



## Full Length Research Paper

# Exploiting and Enhancing Static Testing Techniques

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**Static testing is a technique in which an author manually read its document or code. In contrast to dynamic testing, it focuses mainly on checking the correctness of the requirement document, program code, algorithm. It checks the code or algorithm for its cosmetic appearance and goes for finding errors manually. After detail analysis of formal and informal inspection techniques and considering their corresponding advantages and disadvantages we proposed a technique that merges benefit of formal and informal inspection techniques.**

**Keywords :** Static Testing, inspection, RFT, Formal techniques, Informal Techniques.

## INTRODUCTION

Static testing is a software testing technique which is generally not a detailed testing. In contrast to dynamic testing, it focuses mainly on checking the correctness of requirement document, program code, algorithm. It checks the code or algorithm for its cosmetic appearance and goes for finding errors manually. (Debbarma, 2012)

In the context of black box testing, static testing goes for reviewing the specifications and documents. The purpose of this testing is to verify completeness and correctness of the item under test. In verification and validation it is called verification. All the errors and bugs discovered at this phase of software development are less costlier to fix than any other phase of development cycle. (Dix, 2002)

Static testing method is also known as non-execution technique because in this technique software under test is not executed. In this technique code, specification documents or design models etc are reviewed manually to find syntax and other logical errors.

Static analysis techniques tend to reduce simple defects and produces a program simple data base so that future maintenance may be possible.

Source Program Static Analysis include tools for

- Program Code Analysis
- Checking Program Structure

- Checking Module Interface
- Checking Sequence of Events

Reviews are conducted to remove errors, if reviews are conducted during early phases of development lifecycle than they are most effective as defects detected during these early reviews are less costly as compared to defects detected during any other phase of development life cycle. As defects flow down from requirements to design and then implementation and it cost approximately n times as compare to cost in removing them in early phases .Main task or activity in static testing is to evaluate or read he document or any product under test manually and comments are made about product under test. Product under test can be requirement document, design document, program code, test suits, user manuals etc. Reviews can be performed effectively before dynamic testing, and can be used to test any product (such as program code etc).

## LITERATURE REVIEW

The primary purpose of static testing is to enhance software product quality by removing errors from the product in the early phases of development process.

(Webb, 1990).

### Reviews and the test process

In static testing techniques (Fagan etc) software that is being tested is not executed rather they are manual reading or automated checking such as automatic spelling or grammar checkers.

### Benefits of Reviews

Following are some of the benefits that static testing has over dynamic testing techniques.

- Early detection and correction of defects.
- Improved quality of product under test.
- Reduced development schedules.
- Less development cost.
- Reduced testing time.
- Less maintenance cost.
- Better communications.

### Guidelines for successful Reviews

Following are some of the guidelines that must be followed in order to make the reviews more successful (Dahai, 2009) Every review performed must have a definite objective.

- People involved in the review process (reviewer) should be analytical.
- Do not consider any defect as illogical instead welcome and express each defect objectively.
- Define roles for every reviewer.
- Make use of checklist items.
- Conduct proper training of reviewers regarding inspection techniques.
- Focus on improvement.
- Focus on learning.
- Emphasis on reviewing the product not the producer of the product.

### STATIC TESTING METHODS

Mainly there are two methods for static testing

Formal methods

- Inspections
- Walk-through
- Desk checking
- Peer rating

### Inspections

An inspection is a group of formal procedures and error

detecting techniques to conduct group reading. Inspection team consists of four to five people, one of them is moderator, one is programmer, and one is recorder.

A typical formal review has the following main phases:

### Plan

In this activity named planning, people to perform review that is reviewers are selected, their roles are defined, place for meeting is selected, time for meeting is decided and specify particular portions of document which need to be reviewed. (Li, (2011)

### Distribute Material

In this activity named distribute the review material, material to be reviewed (such as requirement document, program code etc) are distributed to the participants of the review meeting before formal meeting, also the process of review and the objectives of review are explained to the participants.

### Preparation

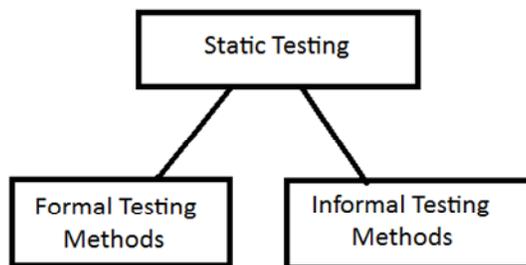
In this activity named individual preparation, individuals involved in the review that is reviewers perform individual evaluation of the product by reading the document individually and record the discovered errors, any misunderstanding, any missing information, questions and note down their comments about the product under the review.

### Hold the Review

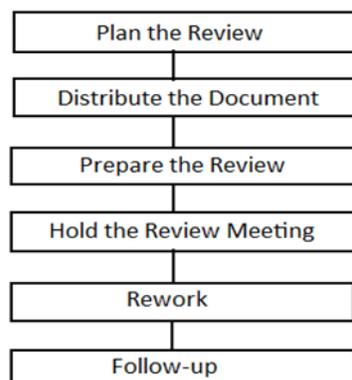
In this activity named hold the review, actual meeting is conducted where all participants meet physically face to face at one geographical place, they discuss the problems discovered during their individual preparation, many false errors are discovered, one person note down the defects, during this discussion many misconceptions about document under review become clear, and suggestion for correcting the errors are also noted, and some actions are agreed for the correction of defects.

### Reworking

In this activity named rework, only producer of the product or document (which is reviewed) is involved, he/she act upon the agreed actions or make changes to the product in order to correct the detected errors or defects. Purpose of this activity is to fix the identified



**Figure 1.** Static Testing Methods



**Figure 1** Inspection Process

errors or defects.

### Conduct Follow up

Finally in this activity named follow up, the chair person of the review checks and make sure that the agreed actions have been performed in order to correct the detected errors. Purpose is to make sure that errors have been removed.

Following are the roles in each formal review process

#### Leader

He/she is the person who is responsible for the review meeting, he/she decides the place and time of the meeting. Decides suitable time schedule within the overall development lifecycle of software for the review meeting. He decides the objectives of review meeting and then afterwards make sure whether those objectives are met or not.

#### Moderator

Moderator is the person who is responsible for the success or failure of the meeting. He/she supervise the meeting, supervise the reviewing of product. He/she

plans the meeting, then conduct the meeting and then supervise the follow up activity. If there is need he/she also act as liaison between different views of participants.

#### Producer

The one who actually produces the product or document that is being reviewed. He/she is the writer of the document.

#### Participants

Participants are stakeholders. They should be from different background and must have training on how to conduct review in order to make the review process more effective. They are also know as inspectors. They perform individual evaluation by reading the document and note down the defects and write their comments about the document, also enlist any shortcomings they find in the product.

#### Recorder

Responsible for writing down all the problems, errors, defects and suggestions of reviewers. He/she is responsible for writing the meeting minutes or summary

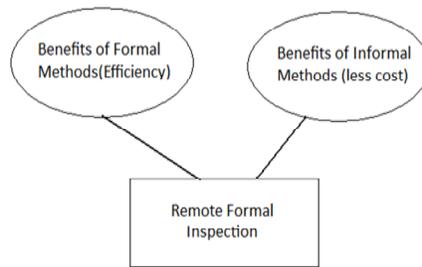


Figure 1 proposed Technique (Remote Formal Inspection)

Inspection Technique	Percentage of Errors Detected	Relative cost
Formal (Fagan)	88%	100%
Informal (email pass around)	60%	30%
Remote Formal Inspection	88%	30%

of all the identified defects during the meeting. (Schilling, 2006).

**Walkthroughs**

It is one the formal testing technique in which reviewer review the product ( requirement document , design specification etc) to find inconsistencies or errors. In this technique author or the producer of the product explain his product to reviewers for suggestions.

**Technical review**

In this testing technique reviewer evaluates or read the document for finding technical errors. He finds from the product (document , program code etc) the ossible technical defects and report them to the author or the producer.

**Informal Review**

These are the least expensive way of conducting review. No definite procedure is followed during such reviews. Any process can be followed and it depends on experience of the reviewer that how well he/she perform the review. It may include pair programming or any other method. Findings of reviewers can be documented or not. Main focus is to reduce cost from formal methods (Kleidermacher, 2008).

Following are some of the informal techniques

- Over the shoulder review
- Emailpass-around

**Proposed Technique: Remote Formal Inspection Technique**

After detail analysis of formal and informal inspection techniques and considering their corresponding advantages and disadvantages we proposed a technique that merges benefit of formal and informal inspection techniques. In formal inspection techniques such as Fagan ,Gilb etc better results are achieved but cost is high. In Informal techniques satisfactory results are not achieved for example in over the shoulder review technique, when reviewer identify some errors or defects and leaves the room, it is rare that reviewer comes back to validate the fixing of errors. Another Informal inspection technique known as email pass-around is very time consuming as each back and forth can take a day so it might take six to seven days to complete inspection rather than forty minutes (as in formal inspection). The suggested technique named Remote Formal Inspection gives benefit of formal technique that is efficiency in performance and better results and benefits of informal inspection technique that is reduced cost.

In this technique one person is considered as moderator, he contacts all participants prior to inspection meeting, all other participants are distant ie they may not be present in one physical space. Video conferencing is main element of this meeting. (to reduce cost of formal meeting). It allows participants to remain at their remote locations and coordinate through online conversation. This online conversation is conducted through video conferencing for example using skype. Moderator contacts everyone and set the meeting time. Time is decided by keeping in view the availability constraints of all participants. Moderator informs about meeting time

and distribute material for inspection via email. Every participant (reviewer) performs advance preparation that is he inspects the material (for example document) before inspection meeting and record errors and defects that he detect in document. At the time of meeting everyone comes online, during inspection any formal inspection techniques can be followed i.e Fagan, Gilb etc. Same like formal inspection techniques one person is producer, one is recorder all other are participants are reviewers, every participant tell the possible errors that he/she discovered in advance preparation.

At the end of meeting 20 minutes improvement session is conducted in which participants suggest possible solutions of errors to producer and also suggest improvements to improve quality of document or code under test. After inspection meeting, recovery session is held in which producer make changes to document or code etc to make corrections or to remove errors. Then again moderator conducts Re-review inspection in which only moderator and producer are online to validate the fixing of error.

### Benefits of Remote Formal Inspection

- Less cost than formal inspection.
- Better results than informal inspection.
- More errors detected or discovered in requirements document than in informal inspection.
- Efficiency in performance like that of formal inspection.
- Improvement session helps producer remove errors that is suggestion from different reviewers help him/her in removing errors.
- Rereview helps validate that errors discovered have been removed.

### ANALYSIS AND FINDINGS

A research was conducted at university of Engineering and technology Taxila, where a requirements document of project named automatic vehicle classification was selected for review. Three groups were made and each group performed inspection. One group performed formal inspection method that is Fagan inspection, second group performed informal inspection that is email pass around, and third performed our suggested method that is remote formal inspection. First group found 89% errors from document but their inspection costs 50% more than

informal inspection and second group found 60% errors out of which mostly were false errors and it took 10 days because of delay in replies via email. Third group also found 89% errors but it costs much lesser than formal inspection.

### CONCLUSION

After evaluating results of our experiments we can see that remote formal inspection is far more better than formal and informal inspection techniques both in efficiency and cost. It is a merged technique that offers benefits of both techniques and helps improve efficiency while reducing cost at the same time.

### Future Work

In our future work we are planning to suggest more improvements in remote formal inspection technique so that it can be accepted as worldwide the best inspection technique.

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