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?
• 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 „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

- Checkstyle
- PMD
Number-of-Broken-Builds

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

• Test Growth Ratio
  • Better than number of Tests for Brownfield-Projects
  • \( \text{testGrowthRatio} = \Delta \text{sourceCode} / \Delta \# \text{Tests} \)
    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>
<thead>
<tr>
<th>Package Name</th>
<th># Classes</th>
<th>Line Coverage</th>
<th>Branch Coverage</th>
<th>Complexity</th>
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### Classes

- **APIManager (9%)**
- **APWarrantyAPI (N/A)**
- **APWarrantyAPIImpl (9%)**
- **AbstractDetailScreenHandler (0%)**
- **AbstractFileSearchHandler (0%)**
- **AbstractMultiPrintHelper (0%)**
- **AbstractPrintDetailScreen (0%)**
- **AbstractPrintViewSearch (0%)**
- **AbstractPrintOfferHandler (0%)**
- **AbstractPrintOfferHandler (0%)**
- **AbstractRecever (0%)**
- **AbstractSearchHandler (0%)**
- **AbstractSearchResultHandler (0%)**
- **AbstractSingletonHelper (0%)**
- **AbstractStateEventFactory (0%)**
- **AbstractVehicleSearch (0%)**
- **AbstractVehicleSearchListHandler (0%)**
- **AbstractWebServiceFactory (0%)**
- **AccountingAPI (N/A)**
- **AccountingAPIImpl (0%)**
- **AccountingCommonBase (63%)**
- **AccountingController (N/A)**
• 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 $\rightarrow$ Automatization $\rightarrow$ CI Engines
  - Code-Base $\rightarrow$ VCS (Version Control System)
- Successful 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 $\rightarrow$ external Quality
  - (Metrics $\rightarrow$ internal Quality)
Continuous Integration

Reviews
Pair Programming

IDE
Version Control System
Continuous Integration

Coding Standards
Refactorings

Dynamic Code-Checks:
Testing
JUnit
• 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

Reviews
Pair Programming

Q-Gate

IDE

Q-Gate

Version Control System

Continuous Integration

Dynamic Code-Checks
Testing

Static Code-Checks
Findbugs
Checkstyle
PMD

Compile- and Build Results

LOC and other Metrics

Reports

Test Coverage

Q-Gate

Coding Standards
Refactorings

Q-Gate

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) $\rightarrow$ 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
Contious Improvement

Which bugs may be detected before going to Production?

Reduction of Bugs in Production

Bugs found by Findbugs

Findbugs Priority 1 Bugs
Continuous Improvement

- Reviews
- Pair Programming
- IDE
- Version Control System
- Continuous Integration
- Continuous Measurement
- Coding Standards
- Refactorings
- Quality Manager

Static Code-Checks
- Findbugs
- Checkstyle
- PMD

Dynamic Code-Checks
- Testing
- JUnit

Reports
- Compile- and Build Results
- LOC and other Metrics
- Test Coverage
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 Continuous Integration as Base
    - Infrastructure for Continuous Measurement
    - Starting Point for Continuous 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: