Testing Habits of Developers @ Worldline
An Empirical Study

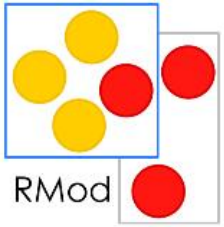
Vincent Blondeau

23-09-2016

PhD Context

- Does test selection modify developers' habits and enhance software quality?

- Second year PhD student
  - SDCO
  - Partnership with Inria
    - Rmod team:
      Re-modularization of applications



Summary

- Problem
- Our Experiment
- Results
- Future Actions

Problem

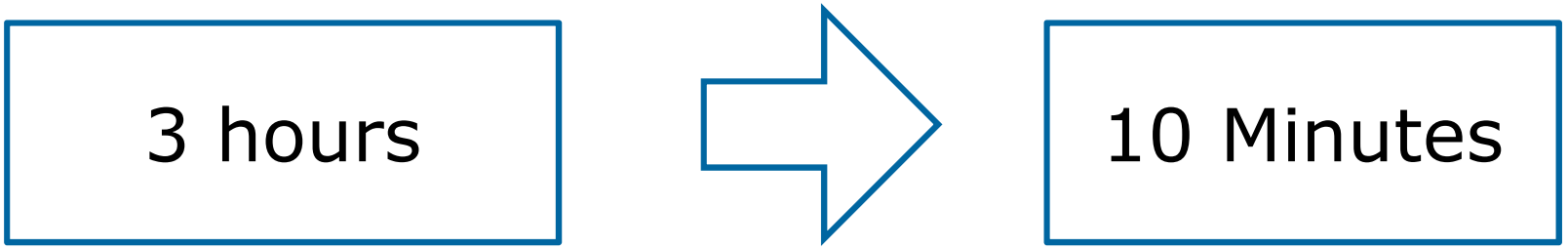
Problem

Running tests takes time!

- No immediate feedback to the developer
- Bugs detected too late

Solution

Select only the tests related to the changes
and run only those ones



- Propose a tool for the developers

But Before

Field Study

- How to evaluate the impact of the tool we will propose?
  - Current use of tests in daily practice?
  - How is test selection made? Why?
- Based on the replication of 2 experiments

When, How, and Why Developers Test
Beller et. Al. (2015)

- Open-source experiment: Anyone can take part into it
- Monitor 416 software engineers

Main conclusions

- Majority of the developers rarely test in their IDE
- Quick tests do not lead to more test executions
- Some failing tests are fixed later:
  50% of the test repairs happen within 10 minutes
  whereas 75% within 25 minutes

Comparison of Manual and Automated Test Selection – Gligoric et al. (2014)

- How developers manually select tests and compare them to an automatic selection
- Academic experiment:
  14 developers: 5 professionals + 9 students

Main conclusions

- Need for better automated test selection techniques
- Better integration with developer IDEs


2
Our Experiment

Experiment

- @Worldline
- Gather developers behavior about tests
- Install a plugin recording anonymously test executions in IDE

Developers selection

1. Through networking
   - SDCO, BlueKiwi, Testing community
     - 25 developers since April

2. Tombola

Gathered Data

- Anonymized id
- Project name
- Repository URLs
- Repository version
- Test session start
- Test session end
- Tests executed
  - Fully qualified method name
  - Test duration
  - Test status

Tests Session

- Execution of JUnit tests or Maven tests
  - Launched in one click
  - Indivisible group of tests (class, package, project)

  - But, not representing the reality of the action:
    - Limitations due to the IDEs
    - ➢ Group sessions

3 Results

Summary of the experiment

	Beller et al. (2015)	Gligoric et al. (2014)	Worldline
# Developers	48	14	19
# Projects	73	17	27
# Test sessions	3 424	5 757	3 801
# Test executions	10 840	264 562	41 996
Tests / Session	3	46	12
Sessions / Developer	71	411	200

worldline
e-payment services

How and why developers run tests?

Do developers test their code changes?

- Correlate:
  - Number of test runs
  - Amount of code changes

- 0.66 for test code changes, 0.38 for production code changes for Beller
- 0.45 for Worldline
- Weak: more code change ~> more tests

How long does a test run take?

		Min	Median	Max
Test session duration (sec)	Worldline	0	3.0	15 820 (4h24)
	Beller	0	0.5	73.8

- Longer test sessions @Worldline
- Broader in scope?
- Seems to be more integration tests than unit ones

Do quick tests lead to more test executions?

- Correlate:
  - Test execution length
  - Number of times test is executed
- Expect Negative correlation:

  Short tests exercised more often

- Positive correlation: 0.26 (Beller) and 0.12 (Worldline)

  No relevant correlation

Do developers practice test selection?

		Min	Median	Max
% of executed tests in the project	Worldline	0.1%	1.8%	100%
	Beller	0%	1%	100%

- Test Selection occurs in 60% for Gligoric, 96% for Beller and 91% for Worldline

- Test Selection is practiced @WL

What are common scenarios for manual selection?

- 2 scenarios:
  - Running again a part of the test suite until all the tests are green
  - Fix tests one after the other, re-running only a single failing test until it passes

How do developers react to test runs?

How frequently tests pass and fail?

	Pass		Fail		Skipped	
Worldline	88%	36 784	11%	4 478	1%	734
Beller	35%	3 793	65%	7 047	-	-

- Lower number of tests failing

How long does it take to fix a failing test?

		Min	Med	Avg	Max
Time to fix failing test (min)	Worldline	0	63	6 397 (4.5j)	140 800 (97j)
	Beller	0	9	65.1	4 881 (3.4j)

- Problems take more time to fix
- Tests broader in scope? more difficult to pinpoint the error
- Less skills? More turnover?

How and why developers perform test selection?

Does manual test selection depend on amount of code changes?

- Correlation:
  - Number of tests selected in each test session
  - Size of recent code changes
- Expected: More tests after large code changes

- Gligoric: 0.28; Worldline: 0.14
- Test selection and execution is not significantly influenced by the number of changes

How do developers commonly perform manual test selection?

- Selecting individual test method, class or project
- Commenting the @Test
- Adding @Ignore
- Creating test scripts

How good is IDE support for manual test selection?

- IDE is not well suited
  - Cannot define easily a group of tests
  - Can relaunch only one method, class, package, project
  - Advanced features are difficult to set

- Improve the IDE for more advanced test selection features

Automatic vs Manual Selection

- Ratio of manually selected tests that are correct
  40% (precision)
- Ratio of required tests that were manually selected
  34% (recall)
- Manual test selection is not accurate (as expected)

Conclusion and Future Steps

Conclusion

- Test practice at Worldline is good compared to open source developers practice
- Test selection performed to a high degree
- Manual test selections is not accurate: minimality rather than safeness
- Test selection does not depend on the size of the test suite nor on the duration of the tests

Future Steps

- Propose a test selection plugin
- Compare impact against current data

Who is in?

What kind of tool for test selection?

- Integrated in the IDE? Or in maven?
- Make test selection for you:
  - In background?
  - On demand?
- Propose a list of tests?
  And you decide when to run them?
- …

Thanks

For more information please contact:
vincent.blondeau@worldline.com

an atos company

worldline
e-payment services