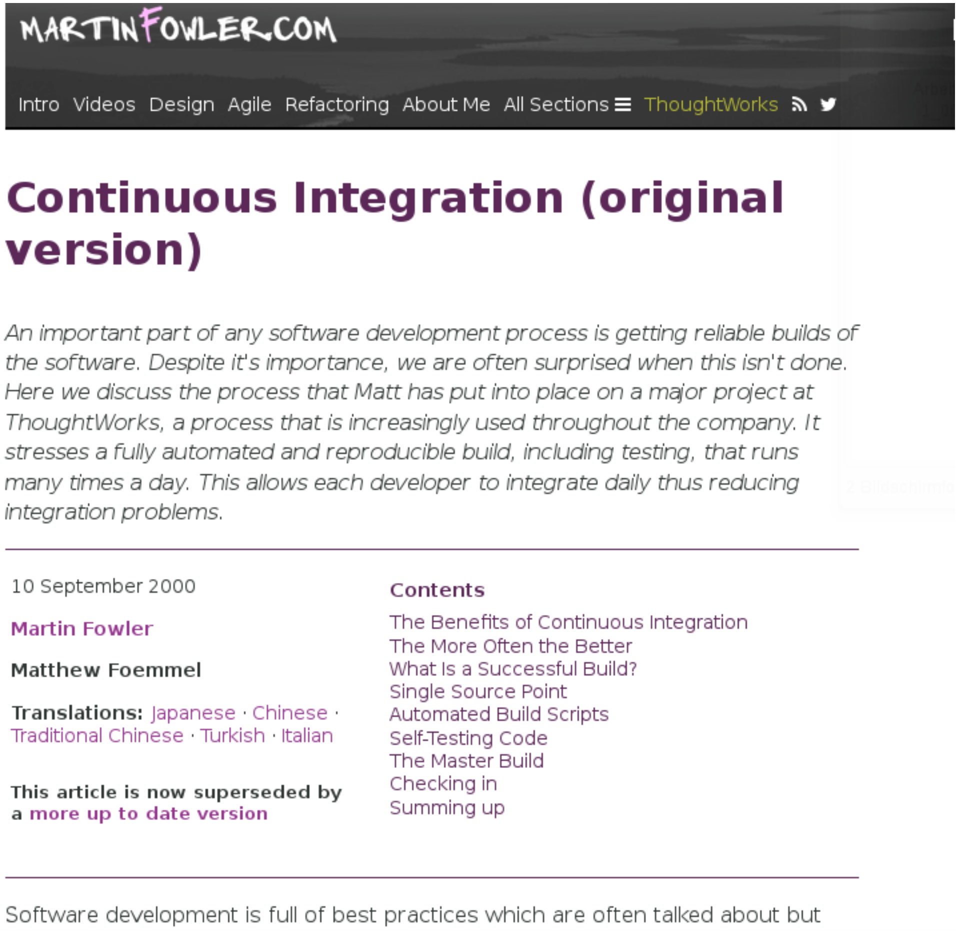
Continuous Integration

@SandraParsick
mail@sandra-parsick.de

Continuous Integration



MARTINFOWLER.COM
Intro Videos Design Agile Refactoring About Me All Sections ThoughtWorks

Continuous Integration (original version)

An important part of any software development process is getting reliable builds of the software. Despite it's importance, we are often surprised when this isn't done. Here we discuss the process that Matt has put into place on a major project at ThoughtWorks, a process that is increasingly used throughout the company. It stresses a fully automated and reproducible build, including testing, that runs many times a day. This allows each developer to integrate daily thus reducing integration problems.

10 September 2000

Martin Fowler

Matthew Foemmel

Translations: Japanese · Chinese · Traditional Chinese · Turkish · Italian

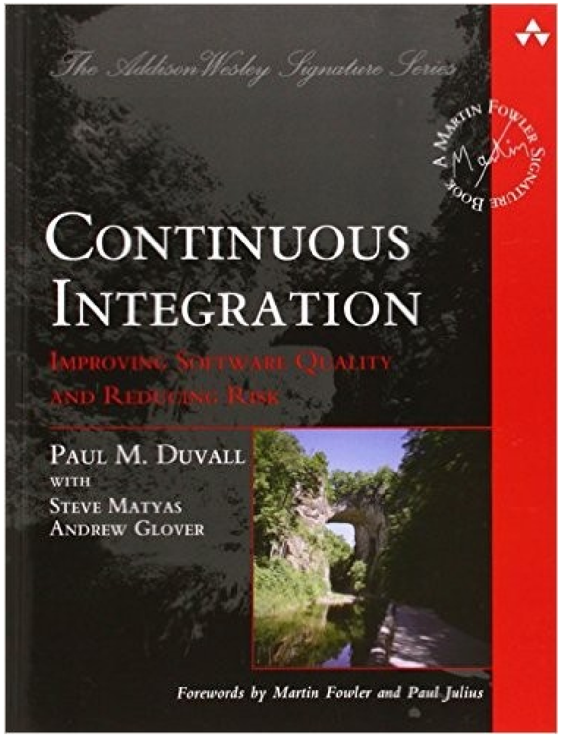
This article is now superseded by a more up to date version

Contents

Software development is full of best practices which are often talked about but

2000

2007



The Addison Wesley Signature Series
A Martin Fowler Signature Book
CONTINUOUS INTEGRATION
IMPROVING SOFTWARE QUALITY AND REDUCING RISK
PAUL M. DUVALL
WITH
STEVE MATYAS
ANDREW GLOVER
Forewords by Martin Fowler and Paul Julius

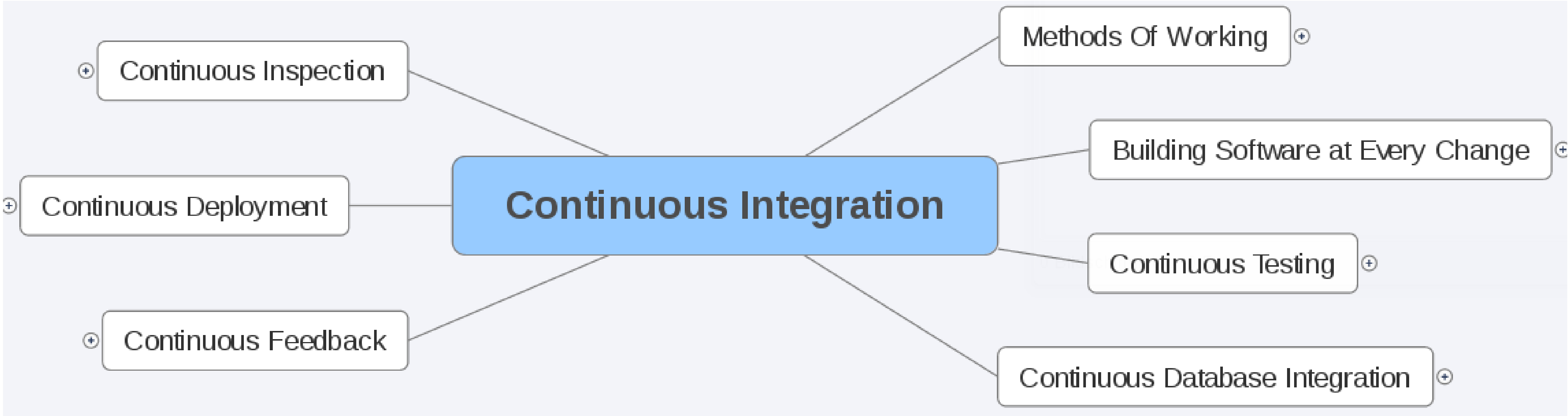
Continuous Delivery / Lean Enterprise

The Addison-Wesley Signature Series
Continuous Delivery
Reliable Software Releases through Build, Test, and Deployment Automation
Jez Humble
David Farley
Foreword by Martin Fowler
Copyrighted Material
Eric Ries, Series Editor
Jez Humble, Joanne Molesky & Barry O'Reilly
Lean Enterprise
How High Performance Organizations Innovate at Scale
O'Reilly
Copyrighted Material

2015

2010

Continuous Integration



Continuous Inspection

Continuous Deployment

Continuous Feedback

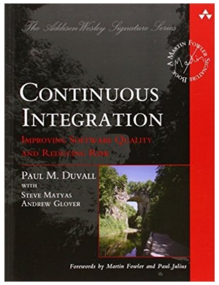
Continuous Integration

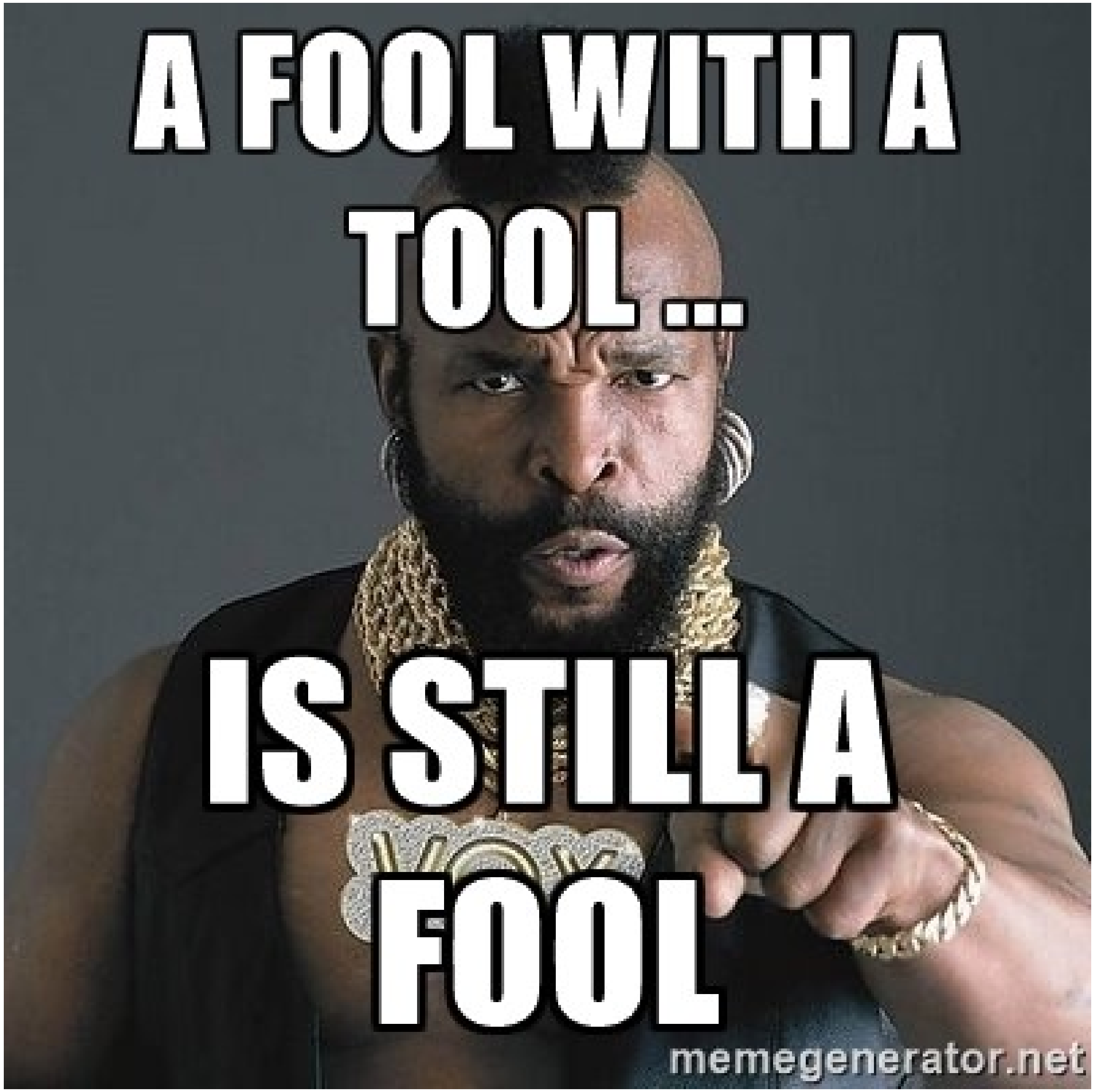
Methods Of Working

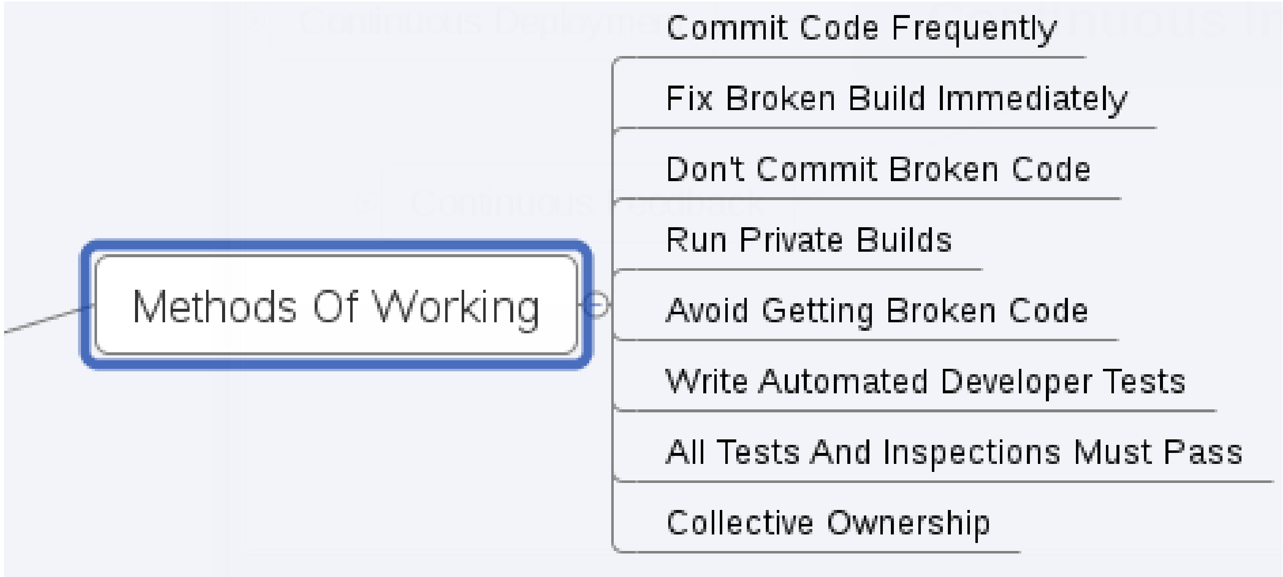
Building Software at Every Change

Continuous Testing

Continuous Database Integration


The Addison Wesley Signature Series
A Martin Fowler Signature Book
Continuous Integration
Improving Software Quality and Reducing Risk
Paul M. Duvall
with
Steve Matyas
Andrew Glover
Forewords by Martin Fowler and Paul Julius

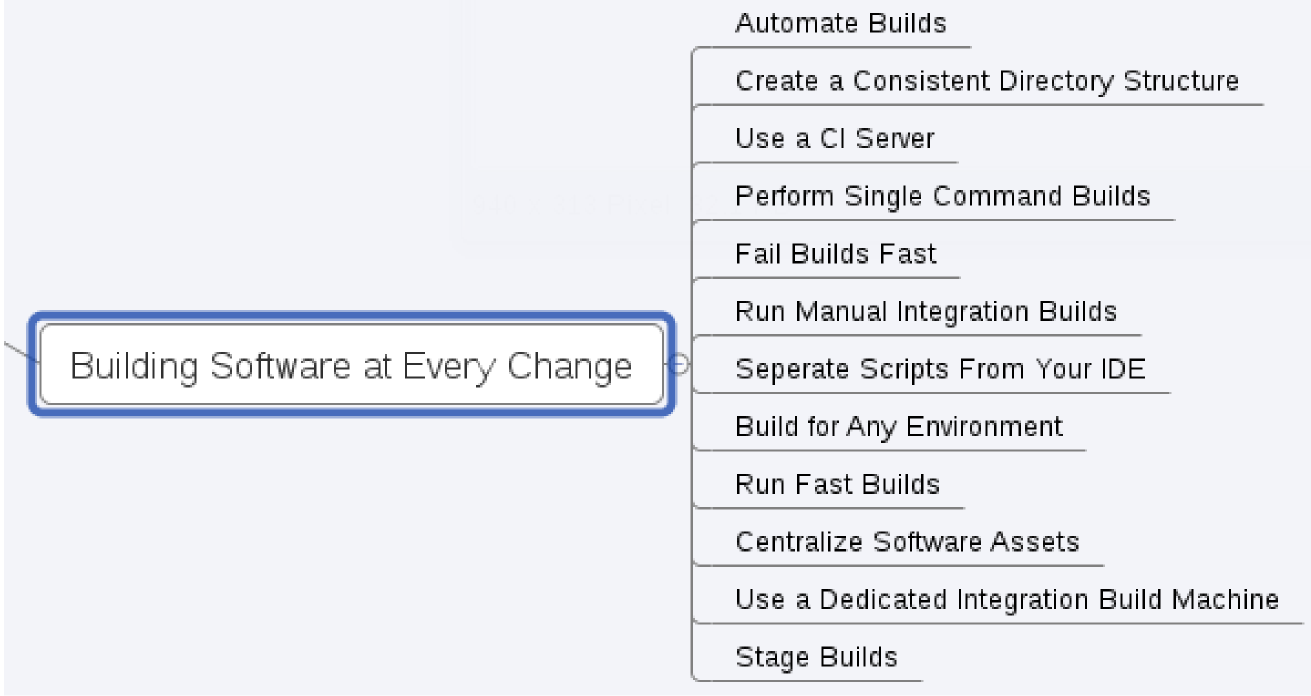

A FOOL WITH A TOOL ...
IS STILL A FOOL
memegenerator.net



Methods Of Working

- Commit Code Frequently
- Fix Broken Build Immediately
- Don't Commit Broken Code
- Run Private Builds
- Avoid Getting Broken Code
- Write Automated Developer Tests
- All Tests And Inspections Must Pass
- Collective Ownership

IT'S TOOL TIME
memegenerator.net



Building Software at Every Change

- Automate Builds
- Create a Consistent Directory Structure
- Use a CI Server
- Perform Single Command Builds
- Fail Builds Fast
- Run Manual Integration Builds
- Seperate Scripts From Your IDE
- Build for Any Environment
- Run Fast Builds
- Centralize Software Assets
- Use a Dedicated Integration Build Machine
- Stage Builds

Building Software at Every Change – Build Tools

Automated Build

Seperate Scripts From Your IDE

Create a Consistent Directory Structure

Run Fast Builds

Fail Builds Fast

Build for Any Environment

Perform Single Command Builds

buildr

- Basiert auf Rake
- Scriptsprache: Ruby
- Hauptsächlich für Java; Support auch für Groovy und Scala
- Beispiel: https://github.com/phoet/buildr-examples/blob/master/examples/building/compiler/buildfile

Pants

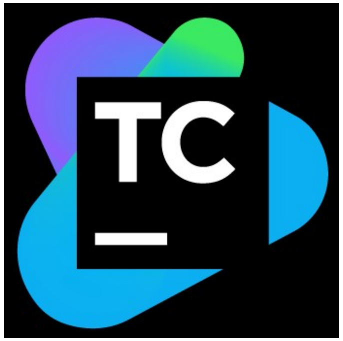
- Twitter
- Skalierung
- Support: Vielzahl an Sprachen (Java, Python, JavaScript, Go, Scala, C/C++)
- Beispiel: https://github.com/cmkimerer/pants-helloworld/blob/master/BUILD.tools

Building Software at Every Change – Integration Server

Use a Dedicated Integration Build Machine

Use a CI Server

Stage Builds



http://localhost:8001/

https://travis-ci.org/sparsick/

Go CD

Building Software at Every Change – Version Control Systems

Centralize Software Assets

Building Software at Every Change - VCS Managment System

Centralize Software Assets

SCMMANAGER

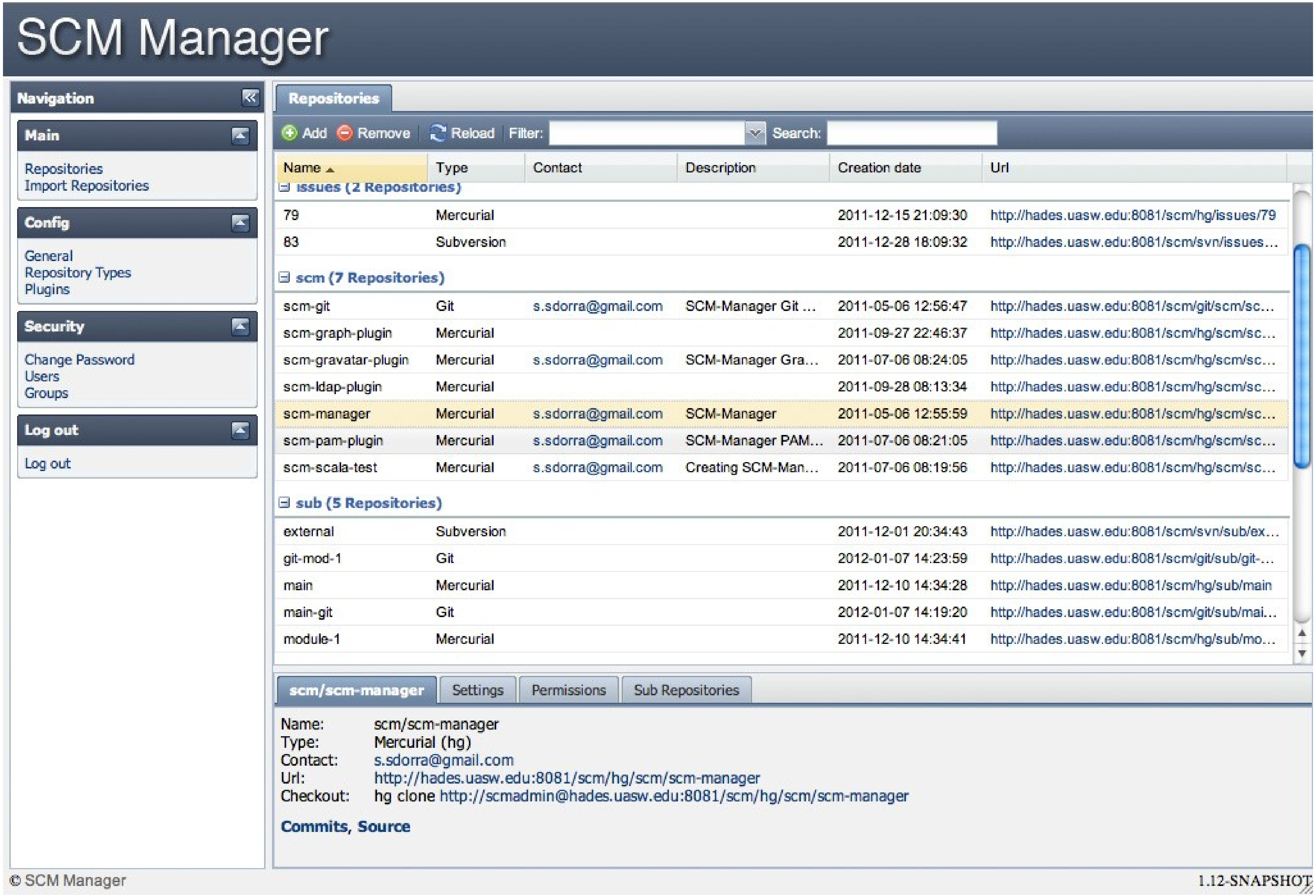
Bonobo Git Server

Bitbucket

GitHub Enterprise

GitLab

SCMMANAGER



Name	Type	Contact	Description	Creation date	Url
issues (2 Repositories)					
79	Mercurial			2011-12-15 21:09:30	http://hades.uasw.edu:8081/scm/hg/issues/79
83	Subversion			2011-12-28 18:09:32	http://hades.uasw.edu:8081/scm/svn/issues…
scm (7 Repositories)					
scm-git	Git	s.sdorra@gmail.com	SCM-Manager Git …	2011-05-06 12:56:47	http://hades.uasw.edu:8081/scm/git/scm/sc…
scm-graph-plugin	Mercurial			2011-09-27 22:46:37	http://hades.uasw.edu:8081/scm/hg/scm/sc…
scm-gravatar-plugin	Mercurial	s.sdorra@gmail.com	SCM-Manager Gra…	2011-07-06 08:24:05	http://hades.uasw.edu:8081/scm/hg/scm/sc…
scm-ldap-plugin	Mercurial			2011-09-28 08:13:34	http://hades.uasw.edu:8081/scm/hg/scm/sc…
scm-manager	Mercurial	s.sdorra@gmail.com	SCM-Manager	2011-05-06 12:55:59	http://hades.uasw.edu:8081/scm/hg/scm/sc…
scm-pam-plugin	Mercurial	s.sdorra@gmail.com	SCM-Manager PAM…	2011-07-06 08:21:05	http://hades.uasw.edu:8081/scm/hg/scm/sc…
scm-scala-test	Mercurial	s.sdorra@gmail.com	Creating SCM-Man…	2011-07-06 08:19:56	http://hades.uasw.edu:8081/scm/hg/scm/sc…
sub (5 Repositories)					
external	Subversion			2011-12-01 20:34:43	http://hades.uasw.edu:8081/scm/svn/sub/ex…
git-mod-1	Git			2012-01-07 14:23:59	http://hades.uasw.edu:8081/scm/git/sub/git-…
main	Mercurial			2011-12-10 14:34:28	http://hades.uasw.edu:8081/scm/hg/sub/main
main-git	Git			2012-01-07 14:19:20	http://hades.uasw.edu:8081/scm/git/sub/mai…
module-1	Mercurial			2011-12-10 14:34:41	http://hades.uasw.edu:8081/scm/hg/sub/mo…

Name: scm/scm-manager
Type: Mercurial (hg)
Contact: s.sdorra@gmail.com
Url: http://hades.uasw.edu:8081/scm/hg/scm/scm-manager
Checkout: hg clone http://scmadmin@hades.uasw.edu:8081/scm/hg/scm/scm-manager

Building Software at Every Change - Repository Managment System

Centralize Software Assets

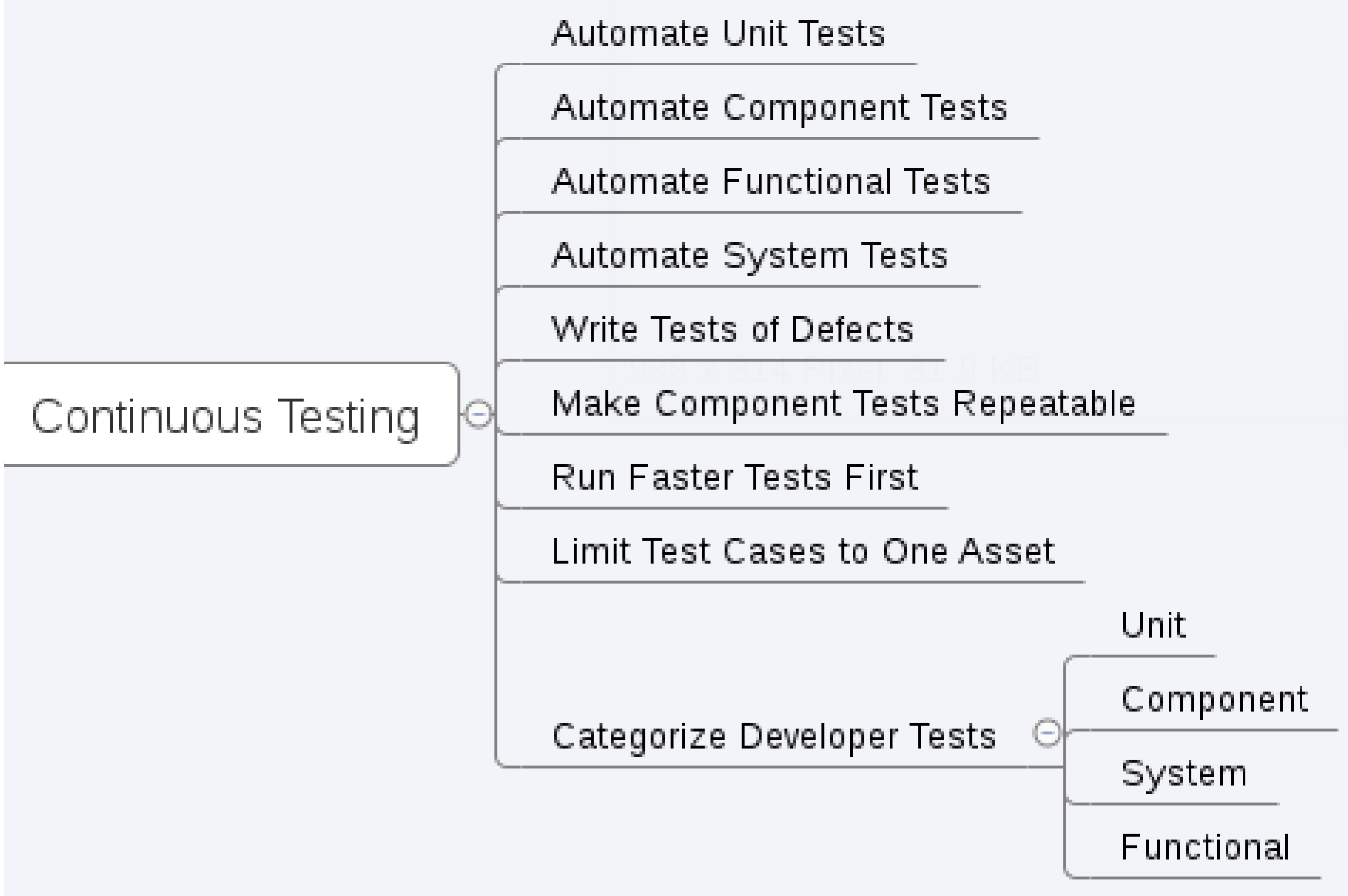
Nexus Repository Manager

JFrog Artifactory

archiva™

Nexus Repository Manager

- Repositories formats
  - Maven, P2, RubyGems, OBR, Yum (v2)
  - Docker, NuGet, npm, Bower (v3)



Continuous Testing

- Automate Unit Tests
- Automate Component Tests
- Automate Functional Tests
- Automate System Tests
- Write Tests of Defects
- Make Component Tests Repeatable
- Run Faster Tests First
- Limit Test Cases to One Asset
- Categorize Developer Tests
  - Unit
  - Component
  - System
  - Functional

Continuous Testing

Automate Unit Tests

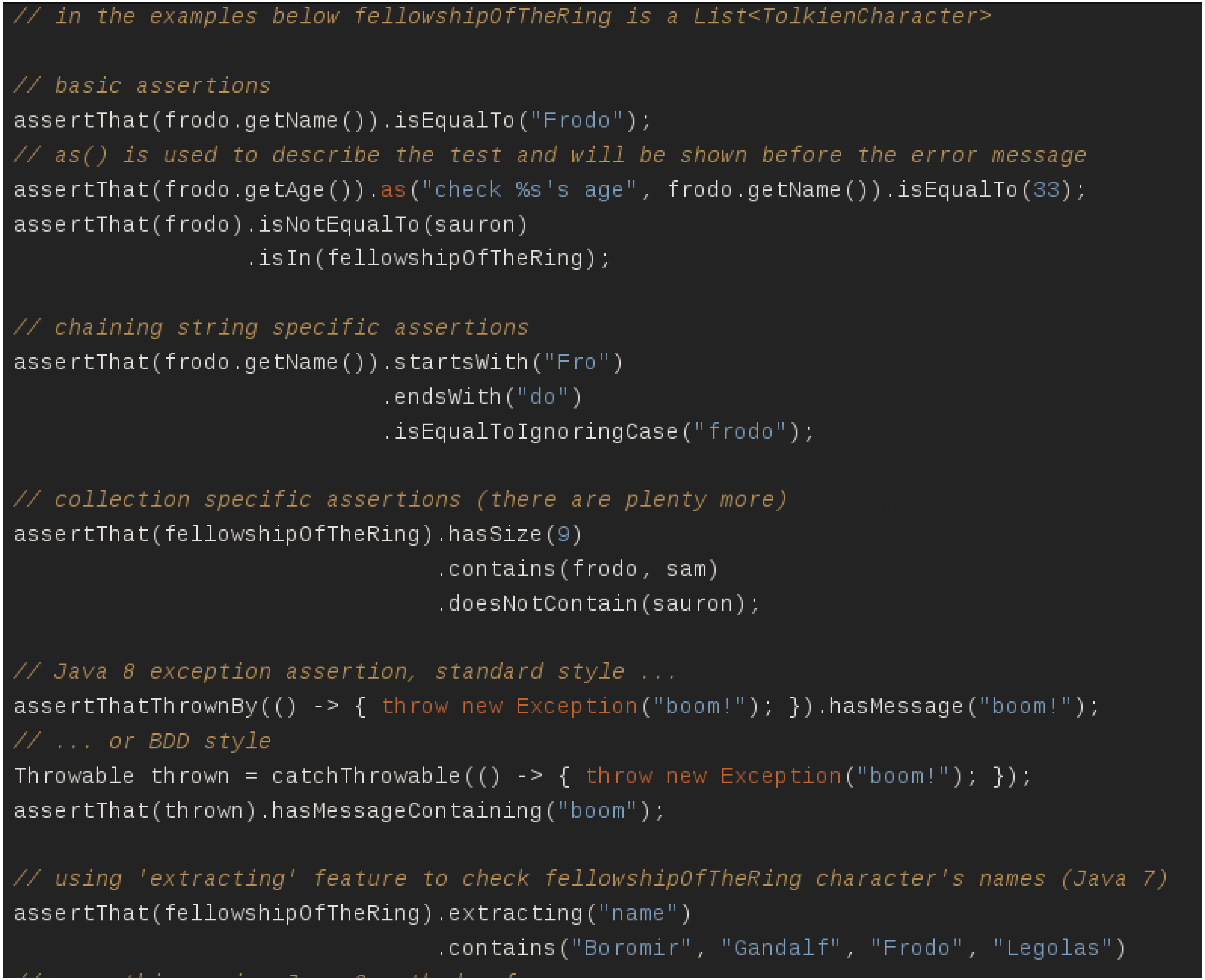
JUnit

Spock Framework

AssertJ

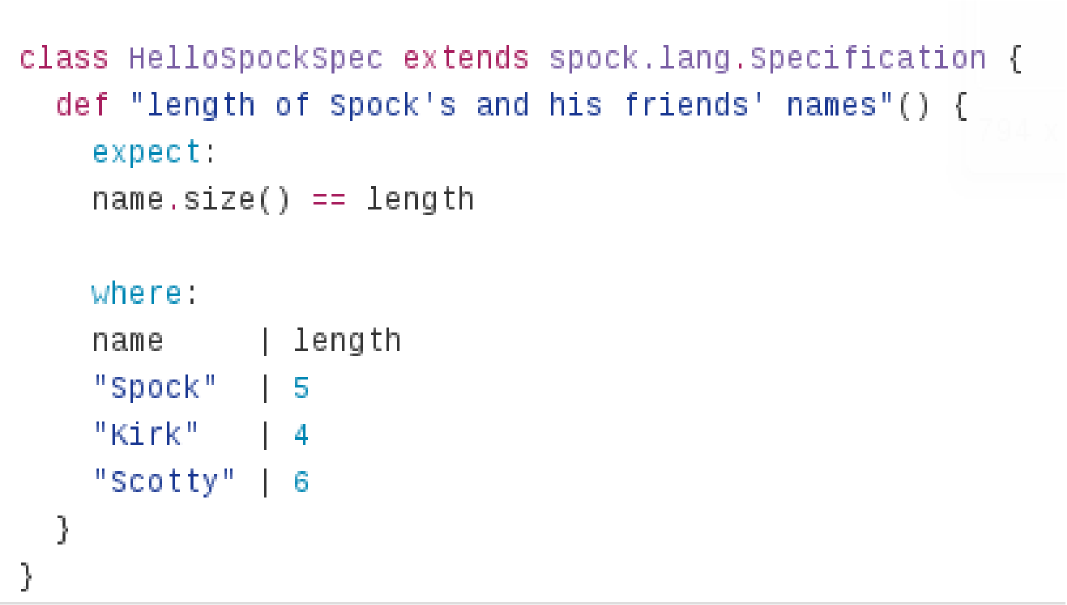
TestNG

AssertJ



```java
// in the examples below fellowshipOfTheRing is a List<TolkienCharacter>

// basic assertions
assertThat(frodo.getName()).isEqualTo("Frodo");
// as() is used to describe the test and will be shown before the error message
assertThat(frodo.getAge()).as("check %s's age", frodo.getName()).isEqualTo(33);
assertThat(frodo).isNotEqualTo(sauron)
                 .isIn(fellowshipOfTheRing);

// chaining string specific assertions
assertThat(frodo.getName()).startsWith("Fro")
                           .endsWith("do")
                           .isEqualToIgnoringCase("frodo");

// collection specific assertions (there are plenty more)
assertThat(fellowshipOfTheRing).hasSize(9)
                               .contains(frodo, sam)
                               .doesNotContain(sauron);

// Java 8 exception assertion, standard style ...
assertThatThrownBy(() -> { throw new Exception("boom!"); }).hasMessage("boom!");
// ... or BDD style
Throwable thrown = catchThrowable(() -> { throw new Exception("boom!"); });
assertThat(thrown).hasMessageContaining("boom");

// using 'extracting' feature to check fellowshipOfTheRing character's names (Java 7)
assertThat(fellowshipOfTheRing).extracting("name")
                               .contains("Boromir", "Gandalf", "Frodo", "Legolas")
```

Spock Framework



```groovy
class HelloSpockSpec extends spock.lang.Specification {
  def "length of Spock's and his friends' names"() {
    expect:
    name.size() == length

    where:
    name     | length
    "Spock"  | 5
    "Kirk"   | 4
    "Scotty" | 6
  }
}
```

Continuous Testing

Automate Functional Tests

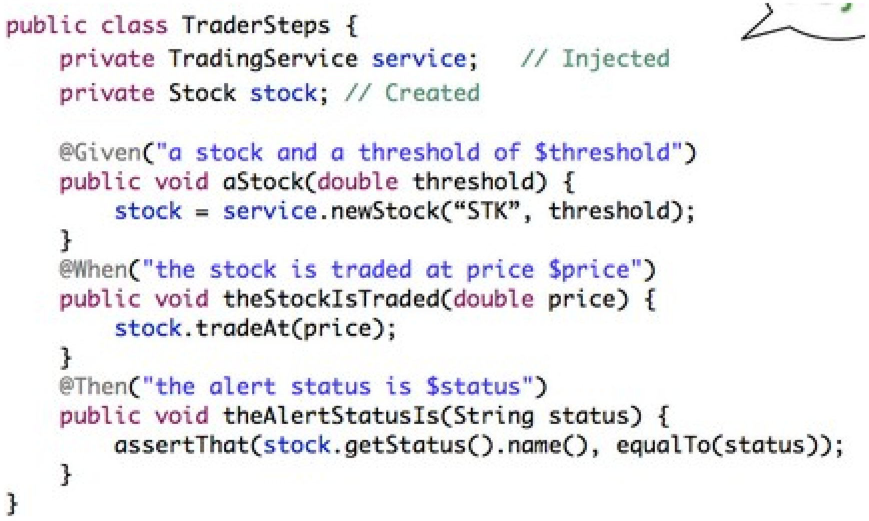
Cucumber

jbehave

livingdoc

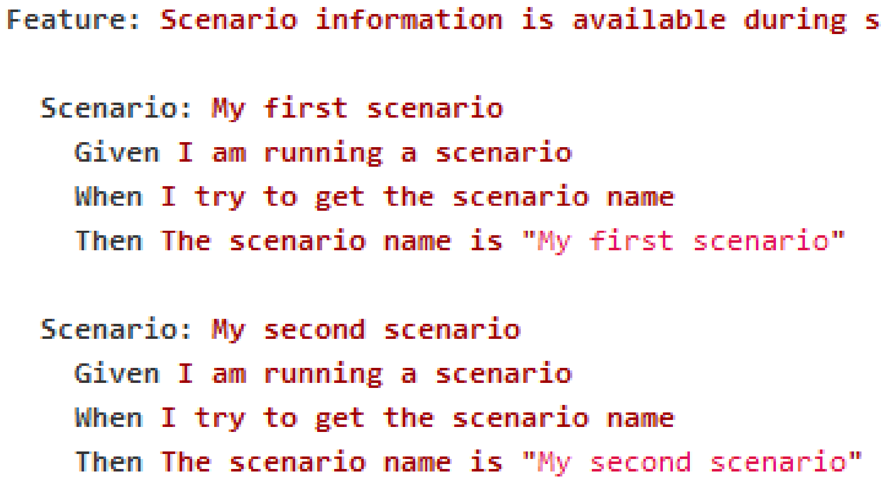
Scenario: A trader is alerted of status

Given a stock and a threshold of 15.0
When stock is traded at 5.0
Then the alert status should be OFF
When stock is traded at 16.0
Then the alert status should be ON

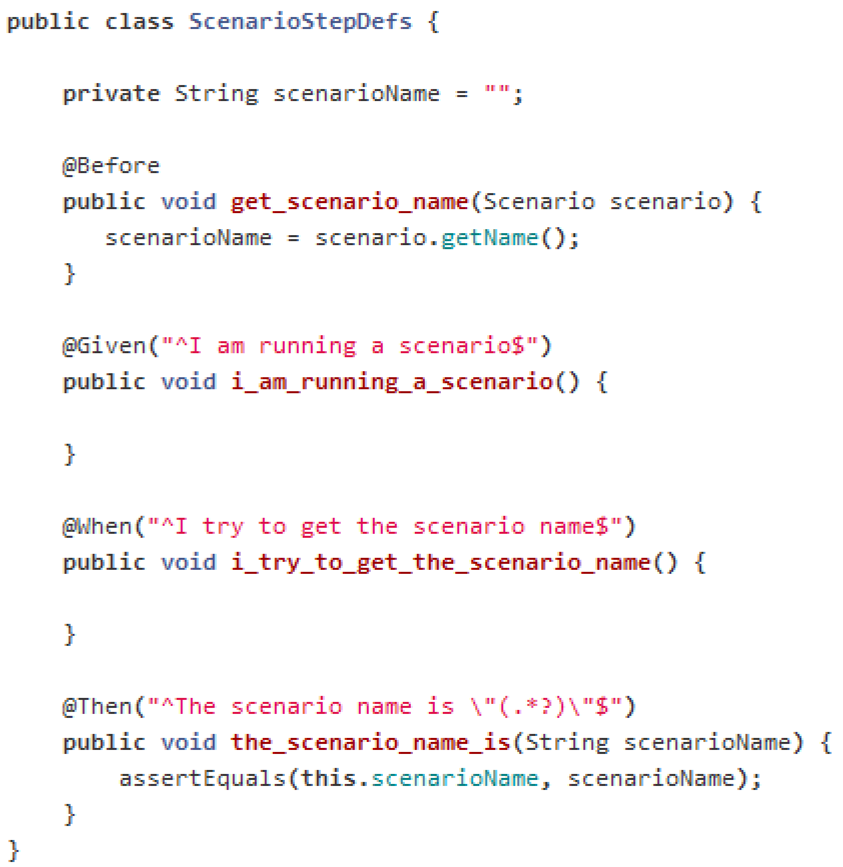


```
public class TraderSteps {
    private TradingService service;   // Injected
    private Stock stock; // Created

    @Given("a stock and a threshold of $threshold")
    public void aStock(double threshold) {
        stock = service.newStock("STK", threshold);
    }
    @When("the stock is traded at price $price")
    public void theStockIsTraded(double price) {
        stock.tradeAt(price);
    }
    @Then("the alert status is $status")
    public void theAlertStatusIs(String status) {
        assertThat(stock.getStatus().name(), equalTo(status));
    }
}
```

Cucumber

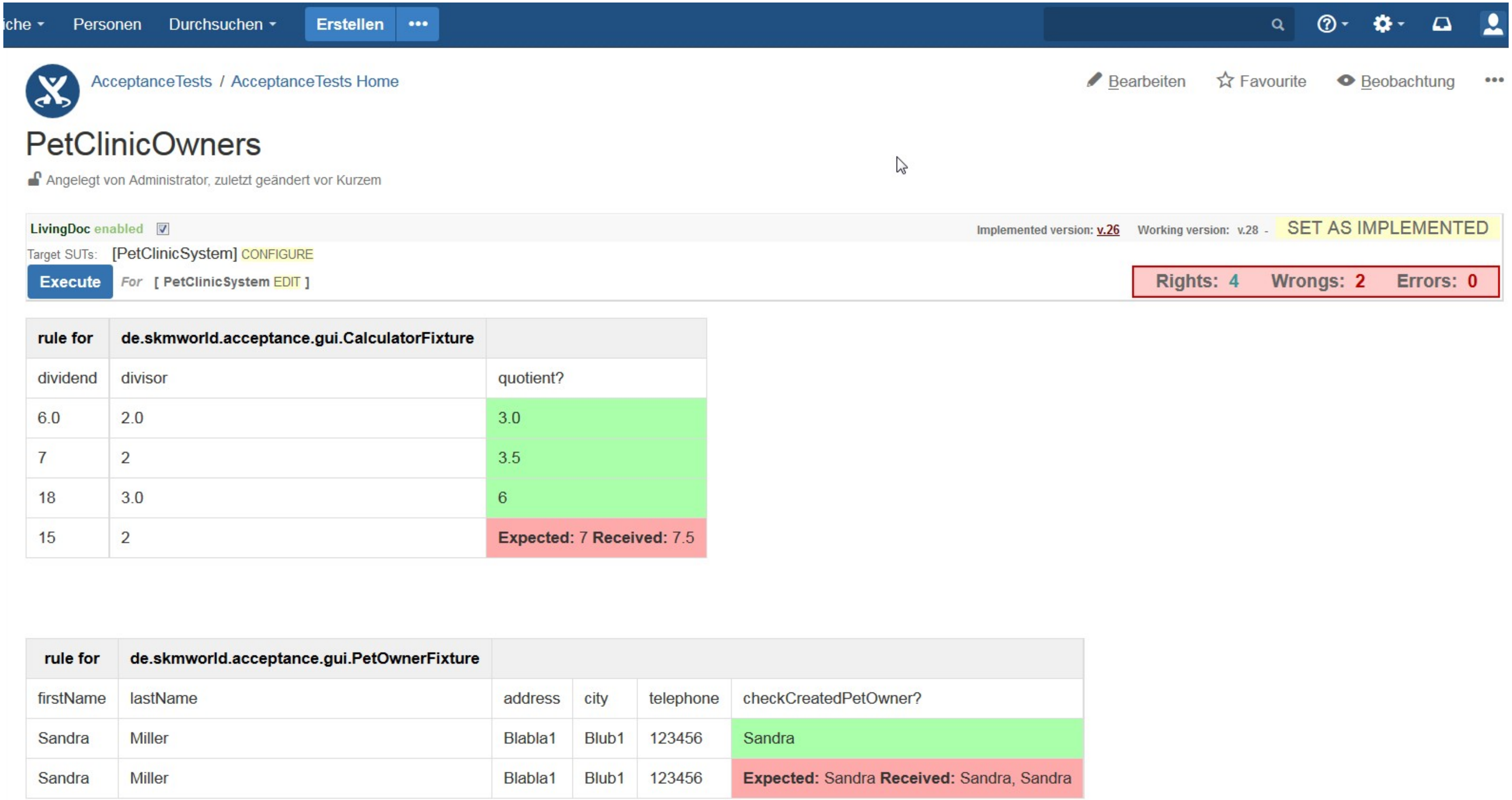


```
Feature: Scenario information is available during step execution

  Scenario: My first scenario
    Given I am running a scenario
    When I try to get the scenario name
    Then The scenario name is "My first scenario"

  Scenario: My second scenario
    Given I am running a scenario
    When I try to get the scenario name
    Then The scenario name is "My second scenario"
```



```java
public class ScenarioStepDefs {

    private String scenarioName = "";

    @Before
    public void get_scenario_name(Scenario scenario) {
       scenarioName = scenario.getName();
    }

    @Given("^I am running a scenario$")
    public void i_am_running_a_scenario() {

    }

    @When("^I try to get the scenario name$")
    public void i_try_to_get_the_scenario_name() {

    }

    @Then("^The scenario name is \"(.*?)\"$")
    public void the_scenario_name_is(String scenarioName) {
        assertEquals(this.scenarioName, scenarioName);
    }
}
```

livingdoc



AcceptanceTests / AcceptanceTests Home

PetClinicOwners

Angelegt von Administrator, zuletzt geändert vor Kurzem

LivingDoc enabled ☑

Implemented version: v.26 Working version: v.28 -

Target SUTs: [PetClinicSystem] CONFIGURE

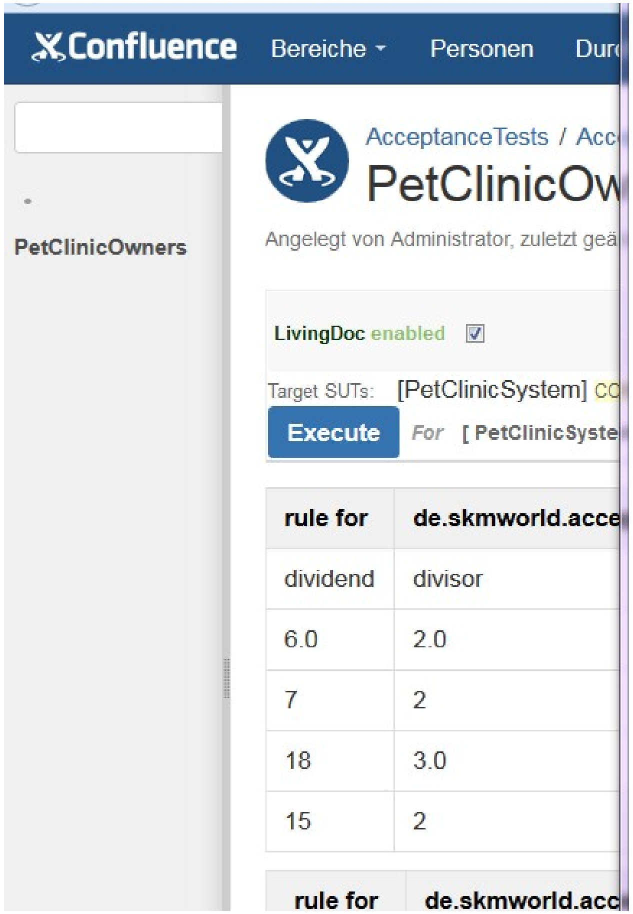
For [PetClinicSystem EDIT]

Rights: 4 Wrongs: 2 Errors: 0

rule for	de.skmworld.acceptance.gui.CalculatorFixture	
dividend	divisor	quotient?
6.0	2.0	3.0
7	2	3.5
18	3.0	6
15	2	**Expected:** 7 **Received:** 7.5

rule for	de.skmworld.acceptance.gui.PetOwnerFixture				
firstName	lastName	address	city	telephone	checkCreatedPetOwner?
Sandra	Miller	Blabla1	Blub1	123456	Sandra
Sandra	Miller	Blabla1	Blub1	123456	**Expected:** Sandra **Received:** Sandra, Sandra

livingdoc



PetClinicOwners

AcceptanceTests / Acc

PetClinicOw

Angelegt von Administrator, zuletzt geä

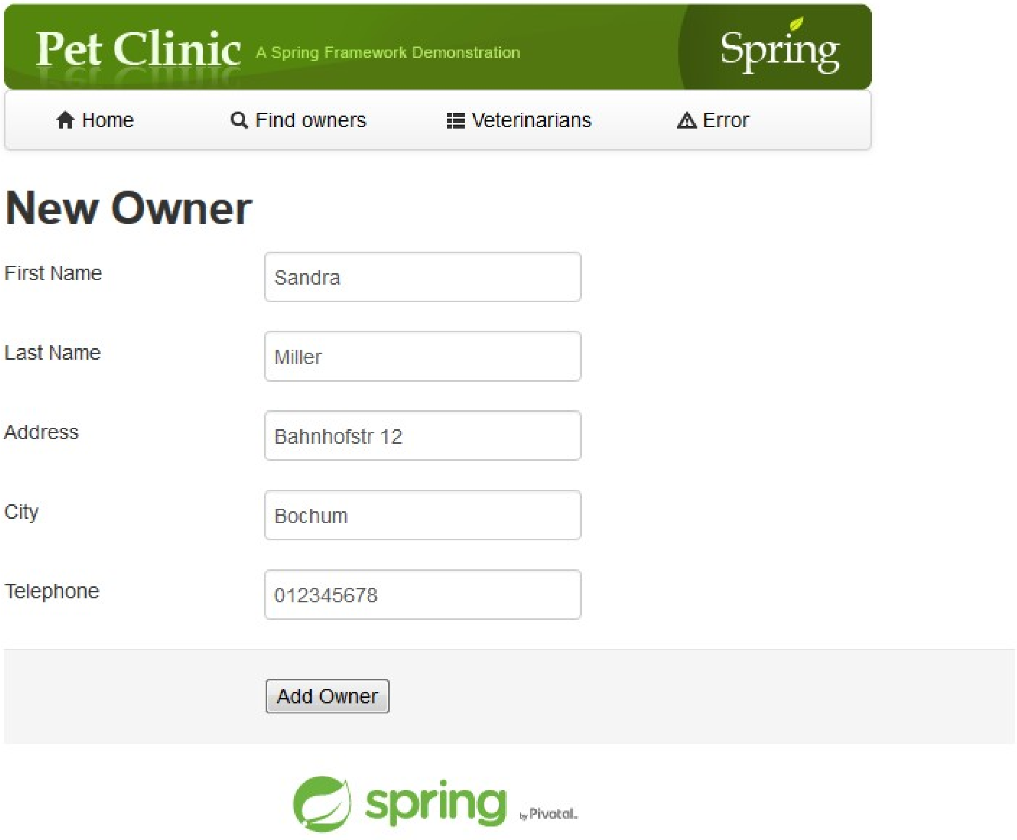
LivingDoc enabled ☑

Target SUTs: [PetClinicSystem] CO

Execute *For* [PetClinicSyste

rule for	de.skmworld.acce
dividend	divisor
6.0	2.0
7	2
18	3.0
15	2

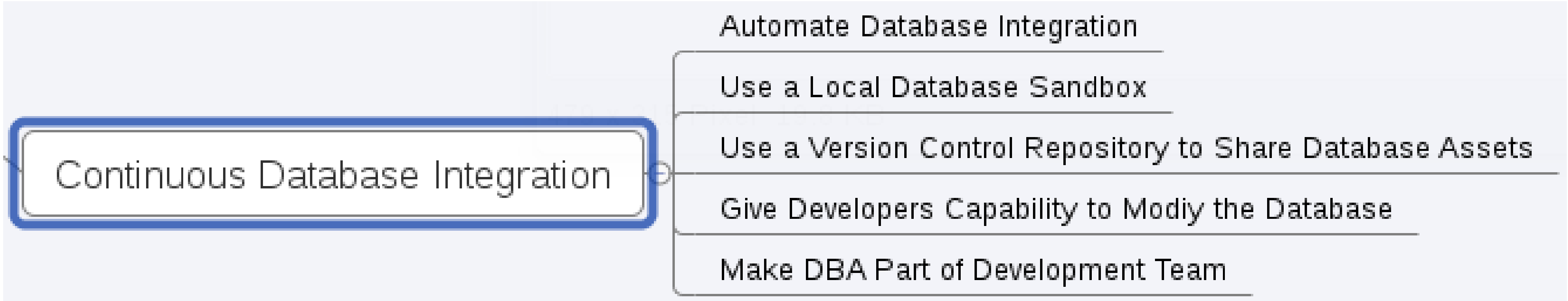
rule for	de.skmworld.acc



New Owner

First Name	Sandra
Last Name	Miller
Address	Bahnhofstr 12
City	Bochum
Telephone	012345678

Add Owner



Continuous Database Integration

- Automate Database Integration
- Use a Local Database Sandbox
- Use a Version Control Repository to Share Database Assets
- Give Developers Capability to Modiy the Database
- Make DBA Part of Development Team

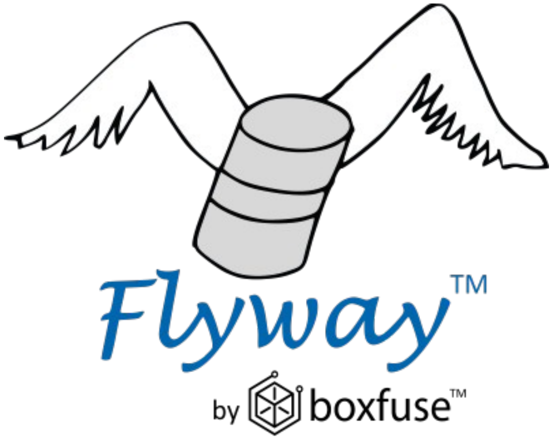
Continuous Database Integration

Use a
Local Database Sandbox

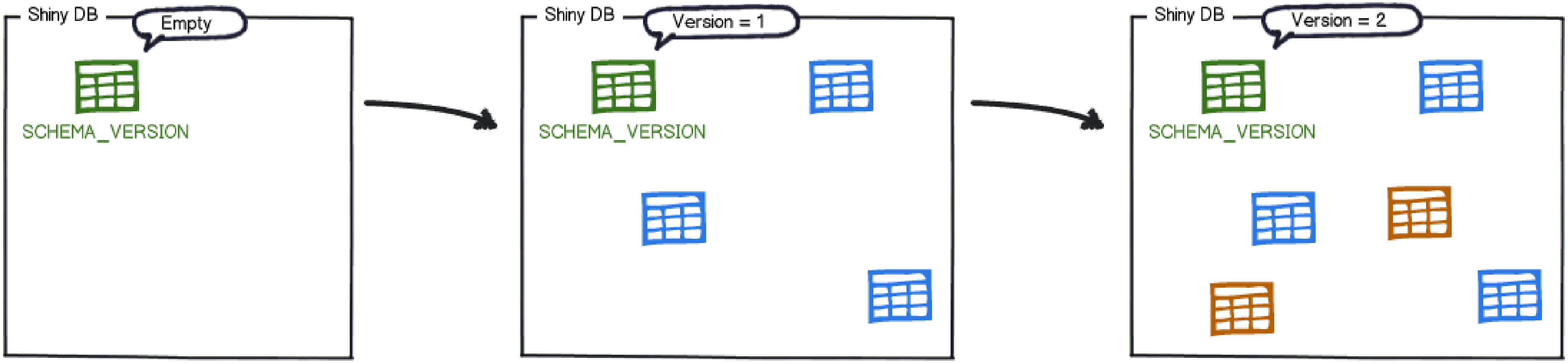
VAGRANT

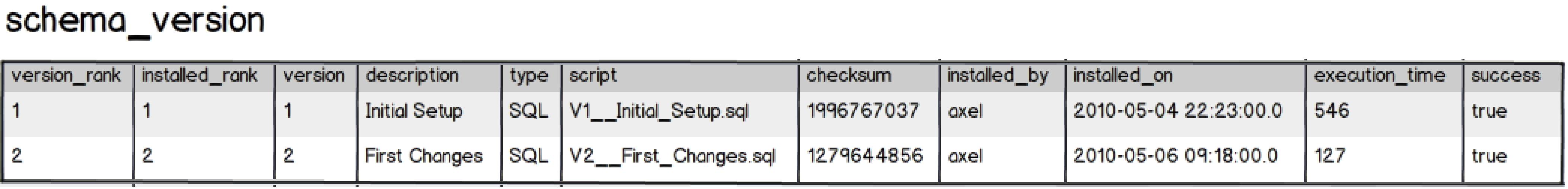
Continuous Database Integration

Automate
Database Integration



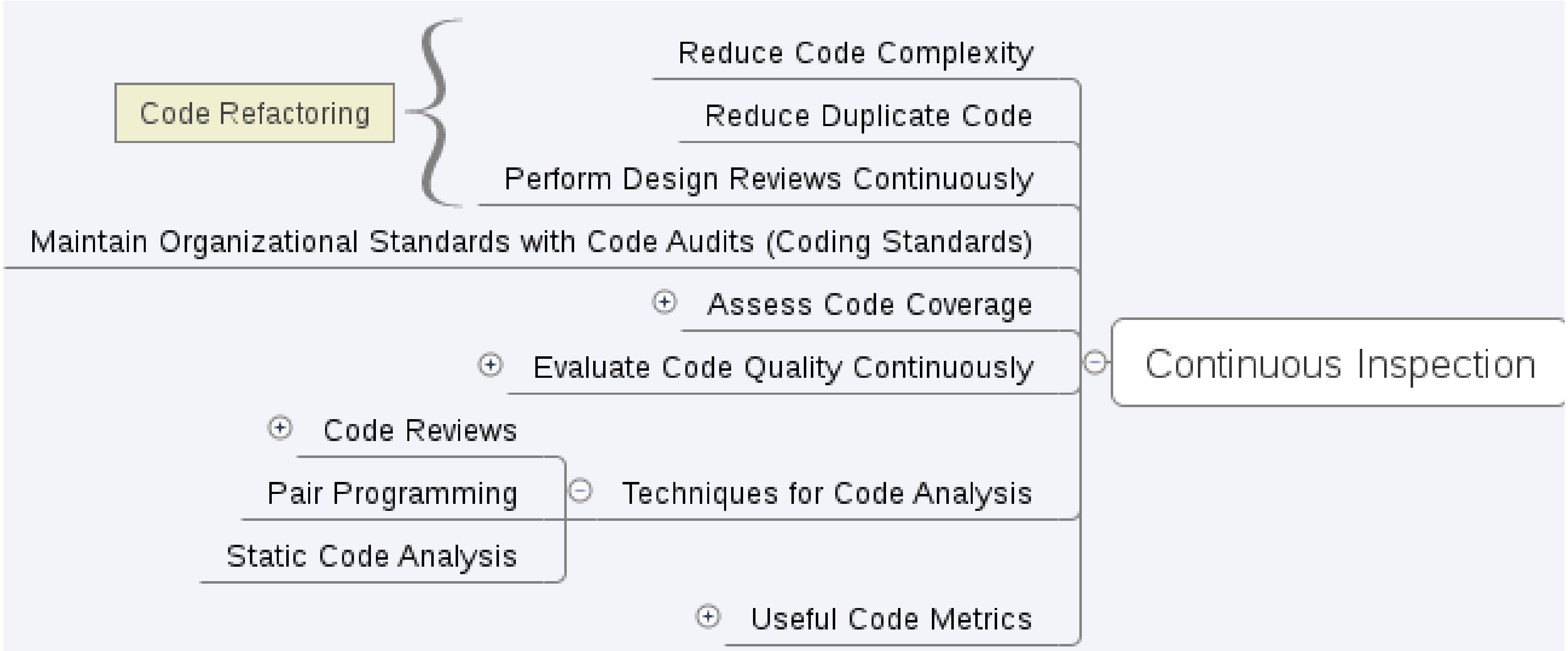
Flyway





schema_version

version_rank	installed_rank	version	description	type	script	checksum	installed_by	installed_on	execution_time	success
1	1	1	Initial Setup	SQL	V1__Initial_Setup.sql	1996767037	axel	2010-05-04 22:23:00.0	546	true
2	2	2	First Changes	SQL	V2__First_Changes.sql	1279644856	axel	2010-05-06 09:18:00.0	127	true



Continuous Inspection

- Reduce Code Complexity
- Reduce Duplicate Code
- Perform Design Reviews Continuously
- Maintain Organizational Standards with Code Audits (Coding Standards)
- Assess Code Coverage
- Evaluate Code Quality Continuously
- Techniques for Code Analysis
  - Code Reviews
  - Pair Programming
  - Static Code Analysis
- Useful Code Metrics

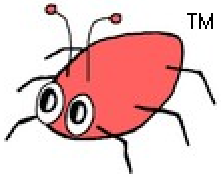
Code Refactoring

Continuous Inspection

Maintain Organizational Standards with Code Audits (Coding Standards)

Continuous Inspection

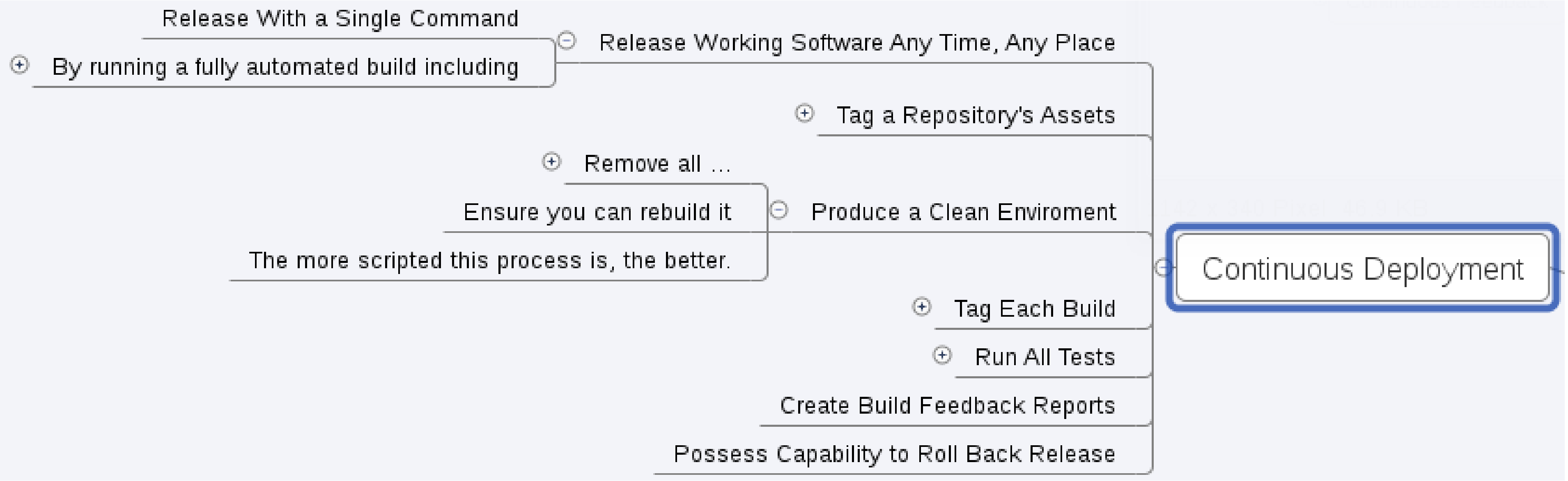
Evaluate Code Quality Continuously



JaCoCo

COVERITY®

sonarqube

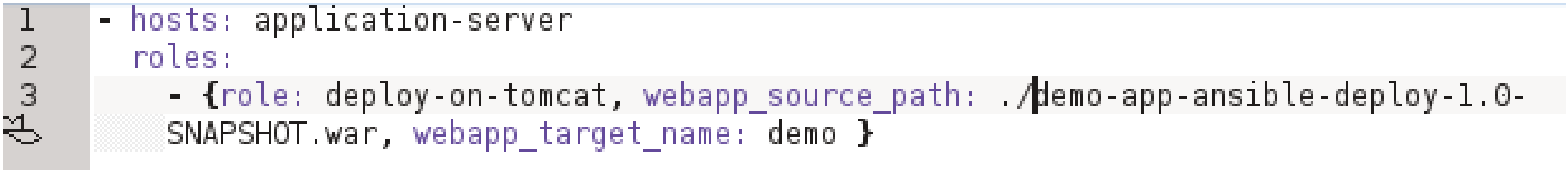


- Continuous Deployment
  - Release Working Software Any Time, Any Place
    - Release With a Single Command
    - By running a fully automated build including
  - Tag a Repository's Assets
  - Produce a Clean Enviroment
    - Remove all ...
    - Ensure you can rebuild it
    - The more scripted this process is, the better.
  - Tag Each Build
  - Run All Tests
  - Create Build Feedback Reports
  - Possess Capability to Roll Back Release

Continuous Deployment

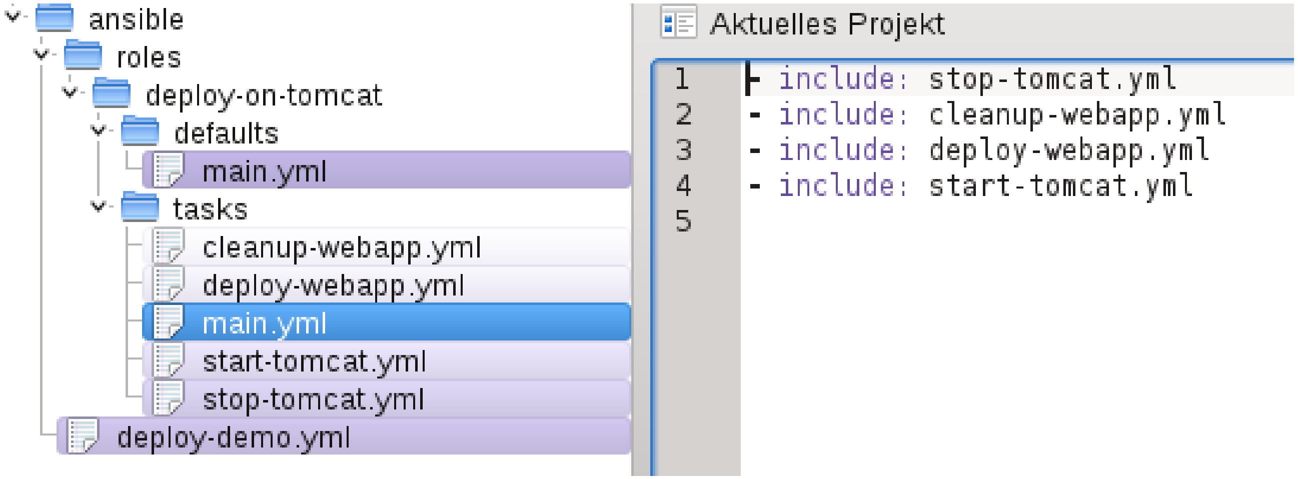
Produce a Clean Enviroment - Ensure you can rebuild it

Deploy Application Playbook



```yaml
- hosts: application-server
  roles:
    - {role: deploy-on-tomcat, webapp_source_path: ./demo-app-ansible-deploy-1.0-SNAPSHOT.war, webapp_target_name: demo }
```

deploy-on-tomcat Role

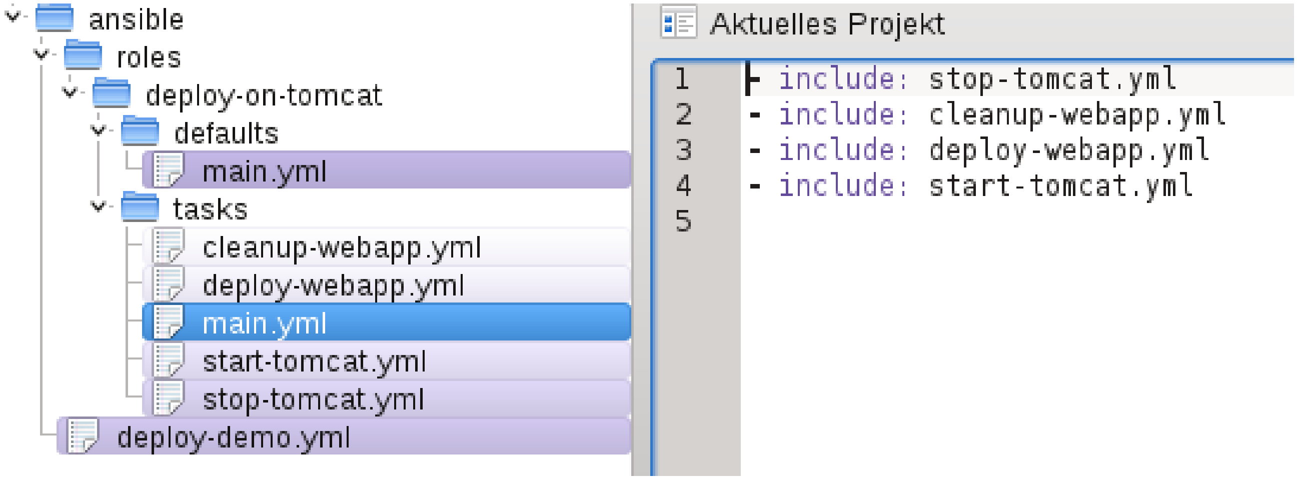


```
ansible
  roles
    deploy-on-tomcat
      defaults
        main.yml
      tasks
        cleanup-webapp.yml
        deploy-webapp.yml
        main.yml
        start-tomcat.yml
        stop-tomcat.yml
  deploy-demo.yml
```

Aktuelles Projekt

```
- include: stop-tomcat.yml
- include: cleanup-webapp.yml
- include: deploy-webapp.yml
- include: start-tomcat.yml
```

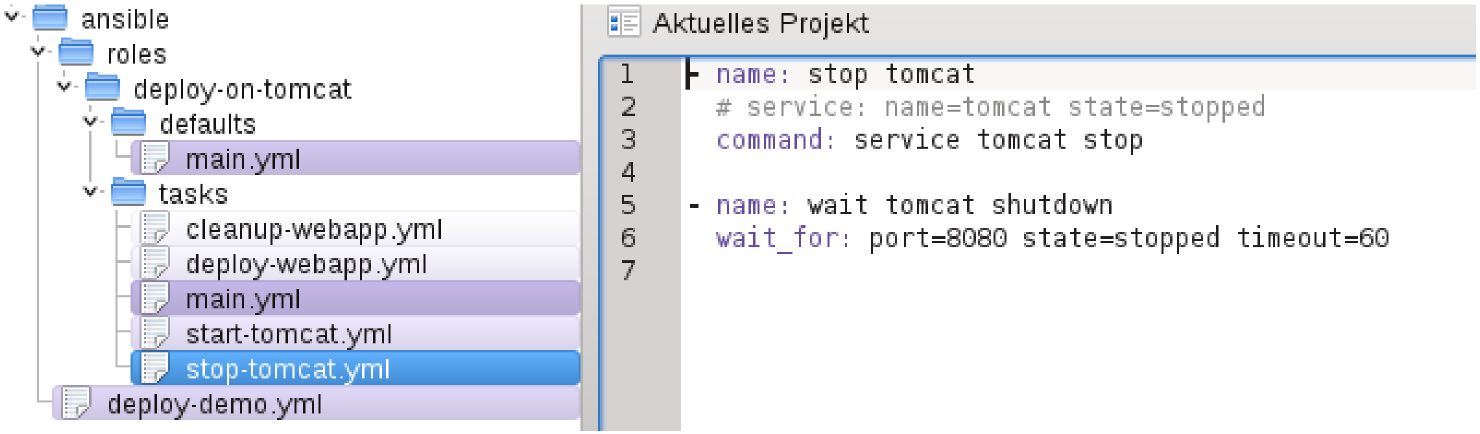
deploy-on-tomcat Role



```
ansible
  roles
    deploy-on-tomcat
      defaults
        main.yml
      tasks
        cleanup-webapp.yml
        deploy-webapp.yml
        main.yml
        start-tomcat.yml
        stop-tomcat.yml
  deploy-demo.yml
```

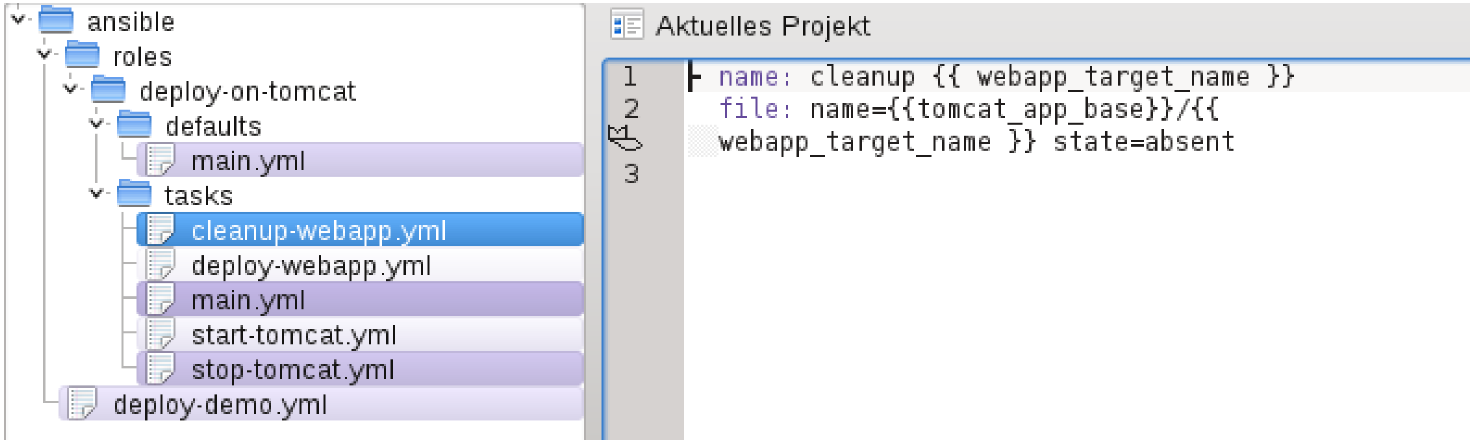
```yaml
- include: stop-tomcat.yml
- include: cleanup-webapp.yml
- include: deploy-webapp.yml
- include: start-tomcat.yml
```

deploy-on-tomcat Role



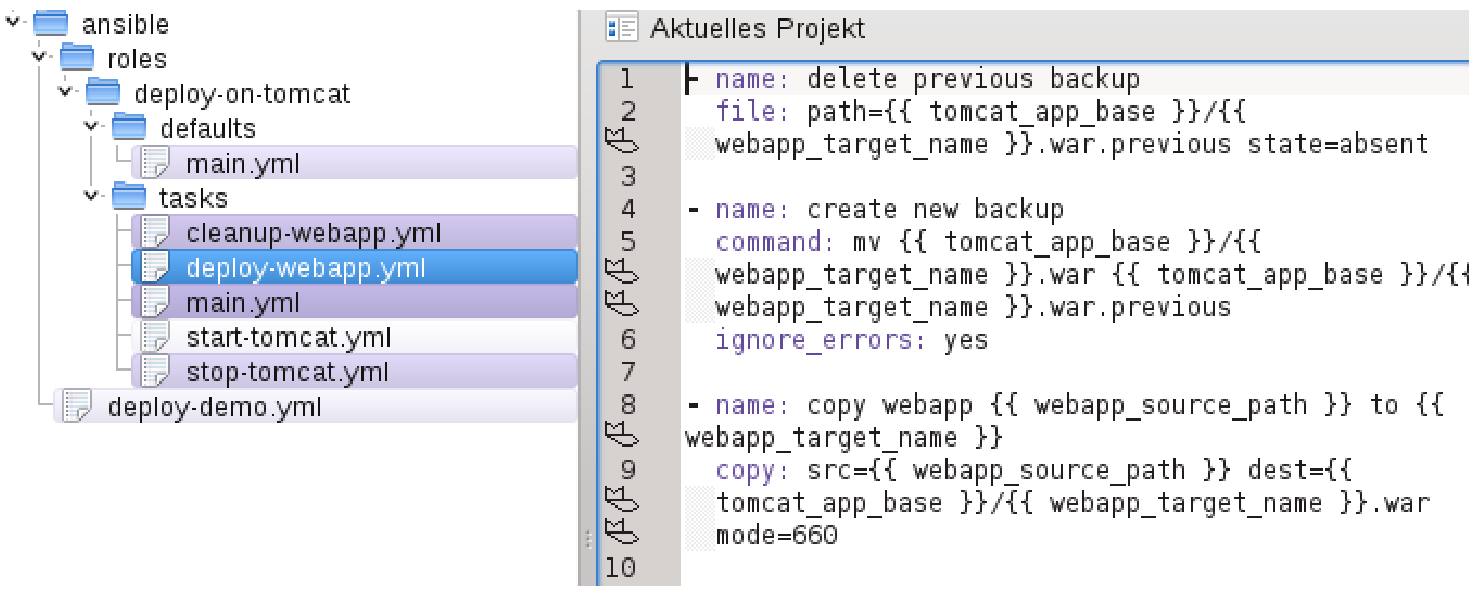
```yaml
- name: stop tomcat
  # service: name=tomcat state=stopped
  command: service tomcat stop

- name: wait tomcat shutdown
  wait_for: port=8080 state=stopped timeout=60
```

deploy-on-tomcat Role



```yaml
name: cleanup {{ webapp_target_name }}
file: name={{tomcat_app_base}}/{{ webapp_target_name }} state=absent
```

deploy-on-tomcat Role

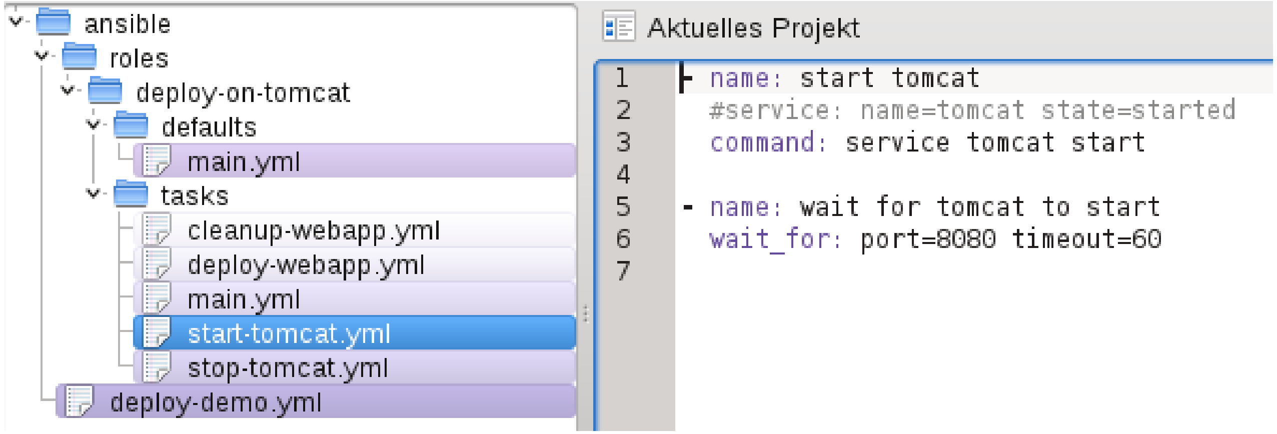


```
ansible
  roles
    deploy-on-tomcat
      defaults
        main.yml
      tasks
        cleanup-webapp.yml
        deploy-webapp.yml
        main.yml
        start-tomcat.yml
        stop-tomcat.yml
  deploy-demo.yml
```

Aktuelles Projekt

```
- name: delete previous backup
  file: path={{ tomcat_app_base }}/{{ webapp_target_name }}.war.previous state=absent

- name: create new backup
  command: mv {{ tomcat_app_base }}/{{ webapp_target_name }}.war {{ tomcat_app_base }}/{{ webapp_target_name }}.war.previous
  ignore_errors: yes

- name: copy webapp {{ webapp_source_path }} to {{ webapp_target_name }}
  copy: src={{ webapp_source_path }} dest={{ tomcat_app_base }}/{{ webapp_target_name }}.war mode=660
```

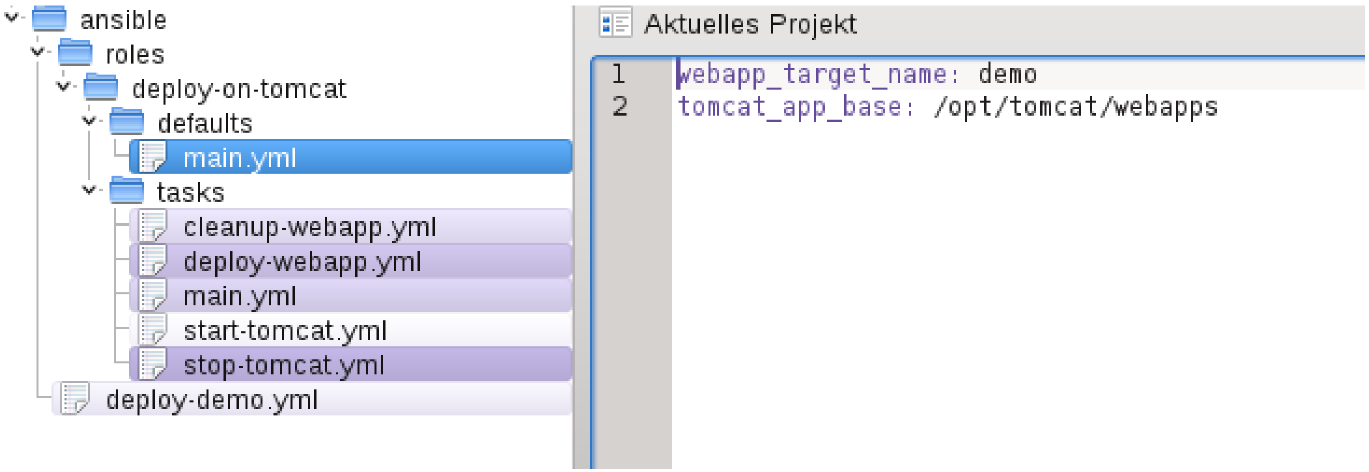
deploy-on-tomcat Role



```
ansible
  roles
    deploy-on-tomcat
      defaults
        main.yml
      tasks
        cleanup-webapp.yml
        deploy-webapp.yml
        main.yml
        start-tomcat.yml
        stop-tomcat.yml
  deploy-demo.yml
```

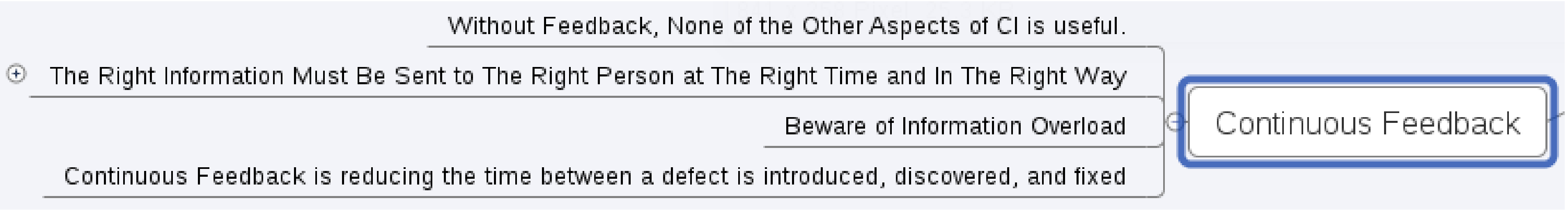
```
- name: start tomcat
  #service: name=tomcat state=started
  command: service tomcat start

- name: wait for tomcat to start
  wait_for: port=8080 timeout=60
```

deploy-on-tomcat Role



```yaml
webapp_target_name: demo
tomcat_app_base: /opt/tomcat/webapps
```

Deploy Application Playbook



Continuous Feedback

Without Feedback, None of the Other Aspects of CI is useful.

The Right Information Must Be Sent to The Right Person at The Right Time and In The Right Way

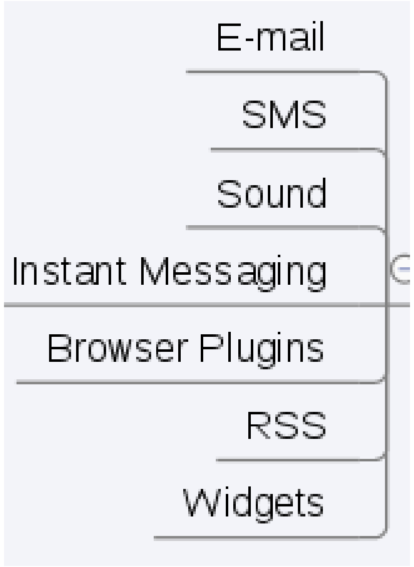
Beware of Information Overload

Continuous Feedback is reducing the time between a defect is introduced, discovered, and fixed

Continuous Feedback

The Right Way

CI-Eye



E-mail

SMS

Sound

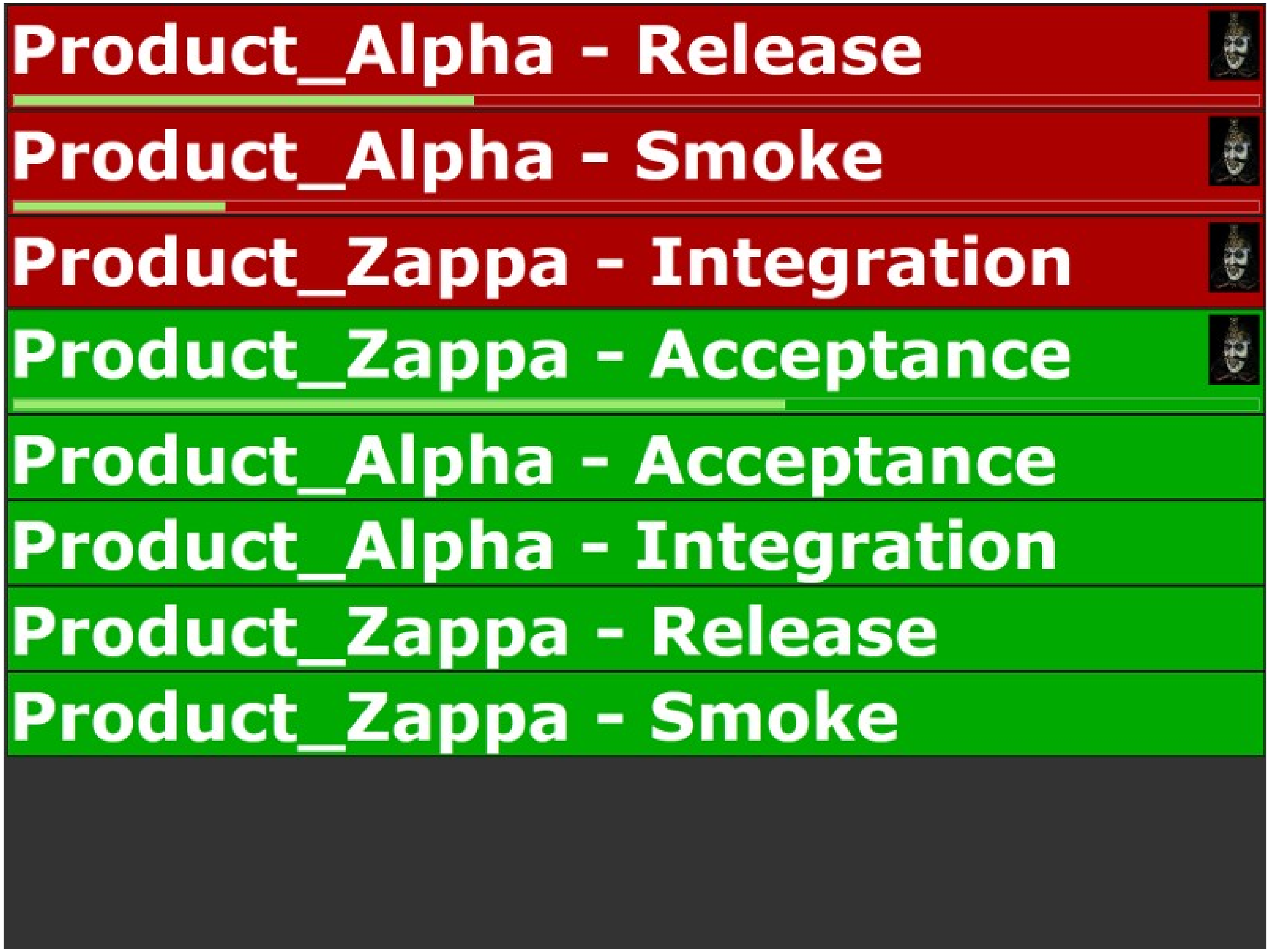
Instant Messaging

Browser Plugins

RSS

Widgets

CI-Eye



Product_Alpha - Release

Product_Alpha - Smoke

Product_Zappa - Integration

Product_Zappa - Acceptance

Product_Alpha - Acceptance

Product_Alpha - Integration

Product_Zappa - Release

Product_Zappa - Smoke