Introducing a New Way to Define Jenkins Pipelines

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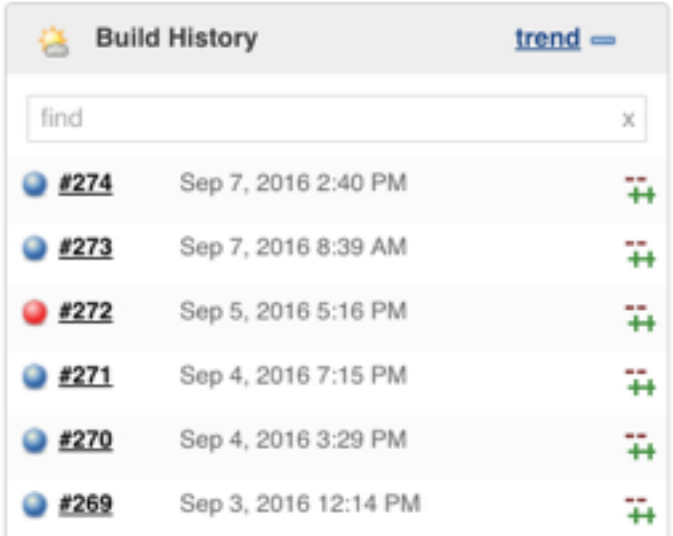
#JenkinsWorld

Introducing myself

- Hi!
- I'm Andrew Bayer
- Long-time Jenkins contributor
- Now a software engineer at CloudBees, working on Jenkins
- Particular focus on Pipeline

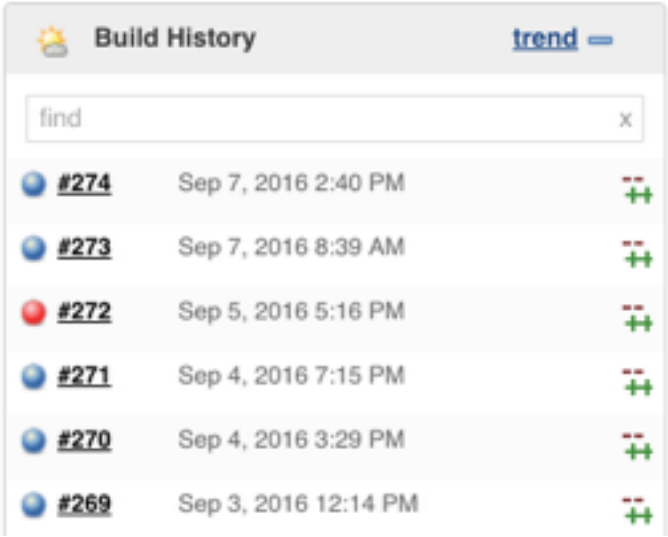
A little Jenkins job history



- Originally, there was Freestyle.
  - Configured through the web UI.
  - Choose your SCM, your build steps, your post-build actions…
  - Run on one node, check out one SCM…

A little Jenkins job history

- And then there was Pipeline
  - DSL scripting!
  - Pipeline-as-code - checked into your SCM
  - Full control over your SCM checkouts, what node you run on, conditionals, you name it
  - Durable, with running jobs surviving master restarts/disruption



But Pipeline isn't perfect…yet.

- Coming from Freestyle (or other CI tools like Travis), Pipeline scripts can be very unfamiliar.
  - You don't *really* need to know Groovy to write great Pipeline scripts, but it can feel that way.
- Behavior we've come to expect from Freestyle isn't there automatically.
  - What, you mean I've got to do a try/catch to make sure I send build emails even if the build fails?
- Pipeline scripting without any additional structure is hard to represent in a visual editor.
  - Which is something else people miss!

And so, here’s what I'm doing about that…

Declarative Pipelines!

Declarative Pipelines!

- Pipelines can now be defined with a simpler syntax.
- Declarative “section” blocks for common configuration areas, like…
  - stages
  - tools
  - post-build actions
  - notifications
  - environment
  - build agent or Docker image
  - and more to come!
- All wrapped up in a `pipeline { … }` step, with syntactic and semantic validation available.

Declarative Pipelines!

- This is not a separate thing from Pipeline. It’s part of Pipeline.
  - In fact, it's actually even still Groovy. Sort of. =)
- Configured and run from a Jenkinsfile.
- Step syntax is valid within the `pipeline` block and outside it.

- But this does make some things easier:
  - `notifications` and `postBuild` actions are run at the end of your build even if the build has failed.
  - `agent` provides simpler control over where your build runs.
  - You’ll see more as we keep going!

What does this look like?


```
1  pipeline {
2      agent none
3      stages {
4          stage("foo") {
5              echo "hello"
6          }
7      }
8  }
```

So what goes in the `pipeline` block?

- What we're calling "sections"
  - Name of the section and the value for that section
- Current sections:
  - `stages`
  - `agent`
  - `environment`
  - `tools`
  - `postBuild`
  - `notifications`

Stages

- The `stages` section contains one or more `stage` blocks.
  - `stage` blocks look the same as the new block-scoped `stage` step.
  - Think of each `stage` block as like an individual Build Step in a Freestyle job.
- There must be a `stages` section present in your `pipeline` block.
- Example:

```
stages {
    stage("build") {
        timeout(time: 5, units: 'MINUTES') {
            sh './run-some-script.sh'
        }
    }
    stage("deploy") {
        sh "./deploy-something.sh"
    }
}
```

Agent

- `agent` determines where your build runs.
  - Current possible settings:
    - `agent label:''` - Run on any node
    - `agent docker:'ubuntu'` - Run on any node within a Docker container of the "ubuntu" image
    - `agent docker:'ubuntu', label:'foo'` - Run on a node with the label "foo" within a Docker container of the "ubuntu" image
    - `agent none` - Don't run on a node at all - manage node blocks yourself within your stages.
  - We are planning to make this extensible and composable going forward.

- There must be an `agent` section in your `pipeline` block.

Tools

- The `tools` section allows you to define tools to autoinstall and add to the PATH.
  - Note - this doesn't work with `agent docker:'ubuntu'`.
  - Note - this will be ignored if `agent none` is specified.
- The `tools` section takes a block of tool name/tool version pairs, where the tool version is what you've configured on this master.
  - Example:

```
tools {
    maven "Maven 3.3.9"
    jdk "Oracle JDK 8u40"
}
```

Environment

- `environment` is a block of `key = value` pairs that will be added to the envionment the build runs in.
- Example:

```
environment {
    FOO = “bar”
    BAZ = “faz”
}
```

Notifications and postBuild

- Much like Post Build Actions in Freestyle
- `postBuild` and `notifications` both contain blocks with one or more build condition keys and related step blocks.
- The steps for a particular build condition will be invoked if that build condition is met. More on this next page!
- `postBuild` checks its conditions and executes them, if satisfied, after all `stage`s have completed, in the same node/Docker container as the `stage`s.
- `notifications` checks its conditions and executes them, if satisfied, after `postBuild`, but doesn't run on a node at all.

Build condition blocks

- `BuildCondition` is an extension point.
- Implementations provide:
  - A condition name
  - A method to check whether the condition has been satisfied with the current build status.
- Built-in conditions are listed on the right.

Name	*Satisfied When…*
`success`	The build is successful
`failure`	The build has failed
`unstable`	The build is unstable
`changed`	The build's status is different than the previous build
`always`	Always true

Notifications and postBuild examples


```
notifications {
    success {
        hipchatSend "Build passed"
    }
    failure {
        hipchatSend "Build failed"

        mail to:"me@example.com",
            subject:"Build failed",
            body:"Fix me please!"
    }
}
```

```
postBuild {
    always {
        archive "target/**/*"
        junit 'path/to/*.xml'
    }
    failure {
        sh './cleanup-failure.sh'
    }
}
```

More sections are coming

- Some common use cases aren't covered by the sections we have right now.
- We know that!
- So more sections are in the works - we'll cover them later in the presentation!

A real-world example with tools, postBuild and notifications


```
pipeline {
    // Make sure that the tools we need are installed and on the path.
    tools {
        maven "Maven 3.3.9"
        jdk "Oracle JDK 8u40"
    }

    // Run on any executor.
    agent label:""

    stages {
        // While there's only one stage here, you can specify as many stages as you like!
        stage("build") {
            sh 'mvn clean install -Dmaven.test.failure.ignore=true'
        }
    }
```

A real-world example with tools, postBuild and notifications

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```
    postBuild {
        always {
            archive "target/**/*"
            junit 'target/surefire-reports/*.xml'
        }
    }

    notifications {
        success {
            mail(to:"abayer@cloudbees.com", subject:"SUCCESS: ${currentBuild.fullDisplayName}",
                body: "Yay, we passed.")
        }
        failure {
            mail(to:"abayer@cloudbees.com", subject:"FAILURE: ${currentBuild.fullDisplayName}",
                body: "Boo, we failed.")
        }
        unstable {
            mail(to:"abayer@cloudbees.com", subject:"UNSTABLE: ${currentBuild.fullDisplayName}",
                body: "Huh, we're unstable.")
        }
    }
}
```

Parallel execution on multiple OSes


```
pipeline {
    agent none
    stages {
        stage("distribute") {
            parallel (
                "windows" : {
                    node('windows') {
                        bat "print from windows"
                    }
                },
                "mac" : {
                    node('osx') {
                        sh "echo from mac"
                    }
                },
                "linux" : {
                    node('linux') {
                        sh "echo from linux"
                    }
                }
            )
        }
    }
}
```

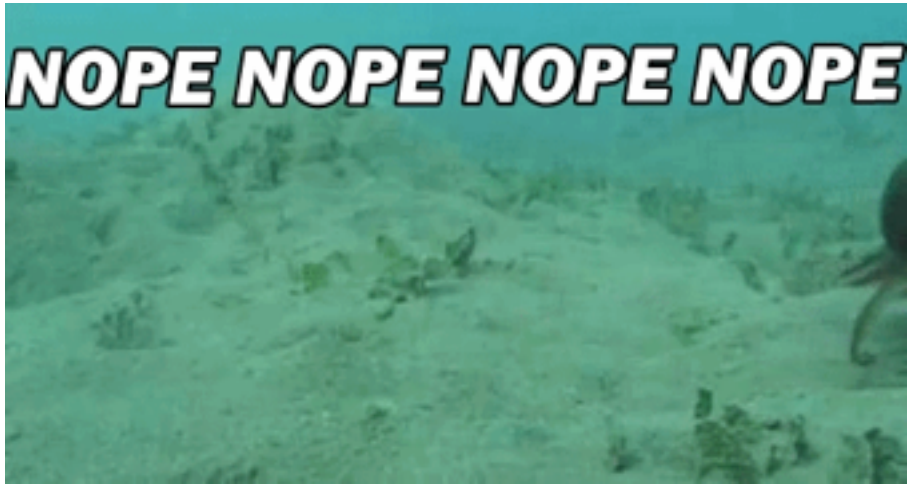
Docker and environment


```
pipeline {
    agent docker:'ubuntu'
    environment {
        KITTENS = "furry"
        BANANAS = "great"
    }
    stages {
        stage("testing 123") {
            sh 'echo "Kittens are ${KITTENS}"'
            echo "Bananas are ${env.BANANAS}"
        }
    }
}
```

Validation!

Error reporting in Pipeline - ow.

- A common complaint with Pipeline: reporting/handling errors in the script itself.
  - Long obscure stacktraces
  - Fix one typo, re-run build, get to the next typo, rinse, repeat
  - No way to verify your Jenkinsfile without running the build!



So let's make that better!

- Declarative Pipelines has an entirely new validation system!
- Validation of semantics, syntax, argument types, and more.
- Run at the very beginning of build execution - reports all issues from the entire definition at once, not just one at a time.
- Errors show up in “compilation” phase, with useful error messages pointing to where the problem is in the configuration.
- There's still a stacktrace, but you can ignore it. =)

What is the validation doing?

- Makes sure all required sections and/or fields are present.
- Checks for required step parameters.
- Verifies parameter types are correct.
- Errors out if a tool or tool version isn't installed.

Example - missing required section

```
pipeline {
    agent none
}
```

Console Output

```
Started by user Andrew Bayer
org.codehaus.groovy.control.MultipleCompilationErrorsException: startup failed:
WorkflowScript: 1: Missing required section 'stages' @ line 1, column 1.
   pipeline {
   ^

1 error
```

Example - duplicate fields

```
pipeline {
    environment {
        FOO = "BAR"
        FOO = "BAZ"
    }

    agent label:"some-label"

    stages {
        stage("foo") {
            sh 'echo "FOO is $FOO"'
        }
    }
}
```

Example - unavailable or unknown tool

Console Output

```
Started by user Andrew Bayer
org.codehaus.groovy.control.MultipleCompilationErrorsException: startup failed:
WorkflowScript: 4: Invalid tool type 'gradle'. Valid tool types: [ant, hudson.tasks.Ant$AntInstallation,
org.jenkinsci.plugins.docker.commons.tools.DockerTool, git, hudson.plugins.git.GitTool, jdk, hudson.model.JDK, jgit,
org.jenkinsci.plugins.gitclient.JGitTool, maven, hudson.tasks.Maven$MavenInstallation] @ line 4, column 9.
           gradle "gradle-2.14.1"
           ^

1 error
```

```
pipeline {
    agent label:"some-label"
    tools {
        gradle "gradle-2.14.1"
    }
    stages {
        stage("foo") {
            sh "gradle --version"
        }
    }
}
```

Example - unavailable or unknown tool

Console Output

```
Started by user Andrew Bayer
org.codehaus.groovy.control.MultipleCompilationErrorsException: startup failed:
WorkflowScript: 5: Expecting int for parameter 'time' but got 'someTime' instead @ line 5, column 27.
                timeout(time: "someTime", banana:"nope") {
                              ^

WorkflowScript: 5: Invalid parameter 'banana', did you mean 'unit'? @ line 5, column 39.
                timeout(time: "someTime", banana:"nope") {
                                          ^

2 errors
```

```
pipeline {
    agent none
    stages {
        stage("foo") {
            timeout(time: "someTime", banana:"nope") {
                echo "hello"
            }
        }
    }
}
```

Linter coming soon!

- API endpoint on Jenkins master already present for validating your Jenkinsfile using Declarative Pipelines.
- We'll be adding a command-line tool available that just needs to be pointed to your Jenkins master and your Jenkinsfile to validate and report any errors!
- Aiming to have this available in the next couple weeks.

The future!

More sections, more functionality

- Currently you can't do things like add a timeout for the entire build, or use build parameters when using the declarative syntax.
- That will be changing!
- New sections already planned for:
  - "Wrappers" around the entire build
  - Build parameters
  - Build triggers
  - Other job properties
  - Shared library loading

Extensibility!

- Build conditions are already extensible.
- Sections will soon be extensible so other plugins can contribute their own!
- Agent backends (like the current "run in this Docker image" or "run on this label") will soon be extensible, and we'll be adding more bundled backends.
  - First on the list: "Build the Dockerfile in this repo root and run in the image that gets built"!

Stage Dependency Graph

- For a given stage, specify what other stages need to be run before or after.
- At runtime, these dependencies will be inspected and a dependency graph will be constructed.
- Result: stages will be executed in dependency order, run in parallel when possible.
- Coming soon!

Eclipse/IntelliJ integration?

- A "schema" for the declarative syntax is available via the Jenkins REST API, as is validation.

- So…we could write plugins for IDEs that:
  - Do autocomplete for sections and their fields based on the declarative syntax schema.
  - Validate on demand (or maybe even on the fly!).

- I've never written an Eclipse or IntelliJ plugin, so no promises, but I'll try!

What's still missing?

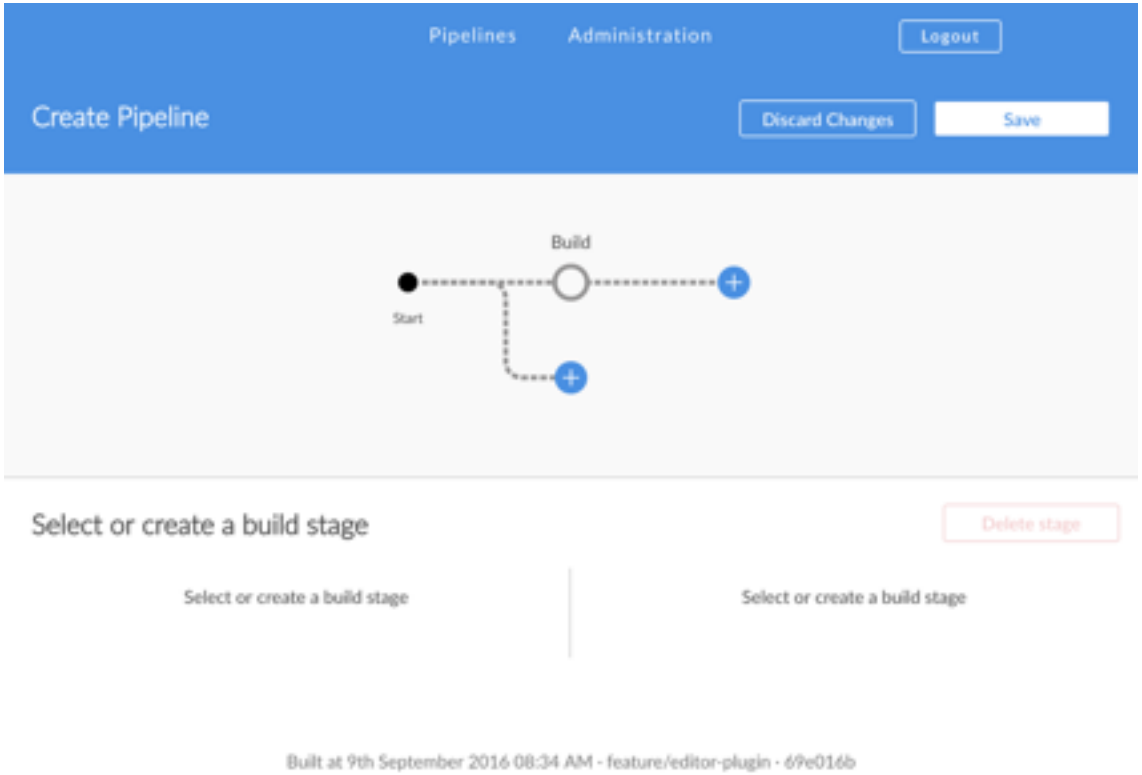
- One big chunk of Freestyle functionality we still don't have in Pipeline…

- Visual editor!

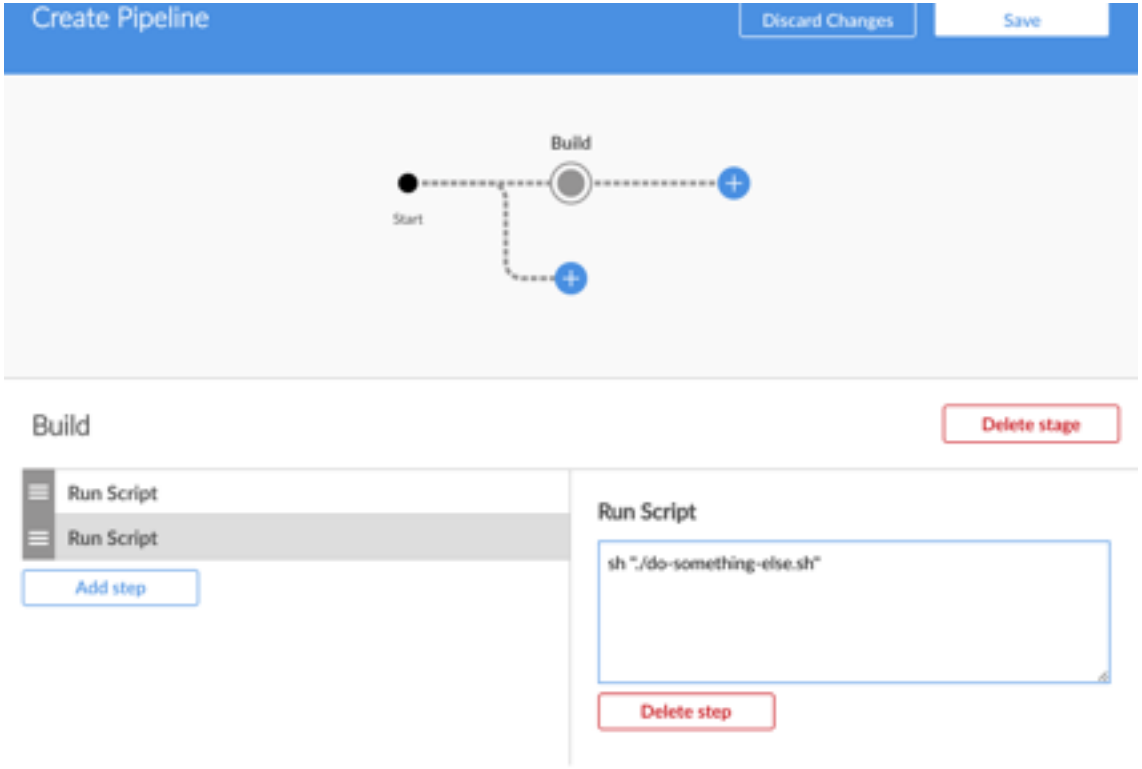
Visual editor plans

- Will be part of Blue Ocean
- Takes advantage of structured form of declarative Pipelines
- Reads the Jenkinsfile from source control
- Saves the Pipeline back to that same Jenkinsfile in source control
- Very, very early work right now, should ramp up in the next couple months

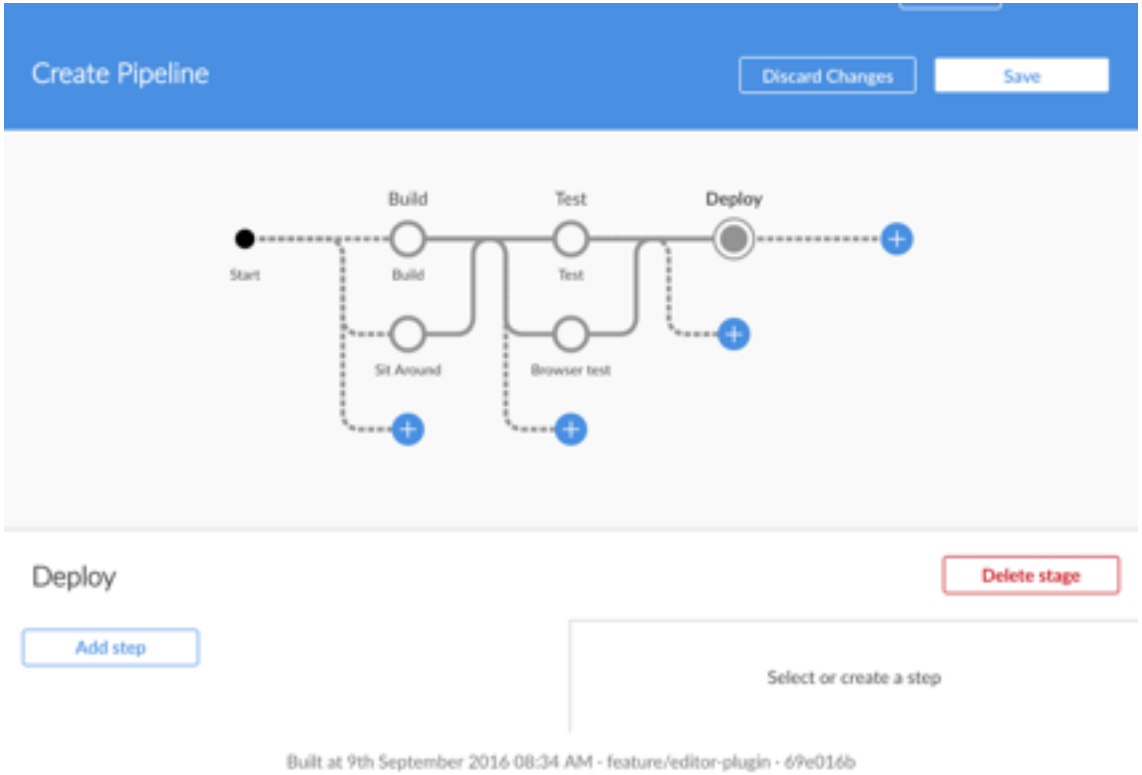
Editor - getting started



Editor - adding steps



Editor - adding stages



Want to try Declarative Pipelines?

Install Blue Ocean!

Thanks!

Questions?

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