Jenkins Pipelines

Steffen Gebert (@StGebert)

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About Me

Julius-Maximilians-
UNIVERSITÄT
WÜRZBURG

Researcher / PhD Student (Software-based Networks)

2011 - 2016

TYPO3

Core Team Member

2010 - 2013

Server Admin Team Member

since 2011

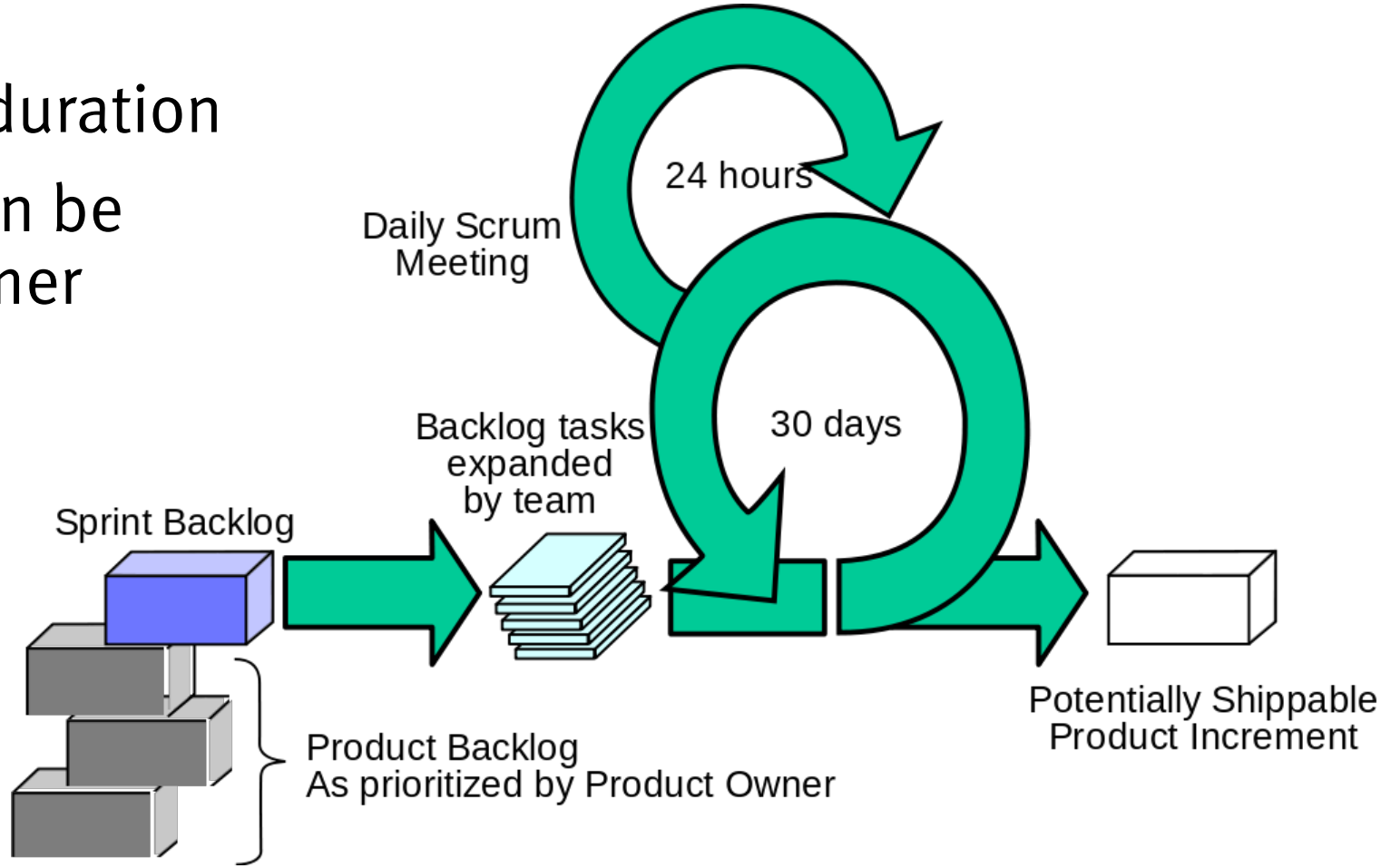
Co-Organizer DevOps Meetup Würzburg

since last week

Continuous Delivery

Agile Development

- Sprints of ~1-4 weeks duration
- Result: Product that can be shown/given to customer
- Return: Feedback



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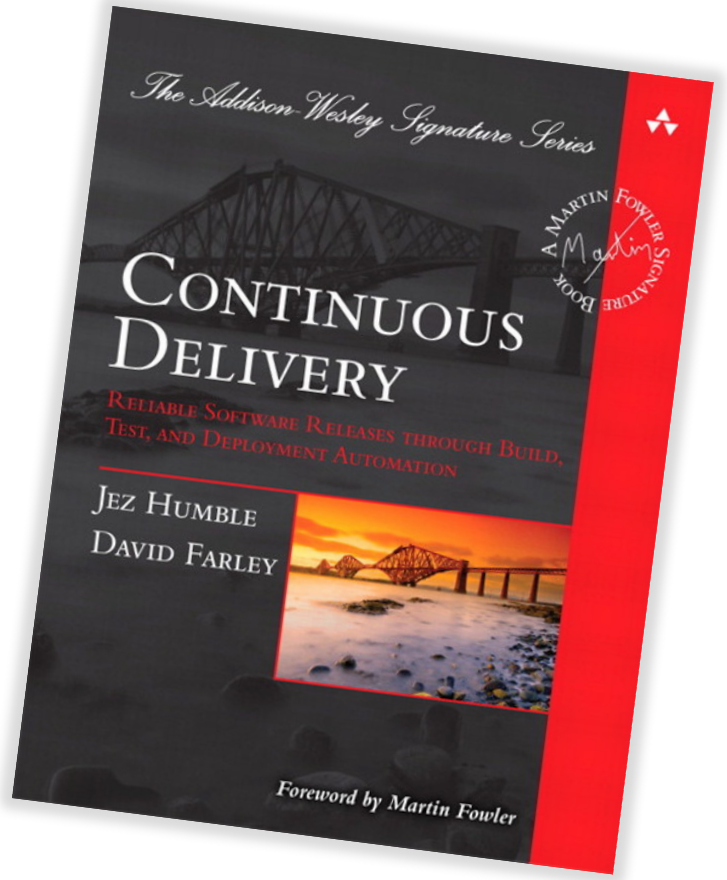
Continuous Delivery

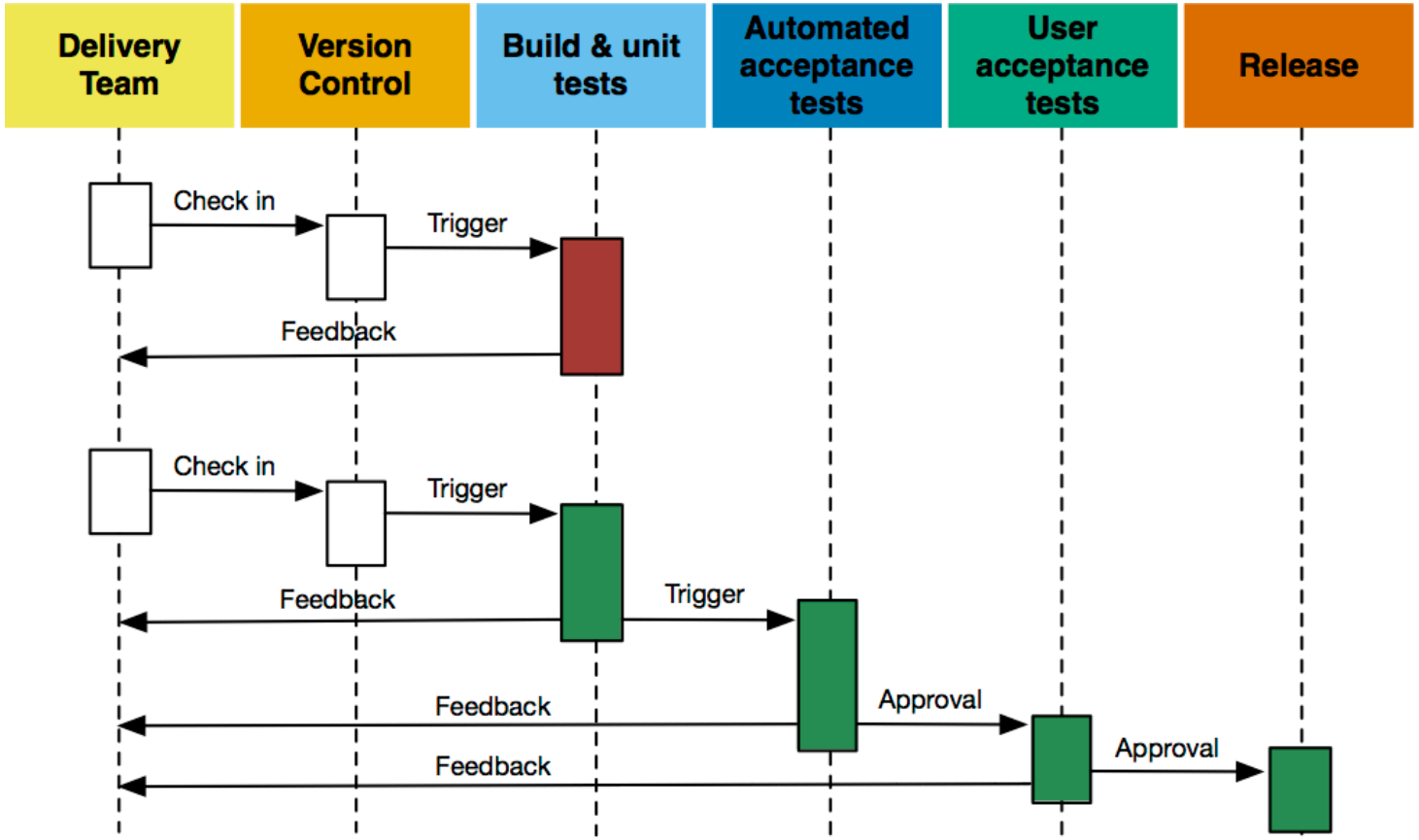
- Reduce cycle times (even more)
  - cf. “DevOps is not enough” talk
  - *“How long does it take to release a one-line change?”*

- Potentially deliverable code with every commit
  - Automated tests decide about acceptance
  - You don’t *have to* release/deploy it, but you *could*
    → Continuous Deployment: Deploy every successfully tested commit automatically



Pipelines

- Every check-in triggers pipeline execution
- Feedback to the team in every stage
  - *“Bring the pain forward”*
  - *“Fail fast, fail often”*
- Minimize execution time
- Always aware of latest *stable* release



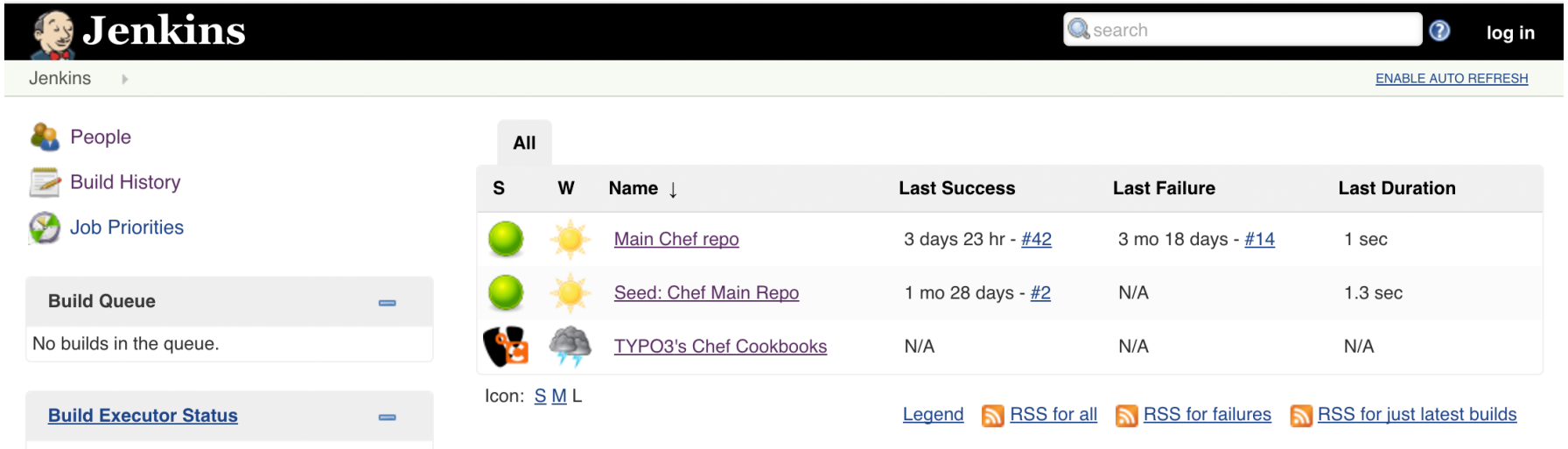
CI & CD Tools

CI/CD Tools

- On-premise
  - *Jenkins*
  - Thoughtworks Go
  - Gitlab CI
- SaaS
  - TravisCI
  - CircleCI
  - AppVeyor
  - Codeship
  - Visual Studio Team Services

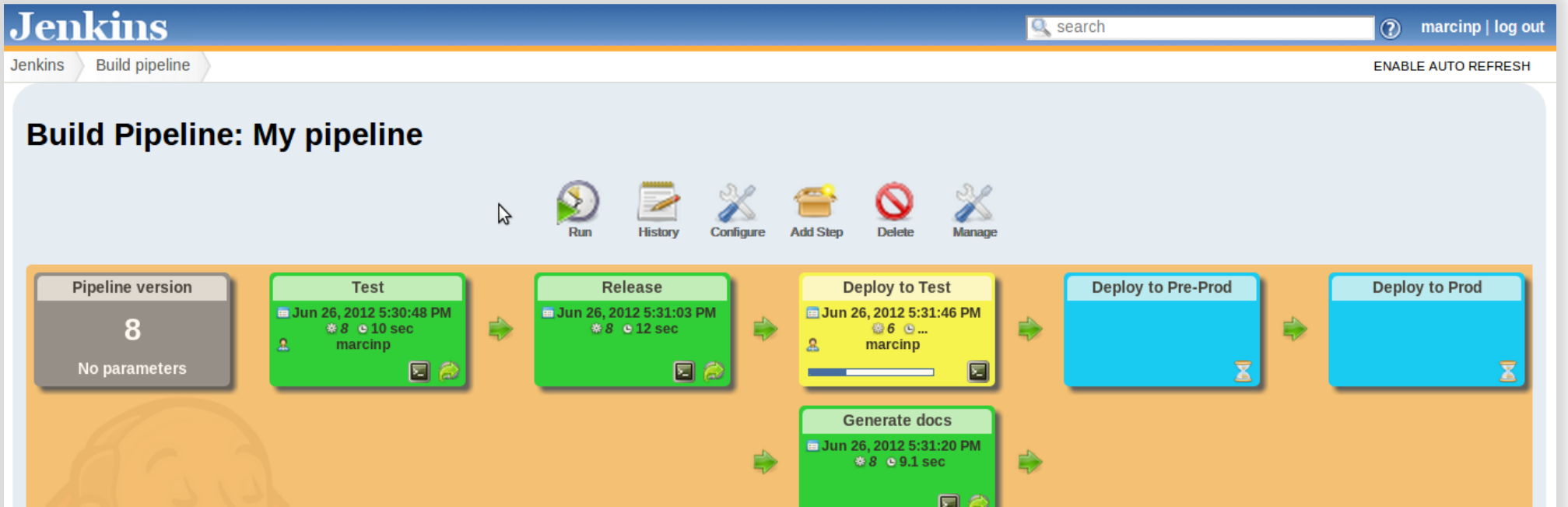
Why (I like) Jenkins

- Established open source project
- On premise installation
- Thousands of plugins
- Integrates with many tools/services
- Tailored to CI/CD



History of CI/CD with Jenkins

- Downstream Jobs
  - Job A triggers job B triggers job C triggers job D trig...
  - If one job fails, fail all
- *Build Pipeline* View



… and what I want instead

But that’s awkward

Configuration as Code

- Define jobs/pipelines as code
  - Avoid point & click
  - **In version control**
  - Can live with the application
  - **Scales better**
- Example: `.travis.yml` (from TravisCI)
- Similar to GitlabCI

```
language: php

services:
- redis-server

before_script:
- composer install

script:
- ./bin/phpunit -c …

notifications:
  slack:
…
```

Code-driven Approaches in Jenkins

- Jenkins Job Builder
  - Python / YAML based, from the OpenStack project

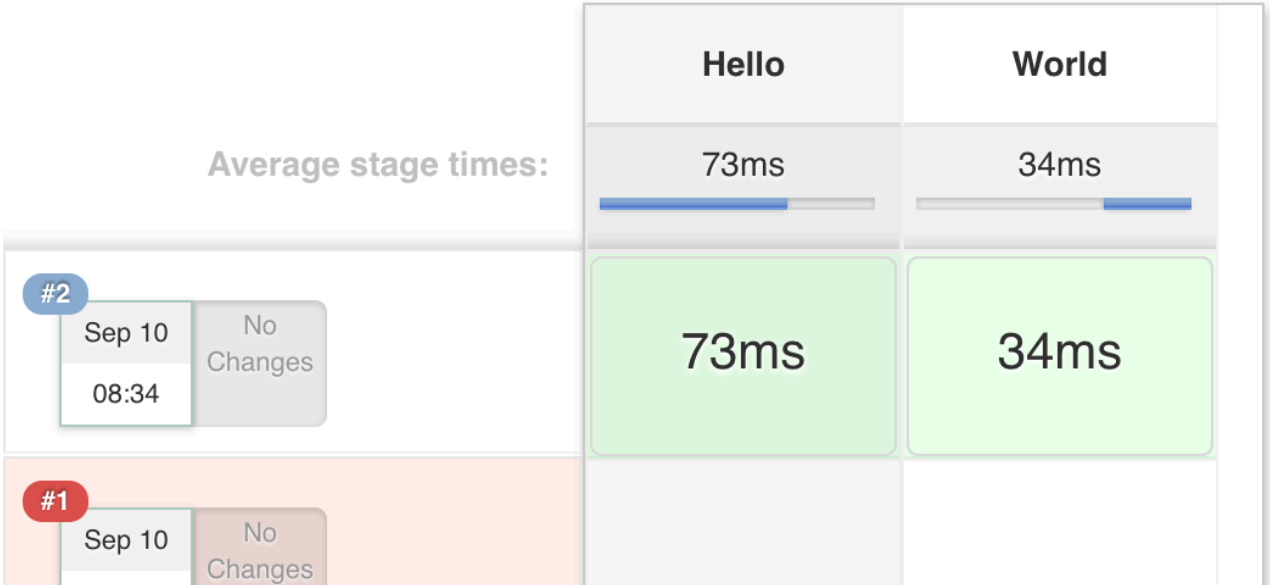
- Job DSL plugin
  - Groovy DSL!
    (e.g. query Github API and create jobs for all branches)
  - Great thing!
  - But creates single jobs

```
job('my-project-main') {
  scm {
    git('https://github.com/...')
  }
  triggers {
    scm('H/15 * * * *')
  }
  publishers {
    downstream('my-project-unit')
  }
}
```

Jenkins Pipeline Plugins

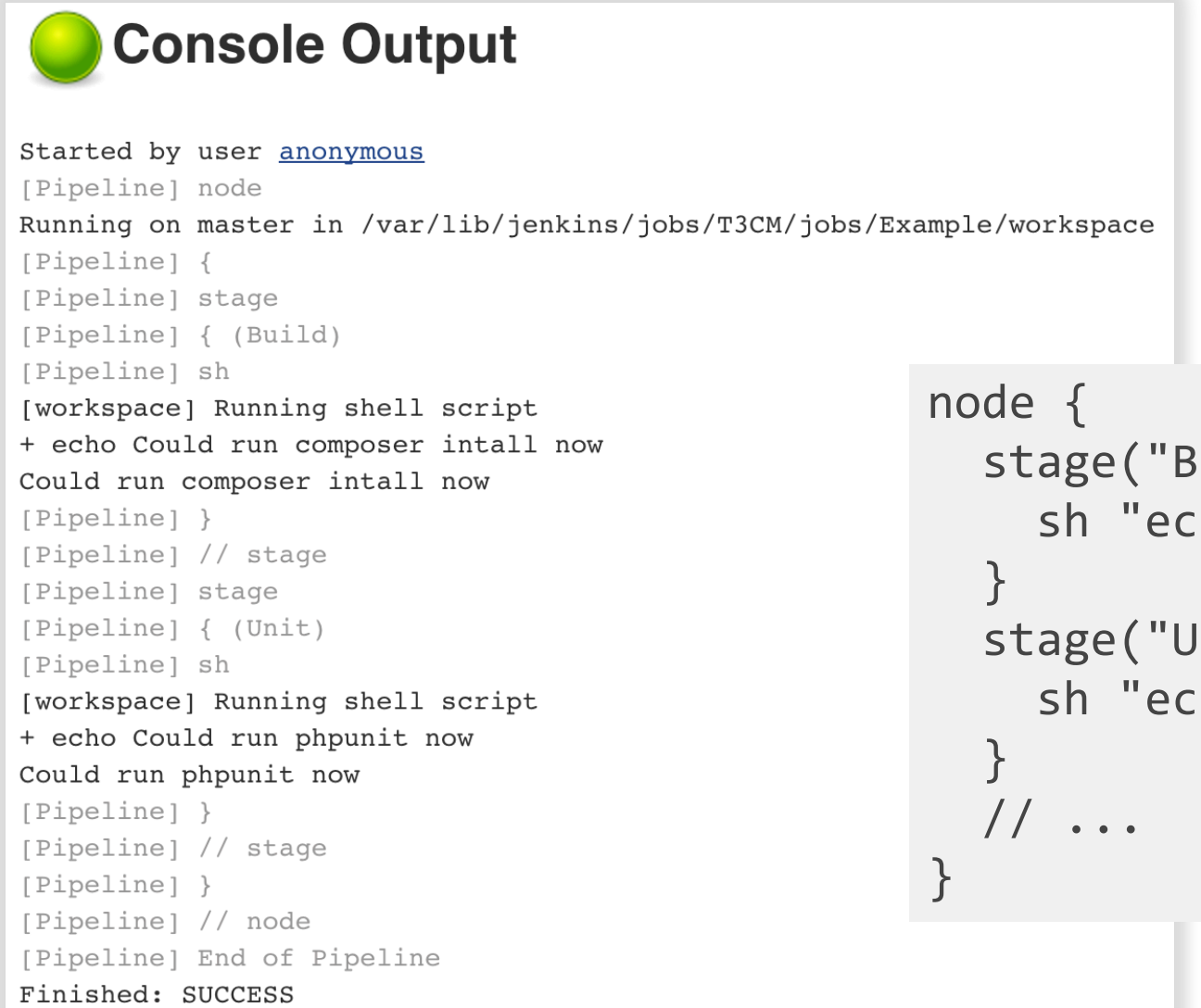
Jenkins Pipeline Plugins

- Whole suite of plugins (10+), open-sourced earlier this year
- Shipped with Jenkins 2.0
- Formerly commercially available by CloudBees, called *Workflow*
- Define pipeline as code (again Groovy DSL)




```
stage("Hello") {
  echo "*Hello*"
}
stage("World") {
  echo "*World*"
}
```

Pipeline Example




```
node {
  stage("Build") {
    sh "echo Could run 'composer install' now"
  }
  stage("Unit") {
    sh "echo Could run 'phpunit' now"
  }
  // ...
}
```

Pipeline Execution

- node step allocates executor slot (“heavyweight executor”)
  - As other Jenkins jobs
  - Filter node by labels (i.e. `node('php7'), node('master')`)
  - Required for heavy lifting
  - Avoid many sequential allocations (slows down pipeline progress)
- Code outside of node
  - Flyweight executor
  - Running on master, "for free”
- Pipeline execution survives Jenkins restarts (CPS)

Pipeline DSL Steps

- Shellout
  - *nix systems: `sh`
    - sh("make"), sh("rm -rf /")
  - Windows systems: `bat`
    - `bat("C:\Program Files\...")`
- SCM
  - `checkout("https://github.com/..git")`
- File handling
  - `readFile("my.config")`
  - `writeFile(file: "README.md", text: "Hello World")`
  - `fileExists`

Pipeline DSL Steps (2)

- Build another job:

```
build("jobname")
build("jobname", wait: false, propagate: false)
Build(job: 'jobname', parameters: [
   [$class: 'StringParameterValue', name: 'target', value: target]
   [$class: 'ListSubversionTagsParameterValue', name: 'release', tag: release],
   [$class: 'BooleanParameterValue', name: 'update_composer', value:
   update_composer.to_boolean()])
```

- Will not go further into detail ☺

Pipeline DSL Steps (3)

- Copy workspace to next executor

```
stage("build") {
  node {
    sh("make")
    stash("my-workspace")
  }
}
stage("release") {
  node('magic-release-tool') {
    unstash("my-workspace")
    sh("release")
  }
}
```

Pipeline DSL Steps (4)

- Specify custom environment variables

```
withEnv(['MYTOOL_HOME=/usr/local/mytool']) {
  sh '$MYTOOL_HOME/bin/start‘
}

env.FOO = "bar"
sh 'echo $BAR'
```

- Use variables provided by Jenkins

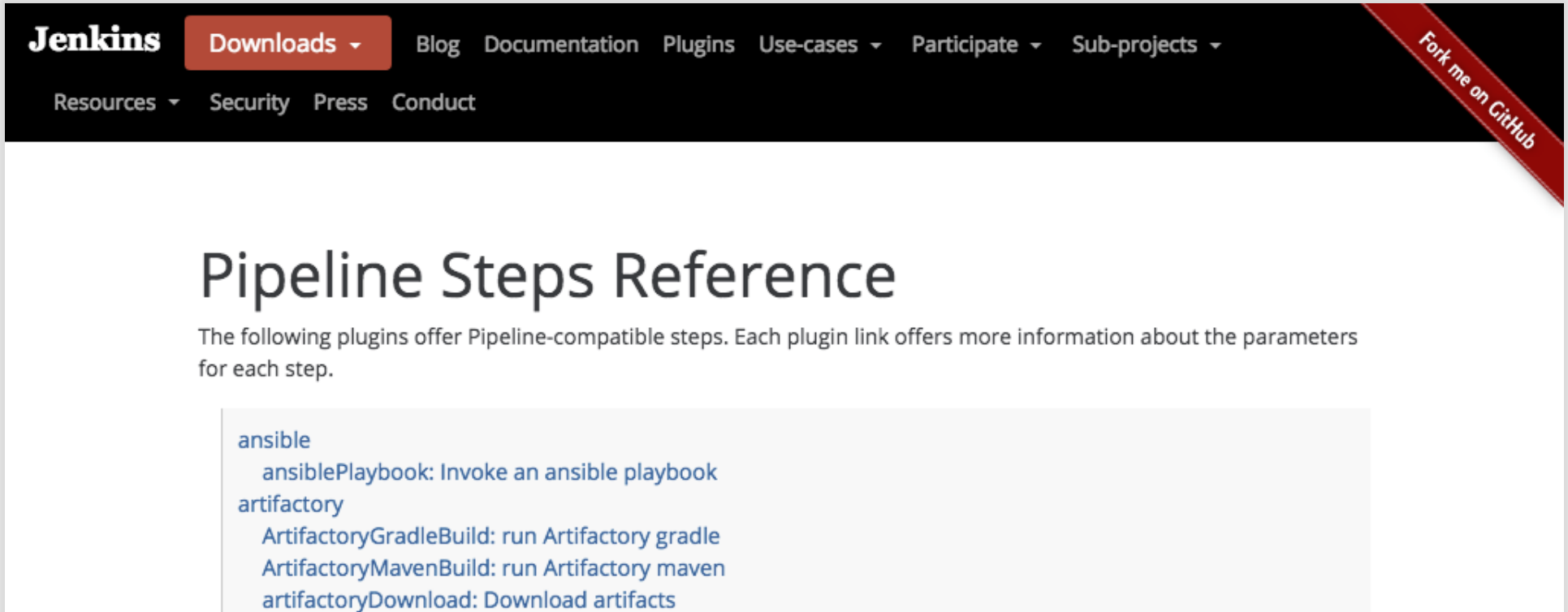
```
sh 'echo $BUILD_NUMBER > version.txt'
```

- Global Groovy variables

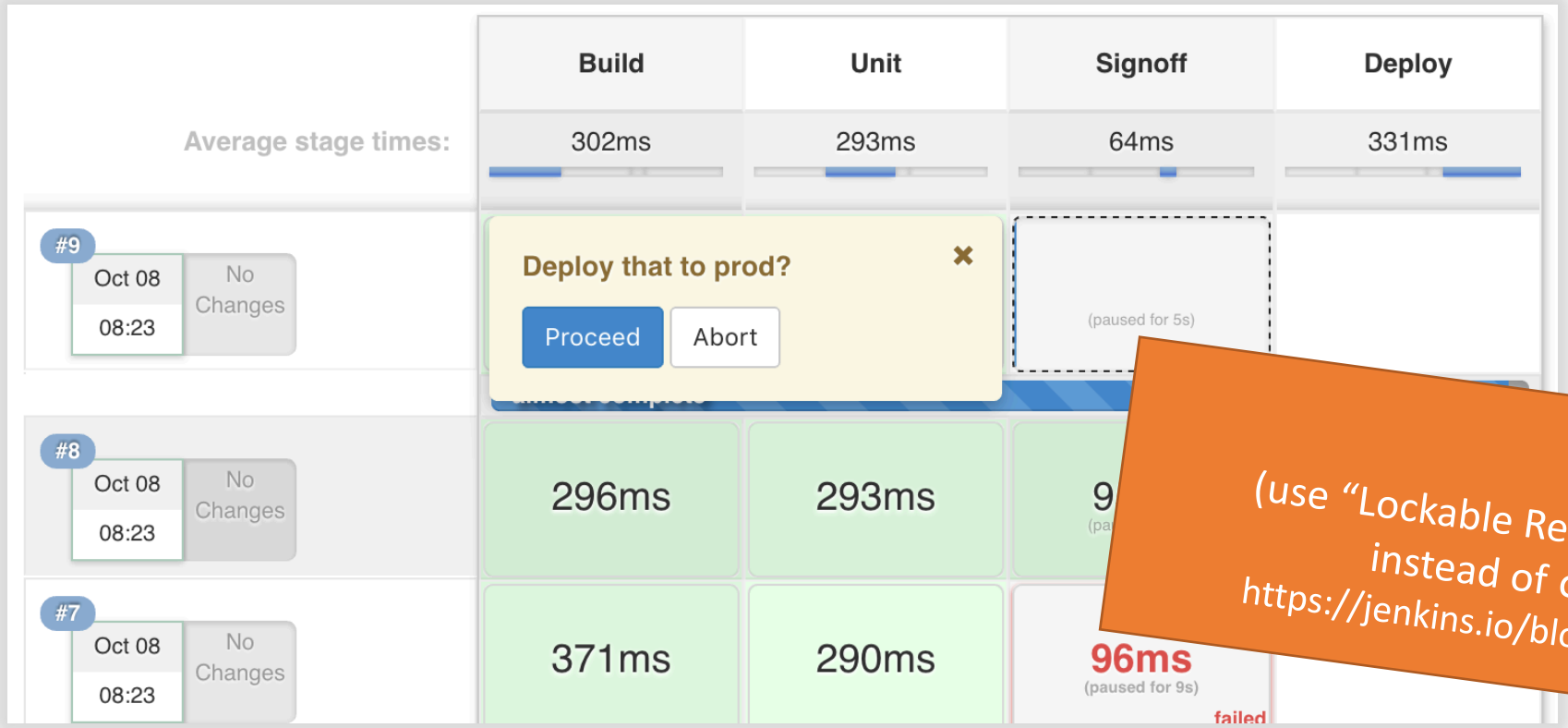
```
currentBuild.result = 'FAILED'
```

Even More Pipeline Steps

- Plugins contribute additional steps
  - Steps available in this Jenkins instance via Pipeline Syntax
  - Online reference: https://jenkins.io/doc/pipeline/steps/



Example: Manually Confirm Deployment



Deprecated!
(use "Lockable Resources" plugin and its lock step instead of concurrency parameter)
https://jenkins.io/blog/2016/10/16/stage-lock-milestone/

```
stage("Signoff") {
  input("Deploy that to prod?")
  milestone()
}
stage(name: "Deploy", concurrency: 1) { node {..} }
```

Docker

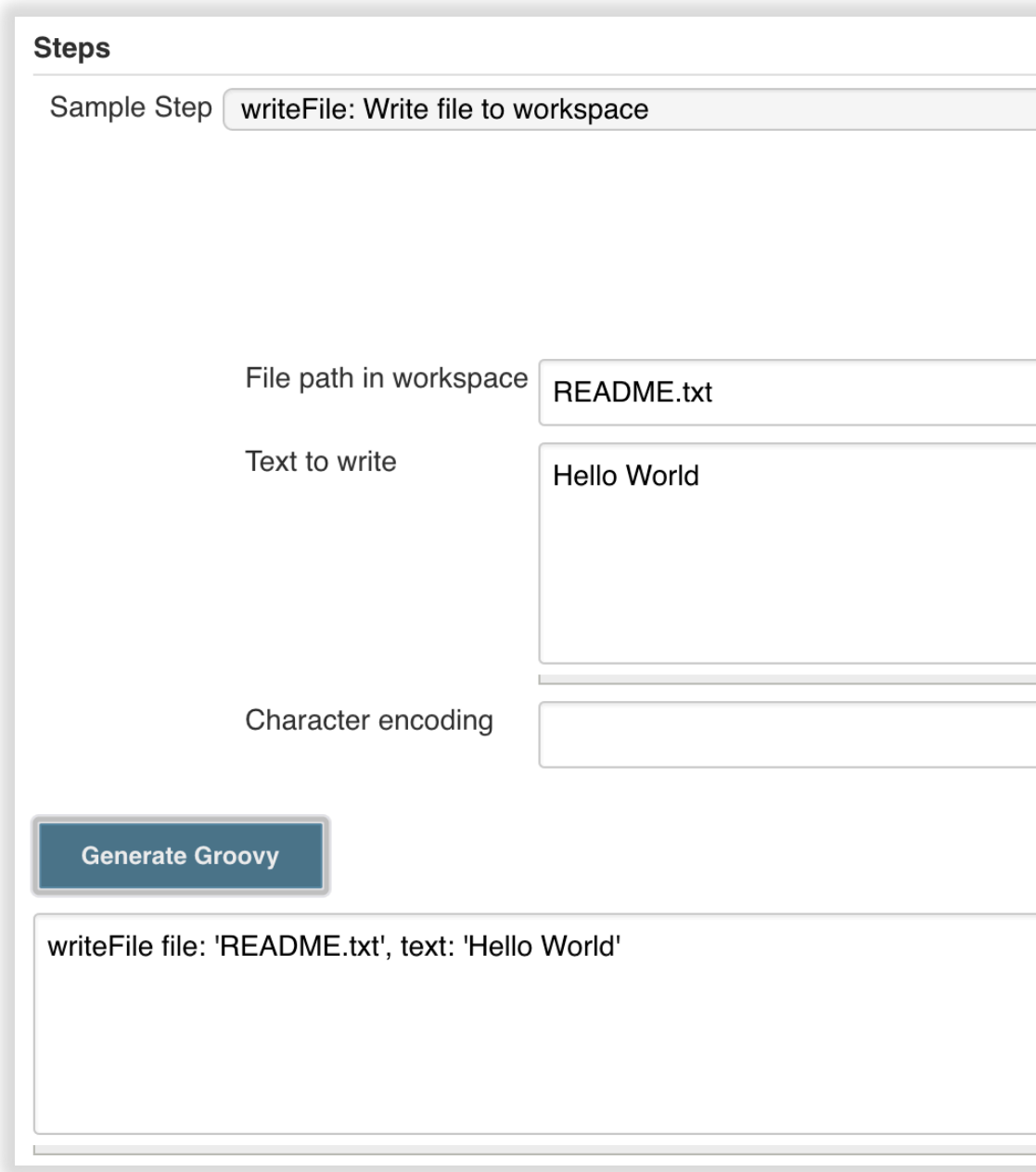
- Run build jobs within Docker containers
  - No need to install software on Jenkins master/slave
  - Use multiple versions of the same tool

- Containers can be existing ones or built on demand
- .. and Kubernetes

```
stage("run in docker") {
  node {
    withDockerContainer("php:7-fpm") {
      sh "php -v”
    }
  }
}
```

Snipped Editor & Docs

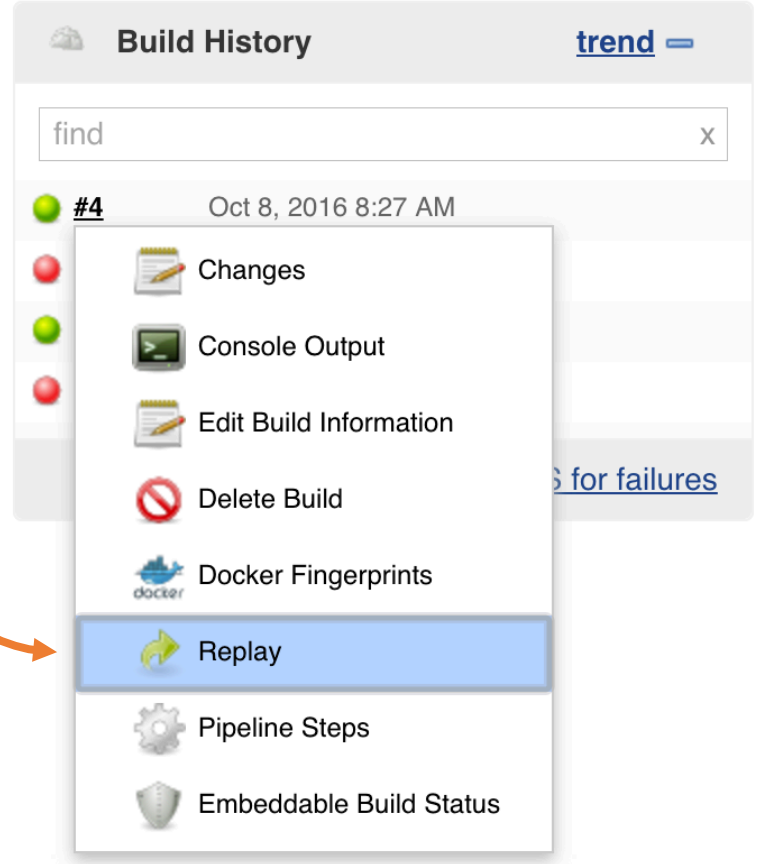
- Because first steps are hard..
- Auto-generated DSL documentation (*Pipeline Syntax → Step Reference*)



Where to put that config?

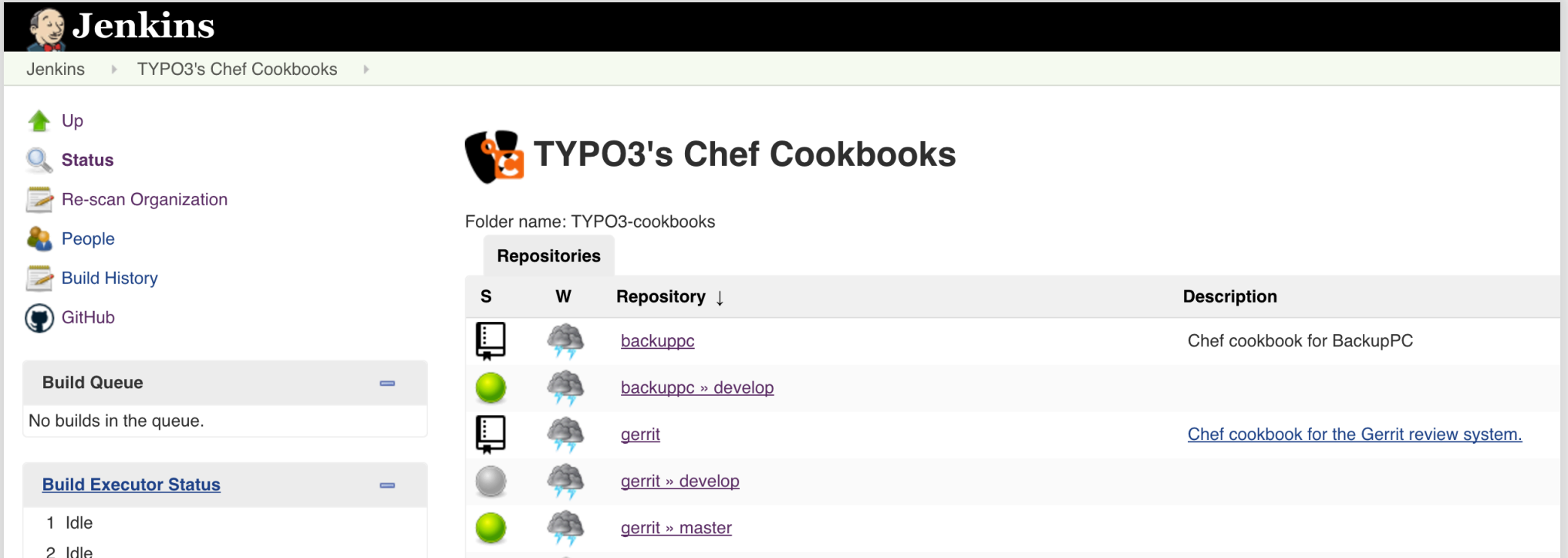
Pipeline Configuration

- Paste code into job config (fine for testing)
- Create pipelines via JobDSL
- Commit it to your repo
  - File called `Jenkinsfile`
  - It evolves with the application
  - It is versioned
  - Everybody can read (and modify) it
  - You can throw away your Jenkins master at any time



Multibranch & Organization Folder Plugins

- Scans a complete GitHub/Bitbucket organisation for `Jenkinsfile`
- Triggered by Webhook and/or runs periodically
- Automatically adds pipeline jobs per repo/branch/PR



DRY: Jenkins Global Library

- Provides shared functionality available for all jobs
- Stored on Jenkins master, available to all slaves
  - Available via Jenkins-integrated Git server
  - Can be loaded from remote Git repos, specified in global configuration and `Jenkinsfile`

```
@Library("https://github.com/..")
node { deployToProd() }
```

Real-World Example

Jenkins Pipelines for Chef Cookbooks

Chef CI/CD at TYPO3.org

- Code that runs the *.typo3.org infrastructure, chef-ci.typo3.org
- Objective: Chef cookbooks
  - Server provisioning (installs packages, configures services)
  - Code: github.com/TYPO3-cookbooks

	lint	resolve dependencies	test-kitchen	archive artifacts	upload
Average stage times:	1s	15s	8min 19s	4s	26s
#2 Aug 28 16:18 — 3 commits	1s	30s	8min 19s	4s	22s
#1 Aug 28 10:08 — No Changes	1s	1s	8min 19s	4s	31s

Many Cookbooks, Many Pipelines

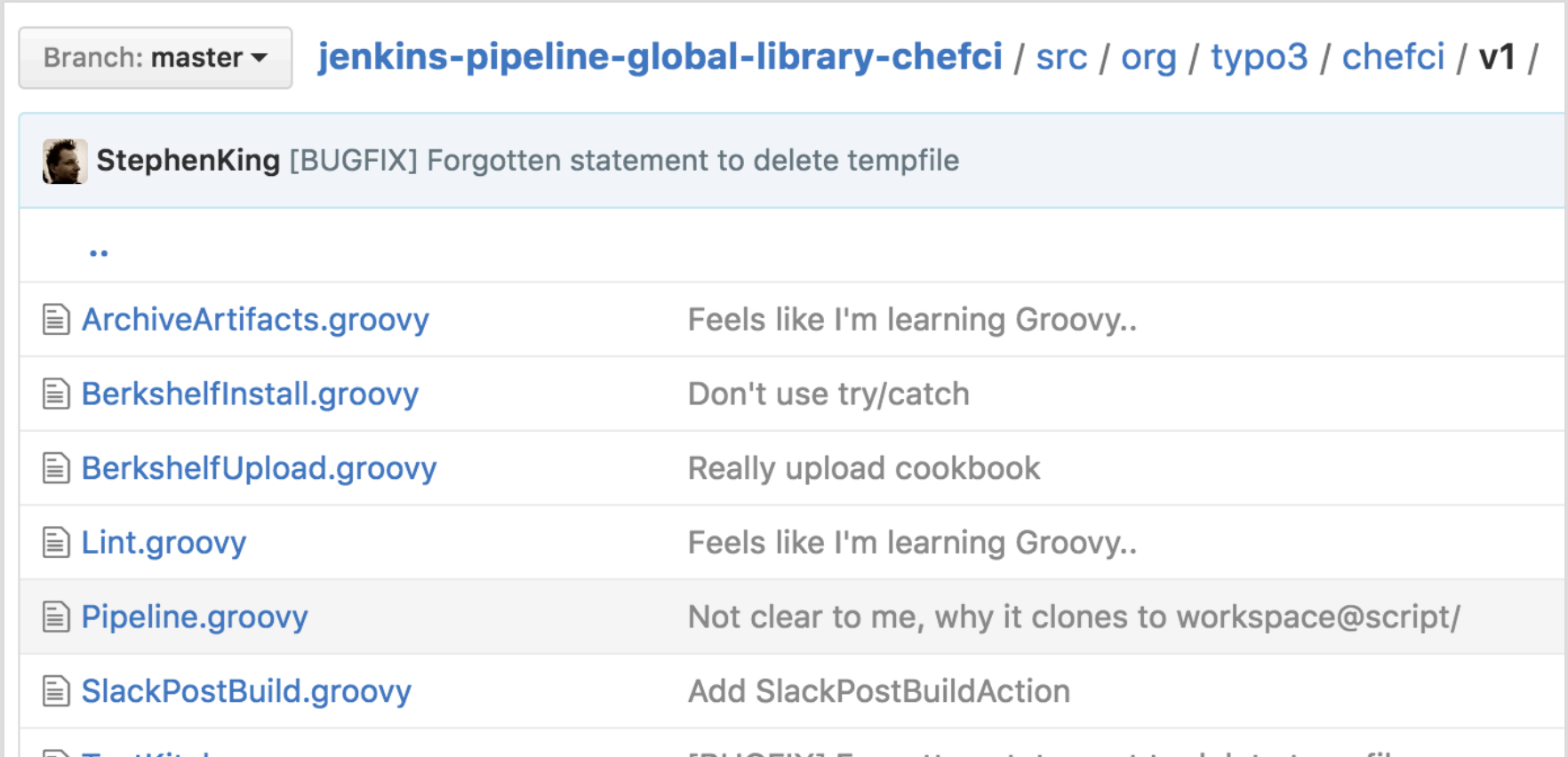
- Scans our GitHub organization *TYPO3-cookbooks*
  - Automatically adds/removes pipelines for branches and pull requests*
  - Triggered via Webhooks
  - Contents of `Jenkinsfile`:

```
def pipe = new org.typo3.chefci.v1.Pipeline()
pipe.execute()
```

* Currently suspicious to arbitrary code execution

Jenkins Global Library

- Pipelines implemented in Global Library
  [TYPO3-infrastructure/jenkins-pipeline-global-library-chefci]



Parallelize Integration Tests

- Run *Test-Kitchen* (integration test for Chef cookbooks)
- Run all instances in parallel (by Jenkins)

```
$ kitchen status
Instance                Driver   Provisioner  [..] Last Action
default-debian-78       Docker   ChefZero           <Not Created>
default-debian-82       Docker   ChefZero           <Not Created>
physical-debian-78      Docker   ChefZero           <Not Created>
physical-debian-82      Docker   ChefZero           <Not Created>
production-debian-78    Docker   ChefZero           <Not Created>
production-debian-82    Docker   ChefZero           <Not Created>
```

Parallelize Integration Tests (2)

- Goal: Extract instance list, run `kitchen` commands in parallel
- Expected result:

```
parallel(
  'default-debian-82': {
    node {
      unstash('cookbook-tk')
      sh('kitchen test --destroy always default-debian-82')
    }
  },
  'physical-debian-82': {
    node {
      unstash('cookbook-tk')
      sh('kitchen test --destroy always physical-debian-82')
    }...
```

Parallelize Integration Tests (3)

- Grab list of instance names

```
def ArrayList<String> getInstances(){
  def instanceNames = []
  node {
    def lines = sh(script: 'kitchen status', returnStdout: true).split('\n')
    for (int i = 1; i < lines.size(); i++) {
      instanceNames << lines[i].tokenize(' ')[0]
    }
  }
  return instanceNames
}
```

* Closures don’t always work well within Pipeline code (cf. @NonCPS)

Parallelize Integration Tests (4)

```
def Closure getNodeForInstance(String instanceName) {
  return {
    // this node (one per instance) is later executed in parallel
    node {
      // restore workspace
     unstash('cookbook-tk')
     sh('kitchen test --destroy always ' + instanceName)
}}}
```

```
for (int i = 0; i < instanceNames.size(); i++) {
  plNodes[instanceName] = this.getNodeForInstance(instanceNames.get(i))
}
parallel plNodes
```

Failure Notification

- Pipeline stops, when any step fails
- But.. I want that info in Slack!

```
def execute() {
  this.prepare()
  this.run(new Lint())
  this.run(new BerkshelfInstall())
  this.run(new TestKitchen())
  this.run(new ArchiveArtifacts())
  // erm… git flow is a bad idea
  if (env.BRANCH_NAME == "master") {
    this.run(new BerkshelfUpload())
  }
}
```

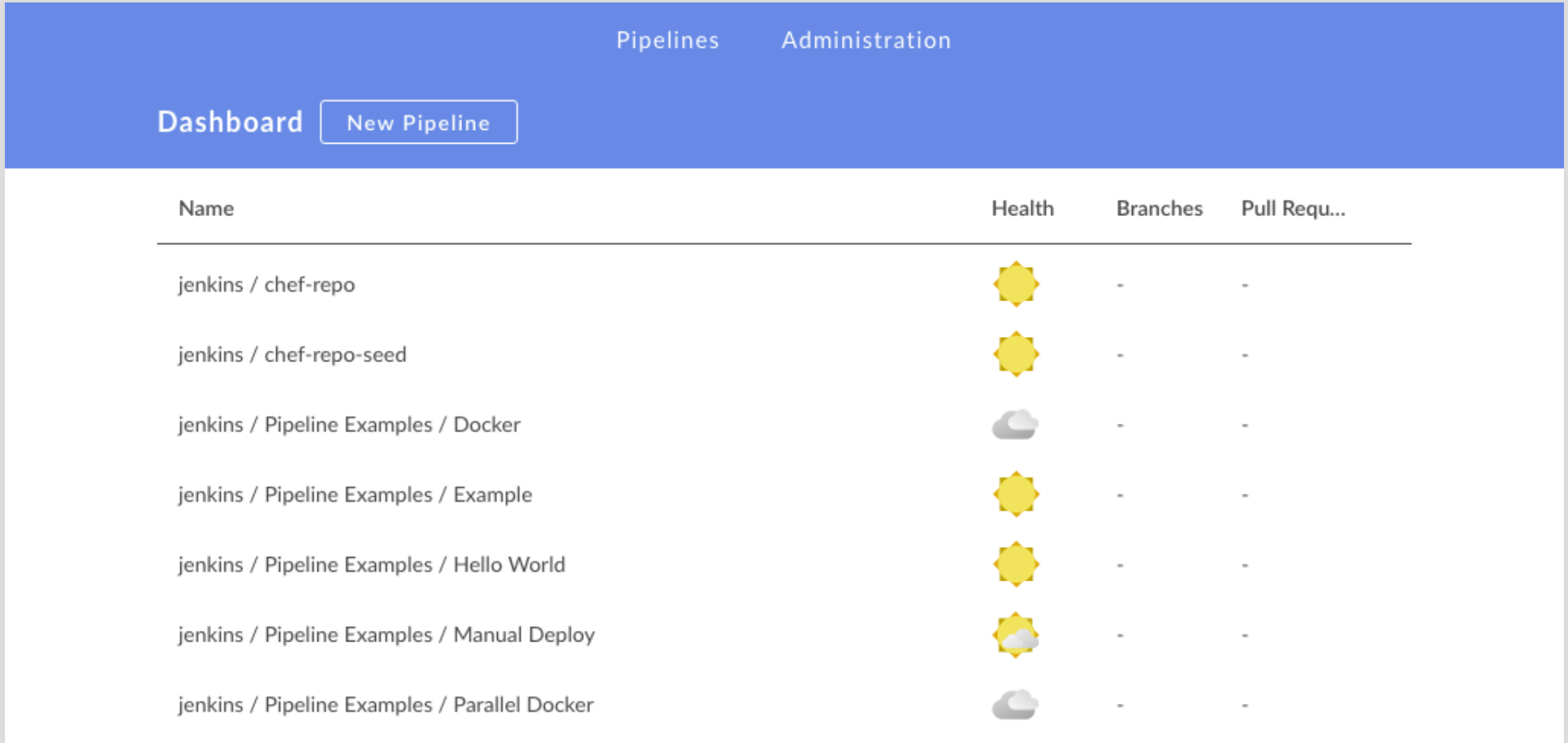
```
def run(Object step){
  try {
    step.execute()
  } catch (err) {
    this.postBuildNotify
    failTheBuild("Build failed")
  }
}
```

A new Jenkins UI

Blue Ocean & Other News

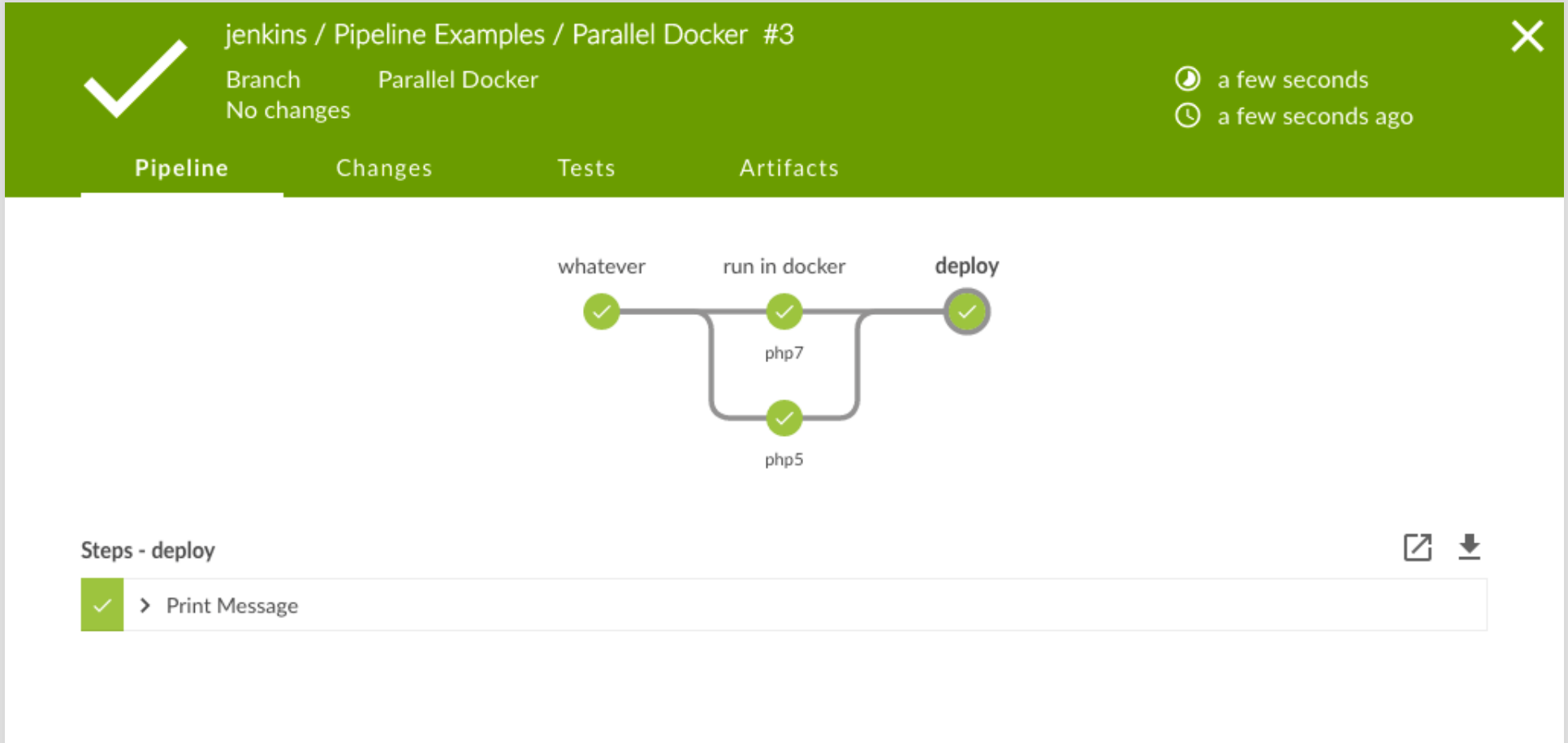
Blue Ocean

- Tailored to the pipeline plugins



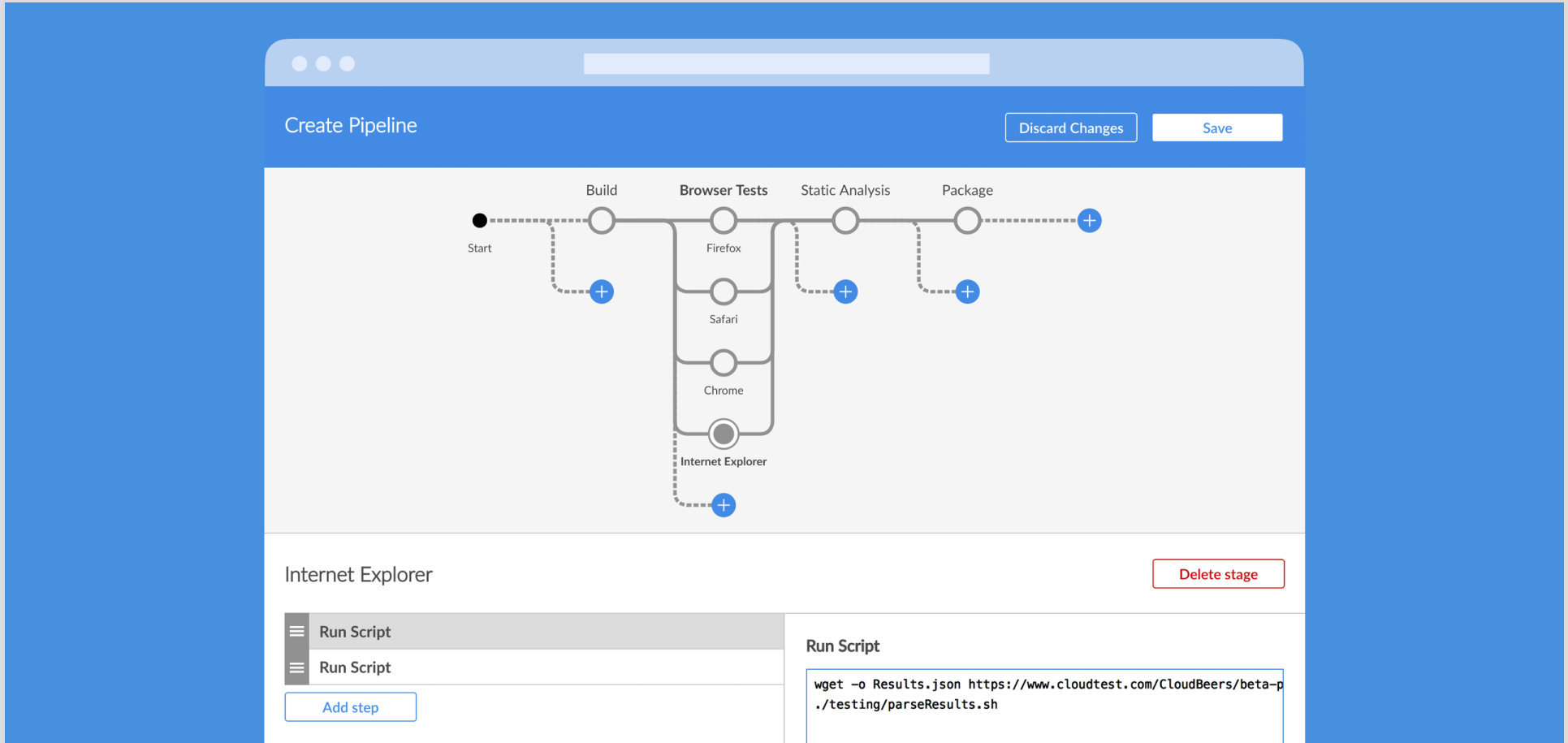
Blue Ocean

- Tailored to the pipeline plugins



Pipeline Editor*

* Recently announced, not yet available



Declarative Pipelines

- Sorry, the code I've shown might be already outdated.. ☺
- Declarative approach solves some issues (failure handling, post-build steps)

```
pipeline {
  agent docker:'node:6.3'
  stages {
    stage('build') {
      sh '..'
    }
    stage ('test') {
      sh 'npm test'
    }
  }
  postBuild {
    always {
      sh 'echo "This will always run"'
    }
    failure {
      sh 'echo "This will run only if failed"'
}}}
```

https://jenkins.io/blog/2016/09/19/blueocean-beta-declarative-pipeline-pipeline-editor/

Summary

- Jenkins pipeline suite modernizes its CI/CD capabilities
  - CloudBees, Inc. is very actively pushing development
  - Many Jenkins plugins already compatible
- Pipeline defined as code
  - Versioned
  - Doesn't mess up Jenkins jobs
  - Code sharing
- Automated pipeline creation based on GitHub/Bitbucket APIs
- Blue Ocean refreshes Jenkins' UI
- Still couple of rough edges (failure handling, frequent changes)

Further Reading

- Pipeline Tutorial:
  https://github.com/jenkinsci/pipeline-plugin/blob/master/TUTORIAL.md
- Getting started with pipelines:
  https://jenkins.io/pipeline/getting-started-pipelines/
- Jenkins World 2016 Wrap Up - Pipelines:
  https://jenkins.io/blog/2016/09/24/jenkins-world-2016-wrap-up-pipeline/
- Step documentation:
  https://jenkins.io/doc/pipeline/steps/
- Pipeline global library:
  https://github.com/jenkinsci/workflow-cps-global-lib-plugin/blob/master/README.md
- Docker in Jenkins pipelines:
  https://jenkins.io/blog/2016/08/08/docker-pipeline-environments/
- Notifications (Mail, Slack, etc.):
  https://jenkins.io/blog/2016/07/18/pipline-notifications/
- Parallel execution:
  https://jenkins.io/blog/2016/06/16/parallel-test-executor-plugin/
- Extending pipeline DSL:
  https://jenkins.io/blog/2016/04/21/dsl-plugins/
- Controlling the Flow with Stage, Lock, and Milestone:
  https://jenkins.io/blog/2016/10/16/stage-lock-milestone/
- TYPO3's Chef CI:
  https://chef-ci.typo3.org

DevOps Würzburg Mainfranken

Startseite Mitglieder Fotos Diskussionen Mehr **Mitglied werden!**

DEVOPS WÜRZBURG

Würzburg, Deutschland
Gegründet 26. Apr 2015

Über uns...

DevOps 74
Anstehende Meetups 1
Unser Kalender

Organisatoren:

Featured Meetup

Erstes DevOps Meetup in Würzburg

Montag, 7. November 2016
19:00

Uni Würzburg, Informatikgebäude
Am Hubland, Würzburg (Karte)

Herzlich Willkommen beim ersten DevOps-Meetup in Unterfranken. Um alle Teilnehmer bei ihrem aktuellen Wissensstand abzuholen, möchten wir das erste Meetup mit zwei kurzen, einführenden Vorträgen beginnen. Hierdurch hoffen wir, ein breites Publikum vom Studenten bishin zum DevOps-Guru zu erreichen.

Vortrag 1 (Lenz Weber, mayflower)
DevOps - neue Antworten auf neue Herausforderungen

Vortrag 2 (Steffen Gebert, Uni Würzburg)
Continuous Delivery - Mit dem Konzept "Continuous Delivery"

Nimmst Du teil?

Beitreten und RSVPen

14 nehmen teil

Steffen G.
Co-Organisator, Event-Koordinator

Andreas R.
Co-Organisator, Event-Koordinator

Sebastian K.
Technical Evangelist at Microsoft. I'm on Twitter: http://twit....