

Testing & Quality Control

Following are taken care of

Test levels

- Target of the test
 - Unit testing
 - Integration testing
 - System testing
- Objectives of the test
 - Acceptance/qualification testing
 - Installation testing
 - Alpha and Beta testing
 - Conformance testing/Functional testing/Correctness testing
 - Reliability achievement and evaluation by testing
 - Regression testing
 - Performance testing
 - Stress testing
 - Back-to-back testing
 - Recovery testing
 - Configuration testing
 - Usability testing

Test Techniques

- How tests are generated
 - Tester's intuition and experience - *ad hoc testing*
 - Specification based
 - Equivalence (classes) partitioning
 - Boundary-value analysis (and robustness testing)
 - Decision table
 - Finite state machine-based
 - Testing from formal specifications
 - Random testing
 - Code based
 - Reference models for code-based testing
 - Control flow-based criteria
 - Fault based
 - Error guessing
 - Mutation testing
 - Usage based
 - Operational profile
 - Software Reliability Engineering Testing (SRET)
 - Nature of the application
 - Object-oriented testing
 - Component-based testing
 - Web-based testing
 - GUI testing
 - Testing of concurrent programs

- Protocol conformance testing
 - Testing of distributed systems
 - Testing of real-time systems
 - Testing of scientific software
- Ignorance or knowledge of implementation
 - Black box - equivalence partitioning, boundary-value analysis, decision table, finite-state machine, from formal specifications, error guessing, random testing, operational profile, SRET
 - White box - Reference models, control-flow based, mutation testing
- Selecting and combining techniques
 - Functional and structural
 - Coverage and operational/Saturation effect

Test related measures

- Evaluation of the program under test
 - Program measurements to aid in planning and designing testing
 - Types classification and statistics of faults
 - Fault density
 - Life test, reliability evaluation
 - Reliability growth models
- Evaluation of the tests performed
 - Converge/thoroughness measures
 - Fault seeding
 - Mutation score
 - Comparison and relative effectiveness of different techniques

Managing the test process

- Management concerns
 - Attitudes/Egoless programming - attitude of software quality and objective of early failure discovery
 - Test process - people, tools, policies, measurements
 - Test documentation and workproducts - IEEE Std 829-1998
 - Test plan
 - Test design specifications
 - Test procedure specification
 - Test case specification
 - Test log and test incident or problem report
 - Internal vs. independent test team
 - Cost/effort estimation and other process measures
 - Termination
 - Test reuse and test patterns
- Test activities
 - Planning
 - Test case generation
 - Test environment development
 - Execution
 - Test results evaluation
 - Problem reporting/test log

- Defect tracking

Tasks

Deliverables

- Test plan
 - Tests
 - Defect log
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Overview

- Quality control techniques
 1. Fault avoidance techniques
 - development methodologies
 - configuration management -
 - verification techniques - proofs using pre- and post- conditions
 - reviews - walkthroughs and inspections
 2. Fault detection techniques
 - debugging - state tracing from unplanned failure to erroneous state
 - correctness
 - performance
 - testing - attempts to create failures in a planned way
 3. Fault tolerance techniques - the recovery from failure while the system is executing.

Testing Concepts

- component - a part that is isolated for testing
- fault - design or coding mistake that causes unspecified behavior
- error - manifestation of a fault
- failure - deviation between specification and behavior
- test case - input and expected results
- test stub & test driver -
- correction - a change to a component

Testing Activities

The testing wheel - overlapping, on going cycle

1. Unit testing
2. Test case design
3. Usability testing
4. Integration testing
5. Performance testing
6. System testing

7. Regression testing

- Component inspection: source code review/walkthrough
 - Fagan's inspection method
 - Overview: purpose and scope of the component and goals of the inspection
 - Preparation: reviews become familiar with the component
 - Inspection meeting
 - Rework
 - Follow-up
- Unit testing
 - equivalence testing (black box)- equivalence classes of test data
 - boundary testing (black box)
 - path testing (white box)
 - state-based testing
- Integration testing
 - big bang testing - jump from unit to complete system
 - bottom-up testing (test drivers; no stubs are necessary)
 - top-down testing (no test drivers are necessary; stubs are necessary for undeveloped lower levels)
 - sandwich testing - combined of top-down and bottom-up
- System testing
 - functional testing (from RAD)
 - performance testing (from SDD)
 - stress testing
 - volume testing
 - security testing
 - timing tests
 - recovery tests
 - pilot testing (with selected in target environment end users)
 - acceptance testing (by client in development environment against acceptance criteria from the Project Agreement)
 - installation testing (usability, functional, and performance testing by client in target environment)

Management of testing

Planning

- select test cases as soon as models become stable
- parallelize tests

Documentation

- test plan
 1. introduction - objectives and extent of the tests
 2. relationship to other documents - RAD, SDD, ODD
 3. system overview
 4. features to be tested
 5. pass/fail criteria
 6. approach
 7. suspension and resumption
 8. testing materials (hardware/software requirements)
 9. test cases
 10. testing schedule
- test case specification
 1. test case specification identifier
 2. test items
 3. input specification
 4. output specification
 5. environmental needs
 6. special procedural requirements
 7. intercase dependencies
- test incident report - actual test results, failures experienced
- test summary report - collection of test incident reports, analysis and priorities

Test organization

This section of the test plan describes the organization around the testing activities. Responsibilities and used resources should be named under this topic.

Communication & procedures

An overview of the communication during the testing activities should be provided in this section. Also the procedures during the software test for bugfixing, version control e.a. should be listed.

Test strategy

This section contains an overview of the test strategy used for the software testing, acceptance criteria and a statement to which level will be tested.

Test items

An overview of the functions to be tested and their priorities should be listed in this section of the software test plan.

Test deliverables

A description of the products used by testing.

- Test input
- Test reports
- Infrastructure to be used
- Progress reports

Test activities

An overview of the activities needed for testing, e.g.

- Installation infrastructure
- Writing of test scripts
- The actual performance of the test
- Monitoring progress
- Creation of reports

Schedule

The actual planning of the software test activities and resources used