Testing

What is testing?

- Activities to unearth problems
- Testing subjects the system or parts of it to some stimuli (inputs or conditions) and evaluates response(s) in comparison to expected outcomes

"Testing is the process of executing a program with the intent of finding errors."

-- Glenford Myers (The Art of Software Testing)

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Verification and Validation

- Verification: is what the system doing correct? (has the product been built right?)

- Validation: does the system do what it is supposed to do? (has the right product been built)?

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Terms from ISTQB…

- Error: “A human action that produces an incorrect result.”

- Defect: “A flaw in a component or system that can cause the component or system to fail to perform its required function, e.g. an incorrect statement or data definition. A defect, if encountered during execution, may cause a failure of the component or system.”

(Glossary of International Software Testing Qualifications Board, http://istqb.org/display/ISTQB/Downloads?atl_token=ajwFZWscSb)

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Testing techniques

- White Box
- Black Box

White Box

- Tests the internal workings of a unit.
- This is also known as glass box testing.
- Types:
  - Code Coverage
    - Statement coverage
    - Branch coverage
  - Static & Dynamic analysis
  - Data integrity

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Statement and Branch coverage

- Code coverage
  - making sure that each statement is executed at least once
  - making sure that each possible path of execution is tested
- Branch coverage
  - Making sure that all the branches in the code are executed and making sure that no branching leads to abnormal behaviour of the application.

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Static analysis

- Going through the code to understand the application and find if there are undesirable statements.
- Undesirable statements could be
  - Non-portable code
  - Memory leak code
  - Unreachable statement

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Dynamic analysis

- This is done by executing programs built from that software system on a real or virtual processor.
- The application must be must be executed with various test inputs to produce all possible behaviours

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Data Integrity

- Tests the quality of the data in permanent storage like database.
- Testing data integrity involves:
  - Making sure that all the data necessary for the system are stored, retrieved and can be changed according to application requirements
  - Conversion of data from application into permanent storage and vice versa
  - Blank value and default values

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Black Box

- Tests that fully check all the functional requirements for the software unit.
- Unlike the white box approach, this is an takes a purely external view
  - Tester ignores how the software works on the inside
- This test is used to find
  - Incorrect or missing functions
  - Interface errors
  - Errors in external database access
  - Initialization and termination errors

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Unit testing

- Done on the smallest unit of software -- could be a module, a class or a component
- Focuses on implementation logic, so the idea is to write test cases for every method in the module.
- Typically done by the person who has written the code

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Integration testing

- Testing as the system is progressively assembled. It takes as its input modules that have been checked by unit testing, groups them, applies tests defined in an Integration test plan and delivers as its output, the integrated system .
- Exposes faults in the interaction between integrated units.
- Test drivers and test stubs are may be written.
  - Driver:" A software component or test tool that replaces a component that takes care of the control and/or the calling of a component or system."
  - Stub: "A skeletal or special-purpose implementation of a software component, used to develop or test a component that calls or is otherwise dependent on it. It replaces a called component."
  - Test harness: "A test environment comprised of stubs and drivers needed to execute a test."

(Glossary of International Software Testing Qualifications Board, http://istqb.org/display/ISTQB/Downloads?atl_token=ajwFZWscSb)

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Regression testing

- Re-execution of a subset of tests that have already been executed each time a unit is added to ensure that undesirable effects have not occurred due to changes
- Done as software is progressively integrated and tested

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Functional testing

- Tests designed from the perspective of functional requirements
- Tests derives from requirements specifications / use cases

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Usability testing

- Tests designed from the perspective of ease of use
  - appropriateness of keyboard shortcuts
  - colours, font sizes, screen enlargement, capabilities for voice rendition, multiple languages..
  - access to help
  - intuitive views that make for faster learning

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Stress testing

- Tests designed from the perspective of load handling
  - large number of concurrent queries
  - large number of concurrent web site hits
  - repeated system backups while transactions are happening

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Stress testing

- Such tests help in measuring the following quality attributes
  - Robustness
    - what happens in abnormal situations such as a breakdown of part of the system?
  - Performance
    - Typically has to do with the time taken by the system to respond to requests
    - In real-time systems, for example, responses within stipulated times are crucial

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Recovery testing

- Checks to ascertain system state after conditions such as crashes / forced re-start etc

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Smoke testing

- A broad approach that executes a subset of all test cases that cover the main functionality of a system
- Checks to see if the system is operational overall (not really concerned about the details)
- Typically used with daily builds

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Security testing

- Tests attempting to penetrate the system, break through any security mechanisms in place
  - Authentication
  - Access control
  - Data security
  - Non-repudiation

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User Acceptance Testing (UAT)

- Formal tests conducted by persons nominated by the customer to check if contracted system requirements have been met

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Alpha and Beta tests

- Alpha tests: conducted at development site by end users with developers present

- Beta tests: conducted at end user sites. The developer is usually not present

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Typical testing process

- Test Planning
- Test Execution
- Defect Management/Bug fixing
- Generate Test cases and conditions with expected results
- Prepare Test Data
- Execute Test cases
- Log defects, if any and review test results
- Verify closure of defects and perform Regression Test

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Test Plan

“A document describing the scope, approach, resources and schedule of intended test activities. It identifies amongst others test items, the features to be tested, the testing tasks, who will do each task, degree of tester independence, the test environment, the test design techniques and entry and exit criteria to be used, and the rationale for their choice, and any risks requiring contingency planning. It is a record of the test planning process.”

(Glossary of International Software Testing Qualifications Board, http://istqb.org/display/ISTQB/Downloads?atl_token=ajwFZWscSb)

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Test Case

"A set of input values, execution preconditions, expected results and execution postconditions, developed for a particular objective or test condition, such as to exercise a particular program path or to verify compliance with a specific requirement."

(Glossary of International Software Testing Qualifications Board, http://istqb.org/display/ISTQB/Downloads?atl_token=ajwFZWscSb)

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Test Script

“Commonly used to refer to a test procedure specification, especially an automated one.”

(Glossary of International Software Testing Qualifications Board, http://istqb.org/display/ISTQB/Downloads?atl_token=ajwFZWscSb)

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Test Bed / Test Environment

"An environment containing hardware, instrumentation, simulators, software tools, and other support elements needed to conduct a test."

(Glossary of International Software Testing Qualifications Board, http://istqb.org/display/ISTQB/Downloads?atl_token=ajwFZWscSb)

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Test Data

“Data that exists (for example, in a database) before a test is executed, and that affects or is affected by the component or system under test.”

(Glossary of International Software Testing Qualifications Board, http://istqb.org/display/ISTQB/Downloads?atl_token=ajwFZWscSb)

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Test Automation

Preferred for:

- Complex and time-consuming tests
- Tests requiring a great deal of precision
- Tests involving many simple, repetitive tests
- Tests involving many data combinations

Not preferred for:

- One-time only tests
- Testing peripheral devices
- Subjective assessment tests (look and feel based)

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Some testing tools

- Purify (Rational): Static code analysis on detection of memory leaks
- QTP (HP): functional and regression test automation
- LoadRunner (HP): automated performance and load testing.
- JUnit: Unit testing framework for java.

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