Testing Driven Development

A mini-lecture series

CSE498 Collaborative Design (W) - Secure and Efficient C++ Software Development

02/05/2025

Kira Chan

https://cse.msu.edu/~chanken1/

Testing (again)

- A software development process that promotes the idea of writing automated test **before** writing the code
- Very tied with the *Agile* development process
- Unit-test
  - Describes a small piece of test case that test a single (isolated) component

Pipeline (actually works well with leetcode)

1. Understand the problem space and inputs (behaviour of the sys)
2. Develop the test cases
    a) Based on what you expect to be easy correct inputs
    b) Correct harder inputs
    c) Edge cases (divide by zeros, negatives, etc.)
3. Run the tests, make sure they should fail
4. Write simplest code that passes the tests (building functionality)
5. Be sure all test cases pass
6. Refractor as needed, while ensuring the test still pass
    a) Move code to where it belongs
    b) Remove duplicated code
    c) Split into multiple methods, etc.

Advantages

- TDD ensures that all code have been tested (since you write the test first)
- Provides confidence for developers in their code (double-edged)
- Well-documented code
- **Facilitates Continuous Integration –** helps CI/CD process
  - **Integration testing:** Future code pushes will not break existing code

Disadvantages

- Increased code written
- False security
- Writing comprehensive test cases is time consuming (maybe not a bad thing)

Verification and Validation (V&V)

- Verification refers to: Does the product / software work correctly (according to requirements)
  - Verify that your product works as designed
- Validation refers to: Does the product / software fit the customer's needs
  - Validate that you build the right product

- Independent Verification and Validation (IV&V): an independent third party tests your software

Broad types of testing

- Unit Testing
- Integration Testing
- Acceptance Testing
- Regression Testing
- Compatibility Testing
- Performance Testing

Unit Testing

- Tests a single function / unit of your code

- Verification or Validation?
  - Verification

Integration Testing

- Does your component work with the system as a whole?
- Think:
  - Will your code break another part of the system
  - Group 1’s code when pushed, should not lead to a failure in Group 3’s test cases

- Verification or Validation?
  - Verification

Regression Testing

- Checks if the application behaves the way it used to (before your new changes / patch)
- Verification or Validation?
  - Validation (?)

Acceptance Testing

- Evaluate the compliance of the system built with the business or customer's needs
- Assess whether it is acceptable for delivery or not

- Definition from ISTQB:
  - Formal testing with respect to user needs, requirements, and business processes conducted to determine whether a system satisfies the acceptance criteria[3] and to enable the user, customers or other authorized entity to determine whether to accept the system
- Verification or Validation?
  - Validation

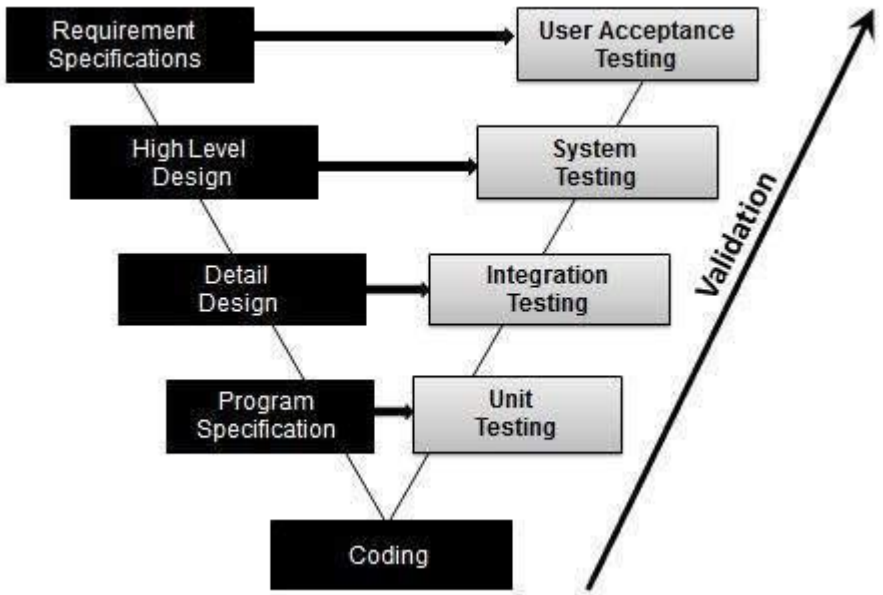
Performance Testing

- Test how well your software performance under certain workload, conditions, on various machines, etc.
- Verification or Validation?
  - ?

Compatibility Testing

- Makes sure that it works on all supported (or extended) platforms
- Verification or Validation?
  - ?

V model summary



Broad types of testing

- Unit Testing [verification]
- Integration Testing [verification]
- Acceptance Testing [validation]
- Regression Testing [verification/validation]
- Compatibility Testing [other]
- Performance Testing [other]

CI/CD

- Continuous Integration and Continuous Delivery
- When you push a change, it will automatically deploy test to make sure it doesn’t break in existence

Person of the Day
Al Gore

- Inventor of the world wide web, HTML markup language, URL, HTTP

- Just kidding, he promoted legislation that funded and expanded the APPANET

Person of the Day
Tim Berners-Lee

- Inventor of the world wide web, HTML markup language, URL, HTTP
- In an interview, he admitted that the initial pair of slashes “//” in a web address are unnecessary
  - “seemed like a good idea at the time”