

SERVICE MESH



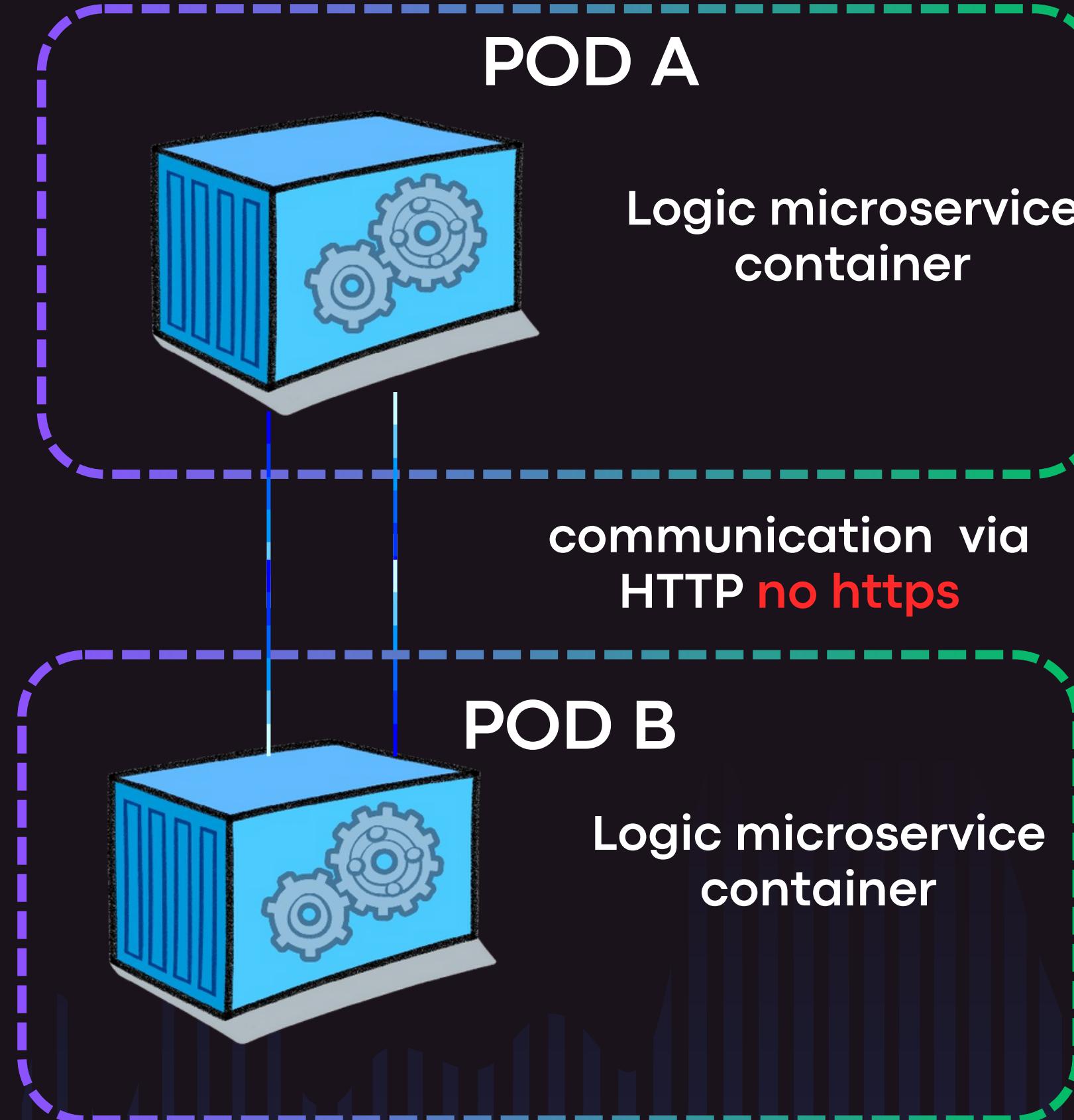
Made By : Saoud Yahya

**A SERVICE MESH IS A DEDICATED
INFRASTRUCTURE LAYER FOR MANAGING
SERVICE-TO-SERVICE COMMUNICATION IN
A MICROSERVICES ARCHITECTURE**





kubernetes (k8s)



In Kubernetes, we only see app logs, not network traffic logs.



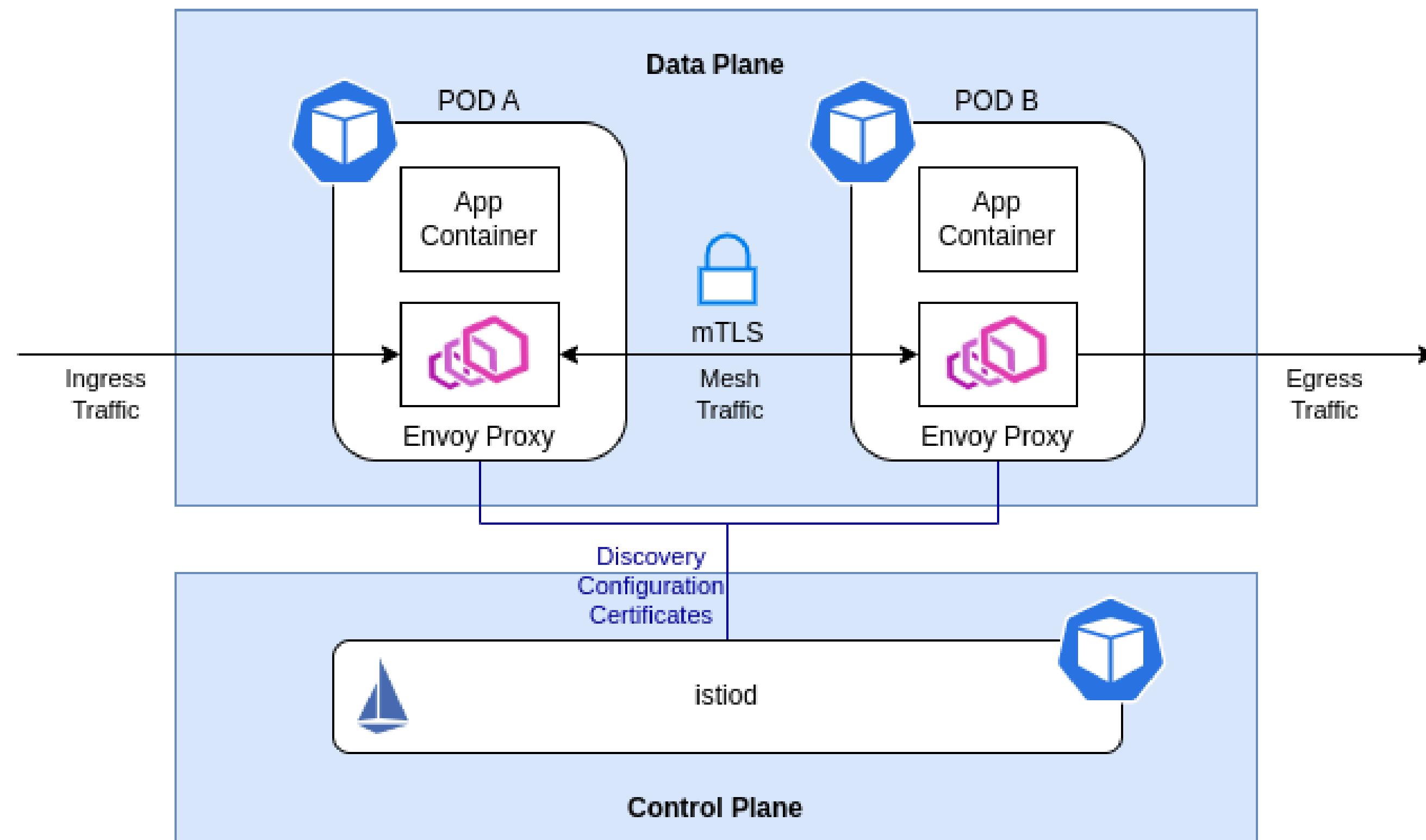
service discovery via CoreDNS works, but communication between services over HTTP is not encrypted.



Kubernetes has no advanced networking features like circuit breakers or auto-retries.

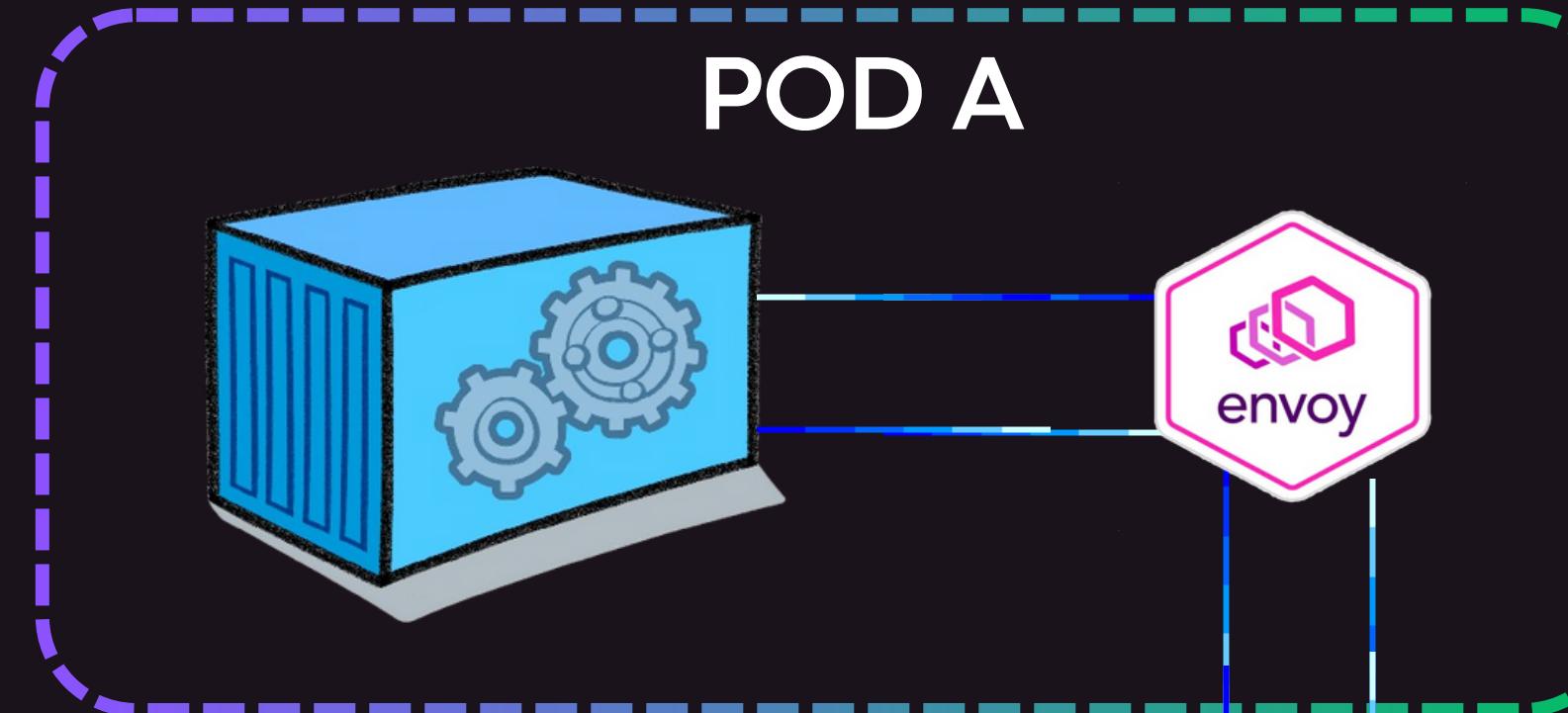


k8s + service mesh

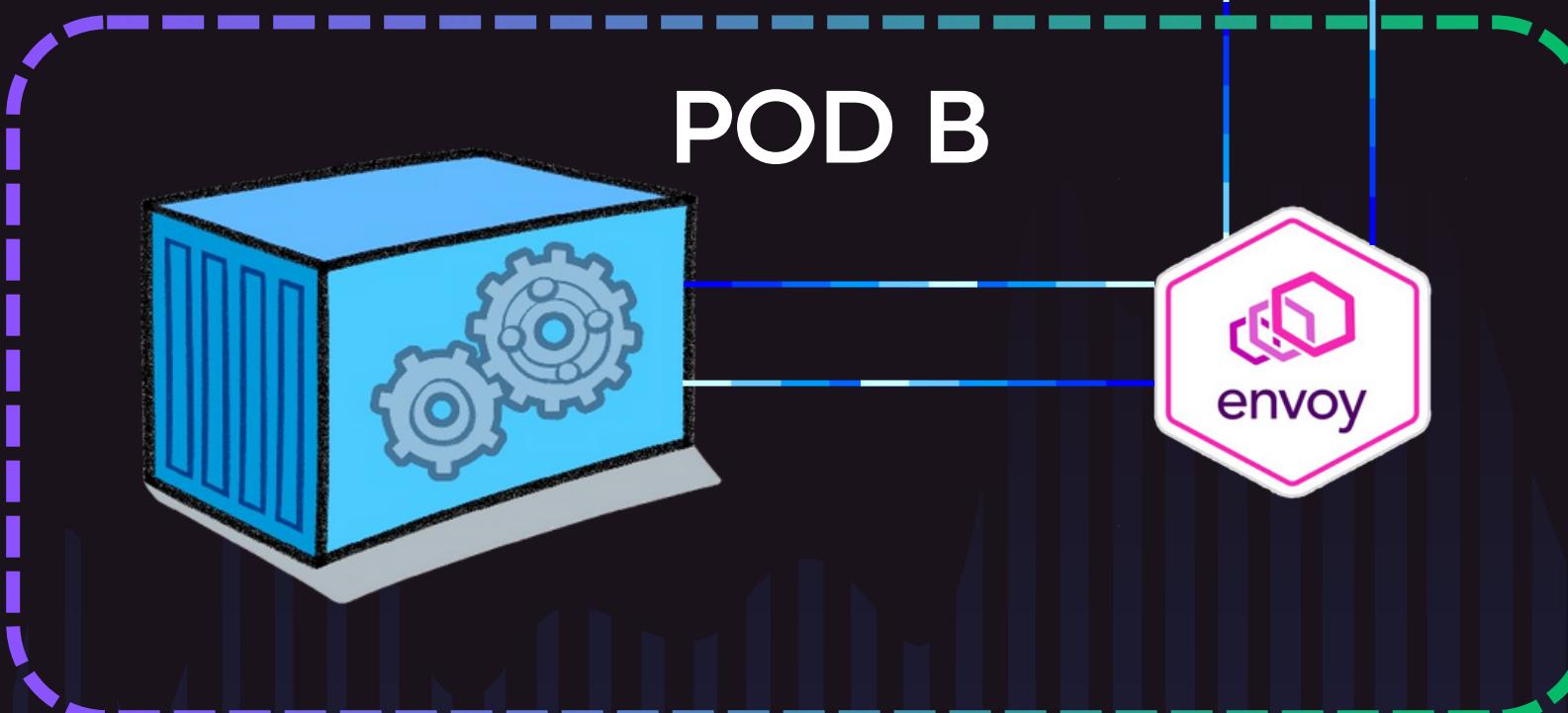




kubernetes (k8s) + Service Mesh



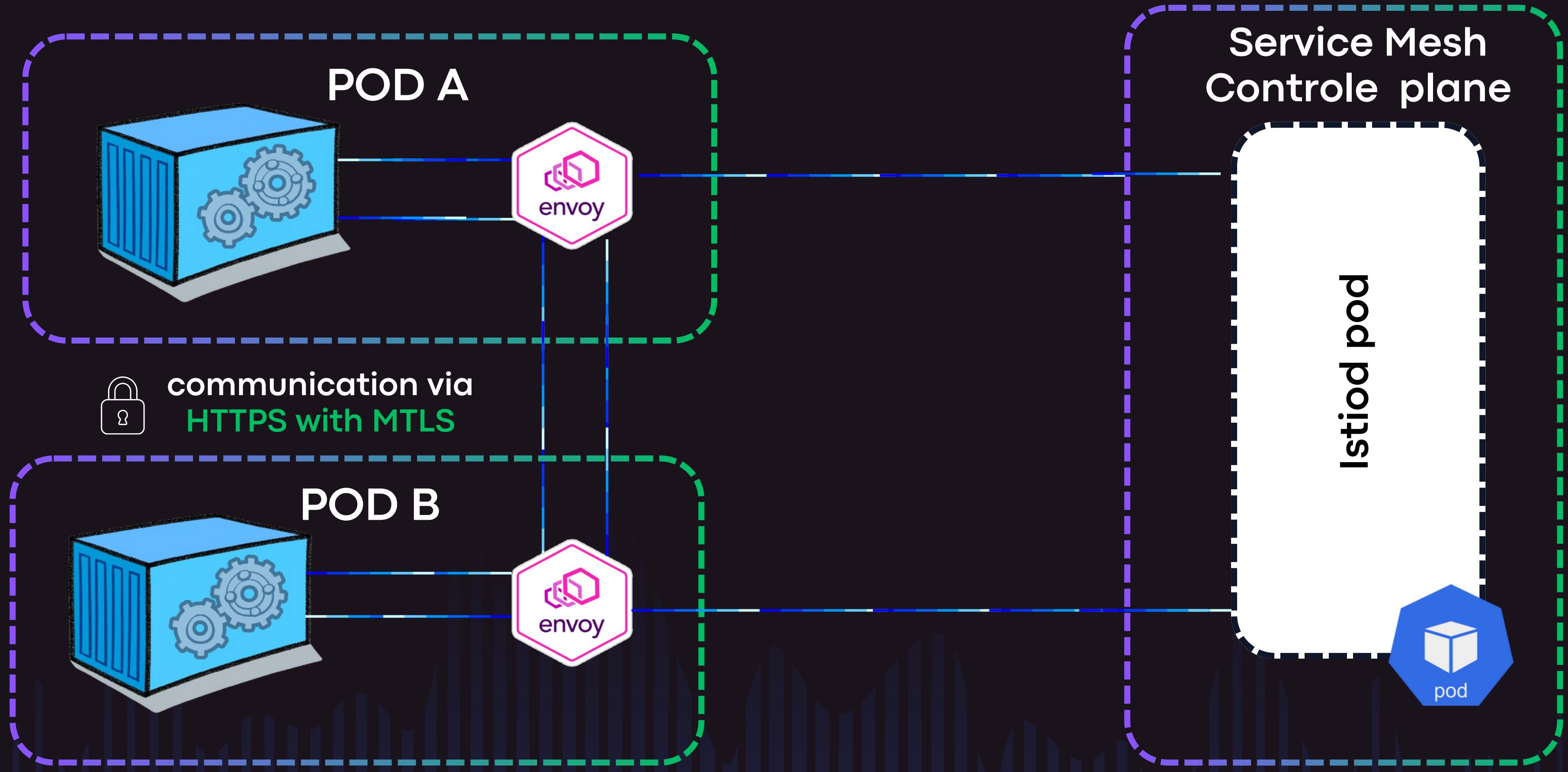
Injecting an Envoy proxy into each pod



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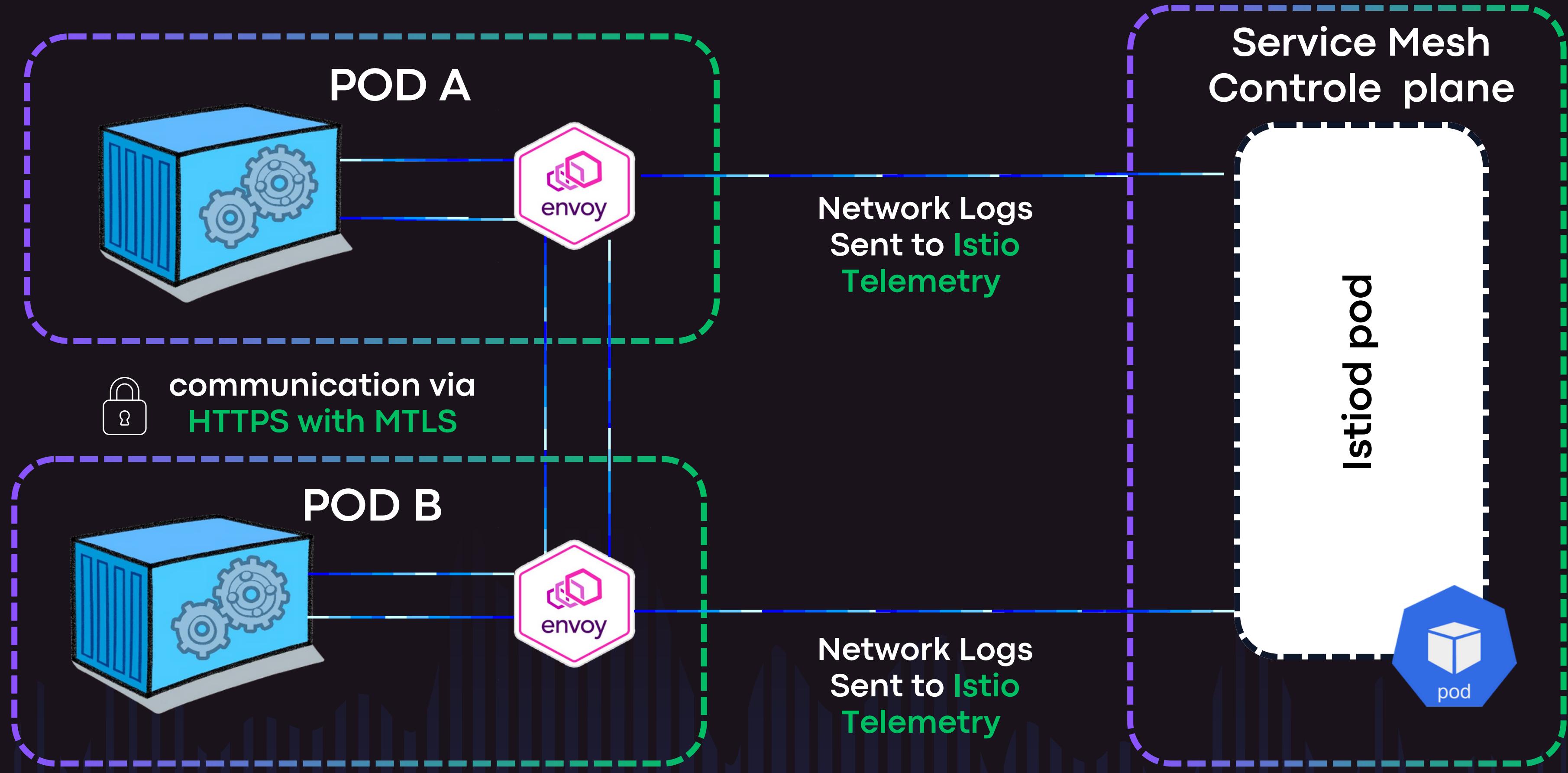


kubernetes (k8s) + Service Mesh



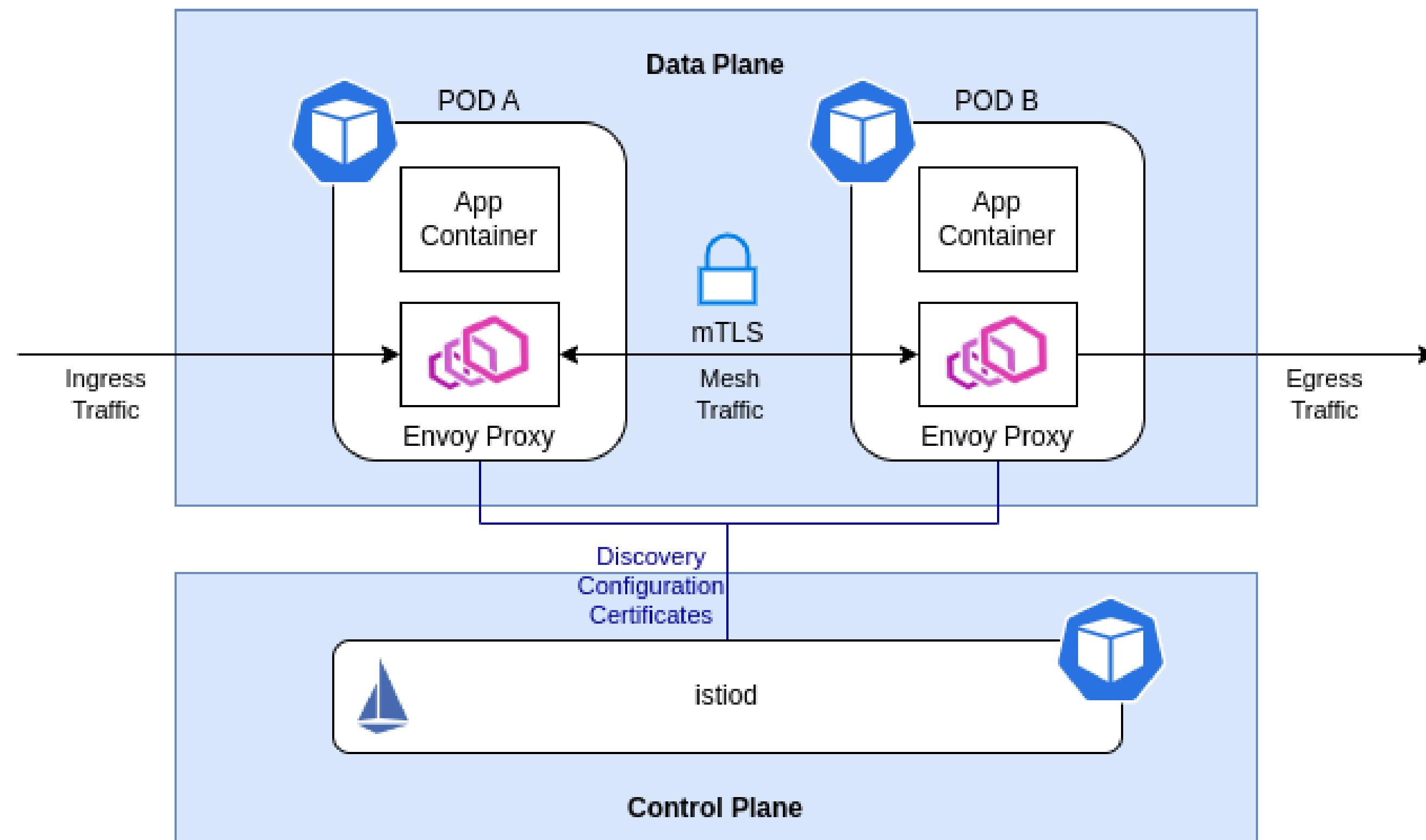


kubernetes (k8s) + Service Mesh





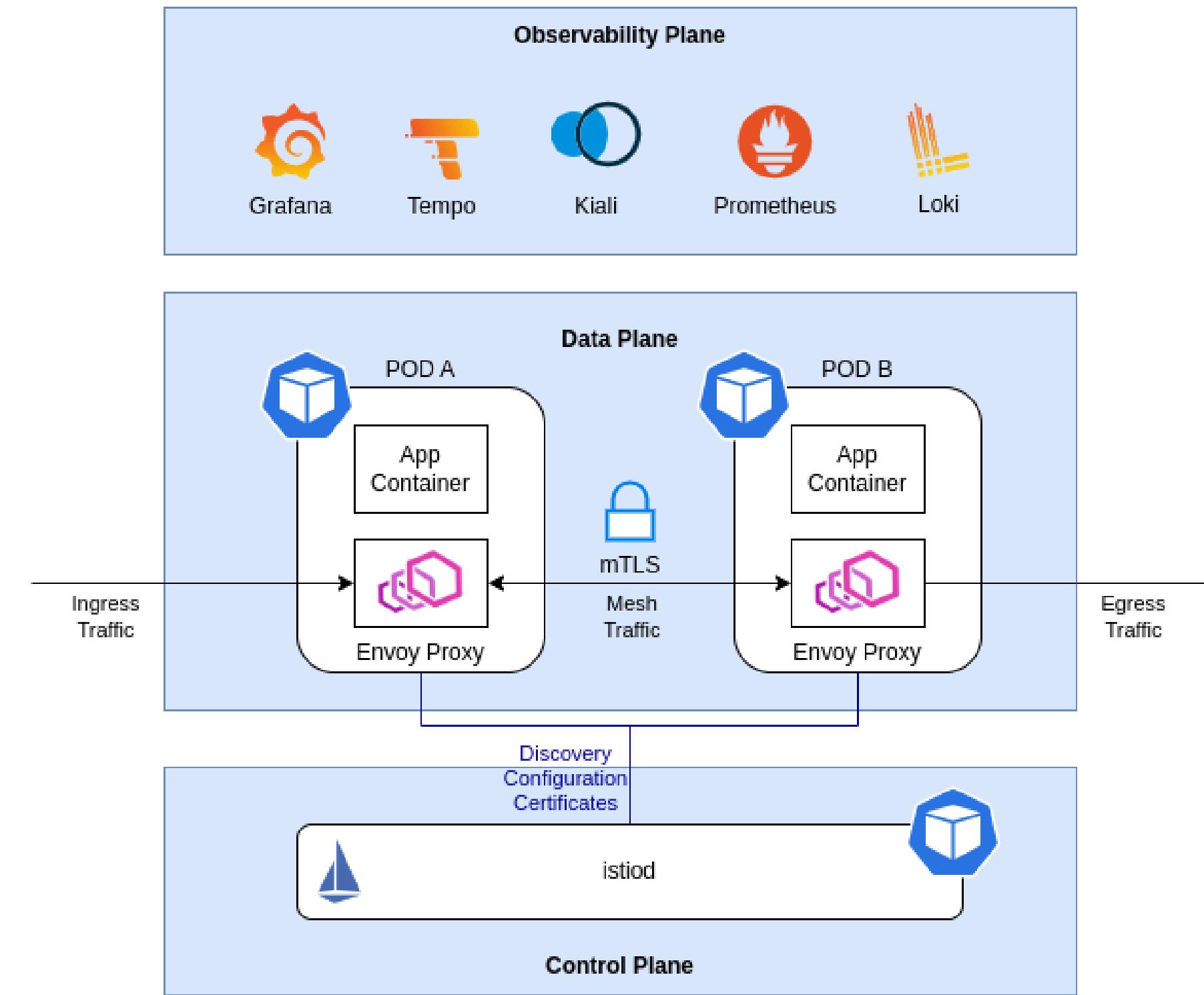
k8s + service mesh





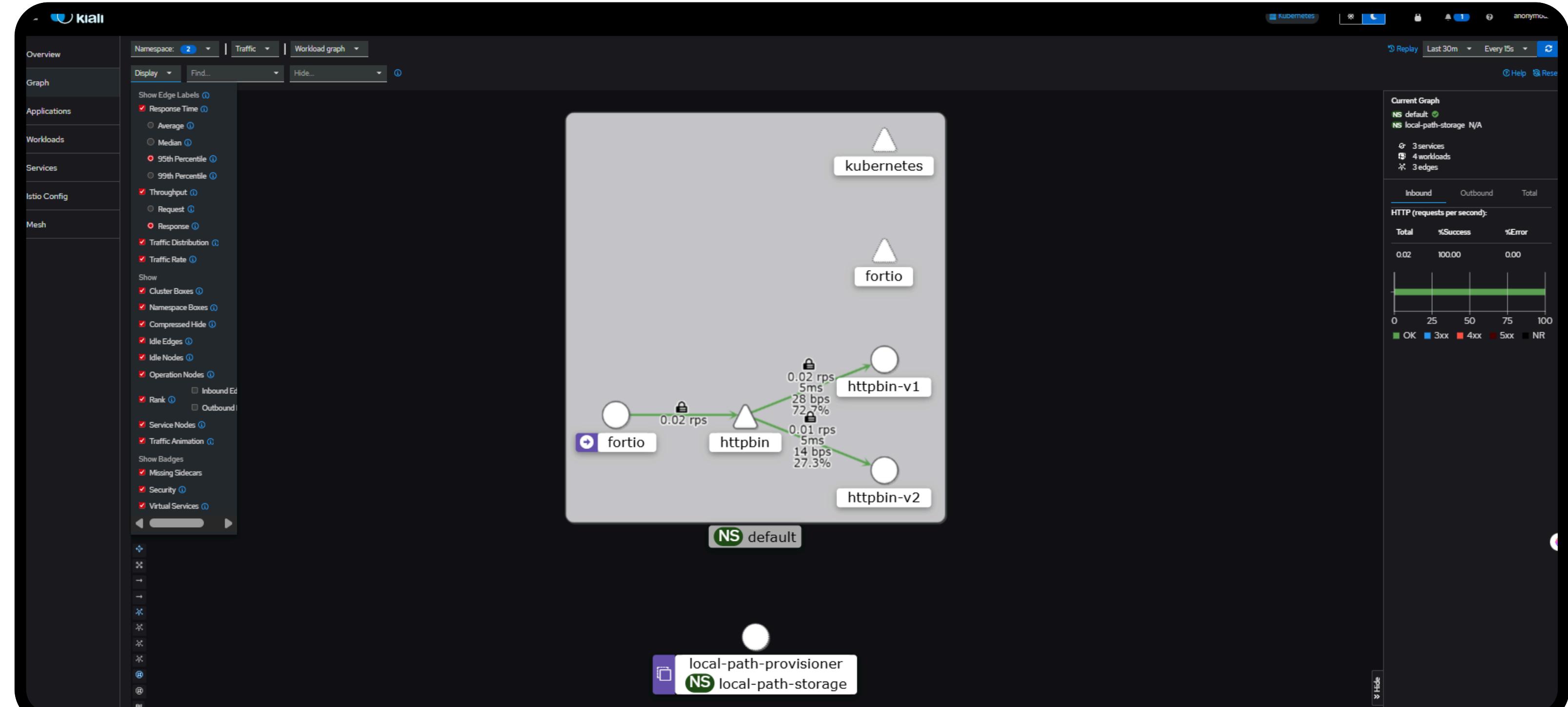
k8s + service mesh

Istio Sidecar Architecture



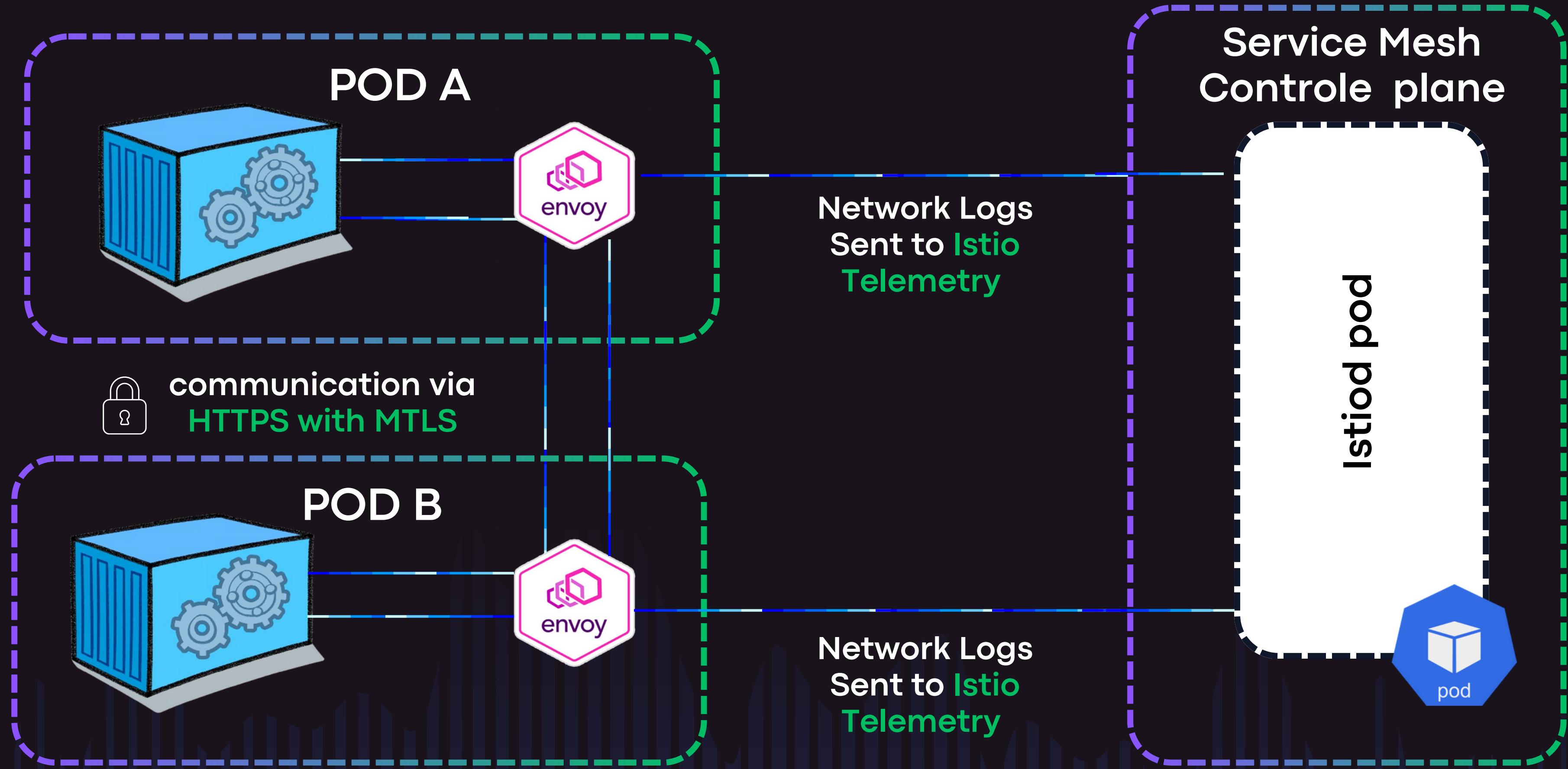


k8s + service mesh



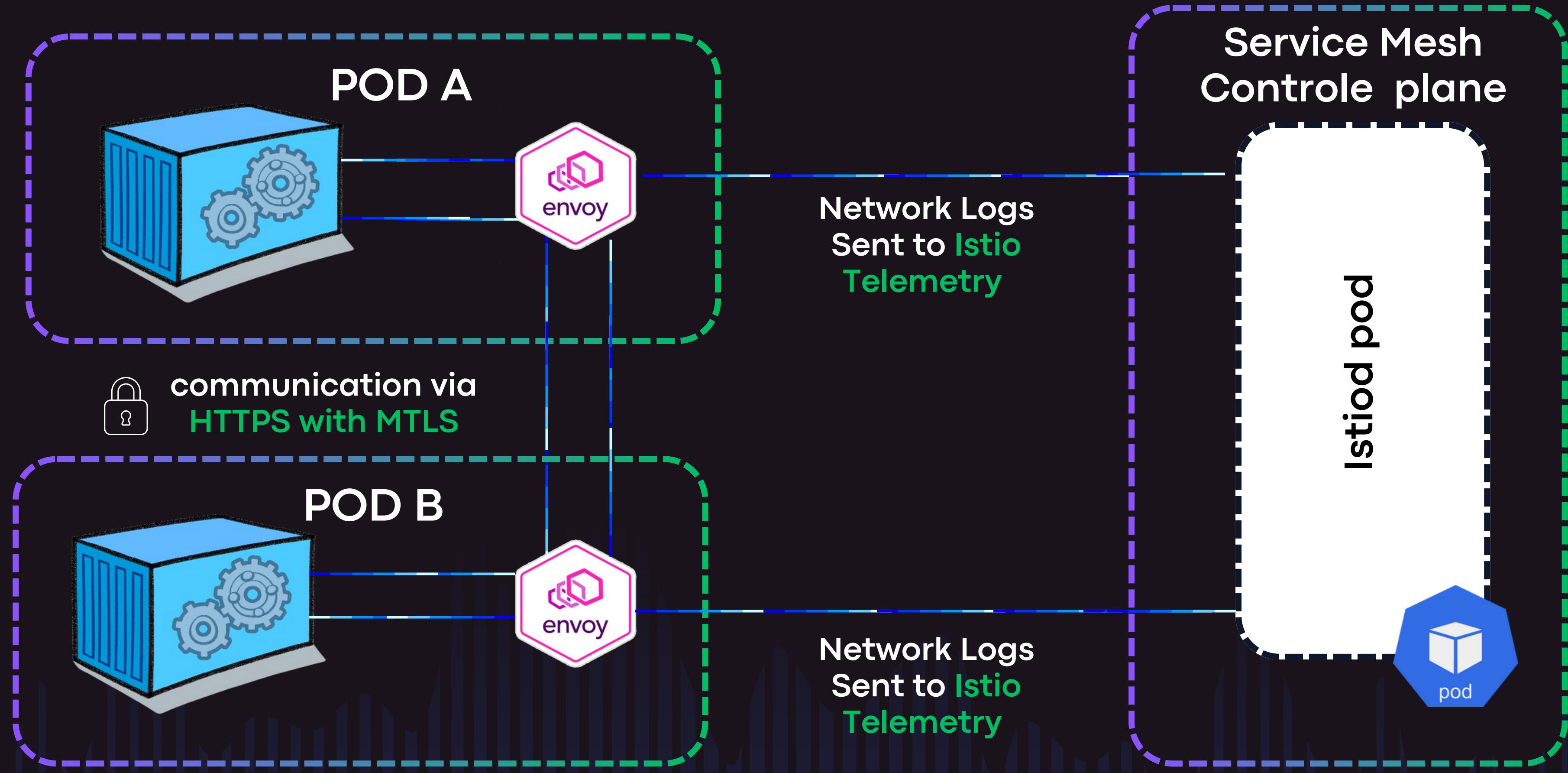


kubernetes (k8s) + Service Mesh





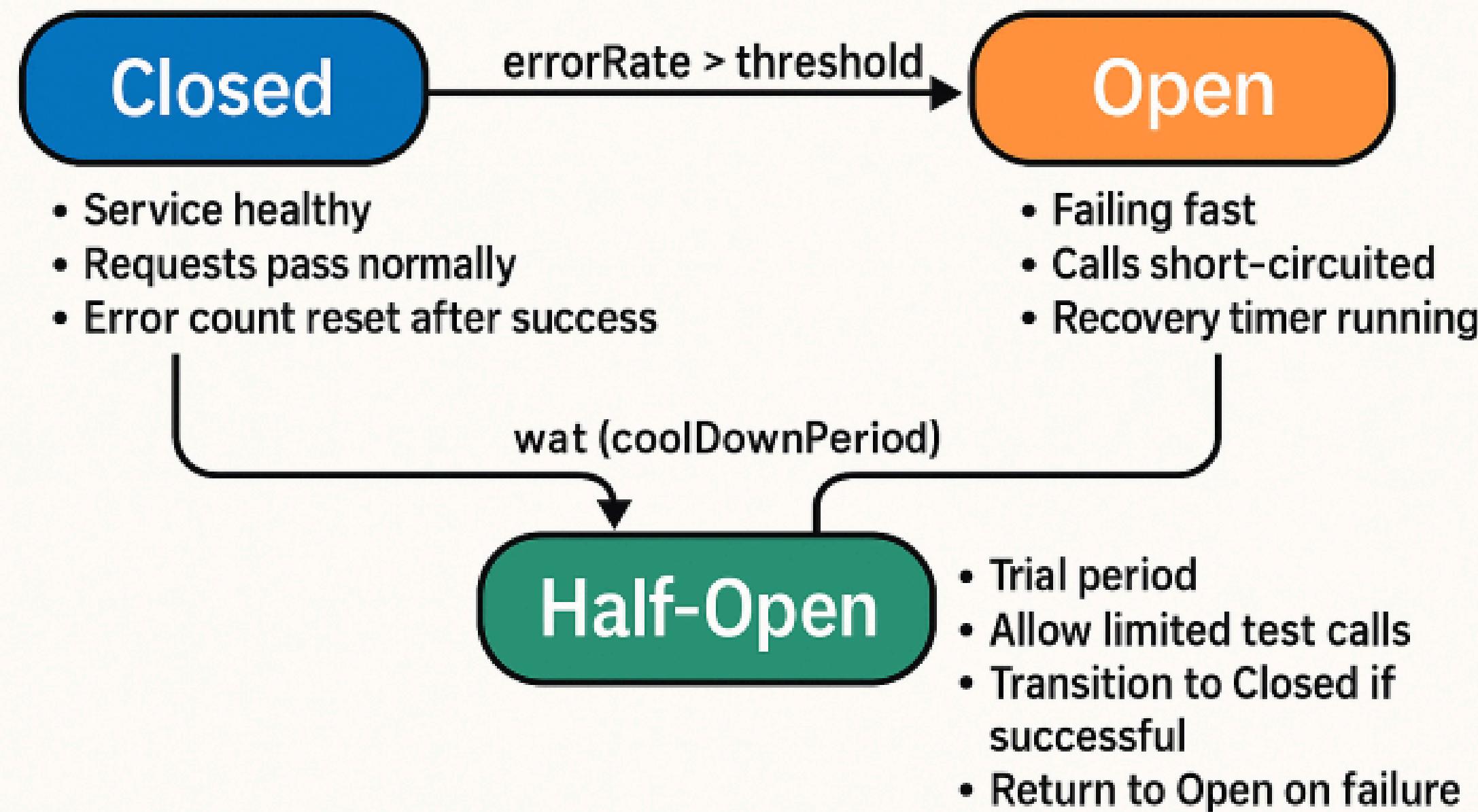
kubernetes (k8s) + Service Mesh





k8s + service mesh

CIRCUIT BREAKER PATTERN

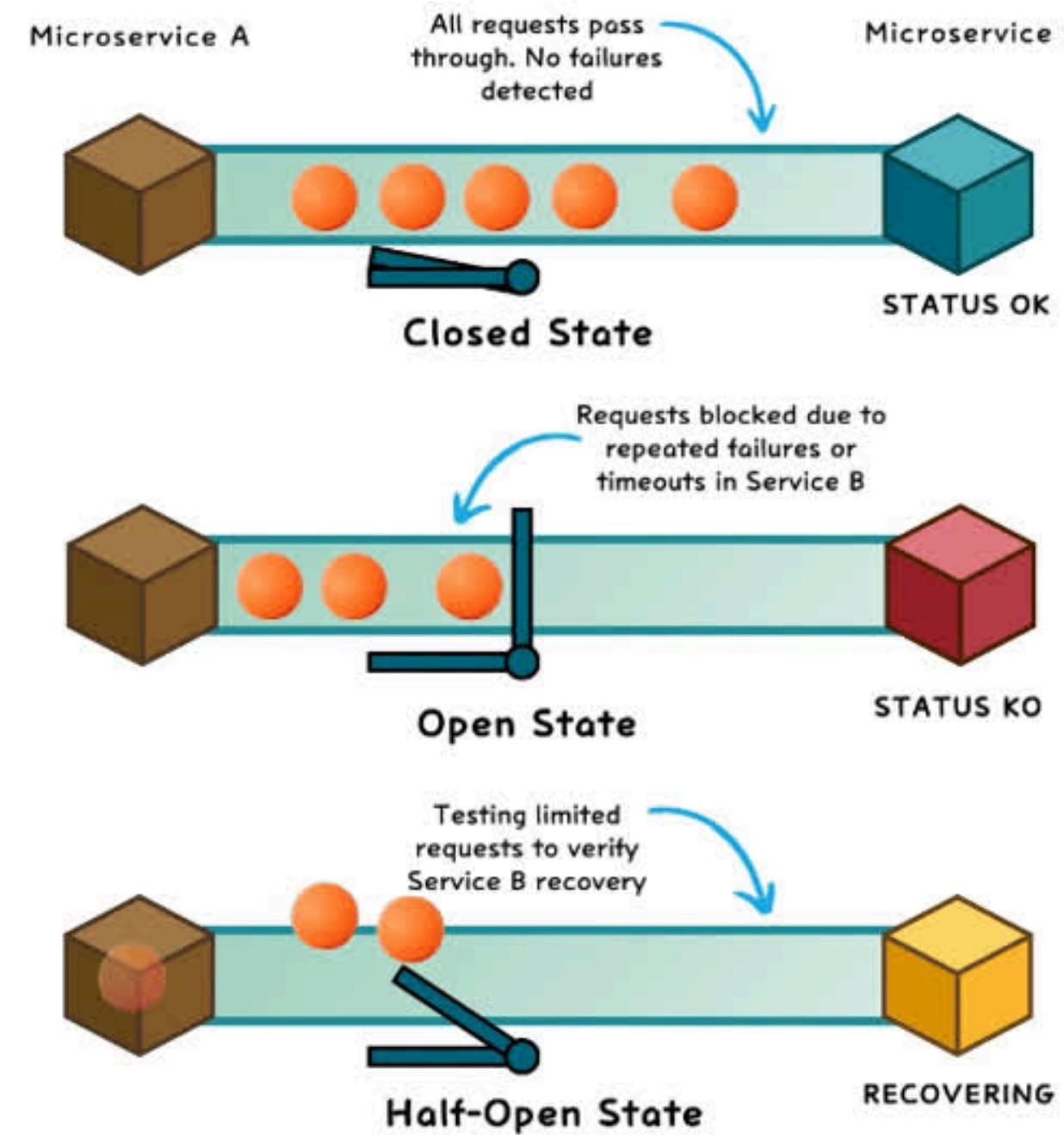




k8s + service mesh

Circuit Breaker

Sketech Newsletter by Nina





kubernetes (k8s) + Service Mesh

Service Type	Apply CB?	Reason
Payment Gateway	<input checked="" type="checkbox"/> YES	Critical + External
User Auth Service	<input checked="" type="checkbox"/> YES	Critical path
Product Catalog	<input checked="" type="checkbox"/> YES	High traffic
External Email API	<input checked="" type="checkbox"/> YES	External + Can fall
Internal Config Service	<input type="checkbox"/> NO	Fast + Reliable
Health Check Endpoint	<input type="checkbox"/> NO	Simple + Local
Database Connection	<input type="checkbox"/> NO	Use connection pools
Cross-team Services	<input checked="" type="checkbox"/> YES	Different reliability

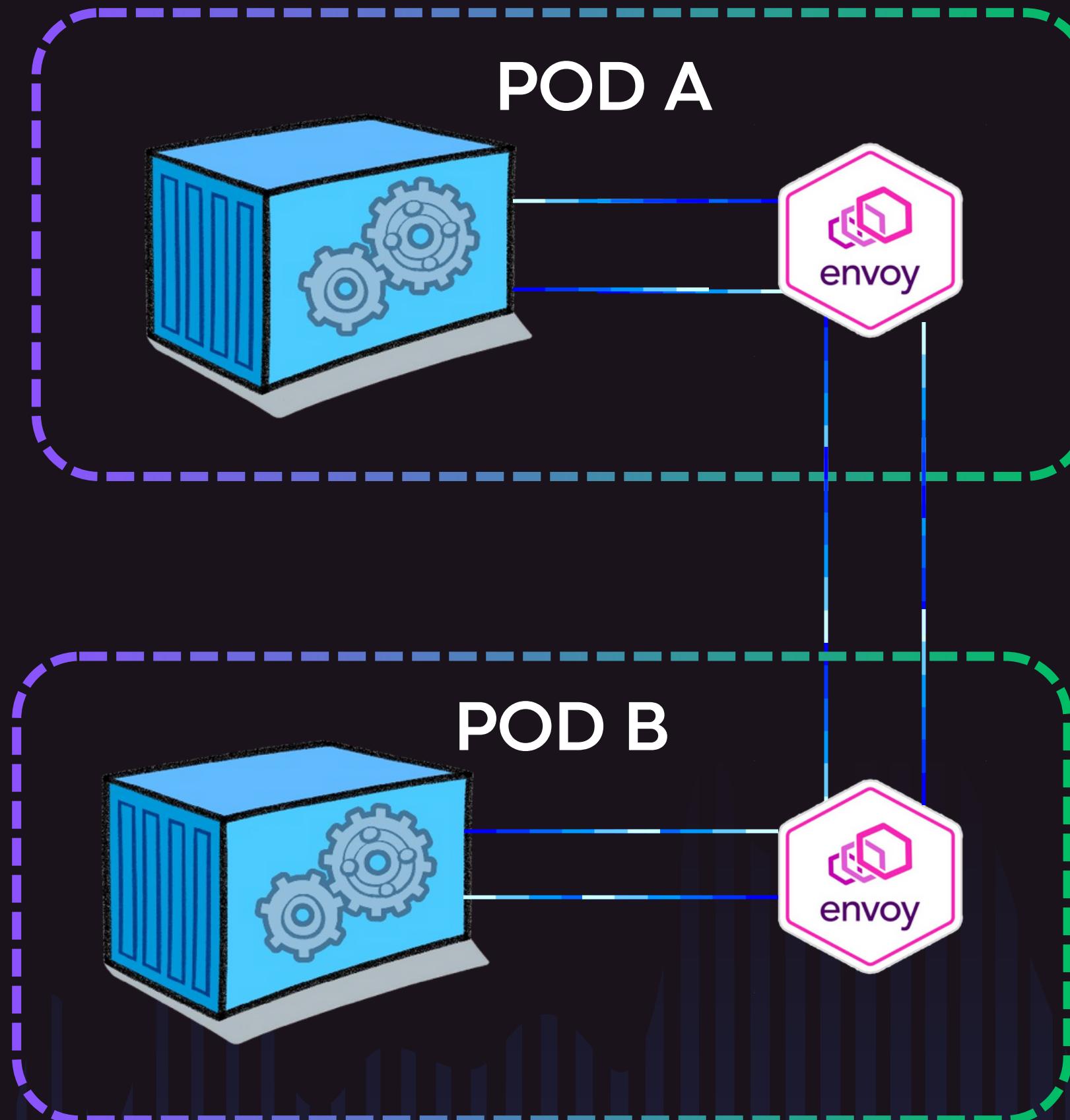


kubernetes (k8s) + Service Mesh

```
apiVersion: networking.istio.io/v1beta1
kind: DestinationRule
metadata:
  name: critical-services-cb
spec:
  host: "*.production.svc.cluster.local"
  trafficPolicy:
    outlierDetection:
      consecutive5xxErrors: 3
      interval: 30s
      baseEjectionTime: 30s
```



kubernetes (k8s) + Service Mesh



Traffic Mgmt: Retries, Timeouts, Load Balancing

Circuit Breaker Pattern

communication via **HTTPS with MTLS**

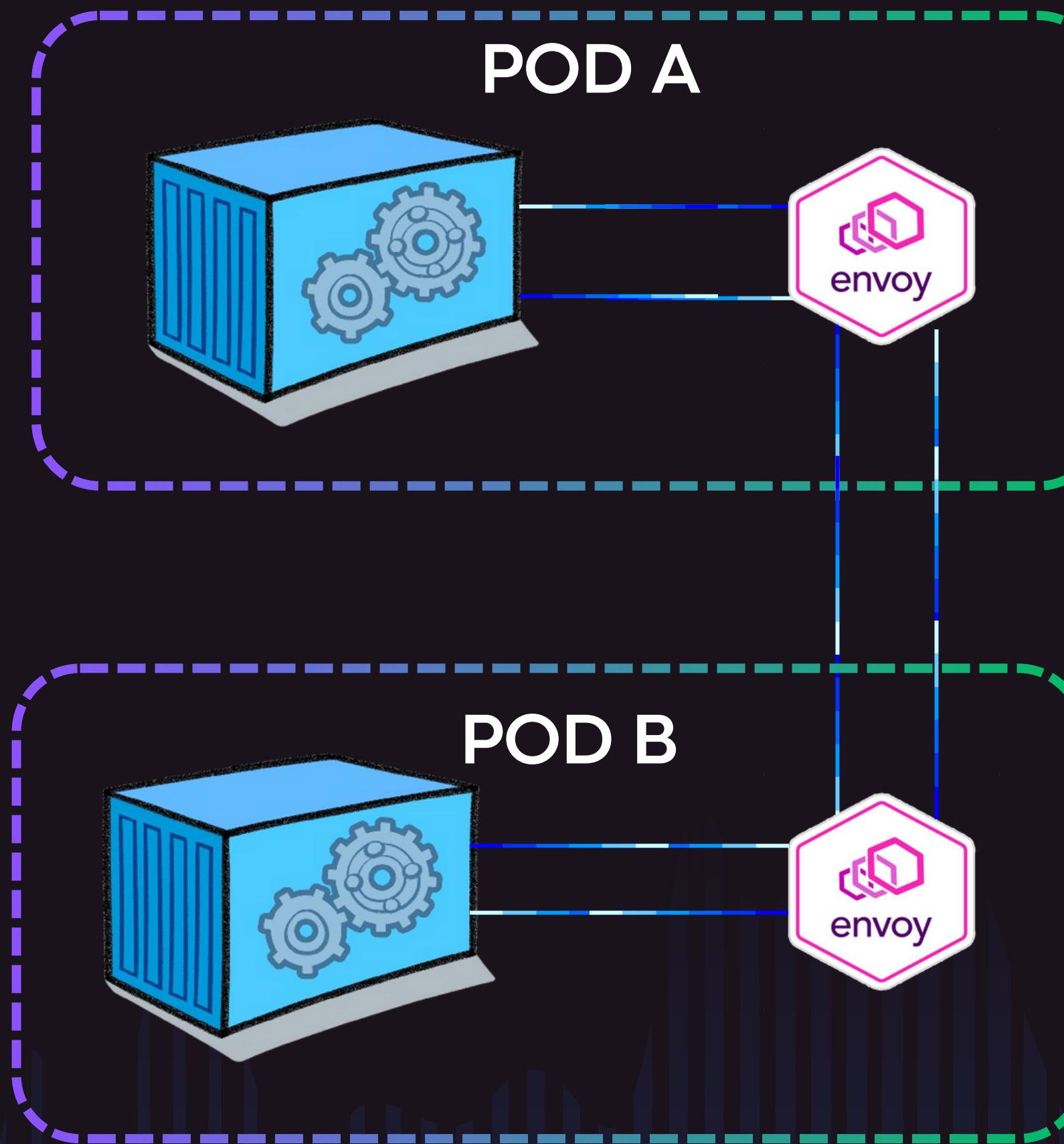
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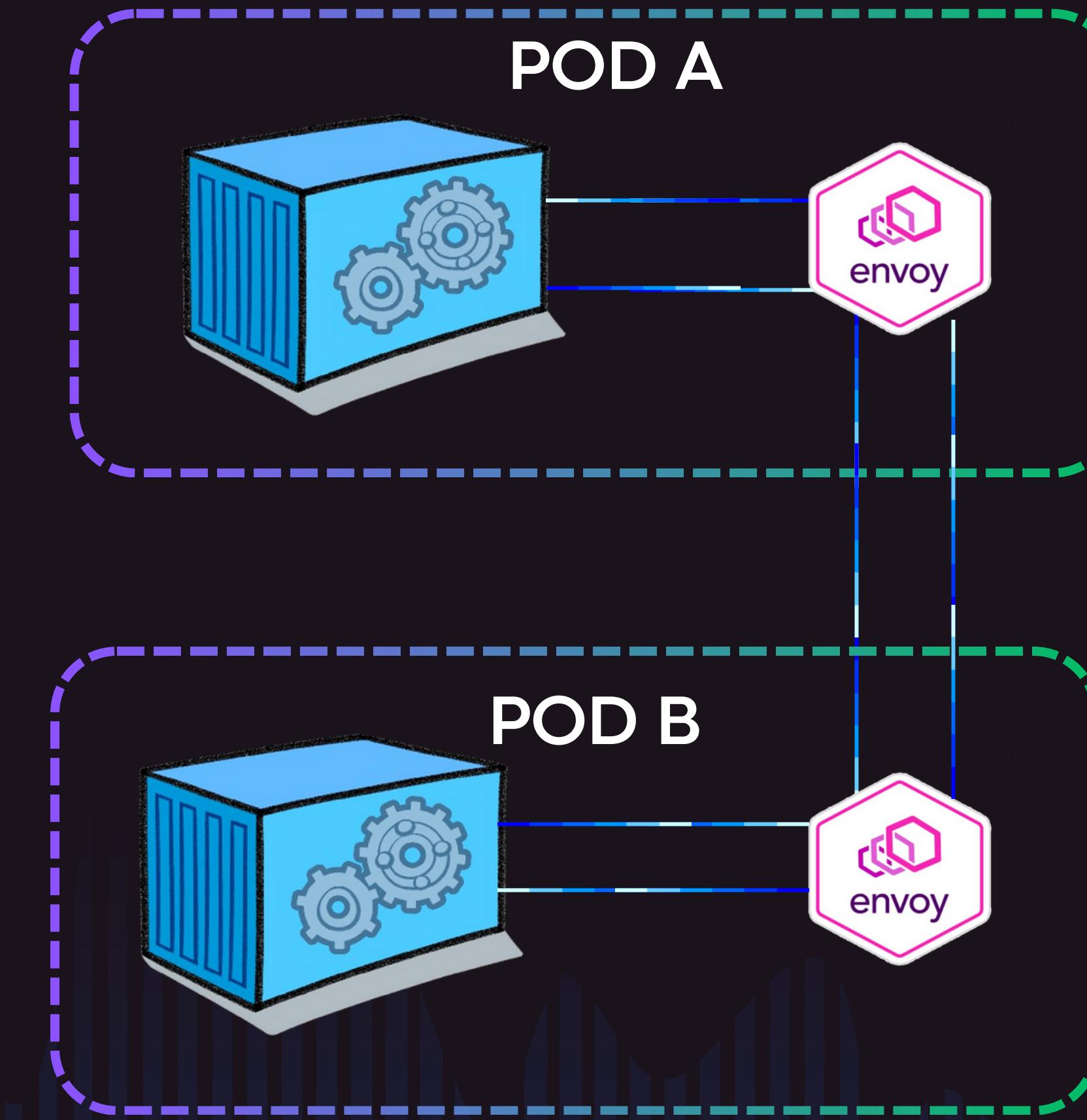


kubernetes (k8s) + Service Mesh



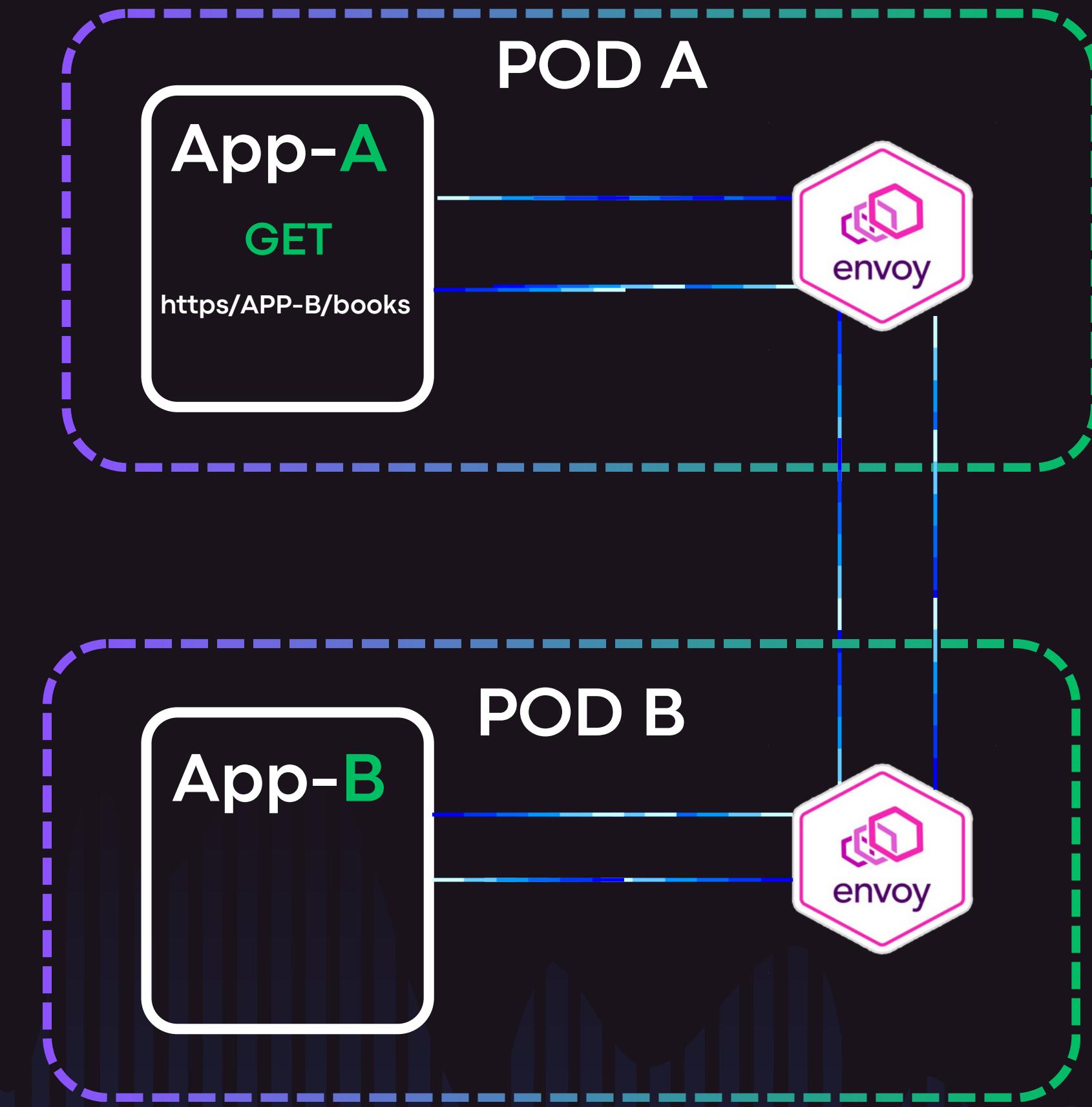


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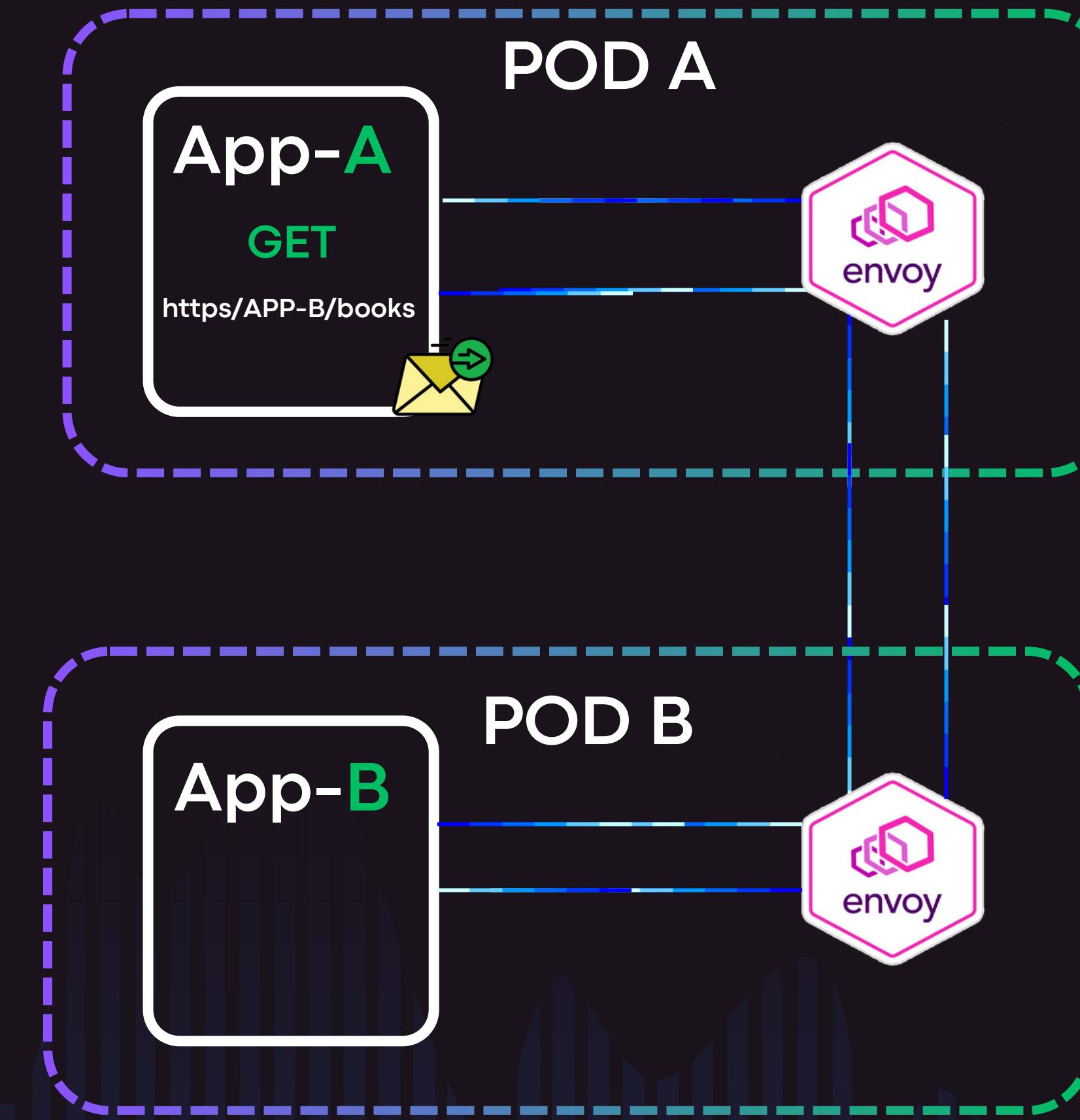


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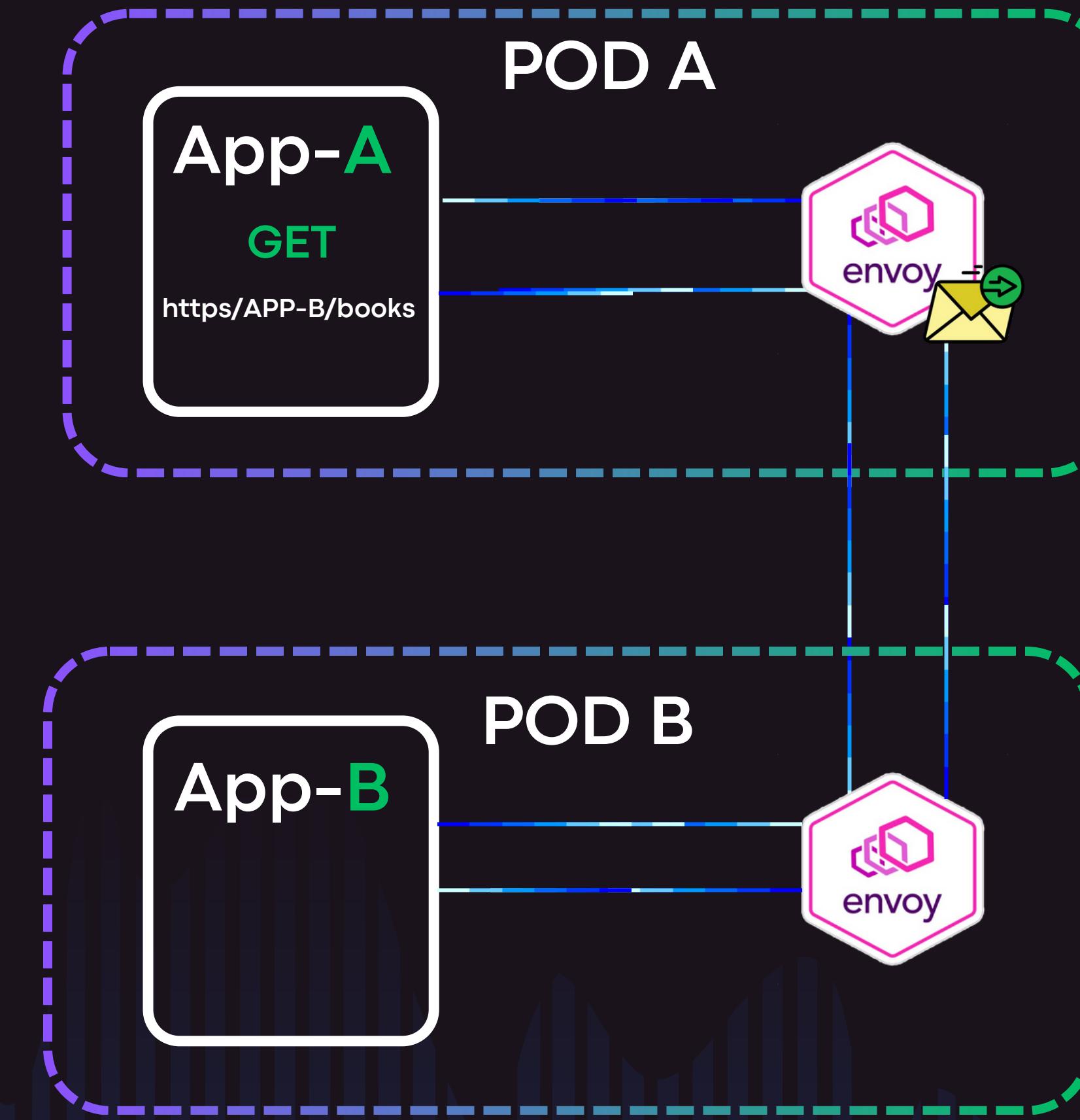


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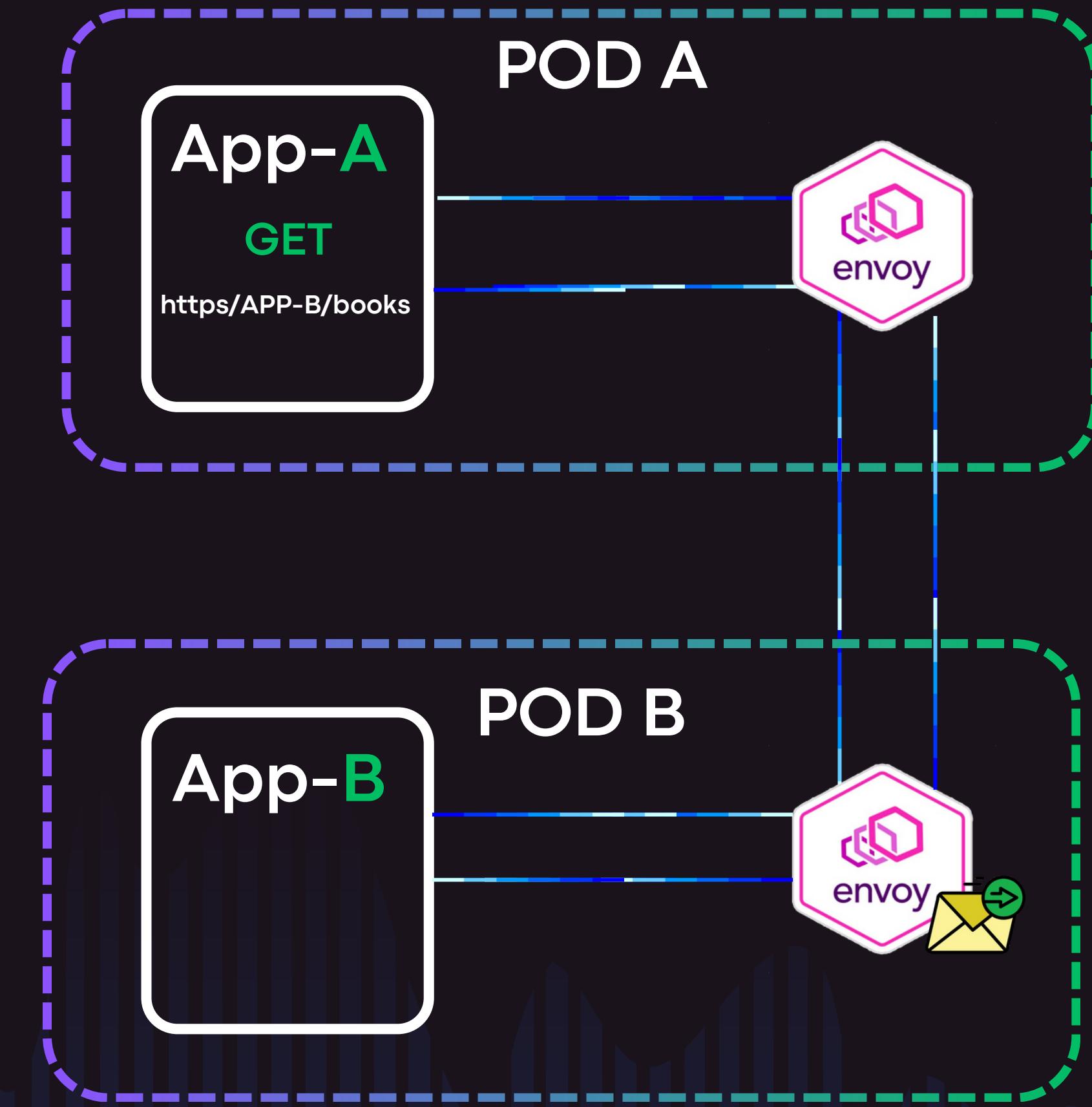


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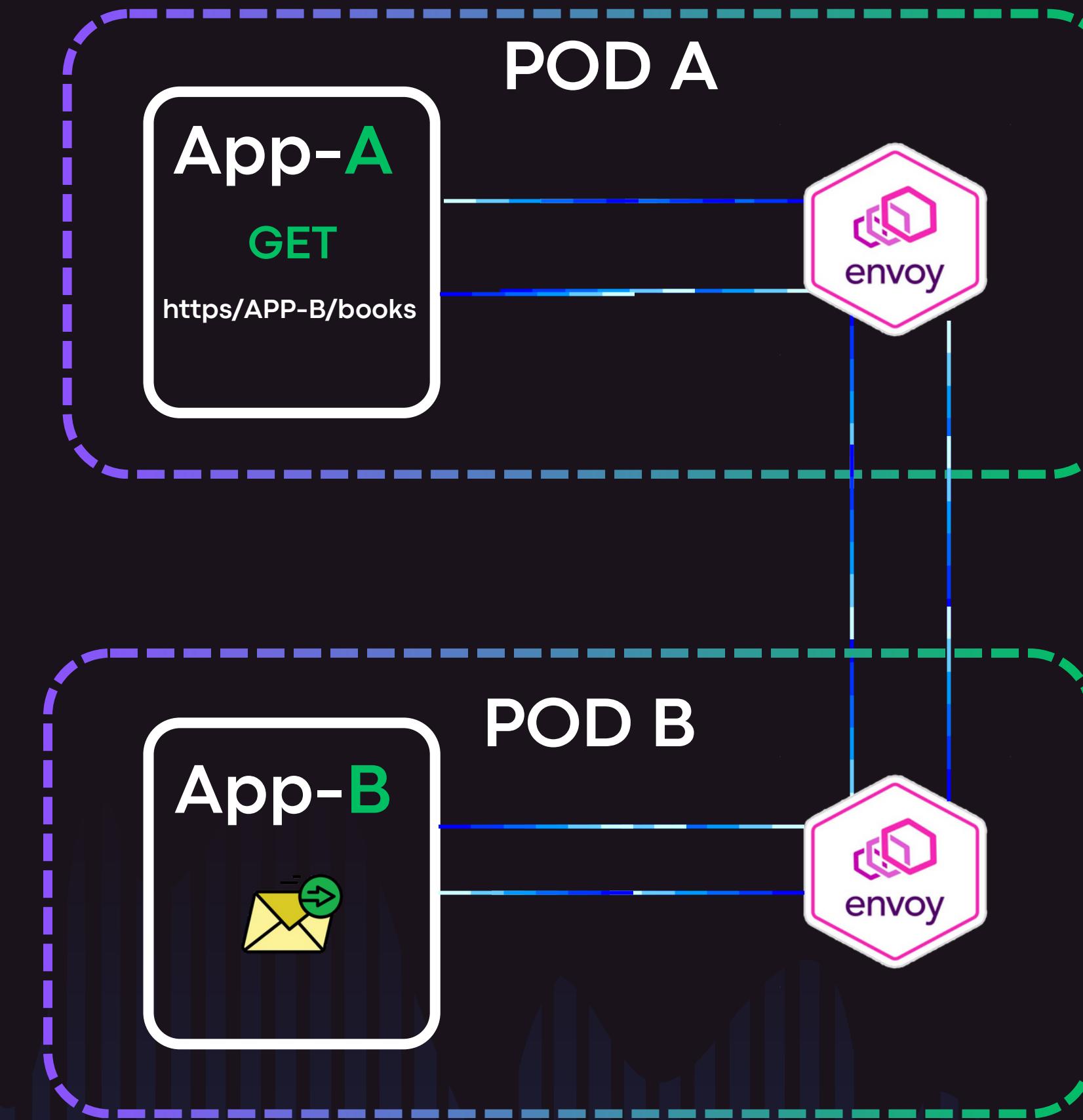


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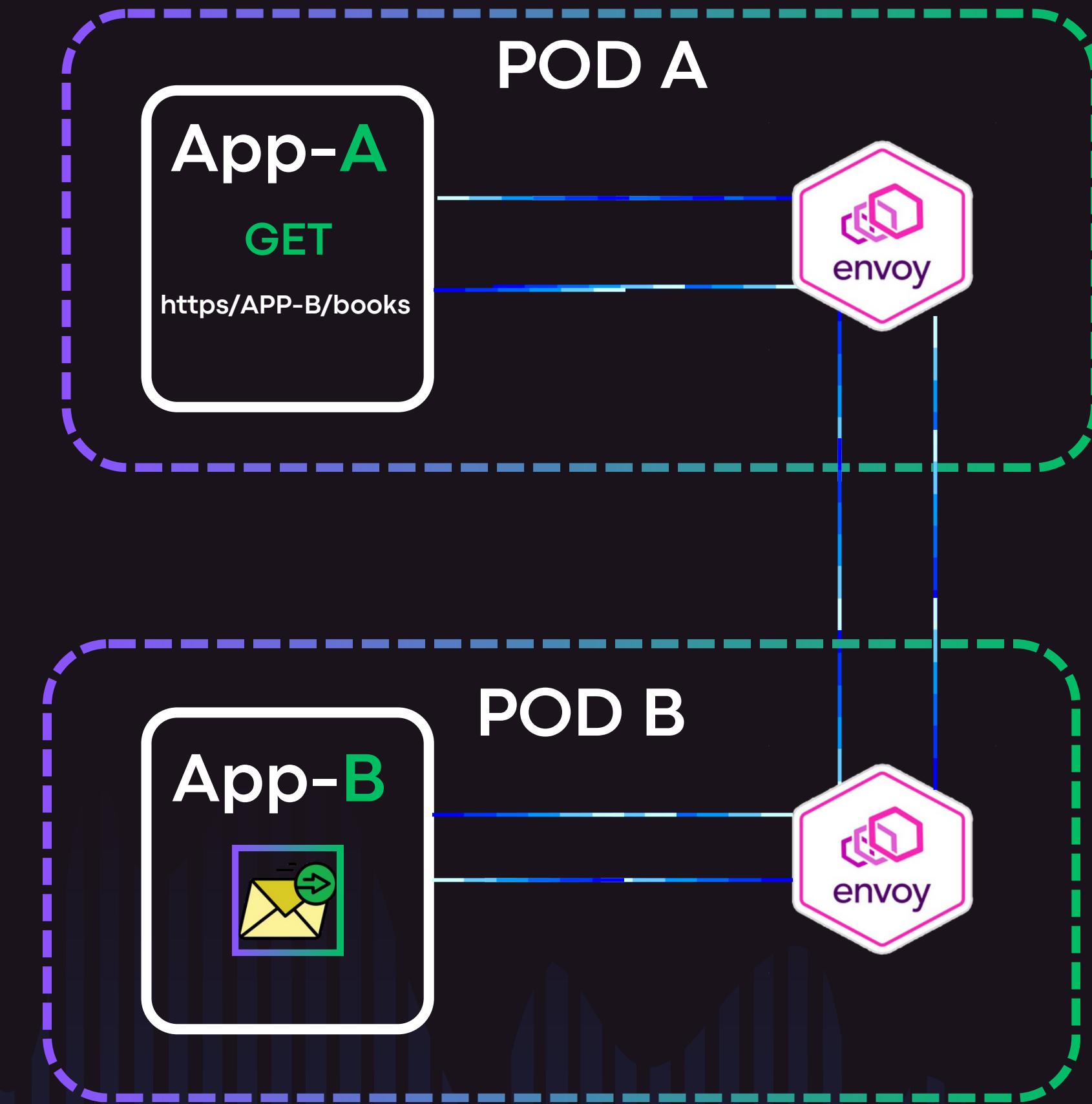


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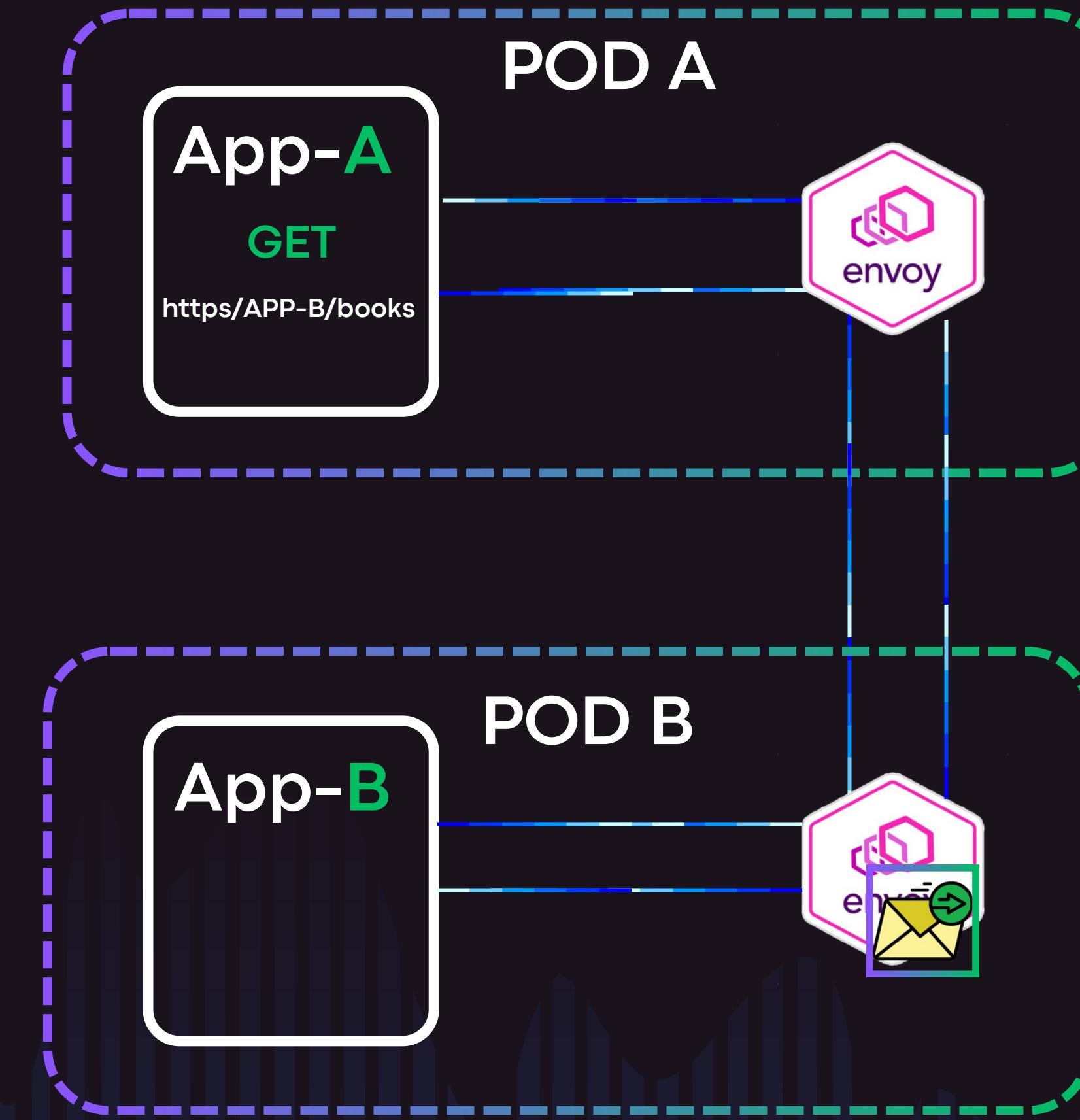


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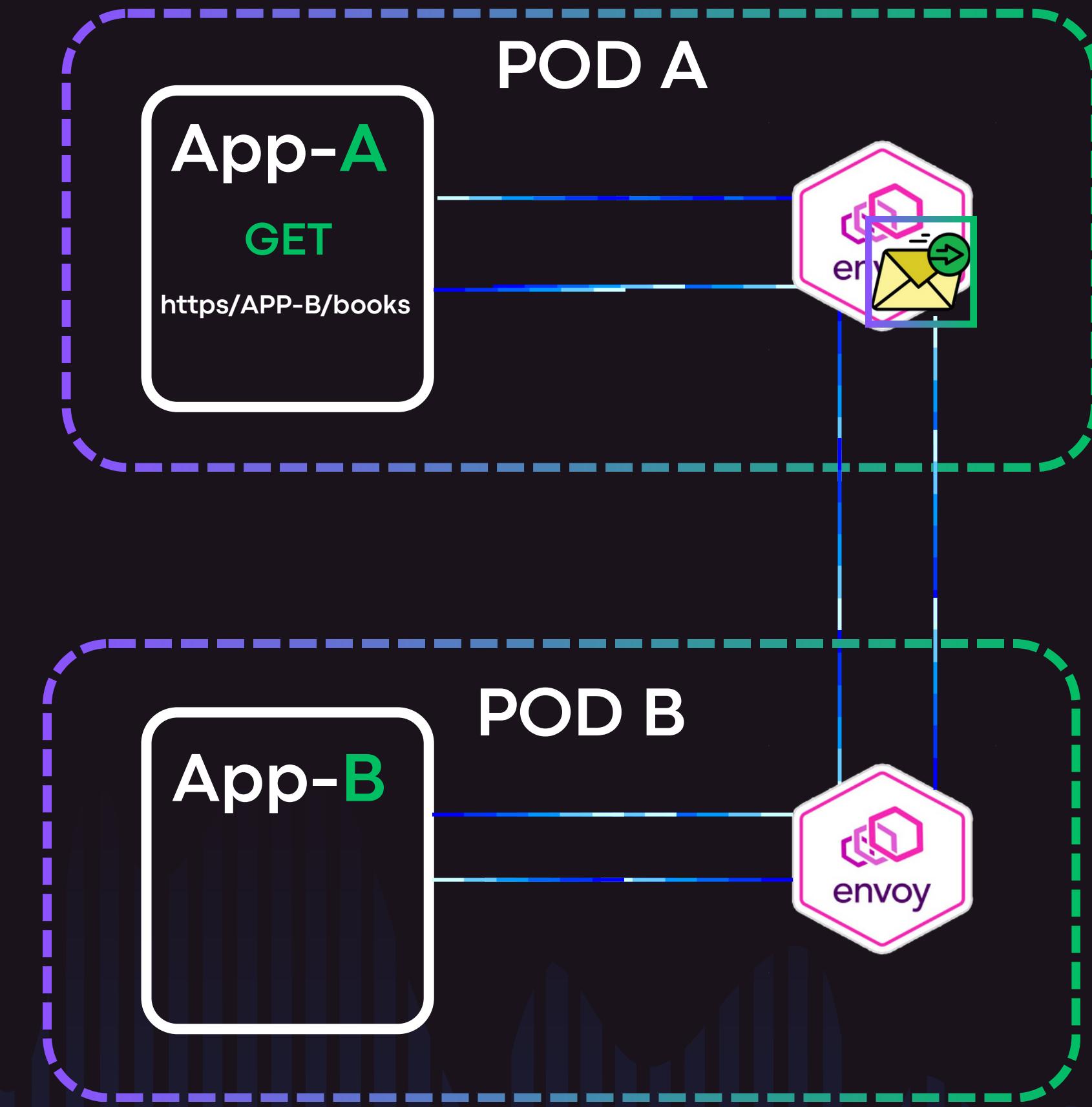


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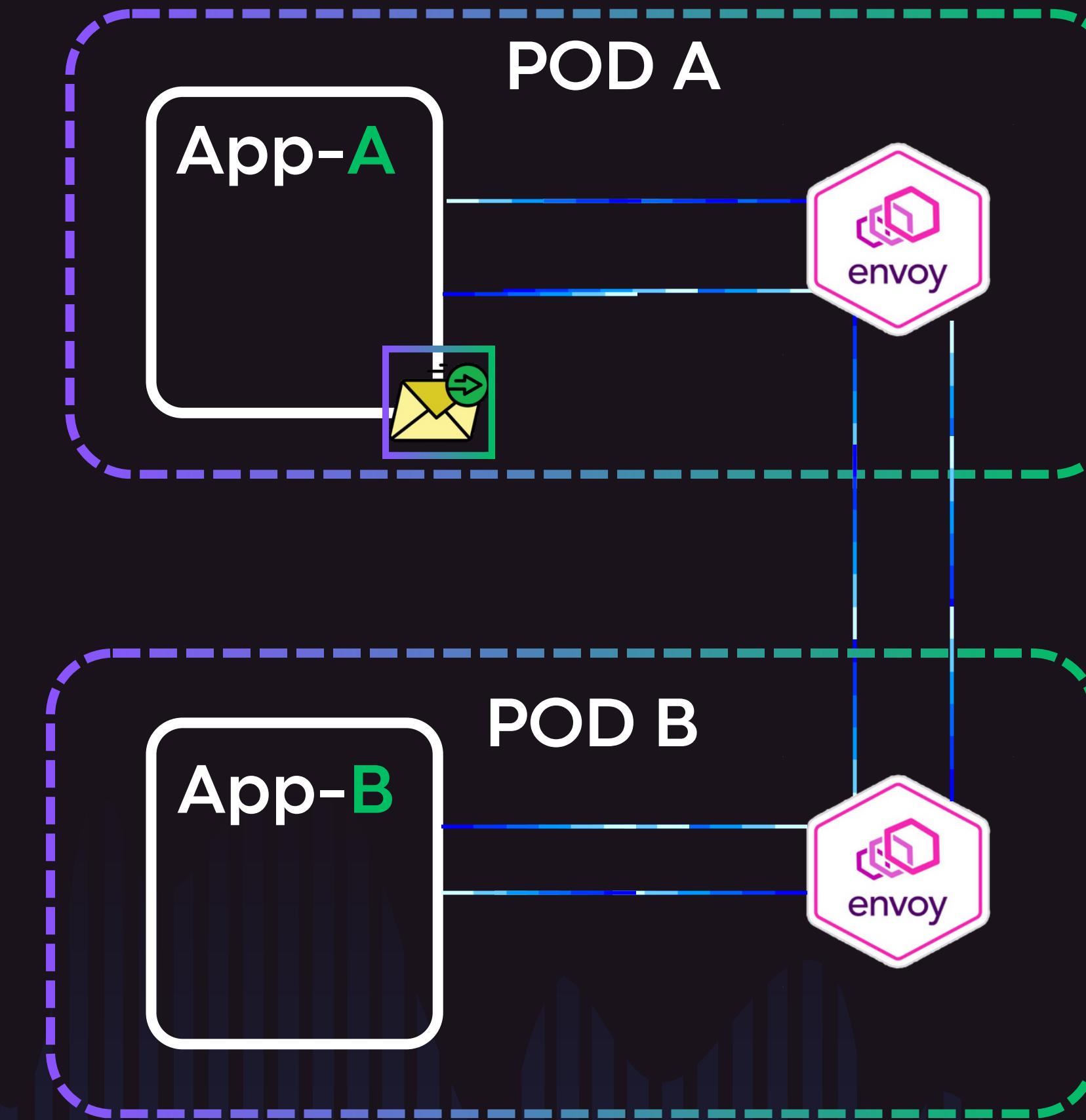


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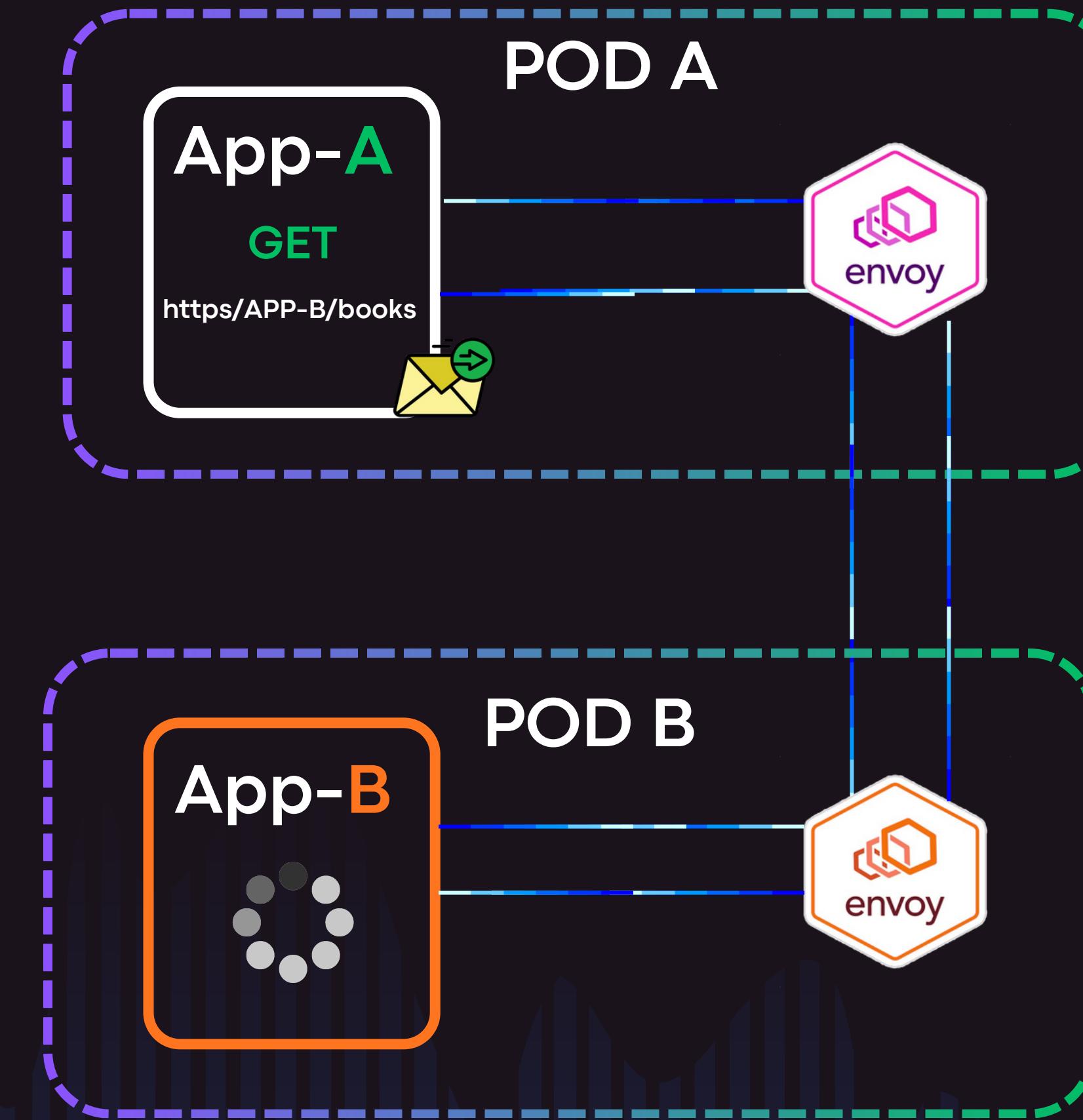


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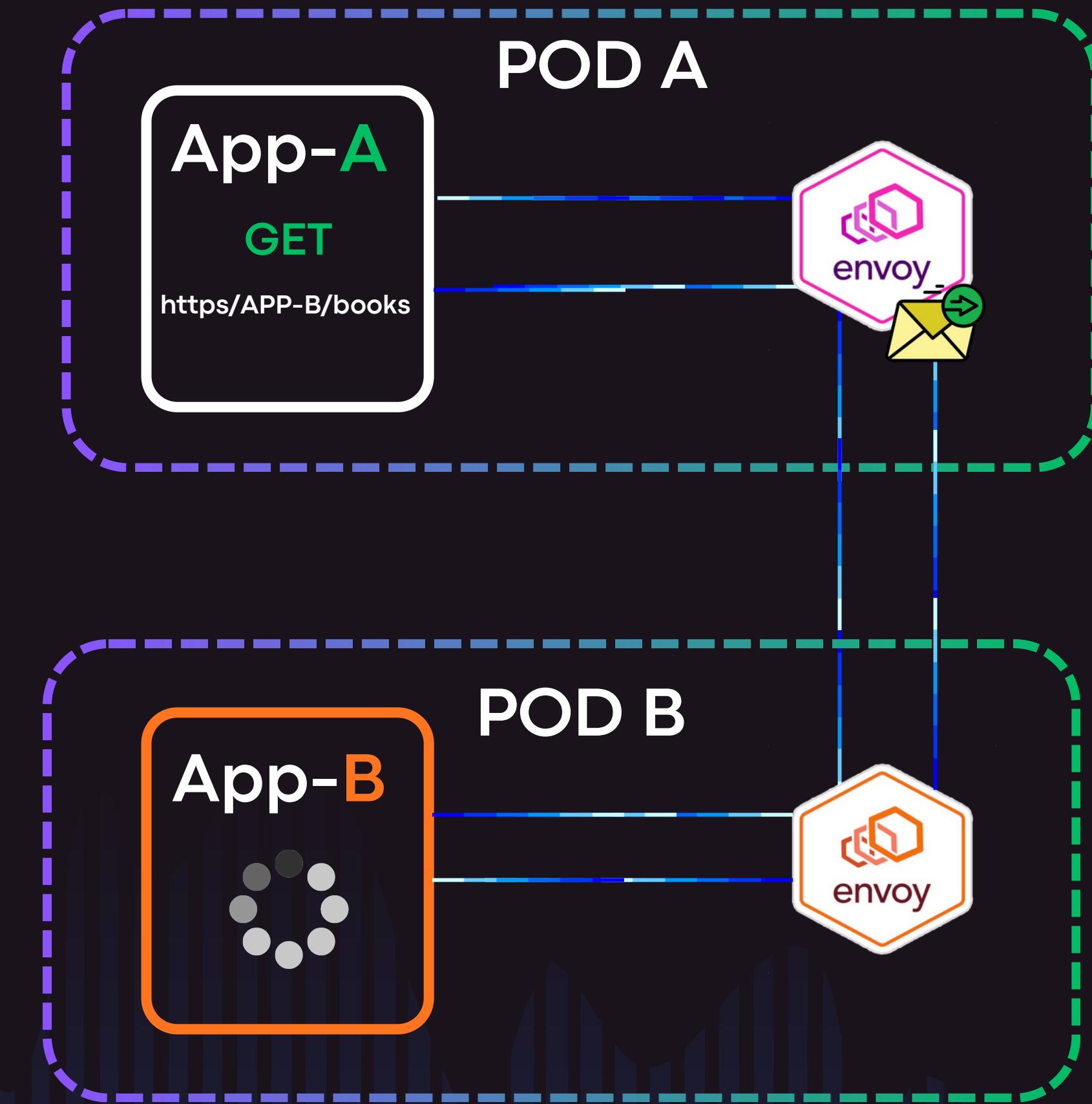


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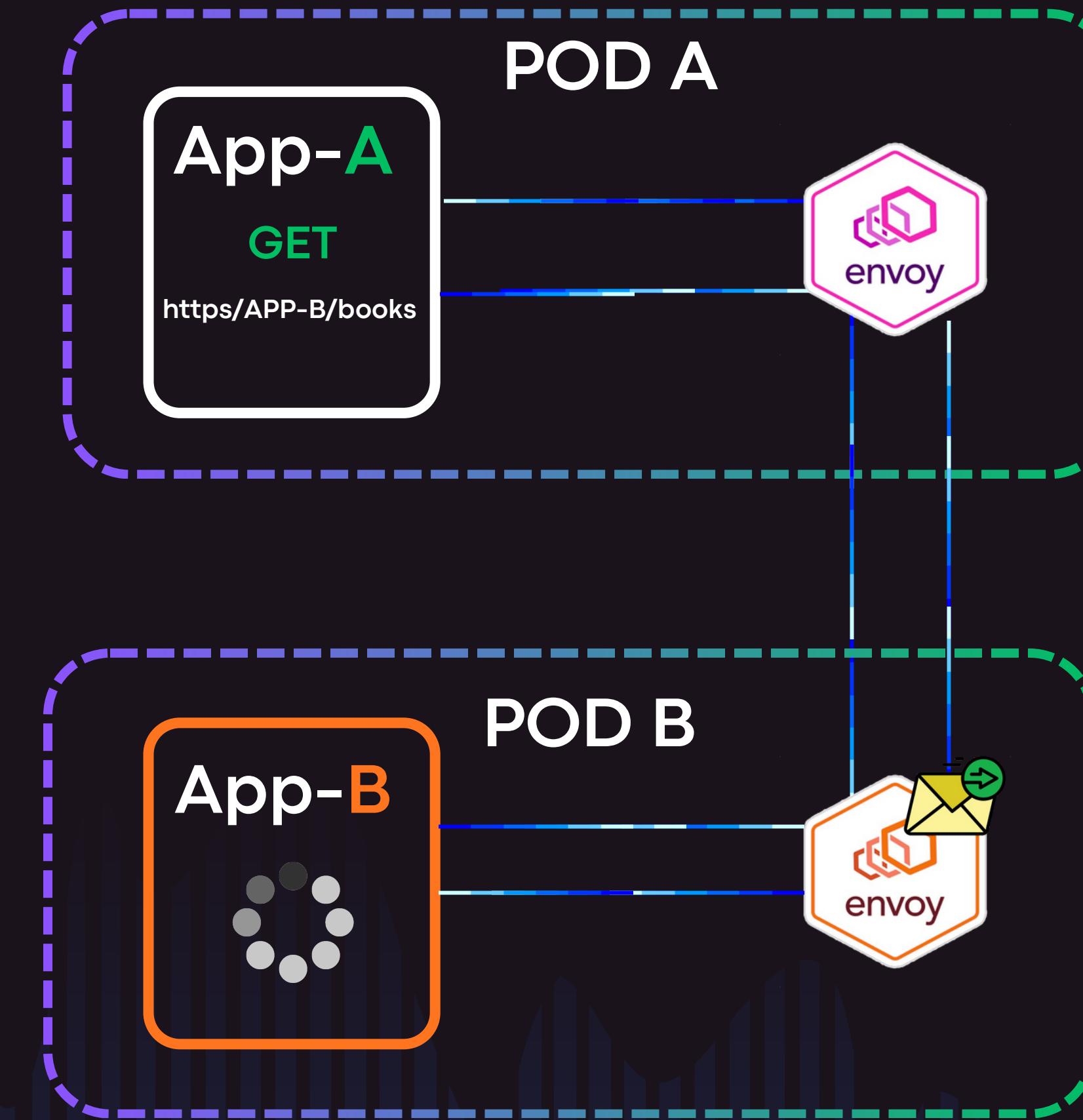


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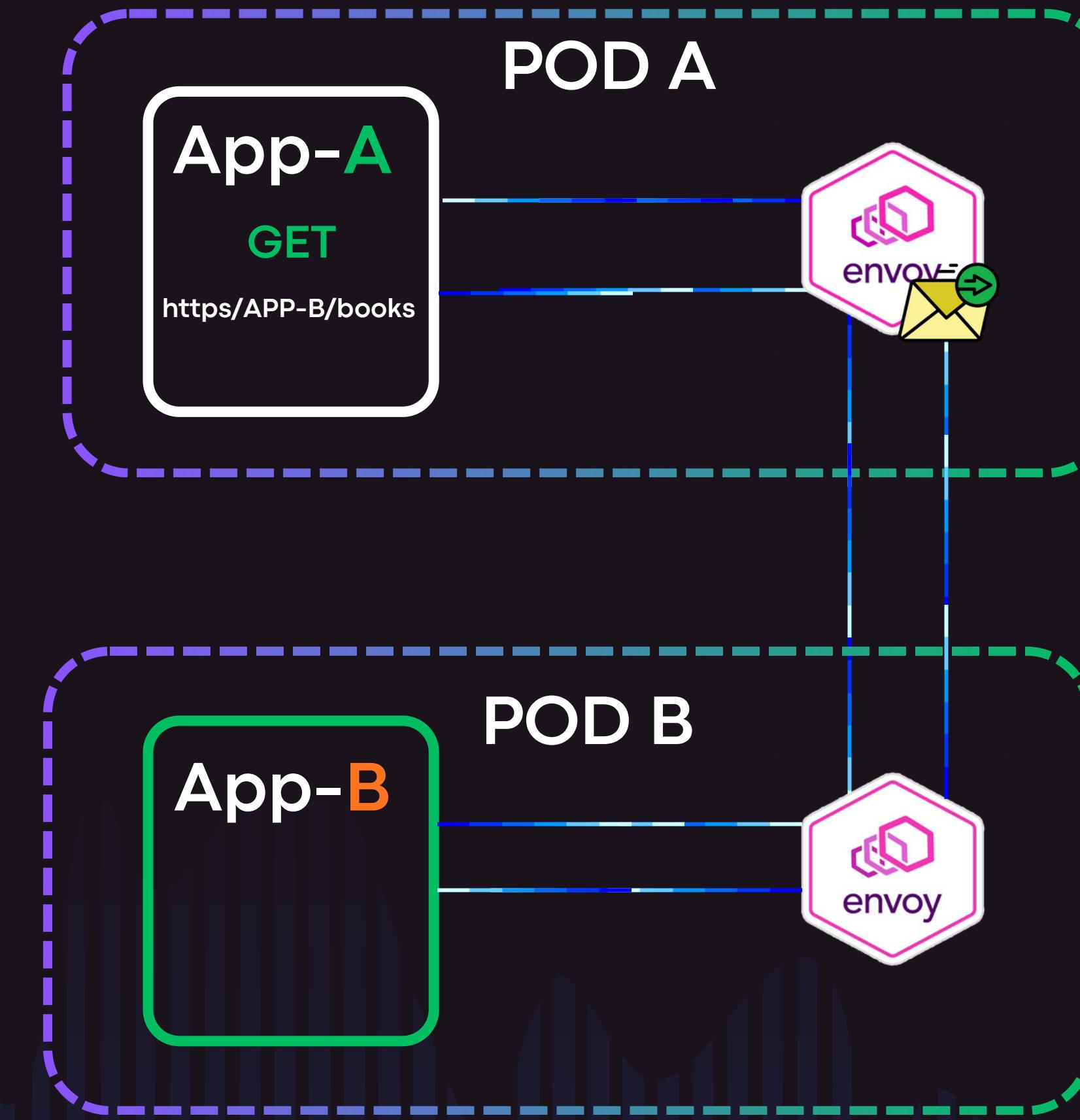


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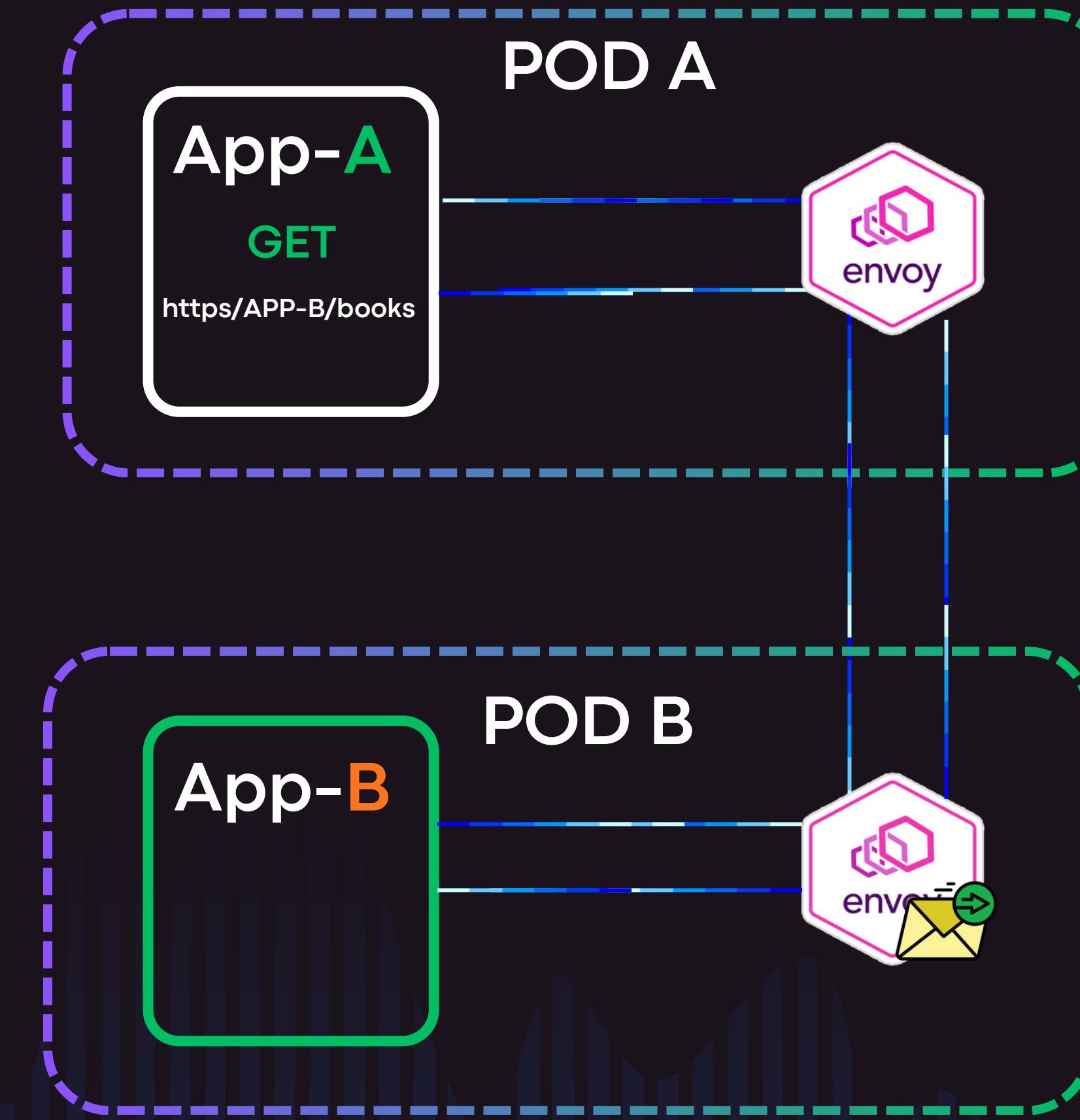


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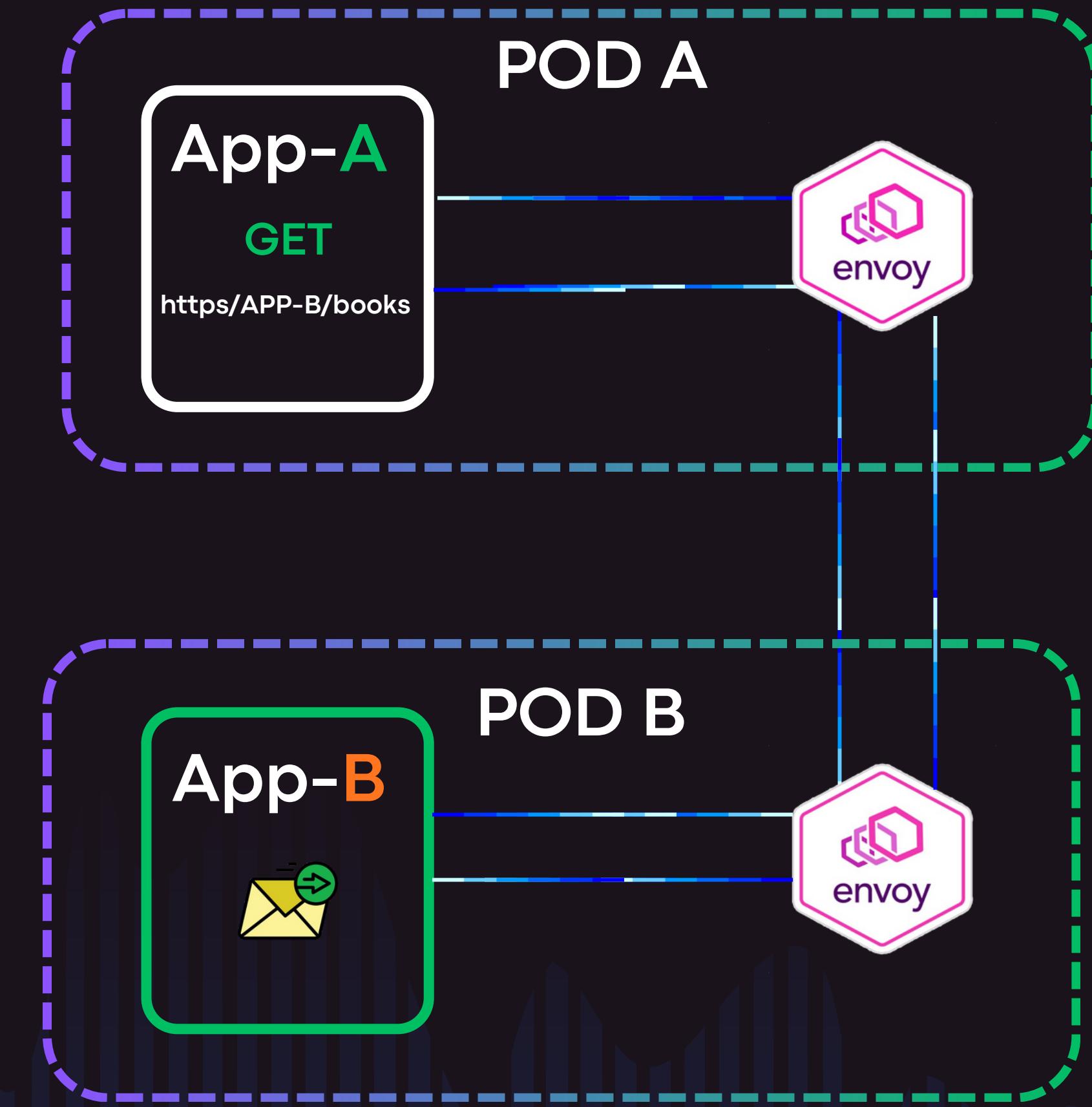


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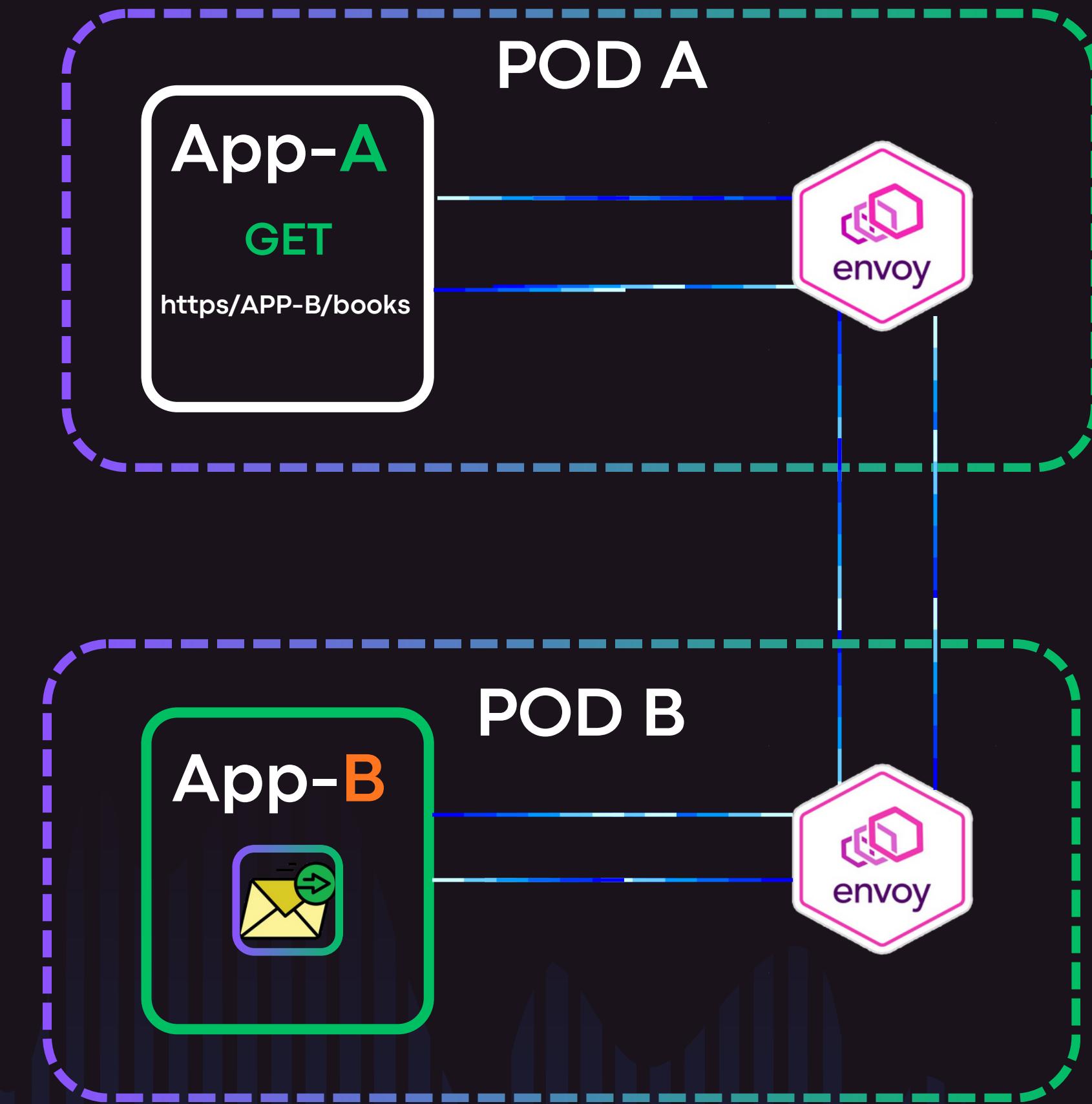


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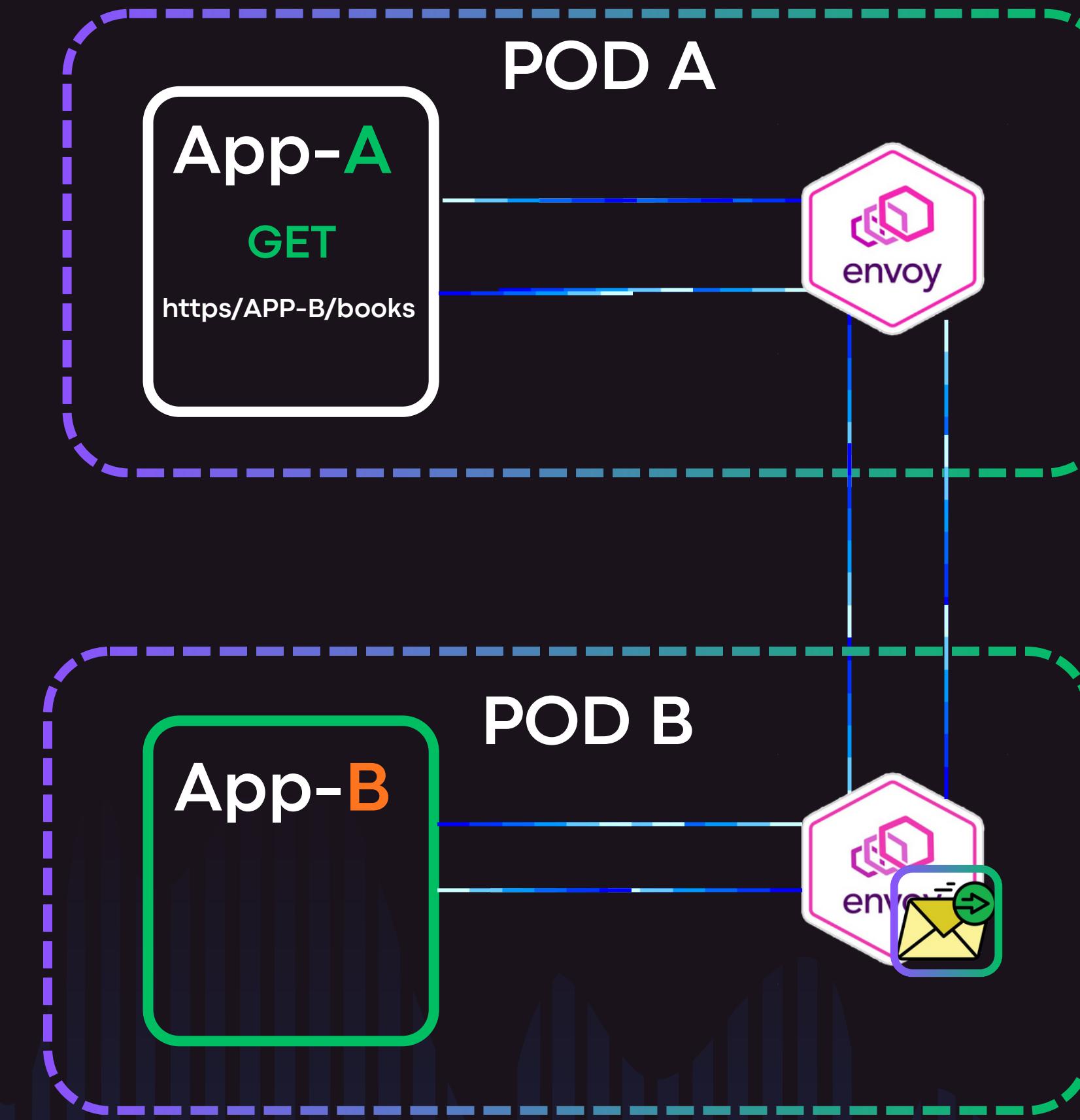


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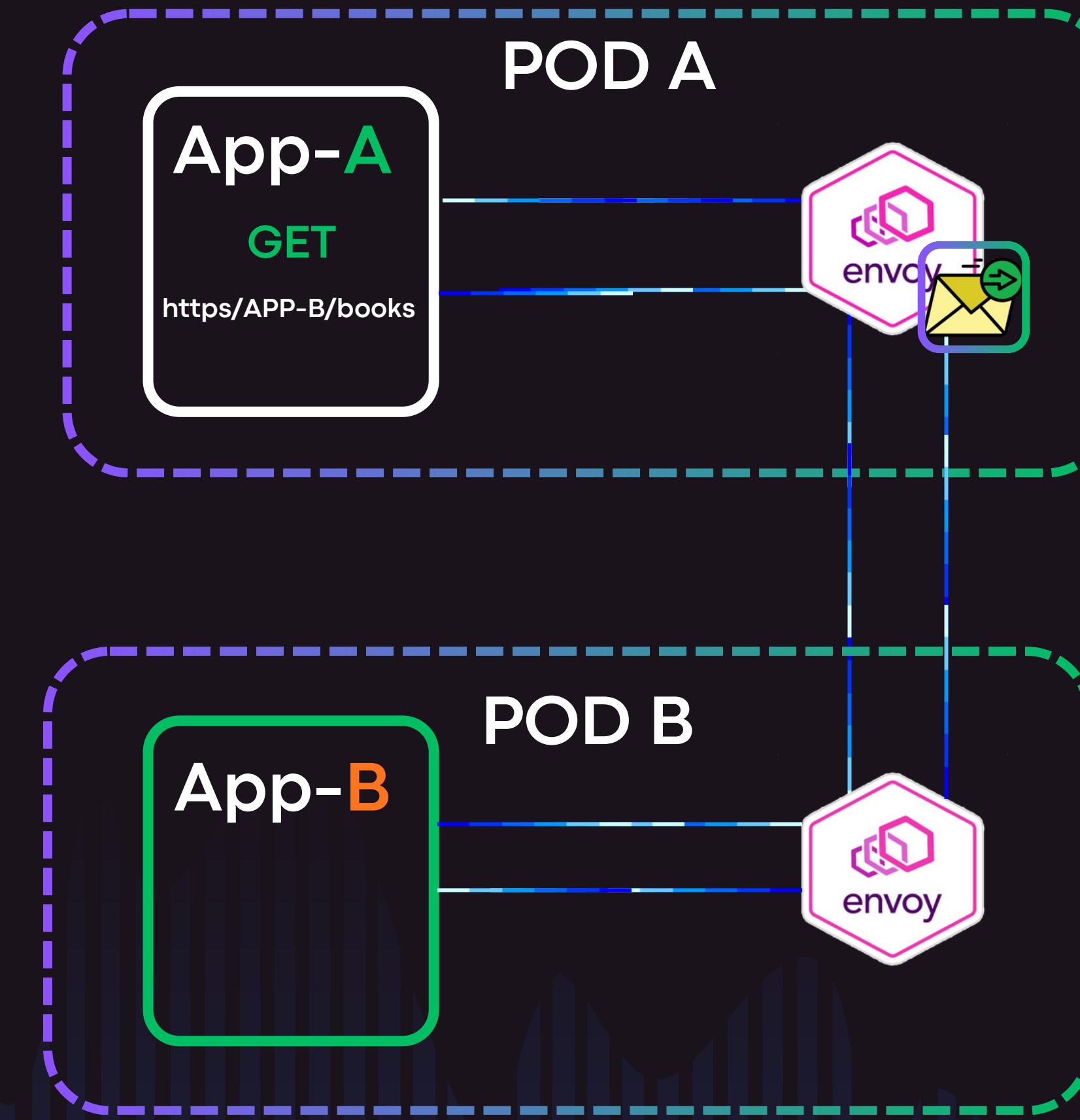


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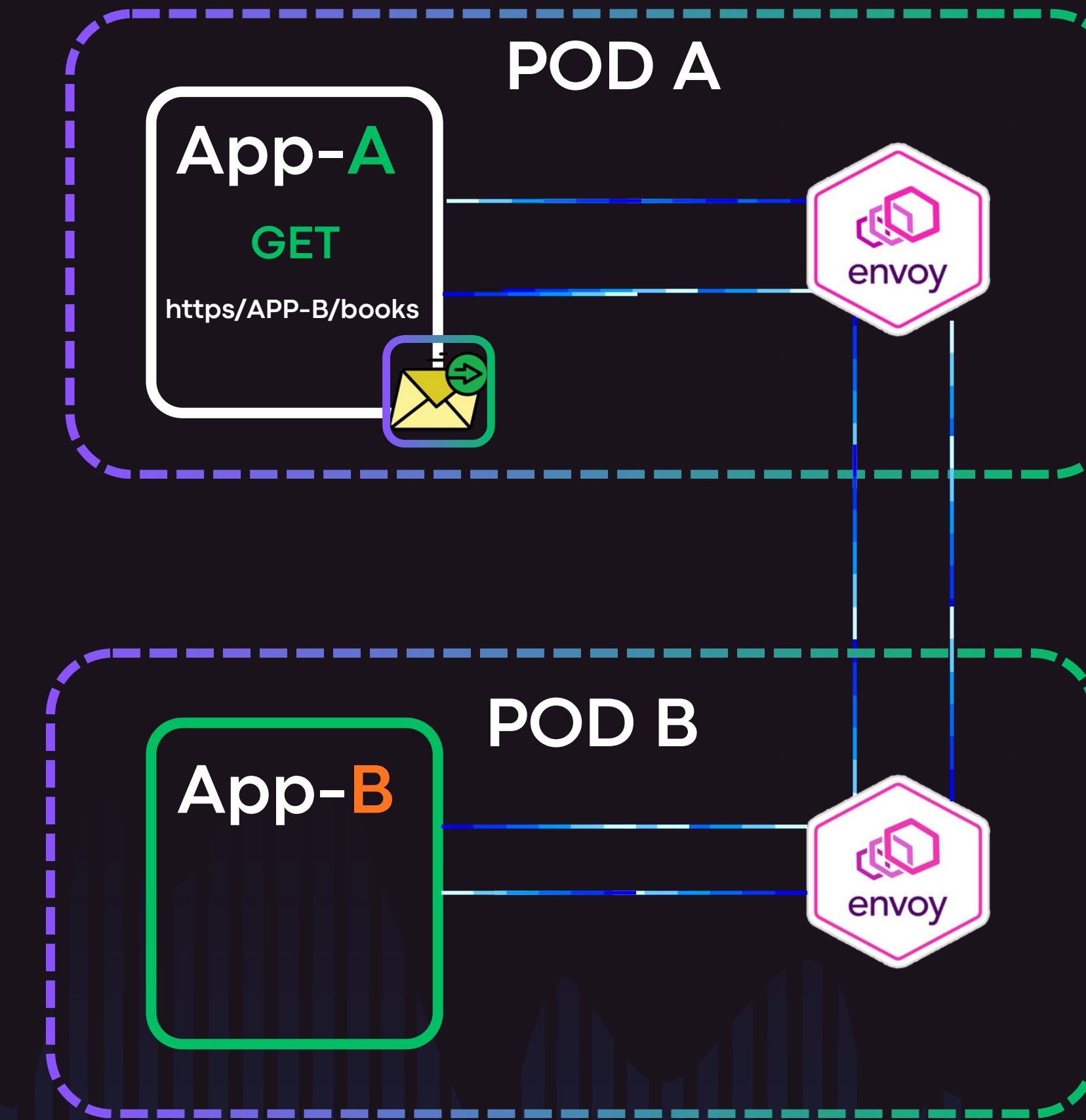


kubernetes (k8s) + Service Mesh





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kubernetes (k8s) + Service Mesh

yaml

```
apiVersion: networking.istio.io/v1beta1
kind: VirtualService
metadata:
  name: my-service-retry
  namespace: default
spec:
  hosts:
  - my-service
  http:
  - route:
    - destination:
        host: my-service
  retries:
    attempts: 5          # Number of retry attempts (default: 2)
    perTryTimeout: 2s    # Timeout per retry attempt
    retryOn: 5xx,reset,connect-failure,refused-stream
    retryRemoteLocalities: true
```

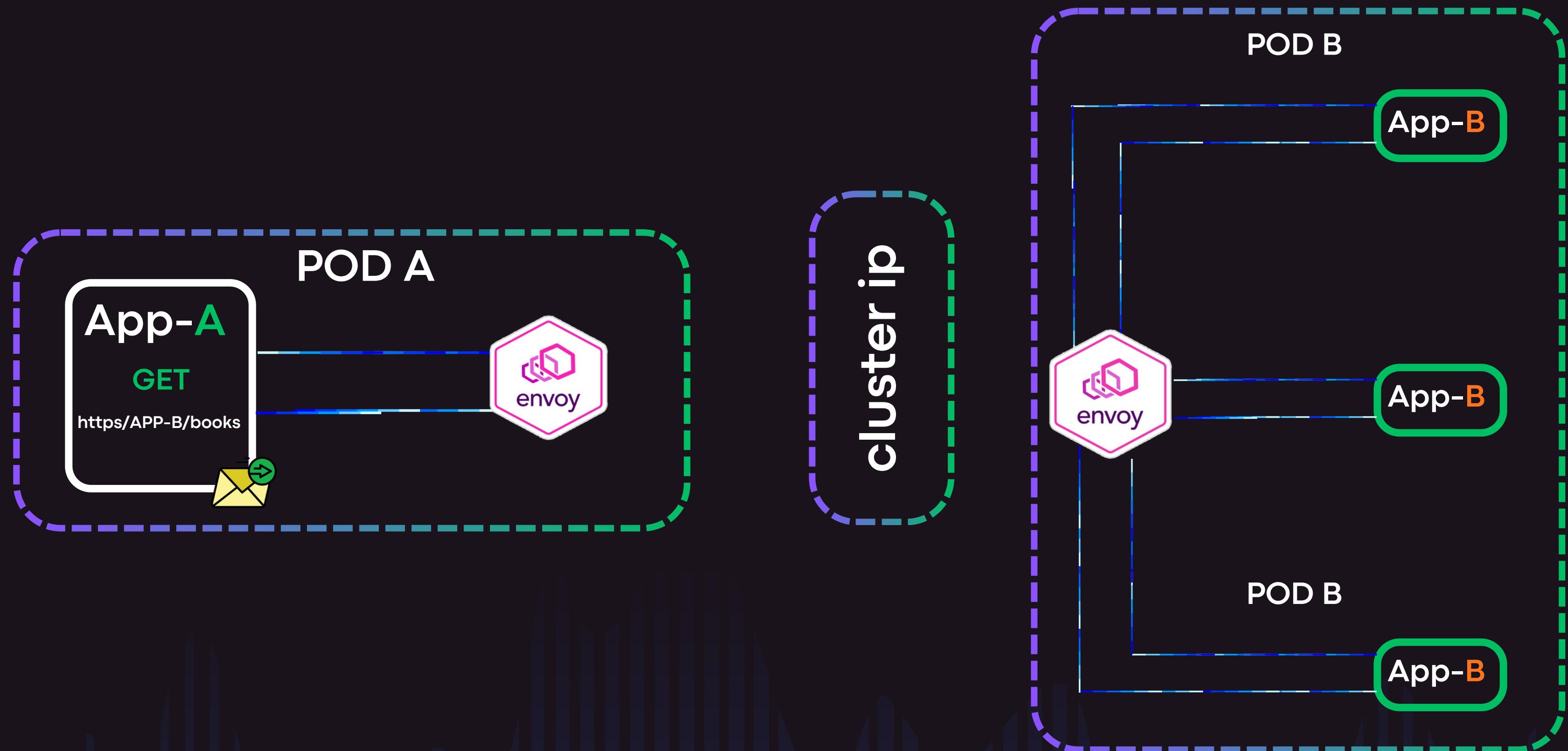


kubernetes (k8s) + Service Mesh

```
retries:  
  attempts: 5          # Number of retry attempts (default: 2)  
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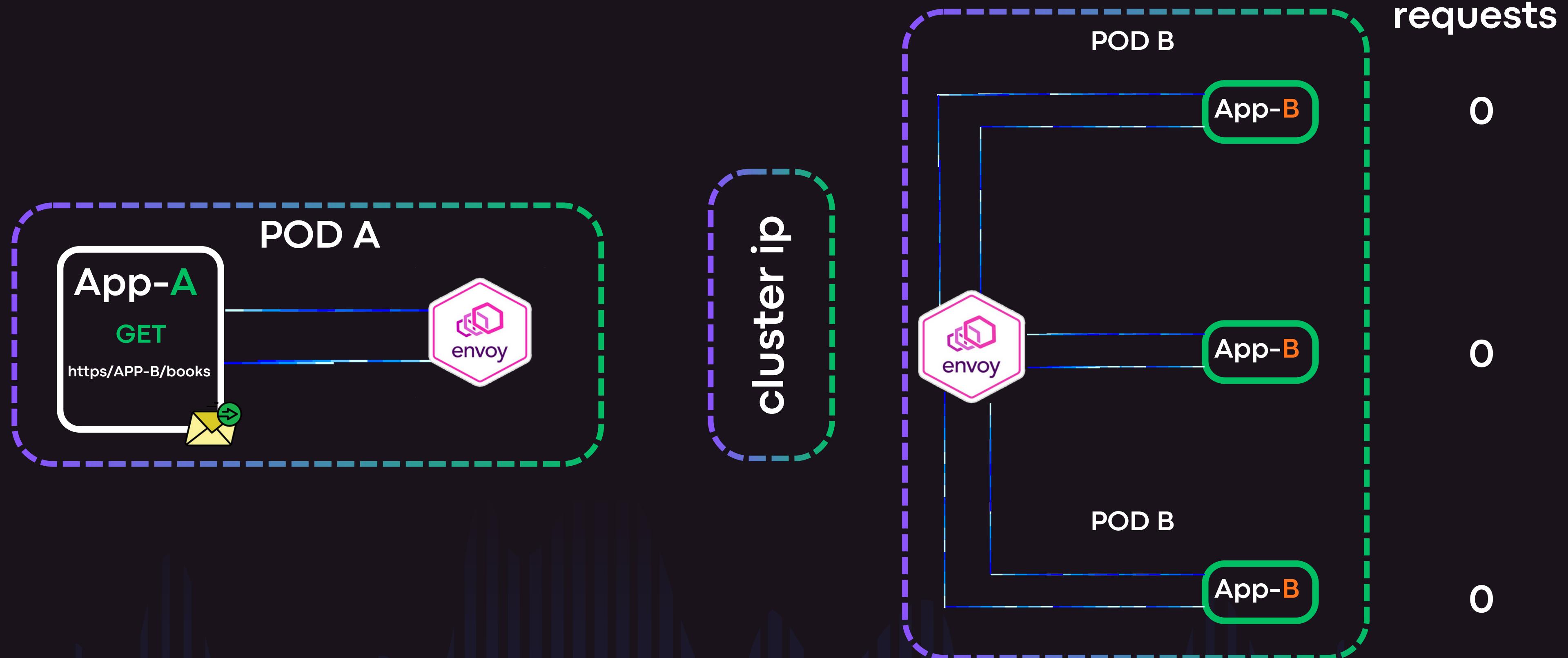


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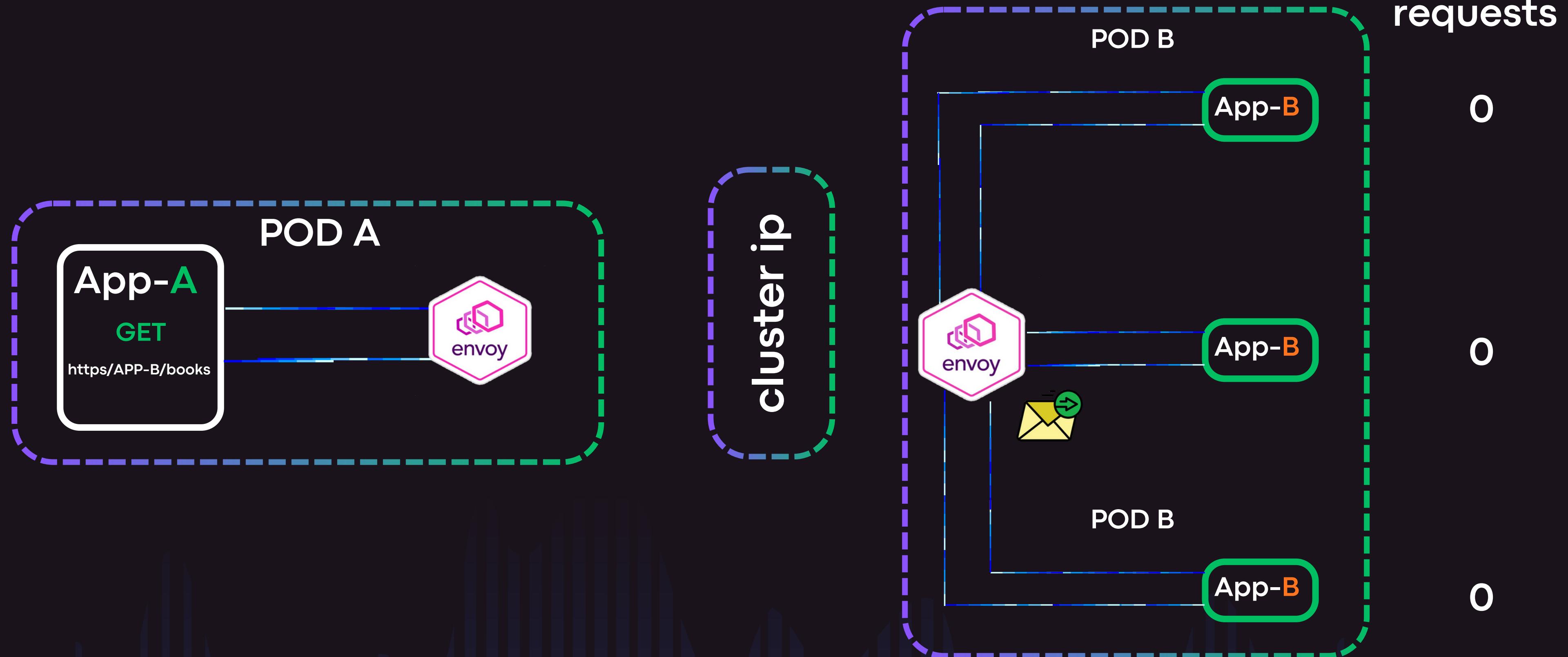


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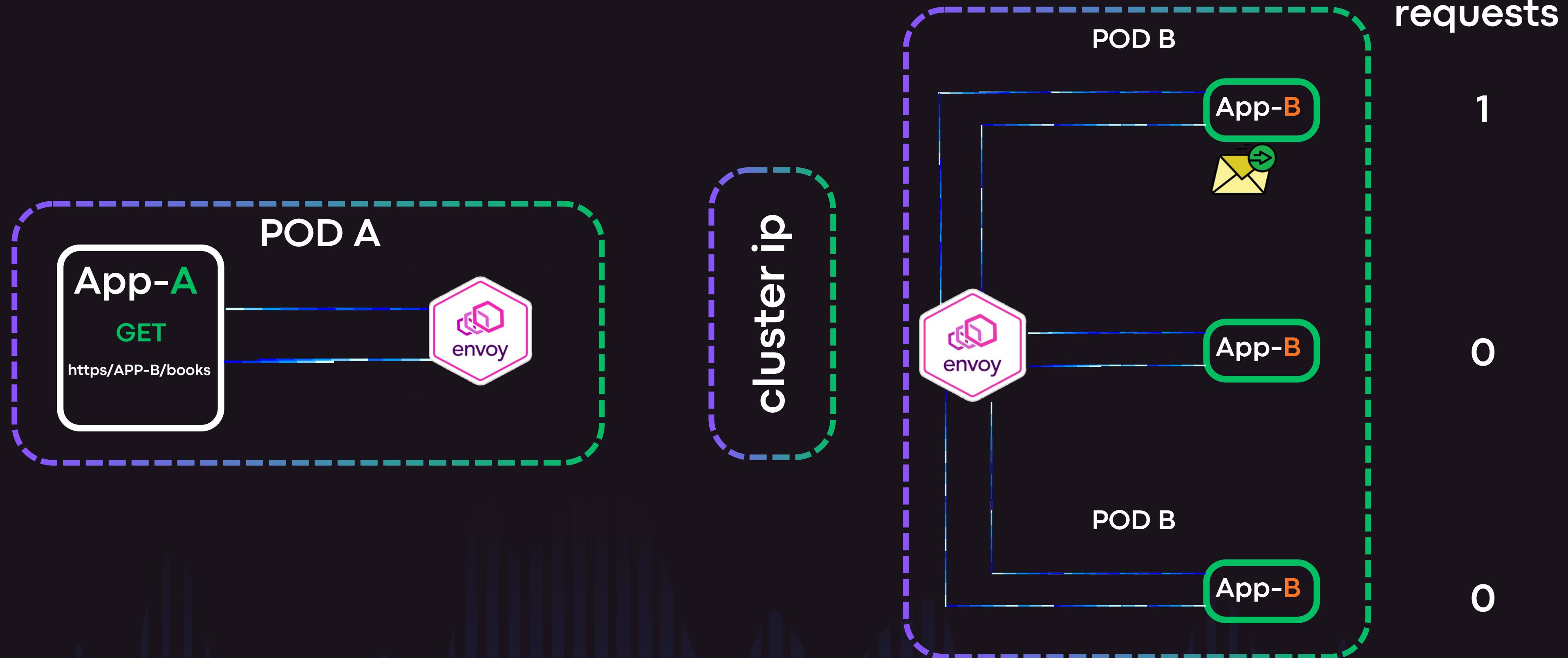


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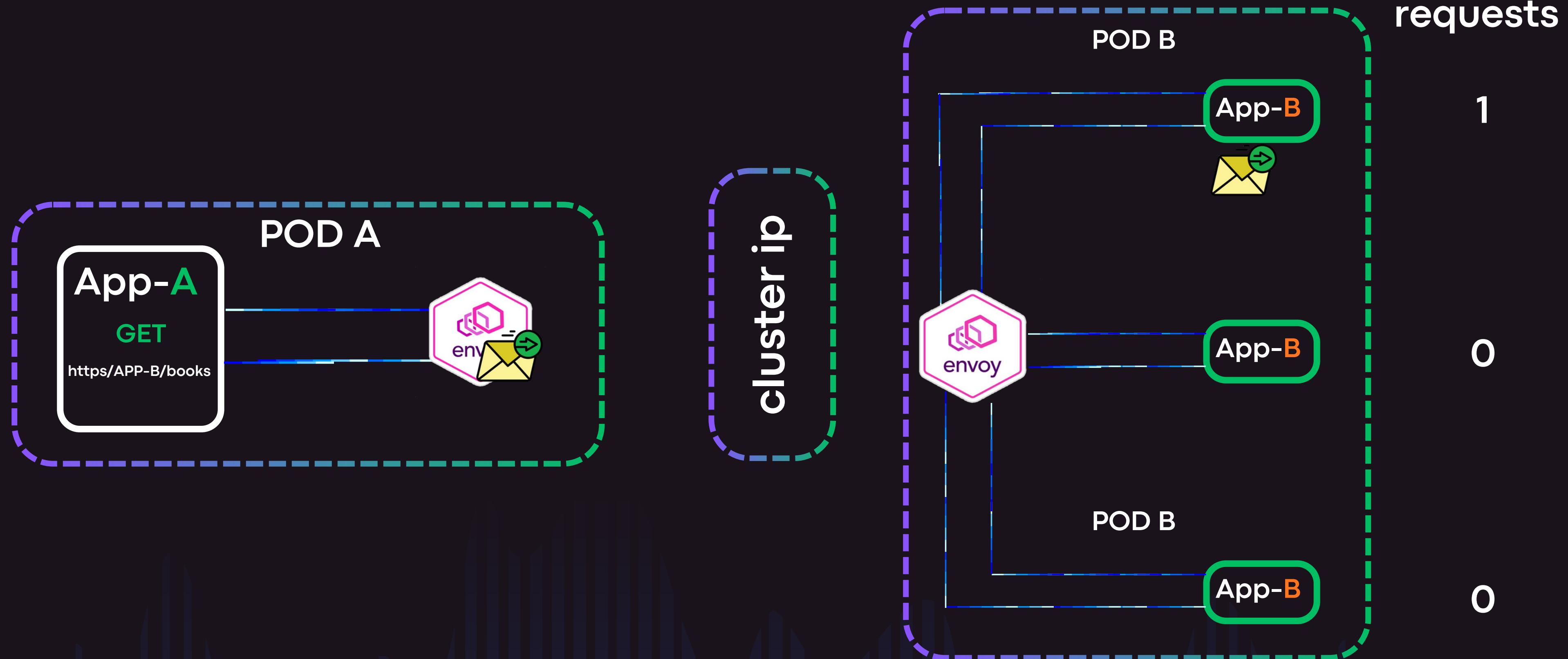


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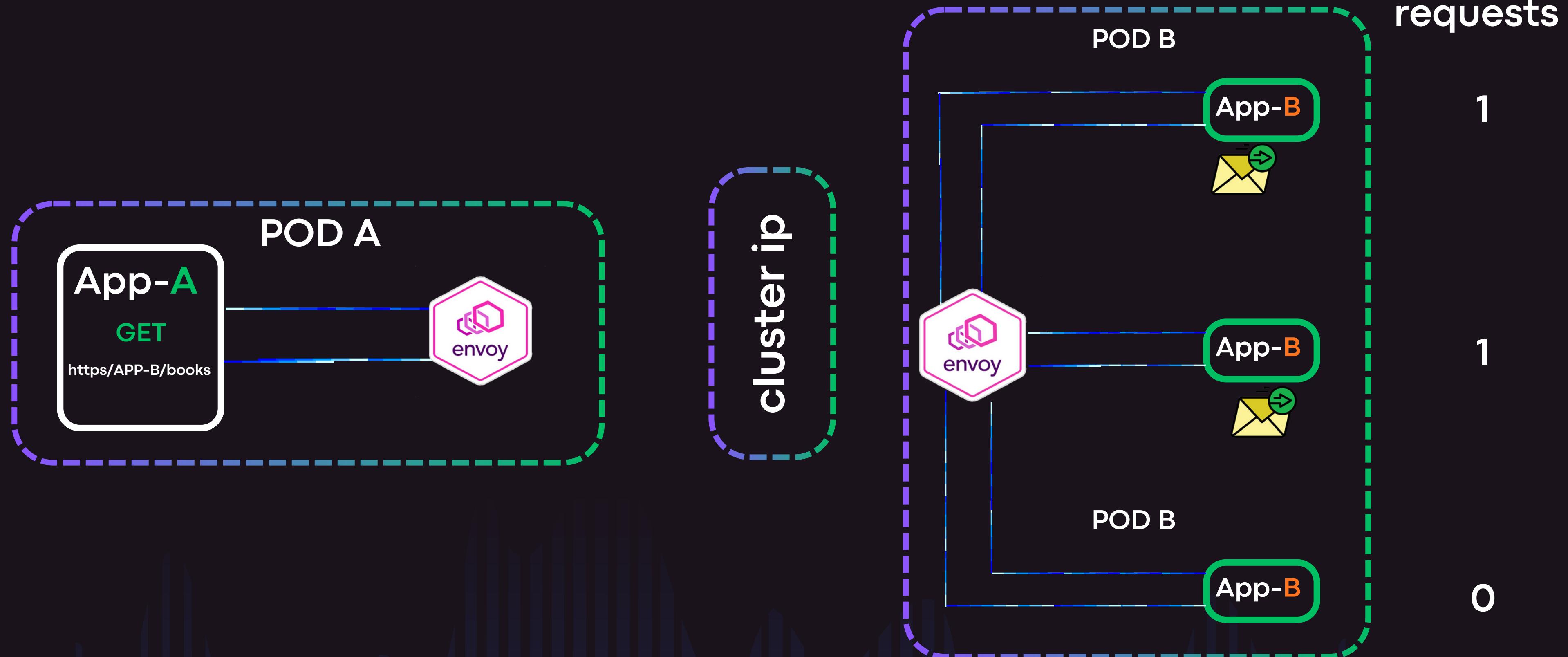


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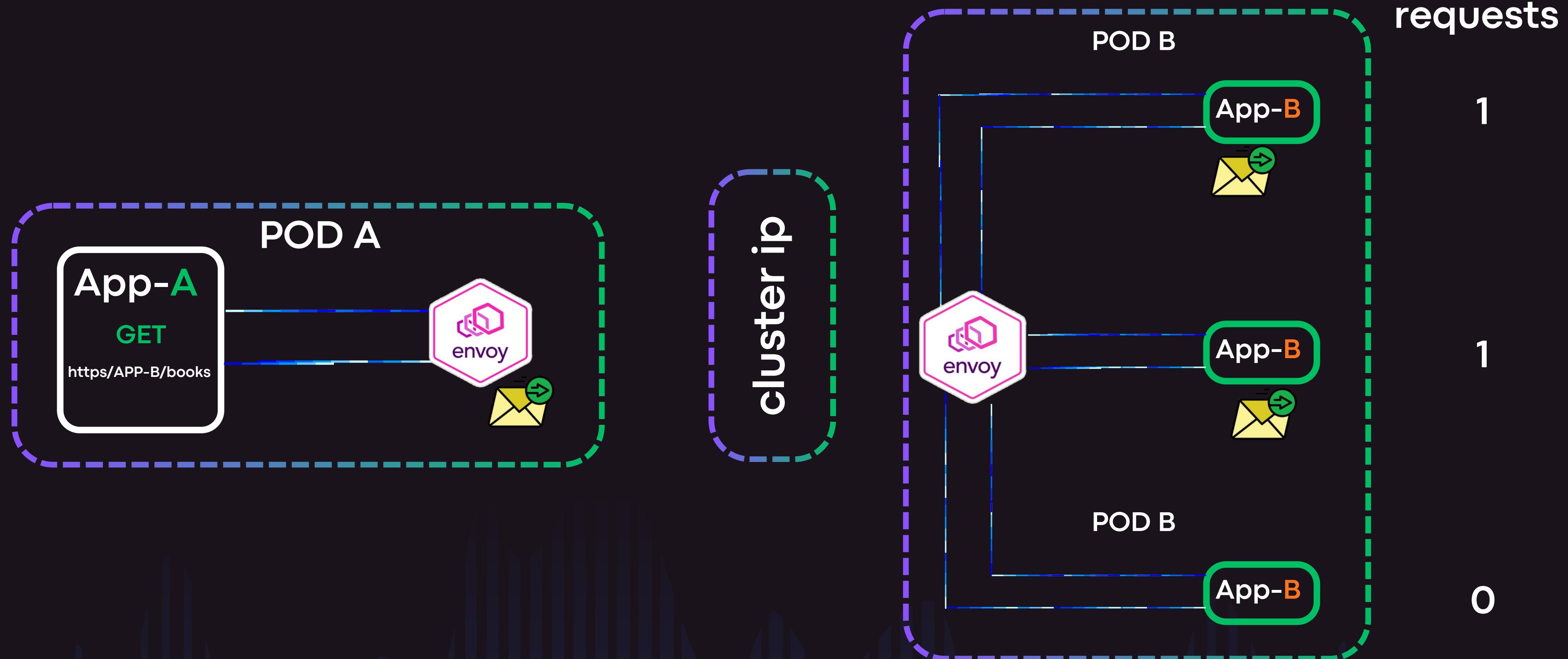


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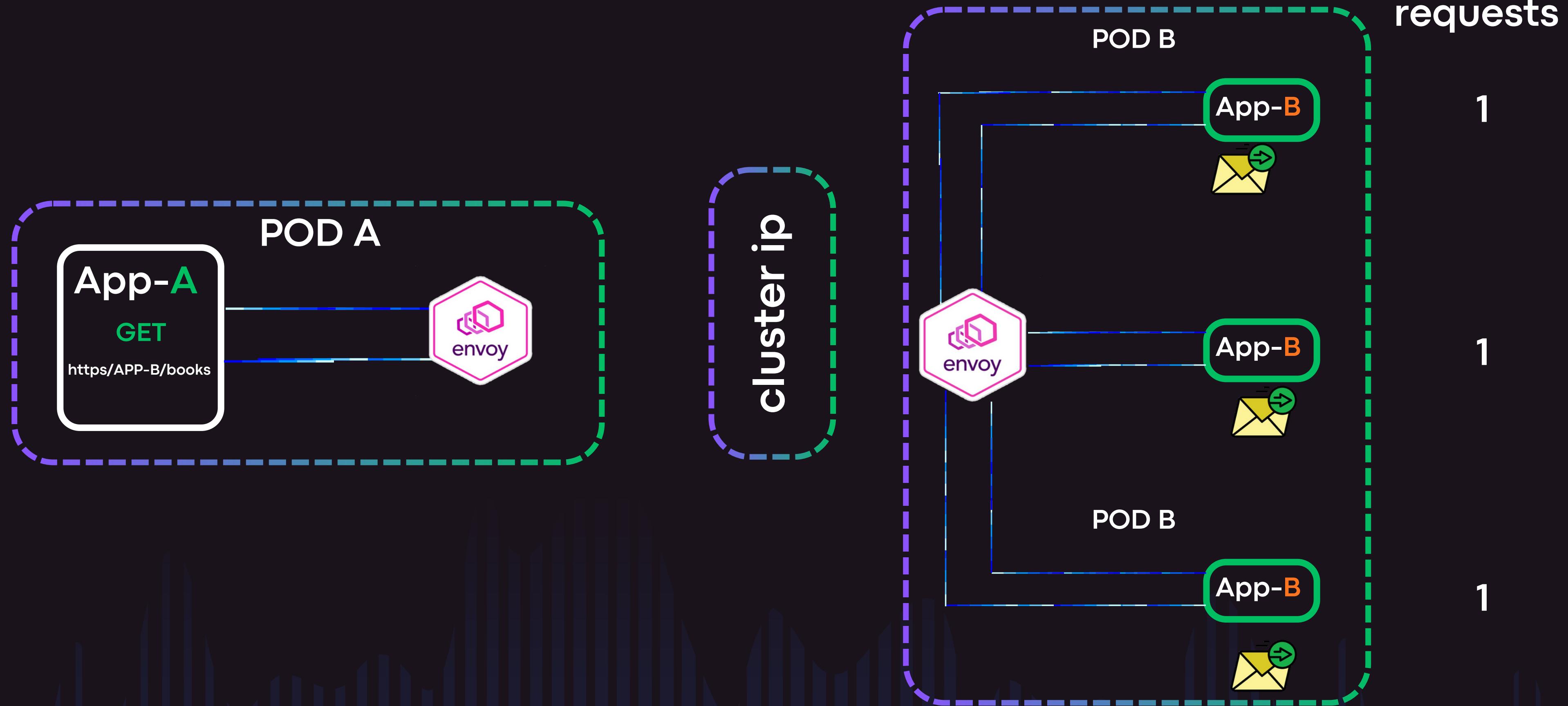


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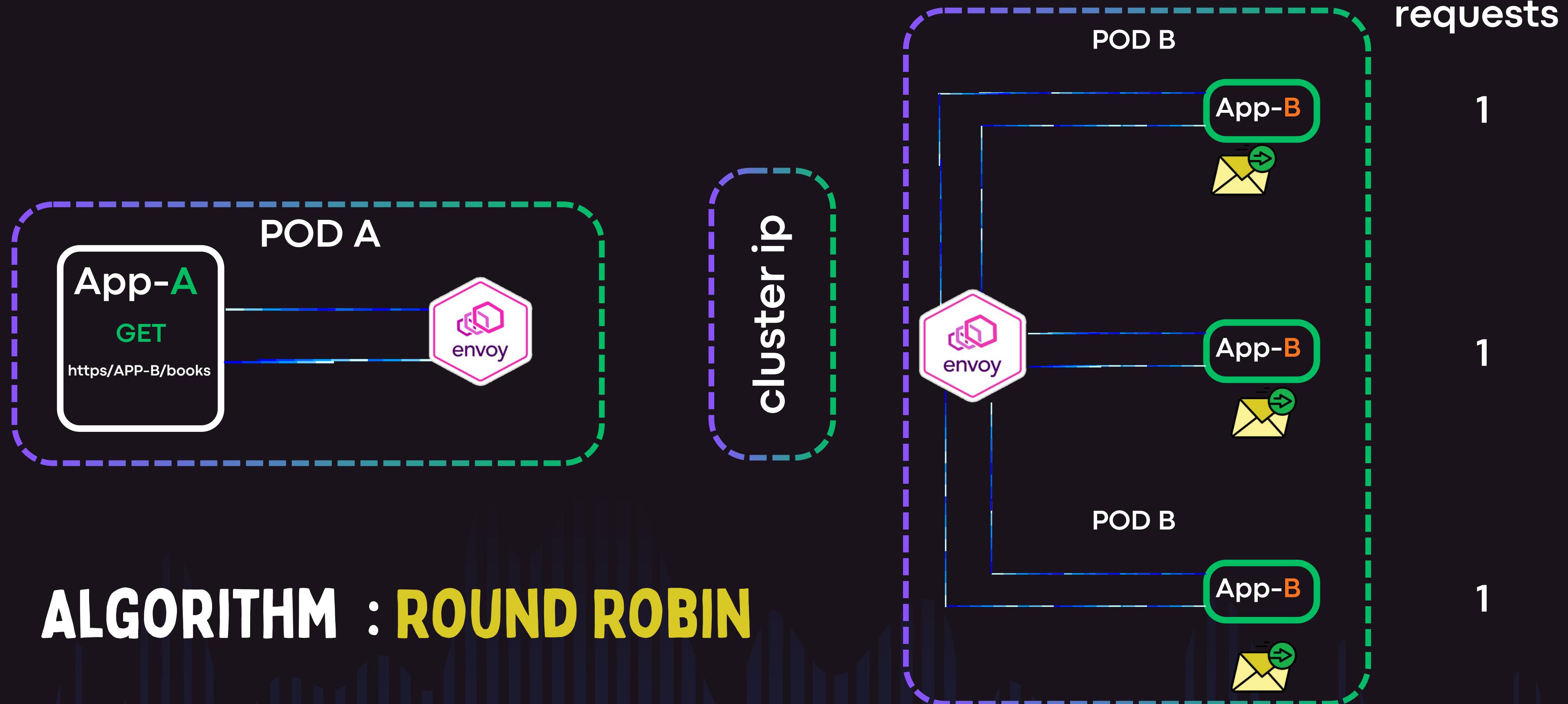


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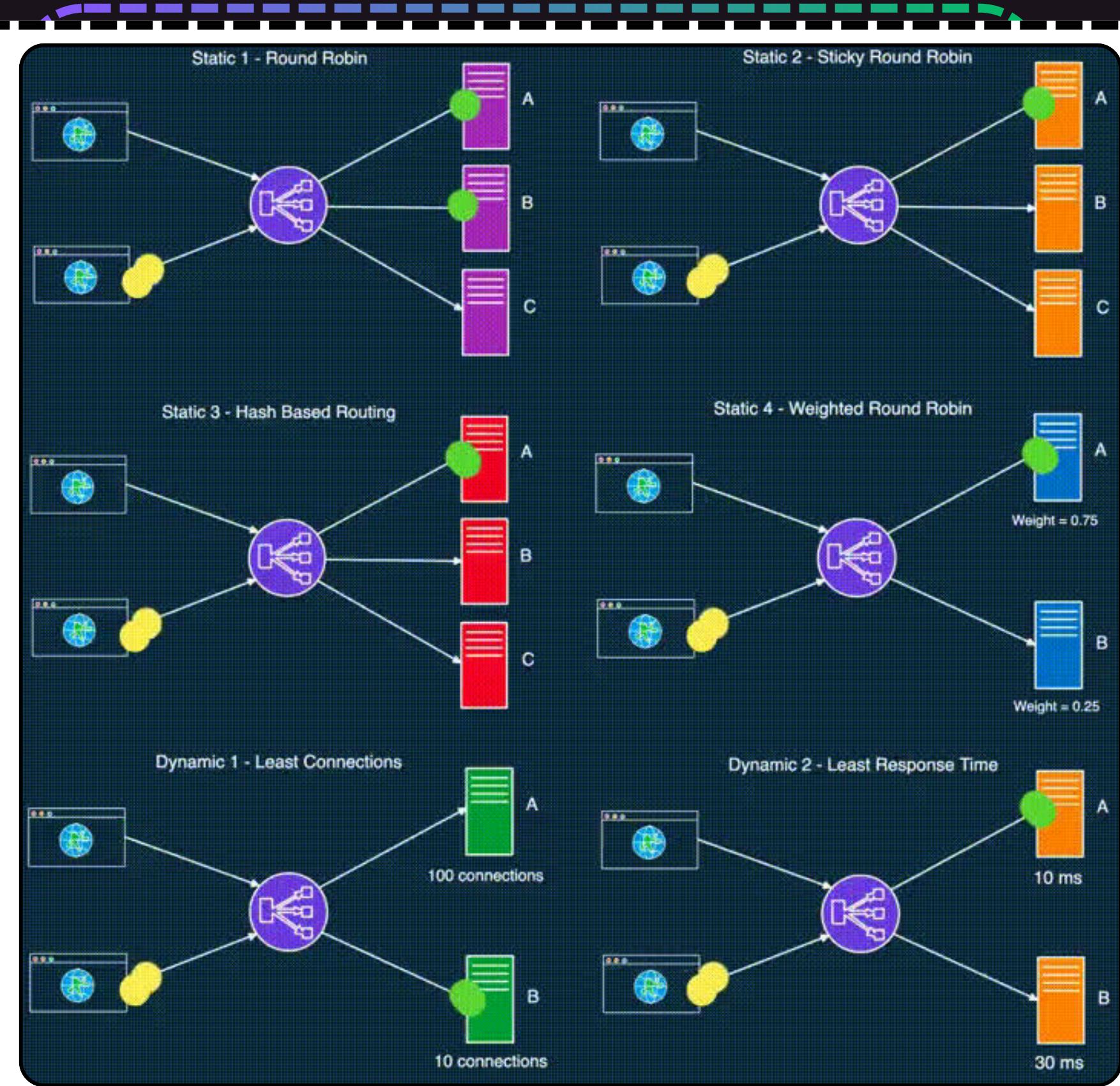


kubernetes (k8s) + Service Mesh





kubernetes (k8s) + Service Mesh





kubernetes (k8s) + Service Mesh

.yaml

```
apiVersion: networking.istio.io/v1beta1
kind: DestinationRule
metadata:
  name: round-robin-lb
spec:
  host: backend-service
  trafficPolicy:
    loadBalancer:
      simple: ROUND_ROBIN
```



kubernetes (k8s) + Service Mesh

Feature	Without Istio	With Istio
Load Balancing Layer	Layer 4 (TCP)	Layer 7 (HTTP)
Algorithms	Random, basic Round Robin	ROUND_ROBIN, RANDOM, LEAST_REQUEST, CONSISTENT_HASH
Session Affinity	ClientIP only	By HTTP header, cookie, source IP
Circuit Breaking	✗ No	✓ Yes
Request Retries	✗ No	✓ Yes
Timeouts	TCP only	HTTP request/idle timeouts
Fault Injection	✗ No	✓ Yes (delay, abort)
Traffic Splitting	✗ No	✓ Yes (A/B testing, canary)
Header-based Routing	✗ No	✓ Yes
Path-based Routing	✗ No	✓ Yes
Request Mirroring	✗ No	✓ Yes

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