Writing tests that stand the test of time

Segun Famisa
Android GDE

APRIL 08+09
DROIDCON BOS19

segunfamisa

segunfamisa.com

Google Developers Experts 2018

Android GDE

Outline

Introduction to TDD

Challenges with TDD

Testing tools in practice

Writing maintainable tests

Recap

Introduction

So, what's Test Driven Development?

“

TDD is a software development process that relies on the repetition of a very short development cycle: requirements are turned into very specific test cases, then the software is improved to pass the new tests, only

Wikipedia

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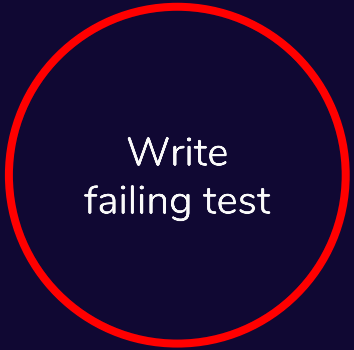
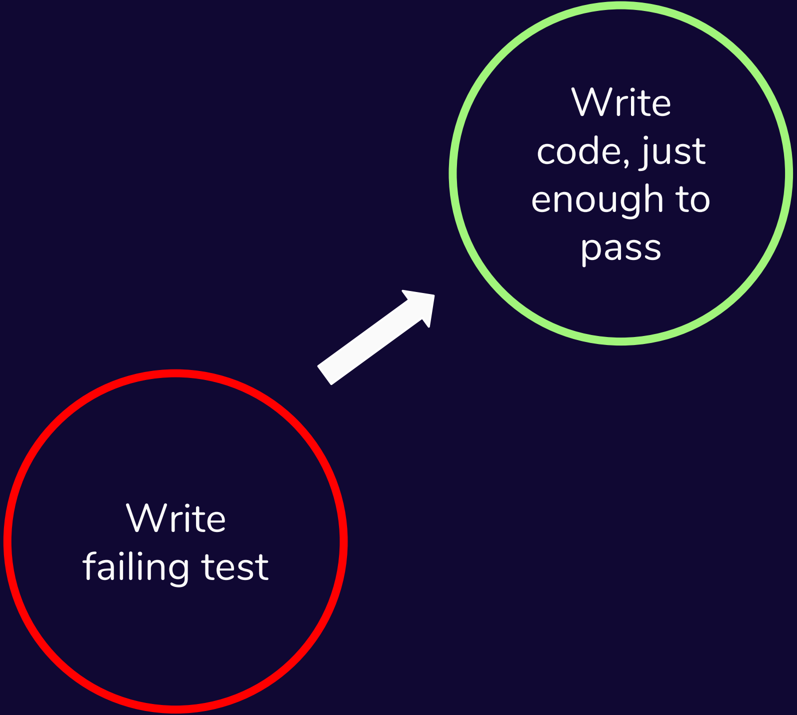
How to do TDD?

Red - Green - Refactor

Red - Green - Refactor



Red - Green - Refactor



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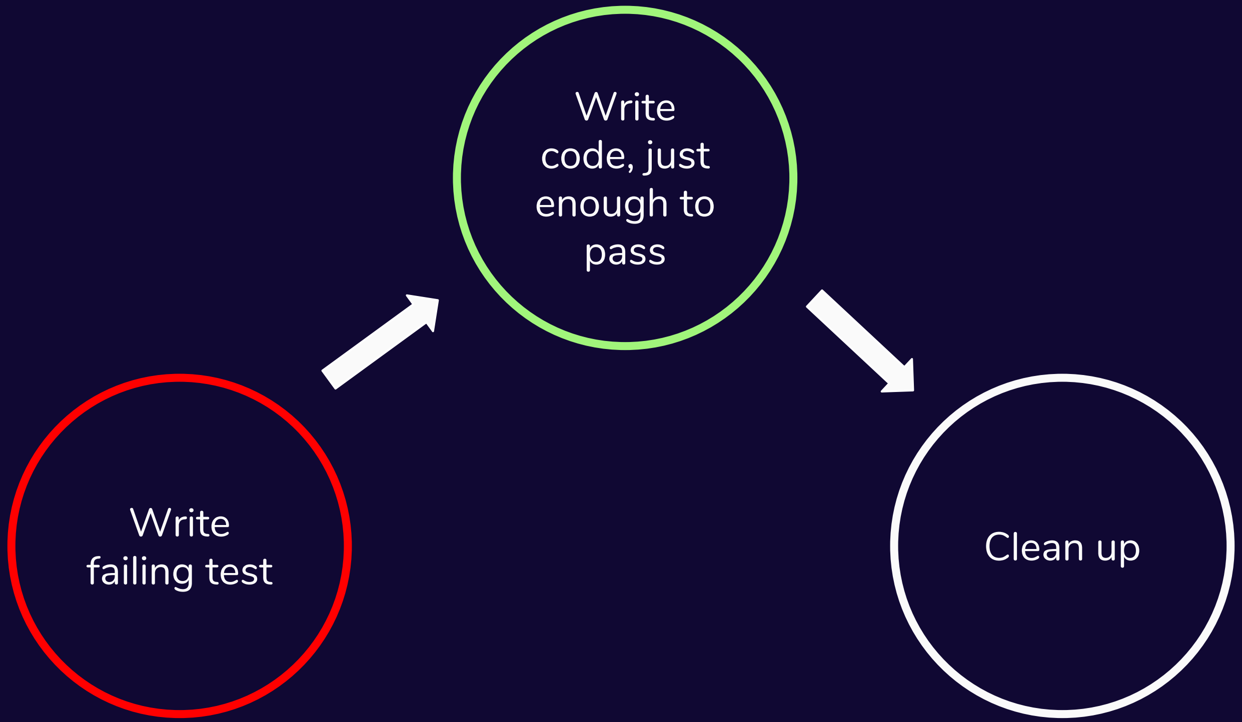

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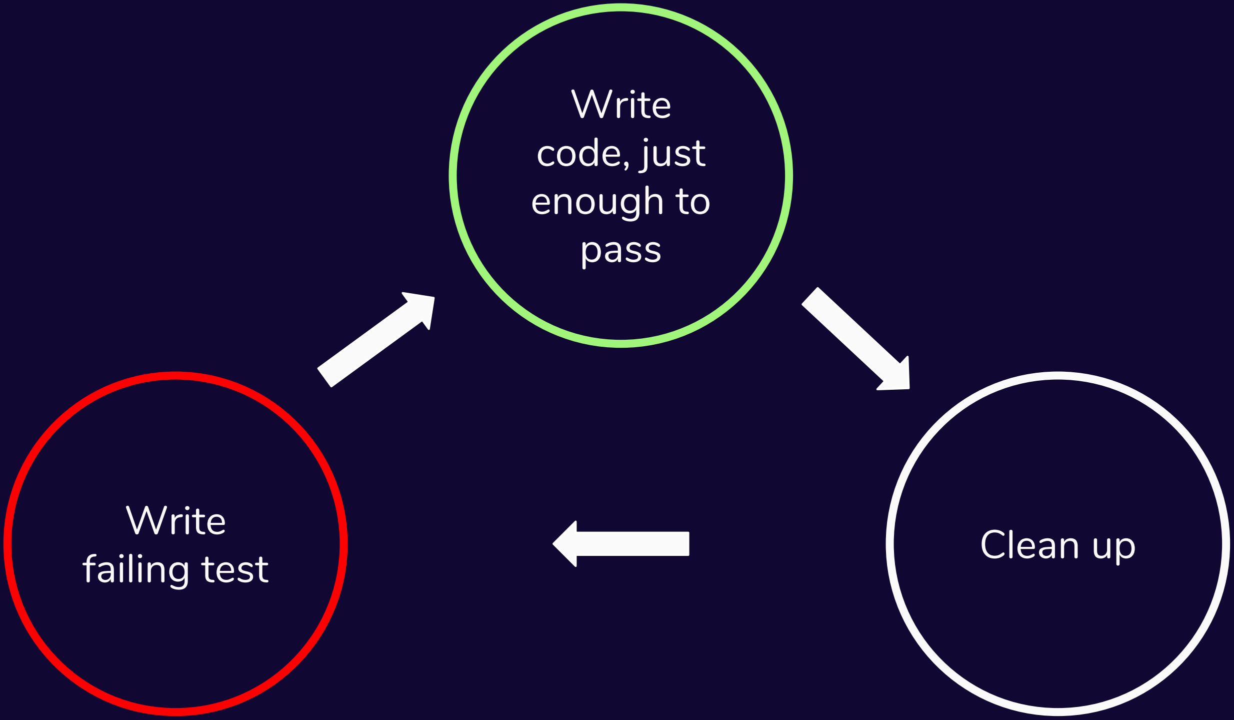

Why do we need tests?

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- Quick feedback about bugs/errors
- Good code design
- Documentation for code behavior
- Confident refactoring

Challenges in practicing TDD

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Legacy code

- Legacy code is difficult to test.

Challenges in practicing TDD

Time

- Tests are code too, so they take time to write

Challenges in practicing TDD

Bad tests

- Fragile and obscure tests defeat the purpose of TDD

Challenges in practicing TDD

Bad tests

- Fragile and obscure tests defeat the purpose of TDD
- “Bad tests” is worse than no tests - time and effort wasted without results

Tools & concepts for writing maintainable tests

Test doubles

Test doubles

Just like stunt doubles

https://people.com/movies/actors-and-their-stunt-doubles-photos

Test doubles - dummies

Test doubles - dummies

- Dummies are like placeholders. Just to fill in parameters.

Test doubles - stubs

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- Objects that return predefined data
- They usually don’t hold state/respond to other actions besides the one they are created for

Test doubles - stubs

```
interface IUserRepository {...}
```

Test doubles - stubs

```
interface IUserRepository {...}

...

class UserRepository(private val userDao: UserDao) : IUserRepository {

    override fun getUser(userId: Long): User {
        return userDao.findById(userId = userId)
    }
}
```

Test doubles - stubs

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interface IUserRepository {...}

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class UserRepository(private val userDao: UserDao) : IUserRepository {

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        return userDao.findById(userId = userId)
    }
}
```

Test doubles - stubs

```
interface IUserRepository {...}

...

class UserRepositoryStub() : IUserRepository {

    override fun getUser(userId: Long): User {
        return User(userId = 1, email = "sf@sf.com")
    }
}
```

Stub returns a preconfigured user

Test doubles - fakes

Test doubles - fakes

- Similar to stubs, slightly more realistic
- Contain working implementation, but different from real version
- Typically models the behavior of the real class

Test doubles - fakes

```
interface UserDao {...}
```

Test doubles - fakes

```kotlin
interface UserDao {...}
...
class FakeUserDao() : UserDao {

    val users = mutableListOf<User>()

    override fun insert(user: User) {
        users.add(user)
    }

    override fun findById(userId: Long): User {
        return users.find { it.userId == userId }
           ?: throw Exception("user not found")
    }
}
```

Test doubles - fakes

```kotlin
interface UserDao {...}
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class FakeUserDao() : UserDao {

    val users = mutableListOf<User>()

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```

Fake dao uses a list instead of a db

Test doubles - fakes

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interface UserDao {...}
...
class FakeUserDao() : UserDao {

    val users = mutableListOf<User>()

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           ?: throw Exception("user not found")
    }
}
```

Fake dao supports the same operations

Test doubles - mocks

Test doubles - mocks

- Objects pre-programmed with expected outputs for given inputs
- Ability to record method calls and verify them
- Throw exceptions if wanted method is not called

Test doubles - mocks

```
@Test
fun userShouldBeReturnedFromDao() {

    val dao: UserDao = mock()
    whenever(dao.getUser(userId = 5)).thenReturn(User(5, "sf@sf.com"))
    ...

}
```

Test doubles - mocks

```
@Test
fun userShouldBeReturnedFromDao() {

    val dao: UserDao = mock()
    whenever(dao.getUser(userId = 5)).thenReturn(User(5, "sf@sf.com"))
    ...

}
```

Mock pre-programmed with input/output

Test doubles - mocks

```kotlin
// SettingsPresenterTest.kt

@Test
fun clickingIconShouldOpenProfileScreen() {
    ...

    val view: SettingsContract.View = mock()

    val presenter = SettingsPresenter(view, userRepo)
    presenter.profileIconClicked()

    verify(view).openProfileScreen()
}
```

Test doubles - mocks

```kotlin
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@Test
fun clickingIconShouldOpenProfileScreen() {
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    val view: SettingsContract.View = mock()

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Ability to verify interactions

Test doubles - spies

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- Hybrid between stubs, fakes and mocks

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- Hybrid between stubs, fakes and mocks
- They are as real as stubs, but also have the ability to record interactions like mocks.

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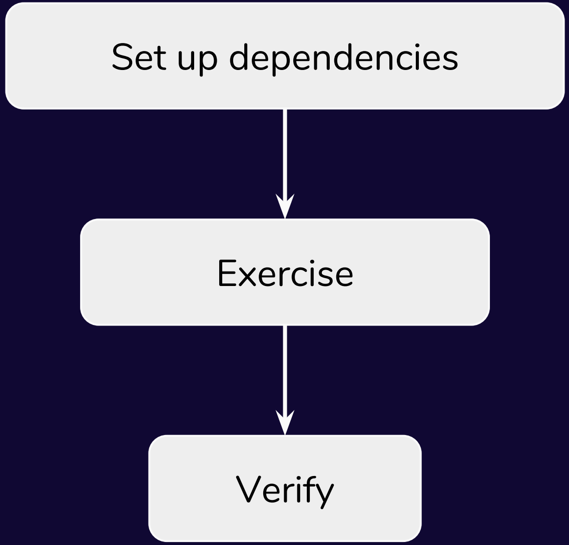
- Old tests do not break often
- Old tests are easy to update
- Easy to add new tests

Writing maintainable tests

1. Use a good test specification system



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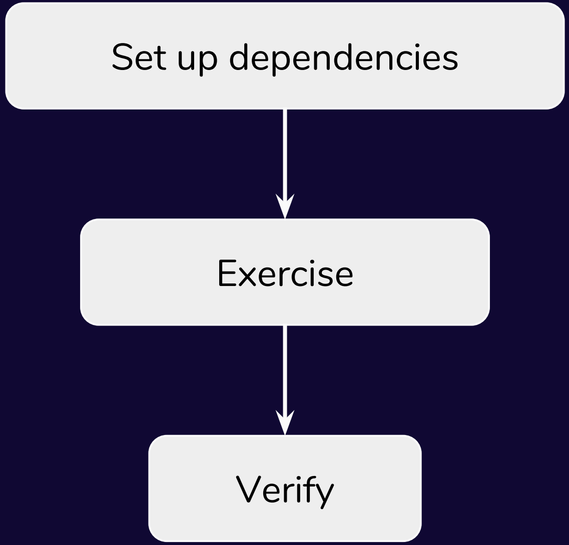

Also known as

Arrange - Act - Assert

Or

Given - When - Then

1. Use a good test specification system

```
@Test
fun scenarioX() {

    // Given the dependencies/behavior

    // When we act on the scenario

    // Then assert that expected behavior happens

}
```

2. Test behavior, not implementation details

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- For methods that return value, you should care only about the output, not how it was calculated.

2. Test behavior, not implementation details

```
@Test
fun `get user details from cache if available`() {
    ...
    val userRepo = UserRepository(cacheSource, networkSource)

    // given that a user exists in cache
    whenever(cacheSource.getUser(5)).thenReturn(User(5, "sf@sf.com"))

    // when we get user from repository
    val user = userRepo.getUser(userId = 5)

    // then verify that the cache source was called
    verify(cacheSource).getUser(5)
}
```

2. Test behavior, not implementation details

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fun `get user details from cache if available`() {
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    // when we get user from repository
    val user = userRepo.getUser(userId = 5)

    // then verify that the cache source was called
    verify(cacheSource).getUser(5)
}
```

This tests implementation details

2. Test behavior, not implementation details

```
@Test
fun `get user details from cache if available`() {
    ...
    // given that a user exists in cache
    val cachedUser = User(5, "sf@sf.com")
    whenever(cacheSource.getUser(5)).thenReturn(cachedUser)

    // when we get user from repository
    val returnedUser = userRepo.getUser(userId = 5)

    // then verify that the returned user is the one from cache
    assertEquals(cachedUser, returnedUser)
}
```

2. Test behavior, not implementation details

```
@Test
fun `get user details from cache if available`() {
    ...
    // given that a user exists in cache
    val cachedUser = User(5, "sf@sf.com")
    whenever(cacheSource.getUser(5)).thenReturn(cachedUser)

    // when we get user from repository
    val returnedUser = userRepo.getUser(user

    // then verify that the returned user is the one from cache
    assertEquals(cachedUser, returnedUser)
}
```

This tests general behavior of this repository in this scenario.

2. Test behavior, not implementation details

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- For methods that do not return any value, verify interactions with dependencies

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- For methods that return value, one should care only about the output, not how it was calculated.
- For methods that do not return any value, verify interactions with dependencies
- Be careful about overusing mocks.

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In most cases, only one assert / verify should be done in each test.

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A test should fail for only 1 reason

3. Assert/verify only one thing per test

```
@Test
fun `enabling setting updates preference and sends tracking`() {
  ...
  // when user enables the setting
  viewModel.enableSetting()

  // then verify that we set preference
  verify(userPreference).enableSetting()

  // then verify that we send tracking
  verify(trackingUtils).trackUserEnabledSetting()
}
```

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}
```

The use of “and” suggests that the test is testing more than one thing

3. Assert/verify only one thing per test

```
@Test
fun `enabling setting updates preference`() {
    ...
    // then verify that we set preference
    verify(userPreference).enableSetting()
}

@Test
fun `enabling setting posts tracking`() {
    ...
    // then verify that we post tracking
    verify(trackingUtils).trackUserEnabledSetting()
}
```

👍

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fun `search field is updated correctly when user has search history`() {
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@Test
fun `search field is updated with last search when user has search history`() {
    ...
}
```

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From the test name, we should be able to tell why the test failed.

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@Test
fun `search field is updated correctly when user has search history`() {
    ...
}
```

```
@Test
fun `search field is updated with last search when user has search history`() {
    ...
}
```

4. Use descriptive test names

Kotlin allows us to use to write test function names with spaces

```kotlin
@Test
fun `welcome dialog should be shown on first log in`() {
    // test goes here
}
```

4. Use descriptive test names

JUnit 5 allows to specify a custom display name for the test

```
@Test
@DisplayName("welcome dialog should be shown on first log in")
void showWelcomeDialogOnFirstLogin() {
    // test goes here
}
```

5. More tips

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- Avoid logic in your tests -> if/else, loops, etc.
- Avoid abstractions in tests
- Be generous with comments
- Use parameterized tests

Resources

- https://martinfowler.com/articles/mocksArentStubs.html
- http://xunitpatterns.com/
- https://testing.googleblog.com/search/label/TotT
- https://mtlynch.io/good-developers-bad-tests/
- https://jeroenmols.com/blog/2018/12/06/fixthetest/

Thank you!

@segunfamisa