

Infrastruktur-Tests und CI-Pipelines

Christopher J. Ruwe <cjr@cruwe.de>

whoami

Motivation

Provisionierung

Test-Systematik

Test-Ausführung

Test-Pipeline

Test-Integration -
Zielzustand

Test-Integration -
Repository

Zusammenfassung

16. November 2017

whoami

Infrastruktur-Tests
und CI-Pipelines

Christopher J.
Ruwe
<cjr@cruwe.de>

- Christopher J. Ruwe
- freiberuflicher IT-Infrastruktur, Deployment und DevOps Consultant
- eigentlich Unix und Netzwerke, aber es wird ständig mehr

whoami

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wie ist eine Applikation eigentlich gebaut?

Infrastruktur-Tests
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Front-
end

wie ist eine Applikation eigentlich gebaut?

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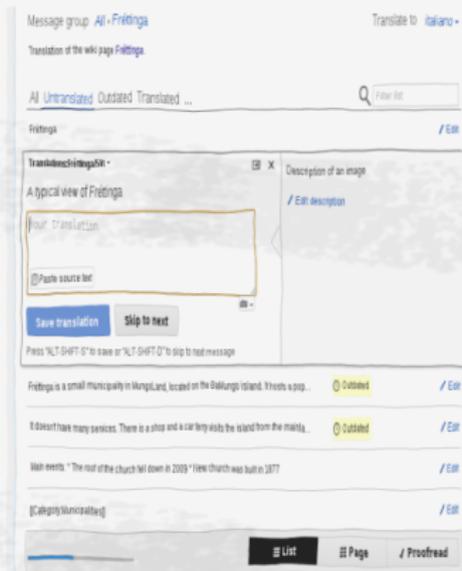
Zusammenfassung

wie ist eine Applikation eigentlich gebaut?

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was wird bei der Applikation getestet?

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The screenshot shows a message group interface for 'Frietings'. At the top, it says 'Message group: All • Frietings' and 'Translate to: italiano'. Below that, it says 'Translation of the wiki page Frietings'. There is a search bar with 'Frietings' entered. The main content area shows a translation tool for the word 'Frietings'. The tool has a text input field containing 'your translation', a 'Paste source text' button, and 'Save translation' and 'Skip to next' buttons. To the right of the input field is a 'Description of an image' section with an 'Edit description' link. Below the tool, there are three list items, each with a 'Outdated' status and an 'Edit' link. The first item is 'Frietings is a small municipality in Mungu Land, located on the Bakkungu Island. It has a pop...'. The second item is 'It doesn't have many species. There is a shop and a car ferry visits the island from the main...'. The third item is 'Wikitext: **The roof of the church fell down in 2009** New Church was built in 2017'. At the bottom of the interface, there are buttons for 'List', 'Page', and 'Proofread'.

was wird bei der Applikation getestet?

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The screenshot shows a message group interface for 'Freitings'. At the top, it says 'Message group: All - Freitings' and 'Translate to: italiano'. Below that, it says 'Translation of the wiki page Freitings'. There is a search bar and a filter dropdown set to 'All'. The main content area shows a message titled 'Freitings' with a description of an image. The message body contains a text input field with the placeholder 'Your translation' and a button labeled '@Paste source text'. Below the input field are two buttons: 'Save translation' and 'Skip to next'. The interface also shows a list of other messages with their titles and 'Outdated' status. At the bottom, there are navigation buttons for 'List', 'Page', and 'Proofread'.

was wird bei der Applikation getestet?

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The screenshot shows a message group titled 'Frietings' with a language setting of 'italiano'. It displays a translation workflow for a message about Frietings. The message content is 'A typical view of Frietings' and 'four translation'. A yellow box highlights the text 'four translation' and the '@Paste source text' button. Below the message, there are buttons for 'Save translation' and 'Skip to next'. The interface also shows a list of other messages with 'Outdated' status and a bottom navigation bar with 'List', 'Page', and 'Proofread' options.

was wird bei der Applikation getestet?

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Daten-
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The screenshot shows a message group titled 'Frietings' with a search bar and a list of messages. The first message is a translation of a wiki page. It features a 'Save translation' button and a 'Skip to next' button. Below the message list, there are navigation options: 'List', 'Page', and 'Proofread'.

was wird nicht getestet?

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The screenshot shows a web interface for a message group titled "Frietings". At the top, it says "Message group: All - Frietings" and "Translation of the wiki page Frietings". There are tabs for "All", "Untranslated", "Outdated", and "Translated". A search bar is present. The main content area shows a translation interface for a message. The message text is "A typical view of Frietings" and "four translation" (highlighted with a yellow box). Below the text are buttons for "Save translation" and "Skip to next". To the right of the text is a "Description of an image" field with an "Edit description" link. Below the translation interface is a list of items, each with a "Outdated" status and an "Edit" link. The items are: "Frietings is a small municipality in Munz, Land, located on the Baligung Island. It roots a pop...", "It doesn't have many species. There is a shop and a car ferry along the island from the mainla...", and "Wah events: "The roof of the church fell down in 2009". New church was built in 2017". At the bottom, there are navigation buttons for "List", "Page", and "Proofread".

was wird nicht getestet?

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Zusammenfassung

Load-
balancer

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end

Back-
end

Daten-
bank

The screenshot shows a web interface for a message group titled "Frétinga". At the top, it says "Message group: All - Frétinga" and "Translate to: italiano". Below this, there's a search bar and a filter menu with options "All", "Untranslated", "Outdated", and "Translated". The main content area is split into two columns. The left column shows a "Translation" interface with a text input field containing "Your translation", a "Paste source text" button, and "Save translation" and "Skip to next" buttons. The right column shows a "Description of an image" with an "Edit description" link. Below the translation interface, there's a list of items, each with a "Outdated" status and an "Edit" link. The items are: "Frétinga is a small municipality in Múgla, located on the Bakkungu island. It has a pop...", "It doesn't have many services. There is a shop and a car ferry visits the island from the mainla...", and "Main events: * The roof of the church fell down in 2019 * New church was built in 1877". At the bottom, there's a navigation bar with "List", "Page", and "Proofread" buttons.

was wird nicht getestet?

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Firewall

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end

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Message group: [All - Fietinga](#) Translate to [italiano](#)

Translation of the wiki page [Fietinga](#)

All [Untranslated](#) [Outdated](#) [Translated](#) ...

Fietinga / [Edit](#)

Überschreibe die Seite [x](#) Description of an image [/ Edit description](#)

A typical view of Fietinga

Your translation

[Paste source text](#)

[Save translation](#) [Skip to next](#)

Press "ALT-SHIFT-S" to save or "ALT-SHIFT-Q" to skip to next message

Fietinga is a small municipality in Mangeland, located on the Bunkungu Island. It has a pop... [Outdated](#) / [Edit](#)

It doesn't have many services. There is a shop and a car ferry to the island from the main... [Outdated](#) / [Edit](#)

Main events: "The roof of the church fell down in 2009" New church was built in 1877 / [Edit](#)

[Category:Uncollected] / [Edit](#)

[List](#) [Page](#) / [Proofread](#)

was wird nicht getestet?

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Zusammenfassung



Message group: [All - Frétinga](#) Translate to [italiano](#)

Translation of the wiki page [Frétinga](#)

[All Untranslated](#) [Outdated](#) [Translated](#) ...

Frétinga / Edit

Translationschritt 6/6 ✕ Description of an image

A typical view of Frétinga

Press "ALT-SHIFT-S" to save or "ALT-SHIFT-Q" to skip to next message

/ Edit description

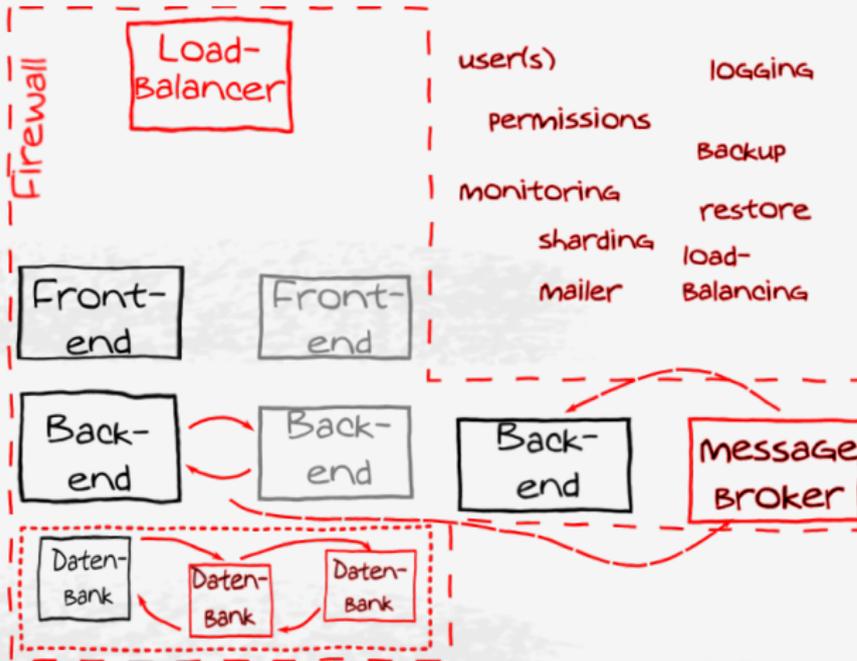
Frétinga is a small municipality in [MunicipiLund](#), located on the [Raukungs Island](#). It has a pop... Outdated / Edit

It doesn't have many services. There is a shop and a car ferry visits the island from the mainla... Outdated / Edit

Main events: "The roof of the church fell down in 2009" [New Church](#) was built in 1877 / Edit

[Category: [Municipalities](#)] / Edit

was wird nicht getestet?



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Zusammenfassung

wie Bauen wir Systeme auf?

Infrastruktur-Tests
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- immutable / atomar:



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wie Bauen wir Systeme auf?

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Zusammenfassung

• immutable / atomar:



• mutable / Komposit:



Fehlererkennung - Fallunterscheidung

- im immutable / atomaren Fall funktioniert ein System oder eben nicht

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Zusammenfassung

Fehlererkennung - Fallunterscheidung

- im immutable / atomaren Fall funktioniert ein System oder eben nicht
- im mutable Fall verkomplizieren
 - Reihenfolgen,
 - Parameter-Änderungen,
 - Abhängigkeiten,
 - ...

die Angelegenheit ganz erheblich

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„Testen“ ist eine Blöde Bezeichnung - eigentlich ist es
die Abnahme!

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Zusammenfassung

- Unit-Tests (Modul-Test, Komponenten-Test, ...),

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Zusammenfassung

- Unit-Tests (Modul-Test, Komponenten-Test, ...),
- Integrations-Tests

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und CI-Pipelines

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Zusammenfassung

- Unit-Tests (Modul-Test, Komponenten-Test, ...),
- Integrations-Tests
- Akzeptanz-Test (Abnahme-Test)

System-Aufbau

Infrastruktur-Tests
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Unit

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Zusammenfassung

NGINX

System-Aufbau

Infrastruktur-Tests
und CI-Pipelines

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Zusammenfassung

```
class {'::nginx' }  
  
nginx::resource::server { 'www.cruwe.de'  
  www_root => '/var/www/www.cruwe.de',  
}
```

Calling a Puppet Module – Stub

System-Aufbau

Infrastruktur-Tests
und CI-Pipelines

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Unit

NGINX

```
class {::nginx} {
```

```
  nginx::resource::server { 'www.cruwede'  
    www_root => '/var/www/www.cruwede'  
  }
```

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System-Aufbau

Unit

Integration /
Komposit

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Zusammenfassung

NGINX

NGINX + files
+ user + ...

```
class {::nginx} {
```

```
  nginx::resource::server { 'www.cruwede'
    www_root => '/var/www/www.cruwede'
  }
```

+

System-Aufbau

Infrastruktur-Tests
und CI-Pipelines

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```
$vhostroots = keys($vhosts).map |String $vhost| {  
  {  
    "/var/www/${vhost}" => {  
      ensure => 'directory',  
      owner   => 'www-data',  
      group   => 'adm',  
      mode    => '0770',  
      require => File['/var/www'],  
    },  
  }  
}.reduce({}) |$coll, $elem| {  
  merge($coll, $elem)  
}  
ensure_resources('file', $vhostroots)
```

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Configuring a Webserver Root Directory - Stub

System-Aufbau

Infrastruktur-Tests
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Unit

Integration /
Komposit

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Zusammenfassung

NGINX

NGINX + files
+ user + ...

```
class 'nginx' {
```

```
  nginx_resource::server { 'www.cruwede'
    www_root => '/var/www/www.cruwede'
  }
```

+

```
$hostroots = keys($hosts).map |String $host| {
  {
    "/var/www/${$host}" => {
      ensure => 'directory',
      owner  => 'www-data',
      group  => 'adm',
      mode   => '0710',
      require => File['/var/www'],
    }
  }
}reduce({$}, |$coll, $elem| {
  merge($coll, $elem)
})
ensure_resources('file', $hostroots)
```

System-Aufbau

Infrastruktur-Tests
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Unit

Integration /
Komposit

Gesamt-
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Zusammenfassung

NGINX

NGINX + files
+ user + ...

NGINX + files
+ user + ...  + files
+ user + ...

 + files
+ user + ...

System-Aufbau

Infrastruktur-Tests
und CI-Pipelines

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```
classes:  
  - role::www  
  
role::www::vhosts:  
  'www.cruwe.de':  
    www_root: '/var/www/www.cruwe.de'  
    rewrite_to_https: true  
    ssl: true  
    ssl_cert: <...>  
    ssl_key: <...>  
    ipv6_enable: true  
    ipv6_listen_options: ''  
    add_header:  
      X-Clacks-Overhead: 'GNU Terry Pratchett'
```

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Configuring a Webserver - Stub

System-Aufbau

Infrastruktur-Tests
und CI-Pipelines

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```
'cruwe.de':  
  use_default_location: false  
  ipv6_enable: true  
  ipv6_listen_options: ' '  
  index_files: [ ]  
  location_custom_cfg: { }  
  vhost_cfg_append:  
    rewrite:  
      '^/(.*) https://www.cruwe.de/$1 permanent'
```

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Configuring a Webserver - Stub

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Unit

NGINX

classes:

- role:www

role:www:hosts:

'www.cruwede':

www_root: '/var/www/www.cruwede'

rewrite_to_https: true

ssl: true

ssl_cert: "/etc/ssl/certs/le_www.cruwede-fullchain.pem"

ssl_key: "/etc/ssl/certs/le_www.cruwede-privkey.pem"

ipv6_enable: true

ipv6_listen_options: "

add_header:

X-Clacks-Overhead: 'GNU Terry Pratchett'

Integration /
Komposit

NGINX + files
+ user + ...

Gesamt-
System

NGINX + files
+ user + ...  + files
+ user + ...
 + files
+ user + ...

'cruwede':

use_default_location: false

ipv6_enable: true

ipv6_listen_options: ''

index_files: []

location_custom_cfg: { }

vhost_cfg_append:

rewrite: "/(.*?) https://www.cruwede/#! permanent"

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Unit Test - RSpec

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Unit



Unit
Test

NGINX

```
class {::nginx} {
```

```
  nginx_resource.server { 'www.cruwede'
```

```
    www_root => '/var/www/www.cruwede'
```

```
}
```

Unit Test - RSpec

Infrastruktur-Tests
und CI-Pipelines

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```
describe 'nginx::resource::server' do
  let(:title) { 'www.cruwe.de' }
  let(:params) {
    { 'www_root' => '/var/www/www.cruwe.de' }
  }

  it { is_expected.to contain_class('nginx') }
  it do
    is_expected.to
      contain_file('/etc/nginx/sites-enabled')
        .with(
          'ensure' => 'present',
          'owner'  => 'root',
          <...>
        )
  end
end
```

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Integration Test - ServerSpec

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Zusammenfassung

Integration /
Komposit



Integration
Test

NGINX + files
+ user + ...

```
class {::nginx' }
```

```
nginx::resource::server { 'www.cruwede'  
  www_root => '/var/www/www.cruwede'  
}
```

```
$hostroots = keys($hosts).map |String $host| {  
  {  
    "/var/www/$host" => {  
      ensure => 'directory',  
      owner  => 'www-data',  
      group  => 'adm',  
      mode   => '0710',  
      require => File['/var/www'],  
    },  
  }  
}  
$reduce($$) |$coll, $elem| {  
  merge($coll, $elem)  
}  
ensure_resources('file', $hostroots)
```

Integration Test - ServerSpec

Infrastruktur-Tests
und CI-Pipelines

Christopher J.
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whoami

Motivation

Provisionierung

Test-Systematik

Test-Ausführung

Test-Pipeline

Test-Integration -
Zielzustand

Test-Integration -
Repository

Zusammenfassung

```
describe 'Check the webserver via ssh.' do
  describe service('nginx') do
    it { should be_enabled }
    it { should be_running }
  end

  describe process('nginx') do
    its(:user) { should eq 'www-data' }
    its(:count) { should eq 4 }
  end

  describe port(80) do <...> end
end
```

Test a Webserver Locally - Stub

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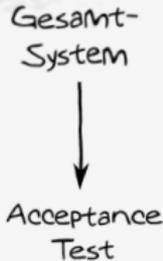
```
describe 'Check the webserver via http.' do
  describe command("curl -I http://www.cruwe.de") do
    its(:stdout) { should match /HTTP\/1.1 301/ }
    its(:stdout) { should match
      /Location: https:\\\/<...>/ }
    its(:stdout) { should match /Server: nginx/ }
    its(:stdout) { should match
      /Content-Type: text\/html/ }
    its(:stdout) { should match /X-Clacks-Overhead:
      GNU Terry Pratchett/ }
  end
end
```

Test a Webserver Remotely - Stub

Acceptance Test

Infrastruktur-Tests
und CI-Pipelines

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NGINX + files  + files
+ user + ... + user + ...

 + files
+ user + ...

```
---  
classes:  
  - role:insultsweb  
  
role:insultweb:domain: insultsweb.cruwede  
<...>
```

```
---  
classes:  
  - role:insultapp
```

whoami

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Acceptance Test

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Zusammenfassung

```
describe 'Check www from localhost.' do
  <...>
end

describe 'Check app-server from frontend.' do
  <...>
end
```

Walk the Servers

Test Pipeline

Infrastruktur-Tests
und CI-Pipelines

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whoami

Motivation

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Test-Systematik

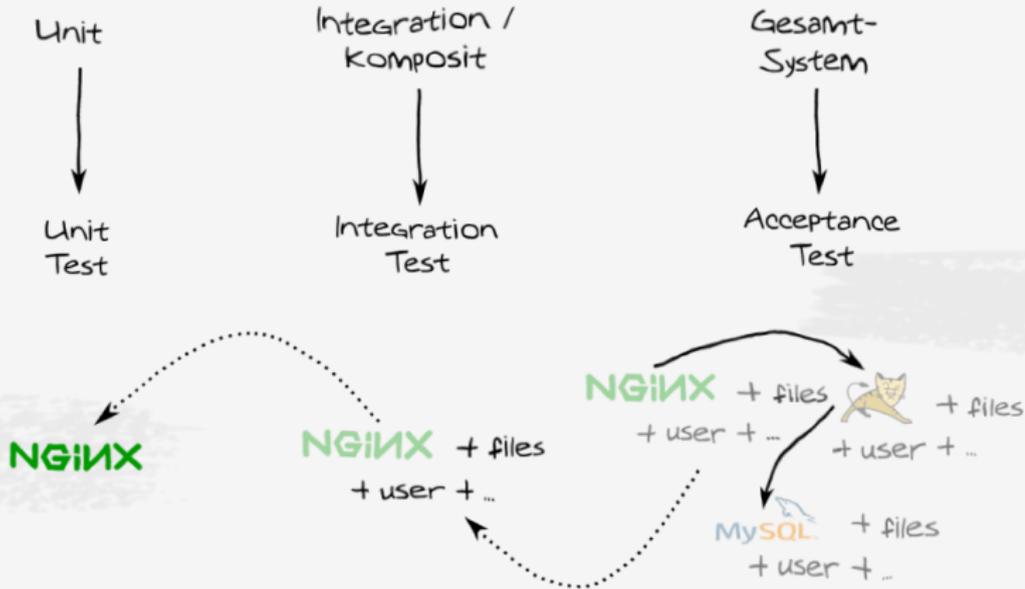
Test-Ausführung

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Zusammenfassung



Test Pipeline

Infrastruktur-Tests
und CI-Pipelines

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```
node('buildslave') {  
  
    properties([  
        buildDiscarder(logRotator(numToKeepStr: '25')),  
        disableConcurrentBuilds(),  
        <...>  
    ])  
  
    stage('Checkout') {  
        cleanWs()  
        checkout(scm)  
    }  
}
```

whoami

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Zusammenfassung

Pipeline – Properties and Checkout

Test Pipeline

Infrastruktur-Tests
und CI-Pipelines

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```
stage('Prepare environment') {  
  parallel(  
    'build_docker_image': {  
      sh '''#!/bin/bash -l  
        docker build \  
          -t cjr/centos_w_puppet:7.3.1611 \  
          -f Dockerfile.centos73 \  
          .  
      '''  
    }  
  )  
}
```

whoami

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Zusammenfassung

Pipeline - Preparing the Environment

Test Pipeline

Infrastruktur-Tests
und CI-Pipelines

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```
stage('Test Dynamically') {  
  try {  
    sh(''#!/bin/bash -l  
      eval $(ssh-agent)  
      bundle exec kitchen create docker  
      bundle exec kitchen converge docker  
      bundle exec kitchen verify docker  
      ''  
    )  
  } catch (err) { } finally {  
    step(  
      [  
        $class      : 'JUnitResultArchiver',  
        allowEmptyResults: true,  
      ]  
    <...>  
  }  
}
```

whoami

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Zusammenfassung

Pipeline – Simulating a Host with Docker

Test Pipeline

Infrastruktur-Tests
und CI-Pipelines

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```
stage('Publish artifact') {  
  withCredentials(  
    [  
      usernamePassword(  
        credentialsId: 'jenkins2nexus',  
        passwordVariable: 'NEXUSPASS',  
        usernameVariable: 'NEXUSER'  
      )  
    ]  
  ) {  
    nexusArtifactUploader(  
      artifacts:  
        [[  
          artifactId: "${artifactId}",  
          <...>  
        ]  
    ]  
  }  
}
```

whoami

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Zusammenfassung

Publishing a Packaged Module

Testläufe auf einen Branch

Average stage times:
(Average full run time: ~3min 39s)

	Checkout	Prepare environment	Test Statically	Test Dynamically	Prepare release	Publish artifact
#25 Oct 13 13:51 1 commits	290ms	18s	3s	2min 37s	334ms	38s
#23 Oct 13 13:45 1 commits	330ms	19s	4s	2min 48s	633ms	22ms failed
#22 Oct 13 13:39 2 commits	303ms	57s	5s	2min 33s		
#1 Oct 13 13:27 No Changes	395ms	18s failed				

Einzelner Testlauf auf einen Branch

The screenshot shows the Jenkins web interface for a specific build. The top navigation bar includes the Jenkins logo and the breadcrumb path: Jenkins > puppetcontrol multibranch > cjr_triggerjenkins > #4. The left sidebar contains a list of navigation links: Back to Project, Status, Changes, Console Output, Edit Build Information, Delete Build, Parameters, Git Build Data, No Tags, Test Result, Replay, Pipeline Steps, and Previous Build. The main content area is titled "Build #4 (Oct 13, 2017 1:51:32 PM)". It features several sections: "Changes" with a list item "1. repair curbranch (detail)"; "Started by upstream project Jenkins Admin - gagstriggered build number 59 originally caused by:" followed by a bullet point "Generic Cause"; "Revision: 7bb823bec008ea78599f6a279e8f862207ddcd06" with a bullet point "cjr_triggerjenkins"; "Puppet-Lint Warnings: 0 warnings." with a list of three items: "No warnings since build 4", "New zero warnings highscore: no warnings since yesterday!", and "During parsing an error has been reported."; "Checkstyle: 0 warnings from one analysis." with a list of two items: "No warnings since build 4." and "New zero warnings highscore: no warnings since yesterday!"; and "Test Result (no failures)".

Jenkins

Jenkins > puppetcontrol multibranch > cjr_triggerjenkins > #4

- Back to Project
- Status
- Changes
- Console Output
- Edit Build Information
- Delete Build
- Parameters
- Git Build Data
- No Tags
- Test Result
- Replay
- Pipeline Steps
- Previous Build

Build #4 (Oct 13, 2017 1:51:32 PM)

Changes

1. repair curbranch ([detail](#))

Started by upstream project [Jenkins Admin - gagstriggered](#) build number [59](#) originally caused by:

- Generic Cause

Revision: 7bb823bec008ea78599f6a279e8f862207ddcd06

- cjr_triggerjenkins

Puppet-Lint Warnings: 0 warnings.

- No warnings since build 4.
- New zero warnings highscore: no warnings since yesterday!
- During parsing an [error](#) has been reported.

Checkstyle: 0 warnings from one analysis.

- No warnings since build 4.
- New zero warnings highscore: no warnings since yesterday!

[Test Result](#) (no failures)

Einzelner Test

Test Result : tests from test/integration/base

0 failures

11 tests

Took 1.1 sec.

 add description

All Tests

Test name	Duration	Status
SSHD Configuration Protocol should cmp _= 2	0.45 sec	Passed
User bath gid should eq 666	0 ms	Passed
User bath group should eq "bath"	0 ms	Passed
User bath groups should eq ["bath", "adm", "wheel", "users", "systemd-journal"]	0 ms	Passed
User bath home should eq "home:bath"	0.25 sec	Passed
User bath maxdays should be <= 90	2 ms	Passed
User bath mindays should eq 0	0.23 sec	Passed
User bath shell should eq "bin/bash"	0 ms	Passed
User bath should exist	0.21 sec	Passed
User bath uid should eq 666	0 ms	Passed
User bath warndays should eq 7	0 ms	Passed

Integration in ein Repository

<reporoot>

└─ .kitchen.yml, hosts.ini, ...

└─ test/integration/serverspec

└─ spec_helpers.rb

└─ webserver_spec.rb

└─ Rakefile, Makefile, pom.xml, ...

└─ Jenkinsfile, .travis.yml, Buildspec.yml, ...

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Zusammenfassung - Motivation

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Zusammenfassung

- Mutable Infrastructure ist tendenziell Bröselig, aber wir kommen davon auf absehbare Zeit nicht vollständig weg
- deswegen müssen wir nach Aufbau und Änderungen verifizieren -> eine Abnahme durchführen
- die Tests als Implementierung der Abnahmekriterien sind geschickterweise in den Applikations-Aufbau-Code integriert

Zusammenfassung - Test-Aufbau

Infrastruktur-Tests
und CI-Pipelines

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Motivation

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Zusammenfassung

wir unterscheiden:

- Test-Aufbau,
- Test-Spezifikation,
- Ausführungs-Logik und
- Test-Ablauf.

Zusammenfassung - Code-Mapping

Infrastruktur-Tests
und CI-Pipelines

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Zusammenfassung

alles kann und sollte als Code vorliegen:

- Test-Aufbau -> hosts.ini, kitchen, ...
- Test-Spezifikation -> rspec, serverspec, inspec, ...
- Ausführungs-Logik -> Rakefile, makefile, JOB-DSL, custom code ... ,
- Test-Ablauf -> Jenkins Workflow Pipeline, travis, ...

Zusammenfassung - Thesen

Infrastruktur-Tests
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Motivation

Provisionierung

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Repository

Zusammenfassung

- Tests führen zu Sicherheit und Wartbarkeit. Sicherheit und Wartbarkeit hält man im Allgemeinen für ein Good Thing™.
- Regelmäßige Tests stellen de facto ein Zustands- und Verfügbarkeits-Monitoring dar. Auch Applikations-Zustands-Monitoring habe ich in der letzten Zeit häufiger beobachtet.