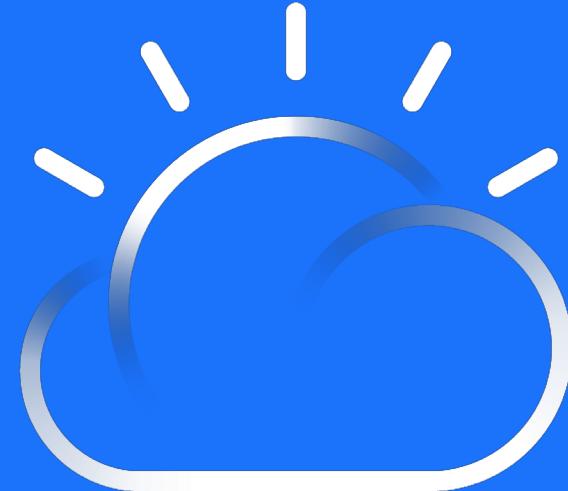


Deploying I&D solutions in Kubernetes

Nick Glowacki



IBM Cloud

IBM

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Why?



Why?

**Wait a minute?
Was this not one of the purposes of WAS?**

Benefits of containerization

Build Agility

Team Productivity

Fine-grained Resilience

Scalability and Infrastructure Optimization

Operational Consistency

Component Portability

Containerization is more than just a re-platforming exercise. “lift and shift” will not bring the above benefits.
Requires: *Fine-grained deployment, organizational decentralization, pipeline automation, disposable components...*

Agile Integration Architecture

Fine grained deployment

Improve build independence and production velocity

Dependency free rapid integration delivery

Decentralized Ownership

Accelerate agility and innovation

Cloud native infrastructure

Dynamic scalability and inherent resilience

Consumer centric exposure of business APIs

Independent application centric messaging

Business autonomy for integration delivery

Self-administration of API exposure and subscription

Self-provisioning of messaging and event capabilities

Scale and administer integrations with applications

Multi-platform cloud agnostic API management componentry

Cloud scale inherently resilient multi-platform messaging

Where did Kubernetes come from?



kubernetes

Kubernetes

The Kubernetes project was started by Google in 2014.

Open source system for managing containerized applications.



December 17, 2016 – January 17, 2017

Excluding merges, **136 authors** have pushed **577 commits** to master and **656 commits** to all branches. On master, **6,096 files** have changed and there have been **343,654 additions** and **301,994 deletions**.

Integral part of the CNCF

Cloud Native Landscape

v20180525

See the interactive landscape at l.cncf.io

Greyed logos are not open source

App Definition and Development

Platforms

Observability & Analysis

Scheduling & Orchestration

Coordination & Service Discovery

Service Management

Runtime

Host Management / Tooling

Kubernetes Training Partner

Cloud

Special

This landscape is intended as a map through the previously uncharted terrain of cloud native technologies. There are many routes to deploying a cloud native application, with CNCF Projects representing a particularly well-traveled path.

l.cncf.io

CLOUD NATIVE
Landscape

CLOUD NATIVE
COMPUTING FOUNDATION

Redpoint Amplify

What's Kubernetes

- Open source by Google
- One sized fits all Container orchestration and cluster management
- Self-healing and Failover
- Horizontal and Vertical Scaling
- Allows custom “plugins” to become part of the internal components
 - Does not ship
 - Package Management (Helm)
 - Networking (Calico/Flannel)
 - Storage (CEPH/Gluster)

How does IBM Cloud Private fit in?

- Takes Kubernetes and a number of “plugins” and makes them fit for enterprise
 - Provides Support
 - Provides Proven patterns
 - Does not stop other 3rd party plugins being used.
 - Includes
 - Helm
 - Calico
 - Gluster FS
 - And Many Others

Key concepts of **Kubernetes**

ACE
Container

Key concepts of **Kubernetes**

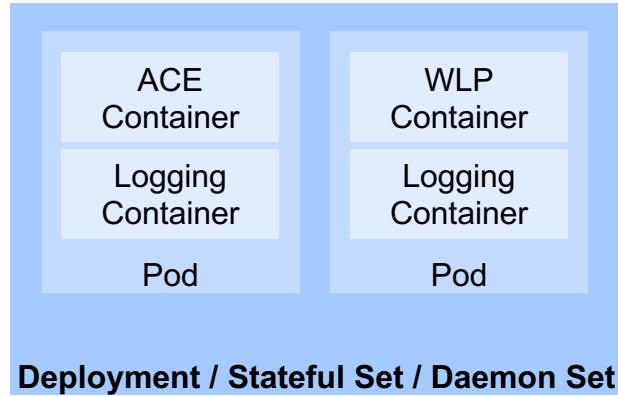
Deployable Bar Files

Global Configuration

ACE Binaries

Operating System - Ubuntu

Key concepts of **Kubernetes**



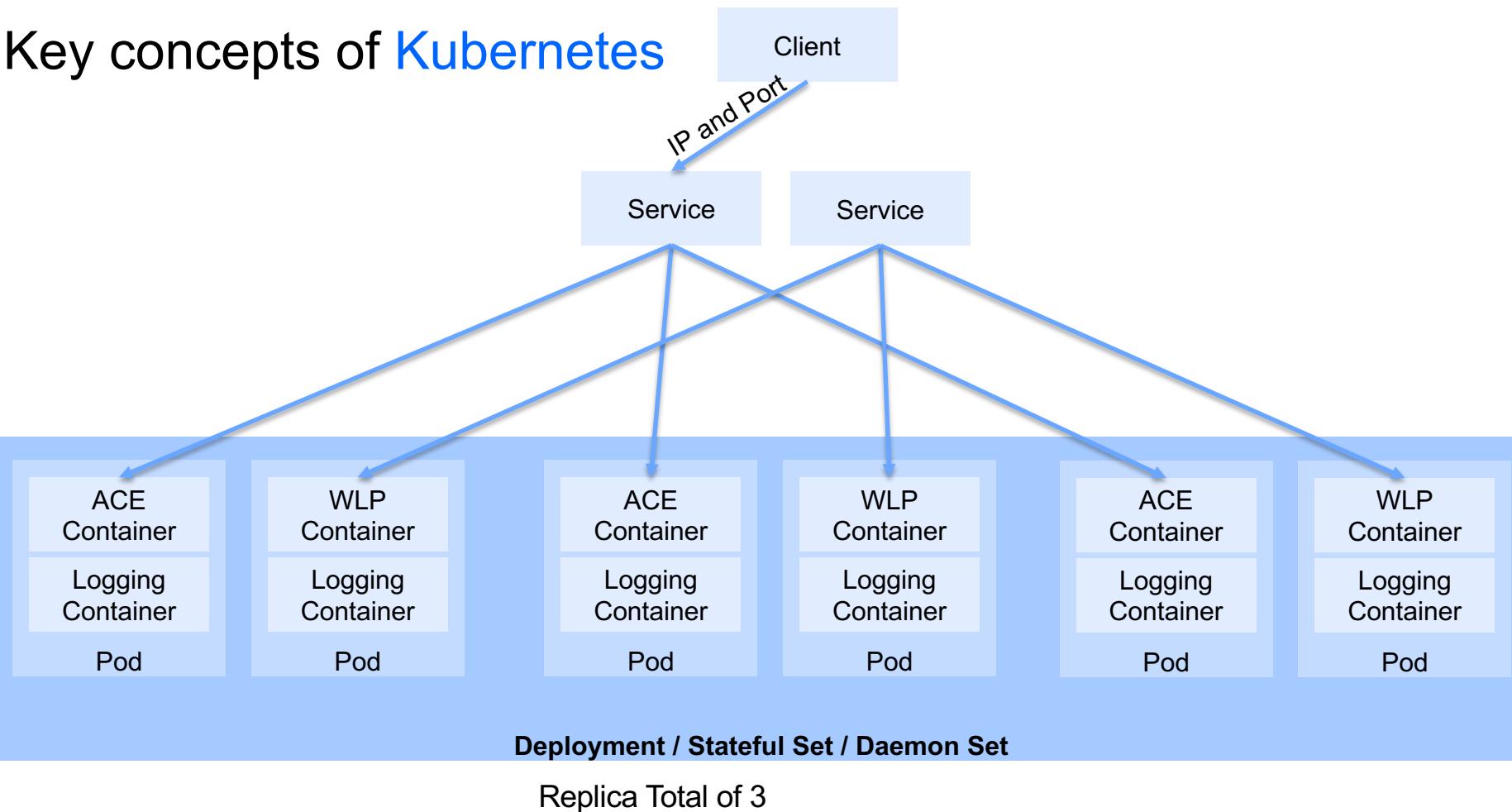
Key concepts of **Kubernetes**



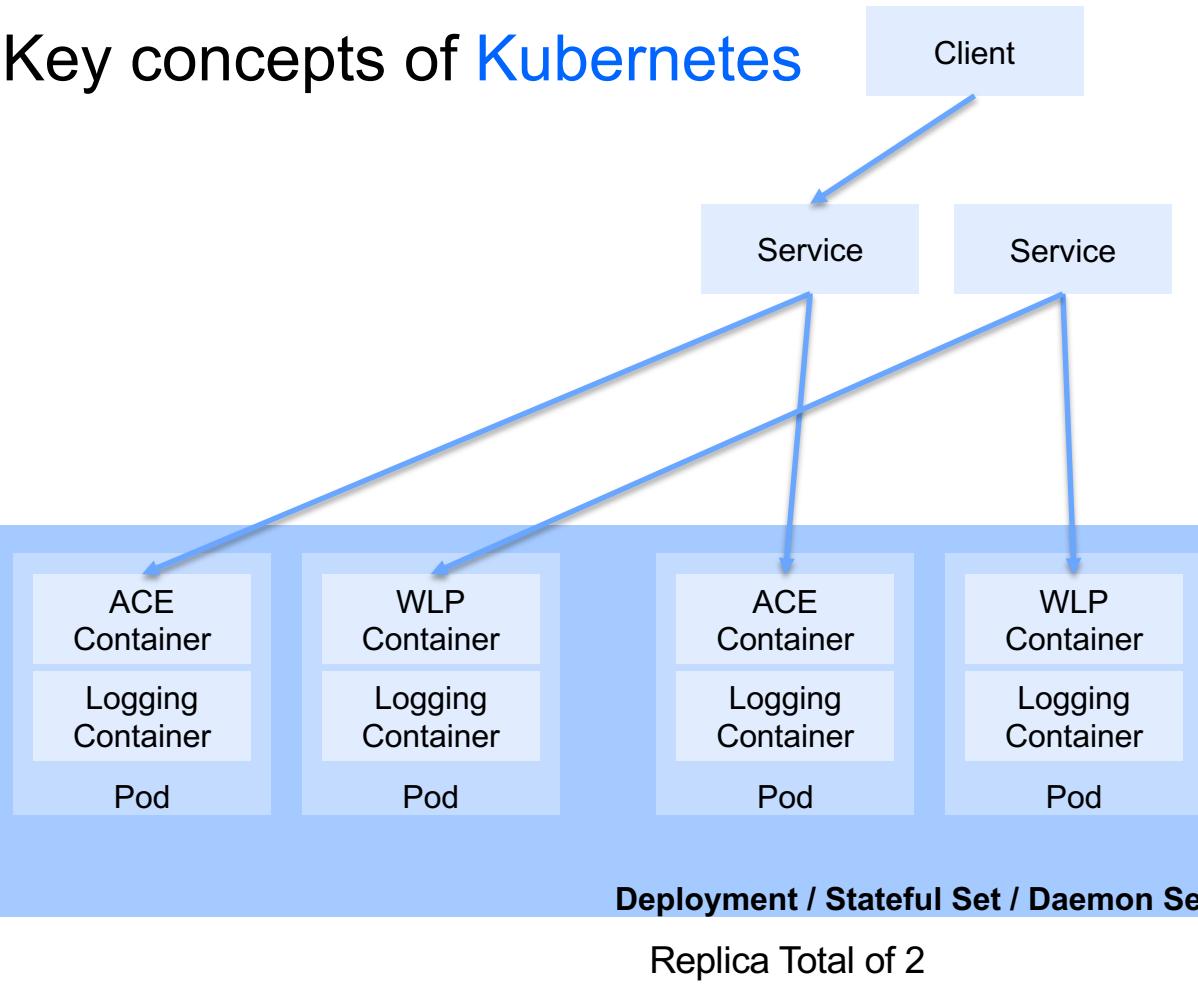
Deployment / Stateful Set / Daemon Set

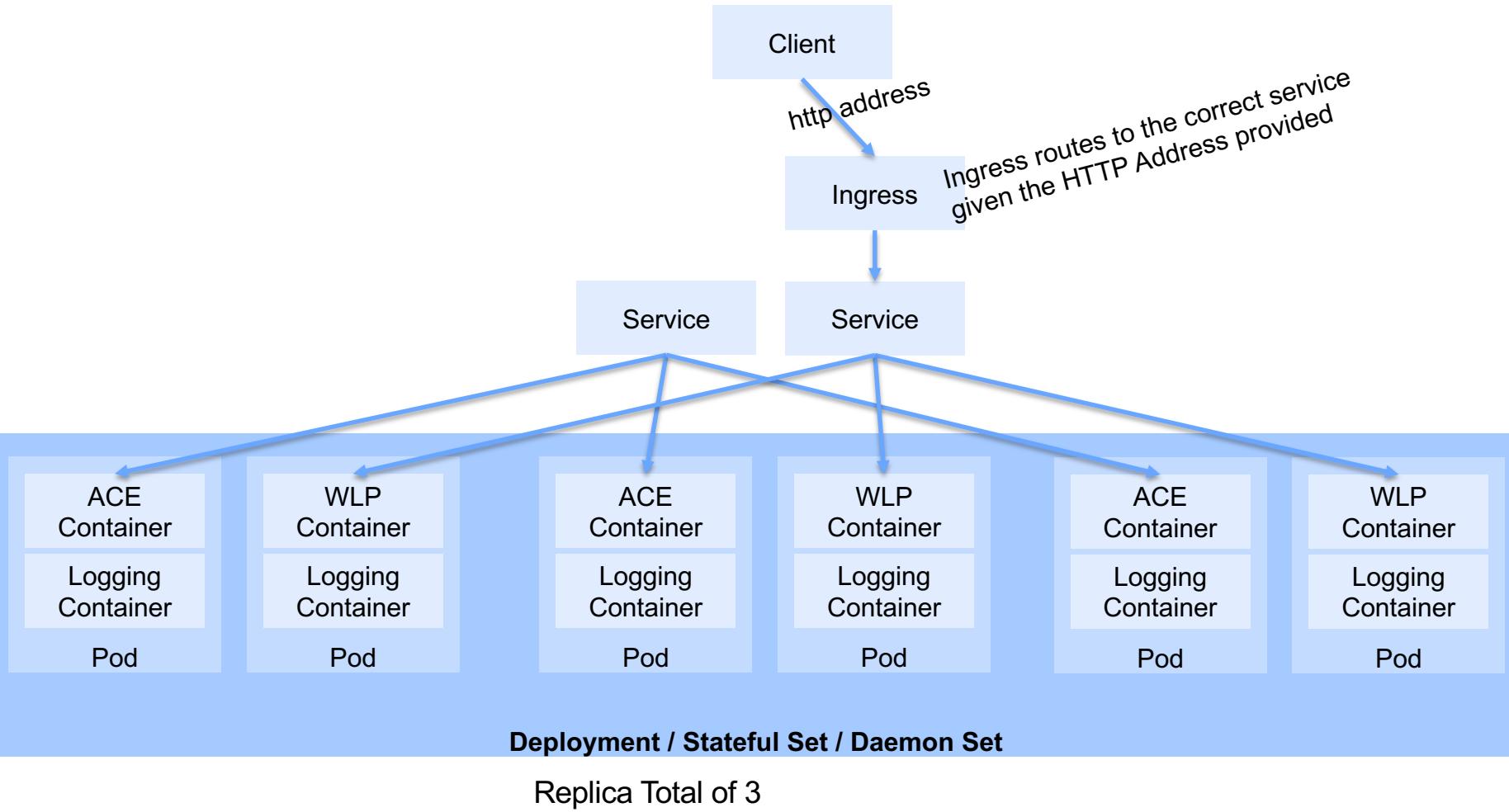
Replica Total of 3

Key concepts of Kubernetes

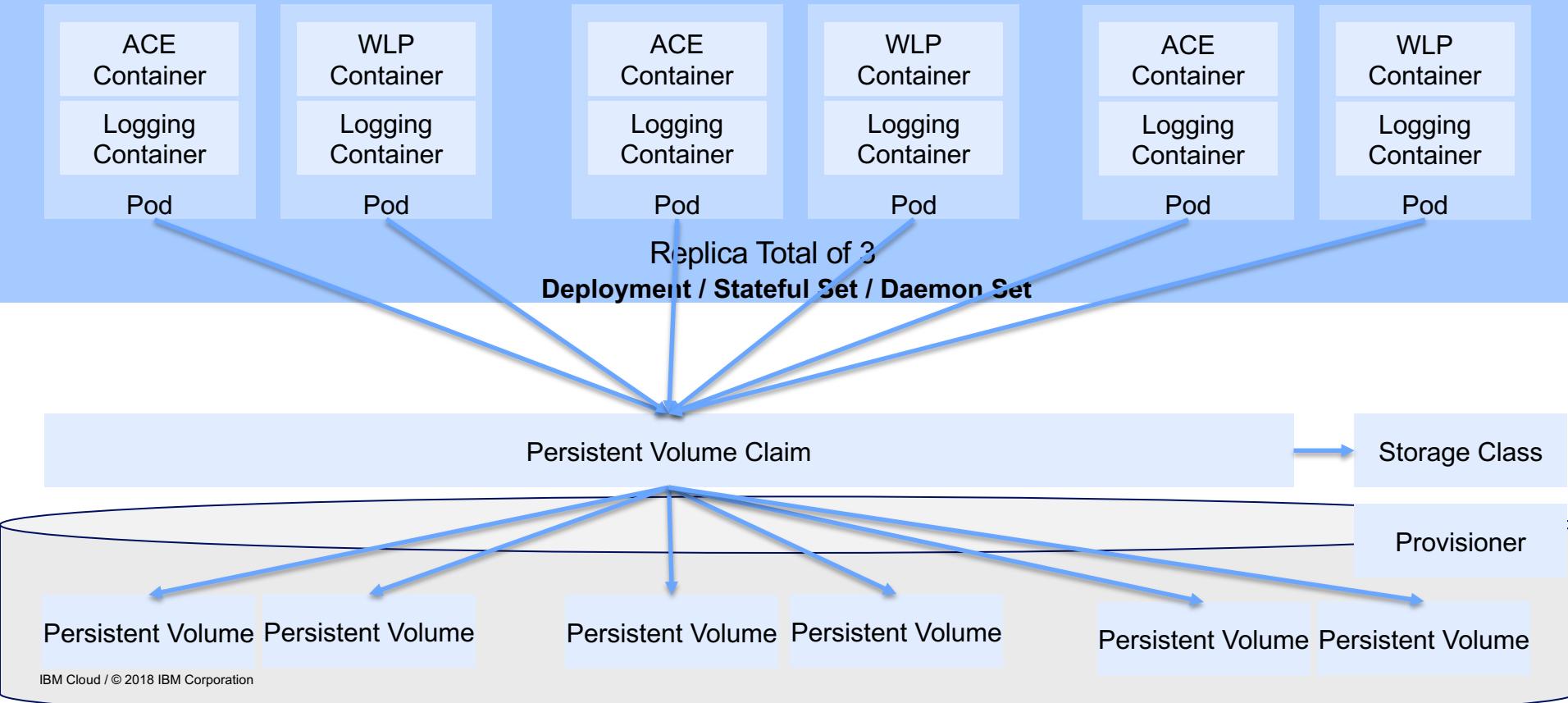


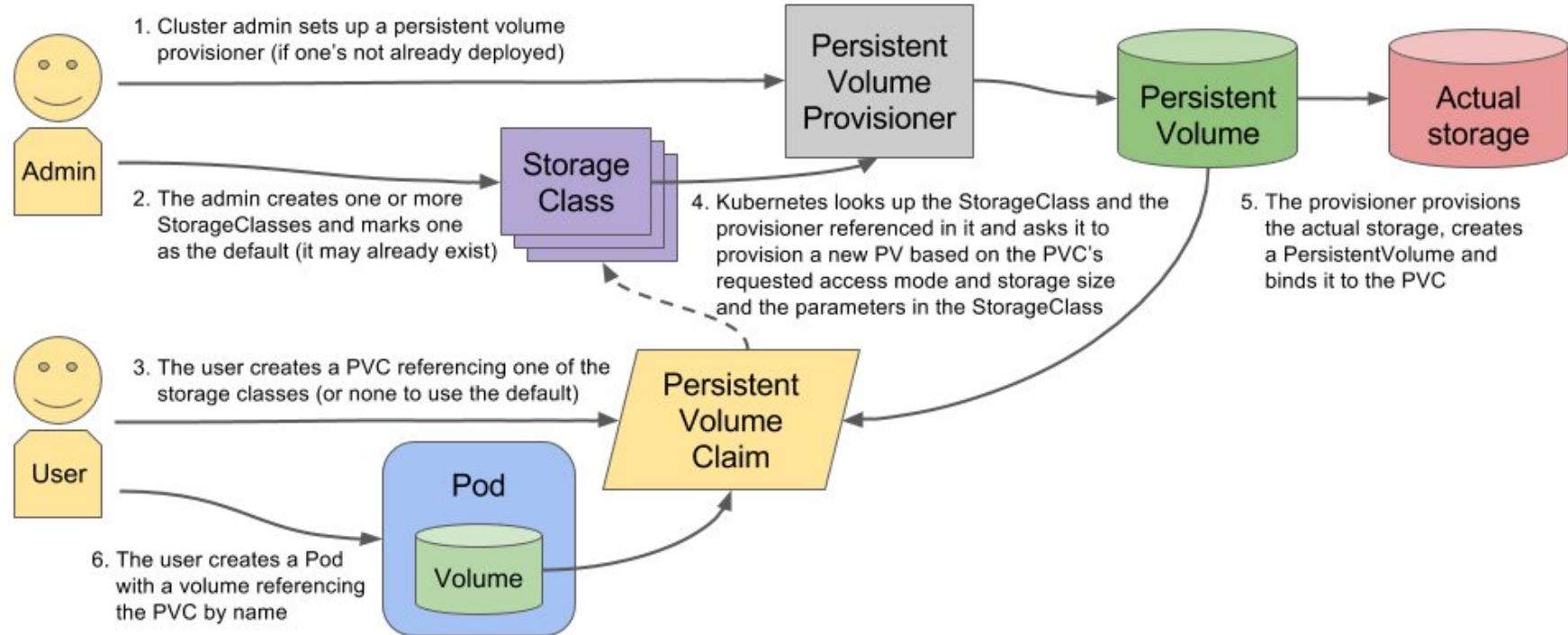
Key concepts of Kubernetes





Key concepts of Kubernetes





What we have covered so far?

- Containers
- Pods
- Deployments
- Services
- Ingress
- PVC
- PV
- StorageClass

ANY Questions so far?

What to consider when using Kubernetes

High Availability Deployments



kubernetes



kubernetes



kubernetes



kubernetes



kubernetes



kubernetes



kubernetes

What is the hardest problem with High Availability?

Managing State



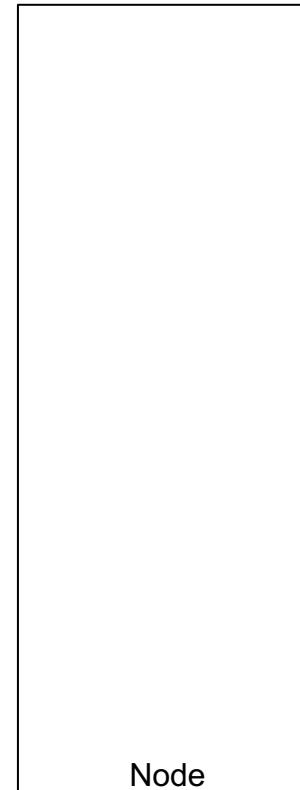
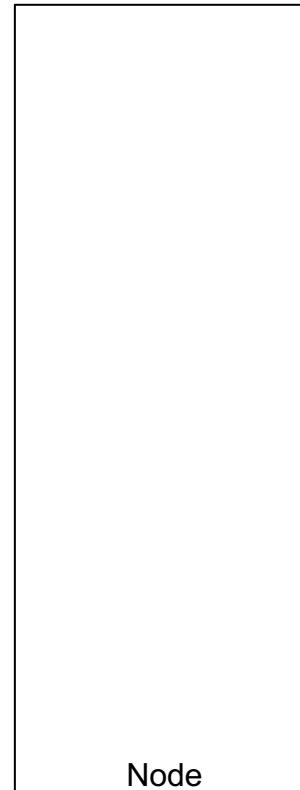
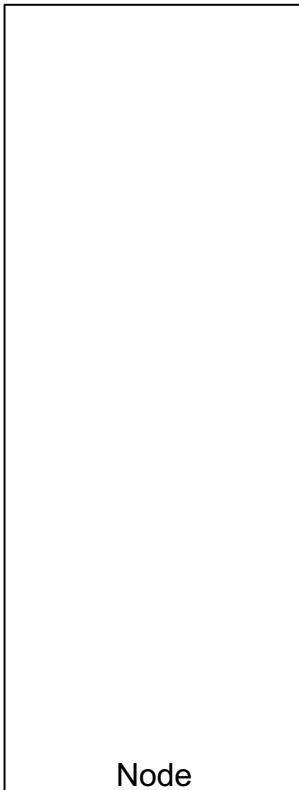
Kubernetes delegates the HA of Application State to the storage solution

	Local				Cloud
	Gluster	CEPH Block	NFS	Host Path	EBS/ABS/IBS
API Connect	No	Yes	No	Limitation	Yes
Event Streams	Yes	Yes	Yes	Limitation	Yes
ACE	Yes	Yes	Yes	Limitation	Yes
MQ	Yes	Yes	Yes	Limitation	Yes

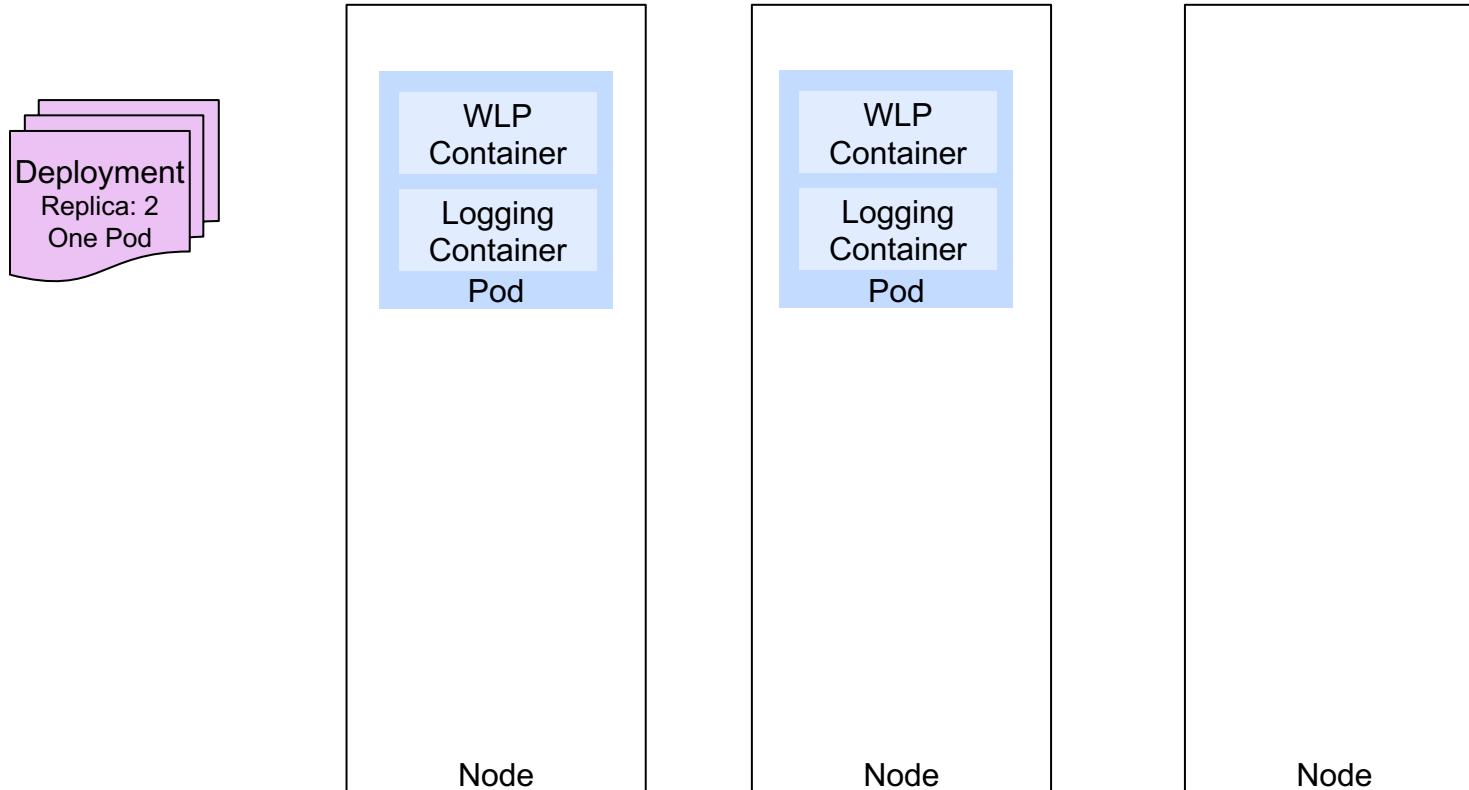
Kubernetes HA – Three Types of Deployment

- Deployment
 - Pods are deployed to any node with capacity.
 - Scenario – Most Scenarios
- Stateful Set
 - Pod Replicas Start one at a time
 - Scenario – Storage
- Daemon Set
 - Pod Replicas have one on each node, no more no less.
 - Scenario – Critical Dependency that cannot afford to go down.

Kubernetes HA - Deployment

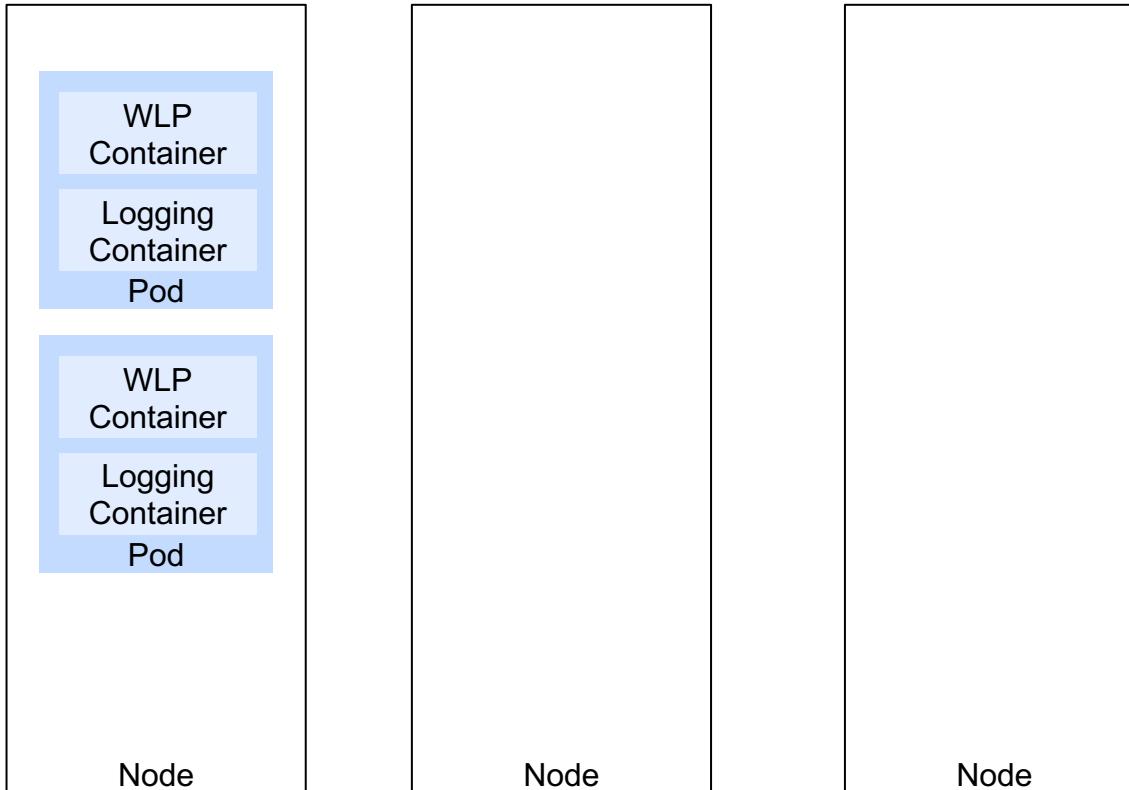


Kubernetes HA - Deployment

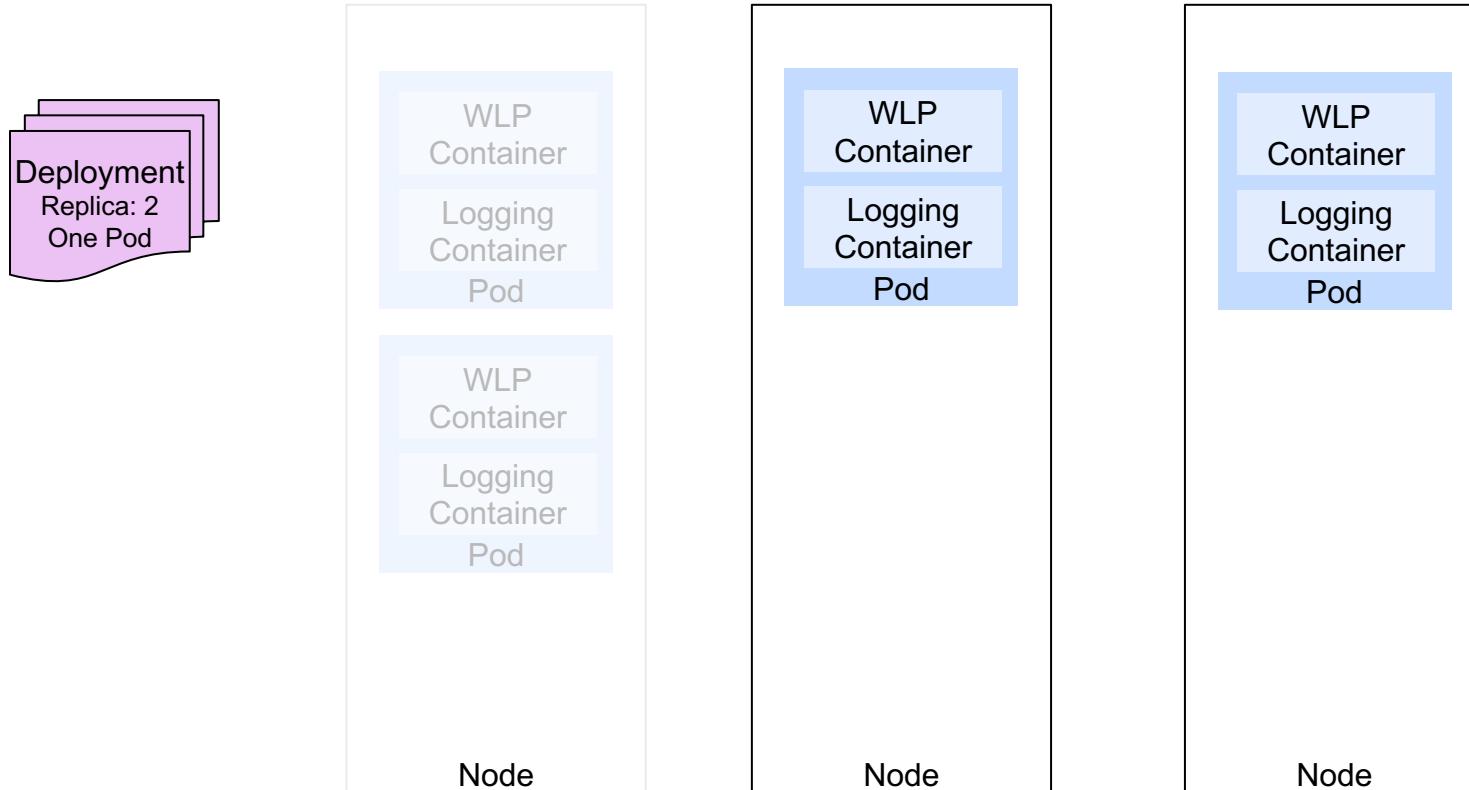


Kubernetes HA - Deployment

Deployment
Replica: 2
One Pod



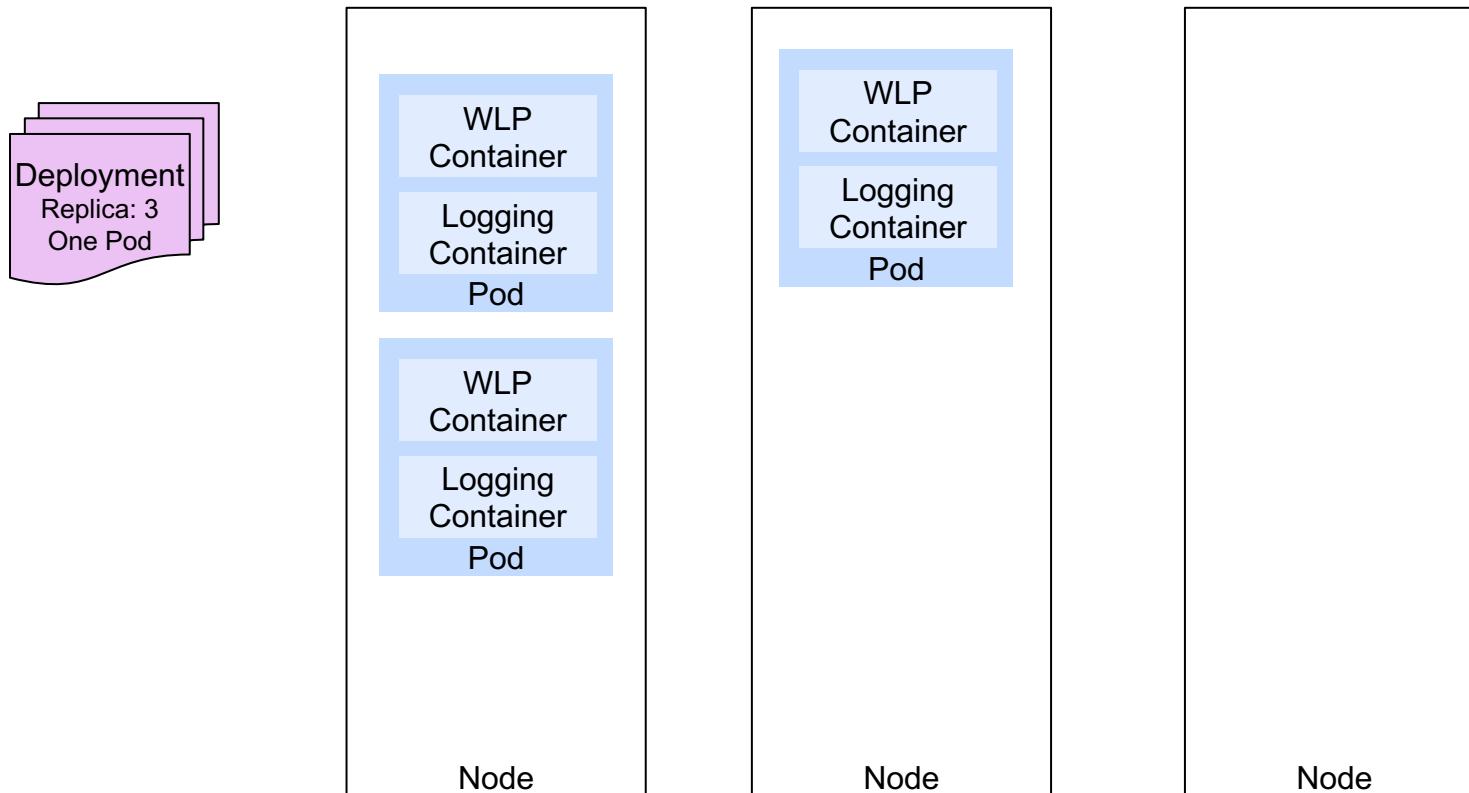
Kubernetes HA – Deployment



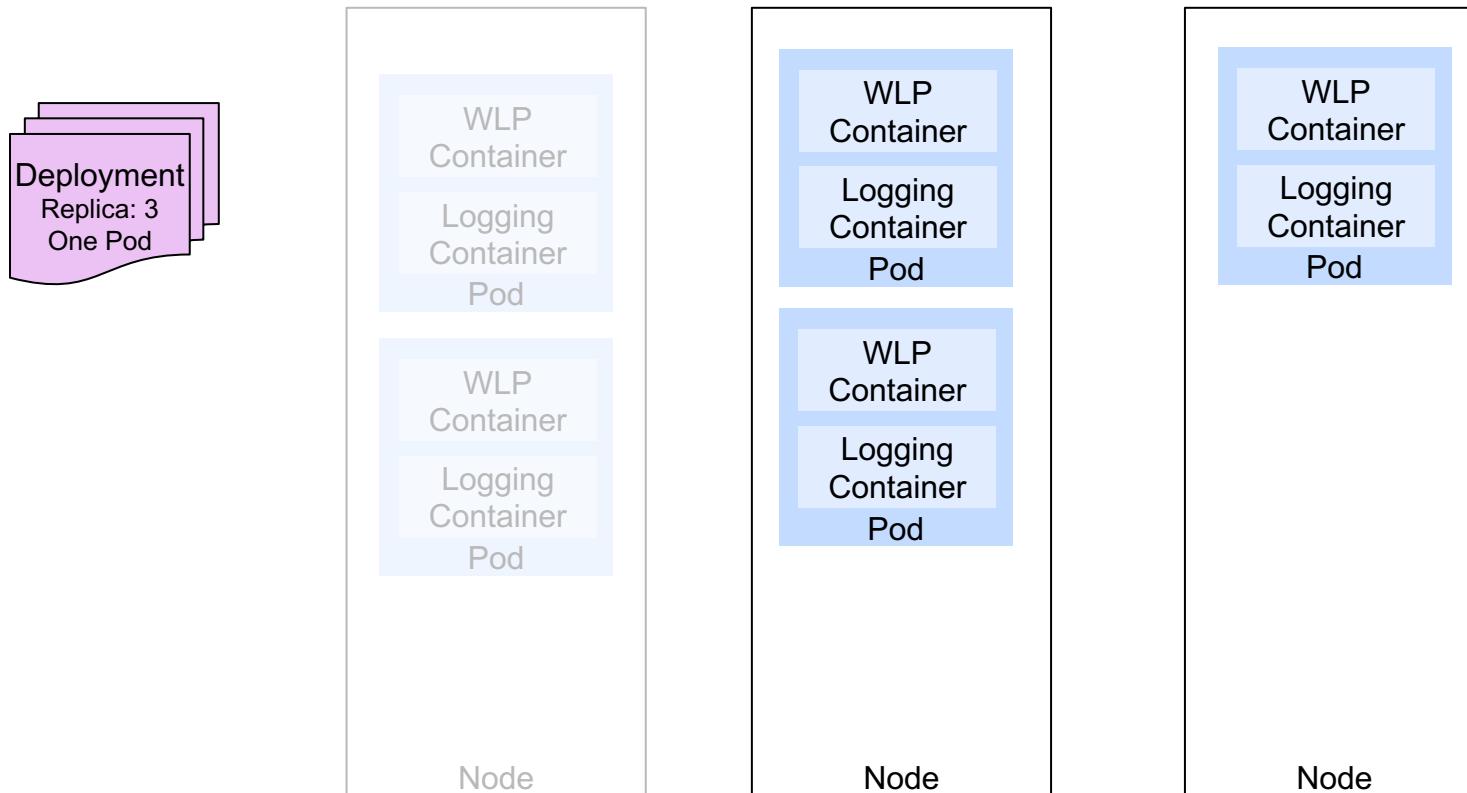
Kubernetes HA – Node Affinity and Anti-Affinity

- Node Affinity
 - A set of rules the pod must follow at deploy time
 - E.g. Hostname
 - Custom Label (Can be used to identify availability zones)
- Node Anti Affinity
 - A set of rules the pod must not follow at deploy time
 - E.g. Hostname
 - Stopping it deploying on a node that already has an instance.

Kubernetes HA - Deployment – Without any additional rules

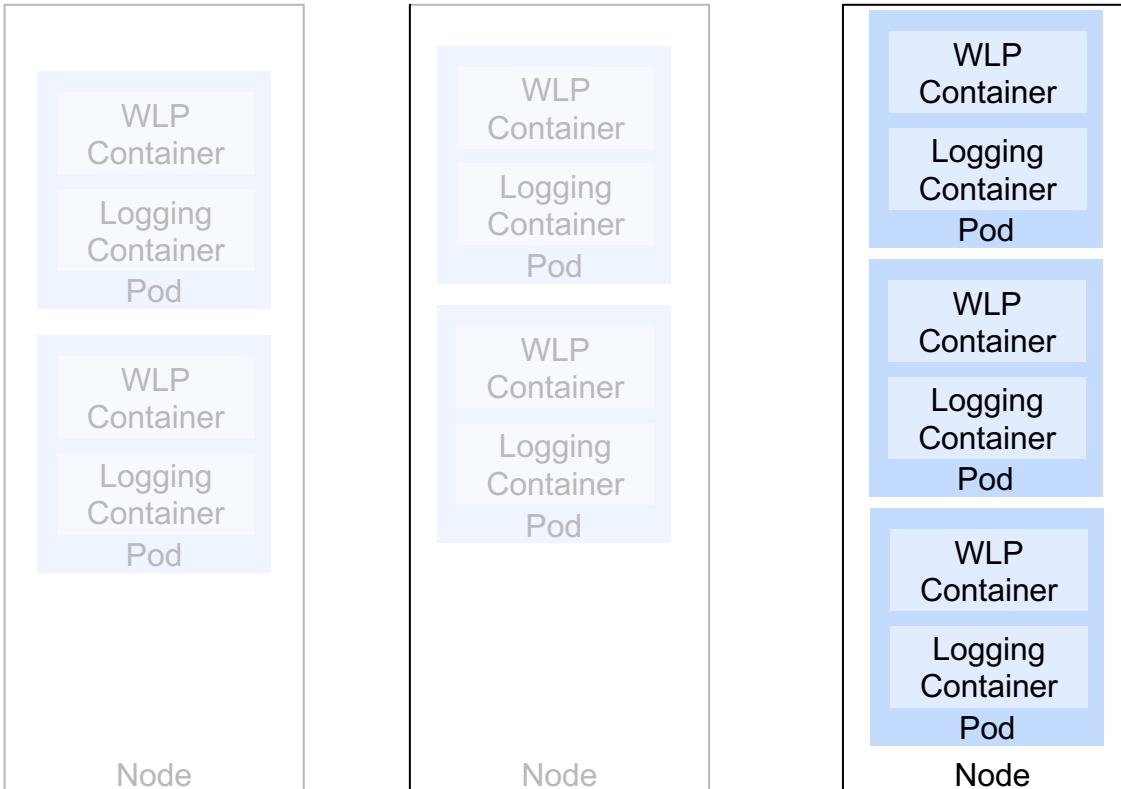


Kubernetes HA - Deployment – Without any additional rules

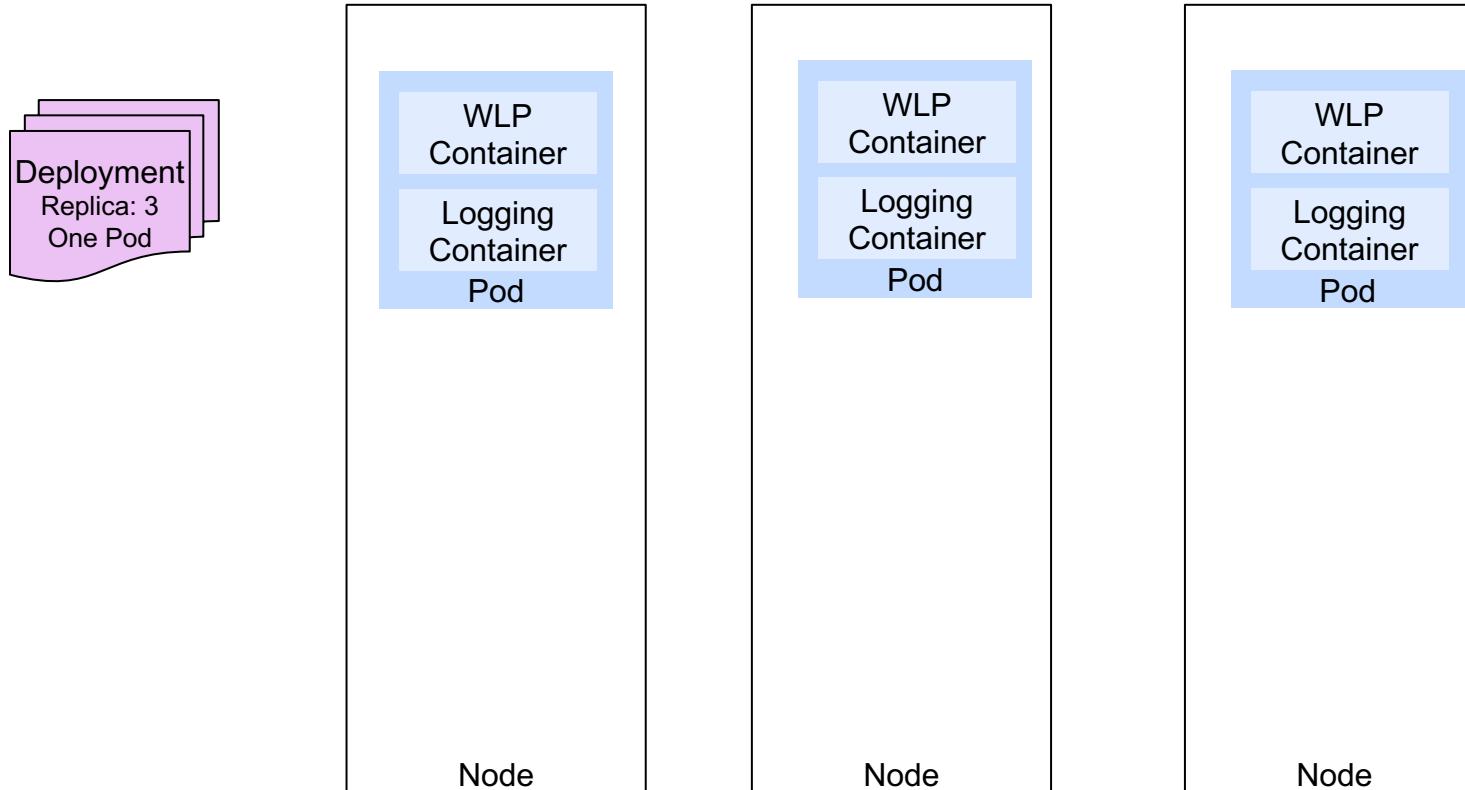


Kubernetes HA - Deployment – Without any additional rules

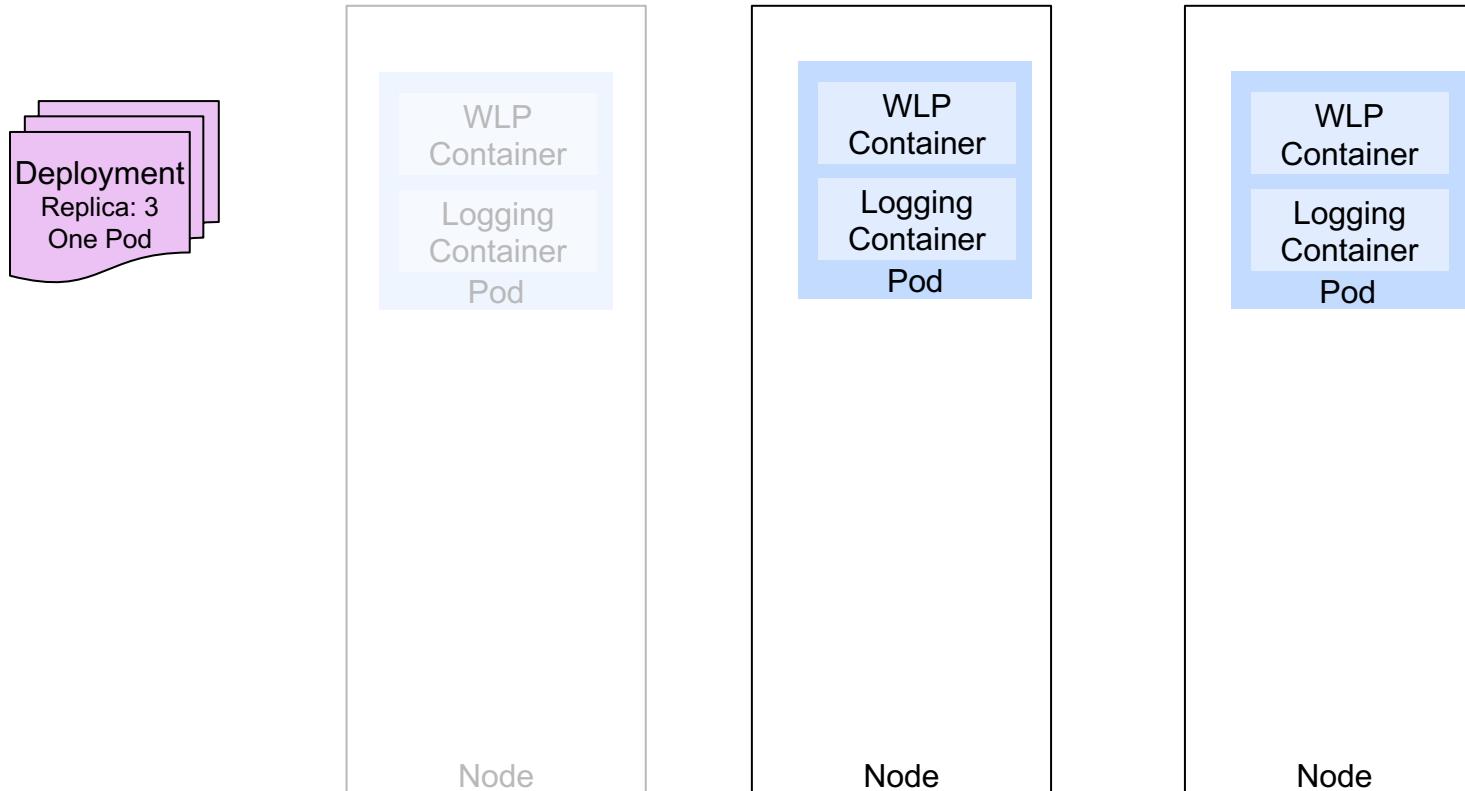
Deployment
Replica: 3
One Pod



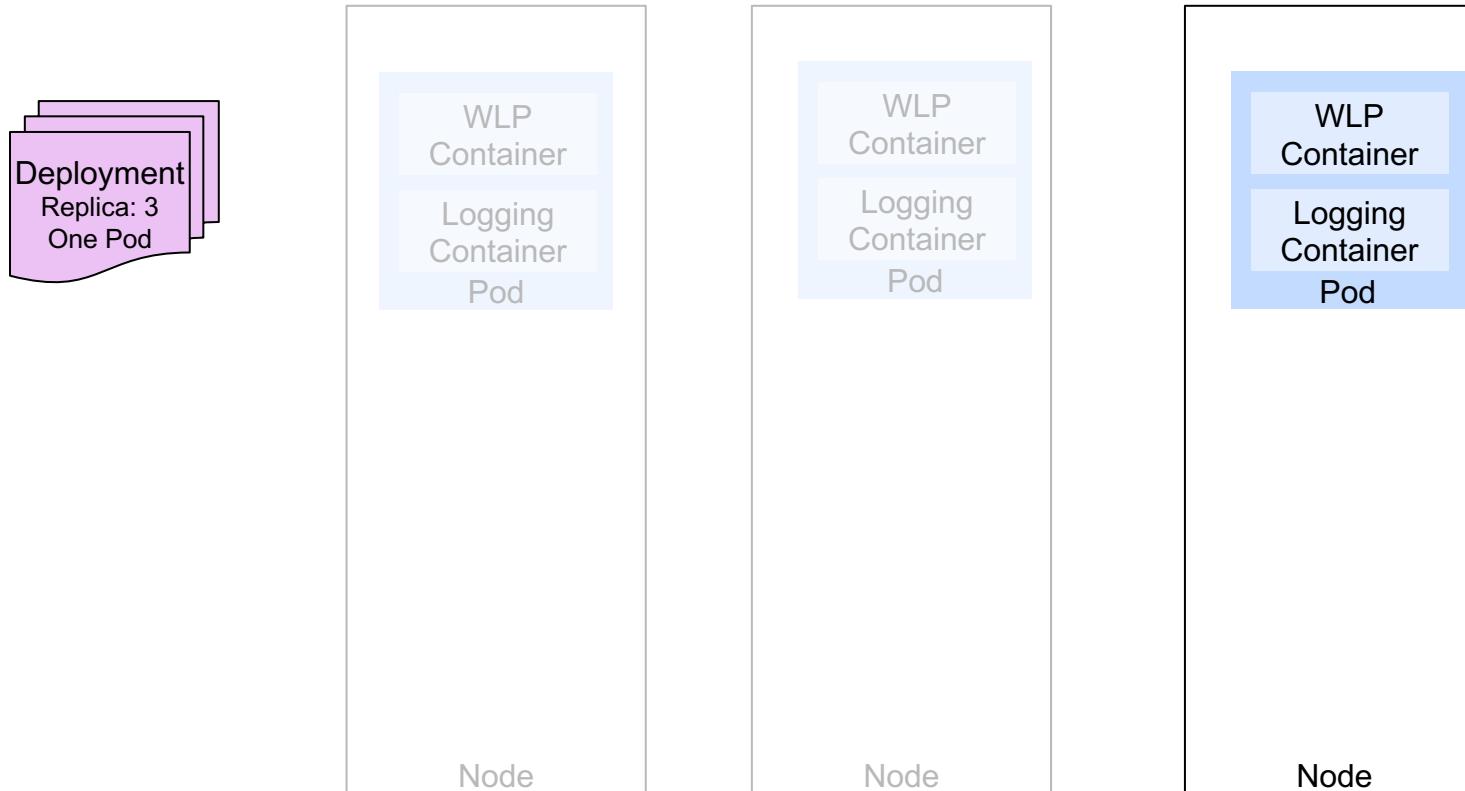
Kubernetes HA - Deployment – With additional rules to ensure that no node has multiple instances



Kubernetes HA - Deployment – With additional rules to ensure that no node has multiple instances



Kubernetes HA - Deployment – With additional rules to ensure that no node has multiple instances



WARNING

- Kubernetes has no system to try and spread pods across all nodes prior to having multiple nodes on the same pod.
- When looking at High Availability understand what the recovery time of a pod is including mapping its storage.

Lessons from the field - 1

Kubernetes provides fixes for the four latest versions 1.x versions

18th December v1.10.12

14th December v1.11.6

13th December v1.12.4

13th December v1.13.1

3rd December v1.13.0

26th November v1.12.3

26th November v1.11.5

26th November v1.10.11

13rd November v1.10.10

25th October v1.11.4

24th October v1.12.2

16th October v1.10.9

5th October v1.12.1

28th September v1.9.11

27th September v1.12.0

14th September v1.10.8

9th September v1.11.3

- New Major Version every Three Months,
- New Minor Version every Month
- No concept of fixes unless you want to go in and change yourself.
- No Liability
- This list does not include Beta Releases

Lessons from the field - 2

No single supplier of crucial components.

i.e. Helm, Calico and Kubernetes are built by different communities.

New version of components **can** cause breakages.

Lessons from the field - 3

- Persistent Storage only left beta in the last year.
- Many critical area of function that are being actively used are still in Alpha and Beta

Lessons from the field - 4

- Pods must be designed to cleanly die and come back.

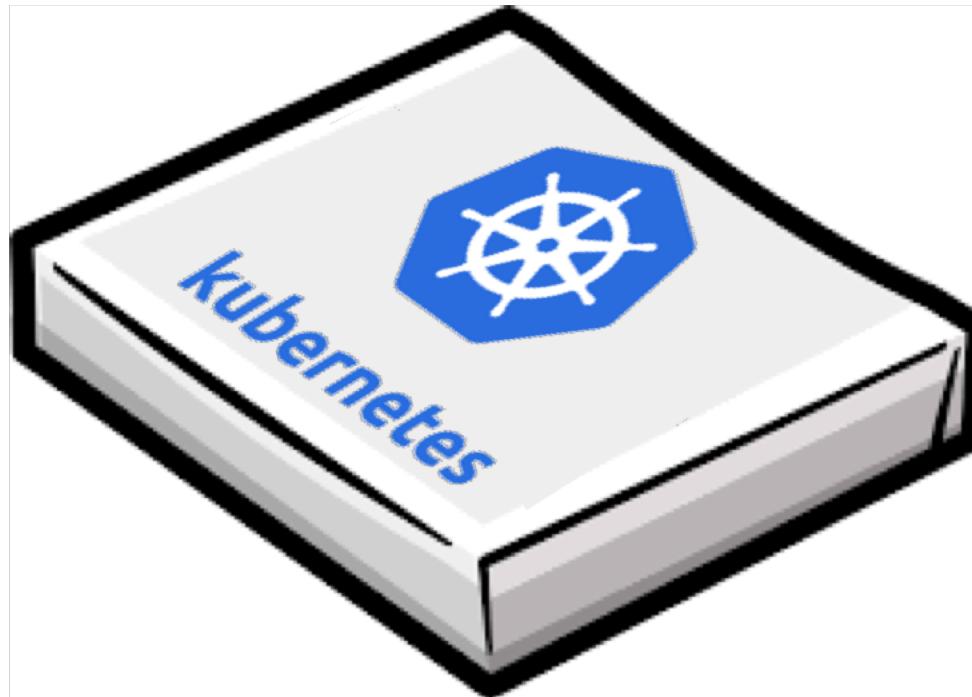
Lessons from the field - 5

- Plan HA, Plan HA, Plan HA, Plan HA, Plan HA
- Document HA
- Test HA, Test HA, Test HA

Lessons from the field - 6

- Avoid kubernetes clusters going across data centers unless there is a low latency network between them

Key takeaways from projects with Kubernetes



Kubernetes is not a magic bullet

Kubernetes is powerful if designed correctly

Kubernetes will challenge the beliefs of anyone experienced in an operation or infrastructure role.

Do NOT just lift and shift

Thank you

Chris Phillips
Master Inventor
SWAT Integration Architect

Chris.Phillips@uk.ibm.com
ibm.com

Ivan Pryanichnikov
Pan-IMT Technical Sales Specialist

ivanpran@ru.ibm.com
ibm.com

