



Cloud Native Applications

- PCF Overview

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Pivotal Facts

Formed in 2013 as spinout from EMC/VMware. Now a publicly-traded company (NYSE:PVTL).

Chief Executive Officer is Rob Mee.

Mission is to **transform how the world build and run software.**

Key customers include DBS, Yahoo Japan, Comcast, Allstate, Ford, Citi, Boeing, Southwest, Verizon.

Over 2,800 employees in 25+ locations globally.

IPO in April 2018. Current Market Cap approx. 4.6B

Pivotal



The Pivotal value proposition



Developer Productivity

- Accelerate feedback loops by improving delivery velocity
- Focus on applications, not infrastructure
- Give developers the tools and frameworks to build resilient apps



Operational Efficiency

- Employ 500:1 developer to operator ratio
- Perform zero-downtime upgrades
- Runs the same way on every public/private cloud



Comprehensive Security

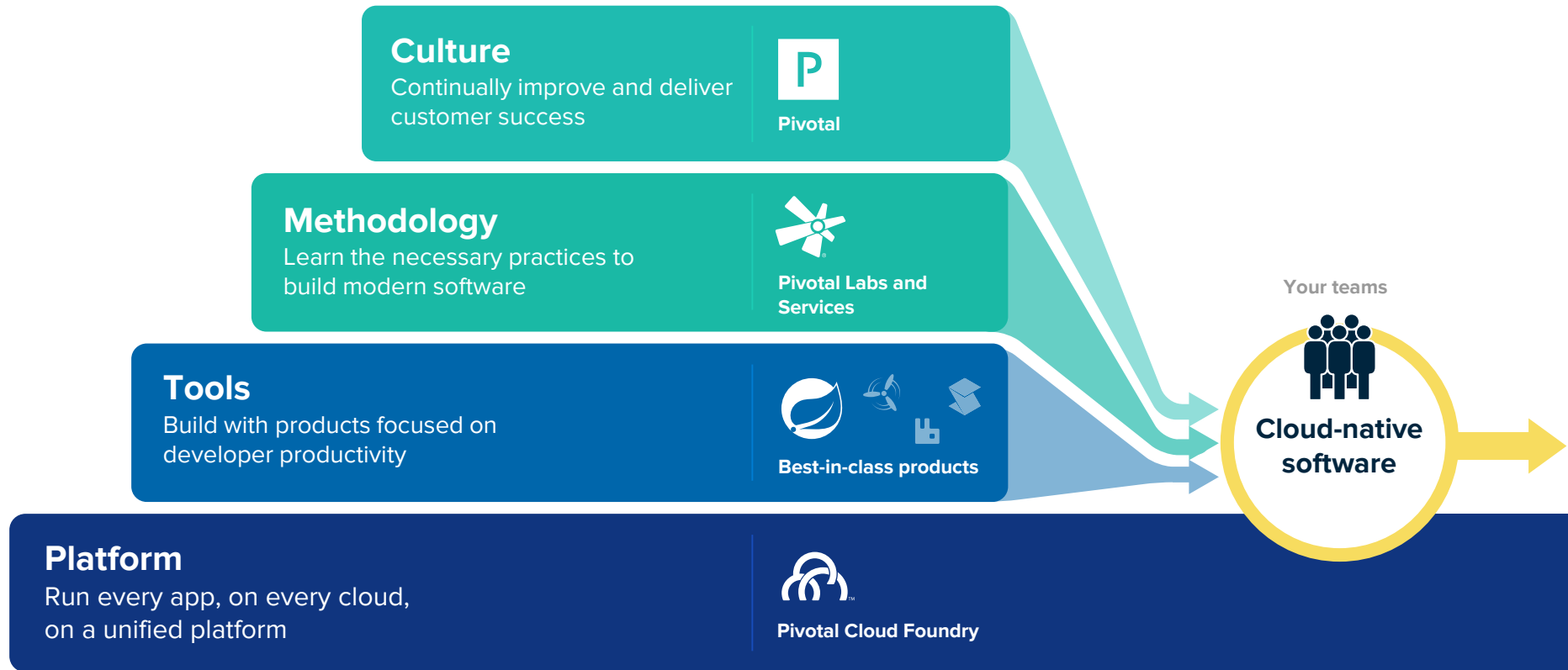
- Adopt a defense-in-depth approach
- Continuously update platforms to limit threat impact
- Apply the 3 R's → repair, repave, rotate



High Availability

- Run platforms that stays online under all circumstances
- Scale up and down, in and out, through automation
- Deploy multi-cloud resilience patterns

Pivotal adopts a holistic partnership approach to software





Faster time to market

6 months
to
< 4 weeks
for
major releases



Increased release cadence

10X
improvement in lead time
(32 hours -> 3 hours)

6X
improvement in effort
needed
(12 hours -> 2 hours)



Self provisioning infrastructure

1 week
To
Intraday



Stability and maintainability

Zero minutes
downtime in
Production
(last 2 years)



Speed

75% 
Time to Deploy

Weeks → 4hrs
Workspace
Provisioning



Scale

Weeks → 5secs
Time to Scale

600k
TPS



Stability

ZERO
Downtime

2hr → 2mins
VM Recovery



Security

5x 
Patch
Frequency

1d → 1hr
Time to Patch



Savings

2:3 → 6:2500
Ops:Dev Ratio

3845
Apps in
Production

What PCF Financial Customers Have To Say on Youtube



<https://www.youtube.com/watch?v=McV0Q5GY-fM>



<https://www.youtube.com/watch?v=WDvClhfb6y4>



<https://www.youtube.com/watch?v=5wokS2VySoQ>



<https://www.youtube.com/watch?v=wk5IFklQYL8>



<https://www.youtube.com/watch?v=v6cE0jXjdtE>



<https://www.youtube.com/watch?v=vabrFqYKNeI>



<https://www.youtube.com/watch?v=dWJexxudXQE>

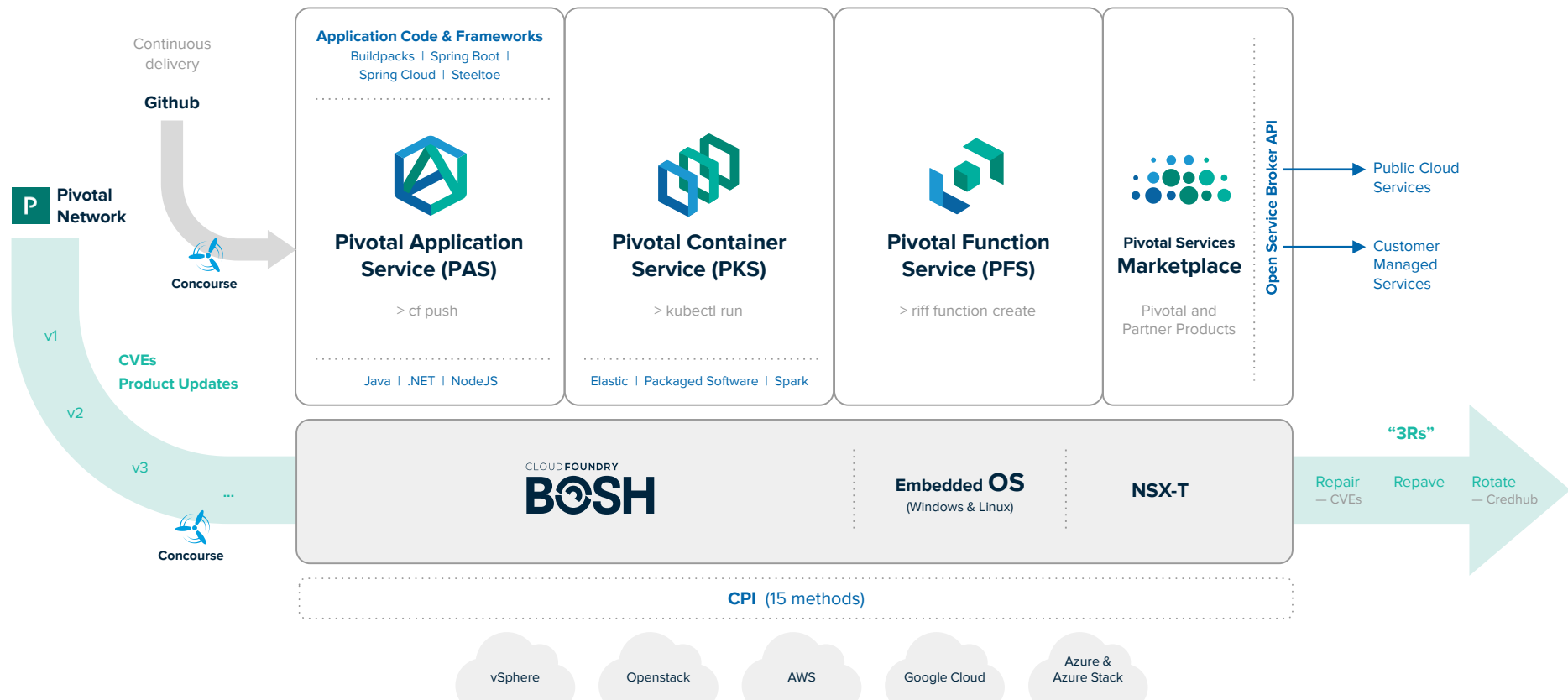


<https://www.youtube.com/watch?v=gP4Utp5M918>

A group of people in a workshop setting. A man on the left is pointing at a wall covered in sticky notes. Several people are seated on stools, listening. A man on the right is standing with his arms crossed. The scene is dimly lit with a blue tint.

PCF

PCF - One platform for all your workloads



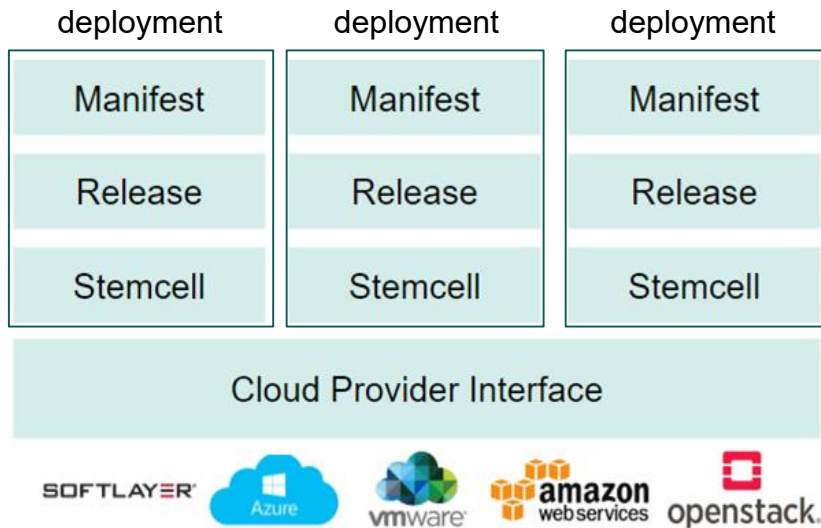
BORG++ = BOSH → the heart of PCF



An open source tool chain for release engineering, deployment, lifecycle management and monitoring of large scale distributed services.

- Declarative immutable infrastructure
- Packaging w/ embedded OS
- Server provisioning on any IaaS
- Software deployment across clusters
- Health monitoring (server AND processes)
- Service state monitoring
- Infrastructure resizing
- Self-healing w/ Resurrector
- Storage management
- Rolling upgrades via canaries

BOSH – declarative immutable deployments



zookeeper.yml

```
---
name: zookeeper

releases:
- name: zookeeper
  version: 0.0.7
  url: git+https://github.com/cppforlife/zookeeper-release

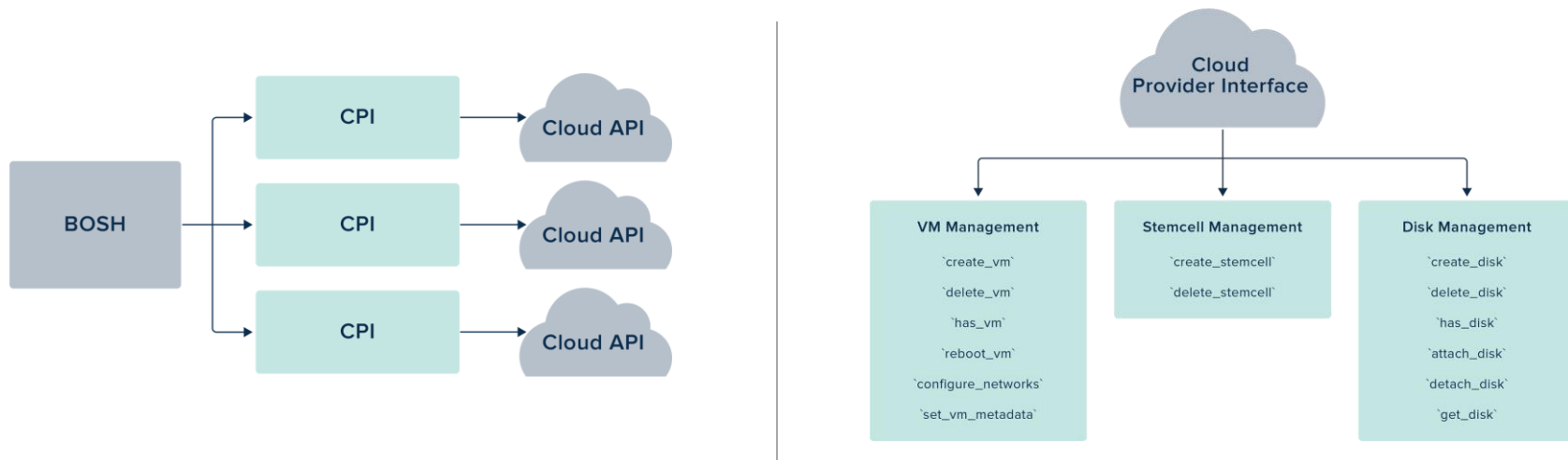
stemcells:
- alias: default
  os: ubuntu-trusty
  version: latest

update:
  canaries: 2
  max_in_flight: 1
  canary_watch_time: 5000-60000
  update_watch_time: 5000-60000
```

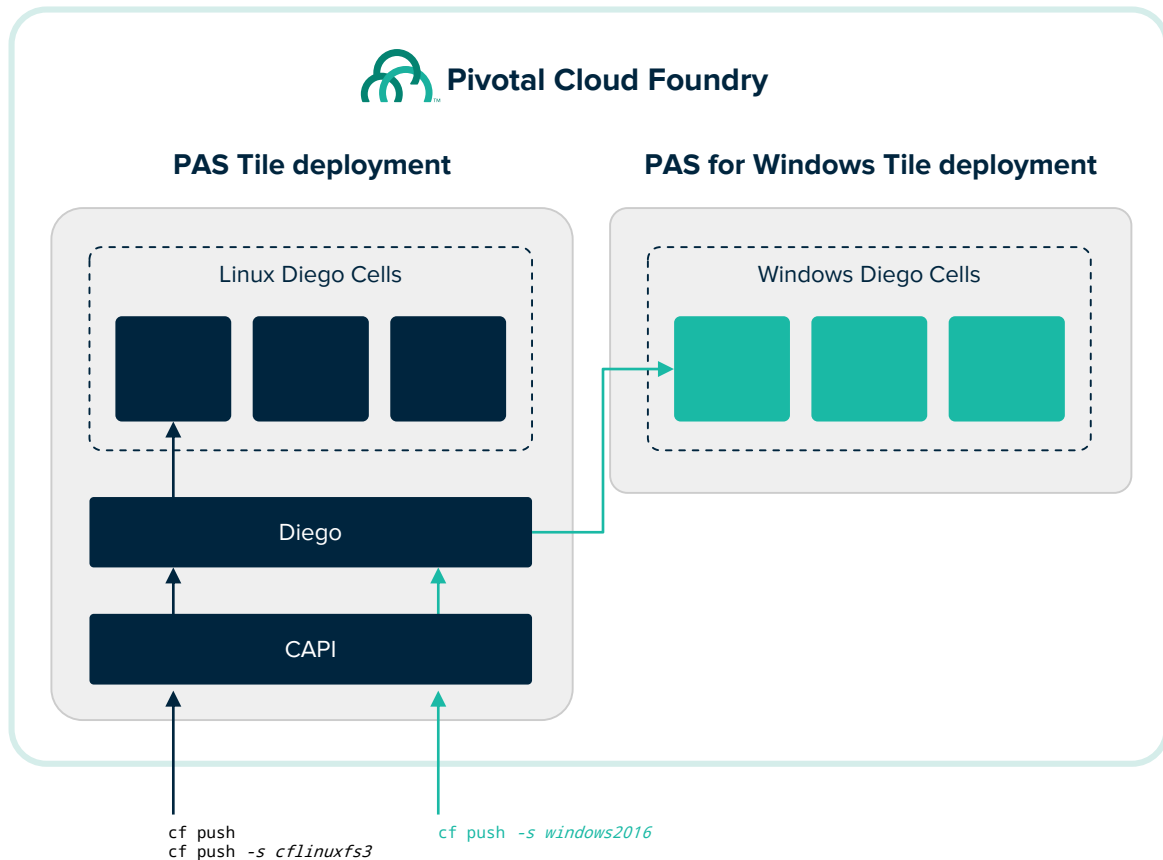
```
instance_groups:
- name: zookeeper
  azs: [z1, z2, z3]
  instances: 5
  jobs:
  - name: zookeeper
    release: zookeeper
    properties: {}
  - name: status
    release: zookeeper
    properties: {}
  vm_type: default
  stemcell: default
  persistent_disk: 10240
  networks:
  - name: default
```

```
- name: smoke-tests
  azs: [z1]
  lifecycle: errand
  instances: 1
  jobs:
  - name: smoke-tests
    release: zookeeper
    properties: {}
  vm_type: default
  stemcell: default
  networks:
  - name: default
```

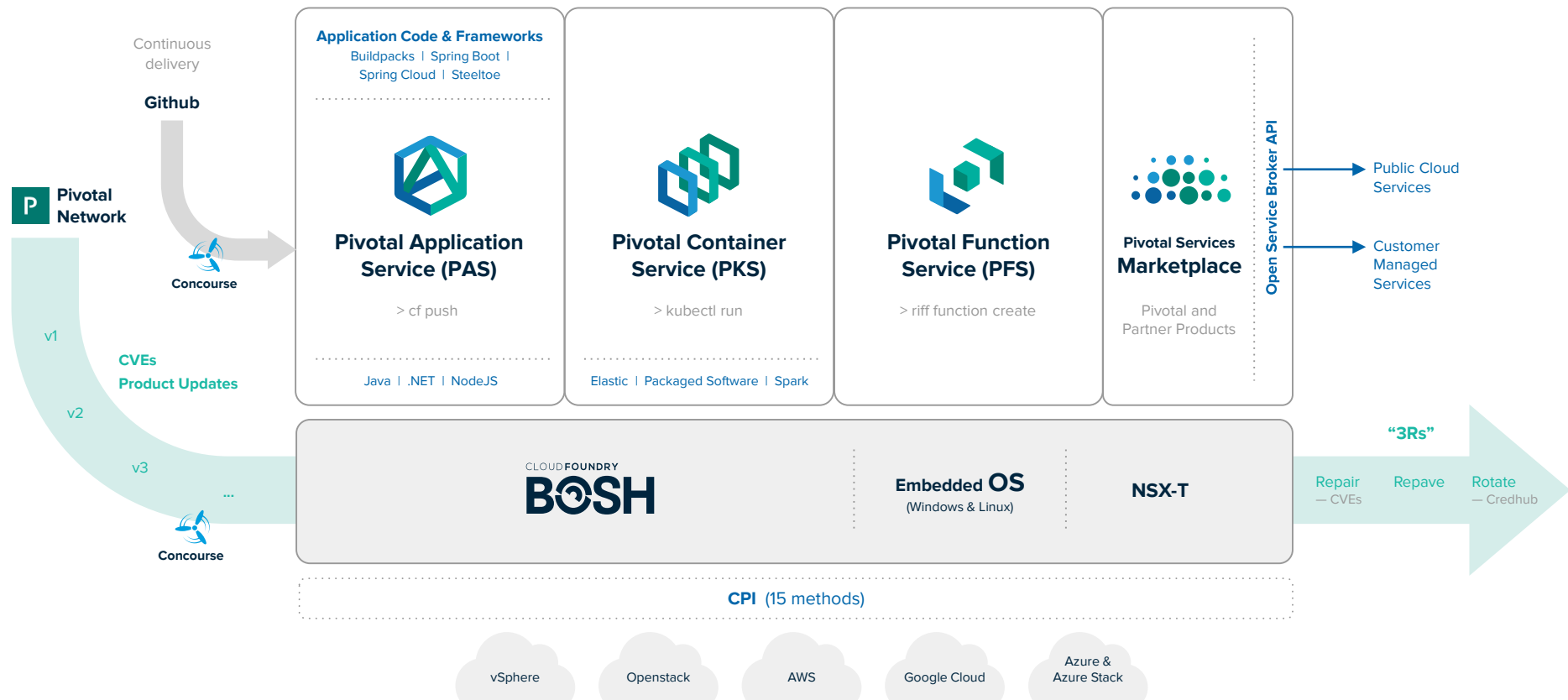
Multi-Cloud with BOSH + CPI



Operating system of choice



PCF - One platform for all your workloads



Pivotal Application Service (PAS): A Runtime for Apps



Pivotal
Application Service™

Increase speed and deploy code to production thousands of times per month. Use PAS to run Java, .NET, and Node apps.

Best runtime for Spring and Spring Boot — Spring's microservice patterns—and Spring Boot's executable jars—are ready-made for PAS.

Turnkey microservices operations and security — Spring Cloud Services brings microservices best practices to PAS. It includes Config Server, Service Registry, and Circuit Breaker Dashboard.

A native Windows and .NET experience — Use PAS to run new apps built with .NET Core. Run your legacy .NET Framework apps on PAS too, using the .NET Hosted Web Core buildpack. Push applications to containers running on Windows Server 2016.

Built for apps — PAS has everything you need to run apps. Buildpacks manage runtime dependencies; metrics, logging, and scaling are done for you. Multitenancy, and blue/green deployment patterns are built-in. Extend apps with a rich service catalog.

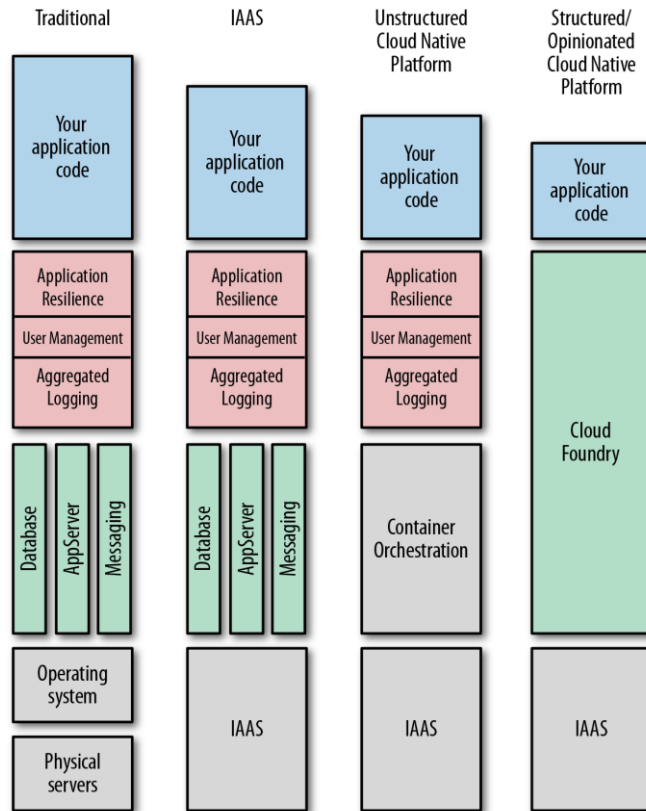
Container-ready — PAS supports the OCI format for Docker images. Run platform-built and developer-built containers.

Pivotal Application Service (PAS): A Runtime for Apps



Pivotal
Application Service™

- Developers focus on actual application code
- Operators gain productivity with automation



source: Cloud Foundry: The definitive guide, 1st Edition

No More Tickets, Just Self-Service

cf push

↓

Speed & Consistency

↓

~45 seconds

Code Complete & Tested

Find available hosts	2 Days
Install & configure runtime	1 Day
Install & configure middleware	1 Day
Pull application source code	¼ Day
Retrieve dependent libraries	¼ Day
Create application package	¼ Day
Install, configure dependent service(s)	2 Days
Deploy container to host(s)	½ Day
Load environment variables	¼ Day
Configure load balancer	2 Days
Configure firewalls	2 Days
Update service monitoring tools	3 Days
Configure log collector	1 Day
...	...

Application in Production

~15+ Days

Spring Boot + App Runtime

The combination proven to boost velocity with enterprise development teams.

Pivotal



Spring Boot

Effortless dependency management

Embedded App Server

Creates self-contained apps
that “just run”



Pivotal Application Service

Generates a container from a jar

Instantly starts the app in a container
upon cf push

Adds environment properties

Microservices Ready | NetflixOSS | Actuator Integration | Metrics & Logging

Spring by Pivotal: The Standard for Cloud Native Java



Spring Boot

Build Anything



Spring Cloud

Coordinate Anything



Spring Cloud Data Flow

Connect Anything

Code Clarity | Lower Complexity | Less Tech Debt | Focus on Business Logic | Better Test Coverage | Faster Code Completion

Build & Operate Microservices with Spring Cloud Services



Config Server for PCF

Delivers a dynamic, central configuration service to manage an application's external properties across all environments.



Service Registry for PCF

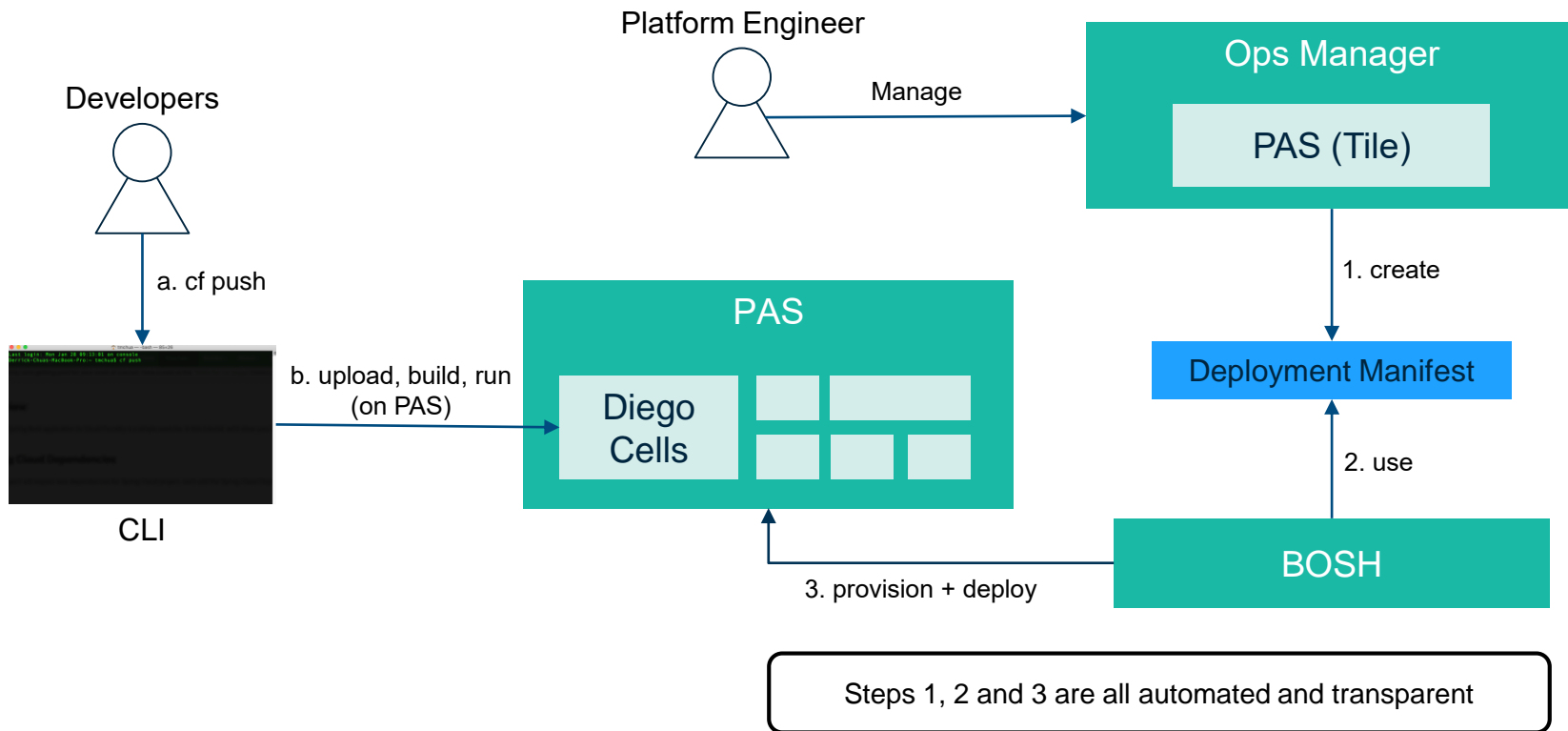
Provides an implementation of the NetflixOSS Eureka Service Discovery pattern, as a service.



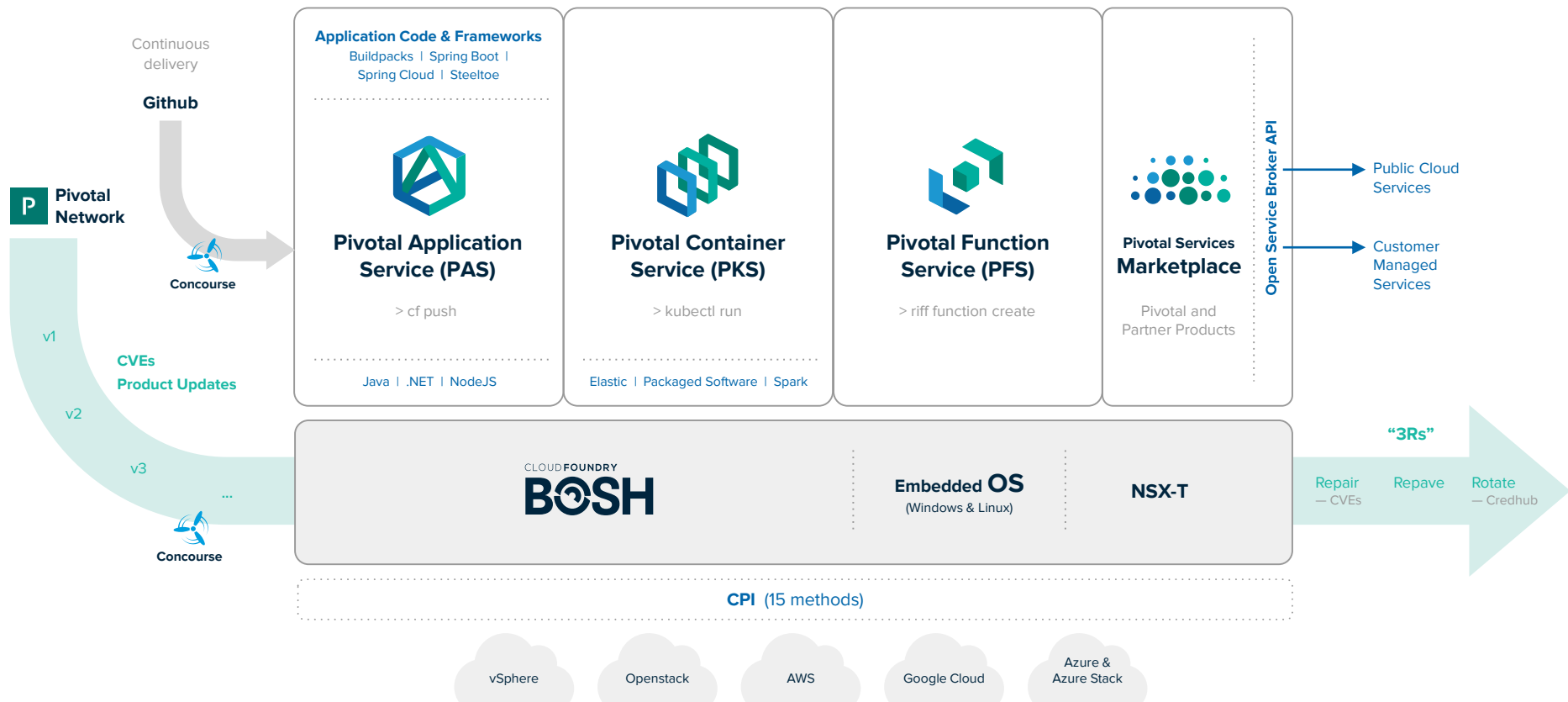
Circuit Breaker Dashboard for PCF

Visualizes a stream of Turbine health and metric data from the circuit breakers inside your microservices or applications.

BOSH + PAS = The full picture



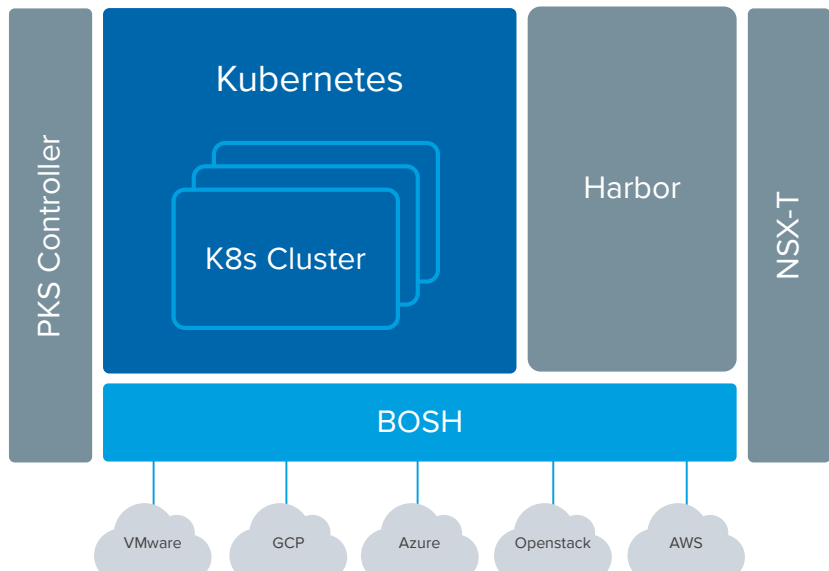
PCF - One platform for all your workloads



Pivotal Container Service (PKS): A Runtime for Containers



Pivotal
Container Service™



Built with open-source Kubernetes — Constant compatibility with the current stable release of Kubernetes, operated by BOSH. No proprietary extensions.

Production-ready — Highly available from apps to infrastructure, no single points of failure with master, etcd and worker nodes spanning multiple availability zones. Built-in health checks, scaling, auto-healing and rolling upgrades.

Multicloud — BOSH provides a reliable and consistent operational experience. For any cloud.

Network management and security out-of-the-box with VMware NSX-T. Automated microsegmentation and multi-tenant isolation.

Fully automated Ops — Fully automated deploy, scale, patch, upgrade. No downtime. Use CD pipelines to deploy your platform, too.

Zero downtime upgrades — Upgrade to the latest version of Kubernetes, apply maintenance without impacting availability using BOSH's Day 2 capabilities.

Pivotal Container Service (PKS): A Runtime for Containers

A turnkey solution to provision, operate and manage enterprise grade Kubernetes clusters



Pure CNCF-Certified Kubernetes Dial Tone:

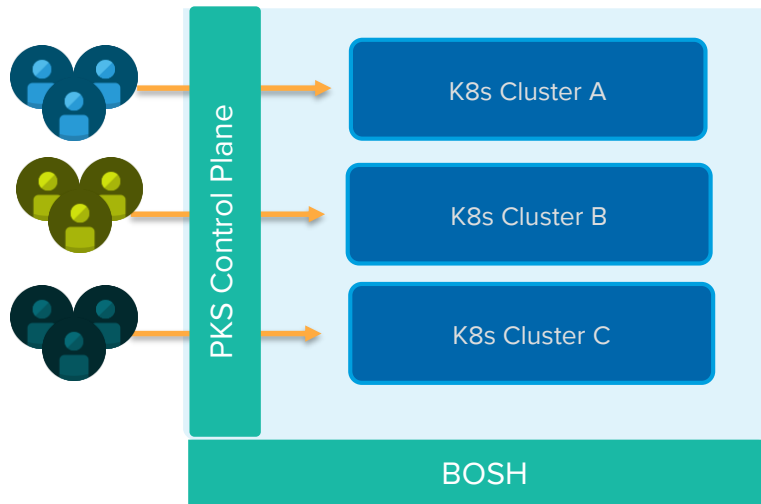
- Health management
- Aggregated metrics and logging
- Autoscaling
- Persistence interface

BOSH Control Plane:

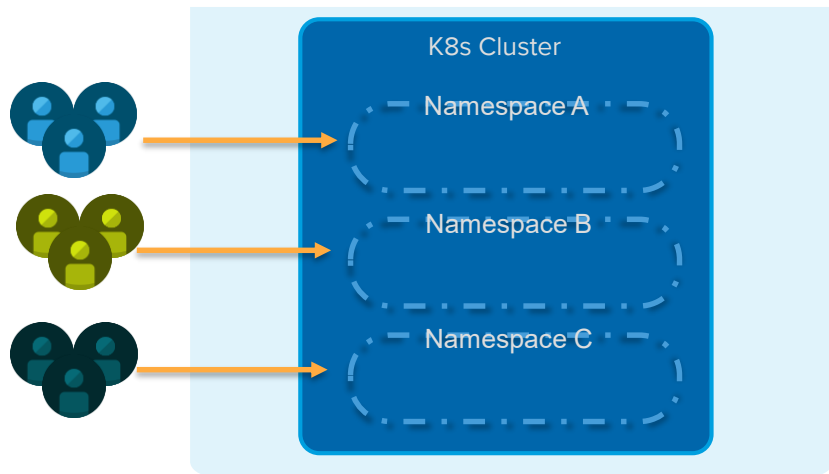
- Provisioning engine
- T-shirt sized clusters
- Self-service clusters
- Software update automation
- Load balancing
- Networking
- Multi-tenancy

Hard vs soft multitenancy

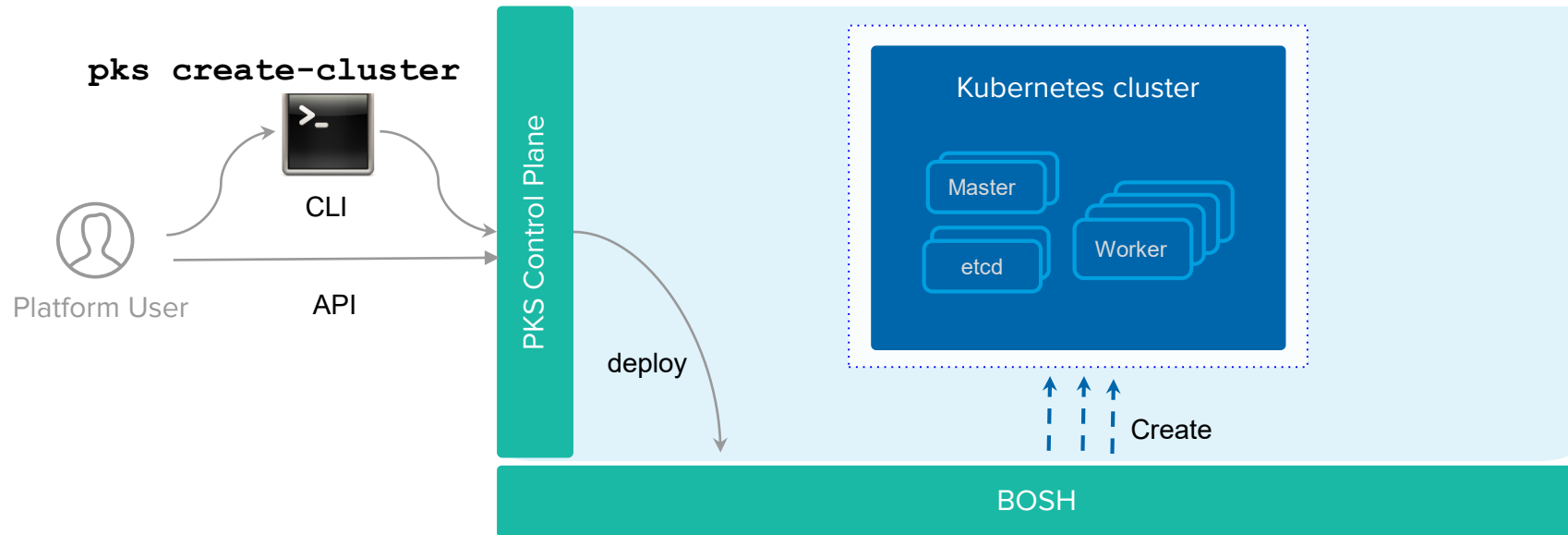
Multi-cluster cluster-based



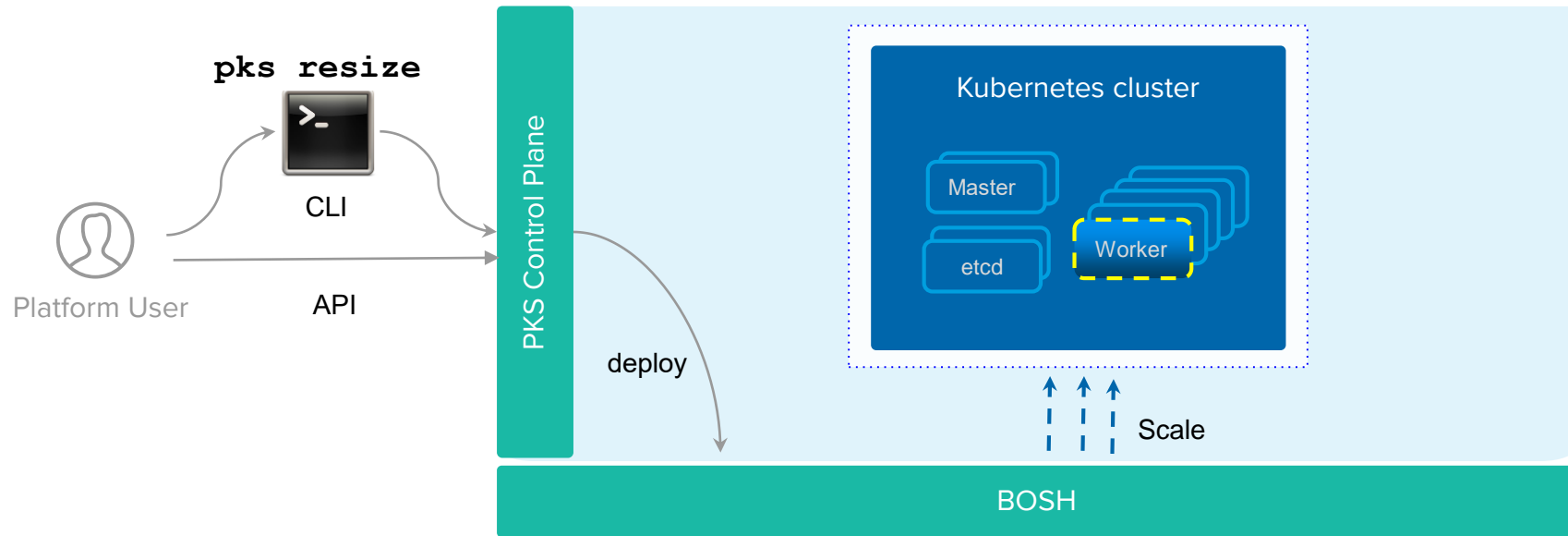
Single cluster namespace-based



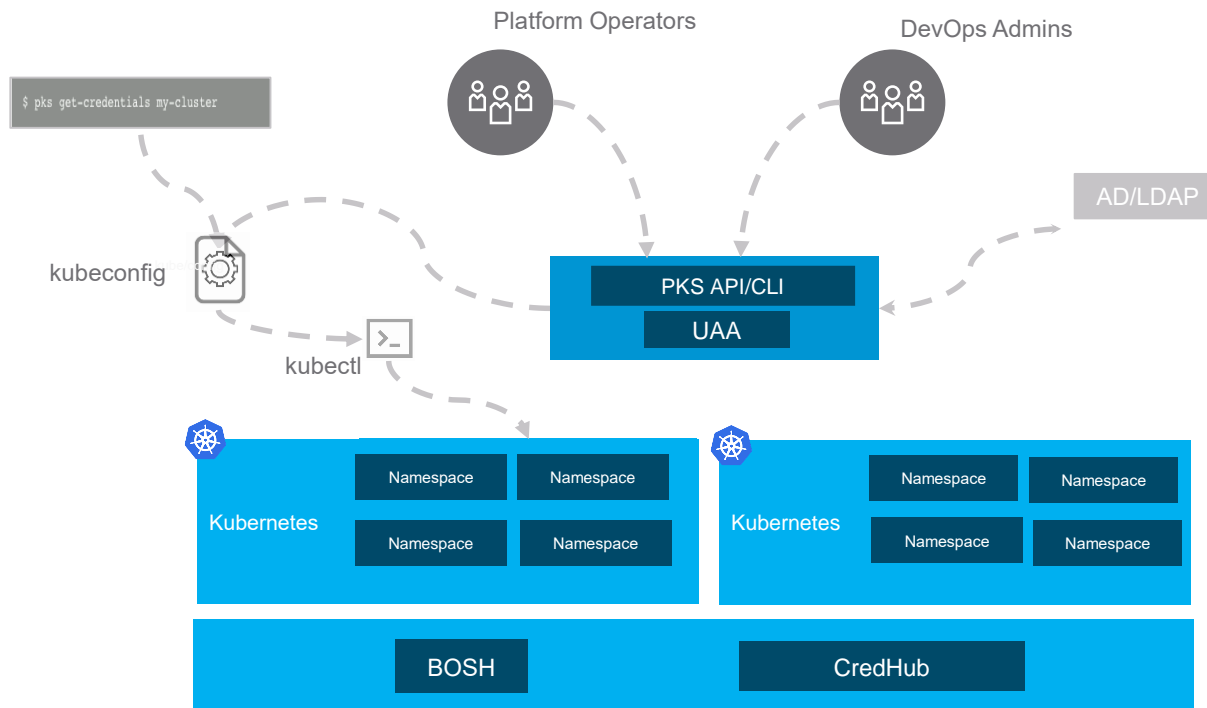
Creating a new kubernetes cluster



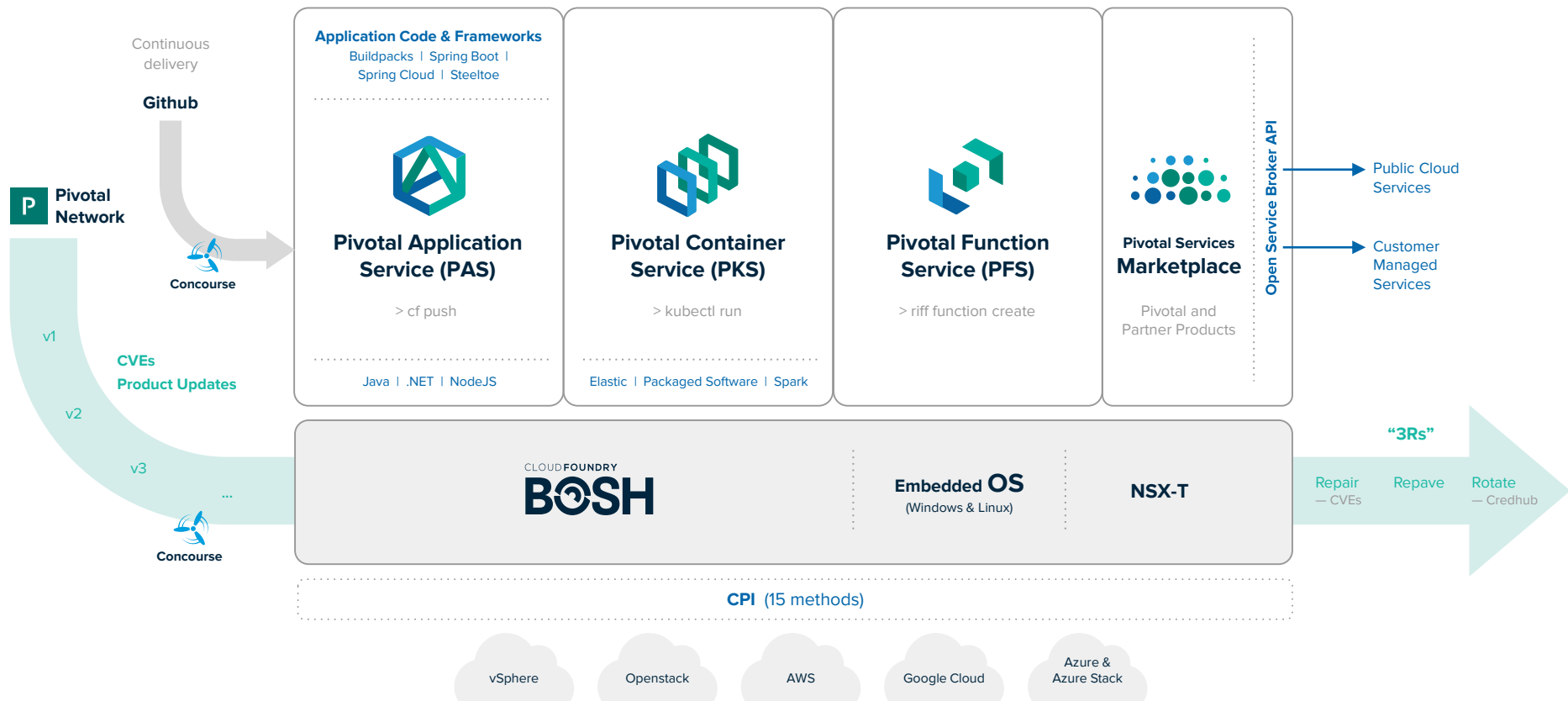
Scaling an existing kubernetes cluster



Centralized identity and access management



PCF - One platform for all your workloads



Pivotal Function Service (PFS): A Runtime for Functions

5 lines (5 sloc) | 120 Bytes

```
1  module.exports = x => {  
2      const xx = x ** 2;  
3      console.log(`the powerof2 result of ${x} is ${xx}`);  
4      return xx;  
5  }
```

Build | Serve | Event

Pivotal Function Service (PFS): A Runtime for Functions



Execute functions in response to events. Use PFS to handle web events, event-based integration, and large scale streaming data.

Trigger functions via HTTP/Message Broker — With PFS, you can quickly set up functions for a variety of events. PFS is architected to support pub/sub message delivery over messaging channels.

Run functions anywhere — PFS lets you easily run functions on-premises and in the public cloud for maximum flexibility.

Built on Knative — PFS is built on Knative, an open-source project led by Google. Knative simplifies how developers deploy functions atop Kubernetes and Istio.

Pluggable build system — PFS features a source-to-container mechanism to simplify deployment. Use proven components like Cloud Foundry Buildpacks.

Pluggable event sources — PFS Event Sources facilitate the creation of Feeds from a variety of external event sources such as GitHub webhooks, blob stores, and database services.

Pluggable event brokers — PFS can be connected easily with popular message brokers such as Kafka, Google Pub/Sub, and RabbitMQ.

PFS - based on solid fundamentals to deliver more value efficiently

Less Code

Function-invoker model

Auto Build

Buildpacks
Revisions
CI/CD

Auto Run

0-N autoscaling

Auto Wire

Event channels & routes

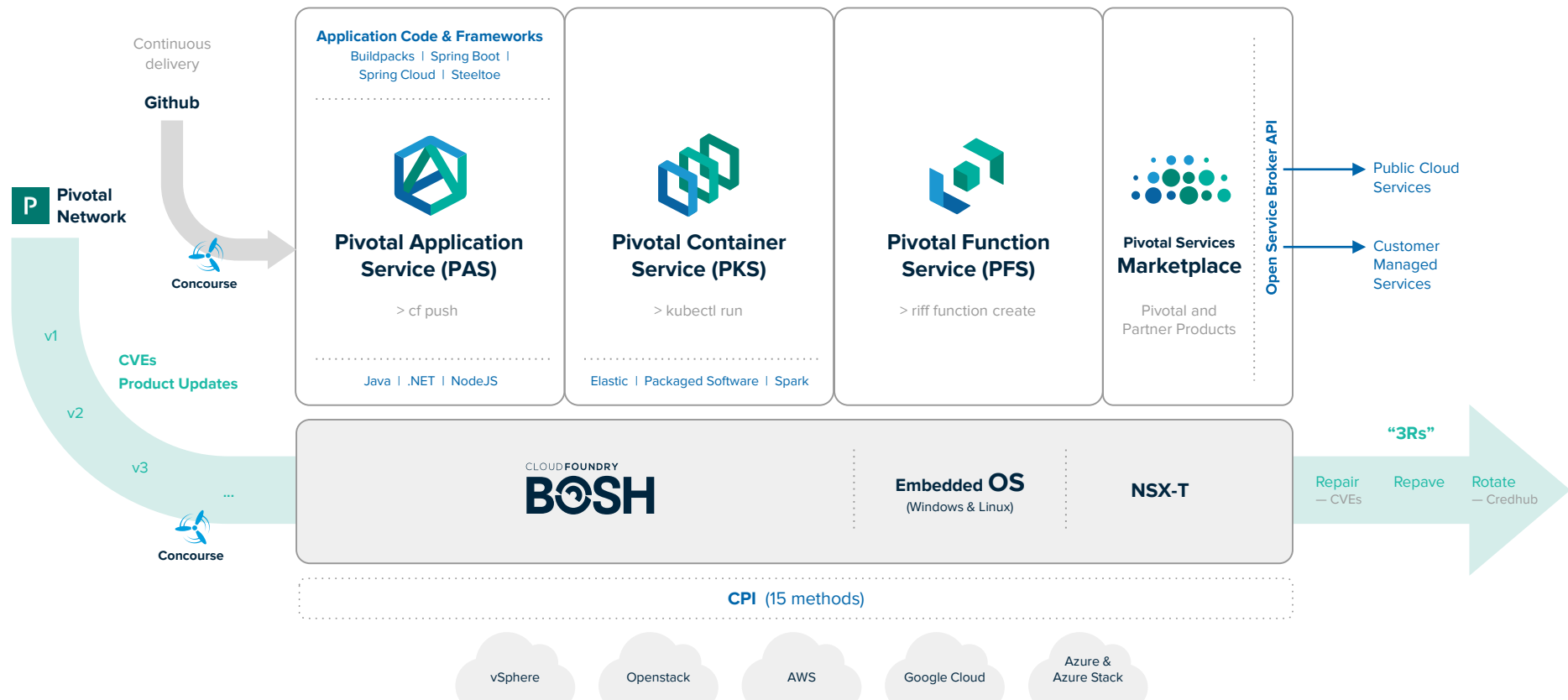
KNative

RIFF

Kubernetes

BOSH

PCF - One platform for all your workloads



Extend Apps with Brokered Services from Pivotal



MySQL for PCF

- Enterprise-ready MySQL for your developers
- Automate database operations in developer workflows
- Leader-follower for DR
- **NEW:** HA via Galera clustering, TLS encryption



Pivotal Cloud Cache

- High performance, in-memory, data at scale for microservices
Look-aside caches & HTTP session state caching
- WAN replication
- **NEW:** TLS encryption, CredHub integration



RabbitMQ for PCF

- Easily connect distributed applications with the most widely deployed open source message broker
- Enable connected scalable, distributed applications
- **NEW:** Service Instance Sharing, TLS encryption

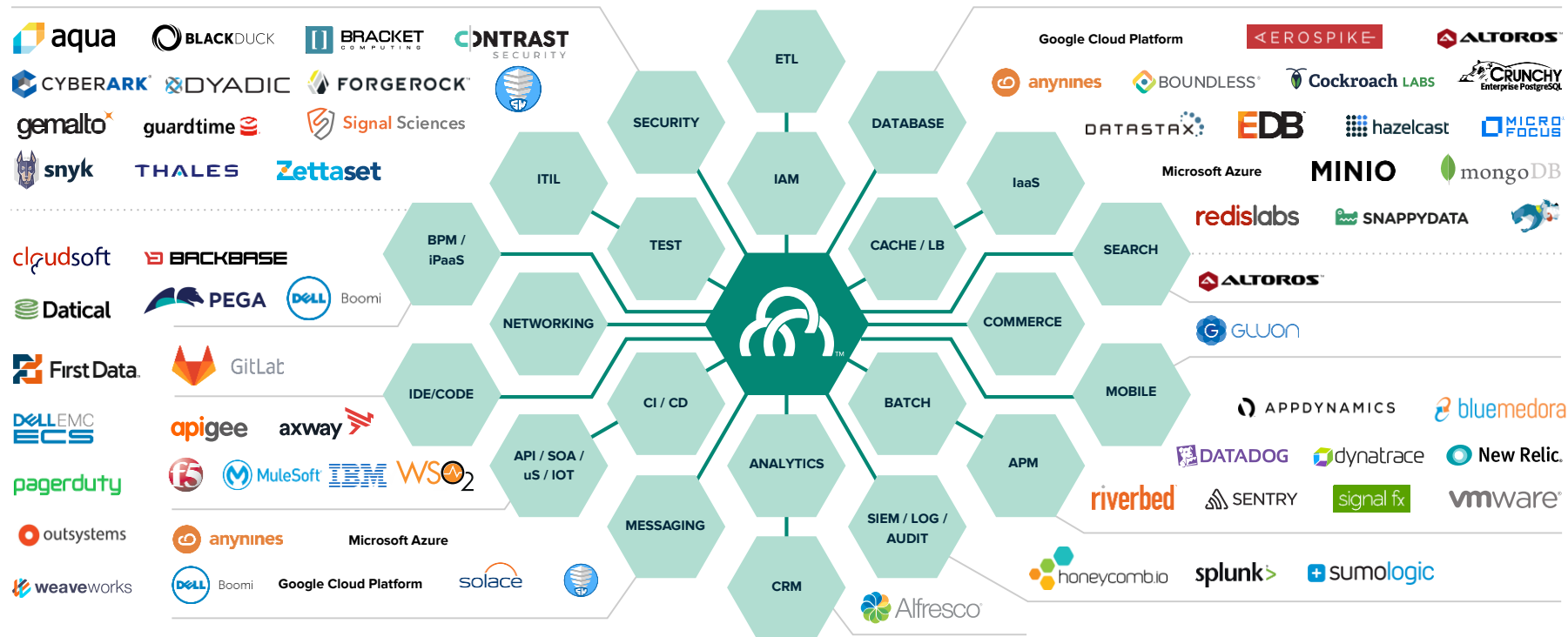


Redis for PCF

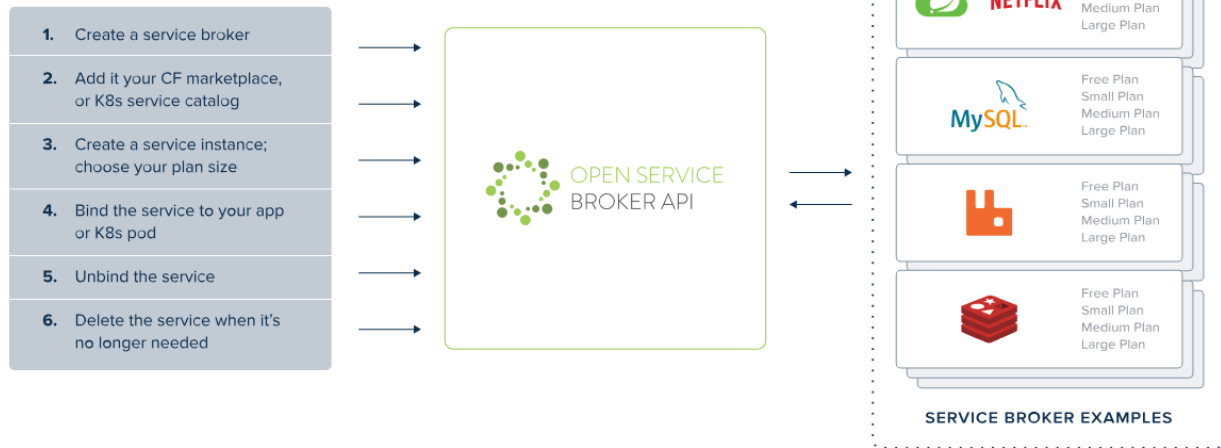
- In-Memory cache and datastore, configured for the enterprise
- Efficient provisioning matched to use cases
- **NEW:** On-demand service instance metrics.

BOSH Managed | **On-Demand Provisioning** | **Dedicated Instances** | **Custom Service Plans**

ISV Ecosystem Momentum Drives Platform Advantage



Open Service Broker API: Easily Add Services to Apps and Containers



Multiplatform & Multicloud | Simple & Structured | Connect Anything

Flexible Deployment Models

Extend Apps with Popular Services

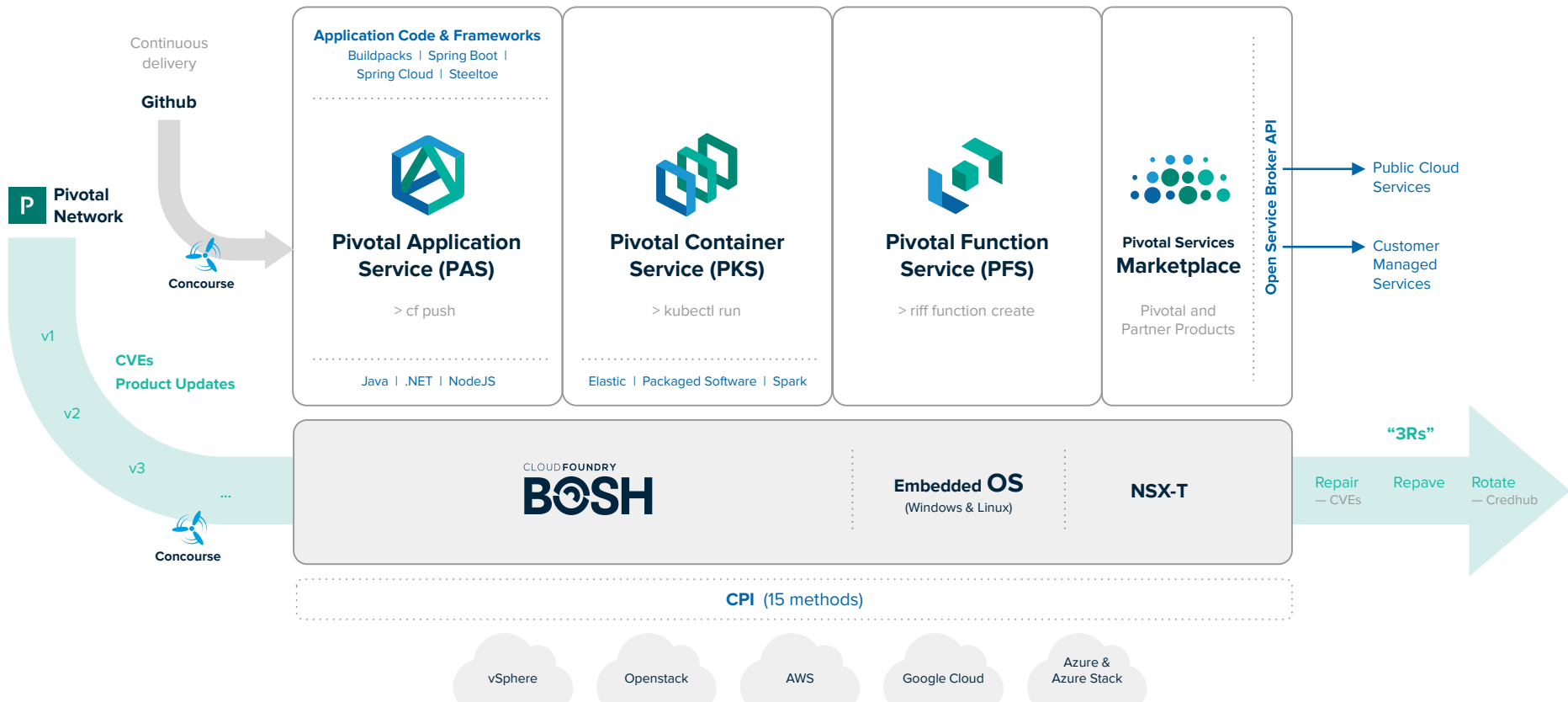
Supports the Permissions of Cloud Foundry and Kubernetes

OSBAPI Supports Unique Credentials for Every App

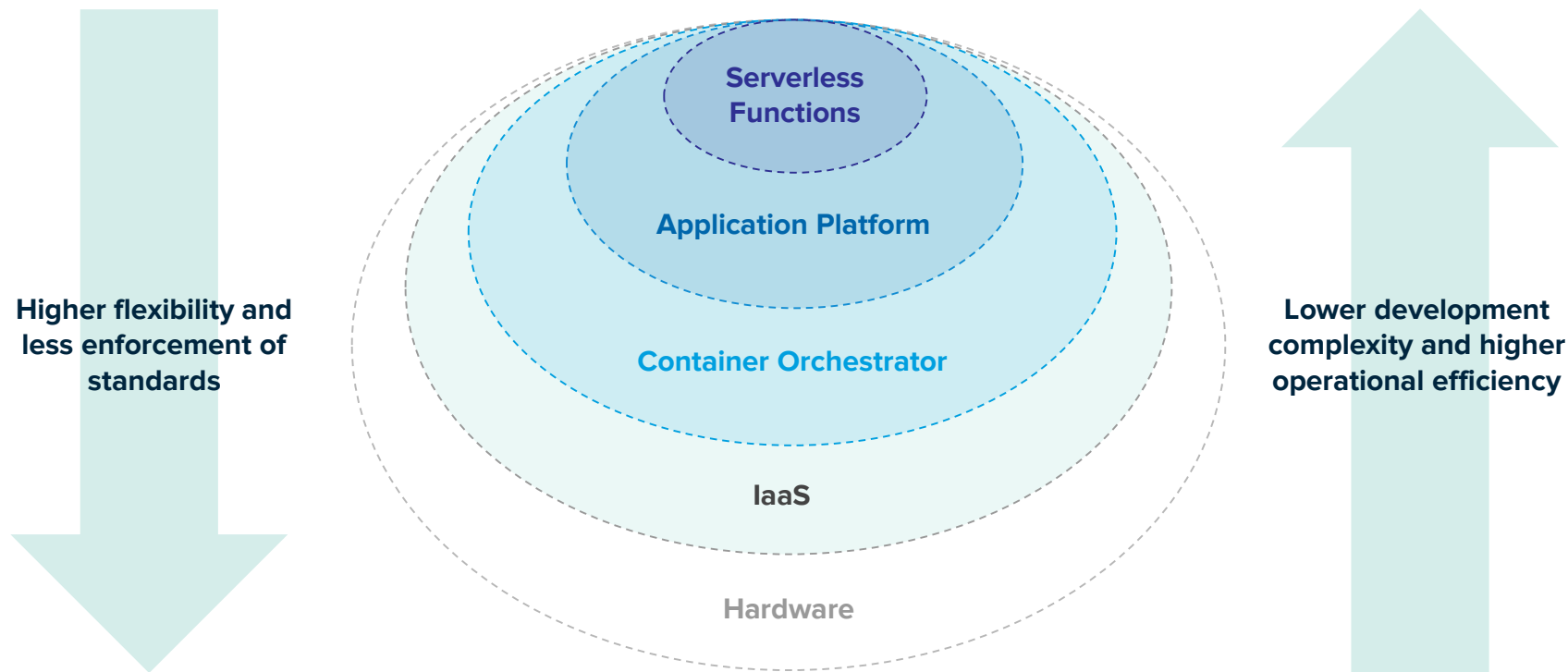
Simple Configuration

Open Source

PCF - One platform for all your workloads



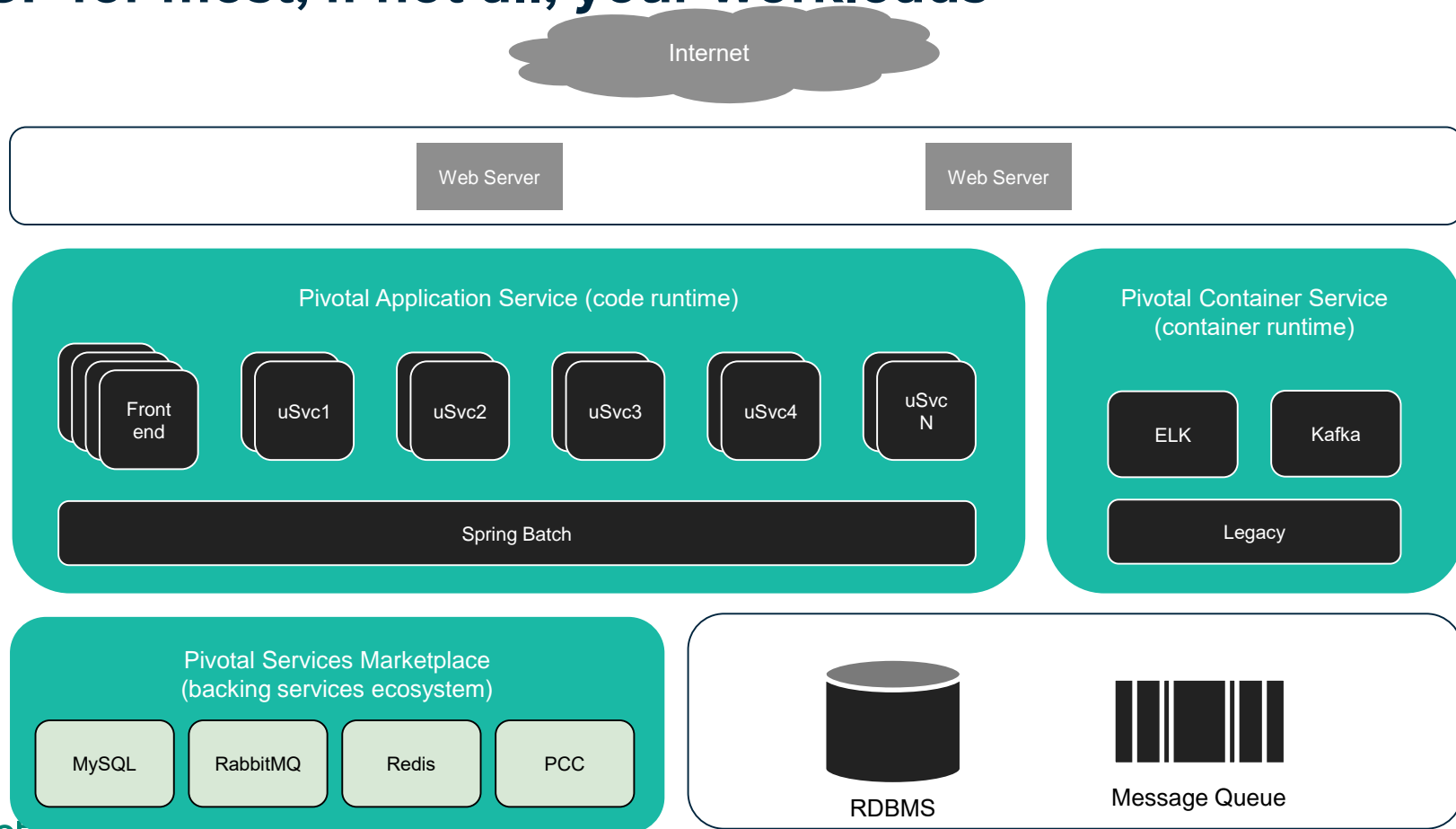
You get to choose the right level of abstraction



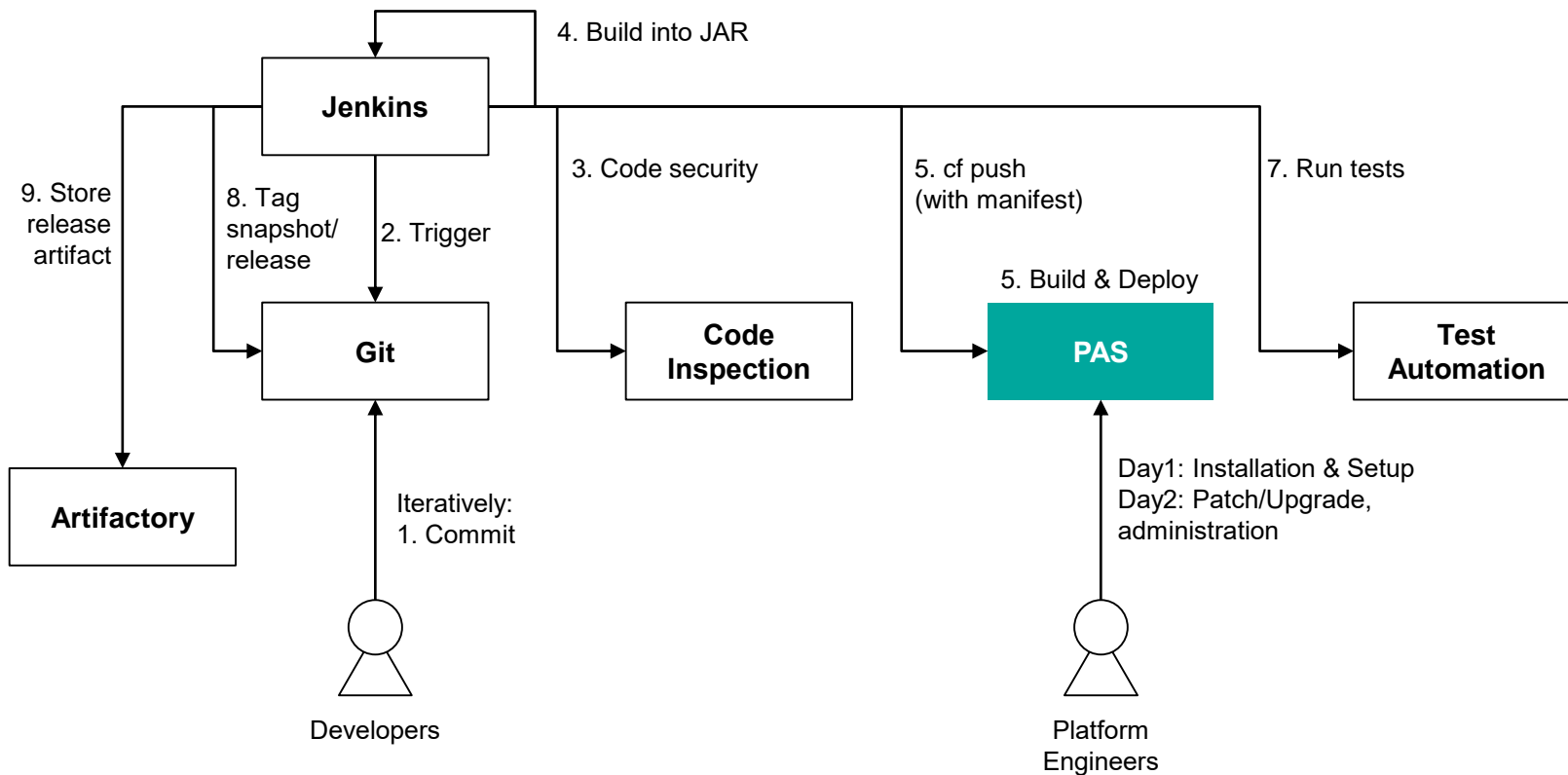


How PCF might look like for you

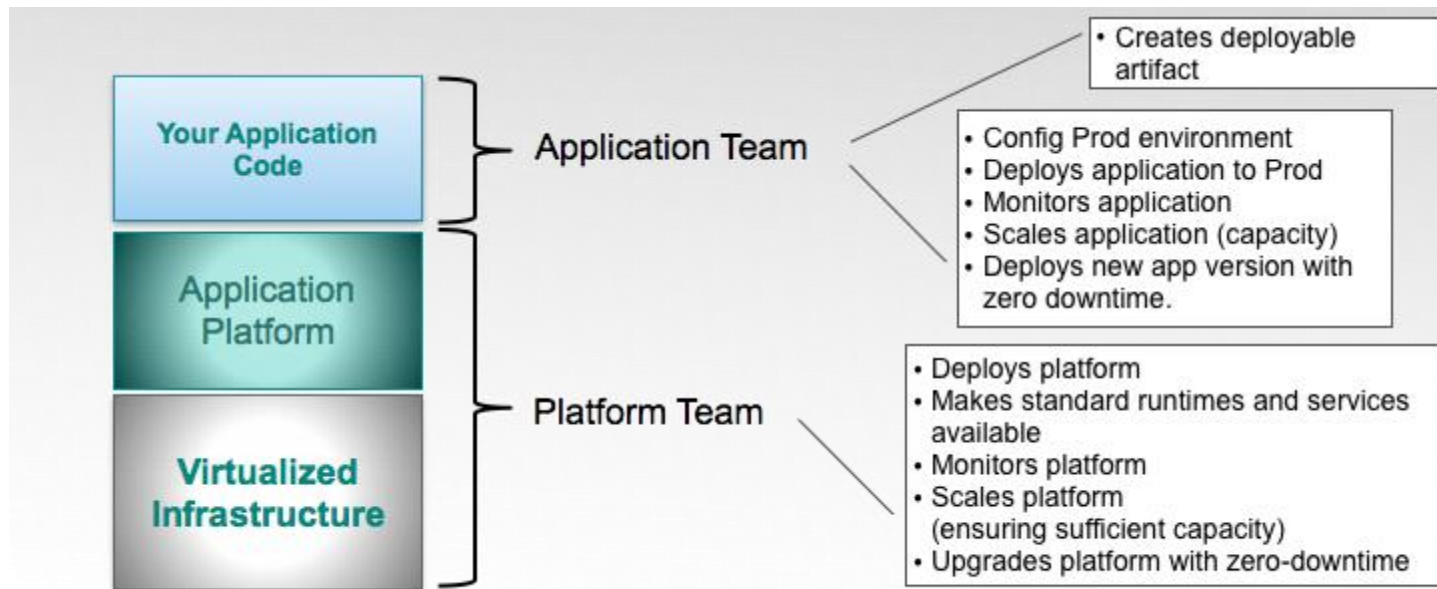
PCF for most, if not all, your workloads



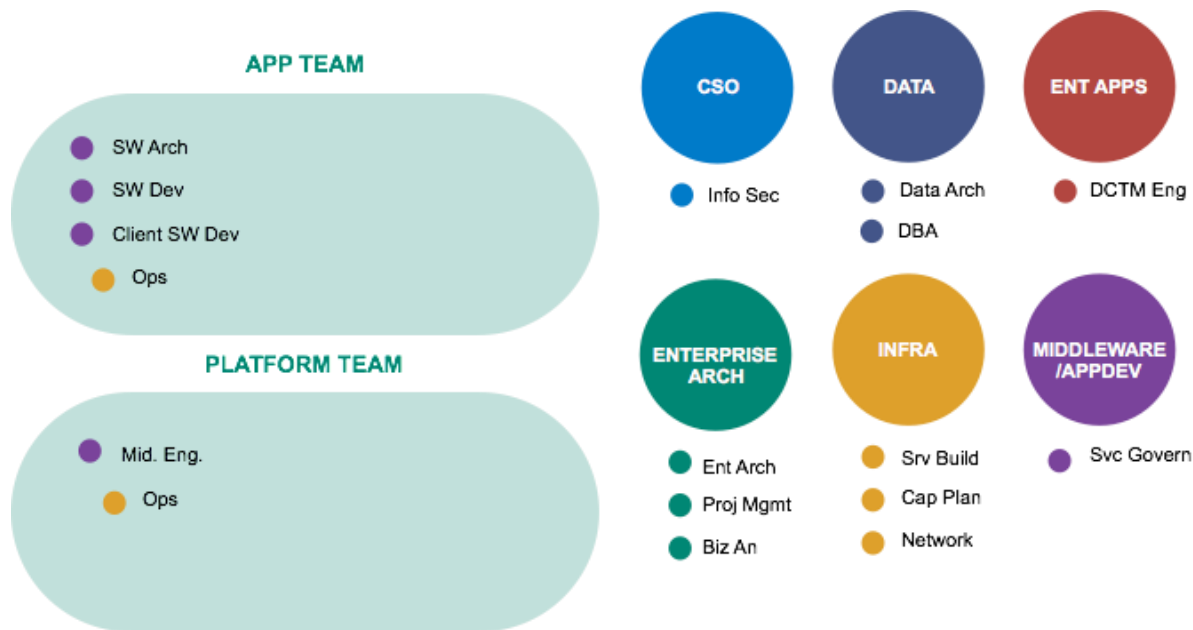
PAS in example CI/CD process



New tribes for PCF



Example mapping to IT roles



[Video: Who Does What? Mapping Cloud Foundry Activities and Entitlements to IT Roles — Cornelia Davis](#)

Code quality with Pivotal

Best Practices

Test Driven Development
Pair Programming

Standardized environments

Buildpacks
BOSH
PaaS, CaaS, FaaS



Path to Production

Production

Continuous feedback and improvements

Zero downtime deployment
Canary, Bluegreen deployment
PCF Metrics

Incentives on code quality
Measure and reward improvements
Active testing of production software
(e.g. bug bounty, Red Teaming,
external code review, Chaos Eng)
App Performance Management

The background of the slide is a teal-colored image of the Golden Gate Bridge, viewed from a low angle looking up at one of the towers. The bridge's cables and structure are visible, extending into the distance.

Pivotal®



Transforming How The World Builds Software