

Test Coverage Analysis Process

Sreenivasa S.Pisupati

Planetsoft

Hyderabad,India

s_pisupati@hotmail.com

Abstract:

The Purpose of the Test Coverage Process is to assist in having a better control over testing. It allows for better management of the unit, functional, system and regression testing phase. It helps:

- a. To check the coverage of testing;
- b. To provide status of testing;
- c. To clarify which functions will be covered under automation testing and which under manual testing, thus managing both efficiently and saving testing time;
- d. To get clear information on the environments to be used for different areas of testing
- e. To get a better picture of the quality of testing;
- f. The Requirements Traceability Coverage Matrix (RTCM) can also expose functionality that has not been tested.

1.0 Introduction

- a. Test coverage process ensures that testing is effectively carried out without missing out all the key functional areas or the features of the application under development.
- b. To ensure that the Use Case requirement / user requirements are completely tested as part of the quality control.
- c. To ensure selective retesting of a software system that has been modified to ensure that bugs have been fixed and that no other previously working functions have failed as a result of the reparations

Test Coverage Analysis Process

and that newly added features have not created problems with previous versions of the software.

- d. To ensure, regression testing is initiated after a programmer has attempted to fix a recognized problem or has added source code to a program that may have inadvertently introduced errors.
- e. Quality control measure to ensure that the newly modified code still complies with its specified requirements and that unmodified code has not been affected by the maintenance activity.

2.0 Purpose

The Purpose of the Requirements Test Coverage Matrix (RTCM) is to assist in having a better control over testing. It allows for better management of the unit, functional, system and regression testing phase

- g. To check the coverage of testing;
- h. To provide status of testing;
- i. To clarify which functions will be covered under automation testing and which under manual testing, thus managing both efficiently and saving testing time;
- j. To get clear information on the environments to be used for different areas of testing
- k. To get a better picture of the quality of testing;
- l. The RTCM can also expose functionality that has not been tested.

3.0 Scope

The scope of test coverage will comprise mainly the following areas of testing:

- a. Code Coverage
- b. Functionality coverage (Manual and Automation coverage)
 - ❑ **Screens** refer the areas where the functionality will be verified. In a web application generally the functionality will be verified on different screens. It can also be data tables if the testing is purely for database.
 - ❑ **Databases** refer the different environments in which the application needs to be tested. It may include information more than the database.

Test Coverage Analysis Process

- c. Systems coverage

4.0 Entry Criteria

- a. Completion of the Unit tested Code.
- b. Requirements / Use Case ~ Test Scripts / Test cases Traceability using Test Traceability Matrix.
- c. Completion of Functional Testing (IT Testing), which includes both Automation and Manual Testing under specific releases as defined for the Agent Gateway application.
- d. Application received for System Testing (ST Testing).

5.0 Inputs

- a. Unit Tested Code.
- b. Screens and Database information updated with respect to functionality in Test Coverage Analysis Excel tool.
- c. Coverage of the screens and database with respect to the functionalities should be available based on each Release / Package per cycle or build and information addressed accordingly as per tool.
- d. Test results from Functional (IT) and System (ST) testing.

6.0 Process Description

Test coverage comprises of Code coverage, functional coverage and systems coverage.

- a. **Code Coverage** – This is an analysis method that determines which parts of the software have been executed (covered) by the test case suite and which parts have not been executed and therefore may require additional attention.
 - Upon completion of unit testing of each discreet unit, tools can be used to check the code coverage in terms of statements, decisions, branches, paths, etc
- b. **Functionality (Manual and Automation) coverage** - is the broader level breakup of the application in terms of the functionalities and various features for the application. It's the form of verification to what extent the high level functional and features satisfy the software system requirements.

Test Coverage Analysis Process

- c. **Systems Coverage** - Ensure proper application navigation, data entry, processing, and retrieval as part of the overall integrated system. It's the form of verification to what extent the high level functional and features satisfy the user or use case and business requirements.

6.1 Code Coverage Analysis - Process Description

The Project Manager identifies the tool to be used for code coverage based on the domain, technology used and business need.

The unit-tested code is subjected to code coverage to check the statement, decisions, branches and paths using the cruise control tool. The Developer himself does this.

The code coverage report is generated and used to check which parts or elements of the code, which have not been covered.

The code coverage data is monitored for every code under development and periodic reports generated for carrying out appropriate analysis for in-process and future improvements.

The project manager ensures that 100% code coverage is achieved before it is released to the next phase i.e. integration testing.

6.2 Functional / Features Requirements Coverage (Manual & Automation)

- 6.2.1 Test lead collates all the functional requirements through Use case requirements, GUI specifications, user requirements specifications and software requirements specifications and puts them as functional and feature requirements in the Test coverage analysis excel based tool.
- 6.2.2 Similarly, the various GUI screens for pertinent functionality or features is identified and mapped along with the database subjected to test. This information is mapped against the functional requirements by the Test Analysts and submitted to Test Lead for review and baseline.
- 6.2.3 Once the Functional Testing is completed by executing only the pre-defined test cases / scripts against the stated cycle or release, for GUI and Database testing. The coverage is measured based on the total identified screens tested for a given functionality against total screens or database to be yet to be verified.
- 6.2.4 A functional coverage is measured in terms of the % coverage for the both manually covered testing and Automation covered testing by Test Lead.

Test Coverage Analysis Process

- 6.2.5 The information is collated by Test Lead and reported on a weekly basis to Test Manager and this information is reported in the metrics tool for coverage analysis and process and productivity improvement.
- 6.2.6 Similarly, Coverage is also computed through the use case.
- 6.2.7 The Use cases for a project are listed in any excel sheet with pertinent use case number in the Test Coverage Analysis tool. The Test Lead performs this activity.
- 6.2.8 Against each use case name and number listed, the number of Test cases or Scripts are listed in terms of total numbers. Test Lead performs this activity.
- 6.2.9 Upon completion of the functional testing by the Test Analysts, the total test scripts executed as against the previous planned is entered into the excel sheet. Test Lead performs this activity.
- 6.2.10 The tool automatically computes the Use Case Coverage in percentage. This information is picked up on a weekly basis and updated on the metrics tools for further computations and Program Level Dashboard. The Test Lead or Test Manager does this.

6.3 System Requirements Coverage

- 6.3.1. The process for the systems requirements coverage is pretty similar to the Functional coverage except the Instead of Test Scripts we do the coverage based on the Scenarios.

7.0 Manage Test Coverage Analysis Process

The PM controls changes to Requirements (additions, modifications, deletions of requirement) by following the 'Change Management' process and thereby maintaining the changes to the software requirements, GUI, Design Changes and Use Case requirements etc....

The Test Lead maintains the changes related to the Test Artifacts such as Test Plan, Test Scripts, Test Ideas, Test Scenarios, Test Traceability Matrix and Test Coverage Matrix.

Developers do the unit test coverage but Project Manager manages reports and analysis information at the Project Level.

The pertinent Functional and System Test Leads handle the test coverage analysis.

Test Coverage Analysis Process

7.1 Measures

- ❑ Effort Spent on Test Coverage Analysis Activities (Planned vs. Actual).

7.2 Validations

- ❑ Review of the Test coverage Analysis document

7.3 Quality Records

- ❑ Test Coverage Analysis Document
- ❑ Metrics Report

7.4 Exit Criteria

- a. Completion of the Code Coverage Analysis and Metrics information reported to Project Manager.
- b. Updated Functional (Automated & Manual) Tested Code Coverage Analysis results and information reported to Test Manager.
- c. Updated System Tested Code Coverage Analysis results and information reported to Test Manager.

8.0 How Much to Test

8.1 Stop Criteria

- **Time Runs out - Poor Criteria!!**

A certain number of errors found

E.G., TEST SHALL CONTINUE UNTIL N NUMBER OF ERRORS HAVE BEEN FOUND AND CORRECTED.

- **Requires a certain test coverage**

E.G., TESTING STOPS WHEN ALL STATEMENTS AND ALL BRANCHES ARE EXECUTED AND ALL TEST CASES EXECUTE WITHOUT FAILURE.

- **Stop when testing becomes unproductive**

E.G., SYSTEM TESTING STOPS WHEN THE NUMBER OF ERRORS DETECTED PER TESTING PERSON DAY DROPS UNDER 2.

Test Coverage Analysis Process

9.0 Template References

Code Coverage Analysis Template:

Use Case #	Test Scenario covered for Testing Functionality	Test Scripts Range	Total Test / Scripts	Build Version / Cycle	Total Test/ Scripts Executed	Test Coverage / Use Case (In percentage)

It exhibits the verification that needs to be performed for each of the functionalities in different scenarios and different types of databases. A Tab for each major functional component of the application can be added.

Test Coverage Analysis Process

10.0 Process Profile Matrix

Roles

PM Project Manager

TM Test Manager

TL Test Lead

Dev. Developer

SQA Software Quality Assurance

Activity	Responsibility				Output
	Prepare	Review	Approve	Accountable	
Test coverage analysis of the unit code	Dev.	Peer	PM	Dev.	Code coverage analysis report for a unit
Updating Test Coverage Matrix TCM for Functionalities and Features.	TL	TM	TM	TL	Partially updated TCM
Updating GUI Screens and database against each function or features listed in TCM.	TA	TL	TM	TA	Fully updated TCM
Updating Test Coverage Matrix TCM for Use Cases	TL	TM	TM	TL	Partially updated TCM
Updating Test Scripts / Test Ideas against the listed Use Cases in TCM.	TL	TM	TM	TL	Fully updated TCM
Changes to requirements and updating the impacting document	PM	SQA	CCB	PM	All impacted documents such as SRS, UCS, GUI Spec, etc.
Changes related to testing related artefacts	TL	SQA	TM	TM	All impacted Test artefacts such as Test Scripts, Cases, Scenario etc.,

Test Coverage Analysis Process
