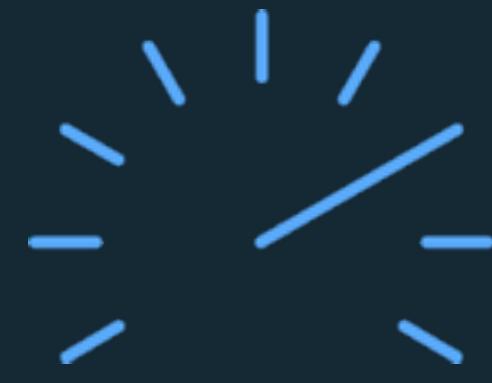


The Future of Compute

Containers, Functions and Microservices

Future of Compute



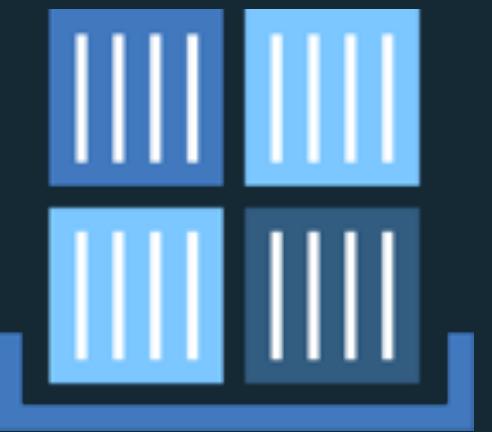
Bare Metal

Maximum performance
and control



Virtual Server or VMware

Leverage existing
languages and tools



Containers

Maximum portability



Cloud Foundry

Open PaaS
environment



IBM Cloud Functions

Maximum speed with
serviceless apps

**PERFORMANCE &
CONTROL**

PORTABILITY

DEVELOPMENT SPEED



**IBM Bluemix
Container Service**



IBM Bluemix Container Service

NOW LIVE!!

Combining Docker and Kubernetes to deliver powerful tools, an intuitive user experience, and built-in security and isolation to enable rapid delivery of applications - all while leveraging IBM Cloud Services including cognitive capabilities from Watson.

www.ibm.com/cloud-computing/bluemix/containers



Container Orchestration



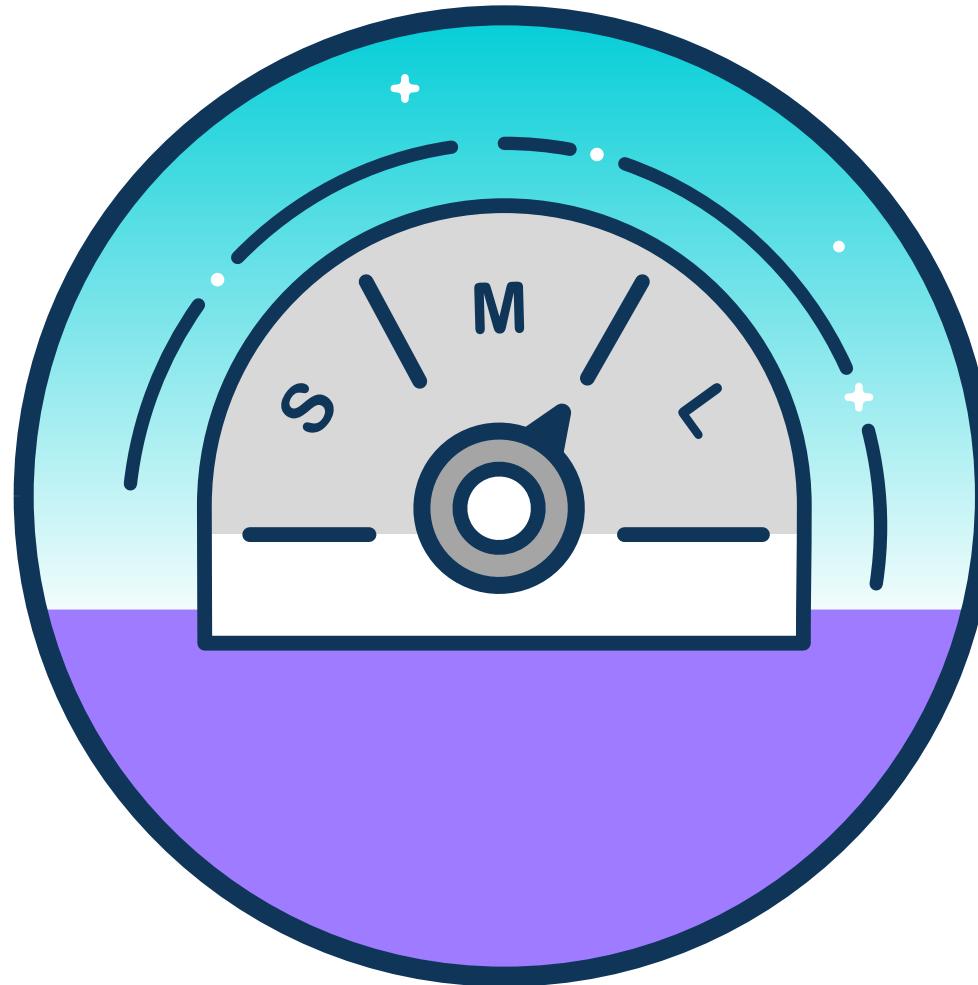
Intelligent Scheduling

- Automatically places containers based on required resources
- Supports mixed workloads to drive increased utilization



Self-healing

- Restarts containers that fail
- Replaces and reschedules containers when nodes die
- Kills containers that don't respond to your user-defined health check



Horizontal scaling

- Scale your application with a simple command
- Automatic scaling based on real-time usage



Service discovery and load balancing

- Simple discovery of services through a single DNS name
- Manage access to container applications through IP address or HTTP route.
- Automatically load balance traffic and route around failure



Automated rollouts and rollbacks

- Roll out changes to your application or its configuration, while monitoring application health to ensure things stay up
- If something goes wrong, Kubernetes will rollback the change for you

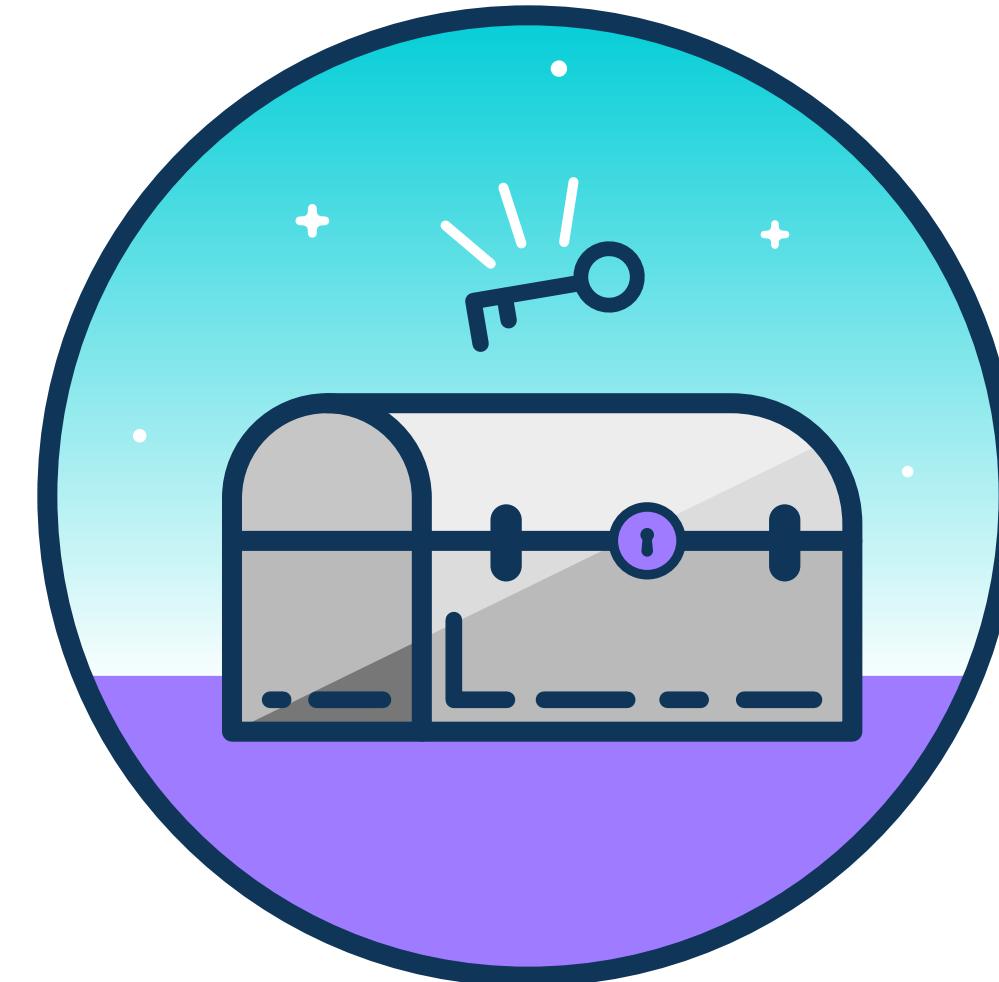


Secret and configuration management

- Safely store application credentials and secrets
- Deploy and update secrets and application configuration without rebuilding your image and without exposing secrets in your stack configuration.



Cluster Management Capabilities



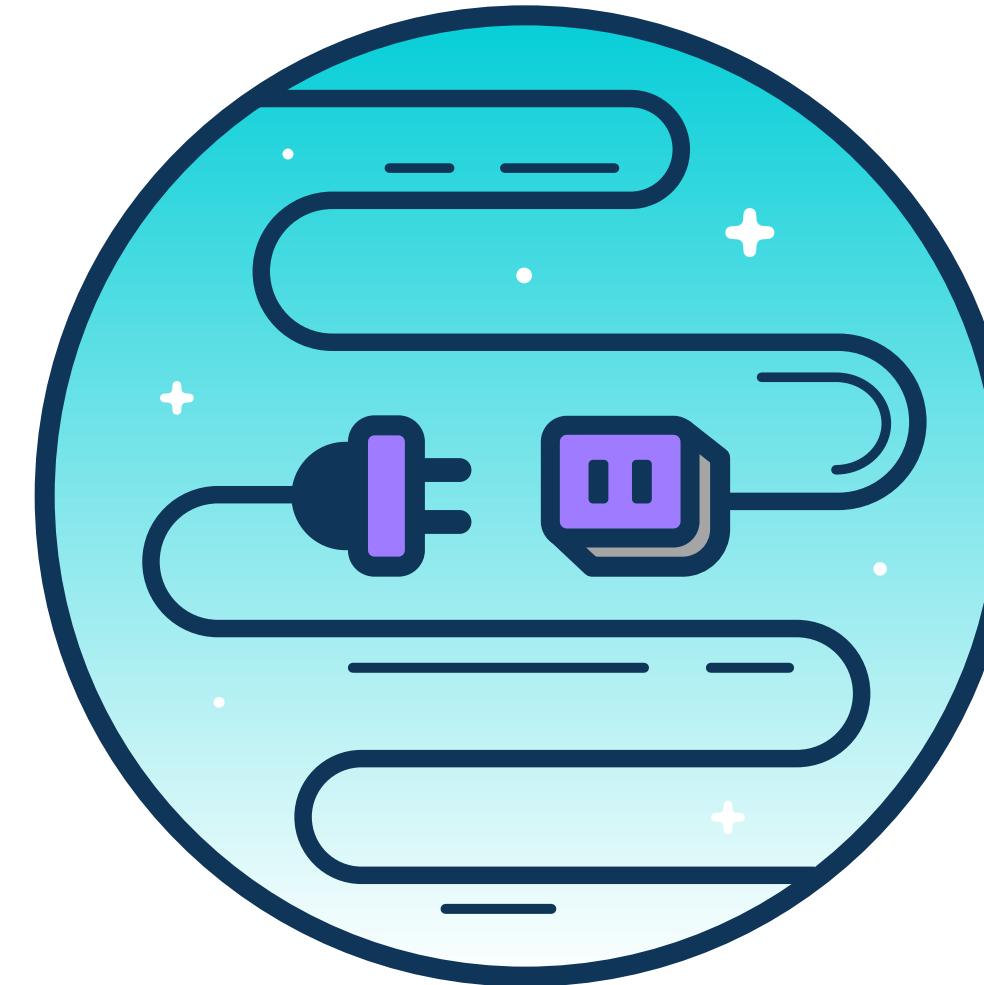
Container Security & Isolation

- Provides Docker image and running application scanning to detect vulnerabilities with Vulnerability Advisor.
- Store your images securely in your hosted private registry
- Automatic encryption of secrets and volumes
- Isolated networking and storage



Design Your Own Cluster

- Tunable capacity
- Select between shared and dedicated compute
- Configurable networking and storage



Leverage IBM Cloud Services

- Enhance your application with Watson, IoT, Analytics and Data Services
- Persistent Volumes using IBM Cloud storage
- IP and application Load Balancing
- Integrated with IBM Cloud access management



Native Kubernetes Experience

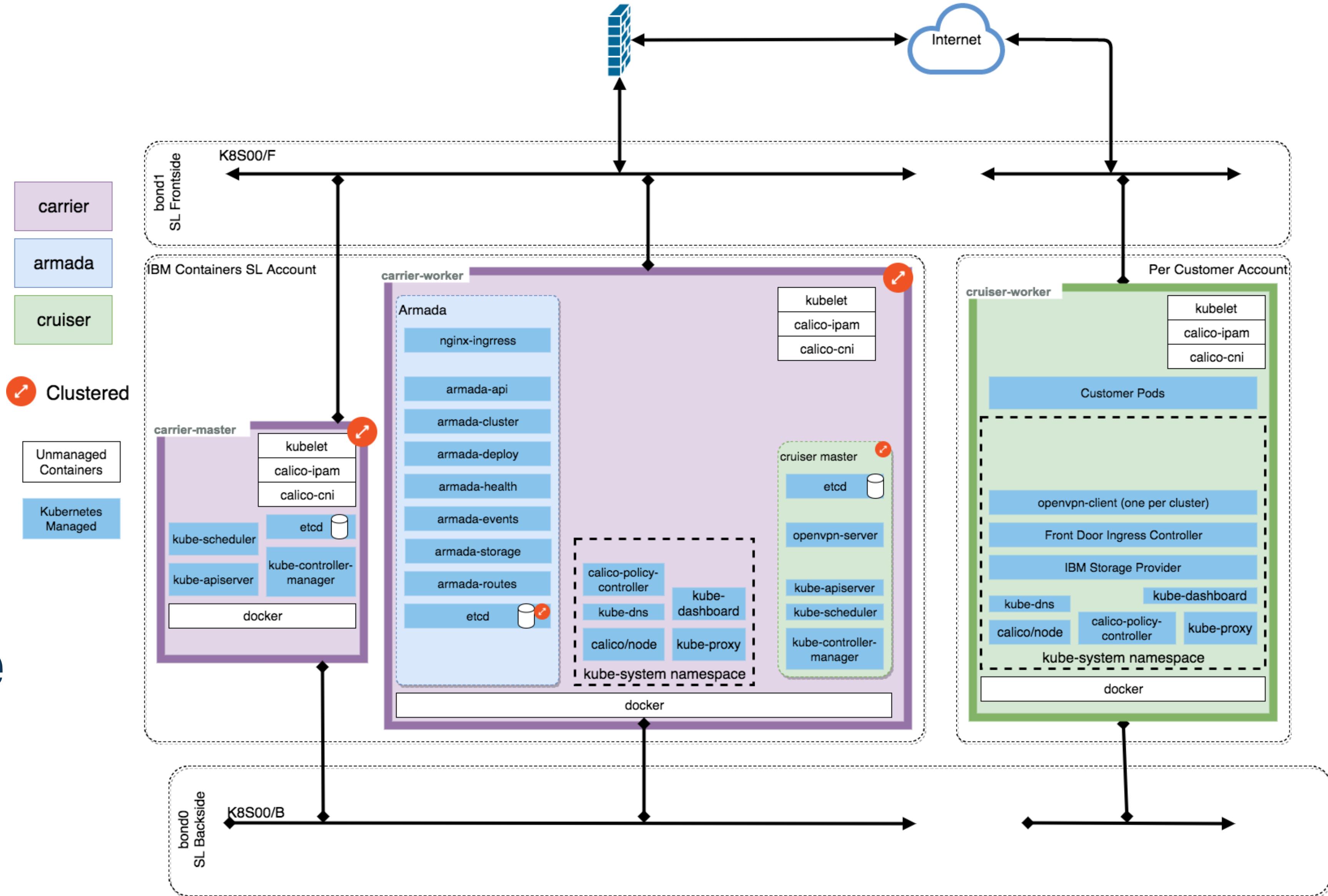
- Seamless experience moving from local development to IBM Bluemix
- 100% Kubernetes API and tools
- Supports Kubernetes dashboard
- Leverage Docker images



Integrated Operational Tools

- Built-in log and metrics collection with IBM Bluemix log and metrics services
- Use with IBM DevOps tools such as Delivery Pipeline
- Supports popular add-ons including Prometheus, Weave, sysdig, fluentd and others

Armada Datacenter Architecture



Microservices

The Definition

An engineering approach focused on ***decomposing*** an application into ***single-function modules*** with ***well-defined interfaces*** which are ***independently*** deployed and operated by a ***small team*** who owns the entire lifecycle of the service.



Microservices are about people

Microservices accelerate delivery by
minimizing communication and
coordination between people while
reducing the scope and risk of
change.

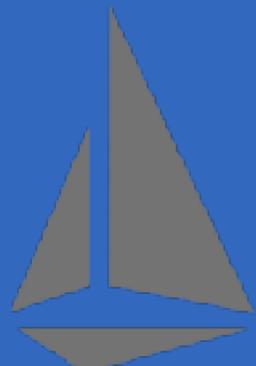


Istio

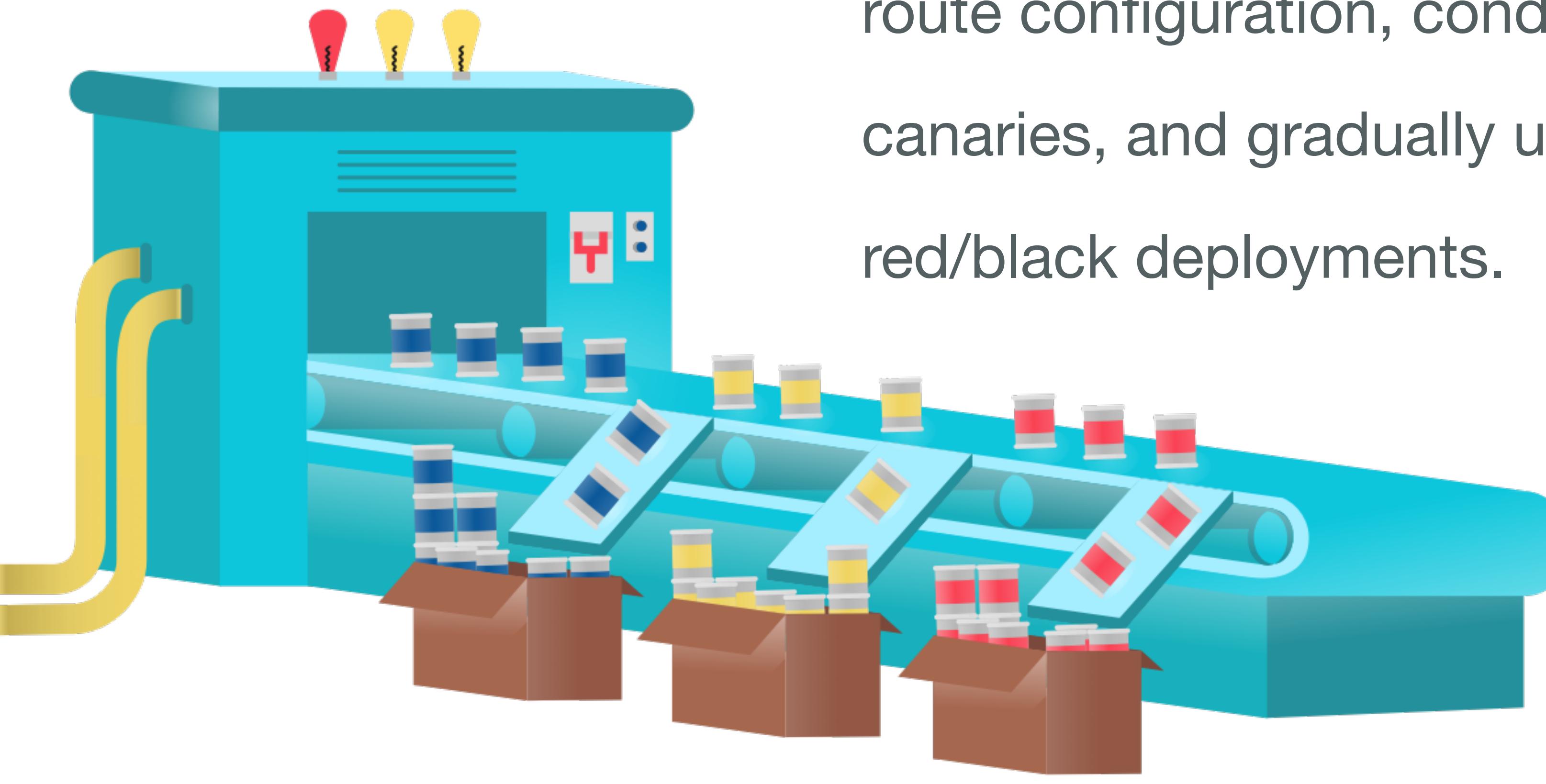


An open platform to connect, manage, and secure microservices

<http://istio.io>

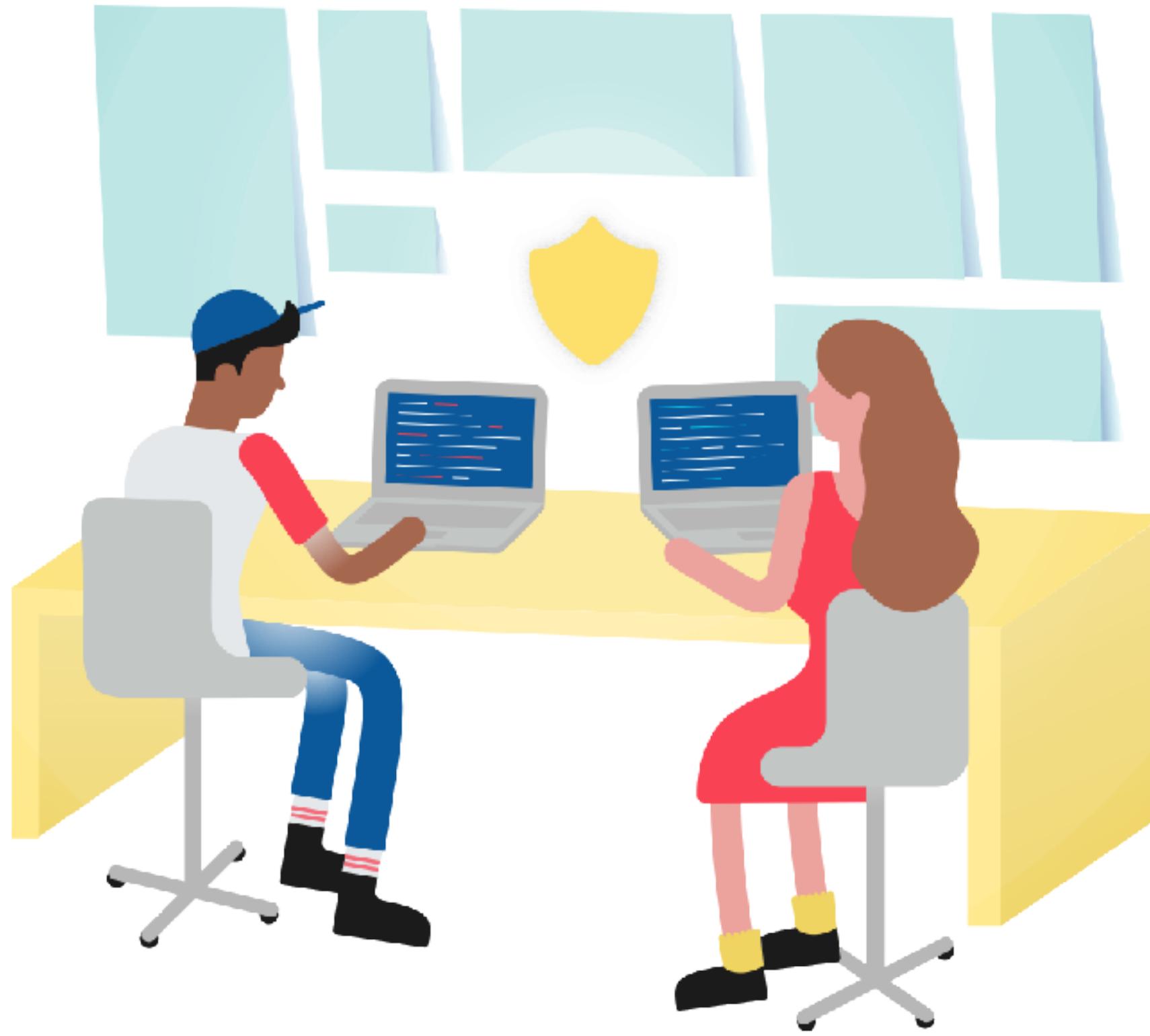


Intelligent Routing and Load Balancing



Control traffic between services with dynamic route configuration, conduct A/B tests, release canaries, and gradually upgrade versions using red/black deployments.

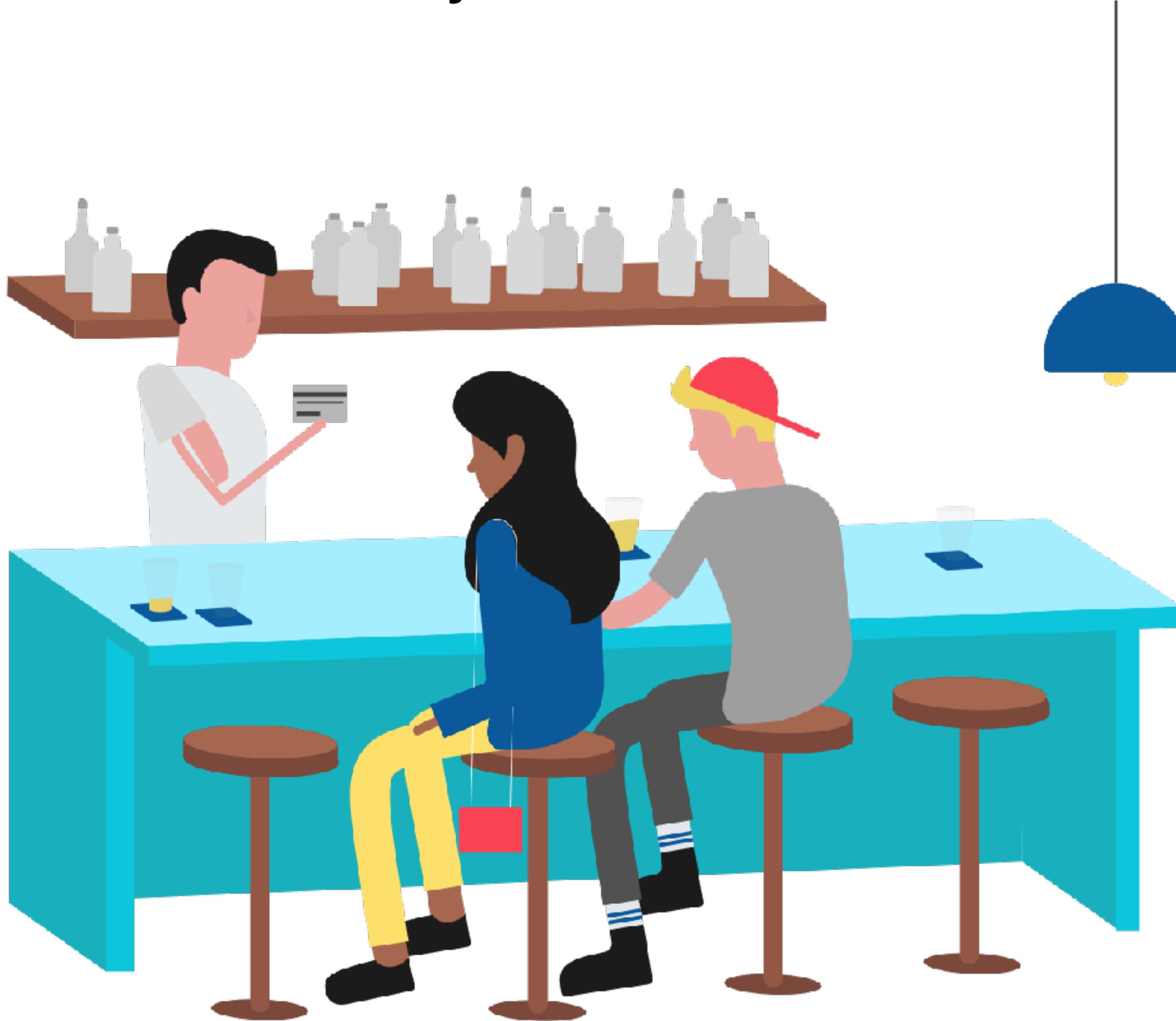
Resilience Across Languages and Platforms



Increase reliability by shielding
applications from flaky networks and
cascading failures in adverse conditions.

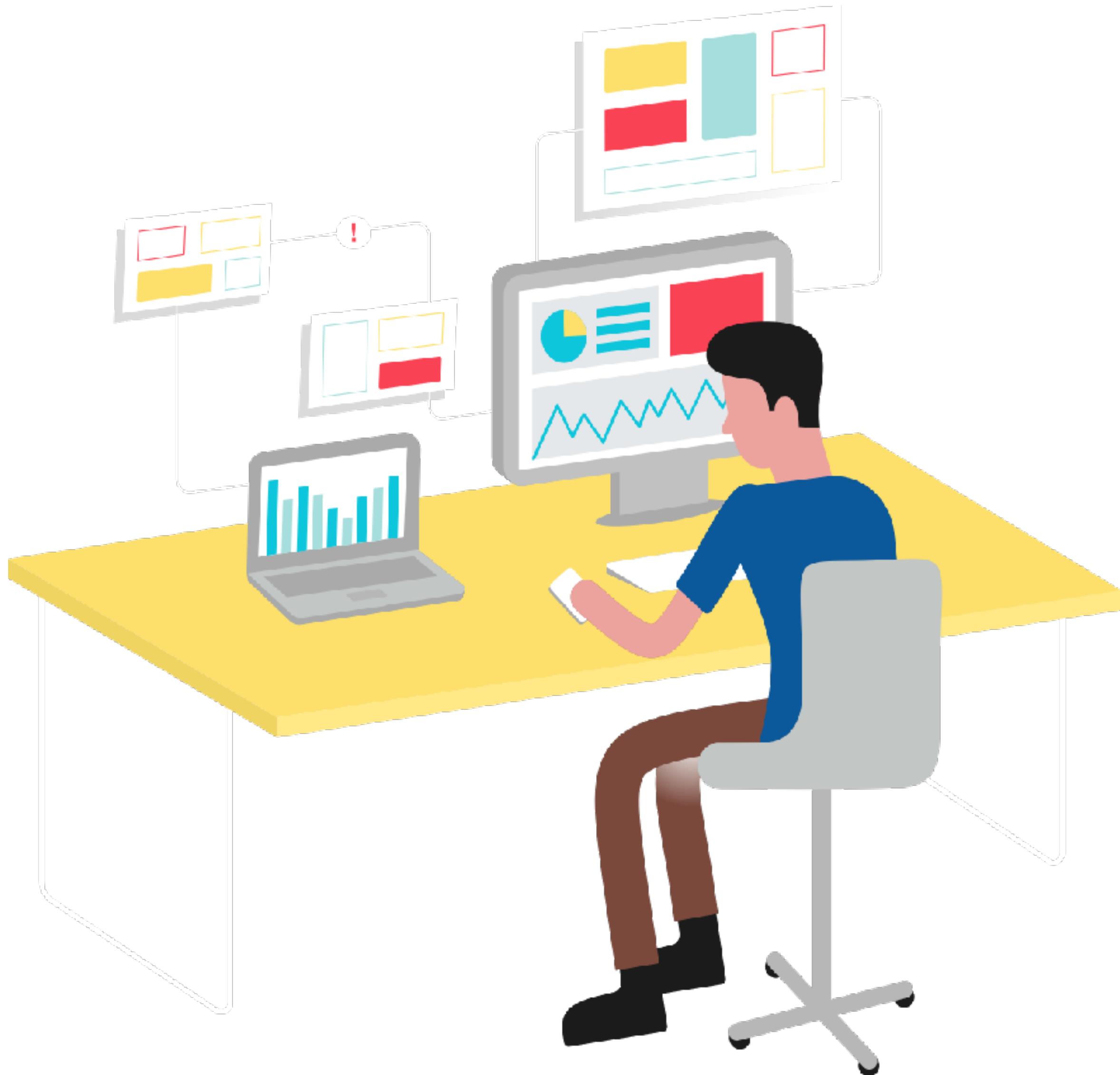


Fleet Wide Policy Enforcement



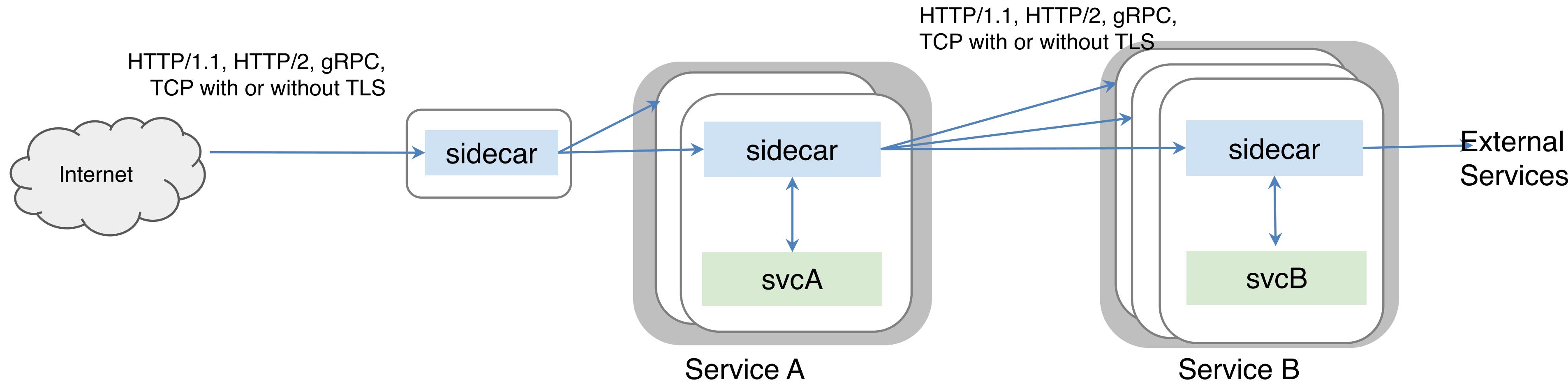
Apply organizational policy to the interaction between services, ensure access policies are enforced and resources are fairly distributed among consumers.

In-Depth Telemetry and Reporting



Understand the dependencies between services, the nature and flow of traffic between them and quickly identify issues with distributed tracing.

Weaving the mesh



Outbound features:

- ❖ Service authentication
- ❖ Load balancing
- ❖ Retry and circuit breaker
- ❖ Fine-grained routing
- ❖ Telemetry
- ❖ Request Tracing
- ❖ Fault Injection

Inbound features:

- ❖ Service authentication
- ❖ Authorization
- ❖ Rate limits
- ❖ Load shedding
- ❖ Telemetry
- ❖ Request Tracing
- ❖ Fault Injection



Our sidecar of choice - Envoy

A C++ based L4/L7 proxy



Low memory footprint

Battle-tested @ Lyft

100+ services

10,000+ VMs

2M req/s

Plus an awesome team willing to work with the community!

Goodies:

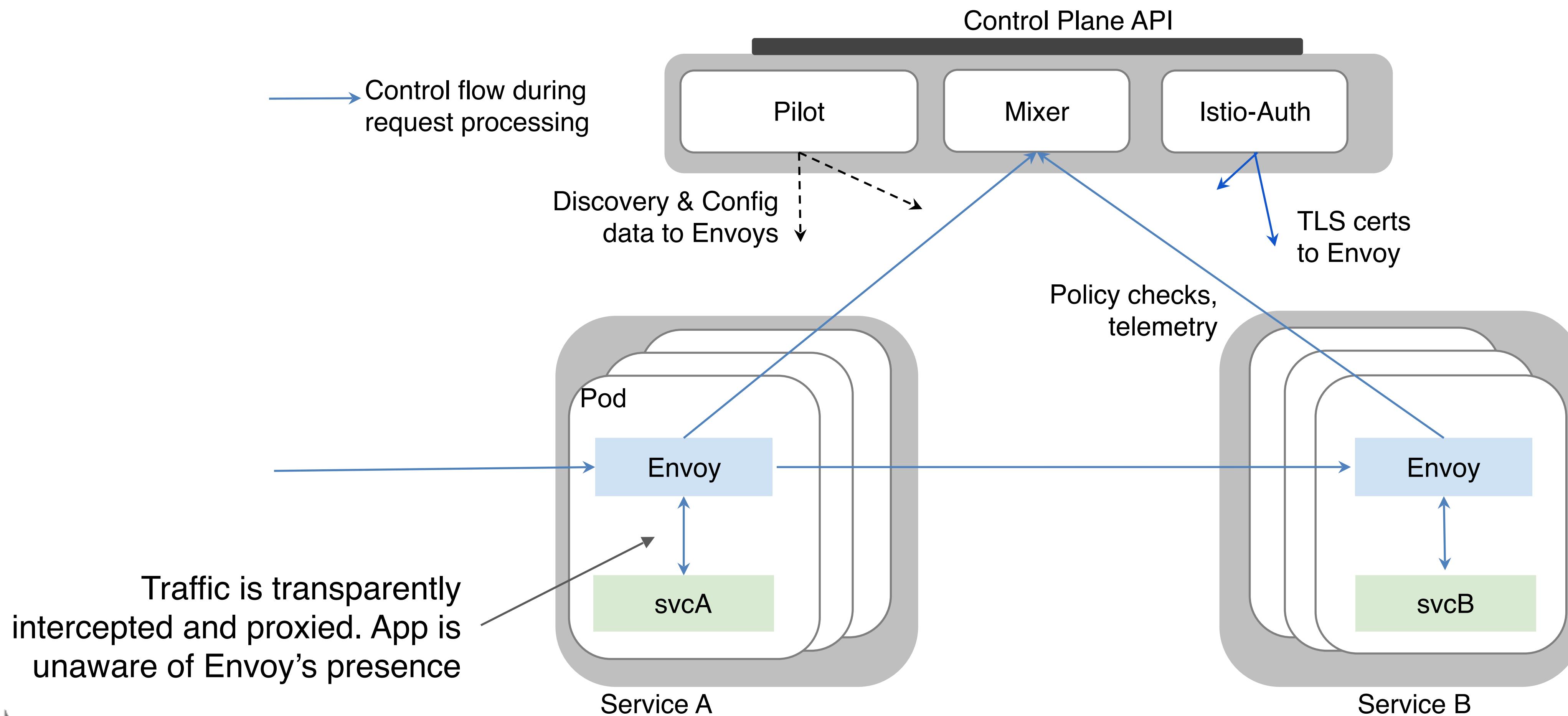
- ❖ HTTP/2 & gRPC
- ❖ Zone-aware load balancing w/ failover
- ❖ Health checks, circuit breakers, timeouts, retry budgets
- ❖ No hot reloads - API driven config updates

Istio's contributions:

- ❖ Transparent proxying w/ SO_ORIGINAL_DST
- ❖ Traffic routing and splitting
- ❖ Request tracing using Zipkin
- ❖ Fault injection



Putting it all together

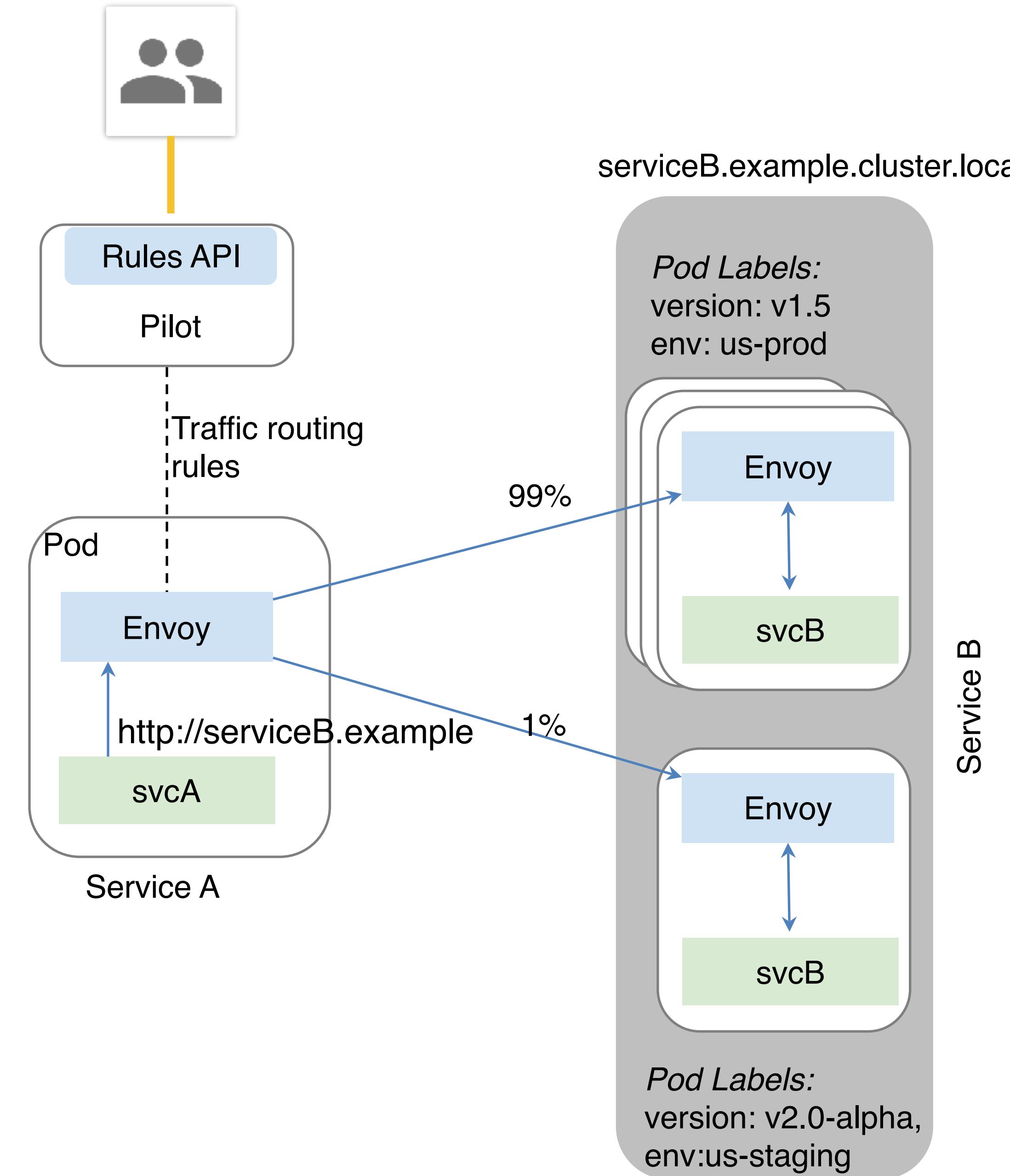


Traffic Splitting

```
// A simple traffic splitting rule

destination: serviceB.example.cluster.local
match:
  source: serviceA.example.cluster.local
route:
- tags:
  version: v1.5
  env: us-prod
  weight: 99
- tags:
  version: v2.0-alpha
  env: us-staging
  weight: 1
```

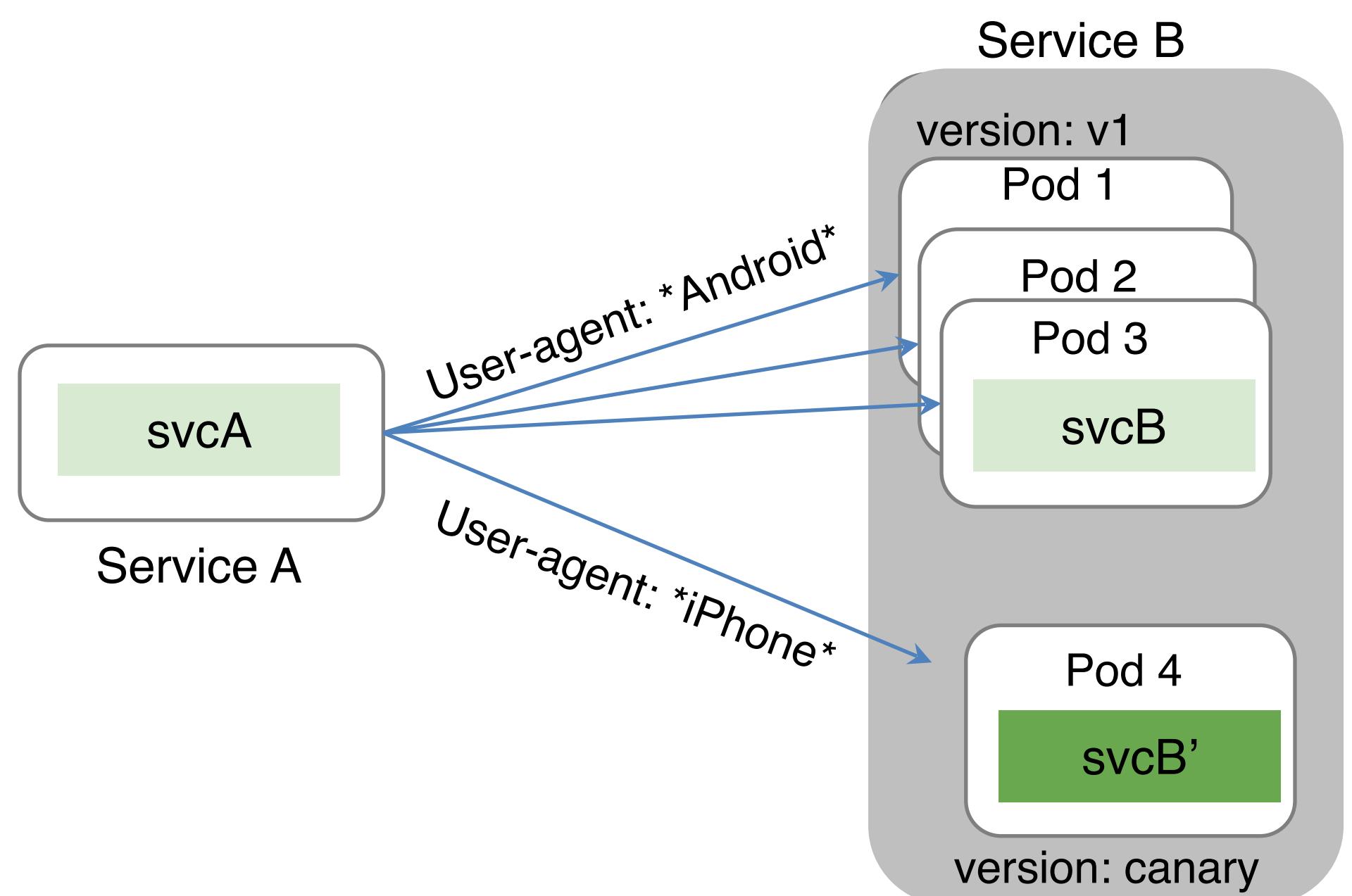
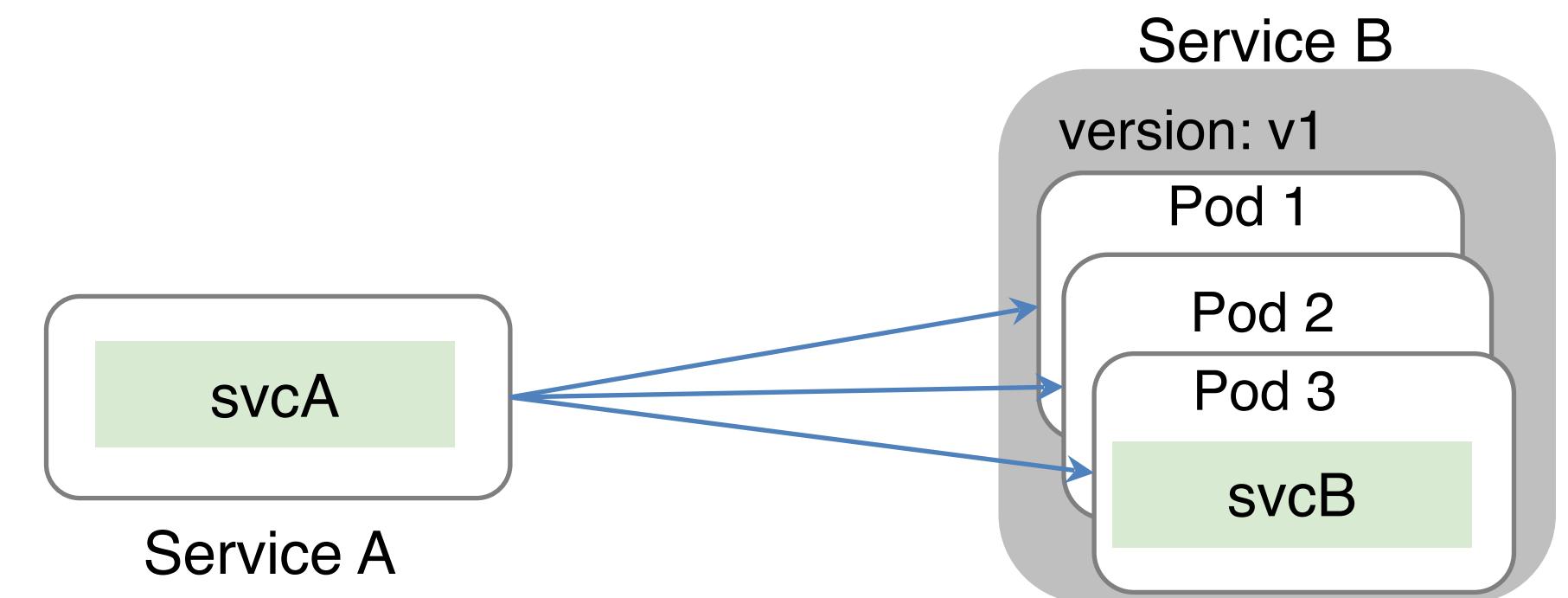
Traffic control is decoupled from infrastructure scaling



Traffic Steering

```
// Content-based traffic steering rule  
  
destination: serviceB.example.cluster.local  
match:  
  httpHeaders:  
    user-agent:  
      regex: ^(.*)?;(iPhone)(;.*)?$  
precedence: 2  
route:  
- tags:  
  version: canary
```

Content-based traffic steering



Resiliency

Istio adds fault tolerance to your application without any changes to code

```
// Circuit breakers

destination: serviceB.example.cluster.local
policy:
- tags:
  version: v1
circuitBreaker:
  simpleCb:
    maxConnections: 100
    httpMaxRequests: 1000
    httpMaxRequestsPerConnection: 10
    httpConsecutiveErrors: 7
    sleepWindow: 15m
    httpDetectionInterval: 5m
```

Resilience features

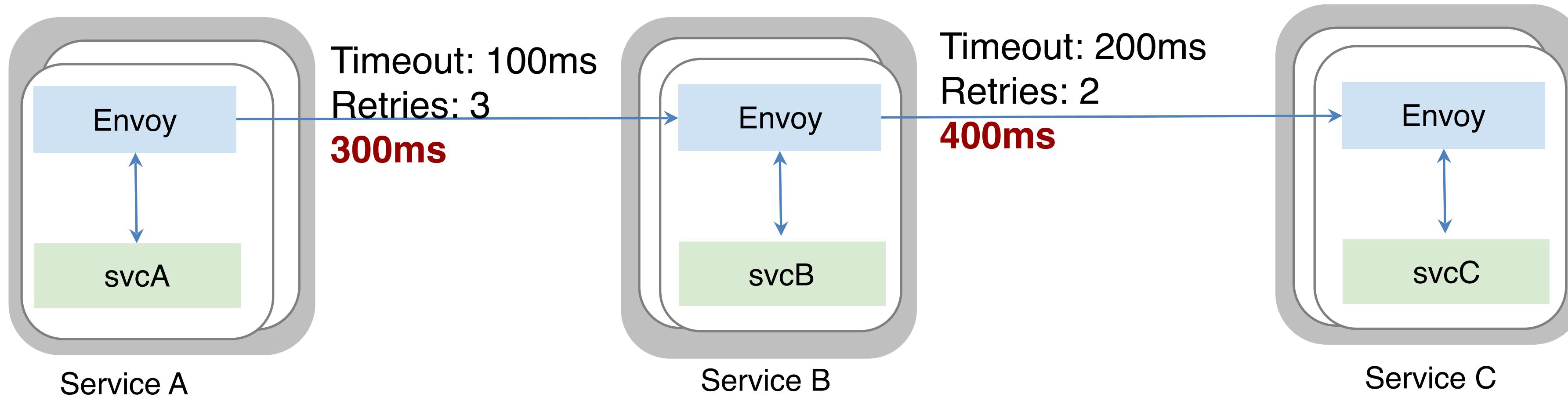
- ❖ Timeouts
- ❖ Retries with timeout budget
- ❖ Circuit breakers
- ❖ Health checks
- ❖ AZ-aware load balancing w/ automatic failover
- ❖ Control connection pool size and request load
- ❖ Systematic fault injection



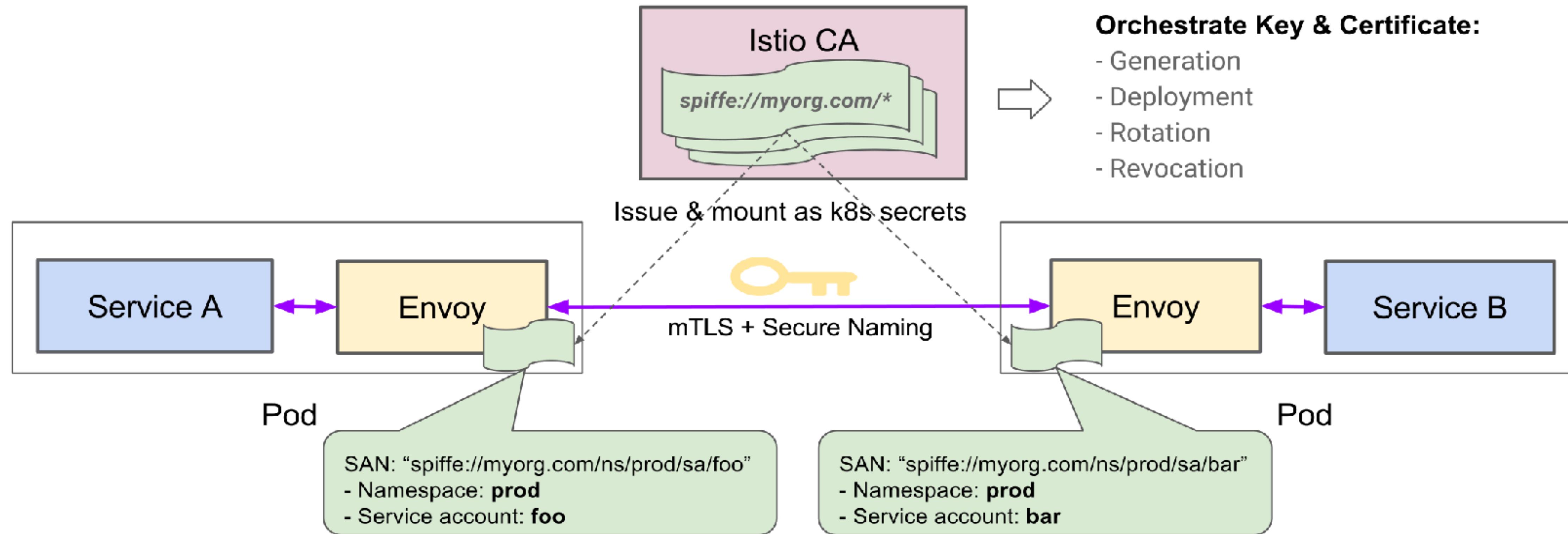
Resiliency Testing

Systematic fault injection to identify weaknesses in failure recovery policies
HTTP/gRPC error codes

Delay injection



Istio - Security at Scale



spiffe.io





CLOUD NATIVE COMPUTING FOUNDATION



Kubernetes

Orchestration



Prometheus

Monitoring



OpenTracing

Tracing



Fluentd

Logging



Linkerd

Service Mesh



gRPC

Remote Procedure Call



CoreDNS

Service Discovery



containererd

Container Runtime



rkt

Container Runtime



CNI

Networking



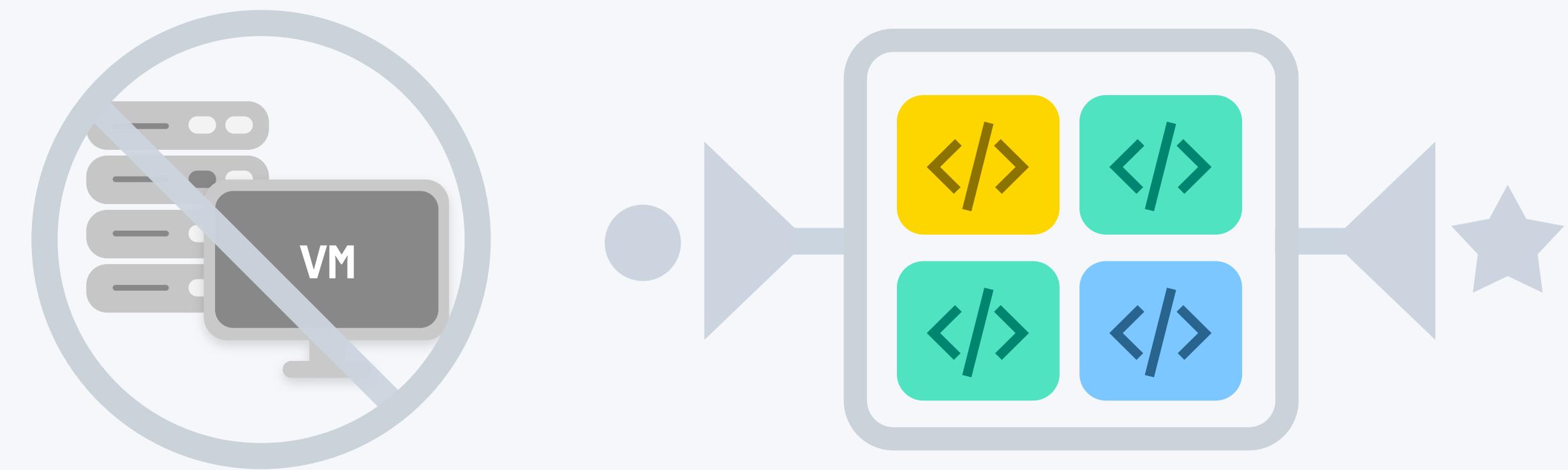
IBM Cloud Functions

Runs code **only**
on-demand on a
per-request basis



Runs code **only** on-demand on
a per-request basis

Serverless deployment & operations model



Functions

Scales inherently

- One process per request

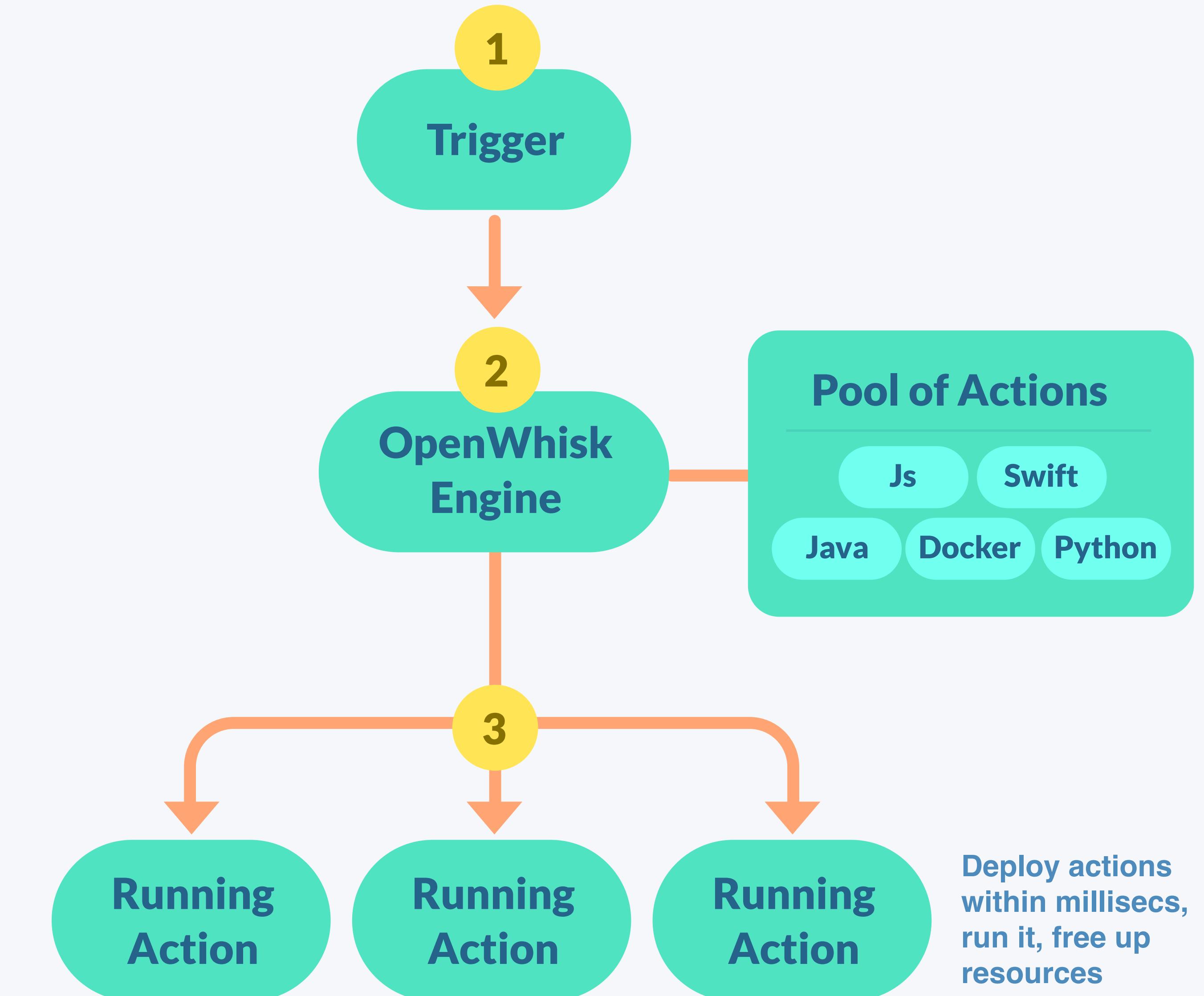
No cost overhead for resiliency

- No long running process for HA

Introduces event programming model

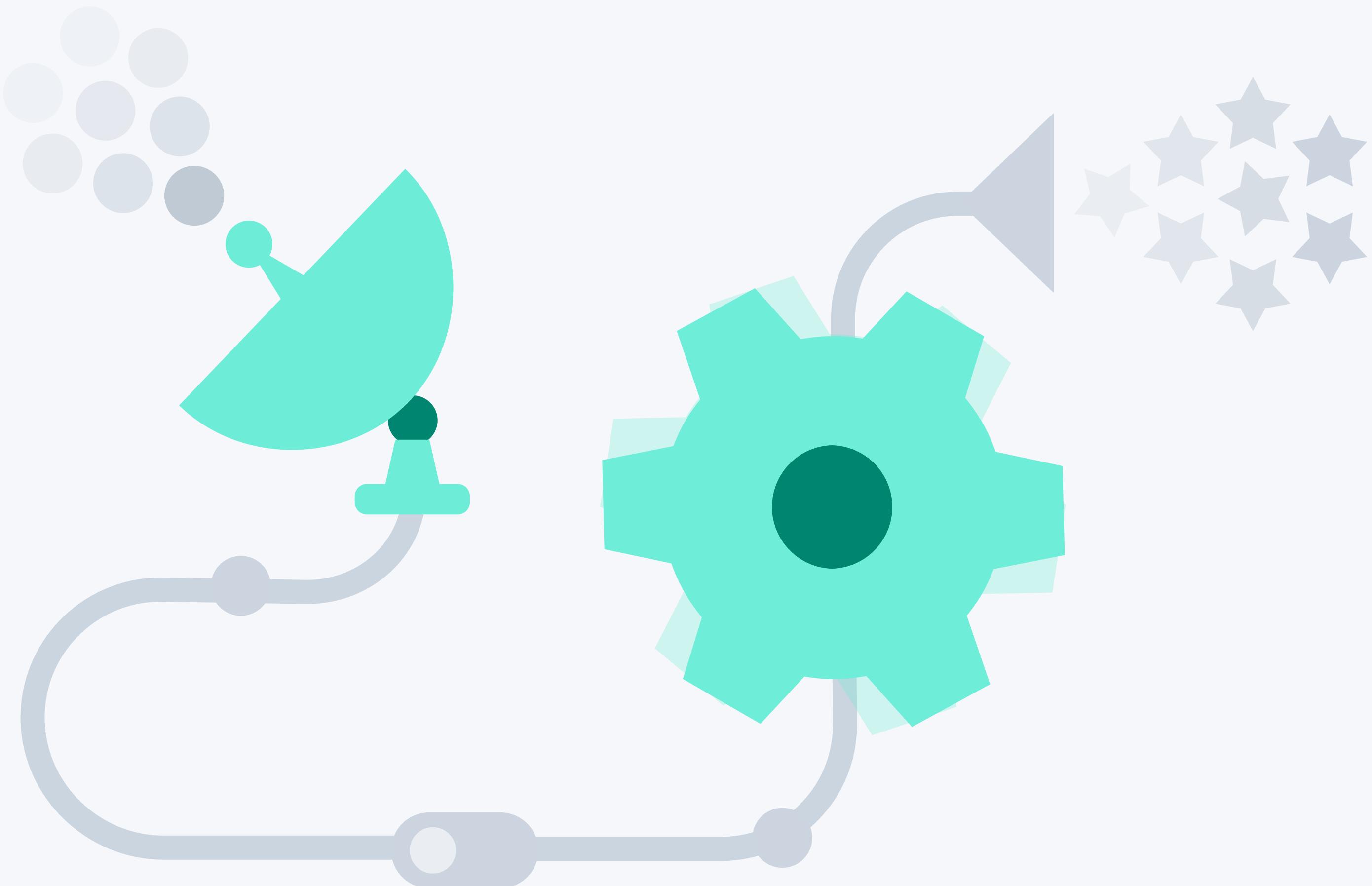
Charges only for what is used

- Only worry about code
- Higher dev velocity, lower operational costs



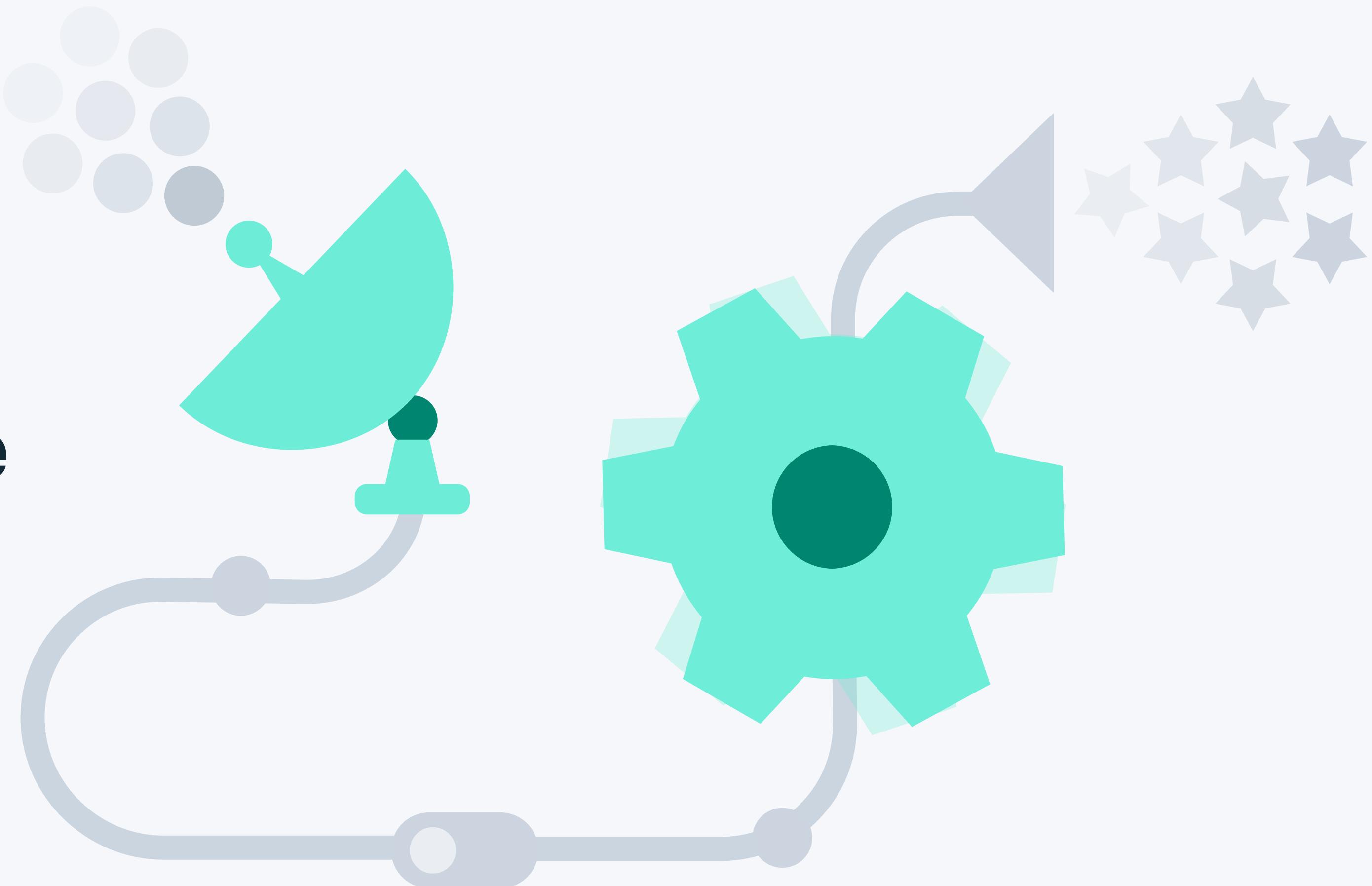
What is IBM Cloud Functions?

FaaS platform to
execute code in
response to
events



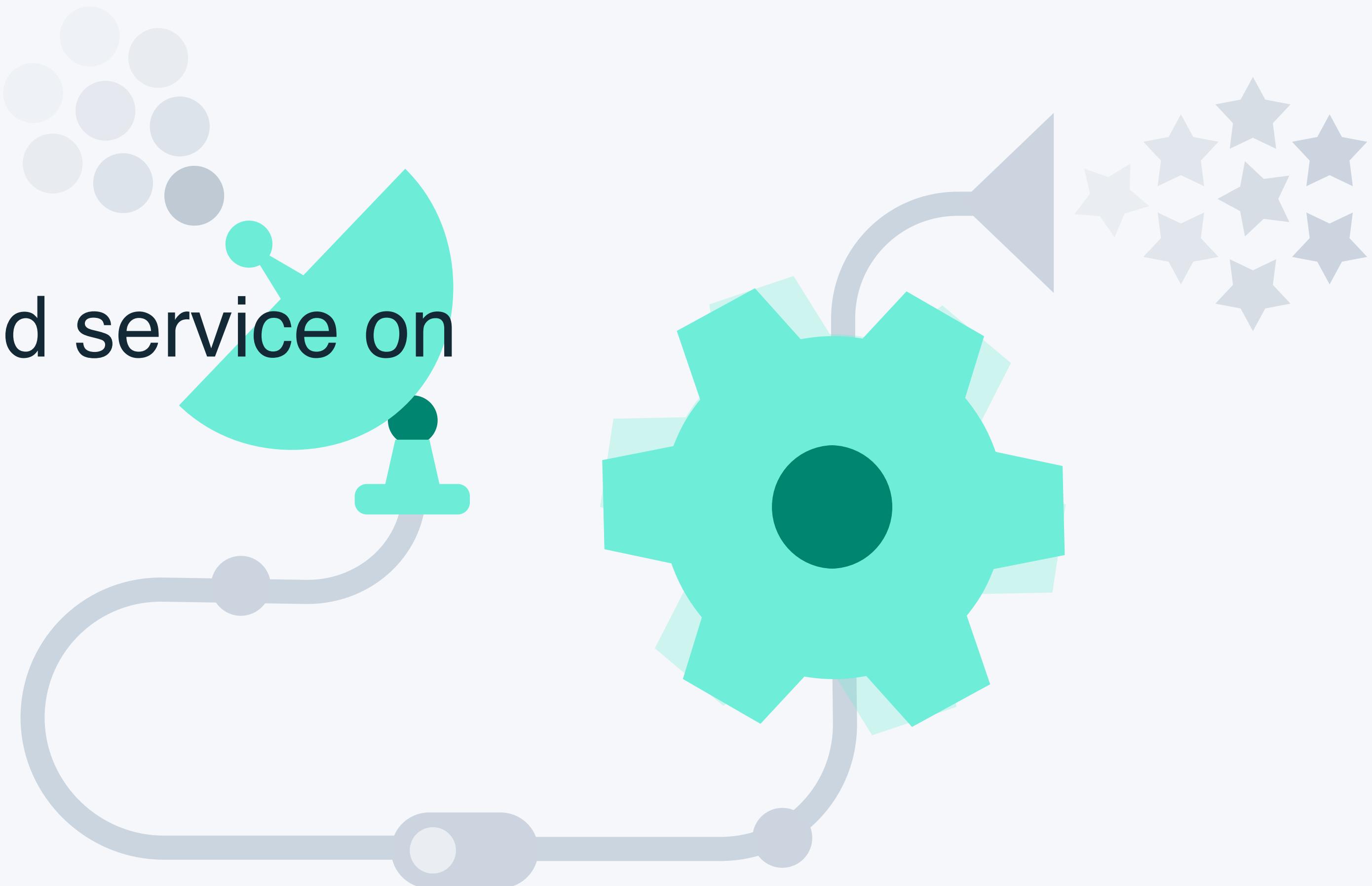
FaaS platform to execute code
in response to events

Available as
open source via Apache
openwhisk.org

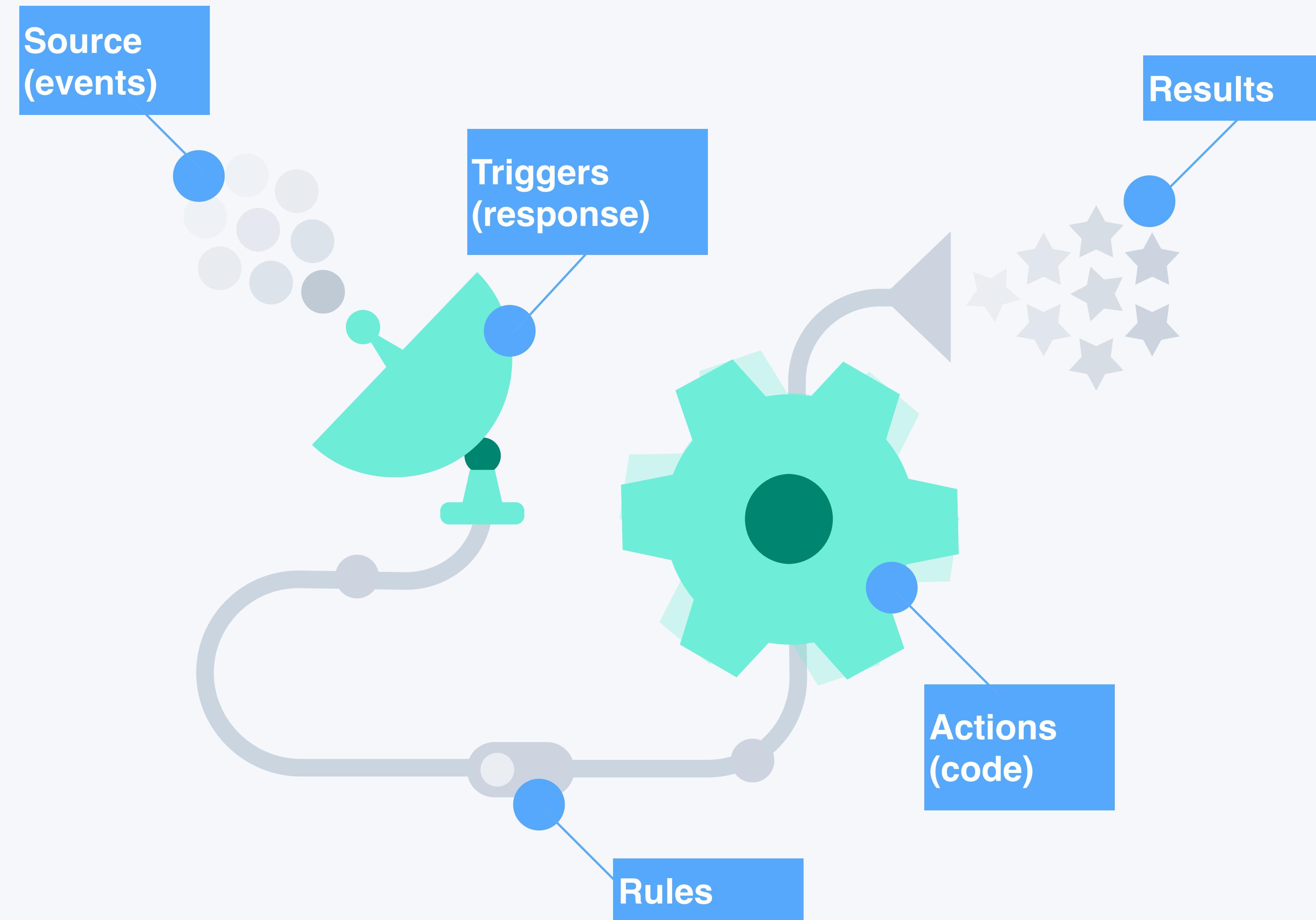


FaaS platform to execute code
in response to events

Also available as managed service on
IBM Bluemix
bluemix.net/functions

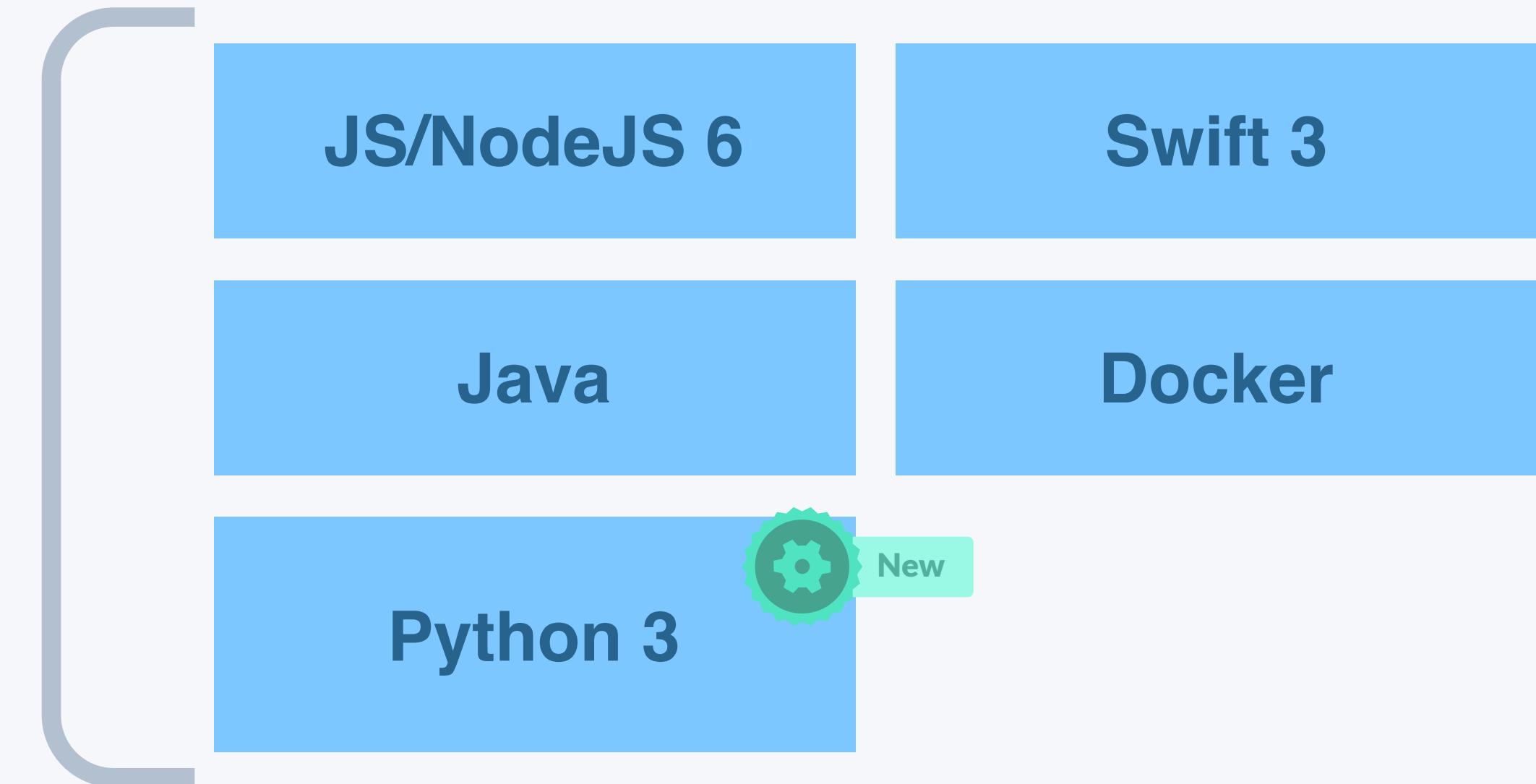


Concepts

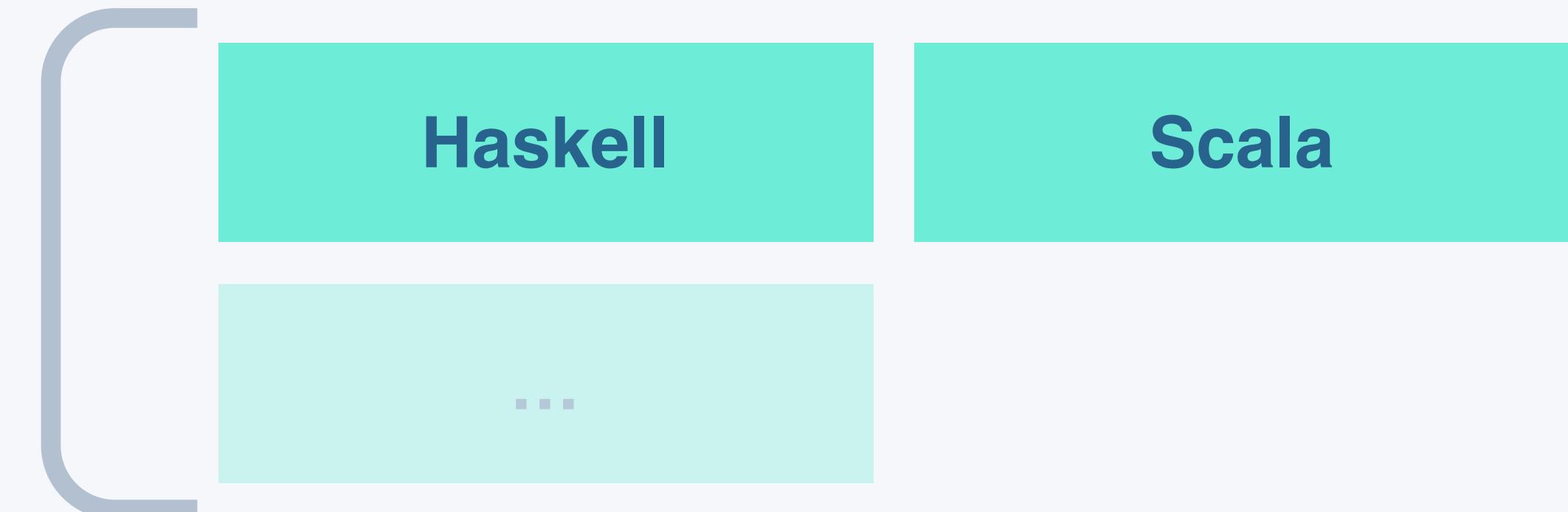


Supported Languages

Multi-language Support



Community Efforts



... and more to come

Event Provider



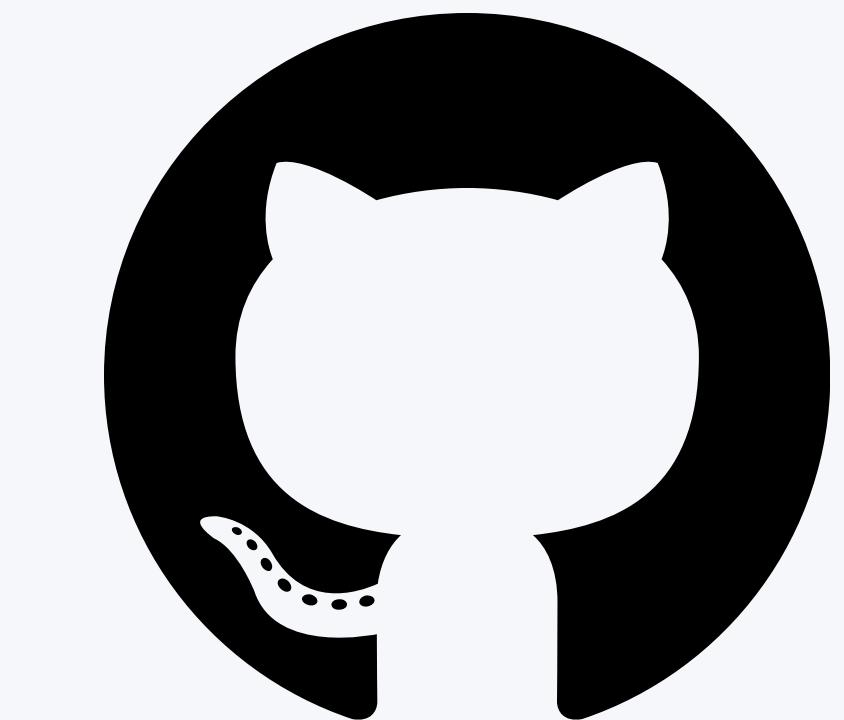
Periodic



IBM Cloudant



Mobile Push



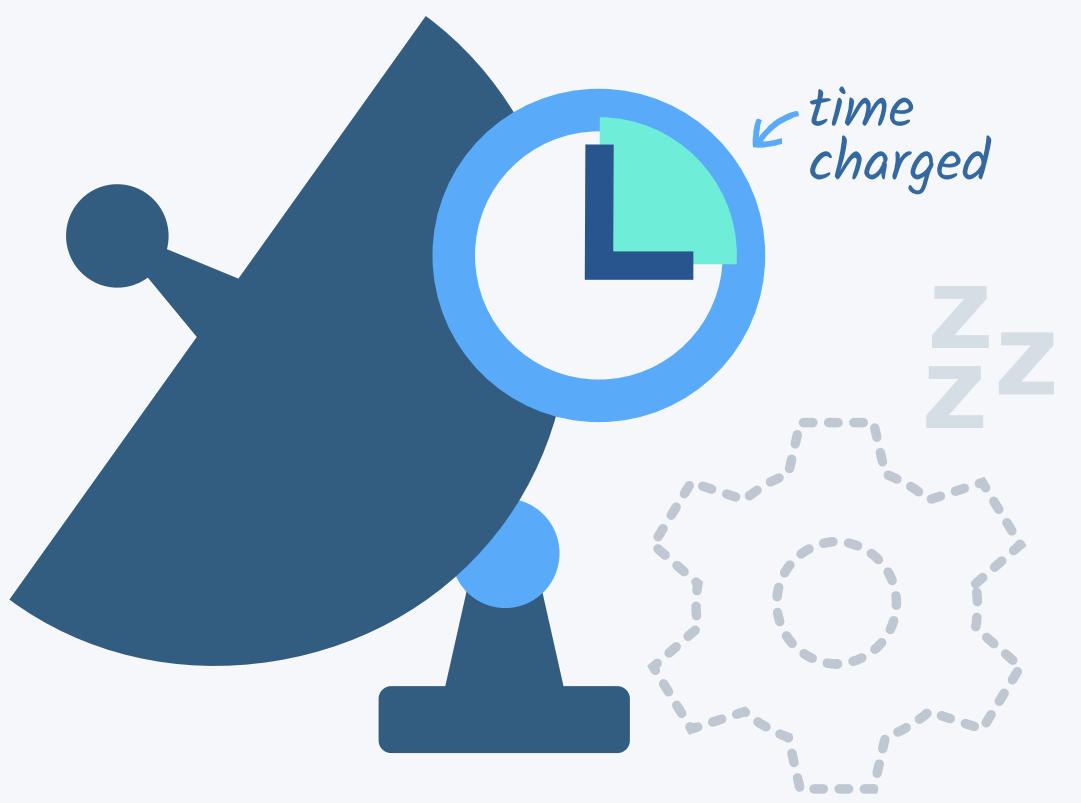
Github

Message Hub
(binary data)

IBM App Connect

Granular pricing

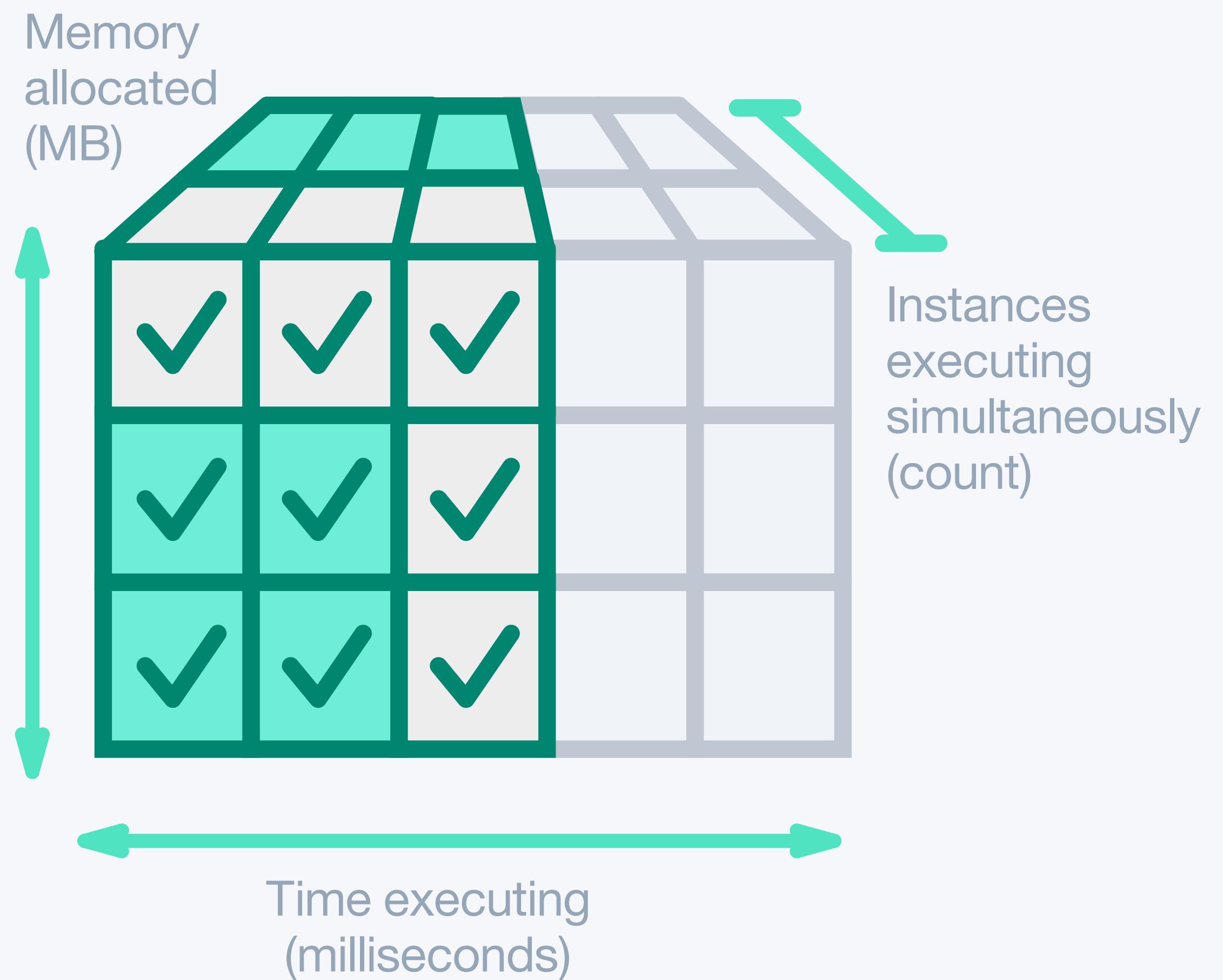
Pay only for the exact time your actions run. When an action is not invoked, it's not in memory, so you don't pay anything.



Reduce Costs

Time an action was running
* memory allocated to action

\$ 0.000017 per GBs
Free tier: 400000 GBs



Questions?