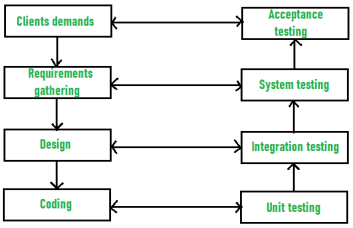
Software Engineering and Testing

Test Automation



LEVELS OF TESTING

Outline

- Need for Automation
- Categorization of Testing Tools
- Selection of Testing Tools
- Cost Incurred in Testing Tools
- Guidelines for Automated Testing
- Overview of some Commercial Testing Tools.

Introduction

- Automation makes machines to do all the repetitive activities by giving the tester freedom and time to do more productive.
- The complexity is selecting a testing tool considering high cost and that a single tool can not cover the whole testing automation.
- Still there are some activities in testing which can not be automated.
- Automated tools will never replace the analytical skills required to conduct test, nor will they replace manual testing.
- So automation is just an enhancement to the manual testing process.

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Need of Automation

- **Reduction of testing Effort** : Test cases for a complete s/w may be hundreds of more in number.
  - Executing all of them takes a lot of testing time.
- **Reduces the testers' involvement in executing tests :** Automating test process will relieve testers to do some other work by increasing parallelism in testing efforts.
- **Facilitates Regression Testing :** Most time consuming process. Automating regression testing will reduce the time taken as compared to the manual testing.
- **Avoids Human mistakes :** Human may be biased towards limited test cases but tool will not cause this problem.
- **Reduces overall cost of the software :** If testing time increases, cost of the s/w increases. Testing tools reduces both by easing the burden of the test case production and execution.

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Need of Automation

- **Simulated testing :** Load performance testing is an example of testing where real-life situation needs to be simulated in test environment.
  - Automated tools can create millions of concurrent users/data and effectively test the project when practically its impossible to create them in real.
- **Internal Testing :** Testing memory leakage or coverage testing would be cumbersome, inaccurate, and time-consuming. Automation makes it quickly and accurately.
- **Test Enablers :** While development is not over, stubs and drivers are needed to prepare data, simulate environment, make calls, and verify results. Automation reduces the effort required.
- **Test case Design :** Automated tools can be used to design test cases also.

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Categories of Testing Tools

- **Static Testing Tools :** Static tools parse the program text, recognize the various sentences, and detect the following:
  - Statements are well-formed.
  - Inferences about the control flow of the program.
  - Compute the set of all possible values for program data.
- Static tools perform following type of static analysis:
  - **Control Flow Analysis** (Loops with multiple Exit and Entry Points, Unreachable Code, etc.)
  - **Data use Analysis** (All data faults)
  - **Interface Analysis** (All interface faults, undeclared functions, uncalled functions, unused function call results)
  - **Path Analysis** (all possible paths and program control)

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Categories of Testing Tools

- **Dynamic Testing Tools :** When some operations are being performed concurrently it becomes difficult to test the system and hence making it difficult to generate test cases.
- Automated test tools enable the test team to capture the state of events during the execution of program by preserving the snapshot of the conditions.
- These tools are called **program monitors**.
- They perform following activities :
  - List the number of times a component is called or line of code is executed. The statement or path coverage of their test cases.
  - Report on whether a decision point has branched in all directions, thereby providing information about branch coverage.

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Categories of Testing Tools

  - Report summary statistics providing a high level view of the percentage of statements, paths, and branches that have been covered by the collective set of test cases run.
    - This information is important when test objectives are stated in terms of coverage.

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Selection of Testing Tools

- The biggest question is to select a testing tool. It depends on,
  - Needs of the organization
  - Project environment
  - Current Testing methodology
- Some guidelines:
  - **Match the tool to its appropriate use:** a tool may not cover many features as most of them are for specific tasks. So for proper selection, the tester needs to be familiar with both the tool and its uses in order to make a proper selection.
  - **Select the tool to its appropriate SDLC phase**: With the methods changing in SDLC, the testing tool also changes so its necessary to select the testing tool according to the SDLC phase.
  - **Select the tool to the skill of the tester**: tester must select a tool that conforms to his skills.

Selection of Testing Tools

  - **Select a tool which is affordable**: costly tools increase the cost of the project and increasing the budget of the project for a costly testing tool is not desired.
  - **Determine how many tools are required for testing the system:** a single tool can not satisfy all the requirement so assess the tool as per test requirements and determine the no and type of tools required.
  - **Select the tool after having the schedule of testing**: check there is enough time for learning/provide training the testing tool and then performing automation with that tool.

Cost Incurred in Testing Tools

- **Automated Script Development:** Automating test execution requires programming exercise to create test scripts as testing tools can not create scripts.
- **Training is required**: Tester may or may not be aware of the testing tool. So it becomes necessary to include cost of training in the project budget and schedule.
- **Configuration Management**: to track large no of files and test related artifacts.
- **Learning Curve for the Tools**: learning curve associated with every tool. E.g. test scripts generated by the tool must be modified manually, requiring tool-scripting knowledge in order to make the script robust, reusable, and maintainable.
- **Multiple Tools are required:** possibly all the requirements cannot be satisfied by one tool only, in that case selecting too many tools may incur a lot of cost.

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Cost Incurred in Testing Tools

- **Testing Tools can be Intrusive**: some tools require special code to be inserted into the system to work correctly and to be integrated with the testing tools.
  - These are known as intrusive tools. They post the risk that defects introduced by the inserted code could interfere with the normal functioning of the system.

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Guidelines for Automated Tools

- Testing tool can never replace analytical skills required to conduct testing in manual testing.
- Guidelines :
  - Consider building a tool instead of buying one if possible.
  - Test the tool on an application prototype.
  - Not all the tests should be automated.
  - Focus on the needs of the Organization and know the resources (budget, schedule) before choosing the automation tool.
  - Use proven test-script development techniques.
  - Automate the regression tests whenever feasible.

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Some Commercial Testing Tools

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