

# Regression Testing for Data-Driven

Vandana Sharma, Arun Prakash Agrawal

**Abstract**—Regression testing is a part of software maintenance and it consumes about two-third of the overall software life cycle cost. It is an expensive activity that is done whenever there are some changes takes places in software. Regression testing tests both the modified code and other parts of the program that may be adversely affected by the changes introduced in the program or a part of it. The regression testing of database applications concerns with the state of the database as it contributes too many components that increase the complexity of the applications because in case of database the test cases are not independent of each other and the database requires to be reset all the time. In this paper we have done a survey of regression testing techniques for testing database applications.

**Index Terms**— Data-driven Applications, Database Testing, Regression Testing, Software testing.

## I. INTRODUCTION

Software testing is the process of executing a program or system with the intent of finding errors. Testing is done after the development phase is complete and regression testing is done when the software is delivered and some changes takes place to that software document [1]. Regression testing is a type of software testing which uncovers new errors or regressions in existing functionality of the software after modifications have been made, such as functional enhancements, patches or configuration changes while performing regression testing a recognized suite of tests is available for reuse. Fig2 below shows the complete process of regression testing [5]. It means that each time a new function is added or modifications are done in the software, all earlier validated test cases are run, and the results are compared with the results previously stored. [1]the test cases are categorized as: reusable, retestable, obsolete, new-structural and new-specification test cases.

### A. Regression Testing Techniques [9]

- 1) Retest all- This is the process of regression testing in which all the tests in the presented test suite are re-executed. This is very expensive as it requires huge time and resources. It is 100% fault detecting technique and also there is no size reduction in the test suite.
- 2) Regression Test Selection (RTS) – RTS selects specific test cases from the existing test suite instead of running the entire test suite again. The strategy of RTS is to minimize the test suite and maximize fault detection ability.
- 3) Prioritization of Test Cases - It is ordering of test cases for testing depending on business impact, critical &

frequently used functionalities. This type of ideal ordering of test cases will greatly reduce the test suite of regression.

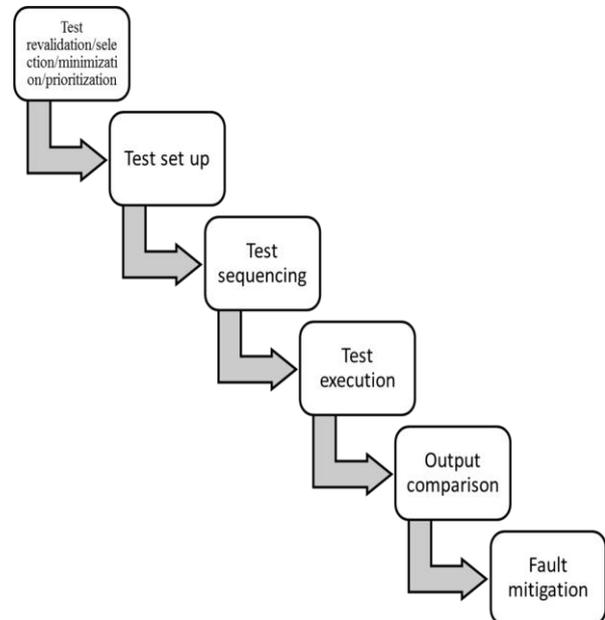


Fig 1: Various tasks performed in Regression Testing [10]

## II. TESTING DATABASE APPLICATIONS

A database application means a software system that uses an RDBMS (relational database management system) as its primary persistence mechanism. A database-driven application is achieved by the manipulation of both the database state and the program state. The application programs which does not involves database are called as stateless applications and those applications which involves database are known as state-full applications. Fig 1 shows various steps involved in performing regression testing. The regression testing of database applications concerns with the state of the database as it contributes too many components that increase the Complexity of the applications because in case of database the test cases are not independent of each other and the database requires to be reset all the time [2].

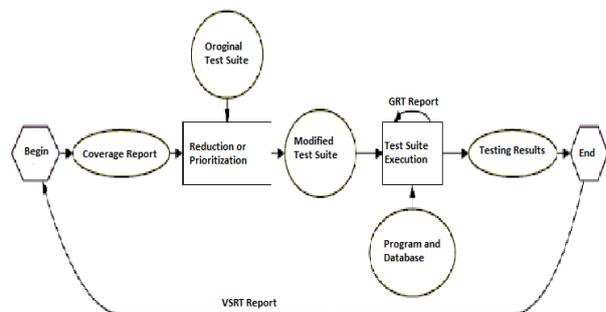


Fig 2: Regression Testing Process with Database [5]

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### A. Testing Process of Database

Testing process consists of writing tests which is a 3-step process of set up the tests, run the test and check the results with the expected results [4]. Setting up the database involves two common strategies i.e., rebuilding the database and data re-initialization. Fig 2 shows the process of regression testing with those applications involving database [5].

### B. Database applications testing involve:

Applications involving database also consists of black-box testing and white-box testing. Fig 3 shows the relational database testing including both of these testings [3]

- 1) Black-Box Testing – This testing is done at the interface which includes O/R mappings including the data information, Incoming data values, Outgoing data values as of queries, stored functions, views, etc...
- 2) White-Box Testing – This testing is done internally within the database and includes code, unit tests, view definitions, referential rules, existence tests for database schema elements, etc...

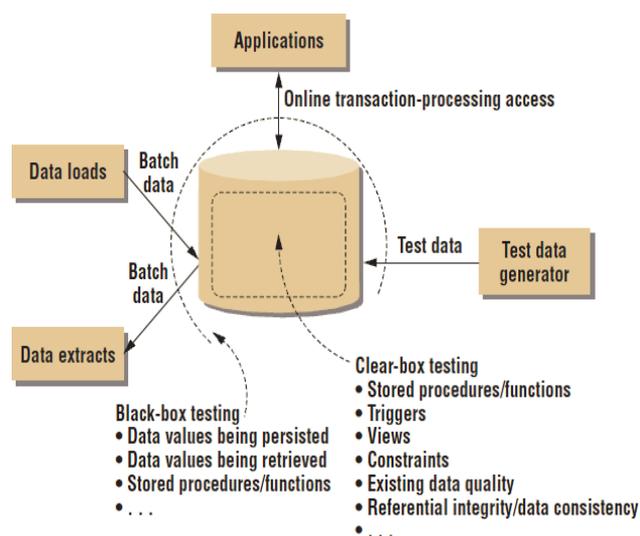


Fig 3: Testing Relational Database [3]

## III. DATABASE REGRESSION TESTING

Database aware regression testing can be achieved by considering both the program and database state which is not satisfied by any of the technique exists. It involves interaction of an application with database schema in a session by an application program using SQL statements. The complete SQL command is constructed at run-time during the interaction session. SQL statements are created in order to modify or view the state of relational database. The regression testing tools is developed with modern integrated development environment especially designed for regression testing of database applications [6]. Database applications characteristics such as Query Language programming, integrity constraints, exception handling and triggers creates problem for maintenance activities especially for regression testing which is a part of maintenance activity of database applications. As a solution two-phase regression testing methodology is proposed in which the control and data flow analysis of database applications are explored as well as two algorithms – Graph-walk and Call Graph Firewall algorithms are proposed for reducing the number of test cases of regression tests [7].

### A. Regression testing of database aware application supports:

- 1) Test Suite Prioritization - The prioritization technique specifies which test case will be addressed first from the original test cases [9]. It does not discard any test case and the efficiency of the regression testing depends on the criteria of the prioritization. It also increases the rate of fault detection and code coverage.
- 2) Test Suite Reduction - The reduction technique aims to find the subset or smaller set of test cases that covers the similar requirements as fulfilled by the original test suite [9]. It reduces the cost of regression testing and size of test suite.

### B. Challenges in Regression testing of data-driven applications

Database testing is new to many people, and will expect to face several challenges [8]:

- 1) Test suites become fairly large with successive regression runs.
- 2) Due to time and budget constraints, the entire regression test suite cannot be executed.
- 3) Challenge of achieving maximum test coverage.
- 4) Challenge of minimizing the test suite.
- 5) Determining the occurrence of Regression Tests after every modification or every change in program is a challenge.
- 6) Testing skills are insufficient for testing database applications.
- 7) Unit tests are not good enough for accessible databases.
- 8) Database testing tools are insufficient.

## IV. TOOLS FOR REGRESSION TESTING OF DATABASE APPLICATIONS

### A. Rational Functional Tester

This is an automated tool for functional and regression testing of data-driven applications. It automatically generates test cases for the application under test and lists the test objects available in that application [13]. It is a simpler test case generation tool which provides data validation, parallel development control, and lifecycle traceability.

### B. Apex Code

It is a tool for regression testing of database applications. It facilitates error-free and robust code for the creation of unit test cases which comprises of classes and methods that validates the working of code properly [12]. Test methods are the critical part of development environment in this tool.

### C. TestComplete

It is an automated tool that enables anyone to create, manage and run test cases in minutes. It makes test case creation simpler by means of some features that can be easily extensible [11]. It tests web and windows through total flexibility. It comes with all-in-one package as well as requires no special skills. It provides some great features and impressive resources support.

#### D. TestNG

It is a testing tool inspired from junit but it consists of some more features than junit in order to create regression testing simpler and easier [14]. It also provides deeper and broader test coverage as compared to junit testing. It covers all categories of tests like: unit, integration, functional, etc...

#### E. DBunit

It is a regression testing tool for testing database applications. It is an extension of Junit test case class and from family of xunit framework. It is a simple tool for. It is a great unit testing for database applications as well as it allows to setup and teardown the database [2]. It also puts the database in a known state among test runs.

### V. CONCLUSION

Regression testing is very costly and time consuming process in applications involving database. According to our study regression will saves up to 60% (approx.) time in bug fixes and 40% (approx.) in money by applying an effective regression testing strategy and selecting appropriate regression testing tools for testing data-driven applications. In this paper we had included a new viewpoint on software testing and a well-organized and successful method for database-aware regression testing.

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