jUnit^{RV}

Adding Runtime Verification to jUnit

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Key Ideas

- Testing temporal properties is difficult
  - complicated logic
  - hard to access necessary information
- *Unit Testing* extended with *Runtime Verification*
- Specify relevant *events*
- Specify *temporal properties* in LTL
- Associate tests with monitors using annotations
- jUnit^{RV} generates and injects monitors
- jUnit^{RV} integrates seamlessly into IDEs and build tools
- jUnit^{RV} is extensible

A jUnit^{RV} Test

```
@RunWith(RVRunner.class)
public class MyDataClientTest {

    private static final String dataServiceQname = "junitrvexamples.DataService";
    private static Event modify = called(dataServiceQname, "modifyData");
    private static Event committed = returned(dataServiceQname, "commit");
    private static Event disconnect = invoke(dataServiceQname, "disconnect");

    private static Monitor commitBeforeClose = new FLTL4Monitor(
            Always(
                implies(
                    modify,
                    Until(not(disconnect), committed))));

    @Test
    @Monitors({"commitBeforeClose", "authWhenModify"})
    public void test1() {
        ...
    }
}
```

jUnit^{RV} Running in Netbeans

Example - NetBeans IDE 7.3

File Edit View Navigate Source Refactor Run Debug Profile Team Tools Window Help

Projects - RVProject | Files | Services

- Example
  - Source Packages
    - de.uni_lubeck.isp.rvtool_example
    - junitrvexamples
      - ContinuationMonitor.java
      - ContinuationMonitorService.java
      - DataService.java
      - MyDataClient.java
      - MyDataService.java
  - Test Packages
    - de.uni_lubeck.isp.rvtool_example
    - junitrvexamples
      - MyDataClientTest.java
  - Other Sources
  - Dependencies
  - Java Dependencies

openBeforeModify - Navigator

Members

- MyDataClientTest
  - test1()
  - test2()
  - test3()
  - close : Event
  - commitBeforeClose : Monitor
  - committed : Event
  - dataServiceQname : String
  - modify : Event
  - openBeforeModify : Monitor
  - opened : Event

MyDataClientTest.java

```
31                  implies(
32                      modify,
33                      Until(not(close), committed))));
34
35      // create a monitor for LTL4 property
36      //(¬modify W opened) ∧ G(close ⇒ ¬modify WU opened)
37      private static Monitor openBeforeModify = new FLTL4Monitor(
38              and(WU(not(modify), opened),
39                  G(implies(close, WU(not(modify), opened)))));
40
41      @Test
42      @Monitors({"commitBeforeClose", "openBeforeModify"})
43      public void test1() {
44          DataService service = new MyDataService("http://myserver");
45          MyDataClient client = new MyDataClient(service);
46          client.authenticate("daniel");
47          client.addPatient("Mr . Smith");
48          client.switchToUser("ruth");
49          client.getPatientFile("miller-2143-1");
50          client.setPhone("miller-2143-1", "012345678");
51          client.exit();
```

Test Results | Usages

junitrvexamples.MyDataClientTest

33,33 %

1 test passed, 2 tests failed.(0,091 s)

- junitrvexamples.MyDataClientTest Failed
  - test1 Failed: Monitor commitBeforeClose evaluated to FALSE
  - test2 Failed: Monitor commitBeforeClose terminated with PFALSE

```
danielconnected.
Data modified
danielconnected.
Data modified
```

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