

# MODERN JENKINS

## CONTINUOUS DELIVERY WITH PIPELINE AND BLUEOCEAN

Let's write Jenkins Declarative Pipeline together, for your application !

# **MOTIVATIONS OF THIS TALK**

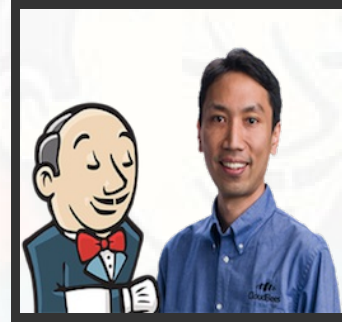
Arguing with an Engineer is  
a lot like wrestling in the  
mud with a pig. After a  
couple of hours, you realize  
the pig likes it.



# **JENKINS PROJECT**

# Jenkins

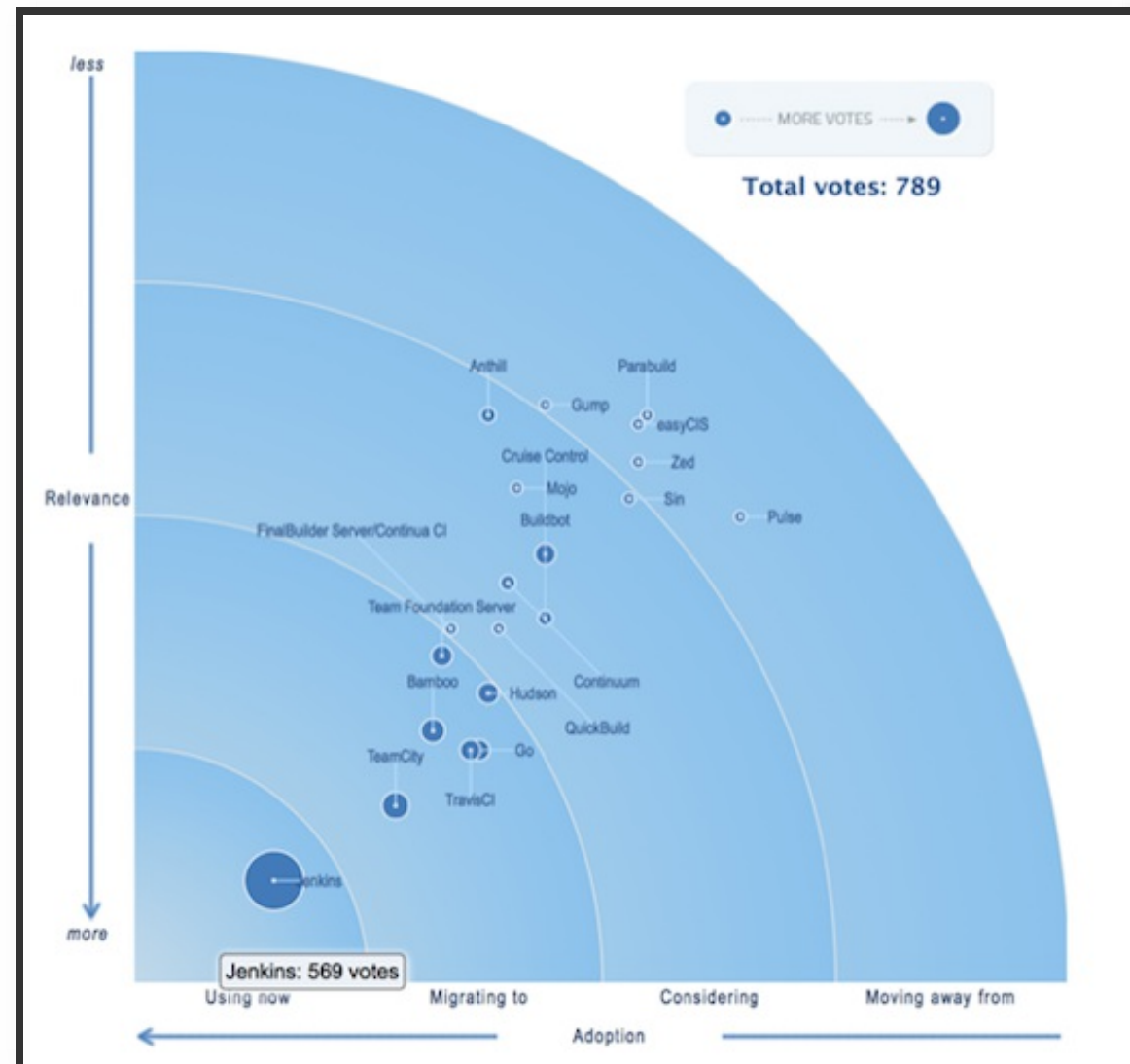
# MEET JENKINS



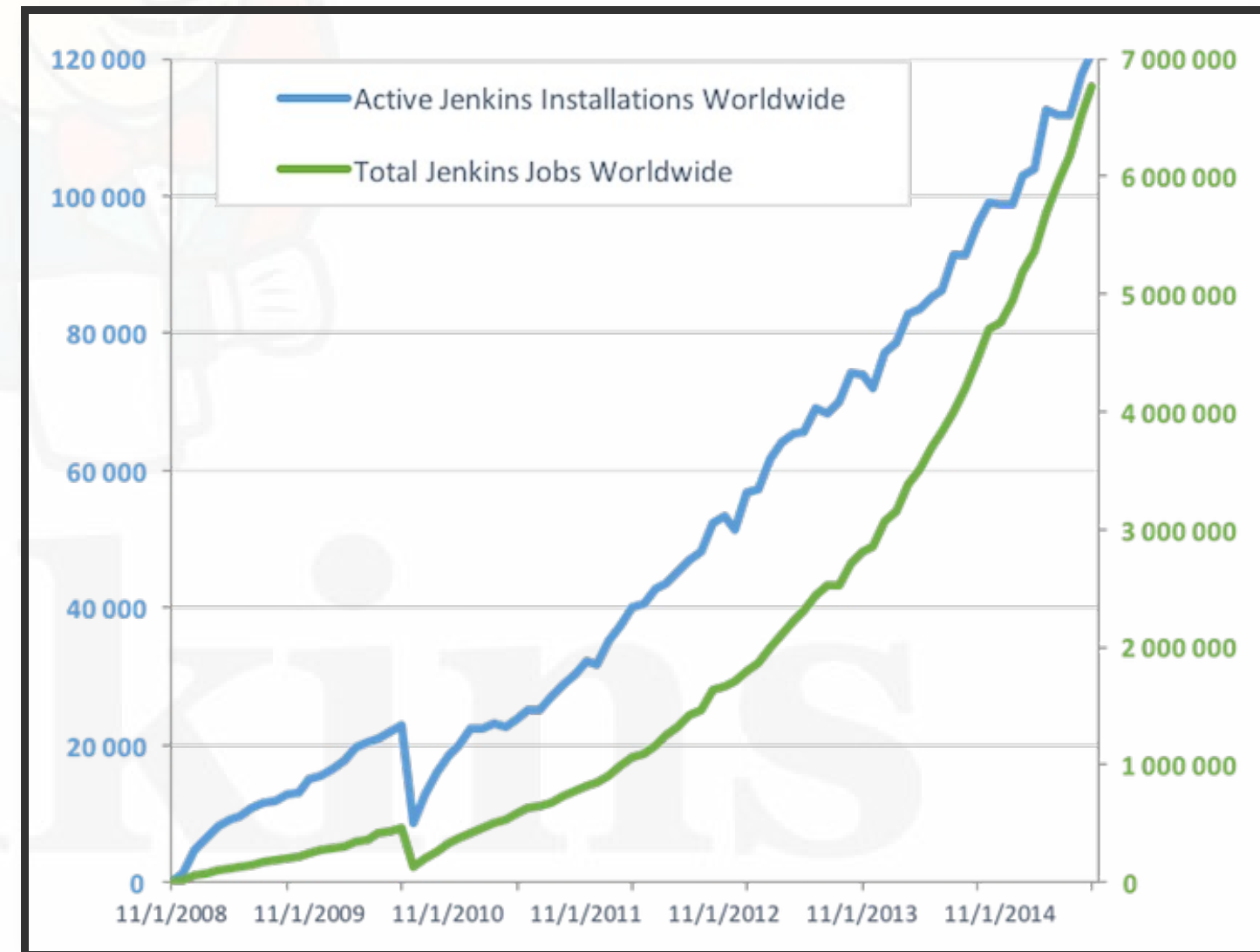
- #1 Continuous Integration and Delivery server
- Created by Kohsuke Kawaguchi 12 years ago (Hudson)
- An independent and active community (<https://jenkins.io>)
- 100,000 active installations
- 300,000 Jenkins servers
- 1,200+ plugins

# JENKINS POPULARITY

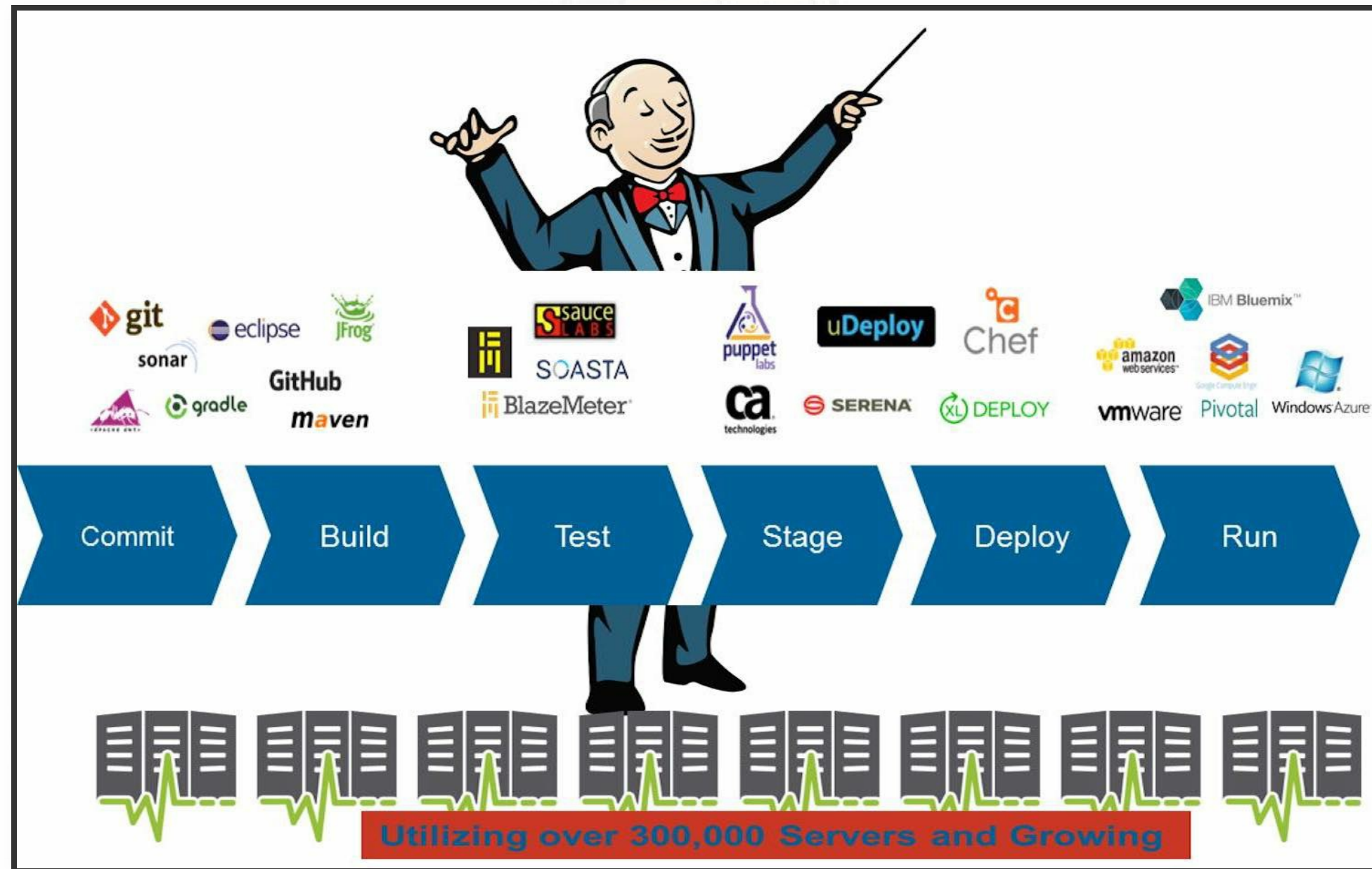
<http://www.infoq.com/research/ci-server>



<http://stats.jenkins.io/>



# JENKINS IS THE CD ORCHESTRATOR





# WHY JENKINS 2

- Jenkins 1 is more than 12 years old
- Because Continuous Integration have changed...
  - [jenkins-ci.org](https://jenkins-ci.org) !?
- slave → agent
- "Fire and forget"
- "Modern Web":
  - <https://jenkins.io>
  - <https://jenkins.io/docs>
  - <https://plugins.jenkins.io>



# JENKINS 2 GOALS

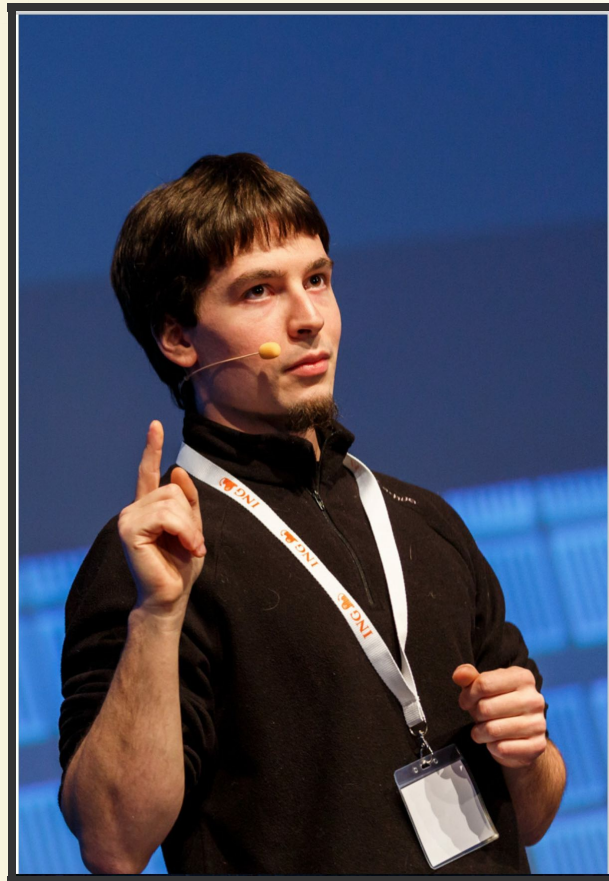
- **Target:** CI → CD
- No breaking changes from Jenkins 1
  - Smooth upgrade
  - Plugins compatibility
- First time experience improvement
  - Brand new Wizard
- **Pipeline-as-Code:**
  - Jenkinsfile stored in SCM
  - Groovy DSL: "Code your Pipeline"

# JENKINS IN 2017

- Declarative Pipeline
  - Still Jenkinsfile
  - Easier
  - Compatible with **Scripted Pipeline**
- BlueOcean
  - Brand new GUI
  - Written in ReactJS
  - Opiniated

**HELLO**

# WHOAMI: DAMIEN DUPORTAL



- Training Engineer @ CloudBees
  - Docker & Apple fanboy. Sorry
  - Human stack focused
  - Rock climber
- Contact:
  - Twitter: [@DamienDuportal](#)
  - Github: [dduportal](#)
  - Google: [damien.duportal@gmail.com](mailto:damien.duportal@gmail.com)

# CLOUDBEES

<sales\_pitch>

- Software at the Speed of Ideas
- Hub of "Enterprise Jenkins and DevOps"
- We provide:
  - Jenkins "Enterprise" Distribution
  - Services around Jenkins

</sales\_pitch>

**WHO ARE YOU ?**

# PREPARE LAB ENVIRONMENT

- Requires VirtualBox  $\geq 5.1.18$

```
vboxmanage --version
```

- Requires Vagrant  $\geq 1.9.1$

```
vagrant version
```

- From a Terminal, download the VM (1 time, ~1Gb):

```
vagrant box add devfest-2017-jenkins \  
https://github.com/oufti-playground/lab-vm/releases/download/devfest-2017/jenkins-lab-c
```

- Initialize the VM project:

```
mkdir devfest-2017-jenkins  
cd devfest-2017-jenkins  
vagrant init -m -f devfest-2017-jenkins
```



# LET'S GET STARTED

- Start the VM from the devfest-2017-jenkins folder:

```
$ ls  
Vagrantfile  
$ pwd  
.../devfest-2017-jenkins  
$ vagrant up
```

- Access your instance homepage:

<http://localhost:10000>

# DEMO APPLICATION

# DEMO APPLICATION: WHY ?

- **Goal:** Illustrate a Software Supply Chain with a demo application
- **Challenge:** So many languages/framework/toolchains
- **Solution:**
  - Opinionated demo application (language, tooling, etc.)
  - Put everyone on same page with initial exercise

# DEMO APPLICATION: WHAT ?

- Web application
- Homepage show a link to /greeting endpoint
- Endpoint /greeting: greets the world
- Provides the parameter **name**: greet the person
  - /greeting?name=Butler prints Hello Butler

# DEMO APPLICATION: TECHNICAL STACK

- This is the **Spring Boot Starter**
- Language: **Java** (OpenJDK 8)
- Toolchain: **Maven** (Maven  $\geq$  3.3)
- Source code stored inside a local **Git** repository

# **DEMO APPLICATION: HOW ?**

# DEMO APPLICATION: ACCESS IT

- Open the local **GitServer**:
  - <http://localhost:10000/gitserver>
- **Sign In** using the top-right button
  - User is butler, same for the password
- Browse to the repository. Either:
  - Click on **Explore** → **butler/demoapp**
  - or direct link: <http://localhost:10000/gitserver/butler/demoapp>



# DEMO APPLICATION: CHECK IT

- Maven configuration: `pom.xml`
- Application Source code: `src/main/java/`
- Application Templates/HTML: `src/main/resources/`
- Application Test code: `src/test/java`

# DEMO APPLICATION: GET IT

- Open the **DevBox**, the Web based command line:
  - `http://localhost:10000/devbox`
  - WebSockets must be authorized
- Copy the demoapp repository URL from **GitServer**
- Run the following commands:

```
# Get the git repository
git clone http://localhost:10000/gitserver/butler/demoapp.git
# Browse to the local repository
cd ./demoapp
# Check source code
ls -l
cat pom.xml
```

# DEMO APPLICATION: DEVBOX TRICKS

- Clean the window: `clear`
- Show command history: `history`
- `CTRL + R`: search the command history interactively
- `CTRL + C`: cancel current command and clean line buffer
- `CTRL + A`: jump to beginning of line
- `CTRL + E`: jump to end of line

# DEMO APPLICATION: MAVEN

- Maven TL;DR:
  - Provide a standardized **workflow**
  - pom.xml describe the application
- Maven Command line : mvn, expects **goals** (workflow steps)

```
mvn dependency:list
```

- Can have **flags** (configuration on the fly)

```
mvn dependency:list -fn
```

# DEMO APPLICATION: COMPILE IT

- Maven goal is **compile**
  - Resolve build dependencies
  - Process source code
  - Generate classes
- Content put in the **./target** folder:

```
mvn compile  
ls -l ./target
```

# DEMO APPLICATION: UNIT-TEST IT

- Maven goal is **test**
  - Execute compile goal
  - Compile Unit Test classes
  - Run Unit Test
- Tests Reports put in the **./target/surefire-reports** folder:

```
mvn test  
ls -l ./target/surefire-reports
```

# DEMO APPLICATION: BUILD IT

- Maven goal is **package**
  - Execute compile and test goals
  - Package the application as specified in pom.xml
- The new artifact (generated packages) is stored in ./target

```
mvn package  
ls -lrh ./target/
```



# DEMO APPLICATION: RUN IT

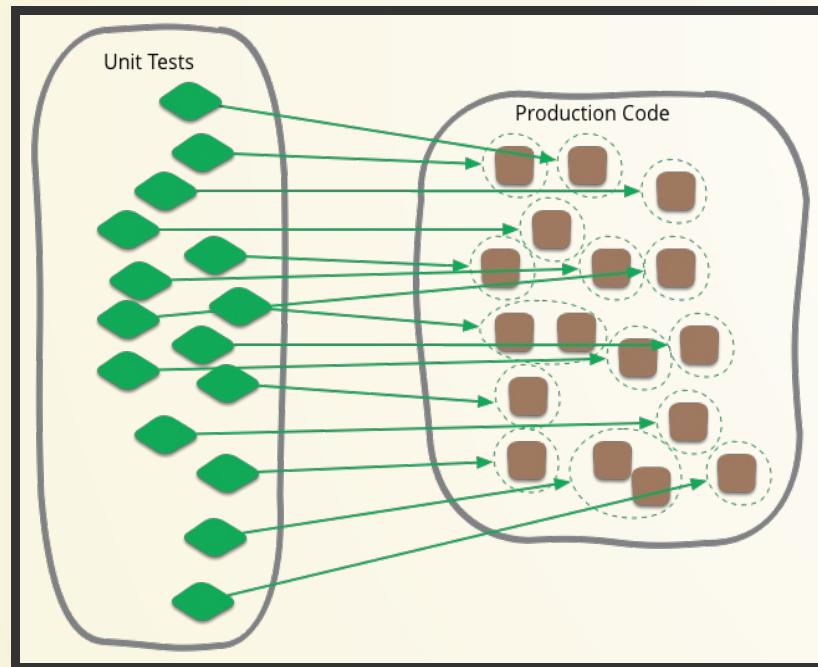
- Spring Boot demo is run as an "Über-Jar"
- You only need the java CLI from a JRE:

```
java -jar ./target/demoapp.jar
```

- Check the application on the 10080 port:
  - <http://localhost:10080>

# DEMO APPLICATION: A NOTE ABOUT TESTS

- Unit / Integration Test ?
  - Bedtime reading: <https://martinfowler.com/tags/testing.html>



# DEMO APPLICATION: INTEGRATION TESTING

- Maven goal is **verify**
  - Execute compile, test and package goals
  - Resolve integration test dependencies
  - Run Tests against the **packaged** application
- Tests Reports stored in the **./target/failsafe-reports** folder:

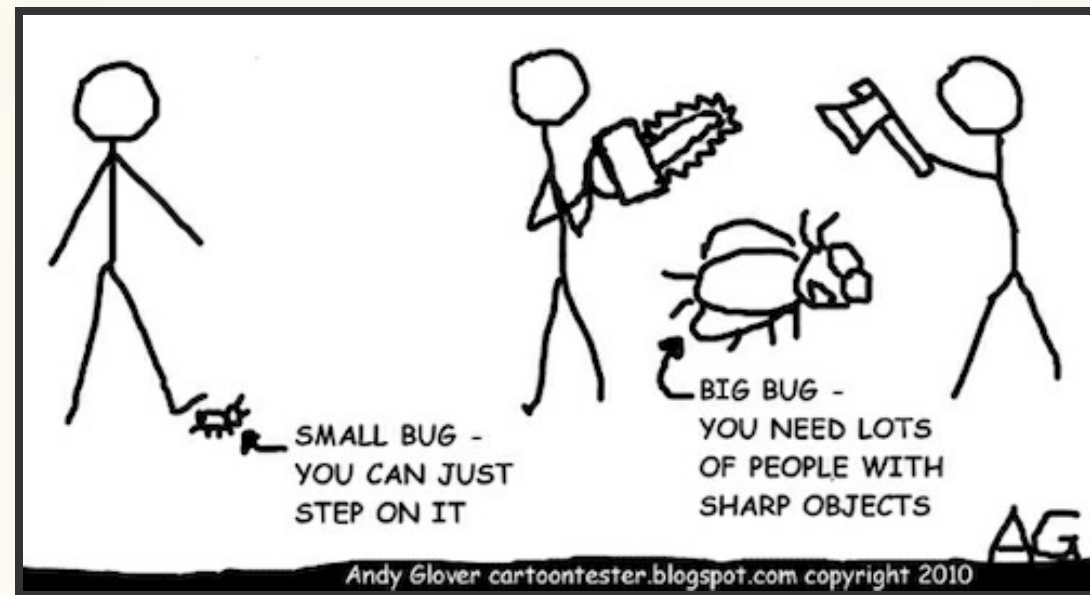
```
mvn verify  
ls -l ./target/failsafe-reports
```

**THAT'S ALL FOLKS !**

# CONTINUOUS INTEGRATION WITH JENKINS

aka "CI"

# CI: WHY ?



*Continuous Integration doesn't get rid of bugs, but it does make them dramatically easier to find and remove.*

— Martin Fowler

# CI: WHAT ?

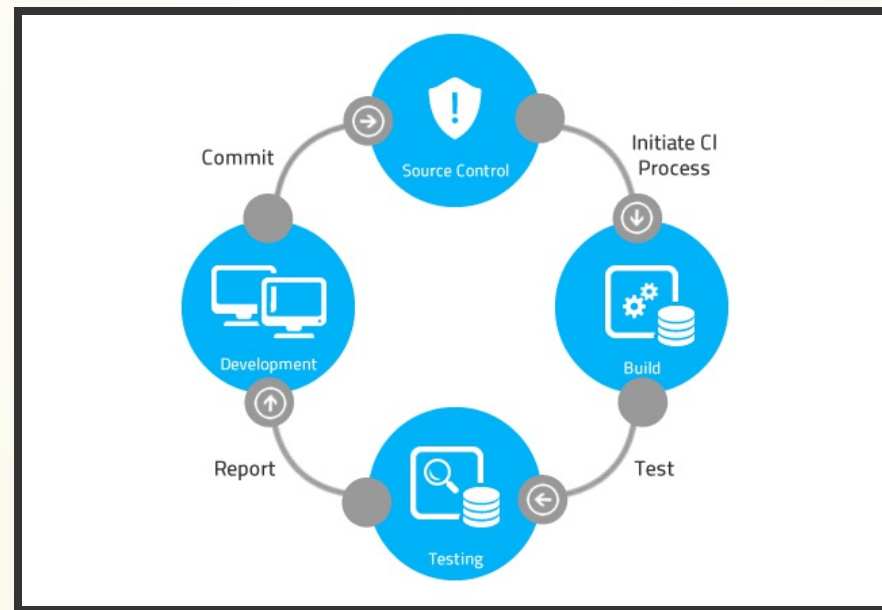
*Continuous Integration is a software development **practice** where members of a team integrate their work **frequently**, usually each person integrates at least daily, leading to **multiple** integrations per day.*

— Martin Fowler - Continuous Integration



# CI: HOW ?

- Each integration is verified by an **automated** build (including test)
- Integrate code **often**, at least daily, to make integration a **non-event**
- **Continuously** build and integrate, with a **feedback loop**



# CONTINUOUS INTEGRATION WITH JENKINS

# CI: ACCESSING JENKINS

- Access your Jenkins instance:
  - <http://localhost:10000/jenkins>
  - **Log in** as the user **butler** (password is the same)
  - It is the "Legacy UI"

# CI: JENKINS BLUEOCEAN

- Switch to BlueOcean, the new UI
  - Direct link: <http://localhost:10000/jenkins/blue>
  - *Or* click on the top button "Open Blue Ocean"

# CI: CREATING PROJECT

- Create your 1st Pipeline:
  - Stored in **Git**
  - Fetch URL from the **Gitserver**
    - Direct link: <http://localhost:10000/gitserver/butler/demoapp.git>
  - Add a **User/password** credential (butler / butler)
  - Pipeline is empty (for now): no Jenkinsfile

# CI: FAST FEEDBACK WITH WEBHOOKS

- We want **Fast feedback** !
  - Pushed code to repository ? Tell Jenkins to build it **now**
- Let's use **Webhook** to the repository
  - HTTP request **Gitserver** → **Jenkins**

# CI: ADD A GOGS WEBHOOKS

- From repo. in **Gitserver** → **Settings** → **Webhooks**
  - Direct link:  
<http://localhost:10000/gitserver/butler/demoapp/settings/hooks>
- Add a **Gogs** webhook:
  - Payload URL: <http://localhost:10000/jenkins/job/demoapp/build?delay=0>
  - When should this webhook be triggered?: **I need everything**

# CI: STARTING WITH PIPELINES

- Pipeline-as-code: We need a Jenkinsfile
  - **Declarative or Scripted ?**
- Where to start ?
  - Documentation: <https://jenkins.io/doc/pipeline>
  - Getting Started: <https://jenkins.io/doc/pipeline/tour/hello-world/>
  - Syntax Reference: <https://jenkins.io/doc/book/pipeline/syntax/>



# CI: BLUEOCEAN PIPELINE EDITOR

- Provides the **full** round trip with SCM
- No Pipeline ? Follow the wizard (not Gandalf, fool !)
- Already have a Pipeline ? Edit, commit, run it
- Needs a **compliant** SCM
  - Only Github with BO 1.0.1
  - Interested ? **Open-Source**: Contribute !

# CI: USE THE PIPELINE EDITOR

- Let's **hack**: open the **BlueOcean Pipeline Editor**
  - Direct (hidden) URL:  
<http://localhost:10000/jenkins/blue/organizations/jenkins/pipeline-editor/>
  - Use CTRL + S (On Mac: CMD + S) to switch to textual version
- The "Legacy" Pipeline Syntax Snippet Generator could be useful:
  - <http://localhost:10000/jenkins/job/demoapp/pipeline-syntax/>

# CI: EXERCISE - YOUR FIRST PIPELINE

- Use the **BlueOcean Pipeline Editor** and **Gitserver**
- Create a Pipeline that have a single stage "Hello"
- This stage have 1 step that prints the message "Hello World"
- Copy/Paste this Pipeline in a new file Jenkinsfile on the repository root
- A build will kick off immediately:
  - **demoapp Activity Dashboard**

# CI: SOLUTION - YOUR FIRST PIPELINE

```
pipeline {  
  agent any  
  stages {  
    stage('Build') {  
      steps {  
        echo 'Hello World !'  
      }  
    }  
  }  
}
```

# CI: EXERCISE - SIMPLE BUILD PIPELINE

- Exercise: Implement a simple build pipeline demoapp
- We want 4 stages, for the 4 Maven goals:
  - clean compile, test, package, verify
- We need to build on the maven agent

# CI: SOLUTION - SIMPLE BUILD PIPELINE

```
pipeline {
  agent {
    node {
      label 'maven'
    }
  }
  stages {
    stage('Compile') {
      steps {
        sh 'mvn compile'
      }
    }
    stage('Unit Tests') {
      steps {
        sh 'mvn test'
      }
    }
  }
}
```

# CI: EXERCISE - ARTIFACTS

- We want to simplify to 2 stages, based on Unit Tests definition:
  - Build: compile, unit test and package the application
  - Verify: Run Integration Tests
- We also want to **archive** the generated jar file
  - Only if the build is in success
- *Clues:* Keywords `post + success` (not in Editor), and `archiveArtifacts`

# CI: SOLUTION - ARTIFACTS

```
pipeline {
  agent {
    node {
      label 'maven'
    }
  }
  stages {
    stage('Build') {
      steps {
        sh 'mvn clean compile test package'
      }
    }
    stage('Verify') {
      steps {
        sh 'mvn verify'
      }
    }
  }
}
```



# CI: EXERCISE - INTEGRATION TESTS REPORTS

- We want the integration test reports to be published to Jenkins
  - **Better** feedback loop
- If Integration Tests are failing, do NOT fail the build
  - Make it **UNSTABLE** instead
- *Clues:*
  - Maven flag -fn ("Fails Never")
  - keyword junit (Pipeline keyword)

# CI: SOLUTION - INTEGRATION TESTS REPORTS

```
pipeline {
  agent {
    node {
      label 'maven'
    }
  }
  stages {
    stage('Build') {
      steps {
        sh 'mvn clean compile test package'
      }
    }
    stage('Verify') {
      steps {
        sh 'mvn verify -fn'
        junit '**/target/failsafe-reports/* xml'
```

# CI: EXERCISE - ALL TESTS REPORTS

- We now want **all** test reports published
  - **Problem:** how to handle Unit test failure ?
- We also want to archive artifacts if build is unstable **only** due to the Verify stage
- *Clues:* post can be used per stage

# CI: SOLUTION - ALL TESTS REPORTS

```
pipeline {
  agent {
    node {
      label 'maven'
    }
  }
  stages {
    stage('Build') {
      steps {
        sh 'mvn clean compile test package'
      }
      post {
        always {
          junit '**/target/surefire-reports/*.xml'
        }
      }
    }
  }
}
```

# CI: FAILING TESTS














- Validate your changes by making your tests fails.
- Edit each one and uncomment the failing block:
  - Integration: `src/master/src/test/java/hello/ApplicationIT.java`
  - Unit Tests: `src/master/src/test/java/hello/ApplicationTest.java`
- Browse the top-level items "Changes", "Tests" and "Artifacts"
- Do **NOT** forget to correct your tests at the end

**THAT'S ALL FOLKS !**

# DOCKER

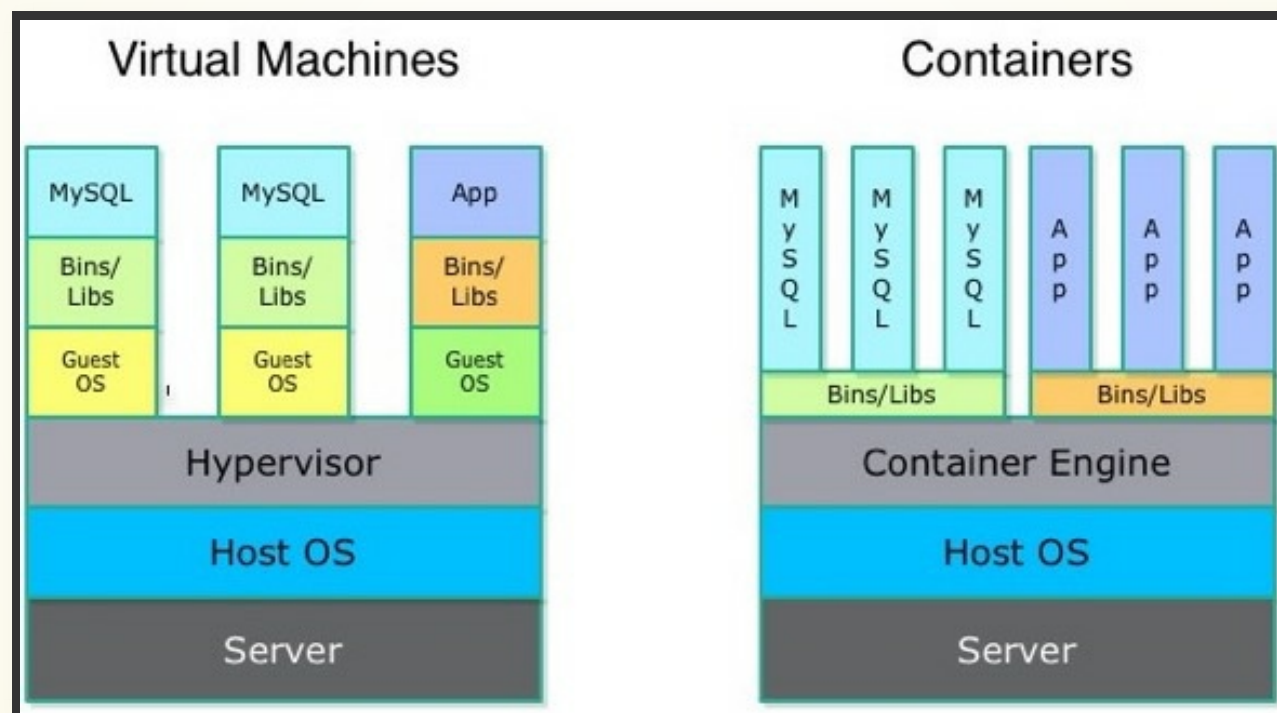
to the Rescue

# DOCKER: WHY ?

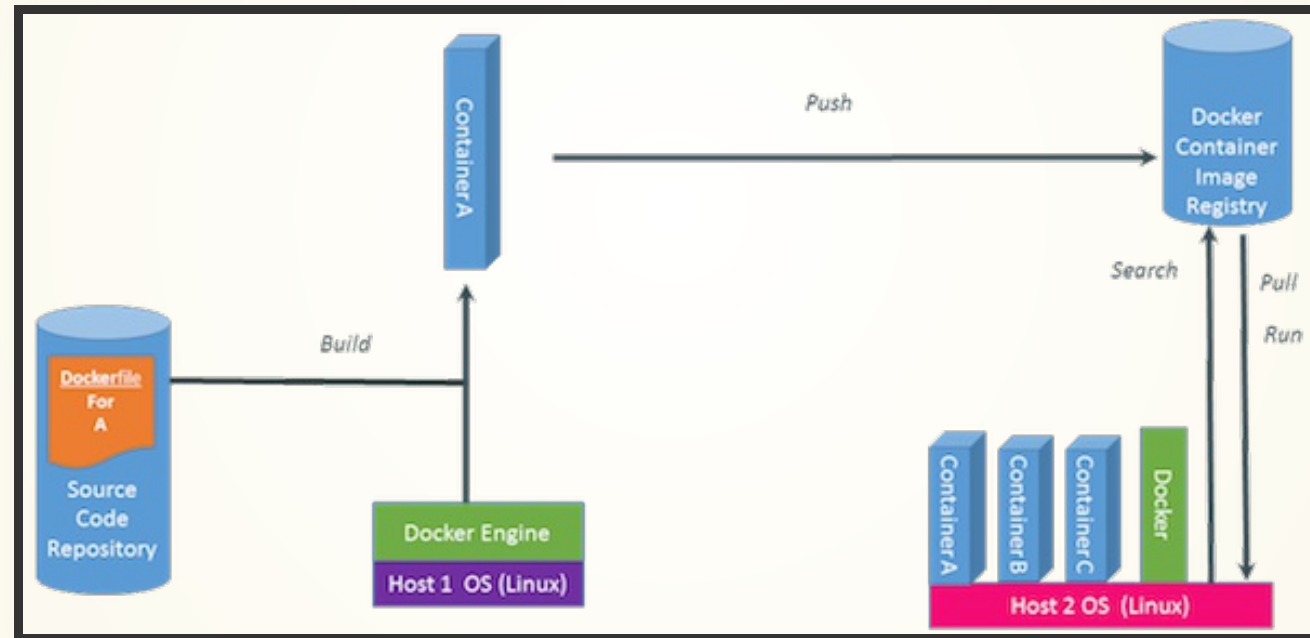
	Static website	?	?	?	?	?	?	?
	Web frontend	?	?	?	?	?	?	?
	Background workers	?	?	?	?	?	?	?
	User DB	?	?	?	?	?	?	?
	Analytics DB	?	?	?	?	?	?	?
	Queue	?	?	?	?	?	?	?
		Development VM	QA Server	Single Prod Server	Onsite Cluster	Public Cloud	Contributor's laptop	Customer Servers
								



# DOCKER: WHAT ?



# DOCKER HOW ?



# DOCKER: DOCKERFILE

- Dockerfile: recipe for building your **immutable** image

```
FROM debian:jessie
LABEL Maintainer="Damien DUPORTAL"

RUN apt-get update && apt-get install -y nginx

VOLUME ["/tmp","/app"]

EXPOSE 80

ENTRYPOINT ["/usr/sbin/nginx"]
CMD ["-g","daemon off;"]
```

# DOCKER: BUILDING DOCKER IMAGE

- Using the docker CLI:

```
docker build -t my_image:1.0.0 ./
```

# DOCKER: RUNNING A DOCKER

- Using the docker CLI:

```
docker run -P -d my_image:1.0.0
```

# DOCKER: DEMO APPLICATION'S DOCKERFILE

- Using **GitServer**, from the repository root
  - Check the Dockerfile content

# DOCKER: BUILDING DEMO APPLICATION

- Using **Devbox**, from the local repository root
  - Checking images with docker images
  - Build an image named demoapp:latest
  - Check again images

# DOCKER: RUNNING DOCKER CONTAINER

- Using **Devbox**, from the local repository root
  - Check running containers with `docker ps`
  - Run and test the container with this command:

```
docker run -p 10081:8080 -d my_image:1.0.0  
# Then open http://localhost:10081/
```

- Stop it with `docker stop <Container ID>`



# CONTINUOUS DELIVERY WITH JENKINS

aka "CD"

# CD: WHY ?

*How long would it take to your organization to deploy a change that involves just one single line of code?*

- Reduce deployment risks
- Allow more frequent user feedback
- Make progress believable by everyone

# CD: WHAT ?

Continuous Delivery is the next step after Continuous Integration:

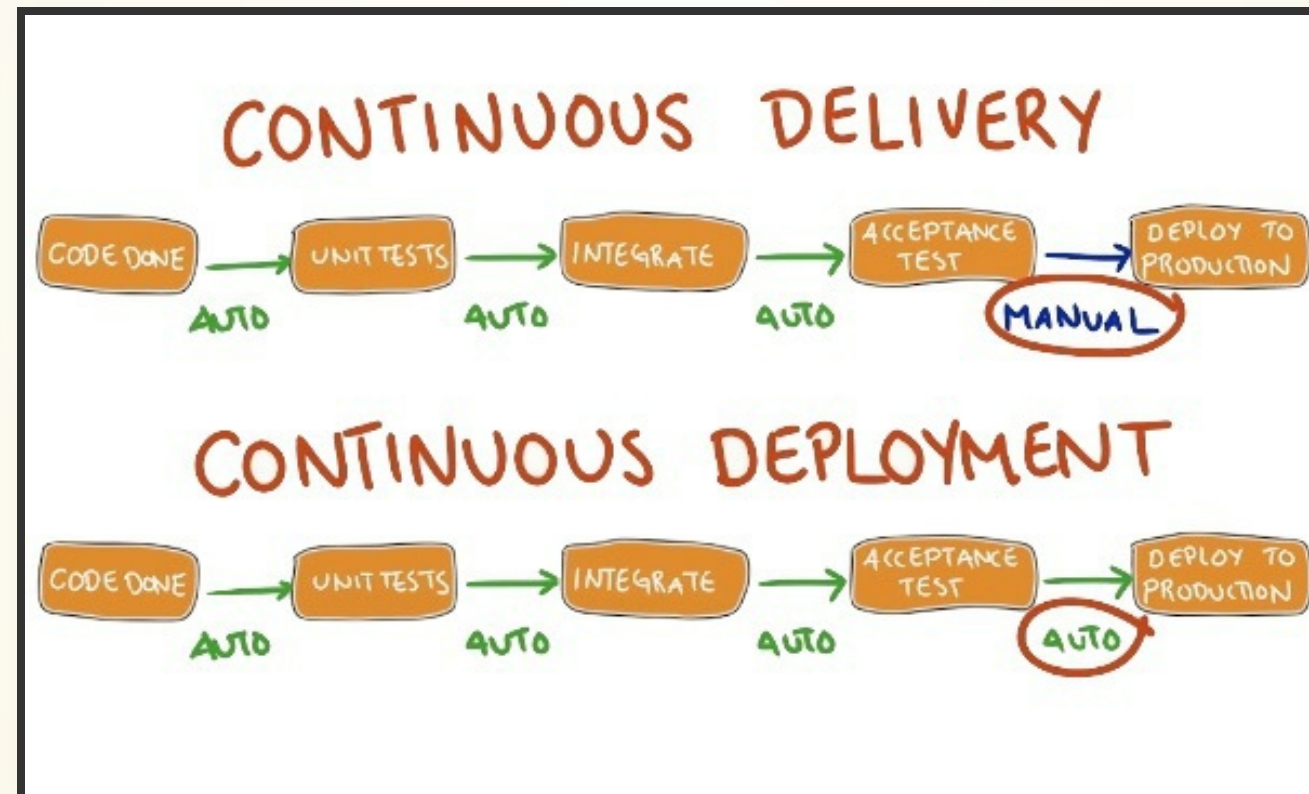
- Every change to the system **can** be released for **production**
- Delivery can be done at **any** time, on **any** environment

*Your team prioritizes keeping the software **deployable** over working on new features*

— Martin Fowler

# CD IS NOT CONTINUOUS DEPLOYMENT

Both are always confused:



# CD: HOW ?

- Having a collaborating working relationship with **everyone** involved
- Using **Deployment Pipelines**, which are automated implementations of your application's build lifecycle process

# CD: DELIVERY TARGET

- Production runs on Docker
- Your Ops team use a Docker Registry
- Expected Artifact:
  - Not a jar file
  - But a Docker image

# CD: EXERCISE - GENERATE DOCKER IMAGE

- Goal: Add a stage named "Docker" for building the Docker image
  - **Before** Integration Test
  - This steps should use the name demoapp:latest
  - **Challenge:** we need the jar file
- *Clues:* Keywords stash and unstash

# CD: SOLUTION - GENERATE DOCKER IMAGE

```
pipeline {
  agent {
    node {
      label 'maven'
    }
  }
  stages {
    stage('Build') {
      steps {
        sh 'mvn clean compile test package'
        stash(name: 'app', includes: 'target/demoapp.jar')
      }
    }
    post {
      always {
        junit '**/target/surefire-reports/*.xml'
      }
    }
  }
}
```



# CD: EXERCISE - DOCKER SMOKE TEST

- Goal: Run a Docker **Smoke Test** before Integration Tests
  - Use the command `bats ./src/test/bats/docker.bats`
    - It takes care of building and naming the docker resources
  - We do not need to archive the artifact unless Integration Test is unstable

# CD: SOLUTION - DOCKER SMOKE TEST

```
pipeline {
  agent {
    node {
      label 'maven'
    }
  }
  stages {
    stage('Build') {
      steps {
        sh 'mvn clean compile test package'
        stash(name: 'app', includes: 'target/demoapp.jar')
      }
    }
    post {
      always {
        junit '**/target/surefire-reports/*.xml'
      }
    }
  }
}
```

# CD: EXERCISE - APPROVAL AND DELIVERY

- Goal: Manual Approval for Delivery
- Add a stage named Delivery that will:
  - Ask for a manual validation, after Integration Tests
  - And will push the Docker Image to the registry localhost:5000
- *Clues:* Keyword input

# CD: SOLUTION - APPROVAL AND DELIVERY

```
pipeline {
  agent {
    node {
      label 'maven'
    }
  }
  stages {
    stage('Build') {
      steps {
        sh 'mvn clean compile test package'
        stash(name: 'app', includes: 'target/demoapp.jar')
      }
      post {
        always {
          junit '**/target/surefire-reports/*.xml'
        }
      }
    }
  }
}
```

# CD: EXERCISE - BUILDING WITH DOCKER

- Goal: Use Docker to provide the build environment
  - Use the agent allocation to build and run builds within a Docker container
  - Use the Dockerfile.build from the repository
- *Clues:* Keyword agent any, agent { dockerfile }

# CD: SOLUTION - BUILDING WITH DOCKER

```
pipeline {
  agent any
  stages {
    stage('Build') {
      agent {
        dockerfile {
          filename 'Dockerfile.build'
        }
      }
    }
  }
  steps {
    sh 'mvn clean compile test package'
    stash(name: 'app', includes: 'target/demoapp.jar')
  }
  post {
    always {
      junit '**/target/surefire-reports/*.*xml'
```

# CD: EXERCISE - PARALLEL STAGES

- Goal: Run Stages in parallels to gain time
  - We can safely run Docker Smoke and Integration Tests in parallel
  - To specify a specific agent, use Scripted Pipeline Block and the node allocation
- *Clues:* Keyword parallel, script, node

# CD: SOLUTION - PARALLEL STAGES

```
pipeline {
  agent any
  stages {
    stage('Build') {
      agent {
        dockerfile {
          filename 'Dockerfile.build'
        }
      }
      steps {
        sh 'mvn clean compile test package'
        stash(name: 'app', includes: 'target/demoapp.jar')
      }
      post {
        always {
          junit '**/target/surefire-reports/*.*xml'
```



# CD: EXERCISE - SCALING PIPELINE

- **Goal:** Share Pipeline across your teams
- We want to use **Shared Libraries**
- There is one autoconfigured named deploy
- Use the annotation to load the Library, on master branch
- Check the library **here**

# CD: SOLUTION - SCALING PIPELINE

```
@Library('deploy@master') _  
  
pipeline {  
  agent {  
    label 'docker'  
  }  
  stages {  
    stage('Build') {  
      agent {  
        dockerfile {  
          filename 'Dockerfile.build'  
        }  
      }  
    }  
  }  
  steps {  
    sh 'mvn clean compile test package'  
    stash(name: 'app', includes: 'target/demoapp.jar')
```

**THAT'S ALL FOLKS !**

# THANK YOU !

- DevFest organization
- CloudBees and Jenkins Community
- YOU