Ripon Al Wasim

riponalwasim@gmail.com

LinkedIn

Course Outline

Course Outline

Chapter 3: Static Testing

No. of Session: 01
Session 05: 3 - 3.2.5

Chapter 3: Static Testing

Session 05

3. Static Testing

3.1 Static Testing Basics

3.1.1 Work Products that Can Be Examined by Static Testing

3.1.2 Benefits of Static Testing

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Session 05 (continued)
3.1.3 Differences between Static and Dynamic Testing
3.2 Review Process
3.2.1 Work Product Review Process

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Session 05 (continued)

3.2.2 Roles and responsibilities in a formal review

3.2.3 Review Types

3.2.4 Applying Review Techniques

3.2.5 Success Factors for Reviews

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Static	Dynamic		
	Specification-based	Structure-based	Experience-based
Informal Reviews	Equivalence Partitioning (EP)	Statement	Error Guessing
Walkthroughs	Boundary Value Analysis (BVA)	Decision/Branch	Exploratory Testing
Technical Reviews	Decision Tables		
Inspection	State Transition		
	Use case testing		

Chapter 3: Static Testing

Static Testing Basics /1

➢ Testing a work product without code being executed.
➢ Static tests include
- Review (manual activity)
- Static analysis (mostly tool-based)
➢ Static test techniques provide a powerful way to improve the quality and productivity of software development.
➢ static testing assists engineers to recognize and fix their own defects early in the software development process.

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Static Testing Basics /2

➢ Static techniques can improve both quality and productivity by impressive factors.

➢ Static testing is not magic and it should not be considered a replacement for dynamic testing.

➢ All software organizations should consider using reviews in all major aspects of their work including

➔ Requirements
➔ Design
➔ Implementation
➔ Testing
➔ Maintenance

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Work products that can be examined by Static testing /1

Reviews can be applied to any type of work product, including:

➢ Any type of specification: business requirements, functional requirements, security requirements.

➢ Epics, user stories and acceptance criteria.

➢ Code.

➢ Testware - test plans, test conditions, test cases, test procedures and automated test scripts.

➢ User guides, help text, wizards and other things designed to help the user to use the system more effectively.

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➢ Web pages (there are also static analysis tools to analyze whether any links are broken for example).
➢ Contracts, project plans, schedules and budgets.
➢ Models such as activity diagrams or other models used in model-based testing (MBT).

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Benefits of Static Testing /1

2 major advantages

1. Since static testing can start early in the life cycle, early feedback on quality issues can be established, for example

    ●   an early validation of user requirements rather than late in the life cycle during acceptance testing.
    ●   Feedback during design review or backlog refinement is more useful than after a feature has been built.

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Benefits of Static Testing /2

2. By detecting defects at an early stage, rework costs are most often relatively low, and thus relatively cheap improvements to the quality of software products can be achieved, as many of the follow-on costs of late updates are avoided, for example additional regression tests, confirmation tests, etc.

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Benefits of Static Testing /3

Additional benefits of static testing may include:

- Defects are more efficiently detected and corrected, particularly since this is done before dynamic test execution.
- Defects that are not easily found by dynamic testing, such as security vulnerabilities, are identified.
- Defects in future design and code are prevented by uncovering inconsistencies, ambiguities, contradictions, omissions, inaccuracies and redundancies in requirements.

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Benefits of Static Testing /4

- Since rework effort is substantially reduced, development productivity figures are likely to increase.
- Reduced development cost and time.
- Reduced testing cost and time.
- Reduced total cost of quality over the software's lifetime.
- Improved communication within the team, since there is an exchange of information between the participants during reviews, which can lead to an increased awareness of quality issues.

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Static testing	Dynamic testing
Testing is performed without executing the program	Testing is done by executing the program
Static testing prevents bugs	Dynamic testing finds and fixes bugs
Static testing examines code and documentation	Dynamic testing reports software bugs and bottlenecks
Static testing includes a checklist and process to follow	Dynamic testing includes specific test cases to execute

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Static testing	Dynamic testing
Can be performed before code compilation	Dynamic testing is done after compilation
Low cost of finding and fixing bugs	High cost of finding and fixing bugs
The ROI is high as this process is involved in the early stages of development	The ROI is low as this process runs in the post-development phase
Requires many meetings	Significantly fewer meetings required

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Review Process:

- Work Product Review Process

➢ Planning
➢ Initiate review
➢ Individual review
➢ Issue communication and analysis
➢ Fixing & reporting

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Work Product Review Process /1

Planning

- ❏ Defining the scope of the review.
- ❏ Estimating effort and the timeframe for the review.
- ❏ Identifying review characteristics such as the type of review with roles, activities and checklists.
- ❏ Selecting the people to participate in the review and allocating roles to each reviewer.
- ❏ Defining the entry and exit criteria for more formal review types (for example inspections).
- ❏ Checking that entry criteria are met before the review starts (for more formal review types).

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Work Product Review Process /2

Initiate review

❏ Distributing the work products (physically or electronically) and any other relevant material such as logging forms, checklists or 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.

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Work Product Review Process /3
Individual review (that is, individual preparation)

- ❏ Reviewing all or part of the work documents(s).
- ❏ Noting potential defects, recommendations and questions.

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Work Product Review Process /4

Issue communication and analysis

- ❏ Communicating identified potential defects, for example 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

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Work Product Review Process /5

Fixing & reporting /1

➢ Creating defect reports for those findings that require changes.

➢ Fixing defects found (typically done by the author) in the work product reviewed.

➢ Communicating defects to the appropriate person or team.

➢ Recording updated status of defects (in formal reviews), potentially including the agreement of the comment originator.

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Work Product Review Process /6

Fixing & reporting /2

➢ Gathering metrics (for more formal review types), for example of defects fixed, deferred, etc.

➢ Checking that exit criteria are met (for more formal review types).

➢ Accepting the work product when the exit criteria are reached.

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Roles and responsibilities in a formal review

6 types of roles can be distinguished within a review team:

1. The author
2. Management
3. Facilitator (often called moderator)
4. Review leader
5. Reviewers
6. Scribe (or recorder)

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Roles and responsibilities in a formal review /1

The author
• Creating the work product under review.
• Fixing defects in the work product (if necessary).

Management
- Ensuring that reviews are planned.
• Deciding on the execution of reviews.
• Assigning staff, budget and time.
• Monitoring ongoing cost effectiveness.
• Executing control decisions in the event of inadequate outcomes.

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Roles and responsibilities in a formal review /2

Facilitator (often called **moderator**)

Ensuring the effective running of review meetings (when held).

Mediating, if necessary, between the various points of view.

Being the person upon whom the success of the review often depends.

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Roles and responsibilities in a formal review /3

Review leader

➢ Taking overall responsibility for the review.

➢ Deciding who will be involved.

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Roles and responsibilities in a formal review /4

Reviewers

➢ Identifying potential defects in the work product under review.
➢ Representing different perspectives as requested, for example tester, developer, user, operator, business analyst, usability expert, etc.

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Roles and responsibilities in a formal review /5

Scribe (or recorder)

➢ Collating potential defects found during the individual review activity.

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

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Types of Review

❖ Informal review
❖ Walkthrough
❖ Technical review
❖ Inspection

Static
Informal Reviews
Walkthroughs
Technical Reviews
Inspection

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Static	Dynamic		
Informal Reviews	**Specification-based**	**Structure-based**	**Experience-based**
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Types of Review /1

Informal review

➢ Main purpose/objective: detecting potential defects.

➢ Possible additional purposes: generating new ideas or solutions, quickly solving minor problems.

➢ Not based on a formal (documented) review process.

➢ May not involve a review meeting.

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

➢ Results may be documented (but often are not). Varies in usefulness depending on the reviewer(s). Use of checklists is optional.

➢ Very commonly used in Agile development.

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Types of Review /2

Walkthrough /1

➢ 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.

➢ Individual preparation before the review meeting is optional.

➢ Review meeting is typically led by the author of the work product.

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Types of Review /3

Walkthrough /2

➢ Use of a scribe is mandatory.

➢ Use of checklists is optional.

➢ May take the form of scenarios, dry runs or simulations.

➢ Potential defect logs and review reports may be produced.

➢ May vary in practice from quite informal to very formal.

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Types of Review /4

Technical review /1

➢ 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.

➢ Reviewers should be technical peers of the author, and technical experts in relevant disciplines.

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Types of Review /5
Technical review /2

➢ Individual preparation before the review meeting is required.
➢ Review meeting is optional, ideally led by a trained facilitator (typically not the author).
➢ Scribe is mandatory, ideally not the author.
➢ Use of checklists is optional.
➢ Potential defect logs and review reports are typically produced.

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Inspection /1

➢ 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.

➢ A defined process is followed, with formal documented outputs, based on rules and checklists.

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Types of Review /7

Inspection /2

➢ Individual preparation before the review meeting is required.

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

➢ Specified entry and exit criteria are used.

➢ A scribe is mandatory.

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Types of Review /8

Inspection /3

➢ The review meeting is led by a trained facilitator/moderator (not the author).
➢ The author cannot act as the review leader, facilitator, reader or scribe.
➢ Potential defect logs and review reports are produced.
➢ Metrics are collected and used to improve the entire software development process, including the inspection process.

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Applying Review Techniques

- ❖ Ad hoc reviewing
- ❖ Checklist-based reviewing
- ❖ Scenario-based reviewing & dry runs
- ❖ Role-based reviewing
- ❖ Perspective-based reading

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Applying Review Techniques /1

Ad hoc reviewing

- No instructions or guidance for how to review.
- possible defects can be noticed by reading the work product from the beginning.
- this may be quite effective if a reviewer is very good.
- Wasteful: finding the same things by all reviewers.

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Applying Review Techniques /2

Checklist-based reviewing /1

- Checklist-based reviewing is often far more effective, because there is helpful guidance given about what to look for in the supplied checklist.
- The checklist would be distributed when the review is initiated.
- Different reviewers may have different checklists which helps to cut down the number of duplicate defects found by reviewers.

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Checklist-based reviewing /2

- It is important to review the checklists regularly: keep major and remove useless things
- A checklist may contain items to check or questions, such as
    - Have references been given for claims shown?
    - Are all pointers valid?
    - Has the customer's viewpoint been considered?

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Applying Review Techniques /4

Scenario-based reviewing & dry runs

- Stepping through the scenario, this is also called a 'dry run', a term used for a rehearsal before a big event or speech.
- Going through the scenario is a rehearsal for the system.
- The reviewers are given a structured perspective such as use case - a use case can be a scenario to work through how the system will work from each actor's point of view (people and other systems).

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Applying Review Techniques /5

Role-based reviewing

- Focus on higher-level work products, for example does the design comply to the requirements.
- Focus on standards, for example internal consistency, clarity, naming conventions, templates.
- Focus on related work products at the same level, for example interfaces between software functions.
- Focus on usage of the work product, for example for testability or maintainability.

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Perspective-based reading

- Perspective-based reading is similar to role-based reviewing, but rather than playing a specific role.
  - as a tester making some test designs.
  - Stakeholder perspectives include end-users, marketing, designer, tester or operations.

- In fact this technique was devised for inspections.
- This technique goes beyond role-based and is therefore typically more expensive, but it also finds more defects.

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Success factors for Reviews /1

➢ Organizational success factors for reviews
➢ People-related success factors for reviews

❑ Organizational success factors for reviews

➔ Have clear objectives
➔ Pick the right review type and technique
➔ Review materials need to be kept up to date
➔ Limit the scope of the reviews
➔ It takes time
➔ Management support is critical

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Success factors for Reviews /2

❏ People-related success factors for reviews

➔ Pick the right reviewers

Thank you