JUnit. HierarchicalContextRunner. Mehr Struktur. TDD. Clean Code. Verantwortung. Skills. Namics.

Stefan Bechtold. Principal Software Engineer.

16. Oktober 2014

Ein typischer (Unit-) Test…

```
package xpdays2014.samples.stack.defaultrunner;

import static org.junit.Assert.*;
import org.junit.Before;
import org.junit.Test;
import xpdays2014.samples.stack.Stack;

public class StackTest {
  private Stack stack;

  @Before
  public void setUp() throws Exception {
    stack = Stack.make(2);
  }

  @Test(expected = Stack.IllegalCapacity.class)
  public void whenCreatingAStackWithNegativeSize_ShouldThrowIllegalCapacity()
throws Exception {
    Stack.make(-1);
  }

  @Test(expected = Stack.Overflow.class)
  public void whenCreatingStackWithZeroCapacity_AnyPushShouldOverflow() throws
Exception {
    stack = Stack.make(0);
    stack.push(1);
  }

  @Test
  public void newlyCreatedStack_ShouldBeEmpty() throws Exception {
    assertTrue(stack.isEmpty());
    assertEquals(0, stack.getSize());
  }

  @Test(expected = Stack.Underflow.class)
  public void whenEmptyStackIsPopped_ShouldThrowUnderflow() throws Exception {
    stack.pop();
  }

  @Test(expected = Stack.Empty.class)
  public void whenStackIsEmpty_TopThrowsEmpty() throws Exception {
    stack.top();
  }

  @Test(expected = Stack.Empty.class)
  public void withZeroCapacityStack_topThrowsEmpty() throws Exception {
    stack = Stack.make(0);
    stack.top();
  }

  @Test
  public void givenStackWithNoTwo_FindTwoShouldReturnNull() throws Exception {
    assertNull(stack.find(2));
  }

  @Test
  public void afterOnePush_StackSizeShouldBeOne() throws Exception {
    stack.push(1);
    assertFalse(stack.isEmpty());
    assertEquals(1, stack.getSize());
  }

  @Test
  public void whenOneIsPushed_OneIsOnTop() throws Exception {
    stack.push(1);
    assertEquals(1, stack.top());
  }

  @Test
  public void whenOneIsPushed_OneIsPopped() throws Exception {
    stack.push(1);
    assertEquals(1, stack.pop());
  }

  @Test
  public void afterOnePushAndOnePop_ShouldBeEmpty() throws Exception {
    stack.push(1);
    stack.pop();
    assertTrue(stack.isEmpty());
    assertEquals(0, stack.getSize());
  }

  @Test
  public void whenOneAndTwoArePushed_TwoAndOneArePopped() throws Exception {
    stack.push(1);
    stack.push(2);
    assertEquals(2, stack.pop());
    assertEquals(1, stack.pop());
  }

  @Test
  public void givenStackWithOneTwoPushed_FindOneAndTwo() throws Exception {
    stack.push(1);
    stack.push(2);
    int oneIndex = stack.find(1);
    int twoIndex = stack.find(2);
    assertEquals(1, oneIndex);
    assertEquals(0, twoIndex);
  }

  @Test(expected = Stack.Overflow.class)
  public void whenPushedPastLimit_ShouldThrowOverflow() throws Exception {
    stack.push(1);
    stack.push(1);
    stack.push(1);
  }
}
```

Ein typischer (Unit-) Test…

→ **Kurze Analyse:**

- Übersichtliche Tests
- Sehr gute Lesbarkeit
- Gutes Naming
- Klar und verständlich

→ **Alles super!**

```
@Test
public void whenOneIsPushed_OneIsOnTop() throws Exception {
  stack.push(1);
  assertEquals(1, stack.top());
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@Test
public void whenOneIsPushed_OneIsPopped() throws Exception {
  stack.push(1);
  assertEquals(1, stack.pop());
}

@Test
public void afterOnePushAndOnePop_ShouldBeEmpty() throws Exception
  stack.push(1);
  stack.pop();
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  stack.push(1);
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  stack.push(1);
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Ein typischer (Unit-) Test…

→ **Kritisches Publikum:**

- Übersichtliche Tests?
- Sehr gute Lesbarkeit?
- Gutes Naming?
- Klar und verständlich?

→ **Ales super?**

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@Test
public void whenOneIsPushed_OneIsOnTop() throws Exception {
  stack.push(1);
  assertEquals(1, stack.top());
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@Test
public void whenOneIsPushed_OneIsPopped() throws Exception {
  stack.push(1);
  assertEquals(1, stack.pop());
}

@Test
public void afterOnePushAndOnePop_ShouldBeEmpty() throws Exception
  stack.push(1);
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}

@Test
public void givenStackWithOneTwoPushed_FindOneAndTwo() throws Excep
  stack.push(1);
  stack.push(2);
  int oneIndex = stack.find(1);
  int twoIndex = stack.find(2);
```

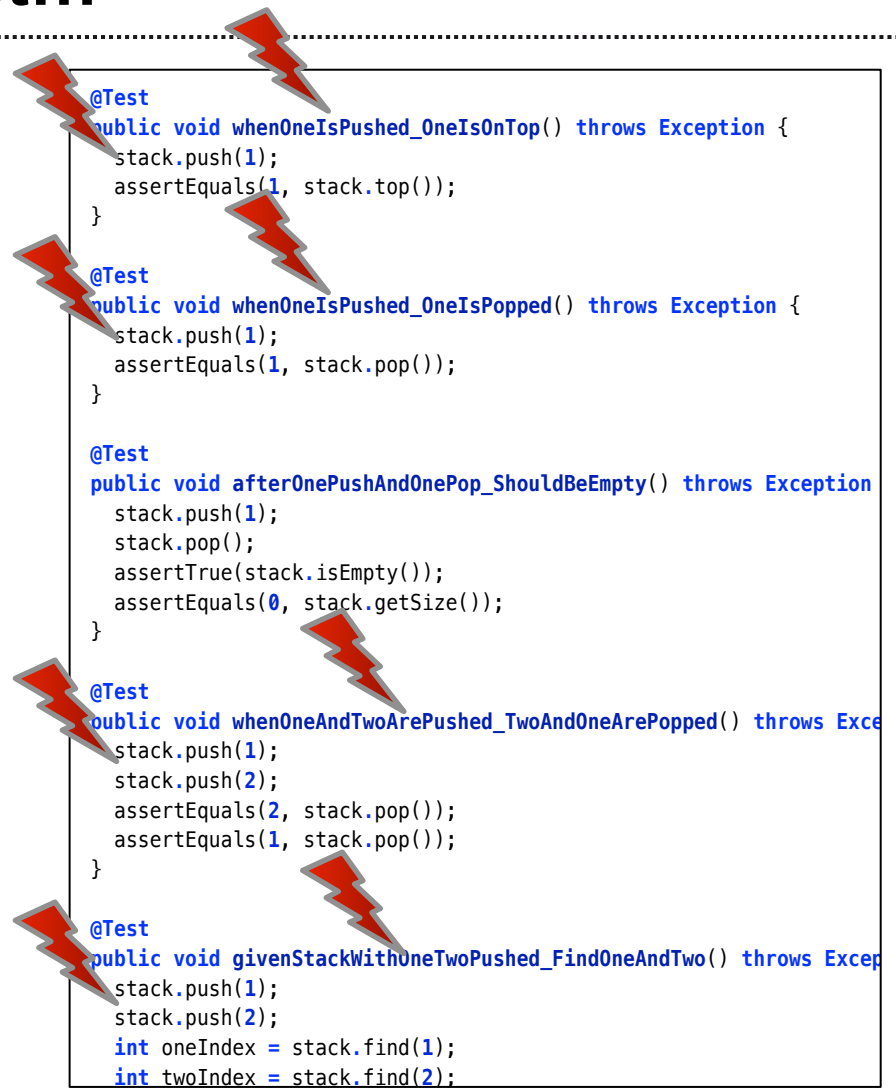
Ein typischer (Unit-) Test…

→ **Was sagt der Bauch?**

- Redundanz im Test-Setup
- Redundanz im Naming
- Naming nicht eindeutig

→ **Gibt es eine Lösung?**

- Test-Setup Helper?
- Test-Object Builder?
- Code-Reviews einführen?



```
@Test
public void whenOneIsPushed_OneIsOnTop() throws Exception {
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@Test
public void whenOneIsPushed_OneIsPopped() throws Exception {
  stack.push(1);
  assertEquals(1, stack.pop());
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@Test
public void givenStackWithOneTwoPushed_FindOneAndTwo() throws Excep
  stack.push(1);
  stack.push(2);
  int oneIndex = stack.find(1);
  int twoIndex = stack.find(2);
```

Wer bin ich...?

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Querdenker. Zielstrebig.
Herzblut. Java. TDD.
Commerce. Namics.

Berufserfahrung
11 Jahre
bei Namics seit 2006

Berufliche Aktivitäten bei Namics:

- Java Commerce- und Content-Management-Systeme
- Coach für Themen rund um:
  TDD, Clean Code, Software Architecture & Design

Aktivitäten in der Open-Source-Community:

- Entwicklung des HierarchicalContextRunner
- JUnit-Framework Committer

Worum geht‘s im Vortrag...?

→ **Motivation für**

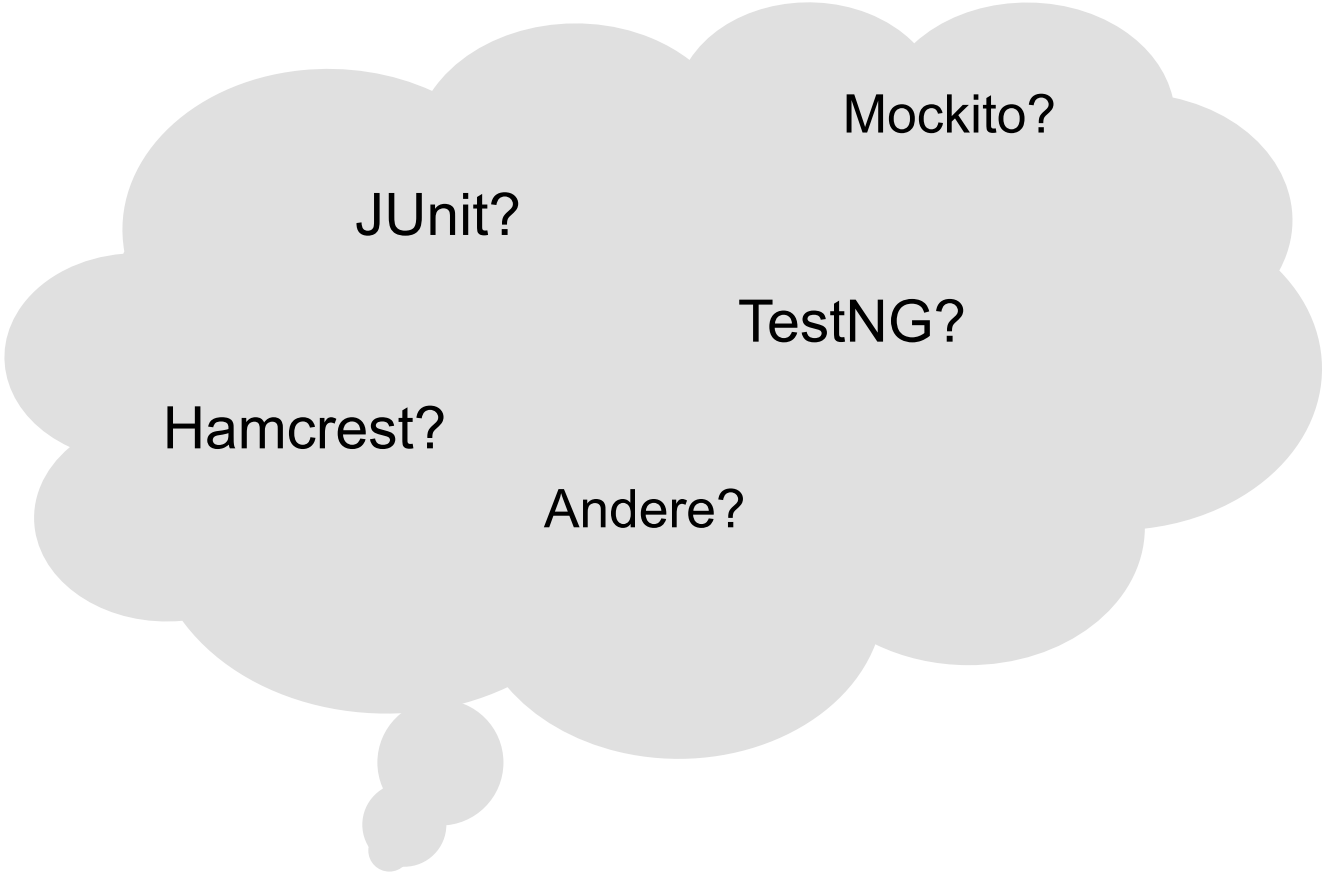
- sauber strukturierte (Unit-) Tests

→ **JUnit – HierarchicalContextRunner**

- Einführung
- Funktionsweise
- Limitierungen

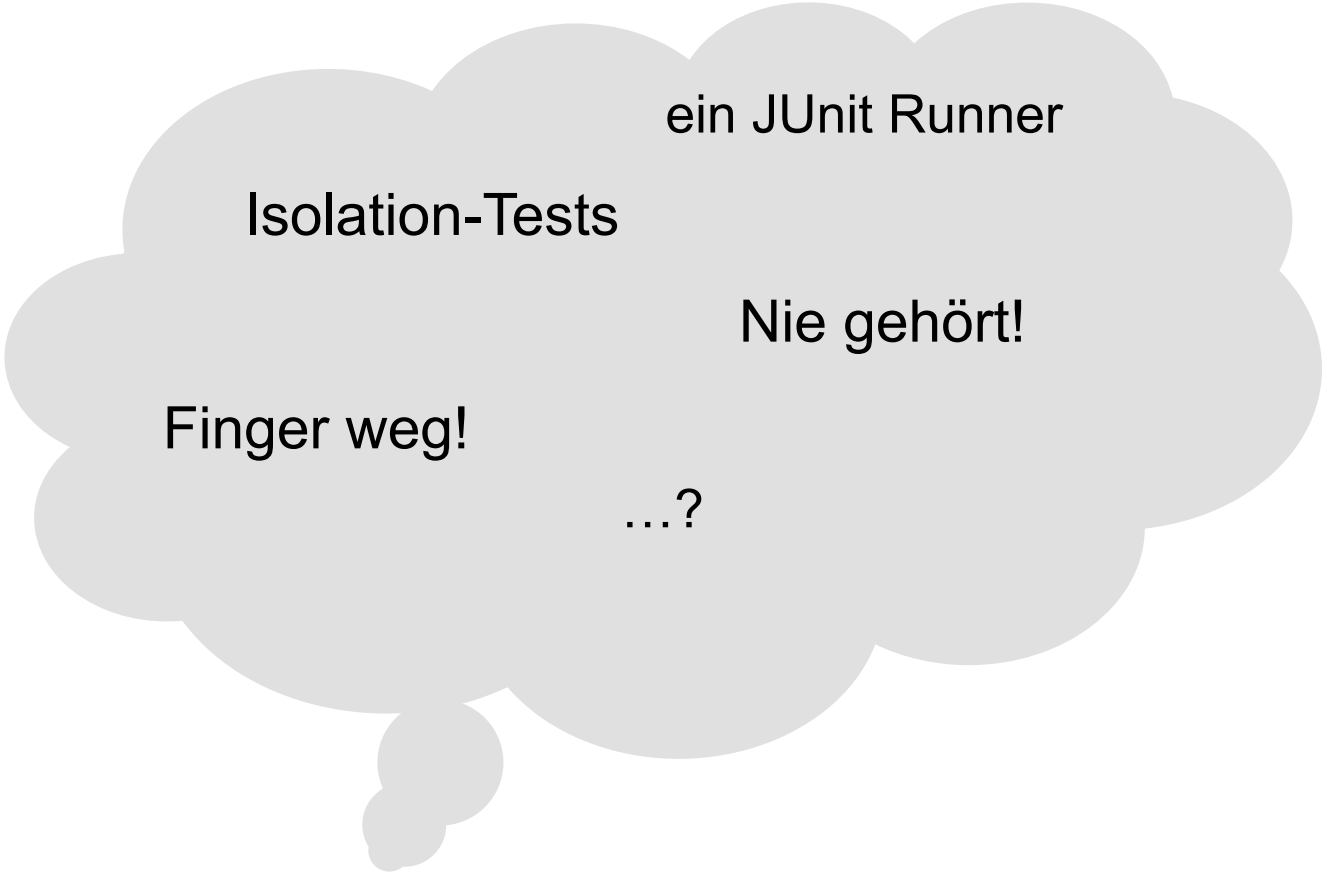
→ **Showcase / Code Samples**

Und wer hört eigentlich zu…?



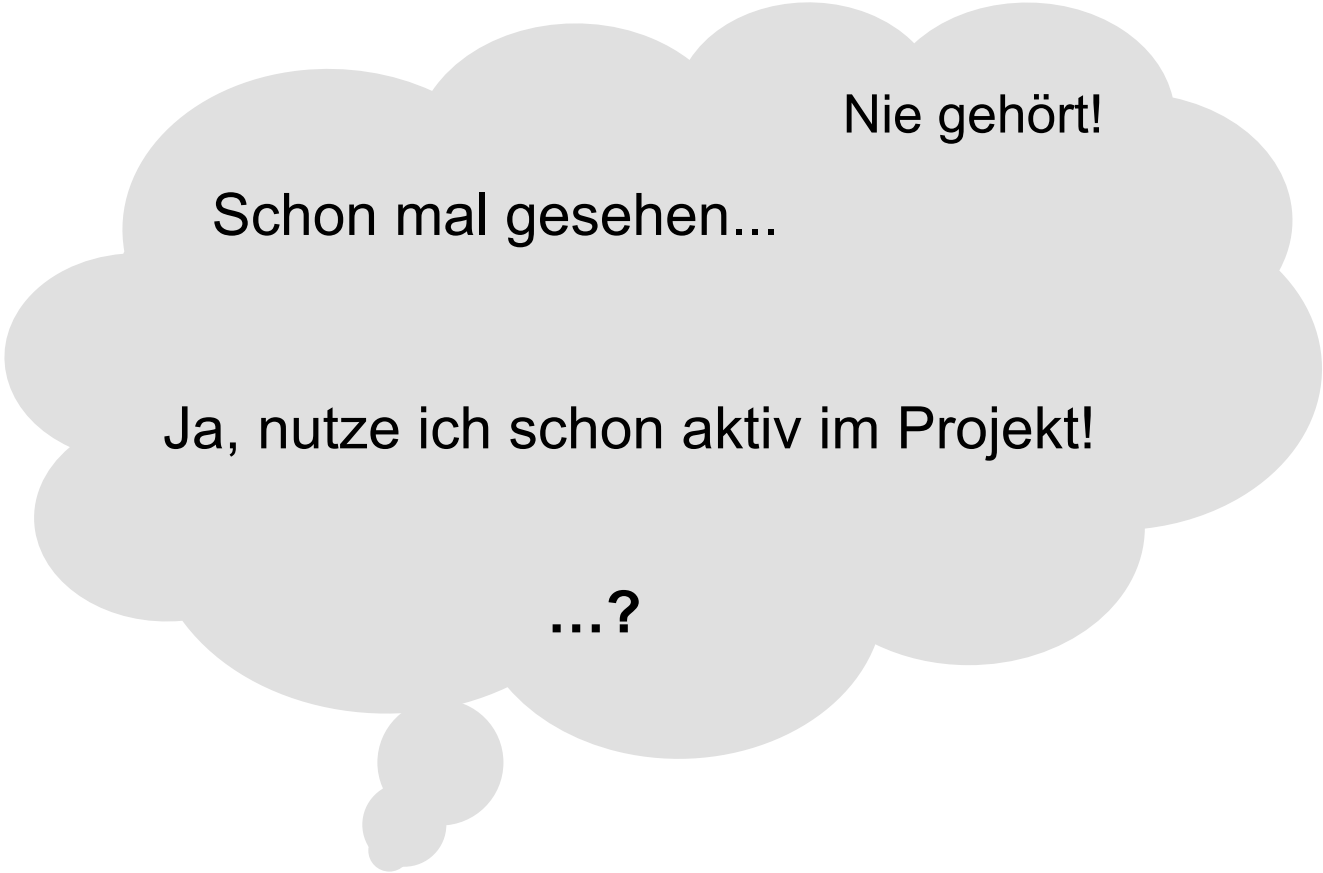
→ **Welche Frameworks nutzt Ihr für (Unit-) Tests in Java?**

Und wer hört eigentlich zu…?

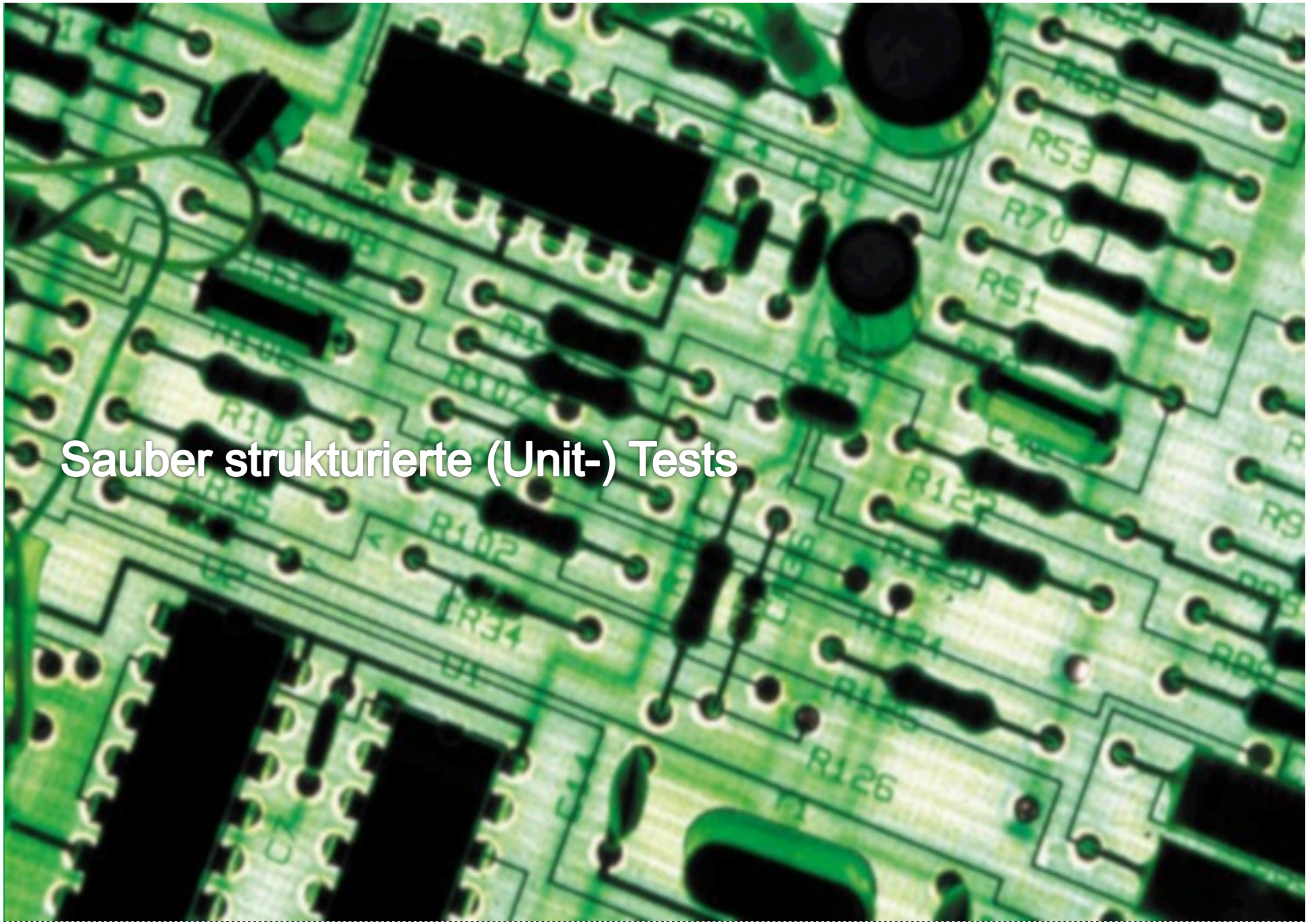


→ **Was fällt Dir ein bei: “@RunWith(Enclosed.class)”?**

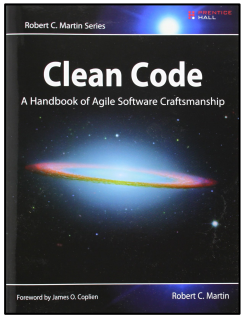
Und wer hört eigentlich zu…?



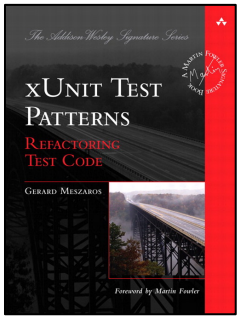
→ **Kennst Du den JUnit HierarchicalContextRunner schon?**


Sauber strukturierte (Unit-) Tests

5 Grundregeln

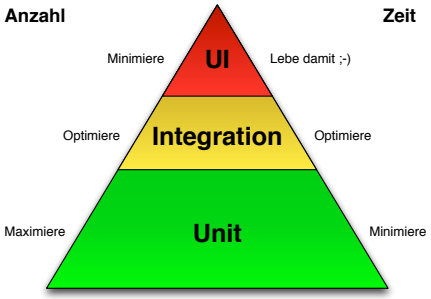


“Behandle Test-Code wie Produktiv-Code”
Robert Martin

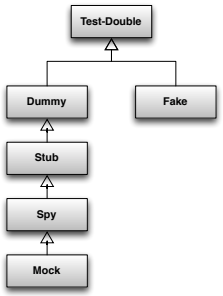


Test-Pattern, z.B.: Arrange, Act, Assert
Gerard Meszaros

“Nicht deterministische Tests gehören gelöscht!”
Martin Fowler



Test-Pyramide einhalten



Verwendung der richtigen Test-Doubles

Die Grundregeln

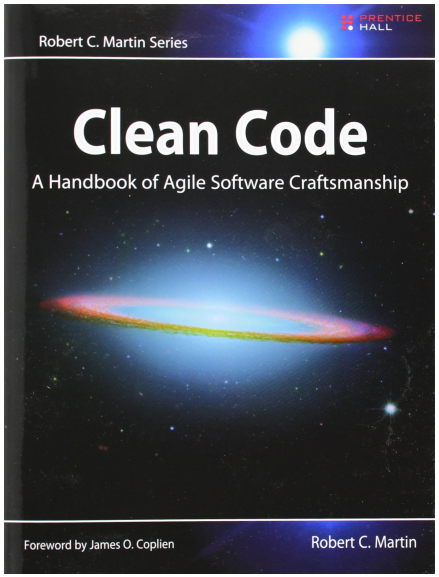
#1 Behandle Test-Code wie Produktiv-Code

→ **Die Tests sind die Spezifikation des Systems**

→ **Fehlgeschlagende Tests müssen Feedback geben**

→ **Lesbarkeit der Tests ist das höchste Gut!**

→ **Clean Code: A Handbook of Agile Software Crafsmanship**
Robert Martin, http://cleancoders.com



Die Grundregeln

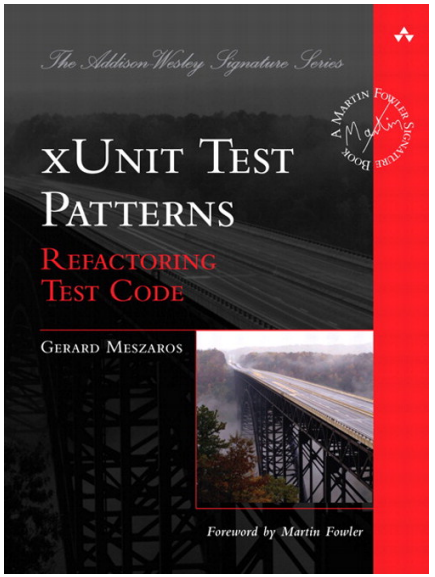
#2 Verwende Test Pattern für bessere Lesbarkeit

→ **Pattern verbessern auch den Test Code ;-)**

→ **Zusätzliche Pattern speziell für Tests:**

- Arrange, Act, Assert (the 3-As)
- Given, When, Then
- viele weitere

→ **XUnit Test Patterns, Refactoring Test Code**
Gerard Meszaros, http://xunitpatterns.com



Die Grundregeln

#3 Vermeide unzuverlässige Tests

→ **(Unit-) Tests müssen deterministisch sein!**

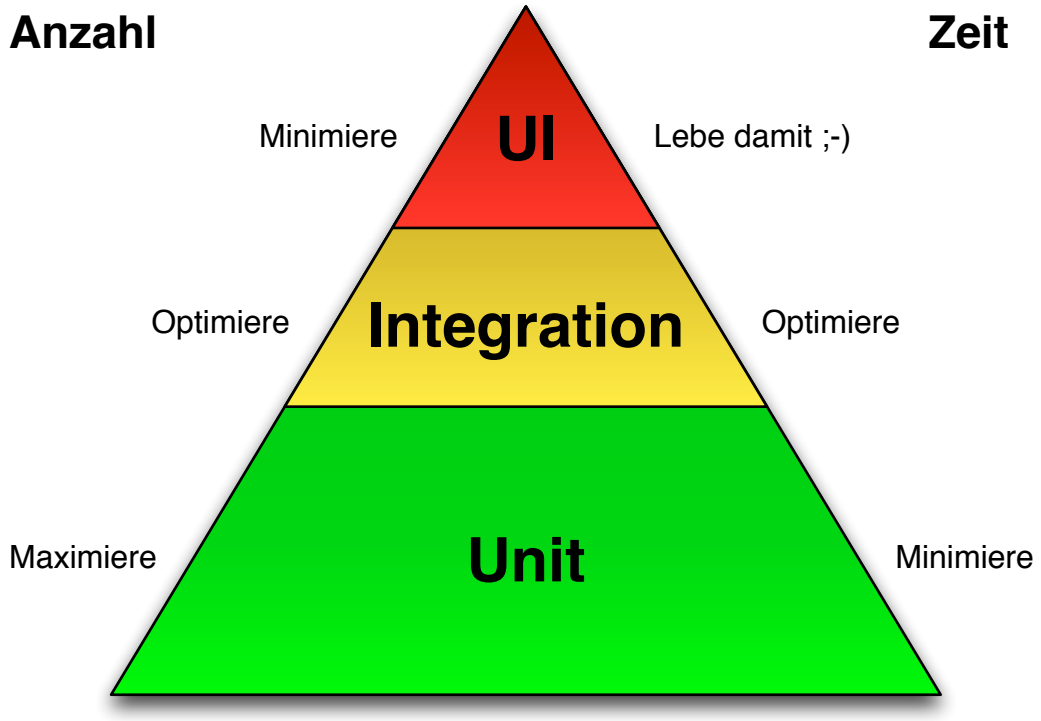
→ **Nachteile nicht-deterministischer Tests:**

- Unerwünschte und unvorhersehbare Fehler in Tests
- Seiteneffekte, die ganze Test-Suites zerstören können
- Verlust des Vertrauens in die Test-Suite

→ **“Indeed you really ought to throw a non-deterministic test away, since if you don’t it has an infectious quality.”**
Martin Fowler, http://martinfowler.com/articles/nonDeterminism.html

Die Grundregeln

#4 Teste im angemessenen Level (Test-Pyramide)



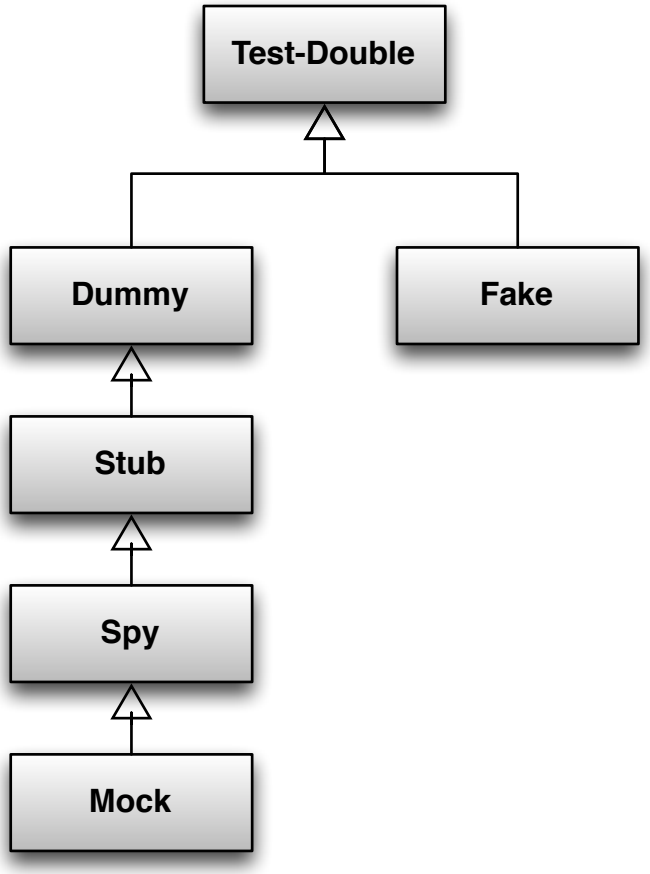
Die Grundregeln

#5 Verwende (die richtigen) Test-Doubles

→ **Einsatz von Mocking Frameworks:**

- Niemals für: Dummy, Stub & Spy
- Manchmal sinnvoll für: Mock / Fake

	Dummy	Stub	Spy	Mock	Fake
Test-Daten	Nein	Ja	Ja	Ja	Ja
Inspektion	Nein	Nein	Ja	Ja	Ja
Verifikation	Nein	Nein	Nein	Ja	Ja
Echte Logik	Nein	Nein	Nein	Nein	Ja



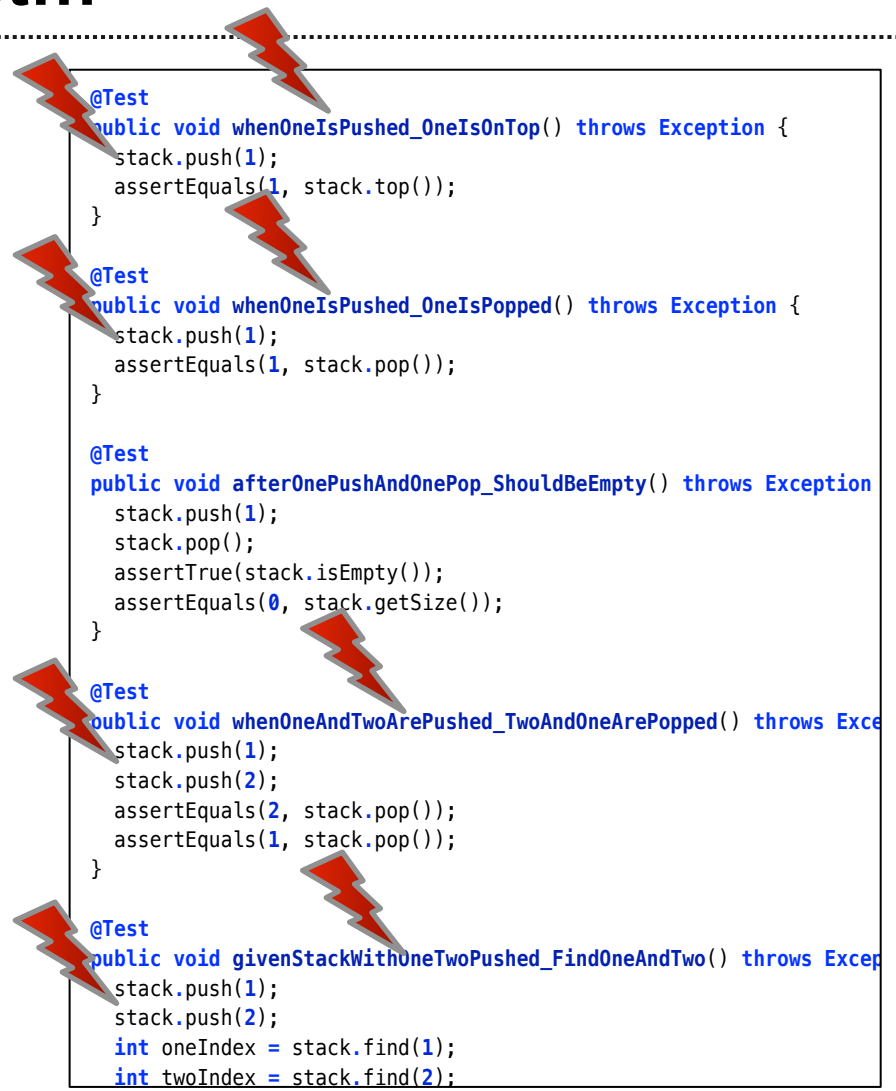

JUnit - HierarchicalContextRunner

Ein typischer (Unit-) Test…

→ **Was sagt der Bauch?**

- Redundanz im Test-Setup
- Redundanz im Naming
- Naming nicht eindeutig

→ **Und die Lösung?**



```
@Test
public void whenOneIsPushed_OneIsOnTop() throws Exception {
  stack.push(1);
  assertEquals(1, stack.top());
}

@Test
public void whenOneIsPushed_OneIsPopped() throws Exception {
  stack.push(1);
  assertEquals(1, stack.pop());
}

@Test
public void afterOnePushAndOnePop_ShouldBeEmpty() throws Exception
  stack.push(1);
  stack.pop();
  assertTrue(stack.isEmpty());
  assertEquals(0, stack.getSize());
}

@Test
public void whenOneAndTwoArePushed_TwoAndOneArePopped() throws Exce
  stack.push(1);
  stack.push(2);
  assertEquals(2, stack.pop());
  assertEquals(1, stack.pop());
}

@Test
public void givenStackWithOneTwoPushed_FindOneAndTwo() throws Excep
  stack.push(1);
  stack.push(2);
  int oneIndex = stack.find(1);
  int twoIndex = stack.find(2);
```

Die Outline der Testklasse

- whenCreatingAStackWithNegativeSize_ShouldThrowIllegalCapacity
- whenCreatingStackWithZeroCapacity_AnyPushShouldOverflow
- newlyCreatedStack_ShouldBeEmpty
- whenEmptyStackIsPopped_ShouldThrowUnderflow
- whenStackIsEmpty_TopThrowsEmpty
- withZeroCapacityStack_topThrowsEmpty
- givenStackWithNoTwo_FindTwoShouldReturnNull
- afterOnePush_StackSizeShouldBeOne
- whenOneIsPushed_OneIsOnTop
- whenOneIsPushed_OneIsPopped
- afterOnePushAndOnePop_ShouldBeEmpty
- whenOneAndTwoArePushed_TwoAndOneArePopped
- givenStackWithOneTwoPushed_FindOneAndTwo
- whenPushedPastLimit_ShouldThrowOverflow

Die Outline der Testklasse

- whenCreatingAStackWithNegativeSize_ShouldThrowIllegalCapacity
- whenCreatingStackWithZeroCapacity_AnyPushShouldOverflow
- withZeroCapacityStack_topThrowsEmpty
- newlyCreatedStack_ShouldBeEmpty
- whenEmptyStackIsPopped_ShouldThrowUnderflow
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Die Outline der Testklasse

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Die Outline der Testklasse

- whenCreatingAStackWithNegativeSize_ShouldThrowIllegalCapacity
- GivenStackWithZeroCapacity
  - anyPushShouldOverflow
  - topThrowsEmpty
- GivenEmptyStack
  - shouldBeEmpty
  - popShouldThrowUnderflow
  - topThrowsEmpty
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- afterOnePush_StackSizeShouldBeOne
- whenOneIsPushed_OneIsOnTop
- whenOneIsPushed_OneIsPopped
- afterOnePushAndOnePop_ShouldBeEmpty
- whenOneAndTwoArePushed_TwoAndOneArePopped
- givenStackWithOneTwoPushed_FindOneAndTwo
- whenPushedPastLimit_ShouldThrowOverflow

Die Outline der Testklasse

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  - shouldBeEmpty
  - popShouldThrowUnderflow
  - topThrowsEmpty
  - findTwoShouldReturnNull
  - GivenOnePushed
    - stackSizeShouldBeOne
    - oneIsOnTop
    - oneIsPopped
    - stackShouldBeEmptyAfterPop
- whenOneAndTwoArePushed_TwoAndOneArePopped
- givenStackWithOneTwoPushed_FindOneAndTwo
- whenPushedPastLimit_ShouldThrowOverflow

Die Outline der Testklasse

- whenCreatingAStackWithNegativeSize_ShouldThrowIllegalCapacity
- GivenStackWithZeroCapacity
  - anyPushShouldOverflow
  - topThrowsEmpty
- GivenEmptyStack
  - shouldBeEmpty
  - popShouldThrowUnderflow
  - topThrowsEmpty
  - findTwoShouldReturnNull
  - GivenOnePushed
    - stackSizeShouldBeOne
    - oneIsOnTop
    - GivenOnePop
      - oneIsPopped
      - stackShouldBeEmptyAfterPop
    - GivenTwoPushed
      - twoAndOneArePopped
      - findOneAndTwo
      - anotherPushShouldThrowOverflow

Erkenntnisse

→ **Beobachtungen:**

- (Unit-) Tests sind hierarchisch abbildbar
- Einzelne Tests können gruppiert werden
- Gültigkeit & Sichtbarkeit von Fixtures
- Keine Redundanz & unnötigen Fixtures
- Leider keine Unterstützung in JUnit ☹

→ **Anforderungen:**

- (Einfache) Definition eines Kontekt notwendig
- SetUp / TearDown je Hierarchie-Stufe benötigt

JUnit - HierarchicalContextRunner

→ **Basiert vollständig auf JUnit**

- Wiederverwendung der Annotations (@Test, @Ignore, etc.)
- Formulierung der (Unit-) Tests unverändert
- JUnit Core Features direkt einsetzbar
- Bestehende Test Suites sofort ausführbar

→ **Zusätzliche Funktionen:**

- Erlaubt die Erstellung von Kontexten
- Kontexte können verschachtelt werden
- Erlaubt SetUp / TearDown in jedem Kontext

JUnit - HierarchicalContextRunner

→ **Erstellung eines Kontext**

```
11    @RunWith(HierarchicalContextRunner.class)
12    public class StackTest {
13      private Stack stack;
14
15      @Test(expected = Stack.IllegalCapacity.class)
16      public void whenCreatingAStackWithNegativeSize_ShouldThrc
17        Stack.make(-1);
18      }
19
20      public class ZeroSizeStackContext {
21        @Before
22        public void setUp() { stack = Stack.make(0); }
25
26        @Test(expected = Stack.Overflow.class)
27        public void anyPushShouldOverflow() { stack.push(1); }
30
31        @Test(expected = Stack.Empty.class)
32        public void topShouldThrowEmpty() { stack.top(); }
35      }
```

JUnit - HierarchicalContextRunner

→ **Verschachtelung von Kontexten**

```
64          public class GivenOnePushed {
65            @Before
66            public void pushOne() { stack.push(1); }
69
70            @Test
71            public void stackSizeShouldBeOne() throws Exception {
72              assertFalse(stack.isEmpty());
73              assertEquals(1, stack.getSize());
74            }
75
76            @Test
77            public void oneIsOnTop() { assertEquals(1, stack.top()); }
80
81            public class GivenOnePopped {
82              private int poppedElement;
83
84              @Before
85              public void popOne() { poppedElement = stack.pop(); }
88
89              @Test
90              public void oneIsPopped() { assertEquals(1, poppedElement); }
```

Ein typischer (Unit-) Test … revisited

```
@RunWith(HierarchicalContextRunner.class)
public class StackTest {
  private Stack stack;

  @Test(expected = Stack.IllegalCapacity.class)
  public void whenCreatingAStackWithNegativeSize_ShouldThrowIllegalCapacity() throws Exception {
    Stack.make(-1);
  }

  public class ZeroSizeStackContext {
    @Before
    public void setUp() throws Exception {
      stack = Stack.make(0);
    }

    @Test(expected = Stack.Overflow.class)
    public void anyPushShouldOverflow() throws Exception {
      stack.push(1);
    }

    @Test(expected = Stack.Empty.class)
    public void topShouldThrowEmpty() throws Exception {
      stack.top();
    }
  }

  public class GivenNewStack {
    @Before
    public void setUp() throws Exception {
      stack = Stack.make(2);
    }

    @Test
    public void shouldBeEmpty() throws Exception {
      assertTrue(stack.isEmpty());
      assertEquals(0, stack.getSize());
    }

    @Test(expected = Stack.Underflow.class)
    public void popShouldThrowUnderflow() throws Exception {
      stack.pop();
    }

    @Test(expected = Stack.Empty.class)
    public void topShouldThrowEmpty() throws Exception {
      stack.top();
    }

    @Test
    public void findTwoShouldReturnNull() throws Exception {
      assertNull(stack.find(2));
    }

    public class GivenOnePushed {
      @Before
      public void pushOne() {
        stack.push(1);
      }

      @Test
      public void stackSizeShouldBeOne() throws Exception {
        assertFalse(stack.isEmpty());
        assertEquals(1, stack.getSize());
      }

      @Test
      public void oneIsOnTop() throws Exception {
        assertEquals(1, stack.top());
      }

      public class GivenOnePopped {
        private int poppedElement;

        @Before
        public void popOne() {
          poppedElement = stack.pop();
        }

        @Test
        public void oneIsPopped() throws Exception {
          assertEquals(1, poppedElement);
        }

        @Test
        public void stackShouldBeEmpty() throws Exception {
          assertTrue(stack.isEmpty());
          assertEquals(0, stack.getSize());
        }
      }

      public class GivenTwoPushed {
        @Before
        public void pushTwo() {
          stack.push(2);
        }

        @Test
        public void givenStackWithOneTwoPushed_FindOneAndTwo() throws Exception {
          int oneIndex = stack.find(1);
          int twoIndex = stack.find(2);
          assertEquals(1, oneIndex);
          assertEquals(0, twoIndex);
        }

        @Test
        public void twoAndOneArePopped() throws Exception {
          assertEquals(2, stack.pop());
          assertEquals(1, stack.pop());
        }

        @Test(expected = Stack.Overflow.class)
        public void anotherPushShouldThrowOverflow() throws Exception {
          stack.push(1);
        }
      }
    }
  }
}
```

Funktionsweise

→ Evaluieren Test-Klasse

- Runner führt @BeforeClass aus
- Runner evaluiert alle Tests der Klasse
- Runner ruft sich rekursive für alle Kontexte auf
- Runner führt @AfterClass aus

→ Evaluierung Test-Methode

- Runner erzeugt Test-Objekt (top-down)
- Runner führt @Before aus (top-down)
- Runner startet die Test-Methode
- Runner führt @After aus (bottom-up)

Limitierungen

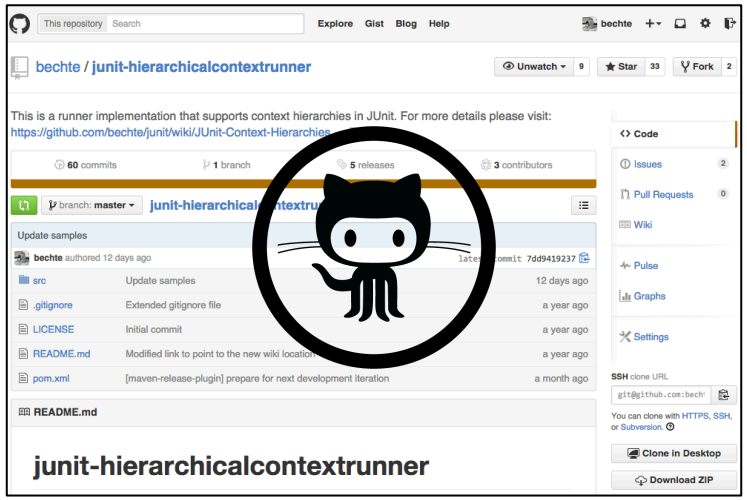
→ Allgemeine Limitierungen

- Keine statischen Klassen innerhalb eines Kontexts
- Keine statischen Methoden innerhalb eines Kontexts
- Ausführung einzelner Test-Methoden (noch) nicht möglich

→ JUnit Limitierungen

- Support (erst) ab Version JUnit 4.11
- Operiert nicht mit anderen JUnit-Runner zusammen
- Beschreibung im Ergebnis (noch) nicht optimal

Weitere Literatur



github Repository
HierarchicalContextRunner

Clean Coders Screencasts
CleanCode Episodes: 20, 21
JavaCaseStudy Episodes: 3, 4


Showcase / Code Samples
Alle Beispiele und die Präsentation sind zu finden unter:
https://github.com/bechte/XPDays2014

JUnit. HierarchicalContextRunner. Mehr Struktur. TDD. Clean Code. Verantwortung. Skills. Namics.

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