Introduction to Software Testing

Speaker: Jerry Gao Ph.D.

Computer Engineering Department
San Jose State University

email: jerry.gao@sjsu.edu
URL: http://www.engr.sjsu.edu/gaojerry

Copyright © 2013, All Right Reserved by Jerry Gao, Ph.D.

Presentation Outline

- *What is Software Testing?*
  - *Definitions*
  - *Testing Objectives*
  - *Who Does Software Testing?*
- *Software Testing Activities*
- *Software Testing Scope*
- *Software Testing Principles*
- *Software Testing Process*
- *Software Testing Myths*
- *Software Testing Limits*
- *Different Types of Software Testing*

All Rights Reserved

What is Software Testing

Several definitions:

"Testing is the process of establishing confidence that a program or system does what it is supposed to." by Hetzel 1973

"Testing is the process of executing a program or system with the intent of finding errors." by Myers 1979

"Testing is any activity aimed at evaluating an attribute or capability of a program or system and determining that it meets its required results."

by Hetzel 1983

What is IEEE's definition?

What is Software Testing

- One of very important software development phases

- A software process based on well-defined software quality control and testing standards, testing methods, strategy, test criteria, and tools.

- Engineers perform all types of software testing activities to perform a software
test process.

- The last quality checking point for software on its production line

Testing Objectives

The Major Objectives of Software Testing:

- Uncover as many as errors (or bugs) as possible in a given timeline.

- Demonstrate a given software product matching its requirement specifications.

- Validate the quality of a software testing using the minimum cost and efforts.

- Generate high quality test cases, perform effective tests, and issue correct and helpful problem reports.

Major goals:

uncover the errors (defects) in the software, including errors in:

- **requirements from requirement analysis**
- **design documented in design specifications**
- **coding (implementation)**
- **system resources and system environment**
- **hardware problems and their interfaces to software**

Who does Software Testing

- Test manager
  - manage and control a software test project
  - supervise test engineers
  - define and specify a test plan

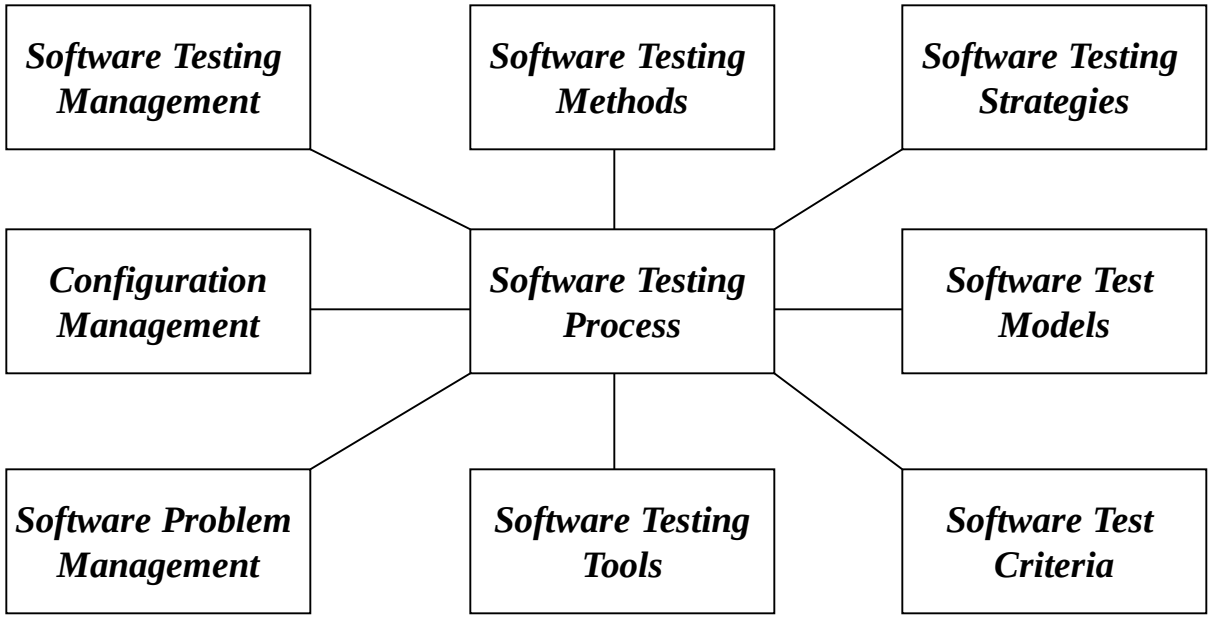
- Software Test Engineers and Testers
  - define test cases, write test specifications, run tests

- Independent Test Group

- Development Engineers
  - Only perform unit tests and integration tests

- Quality Assurance Group and Engineers
  - Perform system testing
  - Define software testing standards and quality control process

Software Testing Scope



Software Testing Activities

- Test Planing
  Define a software test plan by specifying:
    - a test schedule for a test process and its activities, as well as assignments
    - test requirements and items
    - test strategy and supporting tools

- Test Design and Specification
    - Conduct software design based well-defined test generation methods.
    - Specify test cases to achieve a targeted test coverage.

- Test Set up:
    - Testing Tools and Environment Set-up
    - Test Suite Set-up

- Test Operation and Execution
    - Run test cases manually or automatically

Software Testing Activities

- **Test Result Analysis and Reporting**
  Report software testing results and conduct test result analysis

- **Problem Reporting**
  Report program errors using a systematic solution.

- **Test Management and Measurement**
  Manage software testing activities, control testing schedule, measure testing complexity and cost

- **Test Automation**
  - **Define and develop software test tools**
  - **Adopt and use software test tools**
  - **Write software test scripts and facility**

- **Test Configuration Management**
  - **Manage and maintain different versions of software test suites, test environment and tools, and documents for various product versions.**

Verification and Validation

Software testing is one element of a broader topic that is often referred to as
===> Verification and Validation (V&V)

Verification --> refers to the set of activities that ensure that software correctly implements a specific function.

Validation -> refers to a different set of activities that ensure that the software hat has been built is traceable to customer requirements.

Boehm [BOE81]:

Verification: "Are we building the product right?"
Validation: "Are we building the right product?"

The definition of V&V encompasses many of SQA activities, including formal technical reviews, quality and configuration audits performance monitoring, different types of software testing feasibility study and simulation

Software Quality Factors

Functionality (exterior quality)

- Correctness, reliability, usability, and integrity

Engineering (interior quality)

- Efficiency, testability, documentation, structure

Adaptability (future qualities)

- Flexibility, reusability, maintainability

Software Testing Principles

- ***Principle #1: Complete testing is impossible.***

- ***Principle #2: Software testing is not simple.***
  - ***Reasons:***
    - ***Quality testing requires testers to understand a system/product completely***
    - ***Quality testing needs adequate test set, and efficient testing methods***
    - ***A very tight schedule and lack of test tools.***

- ***Principle #3: Testing is risk-based.***

- ***Principle #4: Testing must be planned.***

- ***Principle #5: Testing requires independence.***

- ***Principle #6: Quality software testing depends on:***
  - ***Good understanding of software products and related domain application***
  - ***Cost-effective testing methodology, coverage, test methods, and tools.***
  - ***Good engineers with creativity, and solid software testing experience***

Software Testing Myths

- We can test a program completely. In other words, we test a program exhaustively.

- We can find all program errors as long as test engineers do a good job.

- We can test a program by trying all possible inputs and states of a program.

- A good test suite must include a great number of test cases.

- Good test cases always are complicated ones.

- Software test automation can replace test engineers to perform good software testing.

- Software testing is simple and easy. Anyone can do it. No training is needed.

Software Testing Limits

- Due to the testing time limit, it is impossible to achieve total confidence.

- We can never be sure the specifications are 100% correct.

- We can never be certain that a testing system (or tool) is correct.

- No testing tools can copy with every software program.

- Tester engineers never be sure that they completely understand a software product.

- We never have enough resources to perform software testing.

- We can never be certain that we achieve 100% adequate software testing.