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SCALING JENKINS WITH DOCKER

SWARM, KUBERNETES OR MESOS?

Carlos Sanchez

csanchez.org / @csanchez

ABOUT ME

Engineer @ CloudBees, Private SaaS Edition Team

Contributor to

Jenkins Mesos plugin

Jenkins and Maven official Docker images

Author of Jenkins Kubernetes plugin

Long time OSS contributor at Apache, Eclipse, Puppet, ...

DOCKER DOCKER DOCKER

Kernel Sanders
@lstoll

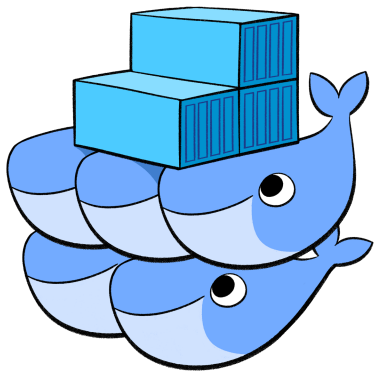
The solution: Docker. The problem? You tell me.

BUT IT IS NOT TRIVIAL

CLUSTER SCHEDULING

- Running in public cloud, private cloud, VMs or bare metal
- HA and fault tolerant
- With Docker support of course


MESOS



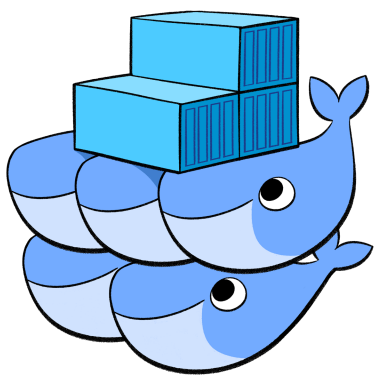

kubernetes

A distributed systems kernel

APACHE MESOS

- Started before 2011
- Runs tasks, any binary or Docker, `rkt`, `appc` images
- Frameworks run on top of Mesos
  - Mesosphere Marathon: long running services
  - Apache Aurora: long running services
  - Chronos: distributed cron-like system
- Used in Twitter, Airbnb, eBay, Apple, Verizon, Yelp,...

DOCKER SWARM



DOCKER SWARM

- By Docker Inc.
- Uses the same Docker API
- No need to modify existing tooling

DOCKER ENGINE SWARM MODE

- New Swarm mode in Docker 1.12
- No need to install extra software, each daemon can run as a Swarm member
- New `service` object to describe distributed containers
  - Existing tooling needs to be updated


kubernetes

KUBERNETES

- Based on Google Borg
- Run in local machine, virtual, cloud
- Google provides Google Container Engine (GKE)
- Other services run by stackpoint.io, CoreOS Tectonic, Azure,...
- Minikube for local testing

SCALING JENKINS

Two options:

- More build agents per master
- More masters

SCALING JENKINS: MORE BUILD AGENTS

- Pros
  - Multiple plugins to add more agents, even dynamically
- Cons
  - The master is still a SPOF
  - Handling multiple configurations, plugin versions,...
  - There is a limit on how many build agents can be attached

SCALING JENKINS: MORE MASTERS

- Pros
  - Different sub-organizations can self service and operate independently
- Cons
  - Single Sign-On
  - Centralized configuration and operation

Covered by CloudBees Jenkins Operations Center and CloudBees Jenkins Platform Private SaaS Edition

@DEVOPS_BORAT

DevOps Borat

To make error is human. To propagate error to all server in automatic way is #devops.

If you haven't automatically destroyed something by mistake, you are not automating enough

RUNNING IN DOCKER

OFFICIAL REPOSITORY

jenkins ★

Last pushed: 11 days ago

Repo Info Tags

Supported tags and respective `Dockerfile` links

- `latest`, `1.609.2` (*Dockerfile*)

For more information about this image and its history, please see the relevant manifest file (`library/jenkins`) in the `docker-library/official-images` GitHub repo.

Jenkins

The Jenkins Continuous Integration and Delivery server.

This is a fully functional Jenkins server, based on the Long Term Support release .

Jenkins

DOCKER PULL COMMAND

```
docker pull jenkins
```

DESCRIPTION

Official Jenkins Docker image

PUBLIC | AUTOMATED BUILD

jenkinsci/jnlp-slave ☆

Last pushed: 6 days ago

Repo Info | Tags | Dockerfile | Build Details

Jenkins JNLP slave Docker image

A Jenkins slave using JNLP to establish connection.
See Jenkins Distributed builds for more info.

Usage :

```
docker run jenkinsci/jnlp-slave -url http://jenkins-server:port <secret> <slave
```

optional environment variables:

- *JENKINS_URL*: url for the Jenkins server, can be used as a replacement to -url option, or to set alternate jenkins URL
- *JENKINS_TUNNEL*: (HOST:PORT) connect to this slave host and port instead of Jenkins server, assuming this one do route TCP traffic to Jenkins master. Useful when when Jenkins runs behind a load balancer, reverse proxy, etc.

CLUSTER SCHEDULING

Isolated build agents and jobs

Using Docker

Capabilities can be dropped

GROUPING CONTAINERS

Example:

- Jenkins agent
- Maven build
- Selenium testing in
  - Firefox
  - Chrome
  - Safari

5 containers

GROUPING CONTAINERS

Mesos	In progress MESOS-2449
Swarm	Supports grouping through Docker Compose Can force execution in the same host
Kubernetes	Supports the concept of Pods natively All running in the same host

MEMORY LIMITS

Scheduler needs to account for container memory requirements and host available memory

Prevent containers for using more memory than allowed

Mesos	required
Swarm	optional
Kubernetes	optional (plus namespaces)

Memory constrains translate to Docker --memory

WHAT DO YOU THINK HAPPENS WHEN?

Your container goes over memory quota?


¡CACHONDEO.COM

WHAT ABOUT THE JVM?

WHAT ABOUT THE CHILD PROCESSES?

CPU LIMITS

Scheduler needs to account for container CPU requirements and host available CPUs

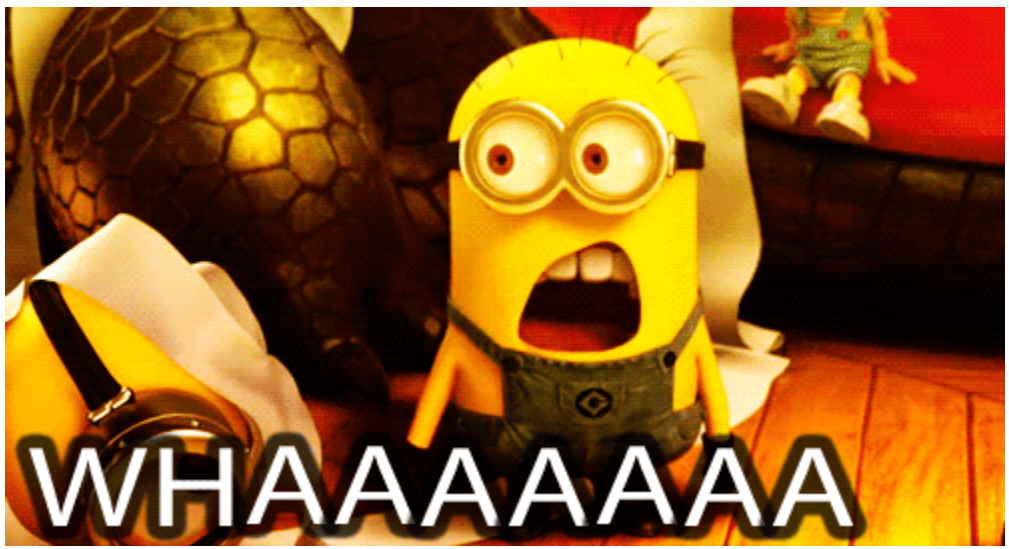
Mesos	required
Swarm	optional
Kubernetes	optional (plus namespaces)

CPU translates into Docker `--cpu-shares`

WHAT DO YOU THINK HAPPENS WHEN?

Your container tries to access more than one CPU

Your container goes over CPU limits



Totally different from memory

STORAGE

Handling distributed storage

Jenkins masters need persistent storage, agents (*typically*) don't

Mesos	Docker volume support in 1.0+
Swarm	Docker volume plugins: RexRay, Convoy, Flocker,...
Kubernetes	Persistent volumes

PERMISSIONS

Containers should not run as root

Container user id != host user id

i.e. `jenkins` user in container is always 1000 but matches `ubuntu` user in host

CAVEATS

Only a limited number of EBS volumes can be mounted

Docs say `/dev/sd[f-p]`, but `/dev/sd[q-z]` seem to work too

NFS users must be centralized and match in cluster and NFS server

NETWORKING

Jenkins masters open several ports

- HTTP
- JNLP Build agent
- SSH server (Jenkins CLI type operations)

Jenkins agents connect to master:

- inbound (SSH)
- outbound (JNLP)

Allows getting one IP per container

Mesos	Network Isolator Modules: Calico, Weave
Swarm	Docker overlay, and others from plugins
Kubernetes	Multiple networking options: GCE, Weave, Calico,...

JENKINS PLUGINS

JENKINS DOCKER PLUGINS

- Dynamic Jenkins agents with Docker plugin or Yet Another Docker Plugin
  - No support yet for Docker 1.12 Swarm mode
- Agent image needs to include Java, downloads slave jar from Jenkins master
- Multiple plugins for different tasks
  - Docker build and publish
  - Docker build step plugin
  - CloudBees Docker Hub/Registry Notification
  - CloudBees Docker Traceability
- Great pipeline support

Docker

Name: swarm

Docker URL: https://52.90.1.70:3376

Credentials: O=csanchez | Add

Connection Timeout: 0

Read Timeout: 0

Container Cap: 100

Images

Docker Template

Docker Image: rastasheep/ubuntu-sshd

Container settings...

Instance Capacity: 1

Remote Filing System Root: /home/jenkins

Labels

Labels

ssh

Usage

Use this node as much as possible

Experimental Options...

Images

ID	evarga/jenkins-slave
Labels	
Credentials	jenkins ▾
	Add
Remote Filing System Root	/home/jenkins
Remote FS Root Mapping	
Instance Cap	
DNS	
Port bindings	
Bind all declared ports	☐
Hostname	
Idle termination time	5
JavaPath	
JVM Options	
Docker Command	
LXC Conf Options	
Volumes	
Volumes From	
Run container privileged	☐

Prefix Start Slave Command

Suffix Start Slave Command

Delete

JENKINS DOCKER PIPELINE

```
def maven = docker.image('maven:3.3.9-jdk-8');

stage 'Mirror'
maven.pull()
docker.withRegistry('https://secure-registry/', 'docker-registry-logi

  stage 'Build'
  maven.inside {
    sh "mvn -B clean package"
  }

  stage 'Bake Docker image'
  def pcImg = docker.build("examplecorp/spring-petclinic:${env.BUILD_

  pcImg.push();
}
```

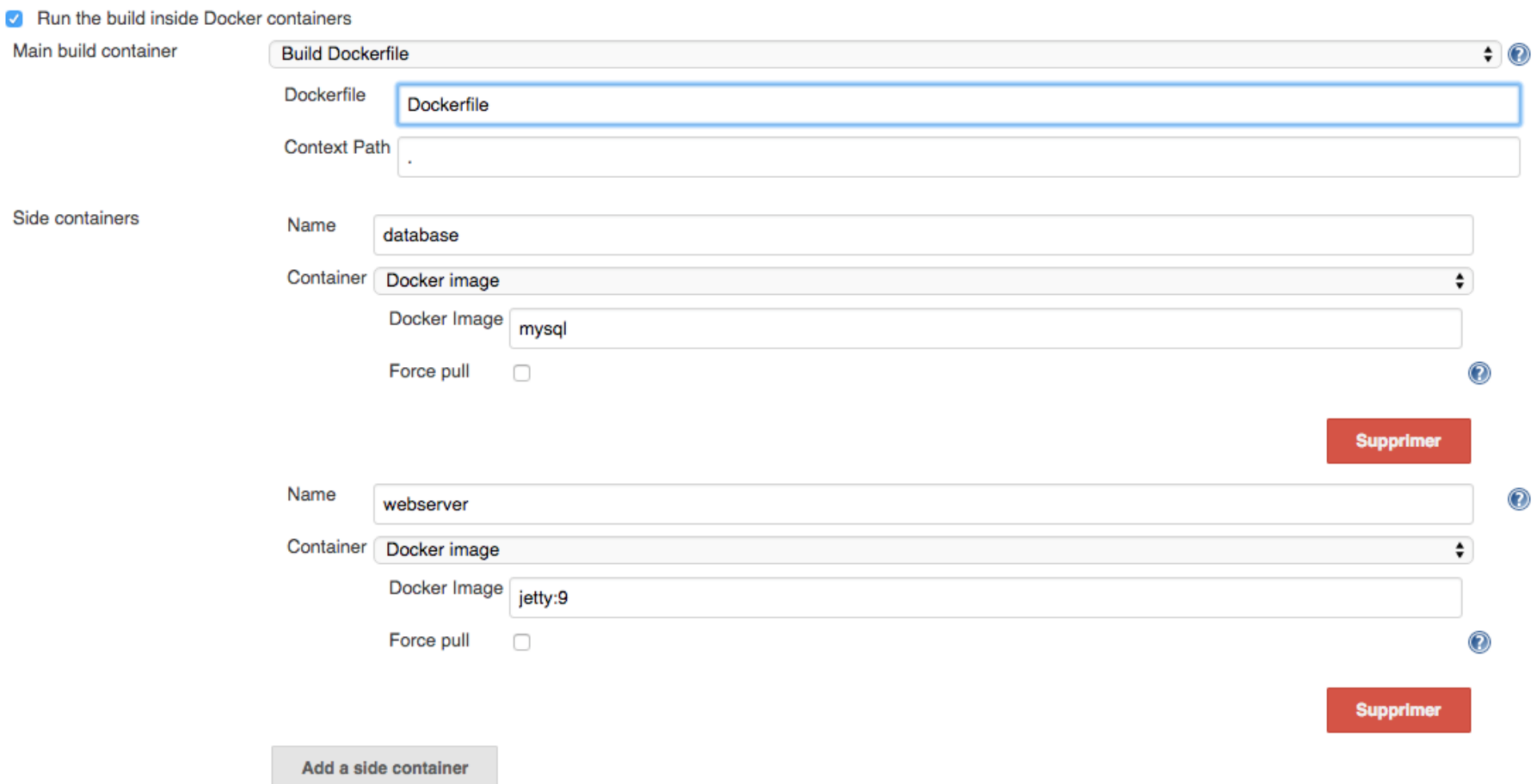
JENKINS DOCKER SLAVES PLUGIN

Use any Docker image, no need for Java

Definition in pipeline

Can have side containers

Just released!


Run the build inside Docker containers
Main build container
Build Dockerfile
Dockerfile
Dockerfile
Context Path
.
Side containers
Name
database
Container
Docker image
Docker Image
mysql
Force pull
Supprimer
Name
webserver
Container
Docker image
Docker Image
jetty:9
Force pull
Supprimer
Add a side container

Building Maven

```
dockerNode("maven:3.3.3-jdk-8") {
  sh "mvn -version"
}
```

JENKINS MESOS PLUGIN

- Dynamic Jenkins agents, both Docker and isolated processes
- Agent image needs to include Java, grabs slave jar from Mesos sandbox
- Can run Docker commands on the host, outside of Mesos

Configuration

Mesos native library path	/usr/bin/mesos
Mesos Master [hostname:port]	zk://10.16.227.74:2181,10.16.186.123:2181,10.16.132.52:2181/mesos
Description	
Framework Name	Jenkins Scheduler
Role	*
Slave username	
Framework credentials	mesos/****** (Mesos Framework credentials) Add
Jenkins URL	
Cloud ID	shared-cloud
Checkpointing	○ Yes ◉ No
	Enable Mesos framework checkpointing?
On-demand framework registration	◉ Yes ○ No
	Enable to make this cloud register as a framework when builds need to be performed. And, disconnect ot
Decline offer duration	600000

Idle Termination Minutes: 3

Mesos Offer Selection Attributes: {"jce_slaves":"true"}

Additional Jenkins Slave JVM arguments: -Xms16m -XX:+UseConcMarkSweepGC -Djava.net.preferIPv4Stack=true

Additional Jenkins Slave Agent JNLP arguments: -noReconnect

Mark this Slave Info as default for all Jobs

Use Docker Containerizer

Container Type

Docker

Docker Image: java

If using Docker, specify the docker image.

Docker Privileged Mode

This will start the image using Docker's privileged mode.

Docker Force Pull Image

This will force a pull of the Docker Image regardless of whether it exists locally.

Docker Image Can Be Customized

This will allow override default docker image using labels. E.g.: mesosSlaveLabel:evarga/jenkins-slave:latest

Use custom docker command shell

Custom docker command shell

Networking

Host

Bridge

Bridge

Port Mappings

Add Port Mapping

Label String

Usage

Utilize this node as much as possible

Node Properties

Environment variables

List of key-value pairs

name _JAVA_OPTIONS

value -Xmx128m

Delete

Add

Delete

Add Node Property

Jenkins Slave CPUs 0.1

Jenkins Slave Memory in MB 512

Minimum number of Executors per Slave 1

Maximum number of Executors per Slave 1

Jenkins Executor CPUs 0.1

Jenkins Executor Memory in MB

Jenkins Executor Memory in MB	128
Remote FS Root	jenkins

JENKINS MESOS PLUGIN

Can use Docker pipelines with some tricks

- Need Docker client installed
- Shared docker.sock from host
- Mount the workspace in the host, visible under same dir

MESOS PLUGIN AND PIPELINE

```
node('docker') {
    docker.image('golang:1.6').inside {

        stage 'Get sources'
        git url: 'https://github.com/hashicorp/terraform.git', tag: '

        stage 'Build'
        sh """#!/bin/bash -e
        mkdir -p /go/src/github.com/hashicorp
        ln -s `pwd` /go/src/github.com/hashicorp/terraform
        pushd /go/src/github.com/hashicorp/terraform
        make core-dev plugin-dev PLUGIN=provider-aws
        popd
        cp /go/bin/terraform-provider-aws .
        """

        stage 'Archive'
        archive "terraform-provider-aws"
    }
}
```

JENKINS KUBERNETES PLUGIN

- Dynamic Jenkins agents, running as Pods
- Multiple container support
  - One jnlp image, others custom
- Pipeline support for both agent Pod definition and execution will be in next version

JENKINS KUBERNETES PIPELINE

```
podTemplate(label: 'mypod', containers: [
        [name: 'jnlp', image: 'jenkinsci/jnlp-slave:alpine', args: '$
        [name: 'maven', image: 'maven:3-jdk-8', ttyEnabled: true, com
        [name: 'golang', image: 'golang:1.6', ttyEnabled: true, comma
    ]) {

    node ('mypod') {
        stage 'Get a Maven project'
        git 'https://github.com/jenkinsci/kubernetes-plugin.git'
        container('maven') {
            stage 'Build a Maven project'
            sh 'mvn clean install'
        }

        stage 'Get a Golang project'
        git url: 'https://github.com/hashicorp/terraform.git'
        container('golang') {
            stage 'Build a Go project'
            sh """
            mkdir -p /go/src/github.com/hashicorp
            ln -s `pwd` /go/src/github.com/hashicorp/terraform
            cd /go/src/github.com/hashicorp/terraform && make core-de
            """
        }
```

JENKINS PLUGINS RECAP

- Dynamic Jenkins agent creation
- Using JNLP slave jar
  - In complex environments need to use the `tunnel` option to connect internally
- Using the Cloud API
  - Not ideal for containerized workload
  - Agents take > 1 min to start provision and are kept around
  - Agents can provide more than one executor

JENKINS ONE SHOT EXECUTOR

Improved API to handle one off agents

Optimized for containerized agents

Plugins need to support it

THANKS

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carlossg