Software Circus Meetup / March 24th 2021

Istio, Linkerd 2, or ...?

A comparison of Service Mesh implementations

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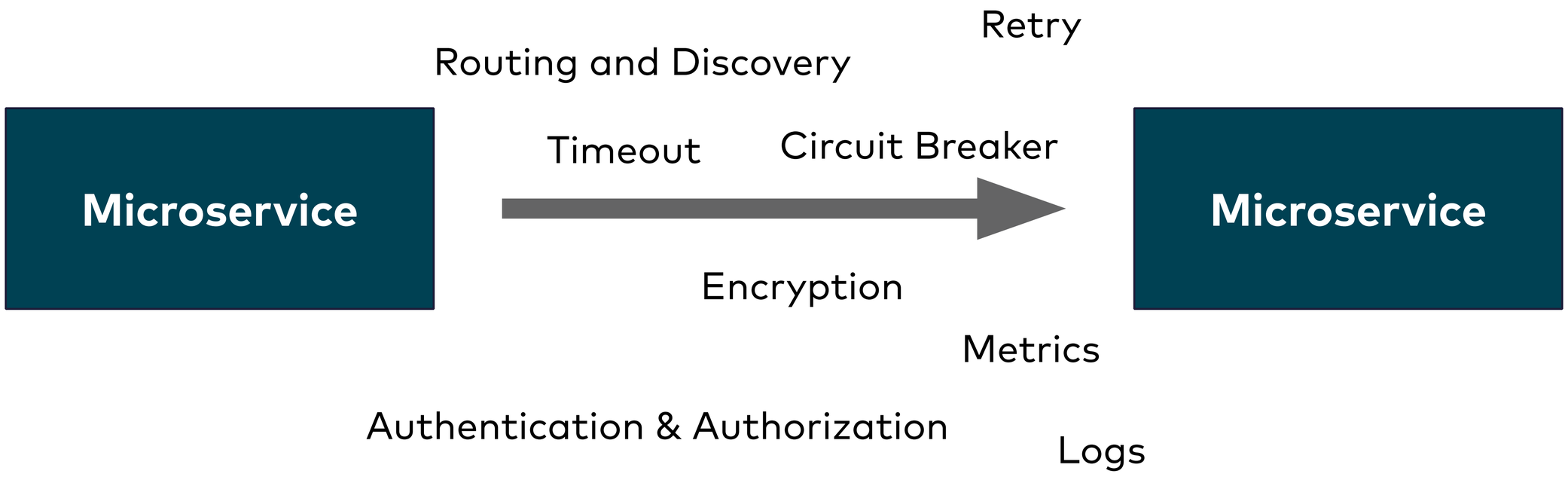
What is a Service Mesh?

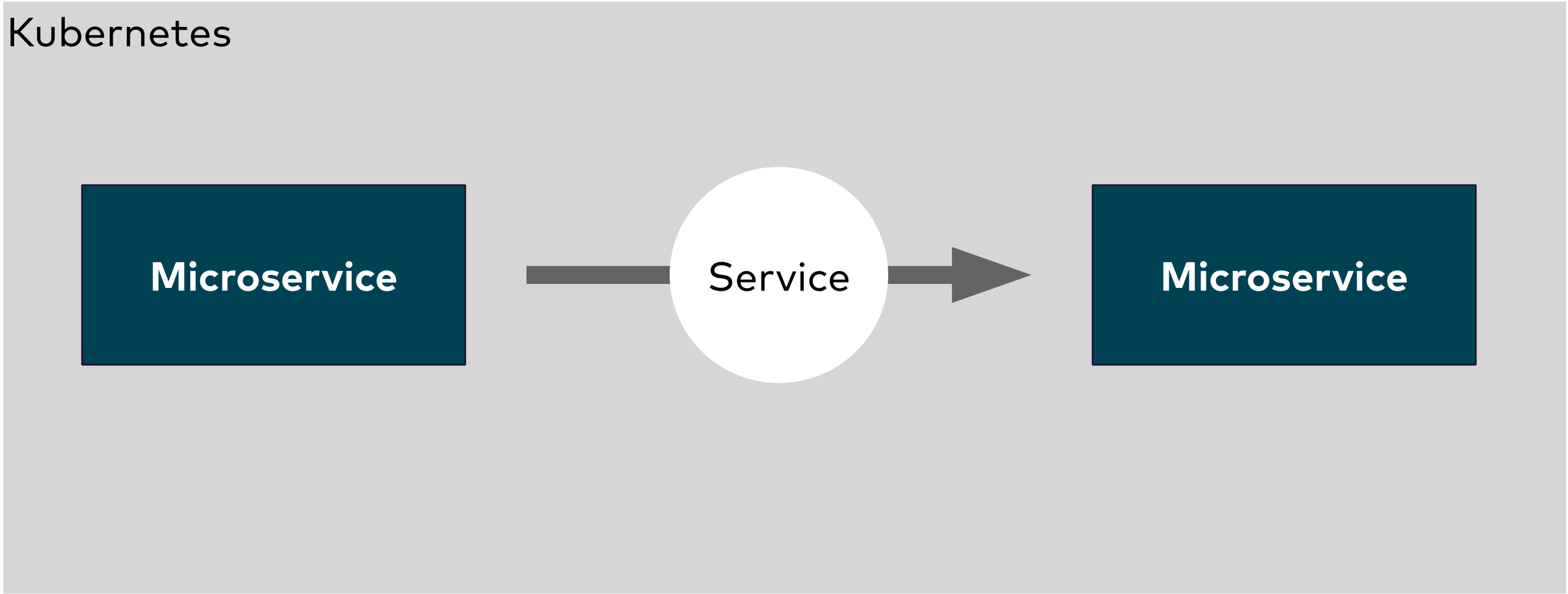
What problems does it try to solve?

Microservices are distributed Systems

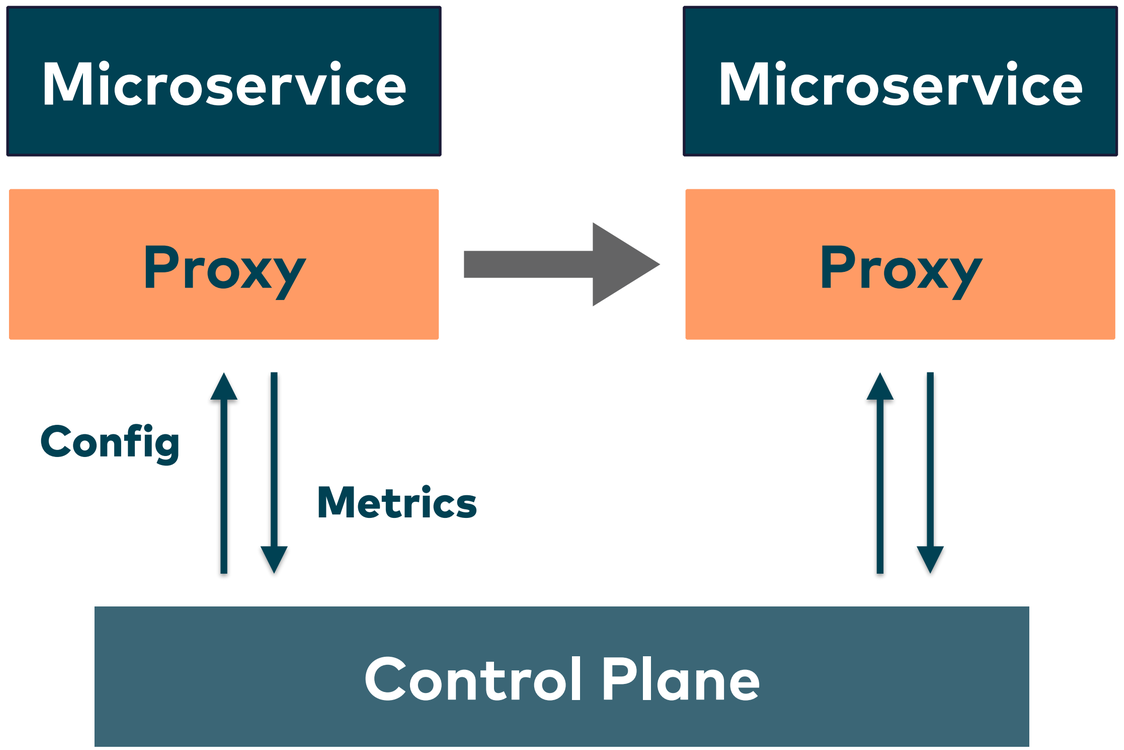


Libraries can help

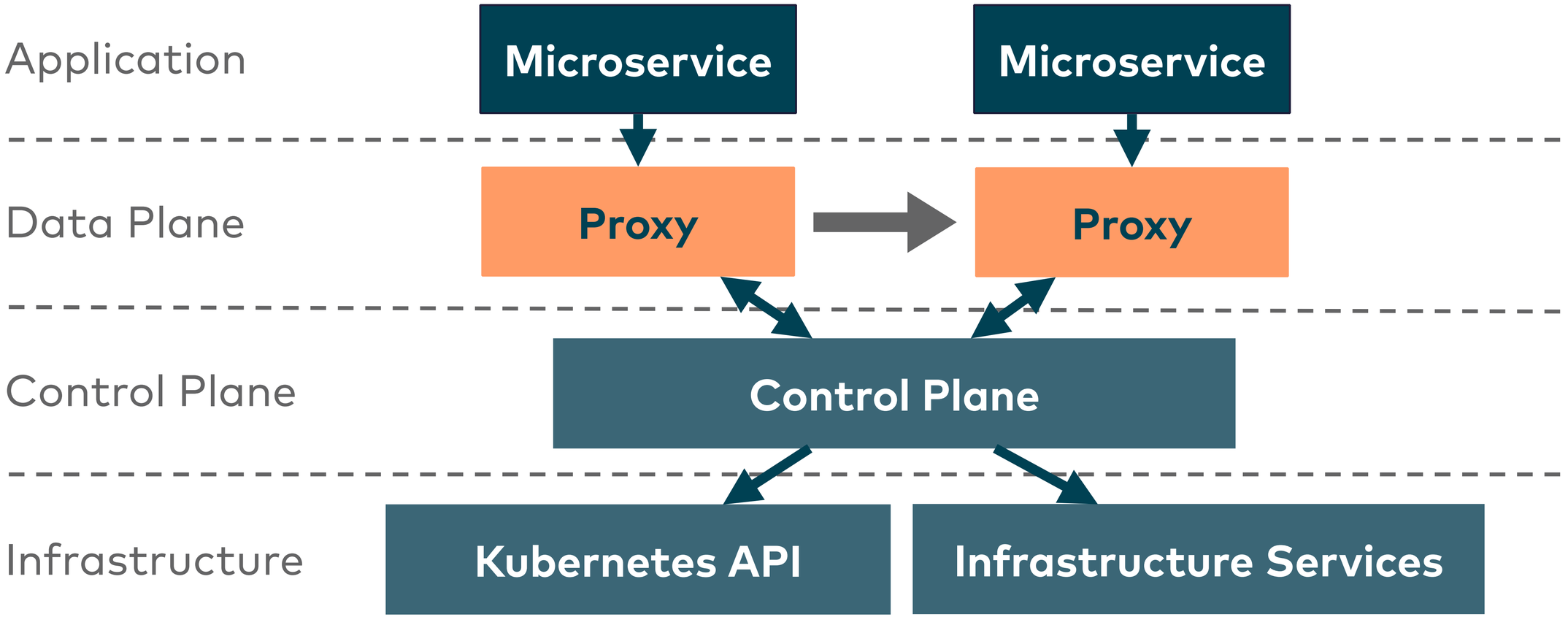
Kubernetes can help as well



Service Mesh Approach



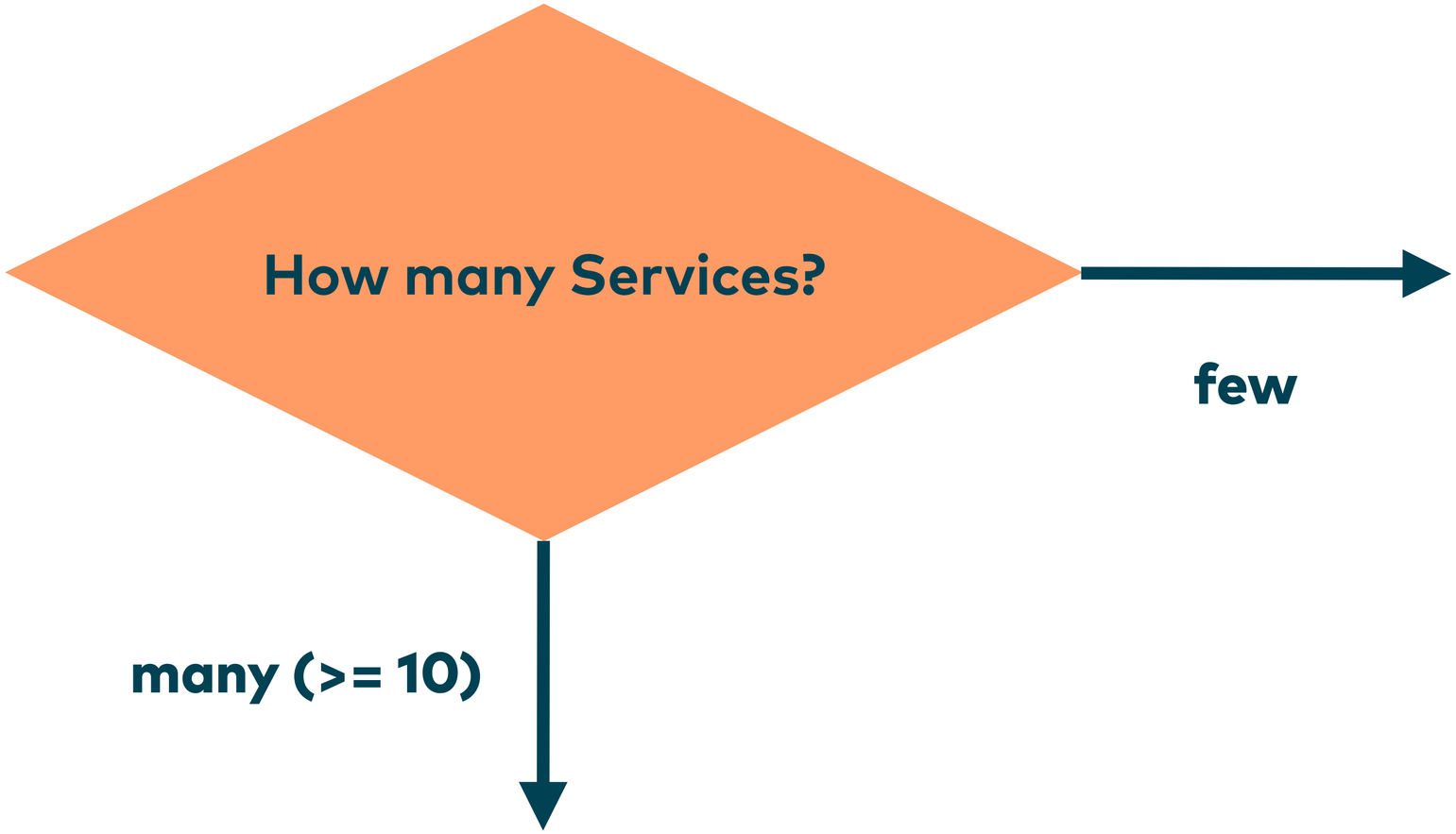
Service Mesh Architecture



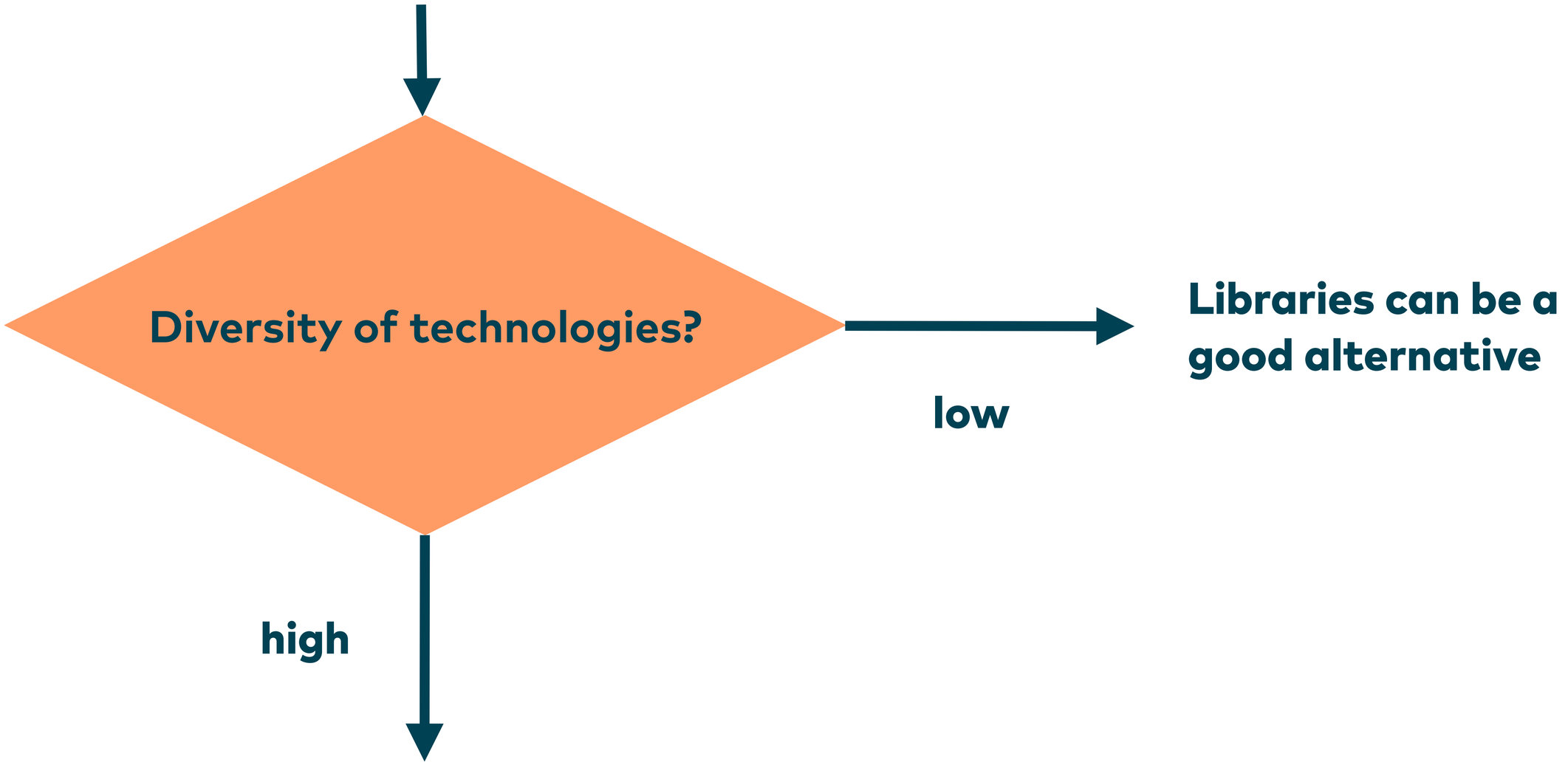
Do you need a service mesh?

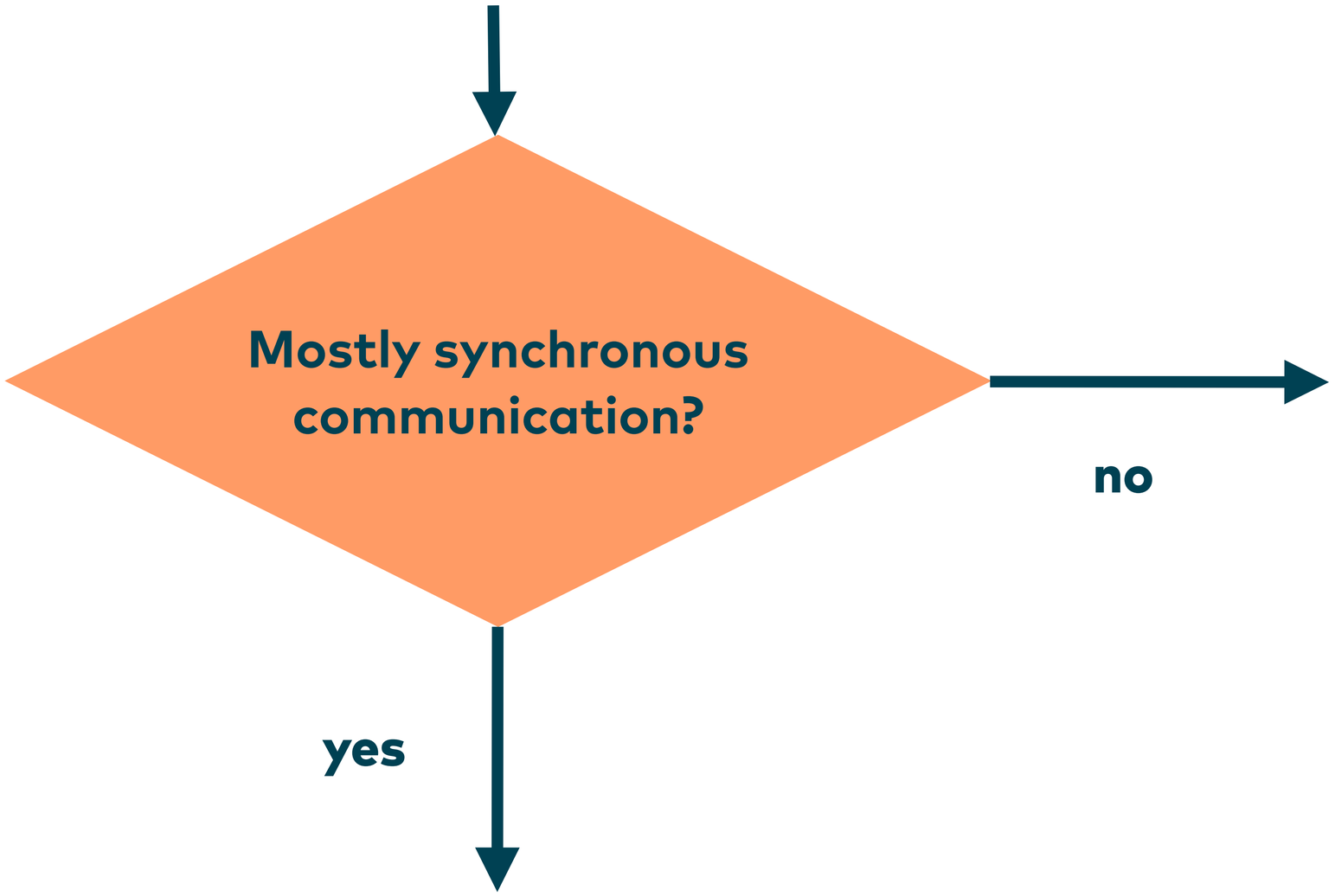
Very often the answer is:

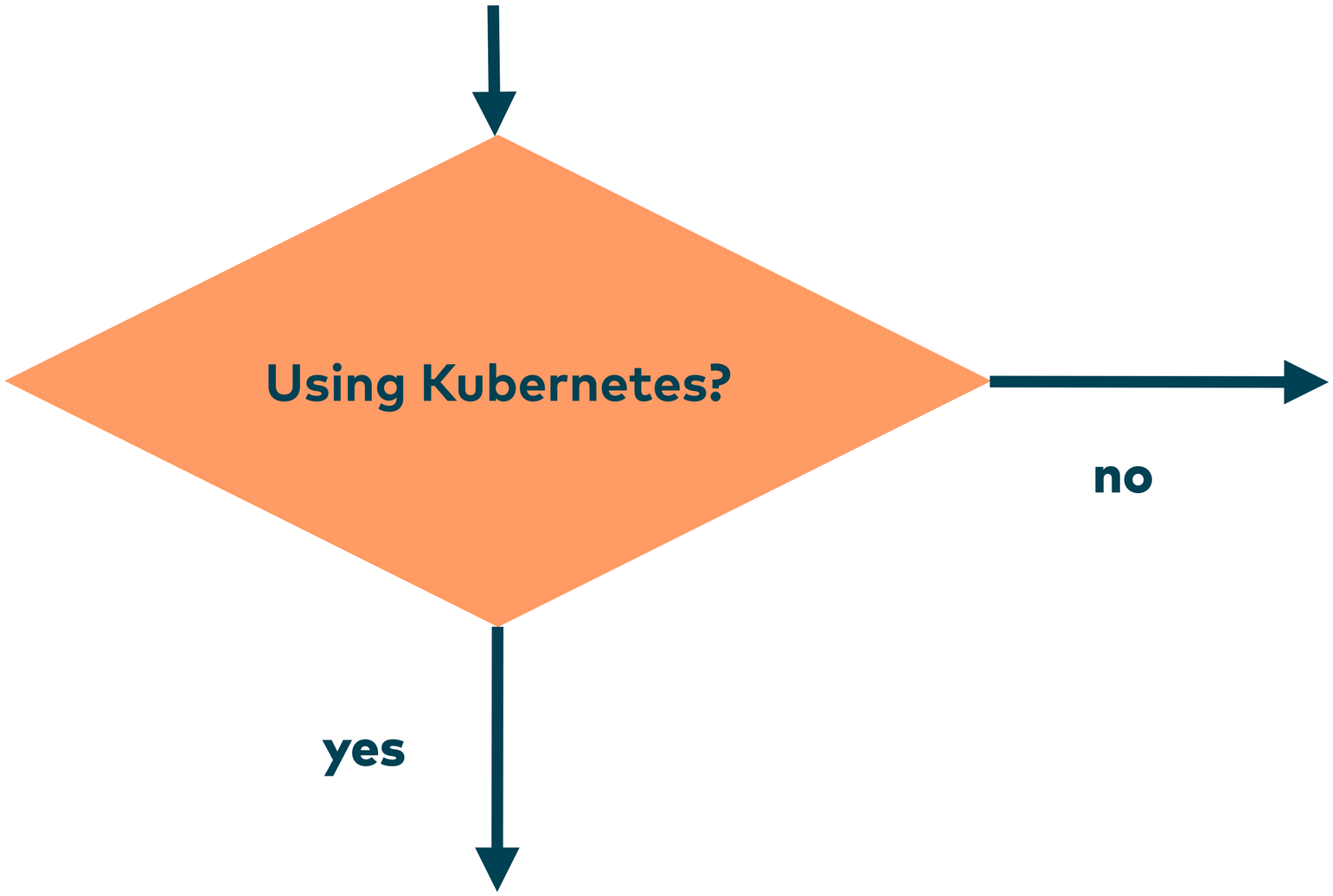
No.



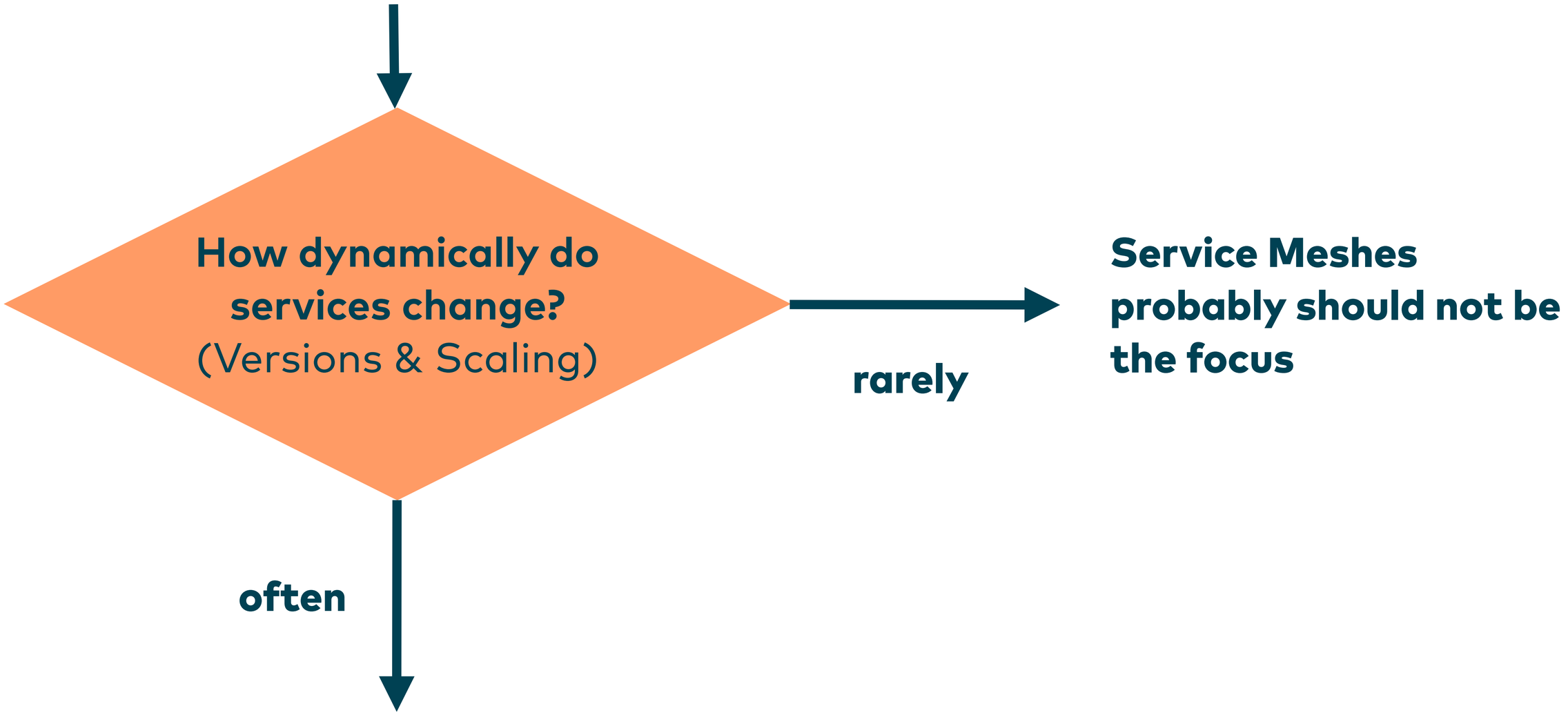
only if certain features are difficult to realize otherwise
(more later)

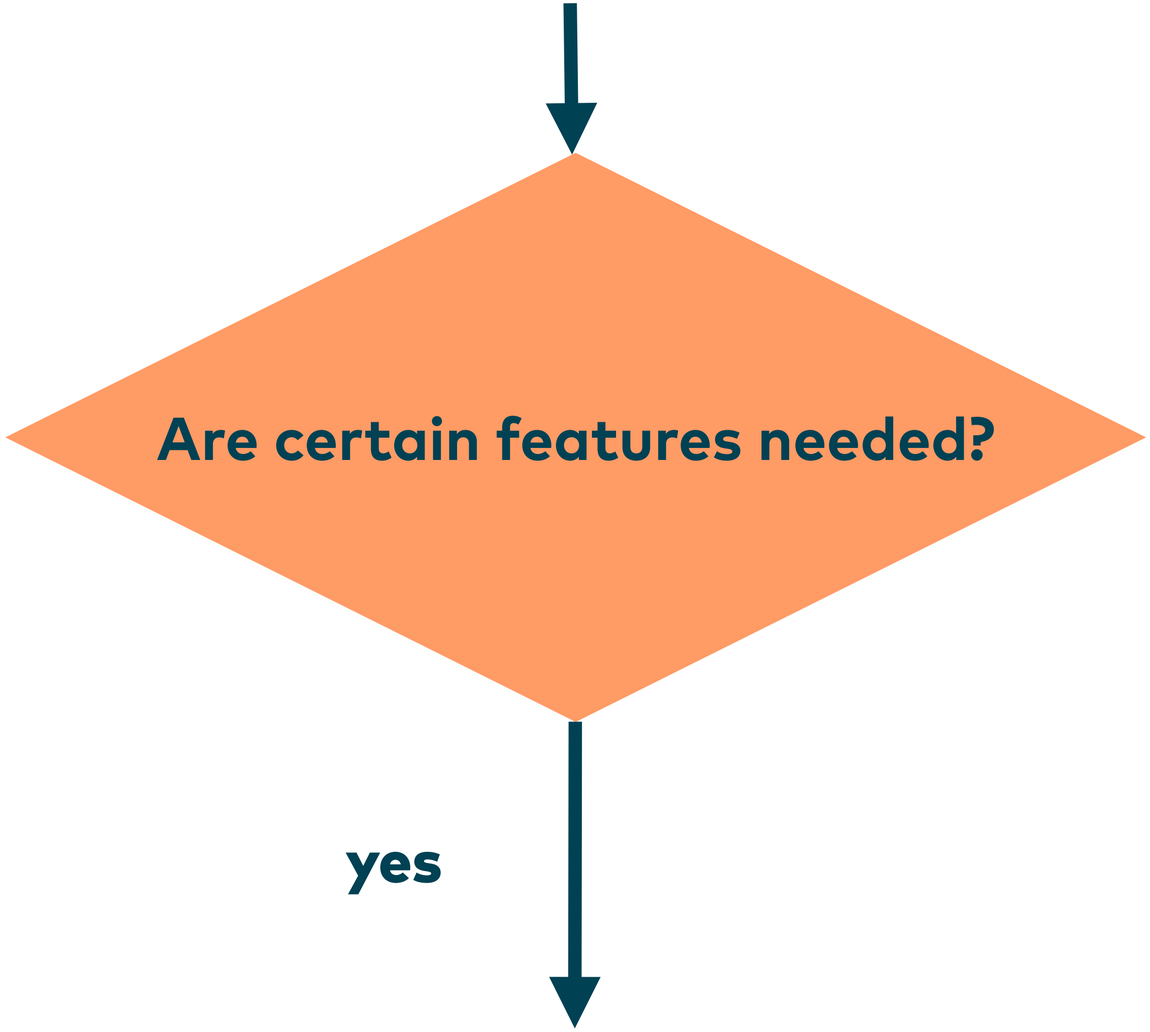

Diversity of technologies?
low
Libraries can be a good alternative
high


Mostly synchronous communication?
no
Probably a service mesh adds little value
yes



The choice of solutions is significantly reduced

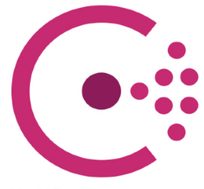

How dynamically do services change?
(Versions & Scaling)
rarely
Service Meshes probably should not be the focus
often



- mTLS
- Tracing
- Routing
- Special Rollouts

Current Implementations

Service Mesh Implementations



LINKERD

Open Service Mesh

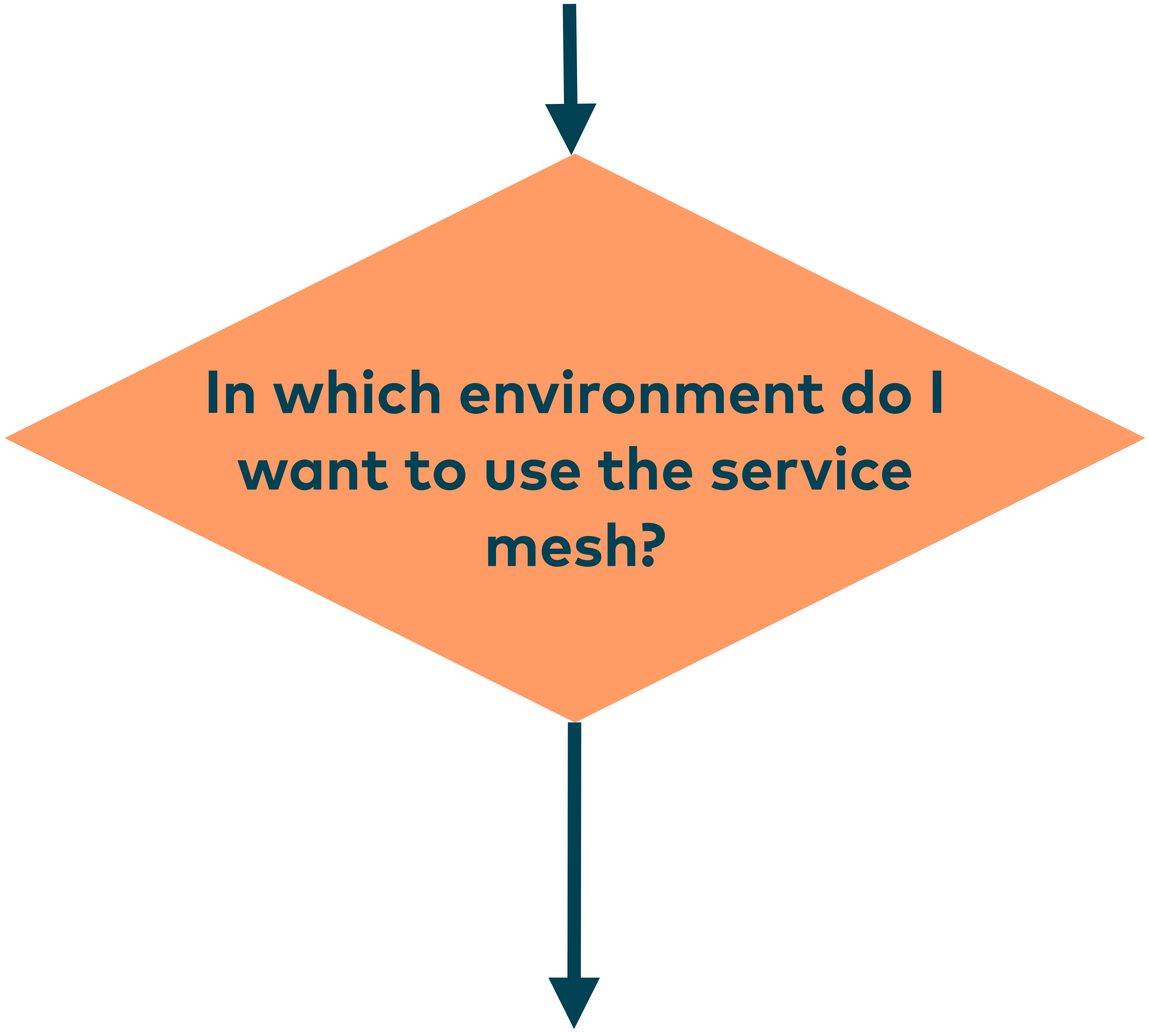
Istio

NGINX Service Mesh

servicemesh.es

	Istio	Linkerd 2	AWS App Mesh	Consul Connect	Maesh	Kuma	Open Service Mesh (OSM)
Current version	1.7	2.8		1.8	1.3	0.7	0.3
License	Apache License 2.0	Apache License 2.0	Closed Source	Mozilla License	Apache License 2.0	Apache License 2.0	MIT License
Developed by	Google, IBM, Lyft	Buoyant	AWS	HashiCorp	Containous	Kong	Microsoft
Service Proxy	Envoy	linkerd-proxy	Envoy	defaults to Envoy, exchangeable	Traefik	Envoy	Envoy
Ingress Controller	Envoy / Own Concept	any		Envoy and Ambassador in Kubernetes	any	any	Nginx, Azure Application Gateway Ingress Controller
Governance	see Istio Community and Open Usage Commons	see Linkerd Governance and CNCF Charter	AWS	see Contributing to Consul	see Contributing notice	see Contributing notice, Governance, and CNCF Charter	see Microsoft OpenSource
	Istio Tasks	Linkerd Tasks	AWS App	HashiCorp Learn	Maesh	Install Kuma on	Install OSM

Choosing an Implementation


In which environment do I want to use the service mesh?

Questions about the environment

- What infrastructure do I have in place?
- Are there preferred cloud providers?
- What knowledge is available?
- How flexible do we want to be?

Kubernetes

Kubernetes only

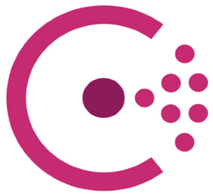
Istio

LINKERD

Open Service Mesh

NGINX Service Mesh

Usable without Kubernetes



AWS App Mesh

Cloud Provider

- The impact is small as long as Kubernetes is used
- Many AWS services (especially Fargate/ECS) can be an indicator for AWS App Mesh
- Google Cloud has very good Istio support
- Microsoft Azure will probably move in the direction of Open Service Mesh (OSM)

Independence through SMI?

- "A standard interface for service meshes on Kubernetes“
- Features:
  - Traffic Access Control
  - Traffic Metrics
  - Traffic Specs
  - Traffic Split
- Defines CRDs in Kubernetes that are used by the implementations

Service Mesh Interface Support

full

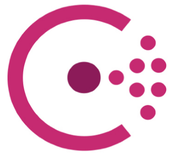
Istio

(unofficial/3rdparty support)

Open Service Mesh

partially

LINKERD



HashiCorp Consul

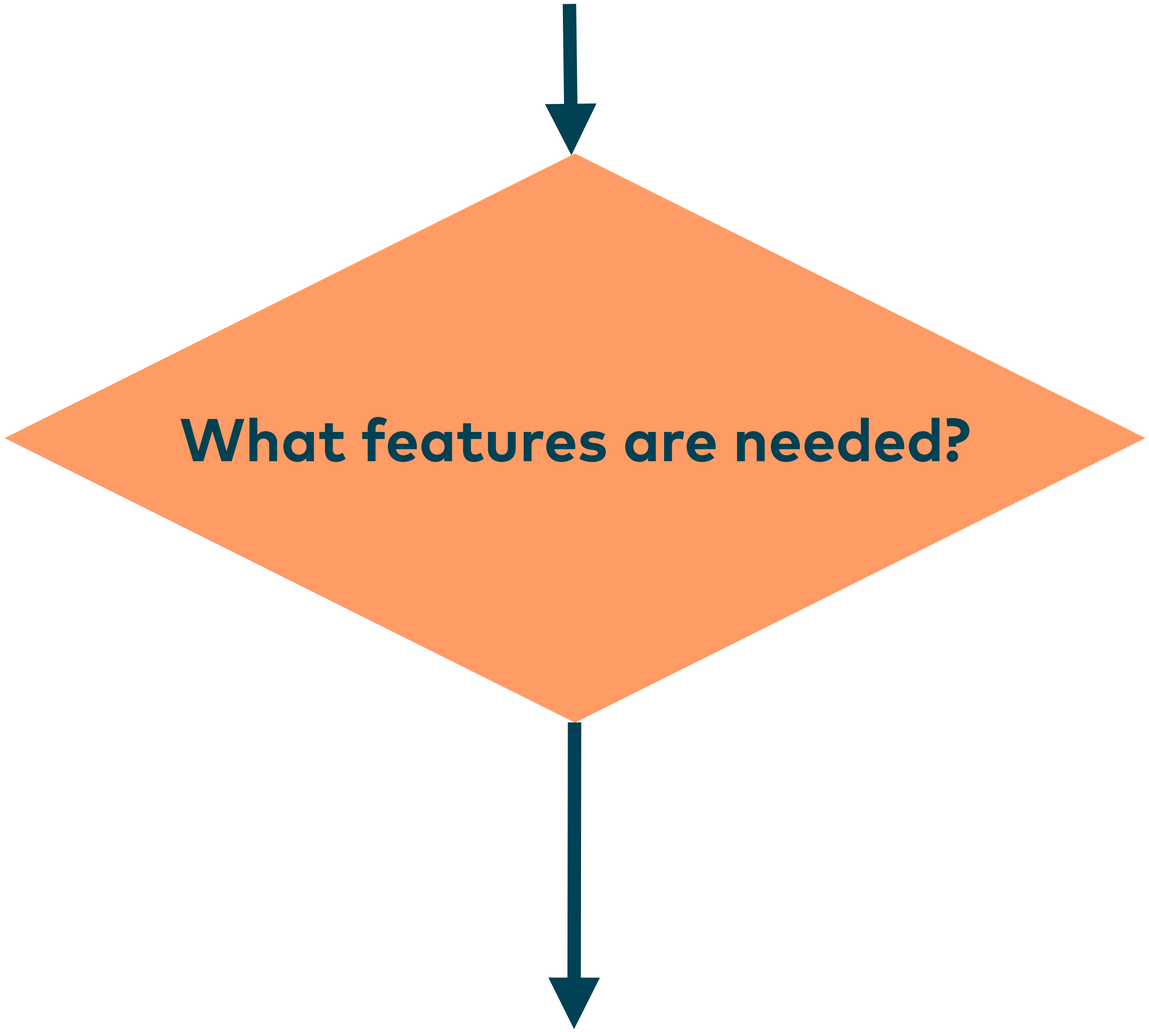
traefik mesh

NGINX Service Mesh

none

AWS App Mesh

Kuma


What features are needed?

Features questions

1. What are the current challenges in the project?

2. Are there must-haves / nice-to-haves?

3. What level of configurability is required?

4. What level of effort are we willing to spend?

Differences Between the Meshes

Routing

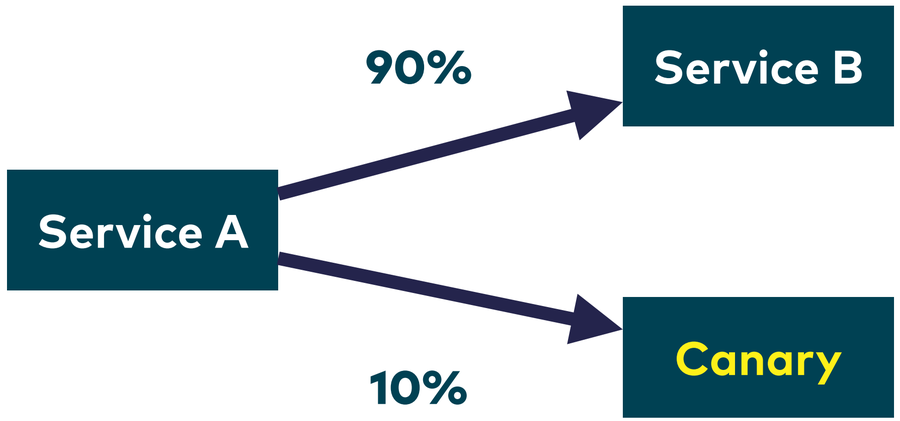
Resilience

Security

Observability

Canary Releasing & A/B Testing

percentual split only



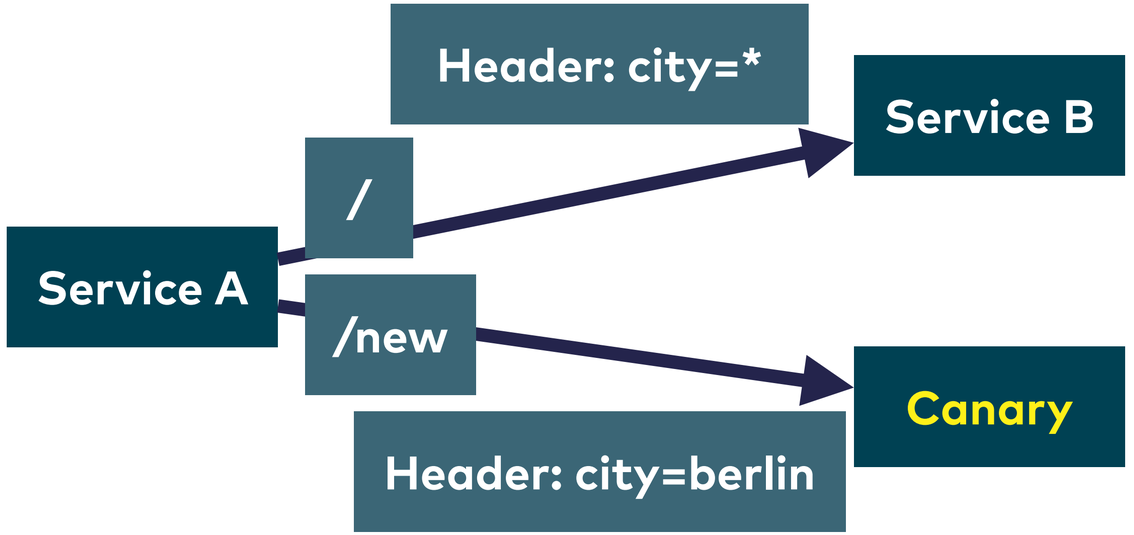
Kuma

traefik mesh

NGINX Service Mesh

LINKERD

+ header- and path-based



Istio

AWS App Mesh

HashiCorp Consul

Open Service Mesh

Differences between the meshes

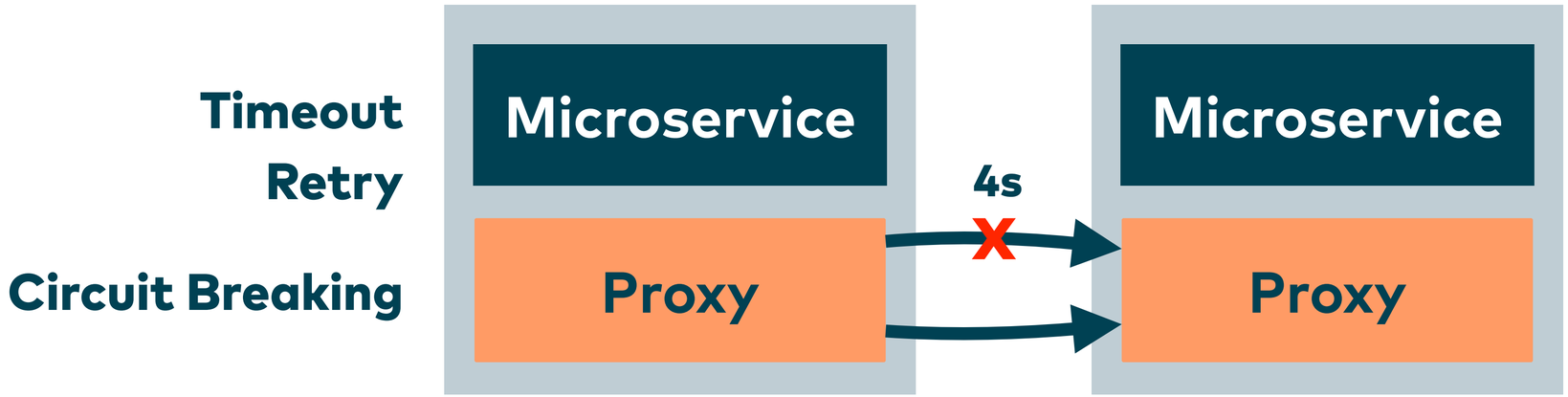
Routing

Resilience

Security

Observability

Resilience Features

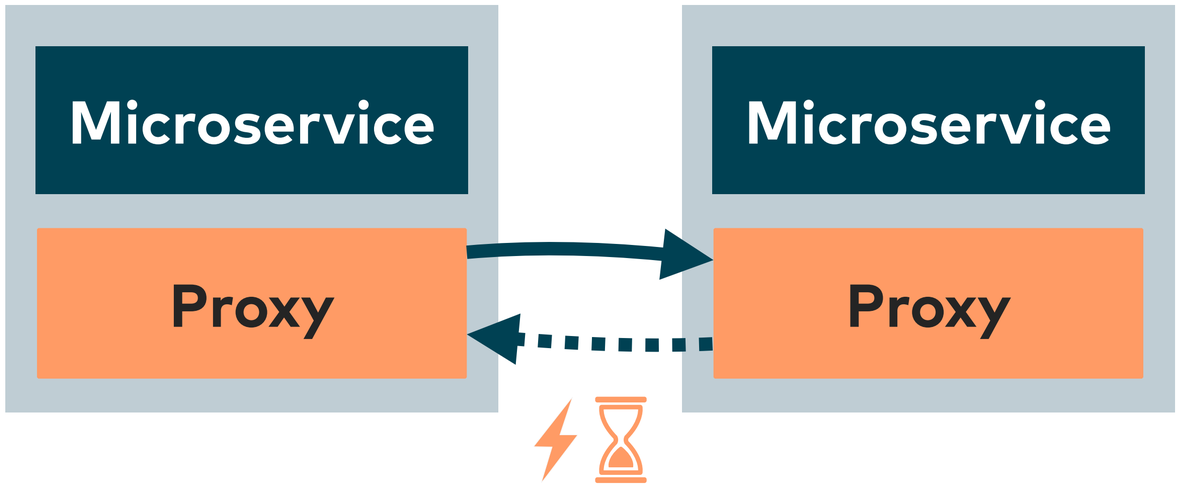


- Many differences in service mesh implementations
- Watch out: retry config may apply per service
  → **No extra config of non-idempotent endpoints like HTTP POST!**

Chaos Engineering

Fault Injection

Delay Injection



- Supported in Istio, Kuma and partly Linkerd 2
- With some meshes, an additional deployment is necessary

Differences between the meshes

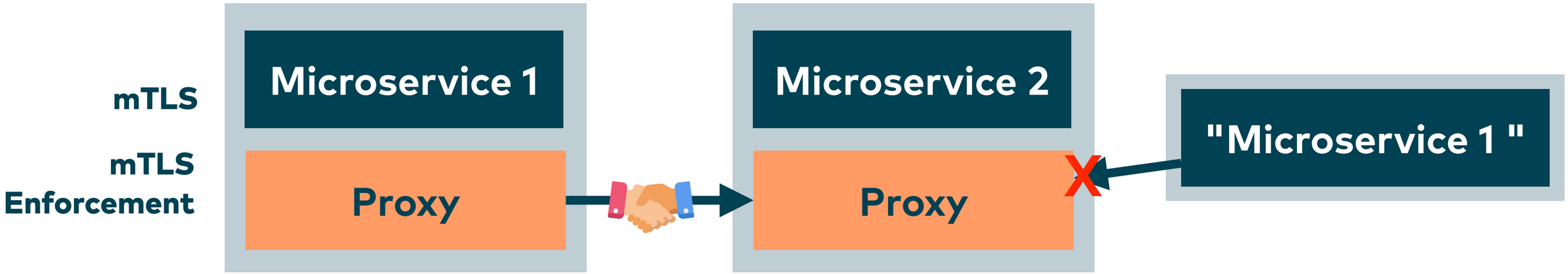
Routing

Resilience

Security

Observability

Differences in Security Features



- All meshes except Traefik Mesh support mTLS
- Main differences:
  - mTLS for TCP connections
  - TLS Enforcement

Differences between the meshes

Routing

Resilience

Security

Observability

Observability Features

- Quality of the dashboard

LINKERD

Namespace > default

CLUSTER

- Namespaces
- Control Plane

DEFAULT

WORKLOADS

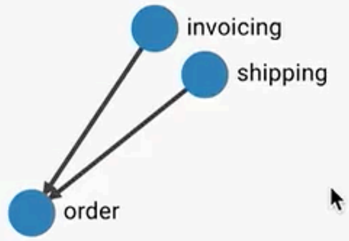
- Cron Jobs
- Daemon Sets
- Deployments
- Jobs
- Pods
- Replica Sets
- Replication Controllers
- Stateful Sets

CONFIGURATION

- Traffic Splits

TOOLS

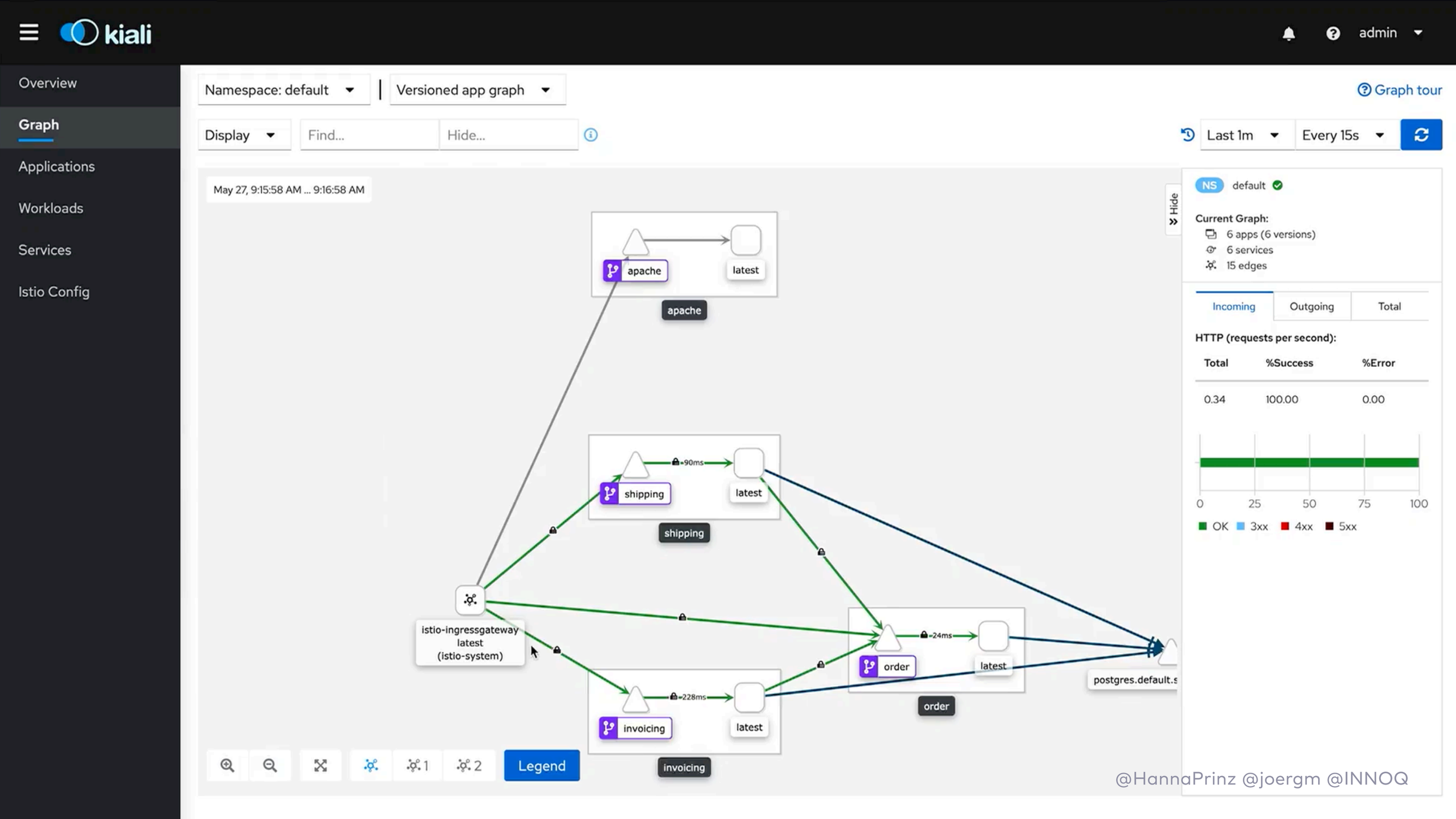
- Tap
- Top



Deployments

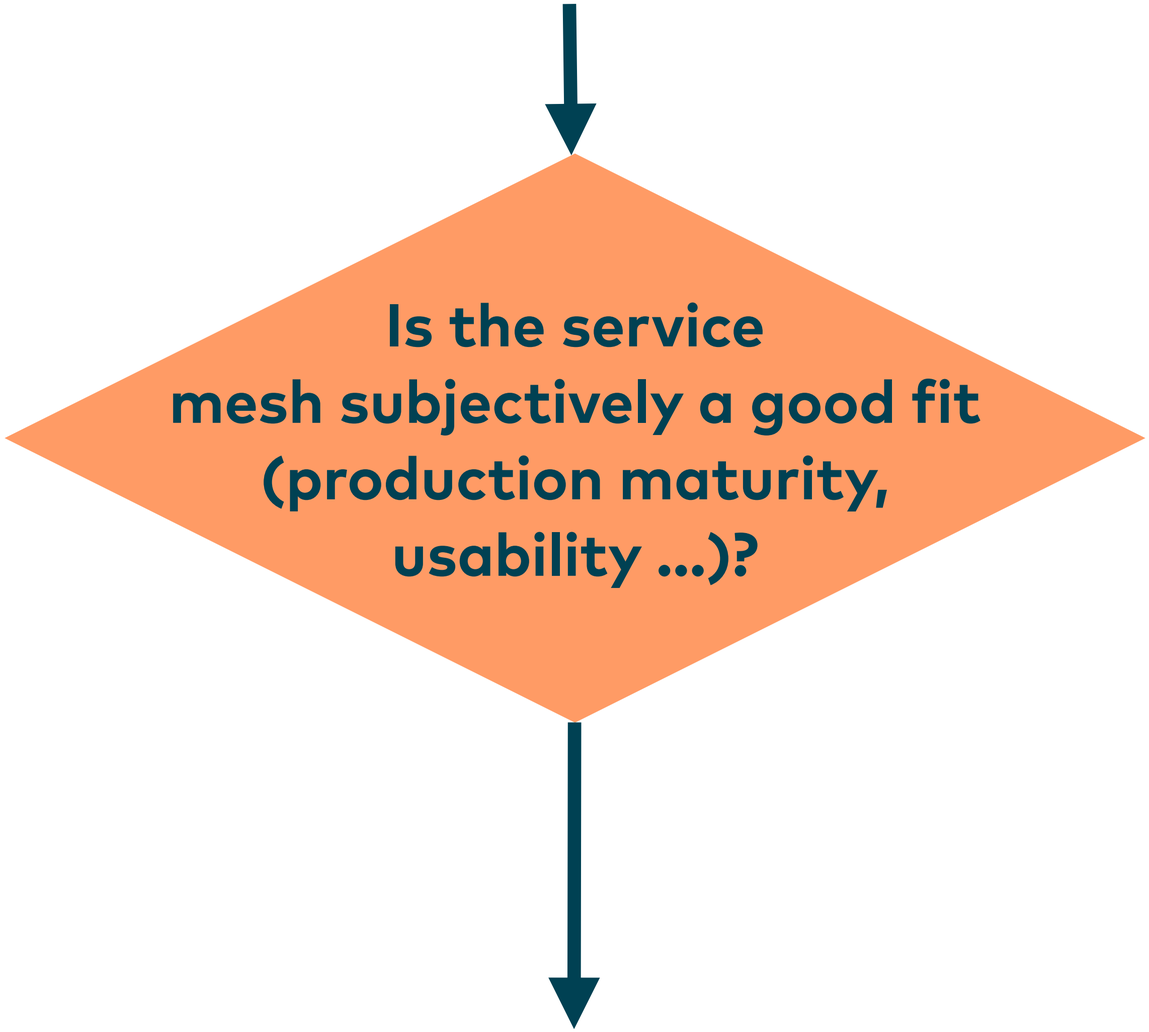
Deployment	Meshed	Success Rate	RPS	P50 Latency	P95 Latency	P99 Latency	Grafana
apache	1/1	100.00%	0.42	1 ms	1 ms	1 ms	
invoicing	1/1	100.00%	0.83	6 ms	16 ms	19 ms	
order	1/1	100.00%	1.75	17 ms	29 ms	30 ms	
postgres	1/1	---	---	---	---	---	
shipping	1/1	100.00%	0.83	10 ms	19 ms	20 ms	

Pods


kiali
admin
Overview
Graph
Applications
Workloads
Services
Istio Config
Namespace: default
Versioned app graph
Graph tour
Display
Find...
Hide...
Last 1m
Every 15s
May 27, 9:15:58 AM ... 9:16:58 AM
apache
latest
apache
shipping
90ms
latest
shipping
istio-ingressgateway
latest
(istio-system)
order
24ms
latest
order
invoicing
228ms
latest
invoicing
postgres.default.s
1
2
Legend
Hide
NS
default
Current Graph:
6 apps (6 versions)
6 services
15 edges
Incoming
Outgoing
Total
HTTP (requests per second):
Total
%Success
%Error
0.34
100.00
0.00
0
25
50
75
100
OK
3xx
4xx
5xx
@HannaPrinz @joergm @INNOQ

Observability Features

- Dashboard quality
- Preconfigured Prometheus, Grafana and Jaeger
- Tracing support
- Access logs (or similar features such as Linkerd 2's "tap")


Is the service
mesh subjectively a good fit
(production maturity,
usability ...)?

Production readiness

leaders

Istio

HashiCorp Consul

LINKERD

followers

AWS App Mesh

traefik mesh

Kuma

new

Open Service Mesh

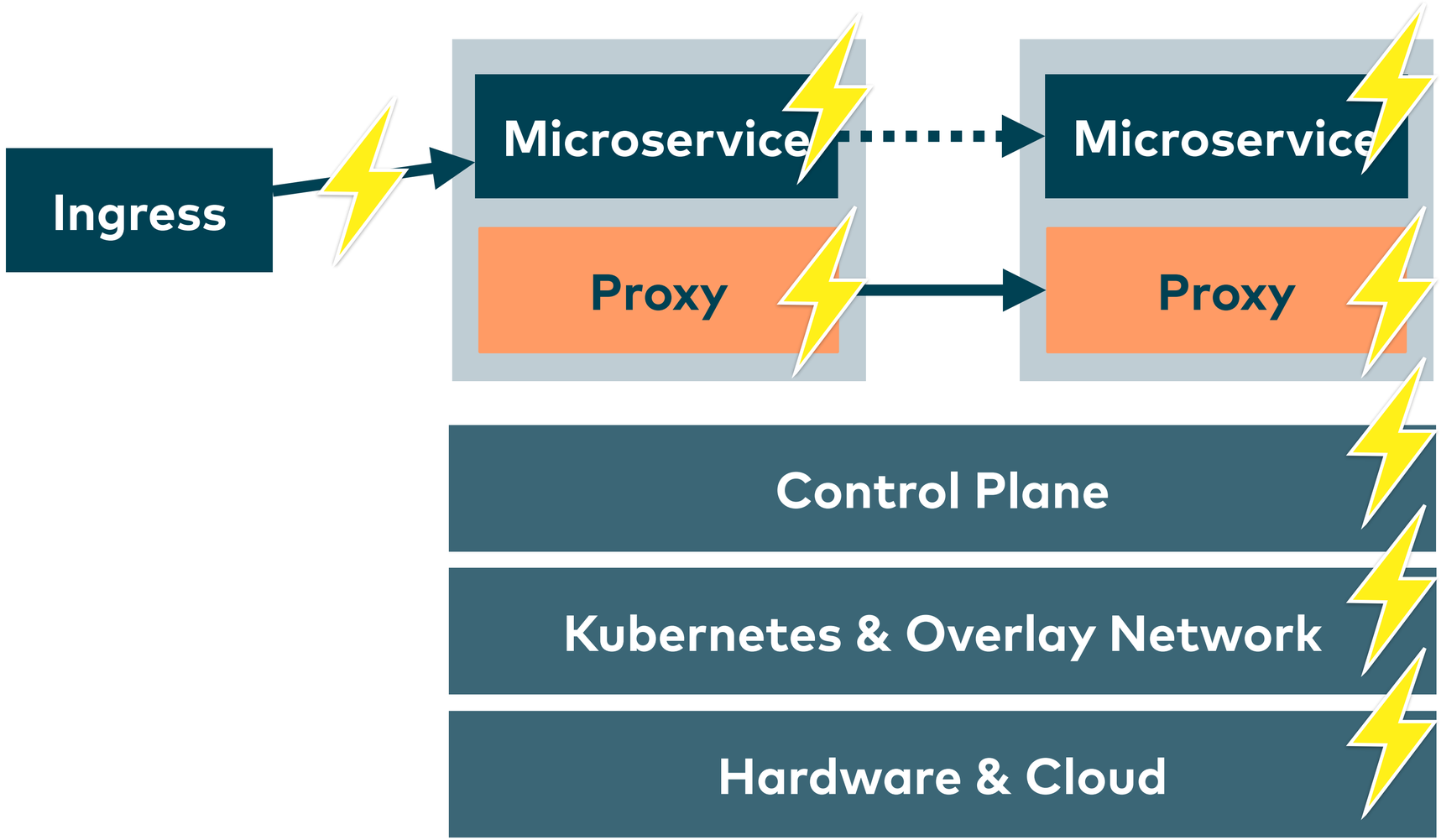
NGINX Service Mesh

Configuration complexity

Example: Traffic Split

can be one CRD with 10 lines of YAML
... or two CRDs with 30 lines of YAML

Debugging Complexity



Performance & Benchmarking

- Additional latency: ~ 3ms
- Additional CPU & memory resources
- Depending on architecture, traffic and mesh implementation

→ **Do your own benchmark!**

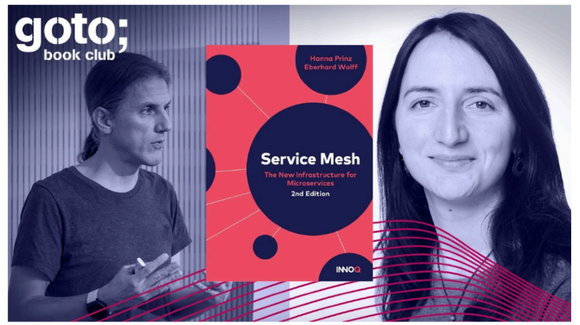
Conclusion

Approaching Service Mesh

0. Is a service mesh the reasonable next step?
   → is the problem somewhere else?
1. What is the technical environment?
   → Kubernetes/Cloud/Infrastructure tools
2. What features are needed?
   → Must-Haves/Nice-to-Haves?
3. Does the service mesh fit subjectively?
   → Production Readiness, Developer Experience, Config, Performance

More about Service Mesh

- **Service Mesh Comparison**
  https://servicemesh.es
- **Blog Post: Happy without a Service Mesh**
  https://www.innoq.com/en/blog/happy-without-a-service-mesh/
- **Linkerd Tutorial**
  https://linkerd.io/2/tasks/
- **Istio Tutorial**
  https://istio.io/docs/setup/getting-started/
- **Sample application with Istio and Linkerd Tutorial on GitHub**
  https://github.com/ewolff/microservice-istio https://github.com/ewolff/microservice-linkerd



GOTO 2020 • Getting started with Service Mesh
https://www.youtube.com/watch?v=w14ge2838Vs

Service Mesh Primer - 2nd Edition
for free at leanpub.com/service-mesh-primer

Thank you! Questions?

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