JUnit-contracts: A Contract Testing Tool

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Who Is Claude Warren?

- claude@xenei.com
- Apache Jena Project Management Committee Member and Committer.
- https://github.com/Claudenw
- Playing with java since version 0.8
- Developer/Architect > 25 years experience
- Currently employed by IBM (Galway, IE)
- Formerly employed by Digital Enterprise Research Institute (Galway, IE), National Renewable Energy Laboratory (Golden, CO, USA)
- Founding member of the Denver Area Mad Scientists Club
- Winner of the first Critter Crunch (Robotics Competition)
- Frustrated Musician
- Author of Junit Contract test extension.
What is Contract Testing

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- Contract testing ensures that all testable facets of the contract are tested.
- A jUnit extension written by Claude Warren and found at https://github.com/Claudenw/junit-contracts
Why Contract Testing

- Verify that implementations are correct.
  - Support can ask for proof of correctness of 2\textsuperscript{nd} or 3\textsuperscript{rd} party implementations.
  - Internal development teams can ensure that they are correctly implementing the interface long before integration test.

- Apply DRY (Don't Repeat Yourself) principles to interface testing. One test covers all implementations.
  - In Java a class can have multiple interfaces but only one parent, so consistent testing across interface implementations is difficult.
Who Benefits

- SPI/API Implementers – Insure full implementation.
- SPI/API Definers – Insure that other teams correctly implement contracts.
- QA Test – can easily validate that contracts are correctly implemented.
- QA Test Managers – can easily determine which contract tests need to be developed or implemented.
public interface Foo {
    // Add an object. Implementations must log action.
    public void add( Object x );
    Public boolean contains( Object x );
    // register a logger to listen. Multiple calls ok.
    public void register( Logger log );
}
Problem

public interface Foo {
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- Define a concrete contract test that tests the instance returned by a “producer”
- Define a jUnit extension that locates all the contract tests, associates them with the interface they test and locates all the classes that implement that interface.
public interface IProducer<T>() {
    public T newInstance();
    public void cleanUp();
};
Solution Diagram

Foo

FooImpl1
Solution Diagram

@Contract(Foo.class)

Foo

FooImpl1

Foo_Ct

Foo_Ct

@Contract(Foo.class)
@Contract(Foo.class)

@RunWith(ContractSuite.class)
@ContractImpl(FooImpl1.class)

@ContractImpl(FooImpl1.class)
@Contract

@Contract(Foo.class)
public class Foo_CT<T extends Foo> {

    private IProducer<T> fooProducer;

    @Contract.Inject
    public final void setFooContractTestProducer(IProducer<T> fooProducer) {
        this.fooProducer = fooProducer;
    }

    @ContractTest
    public void testAdd() {
        TestingLogger logger = …
        Object testObject = …
        Foo foo = fooProducer.newInstance();
        foo.register( logger );
        foo.add( testObject );
        assertTrue( logger.recordedAdd() );
        assertTrue( foo.contains( testObject ) );
    }

    @After
    public void cleanup() {
        fooProducer.cleanUp();
    }
}

Foo

Foo_CT
@ContractImpl(FooImpl1.class)
@RunWith(ContractSuite.class)
@ContractImpl(FooImpl1.class)
public class FooImpl1_CS {
    private IProducer<FooImpl1> fooProducer;
    public FooImpl1_CS() {
        fooProducer = new IProducer<FooImpl1>() {
            @Override
            public FooImpl1 newInstance() {
                return new FooImpl1();
            }
            @Override
            public void cleanUp() {
                // nothing to do
            }
        };
    }
    @Contract.Inject
    public final IProducer<FooImpl1> getTestProducer() {
        return fooProducer;
    }
}
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4. Instantiate each class found in step 3.
5. Create a jUnit suite comprising all ContractTest annotated methods found in the classes from step 3.
7. Execute the suite.
Complex Solution Diagram

@Contract(Foo.class)  @Contract(Foo.class)
@RunWith(ContractSuite.class)  @ContractImpl(FooImpl1.class)

Bar

Foo

FooImpl1

Bar_CT

Foo_CT

@Contract(Bar.class)

@Contract(Bar.class)

@Contract(Foo.class)

@RunWith(ContractSuite.class)

@ContractImpl(FooImpl1.class)
• There can be more than one ContractImpl for a single concrete class.
• ContractImpl has a skip property to ignore specific interface tests (e.g. bar.class).
• Coverage reporting:
  – Unimplemented Tests
  – Untested Interfaces
• Maven reporting plugin.
• Provides a Dynamic interface which triggers testing of the classes returned from methods.
• https://github.com/Claudenw/junit-contracts

• Maven:
  
  `<dependency>
    <groupId>org.xenei</groupId>
    <artifactId>junit-contracts</artifactId>
    <version>0.1.5</version>
  </dependency>`

PHILOSOPHISING GEEKS

Sometimes I ask myself: "But what if this test fails?"

assert(true);