JUnit

TESTING

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Common Missconceptions

1. Testing is an activity that comes at the end
2. It is performed only by testers not by programmers
3. Its more expensive than usefull

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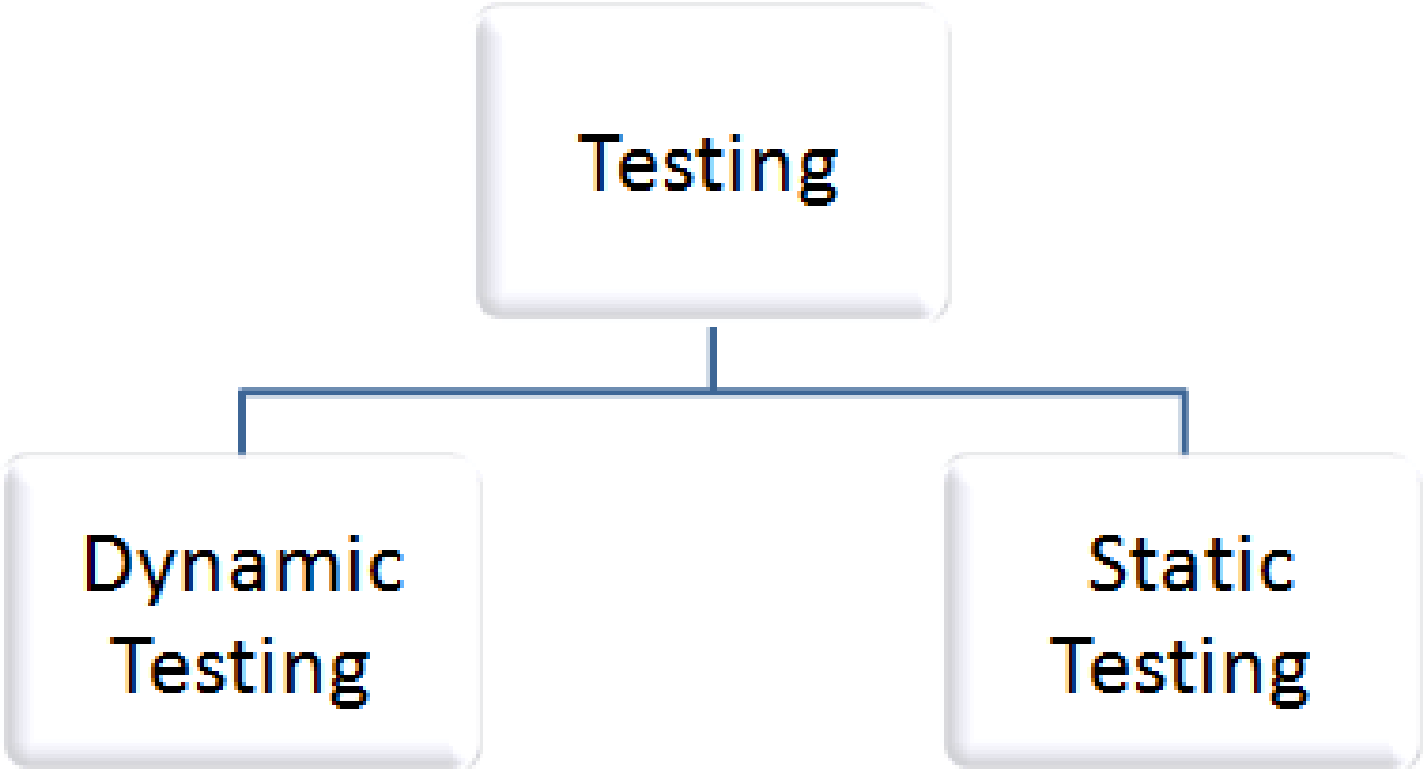
Software Testing

Dynamic vs Static



Black Box Tests, White Box Tests

Review / Static Analyis

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Static Testing

- Static tests are performed on the source code, **without executing it**
- It tests the codes **form, structure, content and documentation**
- **Pros:**
  - Very early error detection,
  - Detects error in code that is not executed.
- **Cons:**
  - Cannot test complex interactions or problems that occur during runtime
- Example: Linters, Review

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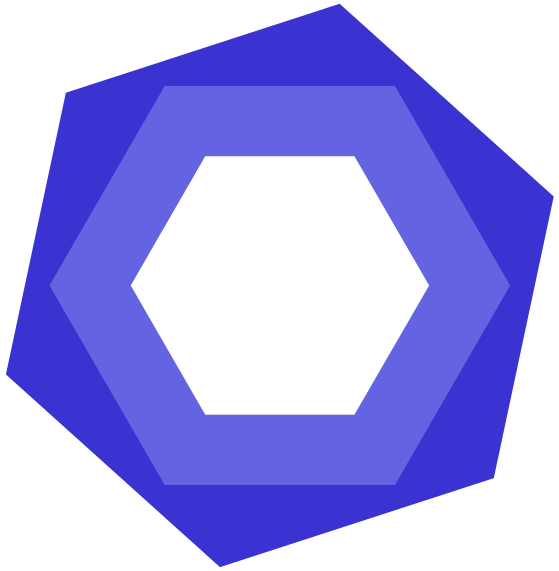
Static Software Testing

Linters

- A linter is a **static code analysis tool** used to flag programming **errors, bugs, stylistic errors** and suspicious constructs
- Especially **useful for dynamically typed languages** like JavaScript and Python



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Dynamic Testing

- Tests software by **executing it and observing ist effects**
- It tests he codes **function**, as well as **nonunctional** aspects (e.g. performance)
- **Pro:**
  - More «realistic» test
  - Tests the interplay of parts of the system
- **Con**:
  - Expensive to implement
  - Only tests parts of the code that are executed
- Examples: Unit Tests, System Tests

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Dynamic Software Testing

Box-Testing

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White Box Testing

What is tested for?

- Internal security holes
- Broken or poorly structured paths in the coding processes
- The flow of specific inputs through the code
- Expected output
- The functionality of conditional loops
- Testing of each statement, object, and function on an individual basis

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White Box Testing

How?

- Understand Source Code!
- Understand Requirenments!
- Create Test cases
  - Code Coverage

- Unit Testing
- Penetration Testing
- Testing for Memory Leaks

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White Box Testing

Pros & Cons

Advantages

- Code optimization by finding hidden errors.
- Can be easily automated.
- Testing is more thorough as most code paths are usually covered.
- Testing can start early in development even if GUI is not available.

Disadvantages

- Quite complex and expensive.
- Requires a detailed understanding of programming and implementation.
- Time-consuming

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Black Box Testing

What is tested?

- **Functional Testing**
  - Does the Software meet the requirements? I.e. are alluser stories implemented & all use cases covered
- **Non-Functional Testing**
  - Performance, scalability, usability etc.
  - Penetration tests (simulate external hacking)
  - Stress testing

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Black Box Testing

How?

- Understand Requirenments!
- Evaluate the set of valid inputs and test scenarios to test the software
- Prepare the test cases to cover a maximum range of inputs.
  - Test Boundary values and invalid cases
- Maunal Testing
- Automated UI Testing to simulate usage scenarios

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Black Box Testing

Pros & Cons

Advantages

- No technical knowledge required
- Testing is performed independent of development.
- Tests the “big picture” functionality of the software.

Disadvantages

- Limited coverage
- Test cases are difficult to design.
- Blind coverage, since the tester cannot target specific code segments or errorprone areas.

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Black Box vs White Box

Zusammenfassung

	Black-box testing	White-box testing
Definition:	Software testing method where the internal structure of the system is not known	Software testing method where the internal structure of the system is known
Used For:	Verifying input methods and outputs of the system.	Verifying internal structure of system's components
Performed By:	Testers	Developers
Applicable To:	Systems and Acceptance testing	Unit testing
Perspective	User	Developer
Introspection	No	Yes
Coding Knowledge:	No	Yes
Implementation Knowledge:	No	Yes
Test Cases:	Based on requirements	Based on detailed design

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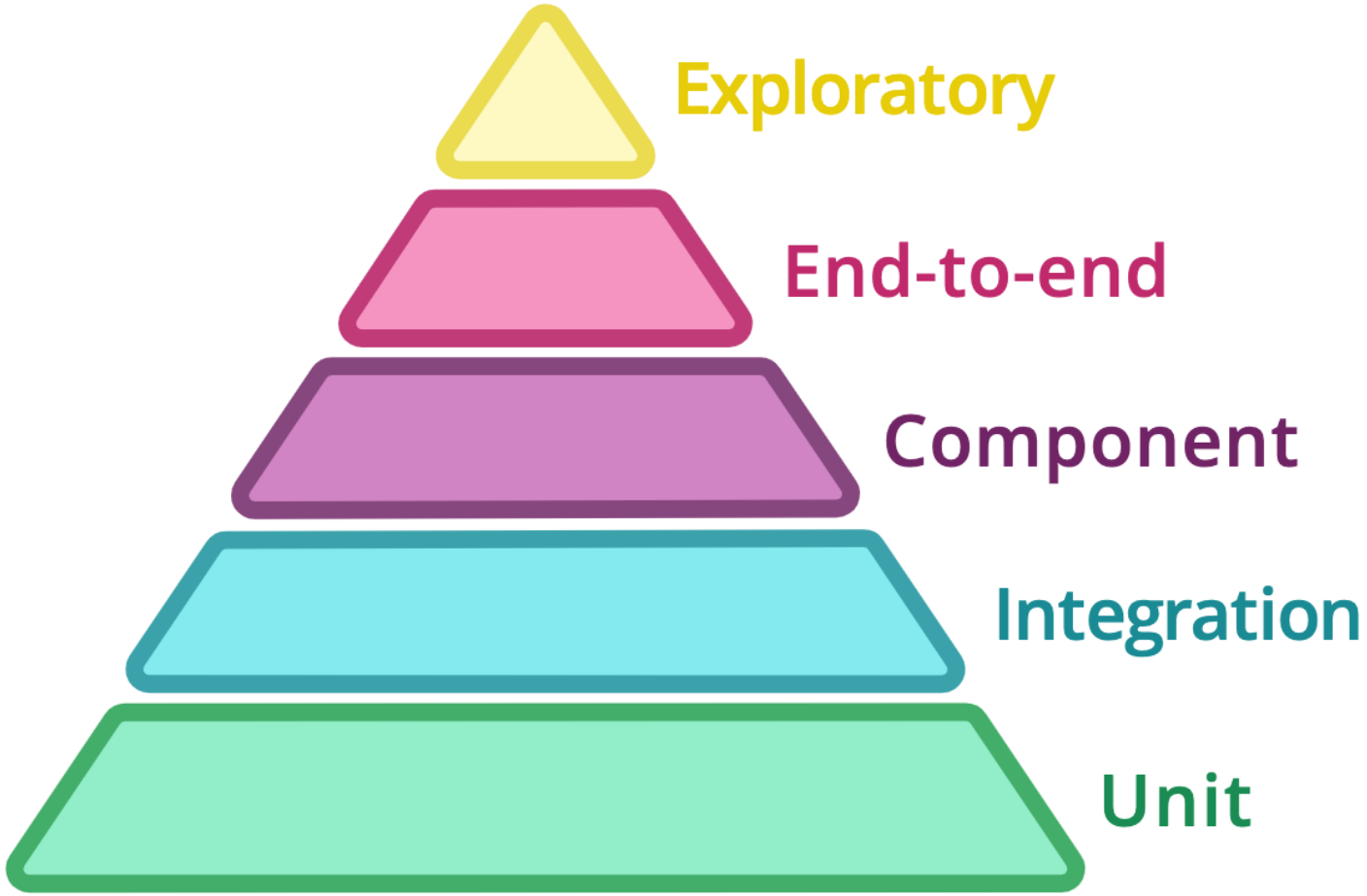
Testing Levels



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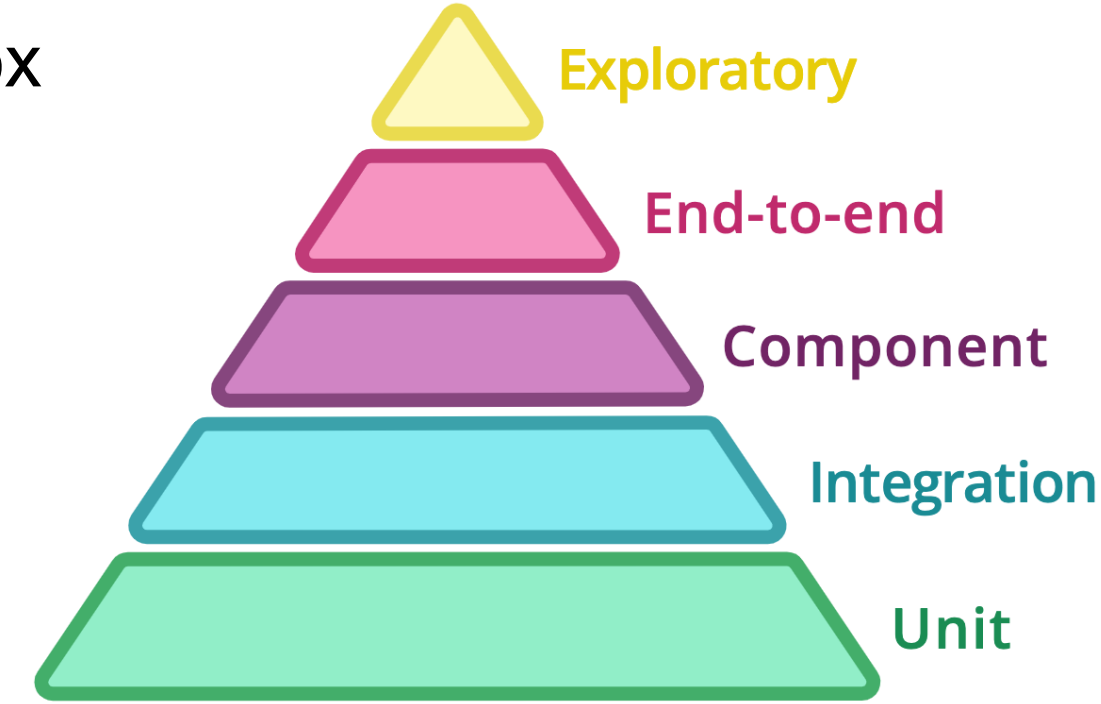
Testing Levels

Why?

- Differnet levels implement Black Box or White Box Testing
- Differnet levels allow for granular testing of differnet levels of the applicaiton



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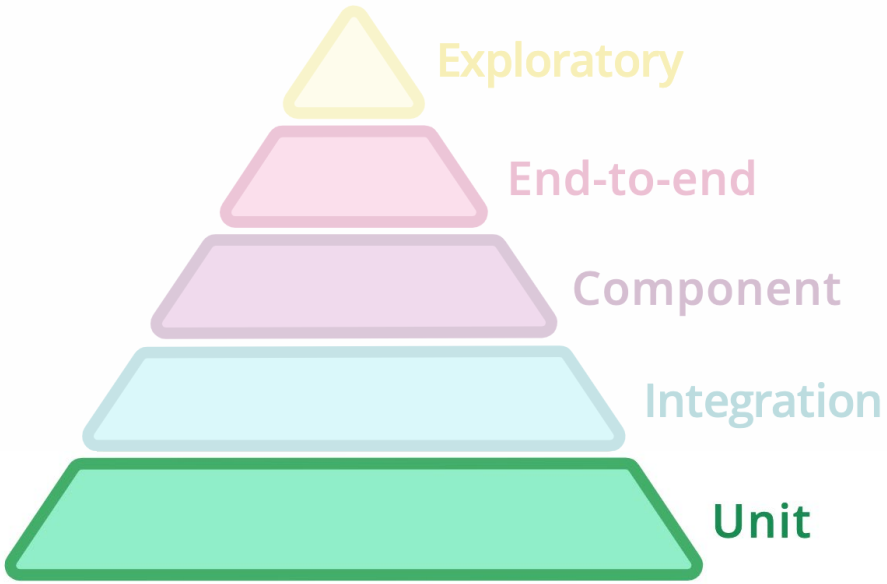
Unit Tests

- In Unit Testing **individual units or components of a software** are tested.
- The test validates if a certain piece of code produces the expected output given a specified input



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Unit Tests

Example

- Should cover a large part of the codebase
- Unit tests are fast!

  ➔can be run regularly

```
class CalculatorTest {

    Calculator calculator;

    @Test

    @DisplayName("Simple multiplication")

    void testMultiply() {
        assertEquals(20,
      calculator.multiply(4, 5), "Regular
      multiplication");
    }
}
```

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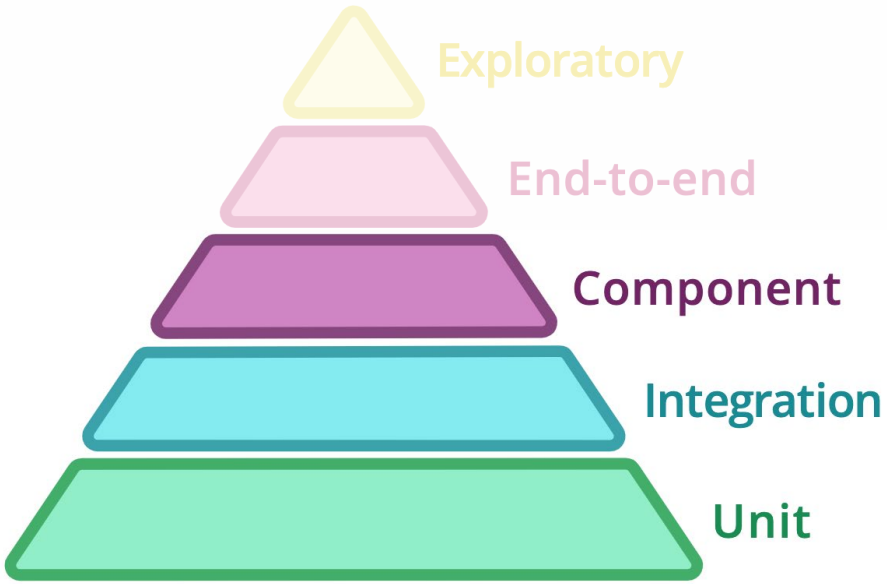
Integration & Component Tests

- Test the correct **inter-operation of multiple subsystems**
- Test the modules which are working fine individually don't have issues when they are integrated.
- This detects errors related to the API design



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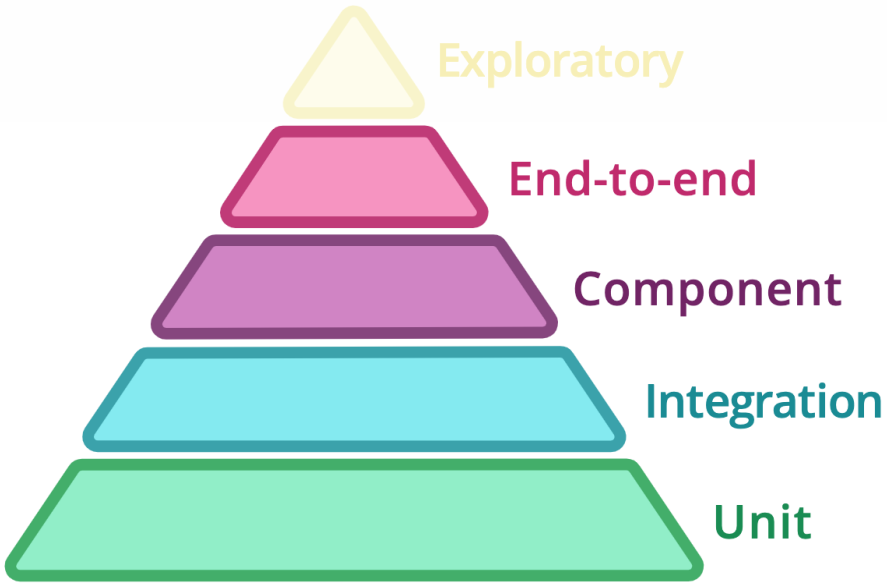
End-to-end / System Test

- Tests a system as a black box.
- Ensures that both **functional and non-functional requirements** are met
- Aims to replicate real user scenarios so that the system can be validated for integration and data integrity.



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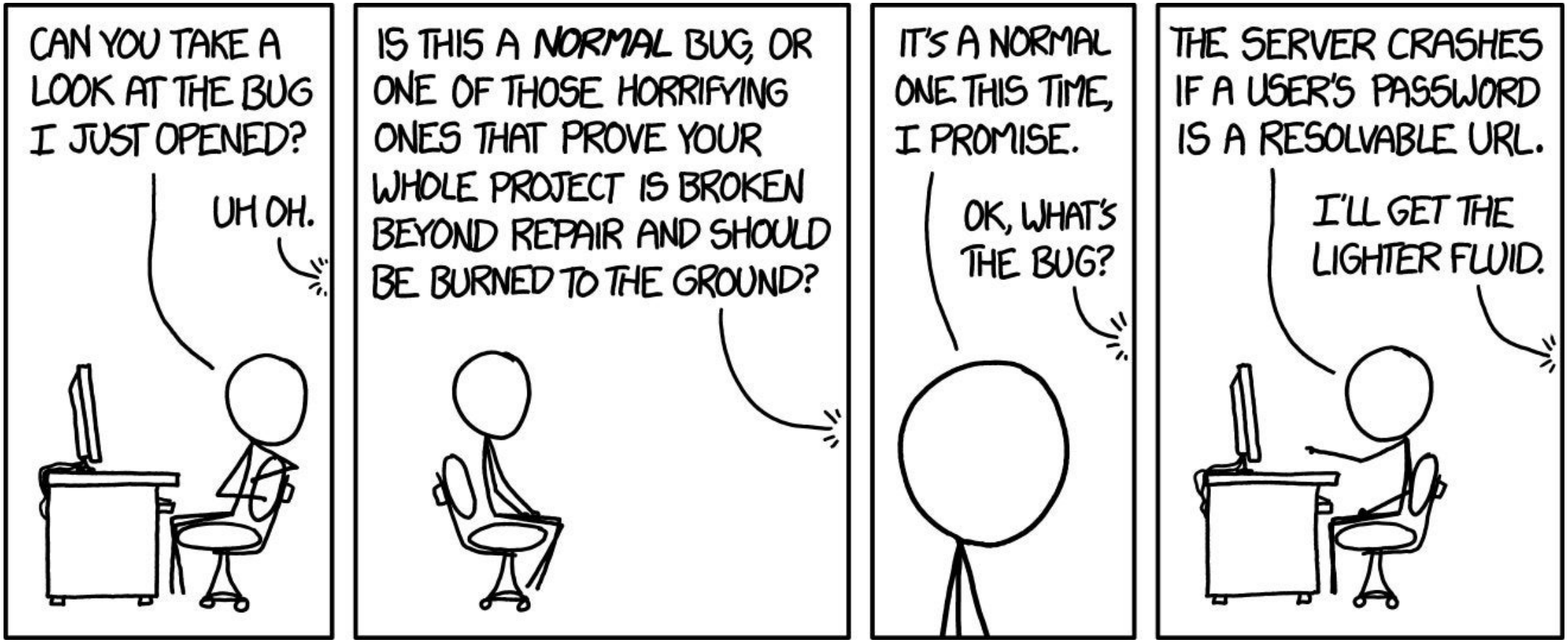
CAN YOU TAKE A LOOK AT THE BUG I JUST OPENED?
UH OH.
IS THIS A NORMAL BUG, OR ONE OF THOSE HORRIFYING ONES THAT PROVE YOUR WHOLE PROJECT IS BROKEN BEYOND REPAIR AND SHOULD BE BURNED TO THE GROUND?
IT'S A NORMAL ONE THIS TIME, I PROMISE.
OK, WHAT'S THE BUG?
THE SERVER CRASHES IF A USER'S PASSWORD IS A RESOLVABLE URL.
I'LL GET THE LIGHTER FLUID.

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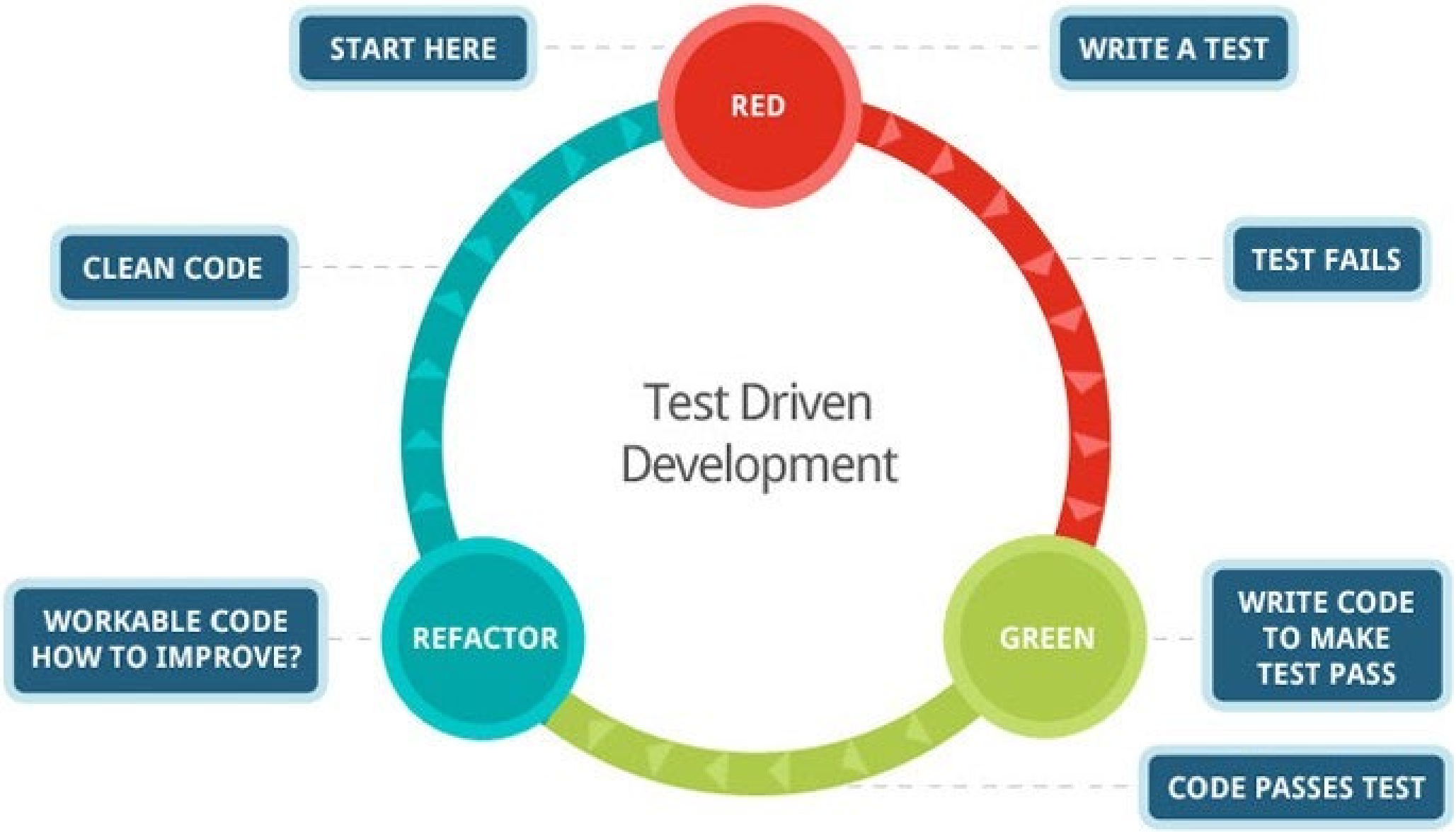
TEST DRIVEN DEVELOPMENT (TDD)


START HERE
RED
WRITE A TEST
CLEAN CODE
TEST FAILS
Test Driven Development
WORKABLE CODE HOW TO IMPROVE?
REFACTOR
GREEN
WRITE CODE TO MAKE TEST PASS
CODE PASSES TEST

Vorteile von TDD

- kein ungetesteter Code
- saubere/testbare Architektur durch TDD als Designstrategie
- keine/wenig Redundanzen durch gnadenloses rechtzeitiges Refactoring
- kein unnötiger Code, welcher nicht gebraucht wird
- Software Entwicklung macht Spass, wenn immer wieder etwas grün wird

Nachteile von TDD

- Hoher Zeitaufwand
- Software nur so gut wie der Test
- Erfordert gewisse Erfahrung in der Software Architektur um sich im Vorfeld vorzustellen, was (welche Methoden) getestet werden soll.

MOCK-OBJEKTE MIT MOCKITO

- Mock = Attrappe / Täuschung