

# Inside Kubernetes Ingress

KubeCon + CloudNativeCon North America 2020





# Dominik Tornow

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[dominik.tornow@gmail.com](mailto:dominik.tornow@gmail.com)





<https://youtu.be/Hk77mToouEI>

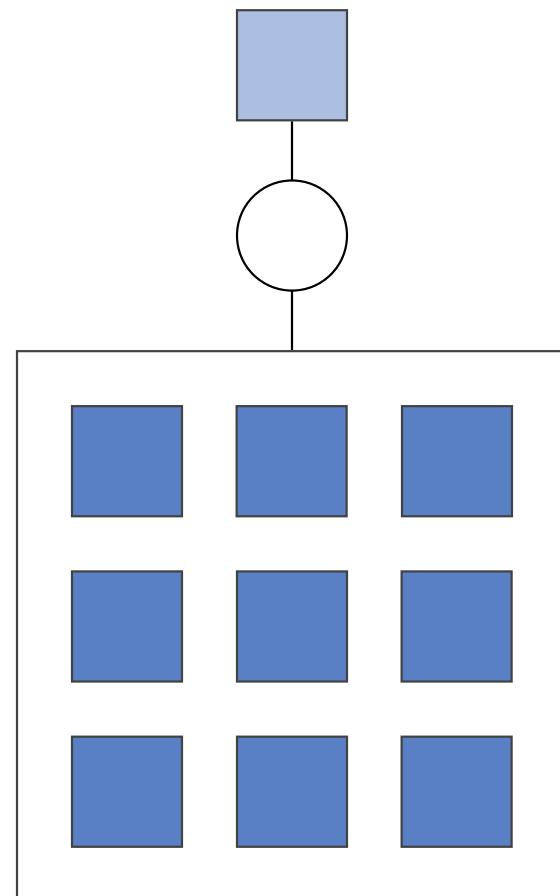
# Inside Kubernetes Services

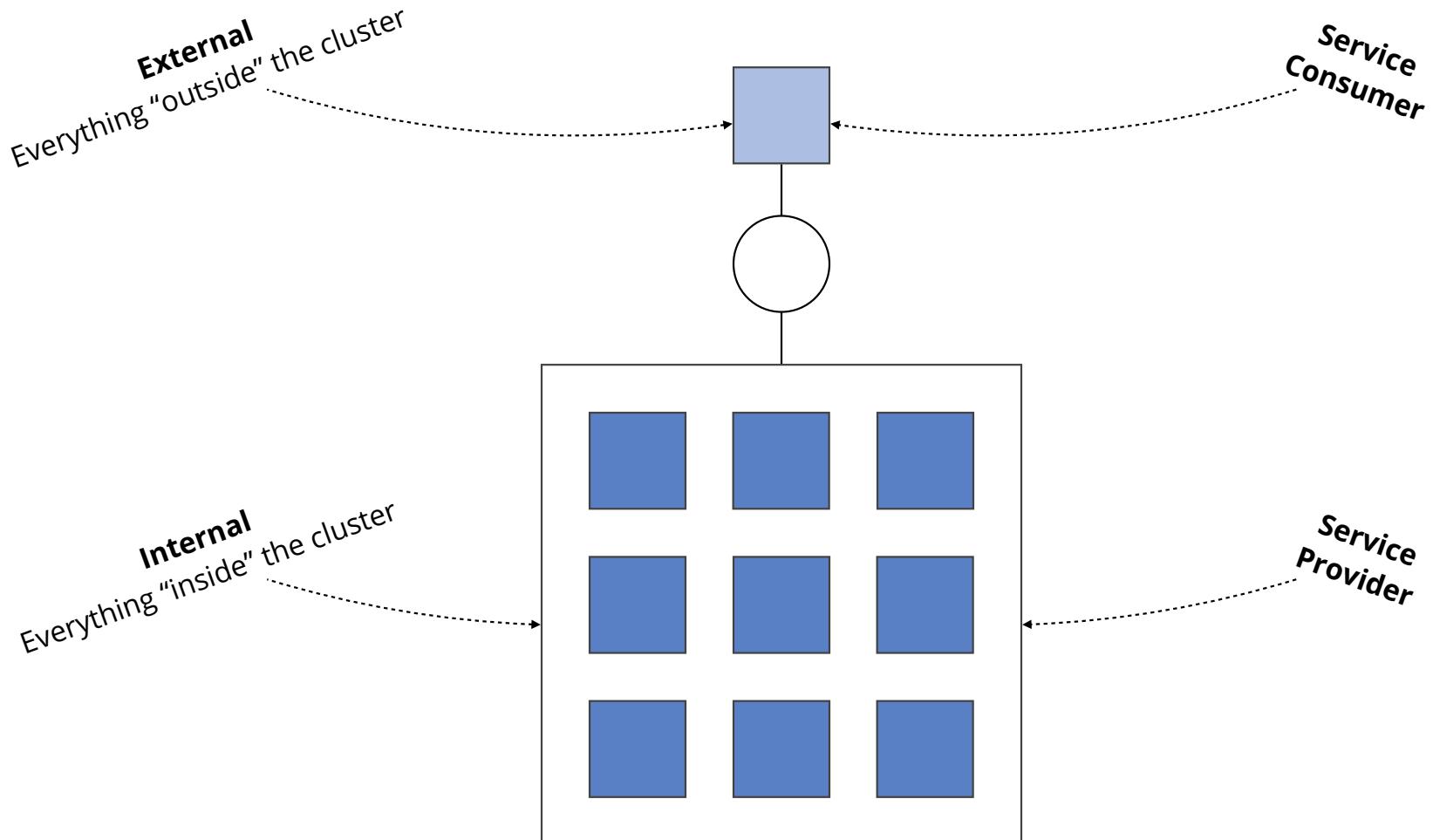
KubeCon + CloudNativeCon North America 2019

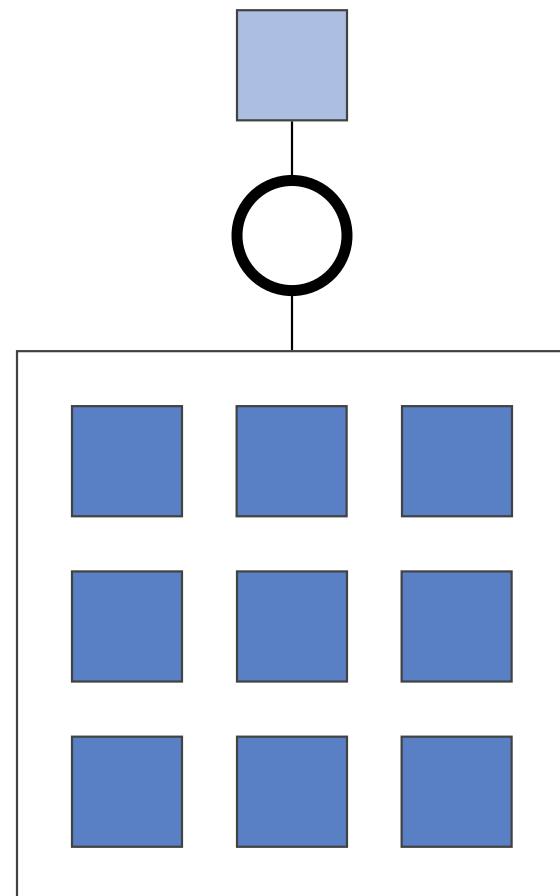
# Ingress for Kubernetes

Problem







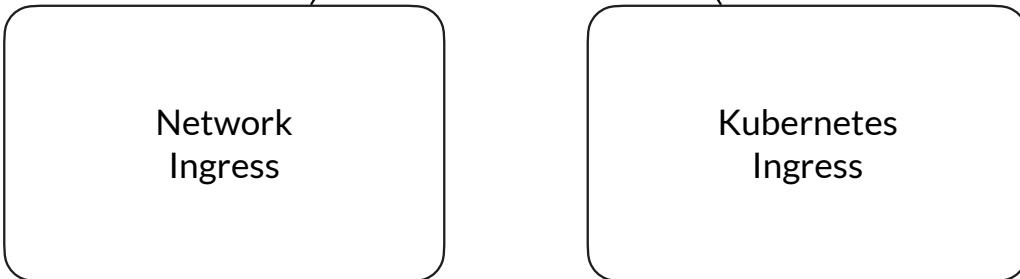


# Ingress for Kubernetes

## Solution



## Ingress for Kubernetes

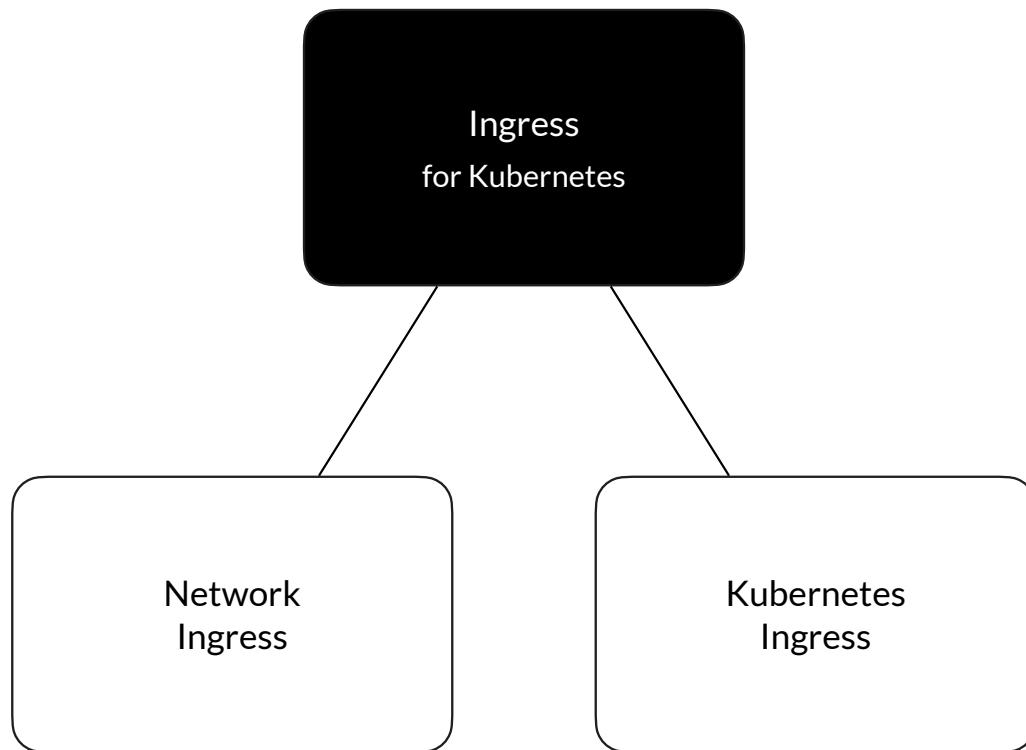


# Ingress for Kubernetes

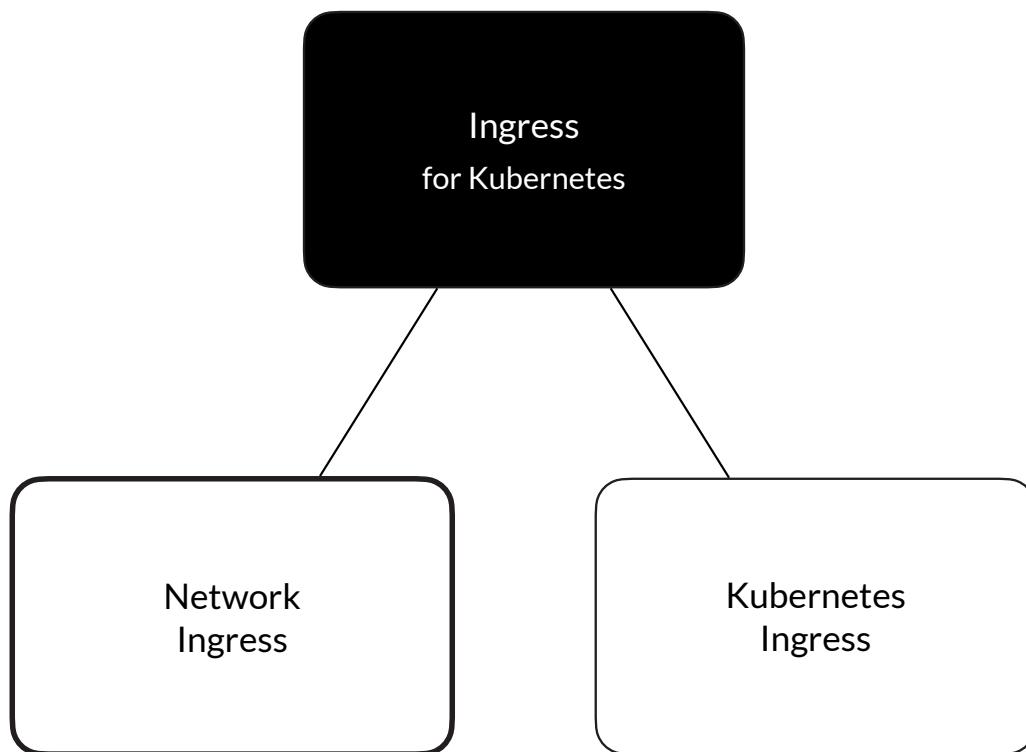
Intuition



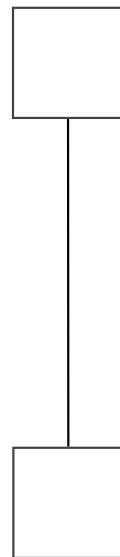
Intuition



Intuition

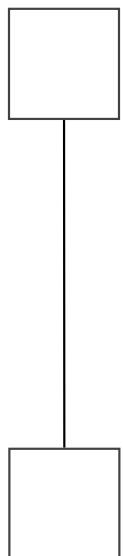


## Network Ingress



Network Ingress

External

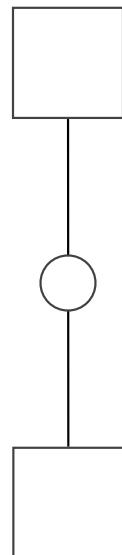


Internal



Network Ingress

External

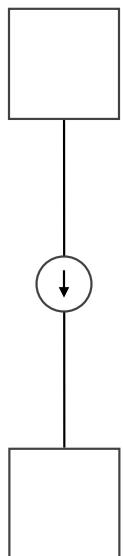


Internal



Network Ingress

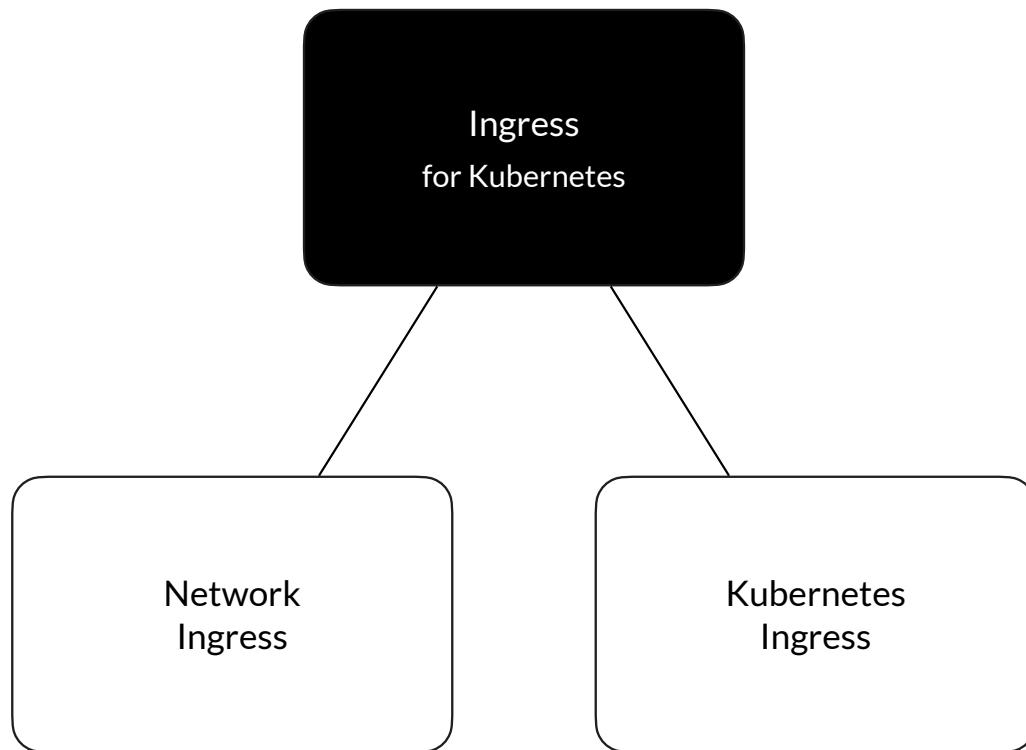
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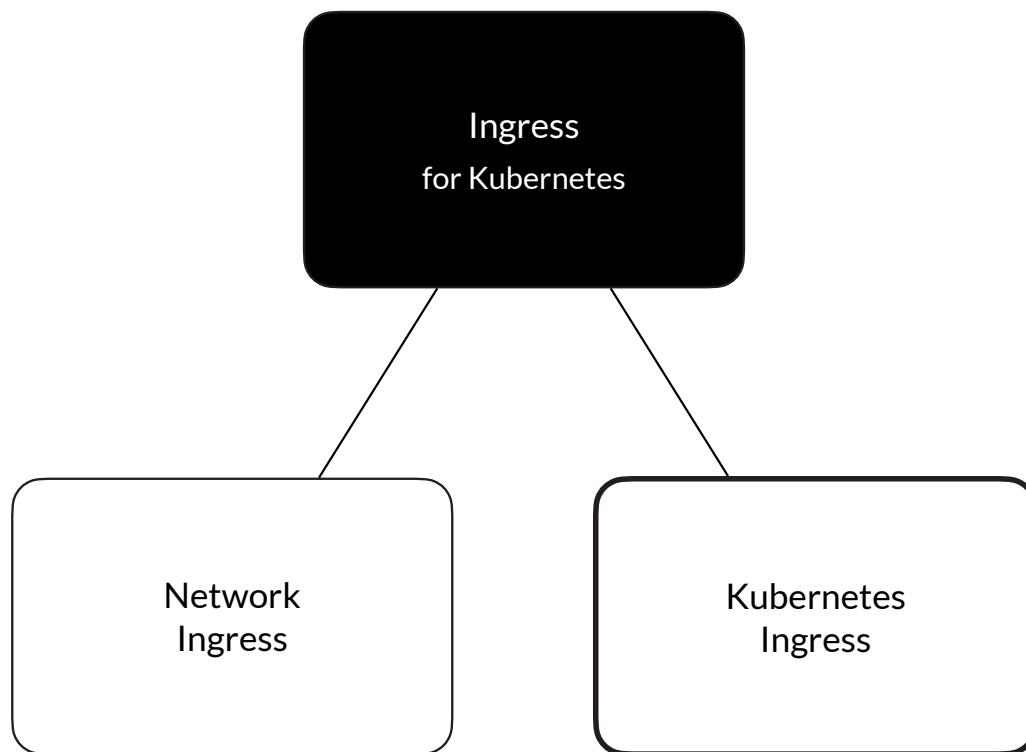
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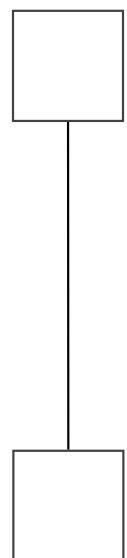
Intuition



Intuition



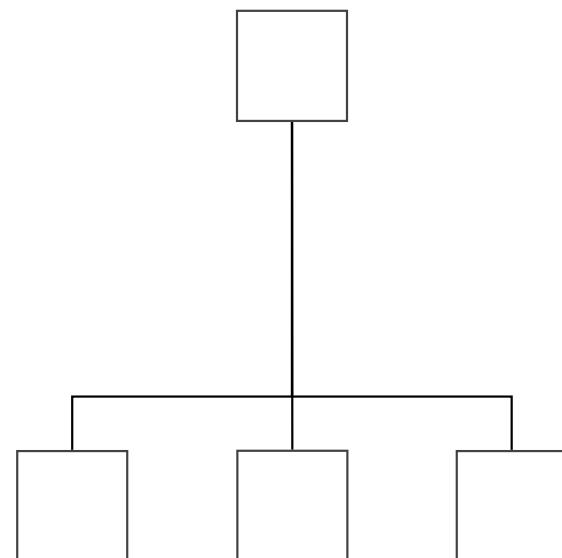
## Kubernetes Ingress



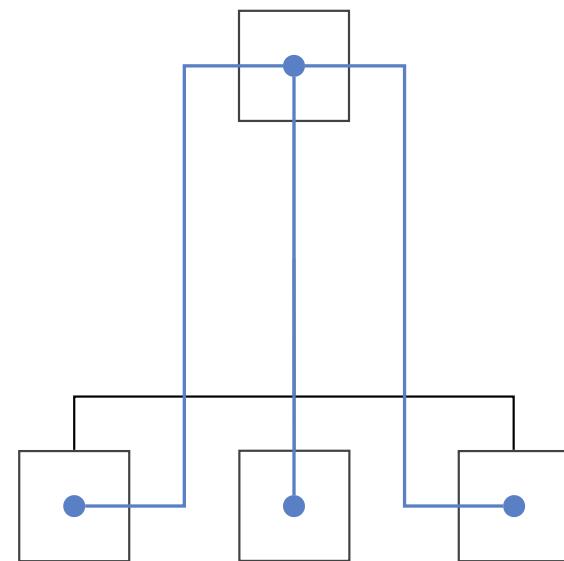
## Kubernetes Ingress



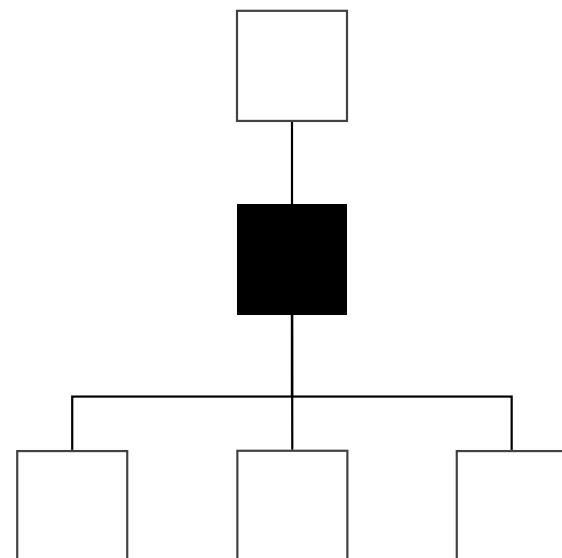
## Kubernetes Ingress



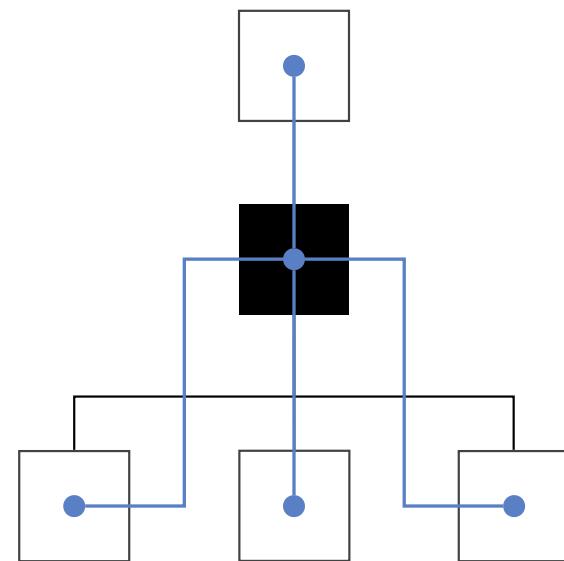
## Kubernetes Ingress



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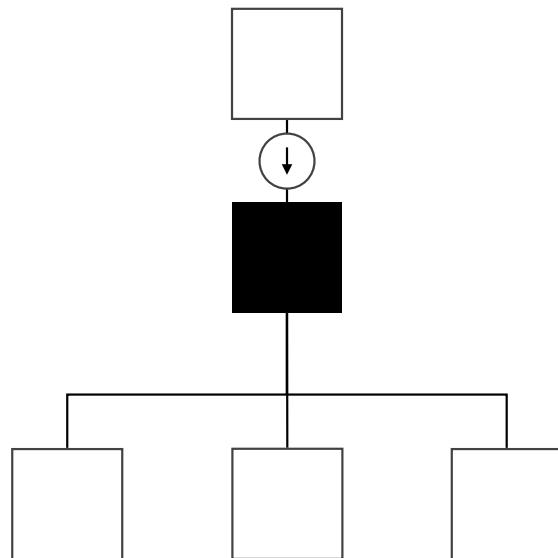


## Kubernetes Ingress

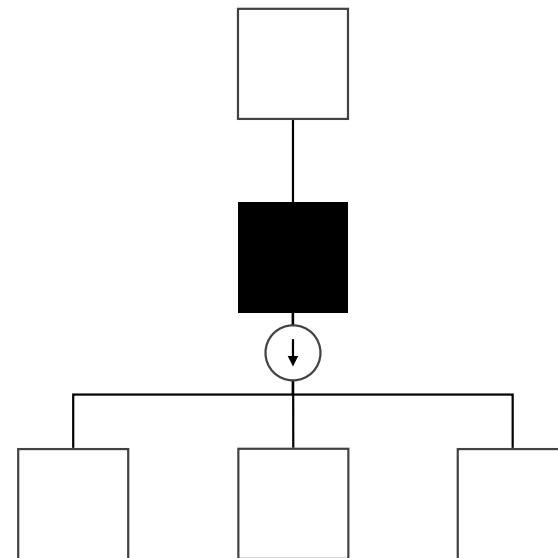


Ingress for Kubernetes  
Network Ingres & Kubernetes Ingress

External



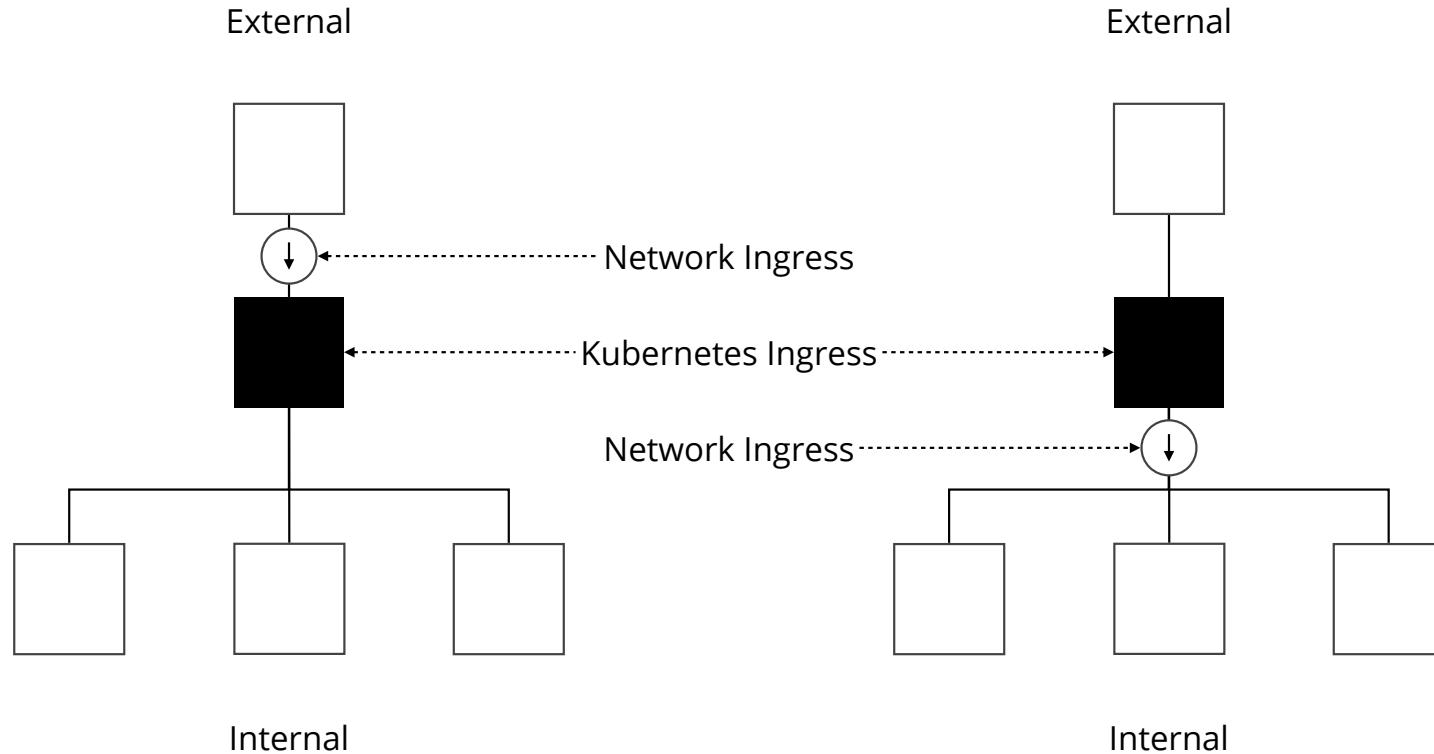
External



Internal



Ingress for Kubernetes  
Network Ingres & Kubernetes Ingress

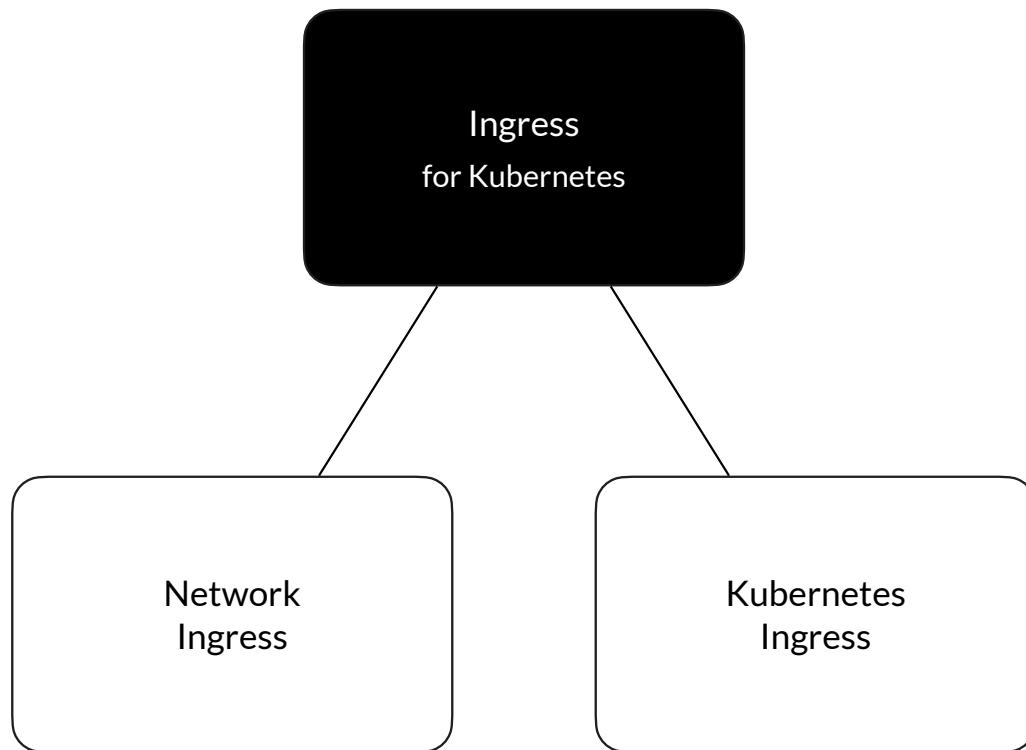


# Ingress for Kubernetes

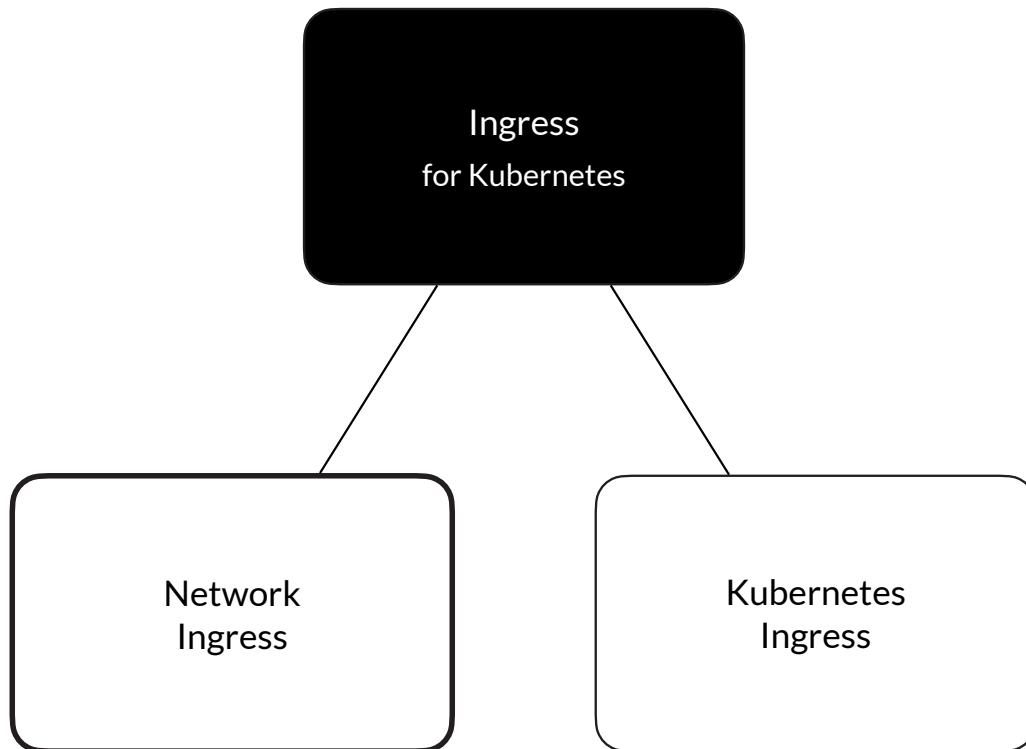
Definition

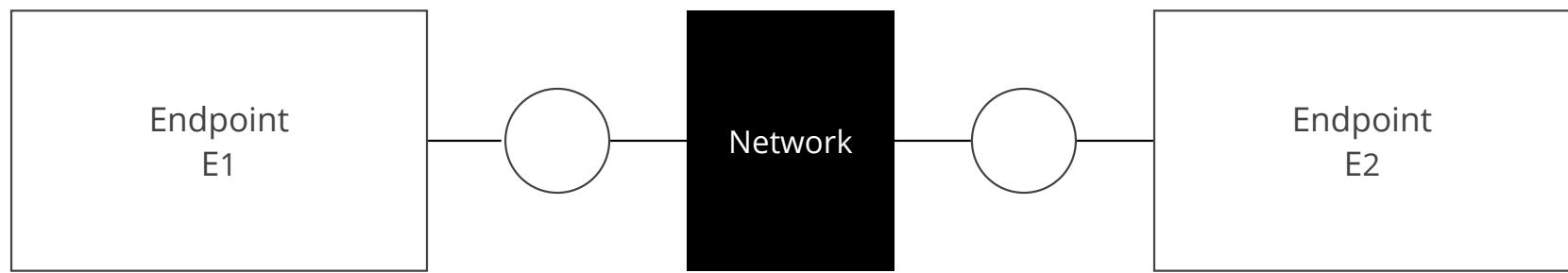


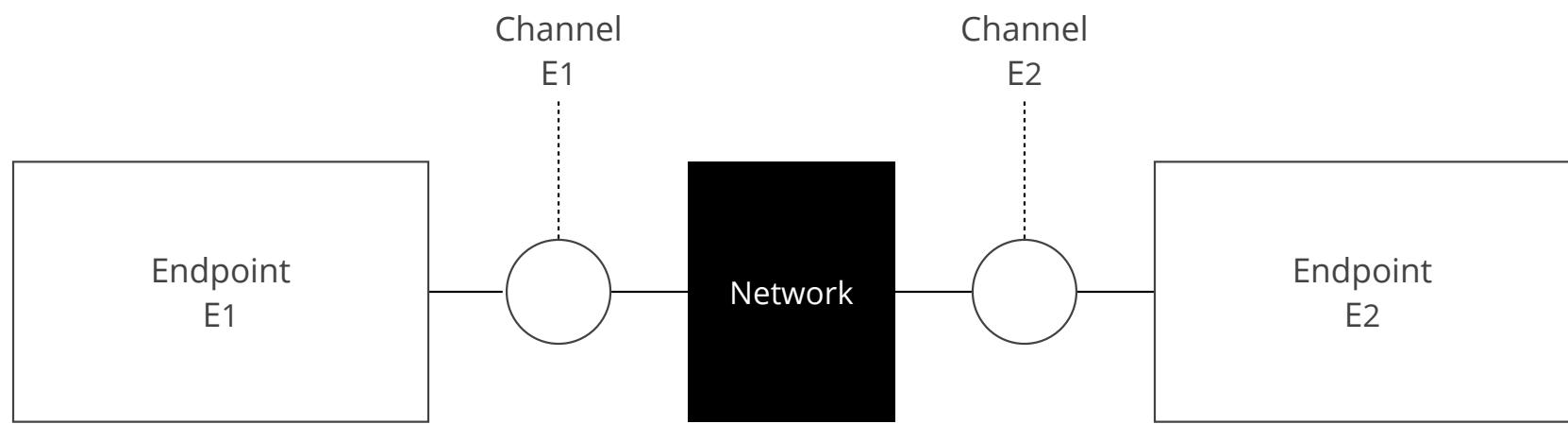
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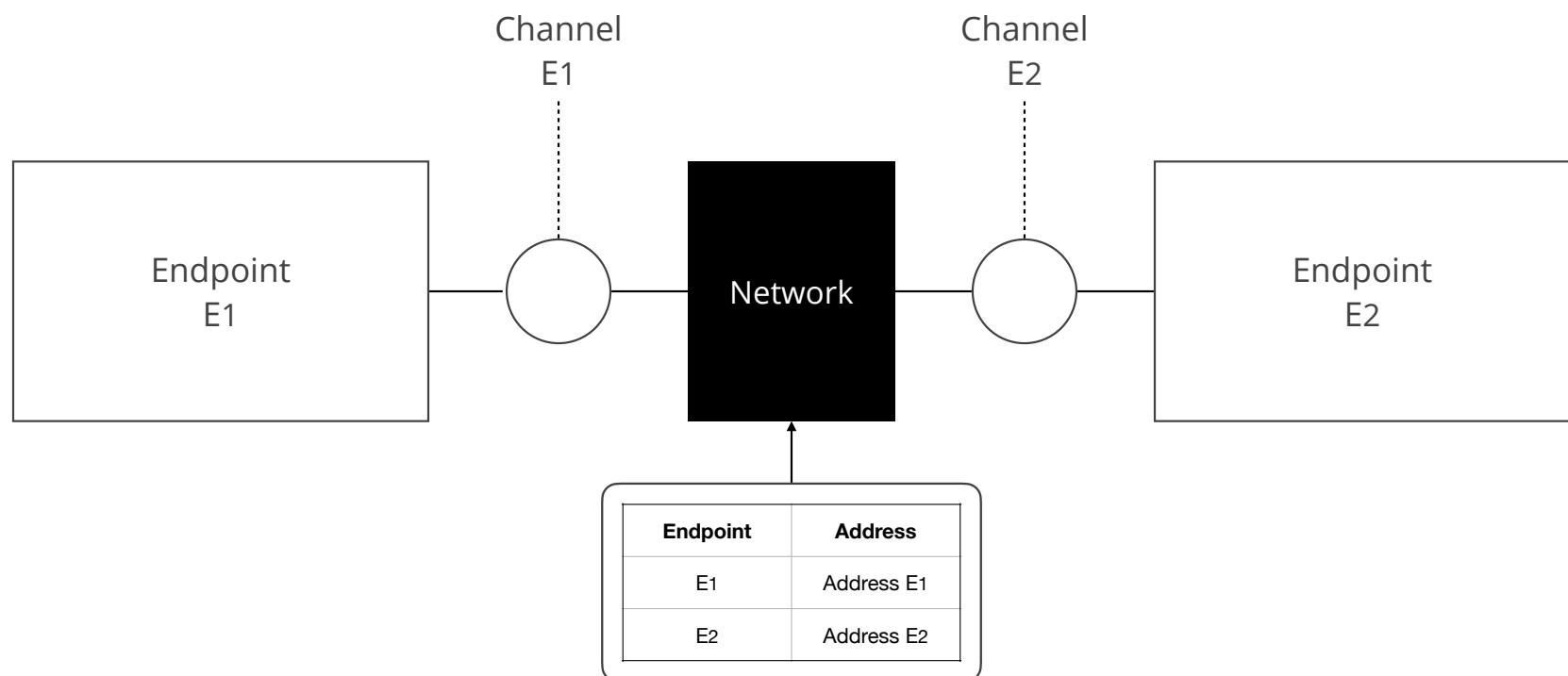


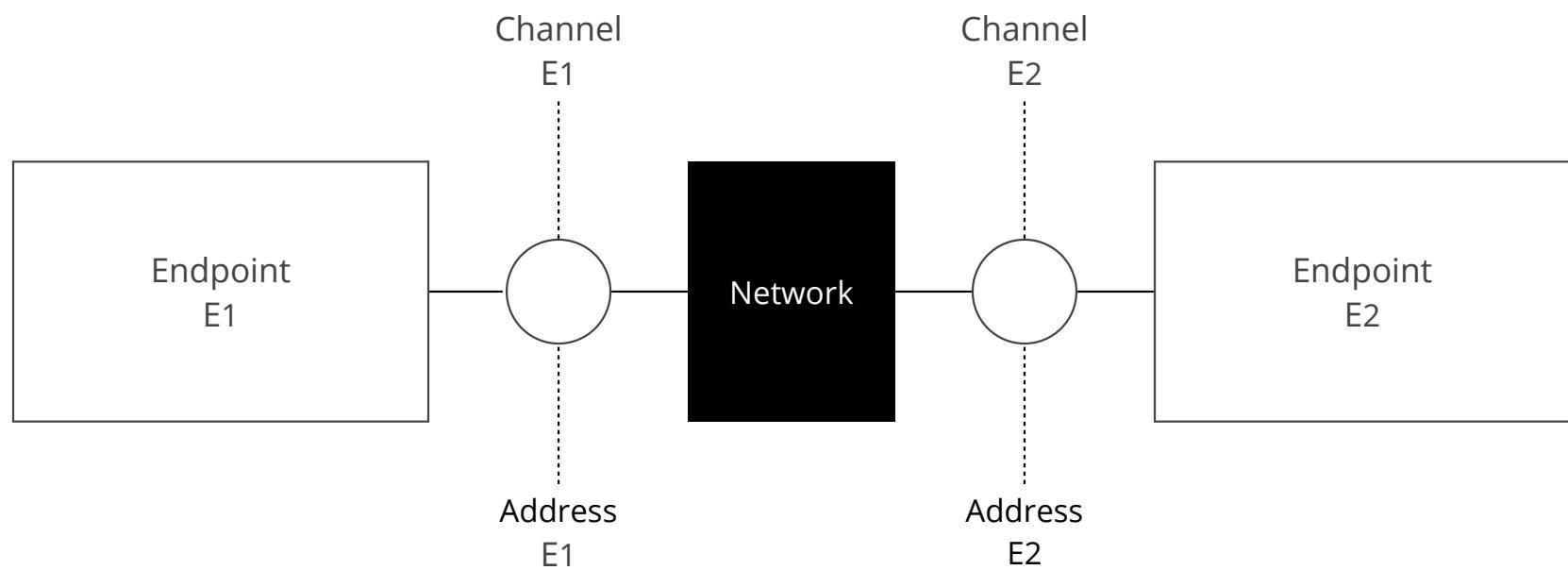
## Definition

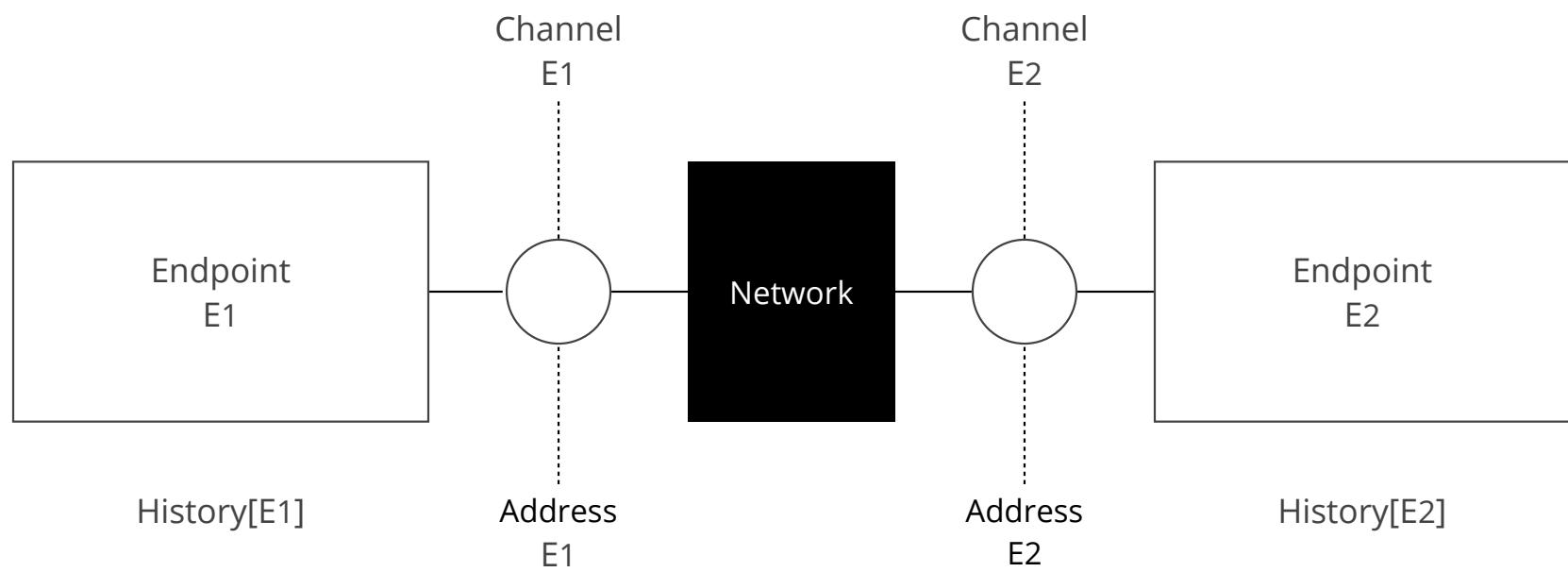


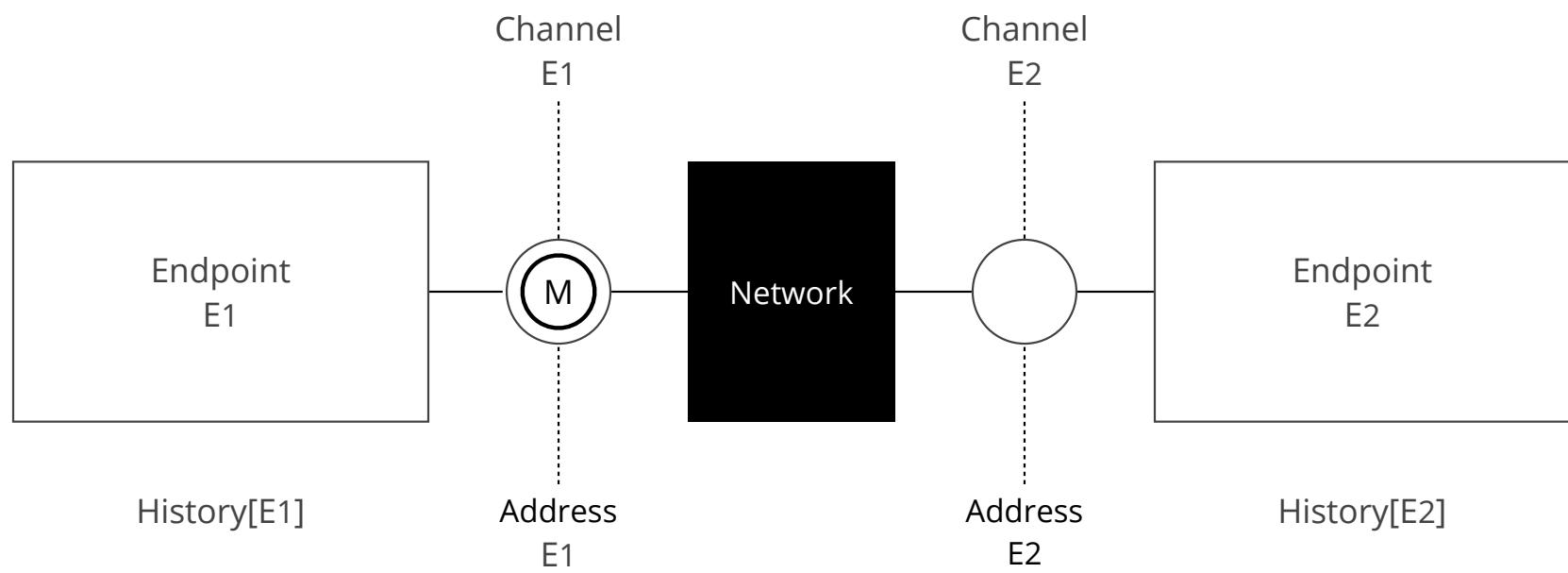


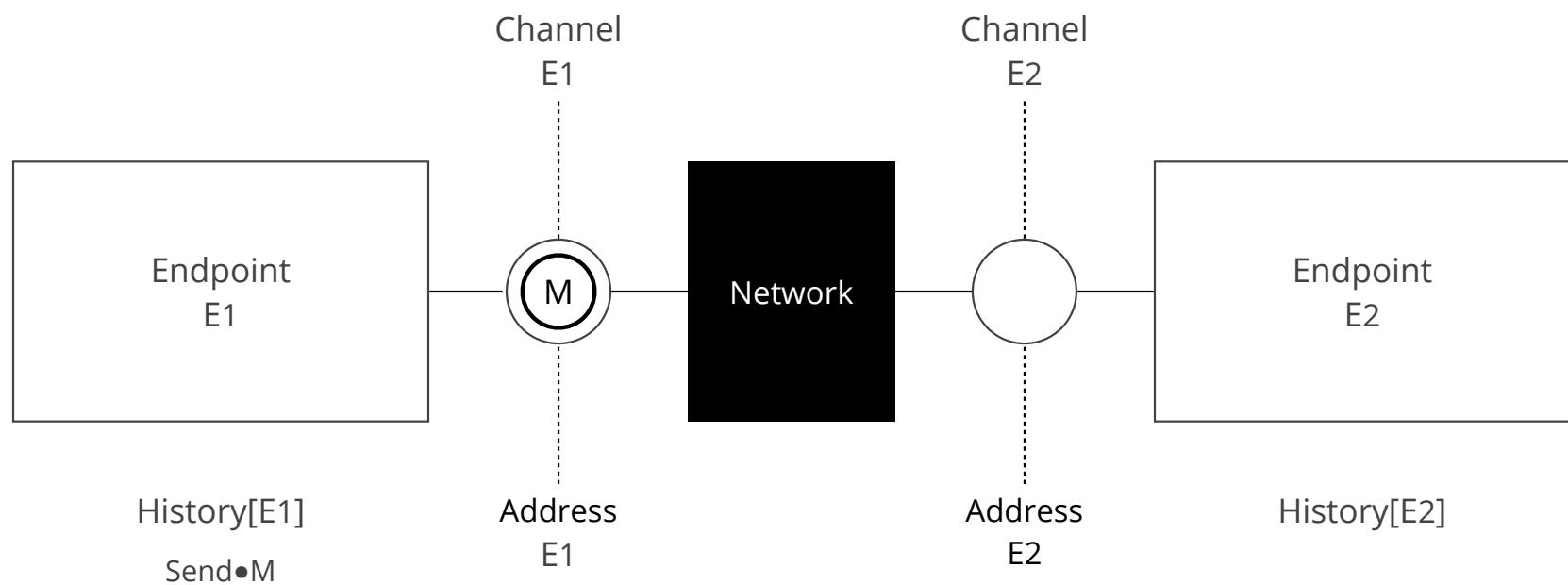


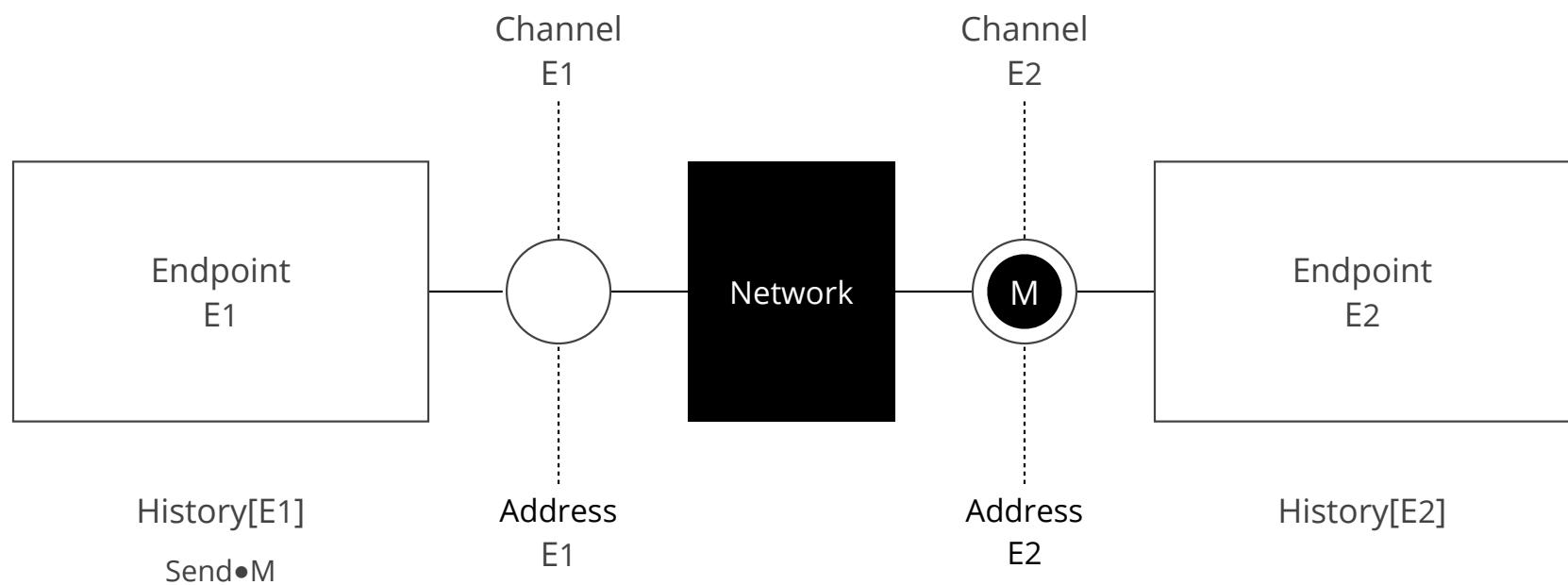


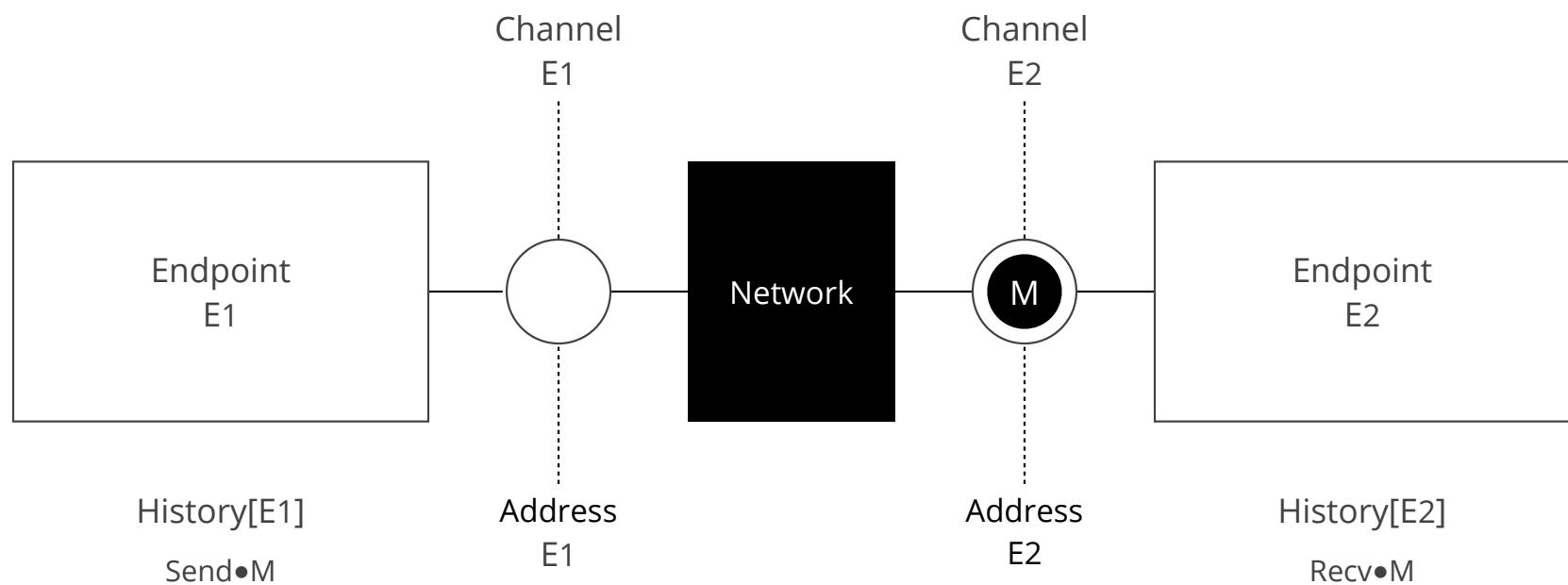


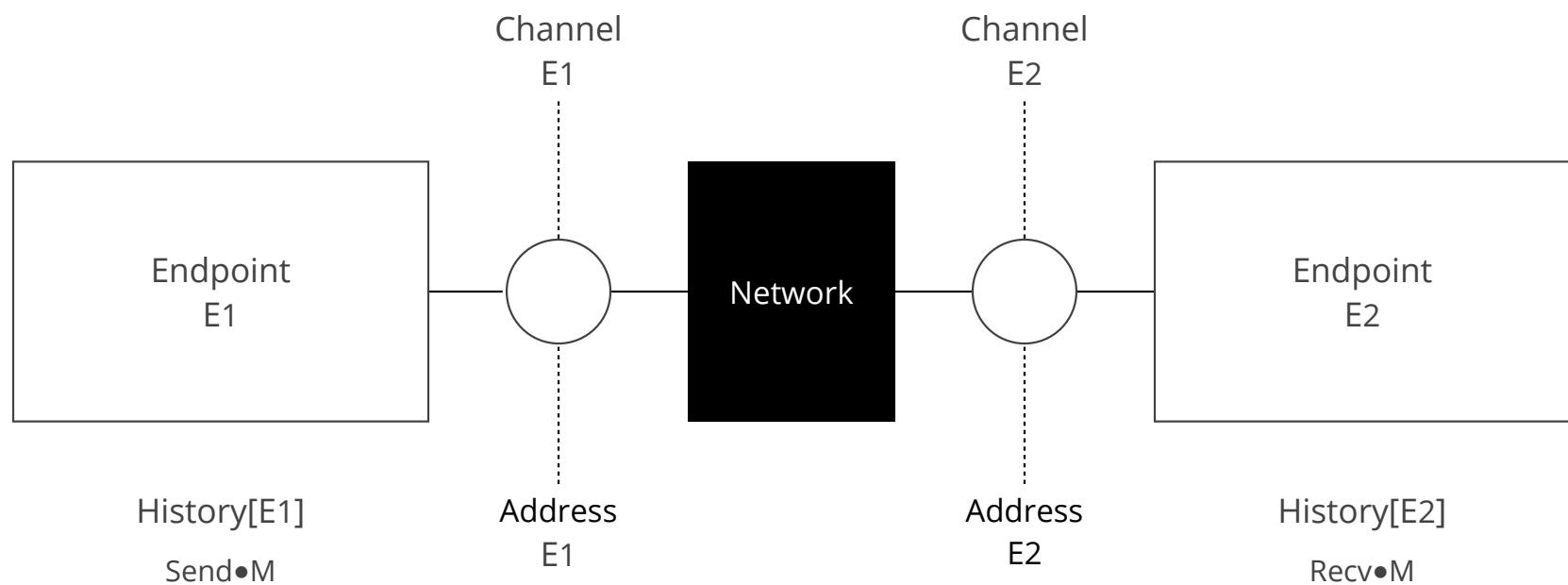


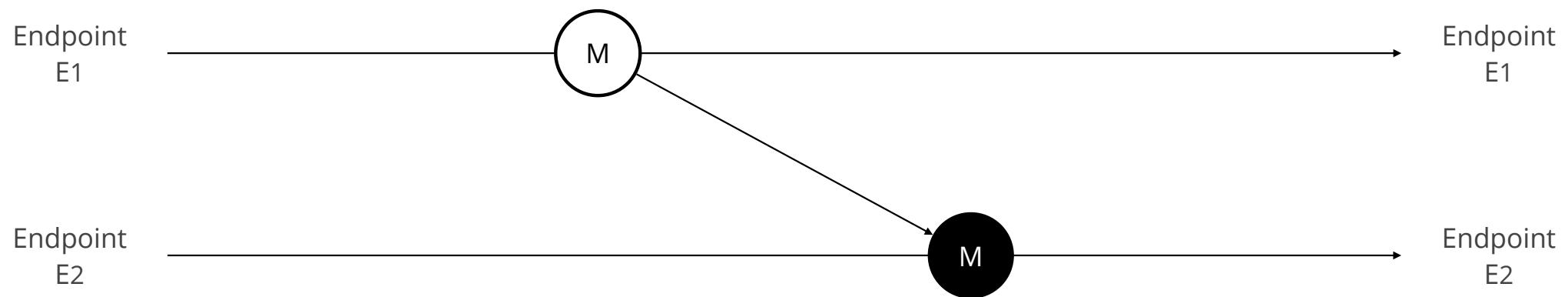


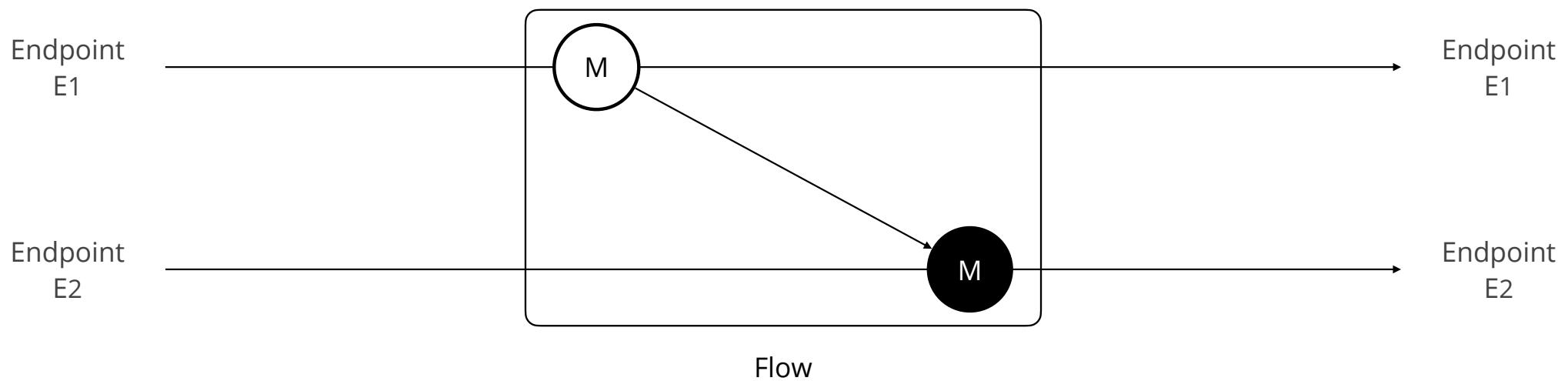


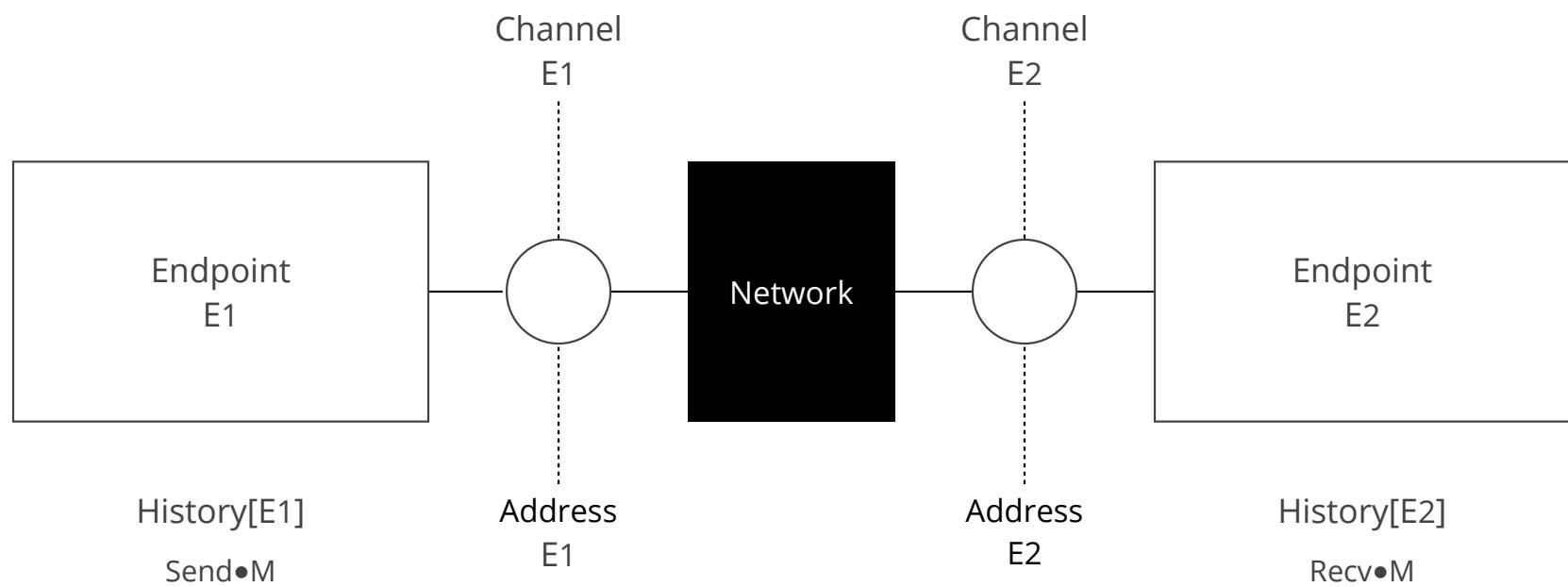


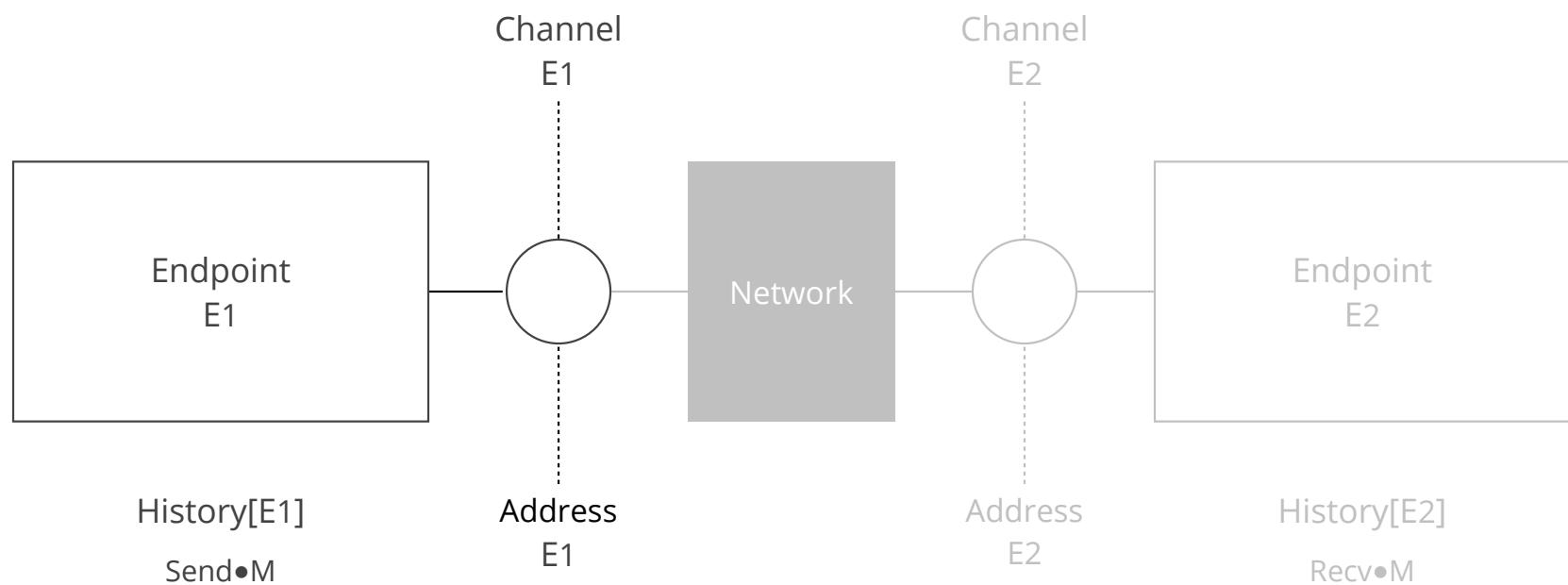


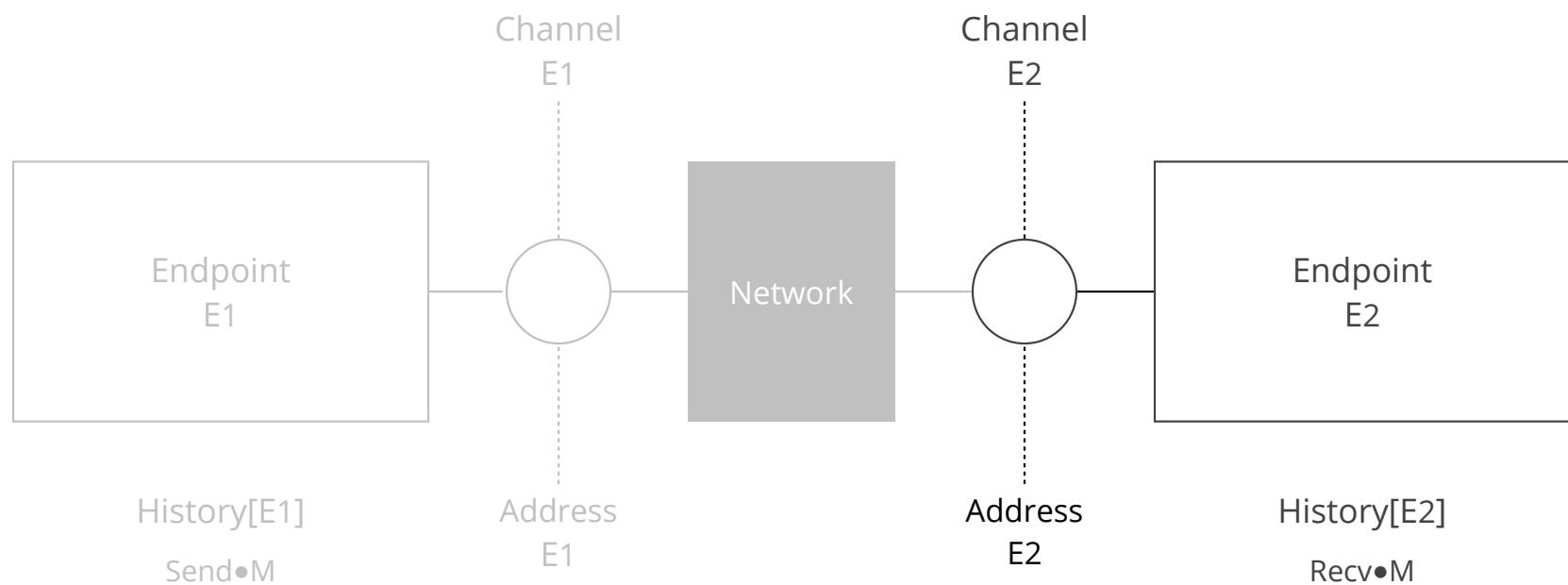
$$\text{Send} \bullet M \in \text{History}[E1] \wedge \text{Recv} \bullet M \in \text{History}[E2] \implies \text{target}[\text{Send} \bullet M] = \text{address}[E2]$$


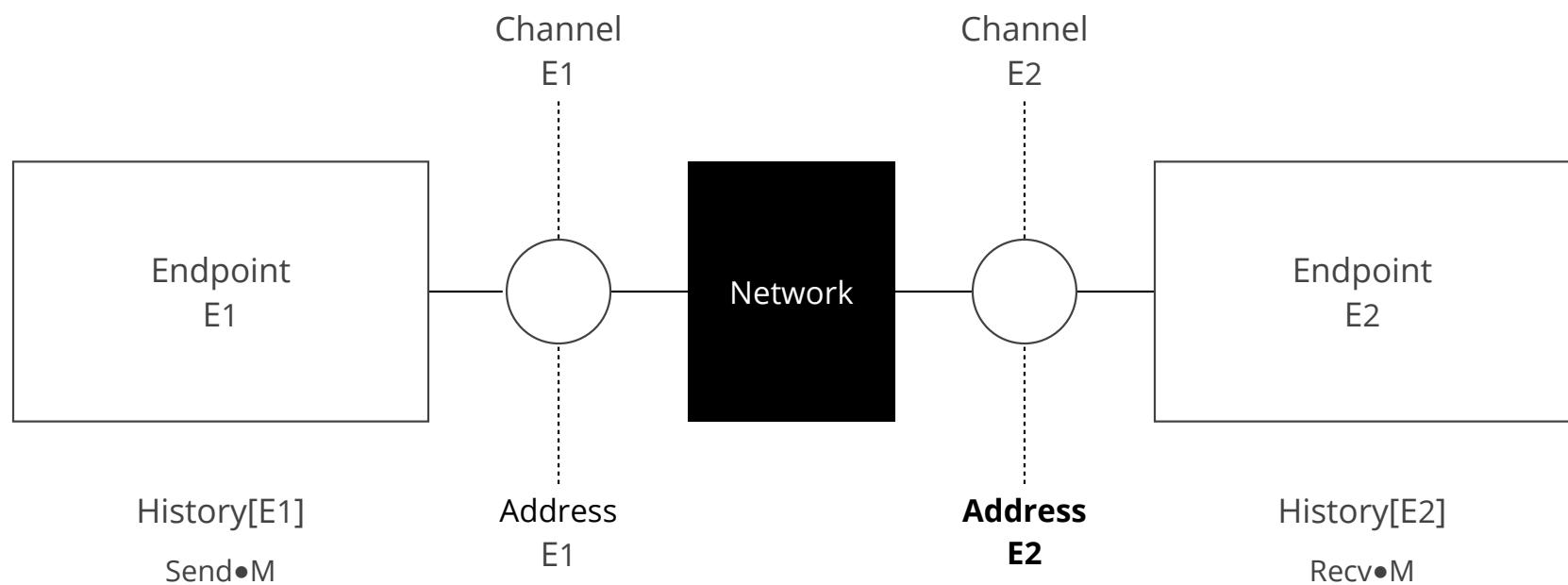
$$\text{Send} \bullet M \in \text{History}[E1] \wedge \text{Recv} \bullet M \in \text{History}[E2] \implies \text{target}[\text{Send} \bullet M] = \text{address}[E2]$$


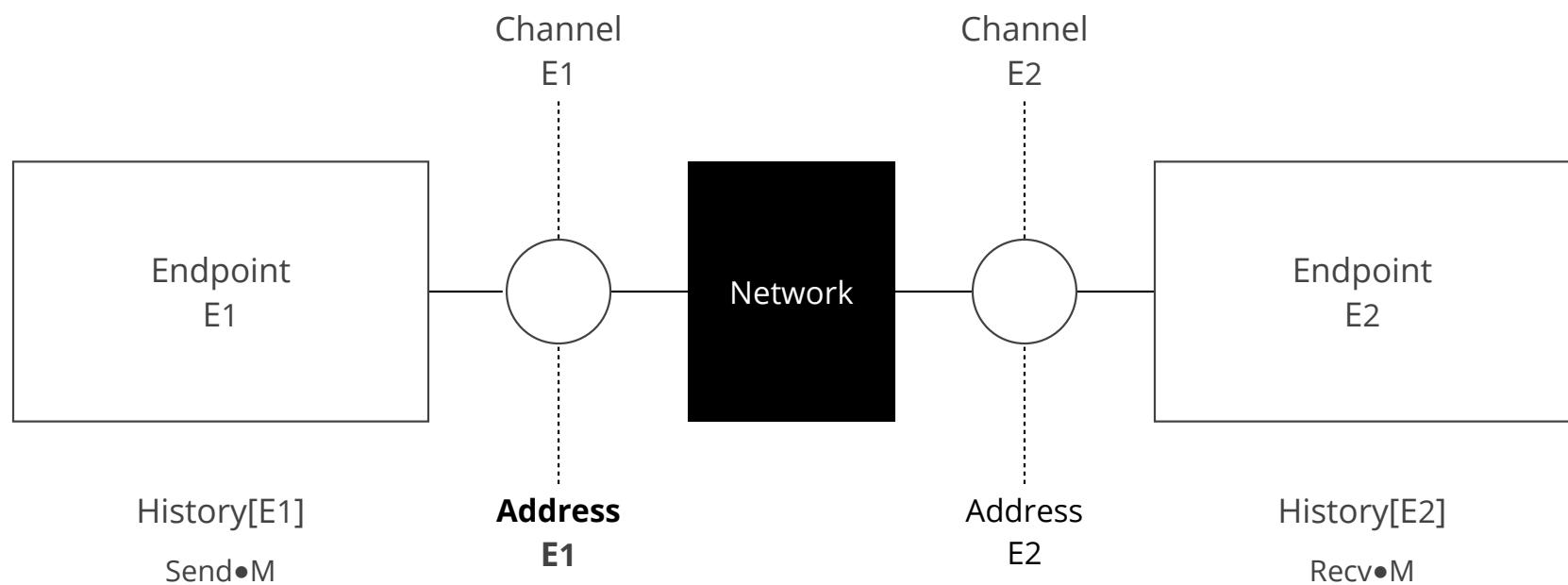
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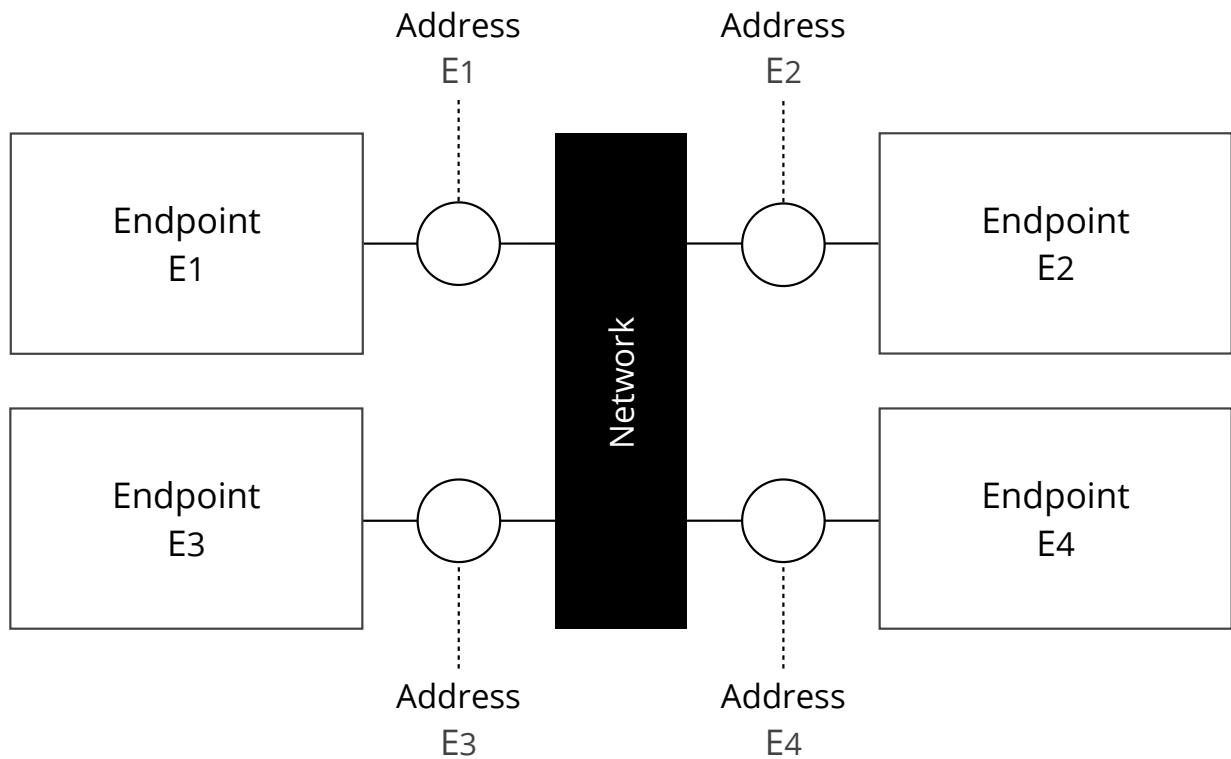


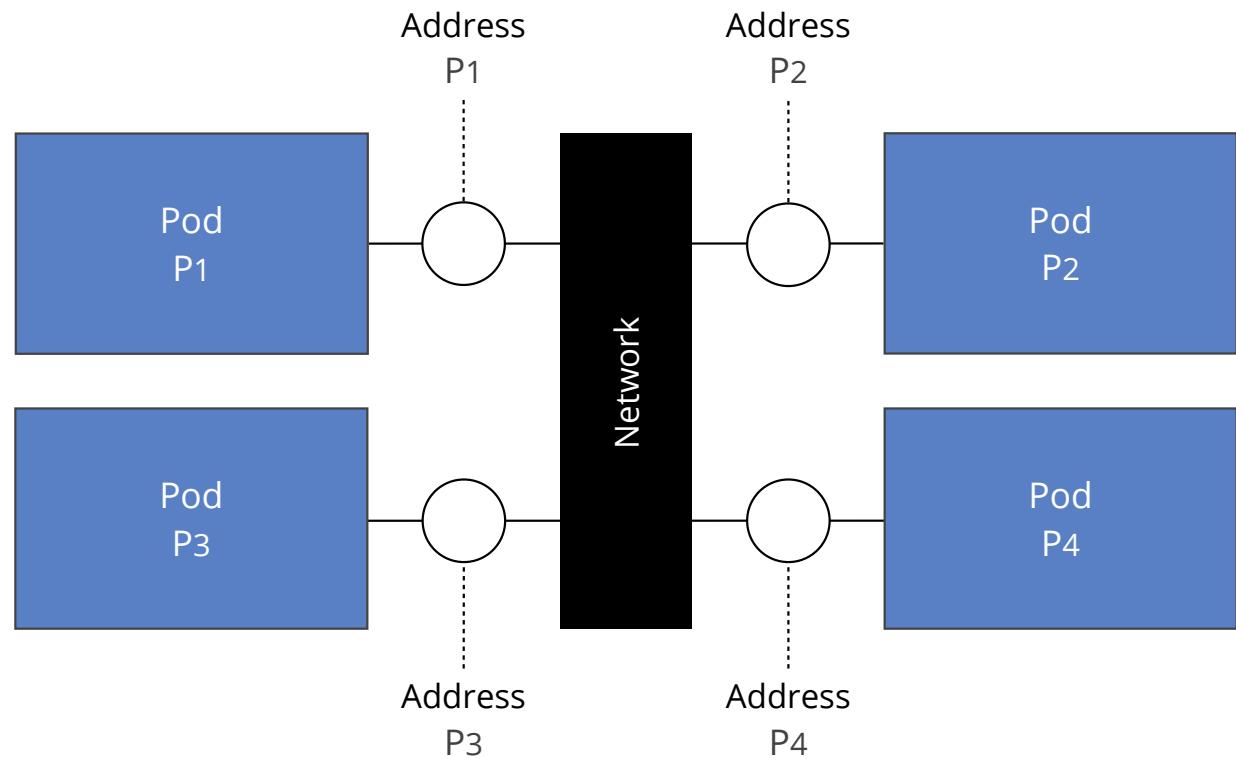


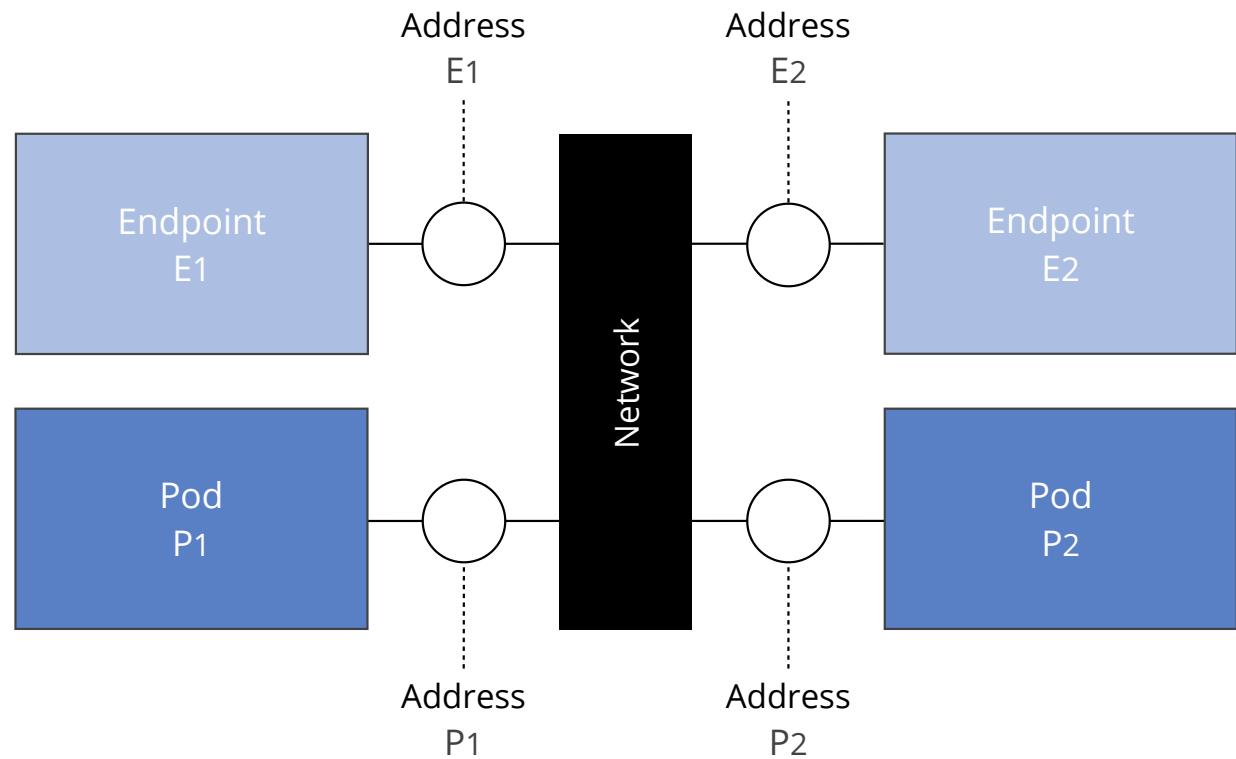


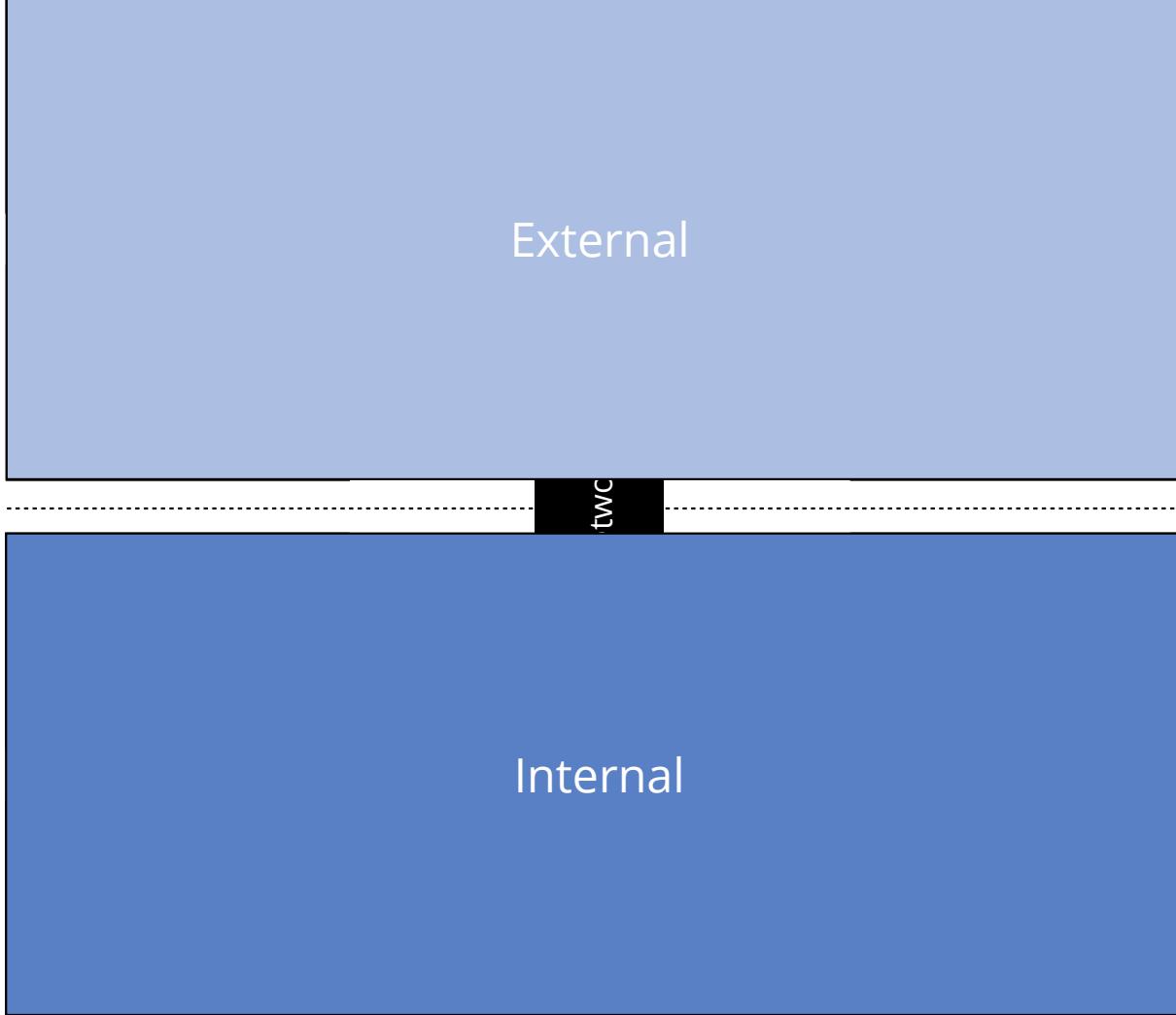












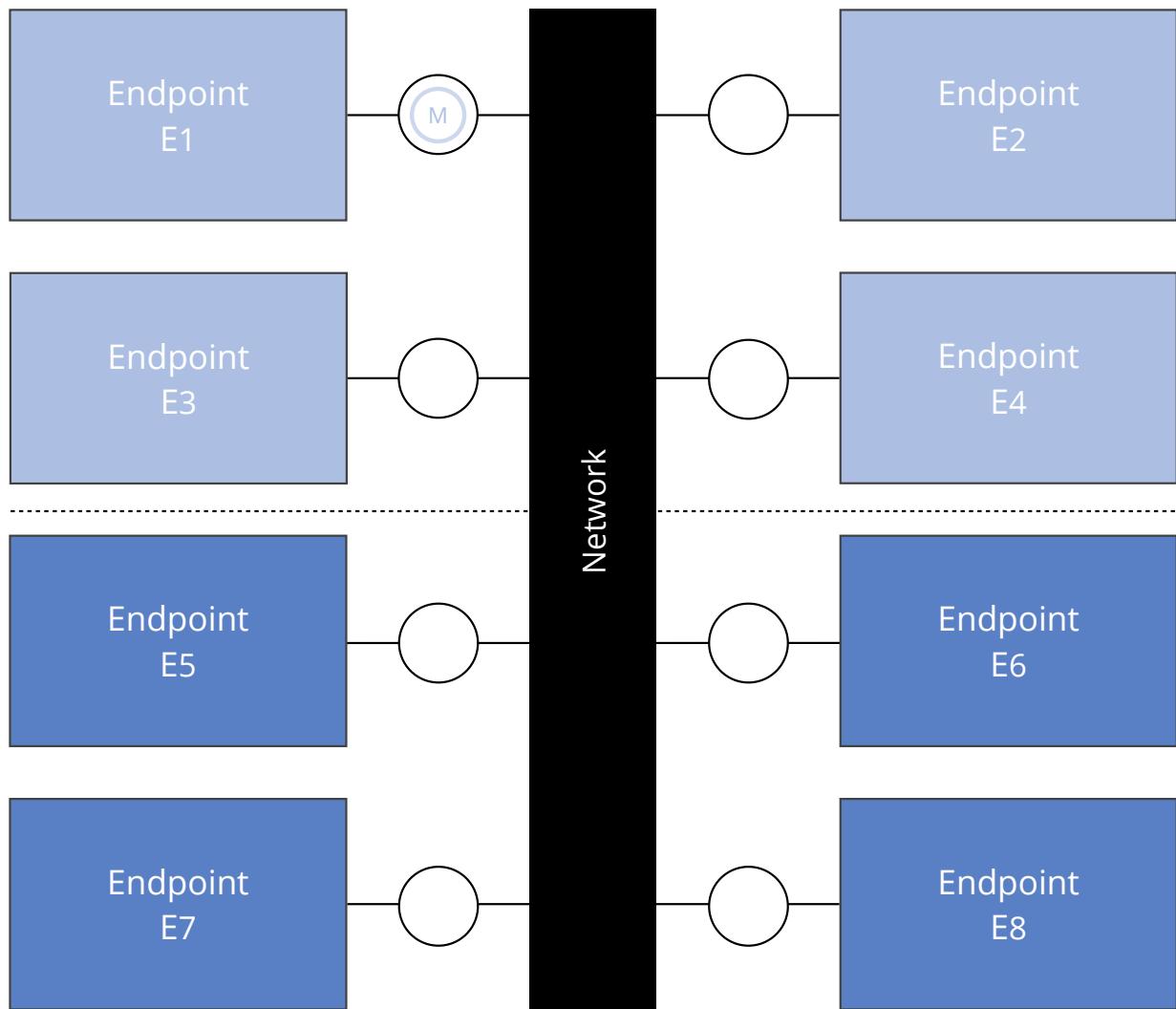
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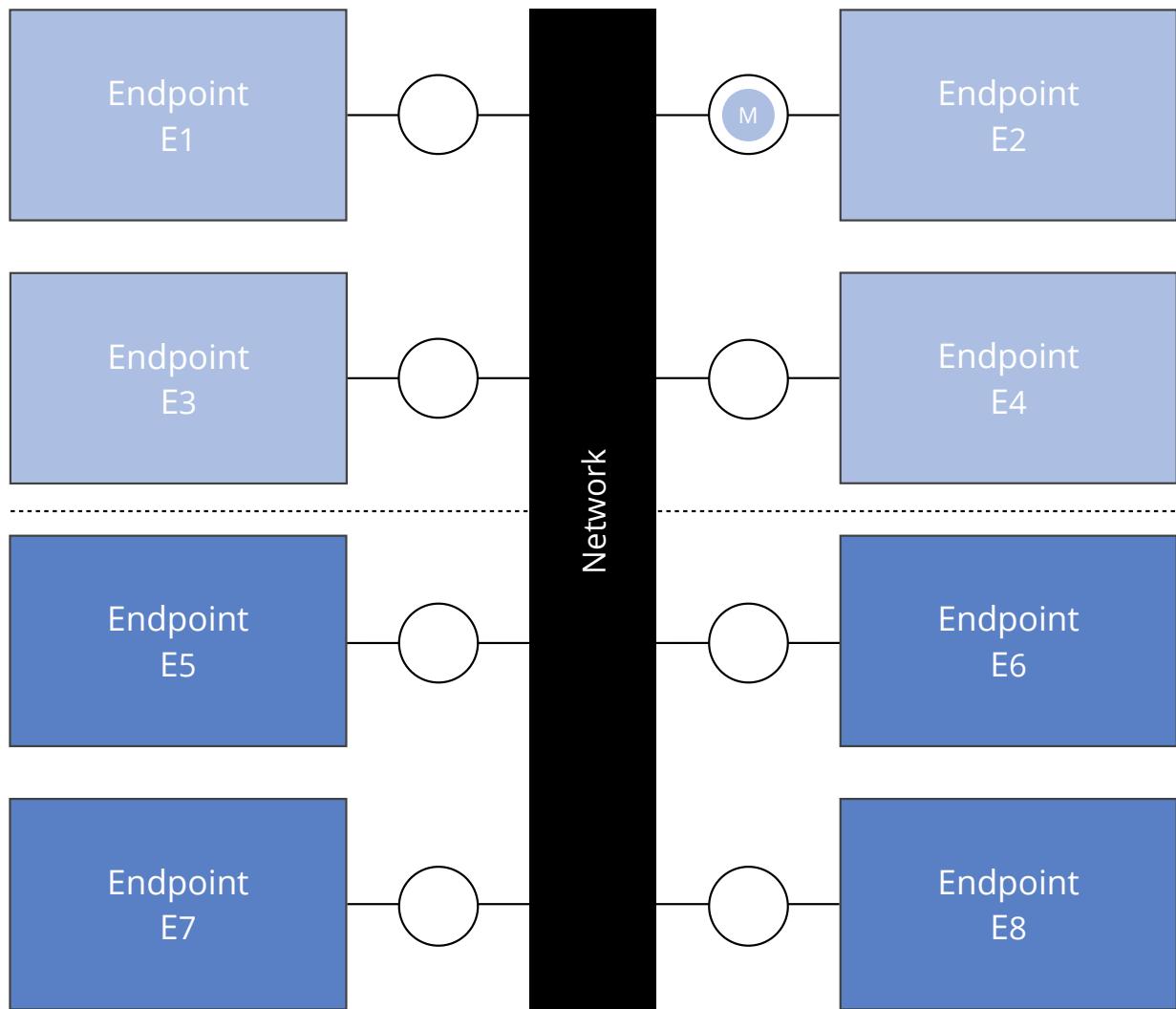
twc

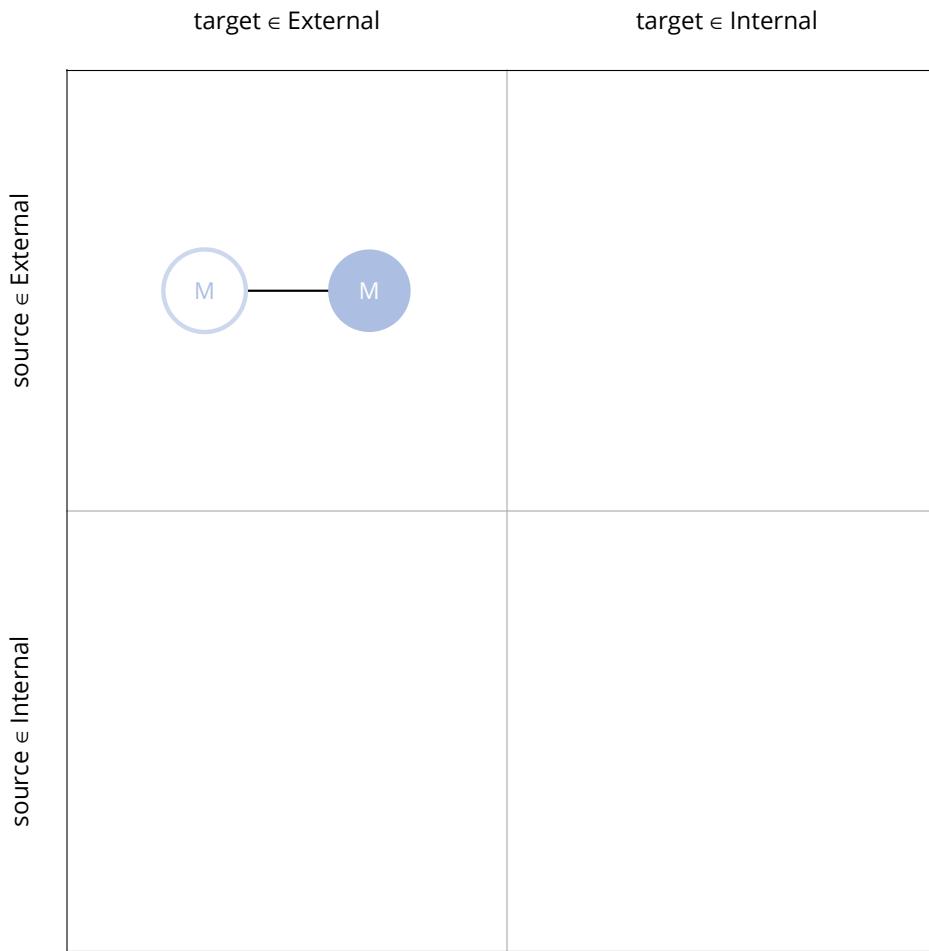
Internal

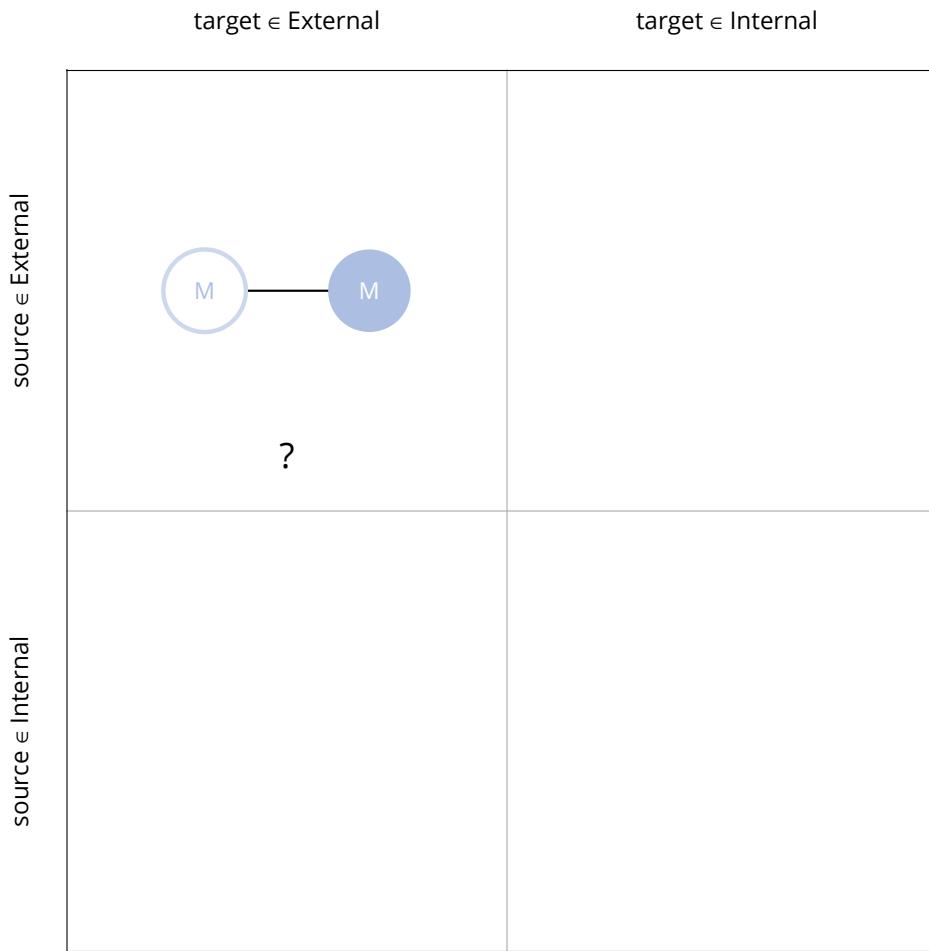
	target ∈ External	target ∈ Internal
source ∈ External		
source ∈ Internal		

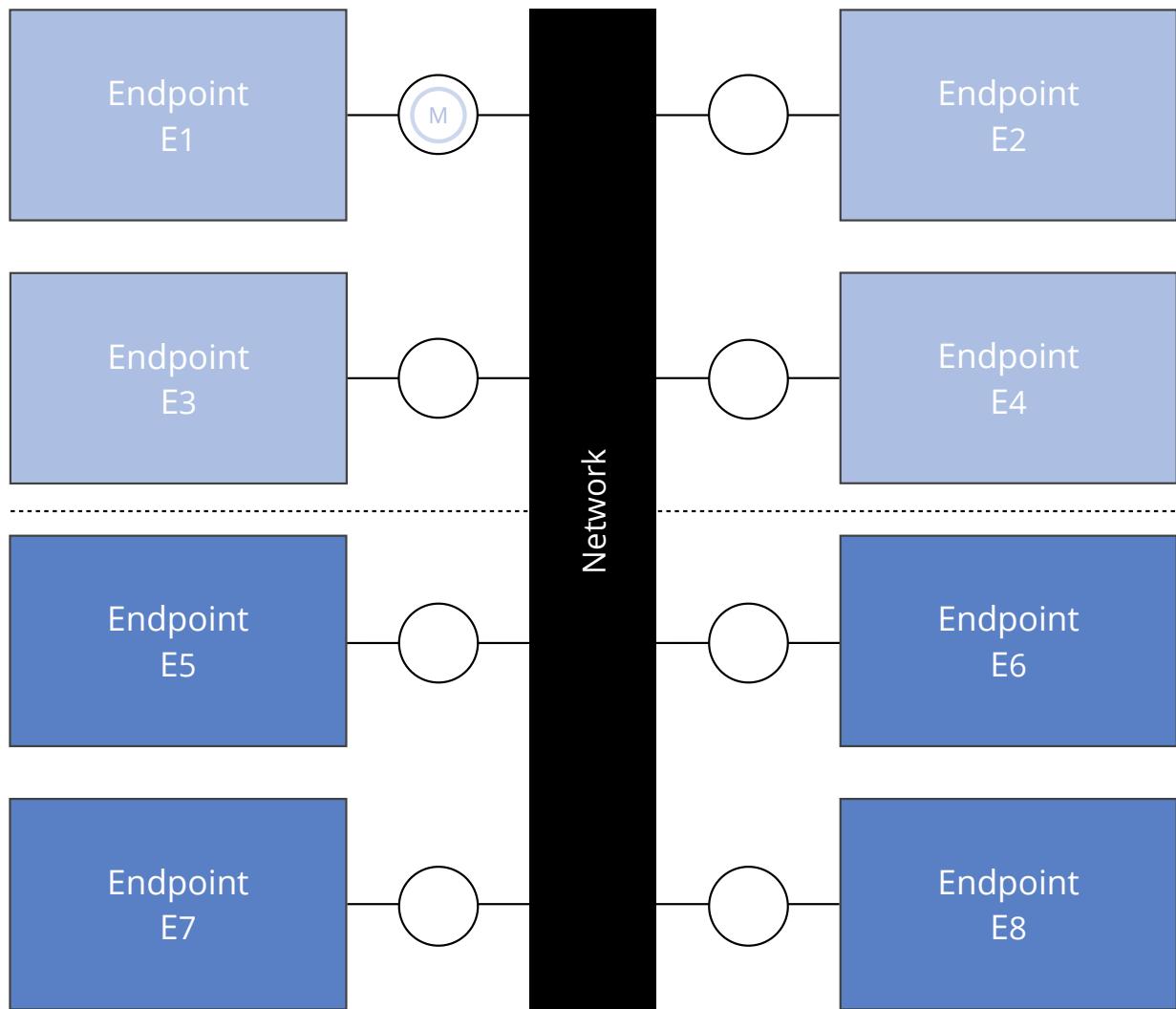


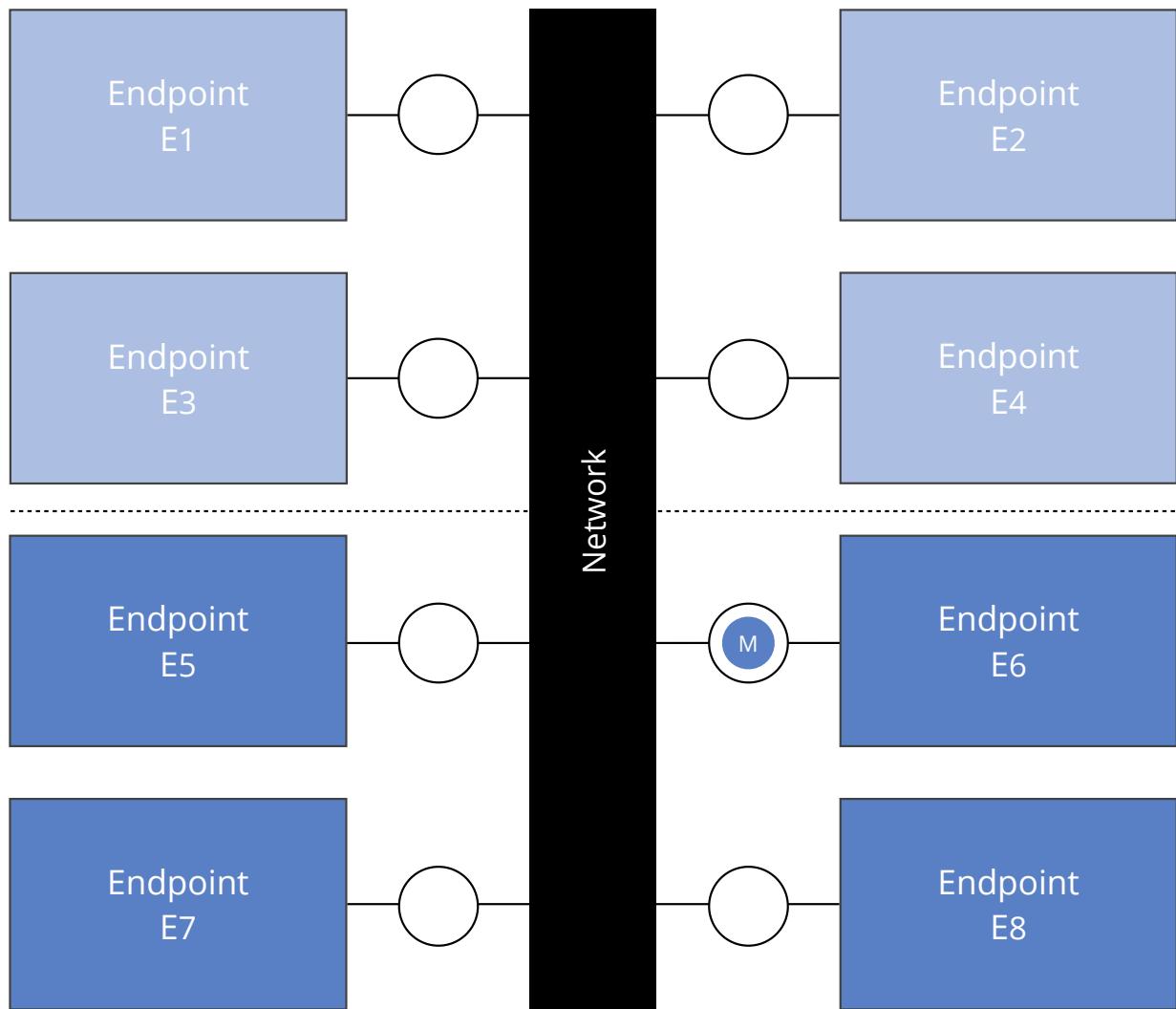


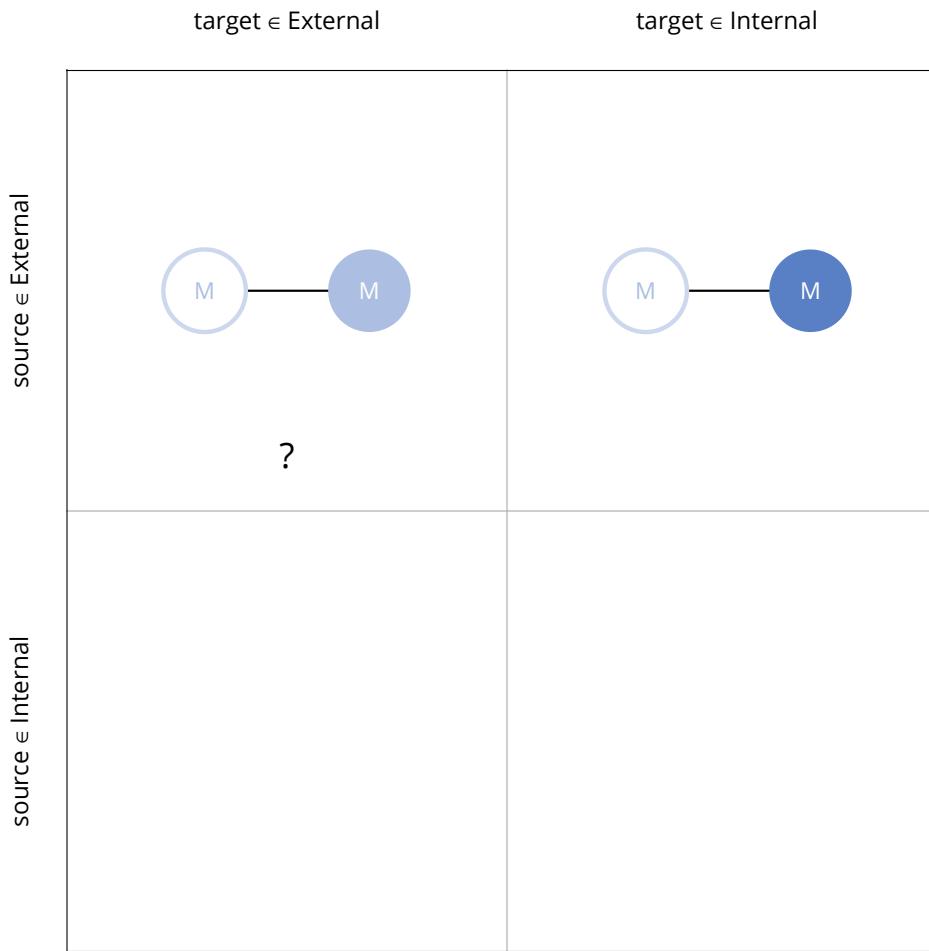


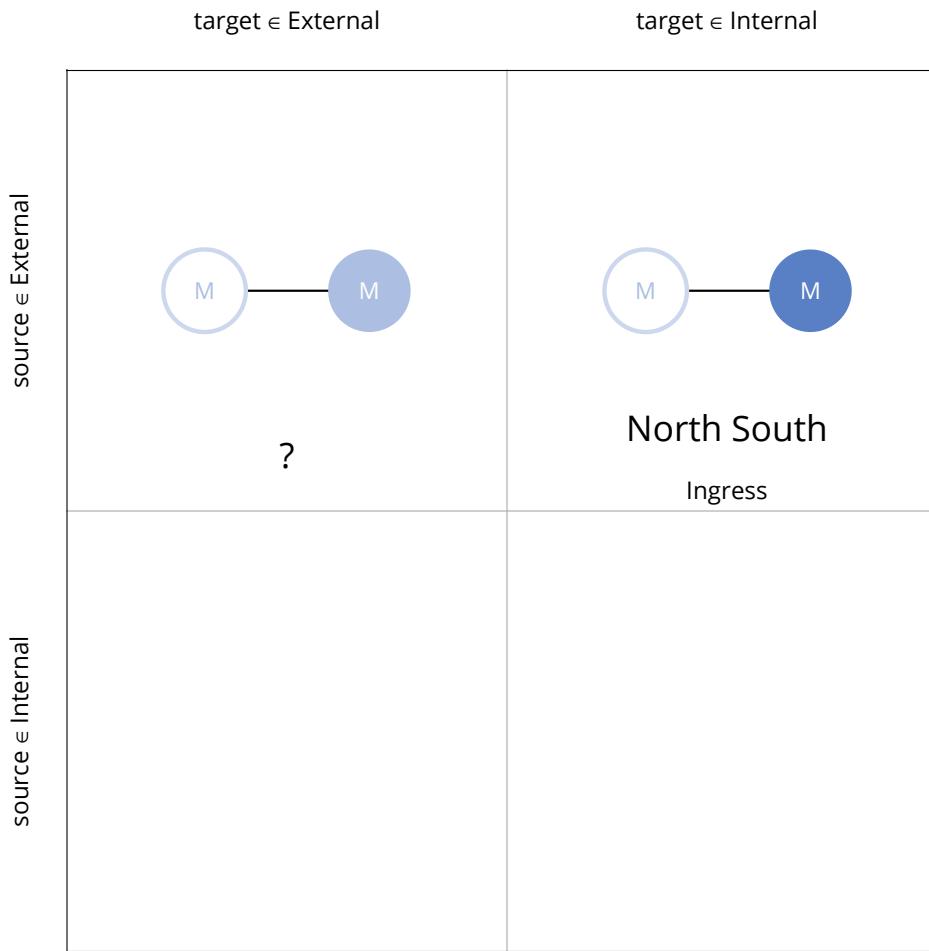


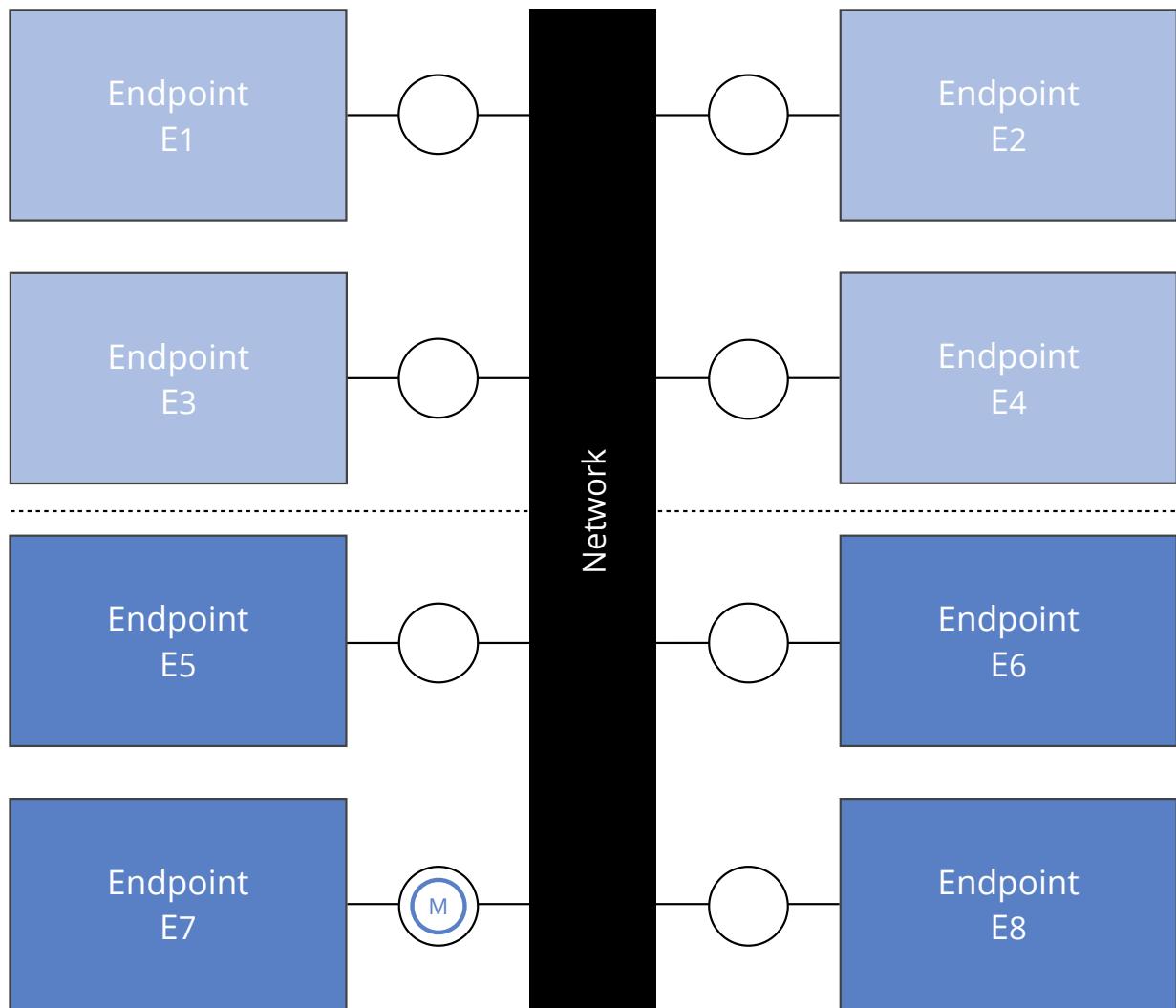


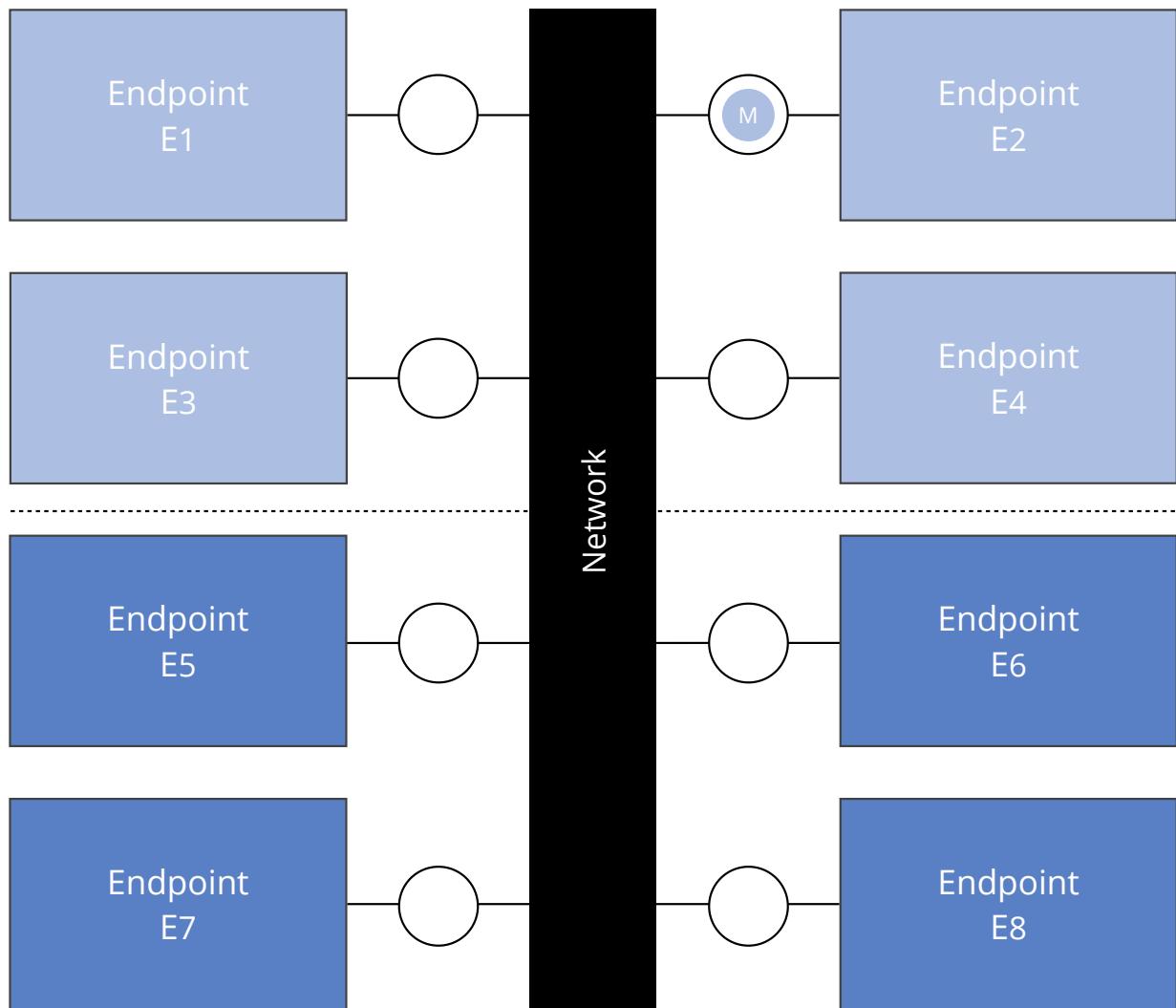


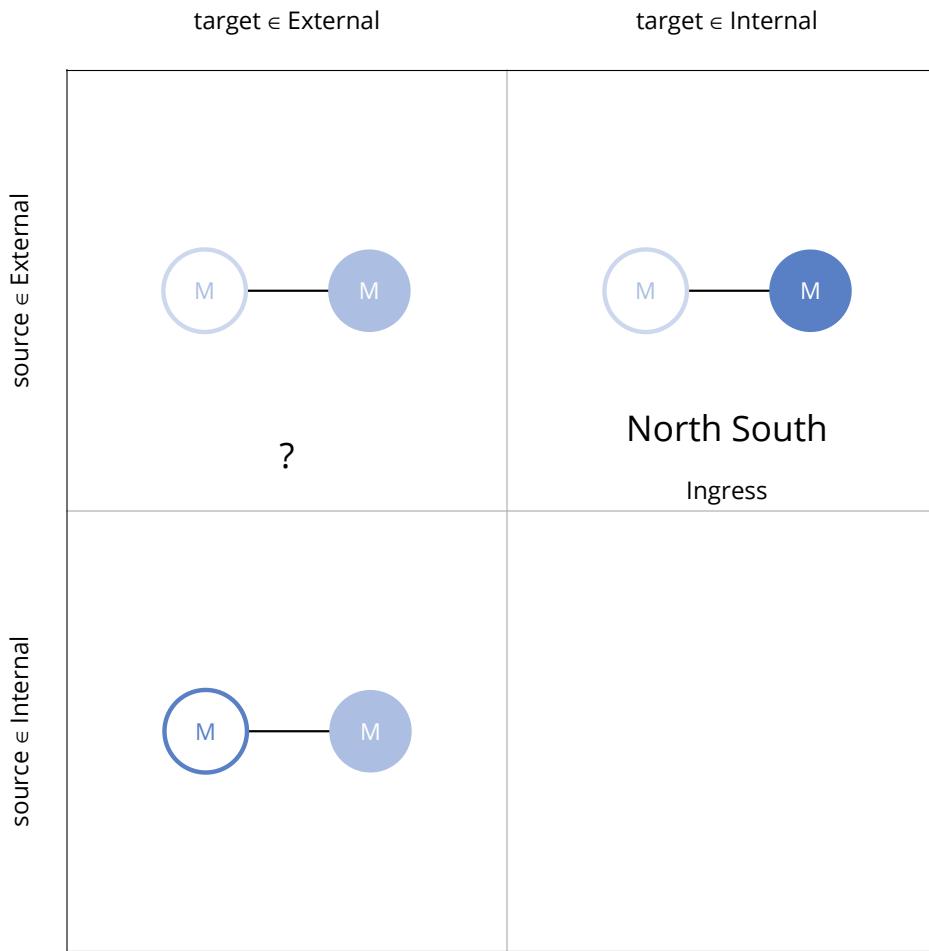


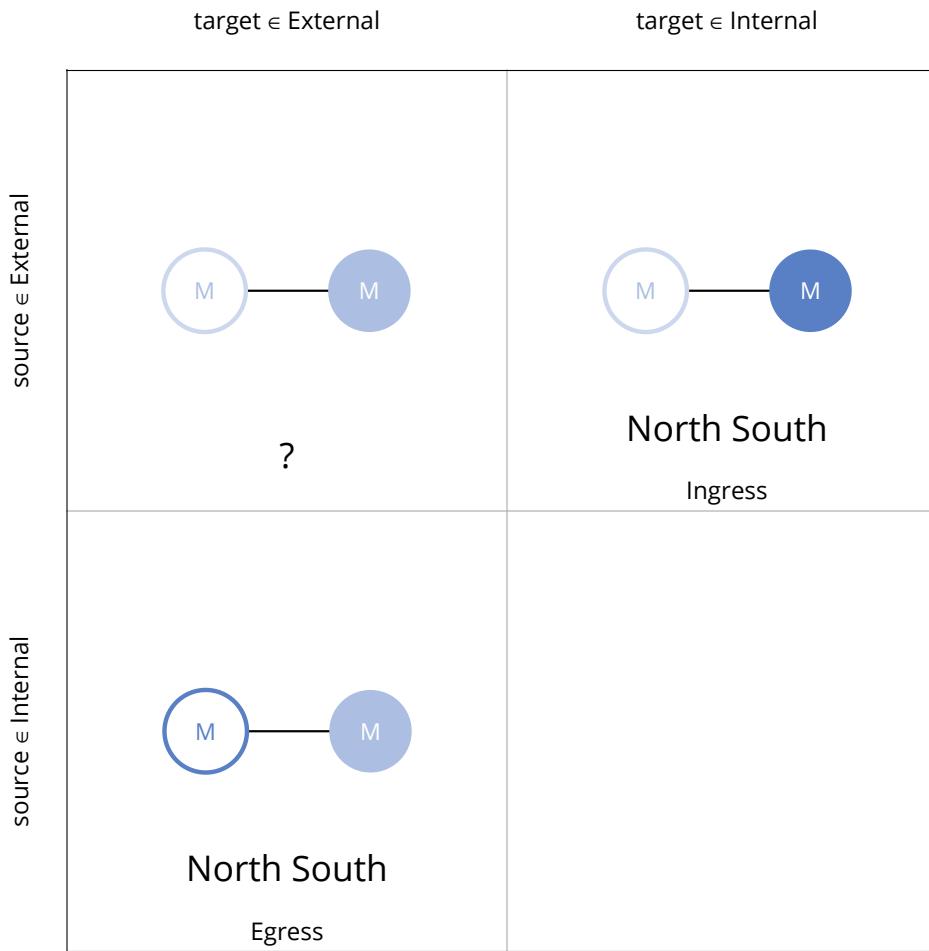


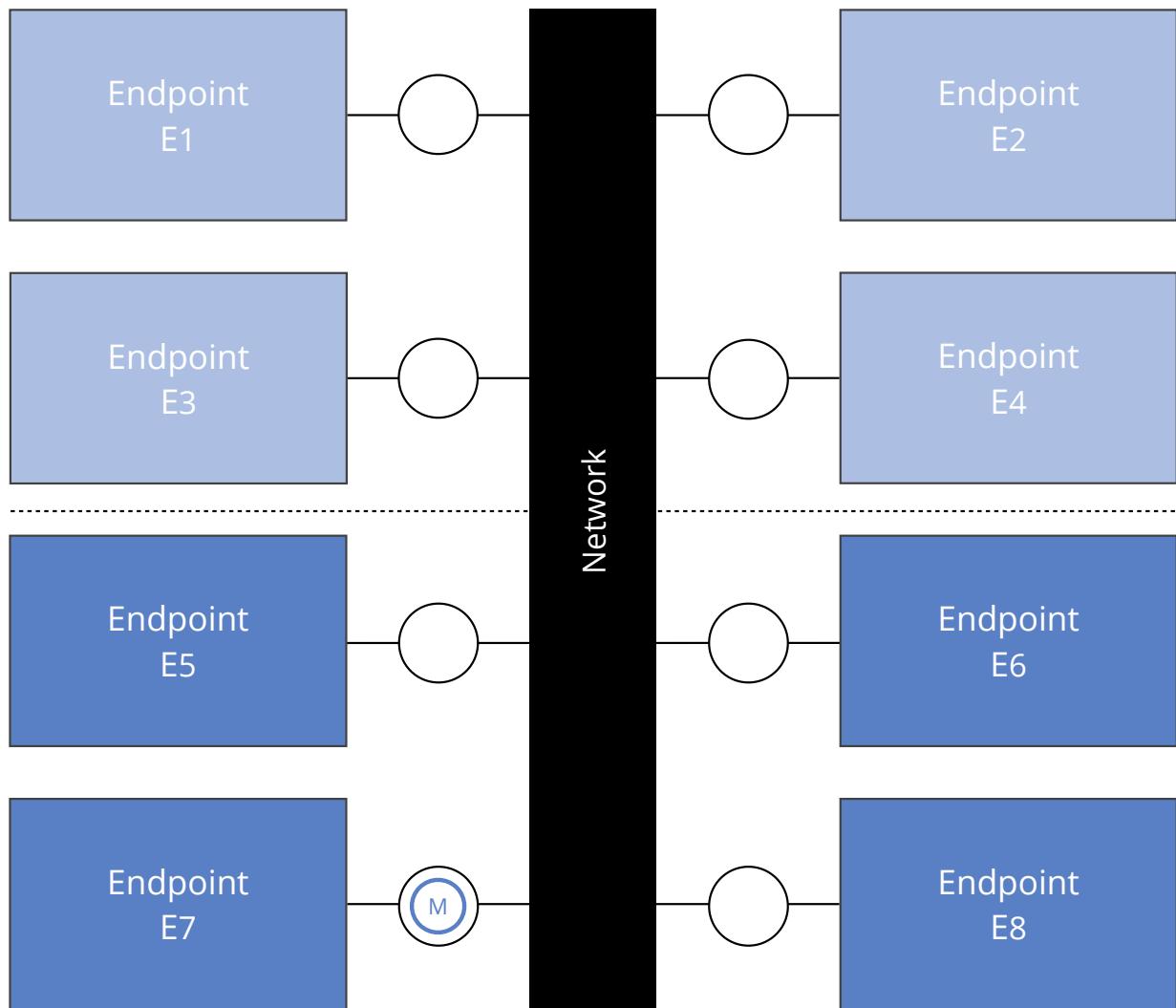


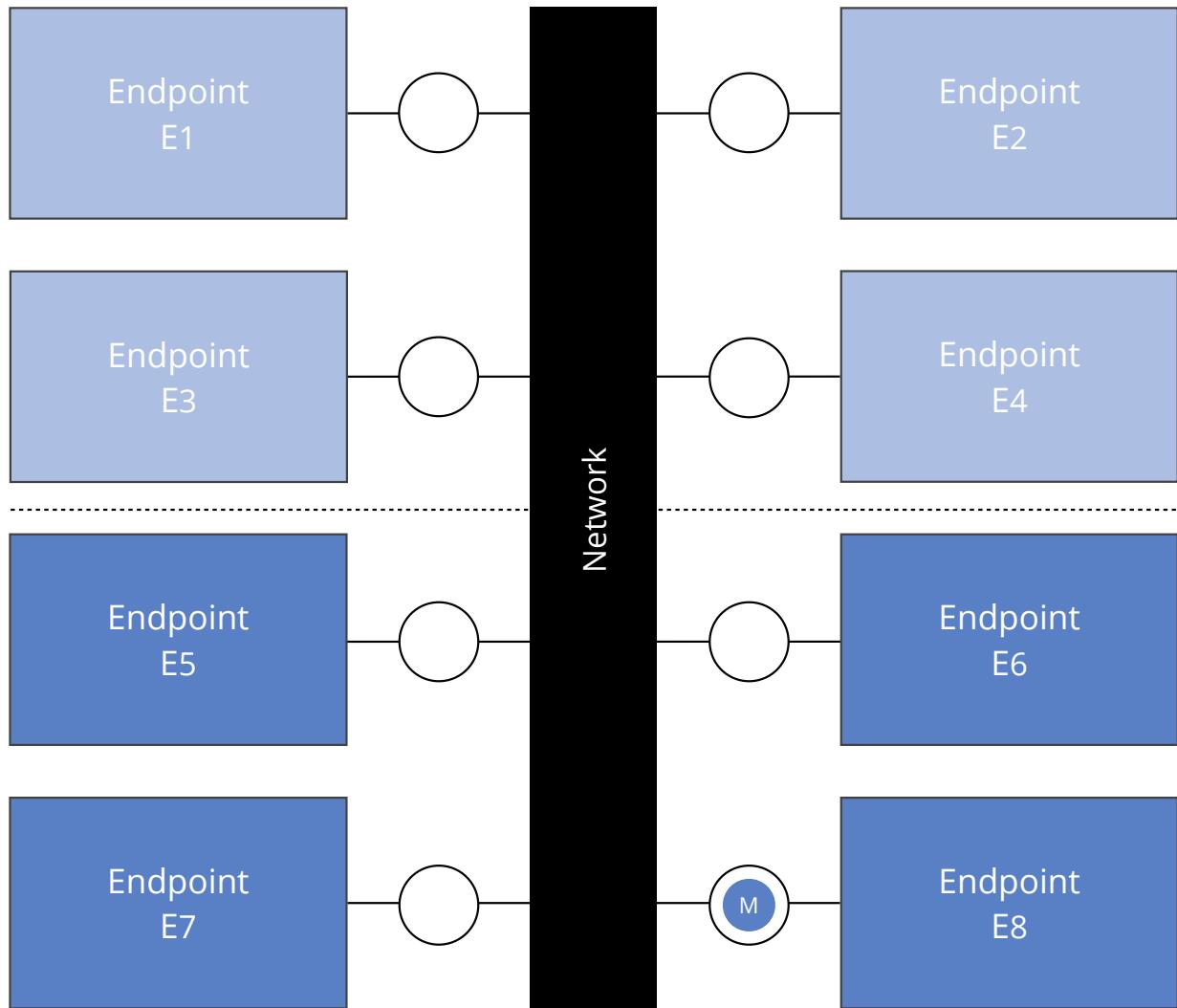


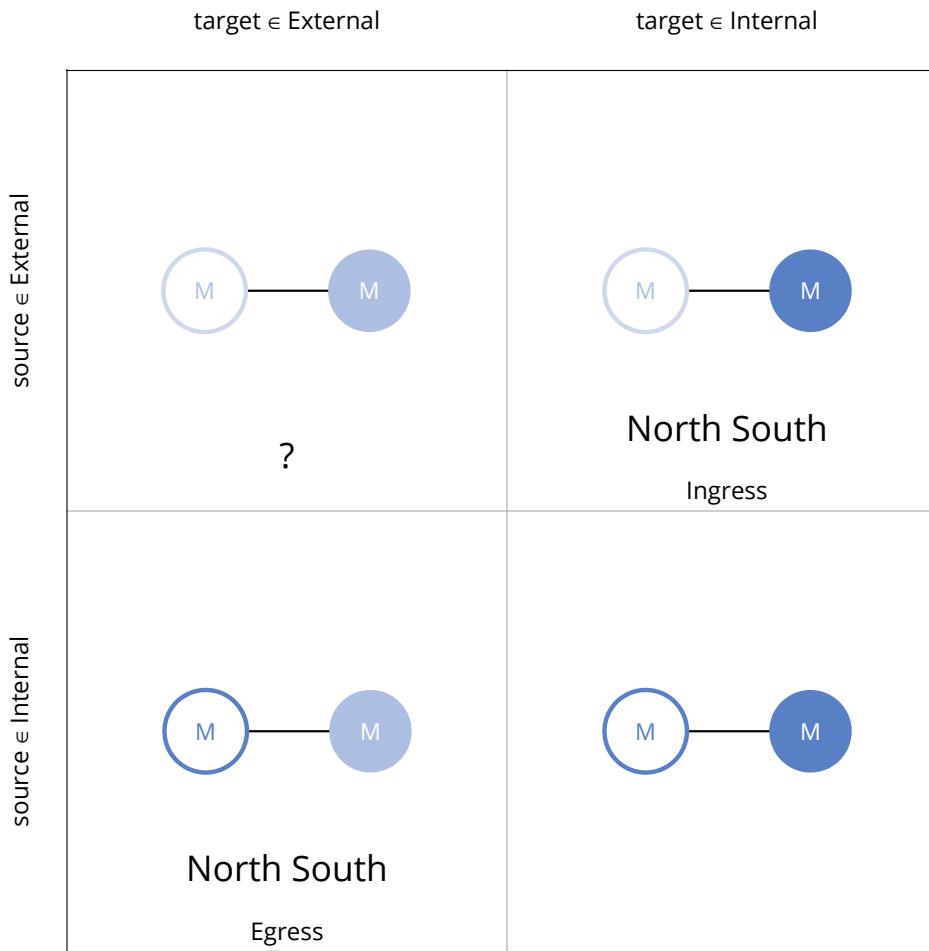


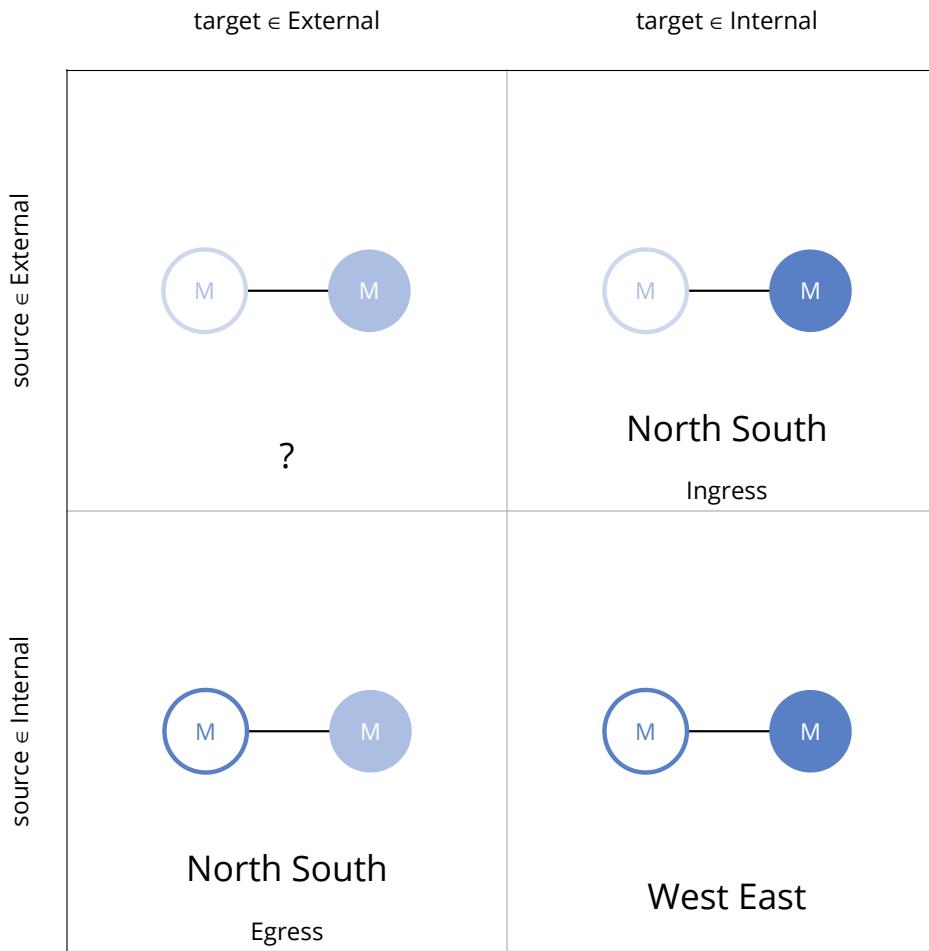












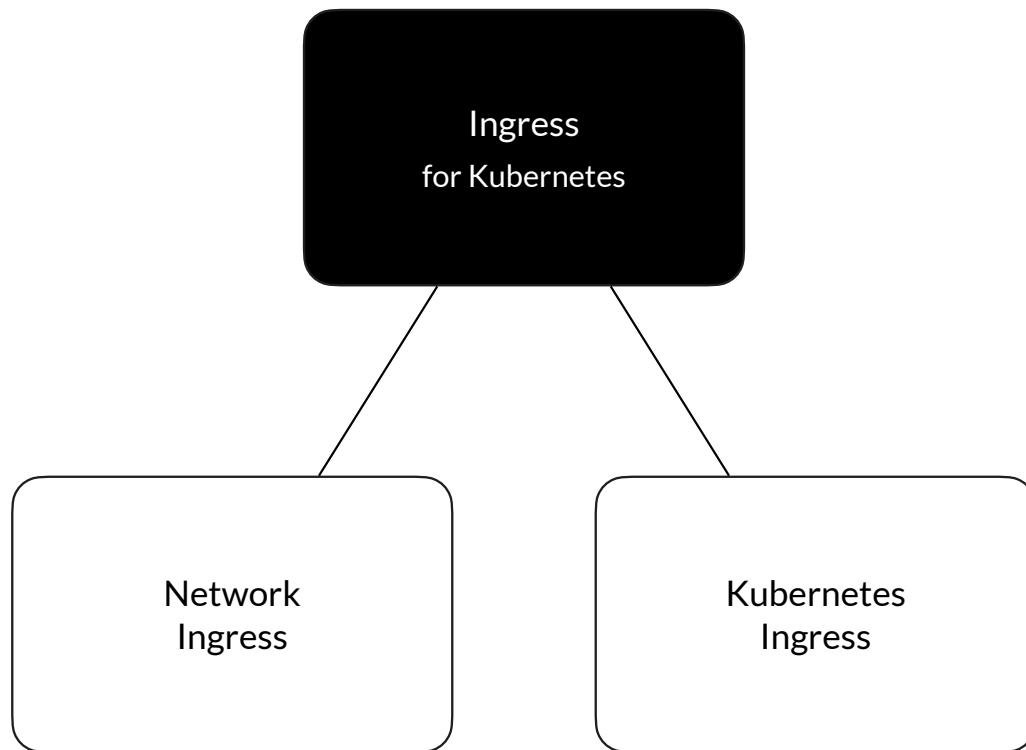
Definition

## Network Ingress

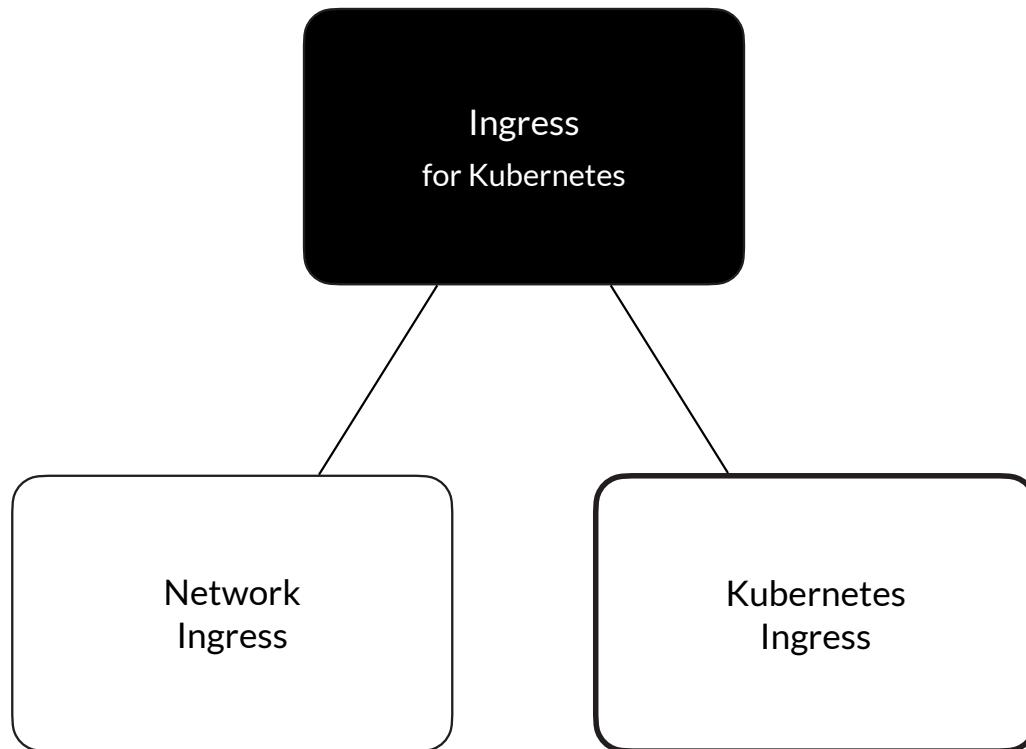
{  $f \in \text{Flow} \mid \text{source}[f] \notin \text{Cluster} \wedge \text{target}[f] \in \text{Cluster} \}$  }

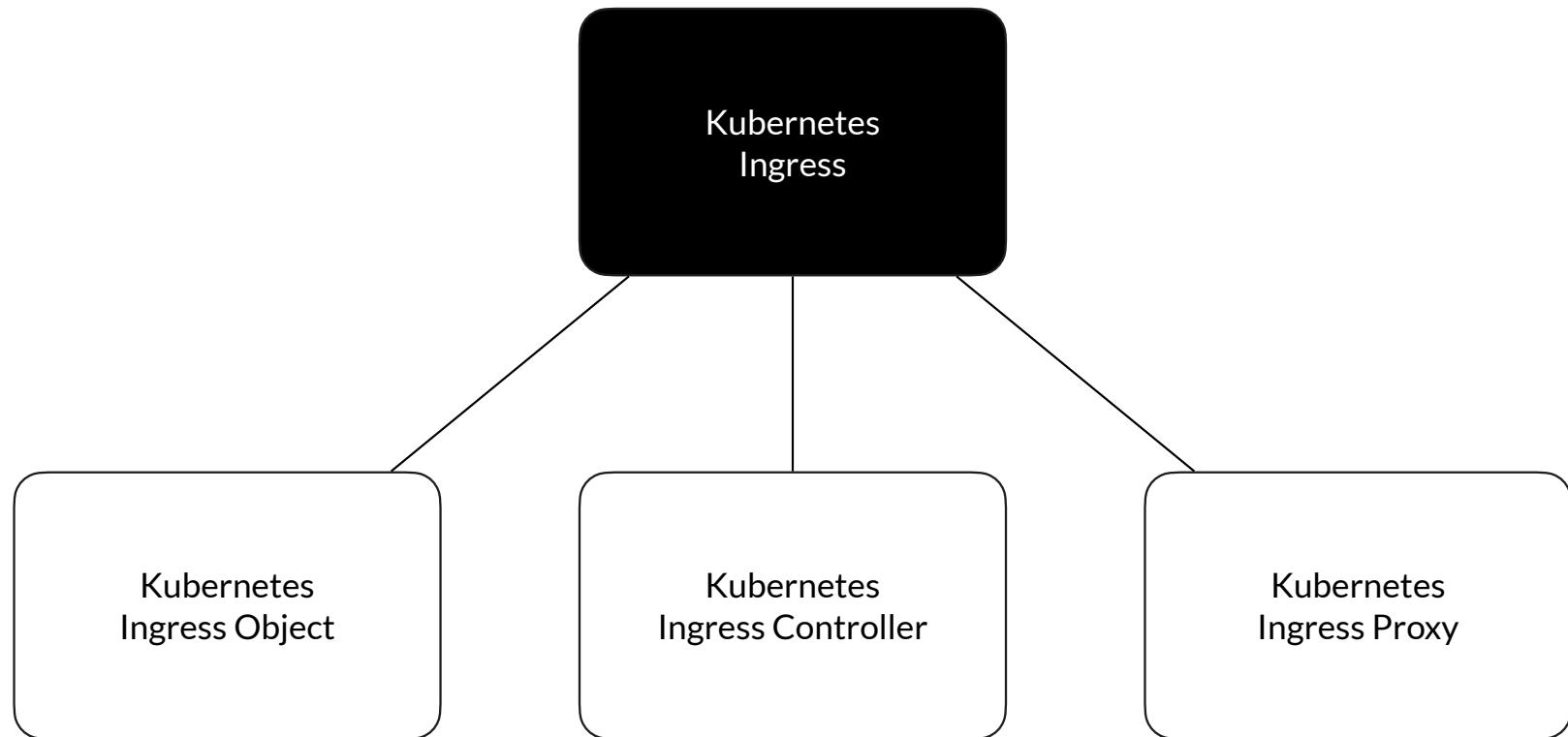


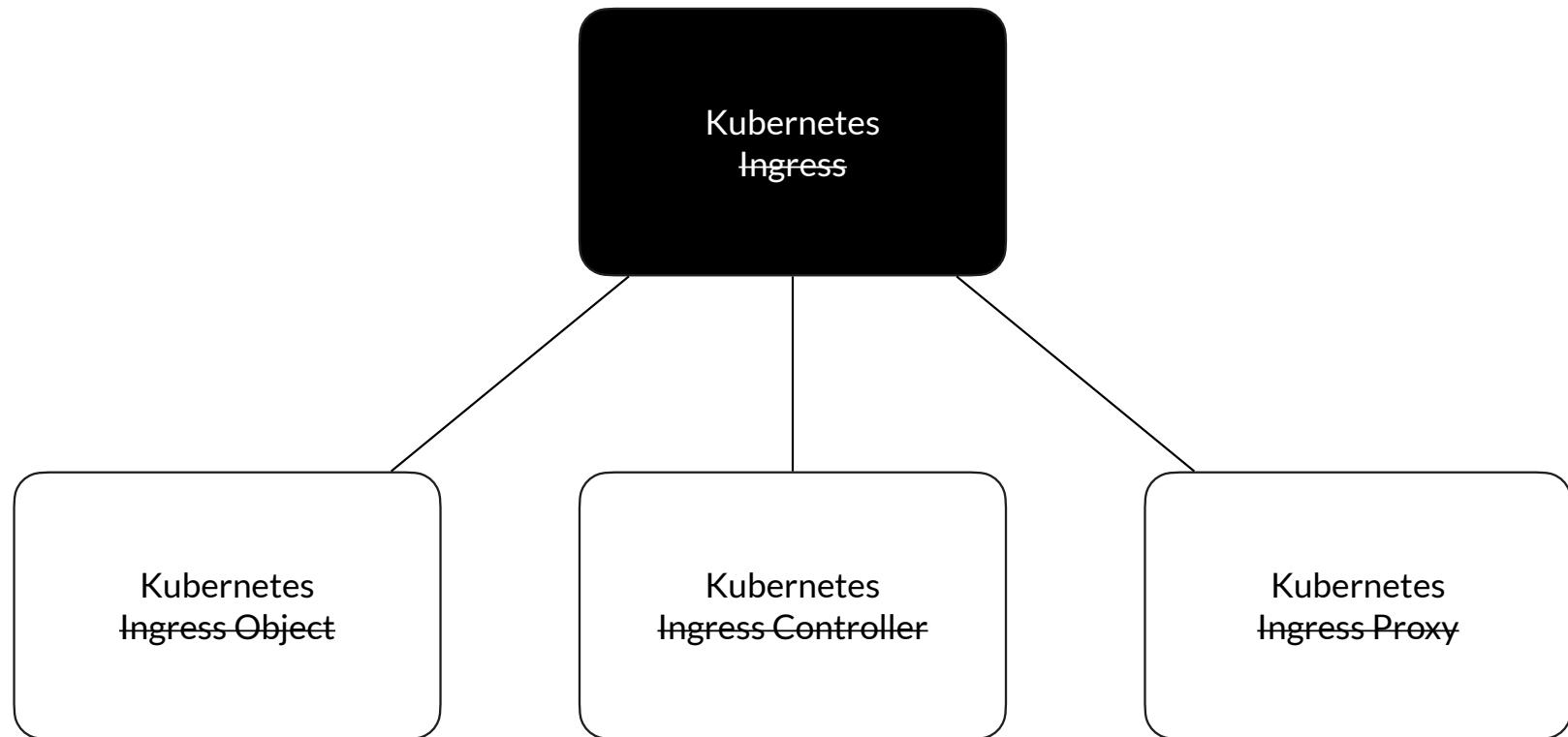
## Definition

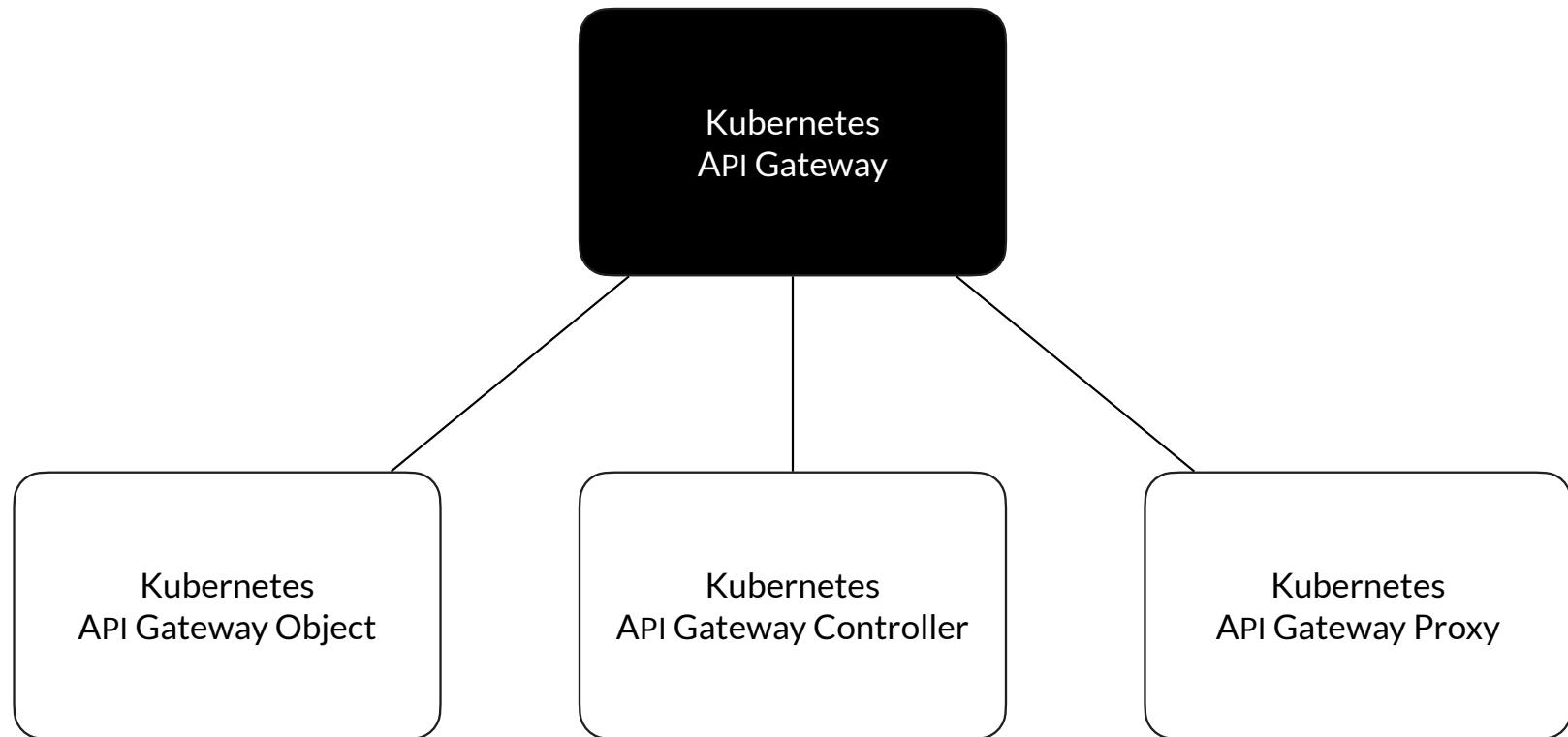


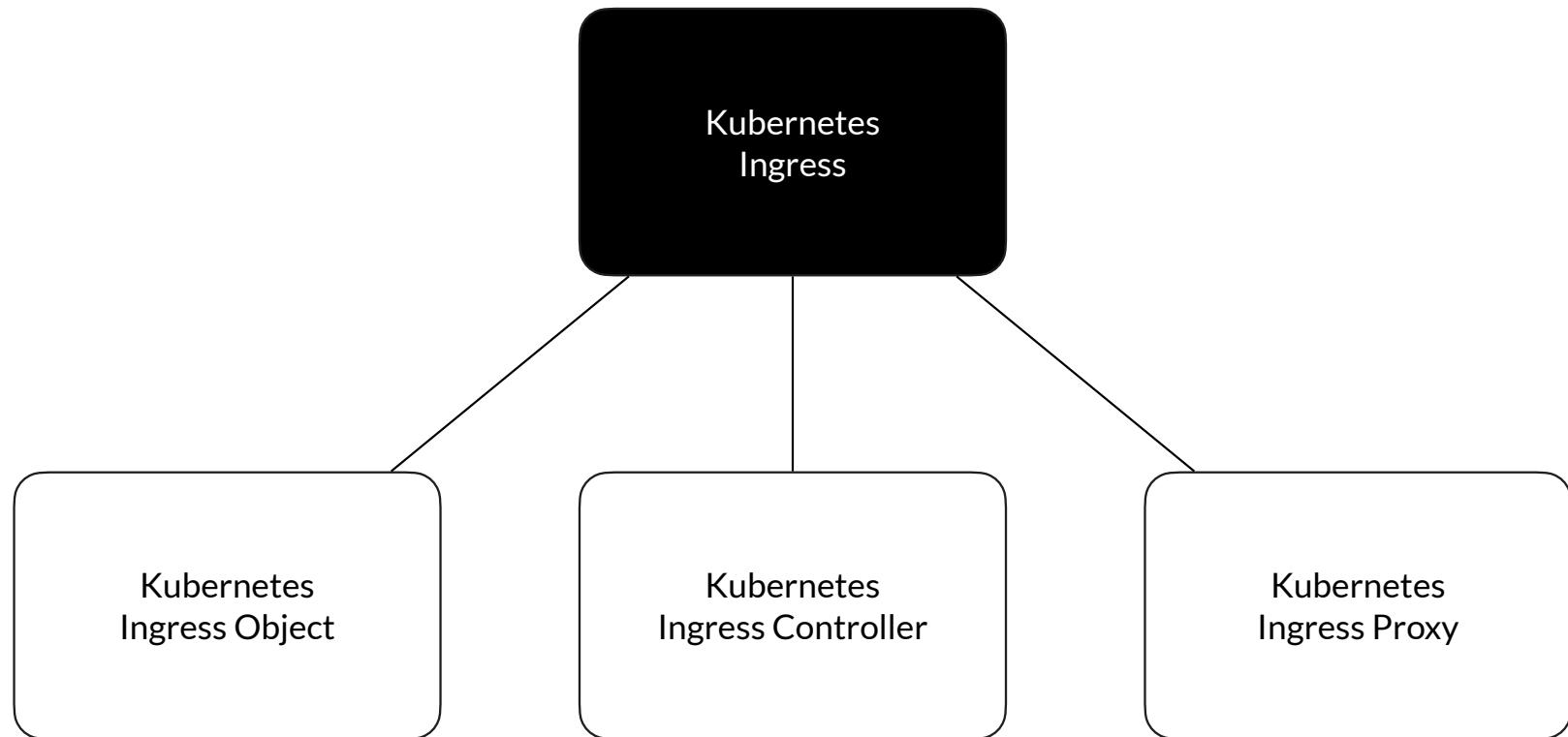
## Definition

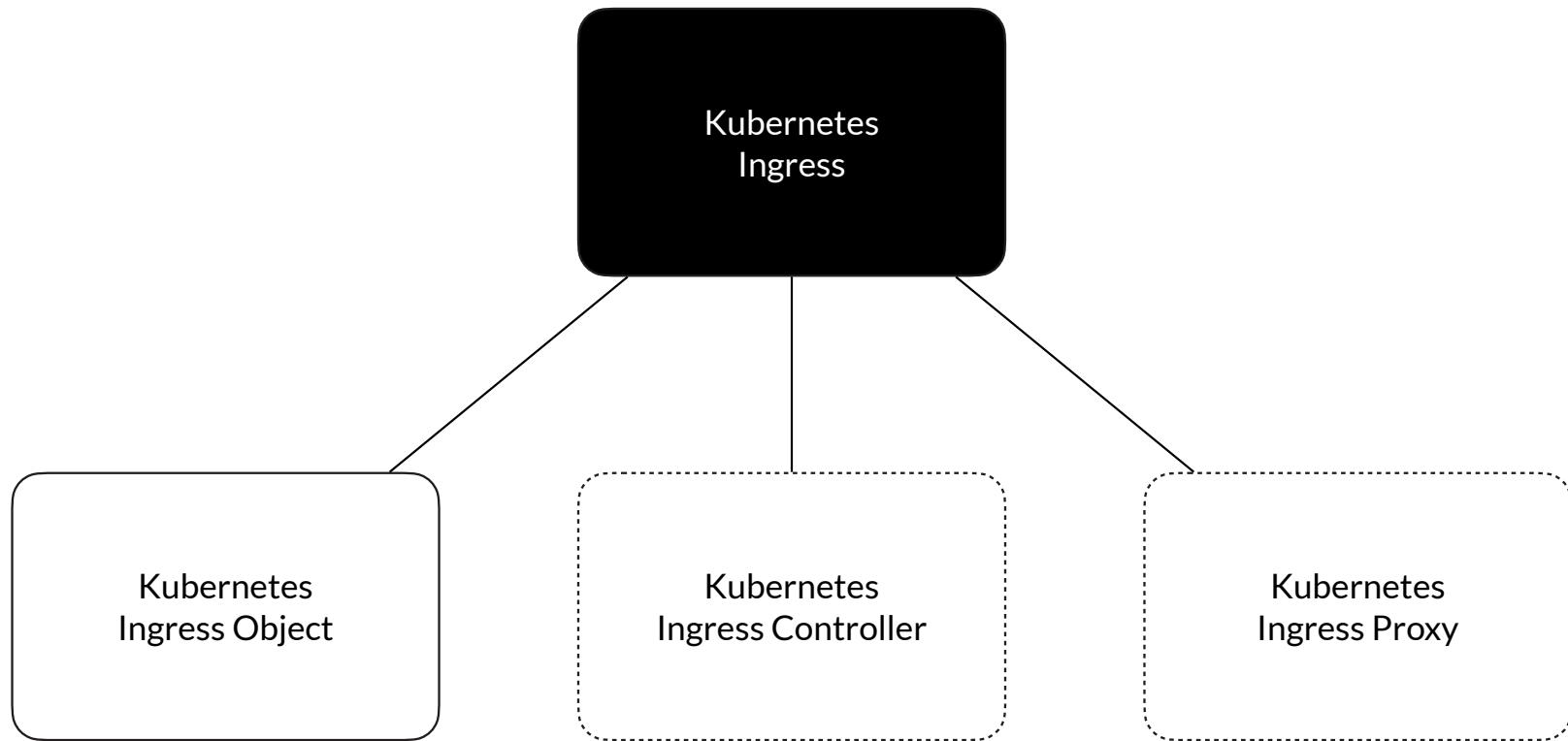


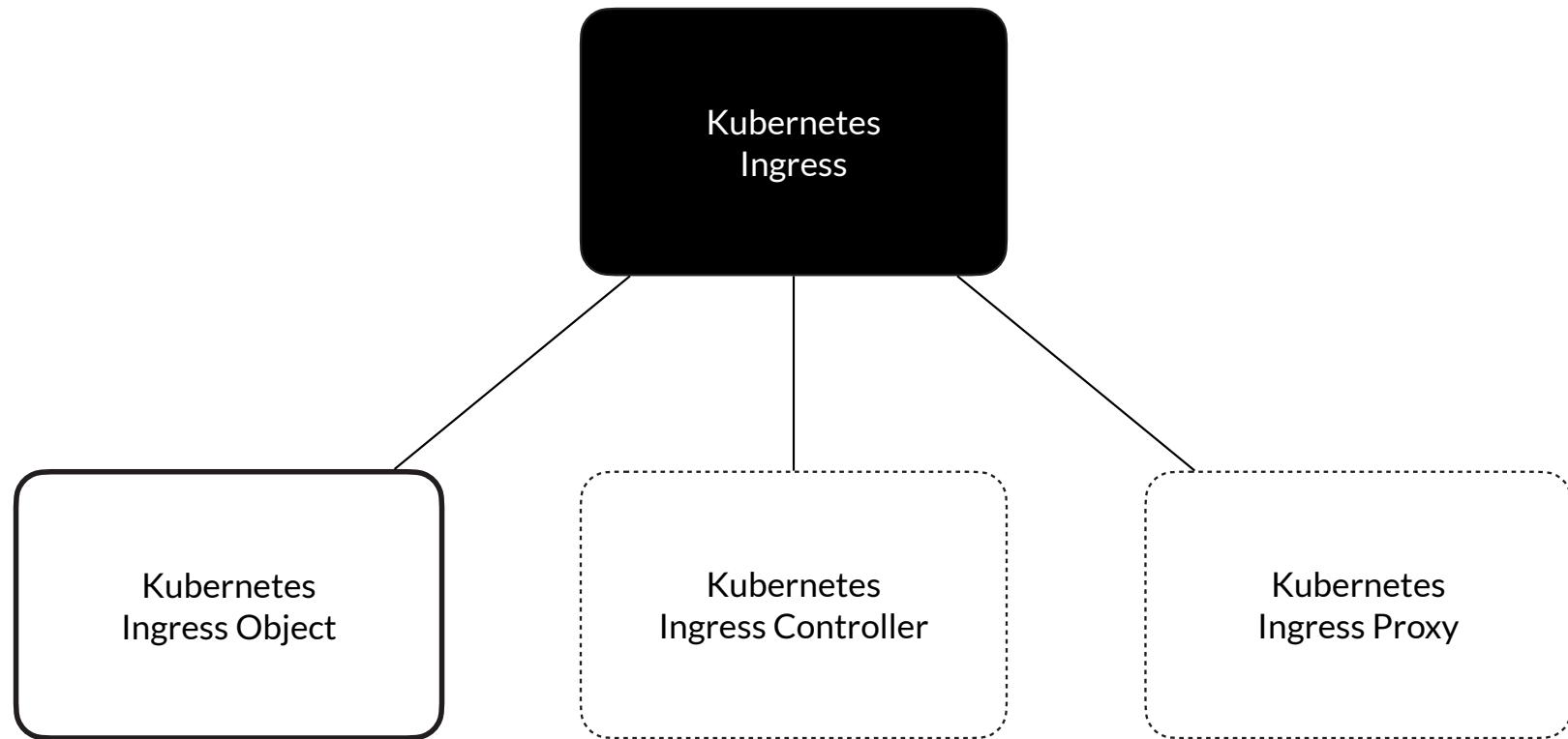












Ingress  
Object



TCP/IP	Source IP	Source Port	Target IP	Target Port	TCP/IP
	Method			Path	
			Host Header		
HTTP					HTTP
			Body		

TCP/IP	Source IP	Source Port	Target IP	Target Port	TCP/IP
	Method			Path	
			Host Header		
HTTP					HTTP
			Body		

TCP/IP	Source IP	Source Port	Target IP	Target Port	TCP/IP
	Method			Path	
			Host Header		
HTTP				Body	HTTP

```
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  name: foobar
spec:
  rules:
  - host: foo.org
    http:
      paths:
      - path: /a
        backend:
          service:
            name: foo-a
            port:
              number: 8080
      - path: /b
        backend:
          service:
            name: foo-b
            port:
              number: 8181
  - host: bar.org
    http:
      paths:
      - path: /a
        backend:
          service:
            name: bar-a
            port:
              number: 9090
      - path: /b
        backend:
          service:
            name: bar-b
            port:
              number: 9191
```

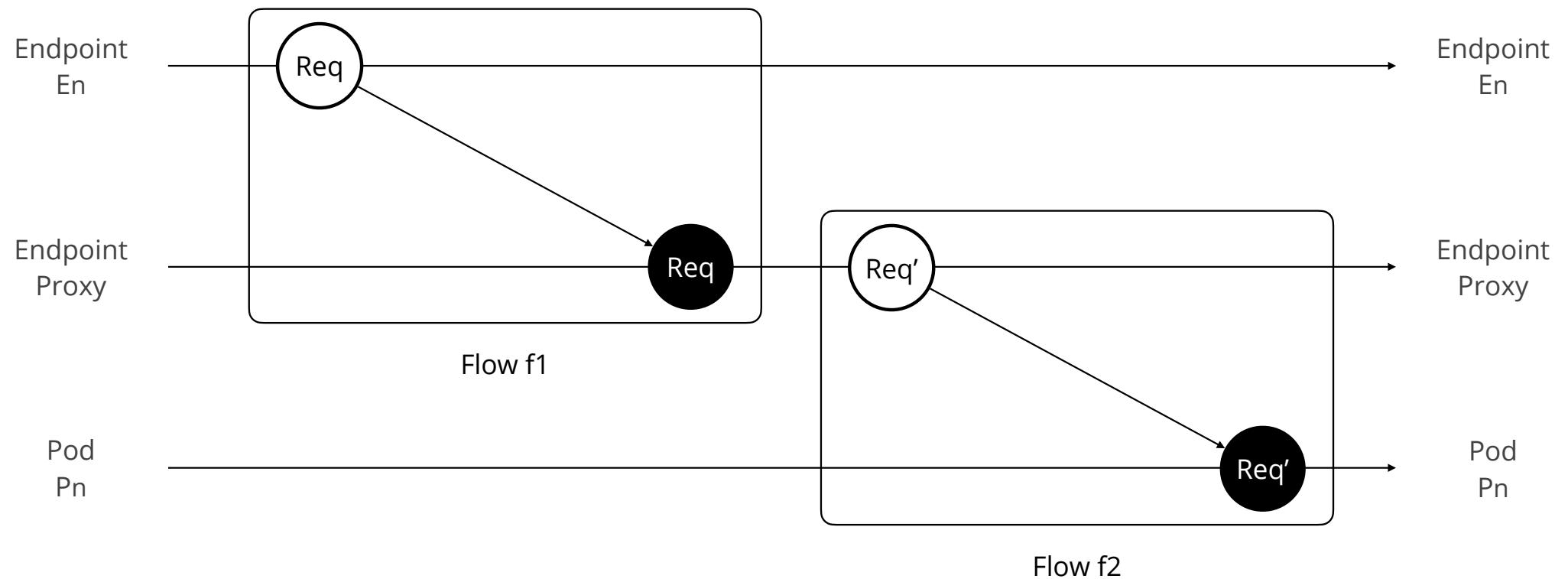
Rule	Host	Path	Service
r <sub>1</sub>	<u>foo.org</u>	/a	foo-a:8080
r <sub>2</sub>	<u>foo.org</u>	/b	foo-b:8181
r <sub>3</sub>	<u>bar.org</u>	/a	bar-a:9090
r <sub>4</sub>	<u>bar.org</u>	/b	bar-b:9191

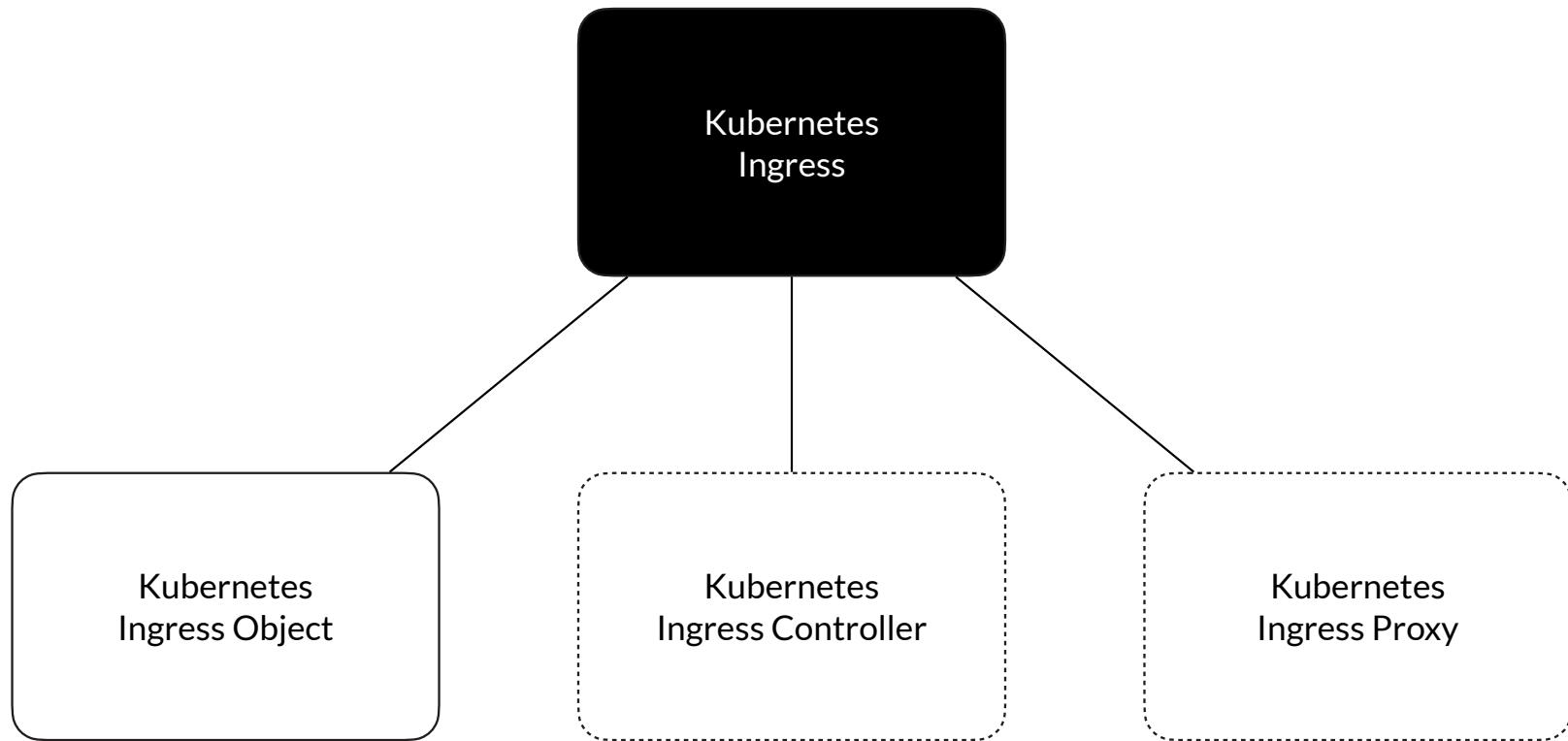
```
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  name: foobar
spec:
  rules:
  - host: foo.org
    http:
      paths:
      - path: /a
        backend:
          service:
            name: foo-a
            port:
              number: 8080
      - path: /b
        backend:
          service:
            name: foo-b
            port:
              number: 8181
  - host: bar.org
    http:
      paths:
      - path: /a
        backend:
          service:
            name: bar-a
            port:
              number: 9090
      - path: /b
        backend:
          service:
            name: bar-b
            port:
              number: 9191
```

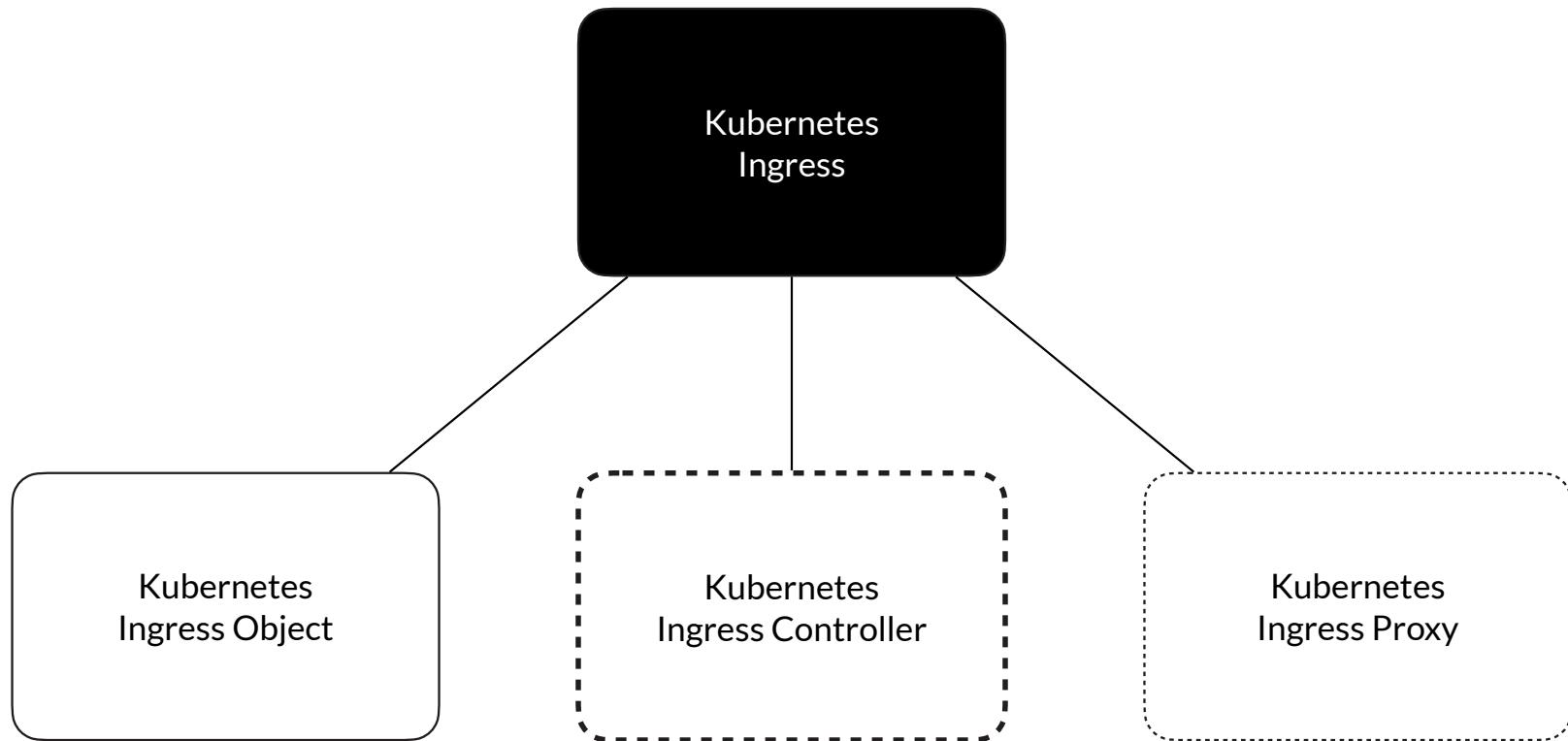
Rule	Host	Path	Service
r <sub>1</sub>	<a href="http://foo.org">foo.org</a>	/a	foo-a:8080
r <sub>2</sub>	<a href="http://foo.org">foo.org</a>	/b	foo-b:8181
r <sub>3</sub>	<a href="http://bar.org">bar.org</a>	/a	bar-a:9090
r <sub>4</sub>	<a href="http://bar.org">bar.org</a>	/b	bar-b:9191

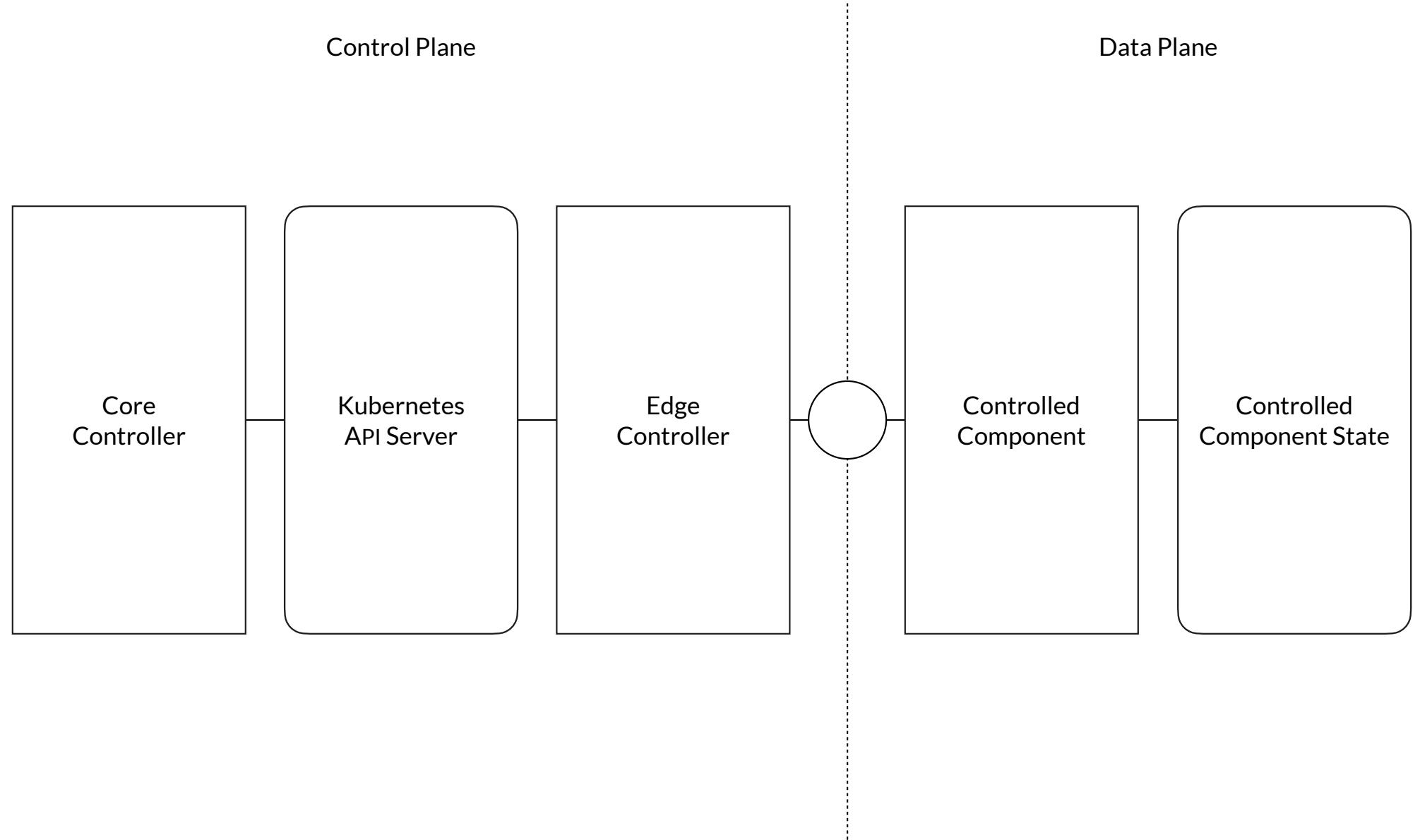
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kind: Ingress
metadata:
  name: foobar
spec:
  rules:
  - host: foo.org
    http:
      paths:
      - path: /a
        backend:
          service:
            name: foo-a
            port:
              number: 8080
      - path: /b
        backend:
          service:
            name: foo-b
            port:
              number: 8181
  - host: bar.org
    http:
      paths:
      - path: /a
        backend:
          service:
            name: bar-a
            port:
              number: 9090
      - path: /b
        backend:
          service:
            name: bar-b
            port:
              number: 9191
```

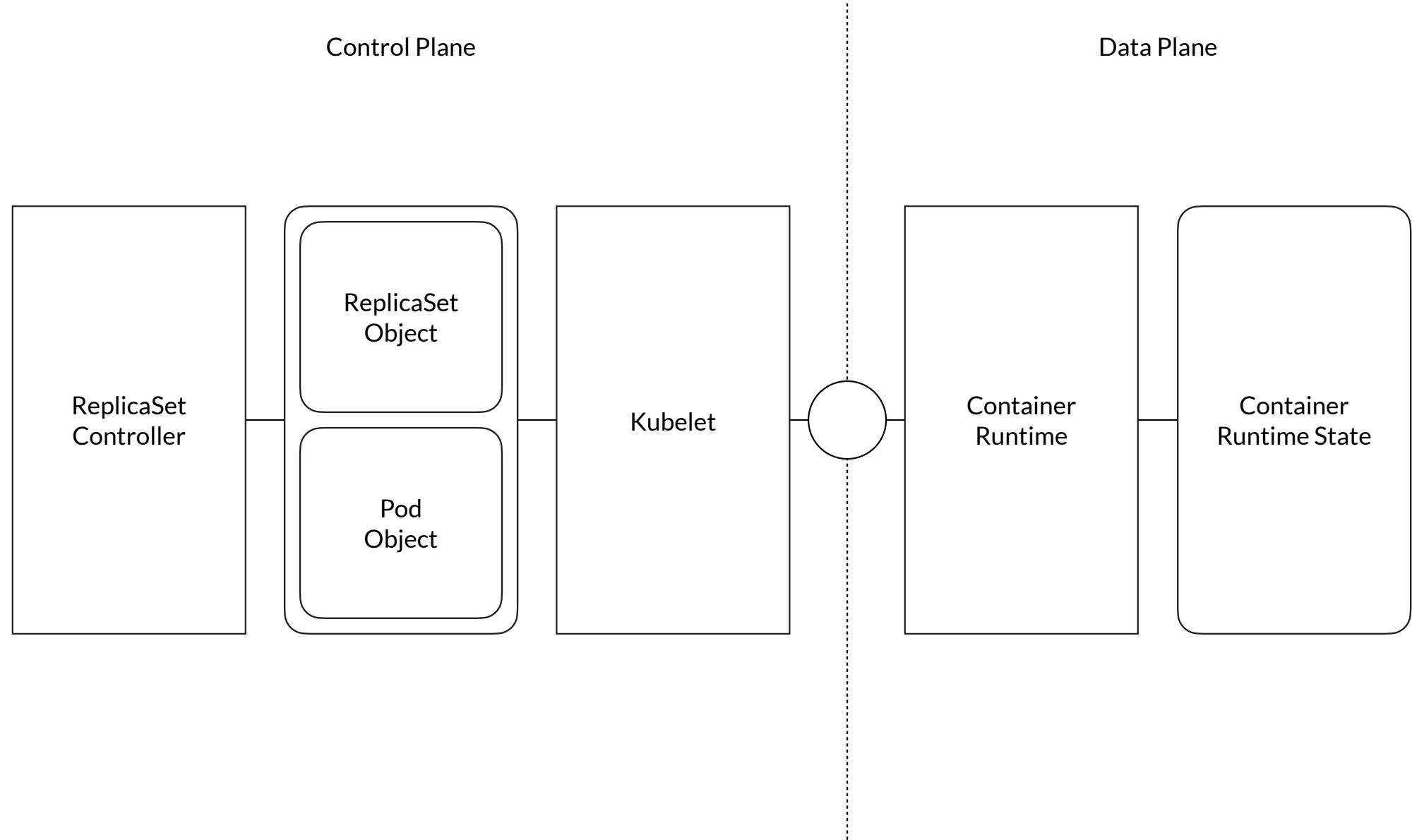
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r <sub>2</sub>	<u>foo.org</u>	/b	foo-b:8181
r <sub>3</sub>	<u>bar.org</u>	/a	bar-a:9090
r <sub>4</sub>	<u>bar.org</u>	/b	bar-b:9191

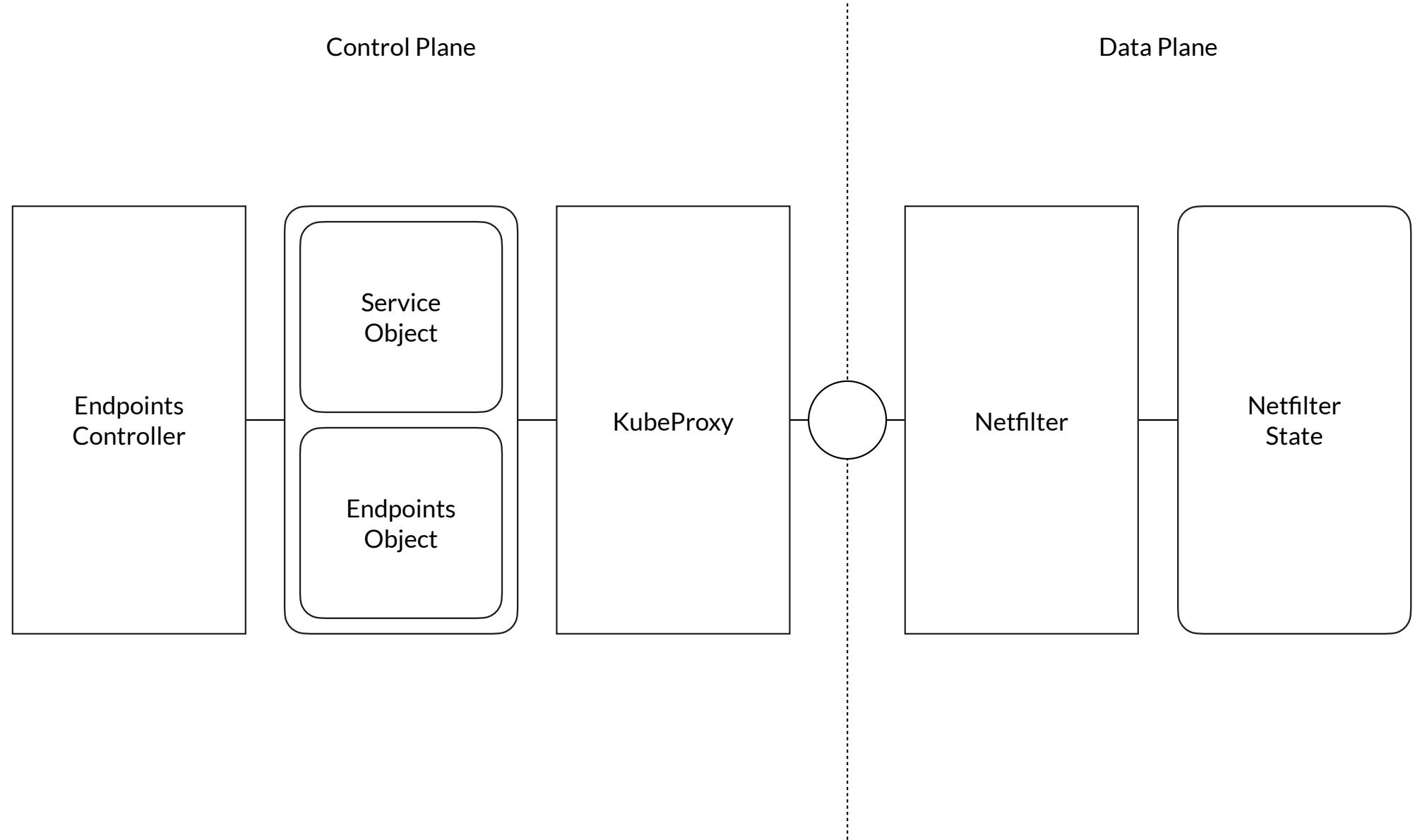


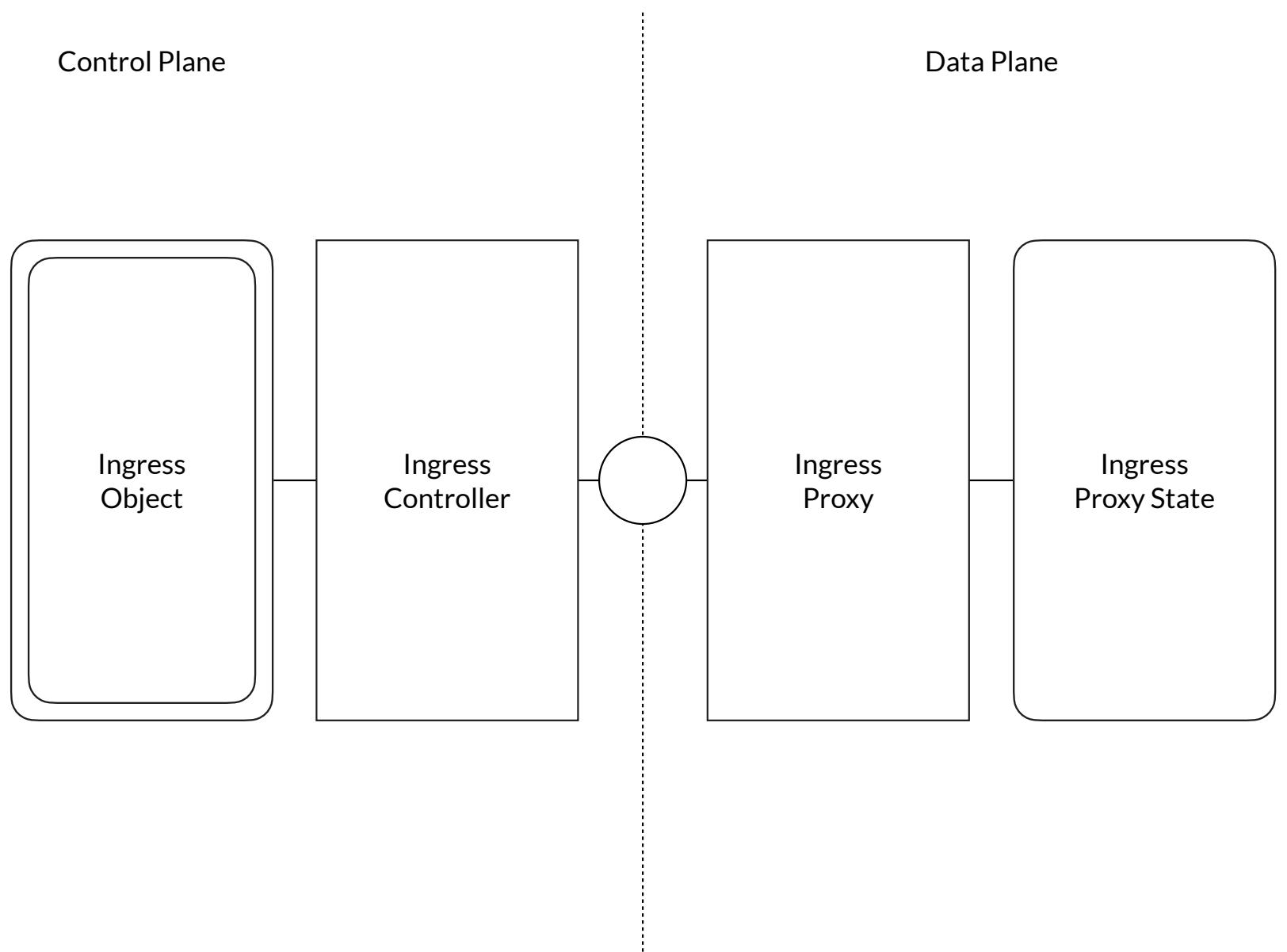


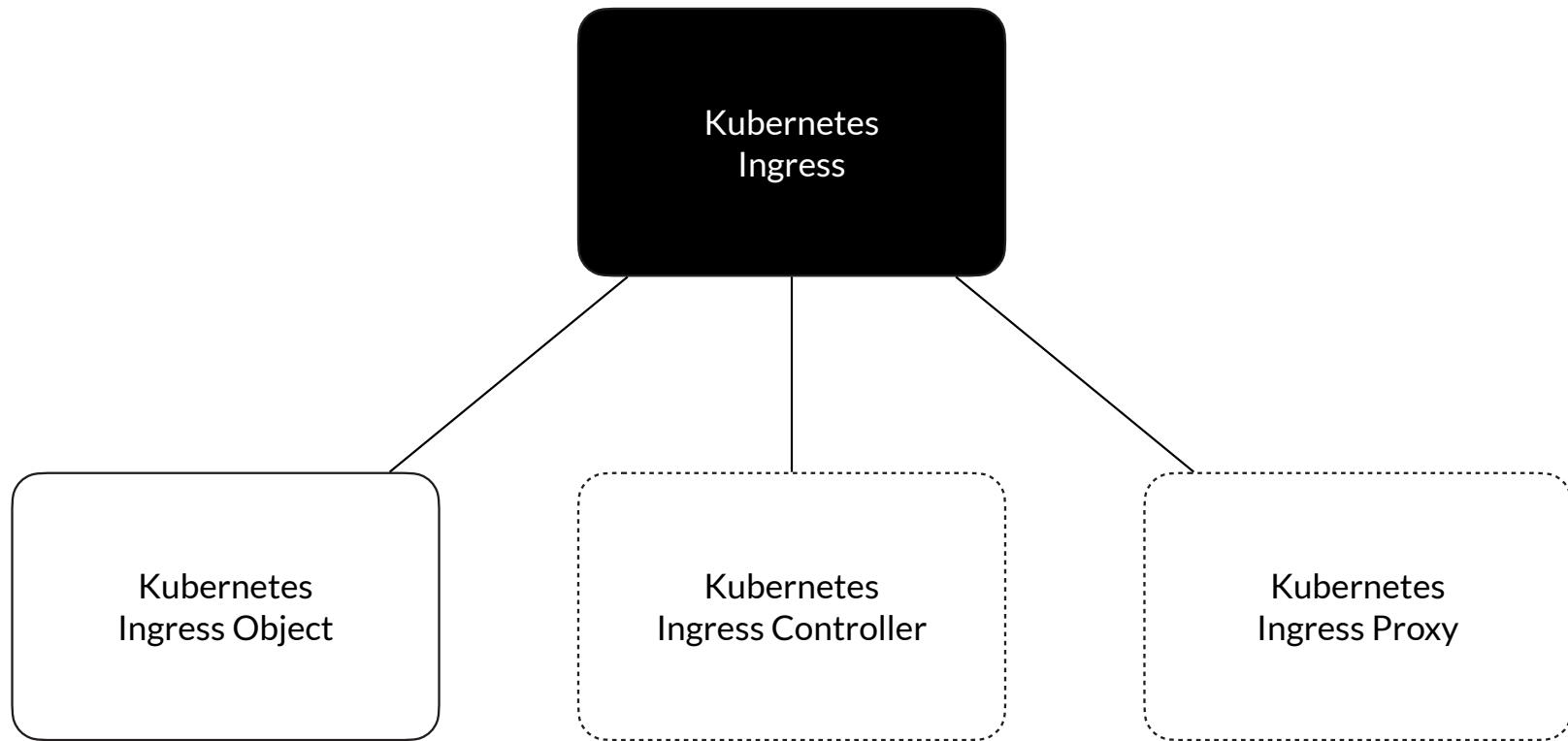


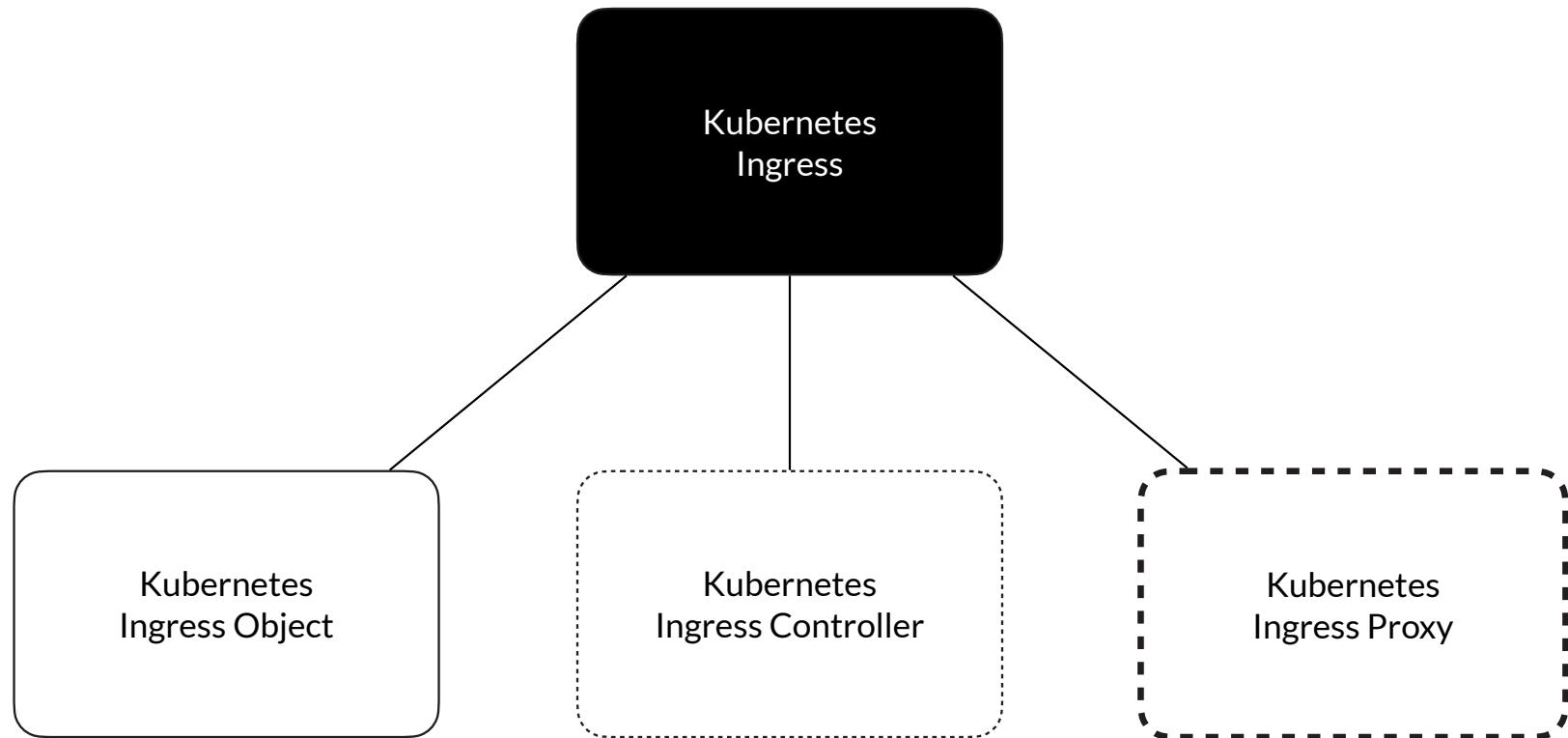


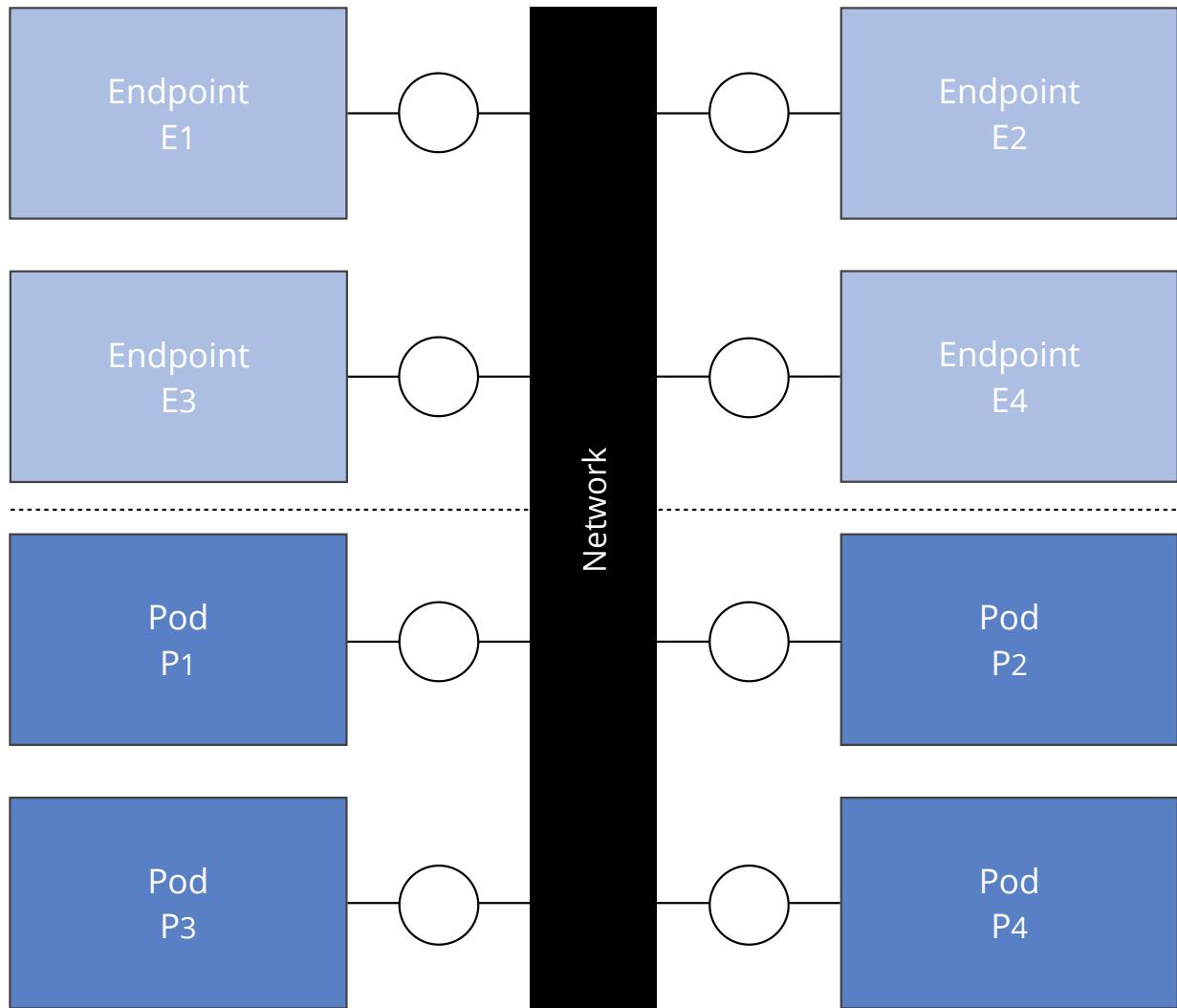


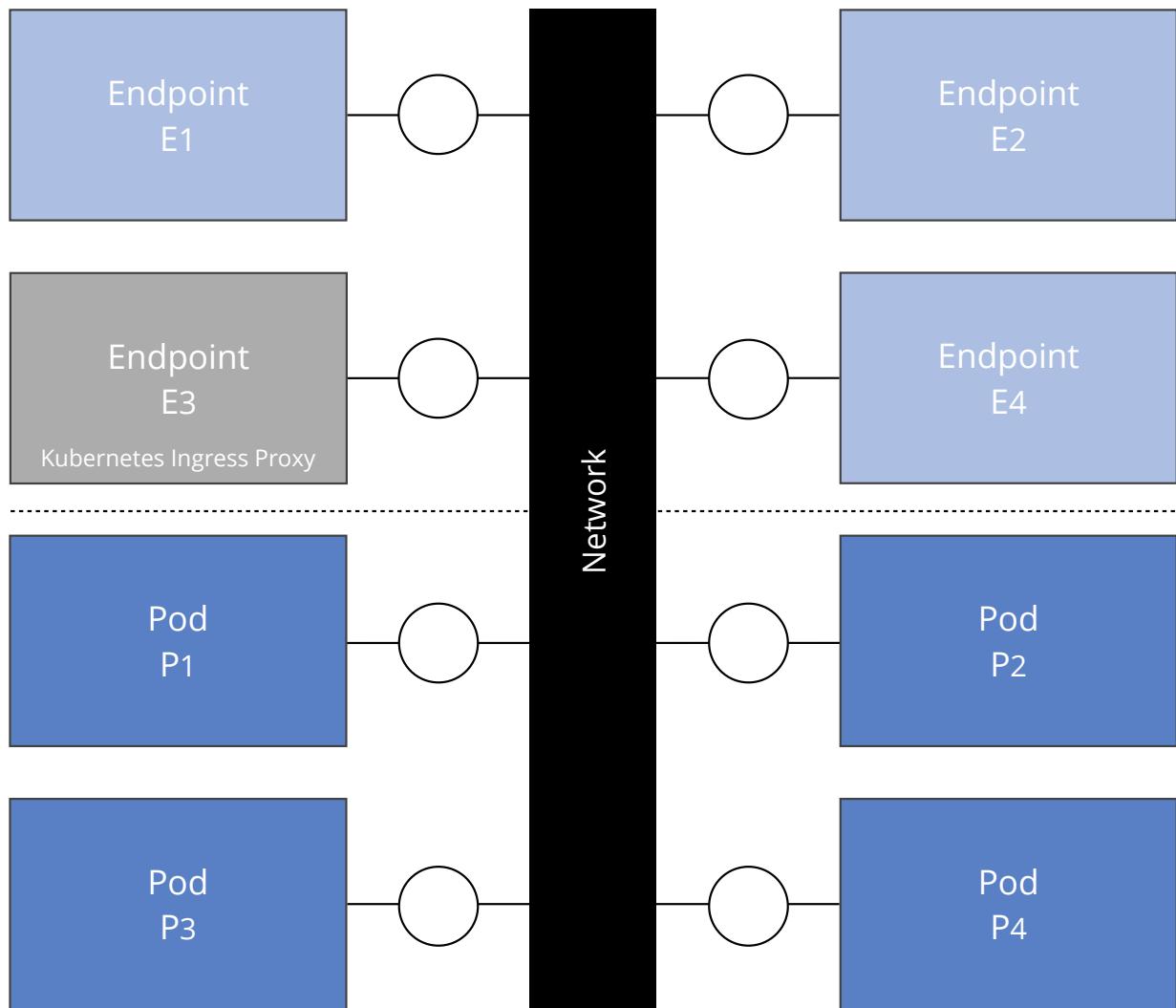


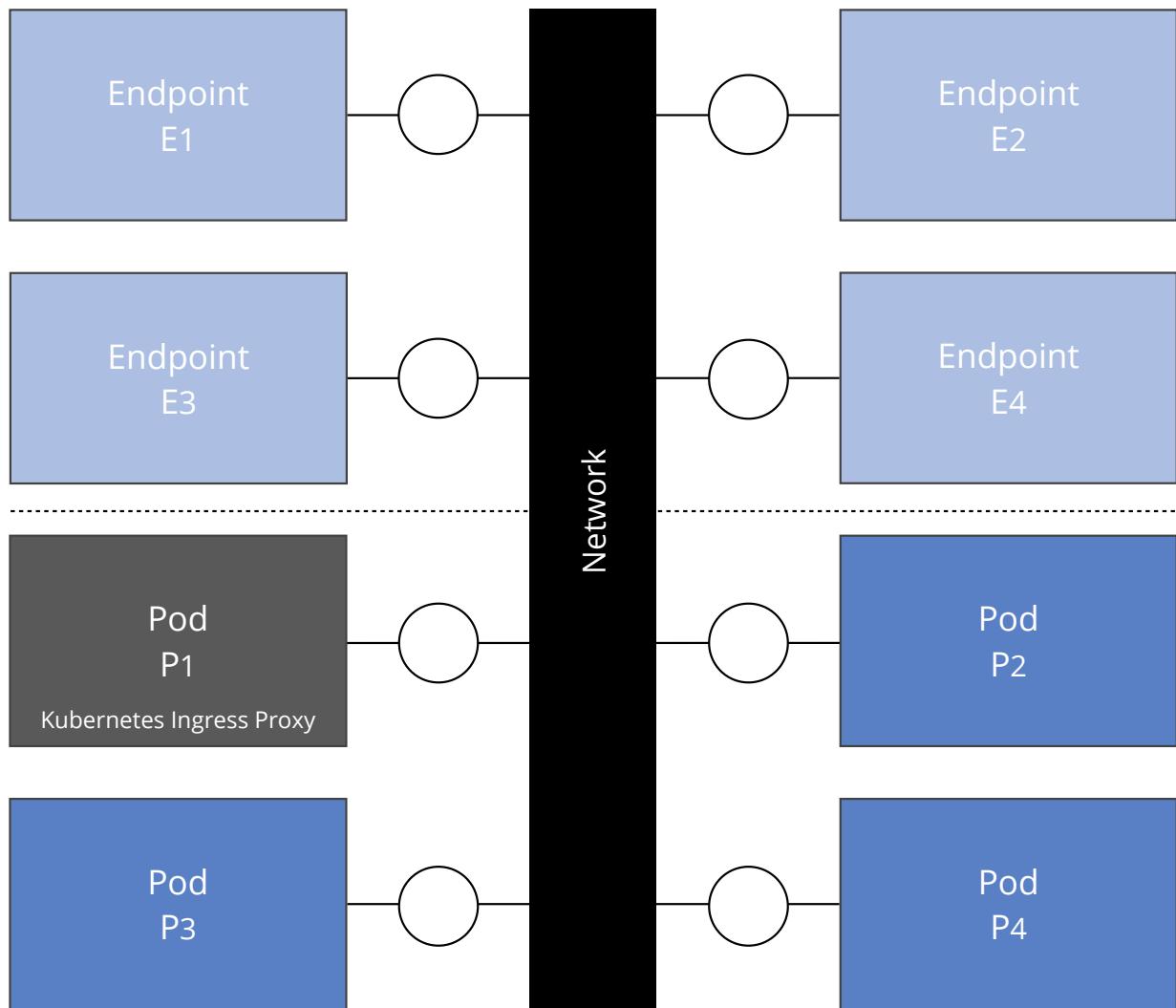


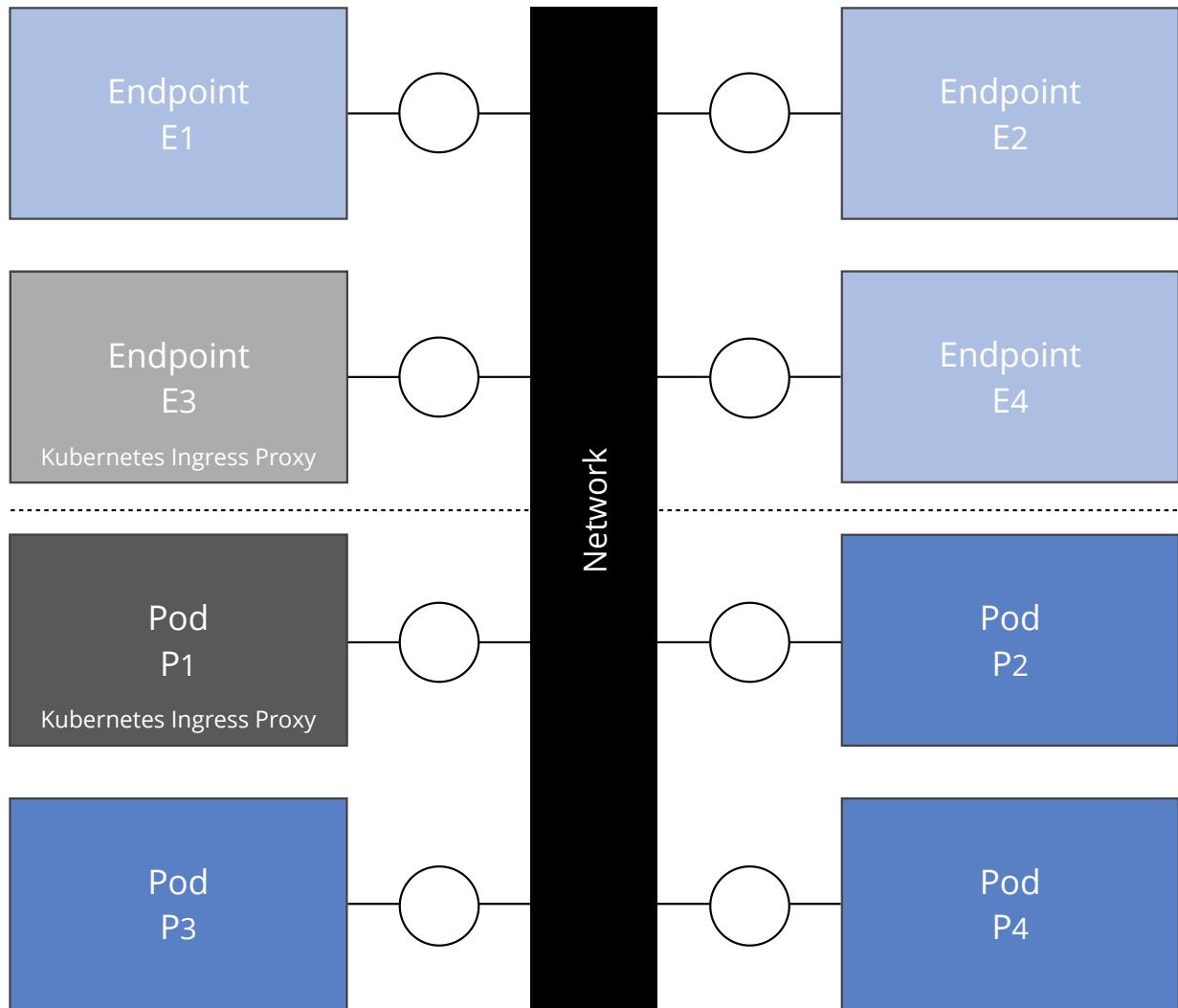












Definition

## Kubernetes Ingress

{  $f_1 \times f_2 \in \text{Flow} \times \text{Flow} \mid \text{target}[f_1] = \text{Proxy} \wedge \text{target}[f_2] = \text{Pod} \wedge \exists r \in \text{Rules}[\text{Proxy}]: \text{Req}_{f_1} \vdash \text{conditions}[r] \wedge \text{Pod} \vdash \text{target}[r]$  }



Definition

## Ingress for Kubernetes

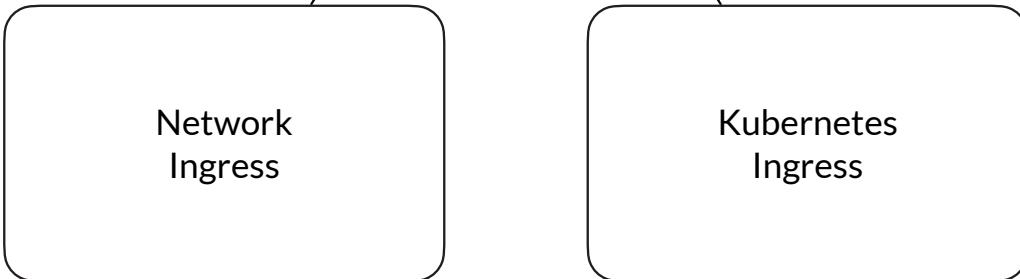
{  $f1 \times f2 \in \text{Flow} \times \text{Flow} \mid \text{source}[f1] \notin \text{Cluster} \wedge \text{target}[f2] \in \text{Cluster} \wedge \text{target}[f1] = \text{Proxy} \wedge \text{target}[f2] = \text{Pod} \wedge \exists \dots \}$  }



# Conclusion



## Ingress for Kubernetes



Ingress  
for Kubernetes

Network  
Ingress

Kubernetes  
Ingress

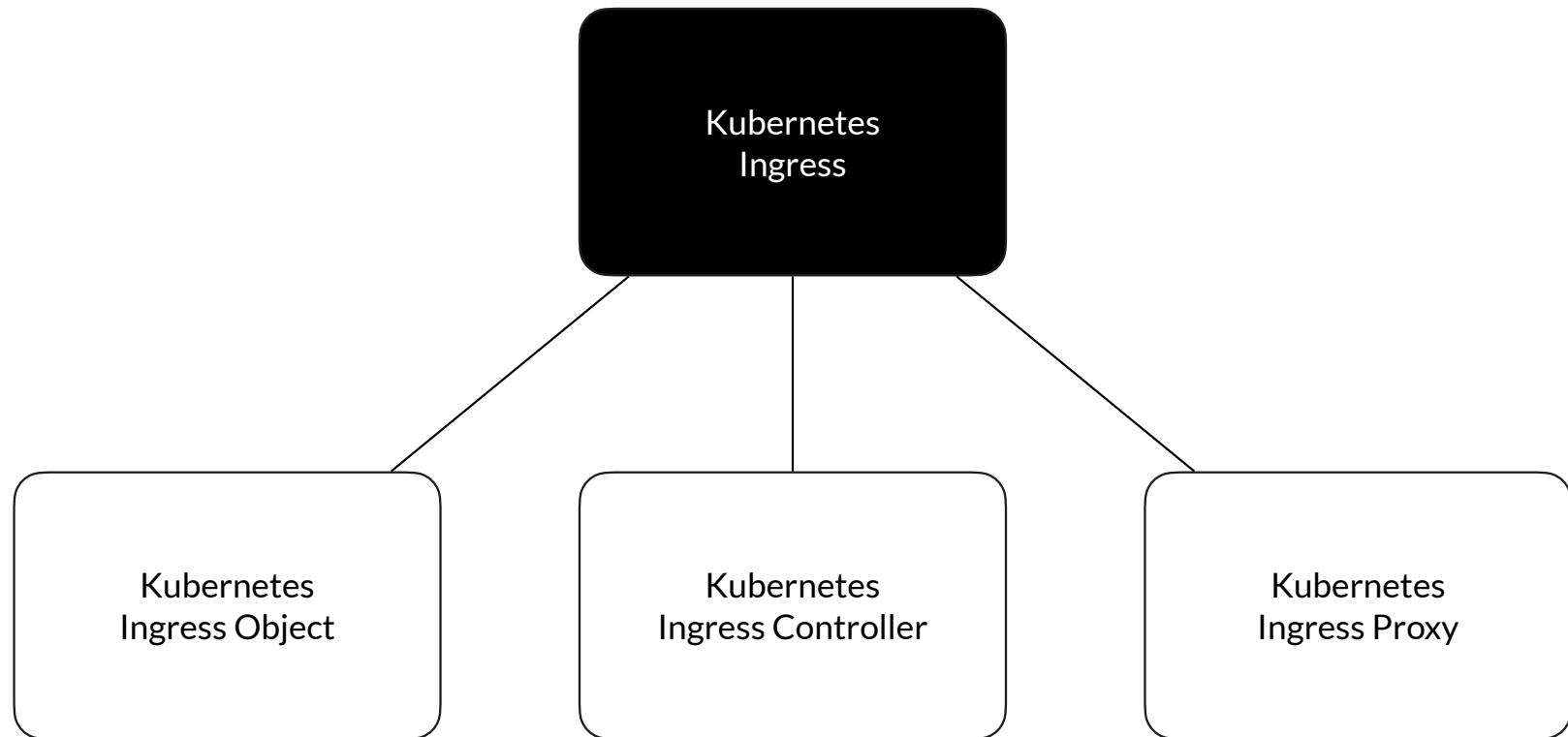


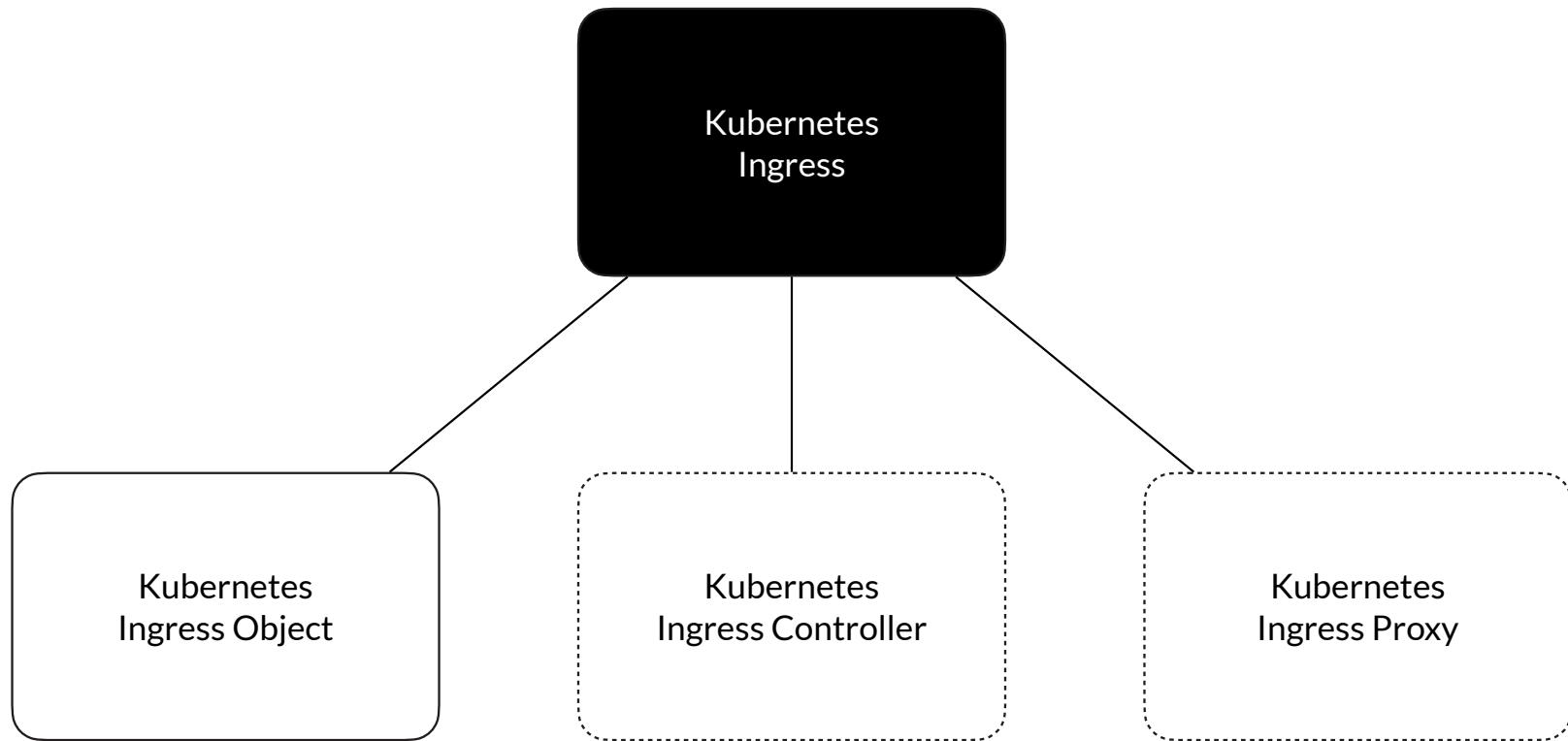
Ingress  
for Kubernetes

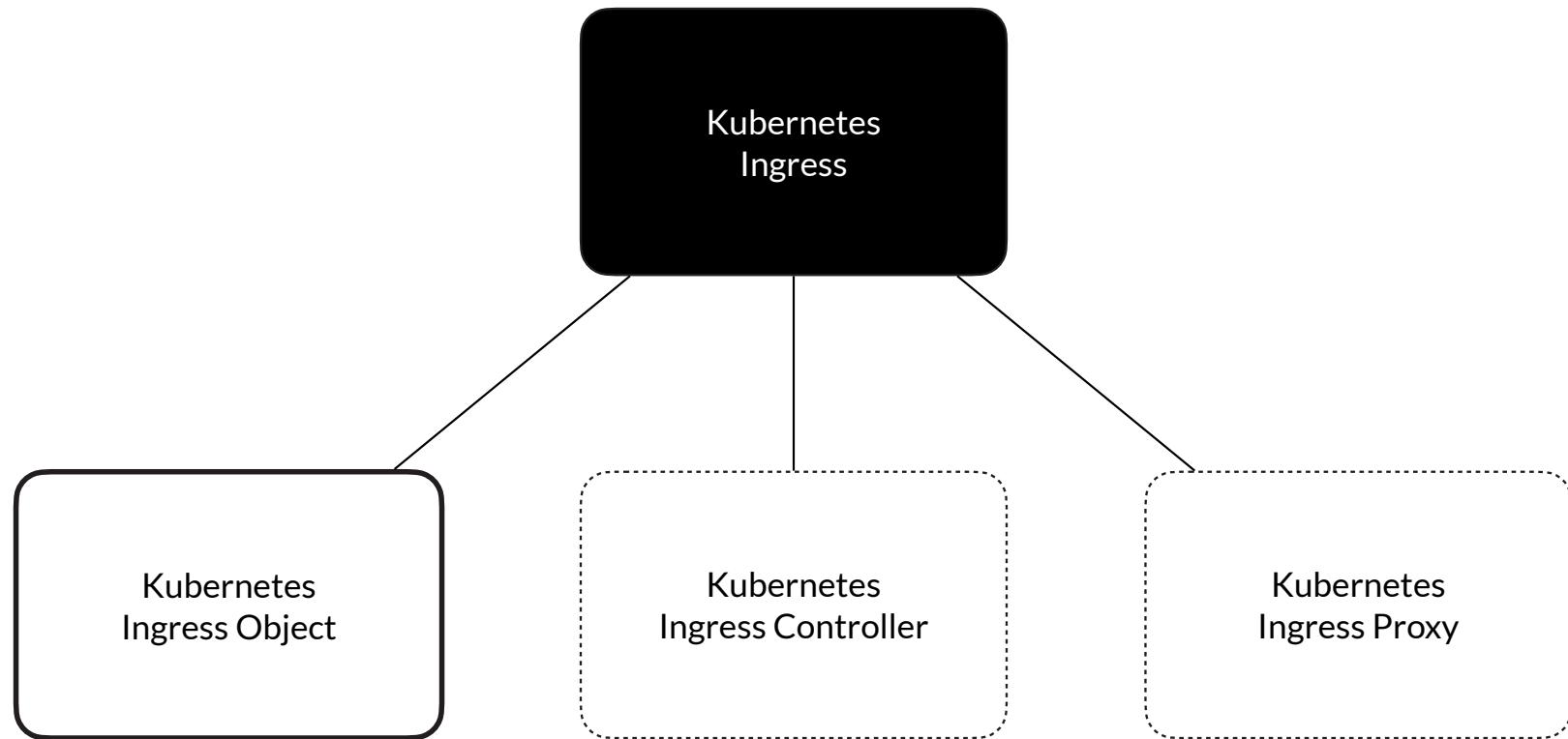
Network  
Ingress

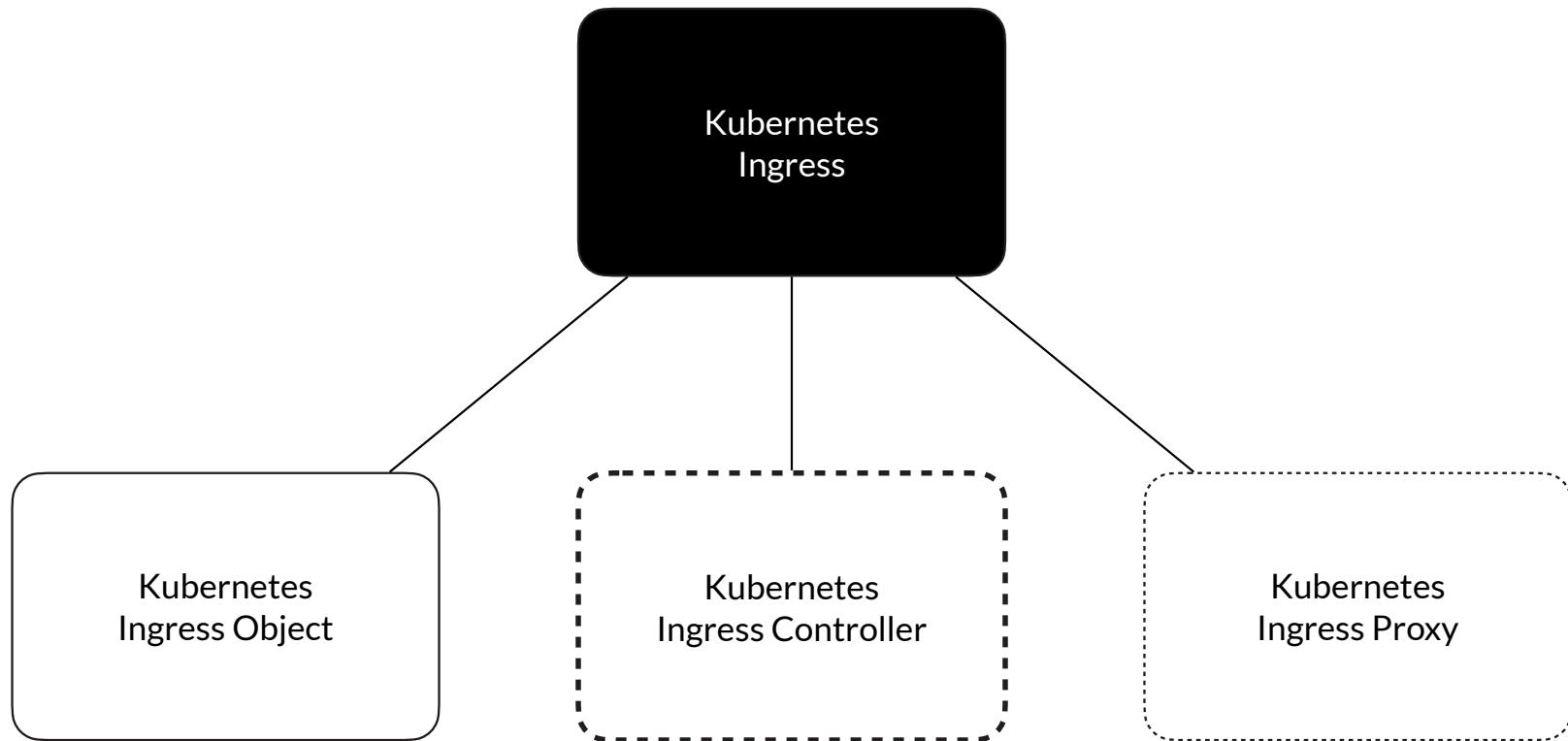
Kubernetes  
Ingress

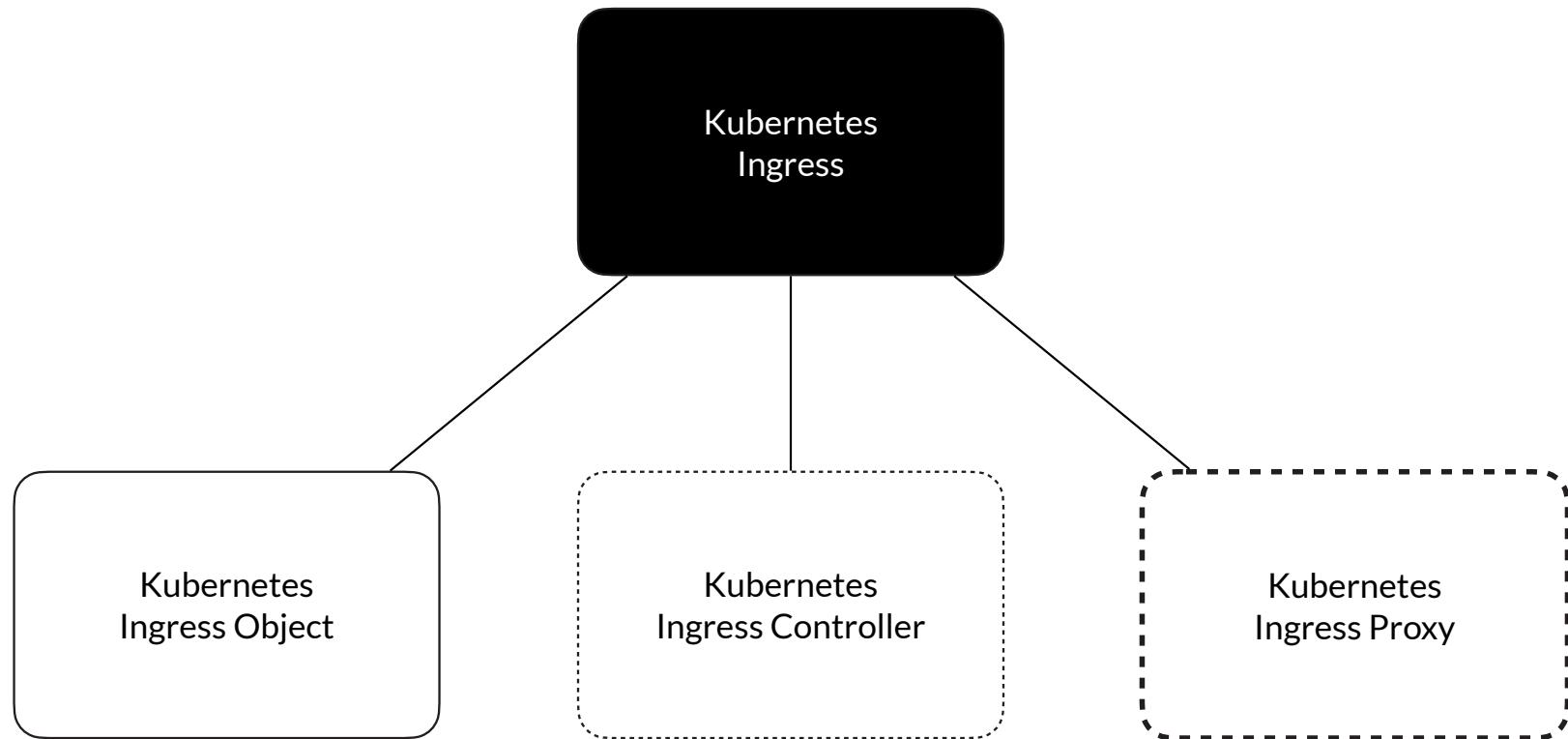












Finally ...



What is the difference between  
Kubernetes Ingress and an API Gateway like the Ambassador API Gateway?





Thank You

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