Fundamentals of Testing (II)

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Testing as a process within the SW development process

Depending on the approach chosen, testing will take place at different points within the development process.

- Testing is a process itself

The testing process is determined by the following phases

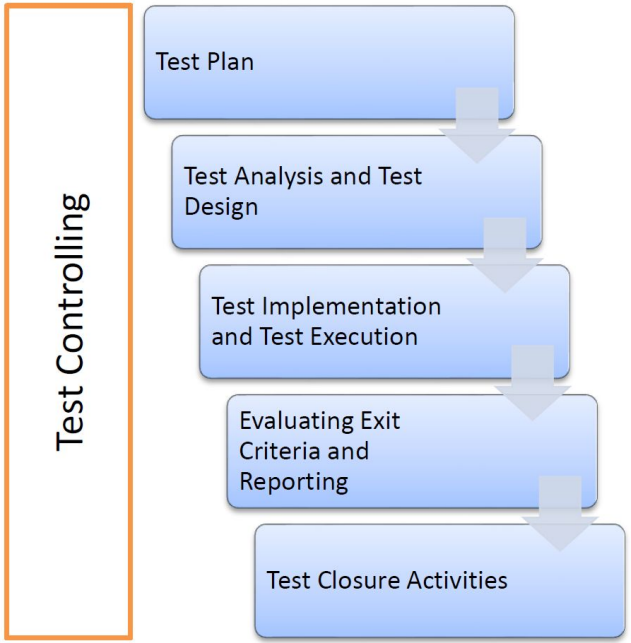
- Test planning
- Test analysis and test design
- Test implementation and test execution
- Evaluating Exit Criteria and reporting
- Test closure activities

as well as -

- Test Controlling (at all phases)
- Test phases may overlap

Testing throughout the software development process

- Testing is more than test execution!
- Includes *overlapping* and *backtracking*
- Each phase of the testing process takes place *concurrent* to the phase of the software development process



Test Control

Main Tasks:

Test control is an ongoing activity influencing test planning.

The test plan may be modified according to the information acquired from best controlling.

- The status of the test process is determined by comparing the **progress** achieved against the last plan. Necessary activities will be started accordingly.
- **Measure and analyze** results
- The test **progress**, test **coverage** and the **exit criteria** are monitored and documented
- Start **correcting measures**
- Prepare and make **decisions**

Test Planning

Main Tasks:

- Determining the scope and risk
- Identifying the objectives of testing and exit criteria
- Determining the approach: test techniques, test coverage, testing teams
- Implement testing method/test strategy, plan time span for active following
- Acquiring and scheduling test resources: people, test environment, test budget

Formal Definitions

Test plan(German: Testkonzept):

A document describing the scope, approach, resources and schedule of intended test activities. It includes, but is not limited to, the test items, the features to be tested, resources and contingency planning.

Test Strategy:

(1) A high level description of the test levels to be performed and the testing within those levels for an organization or program (one or more projects)

(2) According to the overall approach, the test efforts are divided among the test objects and the different test objectives: the choice of test methods, how and when the test activities should be done and when to stop testing (exit criteria)

Exit criteria (after Glib and Graham):

The set of generic specific conditions, agreed upon with the stakeholders, for permitting a process to be officially completed. The purpose of exit criteria is to prevent a task from being considered completed when there are still parts of the task outstanding which have not been finished. Exit criteria are used to report against and to plan **when to stop testing**. This should be done for each test level.

Test Analysis and Design (I)

Main Tasks:

- Reviewing the test basis (requirements, system architecture, design, interfaces)
- Analyze system architecture, system design including interfaces among test objects
- Identify specific test conditions and required test data
- Evaluate the availability of test data and/or the feasibility of generating test data
- Designing the test/test cases
- Create and prioritize logical test causes(test causes without specific values for test data)
- Positive tests give proof of the functionality, negative tests check the handling of error situations
- Testability analysis (more about this following)

Test Analysis and Design (II)

- Organizing the test environment(test bed)
- (Exclusive) availability of the test environment, time windows, etc.
- Define the operation of the test environment, including user administration
- Loading data sets and system parameters
- Connecting the test environment to adjacent systems
- Test infrastructure and test tools, if needed
- Processes, procedures and responsibilities
- Choosing, provisioning, installation and operations of test tools.

More Formal Definitions

Test data:

Data that exists in the system before a test is executed and affects or is affected by the component or system under test.

Input data:

A variable that is read by a component (whether stored within the system or outside)

Test coverage:

The degree of which a specified item has been exercised by a test suite (expressed as a percentage). Used mostly on white box tests to determine code coverage.

Test oracle:

A source to determine the expected results of the software under test: benchmarks (also the results of earlier tests). User's manual or specialized knowledge. It should be the code.

Test Implementation & Execution

Test Implementation & Execution

- Developing and prioritizing test cases
  - Creating test data, writing test procedure
  - Creating test sequences (test suites)
- Creating test automation scripts, if necessary
- Configuring the test environment(test bed)
- Executing test (manually or automatically)
  - Follow test sequence state in the test
- Plan (Test suites, order of test cases)
- Test result recording and analysis
- Retest(After defect correction)
- Regression test
  - Ensure that changes (after installing a new release, or error fixing) did not uncover other or introduce new defects.

Definitions regarding Fundamental Test Process

Confirmation testing retest:

- repeating a test after a defect has been fixed in order to confirm that the original defect has been successfully removed

Test suite/test sequence

- a set of several test cases for a component or system , where post condition of one test is used as the precondition for the next one

Test procedure specification(test scenario)

- a document specifying a sequence of action for the execution of a test. Also known as test script or manual test script.(After IEEE 829)

Test execution

- The process of running a test, producing actual results.

Test log (test protocol, test report)

- A chronological record of relevant details about the execution of tests: when the test was done, what result was produced.

Regression tests:

- testing of a previously tested program following modification of ensure that defected have not been introduced or uncovered in unchanged areas of the software , as a result of the changes made. It is performed when the software or its environment is changed.

Evaluating Exit Criteria

Main Tasks -

Assessing test execution against the defined objectives (e.g. test and criteria)

- Evaluating test logs(summary of test activities, test result , communication exit criteria)
- Provide information to allow the decision, whether more test should take place.

Test Closure Activities

Main Task:

- Collection of data from completed test activities to consolidate experience, test ware, facts and numbers.
- Closure of incident reports or raising change requests for any remaining open points
- Checking which planned deliverables have been delivered and tested.
- Documenting the acceptance of the system
- Finalizing and archiving test ware, the test environment and the test infrastructure for later reuse, hand over to operations
- Analyzing “lessons learned” for future project

Summary of Fundamental Test Process

The testing process can be divided into different phases.

- Testing planning covers the activities defining test strategy for all test phase as well as planning resources (Time, personnel, machines).
- Testing design (specification) covers designing the test cases and their expected results.
- Test execution covers defining test data, performing test execution and comparing results.
- Test evaluation and reporting covers exit criteria evaluation and recording of test results in written form
- Test conclusion cover the closure of incident report and lessons learned
- Test control consists of controlling activities all the above phases of the testing process