



API Gateway with Kong



Agenda

- Why API Gateway ?
- What is API Gateway ?
- Architecture
- Topologies and Tools
- Workshop



1. Problem

2. Solution

3. Technical solution

4. Improvement



Why API Gateway ?

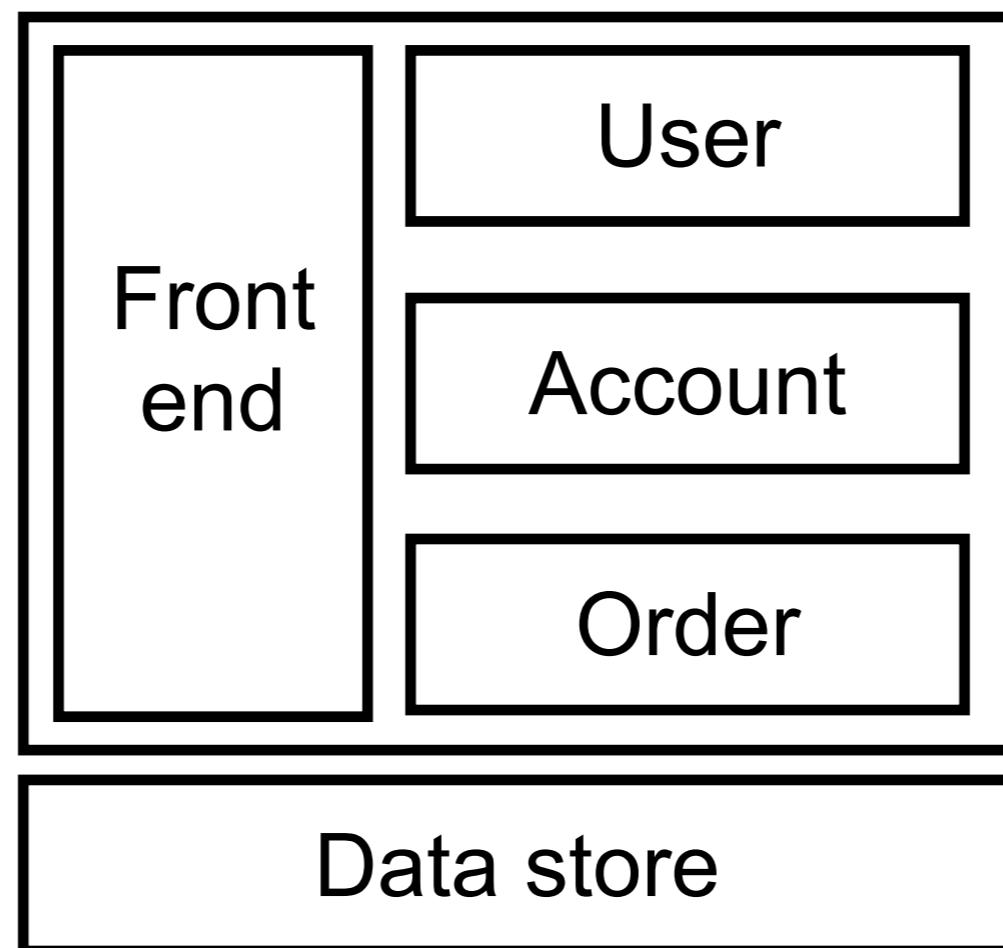


Monolithic

All business logic in one
One data store
Horizontal scale



Monolithic



Pros of Monolithic

Simple architecture
Easy to manage



Cons of Monolithic

Hard to modify
Heavy deployment



Microservices

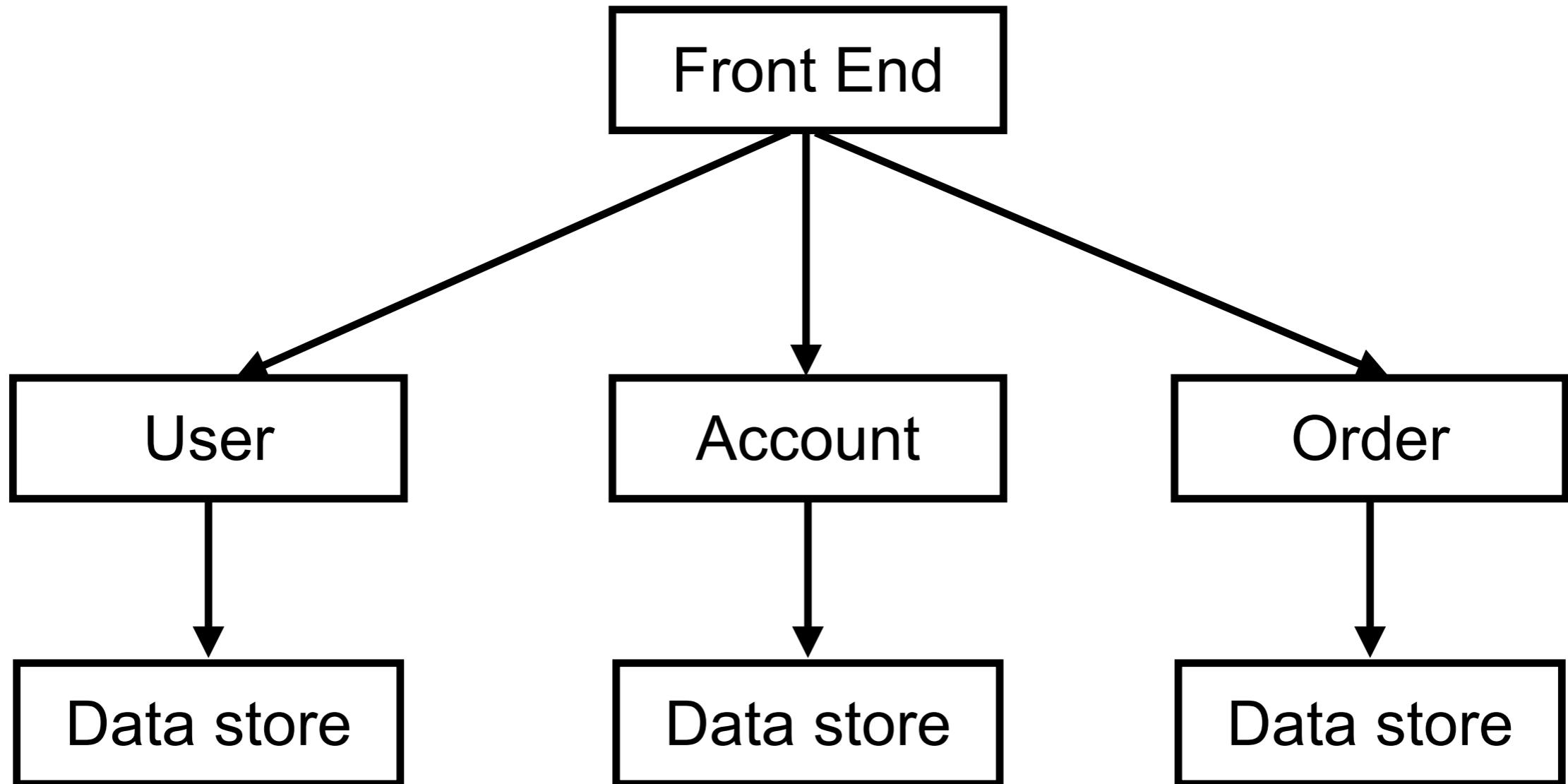
Separate business logic

Each data store per service

Vertical scaling



Microservices



Pros of Microservices

Easy to develop service
Lightweight deployment



Cons of Microservices

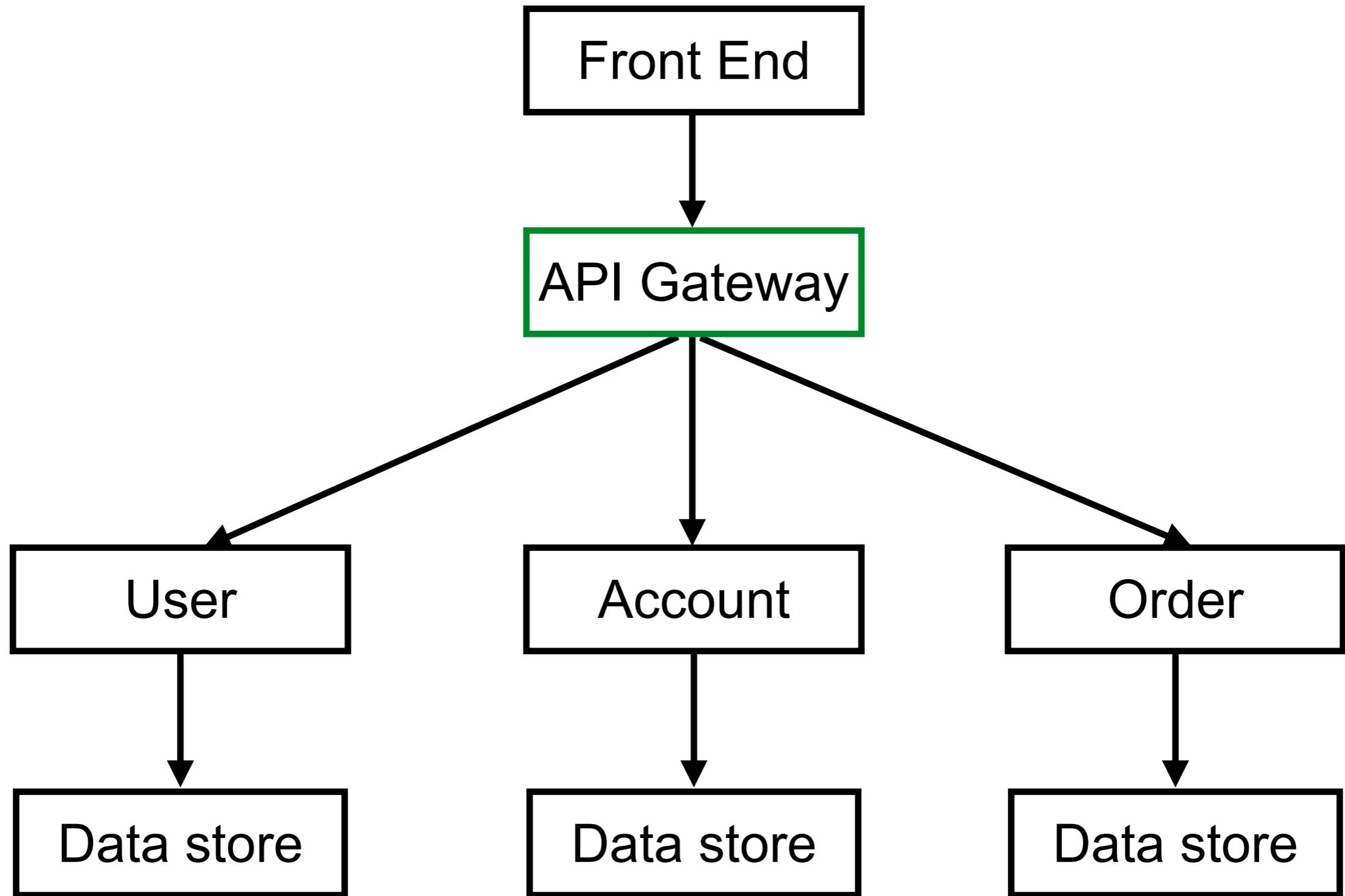
Hard to test and debug
Many manage points



What API Gateway ?



Microservices and API Gateway

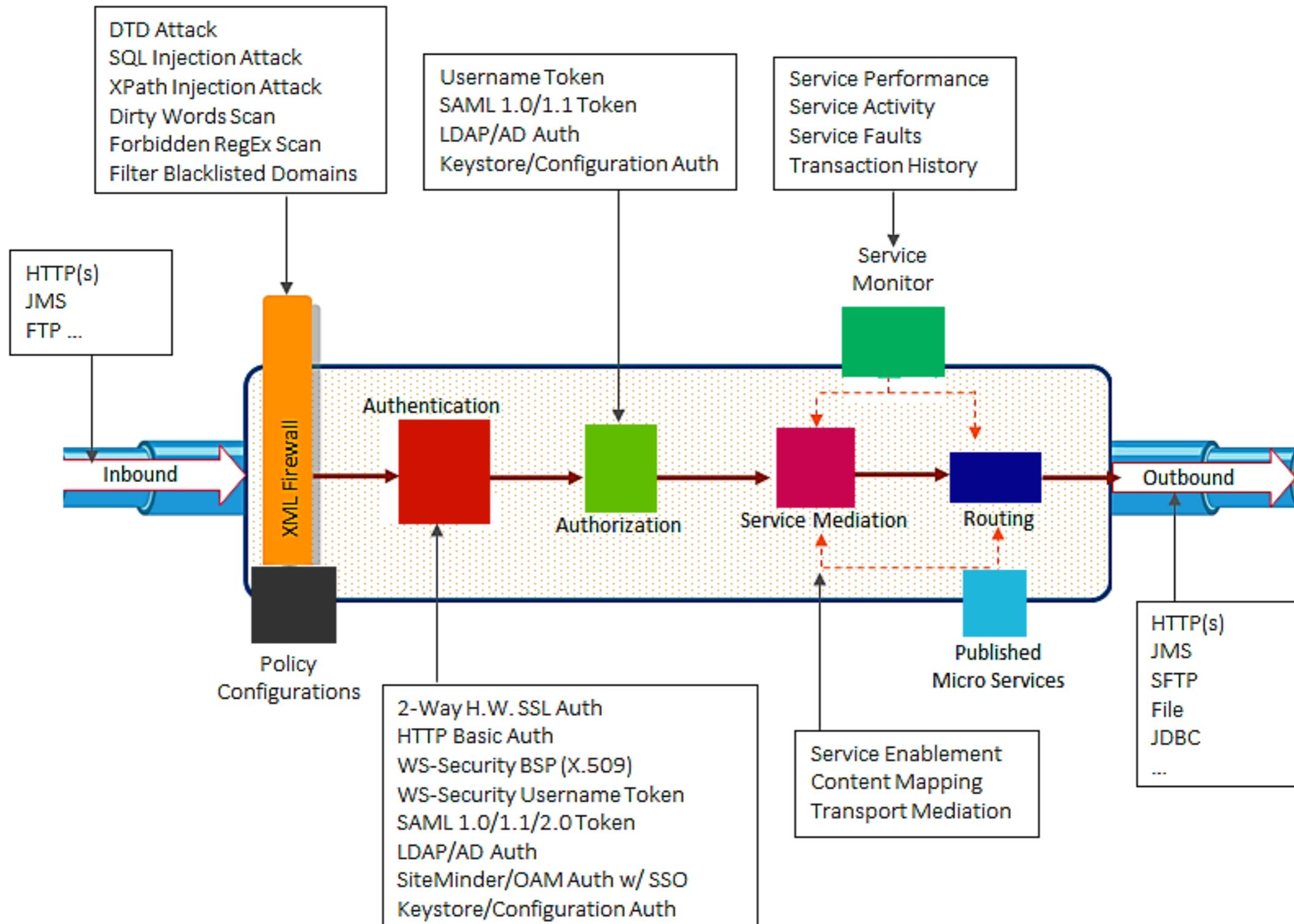


What API Gateway ?

Single entry point for API
Middleware for API
Authentication
Security
Traffic management
Logging
Caching
Load balancing



API Gateway



Responsibility of API Gateway

Request routing
Composition/aggregation
Protocol translator



API Composition

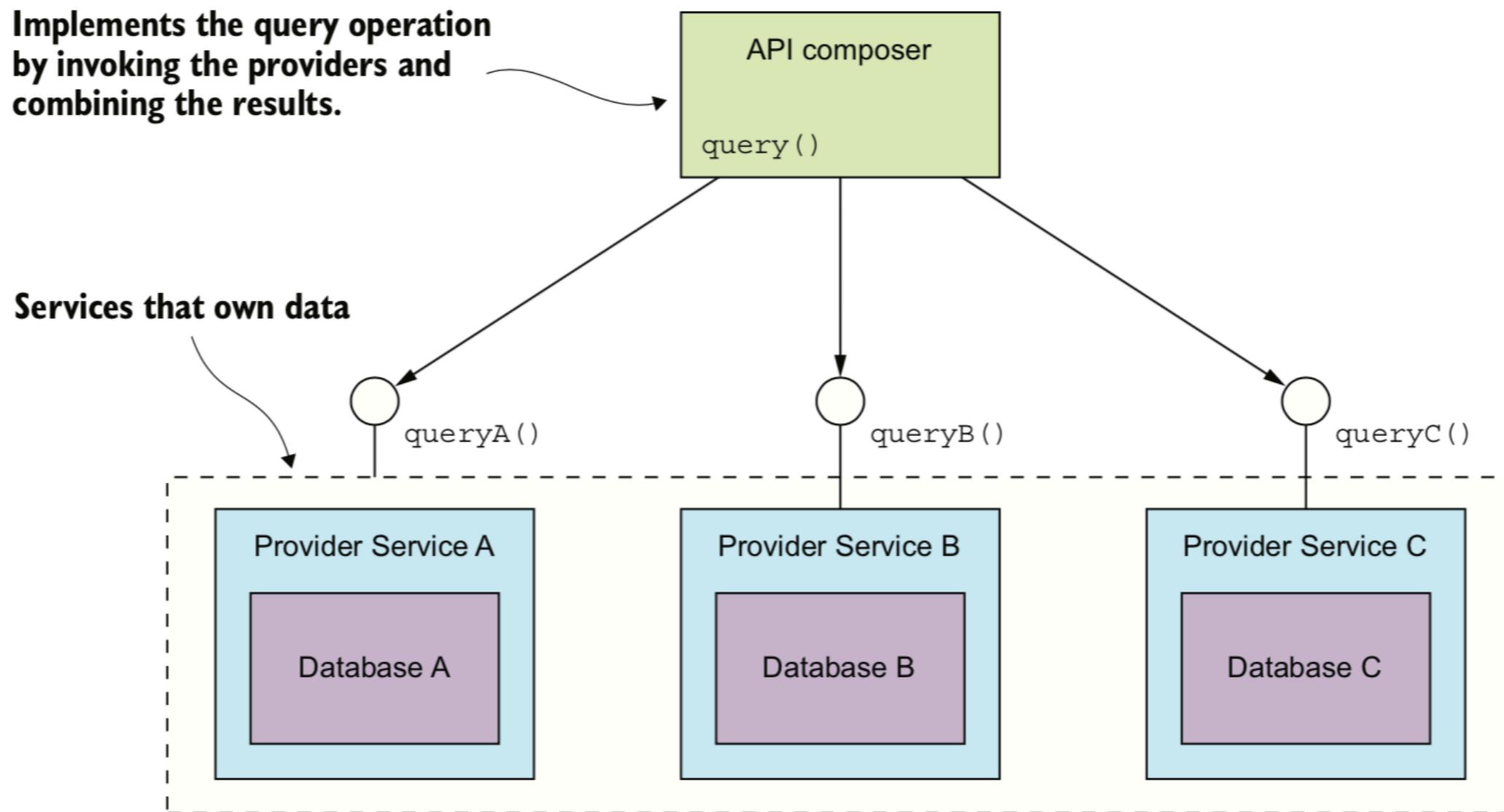
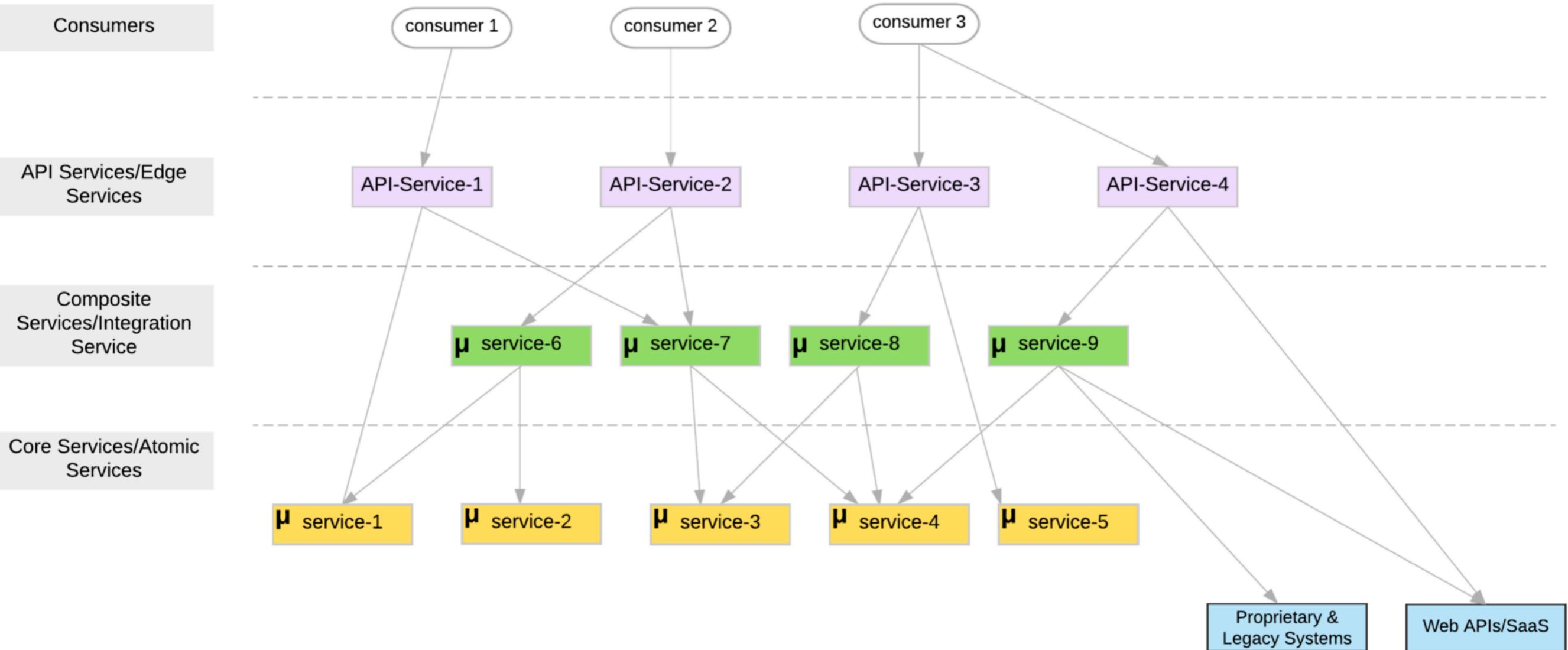


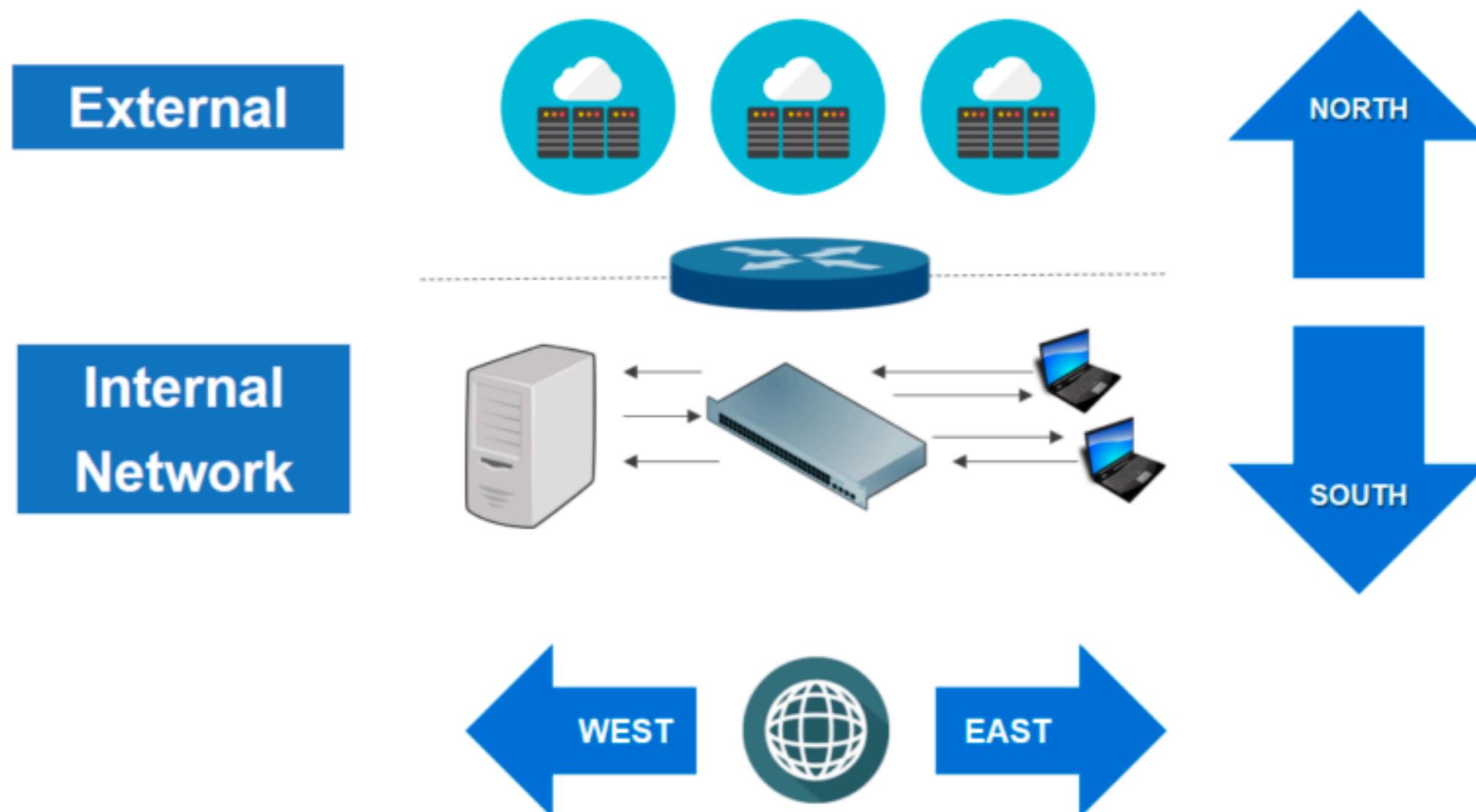
Figure 7.2 The API composition pattern consists of an API composer and two or more provider services. The API composer implements a query by querying the providers and combining the results.



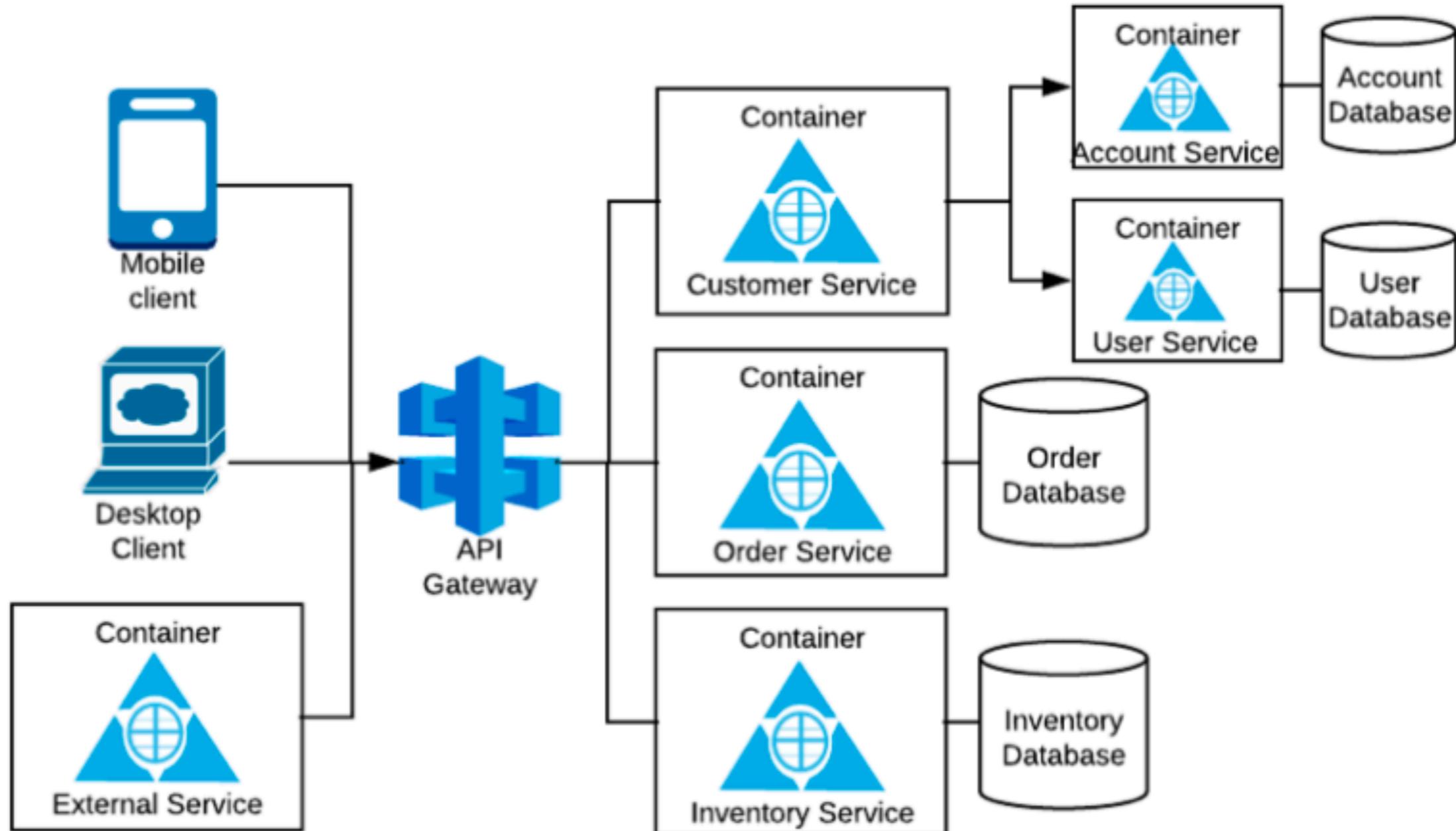
API Gateway and Composition



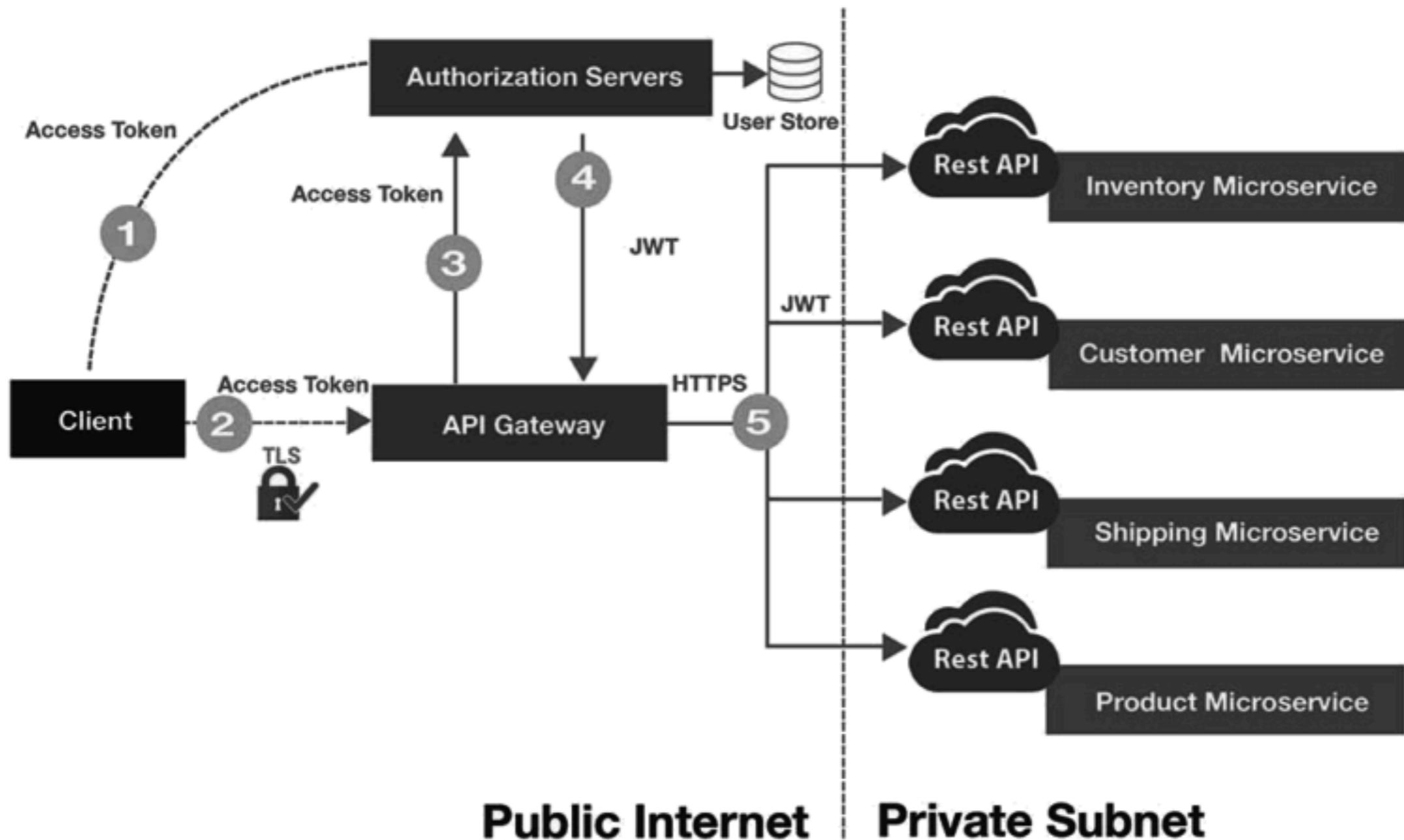
North-South traffic



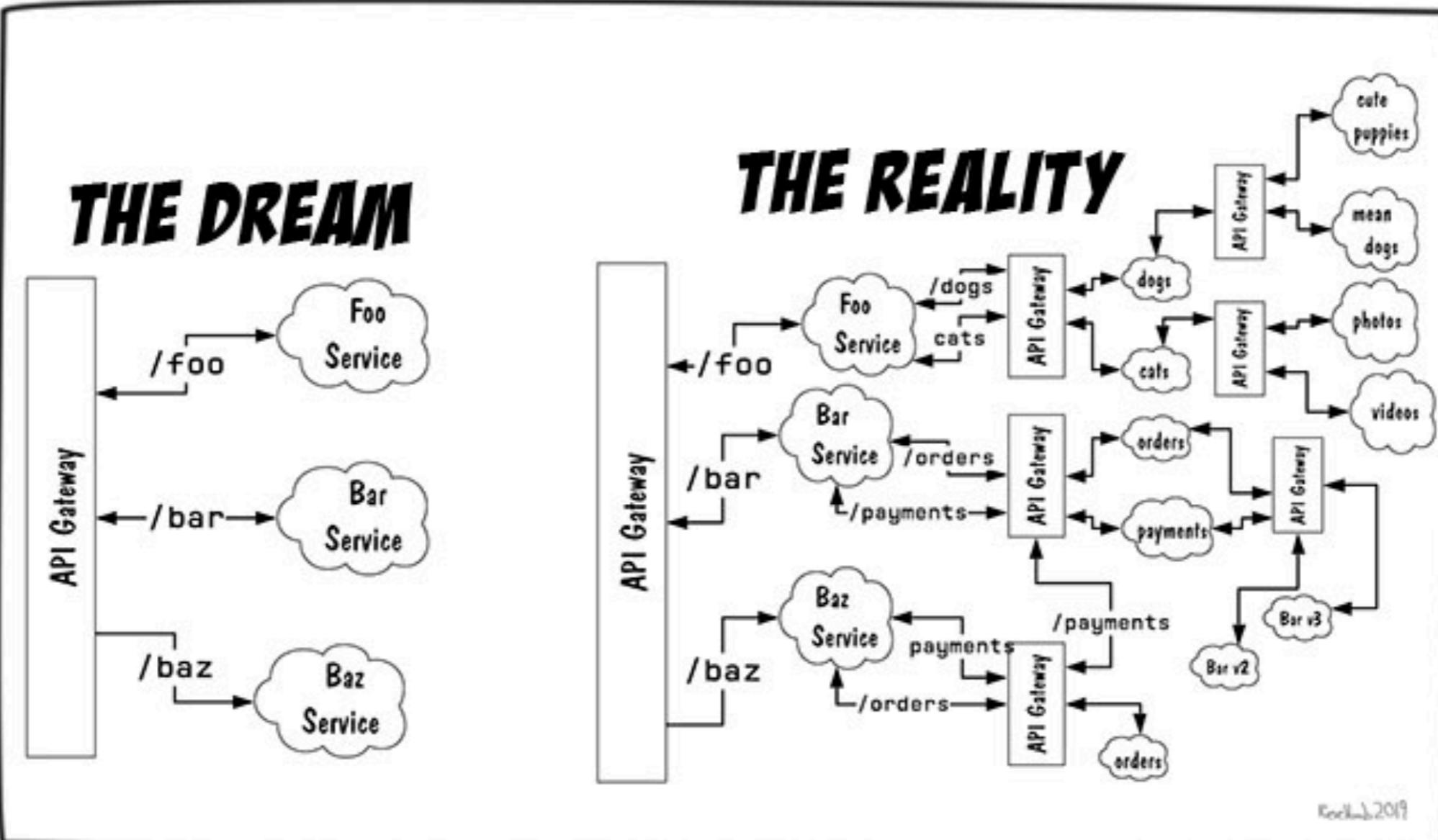
Example with API Gateway



Example with Authentication

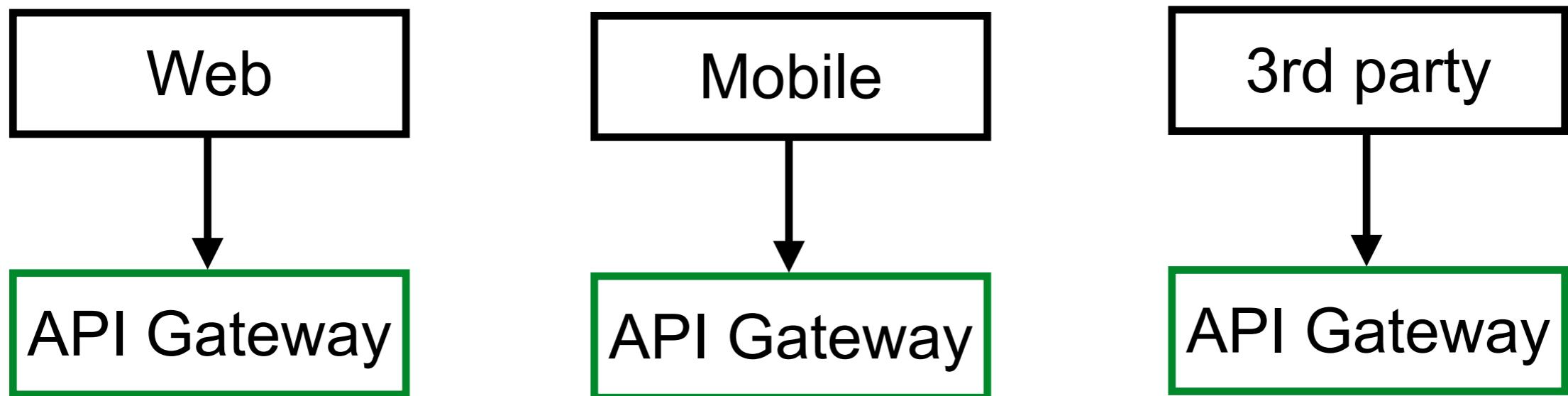


!!!

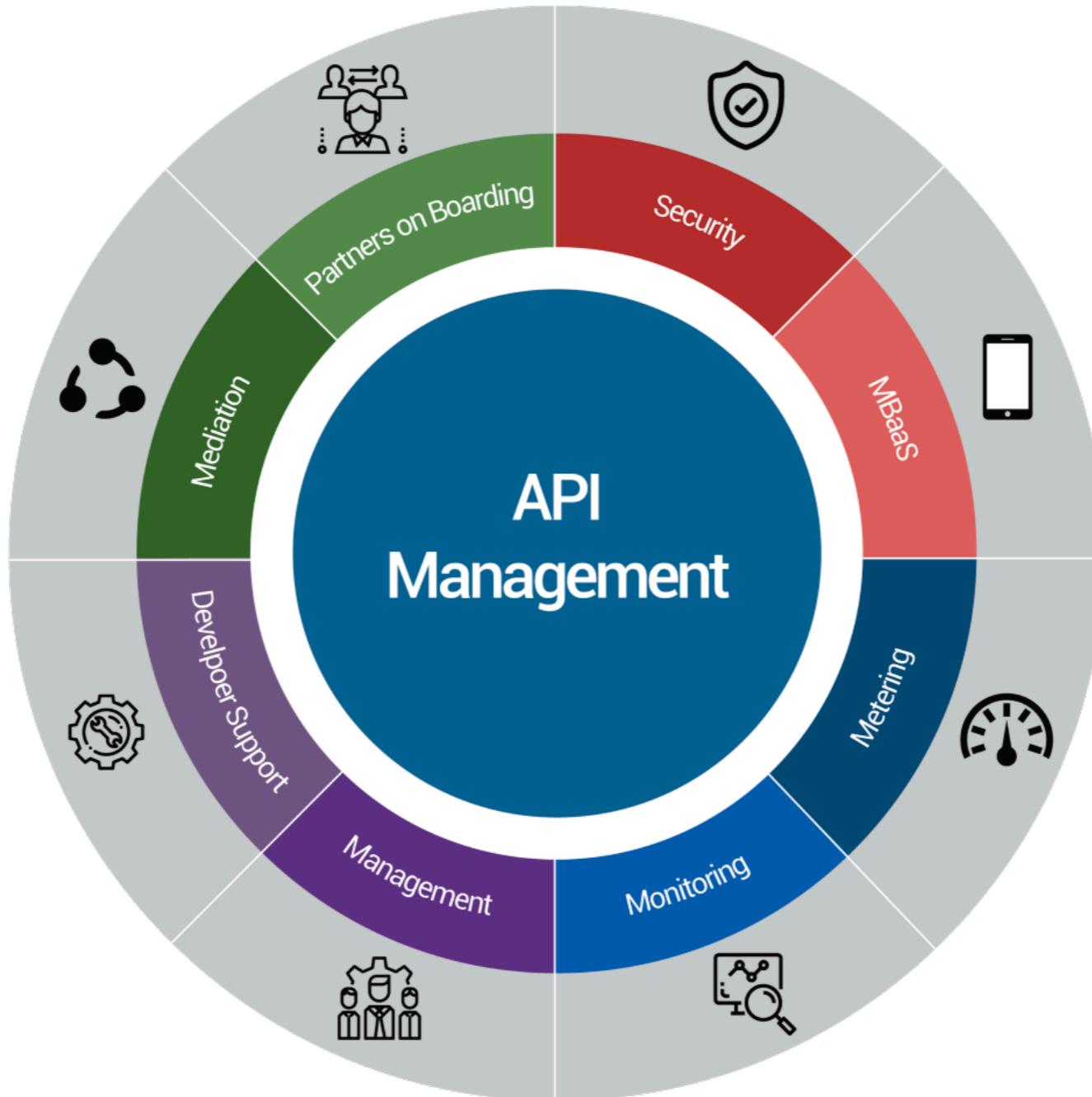


Backend For Frontend

Separate API gateway for each kind of client



API Management



Pros of API Gateway

Simple architecture

Easy to manage

Separation of app layers and requests

Improve development

Increase server load

Buffer zone again attacks



Cons of API Gateway

Increase complexity

Increase response time



API Gateway ?

 3SCALE 3Scale Red Hat	 Ambassador Ambassador Ambassador Labs	 APIOAK APIOAK	 APISIX APISIX Apache Software Foundation	 Gloo Gloo Solo.io
 GRAVITEE · IO Gravitee.io Gravitee.io	 Kong Kong Kong	 krakend KrakenD Brutale	 MuleSoft MuleSoft Salesforce	 Reactive Interaction Gateway Reactive Interaction Gateway Accenture
 Sentinel Sentinel Alibaba Cloud	 Tyk Tyk Tyk	 WSO2 API Microgateway WSO2 API Microgateway WSO2		

<https://landscape.cncf.io/category=api-gateway&format=card-mode&grouping=category>



API Gateway with Kong

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Working with Kong

<https://konghq.com/kong/>



API Gateway with Kong

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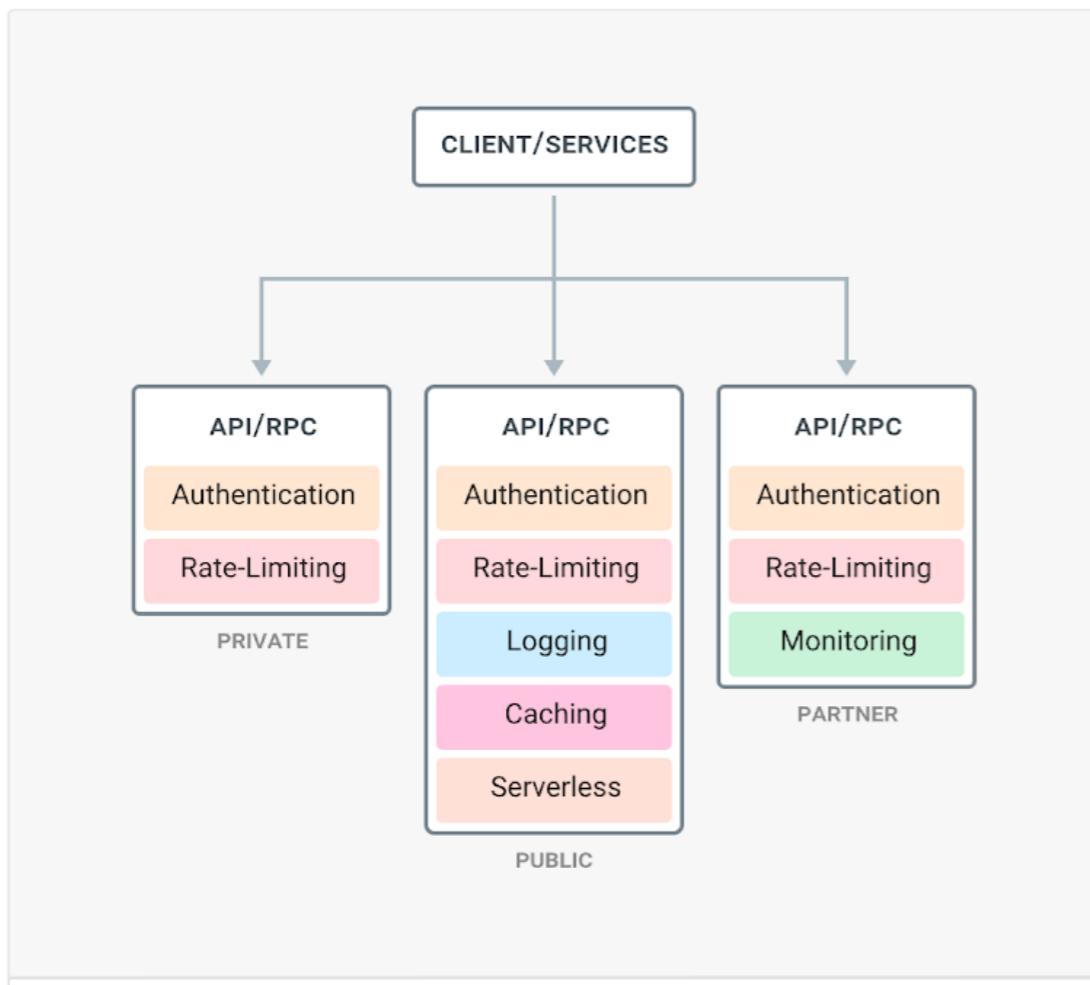
Why Kong ?

Open source and cloud native
Scalability (horizontal)
Performance (based-on NGINX)
Extensible with plugins
RESTFul support



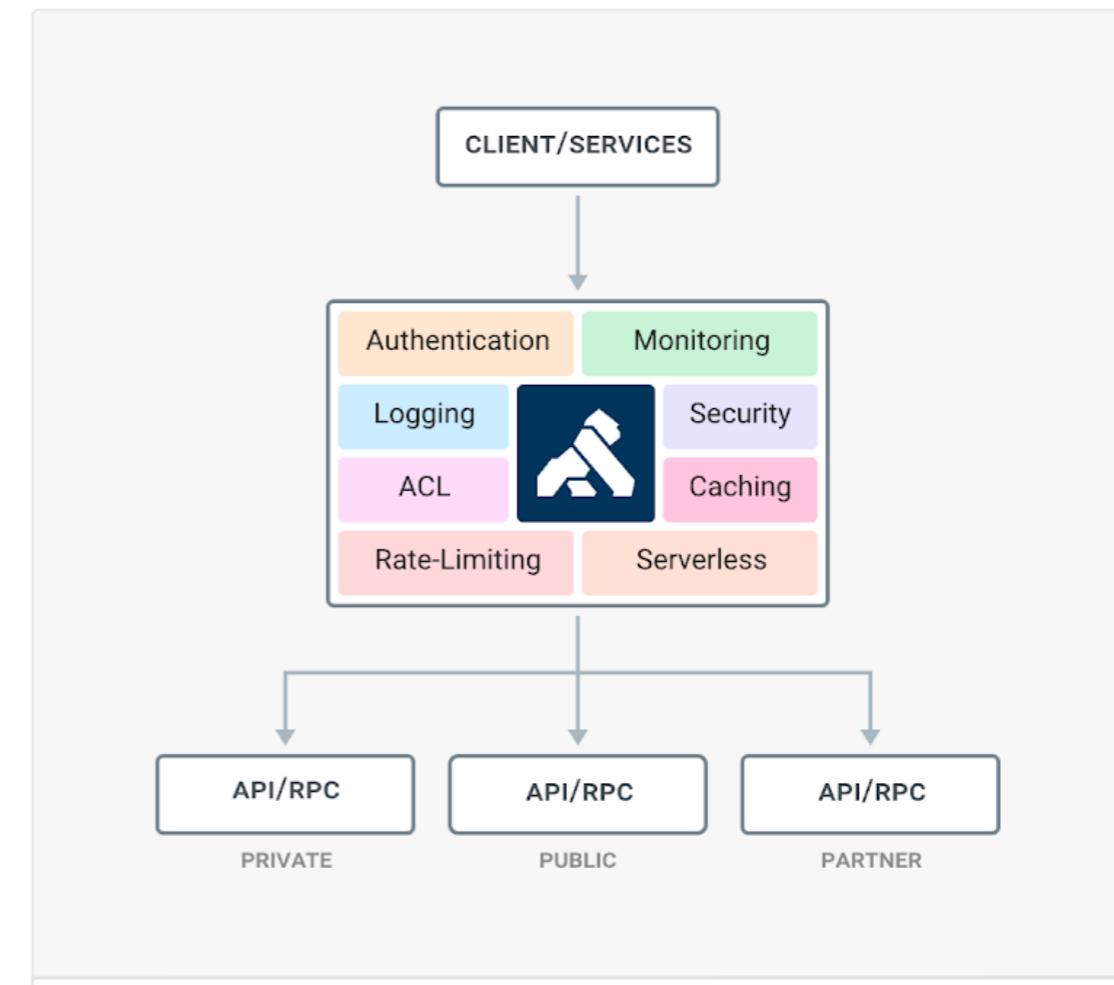
The Kong way

The Redundant Old Way



- ✗ Common functionality is duplicated across multiple services
- ✗ Systems tend to be monolithic and hard to maintain
- ✗ Difficult to expand without impacting other services
- ✗ Productivity is inefficient because of system constraints

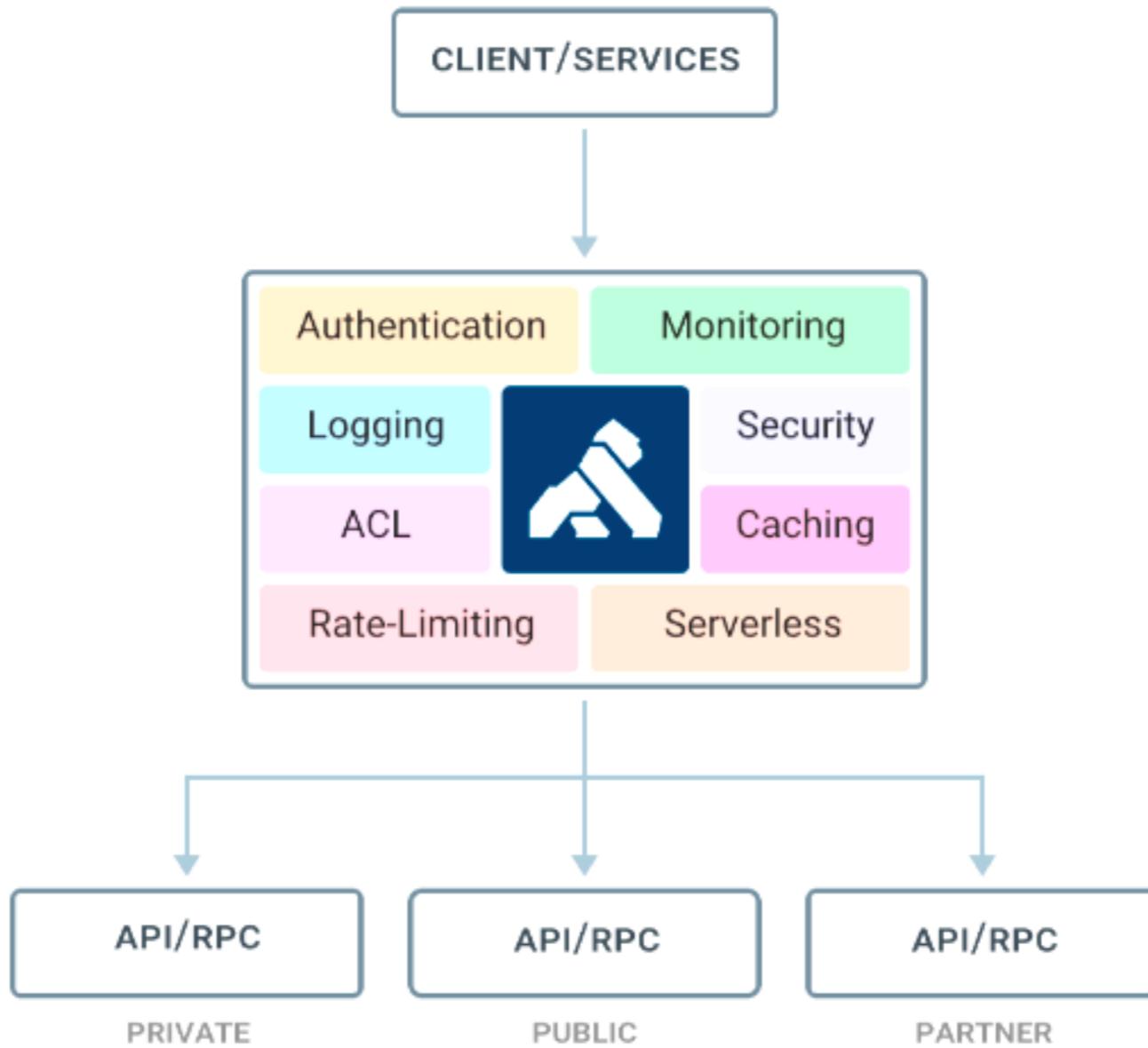
The Kong Way



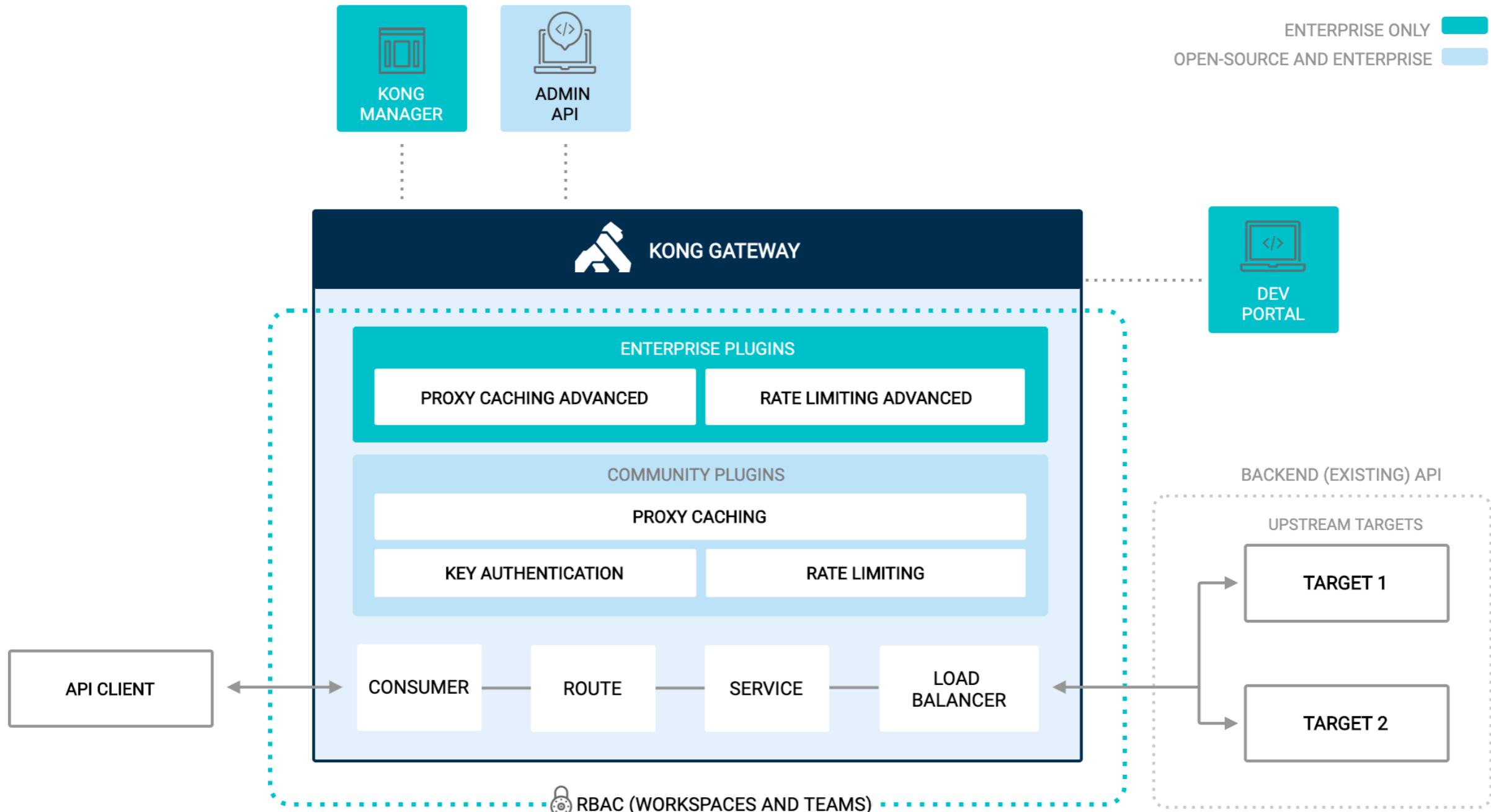
- ✓ Kong orchestrates common functionality
- ✓ Build efficient distributed architectures ready to scale
- ✓ Expand functionality from one place with a simple command
- ✓ Focus on your product and let Kong do the REST



The Kong way



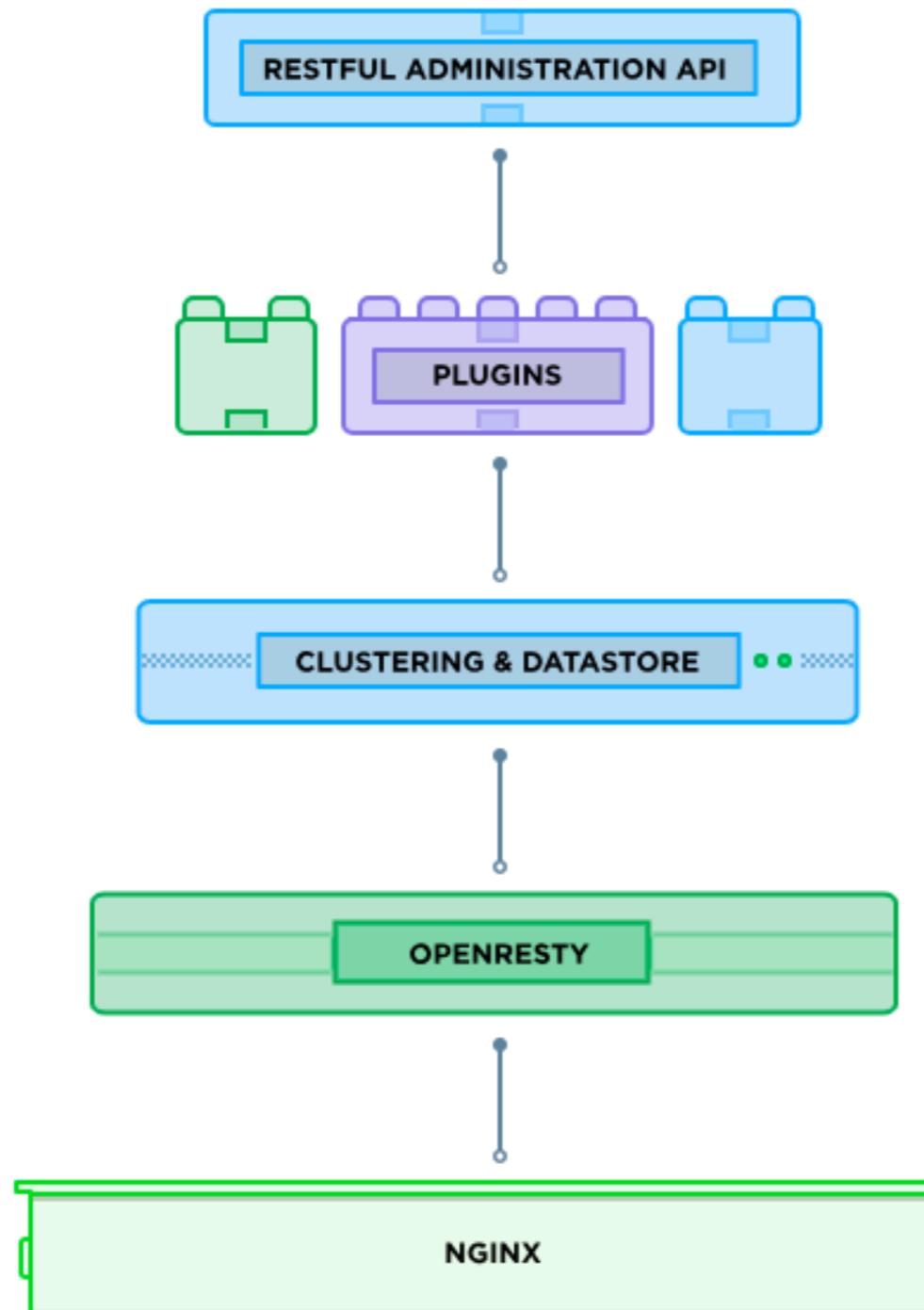
Kong architecture



<https://docs.konghq.com/getting-started-guide/2.1.x/overview/>



Kong architecture



- Administer Kong via RESTful API
- Automate/orchestrate for CI/CD & DevOps
- Extensible with plugins

- Create plugins with Lua
- Implement powerful customizations
- Integrate with third-party services

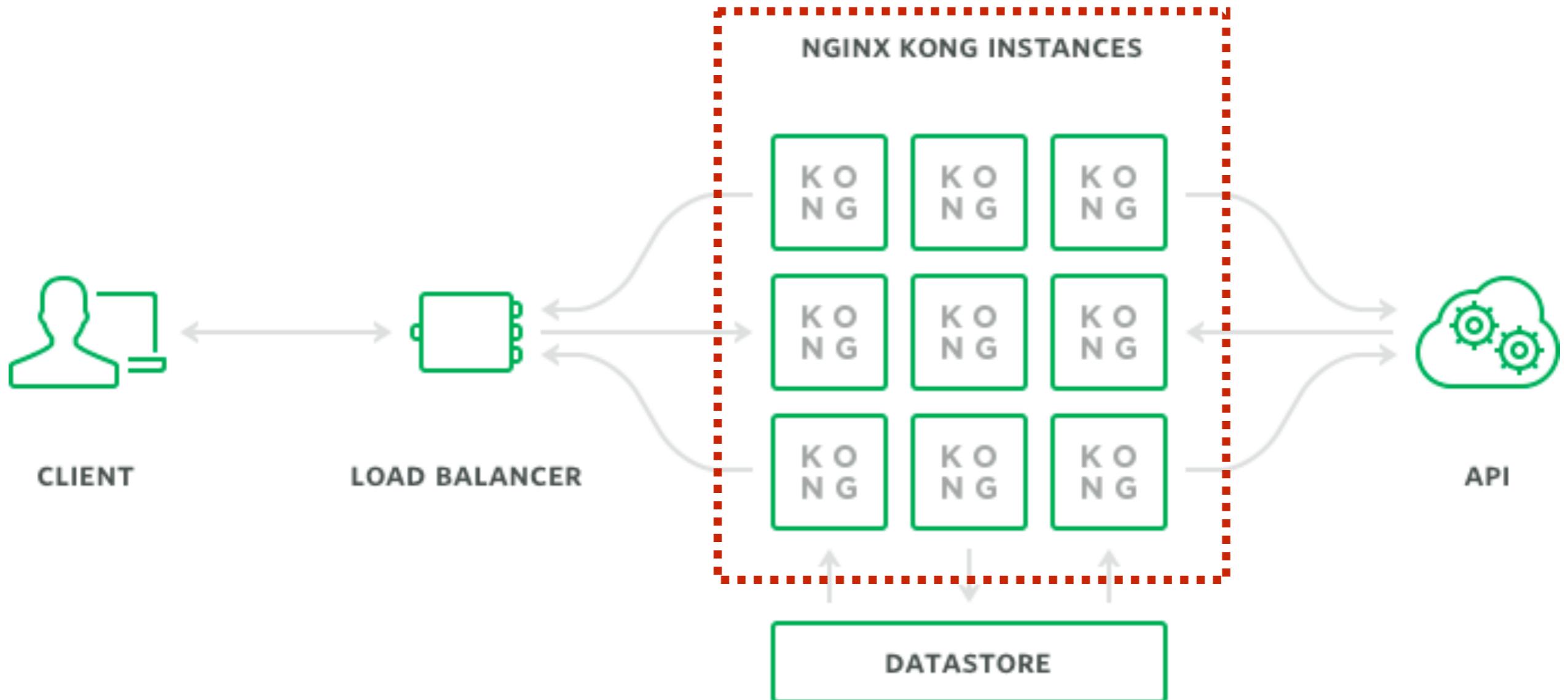
- Choice of Cassandra or PostgreSQL
- Scales from laptop to global cluster
- In-memory caching for performance

- Intercept Request/Response lifecycle
- Extends underlying NGINX
- Scriptable via Lua

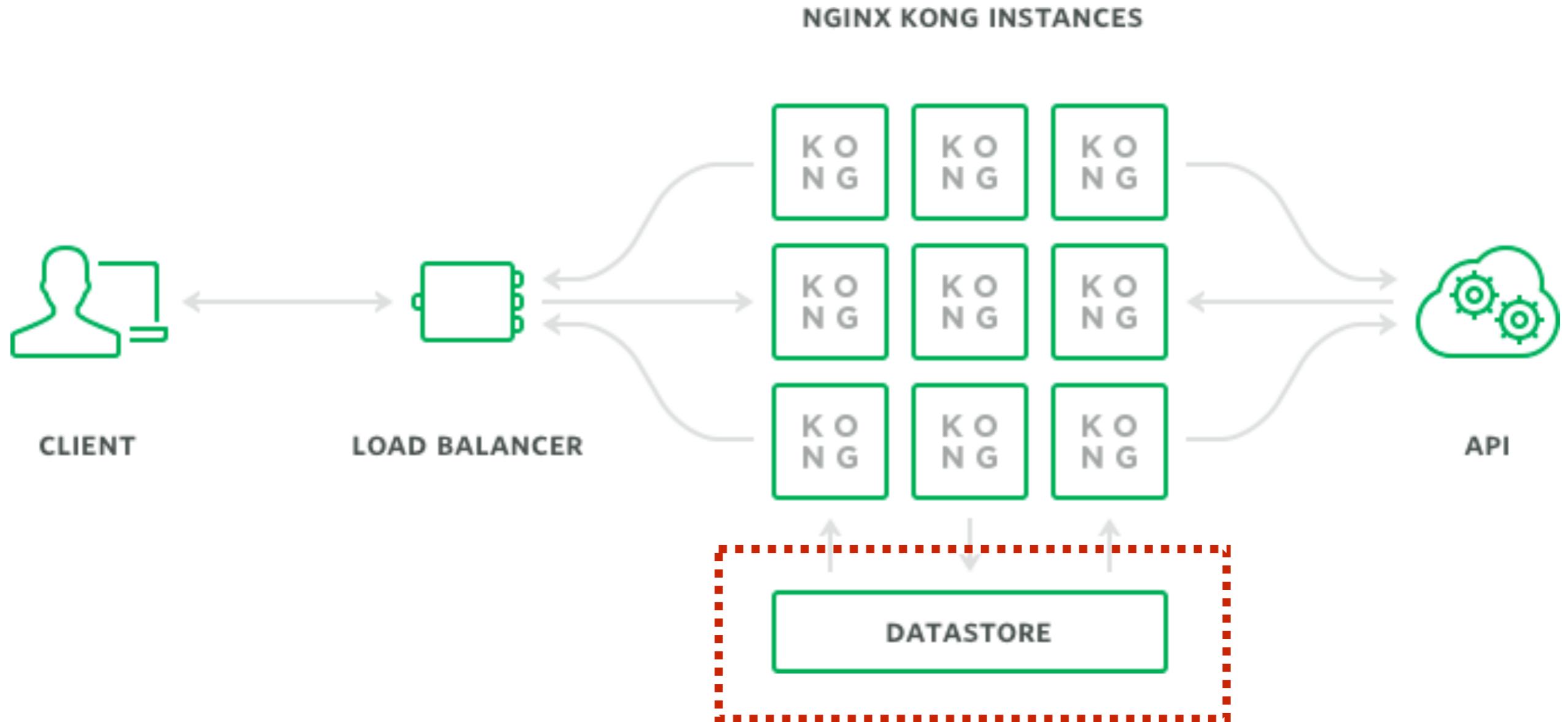
- Proven, high-performance foundation
- HTTP and reverse proxy server
- Handles low-level operations



Kong scaling (Kong server)



Kong scaling (Kong datastore)



Features :: Authentication

Basic Auth

KeyAuth

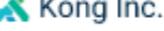
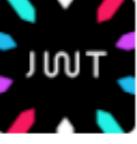
OAuth/OAuth 2

JWT (JSON Web Token)

LDAP



Features :: Authentication

 <p>Portal Application Registration Allow portal developers to register applications against Services Support by:  Kong Inc.</p>	 <p>Basic Authentication Add Basic Authentication to your Services Support by:  Kong Inc.</p>	 <p>HMAC Authentication Add HMAC Authentication to your Services Support by:  Kong Inc.</p>
 <p>Kong JWT Signer Verify and (re-)sign one or two tokens in a request Support by:  Kong Inc.</p>	 <p>JWT Verify and authenticate JSON Web Tokens Support by:  Kong Inc.</p>	 <p>Key Authentication - Encrypted Add key authentication to your Services Support by:  Kong Inc.</p>

<https://docs.konghq.com/hub/>



Features :: Security

ACLs

CORS (Cross-Origin Resource Sharing)

Dynamic SSL

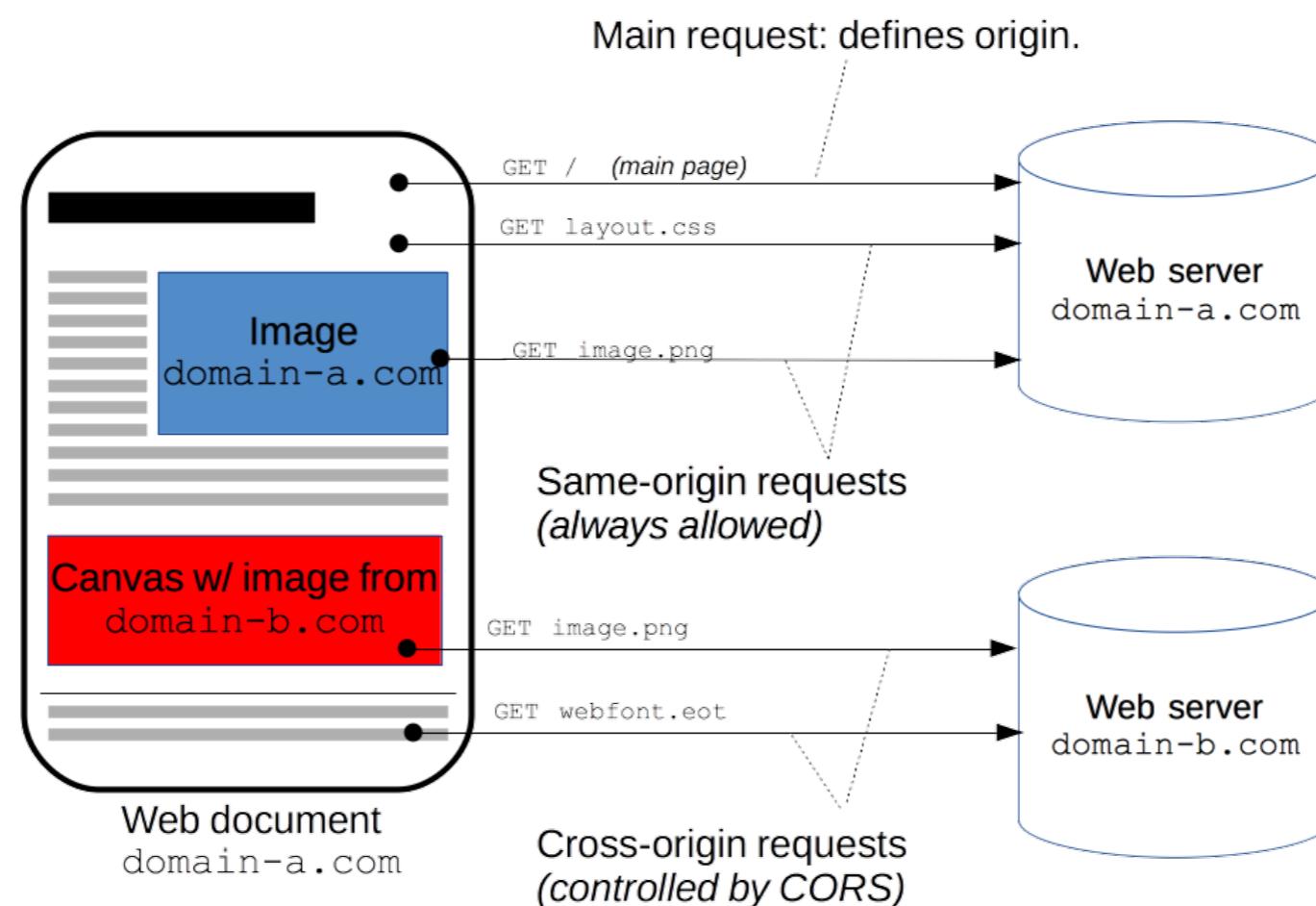
OP Blacklists

Bot detection



CORS (Cross-Origin Resource Sharing)

One way the server at the other end (not the client code in the browser) can relax the same origin policy.



Features :: Security



ACME
Let's Encrypt and ACMEv2 integration with Kong
Support by:




Bot Detection
Detect and block bots or custom clients
Support by:




CORS
Allow developers to make requests from the browser
Support by:




IP Restriction
Allow or deny IPs that can make requests to your Services
Support by:




Cleafy plugin for Kong
Integrate Kong API GW with Cleafy threat detection & protection for API-based apps
Support by:
Cleafy



Approov API Threat Protection
Approov ensures that only genuine and unmodified instances of your mobile app can connect to your server or cloud backend
Support by:
CriticalBlue Ltd

<https://docs.konghq.com/hub/>



API Gateway with Kong

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Features :: Traffic Control

Rate limiting

Response rate limiting

Request size limiting

Proxy cache



Features :: Traffic Control



ACL
Control which Consumers can access Services

Support by:
 Kong Inc.



Canary Release
Slowly roll out software changes to a subset of users

Support by:
 Kong Inc.



Forward Proxy Advanced
Allows Kong to connect to intermediary transparent HTTP proxies

Support by:
 Kong Inc.



GraphQL Proxy Caching Advanced
Cache and serve commonly requested responses in Kong

Support by:
 Kong Inc.



GraphQL Rate Limiting Advanced
Provide rate limiting for GraphQL queries

Support by:
 Kong Inc.



Proxy Caching Advanced
Cache and serve commonly requested responses in Kong

Support by:
 Kong Inc.

<https://docs.konghq.com/hub/>



API Gateway with Kong

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Features :: Transforms

Request transformer
Response transformer
Correlation ID



Features :: Transforms

 Correlation ID Correlate requests and responses using a unique ID Support by:  Kong Inc.	 DeGraphQL Transform a GraphQL upstream into a REST API Support by:  Kong Inc.	 Exit Transformer Customize Kong exit responses sent downstream Support by:  Kong Inc.
 gRPC-gateway Access gRPC services through HTTP REST Support by:  Kong Inc.	 gRPC-Web Allow browser clients to call gRPC services Support by:  Kong Inc.	 Kafka Upstream Transform requests into Kafka messages in a Kafka topic Support by:  Kong Inc.

<https://docs.konghq.com/hub/>



Features :: Visibility

Logs over TCP/UDP/HTTP

Syslog

StatD

DataDog



Features :: Visibility



File Log
Append request and response data to a log file
Support by:
 Kong Inc.



HTTP Log
Send request and response logs to an HTTP server
Support by:
 Kong Inc.

Enterprise



Kafka Log
Publish logs to a Kafka topic
Support by:
 Kong Inc.



Loggly
Send request and response logs to Loggly
Support by:
 Kong Inc.

Enterprise



StatsD Advanced
Send metrics to StatsD with more flexible options
Support by:
 Kong Inc.



StatsD
Send request and response logs to StatsD
Support by:
 Kong Inc.

<https://docs.konghq.com/hub/>



Features :: Visibility



Datadog

Visualize metrics on
Datadog

Support by:
 Kong Inc.



Prometheus

Expose metrics related to
Kong and proxied
Upstream services in
Prometheus exposition
format

Support by:
 Kong Inc.



Zipkin

Propagate Zipkin spans
and report space to a
Zipkin server

Support by:
 Kong Inc.



API Fortress HTTP Log

Record mock responses
with API Fortress.

Support by:
API Fortress



ArecaBay MicroSensor

Discover, Monitor, and
Secure your APIs at
object/data level.

Support by:
ArecaBay



Moesif API Analytics

User Behavior API
analytics and observability

Support by:
Moesif

<https://docs.konghq.com/hub/>



API Gateway with Kong

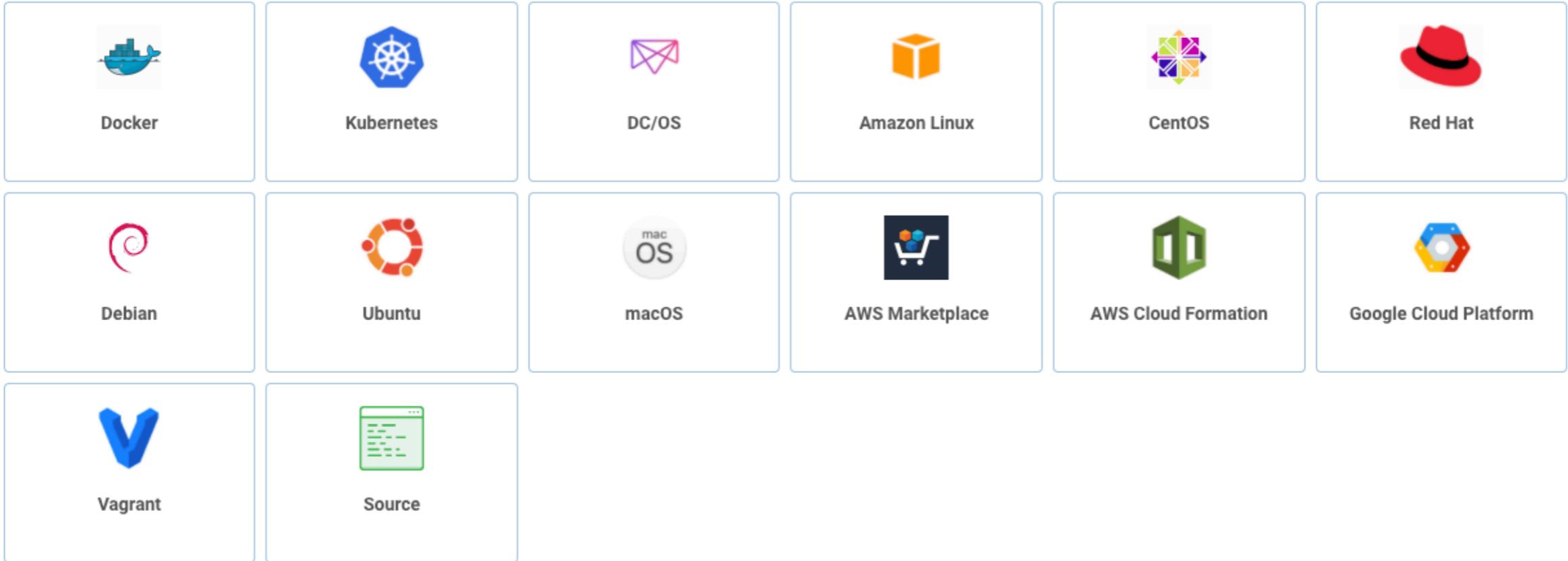
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**We can always build our own
plugin for Kong using Lua**

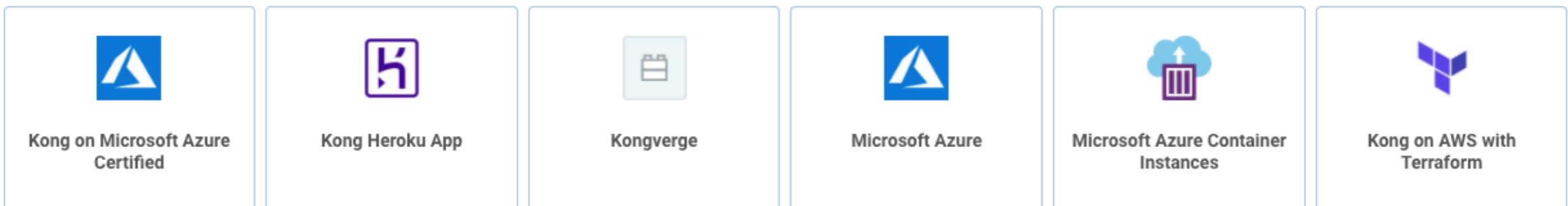


Install Kong

Supported by Kong Inc



Supported by the Community



<https://konghq.com/get-started/#install>



Kong with Database

PostgreSQL
Apache Cassandra
DB-less



Installation

```
$ docker-compose up -d kong-database  
$ docker-compose up migrations  
$ docker-compose up kong
```



Kong Admin API (8001/8444)

Kong Proxy (8000/8443)



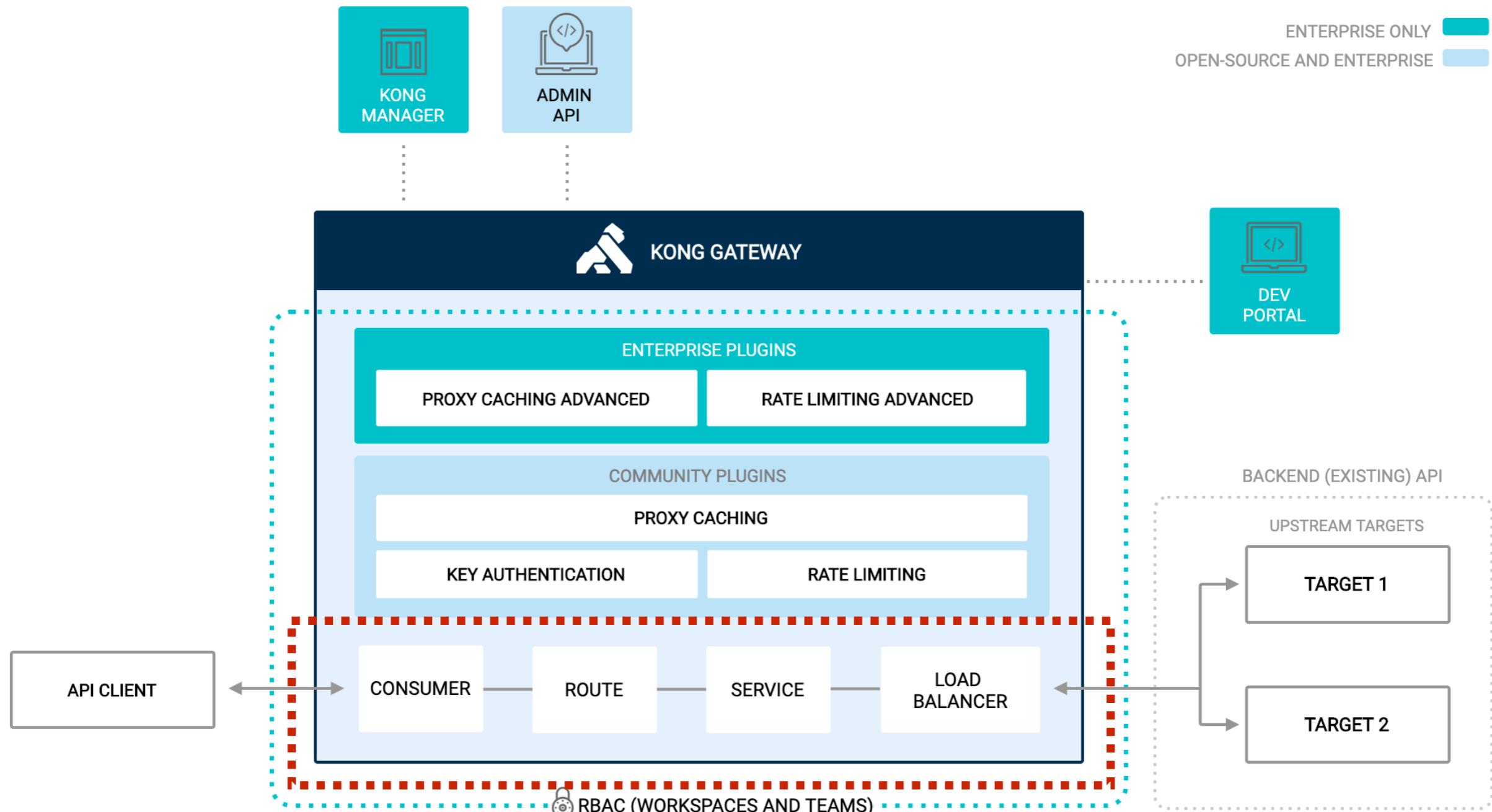
List of plugins (default)

```
"available_on_server": {  
    "correlation-id": true,  
    "pre-function": true,  
    "cors": true,  
    "ldap-auth": true,  
    "loggly": true,  
    "hmac-auth": true,  
    "zipkin": true,  
    "request-size-limiting": true,  
    "azure-functions": true,  
    "request-transformer": true,  
    "oauth2": true,  
    "response-transformer": true,  
    "ip-restriction": true,  
    "statsd": true,  
    "jwt": true,  
    "proxy-cache": true,  
    "basic-auth": true,  
    "key-auth": true,
```

```
"http-log": true,  
"datadog": true,  
"tcp-log": true,  
"rate-limiting": true,  
"post-function": true,  
"prometheus": true,  
"acl": true,  
"syslog": true,  
"file-log": true,  
"acme": true,  
"udp-log": true,  
"response-ratelimiting": true,  
"aws-lambda": true,  
"session": true,  
"bot-detection": true,
```



Kong workshop



<https://docs.konghq.com/getting-started-guide/2.1.x/overview/>



Concepts

Service
Route
Consumer
Admin API
Plugins
Load balancing



Service

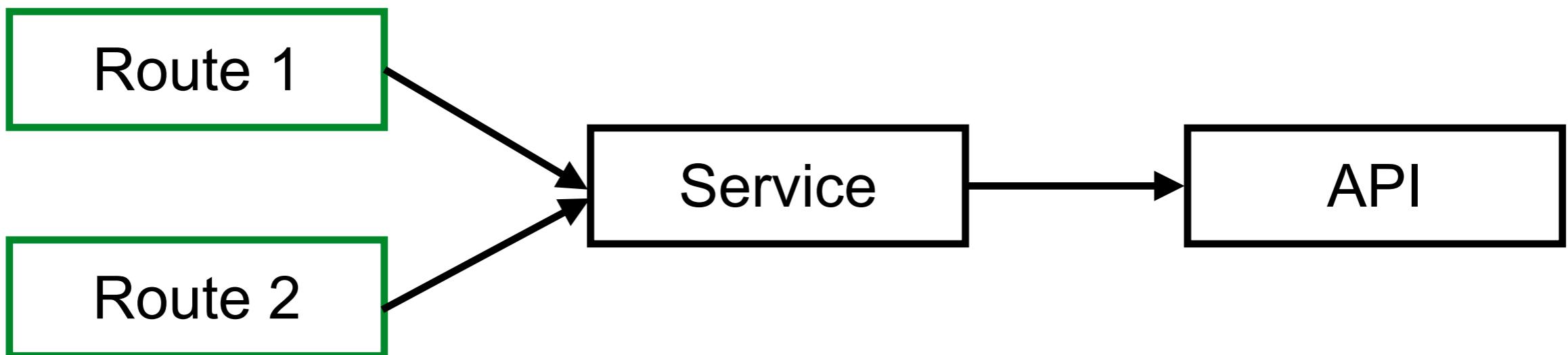
A Service object is the ID Kong Gateway uses to refer to the upstream APIs and microservices it manages.



Route

Routes specify how requests are sent to their services after they reach the API gateway.

A single service can have many routes.



Consumer

Consumers represent end users of your API.

Consumer objects let you control who can access
your APIs.



Admin API

Kong Gateway comes with an internal RESTful API for administration purposes.

API commands can be run on any node in the cluster, and the configuration will apply consistently on all nodes.



Plugin

Plugins provide a modular system for modifying and controlling Kong Gateway's capabilities.

Plugins are one of the most important features of Kong, developed by Lua language



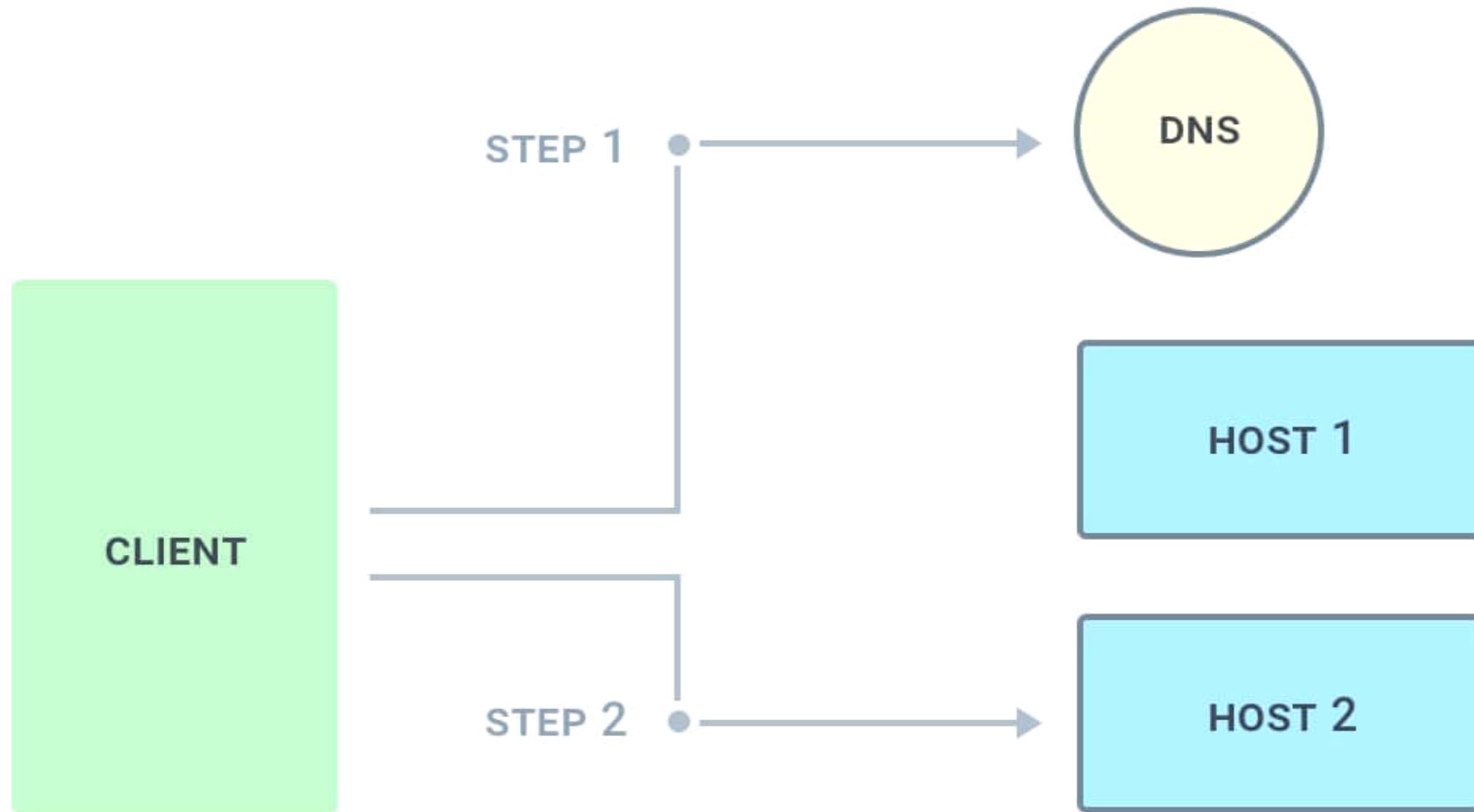
Load balancing

Kong Gateway provides two methods for load balancing

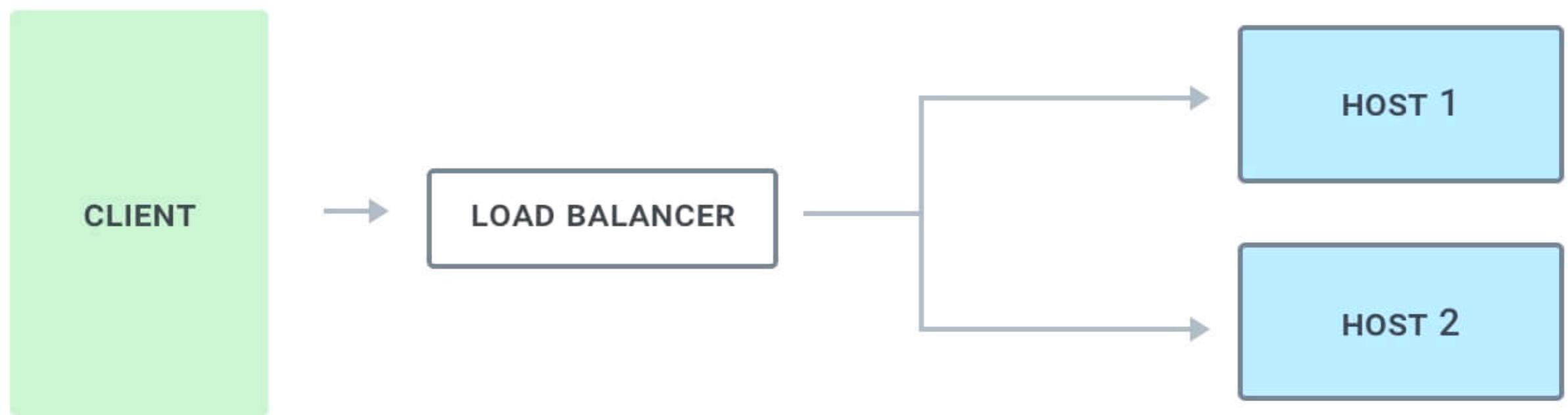
DNS-based or using a Ring-balancer



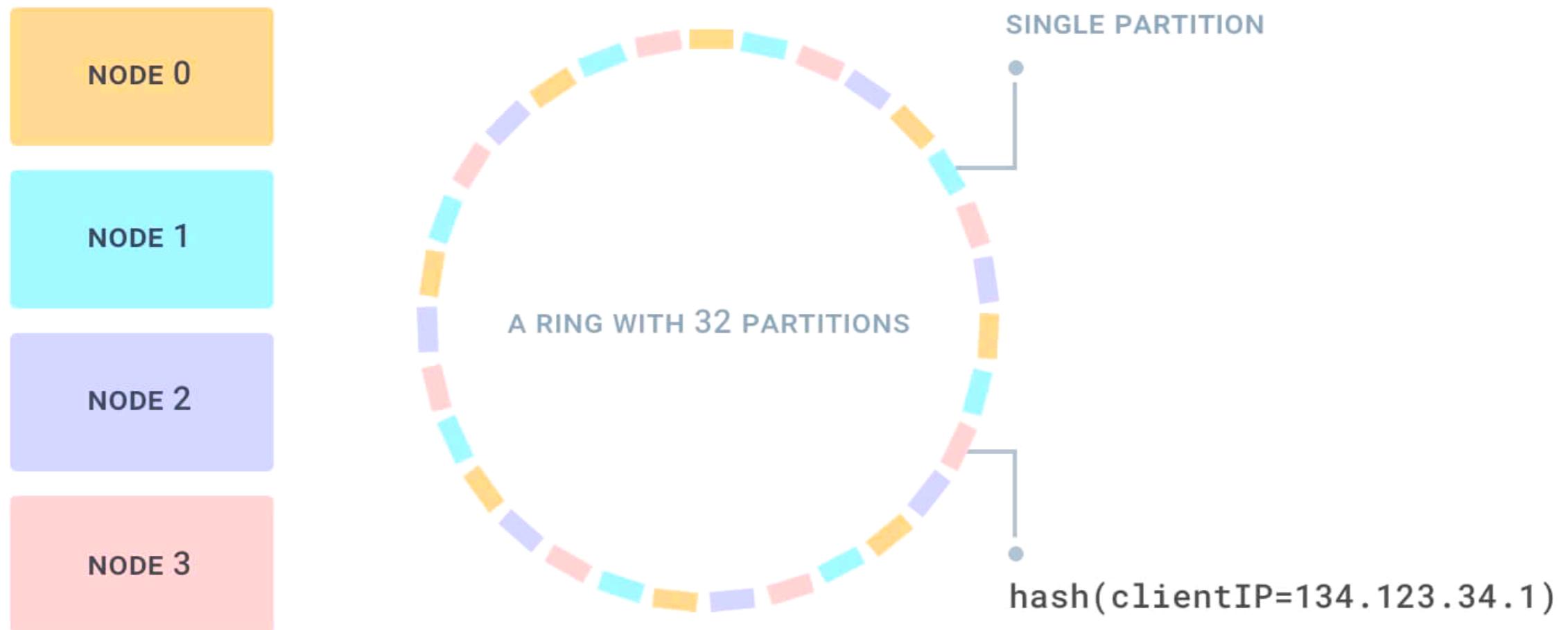
Domain Name Server (DNS)



Round Robin



Ring Balancer



Health Check

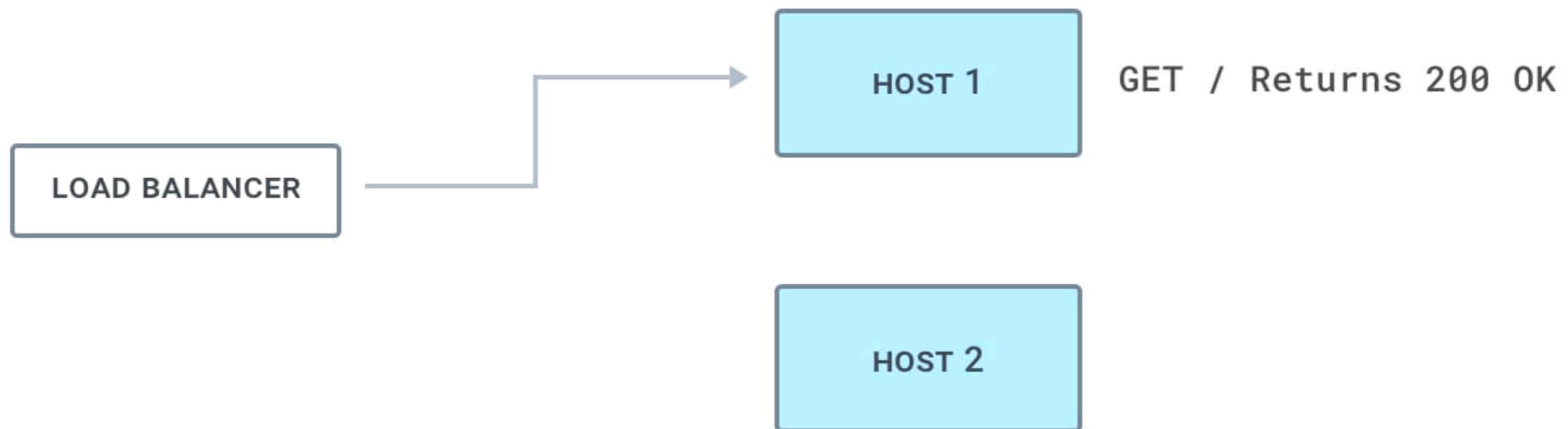
Health checks can help us detect failed hosts so the load balancer can stop requests to them

Active vs Passive



Active Health Check

The load balancer periodically “probes” upstream servers by sending a special health check request



Passive Health Check

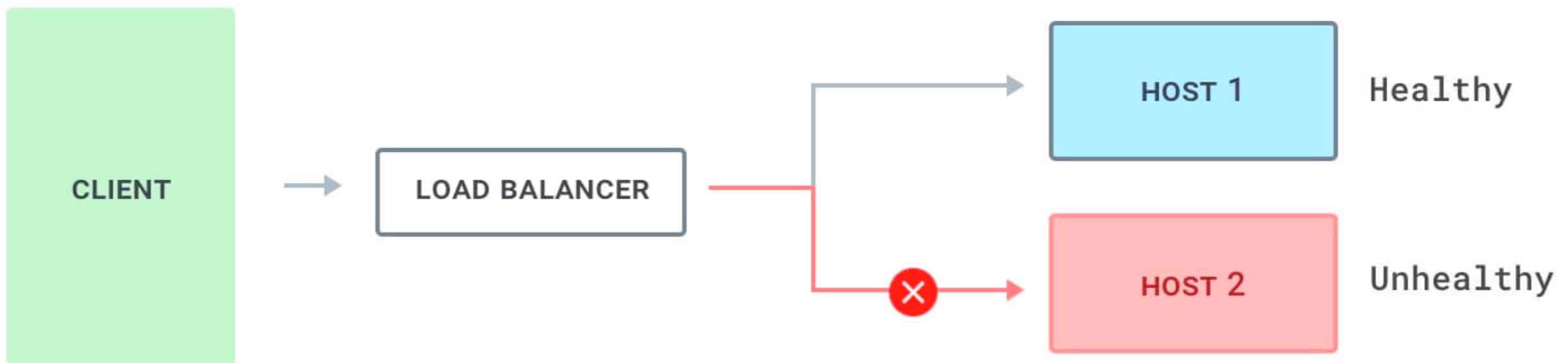
The load balancer monitors real requests as they pass through.

If the number of failed requests exceeds a threshold, it marks the host as unhealthy.



Circuit Breaker

When you know that a given host is unhealthy, its best to “break the circuit” so that traffic flows to healthy hosts instead



Kong workshop

Kong Admin APIs

Kong services

Kong routes

Kong consumers

Kong plugins

Kong GUI

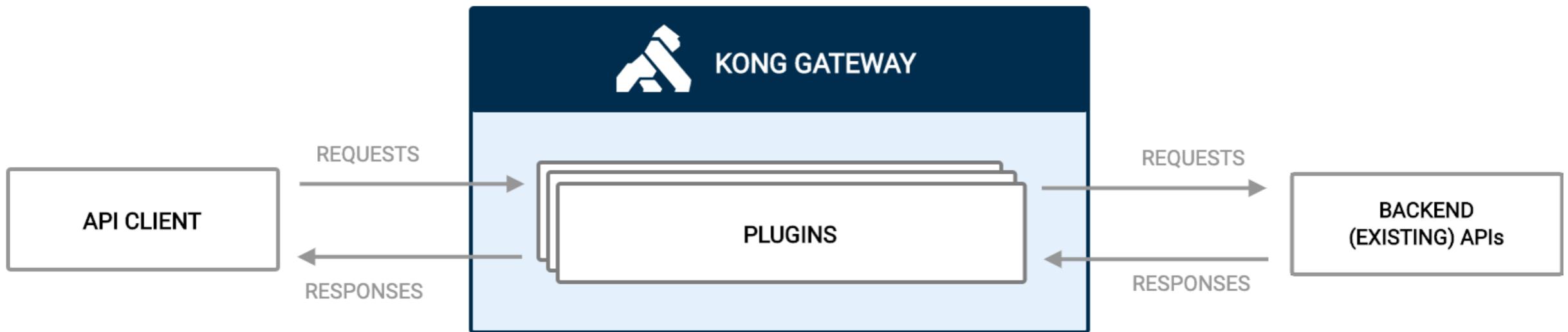


How to administrate and configure ?

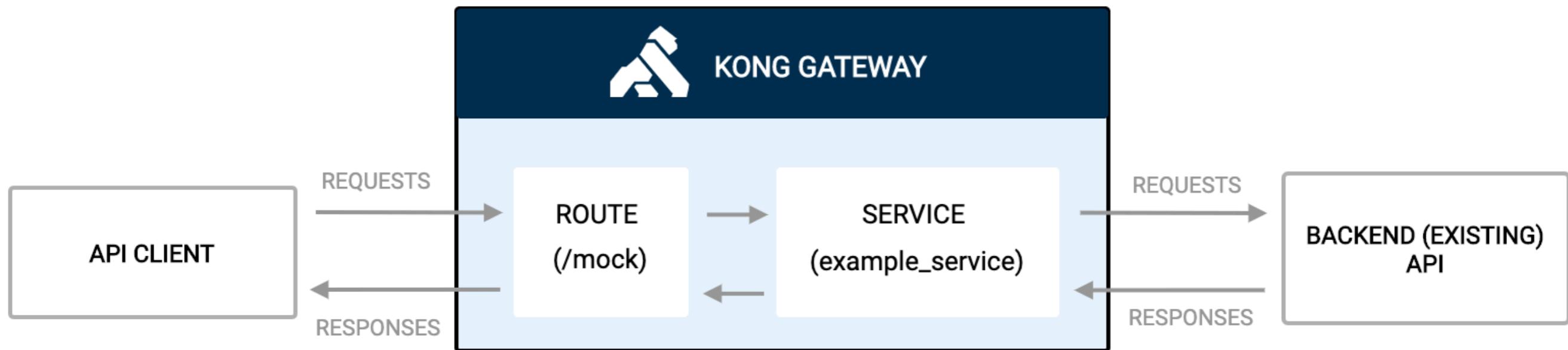
CLI
Postman
GUI (e.g. Konga)



Kong gateway

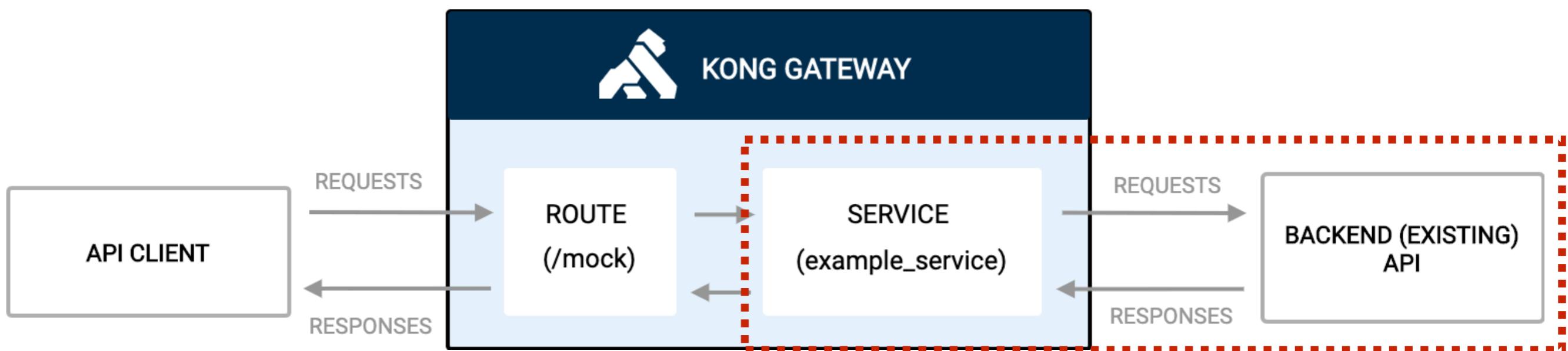


Services and Routes



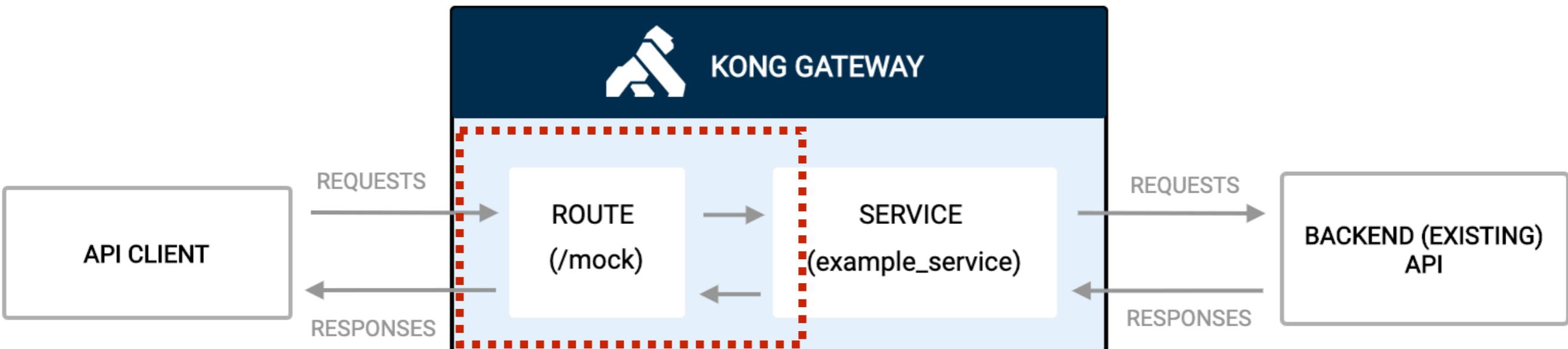
Services

Entity represent and external upstream API



Routes

Routes determine how requests are sent to services



A single service can have many Routes



Workshop services and routes

CRUD



Workshop

Working with {JSON}Placeholder

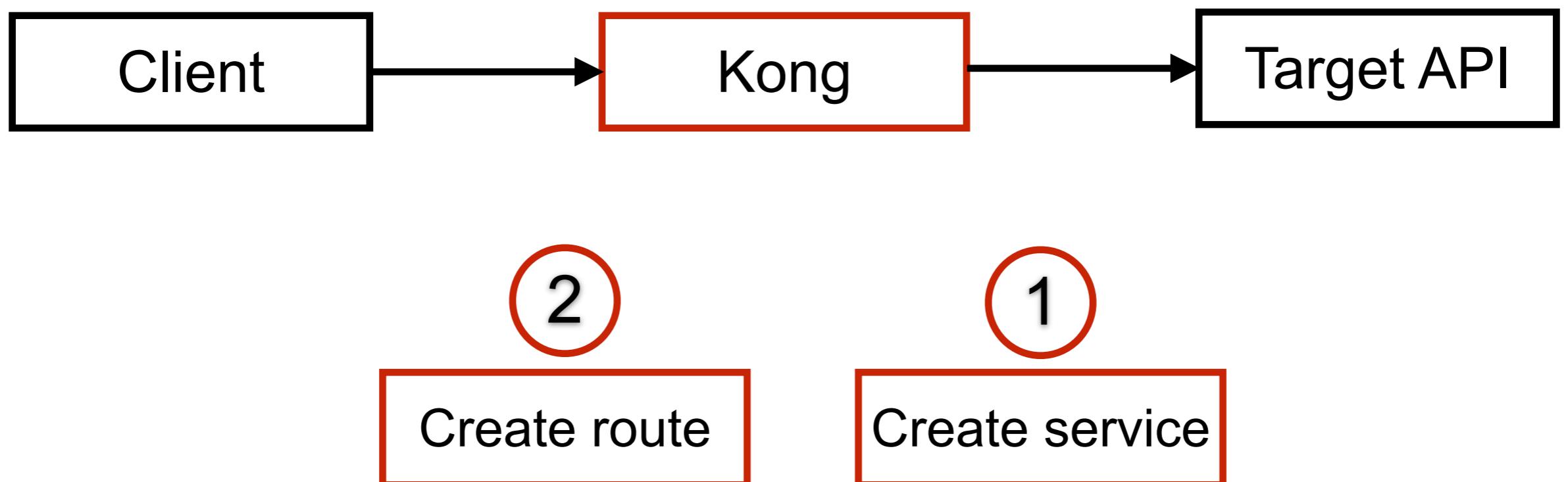


<https://jsonplaceholder.typicode.com/>



Workshop

Working with {JSON}Placeholder



<https://jsonplaceholder.typicode.com/>



Working with Kong plugins

<https://docs.konghq.com/hub/>



Working with plugins

Add plugin to service

Add plugin to route



Authentication

Basic auth
Key auth
JWT
OAuth 2



JWT (JSON Web Token)

Encoded

PASTE A TOKEN HERE

```
eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJzdWIiOiIxMjM0NTY3ODkwIiwibmFtZSI6IkpvaG4gRG9lIiwiaWF0IjoxNTE2MjM5MDIyfQ.Sf1KxwRJSMeKKF2QT4fwpMeJf36P0k6yJV_adQssw5c
```

Decoded

EDIT THE PAYLOAD AND SECRET

HEADER: ALGORITHM & TOKEN TYPE

```
{  
  "alg": "HS256",  
  "typ": "JWT"  
}
```

PAYLOAD: DATA

```
{  
  "sub": "1234567890",  
  "name": "John Doe",  
  "iat": 1516239022  
}
```

VERIFY SIGNATURE

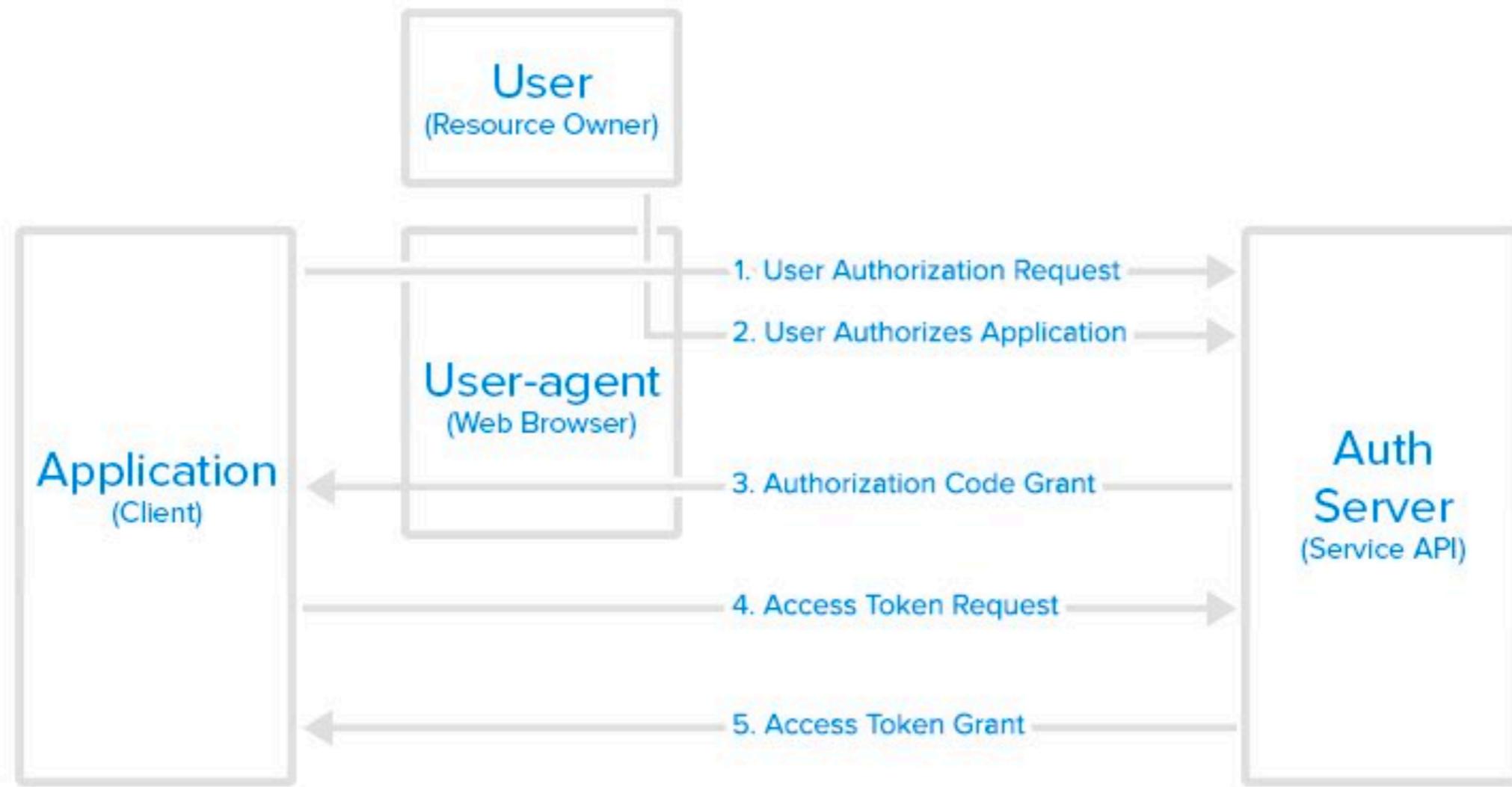
```
HMACSHA256(  
  base64UrlEncode(header) + "." +  
  base64UrlEncode(payload),  
  your-256-bit-secret  
)  secret base64 encoded
```

<https://jwt.io/>



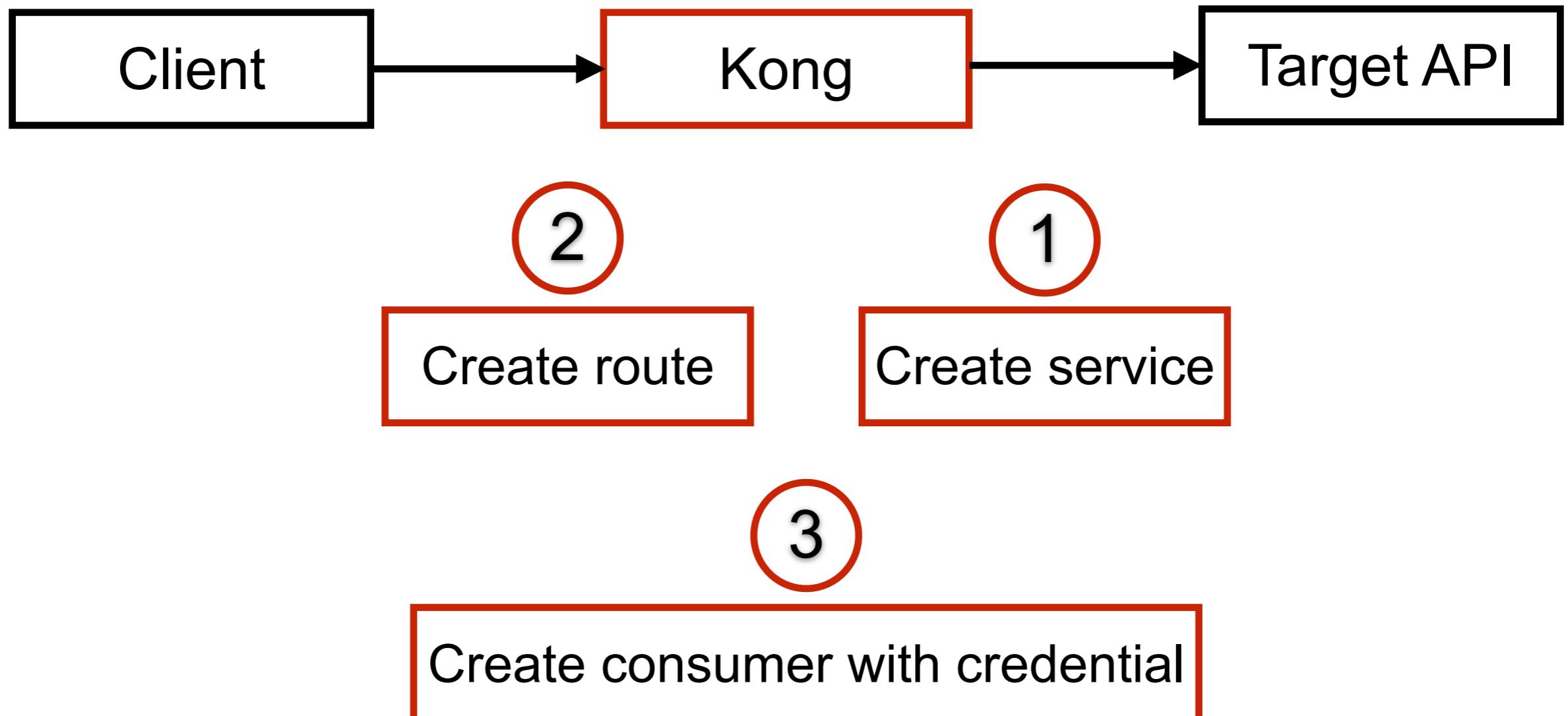
OAuth 2 Workflow

Authorization Code Flow



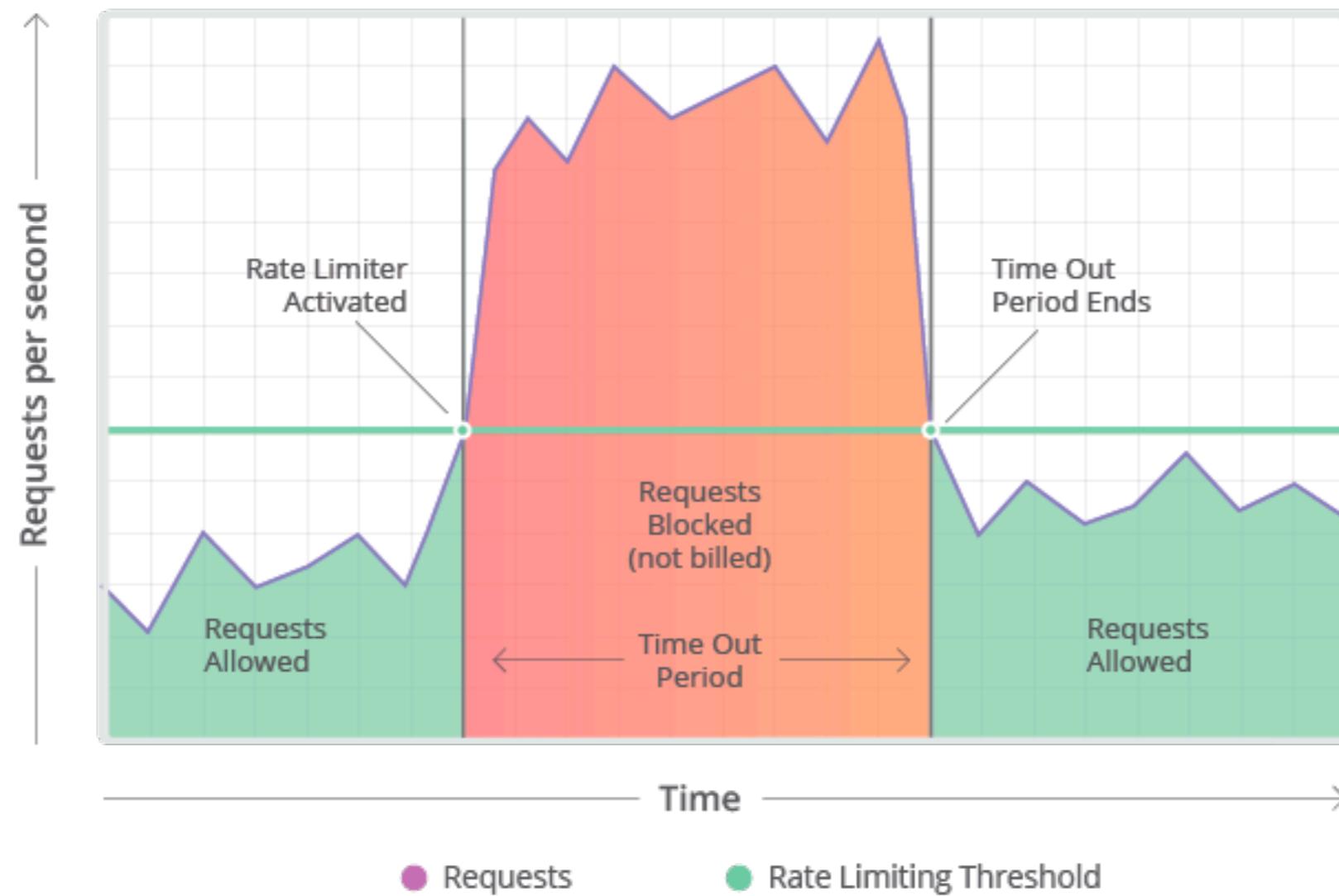
Workshop

Authentication with Kong



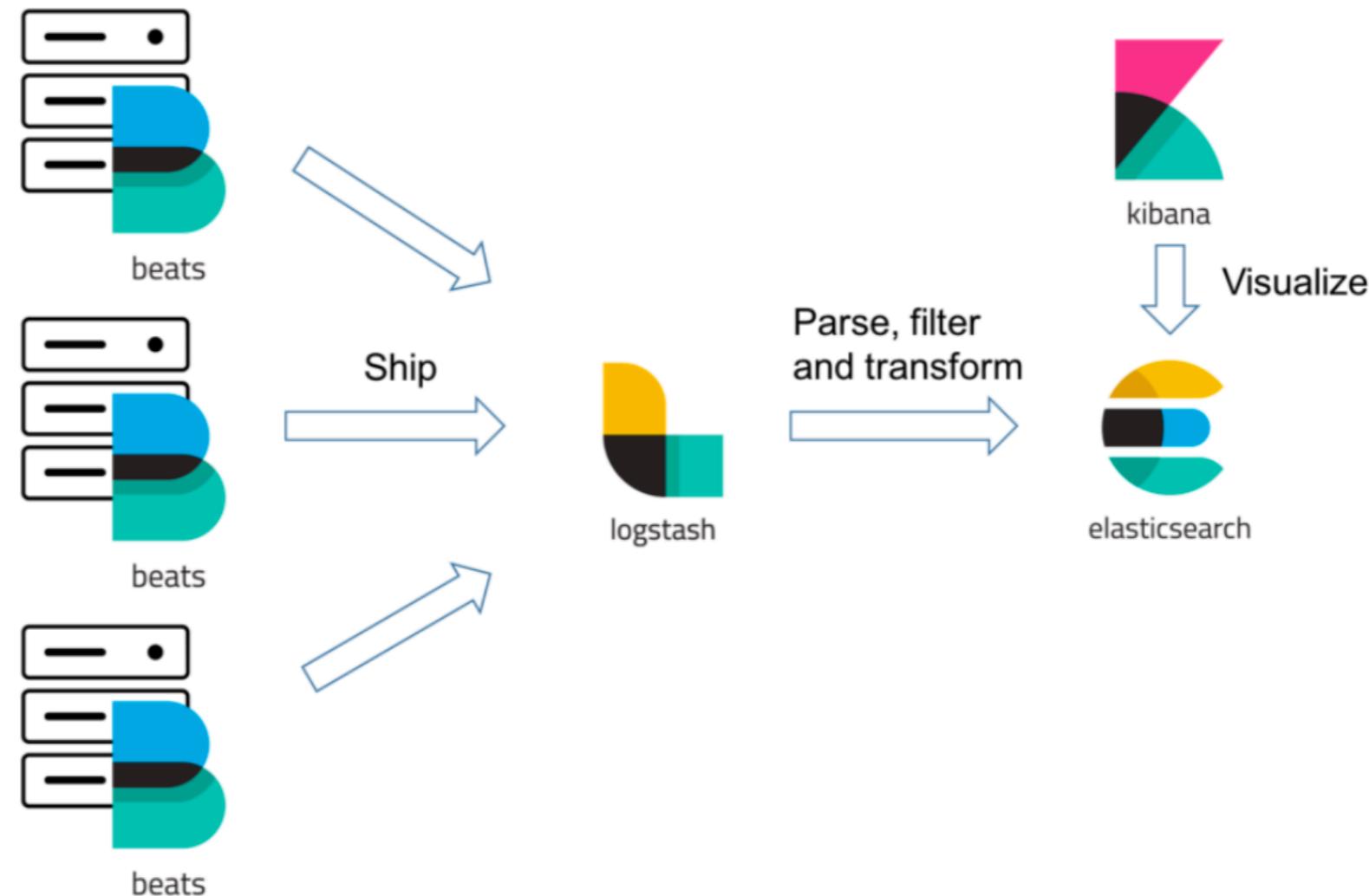
Control traffic

Rate limiting



Logging

Working with ELK and UDP



Monitoring

Working with Prometheus and Grafana



KonGa

(Kong Admin GUI)

<https://pantsel.github.io/konga/>



The screenshot shows the Konga dashboard interface. On the left is a sidebar with a dark blue background containing various navigation links. The main area has a light gray background and displays several key metrics and configuration details.

Connections

ACTIVE	READING	WRITING	WAITING	ACCEPTED	HANDLED
3	0	2	1	38K+	38K+

Total Requests: 40K+

Node Info

HostName	ip-10-0-0-242
Tag Line	Welcome to kong
Version	0.13.1
LUA Version	LuaJIT 2.1.0-beta3
Admin listen	["0.0.0.0:8001","0.0.0.0:8444 ssl"]

Timers

Datastore Info

	Reachable
DBMS	postgres
Host	kplj4fjnrbhxz.chjr89rj7wah.eu-west-1.rds.amazonaws.com
Database	kong
User	Jp2GxJlEEJlt9p
Port	5432

Plugins

A list of available Kong plugins, with **jwt** highlighted in green:

- response-transformer
- correlation-id
- statsd
- jwt**
- cors
- basic-auth
- key-auth
- ldap-auth
- http-log
- oauth2
- hmac-auth
- acl
- datadog
- tcp-log
- ip-restriction
- request-transformer
- file-log
- bot-detection
- loggly
- request-size-limiting
- syslog
- udp-log
- response-ratelimiting
- aws-lambda
- runscope
- rate-limiting
- request-termination

<https://pantsel.github.io/konga/>



Database integration

MySQL
PostgreSQL
MongoDB



Admin GUI

KONGA

DASHBOARD

API GATEWAY

- INFO
- SERVICES
- ROUTES
- APIS (DEPRECATED)
- CONSUMERS
- PLUGINS
- UPSTREAMS
- CERTIFICATES

APPLICATION

- USERS
- CONNECTIONS
- SNAPSHOTS
- SETTINGS

CONNECTIONS

ACTIVE	READING	WRITING	WAITING	ACCEPTED	HANDED
3	0	2	1	38K+	38K+

Total Requests: 40K+

NODE INFO

HostName	ip-10-0-0-242
Tag Line	Welcome to kong
Version	0.13.1
LUA Version	LuaJIT 2.1.0-beta3
Admin listen	["0.0.0.0:8001","0.0.0.0:8444 ssl"]

TIMERS

DATASTORE INFO

Reachable	
DBMS	postgres
Host	kp1j4fj1nnfbhxz.chjr89rj7wah.eu-west-1.rds.amazonaws.com
Database	kong
User	Jp2GxJIEEJlt9p
Port	5432

PLUGINS

- response-transformer
- correlation-id
- statsd
- jwt**
- cors
- basic-auth
- key-auth
- ldap-auth
- http-log
- oauth2
- hmac-auth
- acl
- datadog
- tcp-log
- ip-restriction
- request-transformer
- file-log
- bot-detection
- loggly
- request-size-limiting
- syslog
- udp-log
- response-ratelimiting
- aws-lambda
- runscope
- rate-limiting
- request-termination

KONGA 0.11.0 GitHub Issues

Connected to kong.imeweb.io

API Gateway with Kong
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Installation

```
$docker-compose up -d mongo  
$docker-compose up -d konga
```



Register admin user



KONGA

Welcome to the jungle!

Go ahead and create an administrator account.

Username

Email

Password

Confirm password

CREATE ADMIN

<http://127.0.0.1:1337/register>



Welcome to Konga

KONGA

- DASHBOARD
- APPLICATION
- USERS
- CONNECTIONS
- SNAPSHOTS
- SETTINGS



Hello, admin ▾



Welcome!

First of all, let's setup a connection to Kong Admin.

Select a connection type.

DEFAULT

KEY AUTH

JWT AUTH

BASIC AUTH

Konga will connect directly to Kong's admin API.
This method is mainly suitable for demo scenarios or internal access (ex. localhost).
Kong's admin API **should not** be publicly exposed.

Name *

A unique connection name

Kong Admin URL *

The URL to Kong's admin API

✓ CREATE CONNECTION



Create new connection

DEFAULT

KEY AUTH

JWT AUTH

BASIC AUTH

Konga will connect directly to Kong's admin API.
This method is mainly suitable for demo scenarios or internal access (ex. localhost).
Kong's admin API **should not** be publicly exposed.

Name *

kong

Kong Admin URL *

http://kong:8001/

✓ UPDATE CONNECTION



Welcome

KONGA

- DASHBOARD
- API GATEWAY
- INFO
- SERVICES
- ROUTES
- CONSUMERS
- PLUGINS
- UPSTREAMS
- CERTIFICATES
- APPLICATION
- USERS
- CONNECTIONS
- SNAPSHOTS
- SETTINGS

CONNECTIONS

ACTIVE	READING	WRITING	WAITING	ACCEPTED	HANDLED
2	0	1	1	986	986

Total Requests: 1K+

NODE INFO

HostName	22d7384ce7fc
Tag Line	Welcome to kong
Version	2.0.4
LUA Version	LuaJIT 2.1.0-beta3
Admin listen	["0.0.0.0:8001"]

TIMERS

DATASTORE INFO

DBMS	postgres
Host	kong-database
Database	kong
User	kong
Port	5432

PLUGINS

- correlation-id
- pre-function
- cors
- ldap-auth
- loggly
- hmac-auth
- zipkin
- request-size-limiting
- azure-functions
- request-transformer
- oauth2
- response-transformer
- ip-restriction
- statsd
- jwt
- proxy-cache
- basic-auth
- key-auth
- http-log
- datadog
- tcp-log
- rate-limiting
- post-function
- prometheus
- acl
- syslog
- file-log
- acme
- udp-log
- response-ratelimiting
- aws-lambda
- session
- bot-detection
- request-termination

KONGA 0.14.9 GitHub Issues Support the project Connected to kong

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Use the right tool for the right job



Learn Lua to develop Kong plugins



Q/A

