Unit Testing & Isolation

Testing Essentials, Testing Levels, Unit Testing, Mocking

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Have a Question?

sli.do

#java-web

Testing

Attention please!

Testing

- **Testing** is an important part of the application lifecycle
  - In our ever-changing environment, testing is a necessity
  - New features need to be verified, before delivered to the clients
- **Testing** is a wide area of application development
  - There are several **levels** of testing
  - It does not affect only programmers
  - It has many **concepts** of development
  - There are **different types** of testing

Unit Testing

Unit Testing

- **Unit Testing** is:
  - A level of software testing where individual components are tested
    - The purpose is to validate that each unit performs as designed
  - The lowest level of software testing
  - Normally performed by software developers themselves
  - Often neglected, but it is in fact, the most important level of testing
- **Unit Testing** is often isolated in order to ensure individual testing
  - Testing Frameworks often provide *mocking* functionality

Unit Testing - Mocking

- ***Mocking*** *– something made as an imitation*
- **Mocking** is a software practice, primarily used in **Unit Testing**
  - An object under test may have **dependencies** on other objects
  - To **isolate** the behavior, the other objects are replaced
    - The replacements are **mocked objects**
    - The mocked objects **simulate** the behavior of the **real objects**
  - Useful if the real objects are impractical / incorporate to the unit test
- Basically, **Mocking** is creating objects that **simulate behavior**

Unit Testing - Benefits

- Unit testing increases confidence in changing / maintaining code
- Development is faster:
  - Verifying the correctness of new functionality is not manual
  - Localizing bugs, introduced in development is much faster
- The cost of fixing a defect detected during Unit Testing is lesser
  - Compared to the cost of the bug if it reaches the clients
- Debugging is easy
  - When a test fails, only the latest changes need to be checked
- The code is modular and reusable (necessary for Unit testing)

Unit Testing a Web Application

Simple Demonstration

Unit Testing

- **Unit Testing** web apps is pretty much like casual unit testing
  - Writing test methods to test classes and methods (functionalities)
    - Testing individual code components (**units**)
    - Independently from the **infrastructure**
  - You still use the same testing frameworks as in casual unit testing
- When using a web frameworks such as **Spring MVC**
  - Built-in logic does not need to be tested
    - It is already tested during the development of the framework itself
  - You still need to test your custom functionality

Unit Testing

- Testing a simple service with mocking in an **Spring MVC** app

```
@Entity
@Table(name = "users")
public class User {
    private String id;
    private String username;
    private String password;

    ...
}
```

```
@Repository
public interface UserRepository
extends JpaRepository<User, String> {
    User findByUsername(String username);
}
```

```
public interface UserService {
    User getUserByUsername(String username);
}
```

```
@Service
public interface UserServiceImpl {
    ...
    public User getUserByUsername(String username) {
        return this.userRepository.findByUsername(username);
    }
}
```

Unit Testing

- Testing a simple service with mocking in an **Spring MVC** app

```
public class UserServiceTests {
    private User testUser;
    private UserRepository mockedUserRepository;

    @Before
    public void init() {
        this.testUser = new User() {{
            setId("SOME_UUID");
            setUsername("Pesho");
            setPassword("123");
        }};

        this.mockedUserRepository = Mockito.mock(UserRepository.class);
    }

    ...
}
```

Unit Testing (Arrange)

- Testing a simple service with mocking in an **Spring MVC** app

```
public class UserServiceTests {
    ...
    @Test
    public void userService_GetUserWithCorrectUsername_ShouldReturnCorrect() {
        // Arrange
        Mockito.when(this.mockedUserRepository
                .findByUsername("Pesho"))
                .thenReturn(this.testUser);

        UserService userService = new UserServiceImpl(this.mockedUserRepository);

        User expected = this.testUser;
        ...
    }
}
```

Unit Testing (Act)

- Testing a simple service with mocking in an **Spring MVC** app

```
public class UserServiceTests {
    ...

    @Test
    public void userService_GetUserWithCorrectUsername_ShouldReturnCorrect() {
        ...

        // Act
        User actual = userService.getUserByUsername("Pesho");

        ...
    }
}
```

Unit Testing (Assert)

- Testing a simple service with mocking in an **Spring MVC** app

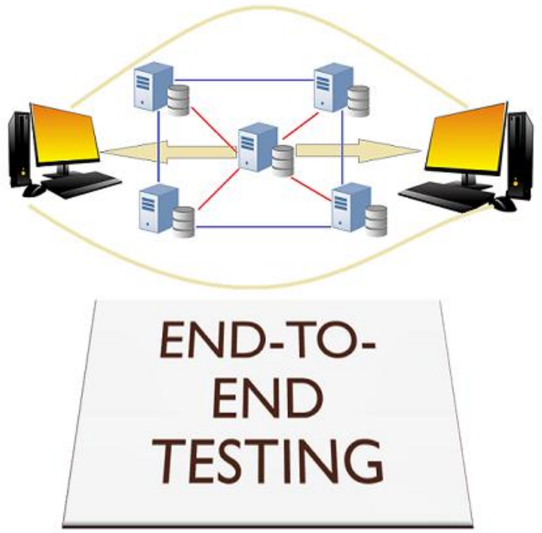
```
public class UserServiceTests {
    ...

    @Test
    public void userService_GetUserWithCorrectUsername_ShouldReturnCorrect() {
        ...

        // Assert
        Assert.assertEquals("Broken...", expected.getId(), actual.getId());
        Assert.assertEquals("Broken...", expected.getUsername(), actual.getUsername());
        Assert.assertEquals("Broken...", expected.getPassword(), actual.getPassword());
    }
}
```

Testing

- **Web applications** also need testing for "**unintentional features**"
  - Controllers, Services, Custom Components etc.
- Different **components** of the application are tested differently
  - They are tested on different levels
    - **Unit** testing
    - **Integration** testing
    - **End-to-End** testing
- Every component of the application must be tested



Testing

- There are also different concepts and practices of test development
  - **Code-first** approach (The usual Development)
  - **Test-first** approach (Test-Driven Development)
- Each has its own **advantages** and **disadvantages**
  - The **Code-first** approach ensures **flexibility** & **fast** development
  - The **Code-first** approach requires **additional refactoring**
  - The **Test-first** approach ensures **quality** and **edge case coverage**
  - The **Test-first** approach is **complicated** and is an "**initial delay**"

Testing

- Some of the most common levels of Software Testing

Testing Level	Description
Unit Testing	Tests **Individiual components** of code, independent from the infrastructure
Component Testing	Testing of **multiple functionalities** (a single component)
Integration Testing	Testing of all **integrated modules** to verify the combined functionality
System Testing	Tests the **system** as a **whole**, once all the components are integrated
Regression Testing	Ensures that a fixed bug **won't happen again**
Acceptance Testing	Tests if the **product** meets the **client**'s **requirements**. Purely done by QAs
Load / Stress Testing	Test the application's limits by attempting **large data processing** and introducting **abnormal circumstances** and **conditions** (edge cases)
Security Testing	Test if the application has any **security flaws** and **vulnerabilities**
Other Types of Testing	Manual, automation, UI, performance, black box, end-to-end testing, etc.

Testing

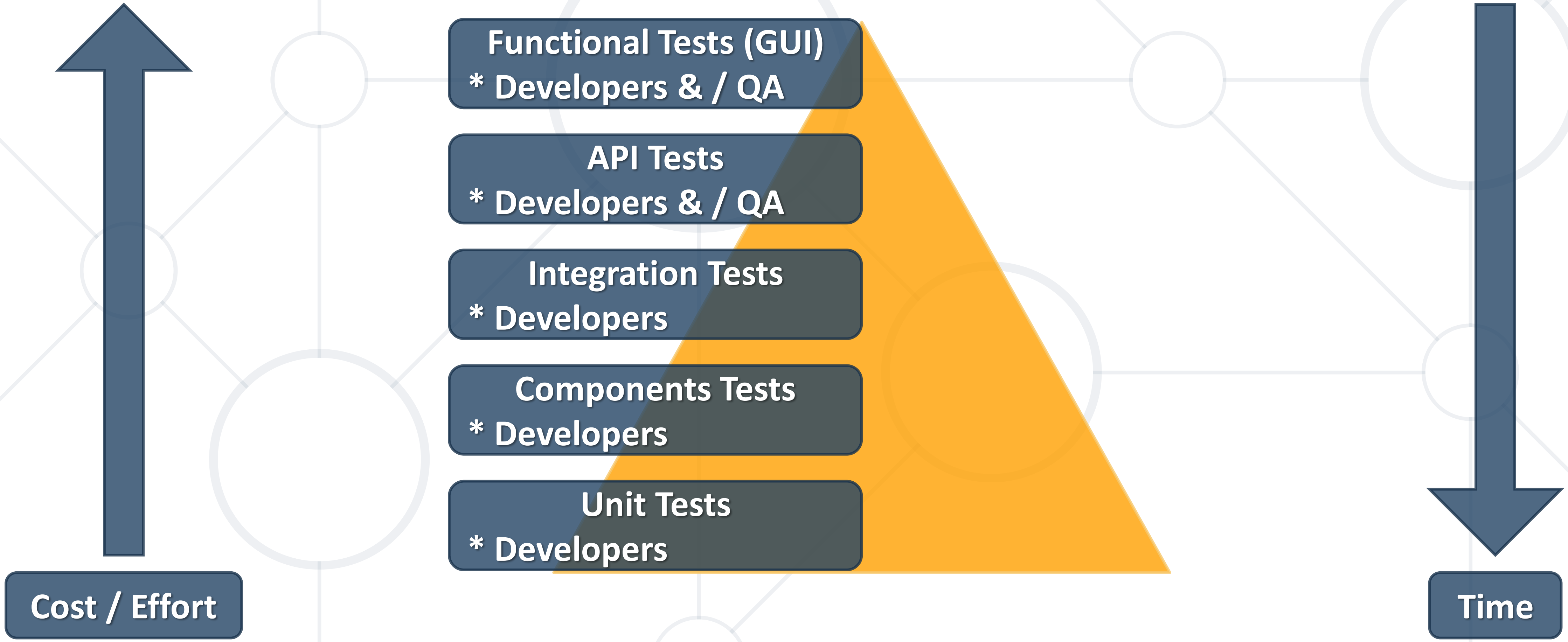
- Why should we bother testing an application on different levels?
  - Isn't Unit testing sufficient enough?
- Unit testing ensures the correctness of a particular unit
  - Not testing all components, as a whole, may lead to false results
    - A single unit may function correctly, independent of the infrastructure
  - Combining components and testing them collectively is necessary
  - Every level of testing is essential to an application's lifecycle
- The questions above are easily answered by this image.

Testing

- Why should we bother with Unit testing?
  - Can’t we just use Integration testing?..
- Unit testing is essential!
  - Helps reduce the scope, when searching for errors
  - They run faster, they fail faster.
    - Unit tests are fast – you are more likely to run them frequently
    - Frequent checks ensure correctness of the functionality
  - Provide unit documentation (in a way)

Testing

- Different Testing levels require different time and resources



Testing

Live Demonstration

Summary

- **Testing** is an important part of the application lifecycle
  - In our ever-changing environment, testing is a necessity
  - New features need to be verified, before delivered to the clients
- **Unit Testing** is:
  - A level of software testing where individual components are tested
    - The purpose is to validate that each unit performs as designed
  - The lowest level of software testing

Questions?

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