Bare metal cluster with Kubernetes, Istio & MetalLB

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VietKubers

Who are we?

💼 Software Engineers **Fujitsu Vietnam**

📝 Organizers of **VietKubers** <https://vietkubers.github.io>

📝 Organizers of GDG Cloud Hanoi

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@annp87

Agenda

Kubernetes - Cluster

MetalLB - Load balancer

Istio - Service Mesh

Demo - Hands on

Kubernetes - Cluster

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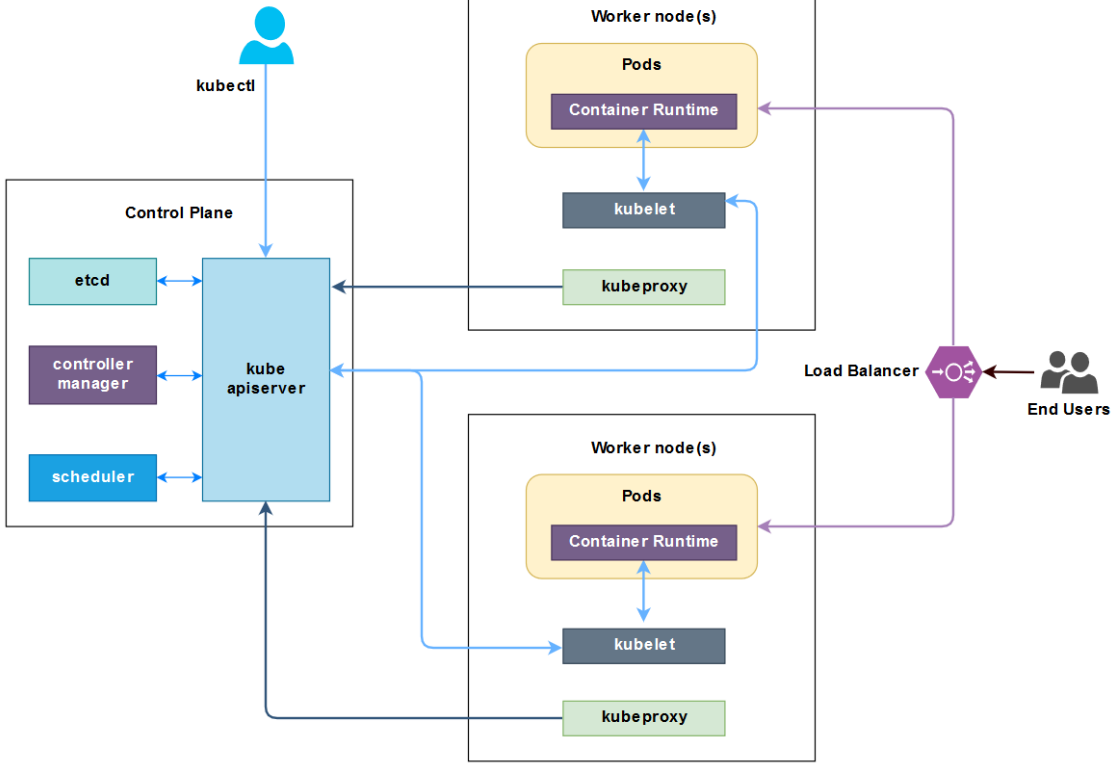
Kubernetes architecture

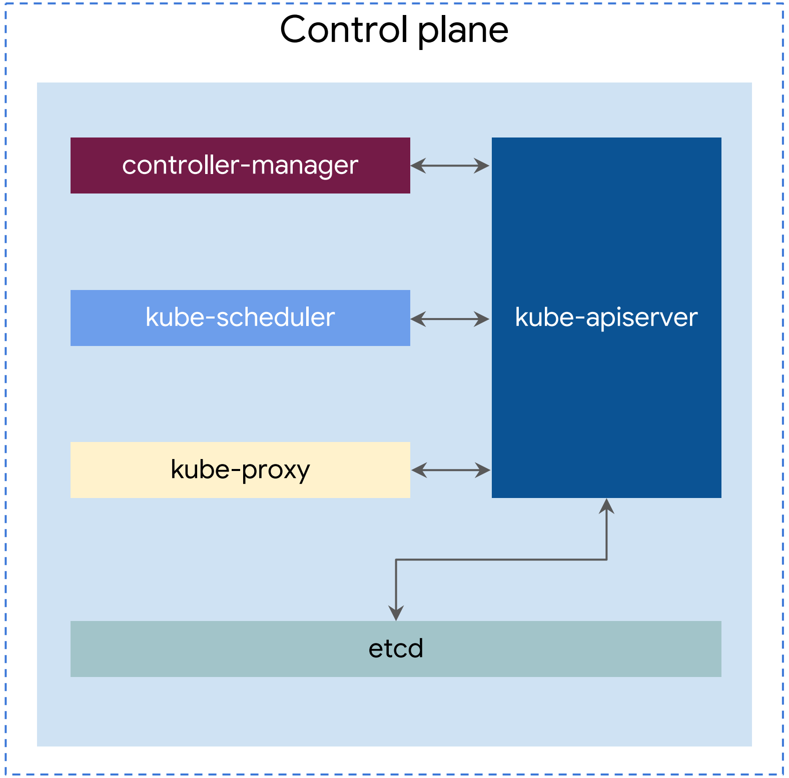


Control Plane (aka master)

- **etcd**: store cluster state
- **kube-scheduler**: Chooses hosts to run those containers on.
- **kube-apisever**: servers REST API request
- **kube-controller**:

✓ watch the desired state in the apiserver

✓ trigger reconciliation function to make actual state matching with desire state



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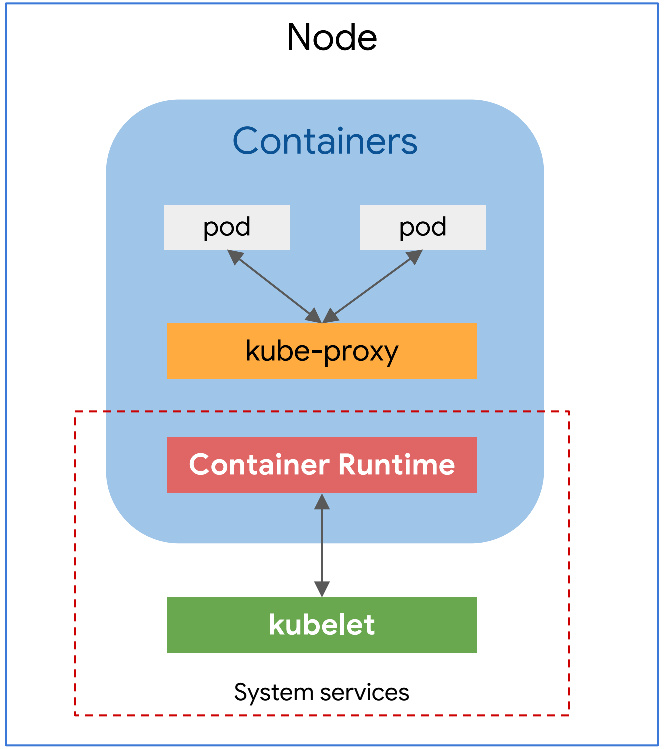
Cluster Nodes (aka worker)

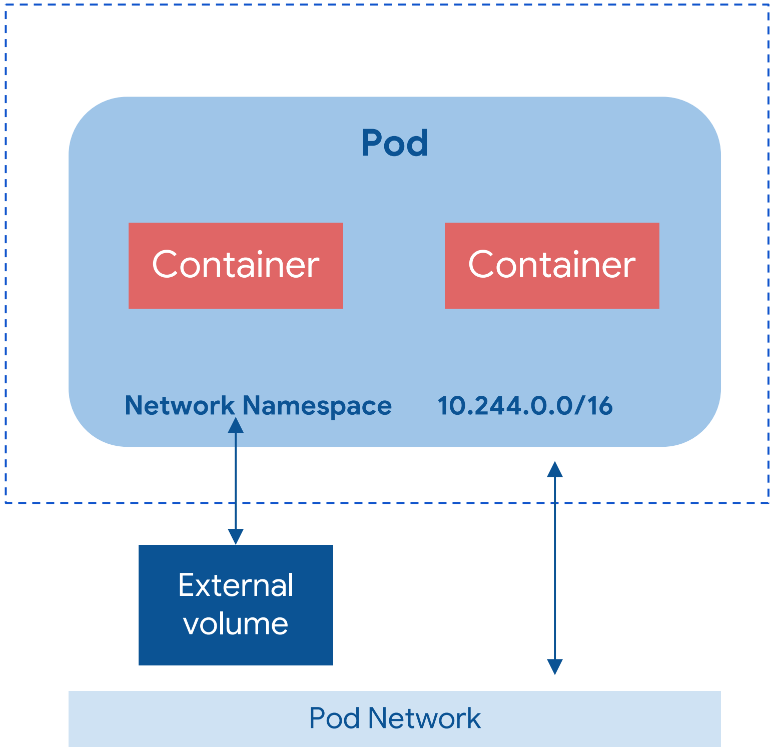
- **container runtime**: which is responsible for downloading images and running containers such as Docker
- **kube-proxy**: a network proxy/loadbalancer to route traffic in/out pods. It is implemented by iptables.
- **kubelet**: Responsible for communicate with master nodes and keep tracks of a pod to ensure that all container are running.

Refers to:
https://github.com/kubernetes/community/blob/master/contributors/design-proposals/architecture/architecture.md



Pod

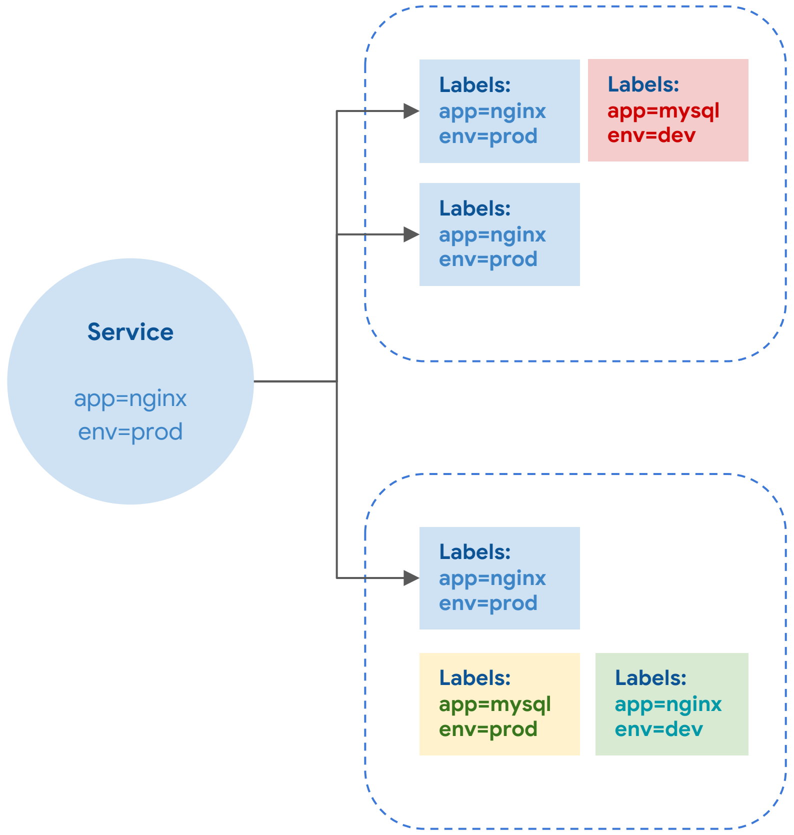
- **ReplicaSet:** the default, is a relatively simple type. It ensures the specified number of pods are running
- **Deployment:** is a declarative way of managing pods via ReplicaSets. Includes rollback and rolling update mechanisms
- **Daemonset:** is a way of ensuring each node will run an instance of a pod
- **StatefulSet:** is tailored to managing pods that must persist or maintain state



Service discovery

- Kubernetes heavily relies on its **integrated DNS service** (either **Kube-DNS** or **CoreDNS**, depending on the cluster version) to do discovery
  - CoreDNS create, update and delete DNS records for services and associated pods.
  - An example of a DNS record for a Kubernetes service: **service.namespace.svc.cluster.local** →A pod would have a DNS record such as: **10.32.0.125.namespace.pod.cluster.local**

- **ClusterIP:** exposes the service on an internal IP only → access in cluster
- **NodePort:** exposes the service on each node's IP at a specific port
- **LoadBalancer:** exposes the service with external IP


Service
app=nginx
env=prod
Labels: app=nginx env=prod
Labels: app=mysql env=dev
Labels: app=nginx env=prod
Labels: app=nginx env=prod
Labels: app=mysql env=prod
Labels: app=nginx env=dev

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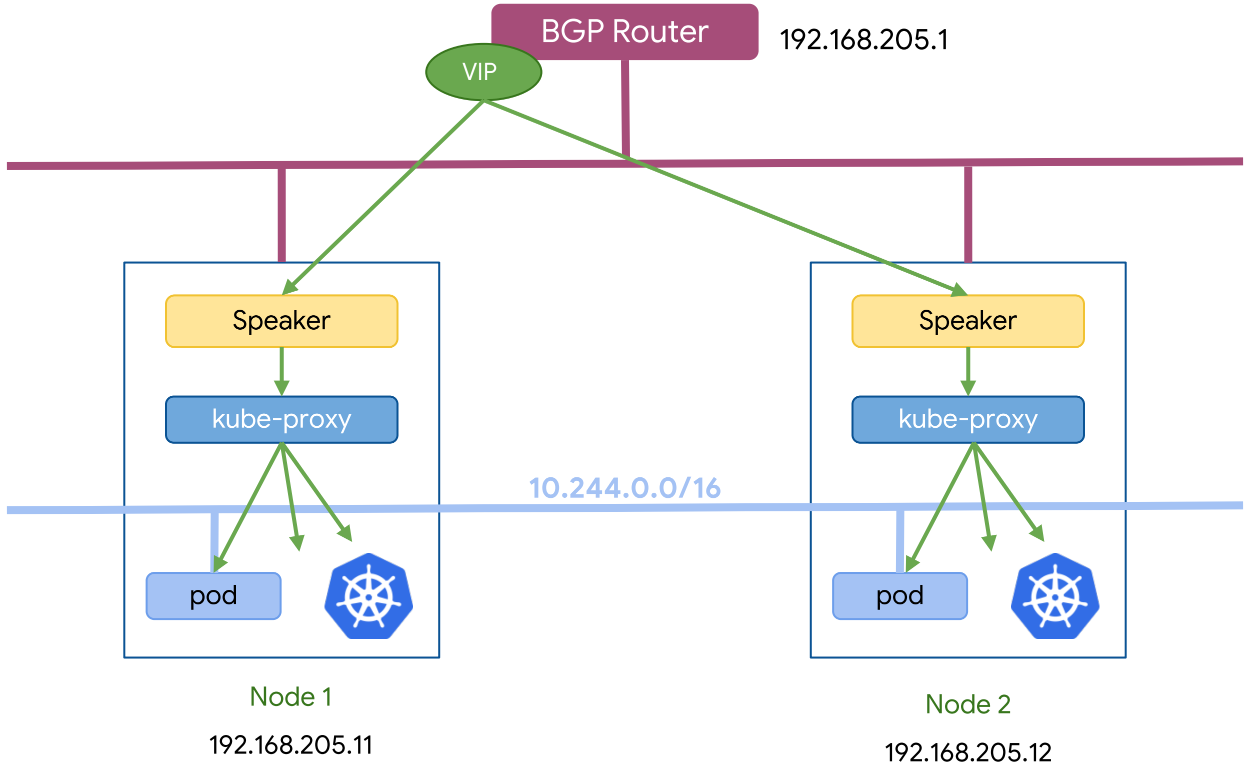
MetalLB - Load balancer

MetalLB (BGP mode)



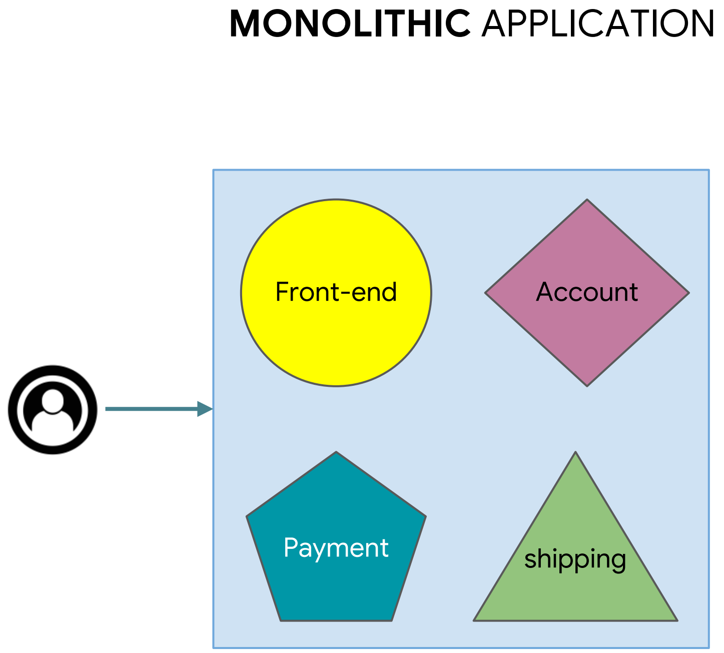
MetalLB overview

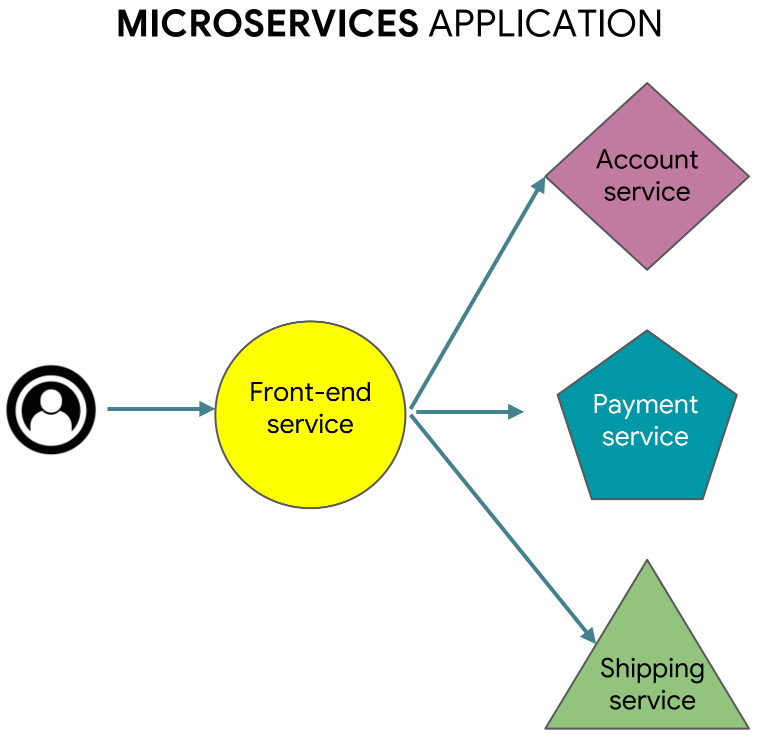
MetalLB uses standard routing protocols:

- **ARP** (IPv4), **NDP** (IPv6) (Layer 2 mode)
  - MetalLB responds to ARP requests for IPv4 services and NDP requests for IPv6
  - It will work on any ethernet network with no special hardware required, not event fancy routers
  - Limitations: single-node bottle-necking and potentially slow failover
- **BGP**
  - Each node in your cluster establishes a BGP peering session with network routers, and uses that peering session to advertise the IPs of external cluster services

Istio - Service Mesh

Microservices





Advantages and Drawbacks of Microservices

Advantages

- Smaller codebase
- Without depend on language programing
- CD will be easier
- Scalability
- Decentralized data
- Isolate failures

Drawbacks

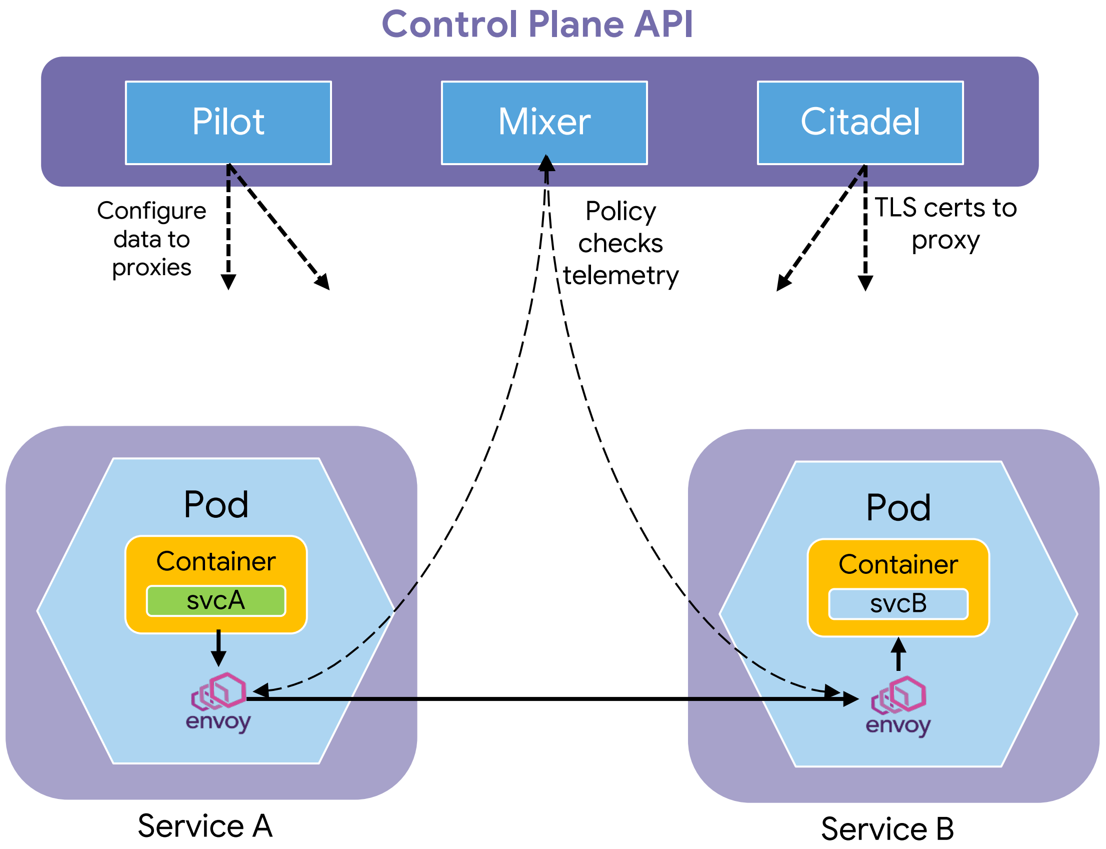
- Hard to keep track of microservices
- Complexity
- Routing microservices will need more work
- Consume more resources

→ Istio addresses some of the drawbacks in microservices

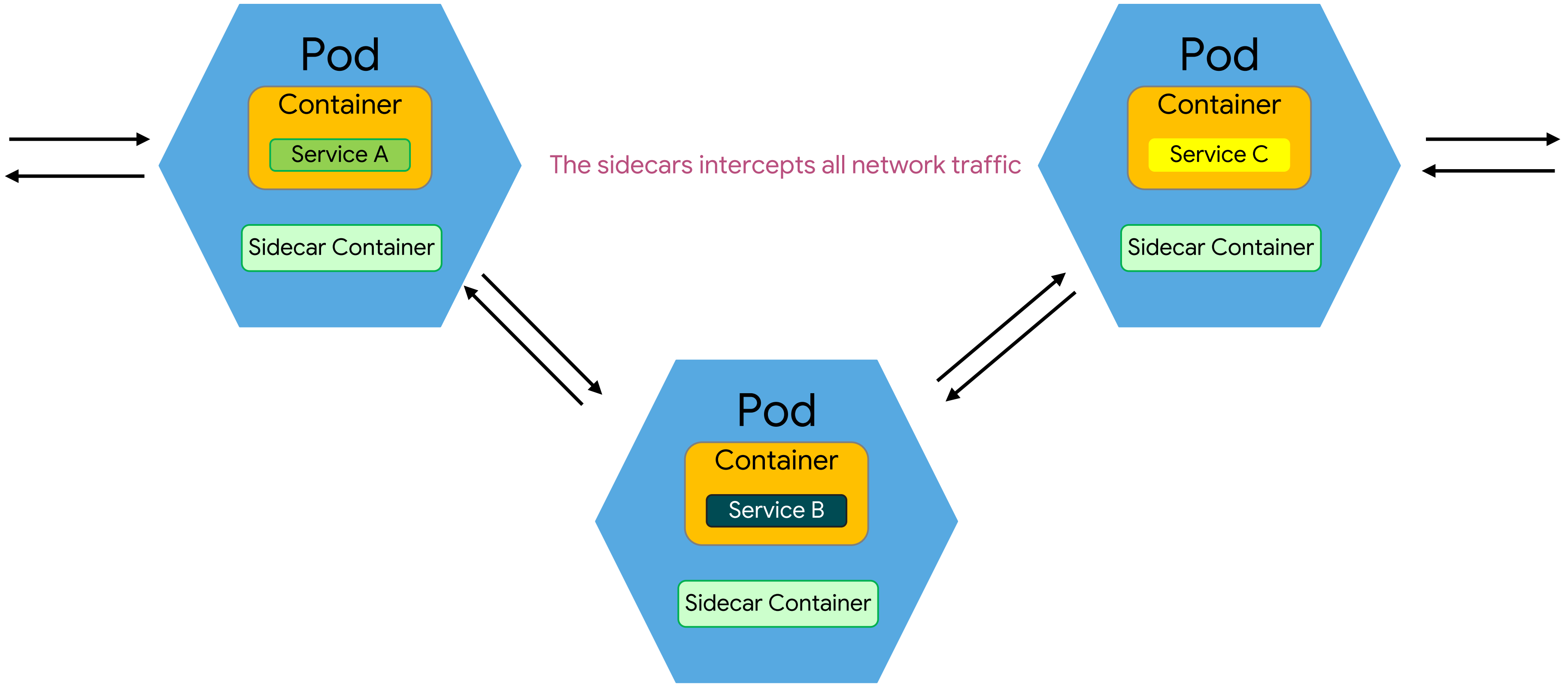
Istio

- An open platform to connect, manage and secure microservices
- Installed on top of K8s cluster, keep track of statuses, bugs of application
- Manages the traffic of Microservice
- Provides security within Microservices like mutual TLS

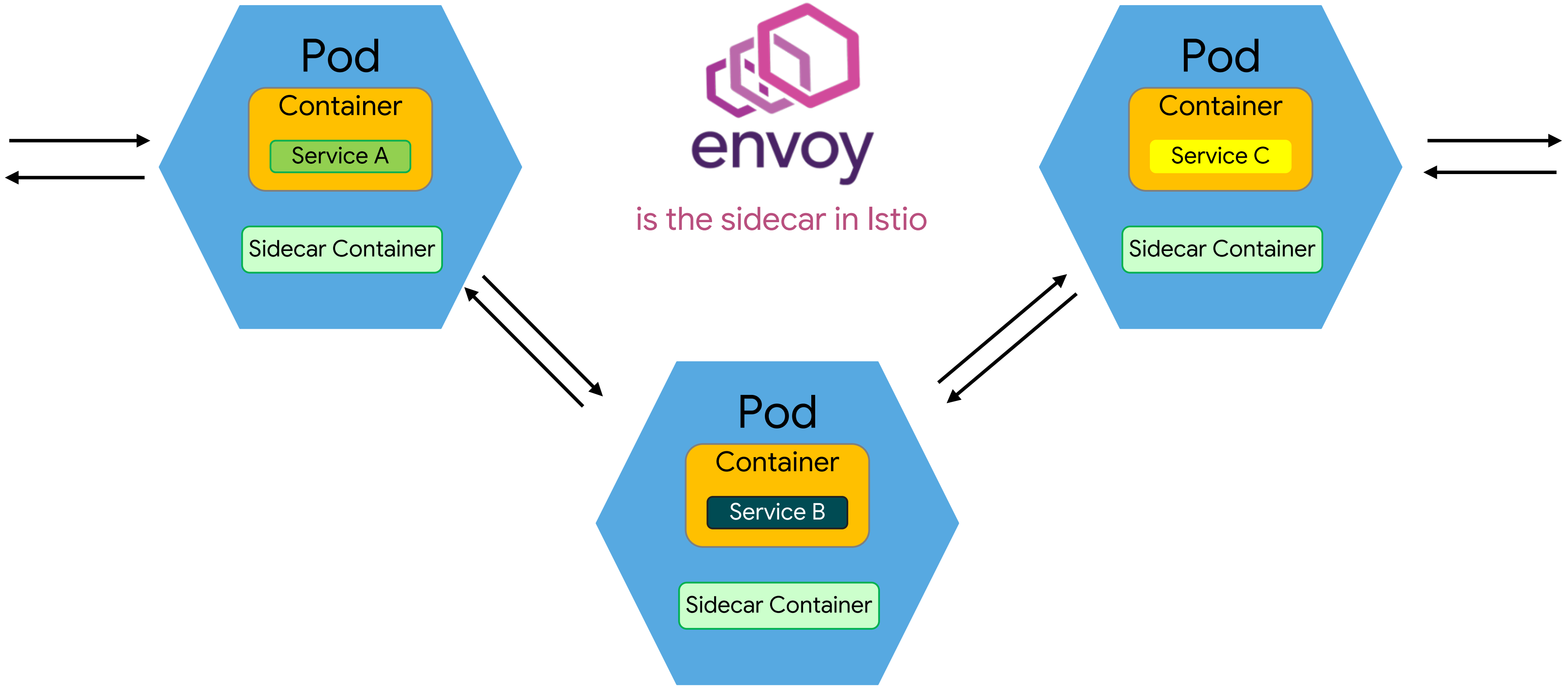
Istio Service Mesh architecture



Sidecar on Kubernetes



Envoy


Pod
Container
Service A
Sidecar Container
envoy
is the sidecar in Istio
Pod
Container
Service C
Sidecar Container
Pod
Container
Service B
Sidecar Container

Envoy

envoy

An open source edge and service proxy, designed for cloud-native applications

- L3/4 network filter

- Advanced load balancing

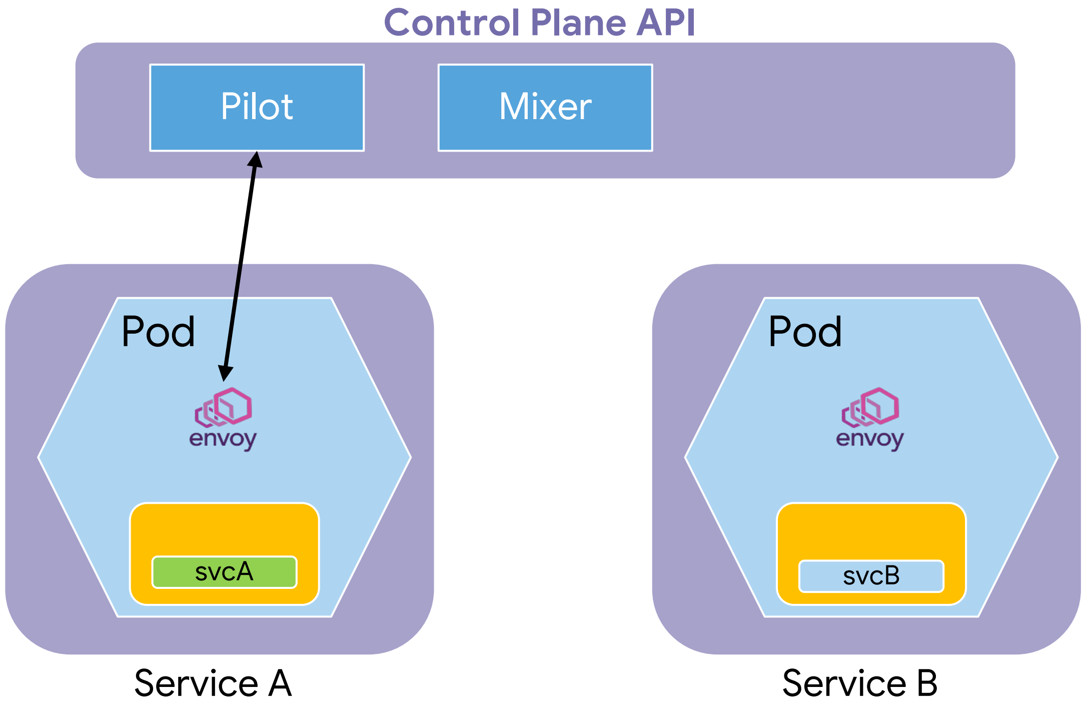
- Stats, metrics, tracing

How Istio works

Service A comes up

Envoy is deployed alongside it

Routing and configuration policy from Pilot



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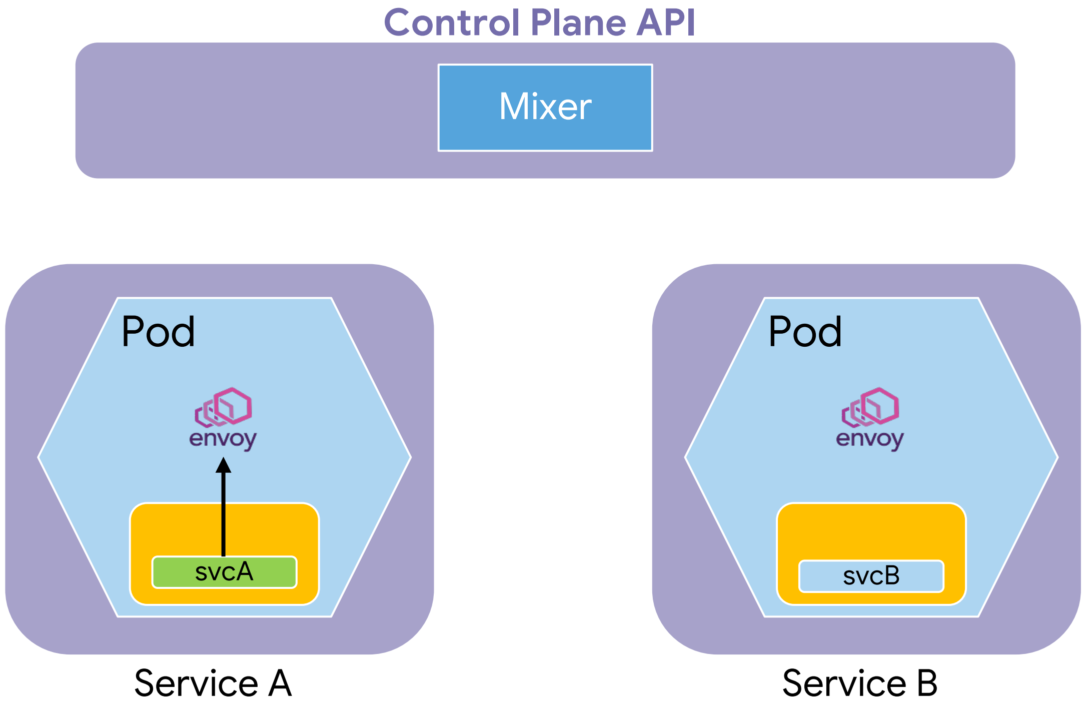
How Istio works

Service A calls service B

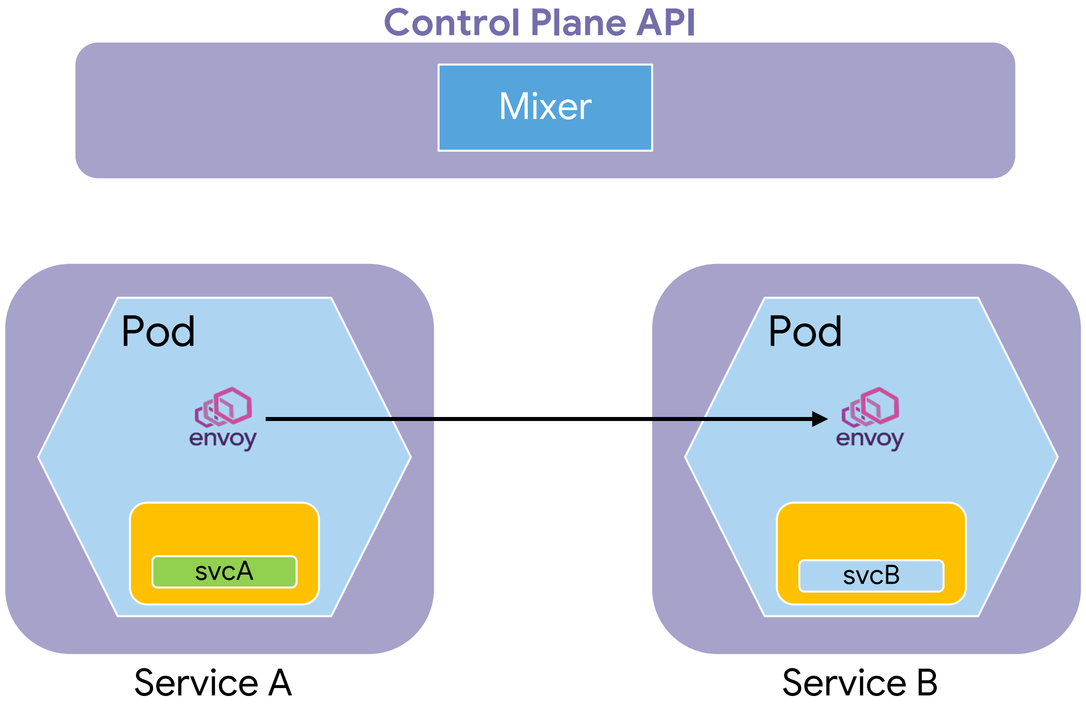
Envoy intercepts the call

Envoy consults Pilot to know **How/Where** to route call to service B



How Istio works

Envoy forwards request to appropriate instance of service B



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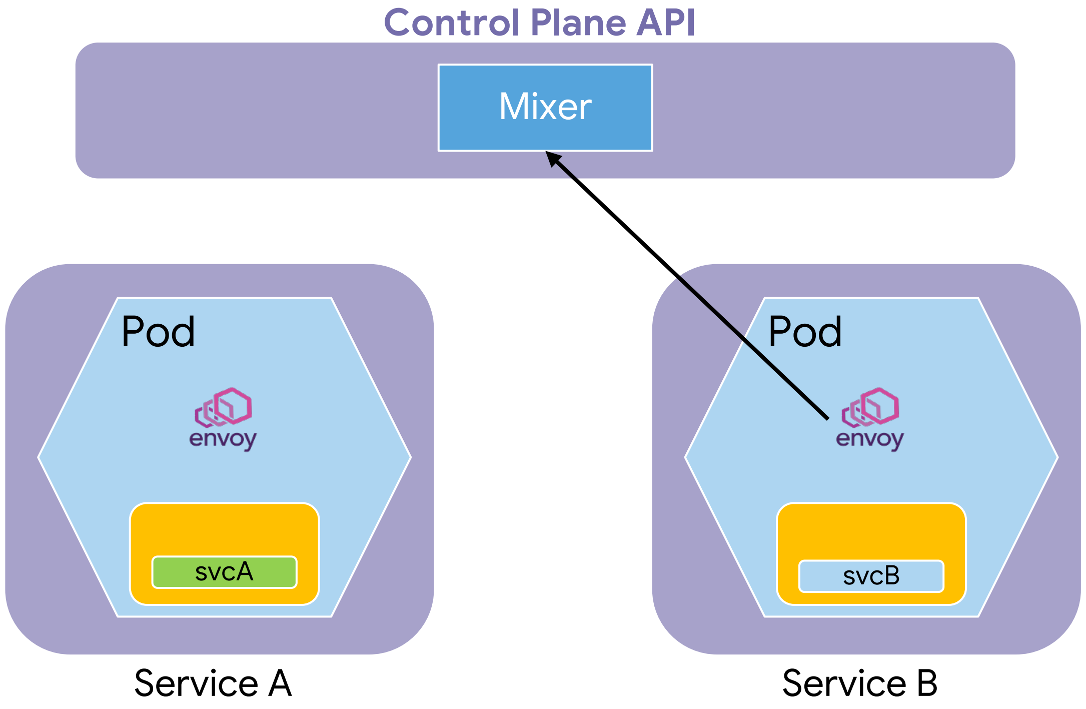
How Istio works

Server-side Envoy checks with Mixer to validate that call should be allowed



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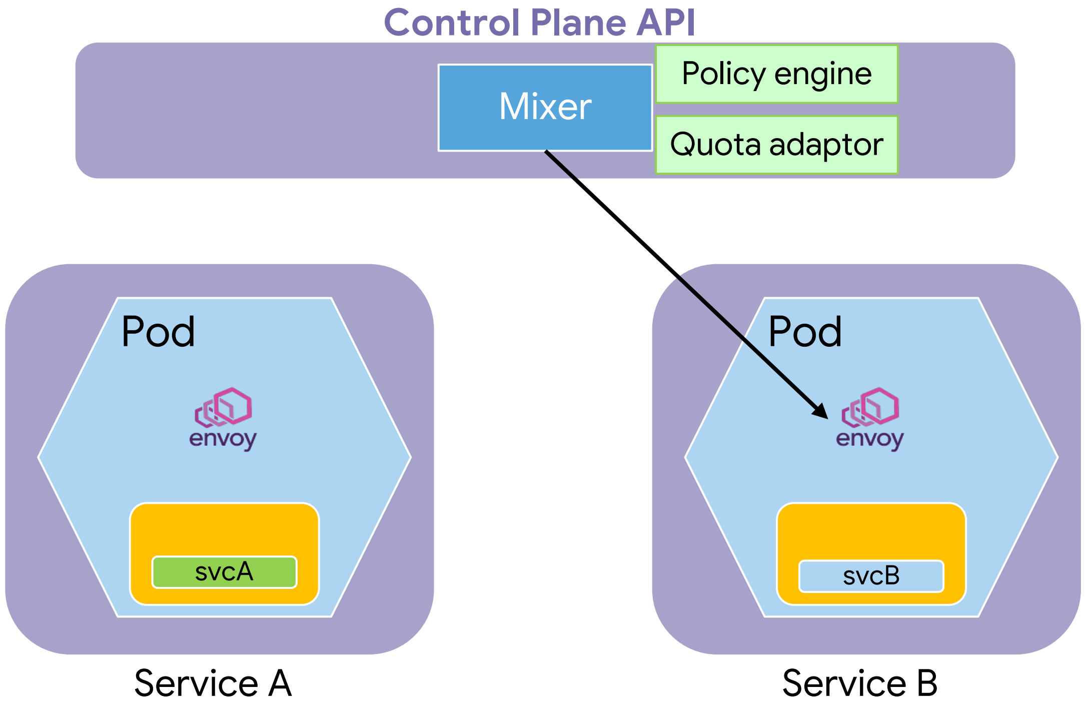
How Istio works

Mixer checks with appropriate adaptors to verify that the call can proceed



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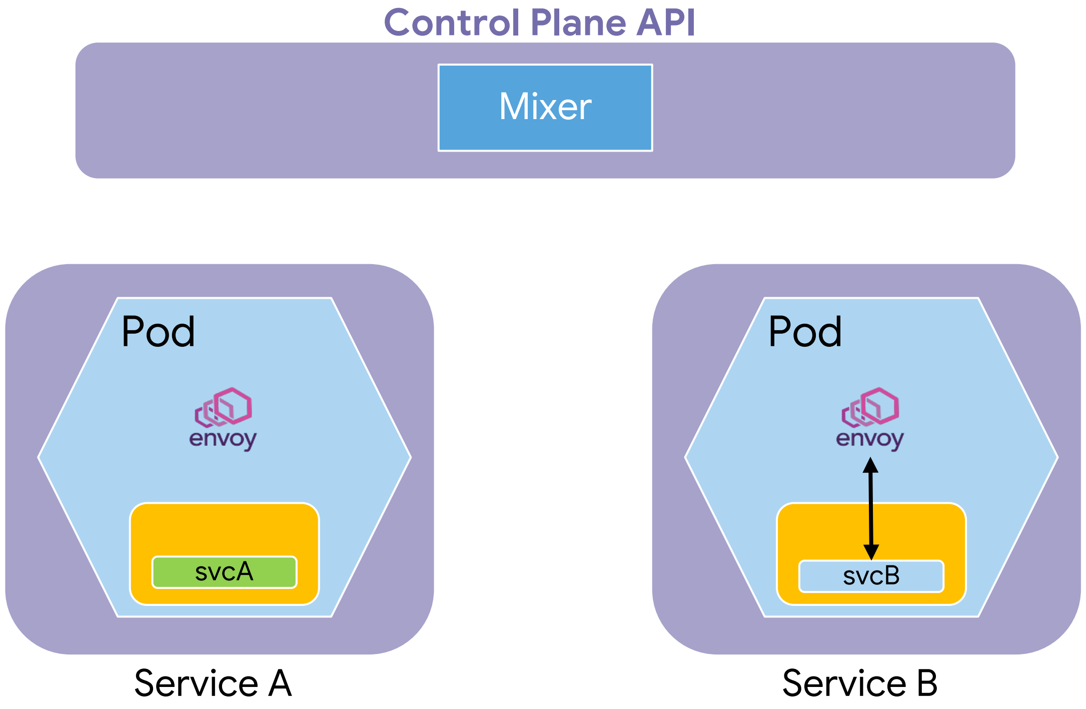
How Istio works

Server-side Envoy forwards requests to service B

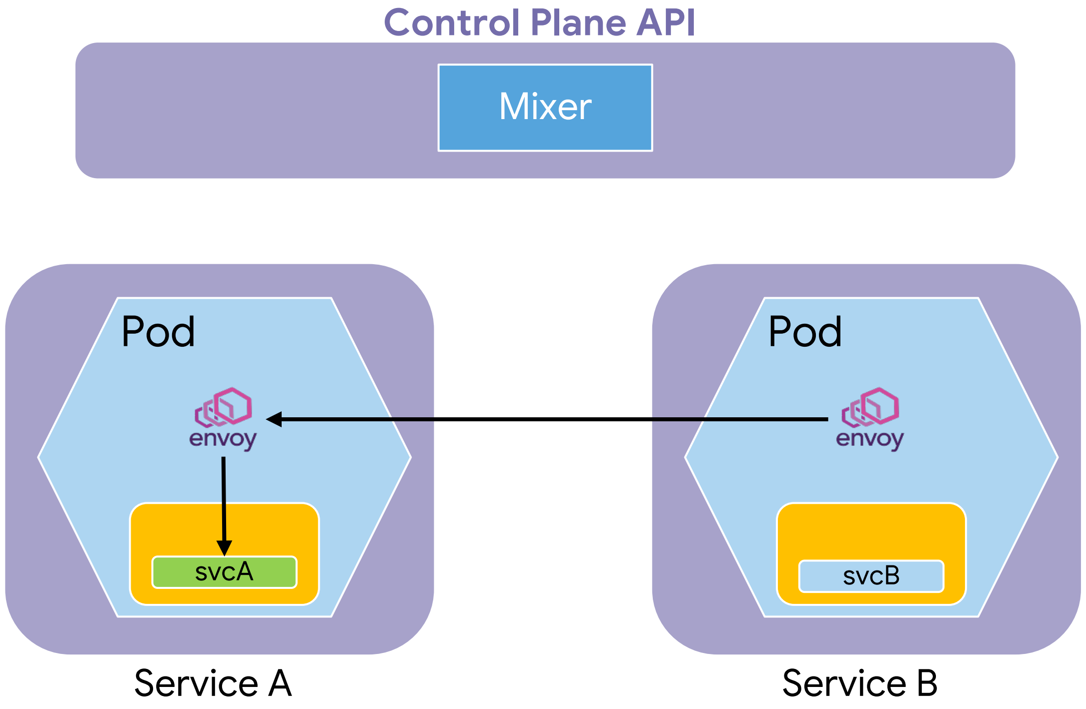
Service B processes the request and returns response



How Istio works

Envoy forwards response to the caller

Client-side Envoy forwards response to the original caller



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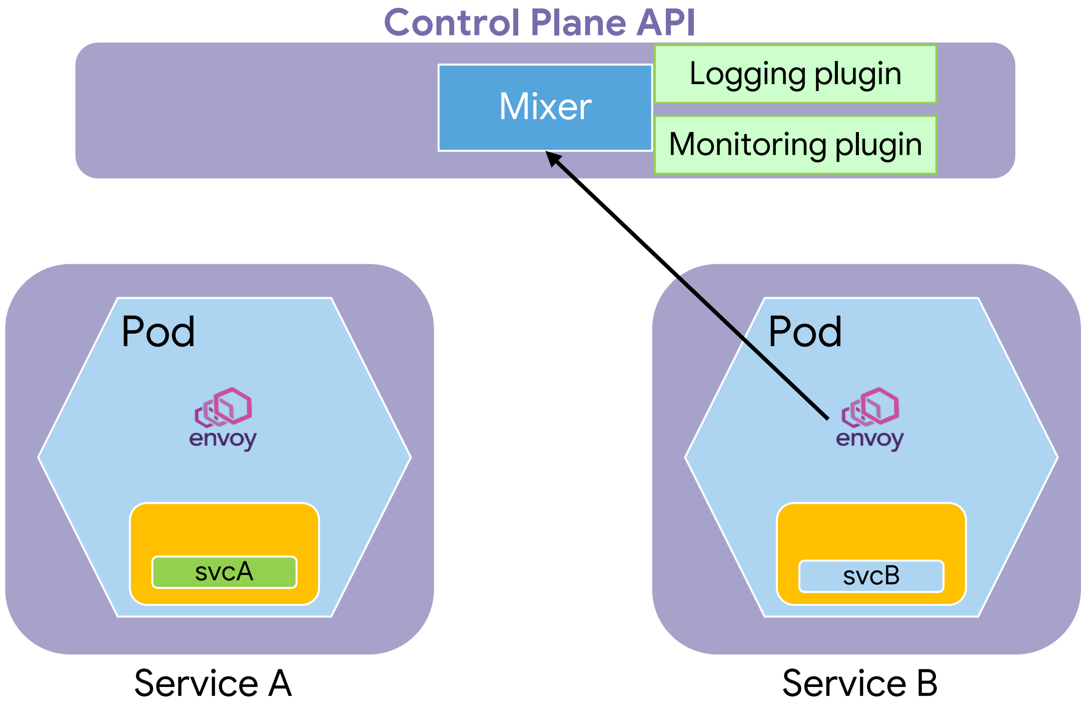
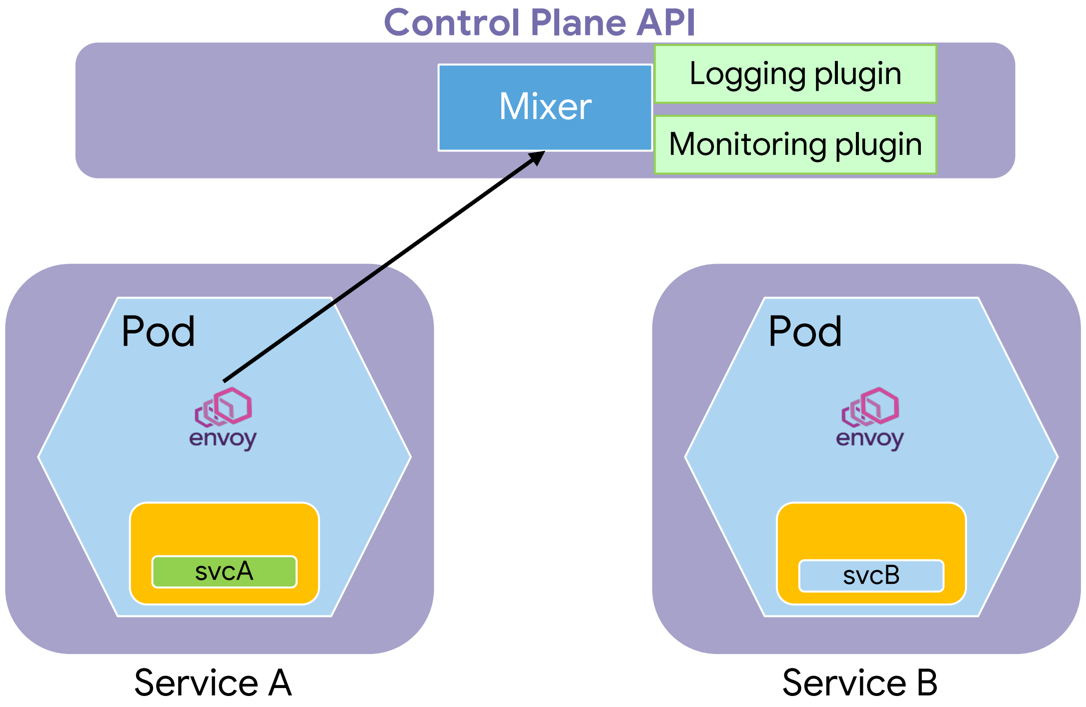
How Istio works

Envoy reports telemetry to Mixer, which in turn notifies appropriate plugins



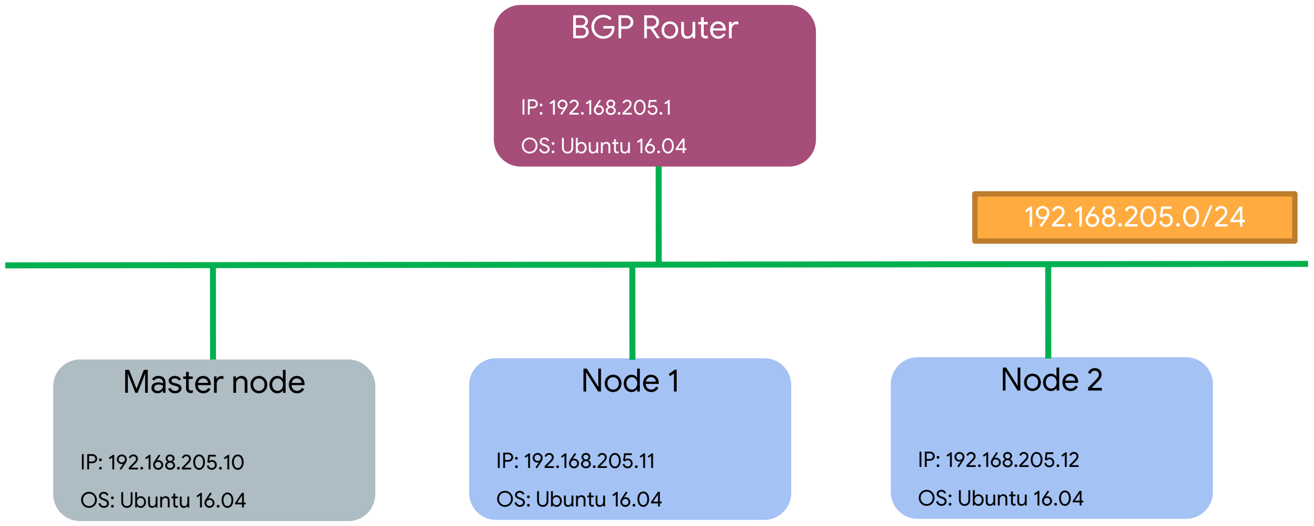
How Istio works

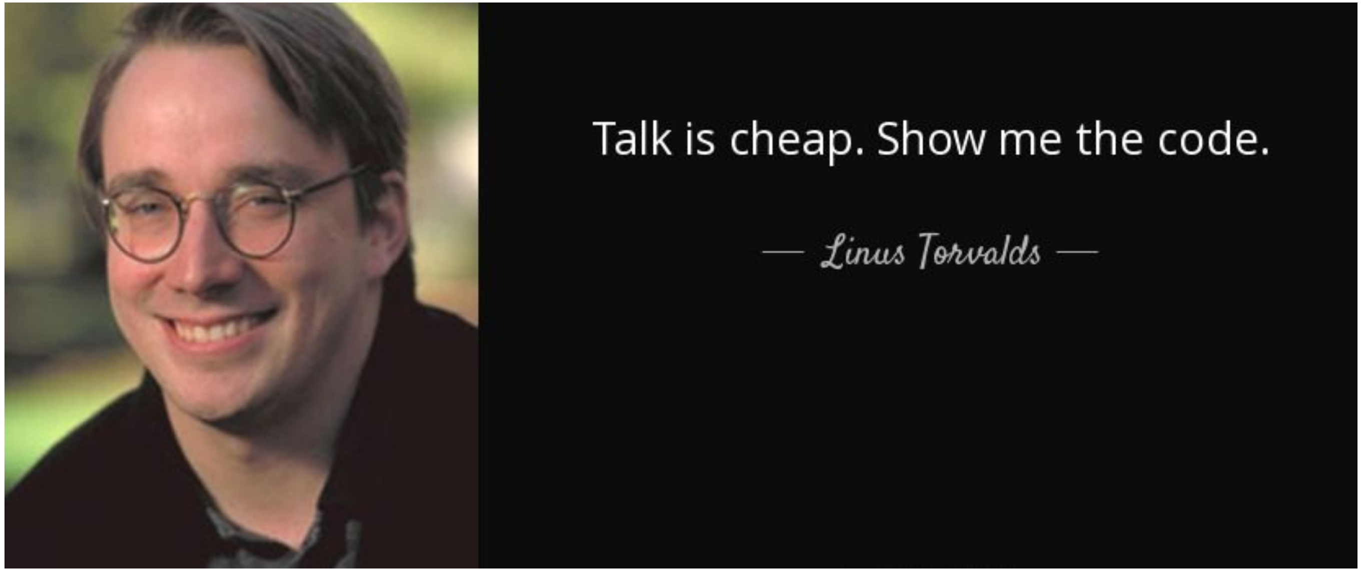
Client-side Envoy reports telemetry to Mixer (including client-perceived latency)



Demo - Hands on

Topology


BGP Router
IP: 192.168.205.1
OS: Ubuntu 16.04
192.168.205.0/24
Master node
IP: 192.168.205.10
OS: Ubuntu 16.04
Node 1
IP: 192.168.205.11
OS: Ubuntu 16.04
Node 2
IP: 192.168.205.12
OS: Ubuntu 16.04



https://github.com/vietkubers/k8s-istio-metallb-hands-on-lab

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