Red Hat OpenShift

Connecting Workloads Across Kubernetes Clusters

OpenShift Meetup, September 15, 2020

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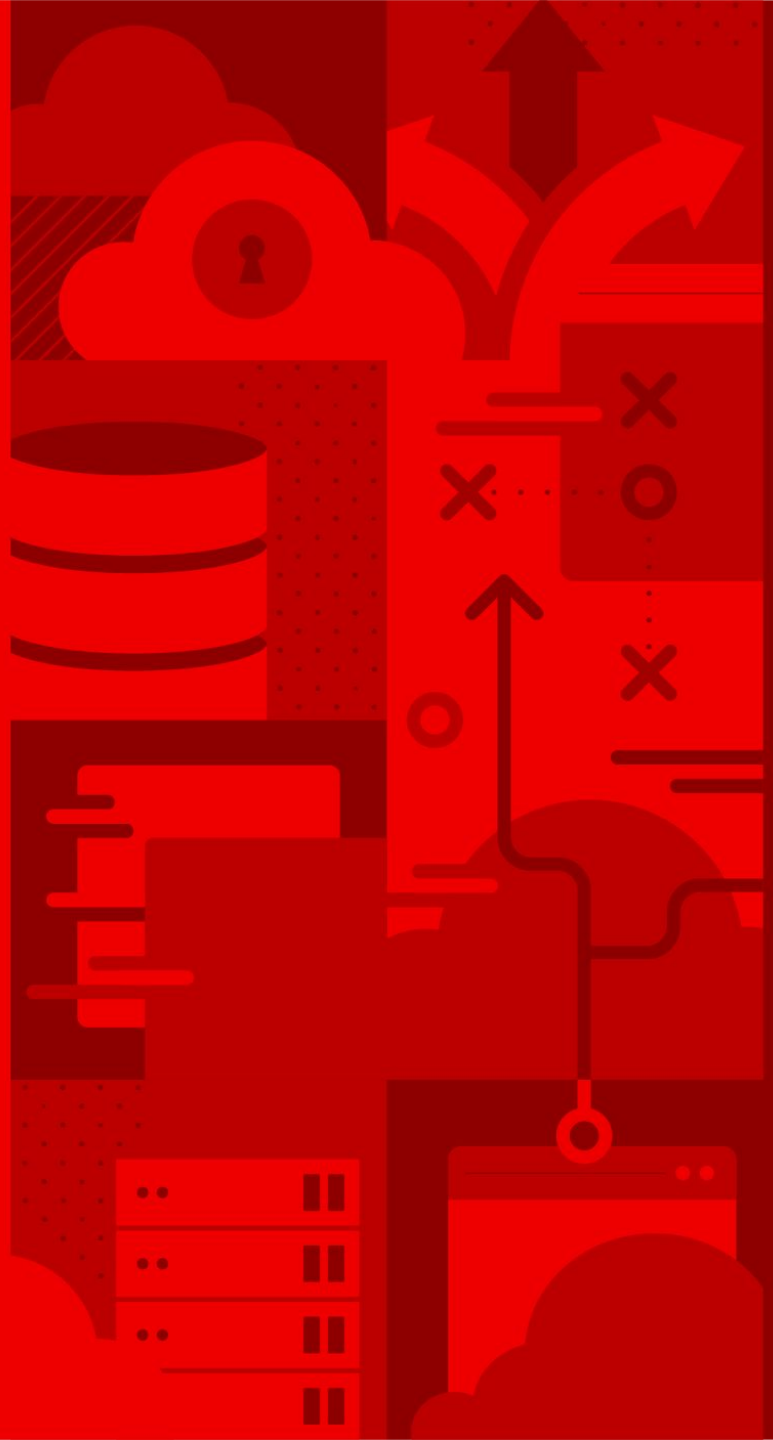
Disclaimer

This is active research and development, with support expected in a future OpenShift release.

Agenda

- Market Trends and Challenges
- Introducing Submariner
- Architecture Overview
- Resources & Next Steps



Market Trends and Challenges

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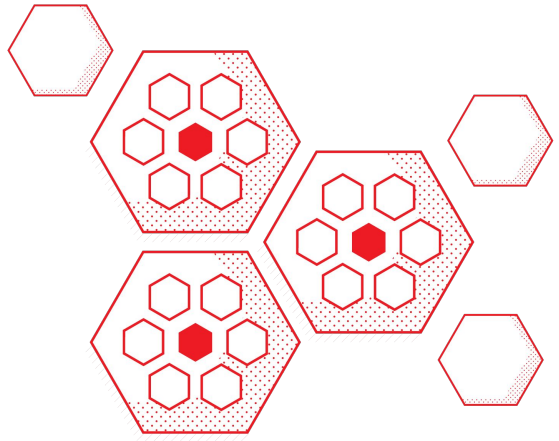
Kubernetes adoption leads to multicluster



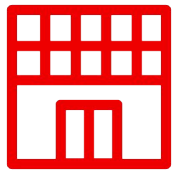
"As Kubernetes gains adoption across the industry, scenarios are arising in which teams are finding they must deploy and manage multiple clusters, either in a single region on-premises or in the cloud, or across multiple regions.... for a number of reasons, including multi-tenancy, disaster recovery, and with hybrid, multi-cloud, or edge deployments."

Source:
Assessing Patterns for Deploying Distributed Kubernetes Clusters doc # G00465217, by Tony Iams

Where is the growth in cluster deployments?

Small Scale Dev Teams

Managing clusters across Dev/QA/Prod clusters

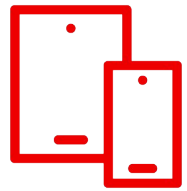


Medium Scale Organizations

Local retails with clusters across 100s of locations

Large Scale Organizations

Global organizations with 100s of clusters, hosting thousand of applications



Edge Scale Telco

100s of zones, 1000s of clusters and nodes across complex topologies

Reasons for deploying multiple clusters

Application availability

Reduced latency

Address industry standards

Geopolitical data residency guidelines

Disaster recovery

Edge deployments

CapEx cost reduction

Avoid vendor lock-in

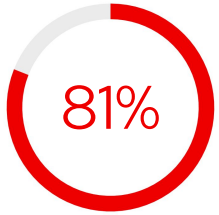
But hybrid cloud management is hard

As organizations deploy more across multiple clouds, new challenges arise.

- **Difficult and error prone** to manage at scale
- **Inconsistent security controls** across environments
- **Overwhelming to verify** components, configurations, policies, and compliance

IDC Survey of 200 US-based $1B companies actively using two or more "infrastructure clouds" for production applications

Using multiple infrastructure clouds*



Using multiple public clouds and one or more private/dedicated clouds*

Source:
DC Multicloud Management Survey, 2019: Special Study, Doc # US45020919, April 2019
*IDC Survey of 200 US-based $1B companies actively using two or more "infrastructure clouds" for production applications

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Multicluster management challenges

How do I normalize and centralize key functions across environments?

Management requirements

Developer

Build and deploy a container app

- Easy cluster provisioning
- Controlling cluster configuration drift
- Ensuring app deployment from development to production

DevOps

Develop, test, and produce clusters

- Consistent cluster provisioning
- Policy enforcement and governance across development, test, and production clusters
- Finding/modifying resources across clusters

Hybrid multicloud

Clusters deployed across public, private clouds, edge, in different geographies

- Single pane of glass visibility
- Deploying and distributing applications at scale
- Auditing and compliance

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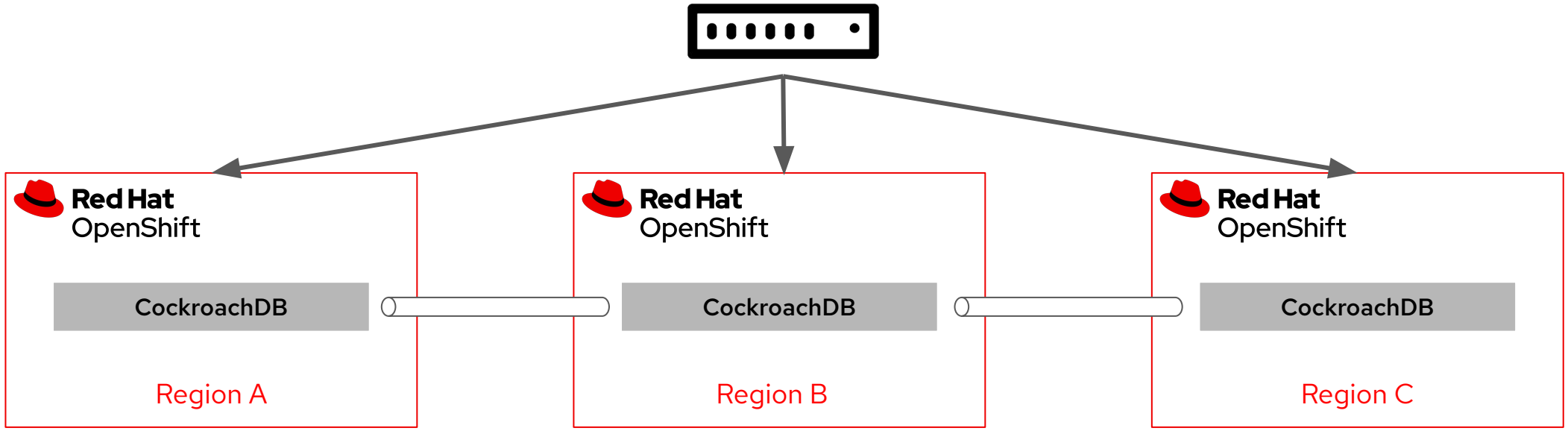
Multicluster networking challenges

Use case for connecting multiple clusters: High Availability



- Example: multi-region CockroachDB cluster
- OpenShift clusters in multiple regions/availability zones, with replicas of the same service in each cluster
- Goal: keep data close to the user, while reducing latency and improving user experience

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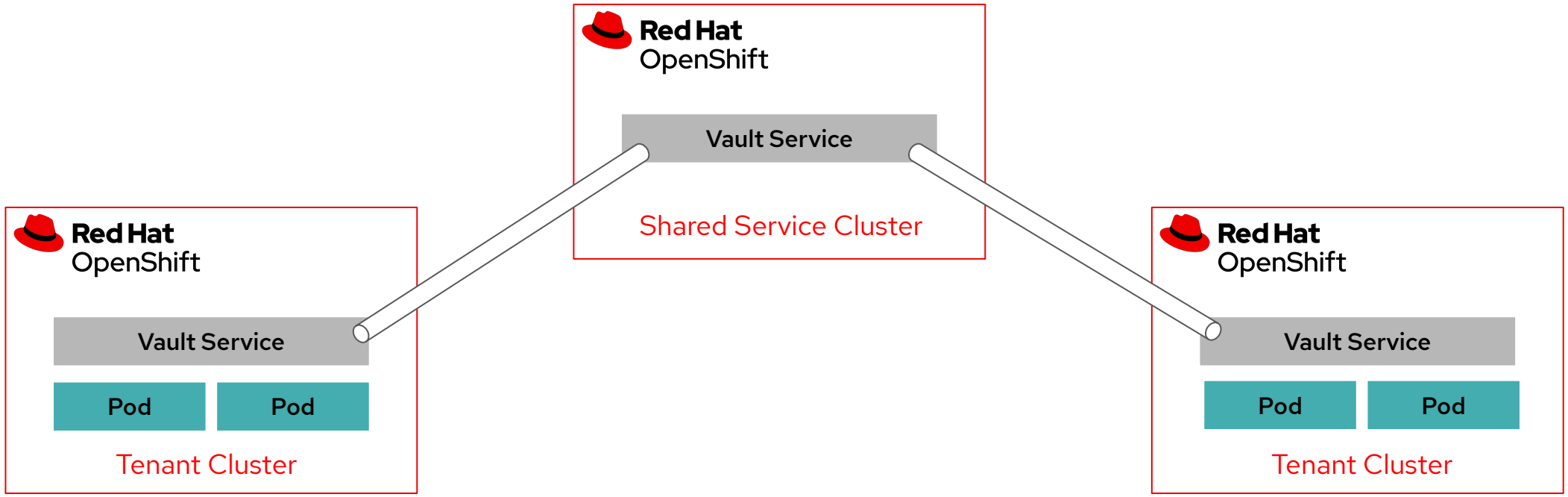
Multicluster networking challenges

Use case for connecting multiple clusters: shared services



- Example: Vault secret management
- Also applicable for other services like logging, monitoring, and metrics collection
- Goal: keep tenant clusters isolated, while avoiding operational overhead in maintaining shared services

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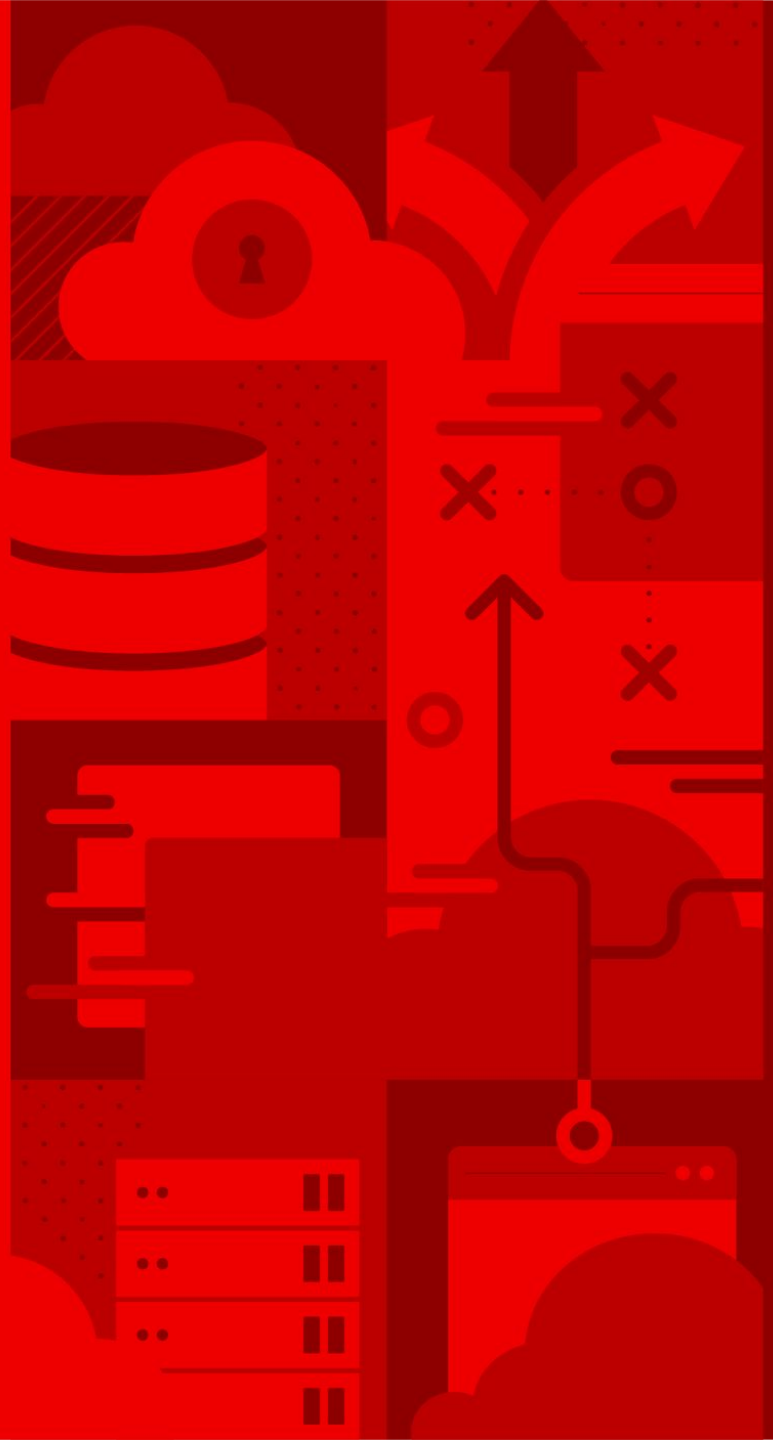

Introducing Submariner

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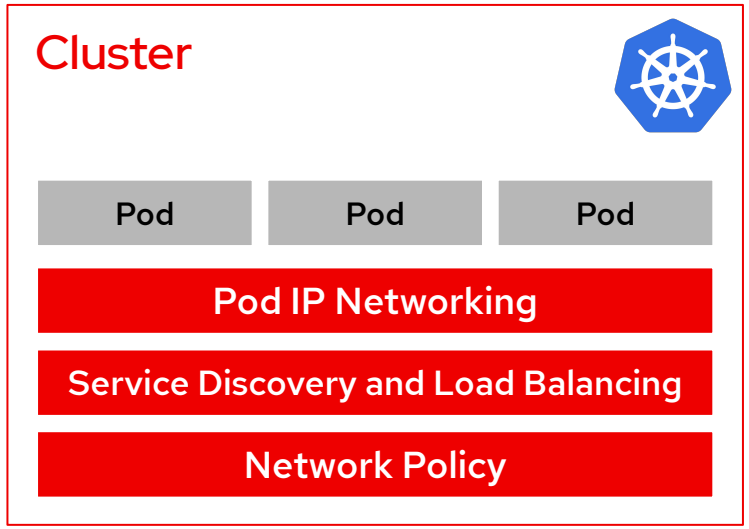
Multicluster networking for OpenShift

- An add-on to OpenShift Container Platform that enables direct network connectivity between multiple clusters
- Exposes a set of new custom resources (CRDs) backed by the Kubernetes datastore
- Available as a *Developer Preview* via OperatorHub.io
- Open source, vendor neutral project: https://submariner.io/

Multicluster networking for OpenShift



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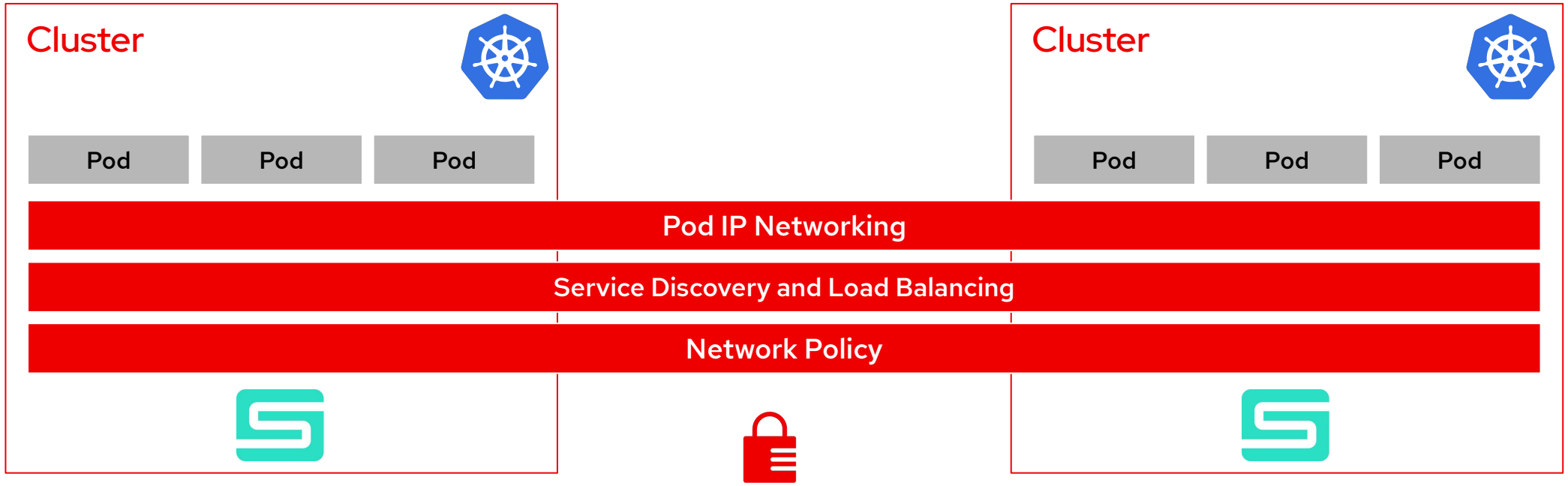
Multicluster networking for OpenShift



- Different regions, same public cloud provider
- Multiple on-prem sites
- Hybrid cloud, including a mix of on-prem and public cloud

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Benefits

Pod-to-pod and pod-to-service communication across clusters

Direct network tunnel to support any application (TCP/UDP) on top; eliminate the need for going through external load-balancers, ingress gateways, etc.

Enhanced security

All traffic flow between clusters is encrypted by default

Deploy services across clusters

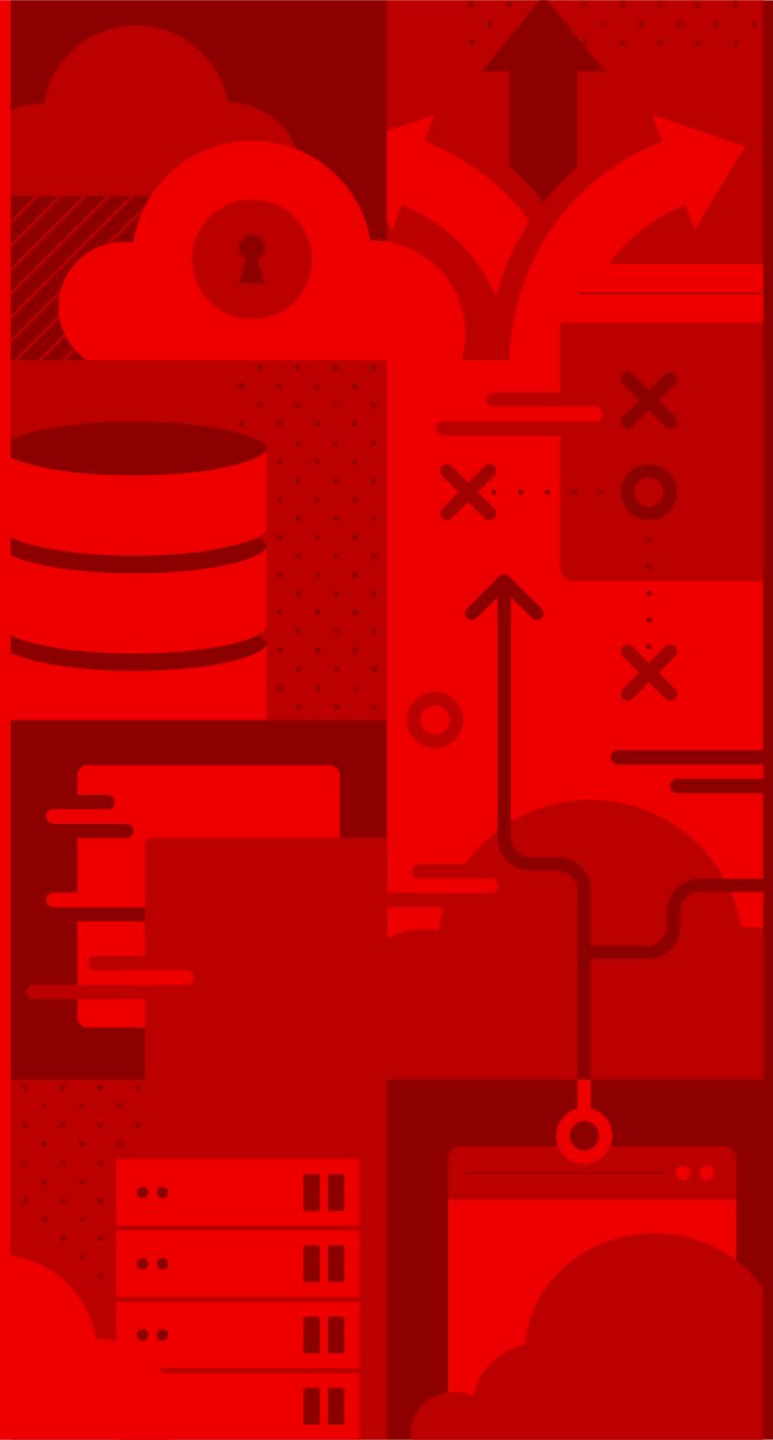
Beyond connectivity, also address the challenge of cross-cluster service discovery (DNS) and network policy

Extend existing OpenShift deployments

Compatible with different cloud providers and network (CNI) plugins; benefit the wider OpenShift ecosystem

Key features

- Cross-cluster L3 connectivity
  - Using encrypted VPN tunnels | demo recording
- An operator-based deployment
  - A single line installation process | demo recording
- Service Discovery across clusters (“Lighthouse”)
  - To facilitate multi-cluster DNS | demo recording
- Support for overlapping IP addresses (“Globalnet”)
  - Can interconnect clusters with overlapping CIDRs | demo in the works, check our YouTube channel!



Architecture Overview

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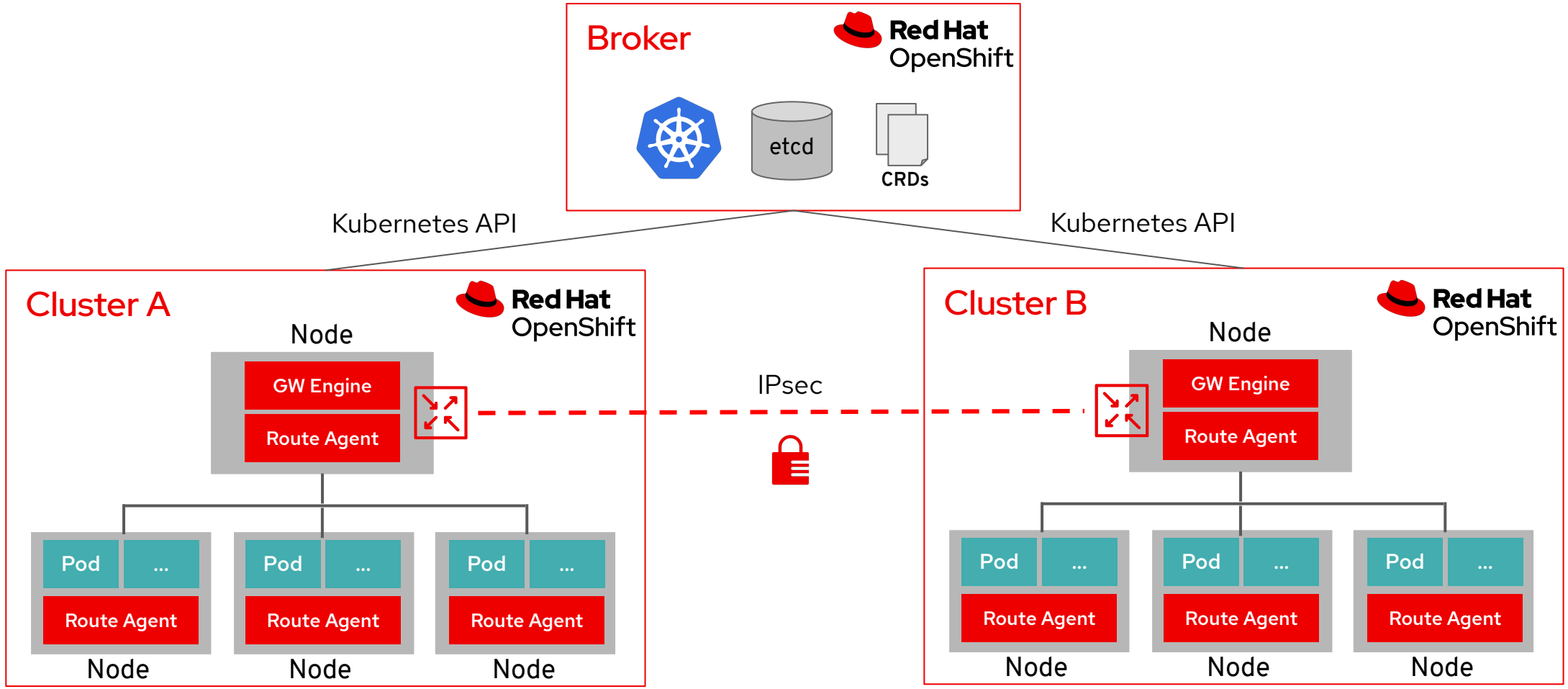
Draw me a picture!



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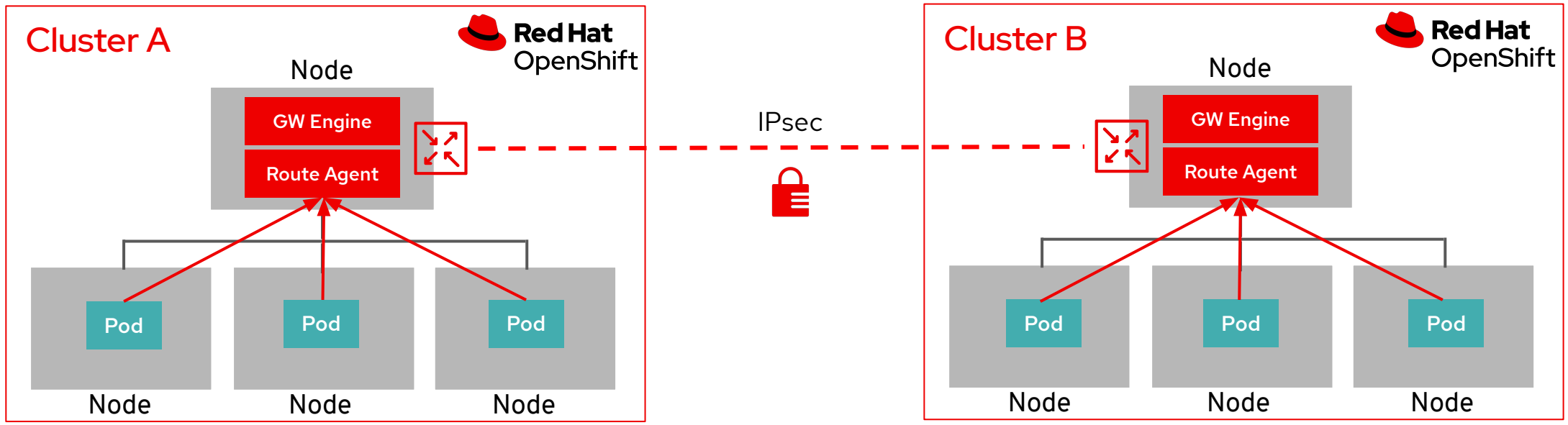
Network connectivity



- No impact on intra-cluster traffic (handled by local network plugin)
- Traffic destined to remote clusters is tunneled to GW Node; source IP is preserved
- Cross-cluster traffic is encrypted with IPsec by default

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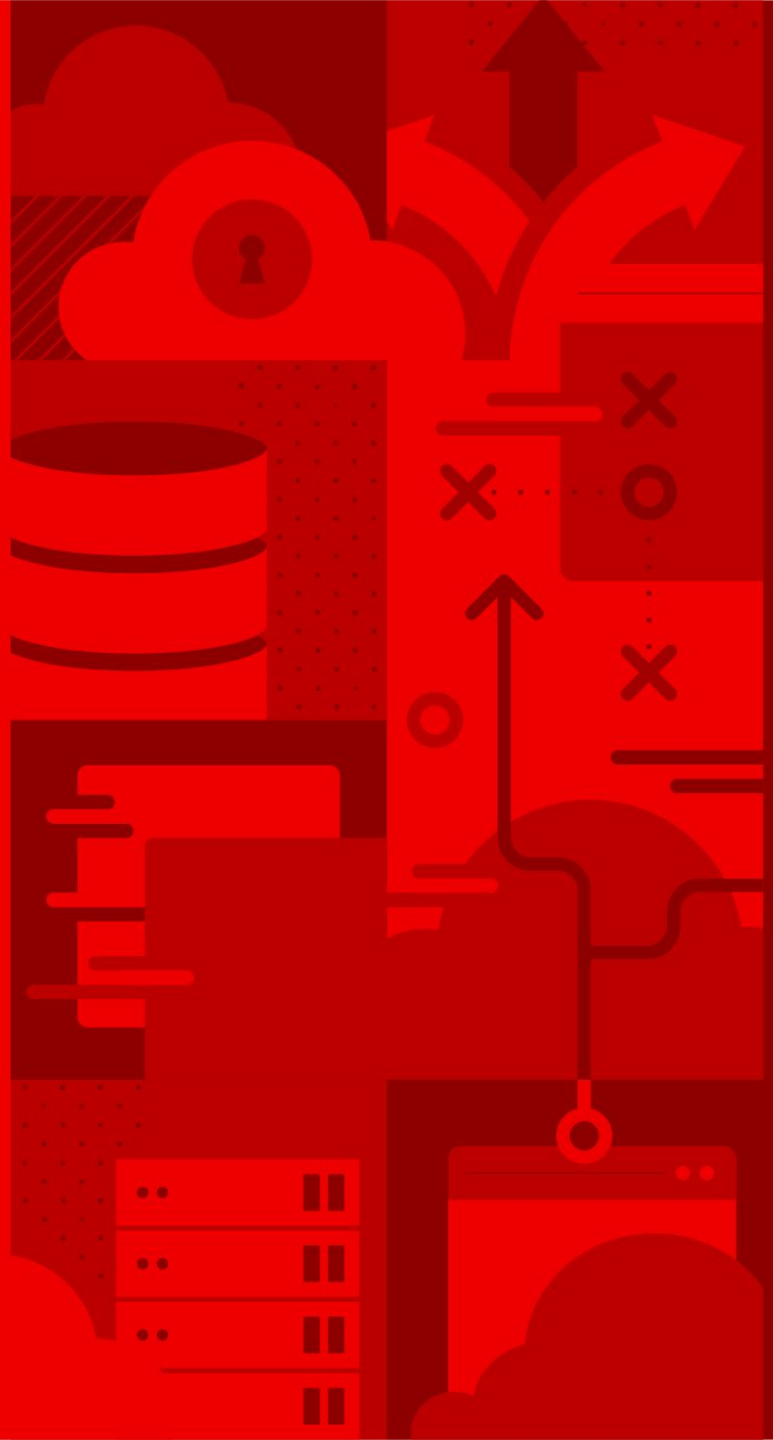

Resources & Next Steps

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subctl

Deploy and run Submariner using three commands

Deploy cluster1 as broker:

```
subctl deploy-broker --kubeconfig output/kubeconfigs/config-cluster1 --service-discovery
```

Join cluster2 and cluster3 to the broker:

```
subctl join --kubeconfig output/kubeconfigs/config-cluster2 broker-info.subm
```

```
subctl join --kubeconfig output/kubeconfigs/config-cluster3 broker-info.subm
```

Give it a try

- Upstream community
  - Website: https://submariner.io
    - https://submariner.io/quickstart/
  - GitHub: https://github.com/submariner-io
  - YouTube: https://tinyurl.com/submariner-youtube
  - Slack (Kubernetes space): #submariner
- Red Hat
  - We are currently seeking design partners and early adopters willing to try out Submariner and give us feedback!

Further reading and other resources

- KubeCon NA 2019
- Kubernetes Multi-Cloud and Multi-Cluster Connectivity with Submariner
- Red Hat Summit 2020
- OpenShift blog:
  - Disaster Recovery Strategies for Applications Running on OpenShift
  - Multicluster Service Discovery in OpenShift (Part 1)
  - Multicluster Service Discovery in OpenShift (Part 2)
- Coffee and Cloud Native Show - S01E34

Thank you

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