Mocking Libraries Shootout

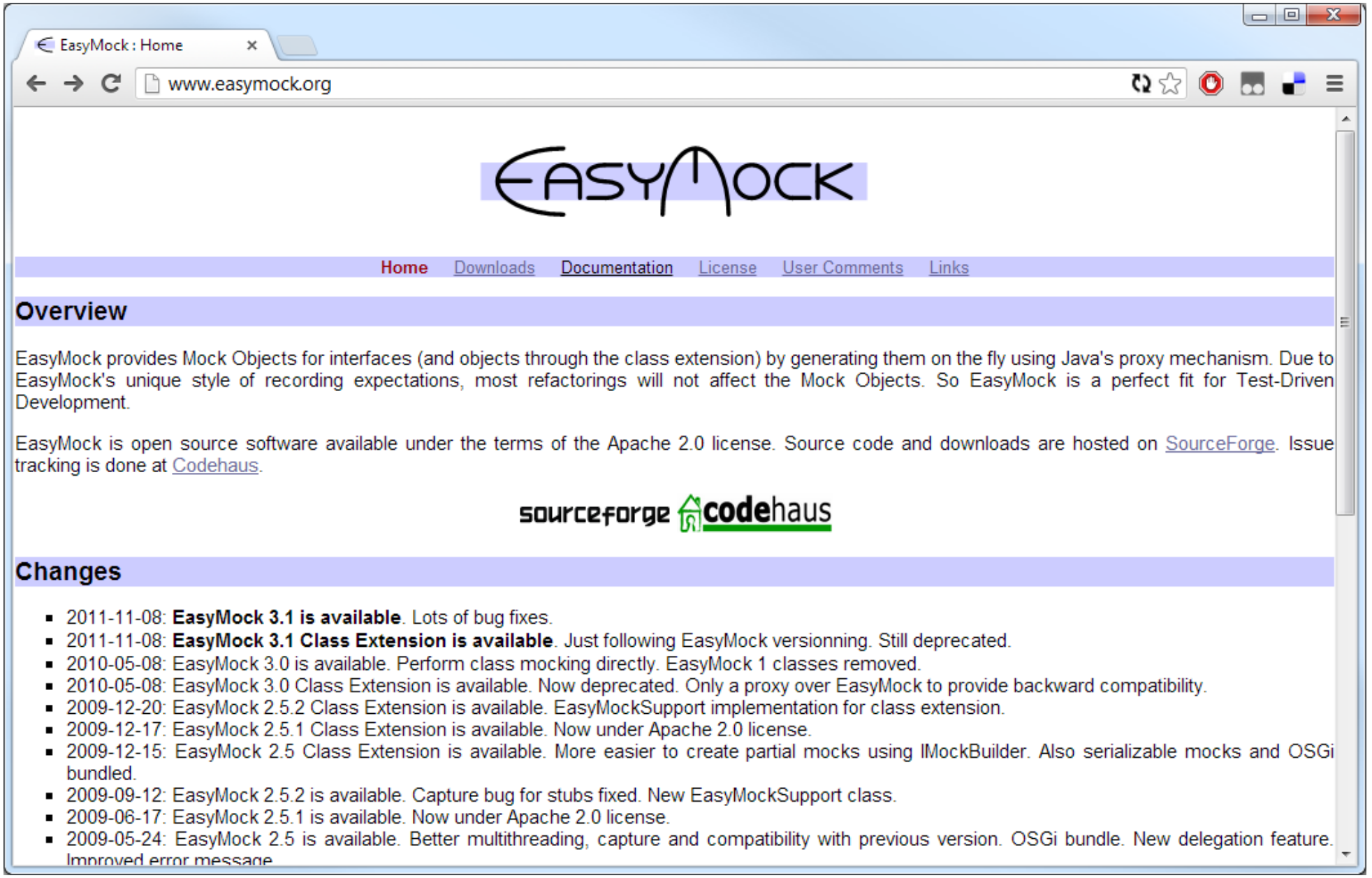
Warum ist Mocking interessant?

- Ermöglicht Tests ohne echte Testumgebung
- Schnelle Tests durch gute Test-Isolation
- Kontrolle des indirekten Inputs
- Simulation von Fehlern
- Überprüfung des indirekten Outputs/Verhaltens
- Überprüfung der Aufrufreihenfolge

Die Kandidaten

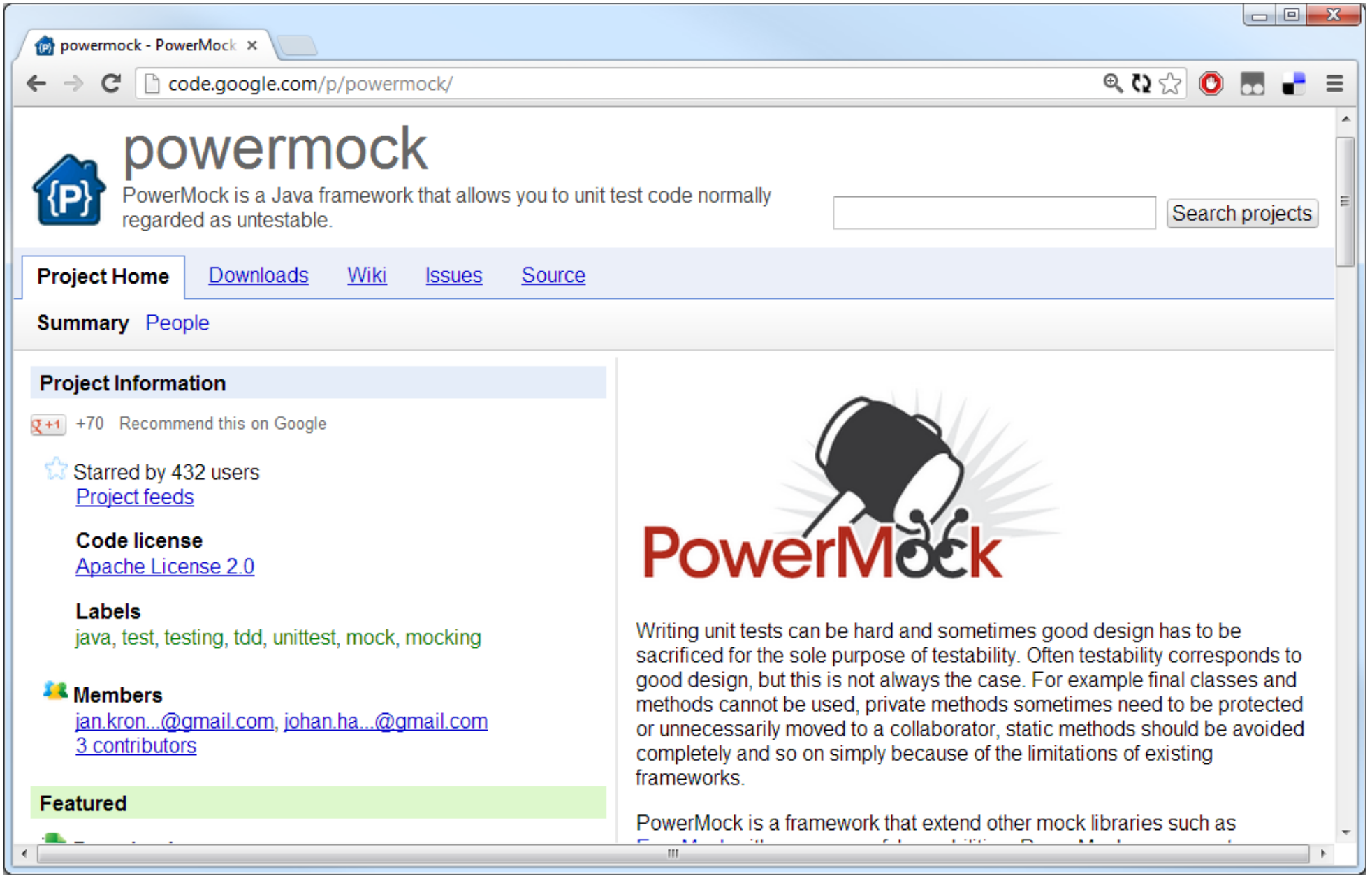
Die Kandidaten

Die Kandidaten

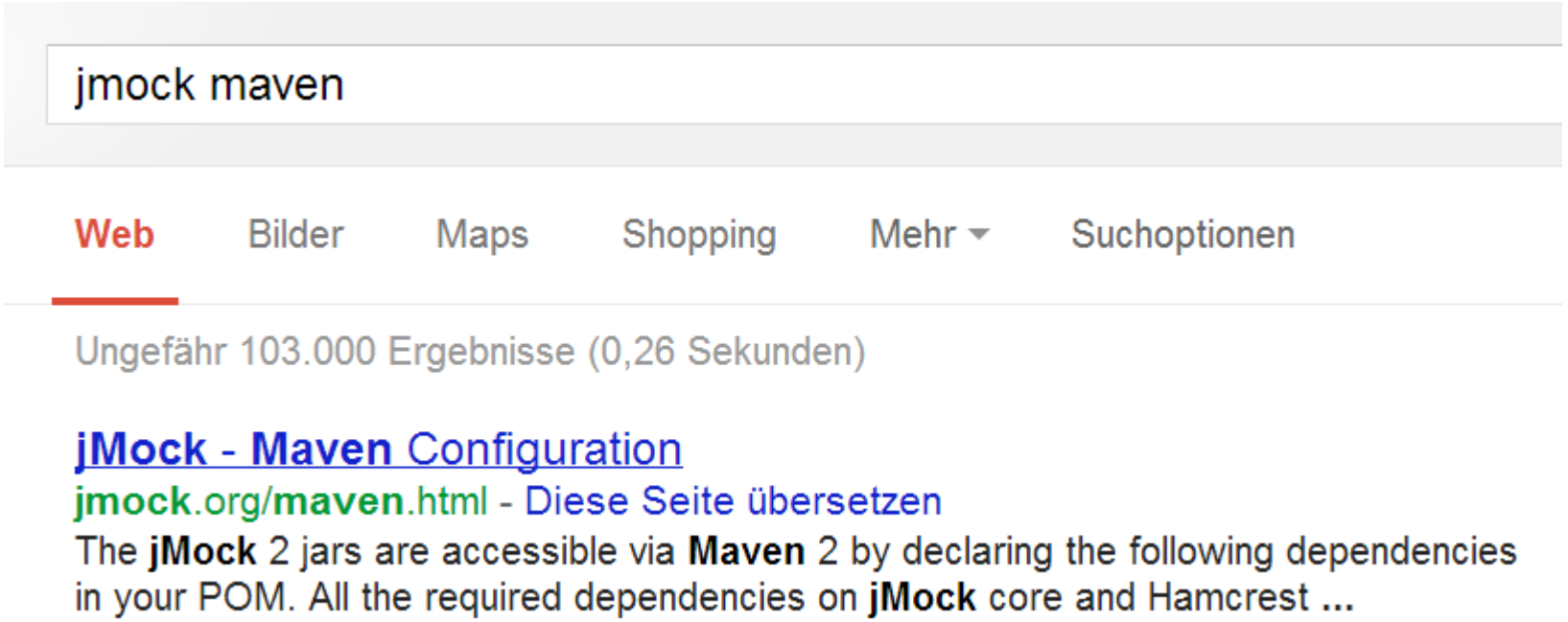


Die Kandidaten

Die Kandidaten



Aufgabe 0: Project Setup



Aufgabe 0: Project Setup

jMock

Software

jMock 2 (Java 1.6)
- Stable: 2.6.0

jMock 1 (Java 1.3+)
- Stable: 1.2.0

Source Repository
Project License
Version Numbering
Extensions

Documentation

Getting Started
Cookbook
Cheat Sheet
API Documentation
Articles and Papers
jMock 1 Documentation
About Mock Objects

User Support

Mailing Lists
Training
Issue Tracker
News Feed (RSS 2.0)

Credits

Development Team
Project hosted by Github
Icons by the Tango Project

Using jMock from Maven Builds

jMock 2

The jMock 2 jars are accessible via Maven 2 by declaring the following dependencies in your POM. All the required dependencies on jMock core and Hamcrest will be inclu

To use jMock 2.6.0 with JUnit 3:

```
<dependency>
  <groupId>org.jmock</groupId>
  <artifactId>jmock-junit3</artifactId>
  <version>2.6.0</version>
</dependency>
```

To use jMock 2.6.0 with JUnit 4:

```
<dependency>
  <groupId>org.jmock</groupId>
  <artifactId>jmock-junit4</artifactId>
  <version>2.6.0</version>
</dependency>
```

Note: From jMock 2.4.0 onwards, the default JUnit 4 Maven dependency is junit:junit-dep. This requires Maven's Surefire to be configured to use it instead of the standard ju surefire-plugin 2.3.1 and 2.4 support the optional `<junitArtifactName>junit:junit-dep</junitArtifactName>` configuration element.

To use jMock 2.6.0 to mock classes:

```
<dependency>
  <groupId>org.jmock</groupId>
  <artifactId>jmock-legacy</artifactId>
  <version>2.6.0</version>
</dependency>
```

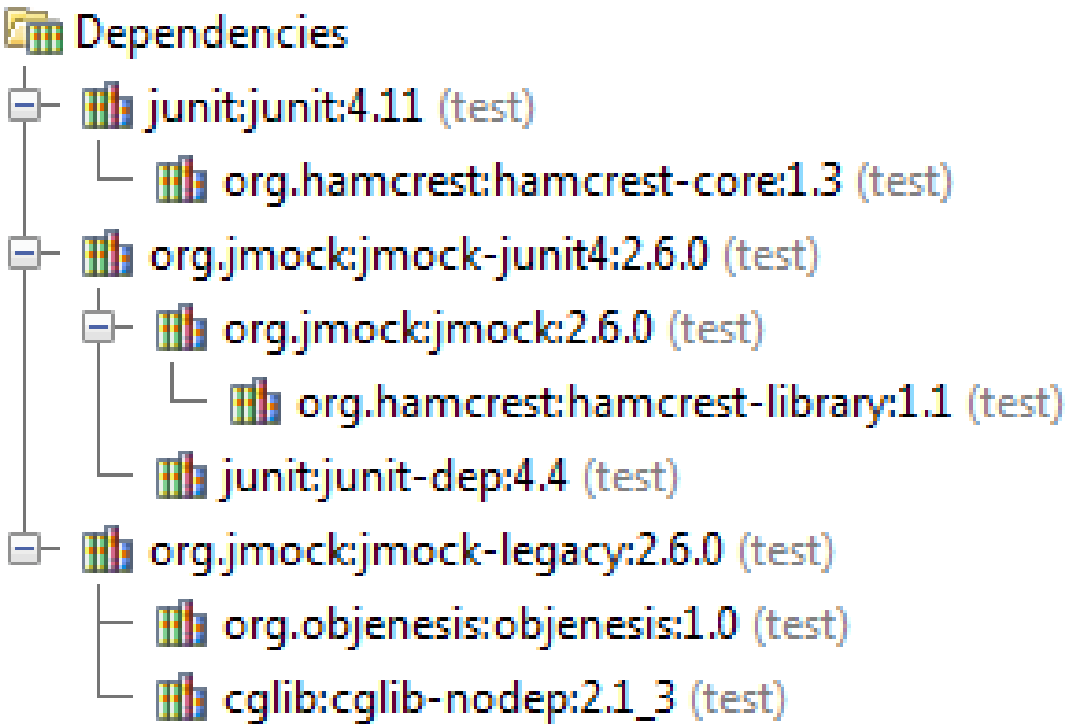
To use other versions of jMock, replace the contents of the version tags.

Aufgabe 0: Project Setup

```
<dependency>
    <groupId>junit</groupId>
    <artifactId>junit</artifactId>
    <version>4.11</version>
    <scope>test</scope>
</dependency>
<dependency>
    <groupId>org.jmock</groupId>
    <artifactId>jmock-junit4</artifactId>
    <version>2.6.0</version>
    <scope>test</scope>
</dependency>
<dependency>
    <groupId>org.jmock</groupId>
    <artifactId>jmock-legacy</artifactId>
    <version>2.6.0</version>
    <scope>test</scope>
</dependency>
```

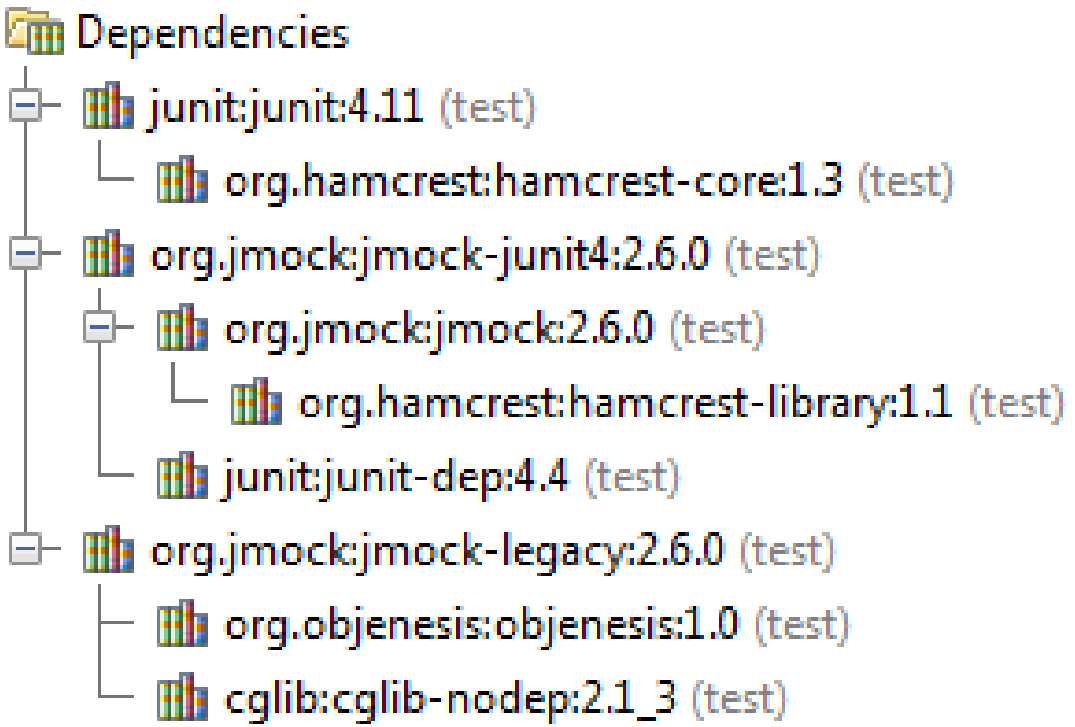
Aufgabe 0: Project Setup

```xml
<dependency>
    <groupId>junit</groupId>
    <artifactId>junit</artifactId>
    <version>4.11</version>
    <scope>test</scope>
</dependency>
<dependency>
    <groupId>org.jmock</groupId>
    <artifactId>jmock-junit4</artifactId>
    <version>2.6.0</version>
    <scope>test</scope>
</dependency>
<dependency>
    <groupId>org.jmock</groupId>
    <artifactId>jmock-legacy</artifactId>
    <version>2.6.0</version>
    <scope>test</scope>
</dependency>
```



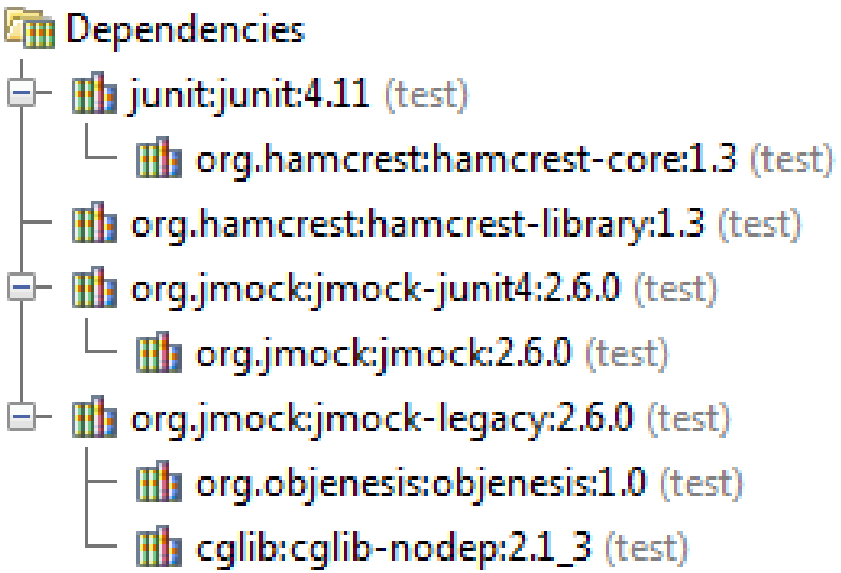
Aufgabe 0: Project Setup

```
<dependency>
    <groupId>junit</groupId>
    <artifactId>junit</artifactId>
    <version>4.11</version>
    <scope>test</scope>
</dependency>
<dependency>
    <groupId>org.jmock</groupId>
    <artifactId>jmock-junit4</artifactId>
    <version>2.6.0</version>
    <scope>test</scope>
</dependency>
<dependency>
    <groupId>org.jmock</groupId>
    <artifactId>jmock-legacy</artifactId>
    <version>2.6.0</version>
    <scope>test</scope>
</dependency>
```

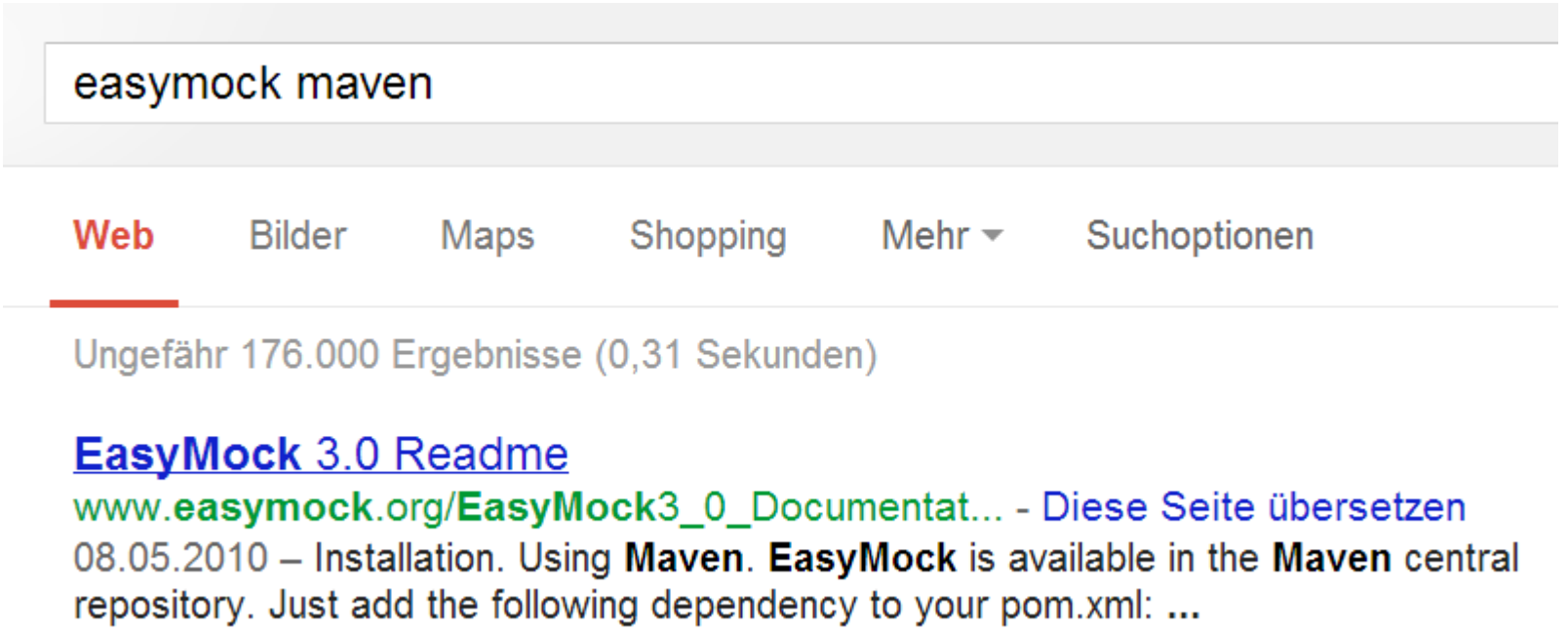


Aufgabe 0: Project Setup

```xml
<dependency>
    <groupId>junit</groupId>
    <artifactId>junit</artifactId>
    <version>4.11</version>
    <scope>test</scope>
</dependency>
<dependency>
    <groupId>org.hamcrest</groupId>
    <artifactId>hamcrest-library</artifactId>
    <version>1.3</version>
    <scope>test</scope>
</dependency>
<dependency>
    <groupId>org.jmock</groupId>
    <artifactId>jmock-junit4</artifactId>
    <version>2.6.0</version>
    <scope>test</scope>
    <exclusions>
        <exclusion>
            <groupId>junit</groupId>
            <artifactId>junit-dep</artifactId>
        </exclusion>
    </exclusions>
</dependency>
<dependency>
    <groupId>org.jmock</groupId>
    <artifactId>jmock-legacy</artifactId>
    <version>2.6.0</version>
    <scope>test</scope>
</dependency>
```



Aufgabe 0: Project Setup



Aufgabe 0: Project Setup

Installation

Using Maven

EasyMock is available in the Maven central repository. Just add the following dependency to your pom.xml:

```
<dependency>
  <groupId>org.easymock</groupId>
  <artifactId>easymock</artifactId>
  <version>3.0</version>
  <scope>test</scope>
</dependency>
```

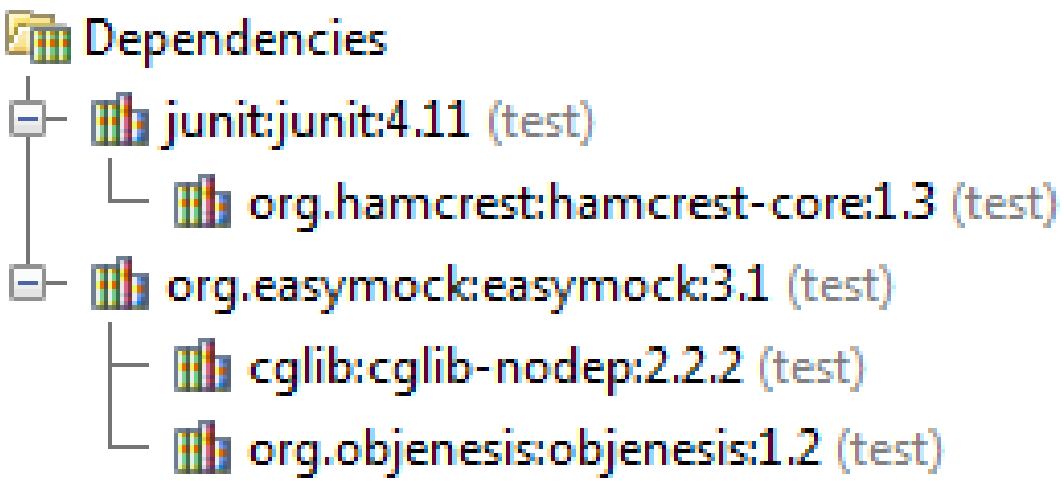
You can obviously use any other dependency tool compatible with the Maven repository.

Aufgabe 0: Project Setup

```
<dependency>
    <groupId>junit</groupId>
    <artifactId>junit</artifactId>
    <version>4.11</version>
    <scope>test</scope>
</dependency>
<dependency>
    <groupId>org.easymock</groupId>
    <artifactId>easymock</artifactId>
    <version>3.1</version>
    <scope>test</scope>
</dependency>
```

Aufgabe 0: Project Setup

```xml
<dependency>
    <groupId>junit</groupId>
    <artifactId>junit</artifactId>
    <version>4.11</version>
    <scope>test</scope>
</dependency>
<dependency>
    <groupId>org.easymock</groupId>
    <artifactId>easymock</artifactId>
    <version>3.1</version>
    <scope>test</scope>
</dependency>
```



Aufgabe 0: Project Setup

mockito maven

Web Bilder Maps Shopping Mehr Suchoptionen

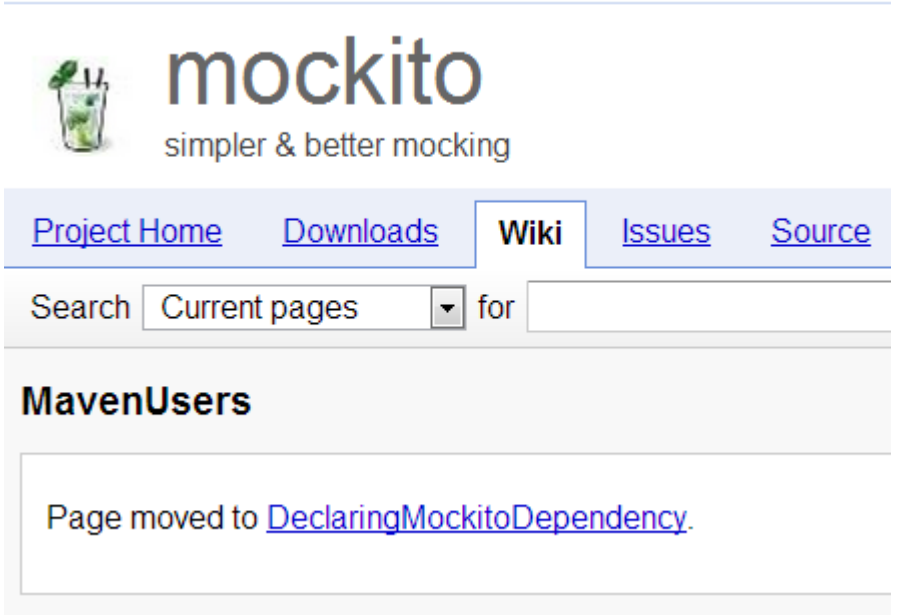
Ungefähr 198.000 Ergebnisse (0,10 Sekunden)

Maven Repository: org.**mockito** » **mockito**-all » 1.8.4
mvnrepository.com/...**mockito**/**mockito**-all/1.8.4 - Diese Seite übersetzen
Mockito. Mock objects library for java **...** HomePage, http://www.**mockito**.org. Organization. Issue Tracker. **Maven**; Ivy; Grape; Gradle; Buildr; SBT. <dependency> **...**

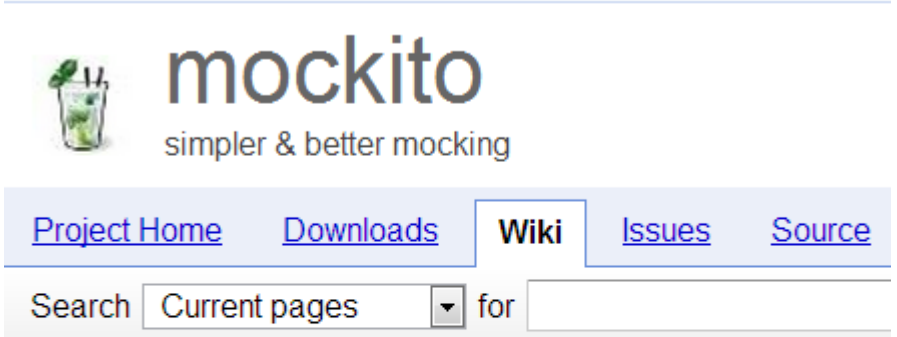
Maven Repository: org.**mockito** » **mockito**-all
mvnrepository.com/artifact/...**mockito**/**mockito**-a... - Diese Seite übersetzen
[See All Tags]. Web site developed by @frodriguez. home » org.**mockito** » **mockito**-all. **Mockito**. Mock objects library for java. tags: **...**

MavenUsers - **mockito** - simpler & better mocking - Google Project **...**
code.google.com/p/**mockito**/wiki/**Maven**Users - Diese Seite übersetzen
How about rolling **mockito**-core-1.7-sources.jar and/or **mockito**-core-1.7-javadoc.jar and putting it in the **maven** repository next to the binaries? Those using **...**

Aufgabe 0: Project Setup



Aufgabe 0: Project Setup



Maven

mockito-core

```
<!-- needs extra dependencies: objenesis & hamcrest -->
<groupId>org.mockito</groupId>
<artifactId>mockito-core</artifactId>
<version>1.9.5</version>
<scope>test</scope>
```

mockito-all

```
<groupId>org.mockito</groupId>
<artifactId>mockito-all</artifactId>
<version>1.9.5</version>
<scope>test</scope>
```

mockito-core VS mockito-all

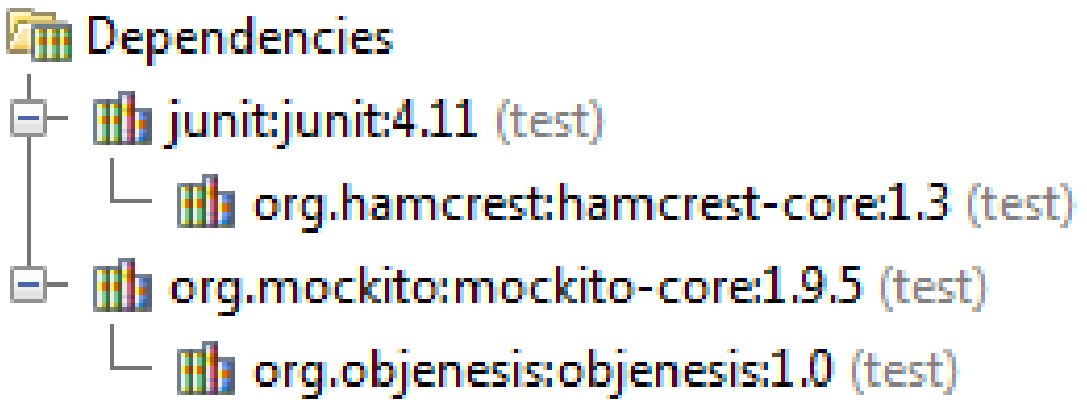
Mockito-all is a single jar will all dependencies inlined inside (that is: hamcrest and objenesis libs as of June'11). Mockito-core is just the mockito jar. Use mockito-core if you want to pull a specific version of hamcrest or objenesis. Mockito-core gives finer control on what jars end up on your classpath. Since maven deals with transitive dependencies well maven users can use mockito-core without any extra hassle.

Aufgabe 0: Project Setup

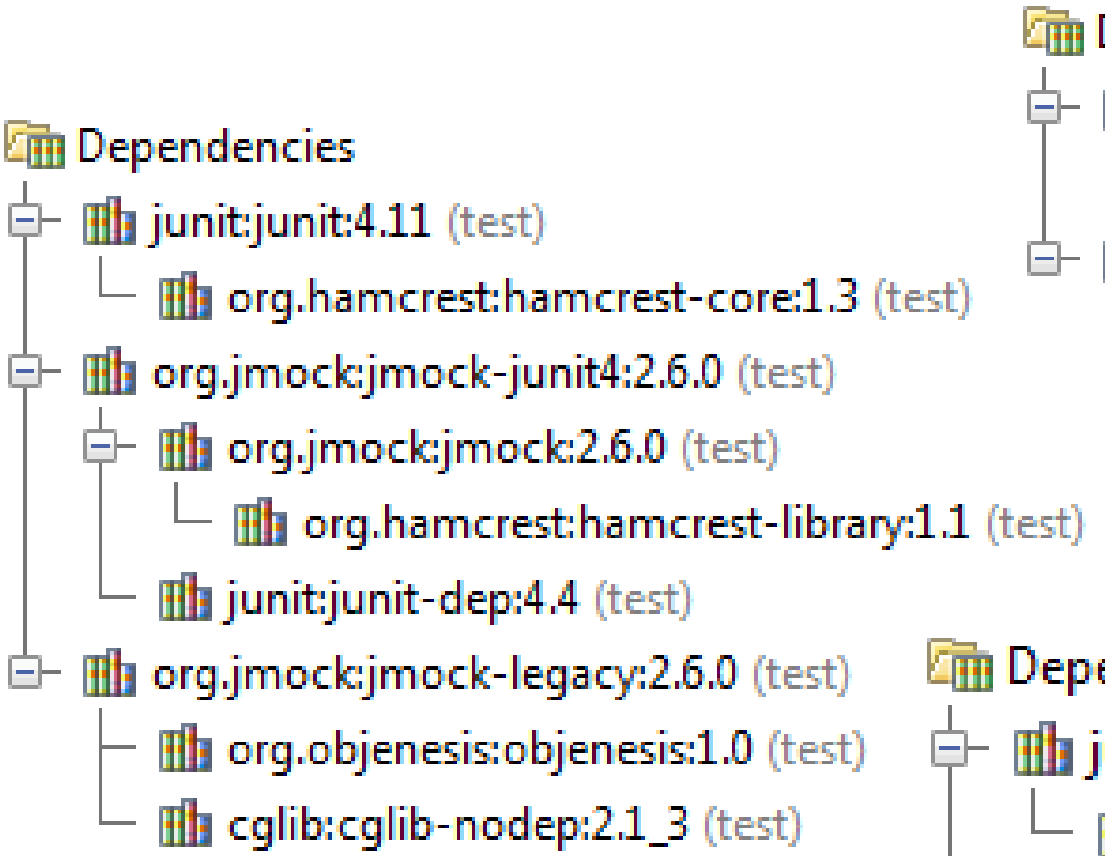
```
<dependency>
    <groupId>junit</groupId>
    <artifactId>junit</artifactId>
    <version>4.11</version>
    <scope>test</scope>
</dependency>
<dependency>
    <groupId>org.mockito</groupId>
    <artifactId>mockito-core</artifactId>
    <version>1.9.5</version>
    <scope>test</scope>
</dependency>
```

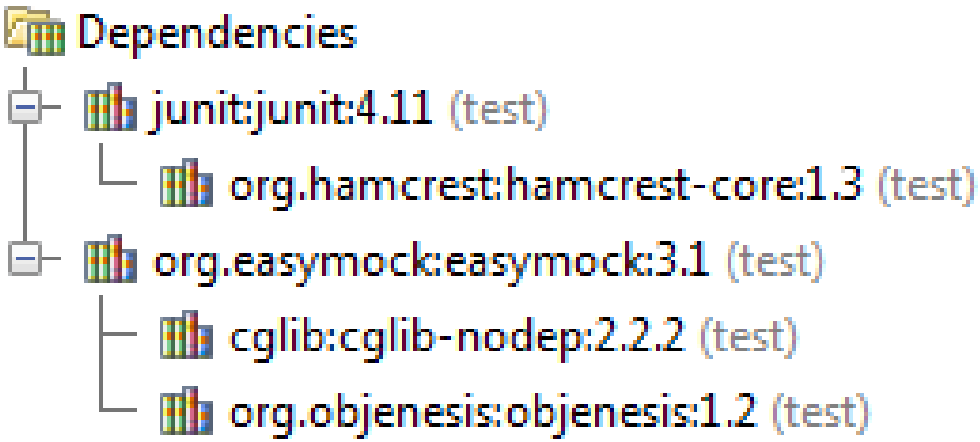
Aufgabe 0: Project Setup

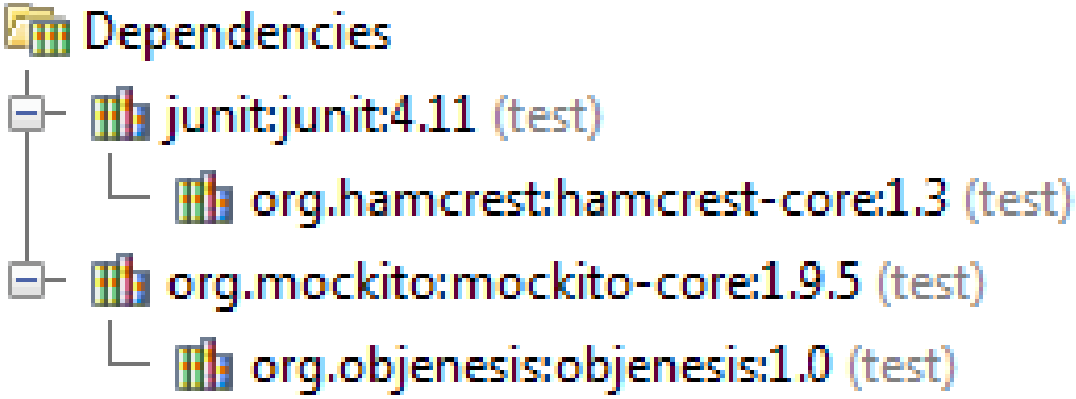
```xml
<dependency>
    <groupId>junit</groupId>
    <artifactId>junit</artifactId>
    <version>4.11</version>
    <scope>test</scope>
</dependency>
<dependency>
    <groupId>org.mockito</groupId>
    <artifactId>mockito-core</artifactId>
    <version>1.9.5</version>
    <scope>test</scope>
</dependency>
```



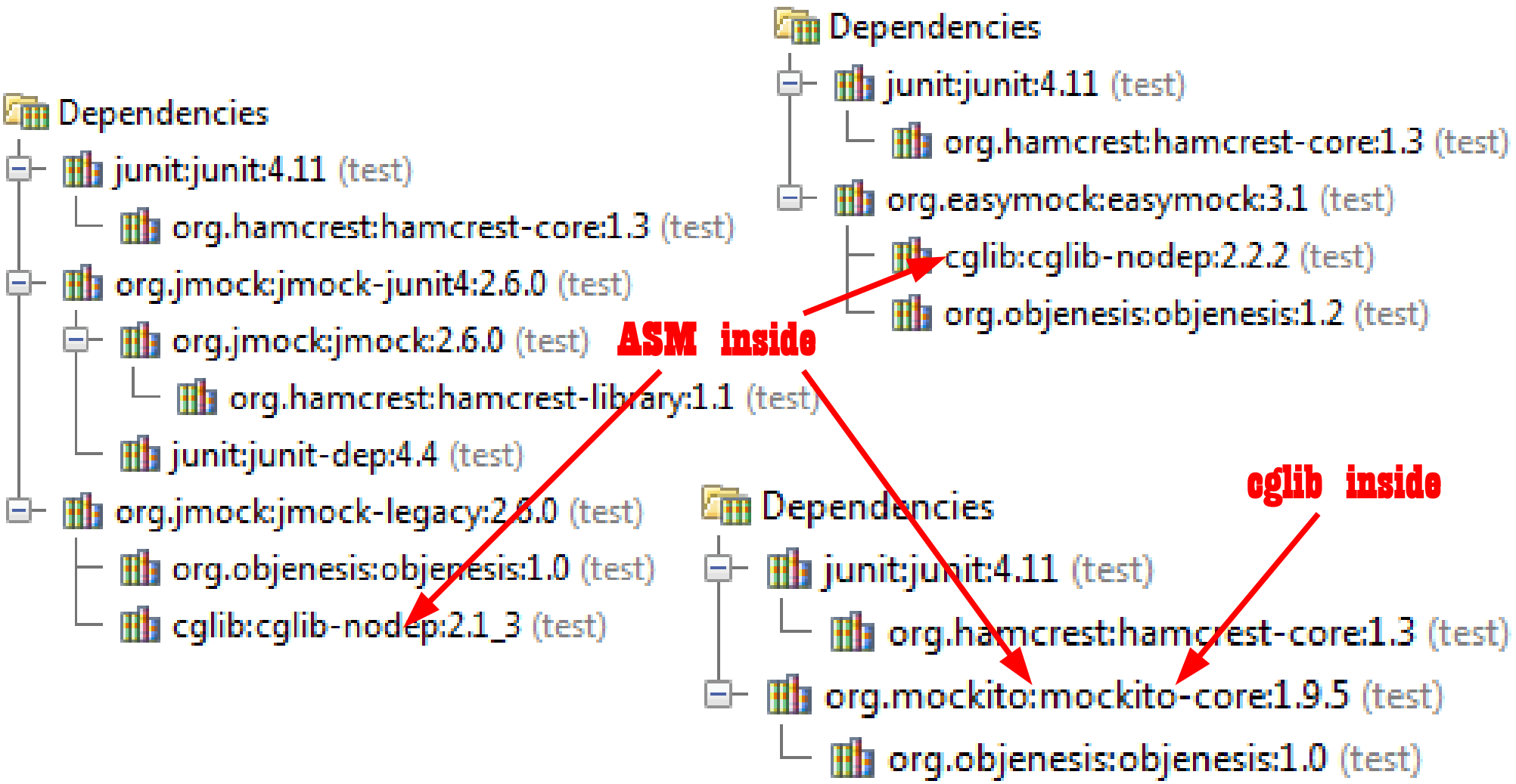
Aufgabe 0: Project Setup



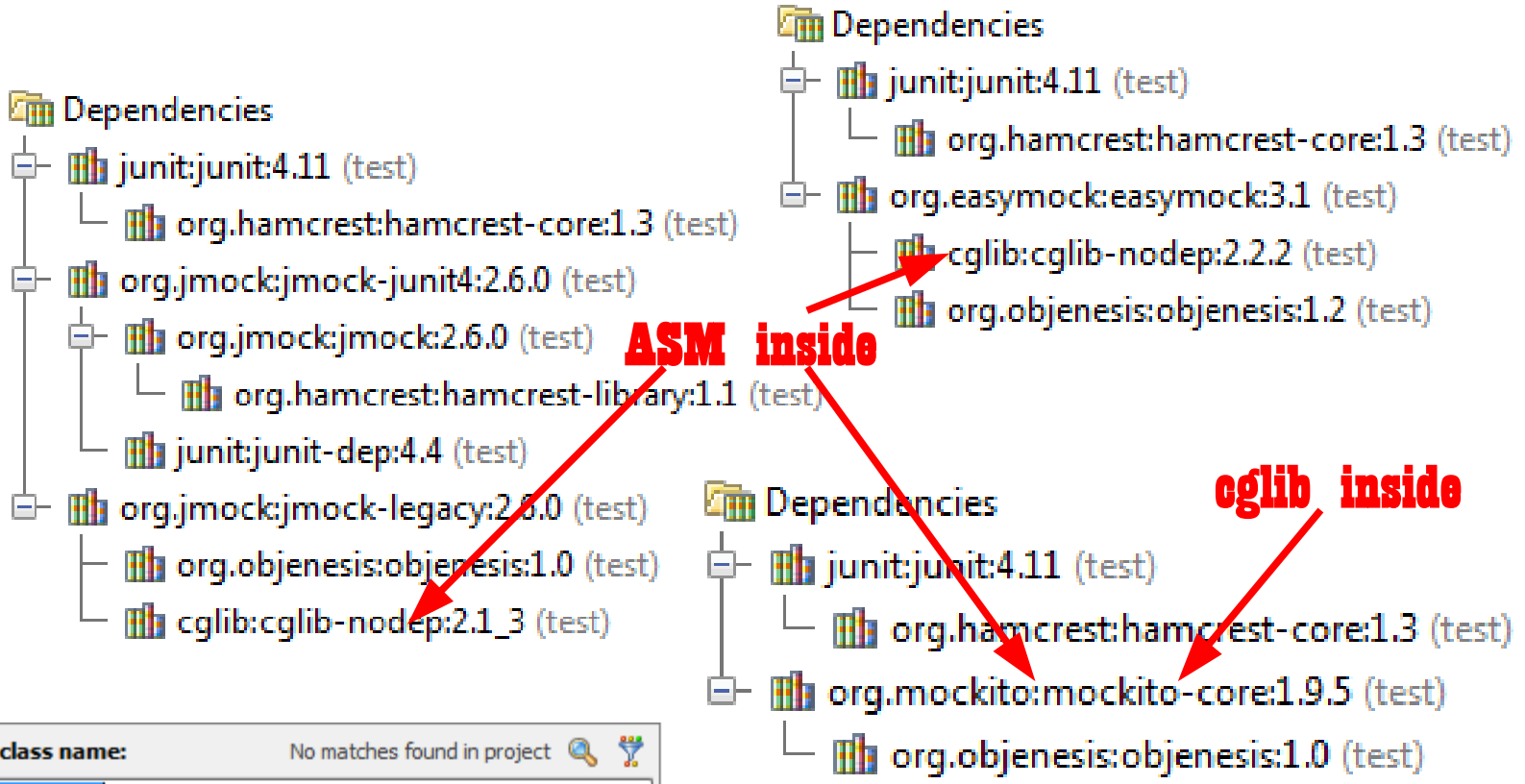


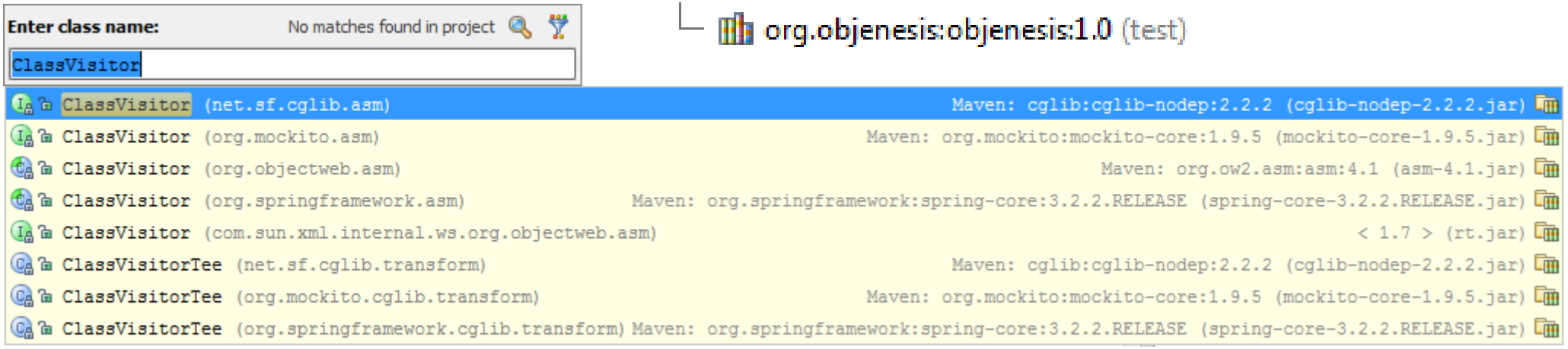


Aufgabe 0: Project Setup



Aufgabe 0: Project Setup





Aufgabe 1: Test Isolation

```java
public class LoginController implements Controller {

    private final UserRepository userRepository;

    @Autowired
    public LoginController(UserRepository userRepository) {
        this.userRepository = userRepository;
    }

    @Override
    public ModelAndView handleRequest(HttpServletRequest request, HttpServletResponse response) throws Exception {
        String username = request.getParameter("username");
        String password = request.getParameter("password");
        User user = userRepository.load(username, password);
        if (user == null) {
            return loginFailed();
        } else {
            request.getSession().setAttribute("currentUser", user);
            return loginSucceeded();
        }
    }

    private ModelAndView loginSucceeded() {...}

    private ModelAndView loginFailed() {...}
}
```

Aufgabe 1: Test Isolation

```
import static aufgabe1.UserBuilder.anUser;
import static org.fest.assertions.api.Assertions.assertThat;

public class LoginControllerTest_jMock2 {

    @Rule
    public JUnitRuleMockery mockery = new JUnitRuleMockery() {{
        setImposteriser(ClassImposteriser.INSTANCE);
    }};

    @Test
    public void testHappyPath() throws Exception {
        // Arrange ...
        final UserRepository userRepository = mockery.mock(UserRepository.class);
        final User user = anUser().withUsername("foo").withPassword("bar").build();
        mockery.checking(new Expectations() {{
            oneOf(userRepository).load("foo", "bar"); will(returnValue(user));
        }});
        LoginController loginController = new LoginController(userRepository);
        MockHttpServletRequest request = new MockHttpServletRequest();
        request.addParameter("username", "foo");
        request.addParameter("password", "bar");
        // Act ...
        loginController.handleRequest(request, null);
        // Assert ...
        assertThat(request.getSession().getAttribute("currentUser")).isSameAs(user);
    }
}
```

Aufgabe 1: Test Isolation

```
import static aufgabe1.UserBuilder.anUser;
import static org.easymock.EasyMock.*;
import static org.fest.assertions.api.Assertions.assertThat;

public class LoginControllerTest_EasyMock extends EasyMockSupport {

    @Test
    public void testHappyPath() throws Exception {
        // Arrange & Record ...
        UserRepository userRepository = createMock(UserRepository.class);
        User user = anUser().withUsername("foo").withPassword("bar").build();
        expect(userRepository.load("foo", "bar")).andReturn(user);
        LoginController loginController = new LoginController(userRepository);
        MockHttpServletRequest request = new MockHttpServletRequest();
        request.addParameter("username", "foo");
        request.addParameter("password", "bar");
        // Switch to replay mode ...
        replayAll();
        // Act ...
        loginController.handleRequest(request, null);
        // Assert ...
        assertThat(request.getSession().getAttribute("currentUser")).isSameAs(user);
    }
}
```

Aufgabe 1: Test Isolation

```
import static aufgabe1.UserBuilder.anUser;
import static org.mockito.Mockito.*;
import static org.fest.assertions.api.Assertions.assertThat;

public class LoginControllerTest_Mockito {

    @Test
    public void testHappyPath() throws Exception {
        // Arrange ...
        UserRepository userRepository = mock(UserRepository.class);
        User user = anUser().withUsername("foo").withPassword("bar").build();
        when(userRepository.load("foo", "bar")).thenReturn(user);
        LoginController loginController = new LoginController(userRepository);
        MockHttpServletRequest request = new MockHttpServletRequest();
        request.addParameter("username", "foo");
        request.addParameter("password", "bar");
        // Act ...
        loginController.handleRequest(request, null);
        // Assert ...
        assertThat(request.getSession().getAttribute("currentUser")).isSameAs(user);
    }
}
```

Aufgabe 2: Behavior Verification

```java
public class LoginController implements Controller {

    private final UserRepository userRepository;
    private final EventBus eventBus;

    @Autowired
    public LoginController(UserRepository userRepository, EventBus eventBus) {
        this.userRepository = userRepository;
        this.eventBus = eventBus;
    }

    @Override
    public ModelAndView handleRequest(HttpServletRequest request, HttpServletResponse response) throws Exception {
        String username = request.getParameter("username");
        String password = request.getParameter("password");
        eventBus.publish(Event.LOGIN_ATTEMPT, username);
        User user = userRepository.load(username, password);
        if (user == null) {
            eventBus.publish(Event.LOGIN_FAILED, username);
            return loginFailed();
        } else {
            request.getSession().setAttribute("currentUser", user);
            eventBus.publish(Event.LOGIN_SUCCESS, user);
            return loginSucceeded();
        }
    }

    private ModelAndView loginSucceeded() {...}

    private ModelAndView loginFailed() {...}
}
```

Aufgabe 2: Behavior Verification

```java
import static aufgabe2.UserBuilder.anUser;

public class LoginControllerTest_jMock2 {

    @Rule
    public JUnitRuleMockery mockery = new JUnitRuleMockery() {{
        setImposteriser(ClassImposteriser.INSTANCE);
    }};

    @Test
    public void testHappyPath() throws Exception {
        // Arrange ...
        final UserRepository userRepository = mockery.mock(UserRepository.class);
        final EventBus eventBus = mockery.mock(EventBus.class);
        final User user = anUser().withUsername("foo").withPassword("bar").build();
        mockery.checking(new Expectations() {{
            oneOf(eventBus).publish(Event.LOGIN_ATTEMPT, "foo");
            oneOf(userRepository).load("foo", "bar"); will(returnValue(user));
            oneOf(eventBus).publish(Event.LOGIN_SUCCESS, user);
        }});
        LoginController loginController = new LoginController(userRepository,eventBus);
        MockHttpServletRequest request = new MockHttpServletRequest();
        request.addParameter("username", "foo");
        request.addParameter("password", "bar");
        // Act ...
        loginController.handleRequest(request, null);
        // Verify is done automatically by JUnitRuleMockery ...
    }
}
```

Aufgabe 2: Behavior Verification

```
import static aufgabe2.UserBuilder.anUser;
import static org.easymock.EasyMock.*;

public class LoginControllerTest_EasyMock extends EasyMockSupport {

    @Test
    public void testHappyPath() throws Exception {
        // Arrange ...
        UserRepository userRepository = createMock(UserRepository.class);
        EventBus eventBus = createMock(EventBus.class);
        User user = anUser().withUsername("foo").withPassword("bar").build();
        LoginController loginController = new LoginController(userRepository, eventBus);
        MockHttpServletRequest request = new MockHttpServletRequest();
        request.addParameter("username", "foo");
        request.addParameter("password", "bar");
        // Record ...
        eventBus.publish(Event.LOGIN_ATTEMPT, "foo");
        expect(userRepository.load("foo", "bar")).andReturn(user);
        eventBus.publish(Event.LOGIN_SUCCESS, user);
        // Switch to replay mode ...
        replayAll();
        // Act ...
        loginController.handleRequest(request, null);
        // Verify ...
        verifyAll();
    }
}
```

Aufgabe 2: Behavior Verification

```java
import static aufgabe2.UserBuilder.anUser;
import static org.mockito.Mockito.*;

public class LoginControllerTest_Mockito {

    @Test
    public void testHappyPath() throws Exception {
        // Arrange ...
        final UserRepository userRepository = mock(UserRepository.class);
        final User user = anUser().withUsername("foo").withPassword("bar").build();
        when(userRepository.load("foo", "bar")).thenReturn(user);
        final EventBus eventBus = mock(EventBus.class);
        LoginController loginController = new LoginController(userRepository, eventBus);
        MockHttpServletRequest request = new MockHttpServletRequest();
        request.addParameter("username", "foo");
        request.addParameter("password", "bar");
        // Act ...
        loginController.handleRequest(request, null);
        // Verify ...
        verify(eventBus).publish(Event.LOGIN_ATTEMPT, "foo");
        verify(userRepository).load("foo", "bar");
        verify(eventBus).publish(Event.LOGIN_SUCCESS, user);
        verifyNoMoreInteractions(userRepository, eventBus);
    }
}
```

Demo

Aufgabe 3: Call Order Verification

```
public class LoginControllerTest_jMock2 {

    @Rule
    public JUnitRuleMockery mockery = new JUnitRuleMockery() {{
        setImposteriser(ClassImposteriser.INSTANCE);
    }};

    @Test
    public void testHappyPath() throws Exception {
        // Arrange ...
        final UserRepository userRepository = mockery.mock(UserRepository.class);
        final EventBus eventBus = mockery.mock(EventBus.class);
        final User user = anUser().withUsername("foo").withPassword("bar").build();
        final Sequence expectedCallOrder = mockery.sequence("expectedCallOrder");
        mockery.checking(new Expectations() {{
            oneOf(eventBus).publish(Event.LOGIN_ATTEMPT, "foo"); inSequence(expectedCallOrder);
            oneOf(userRepository).load("foo", "bar"); will(returnValue(user)); inSequence(expectedCallOrder);
            oneOf(eventBus).publish(Event.LOGIN_SUCCESS, user); inSequence(expectedCallOrder);
        }});
        LoginController loginController = new LoginController(userRepository,eventBus);
        MockHttpServletRequest request = new MockHttpServletRequest();
        request.addParameter("username", "foo");
        request.addParameter("password", "bar");
        // Act ...
        loginController.handleRequest(request, null);
        // Verify is done automatically by JUnitRuleMockery ...
    }
}
```

Aufgabe 3: Call Order Verification

```
public class LoginControllerTest_EasyMock extends EasyMockSupport {

    @Test
    public void testHappyPath() throws Exception {
        // Arrange ...
        IMocksControl strictControl = createStrictControl();
        UserRepository userRepository = strictControl.createMock(UserRepository.class);
        EventBus eventBus = strictControl.createMock(EventBus.class);
        User user = anUser().withUsername("foo").withPassword("bar").build();
        LoginController loginController = new LoginController(userRepository, eventBus);
        MockHttpServletRequest request = new MockHttpServletRequest();
        request.addParameter("username", "foo");
        request.addParameter("password", "bar");
        // Record ...
        eventBus.publish(Event.LOGIN_ATTEMPT, "foo");
        expect(userRepository.load("foo", "bar")).andReturn(user);
        eventBus.publish(Event.LOGIN_SUCCESS, user);
        // Switch to replay mode ...
        replayAll();
        // Act ...
        loginController.handleRequest(request, null);
        // Verify ...
        verifyAll();
    }
}
```

Aufgabe 3: Call Order Verification

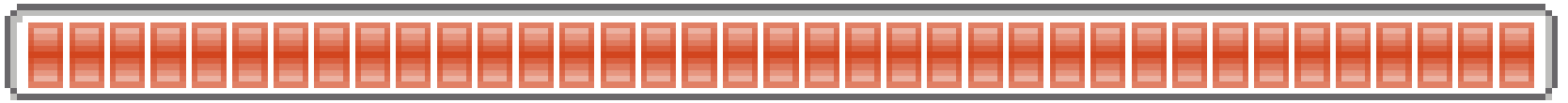
```
public class LoginControllerTest_Mockito {

    @Test
    public void testHappyPath() throws Exception {
        // Arrange ...
        final UserRepository userRepository = mock(UserRepository.class);
        final User user = anUser().withUsername("foo").withPassword("bar").build();
        when(userRepository.load("foo", "bar")).thenReturn(user);
        final EventBus eventBus = mock(EventBus.class);
        LoginController loginController = new LoginController(userRepository, eventBus);
        MockHttpServletRequest request = new MockHttpServletRequest();
        request.addParameter("username", "foo");
        request.addParameter("password", "bar");
        // Act ...
        loginController.handleRequest(request, null);
        // Verify ...
        InOrder inOrder = inOrder(userRepository, eventBus);
        inOrder.verify(eventBus).publish(Event.LOGIN_ATTEMPT, "foo");
        inOrder.verify(userRepository).load("foo", "bar");
        inOrder.verify(eventBus).publish(Event.LOGIN_SUCCESS, user);
        verifyNoMoreInteractions(userRepository, eventBus);
    }
}
```

Demo

Aufgabe 4: Ignore Method Calls

```
public class LoginControllerTest_jMock2 {

    @Rule
    public JUnitRuleMockery mockery = new JUnitRuleMockery() {{
        setImposteriser(ClassImposteriser.INSTANCE);
    }};

    @Test
    public void testHappyPath() throws Exception {
        // Arrange ...
        final UserRepository userRepository = mockery.mock(UserRepository.class);
        final EventBus eventBus = mockery.mock(EventBus.class);
        final User user = anUser().withUsername("foo").withPassword("bar").build();
        mockery.checking(new Expectations() {{
            oneOf(userRepository).load("foo", "bar"); will(returnValue(user));
        }});
        LoginController loginController = new LoginController(userRepository, eventBus);
        MockHttpServletRequest request = new MockHttpServletRequest();
        request.addParameter("username", "foo");
        request.addParameter("password", "bar");
        // Act ...
        loginController.handleRequest(request, null);
        // Assert ...
        assertThat(request.getSession().getAttribute("currentUser")).isSameAs(user);
    }
}
```

Aufgabe 4: Ignore Method Calls



```
java.lang.AssertionError: unexpected invocation: eventBus.publish(<LOGIN_ATTEMPT>, "foo")
expectations:
  expected once, never invoked: userRepository.load("foo", "bar"); returns <User foo>
what happened before this: nothing!
    at org.jmock.api.ExpectationError.unexpected(ExpectationError.java:23)
    at org.jmock.internal.InvocationDispatcher.dispatch(InvocationDispatcher.java:85)
    at org.jmock.Mockery.dispatch(Mockery.java:231)
    at org.jmock.Mockery.access$100(Mockery.java:29)
    at org.jmock.Mockery$MockObject.invoke(Mockery.java:271)
    at org.jmock.internal.InvocationDiverter.invoke(InvocationDiverter.java:27)
    at org.jmock.internal.FakeObjectMethods.invoke(FakeObjectMethods.java:38)
    at org.jmock.internal.SingleThreadedPolicy$1.invoke(SingleThreadedPolicy.java:21)
    at org.jmock.lib.legacy.ClassImposteriser$4.invoke(ClassImposteriser.java:129)
    at aufgabe2.EventBus$$EnhancerByCGLIB$$906ee3da.publish(<generated>)
    at aufgabe2.LoginController.handleRequest(LoginController.java:25)
    at aufgabe4.LoginControllerTest_jMock2.testHappyPath(LoginControllerTest_jMock2.java:38) <7 internal calls>
    at org.jmock.integration.junit4.JUnitRuleMockery$1.evaluate(JUnitRuleMockery.java:49) <16 internal calls>
```

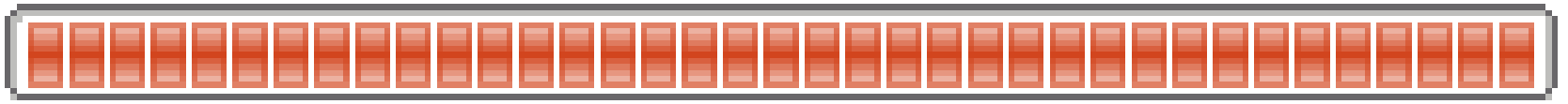
Aufgabe 4: Ignore Method Calls

```
public class LoginControllerTest_jMock2 {

    @Rule
    public JUnitRuleMockery mockery = new JUnitRuleMockery() {{
        setImposteriser(ClassImposteriser.INSTANCE);
    }};

    @Test
    public void testHappyPath() throws Exception {
        // Arrange ...
        final UserRepository userRepository = mockery.mock(UserRepository.class);
        final EventBus eventBus = mockery.mock(EventBus.class);
        final User user = anUser().withUsername("foo").withPassword("bar").build();
        mockery.checking(new Expectations() {{
            oneOf(userRepository).load("foo", "bar"); will(returnValue(user));
            ignoring(eventBus);
        }});
        LoginController loginController = new LoginController(userRepository, eventBus);
        MockHttpServletRequest request = new MockHttpServletRequest();
        request.addParameter("username", "foo");
        request.addParameter("password", "bar");
        // Act ...
        loginController.handleRequest(request, null);
        // Assert ...
        assertThat(request.getSession().getAttribute("currentUser")).isSameAs(user);
    }
}
```

Aufgabe 4: Ignore Method Calls

```
public class LoginControllerTest_EasyMock extends EasyMockSupport {

    @Test
    public void testHappyPath() throws Exception {
        // Arrange & Record ...
        UserRepository userRepository = createMock(UserRepository.class);
        EventBus eventBus = createMock(EventBus.class);
        User user = anUser().withUsername("foo").withPassword("bar").build();
        expect(userRepository.load("foo", "bar")).andReturn(user);
        LoginController loginController = new LoginController(userRepository, eventBus);
        MockHttpServletRequest request = new MockHttpServletRequest();
        request.addParameter("username", "foo");
        request.addParameter("password", "bar");
        // Switch to replay mode ...
        replayAll();
        // Act ...
        loginController.handleRequest(request, null);
        // Assert ...
        assertThat(request.getSession().getAttribute("currentUser")).isSameAs(user);
    }
}
```

Aufgabe 4: Ignore Method Calls



```
java.lang.AssertionError:
  Unexpected method call EventBus.publish(LOGIN_ATTEMPT, "foo"):
    at org.easymock.internal.MockInvocationHandler.invoke(MockInvocationHandler.java:44)
    at org.easymock.internal.ObjectMethodsFilter.invoke(ObjectMethodsFilter.java:85)
    at sun.proxy.$Proxy5.publish(Unknown Source)
    at aufgabe2.LoginController.handleRequest(LoginController.java:25)
    at aufgabe4.LoginControllerTest_EasyMock.testHappyPath(LoginControllerTest_EasyMock.java:31) <23 internal calls>
```

Aufgabe 4: Ignore Method Calls

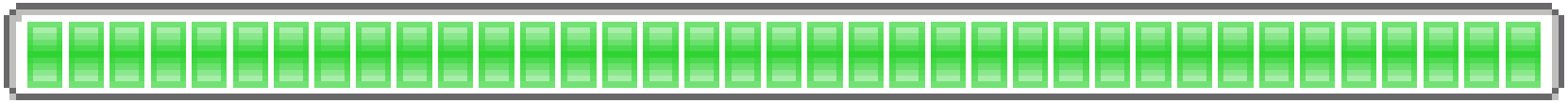
```
public class LoginControllerTest_EasyMock extends EasyMockSupport {

    @Test
    public void testHappyPath() throws Exception {
        // Arrange & Record ...
        UserRepository userRepository = createMock(UserRepository.class);
        EventBus eventBus = createNiceMock(EventBus.class);
        User user = anUser().withUsername("foo").withPassword("bar").build();
        expect(userRepository.load("foo", "bar")).andReturn(user);
        LoginController loginController = new LoginController(userRepository, eventBus);
        MockHttpServletRequest request = new MockHttpServletRequest();
        request.addParameter("username", "foo");
        request.addParameter("password", "bar");
        // Switch to replay mode ...
        replayAll();
        // Act ...
        loginController.handleRequest(request, null);
        // Assert ...
        assertThat(request.getSession().getAttribute("currentUser")).isSameAs(user);
    }
}
```

Aufgabe 4: Ignore Method Calls

```
public class LoginControllerTest_Mockito {

    @Test
    public void testHappyPath() throws Exception {
        // Arrange ...
        UserRepository userRepository = mock(UserRepository.class);
        User user = anUser().withUsername("foo").withPassword("bar").build();
        when(userRepository.load("foo", "bar")).thenReturn(user);
        EventBus eventBus = mock(EventBus.class);
        LoginController loginController = new LoginController(userRepository, eventBus);
        MockHttpServletRequest request = new MockHttpServletRequest();
        request.addParameter("username", "foo");
        request.addParameter("password", "bar");
        // Act ...
        loginController.handleRequest(request, null);
        // Assert ...
        assertThat(request.getSession().getAttribute("currentUser")).isSameAs(user);
    }
}
```

Aufgabe 4: Ignore Method Calls

```
public class LoginControllerTest_Mockito {

    @Test
    public void testHappyPath() throws Exception {
        // Arrange ...
        UserRepository userRepository = mock(UserRepository.class);
        User user = anUser().withUsername("foo").withPassword("bar").build();
        when(userRepository.load("foo", "bar")).thenReturn(user);
        EventBus eventBus = mock(EventBus.class);
        LoginController loginController = new LoginController(userRepository, eventBus);
        MockHttpServletRequest request = new MockHttpServletRequest();
        request.addParameter("username", "foo");
        request.addParameter("password", "bar");
        // Act ...
        loginController.handleRequest(request, null);
        // Assert ...
        assertThat(request.getSession().getAttribute("currentUser")).isSameAs(user);
    }
}
```



Die alte Mocking Philosophie

1. Erwartungen und Antworten aufzeichnen
2. Produktionscode ausführen
3. Erwartungen überprüfen

Die alte Mocking Philosophie

1. Erwartungen und Antworten aufzeichnen
2. Produktionscode ausführen 

3. Erwartungen überprüfen 

- viel Setup-Code
- viel Ausprobieren beim Schreiben von Tests
- Tests brechen öfters
- Erwartungen stehen vor der getesten Aktion

Eine neue Mocking Philosophie

1. Antworten aufzeichnen (Stubbing)
2. Produktionscode ausführen
3. Erwartungen überprüfen (Verification)

Eine neue Mocking Philosophie

1. Antworten aufzeichnen (Stubbing)
2. Produktionscode ausführen
3. Erwartungen überprüfen (Verification)

- \+ weniger Setup-Code
- \+ robustere Tests
- \+ besser verständliche Tests

Eine neue Mocking Philosophie

1. Antworten aufzeichnen (Stubbing)
2. Produktionscode ausführen
3. Erwartungen überprüfen (Verification)

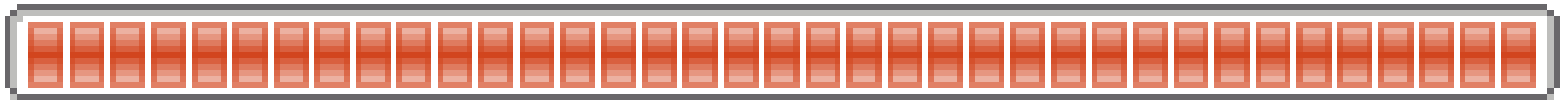
- \+ weniger Setup-Code
- \+ robustere Tests
- \+ besser verständliche Tests

Aber ...

Zusatzaufgabe für Mockito: Do not ignore unexpected calls

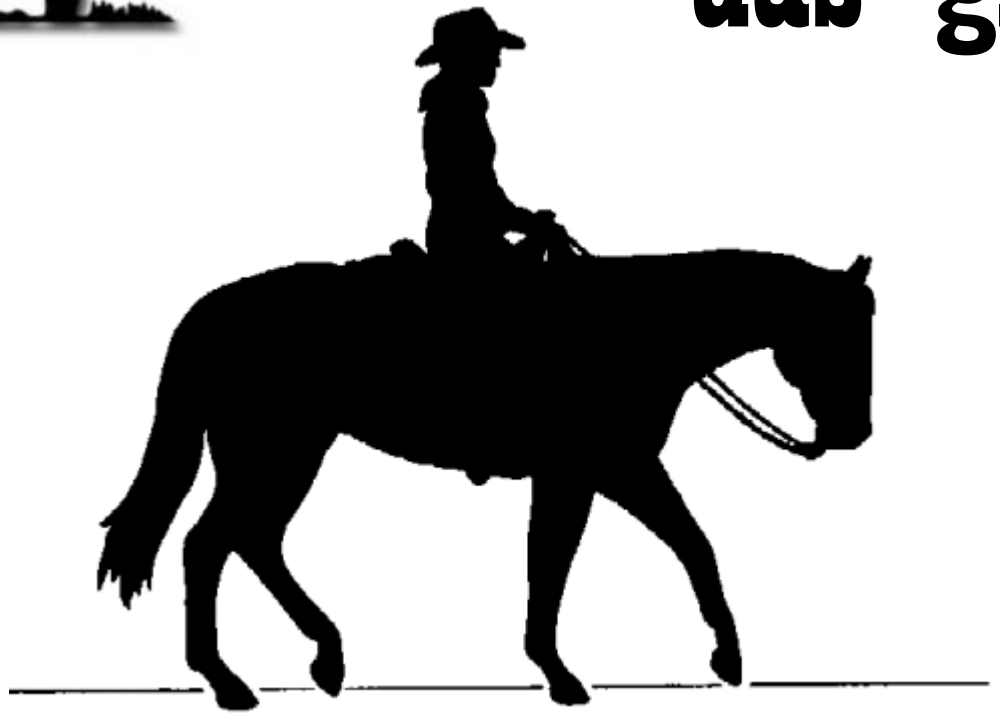
```
public class LoginControllerTest_Mockito {

    @Test
    public void testHappyPath() throws Exception {
        // Arrange ...
        UserRepository userRepository = mock(UserRepository.class);
        User user = anUser().withUsername("foo").withPassword("bar").build();
        when(userRepository.load("foo", "bar")).thenReturn(user);
        EventBus eventBus = pseudo(EventBus.class);
        LoginController loginController = new LoginController(userRepository, eventBus);
        MockHttpServletRequest request = new MockHttpServletRequest();
        request.addParameter("username", "foo");
        request.addParameter("password", "bar");
        // Act ...
        loginController.handleRequest(request, null);
        // Assert ...
        assertThat(request.getSession().getAttribute("currentUser")).isSameAs(user);
    }

    public static <T> T pseudo(Class<T> classToMock) {
        return mock(classToMock, new Answer<Object>() {
            @Override
            public Object answer(InvocationOnMock invocation) throws Throwable {
                throw new AssertionError("Unexpected method call " + invocation);
            }
        });
    }
}
```

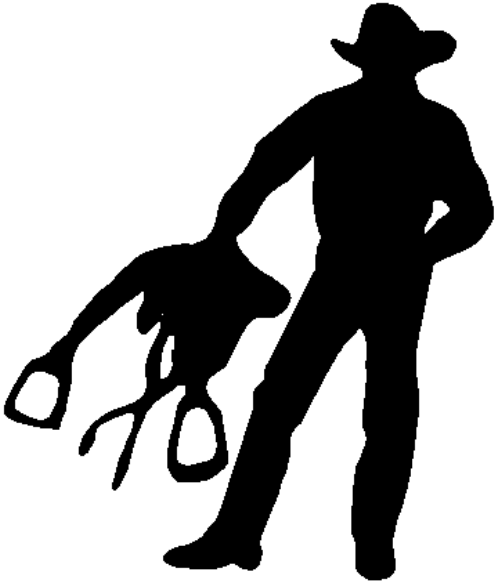
Zusatzaufgabe für Mockito: Do not ignore unexpected calls



```
java.lang.AssertionError: Unexpected method call eventBus.publish(LOGIN_ATTEMPT, "foo");
    at zusatzaufgabe.LoginControllerTest_Mockito$1.answer(LoginControllerTest_Mockito.java:40)
    at org.mockito.internal.handler.MockHandlerImpl.handle(MockHandlerImpl.java:93)
    at org.mockito.internal.handler.NullResultGuardian.handle(NullResultGuardian.java:29)
    at org.mockito.internal.handler.InvocationNotifierHandler.handle(InvocationNotifierHandler.java:38)
    at org.mockito.internal.creation.MethodInterceptorFilter.intercept(MethodInterceptorFilter.java:51)
    at aufgabe2.EventBus$$EnhancerByMockitoWithCGLIB$$26b4bed.publish(<generated>)
    at aufgabe2.LoginController.handleRequest(LoginController.java:26)
    at zusatzaufgabe.LoginControllerTest_Mockito.testHappyPath(LoginControllerTest_Mockito.java:31) <23 internal calls>
```

Können etwa alle Mocking-Bibliotheken das gleiche?





Return values for unexpected method calls

- `false` für `boolean`,
- `'\0'` für `char`
- `0` für alle anderen primitiven Typen,
- `null` in allen anderen Fällen

Return values for unexpected method calls

- `false` für `boolean`,
- `'\0'` für `char`
- `0` für alle anderen primitiven Typen,
- den leeren String `""` für Strings,
- ein leeres Array für Arrays,
- ein Mock-Objekt, das ebenfalls ignoriert wird, wenn von der Klasse des Rückgabewerts ein Mock-Objekt erzeugt werden kann, was eigentlich immer der Fall ist, wenn Sie das Modul *jmock-legacy* benutzen, außer die Klasse ist `final`,
- `null` für alle anderen Typen

Return values for unexpected method calls

- `false` für `boolean` sowie `Boolean.FALSE`, falls die Methode eine Instanz der Wrapper-Klasse `java.lang.Boolean` zurückgibt,
- `'\0'` für `char` sowie für die Wrapper-Klasse `java.lang.Character`,
- `0` für alle anderen primitiven Typen (`int`, `float`, ...) sowie ihren Wrapper-Klassen,
- eine leere `Collection` bzw. `Map`, falls der Typ des Rückgabewerts eines der in `java.util` definierten Interfaces `Collection`, `List`, `Set`, `SortedSet`, `Map` oder `SortedMap` ist, aber auch falls die Methode eine der gebräuchlichsten Implementierungen dieser Interfaces zurückgibt, und zwar: `ArrayList`, `LinkedList`, `HashSet`, `LinkedHashSet`, `TreeSet`, `HashMap`, `LinkedHashMap` oder `TreeMap`.
- `null` in allen anderen Fällen, Ausnahme: `toString()`

Return values for unexpected method calls

`ReturnsMoreEmptyValues` – wie zuvor, aber zusätzlich:

- den leeren String `""` für Strings,
- ein leeres Array für Arrays

`ReturnsMocks` – wie `ReturnsMoreEmptyValues`, aber zusätzlich:

- ein Mock-Objekt statt `null` (wenn möglich)

...

Return values for unexpected method calls

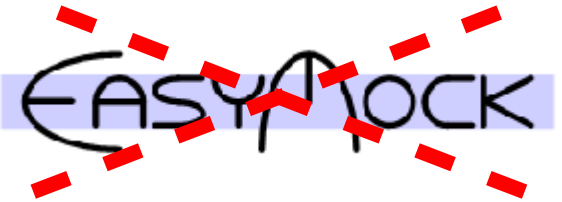
`ReturnsDeepStubs` – ähnlich wie `ReturnsMocks`, aber merkt sich erzeugte Mock-Objekte und gibt diese erneut zurück, falls die gleiche Methode erneut mit den gleichen Parametern aufgerufen wird. Dies ermöglicht *Deep Stubbing*:

```
@Test
public void testDeepStubbing() throws SQLException {
    Statement stmt = mock(Statement.class, RETURNS_DEEP_STUBS);
    when(stmt.executeQuery(startsWith("SELECT COUNT")).getInt(1)).thenReturn(17);

    ResultSet rs = stmt.executeQuery("SELECT COUNT(*) FROM foo WHERE status = 0");

    assertThat(rs.getInt(1), is(17));
}
```

Spy Objects

Spy Objects


```
public void testCreateUsesFsArg() throws Exception {
  FileSystem fs = FileSystem.getLocal(conf);
  FileSystem spyFs = Mockito.spy(fs);
  Path p = new Path(System.getProperty("test.build.data", ".")+"/testCreateUsesFSArg.seq");
  SequenceFile.Writer writer = SequenceFile.createWriter(
      spyFs, conf, p, NullWritable.class, NullWritable.class);
  writer.close();
  Mockito.verify(spyFs).getDefaultReplication(p);
}
```



statische Methoden mocken?

final Klassen/Methoden mocken?

statische Methoden mocken?

final Klassen/Methoden mocken?

statische Methoden mocken?

final Klassen/Methoden mocken?

statische Methoden mocken

```
@RunWith(PowerMockRunner.class)
@PrepareForTest({ Session.class, Transport.class })
public class JavaMailFacadeTest {

    @Test
    public void test_createSession() throws Exception {
        // Mock all static methods of Session ...
        mockStatic(Session.class);
        // Stub static Session.getInstance method ...
        final Session mockSession = mock(Session.class);
        when(Session.getInstance(any(Properties.class))).thenReturn(mockSession);
        JavaMailFacade sut = new JavaMailFacade();

        Session session = sut.createSession();

        assertThat(session, isSameInstanceAs(mockSession));
    }
```

Das war der Mocking Libraries Shootout

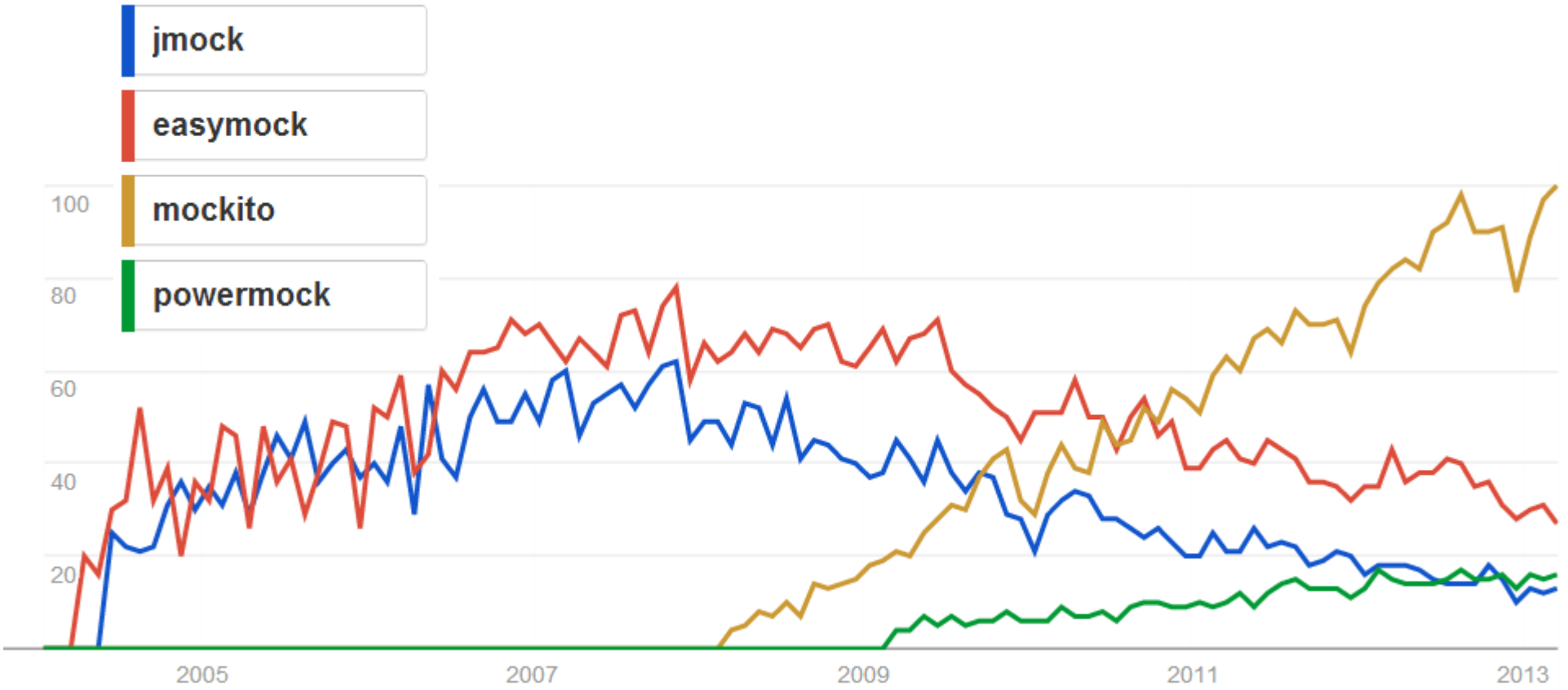
Das war der Mocking Libraries Shootout

Naja, fast ...

Das war der Mocking Libraries Shootout

And The Winner Is ...

Google Trends



http://www.google.de/trends/explore#q=jmock%2C%20easymock%2C%20mockito%2C%20powermock&cmpt=q

Fragen?

Vielen Dank für Ihre Aufmerksamkeit.

Falls Sie mehr wissen möchten: