



Introduction to Declarative Pipeline

In the beginning there was
the Freestyle job...



freestylingit Config [Jenkins]

Craig

05202017259.jenkins.beedemo.net/job/freestylingit/configure

Managed Master

Open Blue Ocean

search

cvitter | log out

Jenkins05202017259freestylingit

General

Source Code Management

Build Triggers

Build Environment

Build

Post-build Actions

Project name

freestylingit

Description

[Plain text] [Preview](#)

☐ Discard old builds

☐ GitHub project

☐ This project is parameterized

☐ Throttle builds

☐ Disable this project

☐ Execute concurrent builds if necessary

☒ Restrict where this project can be run

?

?

?

?

?

?

?

Label Expression

Advanced...

Source Code Management

None

Git

Save

Apply

What's Wrong With Freestyle Jobs?

While the Freestyle job type has served the Hudson/Jenkins community well for years it has some major issues including:

- **UI Bound** - The configuration of a job is limited to what can be expressed via the limits of the Jenkins' UI and doesn't allow for building complicated workflows with features like:
 - Control over where builds are executed
 - Flow control (if-then-else, when, try-catch-finally)
 - Ability to run steps in parallel
- **Not Auditable** - The creation and editing of jobs isn't auditable without using additional plugins

Enter Jenkins Pipeline...



What is a Jenkins Pipeline?

Jenkins Pipeline (formerly known as Workflow) was introduced in **2014** and built into Jenkins 2.0 when it was released.

Pipelines are:

- A **Job** type - The configuration of the job and steps to execute are defined in a script (**Groovy** or **Declarative** based with a Domain Specific Language) that can be stored in an external SCM
- **Auditable** - changes can be audited via your SCM
- **Durable** - can keep running even if the master fails
- **Distributable** - pipelines can be run across multiple agents including execution of steps in parallel
- **Pausable** - can wait for user input before proceeding
- **Visualizable** - enables status-at-a-glance dashboards like the built in Pipeline Stage View and Blue Ocean

Why You Should Use Declarative Instead of Scripted

While Declarative Pipelines use the same execution engine as Scripted pipelines Declarative adds the following benefits:

- **Easier to Learn** - the Pipeline DSL (Domain Specific Language) is more approachable than Groovy making it quicker to get started using
- **Docker Pipeline Integration** - ability to execute builds within one or more docker containers is built into Declarative without requiring additional plugins
- **Syntax Checking** - Declarative syntax adds the following types of syntax checking that don't exist for Scripted pipelines:
 - Immediate runtime syntax checking with explicit error messages.
 - API and CLI based file linting
- **Round Trip Visual Editing** - The Blue Ocean pipeline editor can read and write Declarative syntax (but not Scripted)

Creating a Pipeline



The Simplest Declarative Jenkins File vs Scripted

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

```
node {  
  echo 'Hello World!'  
}
```

Pipeline

Definition Pipeline script

Script

```
1 pipeline {  
2   agent any  
3  
4   stages {  
5     stage('Say Hello') {  
6       steps {  
7         echo 'Hello World'  
8       }  
9       post {  
10        always {  
11          echo "Running ${env.JOB_NAME} (${env.BUILD_ID}) on ${env.JENKINS_URL}"  
12        }  
13      }  
14    }  
15  }
```

☒ Use Groovy Sandbox

[Pipeline Syntax](#)

Save Apply

Hands On Exercise 1.1

Create a Simple Declarative Pipeline

<https://github.com/PipelineHandsOn/intro-to-declarative-pipeline/blob/master/Exercise-01.md>

The Jenkins Snippet Generator

The screenshot shows the Jenkins Snippet Generator web interface. The browser address bar indicates the URL is `localhost:8080/job/BasicPipeline/pipeline-syntax/`. The page header includes the CloudBees Jenkins Enterprise logo, a search bar, and user links for 'admin' and 'log out'. The breadcrumb trail shows 'Jenkins > BasicPipeline > Pipeline Syntax'. On the left sidebar, there are links for 'Back', 'Snippet Generator' (active), 'Step Reference', 'Global Variables Reference', 'Online Documentation', and 'IntelliJ IDEA GDSL'. The main content area has an 'Overview' section explaining the tool's purpose. Below this is a 'Steps' section with a dropdown menu showing 'stash: Stash some files to be used later in the build'. Further down are input fields for 'Name' (containing 'test.lib'), 'Includes', and 'Excludes', along with a checked checkbox for 'Use Default Ant Excludes'. A 'Generate Pipeline Script' button is positioned above a text area that displays the generated snippet: `stash 'test.lib'`. The bottom status bar shows the path `localhost:8080/job/BasicPipeline/pipeline-syntax/globals` and a partially visible 'Global Variables' section.

Pipeline Replay

The screenshot shows the CloudBees Jenkins Enterprise web interface. The browser address bar indicates the URL `localhost:8080/job/BasicPipeline/13/replay/`. The page title is "Replay #13 [Jenkins]". The main header includes the CloudBees logo, the text "CloudBees Jenkins Enterprise", a button "Open Blue Ocean", a red notification badge with the number "1", a search bar, and links for "admin" and "log out". The breadcrumb navigation shows "Jenkins > BasicPipeline > #13 > Replay".

On the left sidebar, there are several navigation links: "Back to Project", "Status", "Changes", "Console Output", "Edit Build Information", "Delete Build", "Replay" (highlighted with a green arrow), "Pipeline Steps", and "Previous Build".

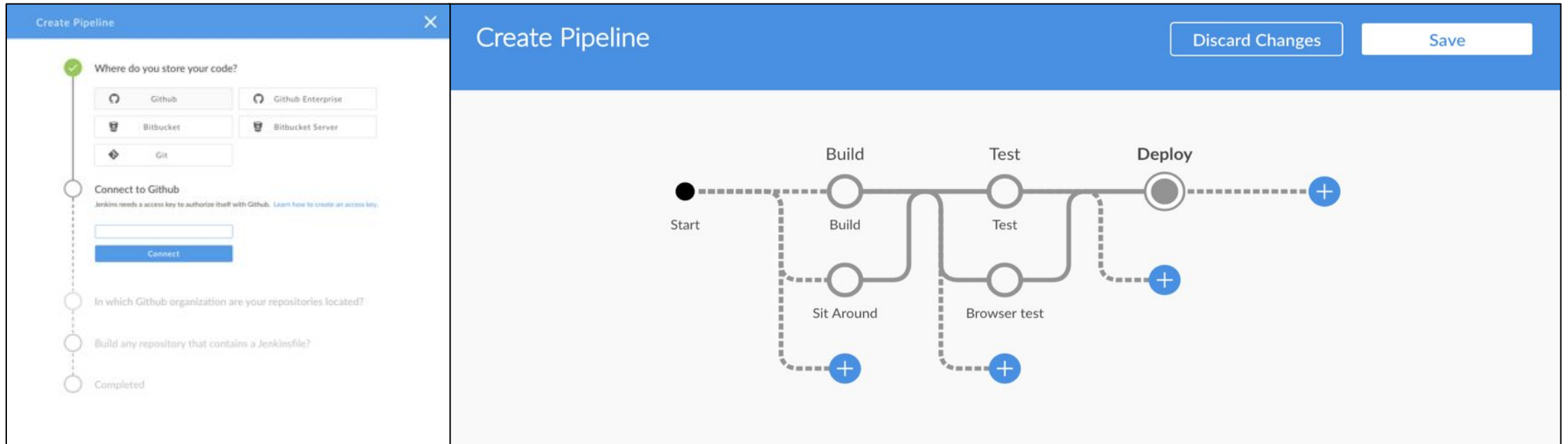
The main content area is titled "Replay #13" and includes a description: "Allows you to replay a Pipeline build with a modified script. If any load steps were run, you can also modify the scripts they loaded." Below this, there is a section for the "Main Script" with a line-numbered code editor. The script is a Jenkins pipeline script:

```
1 pipeline {
2   agent any
3
4   stages {
5     stage('Say Hello') {
6       steps {
7         echo 'Hello World!'
8       }
9       post {
10        always {
11          echo "Running ${env.JOB_NAME} (${env.BUILD_ID}) on ${env.JENKINS_URL}"
12        }
13      }
14    }
15  }
16 }
```

Below the code editor, there is a link "Pipeline Syntax" and a blue "Run" button.

The footer of the page contains the text "CloudBees Jenkins Platform" on the left, "Page generated: May 30, 2017 4:57:06 PM" in the center, and "CloudBees Jenkins Enterprise 2.46.2.1-rolling" on the right.

Blue Ocean Editor



Beyond Hello World



Specifying Agents

```
pipeline {  
  agent any  
  stages { ... }  
}
```

```
pipeline {  
  agent {  
    docker { image 'maven:3.3-jdk-8' }  
  }  
  stages { ... }  
}
```

```
pipeline {  
  agent none  
  stages {  
    stage('Build') {  
      agent any  
      steps {  
        sh 'make'  
        stash includes: '**/target/*.jar', name:  
'app'  
      }  
    }  
    stage('Test') {  
      agent { label 'linux' }  
      steps {  
        unstash 'app'  
        ...  
      }  
    }  
  }  
}
```

Hands On Exercise 1.2

Define a Docker Based Agent

<https://github.com/PipelineHandsOn/intro-to-declarative-pipeline/blob/master/Exercise-01.md#exercise-12>

Environmental Variables

```
pipeline {
  agent any

  environment {
    A_VALUE = 'Some Value'
  }

  stages {
    stage('Build') {
      steps {
        echo "${A_VALUE}"
        echo "${env.BUILD_ID}"
        echo "${currentBuild.result}"
      }
    }
  }
}
```

Credentials

```
pipeline {
  agent any

  environment {
    SONAR = credentials('sonar')
  }

  stages {
    stage('Build') {
      steps {
        echo "${SONAR_USR}"
        echo "${SONAR_PSW}"
      }
    }
  }
}
```

<http://localhost:8080/job/BasicPipeline/pipeline-syntax/globals>

Hands On Exercise 1.3

Add Environmental Variables

<https://github.com/PipelineHandsOn/intro-to-declarative-pipeline/blob/master/Exercise-01.md#exercise-13>

Parameters

```
pipeline {
  agent any

  parameters {
    string(name: 'Greeting', defaultValue: 'Hello',
           description: 'How should I greet the world?')
  }

  stages {
    stage('Example') {
      steps {
        echo "${params.Greeting} World!"
      }
    }
  }
}
```

Hands On Exercise 1.4

Capture Input Parameters

<https://github.com/PipelineHandsOn/intro-to-declarative-pipeline/blob/master/Exercise-01.md#exercise-14>

Capturing User Input

```
stage('Deploy') {  
  steps {  
    input 'Should I Deploy?'  
  }  
}
```

```
[Pipeline] { (Deploy)  
[Pipeline] input  
Should I Deploy?  
Proceed or Abort  
Approved by admin  
[Pipeline] }
```

```
stage('Input') {  
  steps {  
    script {  
      returnValue = input message:  
        'Need some input',  
        parameters: [string(defaultValue: '',  
        description: '',  
        name: 'Give me a value')]  
    }  
    echo "${returnValue}"  
  }  
}
```



Steps - Deploy

Wait for interactive input 1m 54s

Should I Deploy?

Proceed Abort

Steps - Input

Wait for interactive input 41s

Need some input

Proceed Abort

Retry, Timeout, and Sleep

```
stage('Deploy') {  
  steps {  
    retry(3) {  
      sh './flakey-deploy.sh'  
    }  
  
    timeout(time: 3, unit: 'MINUTES') {  
      sh './health-check.sh'  
    }  
  }  
}
```

```
stage('Deploy') {  
  steps {  
    sleep time: 15, unit: 'SECONDS'  
  }  
}
```

```
stage('Deploy') {  
  steps {  
    timeout(time: 3, unit: 'MINUTES') {  
      retry(5) {  
        sh './flakey-deploy.sh'  
      }  
    }  
  }  
}
```

Hands On Exercise 1.5

Capture User Input During Run Time

<https://github.com/PipelineHandsOn/intro-to-declarative-pipeline/blob/master/Exercise-01.md#exercise-15>

Post Actions

```
pipeline {
  agent any

  stages { ... }
  post {
    always {
      echo 'I always run!'
    }
    success { ... }
    failure { ... }
    aborted { ... }
    unstable { ... }
    changed { ... }
  }
}
```

```
pipeline {
  agent any

  stages {
    stage('Build') {
      steps {
      }
      post {
        always {
          echo 'I always run!'
        }
        success { ... }
      }
    }
  }
}
```


Hands On Exercise 1.6

Handling Post Actions

<https://github.com/PipelineHandsOn/intro-to-declarative-pipeline/blob/master/Exercise-01.md#exercise-16>

Shared Libraries

```
// Groovy Library located in
// github.com/example/CraigsLibs/vars/helloWorld.groovy
def call(name) {
    echo "Hello ${name}"
    echo "Have a great day!"
}
```

The screenshot shows the Jenkins configuration page for a shared library named 'CraigsLibs'. The 'Name' field is 'CraigsLibs' and the 'Default version' is 'master'. Below this, it states 'Currently maps to revision: f45ffa4f941692e971fbb9618b6034174ed60a1e'. The 'Load implicitly' checkbox is checked. Under 'Retrieval method', 'Modern SCM' is selected. In the 'Source Code Management' section, 'GitHub' is selected as the provider. The 'Owner' is 'cvitter', the 'Scan credentials' is 'cvitter/***** (GitHub Token)', and the 'Repository' is 'jenkins-pipeline-examples'. There are 'Advanced...' and 'Delete' buttons at the bottom right of the configuration area.

```
library 'CraigsLibs'

pipeline {
    agent any
    stages {
        stage('Example') {
            steps {
                helloWorld("Bob")
            }
        }
    }
}
```

Hands On Exercise 1.7

Using Shared Libraries

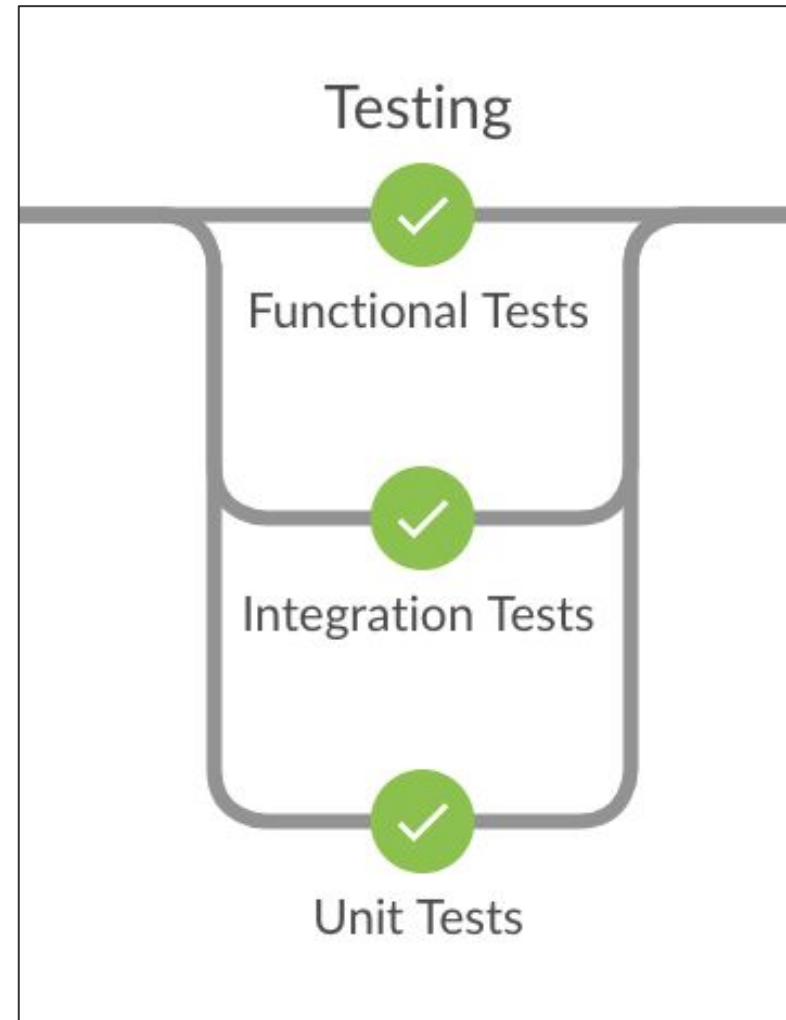
<https://github.com/PipelineHandsOn/intro-to-declarative-pipeline/blob/master/Exercise-01.md#exercise-17>

Conditional Flow Control

```
stage('Deploy') {  
    when {  
        expression {  
            currentBuild.result == null || currentBuild.result == 'SUCCESS'  
        }  
    }  
    steps {  
        ...  
    }  
}  
  
stage('Build Master') {  
    when {  
        branch 'master'  
    }  
    steps {  
        ...  
    }  
}
```

Executing Steps in Parallel

```
pipeline {
  agent any
  stages {
    stage("Testing") {
      parallel {
        stage("Unit Tests") {
          agent { docker 'openjdk:7-jdk-alpine' }
          steps {
            sh 'java -version'
          }
        }
        stage("Functional Tests") {
          agent { docker 'openjdk:8-jdk-alpine' }
          steps {
            sh 'java -version'
          }
        }
        stage("Integration Tests") {
          steps {
            sh 'java -version'
          }
        }
      }
    }
  }
}
```



Hands On Exercise 1.8

Executing Parallel Stages

<https://github.com/PipelineHandsOn/intro-to-declarative-pipeline/blob/master/Exercise-01.md#exercise-18>

Scripted Blocks

```
pipeline {  
  agent any  
  
  environment {  
    APP_VERSION = "0.0.1"  
  }  
  
  stages {  
    stage('Parse POM') {  
      steps {  
        script {  
          pom = readMavenPom file: 'pom.xml'  
          APP_VERSION = pom.version  
        }  
      }  
    }  
  }  
}
```



Hands On Exercise 1.9

Blue Ocean Pipeline Editor

<https://github.com/PipelineHandsOn/intro-to-declarative-pipeline/blob/master/Exercise-01.md#exercise-19>

Building a Multibranch Pipeline



What is a Multibranch Pipeline?

The **Multibranch Pipeline** project type enables you to implement different Jenkinsfiles for different branches of the same project. In a Multibranch Pipeline project, Jenkins **automatically discovers, manages and executes** Pipelines for branches which contain a Jenkinsfile in source control.

A **Github Organization** or **Bitbucket Organization** scans for projects that have a Jenkinsfile and creates a **Multibranch Pipeline** project for each one it finds.

Hands On Exercise 2.1

Fork The sample-rest-server Repo

<https://github.com/PipelineHandsOn/intro-to-declarative-pipeline/blob/master/Exercise-02.md#exercise-21>

Hands On Exercise 2.2

Create a Github Organization Project

<https://github.com/PipelineHandsOn/intro-to-declarative-pipeline/blob/master/Exercise-02.md#exercise-22>

Hands On Exercise 2.3

Add Branch Based Flow Control

<https://github.com/PipelineHandsOn/intro-to-declarative-pipeline/blob/master/Exercise-02.md#exercise-23>

Hands On Exercise 2.4

Handling Feature Branches and Pull Requests

<https://github.com/PipelineHandsOn/intro-to-declarative-pipeline/blob/master/Exercise-02.md#exercise-24>

Enterprise Only Pipeline Features



Checkpoints*

```
stage("Checkpoint") {  
    agent none  
    steps {  
        checkpoint 'Completed Docker Image Testing'  
    }  
}
```

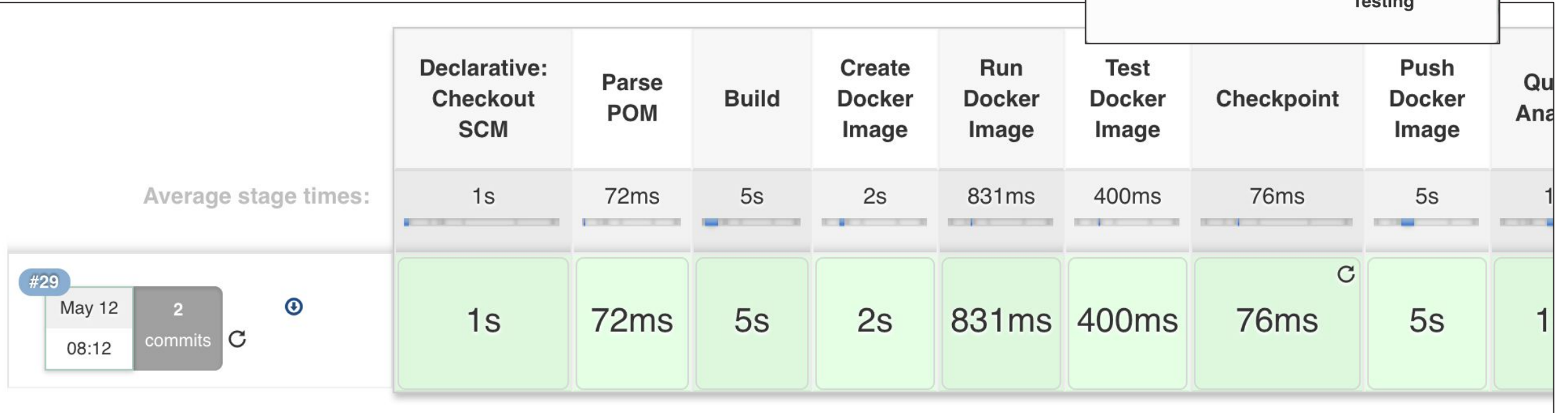
Resume ×

This Pipeline run can be restarted from the following Checkpoint(s)

Delete

Restart

Completed Docker Image Testing



Hands On Exercise 3.1

Create a Checkpoint

<https://github.com/PipelineHandsOn/intro-to-declarative-pipeline/blob/master/Exercise-03.md#exercise-31>

Custom Markers*

Custom script

Marker file

Pipeline

Definition

Pipeline script

Script

1

try sample Pipeline...

☒ Use Groovy Sandbox

[Pipeline Syntax](#)

Custom script

Marker file

Pipeline

Definition

Pipeline script from SCM

SCM

None

Script Path

Jenkinsfile

Lightweight checkout

☒

[Pipeline Syntax](#)

Hands On Exercise 3.2

Use a Custom Marker File

<https://github.com/PipelineHandsOn/intro-to-declarative-pipeline/blob/master/Exercise-03.md#exercise-32>

Best Practices



Pipeline Best Practices

A few best practices for creating pipelines in Jenkins:

- **Use a Jenkinsfile** - your pipeline should be treated like code
- **Keep it simple** - limit the amount of logic you use and don't treat declarative like a general purpose programming language (**hint**: every step should be executable from outside of Jenkins)
- **Parallelize your pipeline** - if stages can run in parallel do it to improve execution time
- **Shift important steps to the left of your pipeline** - fail faster
- **Wrap Inputs in Timeouts** - don't leave jobs waiting indefinitely for input blocking executors
- **Prefer Stash to Archiving** - to share files between stages so that you can move execution of stages across multiple agents seamlessly
- **Use Plugins vs custom code** - easier to develop and maintain
- **Prefer external scripts/tools for complex or CPU-expensive processing** - limit processing requirements on the master
- **Use trusted global libraries** - increases reusability/reduces complexity, but beware of requirements for processing scripts on the master

Thank You!

