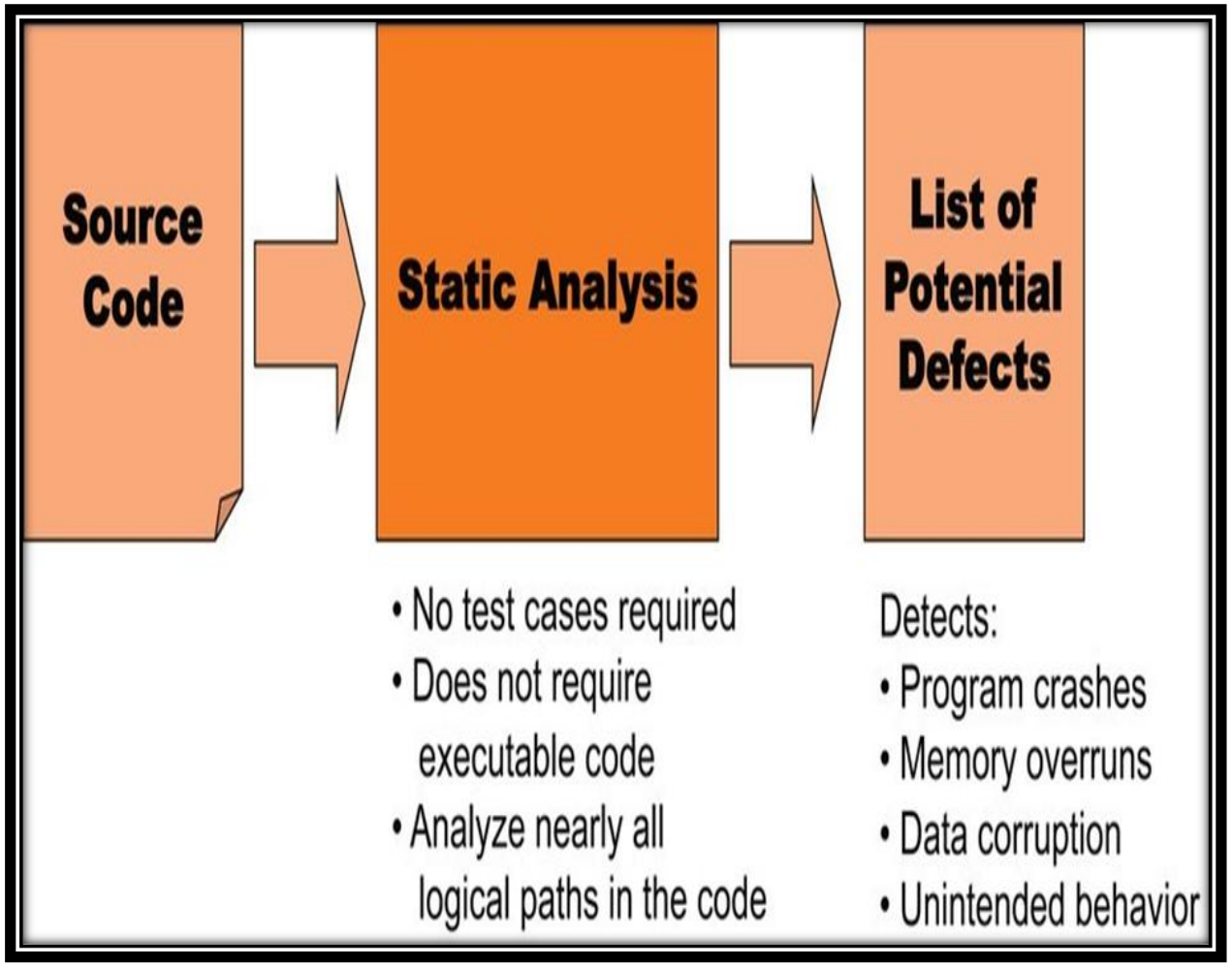
Value of Static analysis

- 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.
- Improved maintainability of code and design.
- Prevention of defects, if lessons are learned in development.

Advantages of static analysis (Image by author)

Typical defects discovered by static analysis tools

- Referencing a variable with an undefined value.
- Inconsistent interface between modules and components.
- Variables that are never used.
- Unreachable (dead) code.
- Programming standards violations.
- Security vulnerabilities.
- Syntax violations of code and software models.



Quiz

1. During a period of intensive project overtime, a system architecture document is sent to various

project participants, announcing a previously-unplanned technical review to occur in one week. No adjustments are made to the participants' list of assigned tasks. Based on this information alone,

which of the following is a factor for review success that is MISSING?

A . Appropriate review type

B. Adequate time to prepare

C. Sufficient metrics to evaluate the author

D. Well-managed review meeting

Option : B

Quiz

2.You are working as a tester on an Agile team and have participated in over two dozen user story refinement sessions with the product owner and the developers on the team at the start of each iteration. As the reviews have gotten more effective at detecting defects in user stories and the product owner more adept at correcting those defects, you and the team notice that the team's velocity, as shown in your burndown charts, has started to increase. Which of the following is a benefit of static testing that MOST DIRECTLY applies to increased velocity?

A . Increasing total cost of quality

B. Reducing testing cost

C. Increasing development productivity

D. Reducing total cost of quality

Option : C