Systematic Study of Tools for Code Coverage Analysis

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Abstract—Software testing ensures good quality and reliability of software programs/ applications. Software testing is selection and evaluation of different test cases. In software testing process Code Coverage analysis helps by finding areas which are not exercised by set of test cases of a program or to find defects in a program which are not exercised. It ensures that without missing out all key functional areas testing effectively carried out and includes all features. The coverage information is very useful for other many related activities, like unit testing, regression testing, mutation testing etc. Code Coverage Analyses tools are used for Languages Java, C, C++, Python etc. working on testing code of programs helps to find problem/defects in particular software. Here in this paper my aim is to provide information of code coverage, different code coverage tools, how to choose the correct tool, its usage and limitations of code coverage tool.

Keywords: Code coverage, Code coverage tools, choose right tool, potential usage, limitations.

I. INTRODUCTION (HEADING 1)

In Software Development Life Cycle (SDLC), Software testing is an essential activity. It is process of detecting the defects and minimizes risk associated with software. It is used to improve software quality, determine software quality and its activity is to obtain the code coverage.

Code Coverage analysis is about Finding areas of a program which are not exercised by a set of test cases or find defects, to increase coverage it create additional test cases. It also determines code coverage's quantitative measurement. Code coverage is a promising measure of test effectiveness; there are a large number of coverage analyzers or coverage tools that perform coverage analysis. To improve the testing process coverage measurement can be used in several ways .The coverage can help to find areas which are not covered in test cases, to increase coverage it create additional test cases which determine a quantitative measure of code coverage, which helps to Identify those redundant test cases who don`t increase coverage but waste time and effort.

A. WHAT IS CODE COVERAGE?

100% Code Coverage ensures product is 100% tested, does not means that product is bug free. Code Coverage can't help, If product was wrongly tested.

It is not about white box testing. Whenever you test the application Code Coverage is generated; happens at code level to analyze the code review. Code Coverage isn`t white box testing.

It is not through Automated Testing or Unit Testing.

B. What role does Code Coverage play?

Code Coverage describes a set of lines of code that is "covered" by test case. Test coverage Tracking can motivate additional test cases development to increase coverage. That`s why, Testers discover more faults in the code not users. It can improve software quality and additional cost reduced.

It drills down source code`s untested part and devise new tests.
It is testing quality`s early indicator and fix it by new tests addition.
It can be used as a criterion for stopping unit testing.
It increases confidence for releases.
Code Coverage removes redundancy in testing.

Table 1: Code Coverage tools and Languages

Tools	**Language**		**Tools**	**Language**
JCover	JAVA		Quilt	JAVA
Emma	JAVA		Serenity BDD	JAVA
Gretel	JAVA		FrogLogic COCO	C, C++, C#
CodeCover	JAVA		Testwell CTC++	C, C++, C#, JAVA
NCover	.NET		Intel C++ Compiler15.0	C++
Cobertura	JAVA		ParasoftJTest	C,C++,JAVA,. NET
Bulleye Coverage	C, C++		SpiraTeam	Any Language
Clover	JAVA		Vector Software	C,C++
CodeCover	JAVA, COBOL		Devel::Cover	PERL
Coverage.py	Python		DotCover	.NET
Hansel	JAVA		OpenCover	.NET2
JACOCO	JAVA		Visual Studio	C,C++
NoUnit	JAVA		PITest	JAVA

II. VARIOUS CODE COVERAGE ANALYZER TOOLS

- JCover

JCover is an code coverage analyzer tool. When an application test runs it provides a mechanism which generates statistical information on coverage. It is for Java Programming.

- Emma

Emma is an open-source tool, which detects dead code and verifies an application's parts which are actually defected. It is for Java Programming.

- Gretel

Gretel is an open-source tool. It is test coverage monitoring tool, implements residual test coverage measurement. It is for Java Programming.

- Code Cover

Code Cover is an extensible open source coverage monitoring tool, especially for condition coverage it performs source instrumentation to measure the coverage. It is for Java Programming fully integrated into Eclipse.

- NCover

NCover is an open-source code coverage tool, tells during run of the application how many times each line of code was executed. It is for .NET Programming.

- Cobertura

Cobertura is a free open-source tool. It calculate the percentage of code coverage which is accessed by tests. It is for Java Programming.

- Bullseye Coverage

Bullseye Coverage analyzer tool, tells about how much of the source code was tested. It pinpoints the areas which need attention to be reviewed by programmer. It is for C and C++ Programming.

- Clover

Clover is a cost coverage analysis tool of low cost. It supports statements, method, classes and package coverage. It is available for Eclipse or using ANT script or IDEA plug-ins. It is for Java Programming.

- Code Cover

Code Cover is an open-source tool, which is a glass box testing tool measures statements, branch, loop and strict collection coverage of an application. It is for Java and COBOL Programming.

- Coverage.py

Coverage.py is an open-source tool release on May 2017. It analyses the source to identify code that could have been executed but was not yet. It notes that which of the part has been executed. It is for Python Programming.

- Hansel

Hansel is an open-source tool, whose source code comes from Gretal, only difference is Hansel is compatible with JUnit but Gretel is not. It let developers know how much code was supposed to test is covered. It is for Java Programming.

- JACOCO

JACOCO stands for Java Code Coverage, is an open-source Code Coverage tool, which is an actively maintained tool. It can integrated with Ant, Maven, Gradle, Jenkins, Visual Studio etc. It is for Java Programming.

- NoUnit

NoUnit is an open-source Code Coverage tool, measures your JUnit tests in projects using Java, XML and XSLT. It gives you a picture of code shows how good your JUnit Test are. It is for Java Programming.

- PITest

PITest is an open-source Code Coverage tool release in 2016, which does mutation testing for Java, which point outs that which line of code isn't tested. It modify code and running unit test on the modified code.if test fails after change, test is useful else indicates it hasn't able to detect the changes. It is for Java Programming.

- Quilt

Quilt is an open-source code coverage analysis tool, it use with the JUnit testing package. It can be used with Ant, Maven and others. It has three different versions. It is used for Java Programming.

- Serenity BDD

Serenity BDD is an open-source coverage tool, is an Automated acceptance tool which monitor testing coverage for each of stories and epics written by user. It integrate with the usually buildtools and QA tools(Browser stack, Appium, Jenkins and Jira). It also provide an integrated testing suite based on Selenium. It is used for Java and Groovy Languages.

- Frog Logic CoCo

Frog Logic CoCo is an code coverage tool, integrated with all major builds, CI, test tools and has a visual studio add-in. It is used for C, C++, C# and Tcl code.

- Testwell CTC++

Testwell CTC++ is an code coverage analysis tool release in 2017 that provides coverage for line, statement, function, decision, multi condition, modified condition/ decision condition(MC/DC) and condition coverage. It is used for over 25 years and still actively developing, which used across industry (Aerospace, Transportation and Healthcare etc.). It is easy to customize and used in embedded applications. It is used for C, C++, Java and C# Programming.

- Intel C++ Compiler 15.0

Intel C++ Compiler 15.0 is an Code Coverage tool that displays dynamic execution counts for each basic block of the application provides differential coverage data and presents code coverage information visually with a customized coloring scheme. It is used for C++ Pragramming.

- ParasoftJTest

ParasoftJTest is an Code Coverage tool release on 2017, does code coverage by line, statement, block, condition, decision, path and MC/DC. It has an option for your concerned about your compliance and security for your application. It can breakdown code coverage by file, class, function, method. It can do unit testing, integration testing, plug-in testing, server side testing, automated end to end functional testing,

scripting testing and user acceptance testing. It is an old tool integrated with all key tools (like build-in tools, CI tools etc.). This code coverage tool is not developer friendly, it is better suited for traditional corporations. It is used for C, C++, Java, .NET Programming.

- Spira Team

Spira Team is an Application Lifecycle Management tool release in 2016, focuses on improving the quality of testing and coding. It can tackle code coverage (How will your code is tested) by its requirements. It is used for any Programming Language.

- Vector Software

Vector Software is an Code Coverage analysis tool used in Software Development Life Cycle(SDLC) in testing. It is used for C, C++ Programming

- Devel::Cover

Devel::Cover is an open-source Code Coverage analysis tool which test code coverage by statement, condition, subroutine, etc. It is still developing but not actively. It is the only tool for PERL Language.

- Dot Cover

Dot Cover is a tool release in 2016 integrated into visual studio and analysis unit test coverage. It can highlight code coverage right inside the code editor, which is very convenient. It is used for .NET Language.

- Open Cover

Open Cover is an open-source tool works only on windows and for visual studio you have a couple of options for code coverage. It is used in .NET2 and above Languages.

- Visual Studio

Visual Studio is a Code Coverage tool release on 2017 has integrated tools to collect code coverage metrics. It is used for C, C++ Languages.

HOW TO CHOOSE RIGHT TOOLS:

- First consider Programming Language
- Consider open-source or commercial tools which is best suited for you
- Make sure tool is actively developed
- Choose tool which response customer support
- Tool must have broad range of development
- Check tools approach(focus on requirement, mutation testing, unit testing etc.) is according to your development or requirement.

I. RELATED WORK

To discover the ideal level of code coverage and the possible impacts they have on the quality of software numerous studies have been conducted. Over the years, various code coverage tools have also been developed to measure levels of coverage. In this section, previous research is discussed on code coverage.

[1] Asaf, S., E. Marcu, "Defining coverage views to improve functional coverage analysis",[2004]

This paper defines a code coverage analysis approach based on views which monitor large scale application coverage. This Paper proposes a method for defining views on the coverage data of cross product functional coverage models. This approach defines code coverage views based on partition operations, selection and projection. This proposed method allows users to focus on certain aspects of the code coverage data to extract relevant and useful information. These studies recommend adopting a selective coverage analysis approach rather than a detailed one or do selective code coverage.

[2] Agustin, "JBlanket: Support for Extreme Coverage in Java Unit Testing", [2005]

This paper targets extreme coverage in unit testing. Unit testing is a tool commonly used to ensure reliability in software development and as soon as core functionality of a program is implemented this can be applied to the software development process. Extreme coverage (method) means, Unit testing where 100% of all unit tests must pass that also exercises 100% of all nontrivial remaining implemented methods. Extreme coverage has been measured by JBlanket (tool), a method level coverage tool developed in the Collaborative Software Development Laboratory(CSDL) at the University of Hawaii(UH). The author showed that in developing quality software Extreme Coverage is useful.

[3] Lormans, "Reconstructing Requirements Coverage Views from Design and Test using Traceability Recovery via LSI", [2005]

This paper targets requirement coverage. Requirements coverage views can help validate that all requirements are implemented in the system. A traceability model was used here. In a software development project a requirement coverage view provides insight in the status of a requirement. For example, coverage views include whether a requirement is covered by an acceptance test, by a system test, by a design artifact, and so on or not. The purpose of the research was to find out how much industry can benefit from the advantages of using Latent Semantic Indexing (LSI) to track and trace the requirements and generate the related coverage views. Author found that managing a requirement set in such a way that adequate coverage views can be obtained is very hard in practice. Implementing traceability in practice and keeping the traceability links consistent during development of the product is a error-prone, time consuming, and labor intensive process demanding disciplined developers.

[4] Li, "Prioritize code for testing to improve code coverage of complex software", [2005]

In this paper authors addressed the issue of reducing testing cost and increasing code coverage. To improve code coverage a novel code prioritization method was presented. They implemented two versions of the code prioritization methods, one using the traditional dominator analysis and the other using the new relaxed method with global view and showed that the latter is consistently better in terms of identifying code for testing to increase code coverage. For automatic test case generation they implemented this method on a tool suite, called eXVantage.

[5] Whalen et al., "Coverage metrics for requirements-based testing", [2006]
In black-box testing, from requirements one is interested in creating a suite of tests that requirements adequately exercise the behavior of a software system without regard of the internal structure of the implementation. In safety-critical domains this is the preferred style of testing and is advocated by standards such as DO-178B. The authors used an example that is a component of overall Flight Control System (FCS). That example is a Fight Guidance System (FGS). Directly on high-level formal software requirements they defined structural coverage metrics. These metrics provide objective of implementation-independent measures that is how well a black-box test suite exercises a set of requirements.

[6] Williams and B. S. a. L., "A Survey on Code Coverage as a Stopping Criterion for Unit Testing", [2008]
This paper presents the results of an online survey. That survey was conducted to estimate the software developer`s percentage of them who use code coverage as a stopping criterion for unit testing. The author found that automated unit testing is performed by a majority of participants; and use code coverage, though not always as a stopping criterion. Those people, who don`t use code coverage, don`t find it useful or provide some other reason. They found that most participants stop testing when they have "tested the most important parts of the code", in place of code coverage.

[7] L.S. et al., "Measuring The Effectiveness Of Open Coverage Based Testing Tools", [2009]
Through the use of automated testing tools in the software development process (SDLC) the levels of quality, maintainability and testability of software can be improved. Automated testing tools do automating the mechanical aspects of the software-testing task by which help in maintaining the quality of software. Code Coverage metric is considered as the most important metric among the various software metrics, for analysis of software projects for testing. Code coverage analysis finds the areas of a program that is not exercised by a set of test case, determine the quantitative measure of the code and creating additional test cases to increase coverage, which is an indirect measure of quality. There are a large number of coverage tools. A complicated process for the test manager is choosing an appropriate tool for the application to be tested. Authors selected four software code coverage tools viz. JCover, Code Cover, Emma and Gretel; and considered various sorting programs like quick sort, bubble sort etc. Authors conclude that out of all these tools Code Cover tool is comparatively better. Code Cover is better in calculating the coverage metrics. Code Cover helps in the selection of best test cases based on coverage for regression testing of Java programs.

[8] Rauf A. and Anwar, "Automated GUI Test Coverage Analysis Using GA", [2010]
This paper presents a GUI testing and coverage analysis technique centered on genetic algorithms. Genetic algorithm is used to explore automated GUI test coverage in MATLAB. Genetic algorithm searches for the best possible test parameter combinations based on some predefined test criterion,. Usually, this test criterion corresponds to a "coverage function" that measures how much of the automatically generated optimization parameters satisfies the given test criterion. Five simple applications were selected to experiment with which included Notepad, WordPad and MS WORD etc. And the experiments have shown encouraging results. The major contributions of their proposed technique are following:

- Recordings of automatic event sequence.
- Fully automated test coverage analysis.
- GA has been used for optimization of test coverage.
- Two indigenous while three off the shelf applications were selected to experiment with.
- Results of the experiments are very encouraging and promising.

The test data was generated by clicking on various GUI elements. These test cases manipulated various aspects of product interface, i.e., menus, toolbars, drop-down bars, etc. Each test case was of variable length depending upon the sequence of events involved to perform that specific action. Coverage analysis showed that system was able to achieve more than 85% coverage.

[9] Omar and S. I., "A Software Traceability Approach to Support Test Coverage Analysis", [2010]
A gray box analyzer prototype is described In this paper, to support finding 20 types of software component coverage GRAYzer was developed. It was applied to an embedded software project, called an OnBoardAutoCruise (OBA). This research dealt with 46 identified requirements, 34 test cases, 80 methods, 23 classes and 12 packages. To analyze and construct the test coverage a software traceability approach was designed and implemented. The prototype's functions were made available to assist users to view coverage trend, simplify the testing activities and retrieve the software component coverage. The study of paper results or confirms a proof of concept to support coverage analysis.

[10] Muhammad and Suhaimi, "An Evaluation of Test Coverage Tools in Software Testing", [2011]
Test Coverage indicates how good the software quality is and it is an essential part of software maintenance. Test Coverage helps by providing data on different coverage items in evaluating the effectiveness of testing. Automated testing tools can be used to enhance the testability, maintainability and stability of software. An evaluation of various test coverage tools in software testing are provided by authors. The evaluation criteria consist of language support, instrumentation, Coverage Measurement, GUI and Reporting. An appropriate tool is required by Management and test managers for the software under test. To select the efficient and effective tool this evaluation can help.

[11] Kajo-Mece and Tartari, "An Evaluation of Java Code Coverage Testing Tools", [2012]
This paper used two tools to perform code coverage analysis: Emma and CodeCover. The main reasons for choosing them are:

- These are 100 % open-source tools.
- Compared with the other open source coverage tools these tools have a large market share.
- These tools have multiple report type format.
- These tools are for both commercial development and open-source projects.

JUnit was used to project the set of tests for input programs in the testing environment. For evaluation the used criteria was: Human-Interface Design (HID), Ease of Use (EU), Reporting Features (RF), and Response Time (RT).

Table I: Analysis of Tool metrics[3]

Tools	HID	EU	RF	RT
Emma	14	82%	78	23min
CodeCover	**13**	**86%**	**90**	**20min**

The authors conclude that more accurate coverage information is reported by CodeCover tool than Emma. CodeCover tool is easy to use, for every command given has a very good response time, and has features of very good reporting compared with Emma tool.

[12] Dabas and Solanki, "**Comparison of Code Coverage Analysis Tools: A Review", [2013]**
Code coverage is measure of test effectiveness. There are a large number of code coverage analyzers or code coverage tools that perform coverage analysis. To improve the testing process the output of coverage measurement can be used in several ways. The coverage can help to find areas that are not covered by test cases. Code coverage also helps in test case prioritization, Regression testing, test suite minimization and test suite augmentation. This paper aims to provide a comparison of code coverage analysis tools. It is still a challenge for developers and test managers to identify the appropriate code coverage tooling solution for the system or application component under test. To select the efficient and effective tool this comparison identified here may help.

[13] Bansal and Solanki, "A Review on code coverage analysis", [2013]
This paper is based on code coverage analysis in Software testing; Software Metrics provide information to support a quantitative managerial decision-making for the test managers. Among the various metrics, Code coverage metric is considered as the most important metric often used in analysis of software projects in the industries for testing. Code coverage analysis helps in the testing process by finding the areas of a program not exercised by a set of test cases. It ensures that testing is effectively carried out without missing out all the key functional areas or the features of the software under development. If made available, the coverage information can be very useful for many other related activities, like, regression testing, test case prioritization, teibes how code coverage is performed. It also describes its potential usage and the challenges faced by industries in implementing code coverage.

[14] Alemerien and Magel, "Examining the Effectiveness of Testing Coverage Tools: An Empirical Study", [2014]
Code coverage is one of the most important aspects of software testing, which helps software engineers to understand which portion of code has been executed using a given test suite throughout the software testing process. Automatic testing tools are widely utilized to provide testing coverage metrics in order to gauge the quality of software, but these tools may have some shortcomings such as the difference among the values of code coverage metric of a given program using different code coverage tools. Therefore, we designed and performed a controlled experiment to investigate whether these tools have a significant difference among the measured values of coverage metric or not. We collected the coverage data that consist of branch, line, statement, and method coverage metrics. Statistically, our findings show that there is a significant difference of code coverage results among the code coverage tools in terms of branch and method coverage metrics.

[15] Haung et al., "Code Coverage Measurement for Android Dynamic Analysis Tools",[2015]
It is common to inspect an Android application using static or dynamic analysis techniques. Most traditional tools adopt static analysis techniques due to its low cost and high performance properties. However, since an inspection target could be obfuscated, it is also common to work with dynamic analysis techniques so that complete runtime information can be obtained to provide in-depth application behavior. Although there are already a lot of tools based on dynamic analysis techniques, the capability of such a tool is unknown. It is straightforward to understand the capability of a dynamic analysis tool by measuring code coverage . However, to our knowledge, there is not a universal approach for measuring code coverage for all dynamic analysis tools, especially when tool is only accessible remotely. In this paper, author propose an approach to measure code coverage for both online and offline dynamic analysis tools. We then pick online tools including ABM, Anubis, Copper Droid, Trecedroid, as well as offline tools including standard Android emulator, Droid Box, and Droid Scope. Our measurement results show that the average coverage rate for each tool lies between 20% and 60%. this approach can provide more information for researchers and developers to better understand and improve the capability of dynamic analysis techniques.

[16] Tengeri and et al., "Relating Code Coverage, Mutation Score and Test Suite Reducibility to Defect Density",IEEE[2016]
Assessing the overall quality of existing test suites is a complex task. Their code coverage is a simple yet powerful attribute for this purpose, so the additional benefits of mutation analysis may not always justify the comparably much higher costs and complexity of the computation. Mutation testing methods and tools slowly start to reach a maturity level at which their use in everyday industrial practice becomes possible, yet it is still not completely clear in which situations they provide additional insights into various quality attributes of the test suites to compare them from the viewpoints of code coverage, mutation score and test suite reducibility(the amount test adequacy is degraded in a reduced test suite). The purpose of the comparison is to find out when the different attributes provide additional insights with respect to defect density, a separately computed attribute for the estimation of real faults. We demonstrate that in some situations code coverage might be a sufficient indicator of the expected defect density, but mutation and reducibility are better in most of the cases.

[17] Kreslin, "Automated Code Coverage Analysis", Software Quality Conference, [2016]
In the world of Agile having lean and reliable Test Automation that covers a products functionality is essential however the development process is creating, updating and reviewing these tests is often tedious and unpredictable and difficult to track as it`s being developed simultaneously by numerous scrum teams. What often results are tests that may cover the functionality of a new features but also cover functionality already covered by existing tests and thus wasting valuable test execution time by exercising thte same functionality repeatedly as well as having additional maintenance costs. Automated Code Coverage analysis helps to avoid much of this. By using automated code coverage analysis Automation developers will know what parts of tests they are planning to automate that are already covered by existing tests and also which parts are not being covered. Engineers can find out about this before they even start writing automation code resulting in

considerable time savings. Automated Code Coverage analysis can also be used to review existing test automation assets and determine which, if any, should be considered for merging, exclusion or retirement from automation suites.

[18] Alfsson, "Analysis of Mutation Testing and Code coverage during progress of projects", [2017]
In order to deliver high quality software projects, a developing team probably needs a well-developed test suite. There are several methods that aim to evaluate test suites in some way, such as Code coverage and Mutation testing. Code coverage describes the degree of source code that a program executes when running a test suite. Mutation testing measures the test suite effectiveness. More development teams use code coverage to a greater extent than mutation testing. With code coverage being monitored throughout a project, could the development teamriskdropofthetestsuiteeffectiveness as the codebase getting bigger with each version? In this thesis, a mutation testing tool called PIT is used during progress of four well known open source projects. The reason for this is to show that mutation testing is an important technique to ensure continuously high test suite effectiveness, and does not only rely on code coverage measurements. In general, all projects perform well in both code coverage and test suite effectiveness, with the exception of one project in which the test suite effectiveness drops drastically. This drop shows that all projects are at risk of low test suite effectiveness, by not using mutation testing techniques.

III. POTENTIAL USAGE OF CODE COVERAGE:

In industrial context code Coverage analysis of large applications is a case of using coverage tools.

1. Test coverage increase Reliability. On the basis of testing a logarithmic–exponential model estimate defects in a program, evaluating reliability growth and projecting can help developers to optimally allocate resources to meet a deadline, which include target of reliability.
2. It provides information of coverage related testing progress's quantification. It detect redundant test cases by which execution of redundant test cases can be removed, which saves time and effort.
3. Code coverage analysis becomes a motivation for testers to improve tests/test cases in testing. It provides a quantitative measure to improve testing by reports of testing progress. Its goal of correcting errors may reduce the cost.
4. A significant benefit of coverage analysis is, it discover dead pieces of code. Those codes which are never executed are called dead piece of code in application. These dead pieces of code increase complexity of software maintenance. It should be removed.
5. All data obtained by coverage in different test cases/ test runs can be combined or merged. In it we can reset or drop/dump code coverage data remotely without JVM exit.
6. It is not required to access of the source code and provide decreasing debug information which is available in the input classes.

IV. LIMITATIONS OF CODE COVERAGE:

Code coverage analysis is very important while testing but still these tools are not very popular in this industrial world. Use of these tools facing several challenges in industry.

1. Less importance is given to these (testing and quality assurance) because of market pressure, they want to short the development lifecycle of application/ software.
2. Code coverage looks like an additional expensive because it not ensure immediate response in investment which we ask from developers/ programmers/ testers.
3. There is no direct theory that shows/predicts with use of coverage how much quality improved.
4. We cannot check/ calculate that by increasing coverage how many more defects can be found. There is a fact that full code coverage test (100%) not means the absence of defects/problem. When picking a measure, in a measure between usability and thoroughness there is always a balance.
5. There is a need for developers to learn how to use these tools for testing and to interpret coverage requires investment.
6. Data analyzing in code coverage is a complex activity and is often misused.
7. Code coverage analysis is a guide, it is not a goal/target. It helps you to do right testing/create right test cases which leads to get syntactic execution of your code.

V. CONCLUSION :-

This paper, studied about different code coverage analysis tools which used for finding defects in a program or software. These tools can be used in broad ways, and different tools used for different suitable languages selected by user which make it broad. It is found that purpose of selecting particular tool according to a particular software is fulfilled.
But still there are many aspects such as can`t get 100% error free software is not fulfilled by taking simple steps or using a tool that can work in all environments and provide a software according to user requirement. Still changes are happening there in our developing world. The goal of providing information about different tool is fulfilled and may help in future.

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