Automated Integration Tests for Mobile Applications in Java 2 Micro Edition

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Who is who

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What are “software tests”?

What are "software tests"?

(Wikipedia)

Software testing is the process used to help identify the **correctness**, **completeness**, **security**, and **quality** of developed computer software.

How can we “test software”?

Unit tests

Correctness of individual units of source code

Module/ integration tests

Chunks of functionality, sometimes the entire program. testing in various target environments (O/S's, processors etc.).

Acceptance tests

Compliance to customer's requirements; often manual work.

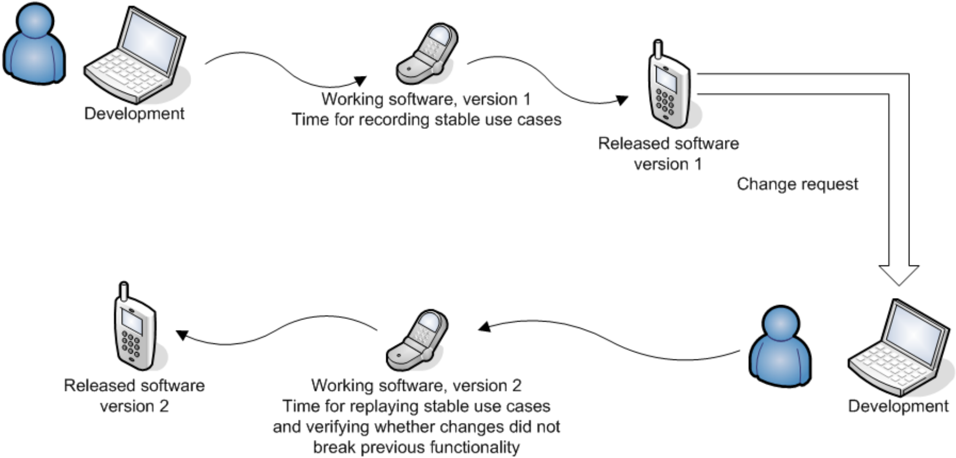
Regression tests

System stability/ correctness in response to ongoing changes.

Project scope

- Tool for acceptance, integration and regression tests for Java ME business applications.
- Automatic (capture-replay).
- Works on both actual devices and emulators.
- XML testing scripts compiled to binary intermediate language and vice versa.

Usage example



Development

Working software, version 1
Time for recording stable use cases

Released software
version 1

Change request

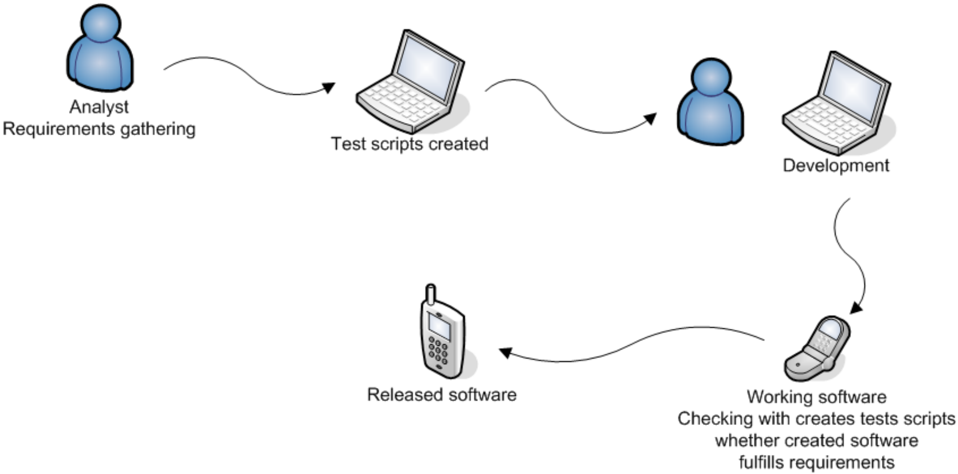
Development

Working software, version 2
Time for replaying stable use cases
and verifying whether changes did not
break previous functionality

Released software
version 2

Scenario with capture-replay process.

Usage example



Scenario with human-friendly test scripts.

Constraints

- Programming and testing are more difficult compared to desktop programs.
- Each mobile has different hardware configuration
- ‘Standard’ APIs implemented by hardware vendors contain differences.
- A number of non-standard APIs and proprietary solutions.
- Lack of system-level support for handling events (GUI, sounds, SMS, . . .).

Related projects

- J2ME Unit
- Sony-Ericsson Mobile JUnit
- Motorola Gatling
- CLDC Unit
- IBM Rational Test RT
- Research In Motion – BlackBerry Fledge emulator

Dynamic code injection

- One possible solution for dealing with environment's constraints.
- Intercepting **events** and injecting our custom **proxies** at several **injection points**.

```java
public final class MyMidlet extends MIDlet {
   protected void startApp()
      throws MIDletStateChangeException {
      // original code
   }
...
```

```java
public final class MyMidlet extends MIDlet {
   protected void startApp()
      throws MIDletStateChangeException {
      // record: before-start-event
      try {
         this.orig$startApp();
         // record: after-start-event
      } catch (Throwable t) {
         // record: start-exception-event
      }
   }

   private void orig$startApp()
      throws MIDletStateChangeException {
      // original code
   }
...
```

Code injection example – capturing startApp event.

Phase 1: Recording

- Intercepting user events (key press, pointer events, text edit).
- Intercepting environment events (sounds, screen changes, Internet access, SMS).
- Transferring to remote console (through GPRS, bluetooth, IRDA or serial port).

Phase 2: Replaying

- Simulating user events (key press, pointer events, text edit).
- Assertions: Intercepting environment events (sounds, screen changes, Internet access, SMS).
- Transferring to remote console (through GPRS, bluetooth, IRDA or serial port).

Phase 3: Test maintenance

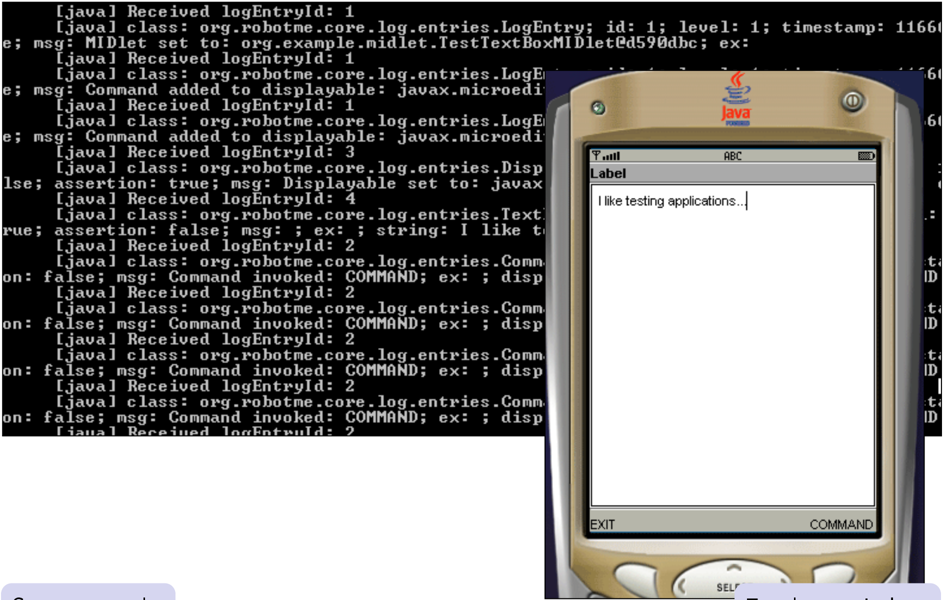
Maintenance through **human-comprehensible test scripts**.

```
<scenario>
  <event timestamp="1000">
     <displayable-changed title="Hello screen" type="TEXTBOX" />
  </event>

  <event timestamp="2000">
     <command cmdLabel="Start app" displayableTitle="Hello screen" />
  </event>

  <event timestamp="3000">
     <textbox-modification assertion="true" strongAssertion="true"
                     string="I like testing" />
  </event>
</scenario>
```

Screenshots from test recording session.



```
     [java] Received logEntryId: 1
     [java] class: org.robotme.core.log.entries.LogEntry; id: 1; level: 1; timestamp: 1166
e; msg: MIDlet set to: org.example.midlet.TestTextBoxMIDlet@d590dbc; ex:
     [java] Received logEntryId: 1
     [java] class: org.robotme.core.log.entries.LogE                                    6
e; msg: Command added to displayable: javax.microedi
     [java] Received logEntryId: 1
     [java] class: org.robotme.core.log.entries.LogE                                    6
e; msg: Command added to displayable: javax.microedi
     [java] Received logEntryId: 3
     [java] class: org.robotme.core.log.entries.Disp
lse; assertion: true; msg: Displayable set to: javax
     [java] Received logEntryId: 4
     [java] class: org.robotme.core.log.entries.Text                                    :
rue; assertion: false; msg: ; ex: ; string: I like t
     [java] Received logEntryId: 2
     [java] class: org.robotme.core.log.entries.Comm                                    ta
on: false; msg: Command invoked: COMMAND; ex: ; disp                                    ID
     [java] Received logEntryId: 2
     [java] class: org.robotme.core.log.entries.Comm                                    ta
on: false; msg: Command invoked: COMMAND; ex: ; disp                                    ID
     [java] Received logEntryId: 2
     [java] class: org.robotme.core.log.entries.Comm                                    ta
on: false; msg: Command invoked: COMMAND; ex: ; disp                                    ID
     [java] Received logEntryId: 2
     [java] class: org.robotme.core.log.entries.Comm                                    ta
on: false; msg: Command invoked: COMMAND; ex: ; disp                                    ID
     [java] Received logEntryId: 2
```

Label

I like testing applications...

Server console.

Emulator window.

Summary

- Useful testing framework for J2ME environment **does not exist**.
- Solution: **dynamic code injection**.
- For **developers** and **clients**.

Little victories

- Poznan University of Economics – ‘10th International Conference on Business Information Systems’
- UAM Foundation – ‘Pomysł na biznes’ competition

Thank you for your attention.