A dark blue-tinted photograph of a busy port. In the foreground, several large white port cranes are positioned over a large cargo ship. The ship's hull is covered in shipping containers from various companies. The cranes have "PORT OF OAKLAND" printed on their booms. In the background, more shipping containers are stacked high, and the sky is overcast.

Pivotal

FedEx

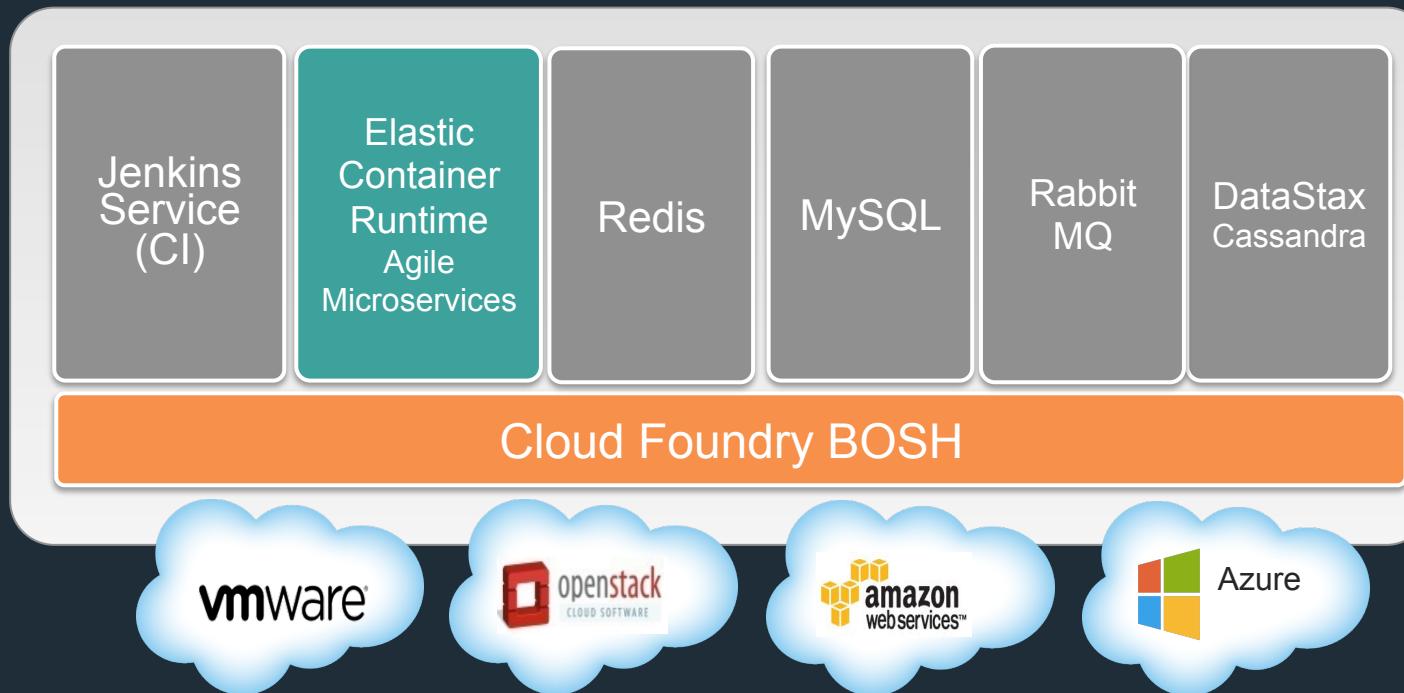
Pivotal Cloud Foundry

Architecture & Operations

Pivotal

The Whole Stack

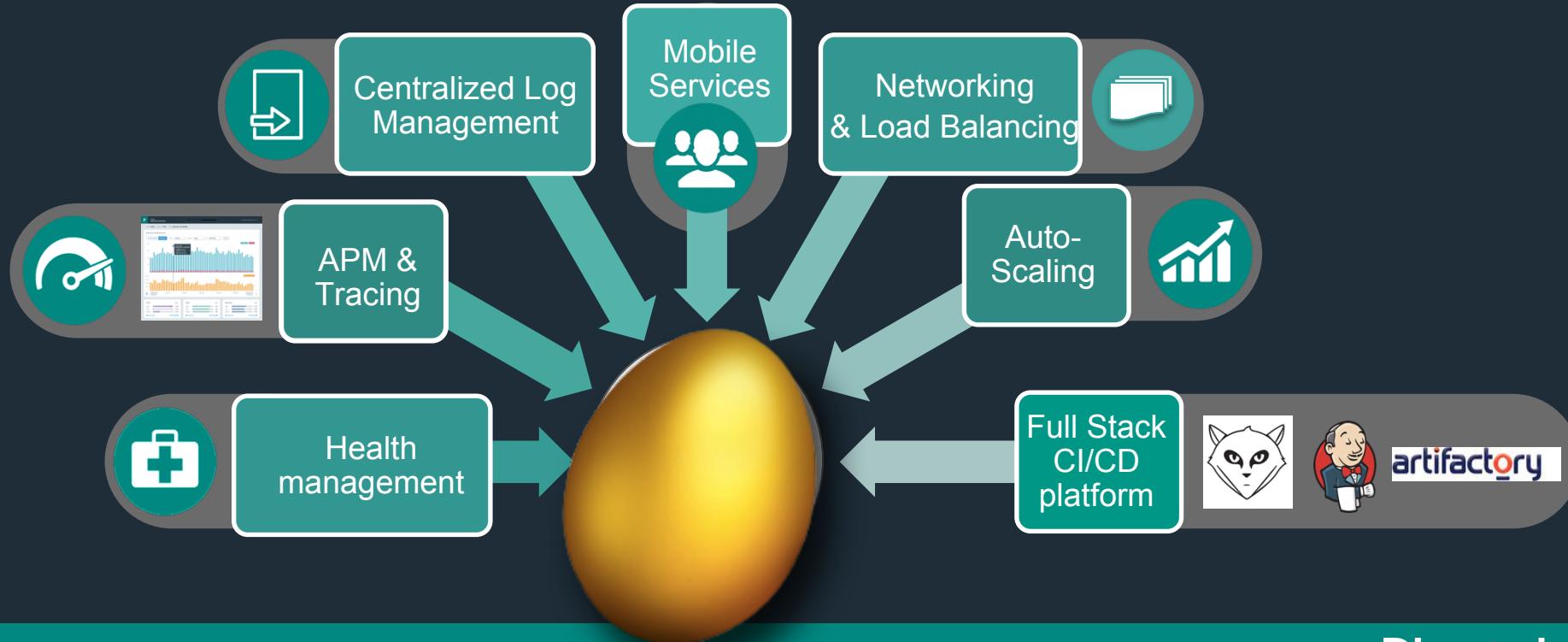
A Multi-Cloud Platform: Cloud Foundry



Elastic managed runtime service integrated into leading data services; all scaled and managed by CF BOSH

Multi-Cloud Declarative Service Deployment, Operations

Cloud Foundry: An Application-centric Platform



Elastic Container Runtime

Technical Drill Down

Pivotal Cloud Foundry

Platform Access

Dynamic Router



Elastic Container Runtime

Logging / Metrics

Application
Access

Ops Manager

Service

Service

BOSH - Automation Layer

VMware

openstack
CLOUD SOFTWARE

amazon
web services™

Azure

Pivotal™

DEMO



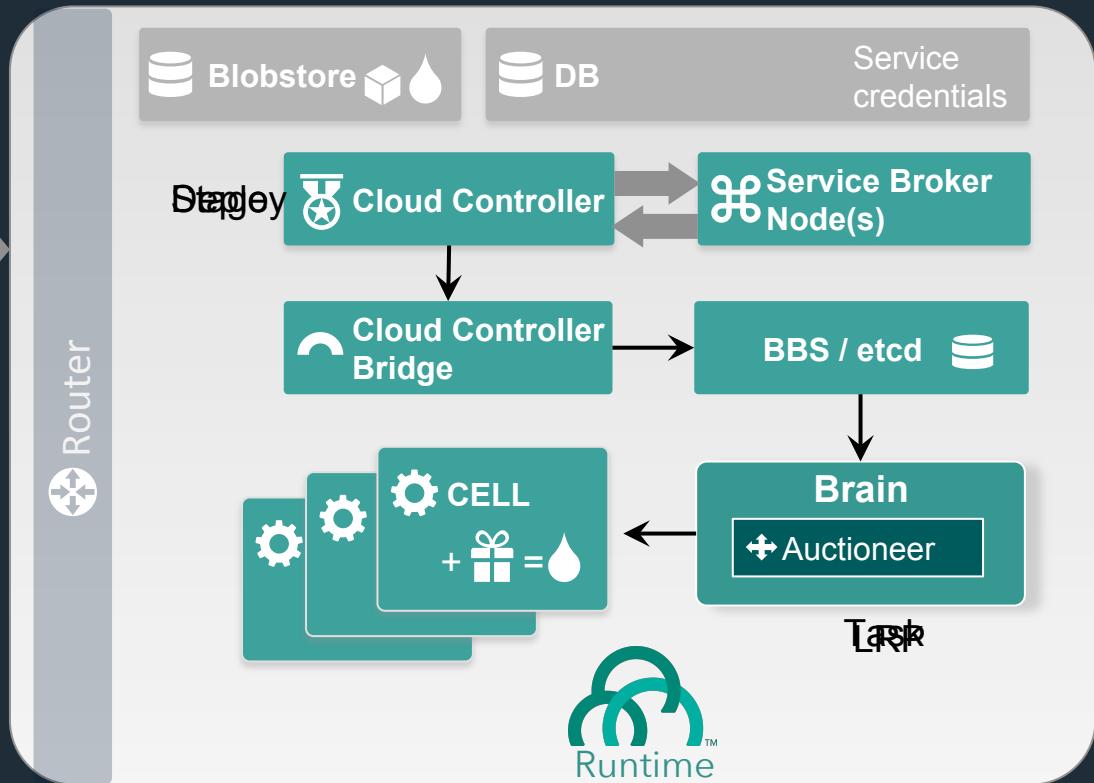
CF

Overview: Pushing an Application

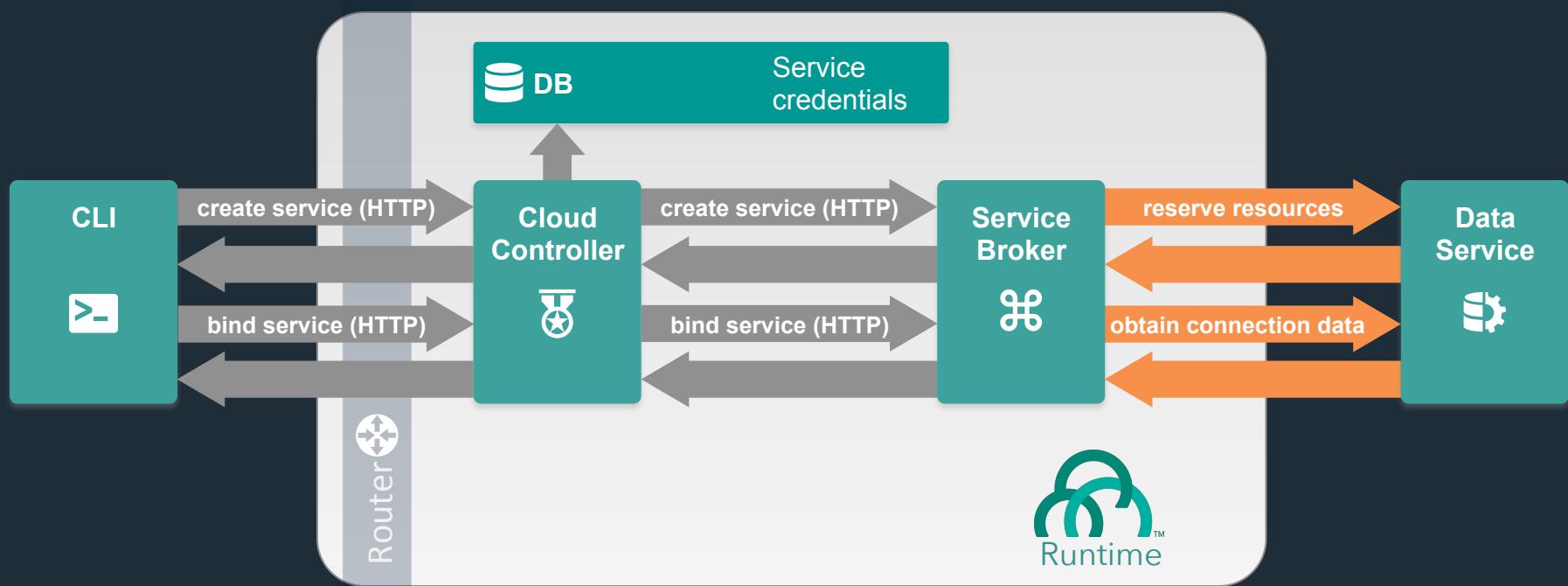
- ① Upload app bits and metadata
- ② Create and bind services
- ③ Stage application
- ④ Deploy application
- ⑤ Manage application health



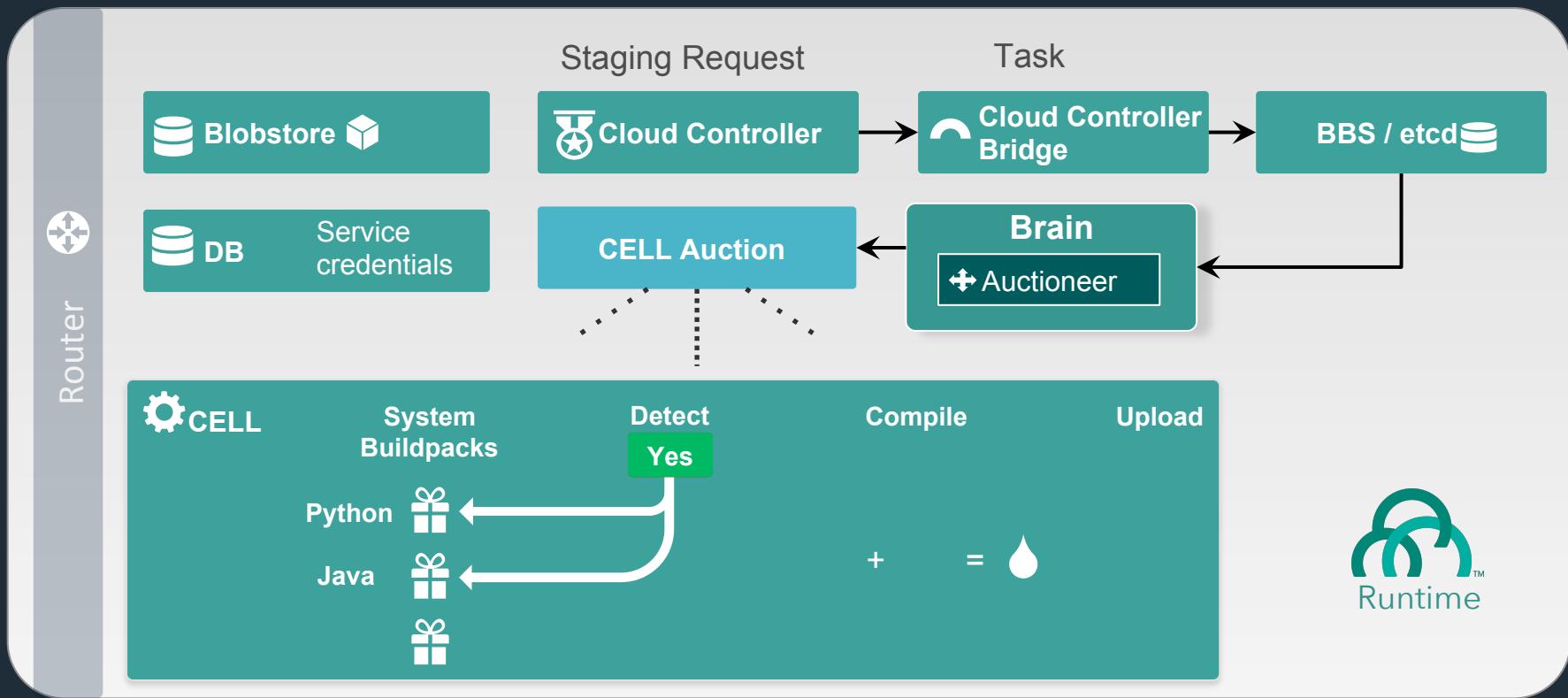
push app
+ app MD



Creating and Binding a Service

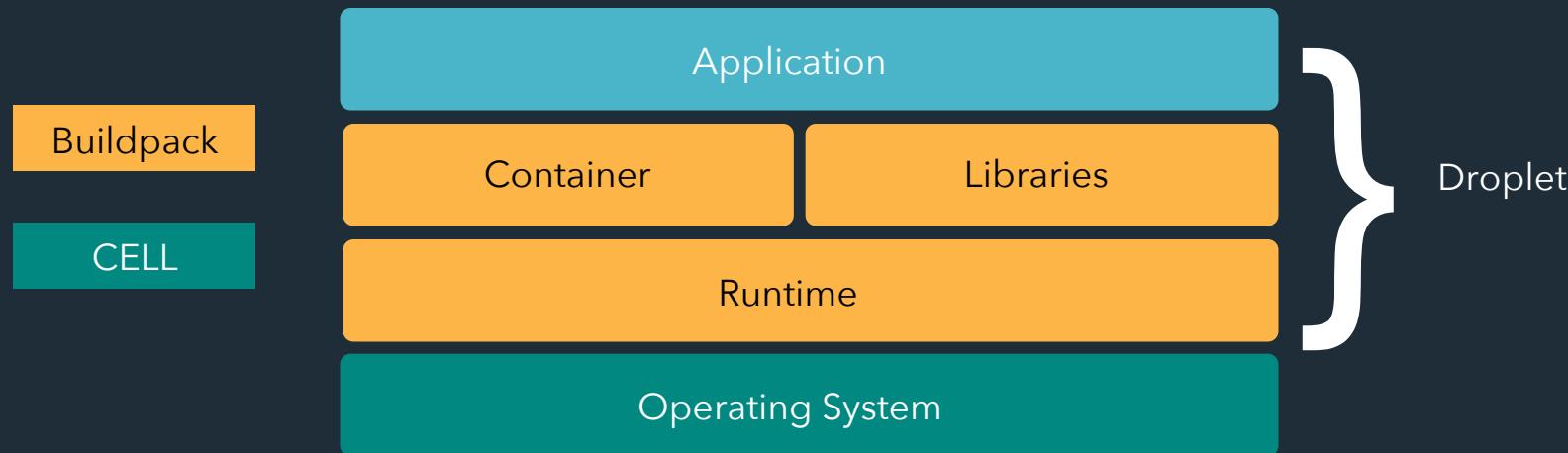


Staging an Application



Staging and Buildpacks

Buildpacks are responsible for preparing the machine image for an application.



Buildpack Flavors

Buildpacks installed into a Cloud Foundry instance or loaded from an external location at app deployment time

Buildpacks provided by public Cloud Foundry

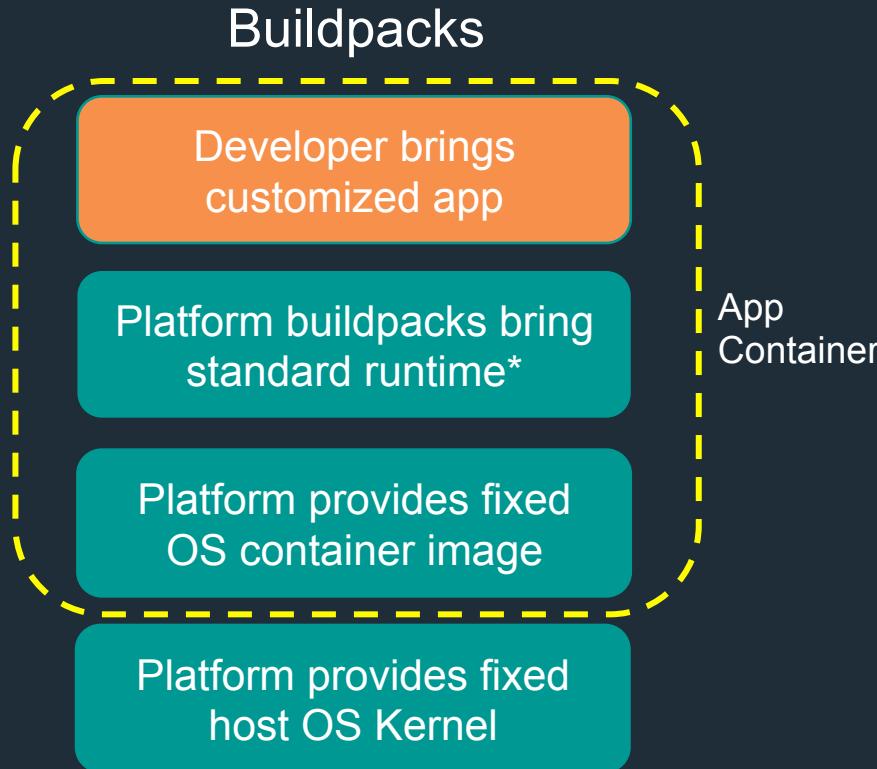
- Java
- Ruby
- Node.js
- Binary
- Go
- Python
- PHP
- Staticfile
- .NET

[Java Buildpack](#)

[Cloud Foundry Community Buildpack](#)

Write your own

Customize the Container Experience



* Devs may bring a custom buildpack

Containers and Scaling

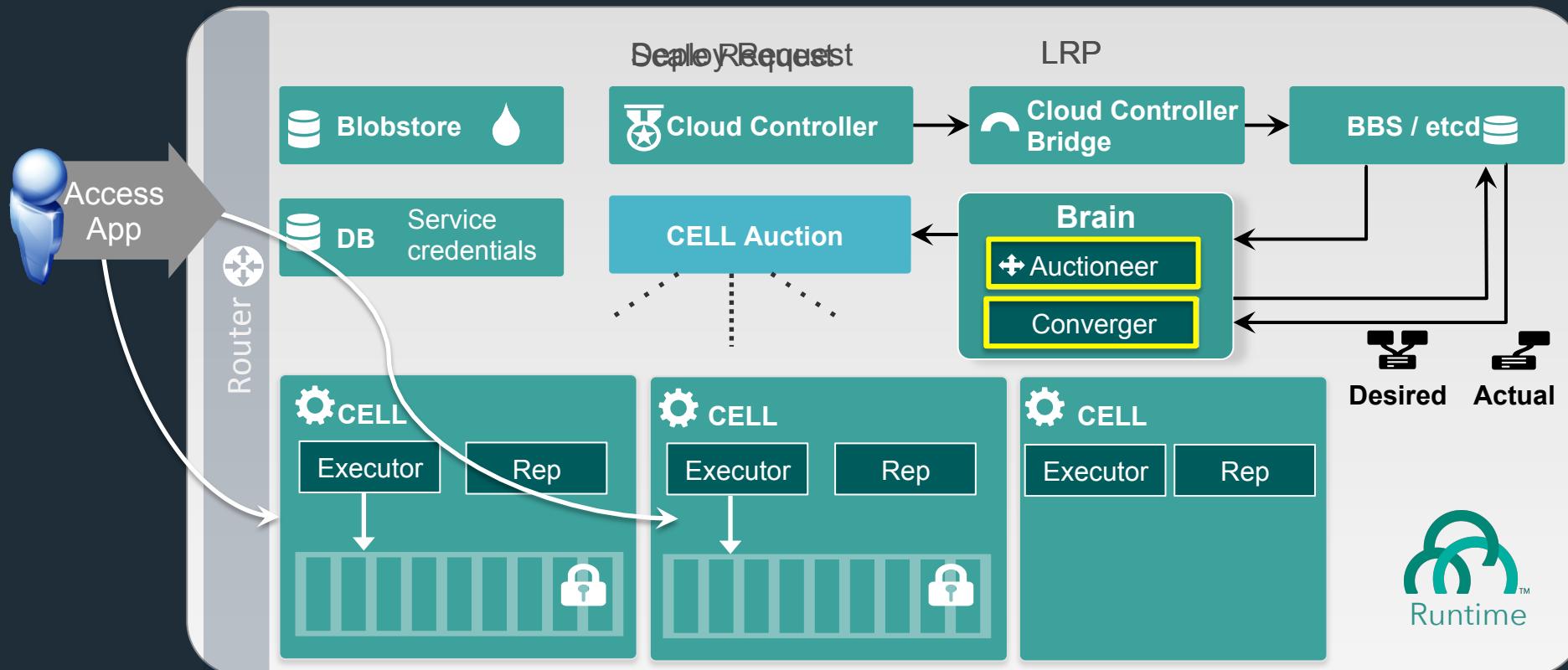
Overview



DEMO

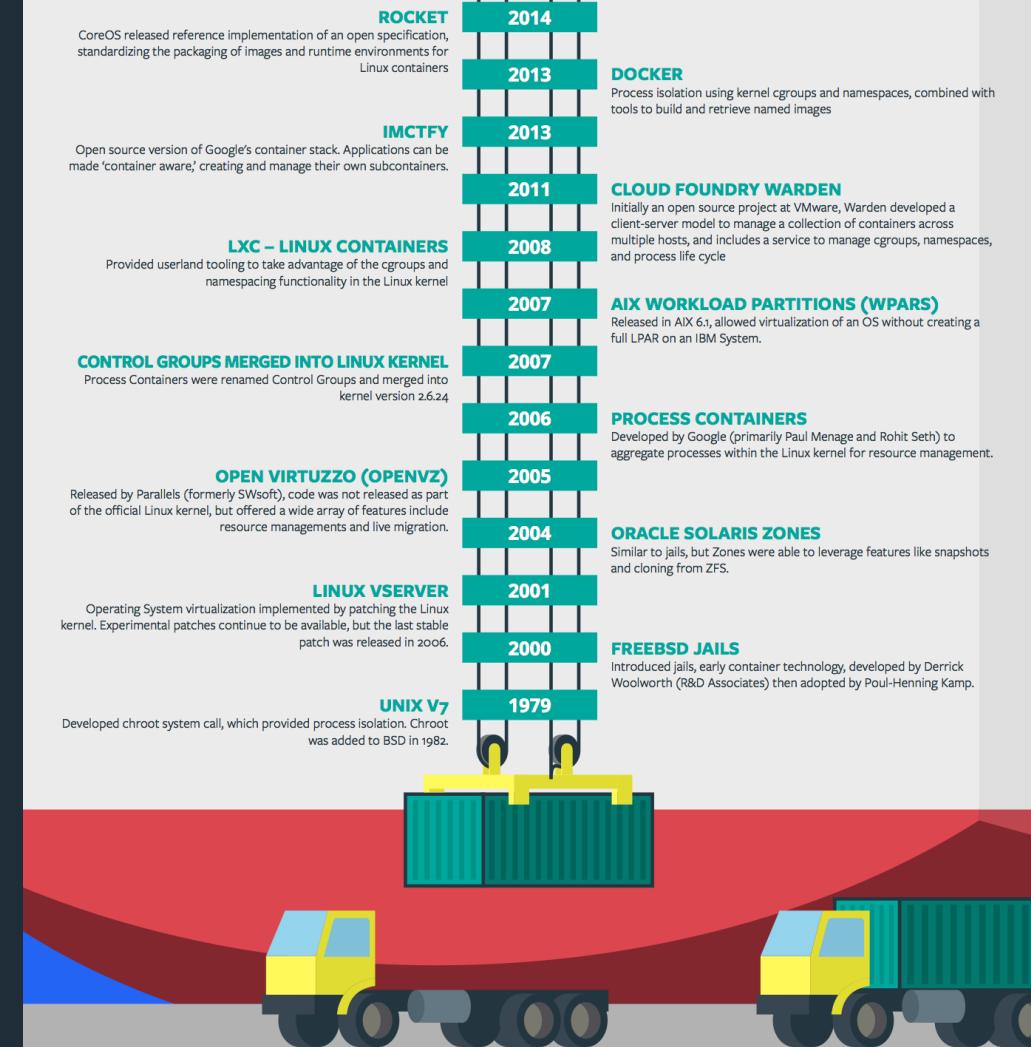
CF

Application Containers and Scaling

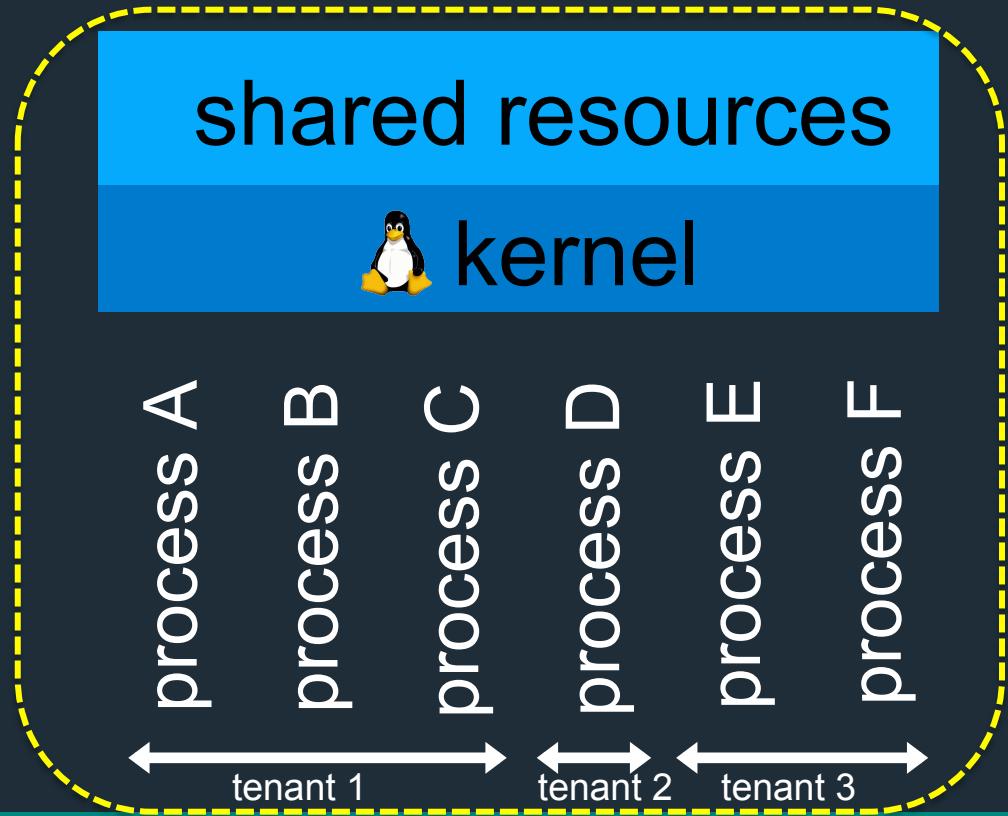


Containers - History

- Containers are not new
- CF has used containers since it's inception
- CF supports multiple container technologies as first class citizens including Docker, Warden, Garden and runC



Container Isolation

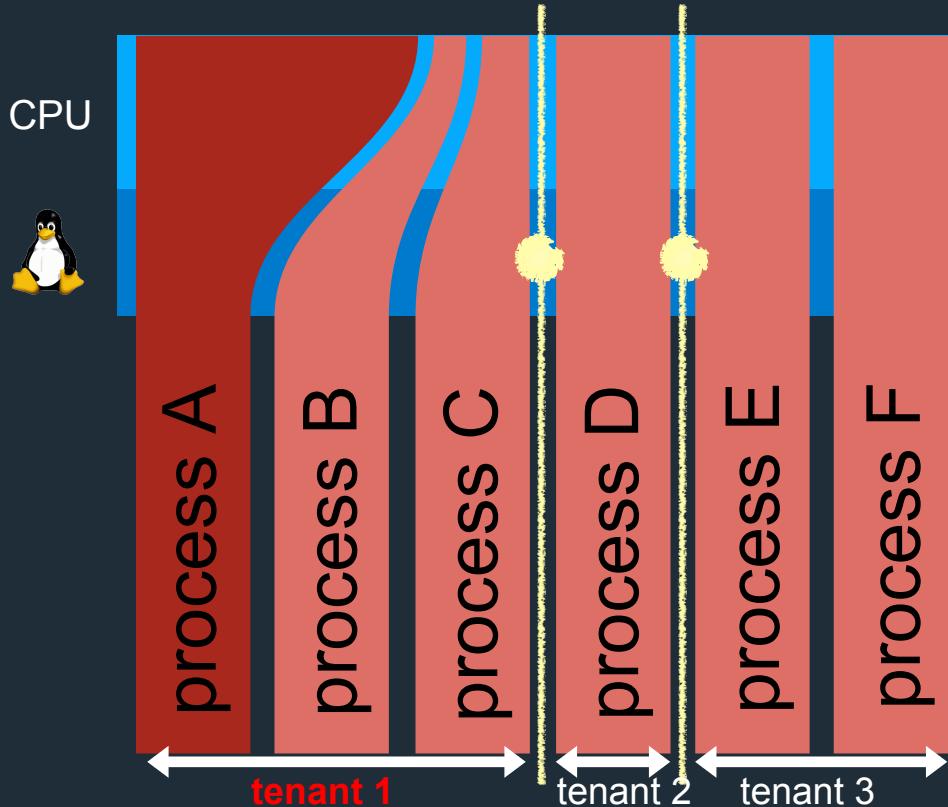


resource isolation

namespace isolation

Cell

Container Isolation



resource isolation

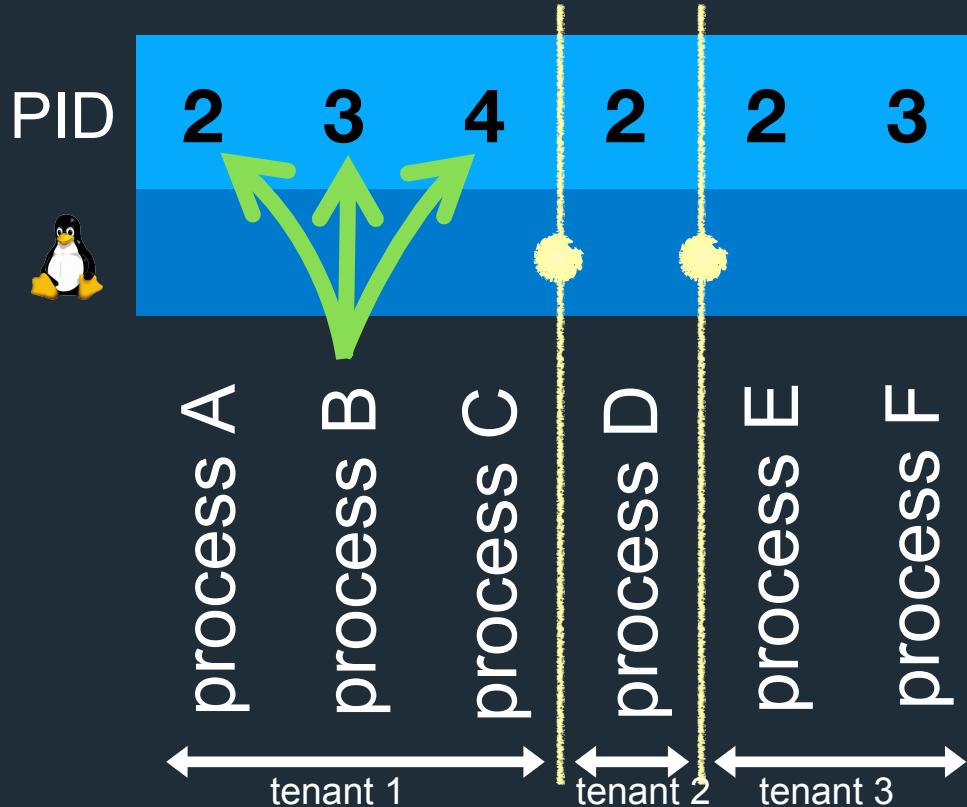
namespace isolation



cgroups

A Linux kernel feature that limits, accounts for, and isolates the resource usage of a collection of processes

Container Isolation



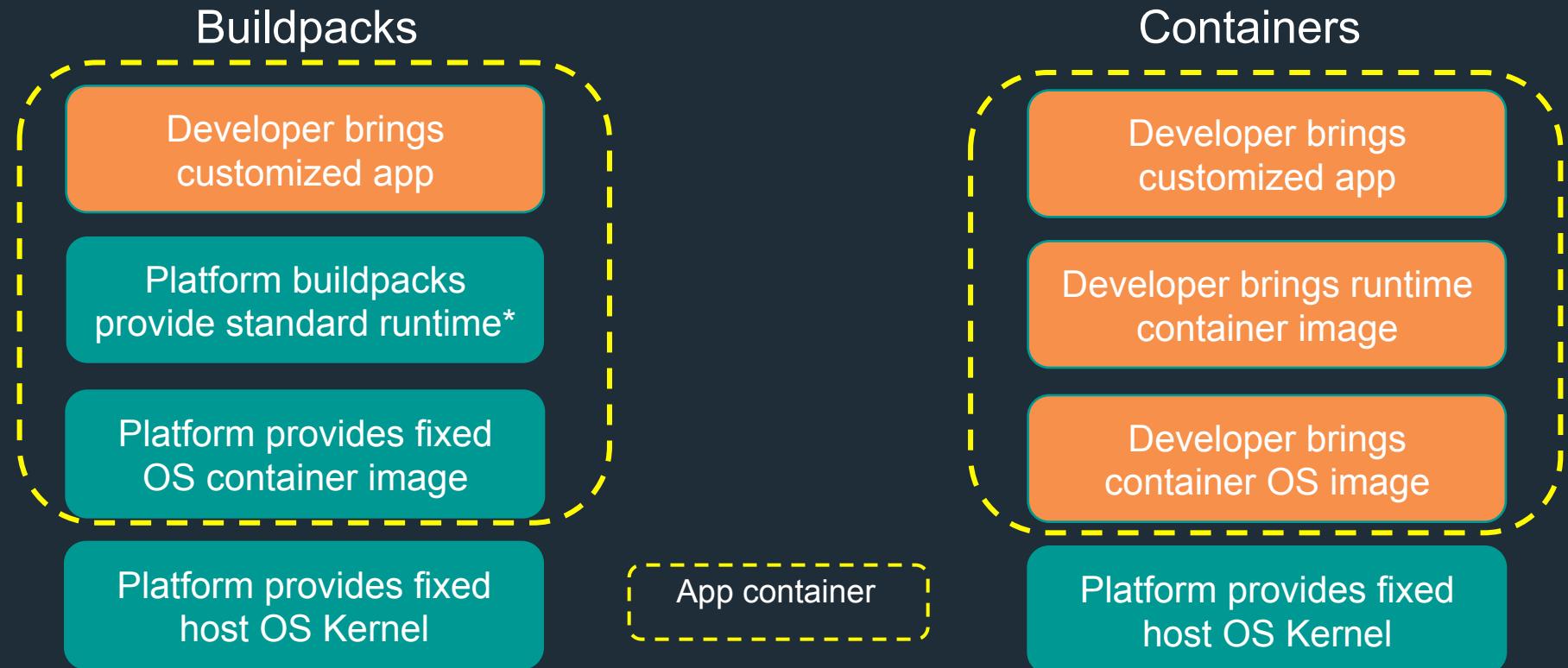
resource isolation

namespace isolation

PID namespace

The PID namespace provides isolation for the allocation of process identifiers (PIDs), lists of processes and their details.

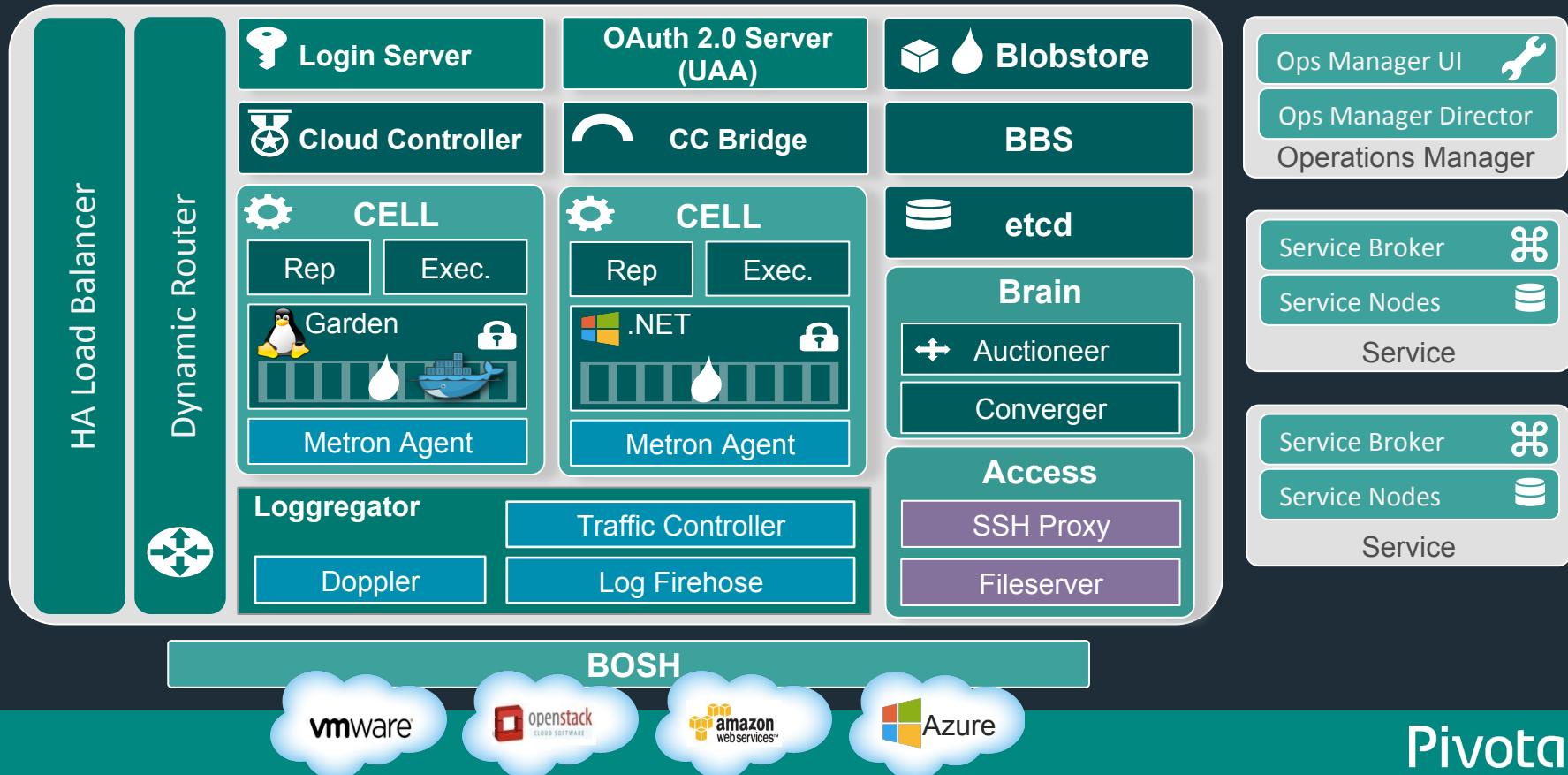
Customize the Container Experience



* Devs may bring a custom buildpack

Pivotal™

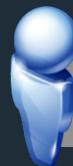
Pivotal CF Architecture - Recap



Deploying Cloud Foundry

Overview

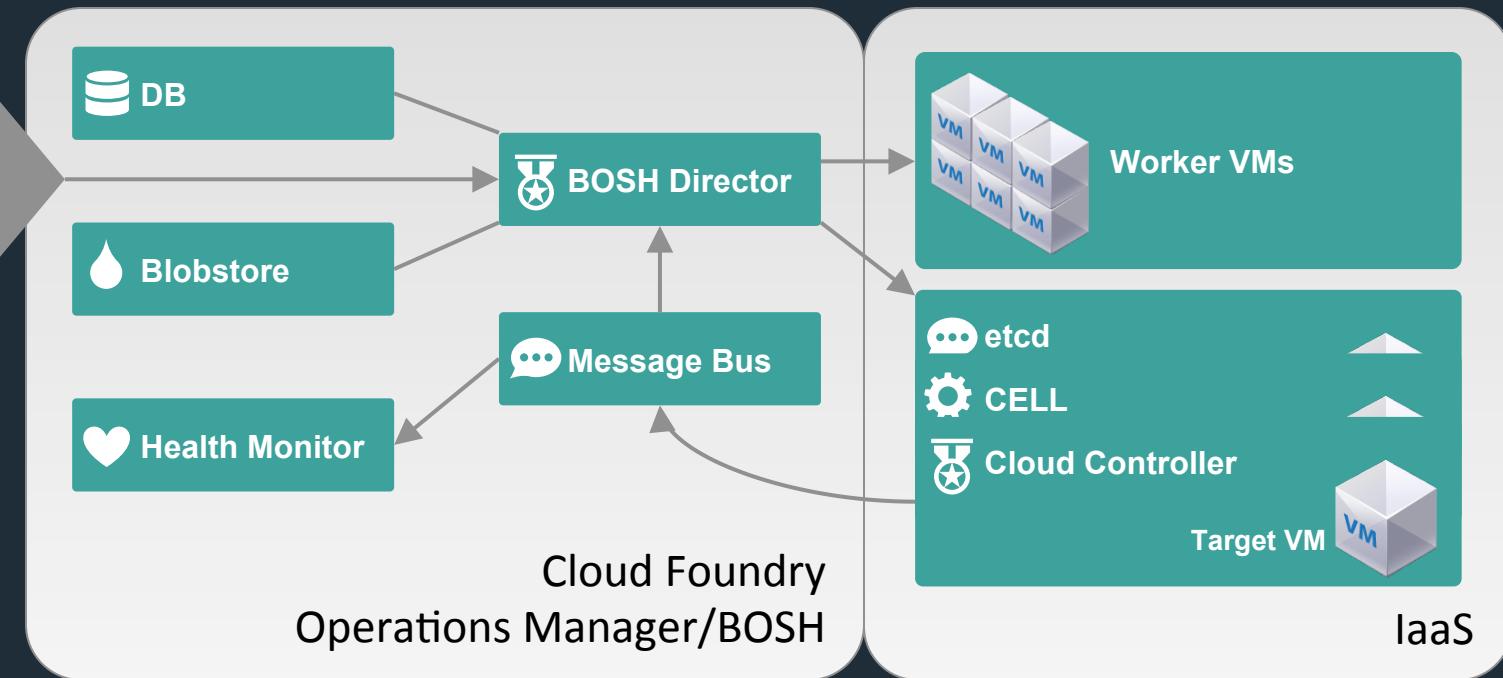
Deploying the CF Runtime with Cloud Foundry BOSH



Deploy new
CF Instance

Deployment

- Packages
- Blobs
- Source
- Jobs
- Manifest





DEMO

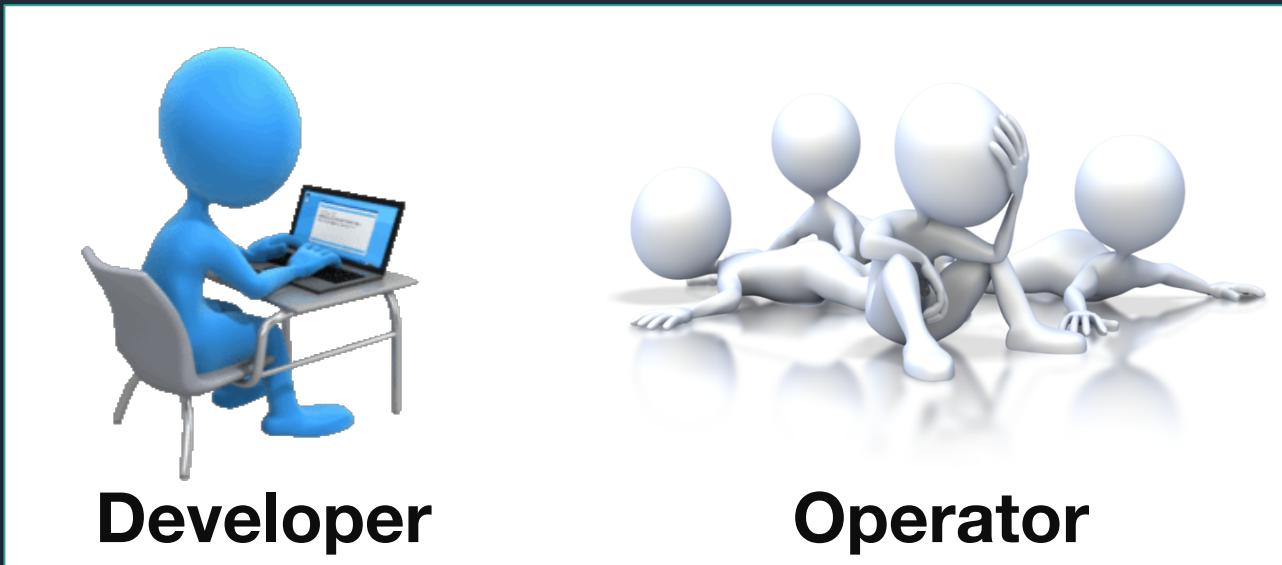
CF

Pivotal Cloud Foundry

Operations

Pivotal™

Pivotal CF operations





Deploy to dev



App Deployed



Install runtime and container



Install services (db, messaging, hadoop, ...)



Setup load-balancing, SSL termination and dynamic routing



Setup / config High Availability



Setup APM

Setup log streaming



Pivotal™

Restart server

Create service

Deploy to dev

Scale Platform

Update app

Deploy to QA

Bind

Update

Provision

Escalate

Scale down

Delete App

Blue-green deployment

Upgrade app

Deploy to Test

Change JDK

Redeploy

Scale up

Bind

Update

Deploy to QA

Bind

Update

Provision

Escalate

Scale down

Delete App

Bind

Update

The Pivotal CF Way



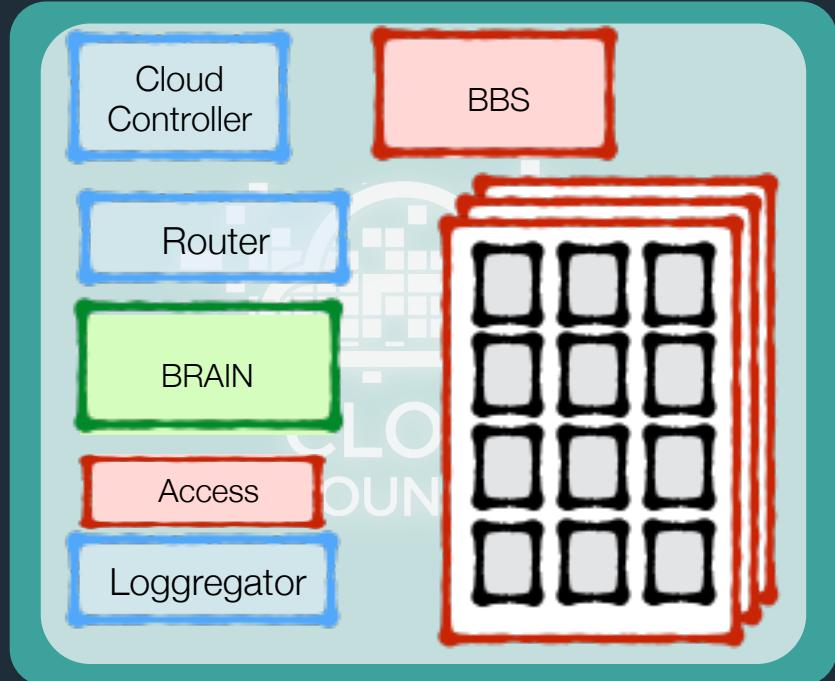
Deploy to dev



>cf push



App Deployed



Pivotal™

Operators in the Cloud Native Platform Era



Operator Concerns



Manage users
and quotas



Plan capacity



Install the
platform



Setup High
Availability



Handle upgrades
and updates



Monitor the
platform



Install the platform

Pivotal Ops Manager



Setup High Availability



Target multiple clouds

Pivotal CF

CLOUD
FOUNDRY™



Install and manage services



Scale and plan capacity



Handle live upgrades and updates



Click to install

No downtime updates

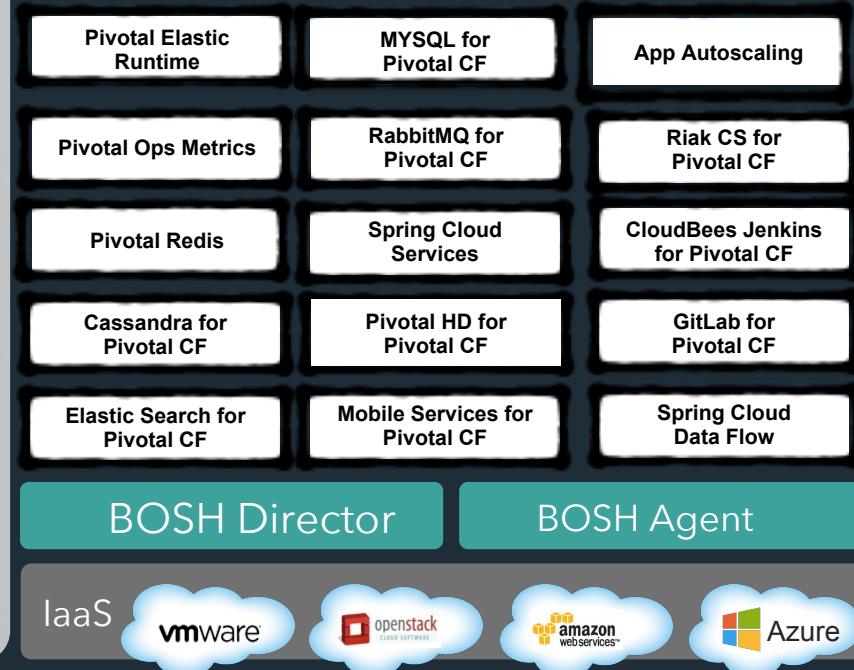
Explore install logs

Click to scale the platform

Built-in High Availability

Built-in Platform Monitoring

Integrated services



Pivotal™



DEMO

CF

Platform Monitoring

Pivotal Ops Metrics provides a single JMX interface to access metrics for each Pivotal CF component

- Cells
- Cloud Controllers
- Routers
- Health Managers
- BBS, UAA, Login Server, ...



MONITOR

EXPLORE

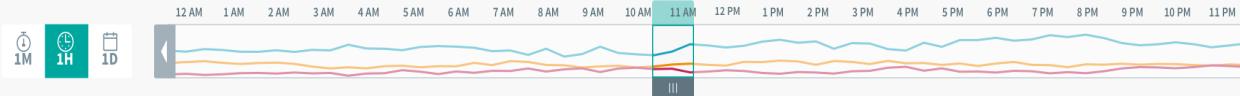
 Container Network Logs

Lorem Ipsum Dolor App

ORG: Pivotal SPACE: Labs STATUS: Running

TIMEFRAME

Container

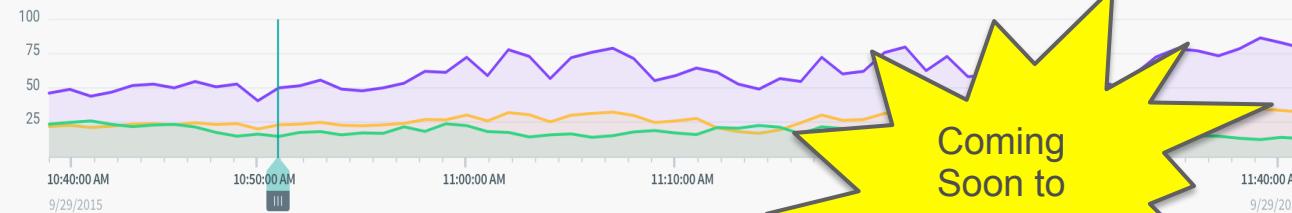


METRICS

Container

percent usage/minute

- CPU
- MEMORY
- DISK



LOGS

Sources: Apps, Health

Apply

```
▶ Tue Nov 03 2015 10:50:49.123 GMT-0800 (PST) [RTR] OUT console.run.pivotal.io - [03/11/2015:18:28:49 +0000] "GET /api/apps/f136eb5a-9d8d-41be-9571-578d95feeb0a/env_vars HTTP/1.1" 200 0 4 "https://console.run.pivotal.io/organizations/99345203-f06a-4e1e-8f04-f05060d881d8/spaces/99345203-f06a-4e1e-8f04-f05060d881d8/spaces/51ff-2bd4-4b70-155c-04cc-65-aaef2dcf5e/announcements/fff9c6b2-040d-41bc-9571-578d95feeb0a#liveload" "Max(11.1a/5.0) (Windows NT 6.3; Win32; Trident/7.0+ rv:11.0) like Gecko"
```

```
Tue Nov 03 2015 10:50:50.202 GMT-0800 (PST) [APP] OUT /home/vcap/app/vendor/bundle/ruby/2.0.0/gems/actionpack-4.1.11/lib/action_dispatch/journey/router.rb:73:in `block in call'
```

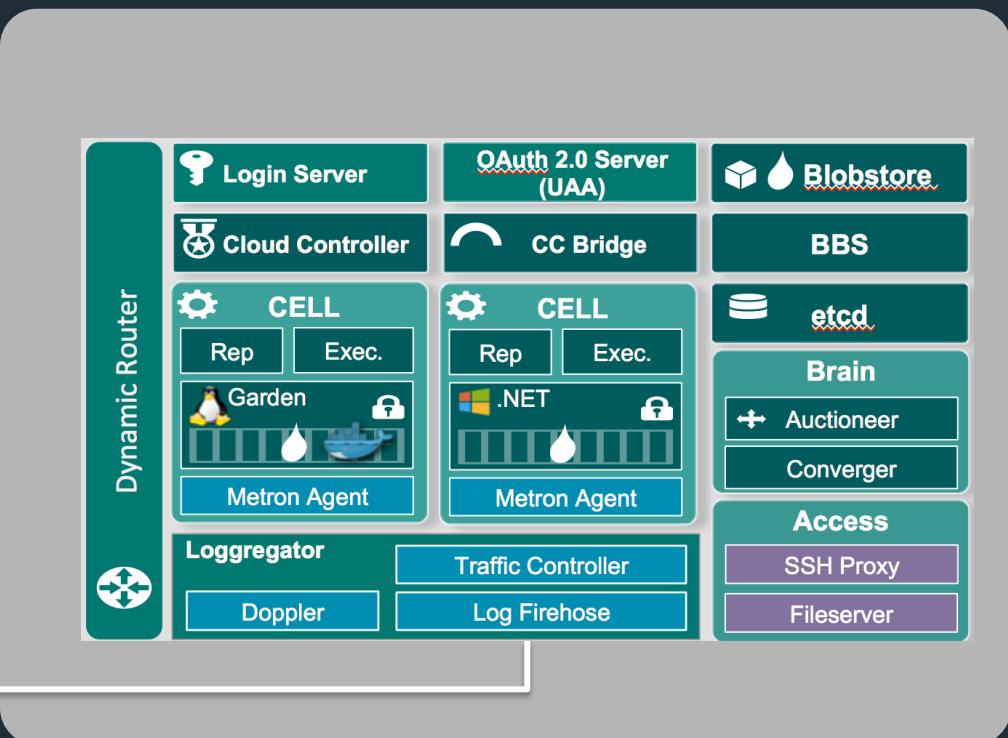
```
Tue Nov 03 2015 10:50:50.820 GMT-0800 (PST) [APP] ERROR /home/vcap/app/vendor/bundle/ruby/2.0.0/gems/newrelic_rpm-3.10.0.279/lib/new_relic/agent/instrumentation/middleware_tracing.rb:67:in `call'
```

```
Tue Nov 03 2015 10:50:51.151 GMT-0800 (PST) [HEALTH] OUT /home/vcap/app/vendor/bundle/ruby/2.0.0/gems/actionpack-4.1.11/lib/action_controller/metal/instrumentation.rb:32:in `block in process_action'
```

Platform Monitoring

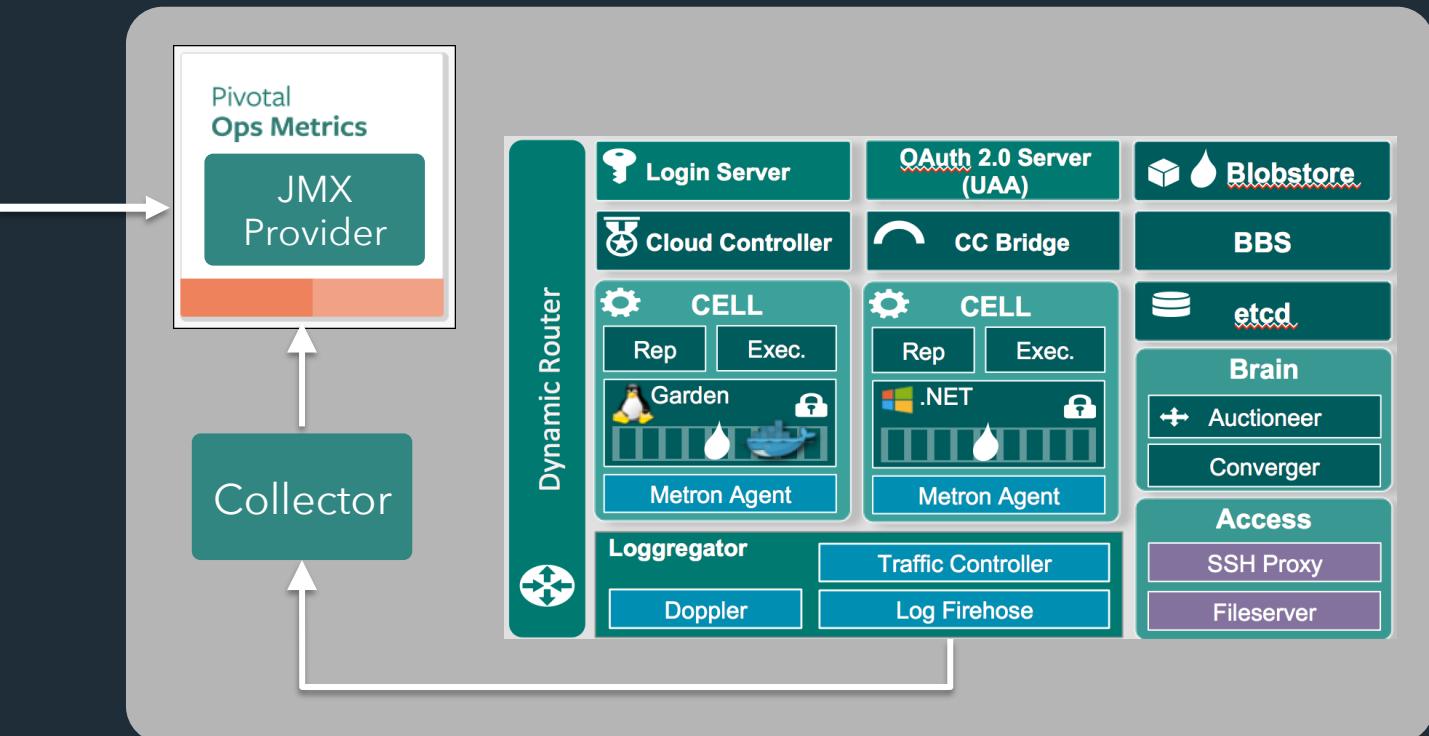
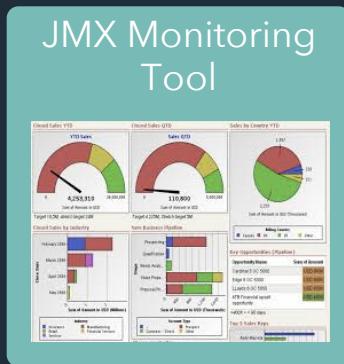
The screenshot shows the Splunk search interface with the search bar containing 'execution'. A red box highlights the search bar, and another red box highlights the 'Search' button. The results pane displays 177 matching events from 09:41:08 to 09:41:24 on Wednesday, May 1, 2013. The logs are from a 'PolicyService' component, detailing errors related to 'getPolicyExecution' calls to 'storage' and 'metron' services, specifically mentioning 'FileNotFoundException' and 'ItemNotFoundException'.

```
[{"time": "2013-05-01T09:40:40.000Z", "log": "04/05/2013 09:40:40 [27] 00000000 PolicyService E com.lim.wps.policy.services.PolicyService getPolicyExecution calling storage east.com.lim.wps.storage.StorageException: E1Q4W00011: An ItemNotFoundException occurred in method LogExecutionForPolicyRequest..."}, {"time": "2013-05-01T09:40:40.000Z", "log": "04/05/2013 09:40:40 [27] 00000000 PolicyService E com.lim.wps.policy.services.PolicyService getPolicyExecution calling storage east.com.lim.wps.storage.StorageException: E1Q4W00011: An ItemNotFoundException occurred in method LogExecutionForPolicyRequest..."}, {"time": "2013-05-01T09:40:40.000Z", "log": "04/05/2013 09:40:40 [27] 00000000 PolicyService E com.lim.wps.policy.services.PolicyService getPolicyExecution calling storage east.com.lim.wps.storage.StorageException: E1Q4W00011: An ItemNotFoundException occurred in method LogExecutionForPolicyRequest..."}, {"time": "2013-05-01T09:40:40.000Z", "log": "04/05/2013 09:40:40 [27] 00000000 PolicyService E com.lim.wps.policy.services.PolicyService getPolicyExecution calling storage east.com.lim.wps.storage.StorageException: E1Q4W00011: An ItemNotFoundException occurred in method LogExecutionForPolicyRequest..."}]
```



Pivotal™

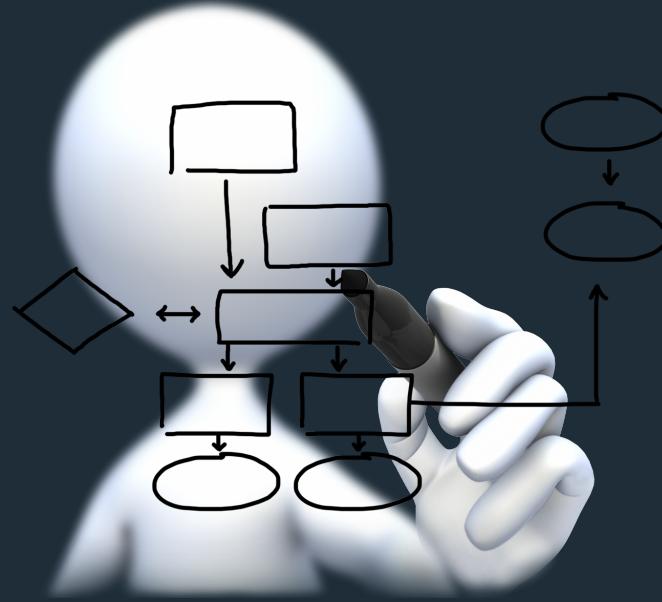
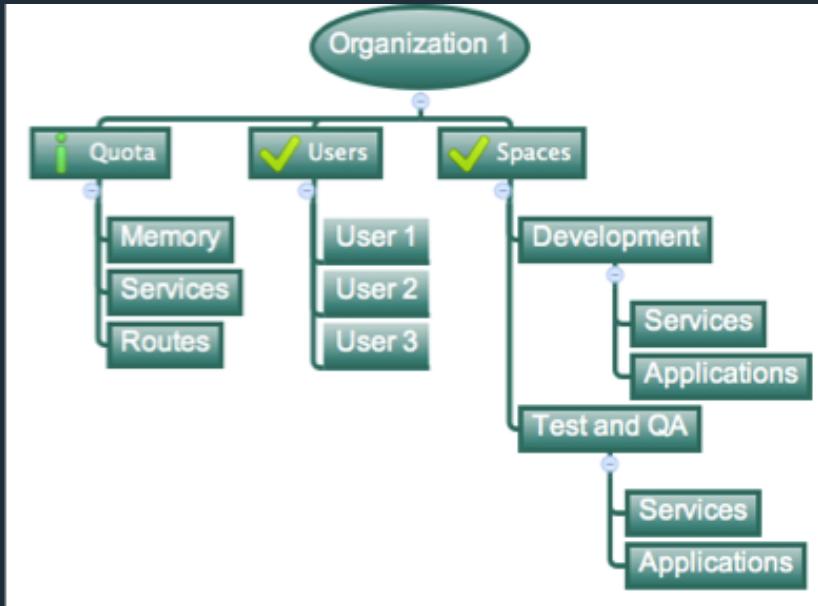
Platform Monitoring



Multi-tenancy

Overview

Orgs, Spaces, Users & Quotas



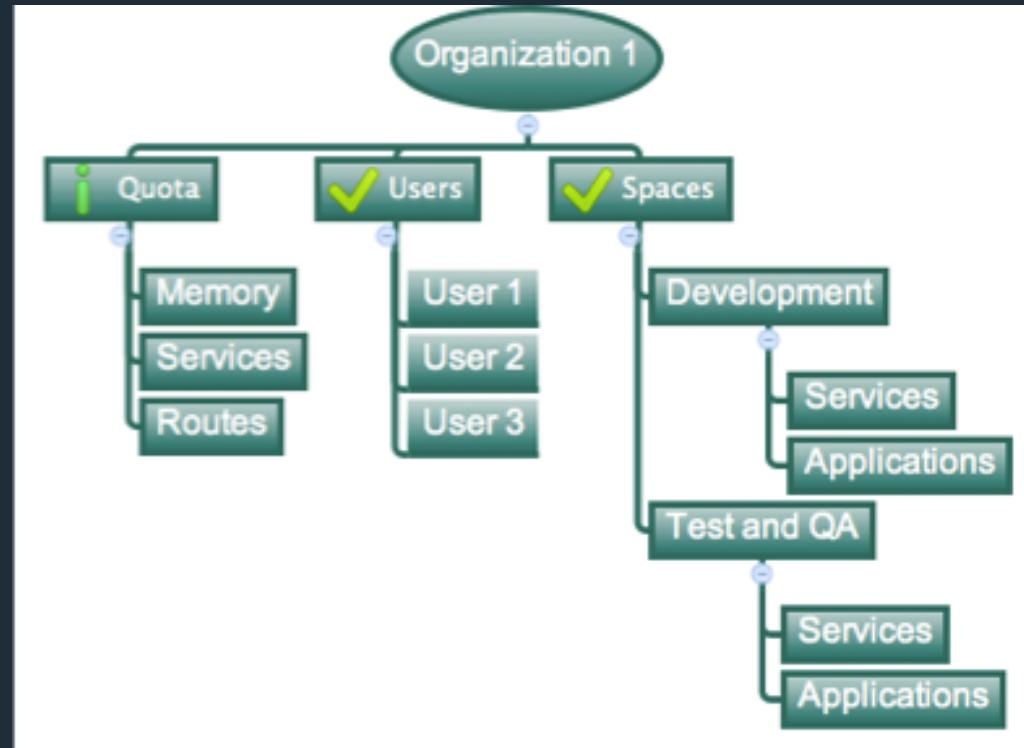
Organizations

Logical division within a Pivotal CF install / Foundation.

Each organization has its own users and assigned quota

User permissions / roles are specified per space within an organization

Sub-divided into Spaces

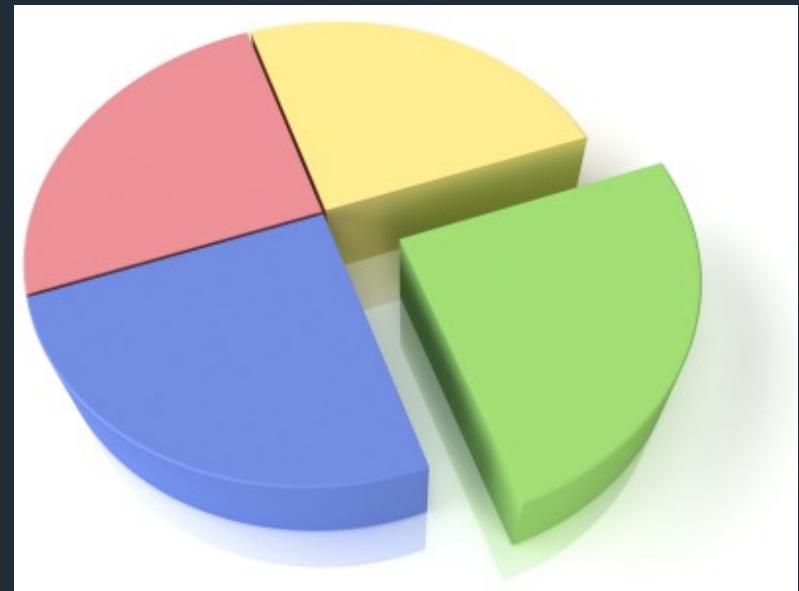


Quotas & Plans

Different quota limits (e.g. “small”, “enterprise”, “default”, “runaway”) can be assigned per Organization

Quota defines

- Total Memory
- Total # of Services
- Total # of Routes



Spaces

Logical sub-division within an organization

Users authorized at an organization level can have different roles per space

Services and Applications are created / specified per Space

Same Service can have different meanings per space

Spaces can be assigned quotas



Platform Monitoring



- How do I know when to scale Cells?
- How many requests each Router is servicing?
- What is the current load of my Cloud Controllers?

Platform Monitoring

Pivotal Ops Metrics provides a single JMX interface to access metrics for each Pivotal CF component

- Cells
- Cloud Controllers
- Routers
- Health Managers
- BBS, UAA, Login Server, ...



Four Levels of HA

Built In!

Four Layers of High Availability – Built In

Application Instance

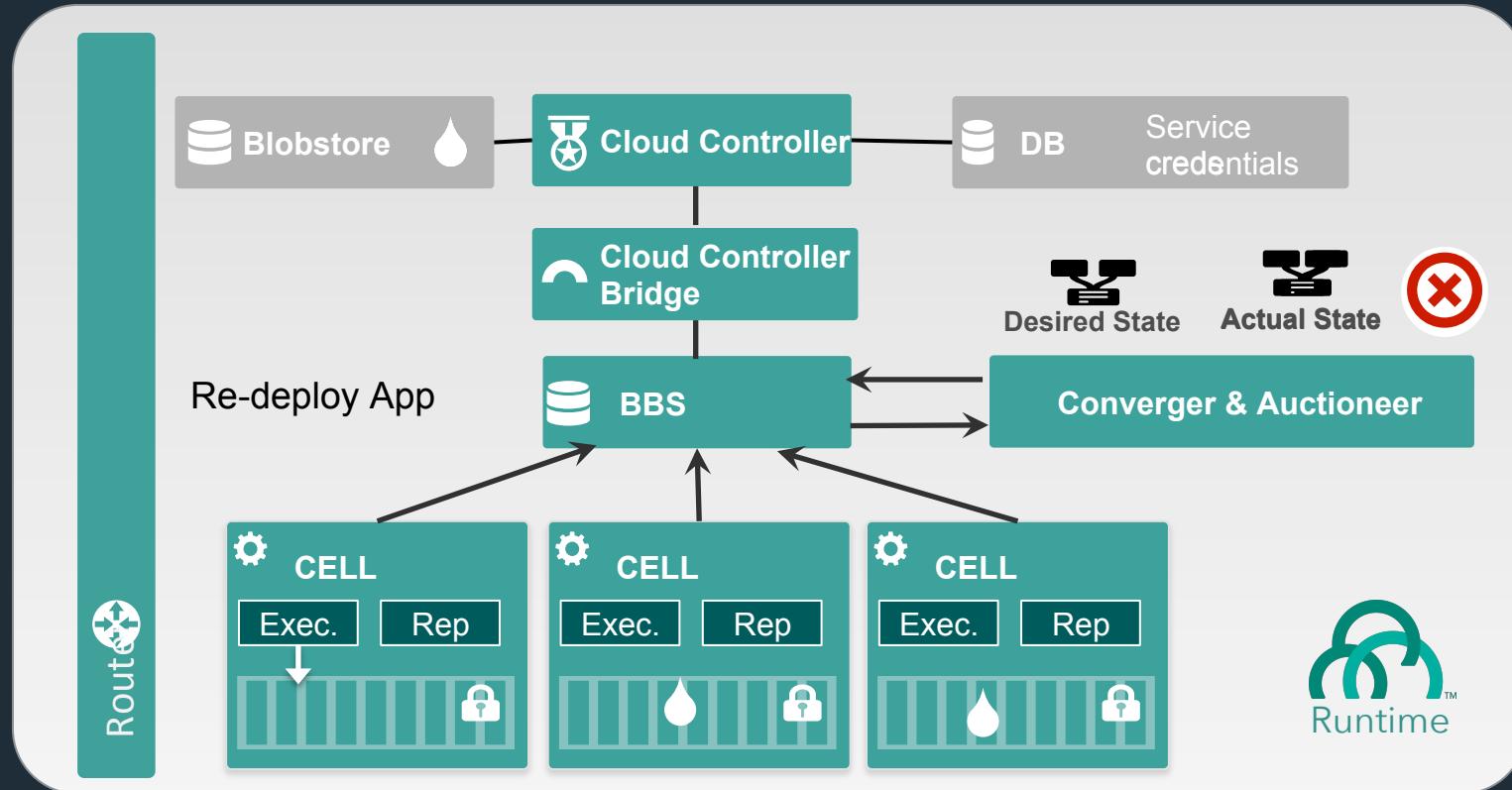
Platform Processes

Platform VMs

Availability Zones



Application Instance HA

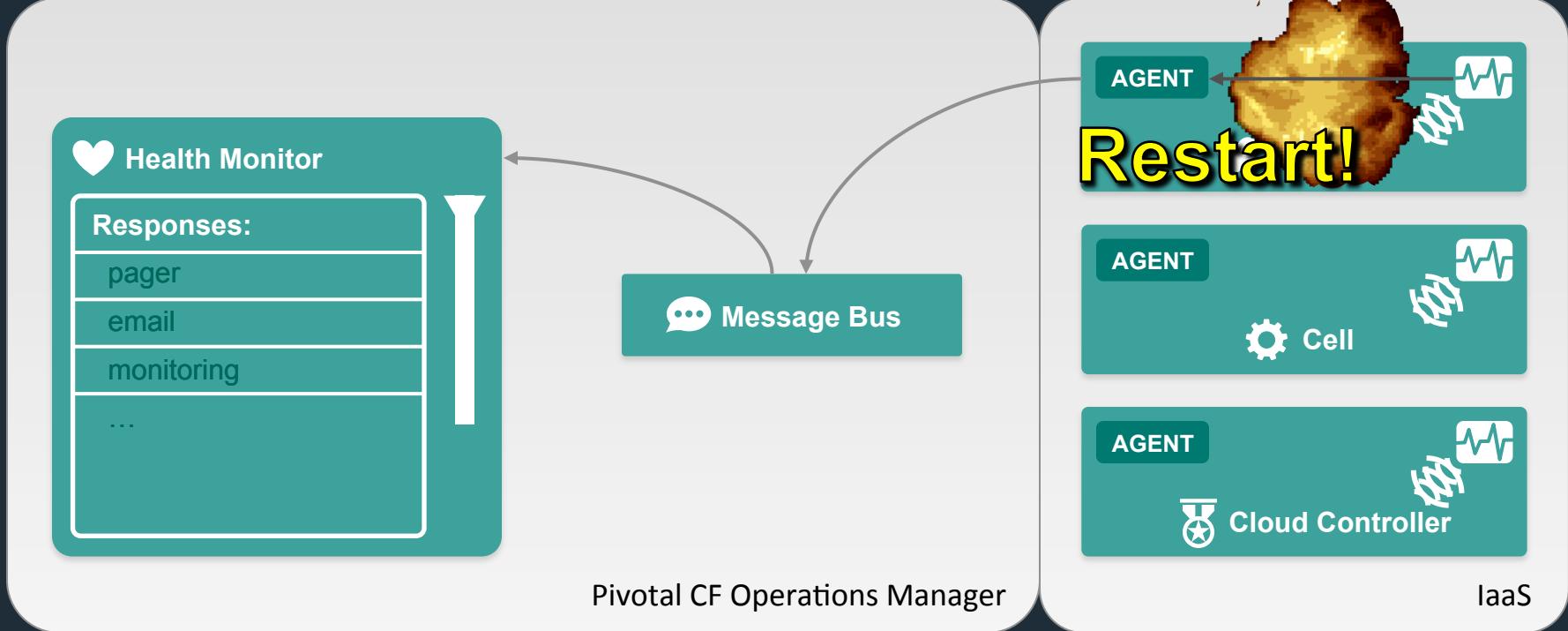




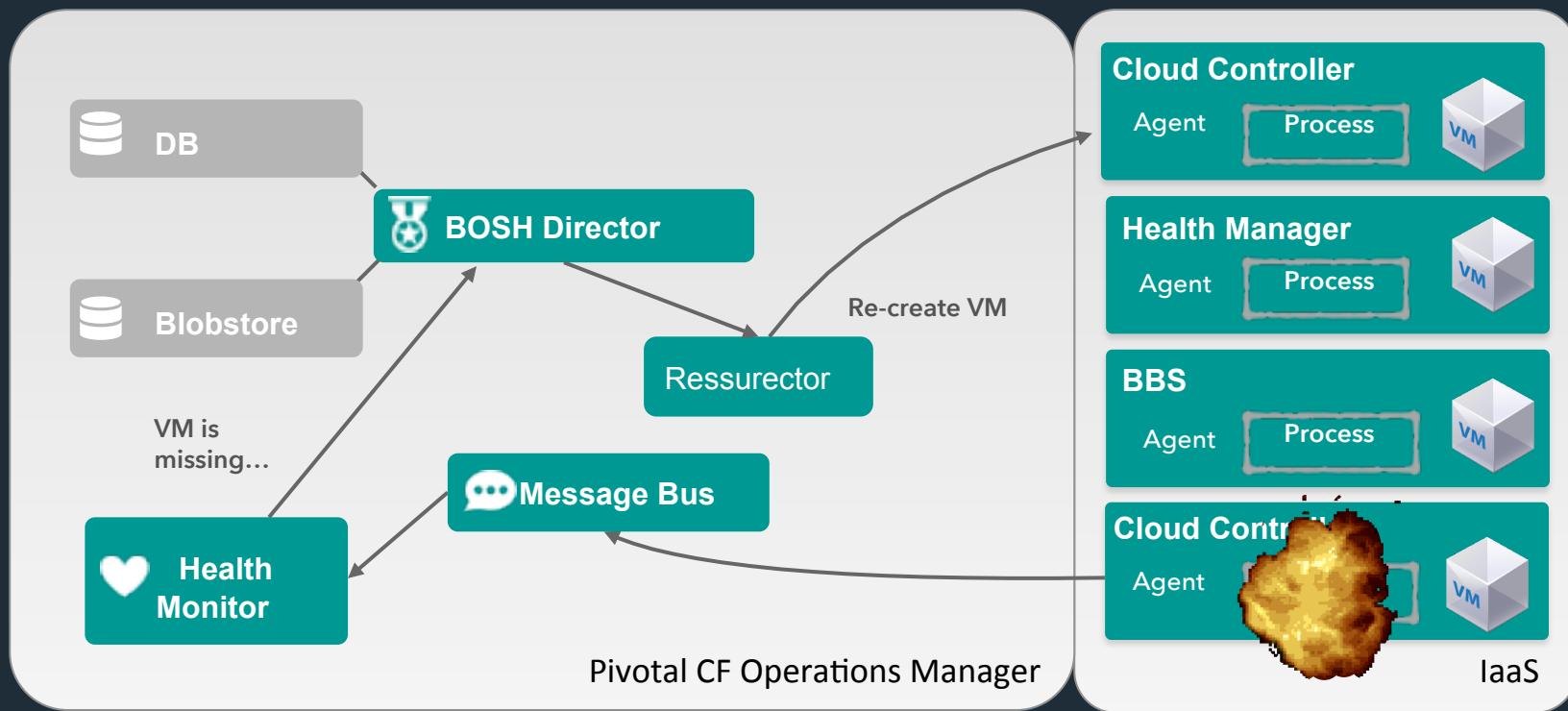
DEMO

CF

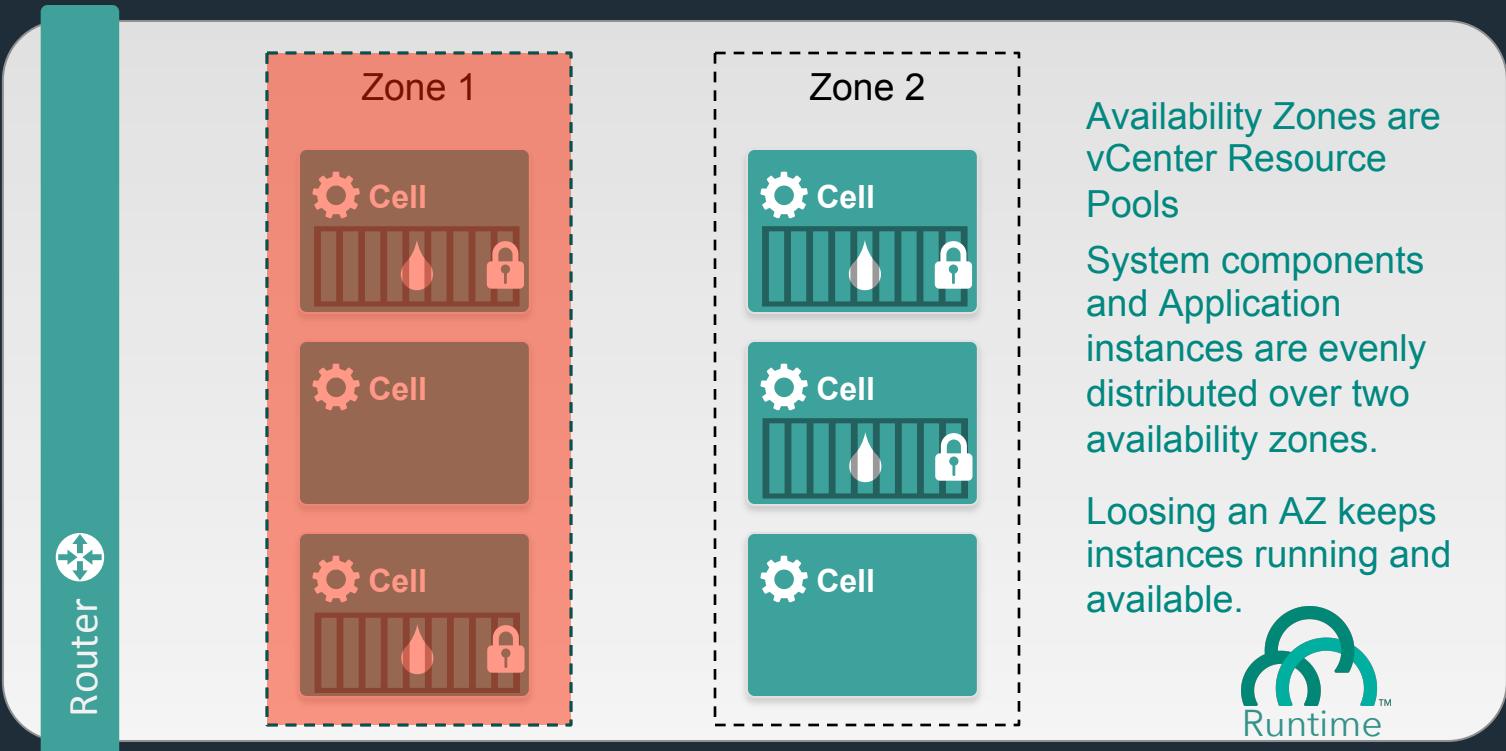
Platform Process HA



Platform Virtual Machine HA

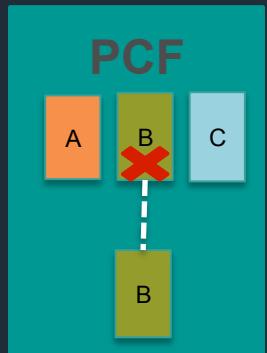


Availability Zone HA

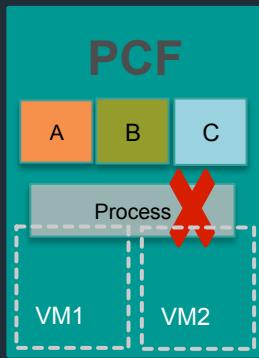


How Pivotal Enables Four Levels of HA

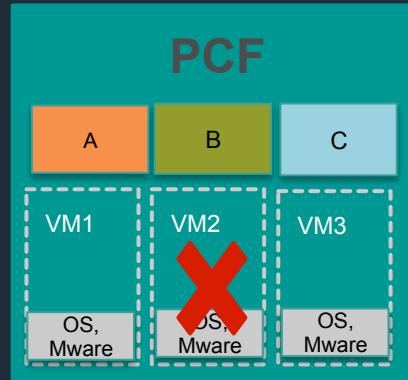
1.



2.



3.



4.



If an **app fails**, PCF reboots app in a new container.

App Fail

If a **process fails**, PCF restarts the process

Process Fail

If an **OS or network failure occurs** PCF kills the VM and reboots the host in a new Virtual machine.

VM Fail

If a **datacenter rack fails**, PCF ensures applications stay running in multiple availability zones

Rack Fail

Operator Concerns



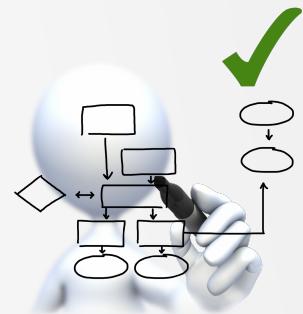
Plan capacity



Install the platform



Setup High Availability



Manage users and quotas



Handle upgrades and updates



Monitor the platform



DEMO

CF

Capabilities of Pivotal Cloud Foundry

Automatic App Server & OS Configuration with Buildpacks (“just push your app”)



Application Containerization & Cluster Scheduling



Application Network Security Groups



Application to Services Binding and Access



App Health, Load Balancing, Rapid Scaling, Availability Zones



Policy, Identity and Roles Management



Native & Extended Data, Mobile and Platform Services



IaaS Provisioning, Scaling & Configuration



Logging as a service, Application metrics & performance, Metric based scaling



Deploy, Operate, Update & Scale with minimal downtime on choice of IaaS

vmware

openstack
CLOUD SOFTWARE

amazon
web services™

Azure

Pivotal™

Pivotal

A NEW PLATFORM FOR A NEW ERA