

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 a city skyline is visible under a clear sky.

Pivotal



EXPRESS SCRIPTS®

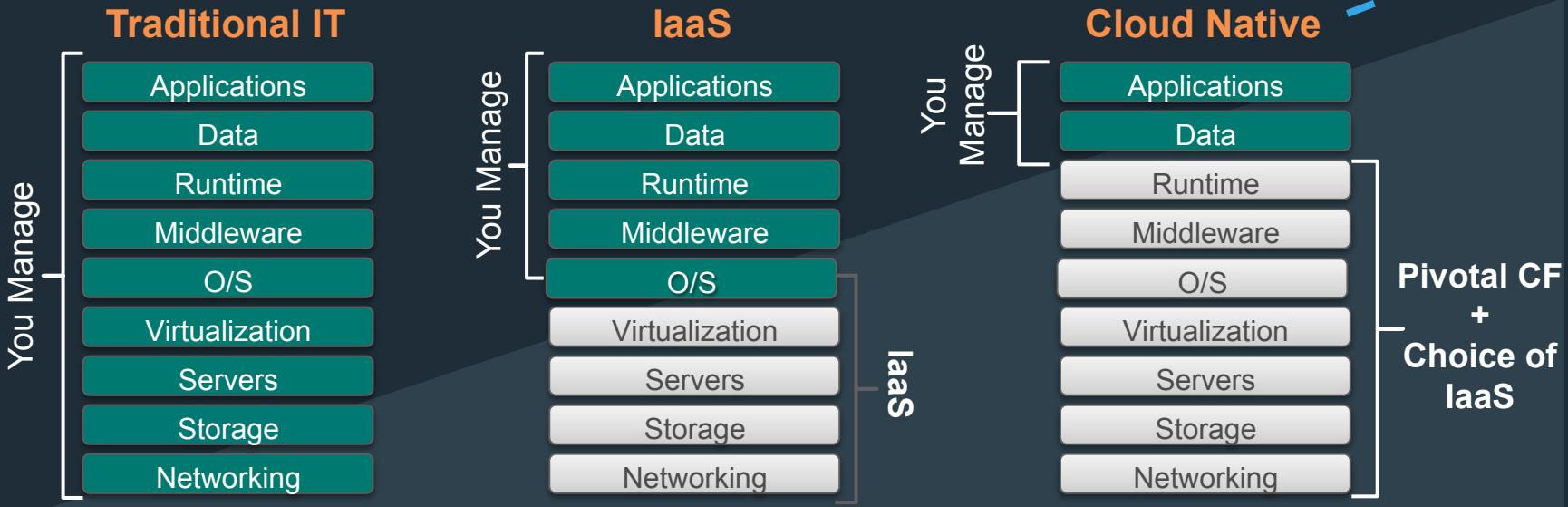
# Pivotal Cloud Foundry

## Architecture, Containers, and Operations

Pivotal

# Cloud Native Application Platforms

Business Value, Agility & Cost Savings



# Pivotal Cloud Foundry

## Platform Access

HA Load Balancer

Dynamic Router



## Elastic Runtime

Logging / Metrics

Application  
Access

Ops Manager

Service

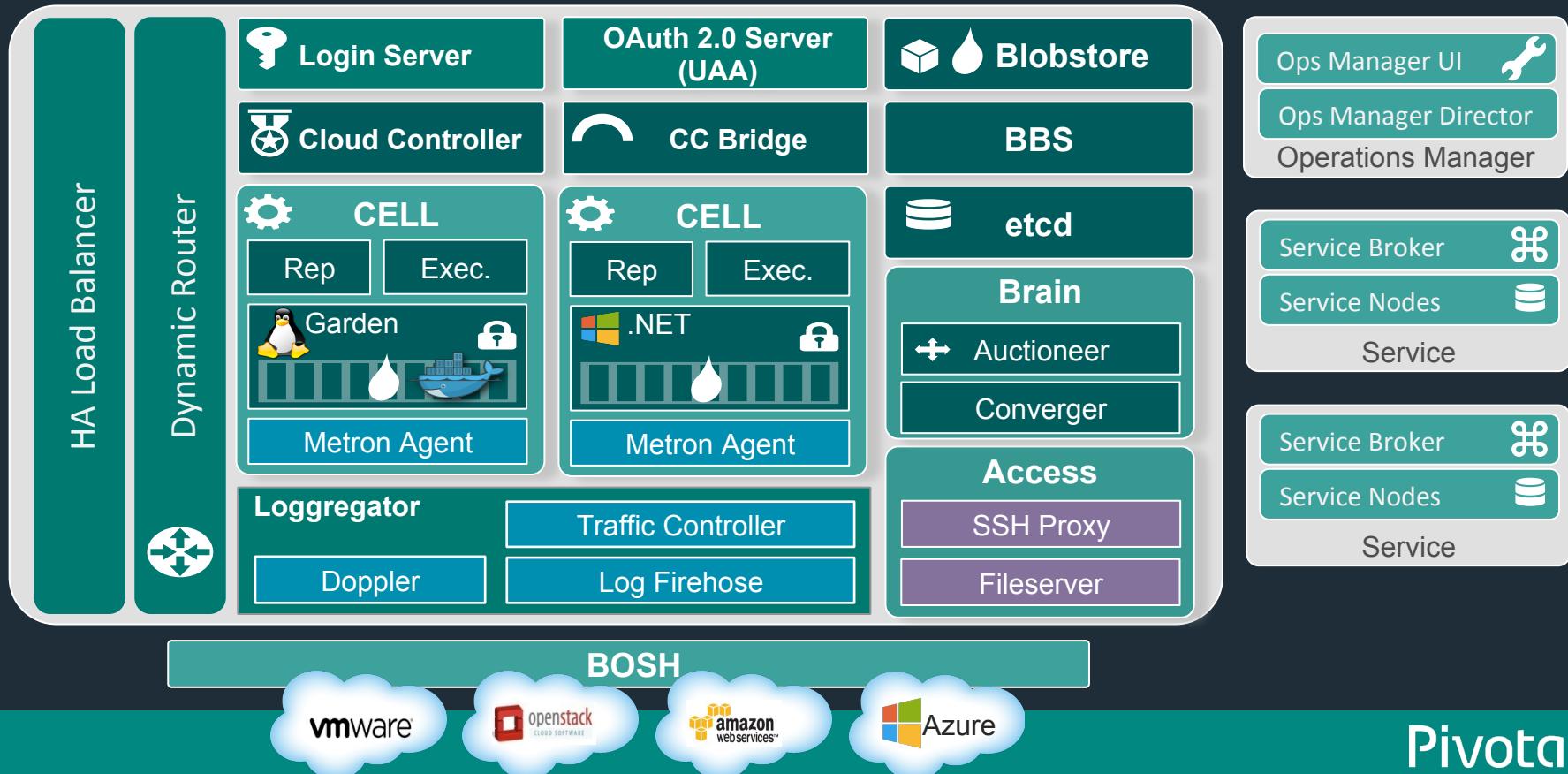
Service

## BOSH - Automation Layer



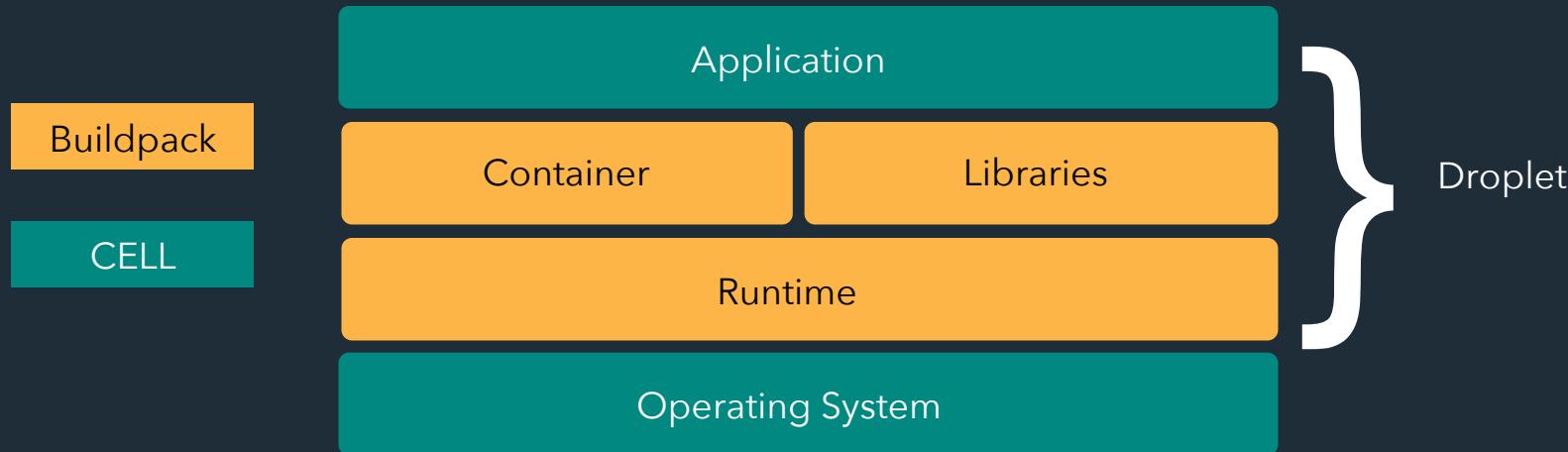
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# Pivotal CF Architecture



# Staging and Buildpacks

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



# Buildpacks

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

[Java Buildpack](#)

[Cloud Foundry Community Buildpack](#)

Write your own

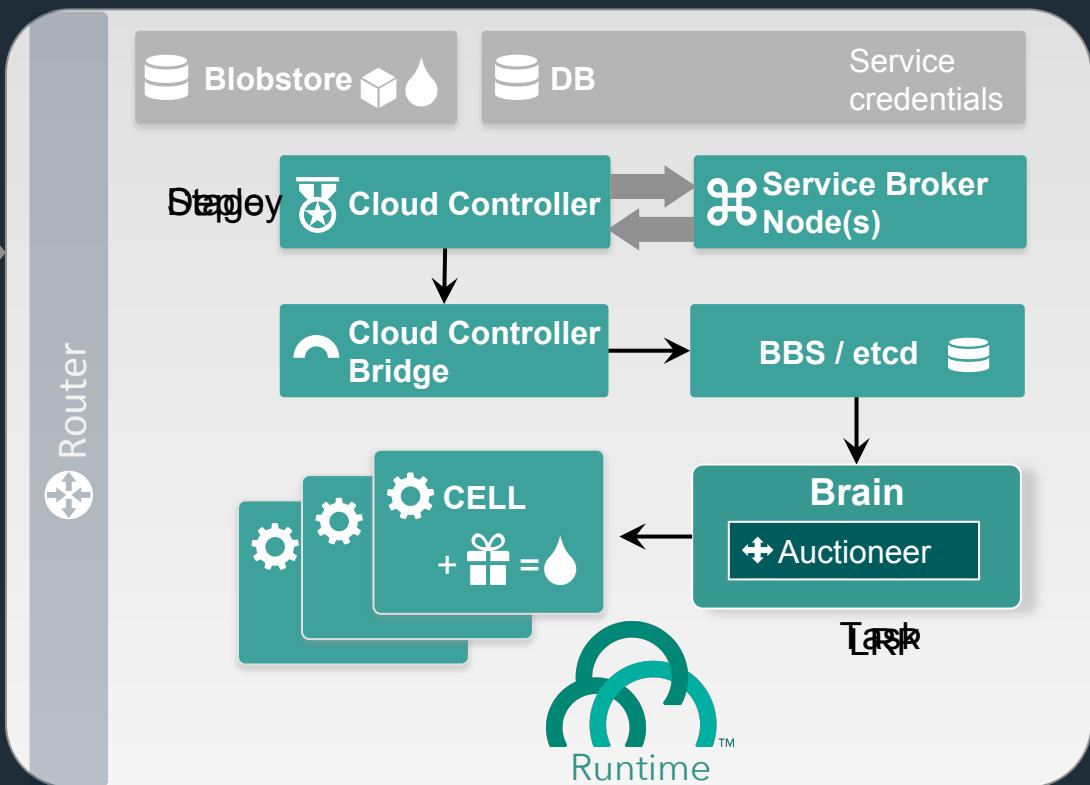


# DEMO

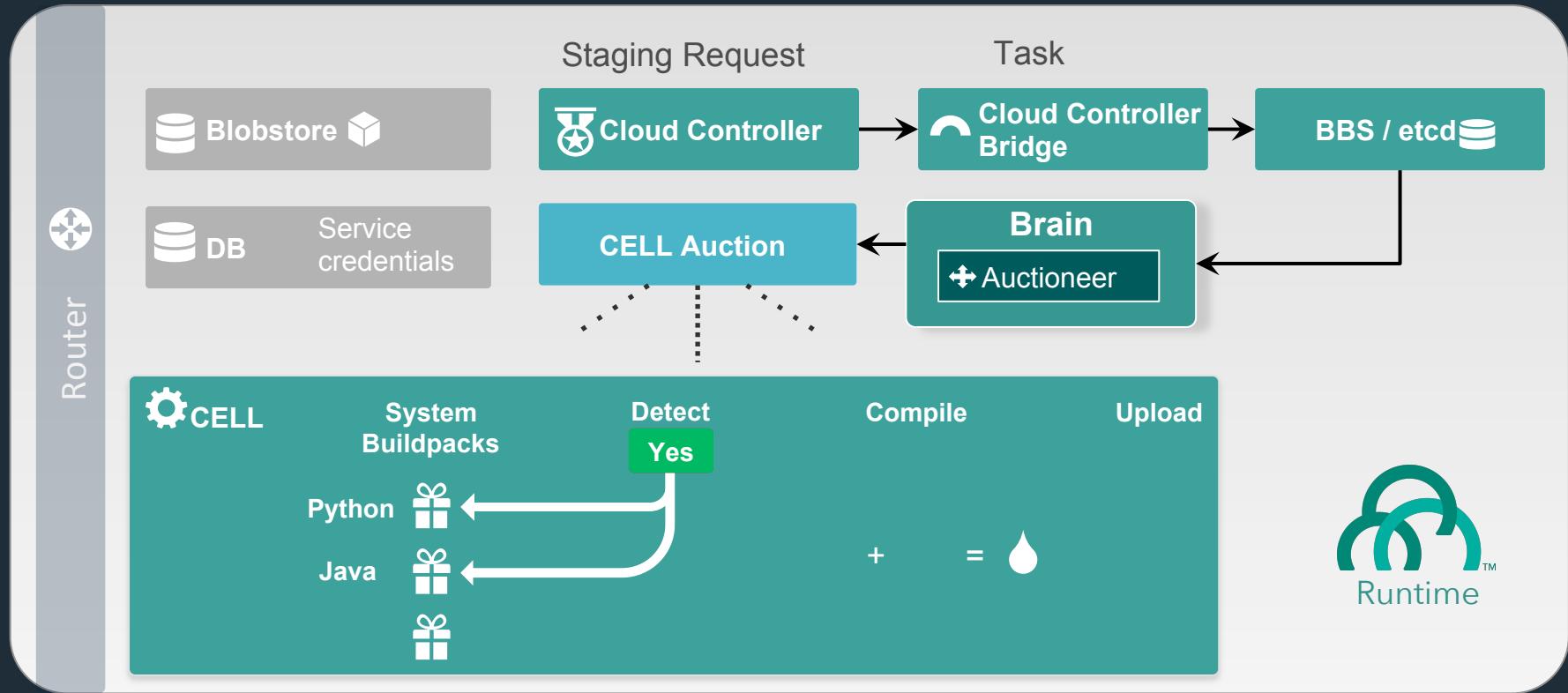
CF

# Overview: Pushing an Application

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



# Staging an Application



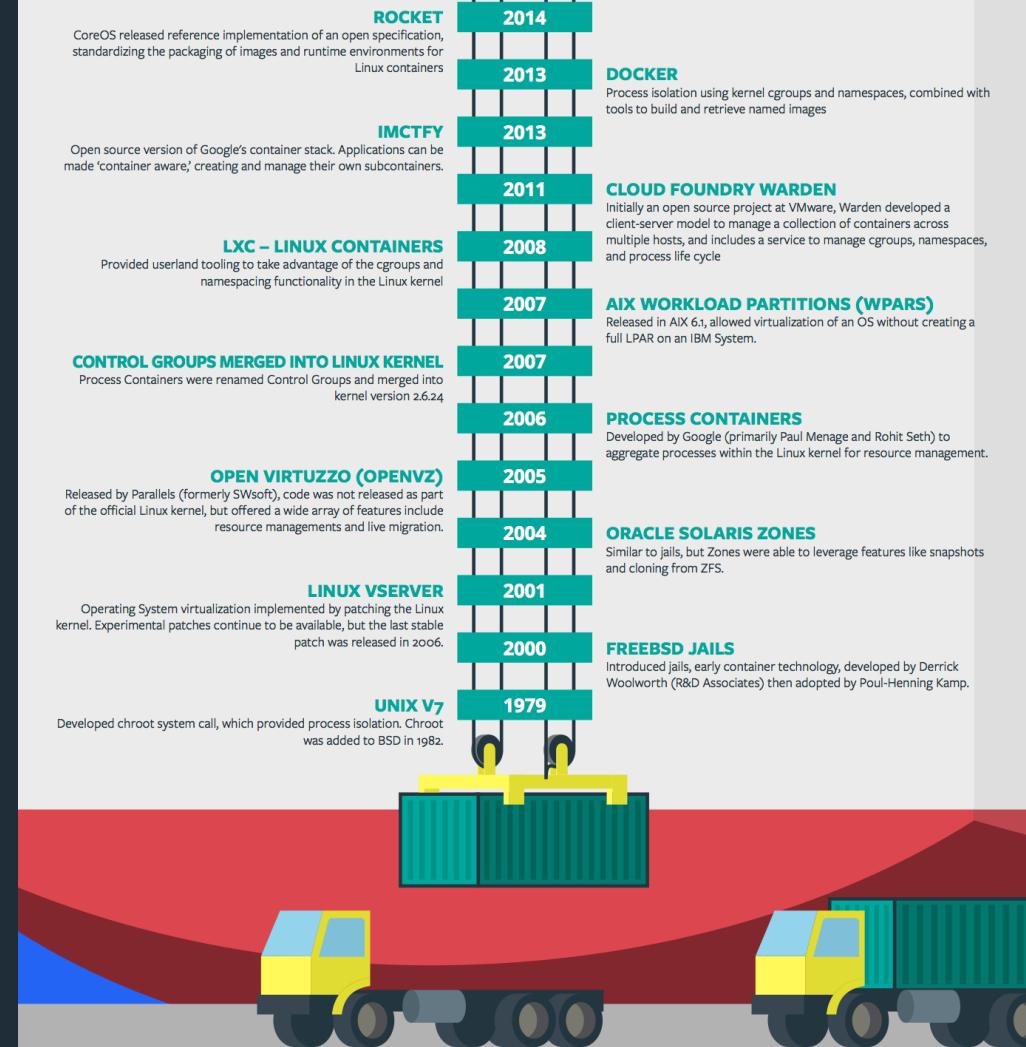


# DEMO

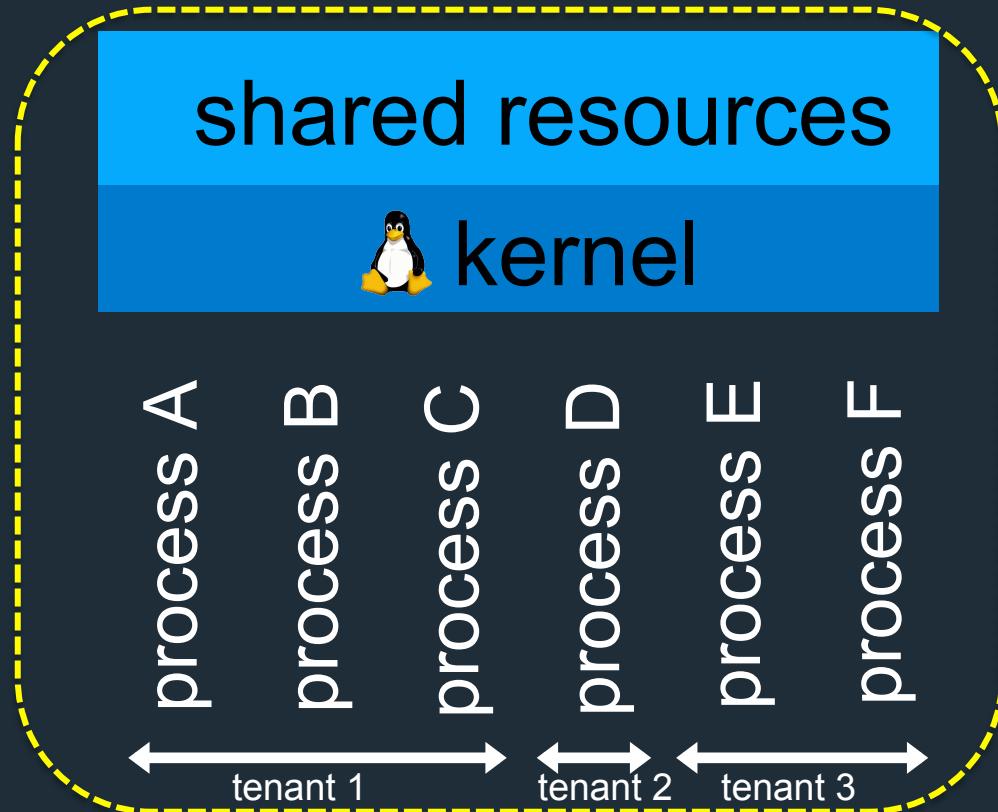
CF

# 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

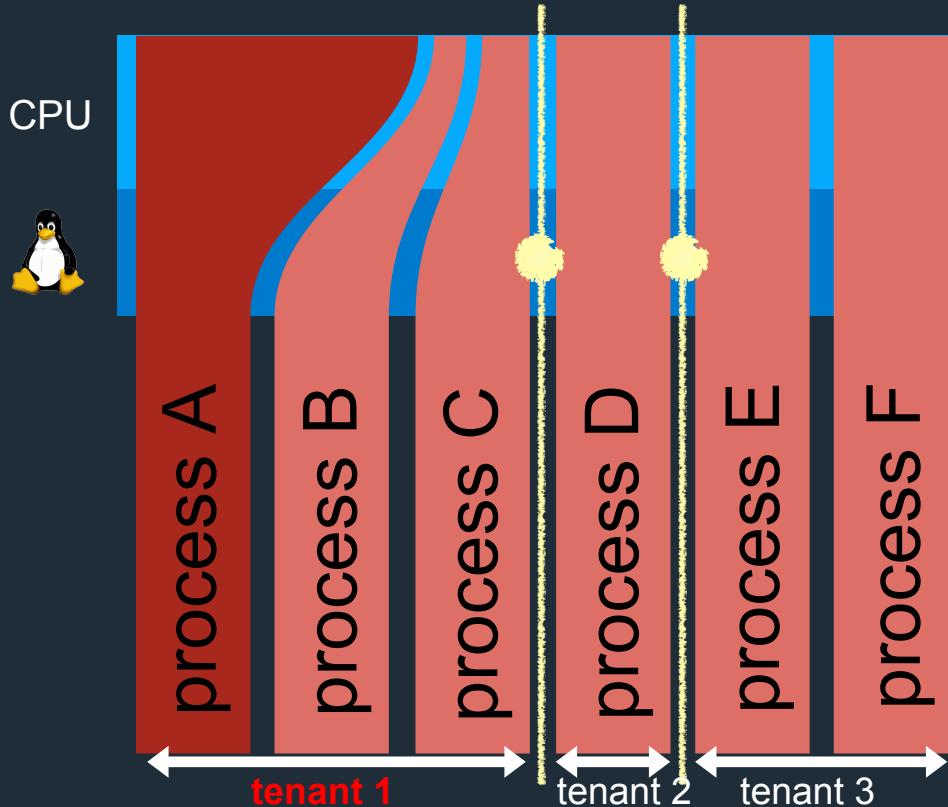


resource isolation

namespace isolation

Diego Cell

# Container Isolation



resource isolation

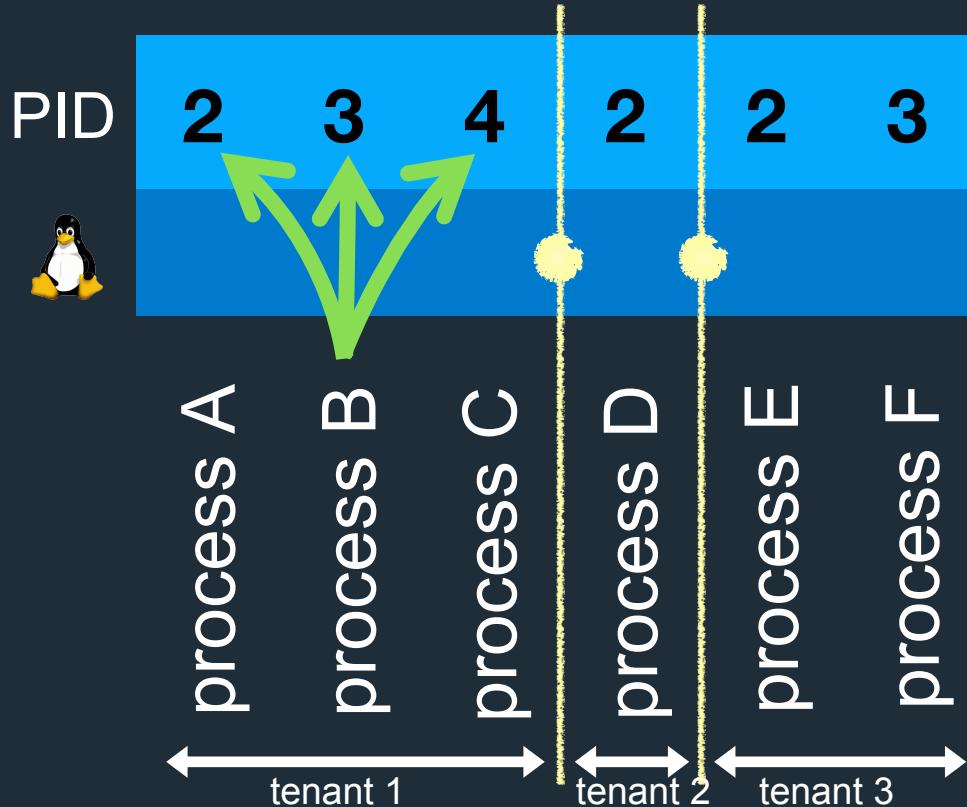
namespace isolation



cgroups

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

# Container Isolation



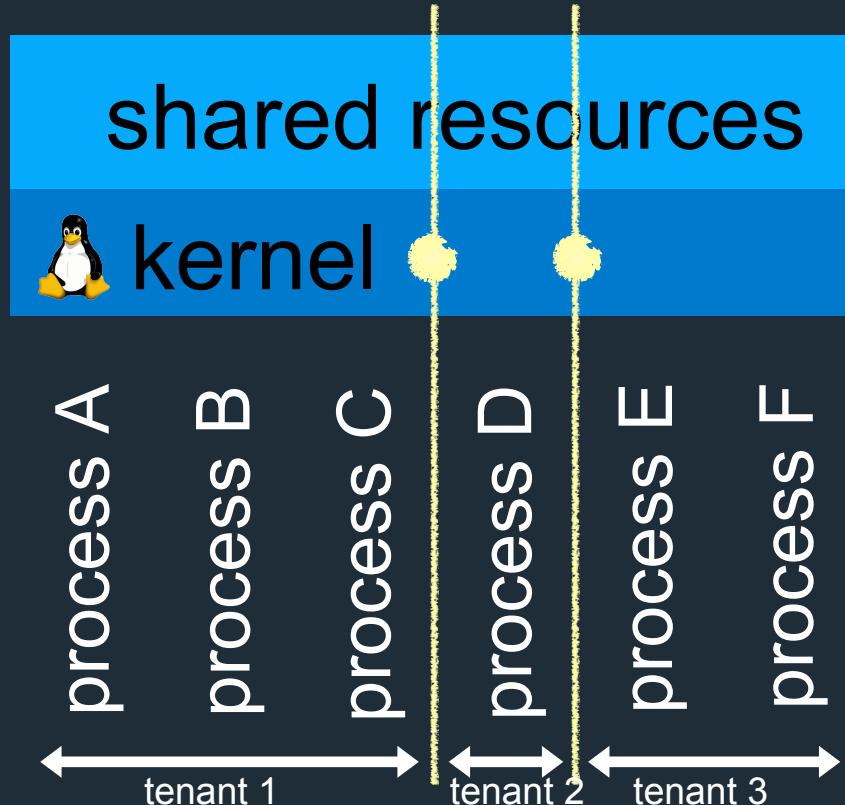
resource isolation

namespace isolation

## PID namespace

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

# Container Isolation



resource isolation

namespace isolation

namespaces

PID

Network

Mount

User

# Customize the container experience

## Buildpacks

Developer brings customized app

Platform buildpacks bring standard runtime\*

Platform brings fixed OS container image

Platform brings fixed host OS Kernel

App Container

\* Devs may bring a custom buildpack

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# Customize the container experience

## Buildpacks

Developer brings customized app

Platform buildpacks bring standard runtime\*

Platform brings fixed OS container image

Platform brings fixed host OS Kernel

## Docker

Developer brings customized app

Developer brings runtime docker image

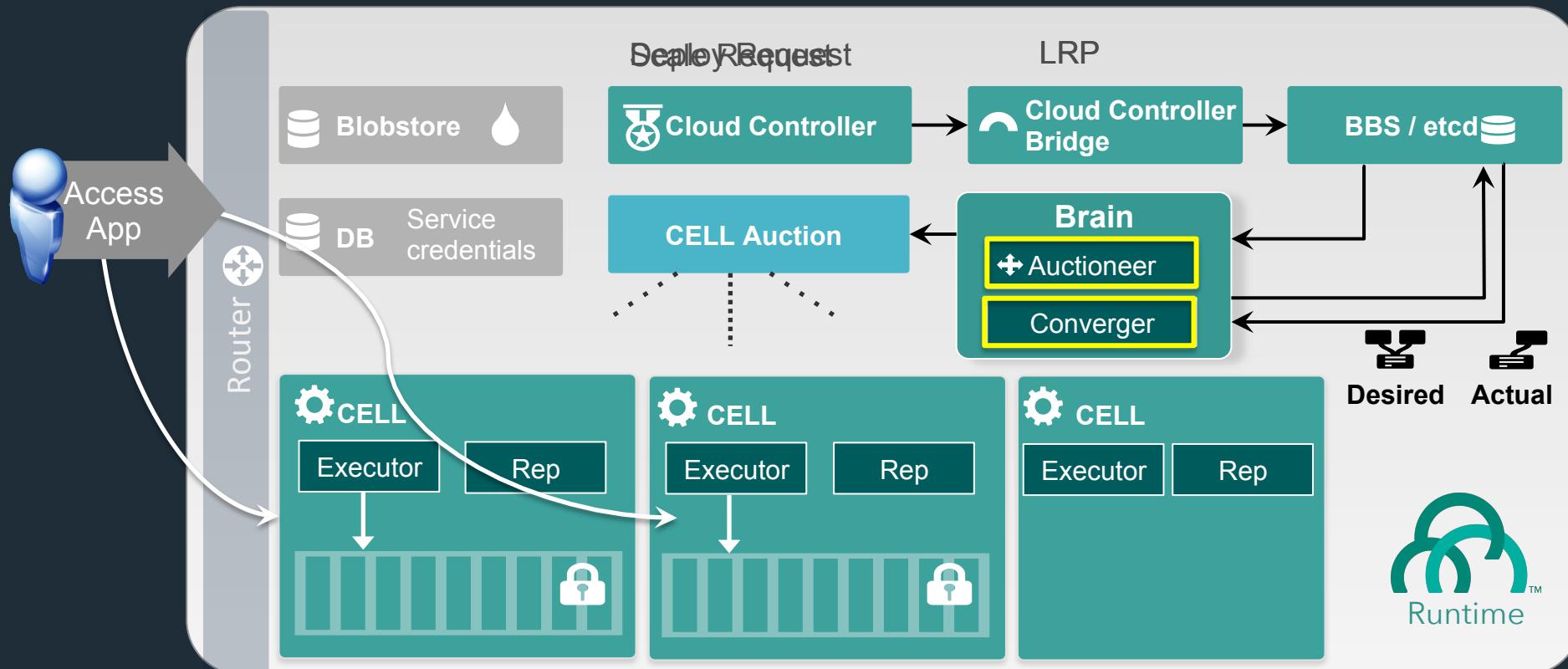
Developer brings Docker OS image

Platform brings fixed host OS Kernel

App container

\* Devs may bring a custom buildpack

# Application containers and scaling



# Pivotal Cloud Foundry

## Services

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# Pivotal Cloud Foundry Services

## Mobile



App Distribution



Push Notifications

## Security



Single Sign-on

## Data



Redis



DataStax  
Cassandra



MySQL



RabbitMQ



Data Flow



PivotalHD



Session state  
caching



GemFire

## CI/CD



Git Lab



Jenkins  
Enterprise

## Monitoring



App  
Dynamics



New Relic

## Cloud Native



Config  
Server



Service  
Directory



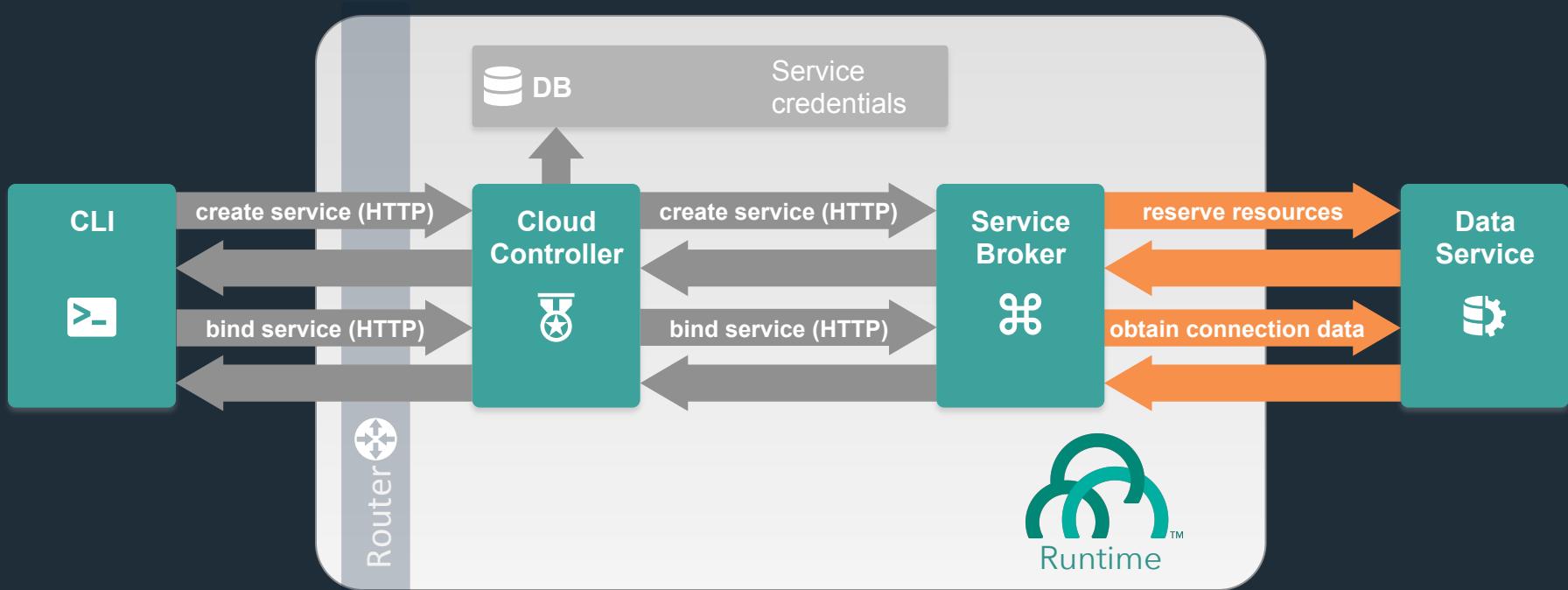
Circuit  
Breaker



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# Creating and Binding a Service

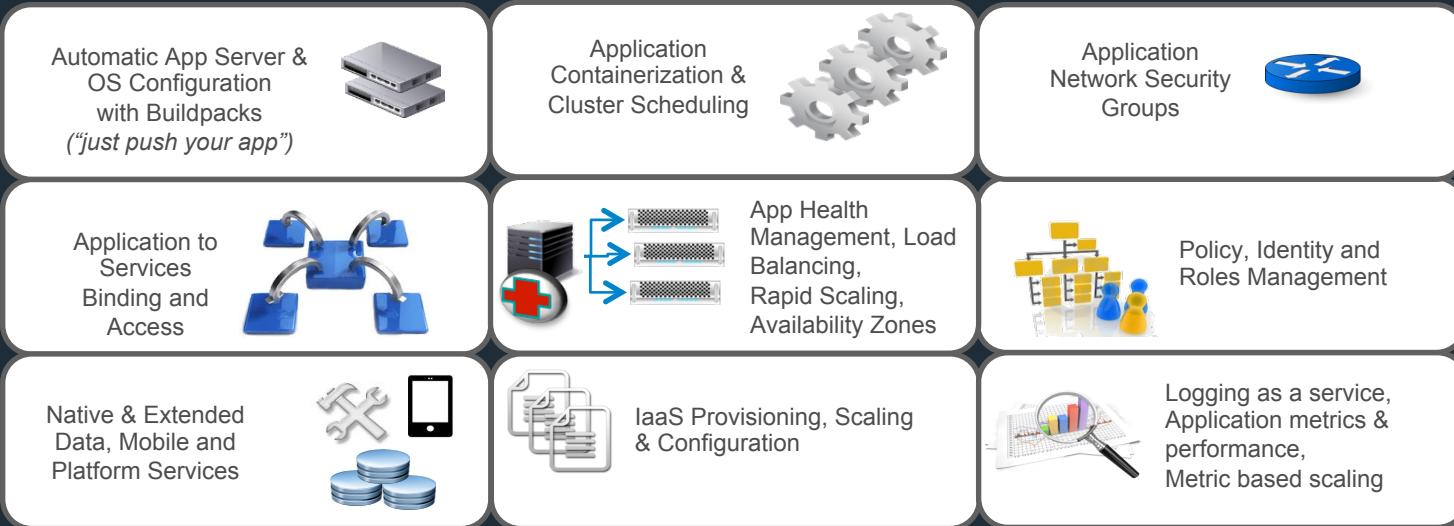




# DEMO

CF

# Pivotal CF: Technical Capabilities



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



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# Pivotal Cloud Foundry

## Platform Access

HA Load Balancer

Dynamic Router



## Elastic Runtime

Logging / Metrics

Application  
Access

Ops Manager

Service

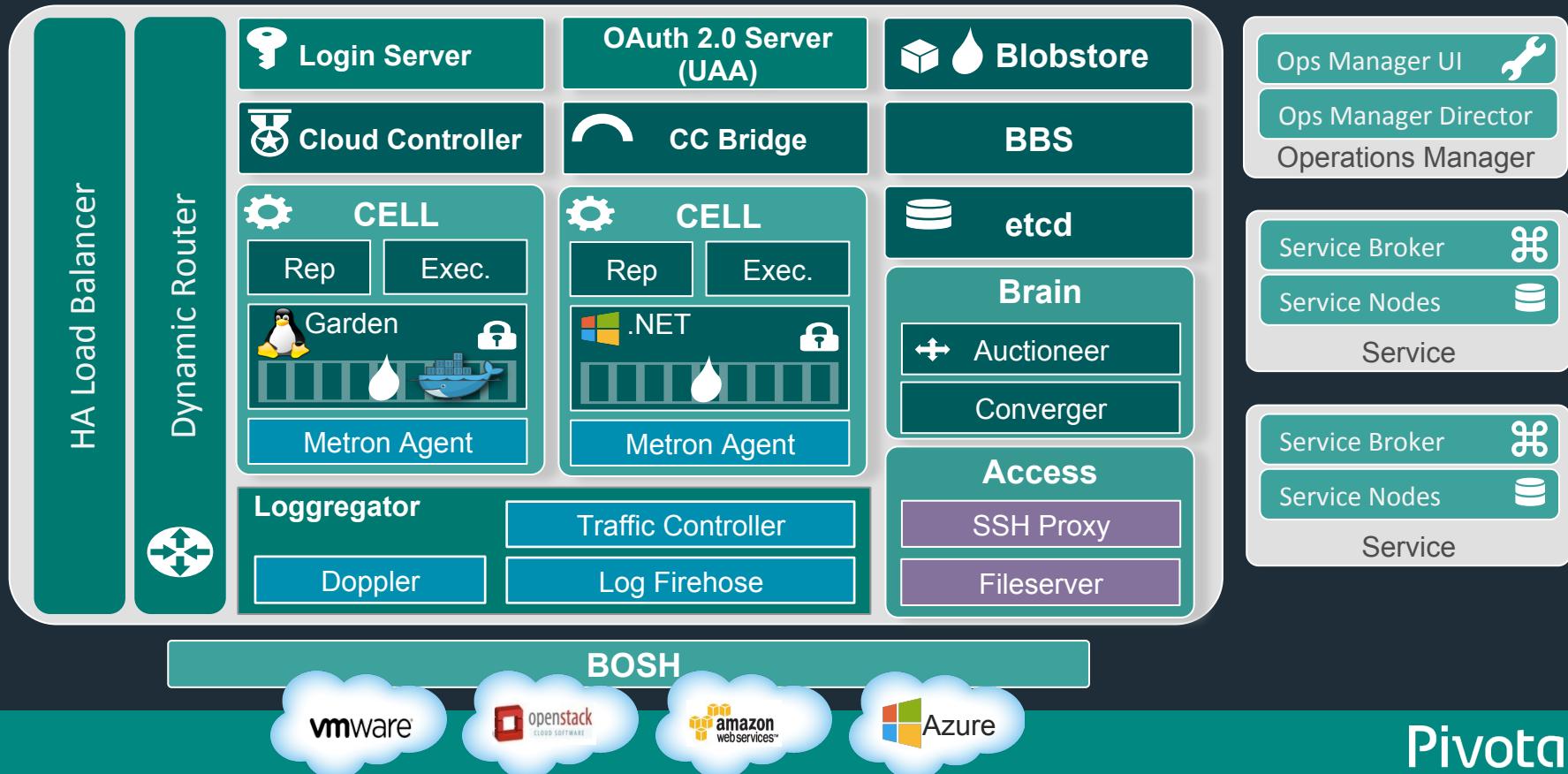
Service

## BOSH - Automation Layer



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# Pivotal CF Architecture - Recap

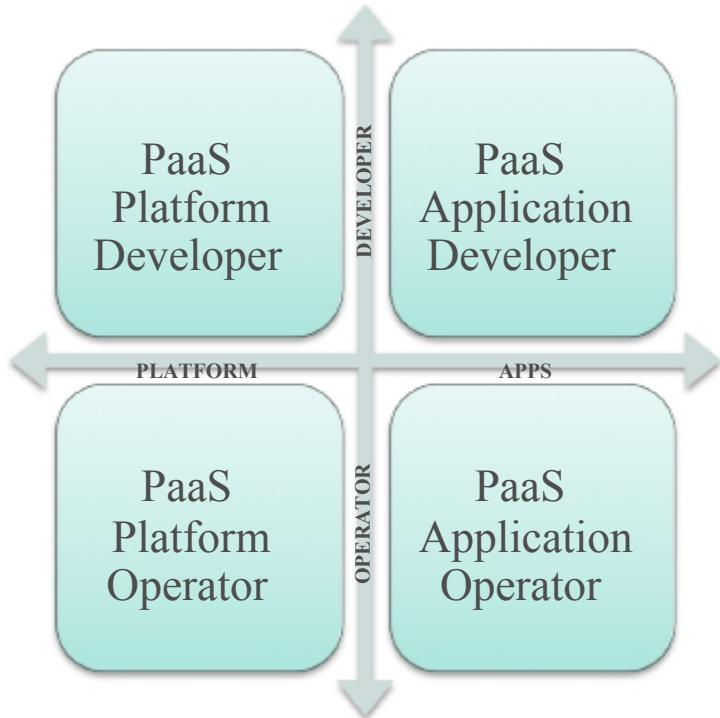


# Pivotal Cloud Foundry

## Operations

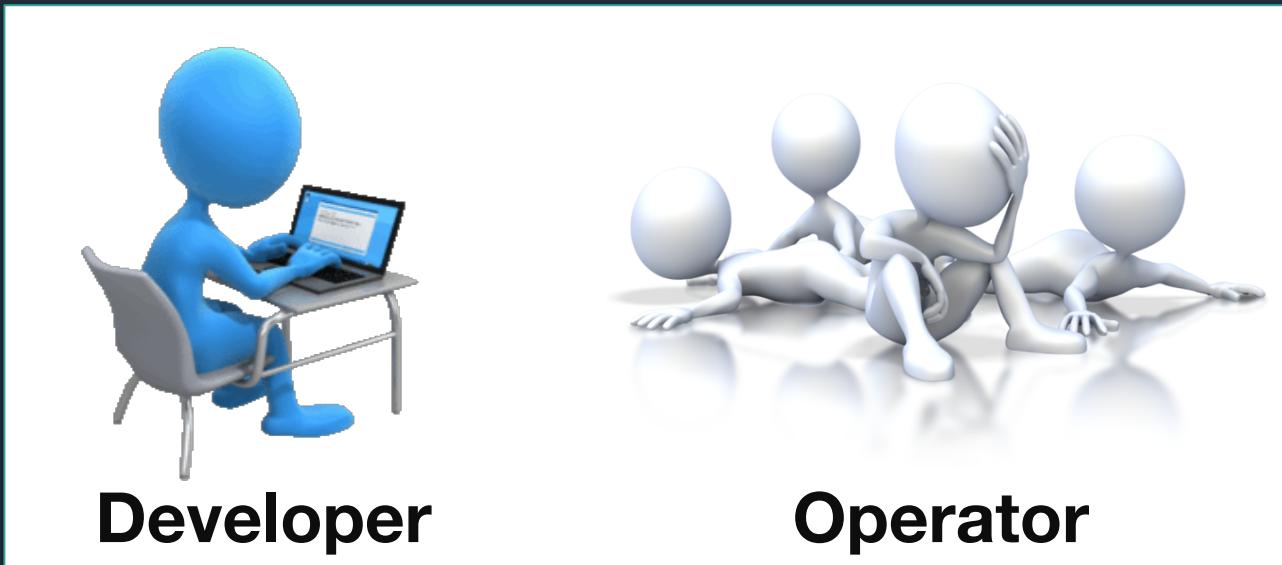
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# Roles That Support Pivotal Cloud Foundry



- **PaaS Application Developer:** Builds new apps and migrates existing apps to Pivotal Cloud Foundry
- **PaaS Platform Developer:** Builds new and modifies existing buildpacks; service brokers; Pivotal Cloud Foundry tiles
- **PaaS Application Operator:** Manages continuous delivery process for apps, acts as conduit between platform and apps teams
- **PaaS Platform Operator:** Installs, configures, upgrades, scales, operates Pivotal Cloud Foundry underlying IaaS infrastructure, and supporting systems (e.g. management, monitoring tools, etc.)

# 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



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# The Pivotal CF Way



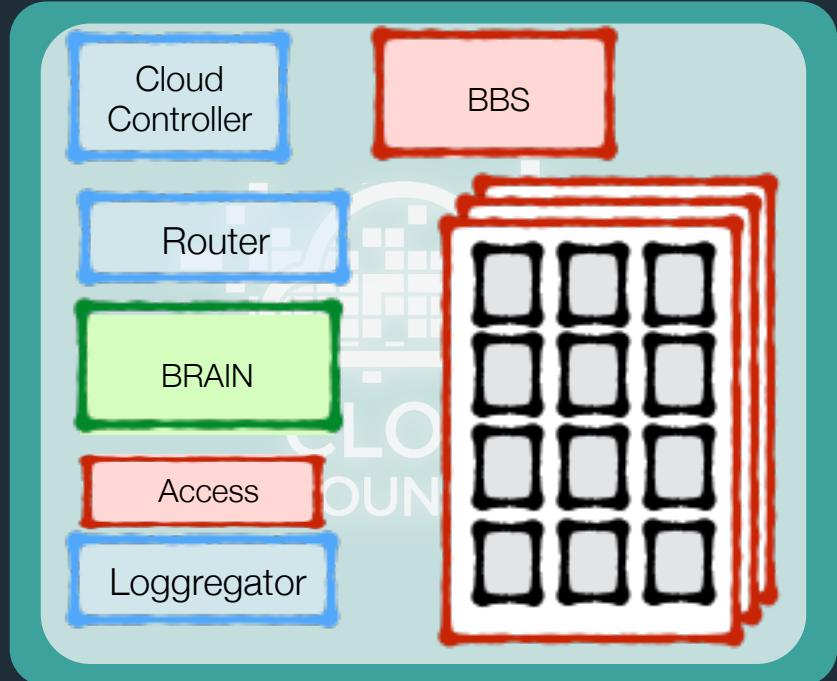
Deploy to dev



>cf push



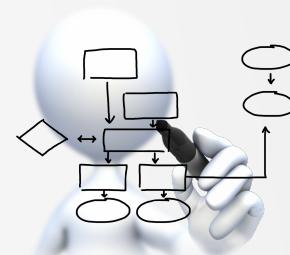
App Deployed



# 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

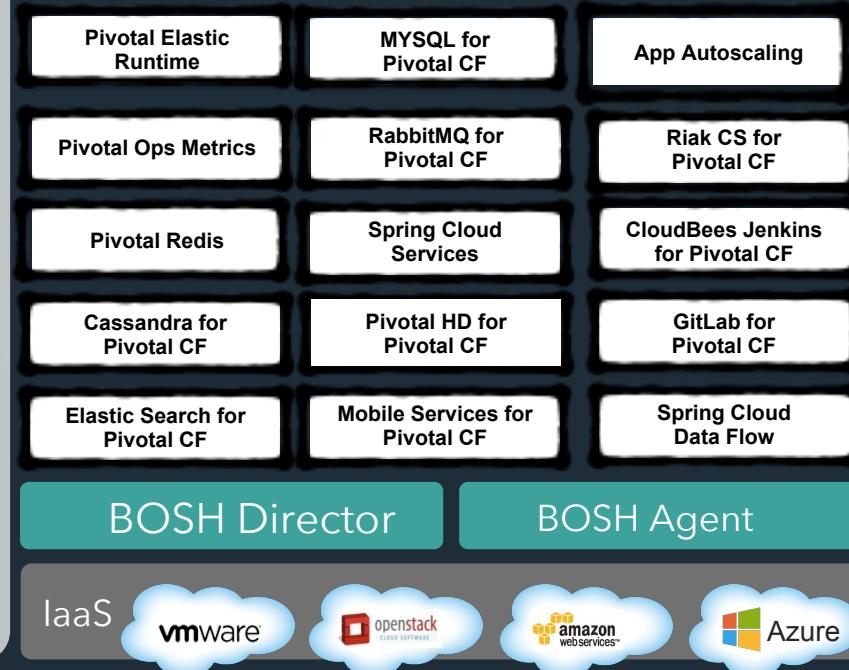
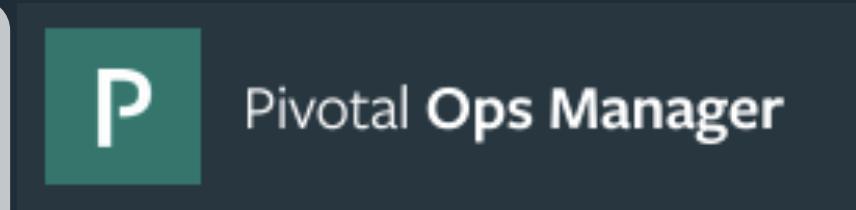
Explore install logs

Click to scale the platform

Built-in High Availability

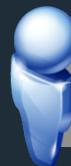
Built-in Platform Monitoring

Integrated services



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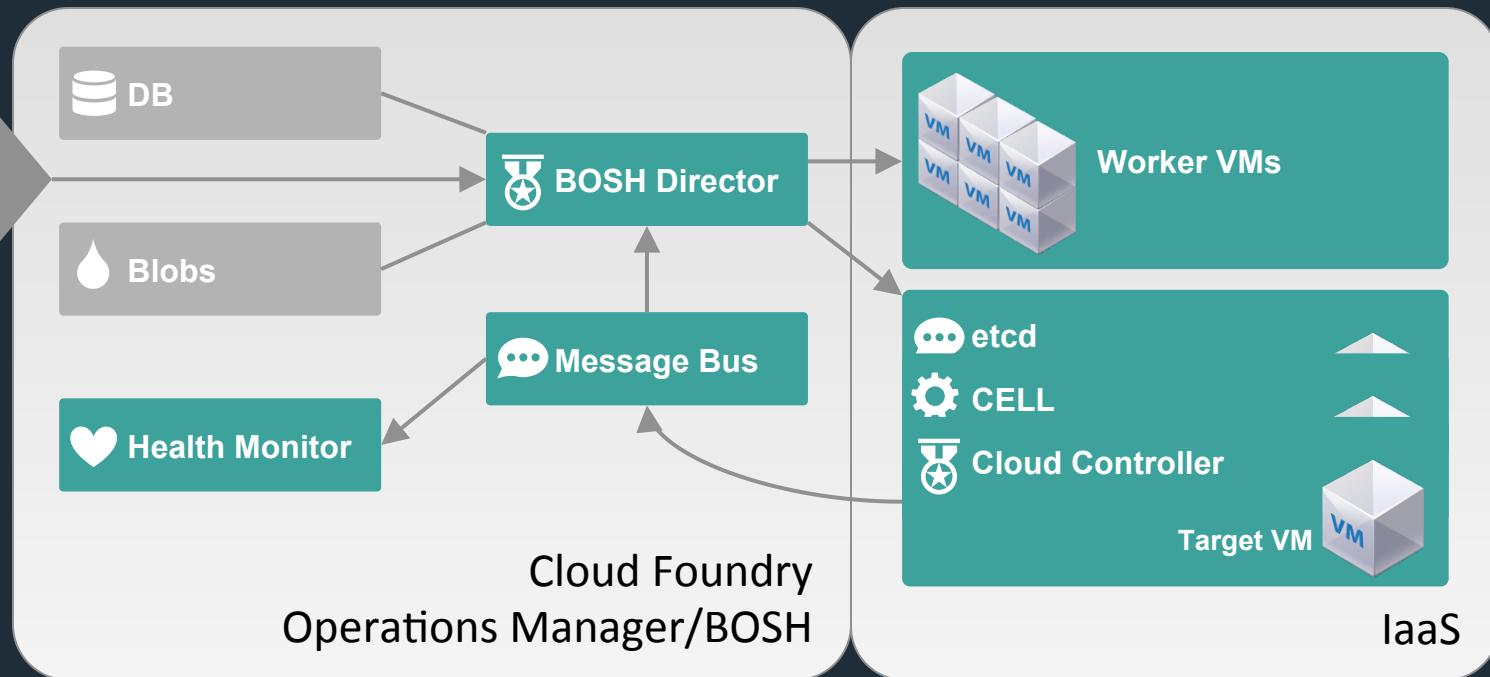
# Deploying the CF Runtime with Cloud Foundry BOSH



Deploy new  
CF Instance

## Deployment

- Packages
- Blobs
- Source
- Jobs
- Manifest





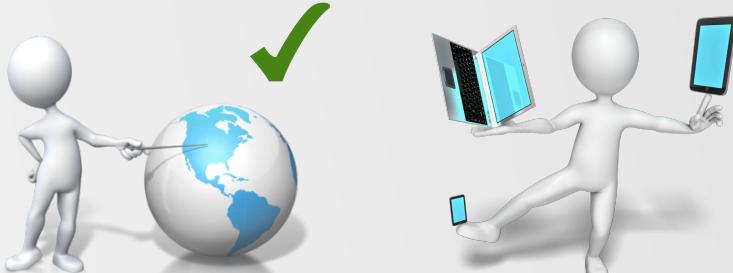
# DEMO

CF

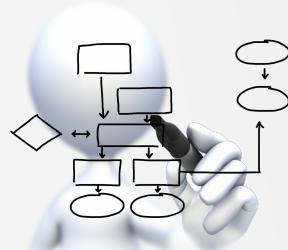
# Operator Concerns



Plan capacity



Install the platform



Manage users and quotas

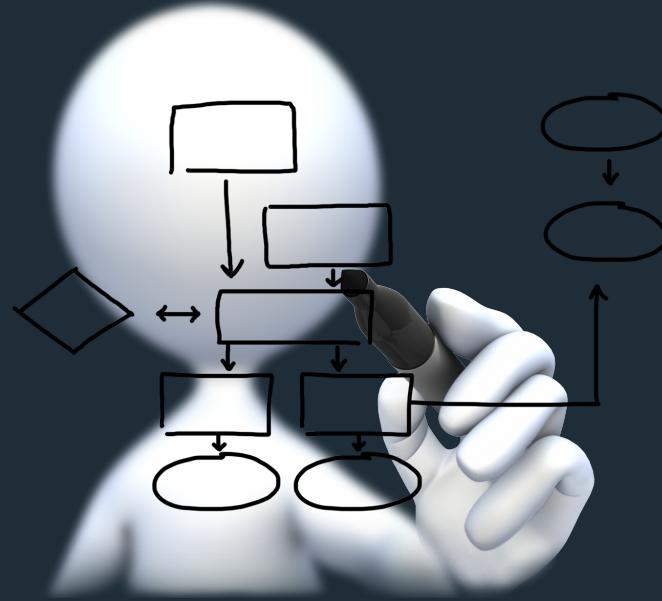
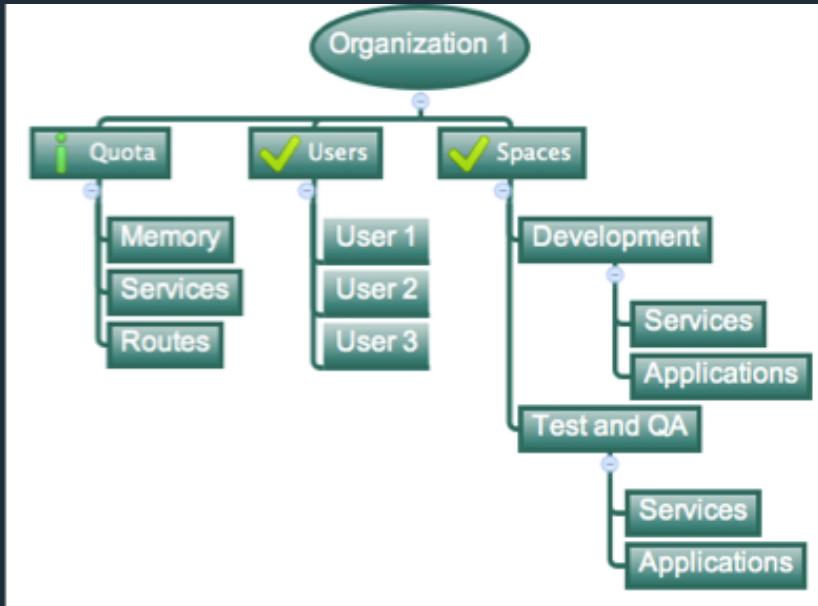


Handle upgrades and updates



Monitor the platform

# Orgs, Spaces, Users & Quotas



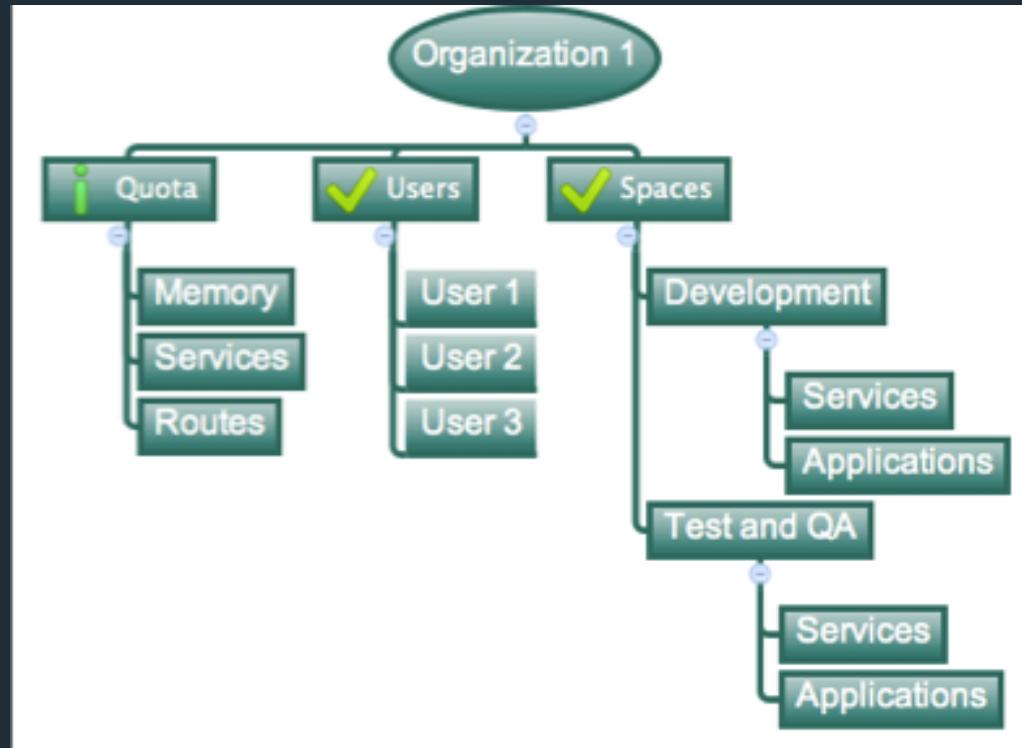
# Organizations

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

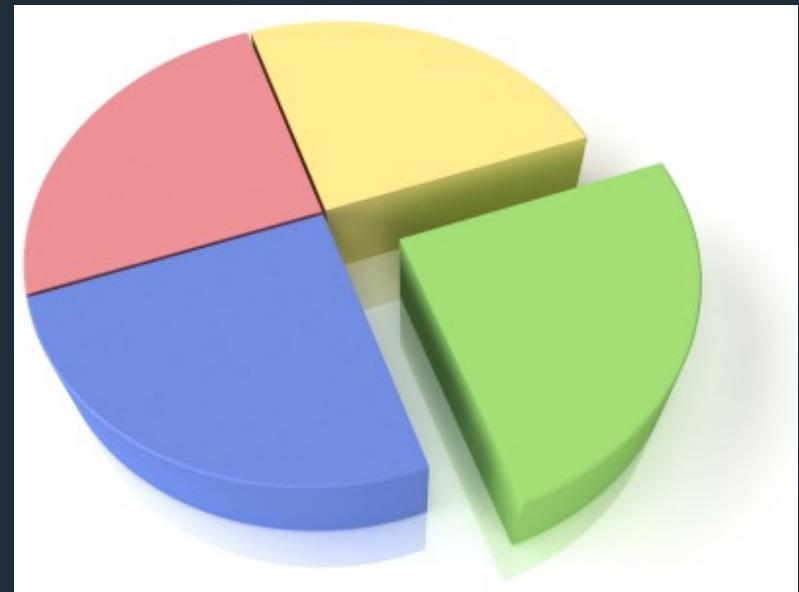


# Quotas & Plans

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

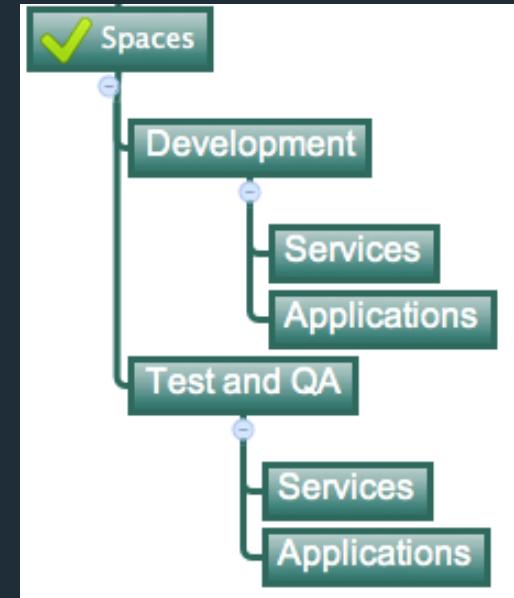
Logical sub-division within an organization

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





# DEMO

CF

# Operator Concerns



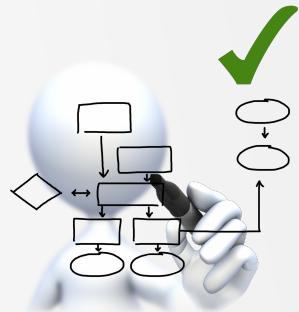
Plan capacity



Install the platform



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Monitor the platform

# 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?

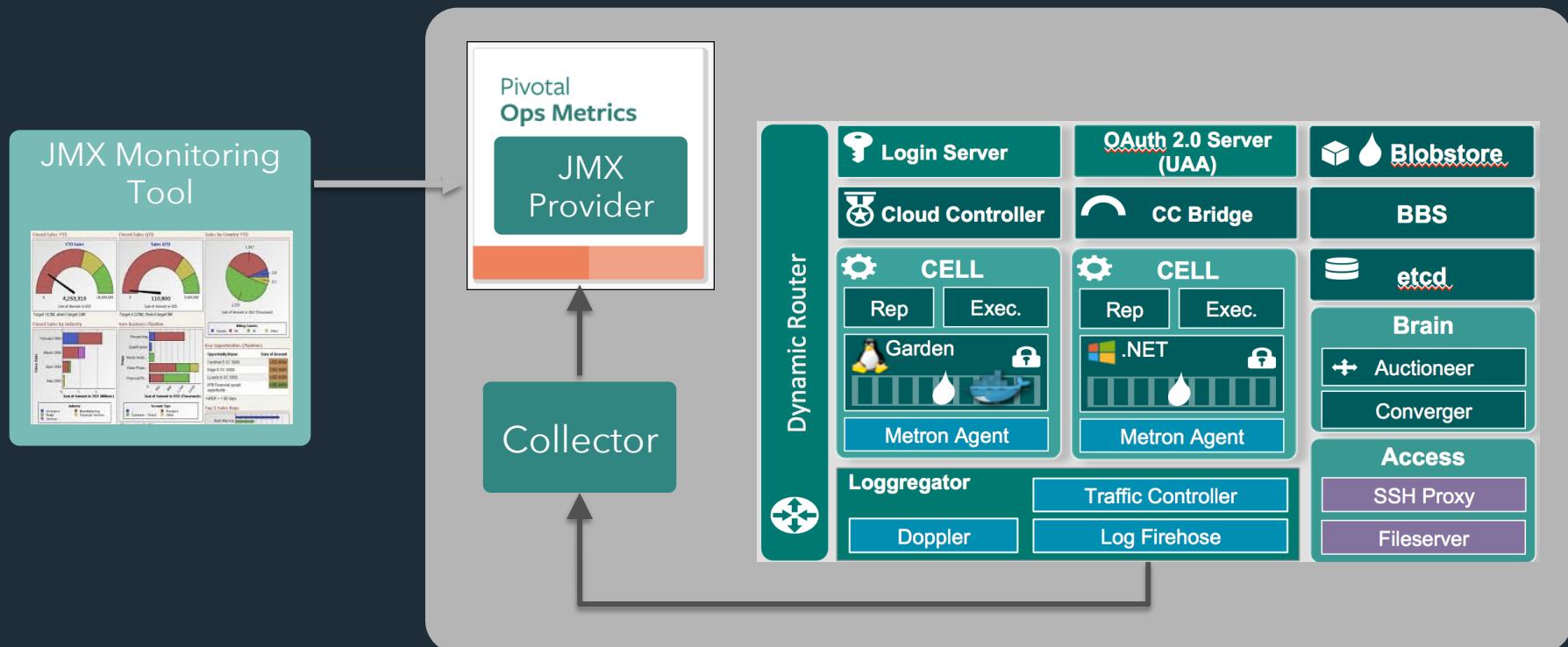
# Platform Monitoring

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, ...



# Platform Monitoring



## MONITOR

## EXPLORE

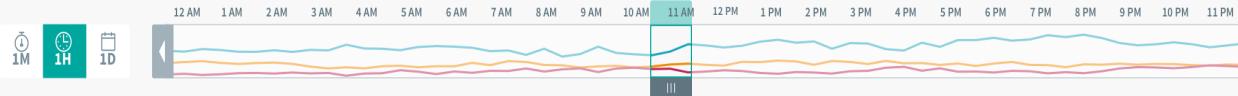
 Container Network Logs

## Lorem Ipsum Dolor App

ORG: Pivotal SPACE: Labs STATUS: Running

## TIMEFRAME

Container

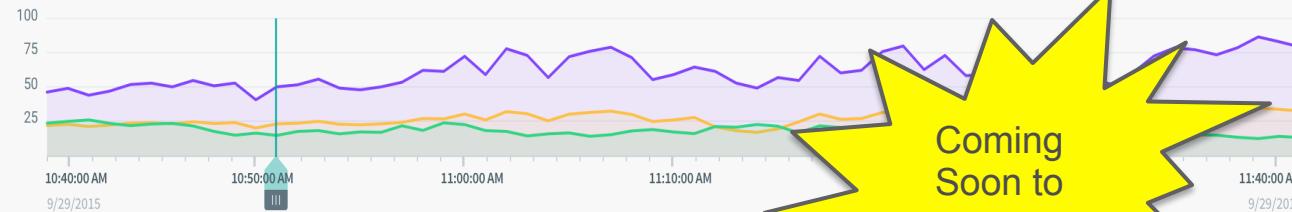


## METRICS

## 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-bb70-155c-04cc-65-aaef2dcf5e/announcements/fff9c6b2-040d-11bc-9571-578d95feeb0a#liveload" "Max(112.5.0.1/Windows NT 6.3; Mozilla/5.0 (Windows NT 6.3; Win64; x64) AppleWebKit/537.36 (KHTML 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'
```

# Operator Concerns



Plan capacity



Install the platform



Setup High Availability



Manage users and quotas



Handle upgrades and updates



Monitor the platform

# Four Layers of High Availability – Built In

Application Instance

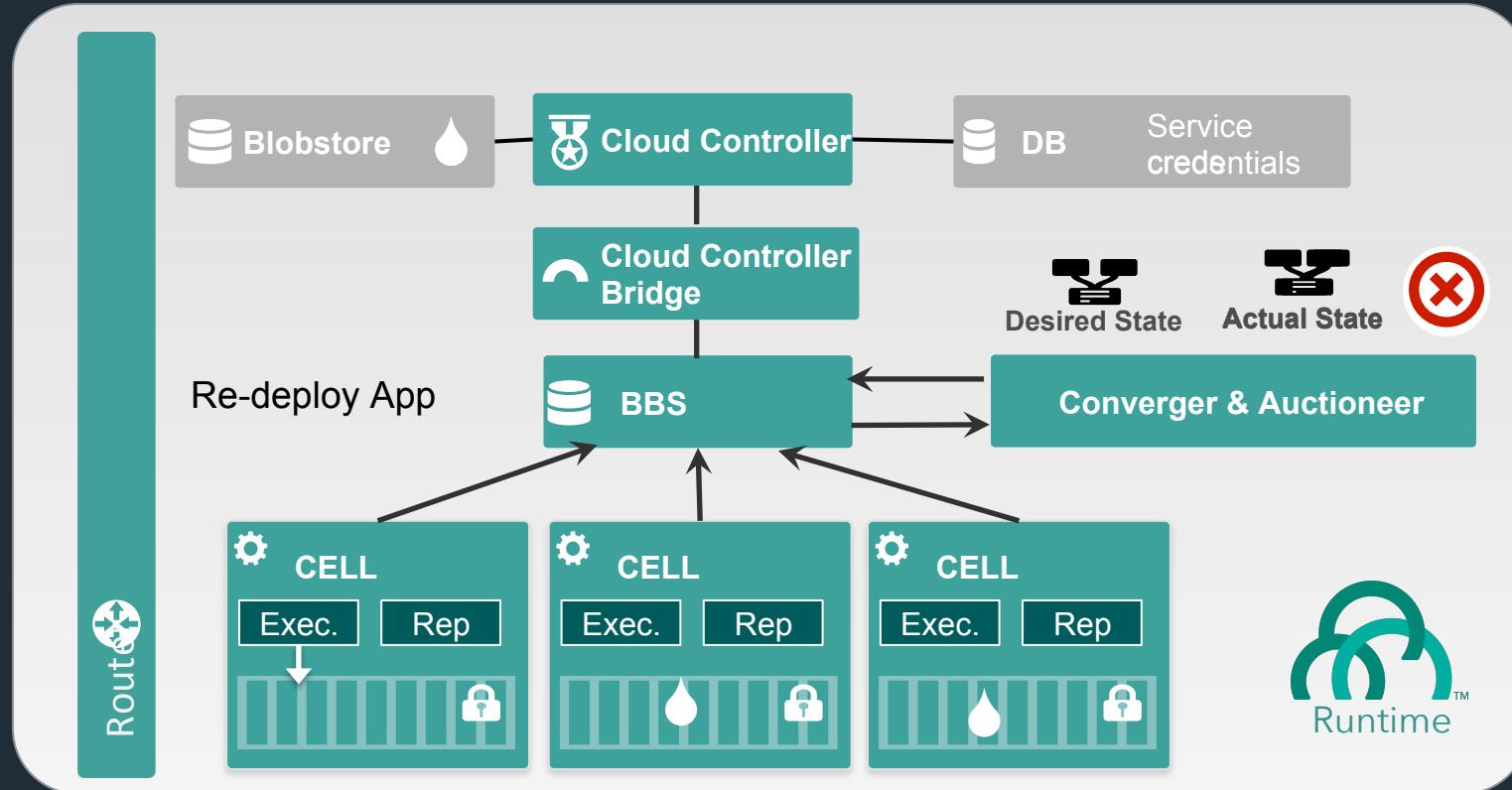
Platform Processes

Platform VMs

Availability Zones



# Application Instance HA

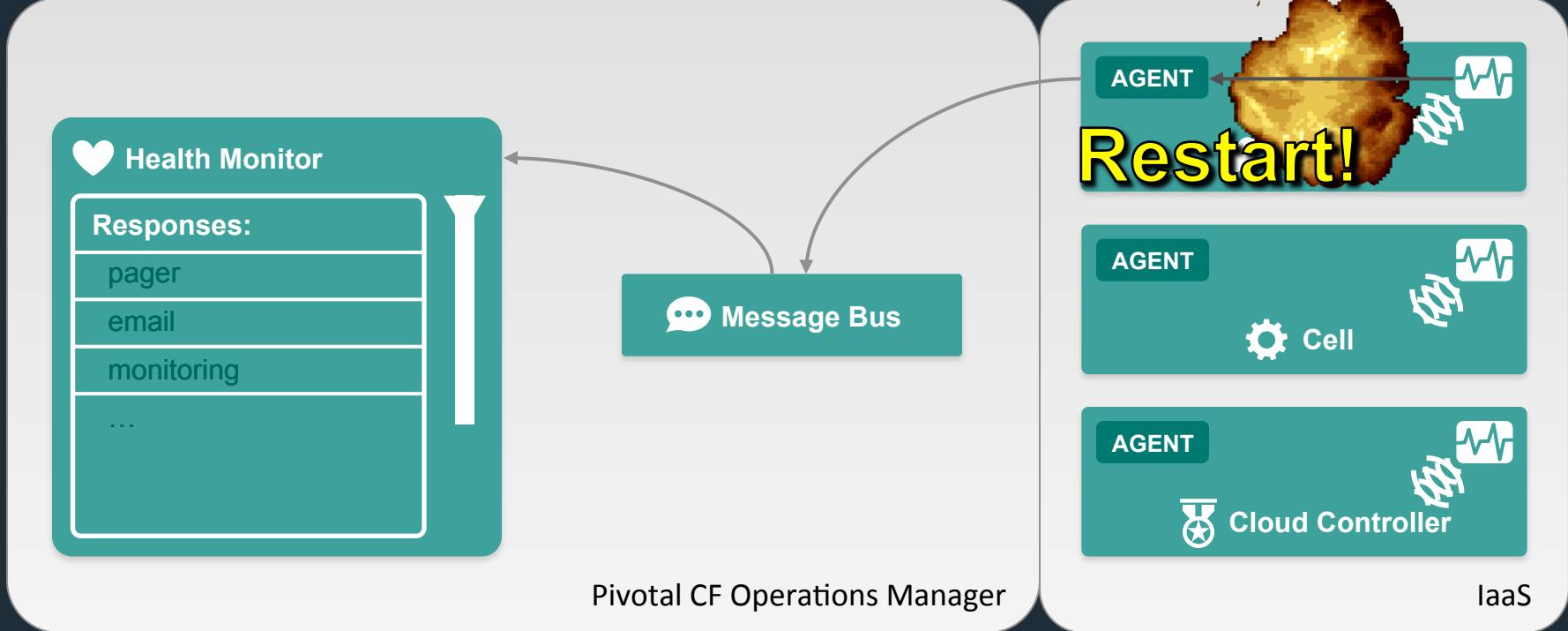




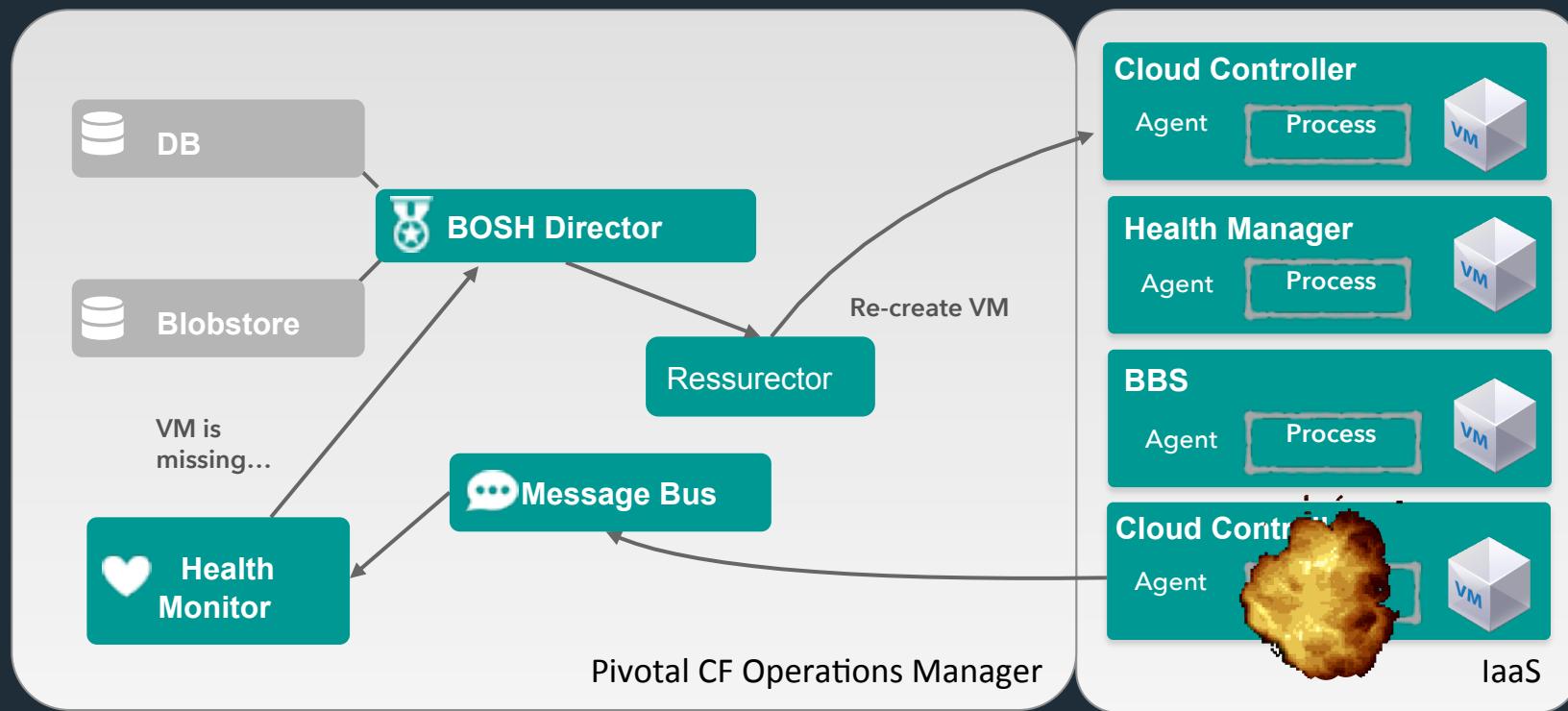
# DEMO

CF

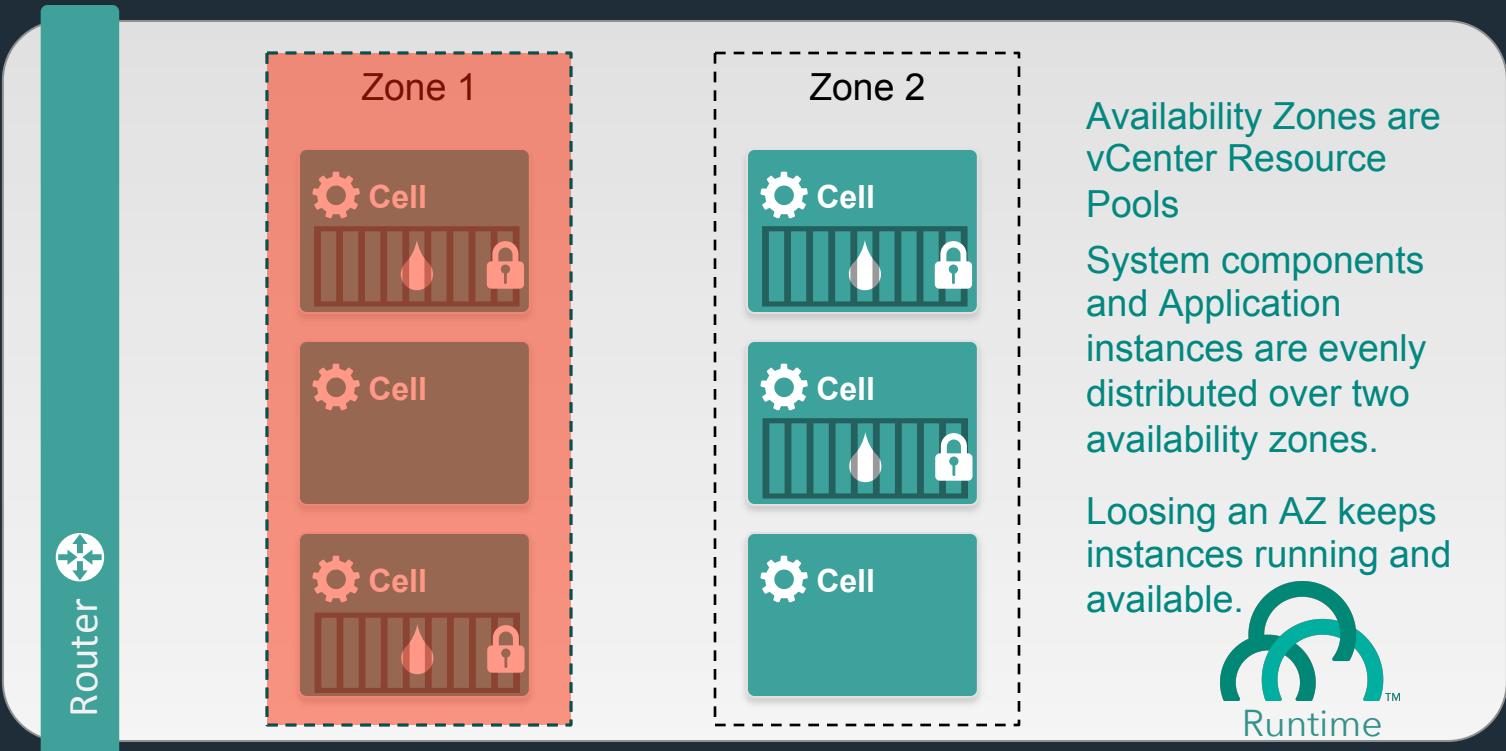
# Platform Process HA



# Platform Virtual Machine HA

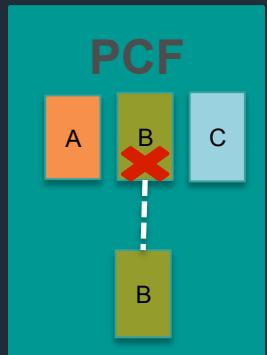


# Availability Zone HA

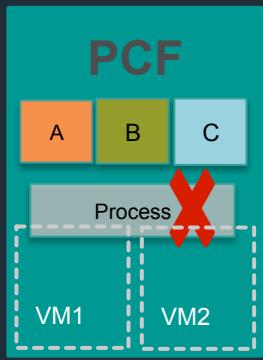


# How Pivotal Enables Four Levels of HA

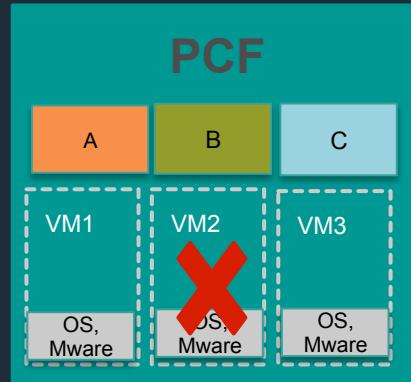
1.



2.



3.



4.



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

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

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

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

App Fail

Process Fail

VM Fail

Rack Fail

# Operator Concerns



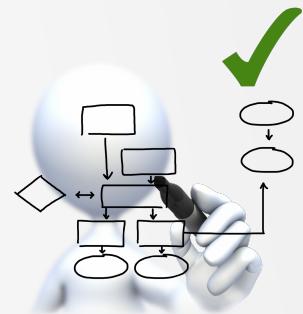
Plan capacity



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Monitor the platform

# Pivotal

A NEW PLATFORM FOR A NEW ERA