Test-Driven Development Exposed

Growing Complex Software One Test at a Time

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Introduction

- Software engineering has seen its share of controversies, fads, and techniques recently
- One technique that has stirred controversy and been called a fad is test-driven development (TDD)
- While it shares a lot of letters, it's not the same as ATDD or BDD
- TDD is not where testers tell the developers what to do
- TDD might not really even be testing, at least not as testers typically mean that word
- While it came from Agile, it's not specific to Agile
- Let's look more closely at this oft-discussed, sometimes-misunderstood technique…

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Test-driven Development

- A development technique (test-first)
  - Add test for small piece of code
  - Run the test (which should fail)
  - Write code until test passes
  - Refactor code
  - Repeat process (previous tests and added tests)
- Used in Agile and sequential lifecycles
- Fix code bugs on introduction
- TDD provides executable design specifications, as automated tests, in continuous integration

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Acceptance Test-driven Development

- Define acceptance criteria and tests early in development
- Collaborate so every stakeholder understands behavior
- Process:
  - Define tests for intended behavior
  - Create automated acceptance tests
  - Program intended behavior
  - Run automated acceptance tests
- Create reusable regression tests for continuous integration
- Test data and service layers, too
- Test system/acceptance level in appropriate environments
  - Identify/quickly resolve defects
  - Verify feature behavior
  - Measure acceptance criteria
  - Deliver to external testing teams

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Behavior-driven Development

- Behavior-driven development is a black-box approach
- Focus on expected behavior:
  - Developer creates a test for the class under development
  - Tests should make sense to stakeholders (including testers)
  - Clarify where defect lies (code, user story, or test)
- Behavior-driven development defines tests:
  - Given some context
  - When some event occurs
  - Then the system should produce some outcome(s)
- Helps to define test cases for developer based on tester/stakeholder collaboration

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TDD Process

- If first starting, set up unit test framework
- Design the module by defining the steps (and thus tests) making up the task
- For each step
  - Create one new unit test
  - Run the new unit test to confirm it fails
  - Write only code needed to make the new test pass
  - Refactor the code until you're happy with it
  - Ensure that all unit tests continue to pass
  - Move on to the next unit test
- Check code and automated tests into continuous integration framework

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What Some People Mean by TDD

- When some people say they use TDD, they might mean:
  - "We have automated unit tests"
  - "We create unit tests after writing code"
  - "We have a continuous integration framework"
  - "We create unit tests unless the code is too tightly coupled" (excuse alert!)
  - "We'd like to use TDD, but there aren't any frameworks for our language" (excuse alert!)
  - "We don't really know what TDD is, but our developers say it's cool, so I'm sure we do it" (BS alert!)
- Often, pure TDD is not done, but the first three items provide the real benefits

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Not Testing as We Know It, Jim

- The process leaves many open questions:
  - What are the test bases?
  - What are the test oracles?
  - Are any black-box and other techniques used?
  - Are positive *and* negative tests written?
  - Is any level of code coverage required?
  - Is static analysis used?
  - Is an effective code review required?
- Without good answers to these questions, TDD tests are executable design specifications, but not tests

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What Can Testers Do in TDD?

- By involving testers, organizations can make TDD truly testing
- Skills required of testers:
  - Code literacy, in system language(s)
  - Knowledge of unit test tools
  - Ability to interpret static analysis results
  - Understanding of code coverage
  - Knowledge of the right test bases and oracles to use
  - Ability to organize and participate in code reviews
- The more skill in each area, the more the tester can contribute
- Testers should aim to complement (not duplicate) coverage in the tests they create

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An Example of TDD in Action

- Building an e-commerce application
- One function needed: processing credit and debit card payments
- An online payment processing service will be used
- A programmer will use TDD to create a module to access this service
- Let's see the steps…

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Creating the Module

- Write test, write code, refactor:
  1. Verify valid input parameters (probably multiple steps here)
  2. Establish a connection to the web service
  3. Transmit the parameters
  4. Handle successful transactions
  5. Handle unsuccessful transactions (probably multiple steps here)
- The tests *will* provide executable specifications for the code as it grows
- The tests *might* also truly test the code as it is written

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TDD Controversy

- Boosters of TDD (i.e., Beck, Fowler, Martin) claim big things for TDD
  - "Re-factor code with zero regression risk"
  - "Clarify thinking before coding"
- Does TDD live up to the claims?
- I asked Beck to comment, but got no response
- I also asked TDD critic Jim Coplien to summarize his concerns…

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Coplien's Case Against TDD

- TDD is not a testing technique, it's a design technique
- It has the weaknesses of unit testing (see articles)
  - The author bias is a problem
  - It tests individual objects, not interfaces or emergent system behaviors
- As a design technique, it encourages the wrong perspective
  - Objects should reflect usage (top-down)
  - TDD encourages procedural design (bottom-up)
- TDD can create as much test code as delivered code
- Automated TDD tests give:
  - An ever-growing inventory of tests
  - A sense of false confidence
  - Pure verification; no validation
- Empirical research does not support Beck's claims for improved coupling and cohesion or for reduced bug density
- So, TDD has little or no benefit with very high cost

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Conclusions

- TDD is part of the alphabet soup of agile techniques, along with ATDD and BDD
- TDD can mean different things to different people
- TDD is different from most other testing, and may not really be testing at all
- Technically skilled testers can contribute to TDD if it's used in their teams
- Controversies exist around TDD, which might lead to changes in the future

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