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Best practice: Karmada & Istio improve workload & traffic resilience of production distributed cloud

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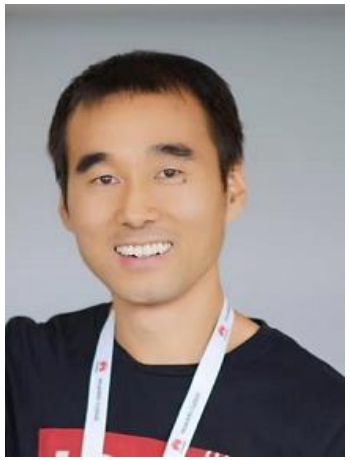
About Me



Architect of HUAWEI Distributed Cloud Native, with 9 years cloud computing related design and developing experience in HUAWEI Cloud, including service mesh, Kubernetes, micro service, cloud service catalog, big data, APM, cloud computing reliability and DevOps. He is Istio community member, an experienced speaker of KubeCon, IstioCon, ServiceMeshCon, author of books “Cloud Native Service Mesh Istio”(《云原生服务网格 Istio》) and “Istio: the Definitive Guide”(《Istio权威指南》)

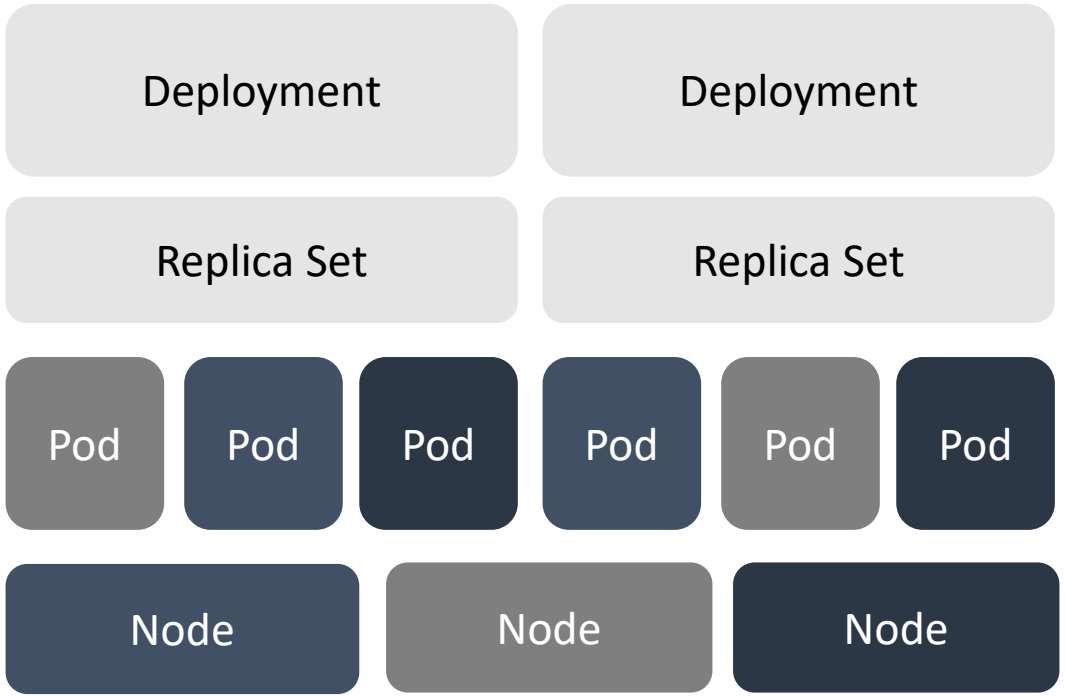
Agenda

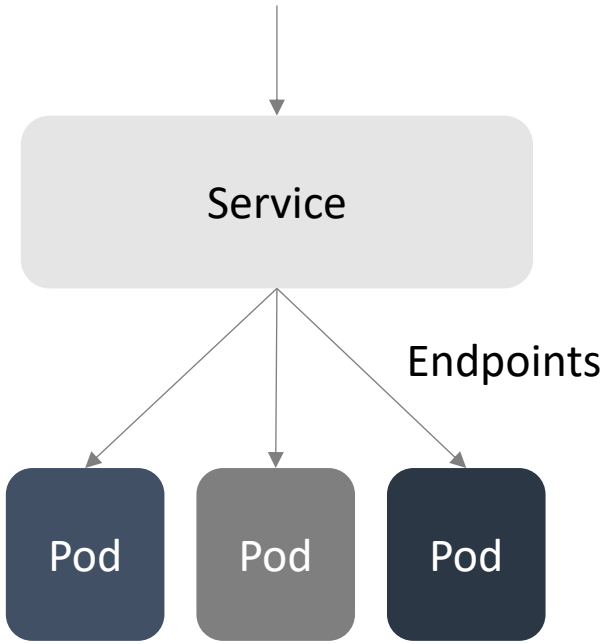
- **Backend:**
  - Resilience challenges and Kubernetes & Istio’s solution
  - Distributed Cloud resilience improvement and new challenges
- **Practice**
  - Karmada improve workload resilience of multi-cloud env
  - Istio improve traffic resilience of multi-cloud env
  - Karmada and Istio total multi-cloud application resilience

Resilience

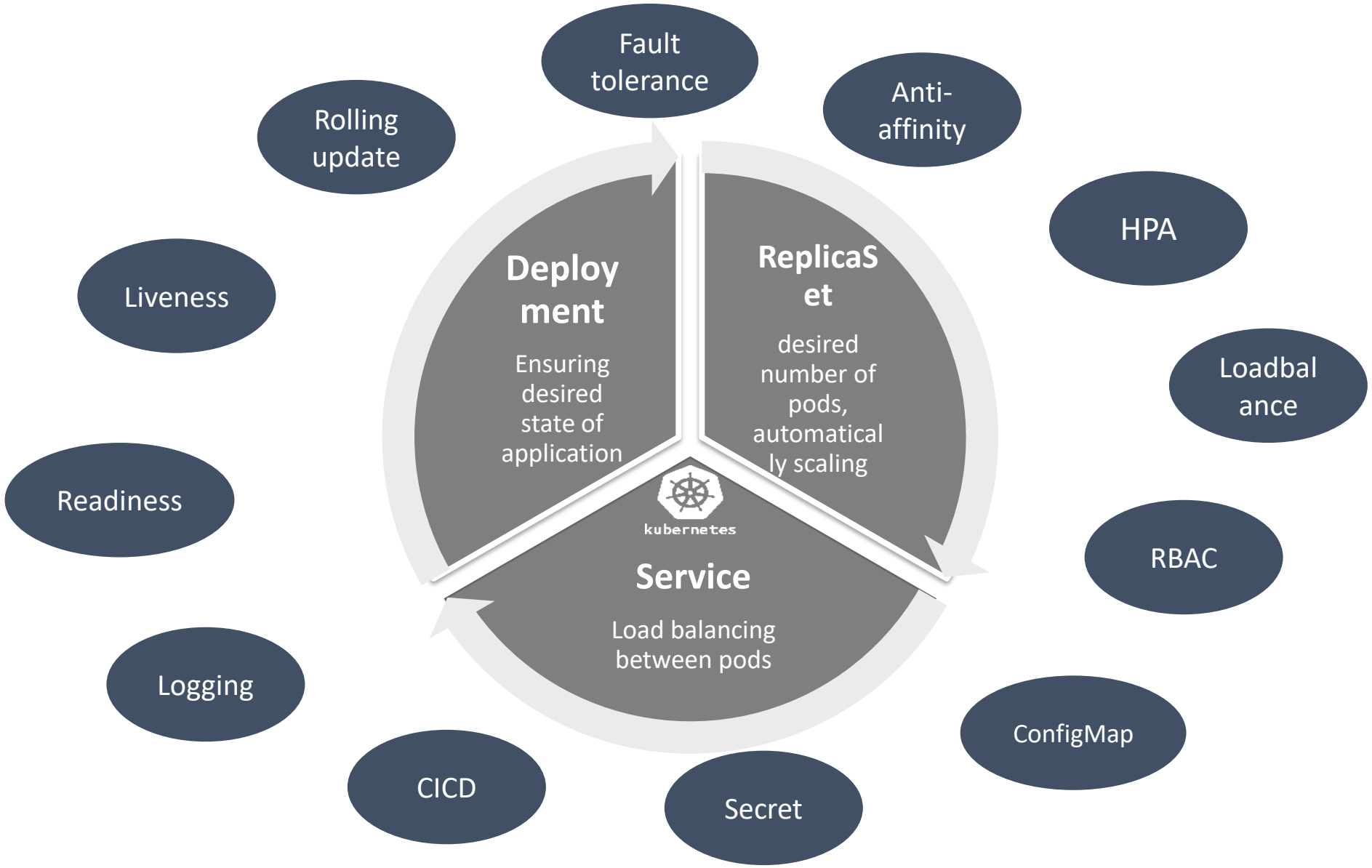
Resilience：the ability of a system or organization to respond to or recover readily from a crisis, disruptive process, etc.

Kubernetes Resilience (1)

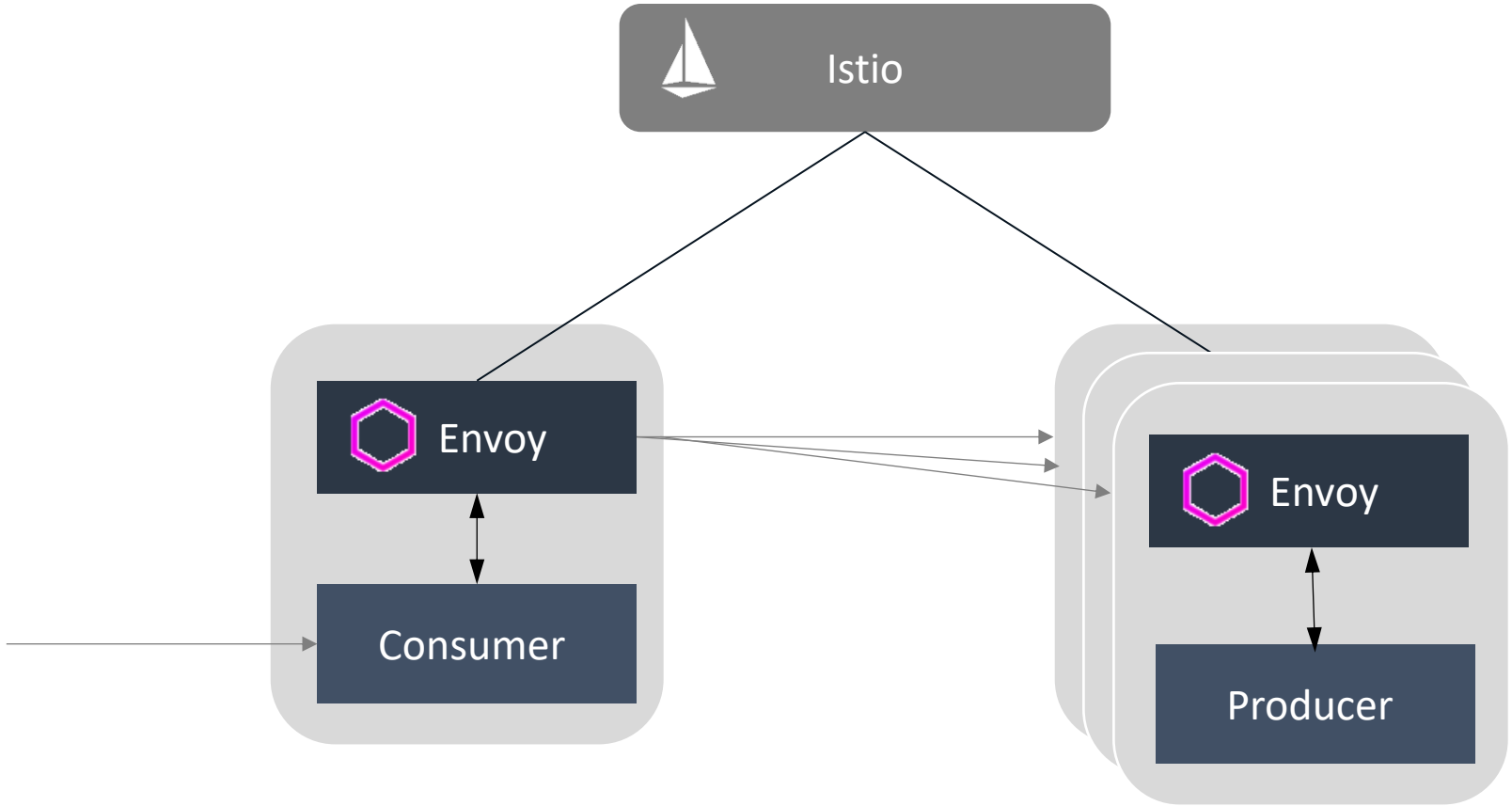




Kubernetes Resilience (2)



Istio Resilience (1)



Istio Resilience (2)

Infrastructure

- Rolling Update
- Redundancy
- Anti-affinity
- Auto scaling
- Health Check
- Loadbalance

Application

- Circuit breaker
- Retry
- Timeout
- Rate limit
- Locality
- Canary

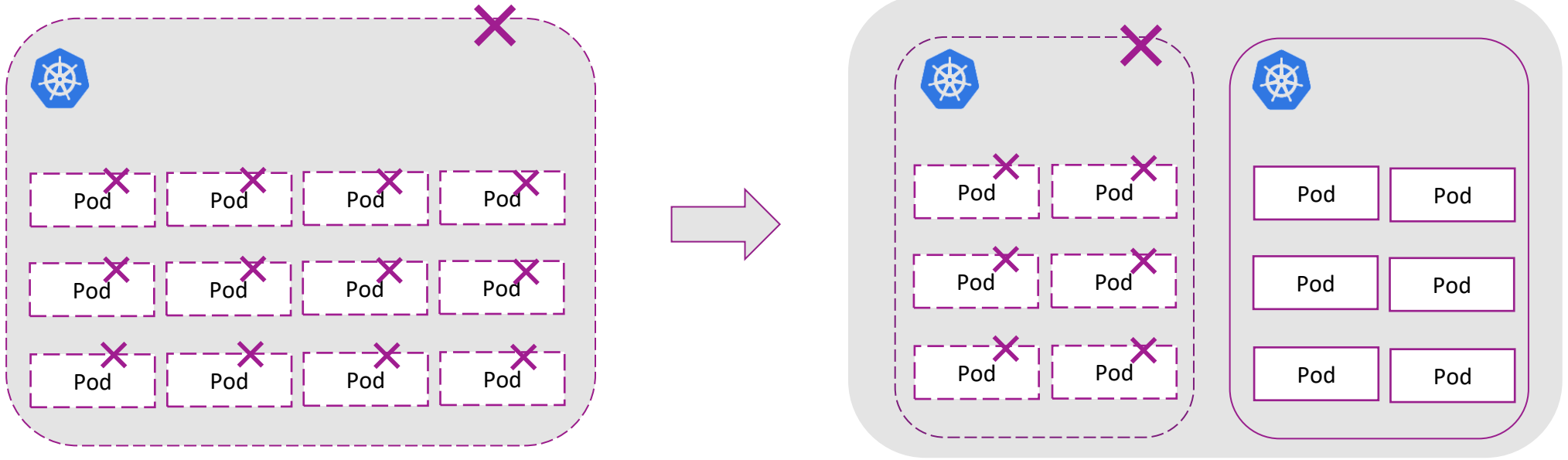
Ops

- Tracing
- Access log
- Metric

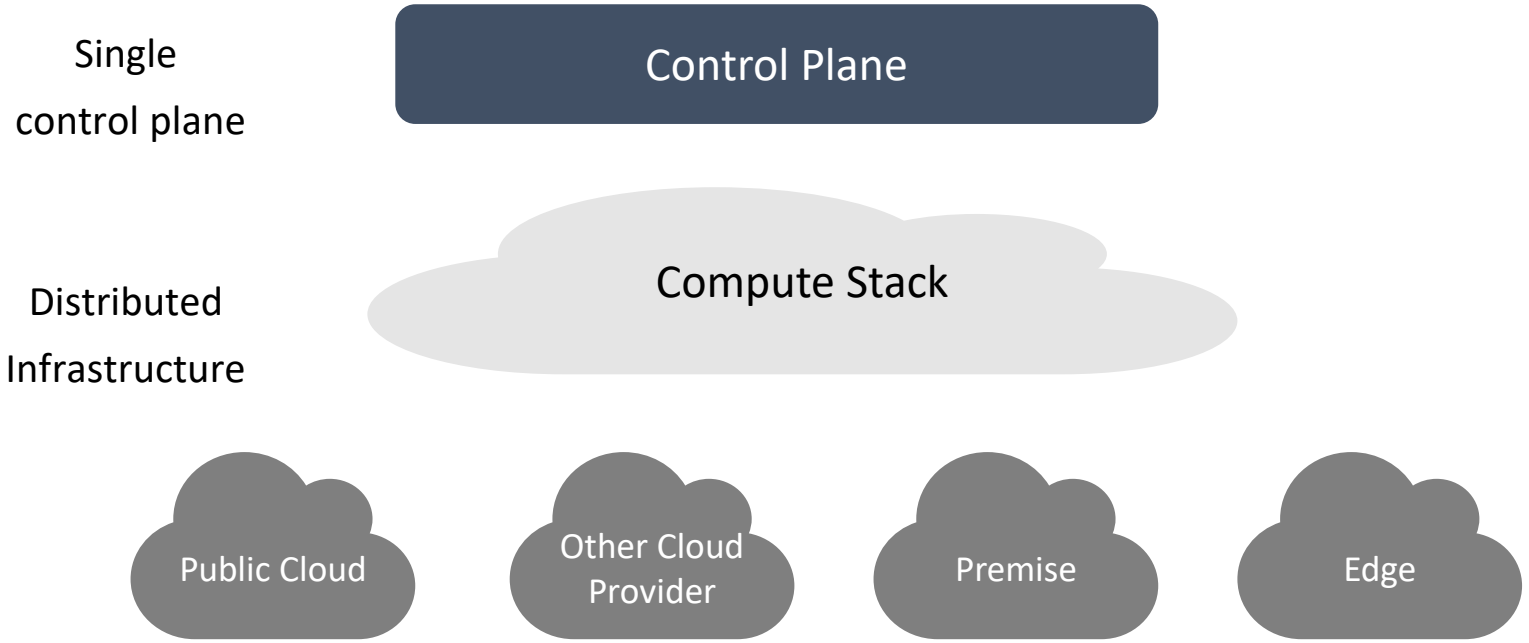
Testing

- Fault Injection

Kubernetes Resilience Challenges



Distributed Cloud's Solution



A distributed cloud service is a public cloud that run public cloud infrastructure in different geological locations, distributes its services to wherever a customer might need it, and manages as one unified entity from a single control plane.

UCS(HUAWEI Distributed Cloud Native)

Distributed Cloud's Challenges

Advantages

Less latency and enhanced performance: data and service closer to end users

Increased regulatory compliance: workloads and data located where meet regulatory demands

Better scalability: release resources across multiple sites quickly

Enhanced visibility: monitor and manage multi cloud in one console

Improved Resilience and Availability: fault-tolerant and greater redundancy prevent SPOF

Challenges

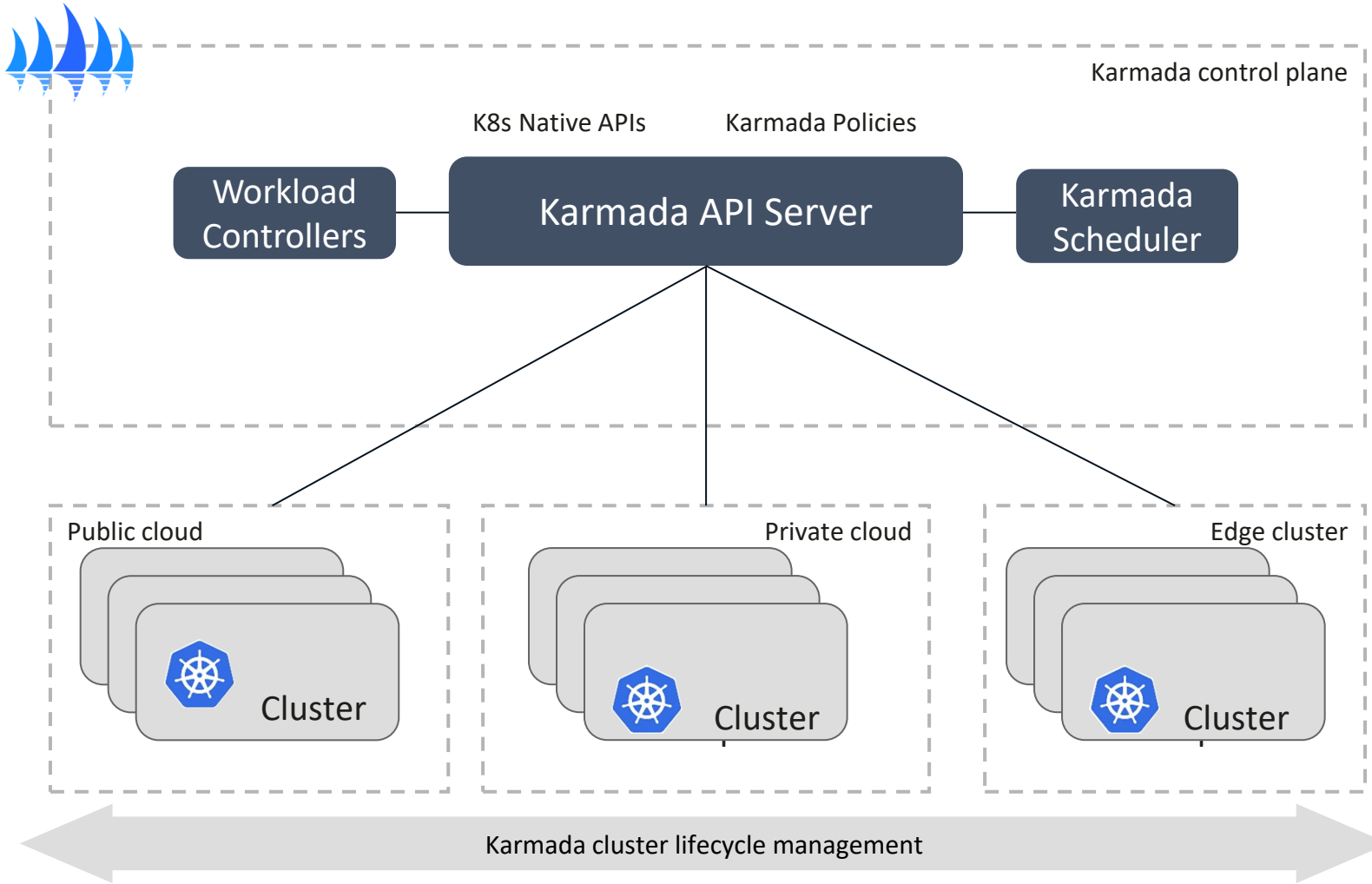
Complexity : managing, troubleshooting, config dispersed cloud resources

Security: more difficult to protecting data and applications in distributed environment.

Heterogeneity: different hardware, software, OS, and cloud providers

Latency: new network performance introduced in distributed environment.

About Karmada



Multi-cluster management

Significantly reducing repeated management operations

Workload propagation across clusters

Advanced policies meet various scheduling requirements

Cross-cluster application failover

Graceful migration ensures uninterrupted services

Unified authentication

Significantly reducing the effort required for authentication/audit

Global resource view

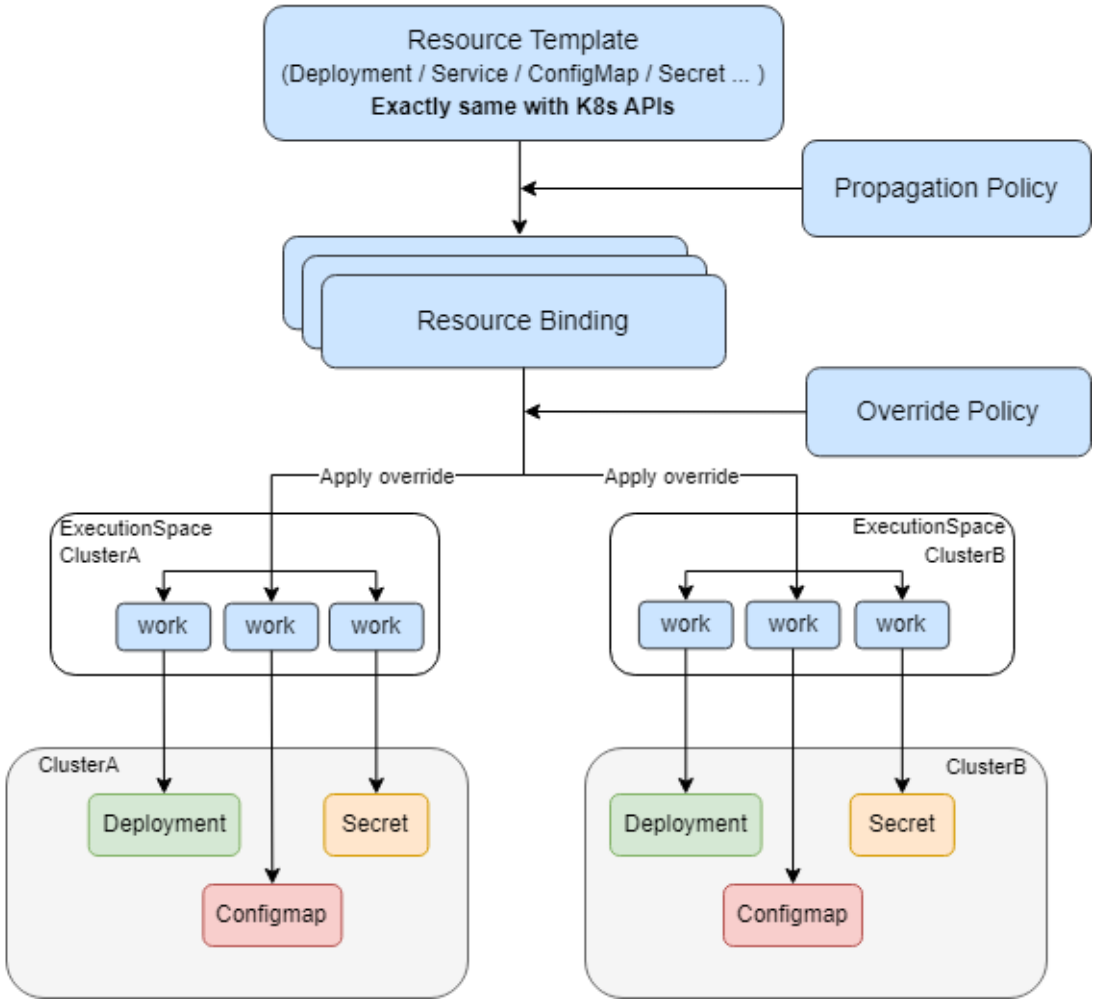
Unified query entry with efficient search support

Multi-cluster service discovery

Effortless cross-cluster service communication

Core Concepts of Karmada

Karmada Concepts



Resource Template

- Same as native Kubernetes API definitions, including CRDs
- Used to create multi-cluster applications without modification

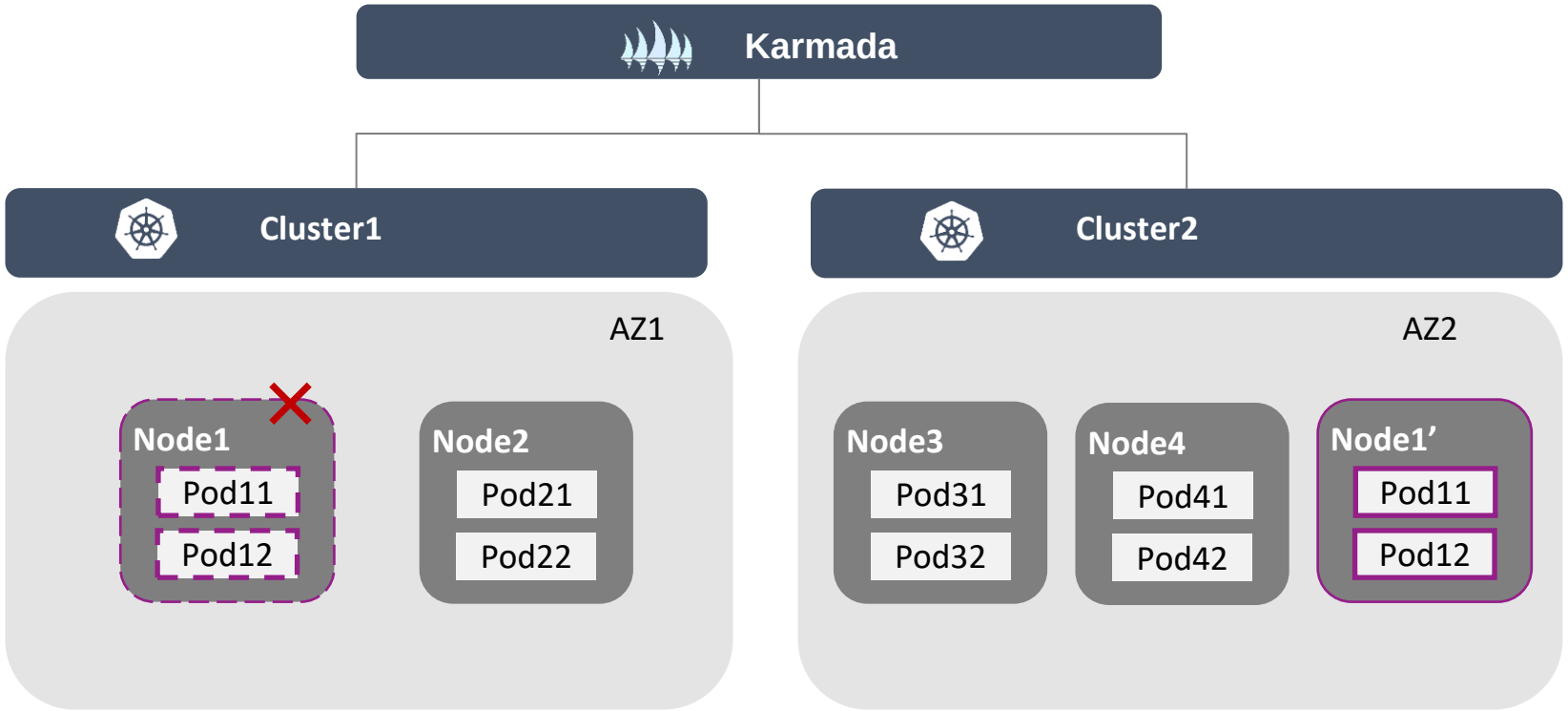
Propagation Policy

- Widely applicable policy for multi-cluster application scheduling

Resource Binding

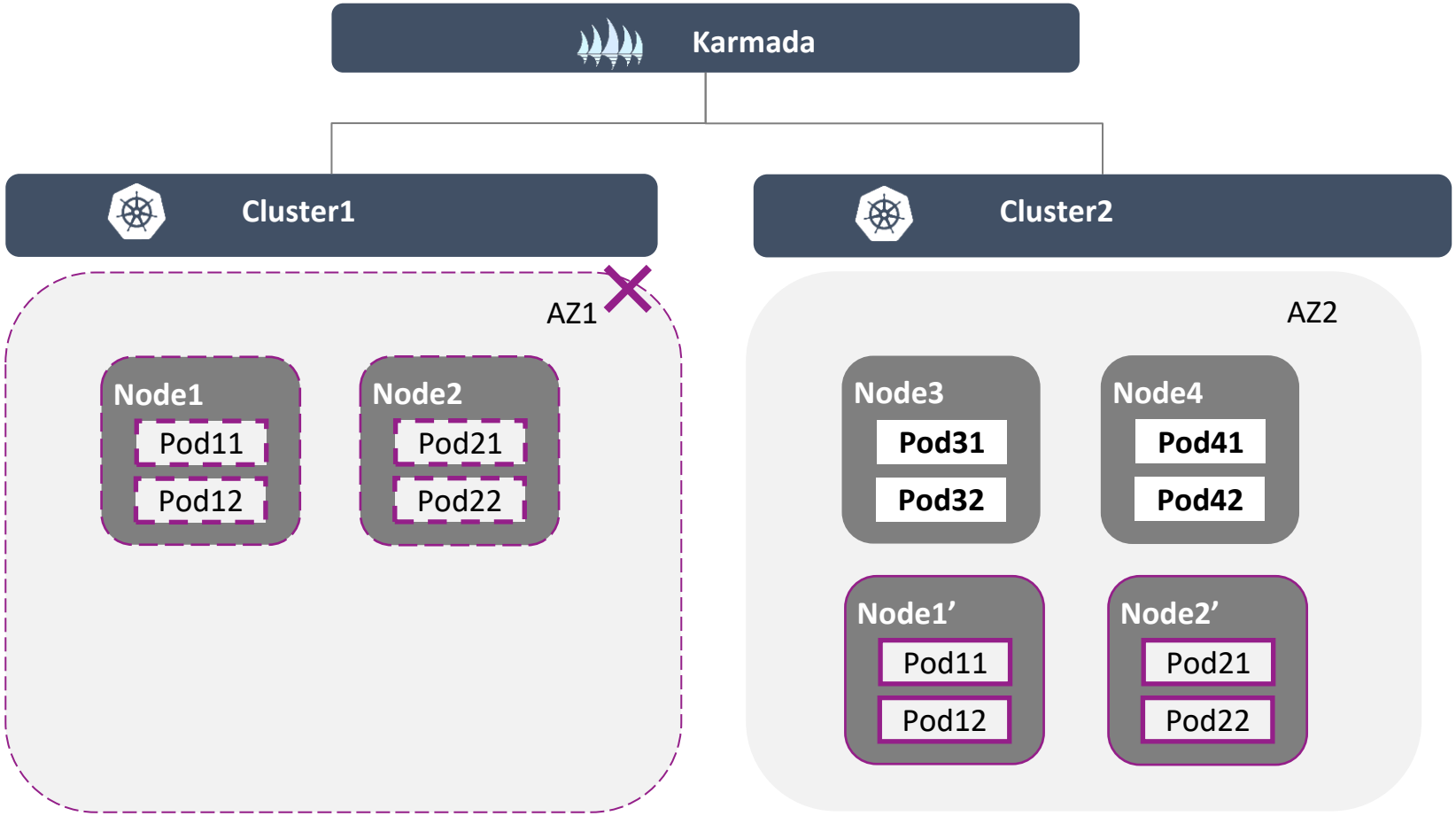
- Unified abstraction, which drives internal processes

Karmada Resilience 1：Node Failure



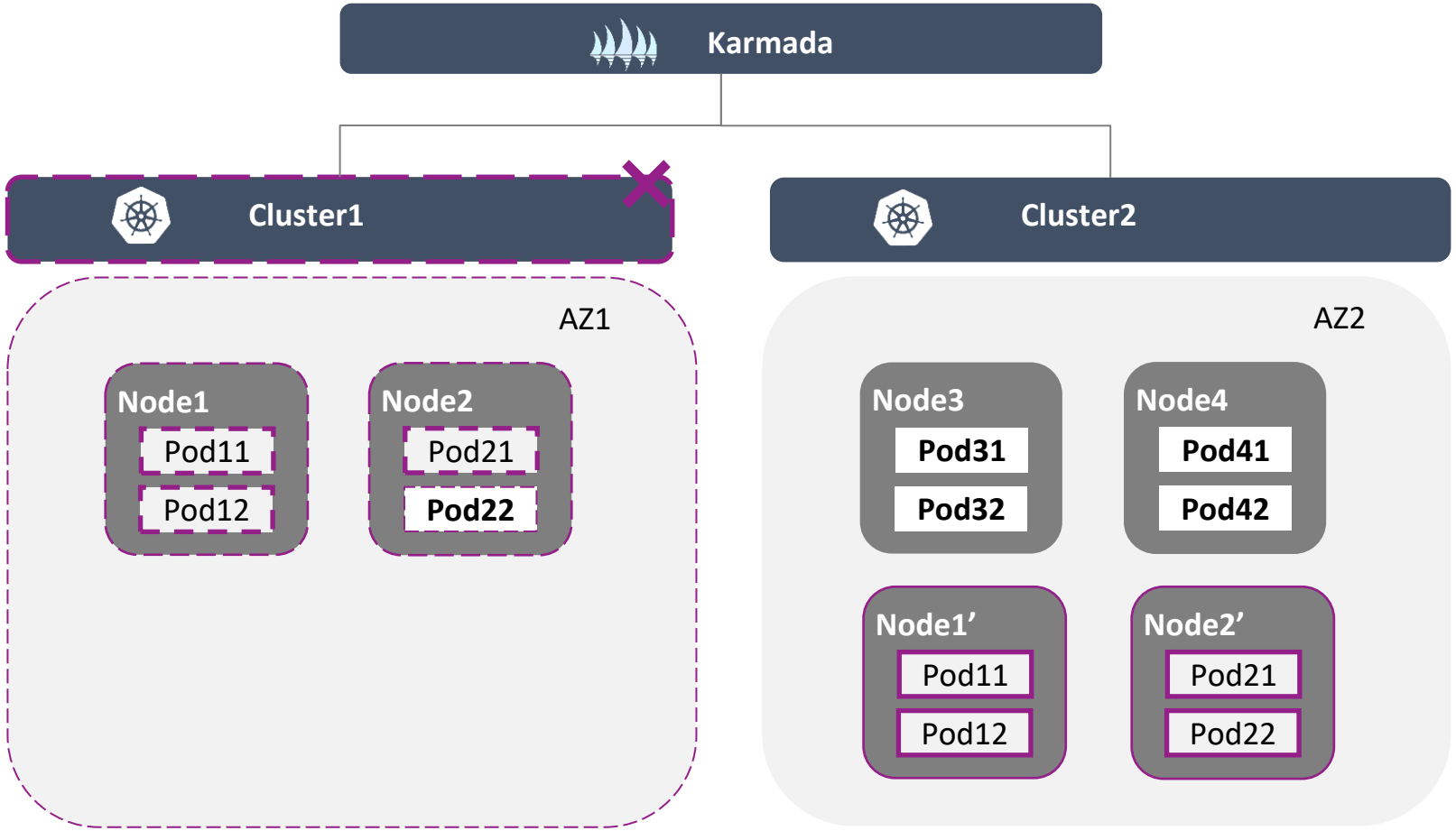
Workload migration

Karmada Resilience 2：AZ Failure



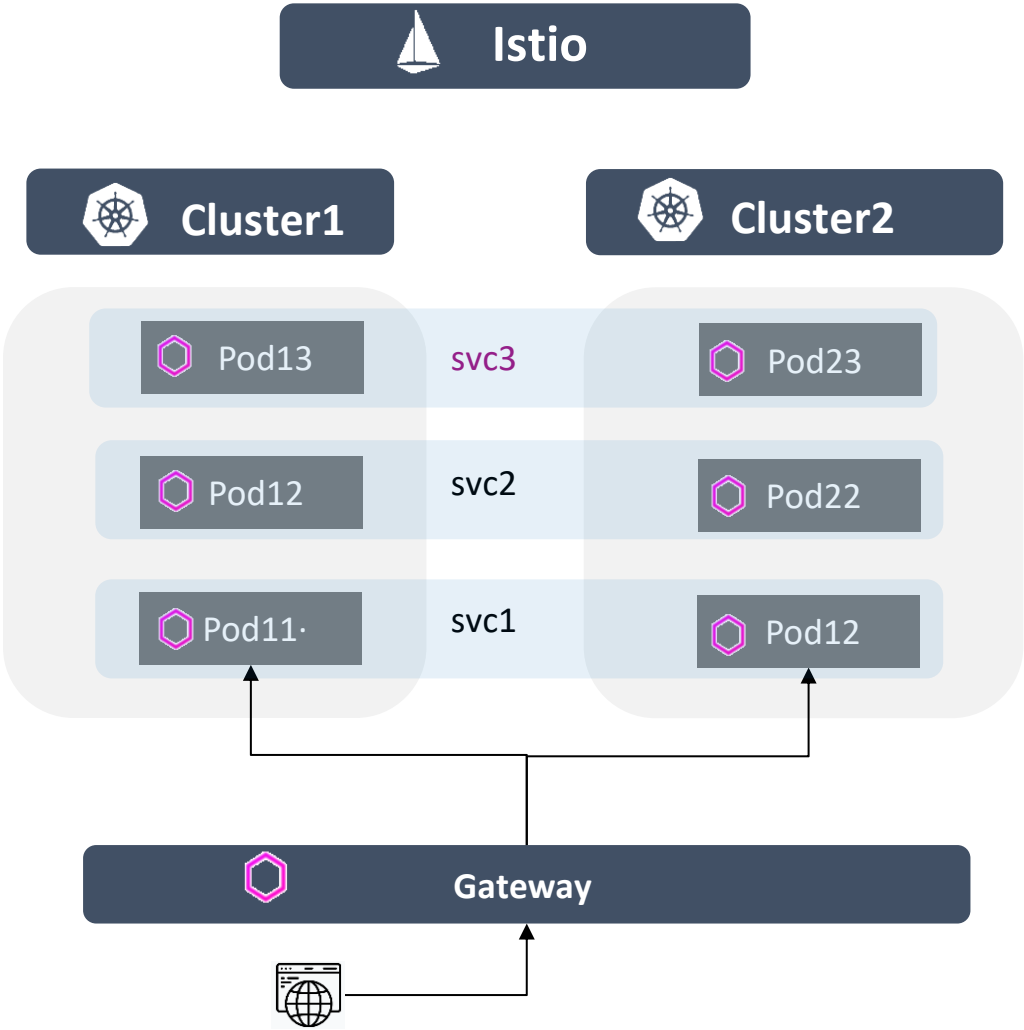
Workload migration

Karmada Resilience 3： Cluster Failure



Workload migration

Istio Multi Cluster Traffic Management



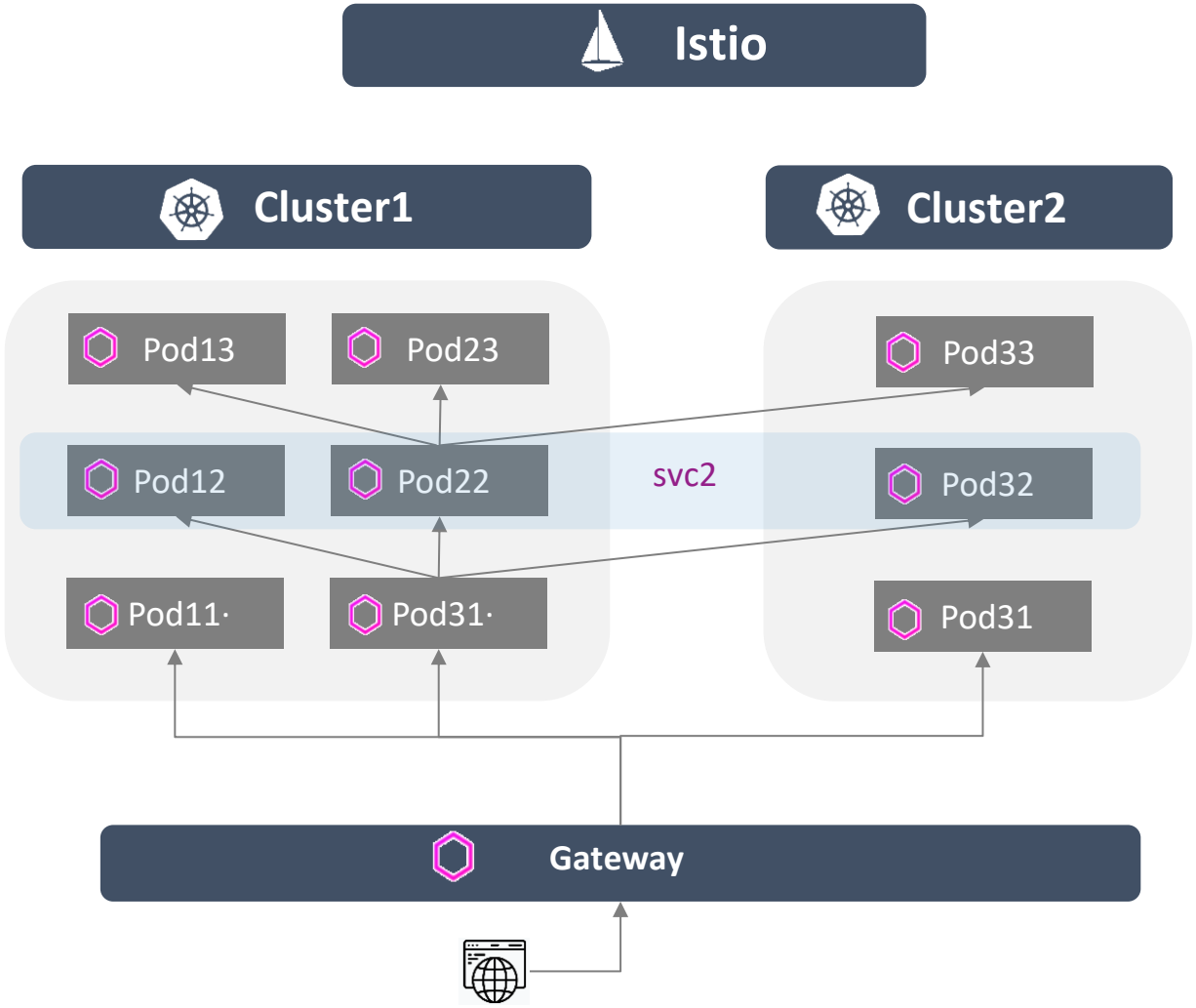

```
apiVersion: networking.istio.io/v1
kind: VirtualService
metadata:
  name: svc3-route
spec:
  hosts:
  - svc3

apiVersion: networking.istio.io/v1
kind: DestinationRule
metadata:
  name: svc3-rule
spec:
  host: svc3
…
```

- Circuit breaker
- Rate limit
- Retry
- Timeout
- Fault injection
- Tracing,
- Accesslog

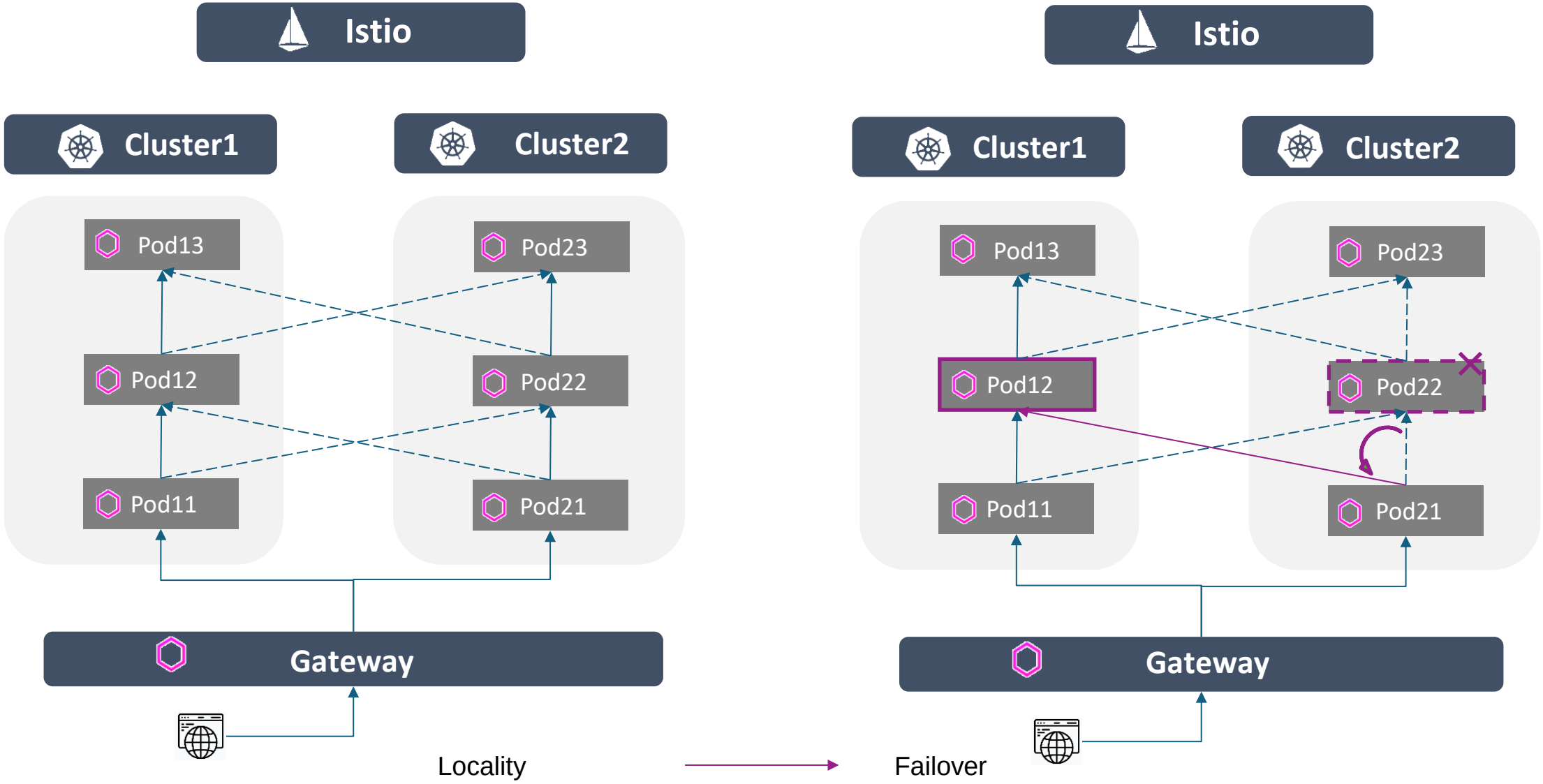
…

Istio Global Loadbalance

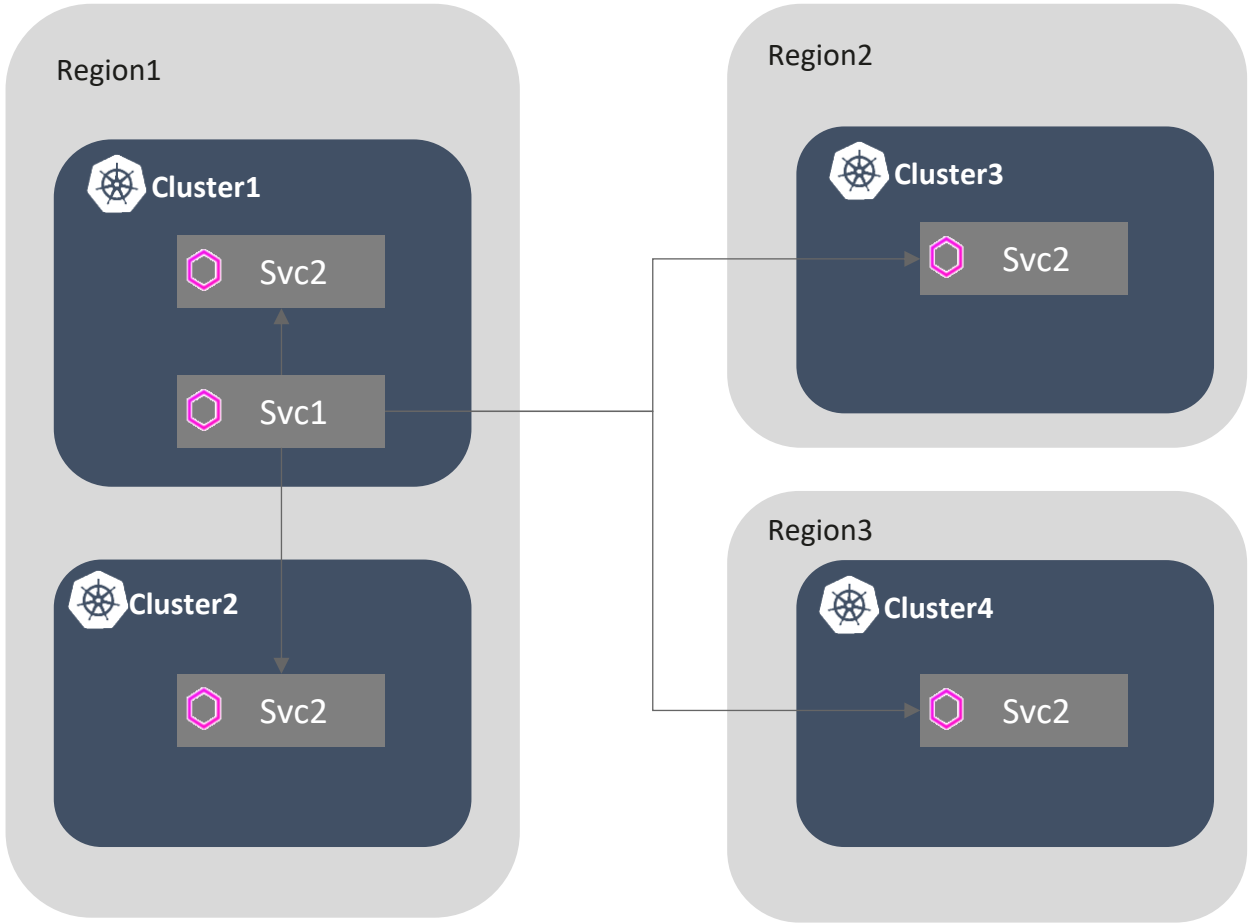



```
apiVersion: networking.istio.io/v1alpha3
kind: DestinationRule
metadata:
  name: dr-svc2
spec:
  host: svc2
  trafficPolicy:
    loadBalancer:
      simple: RANDOM
```

Istio Locality Failover (1)

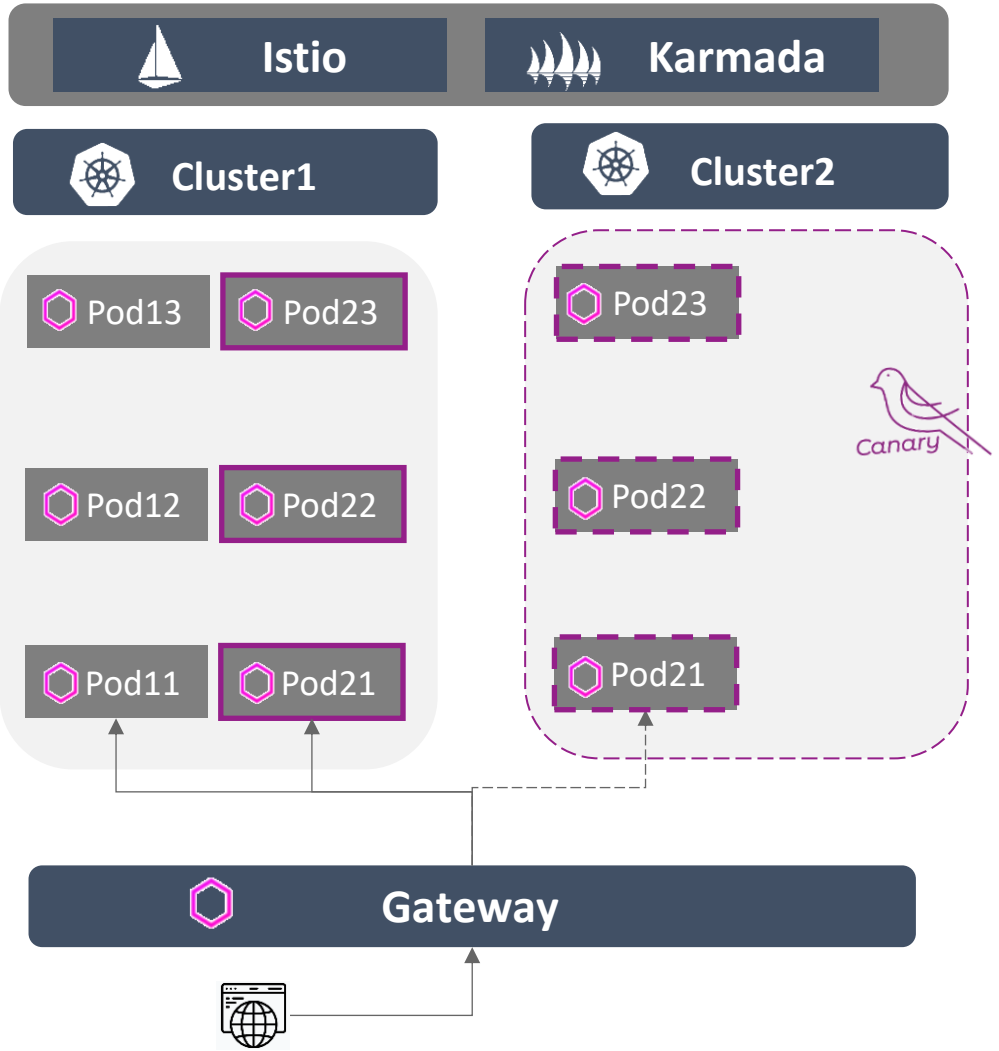


Istio Locality Failover (2)



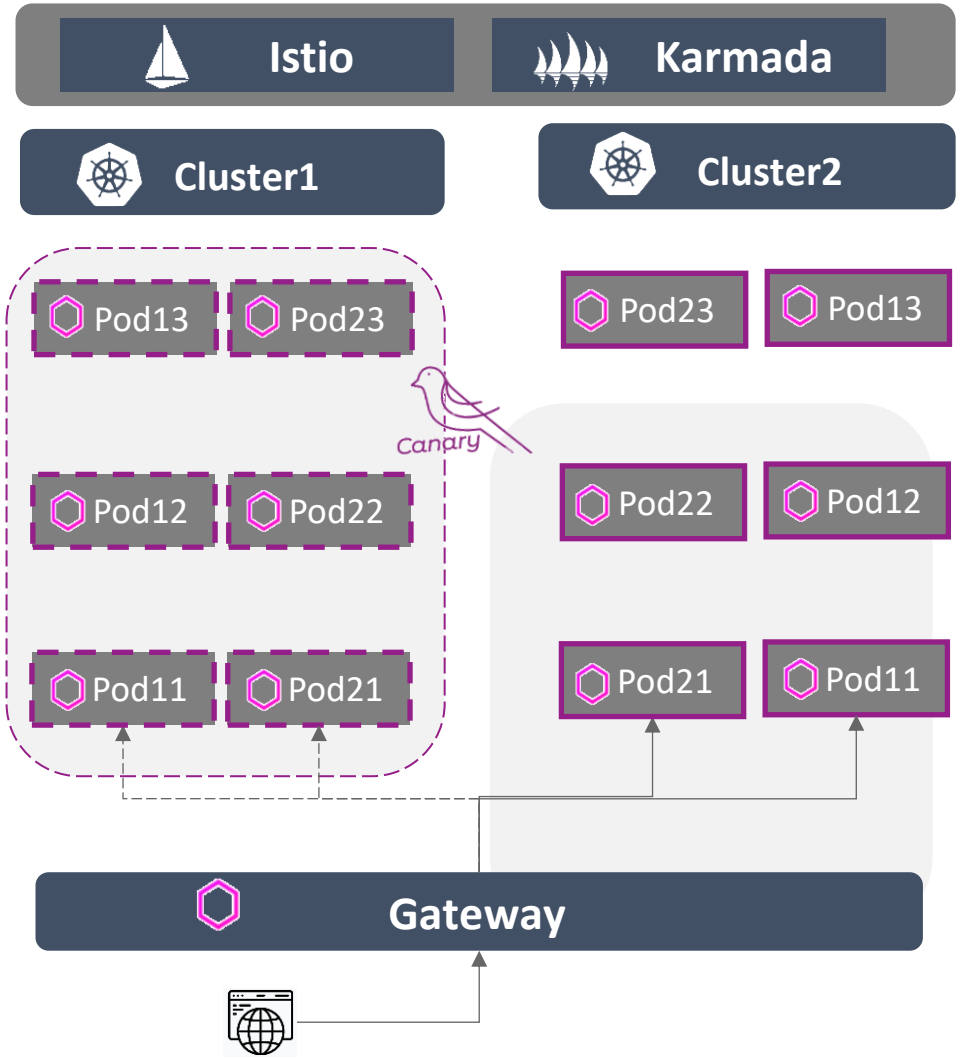
Priority	Locality	Details
1	region1.cluster1	Region, cluster all match.
2	region1.cluster2	Different cluster within the same region.
3	region2.cluster3	No match, failover is defined for region1->region2.
4	region3.cluster4	No match and no failover defined for region1->region3.

Cluster Canary Upgrade (1)



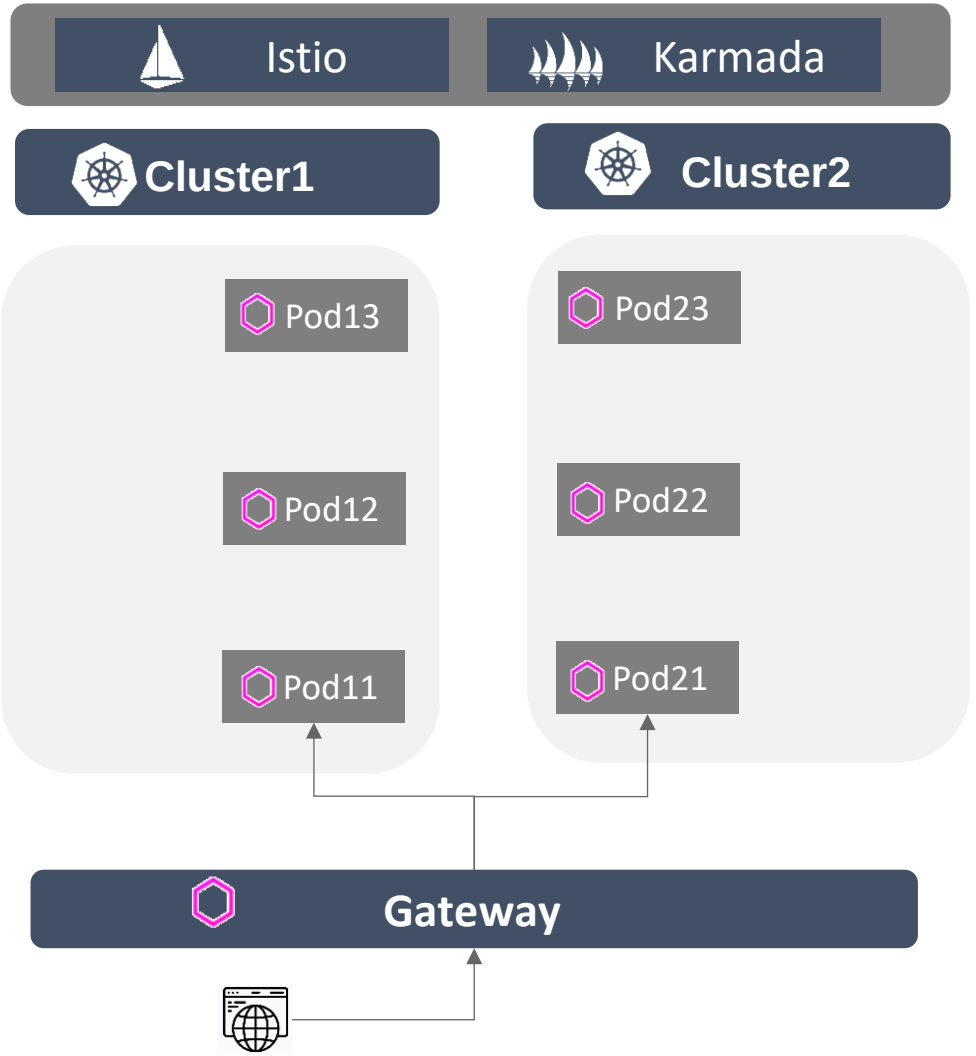
1. Select one cluster as canary cluster
2. Switch traffic to another cluster
3. Migrate workloads to another clustr
4. Upgrade canary cluster
5. Check canary cluster work ok
6. Migrate parts of workload to canary cluster
7. Split some traffic to canary cluster
8. Check application in canary response ok

Cluster Canary Upgrade (2)



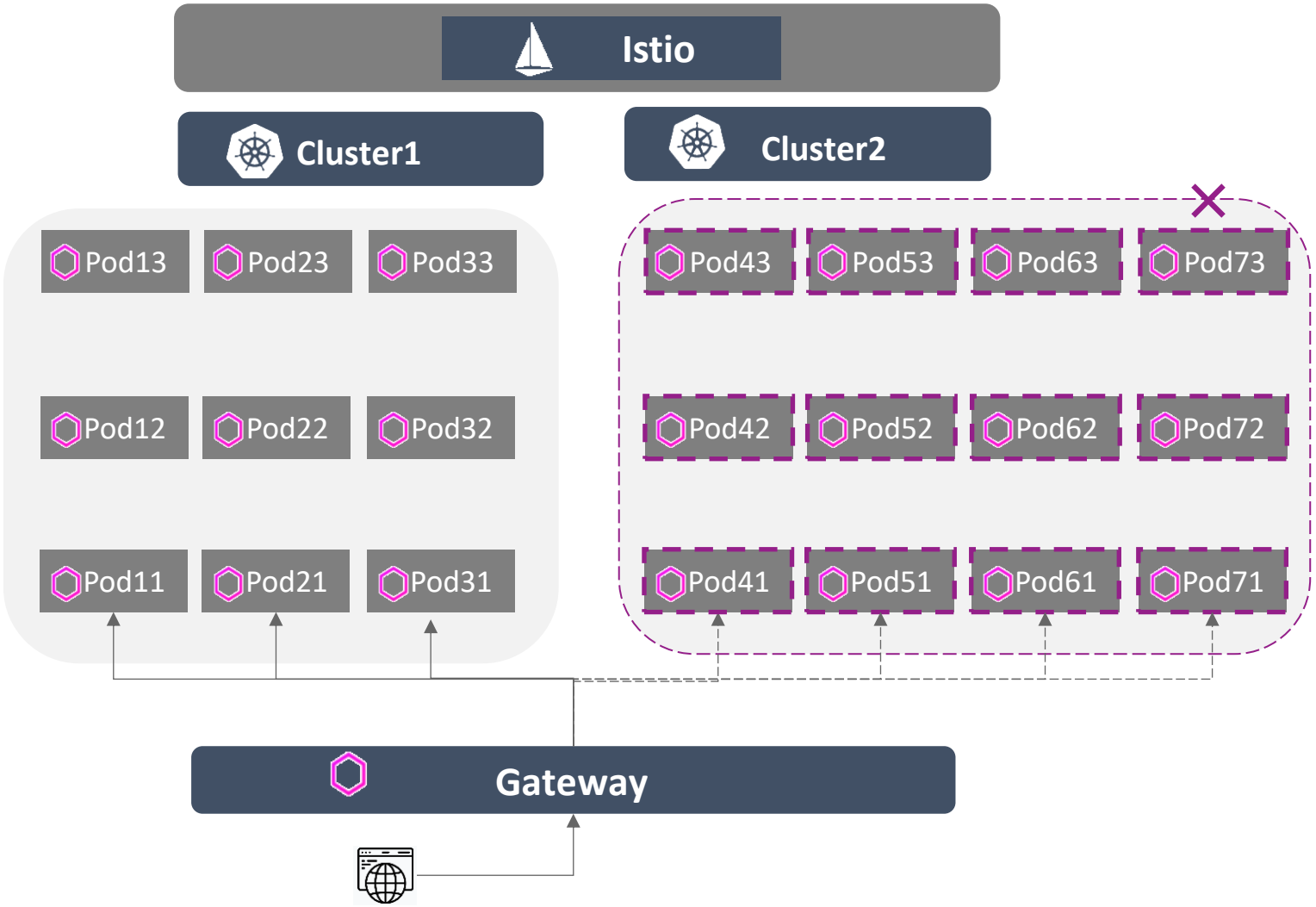
1. Select anther cluster as canary cluster
2. Upgrade cluster1 by repeating above Steps

Cluster Canary Upgrade (3)



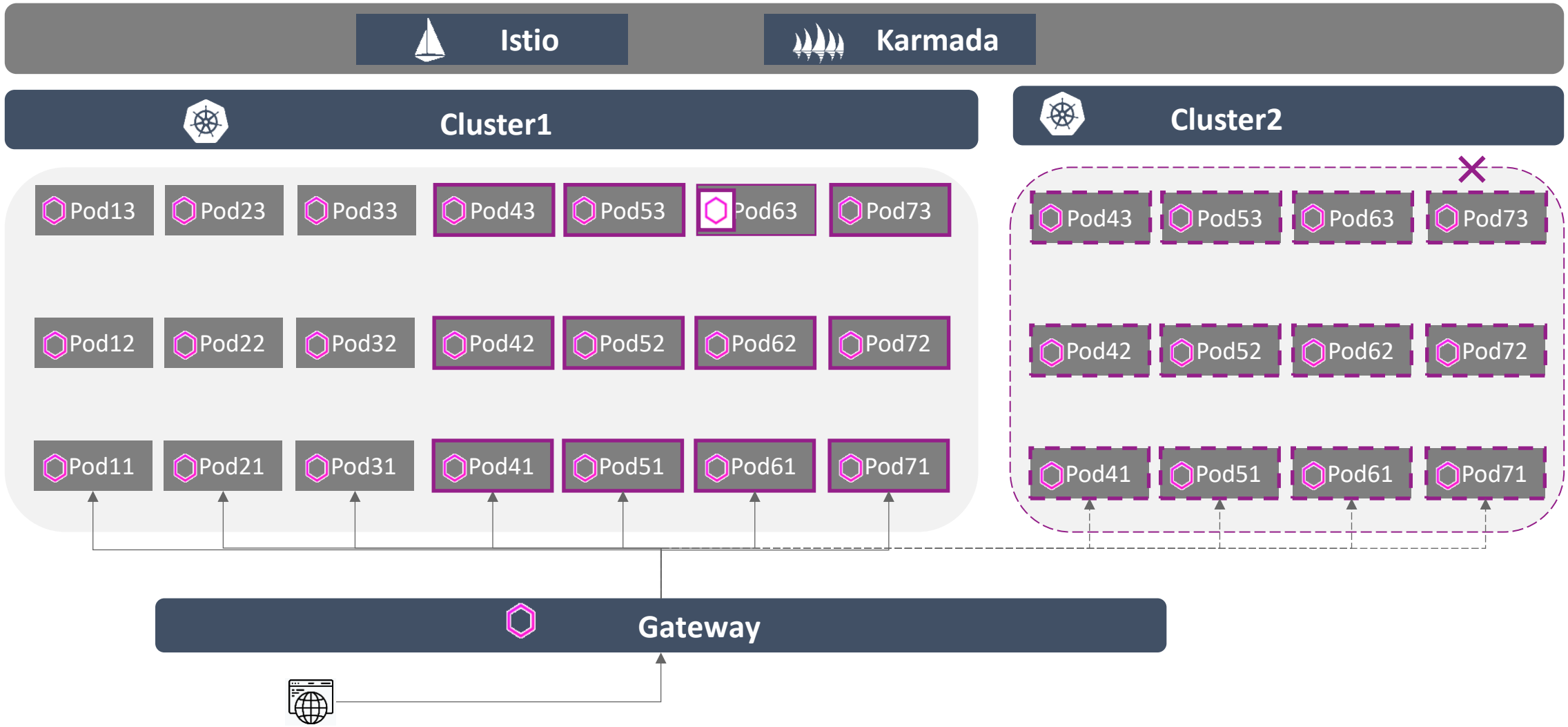
1. Restore workloads to original condition before canary
2. Restore traffic distribution to original condition before canary
3. Final check and finish canary

Circuit Breaker and dynamic Workload Migration over Multi cluster (1)




```
trafficPolicy:
  outlierDetection:
    consecutive5xxErrors: 5
    interval: 4m
    baseEjectionTime: 10m
    maxEjectionPercent: 30
```

Circuit Breaker and dynamic Workload Migration over Multi cluster (2)



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