The 3C Approach for Agile Quality Assurance

Continuous Integration, Continuous Measurement, Continuous Improvement

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About me

- Jens Jäger
- Freelance IT Consultant
- Java, Ruby, Javascript, Web,...
- Agile methods
Agenda

- Motivation & Goal
- Project Context
- Traditional and Agile Measurement & Metrics
  - Continuous Integration
  - Continuous Measurement
  - Continuous Improvement
- Conclusion & Outlook
Motivation

Independent from Process Model!

Traditional Measurement

Contradiction?

Integration of Metrics in Agile Processes?
Goal

- looking for: Agile Quality Assurance
  - Metrics-based
  - Embedded in Agile Process

- Solution: 3C-Approach
  - Agile Practice: **Continuous Integration**

- Enhanced with **Continuous Measurement**
- Enhanced with **Continuous Improvement**
Project Context

- Project „IBIS“ (within project cluster I2)
  - T-Systems, Systems Integration
  - Agile Process Model I2 (based on XP)
  - Industrial Context: Automotive

- Technology Context:
  - Web-Technology
  - Distributed Systems (EAI)

- Project-/Product-State
  - Evolution (new features)
  - Maintenance (bugfixing)
  - so-called „Brownfield-Project“
Project Context

- Internal Software Quality?
- partly in need for improvement!

- Causes
  - Missing Quality Rules
  - Time & Budget Pressure
  - Missing QA-KnowHow
  - Missing QA-Tools
  - „out-dated“ Source Code (based on Java 1.3)

ISO 25000
Traditional and Agile Measurement & Metrics

• Traditional Metrics
  • LOC
  • CK-Metrics
  • Comments Density
  • Duplicated Code
  • Code-Style-Violations
  • Design-Rule-Violations

• Agile Metrics
  • Number of Broken Builds/Number-Of-Failed-Integrations
    • Process-Metric/Quality-Constraint
    • Broken Build = found bug
    • Dysfunctional effects: use as KPI
    • Problem: Infrastructure
Number-of-Broken-Builds

Number of Build Attempts: 521
Number of Broken Builds: 112
Number of Successful Builds: 409

Breakdown of build types

![Pie chart showing the breakdown of good and broken builds.]

![Graph showing the breakdown of build types over time.]

Date: 01/01 to 01/31
Time: 06:00 to 22:00
• Number of Tests

• Test Growth Ratio
  • Better than number of Tests for Brownfield-Projects
  • \( \text{testGrowthRatio} = \frac{\Delta \text{sourceCode}}{\Delta \# \text{Tests}} \)
    with (usually)
    \( \Delta \text{sourceCode} \geq 0 \)
    \( \Delta \# \text{tests} \geq 0 \)

• Test-Coverage
  • C0-Line-Coverage
  • C1-Branch-Coverage
  • \( \text{testCoverage} = \frac{\text{codeCoveredByTests}}{\text{completeCode}} \)
    with \( 0 \leq \text{testCoverage} \leq 1 \)
## Test-Coverage

### Coverage Report - All Packages

<table>
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<tr>
<th>Package</th>
<th># Classes</th>
<th>Line Coverage</th>
<th>Branch Coverage</th>
<th>Complexity</th>
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</table>
• Germany's autobahn network has a total length of about 12,800 km (7,953 Miles)

• Which ranks as the fifth-longest in the world

• There is no speed limit on german autobahn
Stuttgart – Boarder: 150Km - 1hour
Border – Zürich: 50Km - 1hour
Continuous Integration

- Continuous Integration of Source Code in Code-Base
  - Continuous Integration → Automatization → CI Engines
  - Code-Base → VCS (Version Control System)
  - Successfull Integration =
    - No Compile Errors
    - No Test Failures (Regression Tests)
  - Procedure in case of Broken Build: Fixing is highest priority for the team

- Quality Aspects
  - Tests → external Quality
  - (Metrics → internal Quality)
Continous Measurement

- Generation of Reports through CI-Engine
  - Total Lines (Java)
  - Effective Lines (Java)
  - Total Lines (JSP)
  - JUnit Tests
  - Checkstyle error/warning/info
  - Findbugs Prio 1/2/3
  - PMD Prio 1/2/3
Continuous Measurement
Continuous Measurement

- Continuous Measurement
- Reviews
- Pair Programming
- IDE
- Q-Gate
- Version Control System
- Continuous Integration
- Coding Standards
- Refactorings

Dynamic Code-Checks

Testing

Static Code-Checks

Findbugs
Checkstyle
PMD

Reports

Compile- and Build Results

LOC and other Metrics

Test Coverage

Continuous Measurement
Continuous Improvement

- Manual Interpretation of the Reports
- Deduction of Improvement Steps
  - Changes to Coding Standards / Coding Style Guide
  - Plan Refactorings
  - Set new thresholds (Tools) → Break-off criteria for CI
- Completion through Quality-Manager
- Plan under consideration of functional evolution and budget
- Use of the GQM (Goal-Question-Metric)-Approach
Which bugs may be detected before going to Production?
Continuous Improvement

Reviews
Pair Programming

IDE

Version Control System
Continuous Integration
Continuous Measurement

Static Code-Checks
Findbugs
Checkstyle
PMD

Dynamic Code-Checks
Testing
JUnit

automated
manual

Reports
Compile- and Build Results
LOC and other Metrics
Test Coverage

Coding Standards
Refactorings

Continuous Improvement

Quality Manager
Conclusion

- Advantages of the Measurement Process
  - Changes to the Metrics / Code Quality over time

- Advantages of the Improvement Process
  - Not only selective improvements...
  - ...but preservation through automated Q-Gates

- Combination of agile and (traditional) Metrics
  - Agile Practice Continous Integration as Base
    - Infrastructure for Continous Measurement
    - Starting Point for Continous Improvement
Outlook

• Challenges
  • Analyzation of Metrics
  • Deduction of Improvement Steps
  • Setting of thresholds

• Further consideration of context
  • Evolution and Maintenance
    • in Agile Processes
    • in Measurement Process
  • New Agile Practices?
  • New Agile Metrics?
  • Adjustment of existing Agile Practices?
Extreme Feedback Device

Shows off if Continuous Integration is broken 😊

Quality-Manager: Batman-Shirt!
Questions/Feedback?

• Contact me
  • Email:  mail@jensjaeger.com
  • Blog:  jensjaeger.com

• Build our own Batman lamp: