CI AND CD AT SCALE

SCALING JENKINS WITH DOCKER AND APACHE MESOS

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See online at http://carlossg.github.io/presentations

ABOUT ME

Senior Software Engineer @ CloudBees

Contributor to the Jenkins Mesos plugin and the Java Marathon client

Author of Jenkins Kubernetes plugin

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

OUR USE CASE

Scaling Jenkins

Your mileage may vary

SCALING JENKINS

Two options:

- More build agents per master
- More masters

SCALING JENKINS: MORE BUILD AGENTS

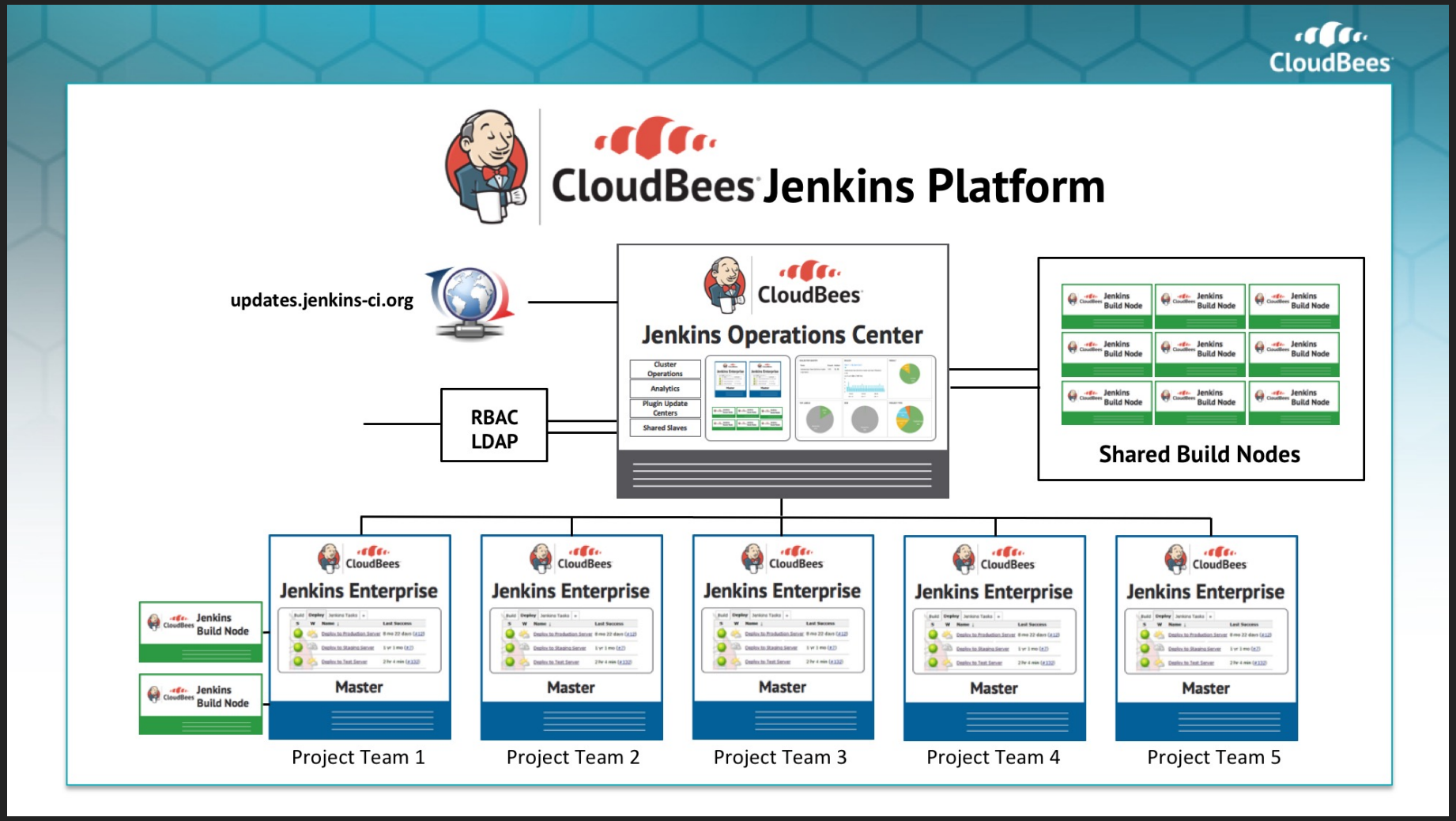
- Pros
  - Multiple plugins to add more agents, even dynamically
- Cons
  - The master is still a SPOF
  - Handling multiple configurations, plugin versions,...
  - There is a limit on how many build agents can be attached

SCALING JENKINS: MORE MASTERS

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

CLOUDBEES JENKINS ENTERPRISE EDITION

CloudBees Jenkins Operations Center



CLOUDBEES JENKINS PLATFORM - PRIVATE SAAS EDITION

The best of both worlds

CloudBees Jenkins Operations Center with multiple masters

Dynamic build agent creation in each master

ElasticSearch for Jenkins metrics and Logstash

BUT IT IS NOT TRIVIAL

ARCHITECTURE

Docker Docker Docker

Kernel Sanders
@lstoll

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

Isolated Jenkins masters

Isolated build agents and jobs

Memory and CPU limits

How would you design your infrastructure if you couldn't login? Ever.

Kelsey Hightower

EMBRACE FAILURE!

CLUSTER SCHEDULING

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

APACHE MESOS

A distributed systems kernel

ALTERNATIVES

Docker Swarm / Kubernetes

MESOSPHERE MARATHON

STORAGE

Handling distributed storage

Servers can start in any host of the cluster

And they can move when they are restarted

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

Supporting EBS (AWS) and external NFS

SIDEKICK CONTAINER

A privileged container that manages mounting for other containers

Can execute commands in the host and other containers

SIDEKICK CONTAINER *CASTLE*

A lot of magic happening with `nsenter`

both in host and other containers

CASTLE: BACKUPS AND CLEANUP

Periodically takes S3 snapshots from EBS volumes in AWS

Cleanups happening at different stages and periodically

EMBRACE FAILURE!

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

MEMORY

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

Prevent containers for using more memory than allowed

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

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

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

CPU translates into Docker `--cpu-shares`

NETWORKING

Jenkins masters open several ports

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

NETWORKING: HTTP

We use a simple `nginx` reverse proxy for

- Mesos
- Marathon
- ElasticSearch
- CJOC
- Jenkins masters

Gets destination host and port from Marathon

NETWORKING: JNLP

Build agents started dynamically in Mesos cluster can connect to masters internally

Build agents manually started outside cluster get host and port destination from HTTP, then connect directly

SCALING

New and interesting problems


If you never used Docker in
production, leave the room now

A 300 JENKINS MASTERS CLUSTER

- 3 Mesos masters (m3.xlarge: 4 vCPU, 15GB, 2x40 SSD)
- 80 Mesos slaves (m3.xlarge)
- 7 Mesos slaves dedicated to ElasticSearch: (r3.2xlarge: 8 vCPU, 61GB, 1x160 SSD)

Total: 1.5TB 376 CPUs

Running 300 masters and ~3 concurrent jobs per master

Masters: 2GB 0.1 CPU / Build agents: 512MB 0.1 CPU

		master-0286		3	3	1	1.642.2.1
		master-0287		3	2	1	1.642.2.1
		master-0288		3	0	1	1.642.2.1
		master-0289		3	0	3	1.642.2.1
		master-0290		3	0	2	1.642.2.1
		master-0291		3	0	1	1.642.2.1
		master-0292		3	3	1	1.642.2.1
		master-0293		3	3	1	1.642.2.1
		master-0294		3	0	2	1.642.2.1
		master-0295		3	2	1	1.642.2.1
		master-0296		3	1	2	1.642.2.1
		master-0297		3	0	2	1.642.2.1
		master-0298		3	0	2	1.642.2.1
		master-0299		3	0	1	1.642.2.1
		master-0300		3	0	2	1.642.2.1

Mesos Frameworks Slaves Offers

Slaves

Activated	87
Deactivated	0

Tasks

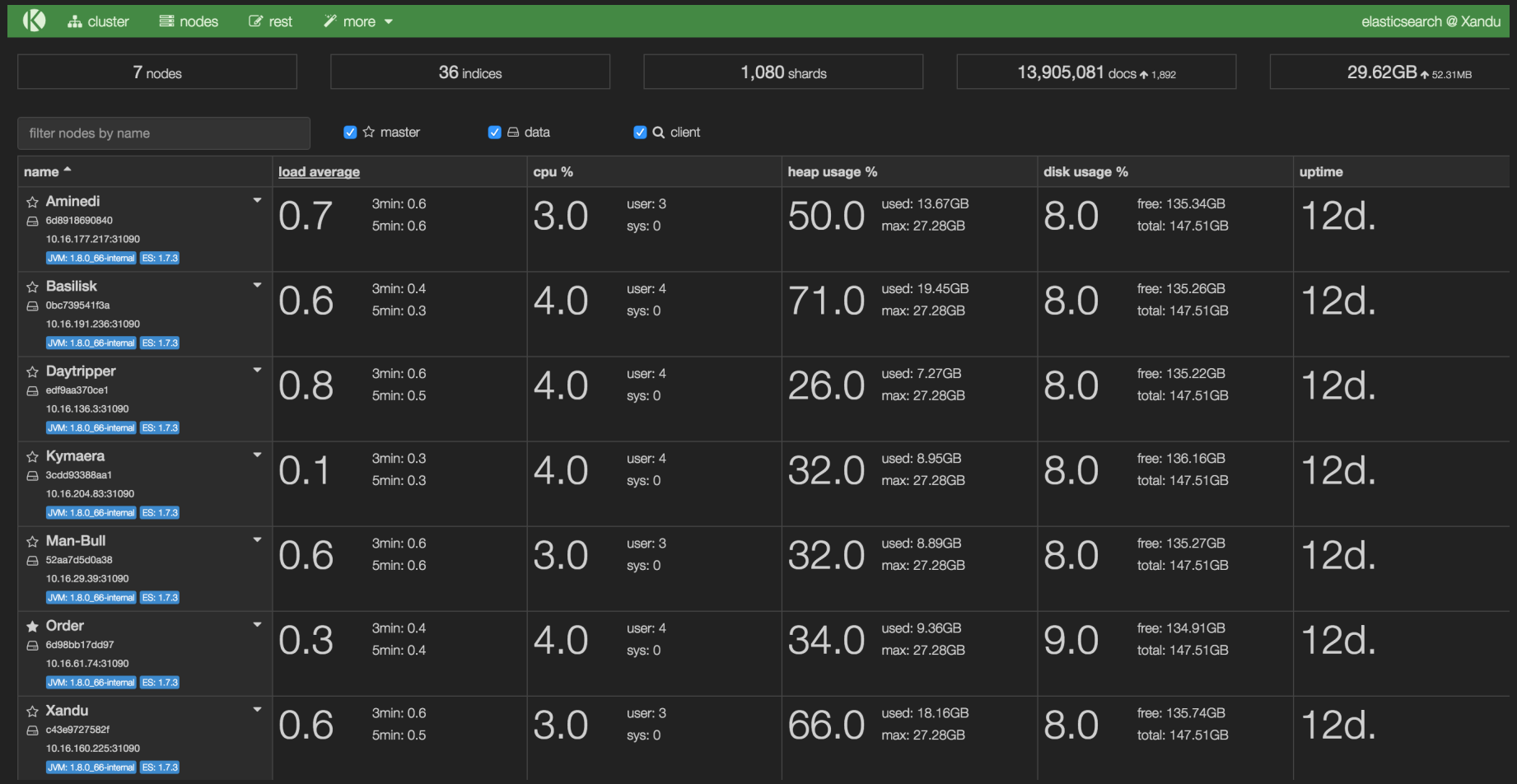
Staged	
Started	
Finished	
Killed	
Failed	
Lost	

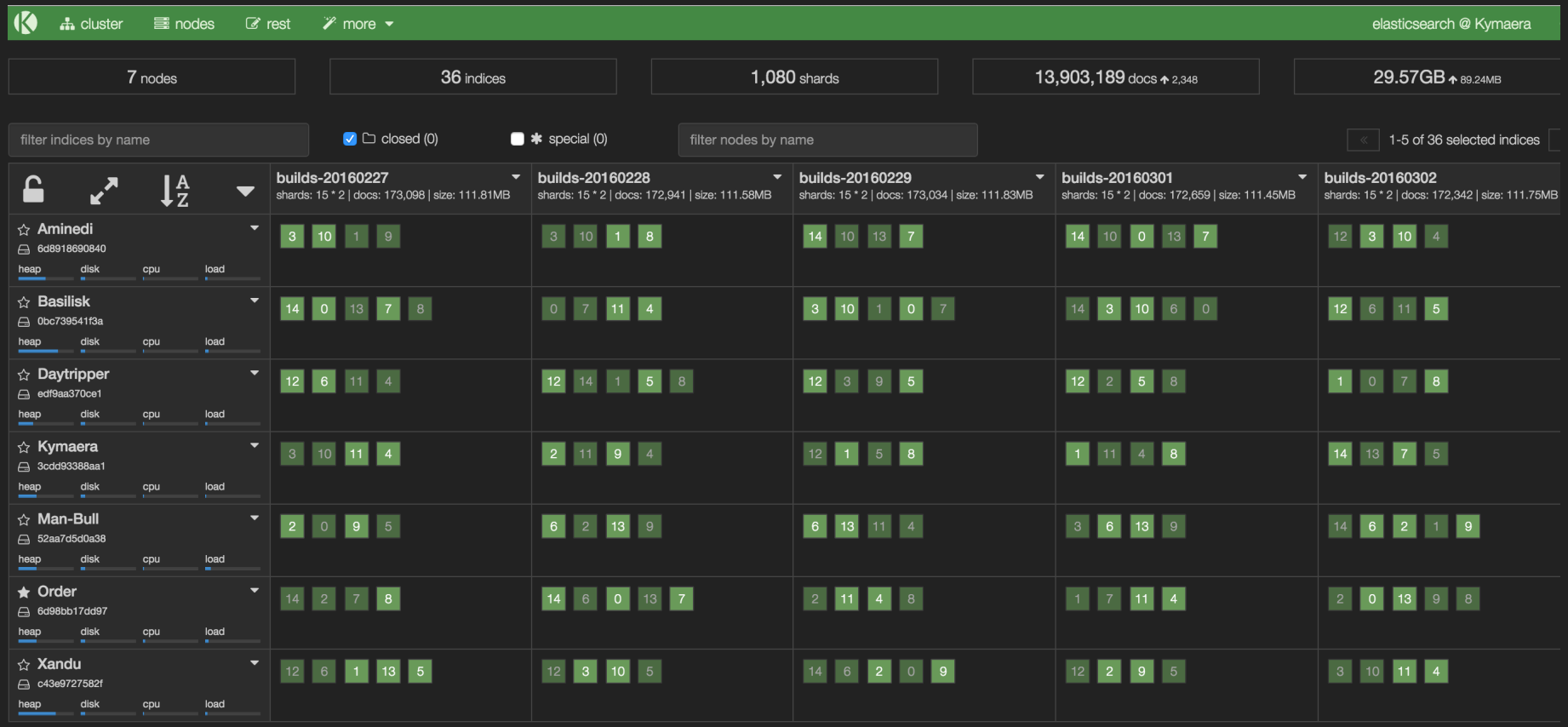
Resources

	CPUs	Mem
Total	376	1507.9 GB
Used	192.500	1457.7 GB
Offered	0	0 B
Idle	183.500	50.2 GB

8fb234eb6d5e47049a1d07f0e297cd97-mesos	8fb234eb6d5e47049a1d07f0e297cd97-mesos		minutes ago	36.compute-1.amazonaws.com	
mesos-jenkins-be97d6997b6e473d8acabea8ef8587f8-mesos	task mesos-jenkins-be97d6997b6e473d8acabea8ef8587f8-mesos	RUNNING	24 minutes ago	ec2-54-164-181-123.compute-1.amazonaws.com	Sandbox
mesos-jenkins-0727b10e0bdd4711b34470bef33e2ff9-mesos	task mesos-jenkins-0727b10e0bdd4711b34470bef33e2ff9-mesos	RUNNING	25 minutes ago	ec2-54-85-24-59.compute-1.amazonaws.com	Sandbox
mesos-jenkins-c0e330cab95b410b929a1e01cb93e108-mesos	task mesos-jenkins-c0e330cab95b410b929a1e01cb93e108-mesos	RUNNING	25 minutes ago	ec2-54-165-41-44.compute-1.amazonaws.com	Sandbox
mesos-jenkins-7786f1fa4ea24d2a904c35095dcdd157-mesos	task mesos-jenkins-7786f1fa4ea24d2a904c35095dcdd157-mesos	RUNNING	25 minutes ago	ec2-54-175-146-38.compute-1.amazonaws.com	Sandbox
mesos-jenkins-df03482cbf8644998b6712489c73268e-mesos	task mesos-jenkins-df03482cbf8644998b6712489c73268e-mesos	RUNNING	25 minutes ago	ec2-54-175-113-162.compute-1.amazonaws.com	Sandbox
mesos-jenkins-cbf3857cfd8045698bc3e56b7af8c6e8-mesos	task mesos-jenkins-cbf3857cfd8045698bc3e56b7af8c6e8-mesos	RUNNING	26 minutes ago	ec2-54-164-243-131.compute-1.amazonaws.com	Sandbox
mesos-jenkins-d3a4b6a5d72f497ca03b2c8d657f59e0-mesos	task mesos-jenkins-d3a4b6a5d72f497ca03b2c8d657f59e0-mesos	RUNNING	28 minutes ago	ec2-54-83-61-112.compute-1.amazonaws.com	Sandbox

/masters/master-0286	2048	0.2	1 / 1		Running
/masters/master-0287	2048	0.2	1 / 1		Running
/masters/master-0288	2048	0.2	1 / 1		Running
/masters/master-0289	2048	0.2	1 / 1		Running
/masters/master-0290	2048	0.2	1 / 1		Running
/masters/master-0291	2048	0.2	1 / 1		Running
/masters/master-0292	2048	0.2	1 / 1		Running
/masters/master-0293	2048	0.2	1 / 1		Running
/masters/master-0294	2048	0.2	1 / 1		Running
/masters/master-0295	2048	0.2	1 / 1		Running
/masters/master-0296	2048	0.2	1 / 1		Running
/masters/master-0297	2048	0.2	1 / 1		Running
/masters/master-0298	2048	0.2	1 / 1		Running
/masters/master-0299	2048	0.2	1 / 1		Running
/masters/master-0300	2048	0.2	1 / 1		Running


cluster
nodes
rest
more
elasticsearch @ Xandu
7 nodes
36 indices
1,080 shards
13,905,081 docs ↑ 1,892
29.62GB ↑ 52.31MB
filter nodes by name
master
data
client
name
load average
cpu %
heap usage %
disk usage %
uptime
Aminedi
6d8918690840
10.16.177.217:31090
JVM: 1.8.0_66-internal
ES: 1.7.3
0.7
3min: 0.6
5min: 0.6
3.0
user: 3
sys: 0
50.0
used: 13.67GB
max: 27.28GB
8.0
free: 135.34GB
total: 147.51GB
12d.
Basilisk
0bc739541f3a
10.16.191.236:31090
JVM: 1.8.0_66-internal
ES: 1.7.3
0.6
3min: 0.4
5min: 0.3
4.0
user: 4
sys: 0
71.0
used: 19.45GB
max: 27.28GB
8.0
free: 135.26GB
total: 147.51GB
12d.
Daytripper
edf9aa370ce1
10.16.136.3:31090
JVM: 1.8.0_66-internal
ES: 1.7.3
0.8
3min: 0.6
5min: 0.5
4.0
user: 4
sys: 0
26.0
used: 7.27GB
max: 27.28GB
8.0
free: 135.22GB
total: 147.51GB
12d.
Kymaera
3cdd93388aa1
10.16.204.83:31090
JVM: 1.8.0_66-internal
ES: 1.7.3
0.1
3min: 0.3
5min: 0.3
4.0
user: 4
sys: 0
32.0
used: 8.95GB
max: 27.28GB
8.0
free: 136.16GB
total: 147.51GB
12d.
Man-Bull
52aa7d5d0a38
10.16.29.39:31090
JVM: 1.8.0_66-internal
ES: 1.7.3
0.6
3min: 0.6
5min: 0.6
3.0
user: 3
sys: 0
32.0
used: 8.89GB
max: 27.28GB
8.0
free: 135.27GB
total: 147.51GB
12d.
Order
6d98bb17dd97
10.16.61.74:31090
JVM: 1.8.0_66-internal
ES: 1.7.3
0.3
3min: 0.4
5min: 0.4
4.0
user: 4
sys: 0
34.0
used: 9.36GB
max: 27.28GB
9.0
free: 134.91GB
total: 147.51GB
12d.
Xandu
c43e9727582f
10.16.160.225:31090
JVM: 1.8.0_66-internal
ES: 1.7.3
0.6
3min: 0.6
5min: 0.5
3.0
user: 3
sys: 0
66.0
used: 18.16GB
max: 27.28GB
8.0
free: 135.74GB
total: 147.51GB
12d.


cluster
nodes
rest
more
elasticsearch @ Kymaera
7 nodes
36 indices
1,080 shards
13,903,189 docs ↑ 2,348
29.57GB ↑ 89.24MB
filter indices by name
closed (0)
special (0)
filter nodes by name
1-5 of 36 selected indices
builds-20160227
shards: 15 * 2 | docs: 173,098 | size: 111.81MB
builds-20160228
shards: 15 * 2 | docs: 172,941 | size: 111.58MB
builds-20160229
shards: 15 * 2 | docs: 173,034 | size: 111.83MB
builds-20160301
shards: 15 * 2 | docs: 172,659 | size: 111.45MB
builds-20160302
shards: 15 * 2 | docs: 172,342 | size: 111.75MB
Aminedi
6d8918690840
heap disk cpu load
3 10 1 9
3 10 1 8
14 10 13 7
14 10 0 13 7
12 3 10 4
Basilisk
0bc739541f3a
heap disk cpu load
14 0 13 7 8
0 7 11 4
3 10 1 0 7
14 3 10 6 0
12 6 11 5
Daytripper
edf9aa370ce1
heap disk cpu load
12 6 11 4
12 14 1 5 8
12 3 9 5
12 2 5 8
1 0 7 8
Kymaera
3cdd93388aa1
heap disk cpu load
3 10 11 4
2 11 9 4
12 1 5 8
1 11 4 8
14 13 7 5
Man-Bull
52aa7d5d0a38
heap disk cpu load
2 0 9 5
6 2 13 9
6 13 11 4
3 6 13 9
14 6 2 1 9
Order
6d98bb17dd97
heap disk cpu load
14 2 7 8
14 6 0 13 7
2 11 4 8
1 7 11 4
2 0 13 9 8
Xandu
c43e9727582f
heap disk cpu load
12 6 1 13 5
12 3 10 5
14 6 2 0 9
12 2 9 5
3 10 11 4

TERRAFORM AWS

- Instances
- Keypairs
- Security Groups
- S3 buckets
- ELB
- VPCs

AWS

Resource limits: VPCs, S3 snapshots, some instance sizes

Rate limits: affect the whole account

Retrying is your friend, but with exponential backoff

AWS

Running with a patched Terraform to overcome timeouts and AWS *eventual consistency*

```
<?xml version="1.0" encoding="UTF-8"?>
<DescribeVpcsResponse xmlns="http://ec2.amazonaws.com/doc/2015-10-01/
  <requestId>8f855bob-3421-4cff-8c36-4b517eb0456c</requestId>
  <vpcSet>
    <item>
      <vpcId>vpc-30136159</vpcId>
      <state>available</state>
      <cidrBlock>10.16.0.0/16</cidrBlock>
                              ...
</DescribeVpcsResponse>
2016/05/18 12:55:57 [DEBUG] [aws-sdk-go] DEBUG: Response ec2/Describe
--[ RESPONSE] ----------------------------------
HTTP/1.1 400 Bad Request
<Response><Errors><Error><Code>InvalidVpcID.NotFound</Code><Message>
The vpc ID 'vpc-30136159' does not
exist</Message></Error></Errors>
```

TERRAFORM OPENSTACK

- Instances
- Keypairs
- Security Groups
- Load Balancer
- Networks

OPENSTACK

Custom flavors

Custom images

Different CLI commands

There are not two OpenStack installations that are the same

THANKS

csanchez.org

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 carlossg