

Apache APISIX

微服务网关性能架构解析

--by Yuansheng



王院生

通过写书开始交朋友
《OpenResty 最佳实践》

今年 3 月和温铭创办深圳支流科技，专注微服务的开源技术公司。

Apache APISIX PPMC 成员。

公司刚起步，希望大家支持。



开源，开心



开源, 开心



Working from home

YuanSheng Wang
membphis

Edit profile

iresty.com
Zhuhai, China
membphis@gmail.com

Organizations



Overview Repositories 87 Projects 0 Packages 0 Stars 148 Followers 203 Following 2

Pinned

Customize your pins

iresty/apisix

Cloud-Native Microservices API Gateway

Lua ★ 964 🍴 166

iresty/lu-resty-etcd

Nonblocking Lua etcd driver library for OpenResty

Lua ★ 37 🍴 11

iresty/lu-resty-radixtree

Adaptive Radix Trees implemented in Lua for OpenResty

C ★ 25 🍴 4

iresty/jsonschema

Pure Lua JSON schema validator for Lua/LuaJIT

Lua ★ 3

2,045 contributions in the last year

Contribution settings

2019

2018

2017

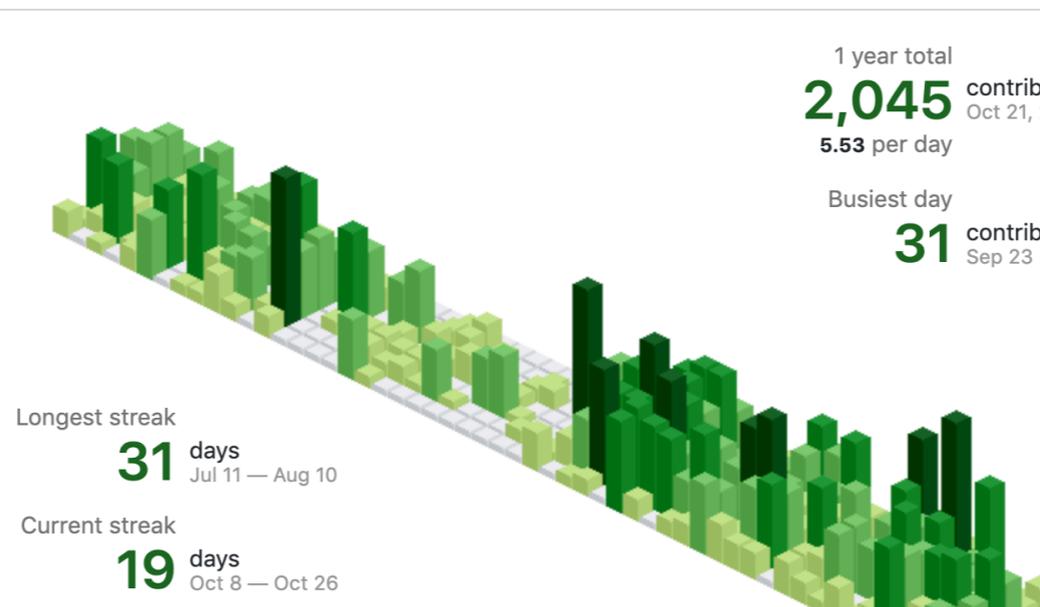
2016

2015

2014

1 year total
2,045 contributions
Oct 21, 2018 — Oct 26, 2019
5.53 per day

Busiest day
31 contributions
Sep 23



Longest streak
31 days
Jul 11 — Aug 10

Current streak
19 days
Oct 8 — Oct 26

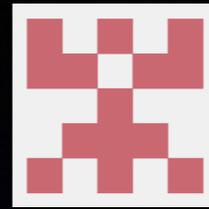
理想主义者，想活的有理想



Yuansheng Wang



fc13240



cuiweixie



orange



Wen Ming



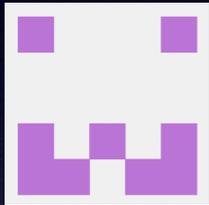
juzhiyuan



hwangjr



linsir



xiwangzishi



Tinywan



Ynge



forging2012



ZhouJing



Junxu Chen



Miss-you



supermario1990



JinChao Shuai



vkill



wanghui1125



np1e



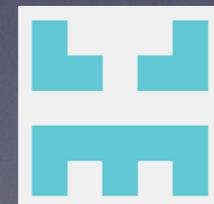
coolsoul



totemofwolf



Lee哥



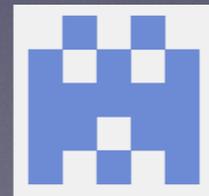
sushuai



chnliyong



onlytiancai



brileyhe

General

- [Welcome](#)
- [Incubation Overview](#)
- [Incubation Policy](#)
- [Incubation Guides](#)
- [Roles and Responsibilities](#)
- [General FAQ](#)
- [Incubator Wiki](#)
- [Who We Are](#)

Status

- [Project List](#)
- [Clutch Report](#)
- [IP Clearance](#)
- [Incubator History](#)

Entry Guides

- [Proposal Guide](#)

Podling Guides

- [Podling Committers](#)
- [Podling PMC \(PPMC\)](#)
- [Podling Mentor](#)
- [Podling Releases](#)
- [Podling Branding/Publicity](#)
- [Podling Websites](#)
- [Graduation](#)
- [Retirement](#)

Other Guides

▶ Apache APISIX Project Incubation Status

This page tracks the project status, incubator-wise. For more general project status, look on the project website.

▶ Description

APISIX is a cloud-native microservices API gateway, delivering the ultimate performance, security, open source and scalable platform for all your APIs and microservices.

▶ News

- 2019-10-17 Project enters incubation.

▶ Project info

- APISIX Website - <http://apisix.incubator.apache.org>
- [Community Pages](#)
- [Current Documentation](#)
- [Releases](#)
- link to the project status file (Committers, non-incubation action items, project resources, etc)

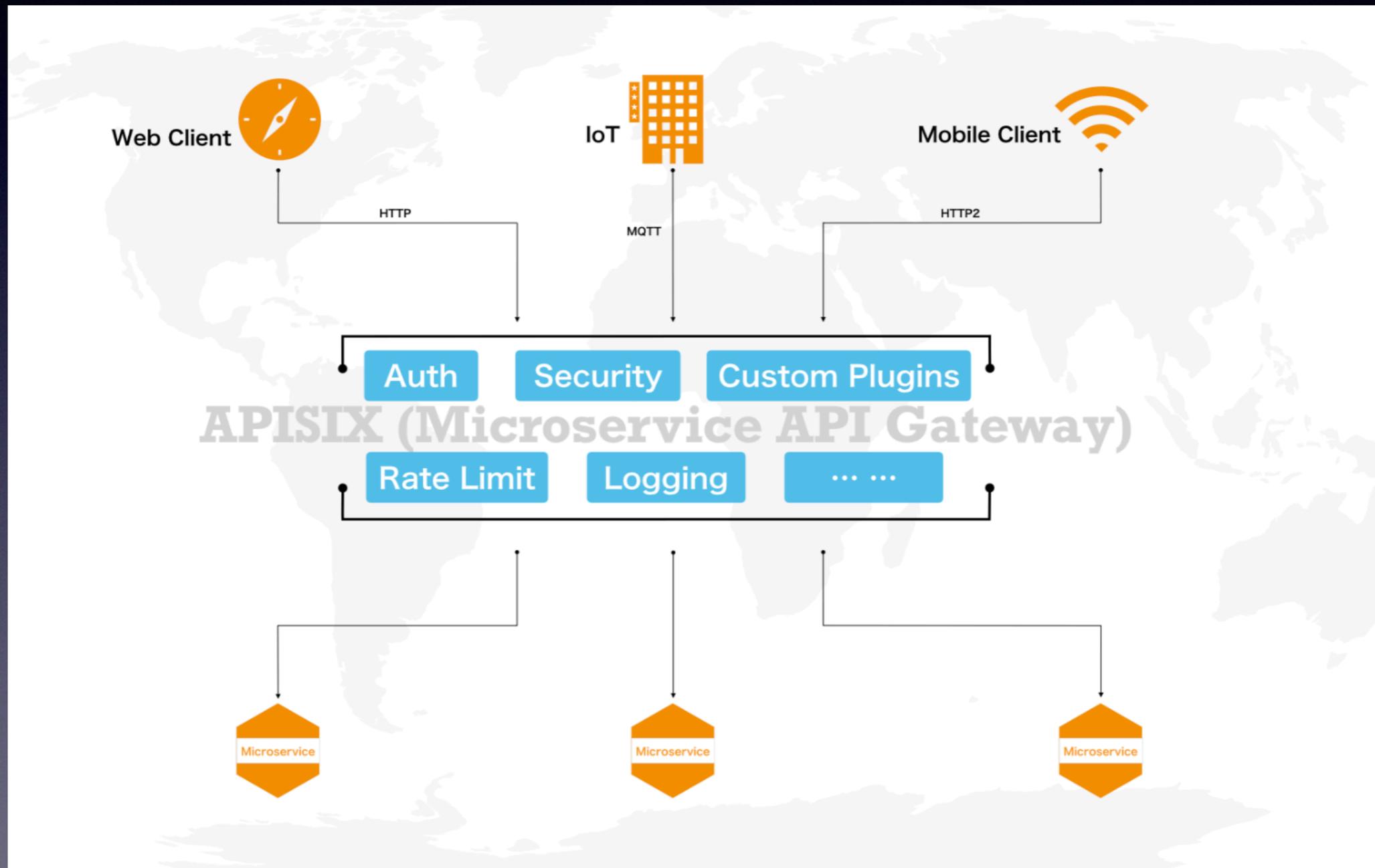
If the project website and code repository are not yet setup, use the following table:

item	type	reference
Website	www	http://apisix.incubator.apache.org/
Mailing list	dev	dev @ apisix.incubator.apache.org
.	private	private @ apisix.incubator.apache.org
.	notificiatons	commits @ apisix.incubator.apache.org

开源，开心



什么是 API 网关



微服务 API 网关

基础设施

分布式

Dubbo

良好社区

版本控制

高性能

低延迟 被动健康检查

Serverless 热加载

UDP

TCP

中间件

gRPC

限流

单机模式

自定义插件

扩展性

熔断

Websocket

IPv

JWT-auth

zipkin

日志审计

prometheus

Key-auth

毫秒通知

开源

MQTT

限速

opentracing

主动健康检查

HTTP 高可用

动态规则



重复造轮子 why?

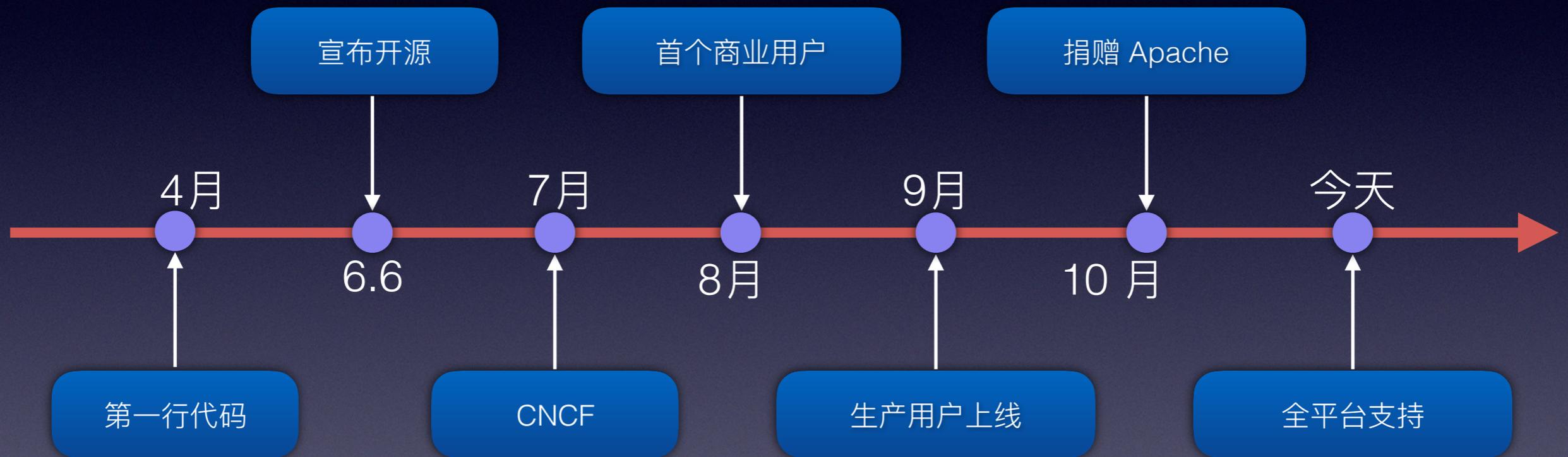
行业老大：大多基于 Java + JS，性能差，不支持二次开发。比如 Apigee、3Scale、Amazon 等。

行业远见者：多基于 OpenResty + Golang，少数开源，比如：Tyk、Kong 等，代码量较重。

Apache APISIX 机会：轻巧 + 极致性能 + 热插件



Apache APISIX



Apache APISIX 自豪

- 核心代码量，3892 行
- 极致的动态转发性能
- 平均请求延迟：740 us
- 插件热加载/卸载
- 允许插件挂载任何阶段
- 路由自身也是插件

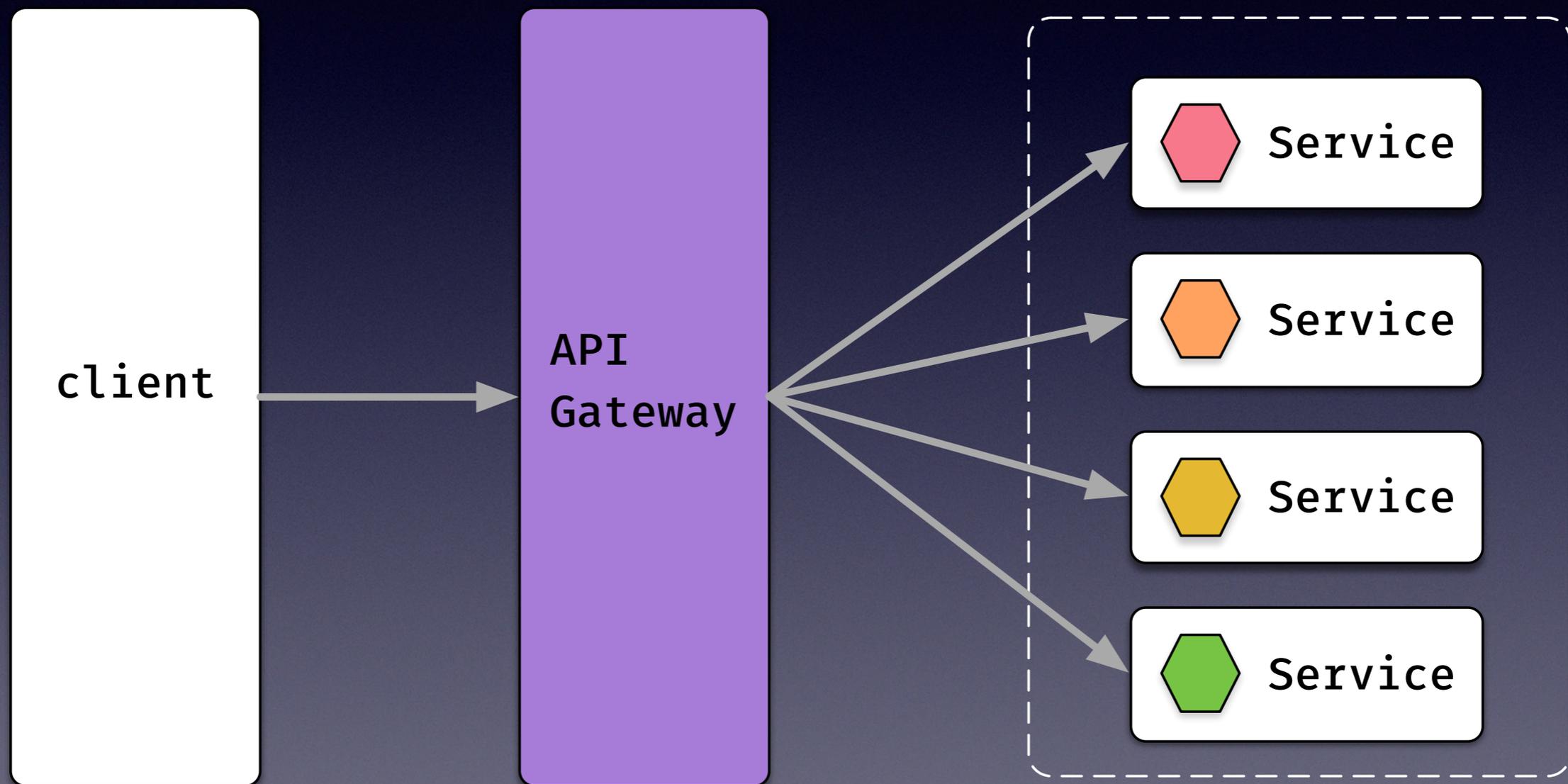


Apache APISIX 自豪

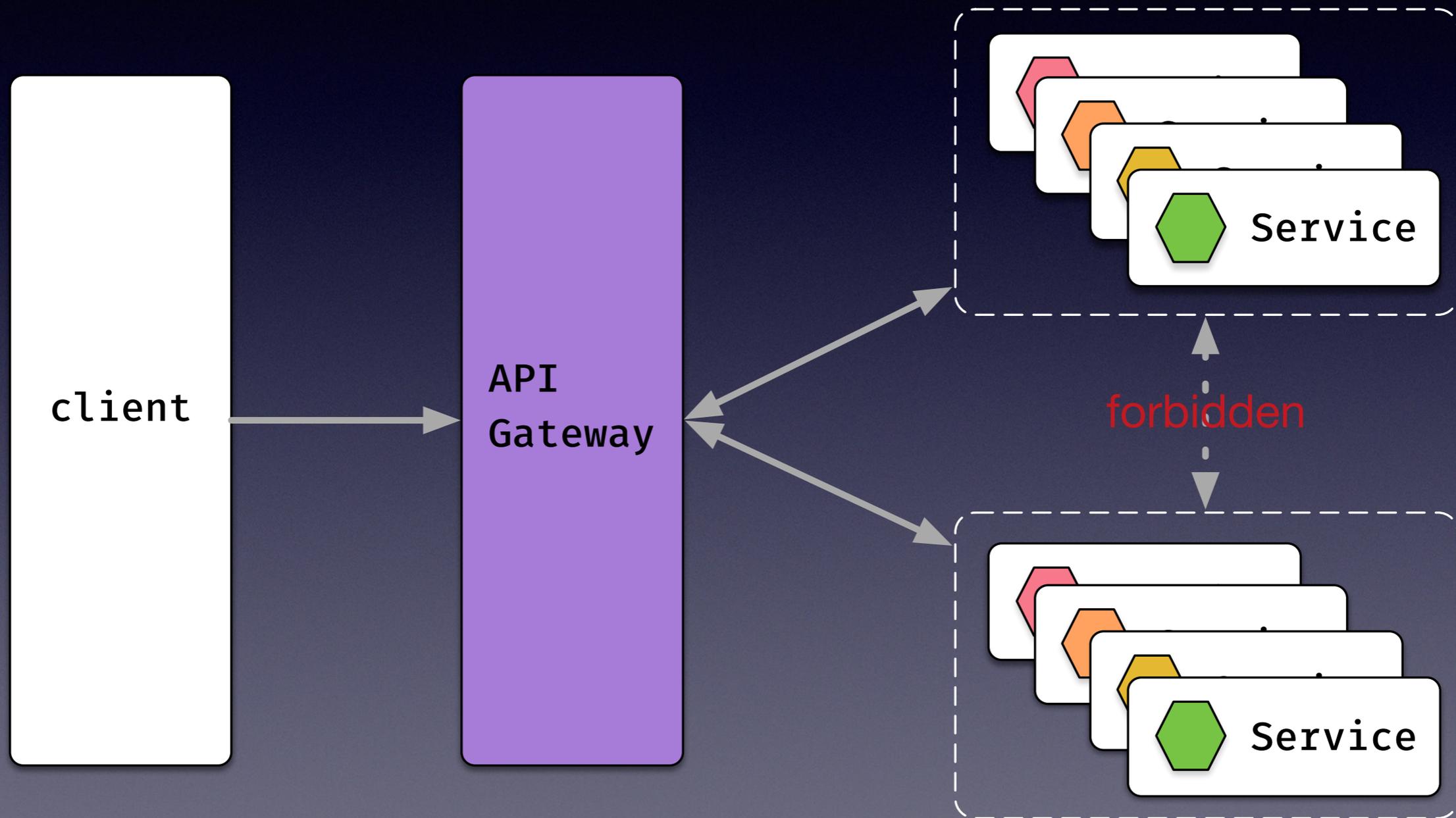
- 支持 ARM64
- 完整支持 IPv6
- 物联网 MQTT 协议
- 基于 OpenResty / Tengine
- 极致性能 jsonschema
- ASF 第一个 API 网关项目



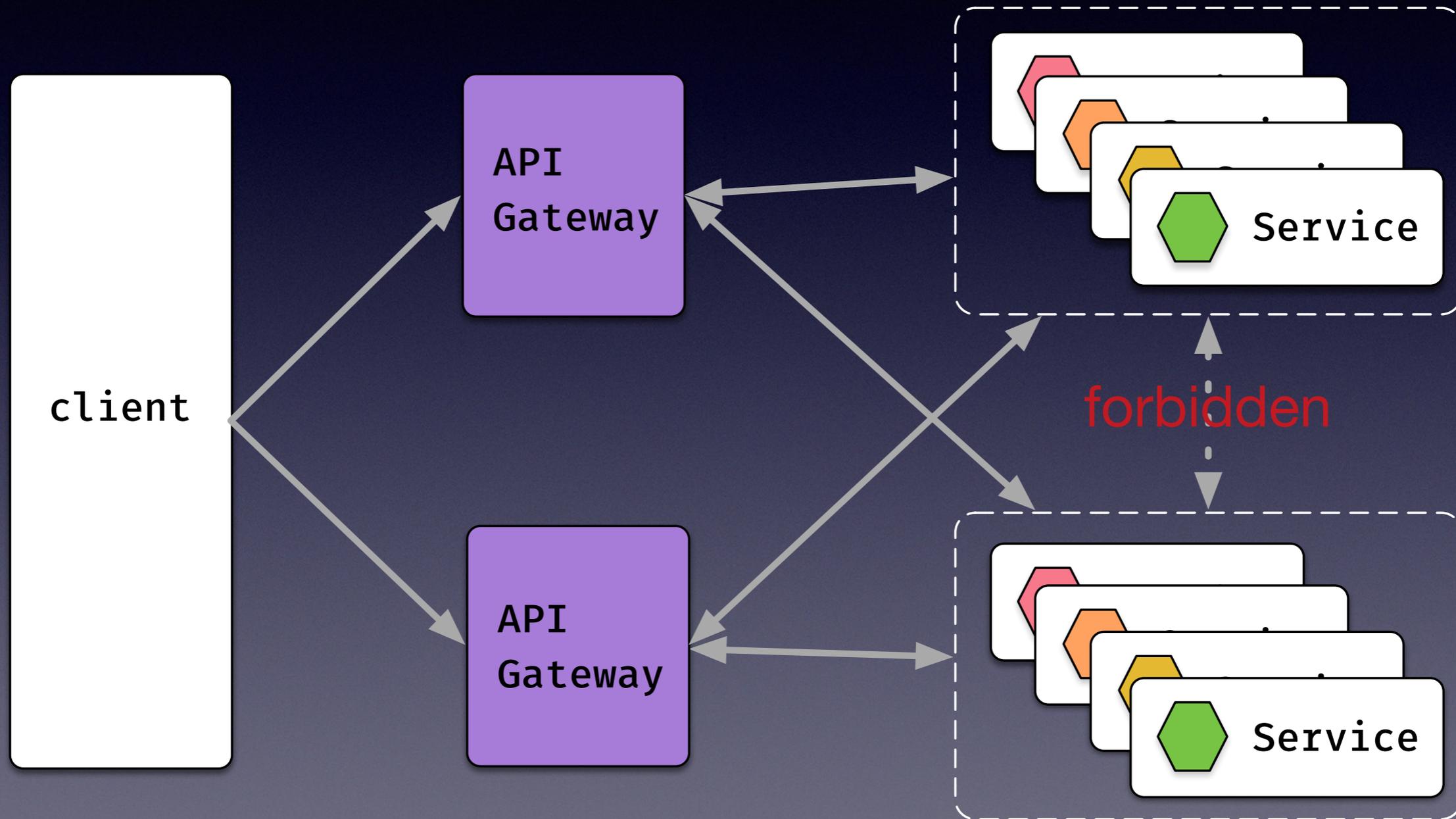
微服务 API 网关部署



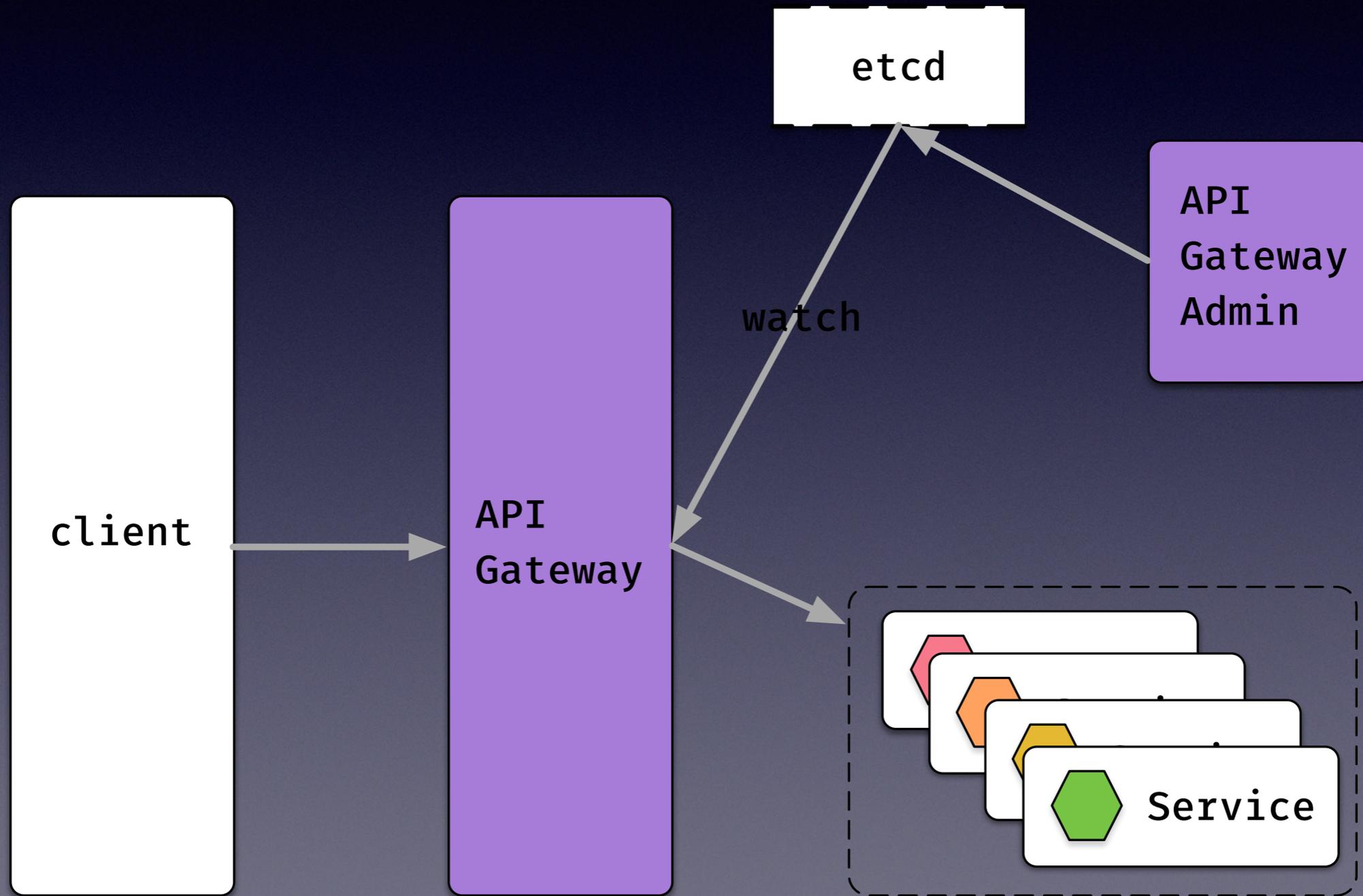
微服务 API 网关部署



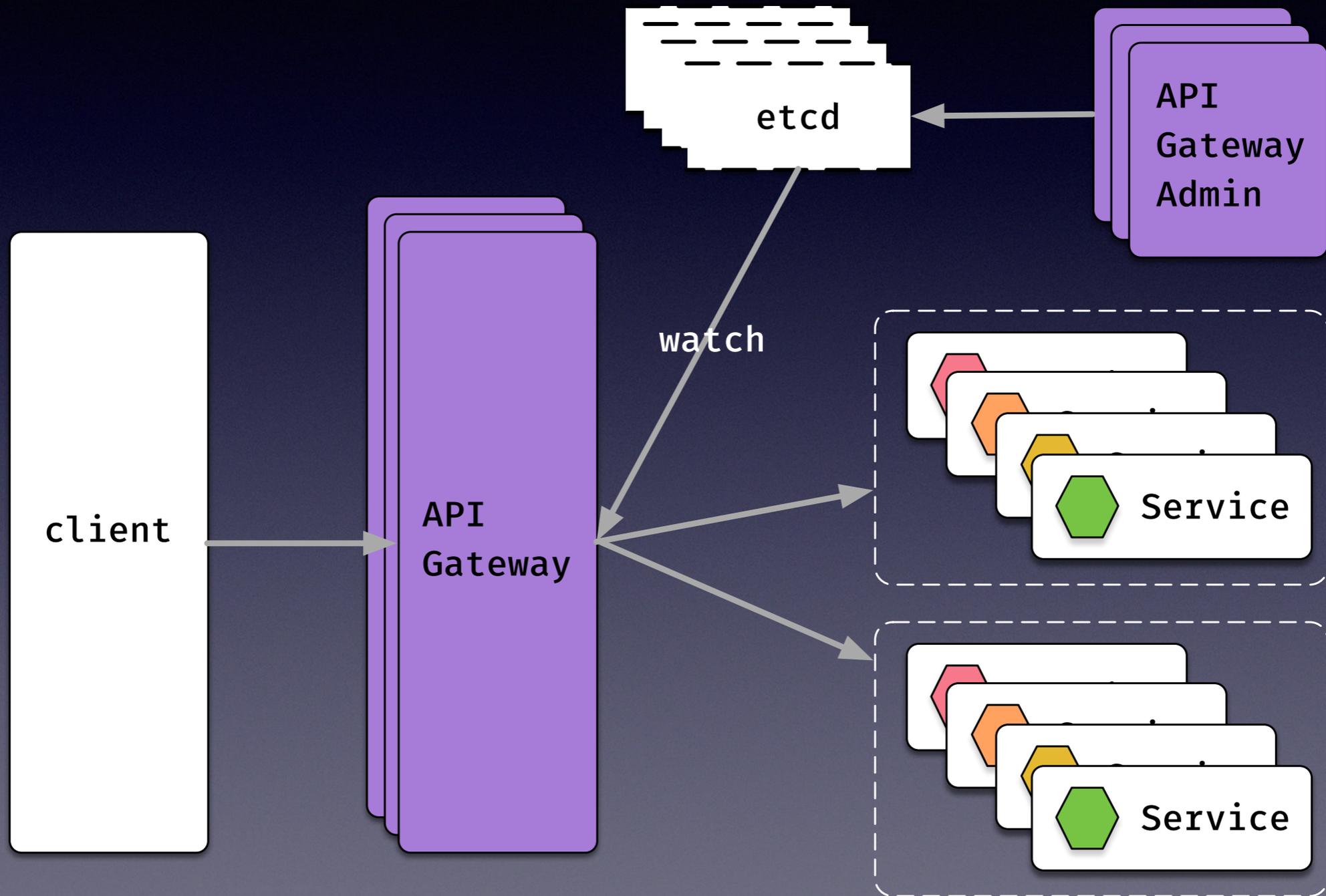
微服务 API 网关部署



微服务 API 网关部署

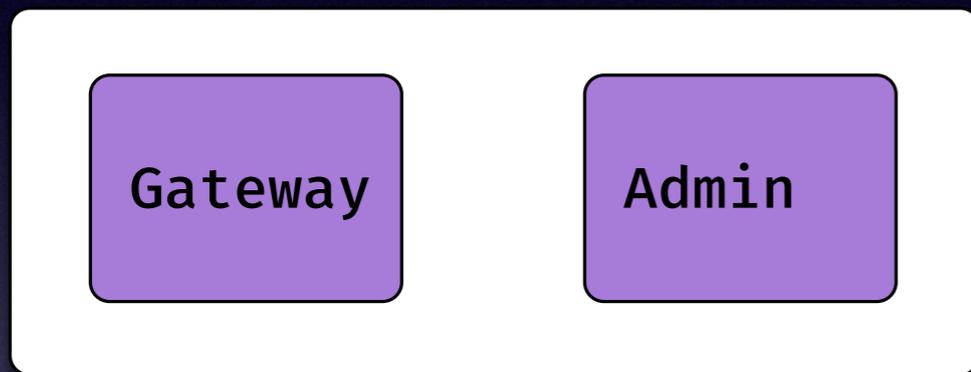


微服务 API 网关部署



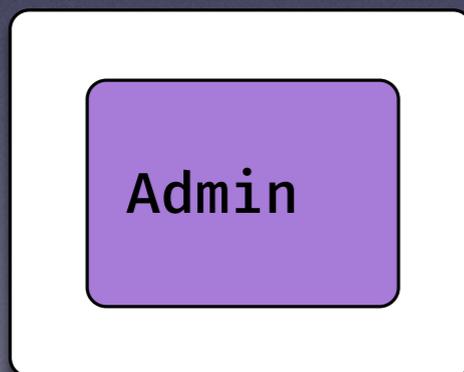
Apache APISIX 部署

APISIX



All In One
节点无状态特性

APISIX



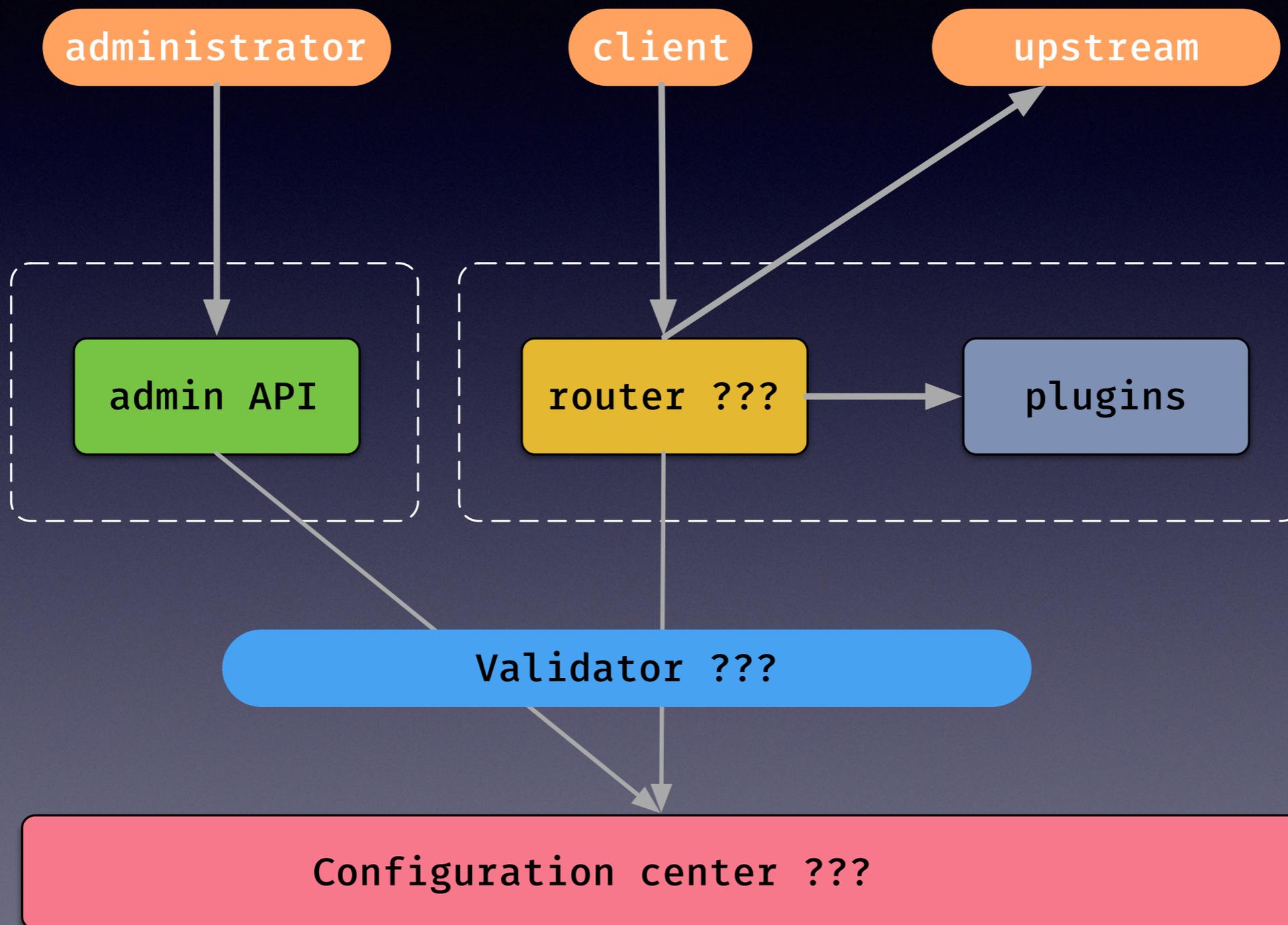
APISIX



- 高可用
- 弹性伸缩
- 分布式
- 集群
- 故障自动转移



API 网关基本架构



Apache APISIX 技术选型

- 配置中心
- 语言或开发平台
- 数据校验
- 加分项： 顶级路由实现



Apache APISIX 技术选型

- 配置中心：高可用、增量订阅、历史记录
- 语言或开发平台：动态、高性能、网关的周边资源丰富
- 数据校验：开放标准、有一定的生态系统
- 学习竞对：从 Gartner 报告中获取前辈列表，做分析、比较



Apache APISIX 技术选型

配置中心 why etcd?

- 集群支持
- 历史+事务
- 低于毫秒的变化通知

	etcd	ZooKeeper	Consul	NewSQL (Cloud Spanner, CockroachDB, TiDB)
Concurrency Primitives	Lock RPCs, Election RPCs, command line locks, command line elections, recipes in go	External curator recipes in Java	Native lock API	Rare, if any
Linearizable Reads	Yes	No	Yes	Sometimes
Multi-version Concurrency Control	Yes	No	No	Sometimes
Transactions	Field compares, Read, Write	Version checks, Write	Field compare, Lock, Read, Write	SQL-style
Change Notification	Historical and current key intervals	Current keys and directories	Current keys and prefixes	Triggers (sometimes)
User permissions	Role based	ACLs	ACLs	Varies (per-table GRANT, per-database roles)
HTTP/JSON API	Yes	No	Yes	Rarely
Membership Reconfiguration	Yes	>3.5.0	Yes	Yes
Maximum reliable database size	Several gigabytes	Hundreds of megabytes (sometimes several gigabytes)	Hundreds of MBs	Terabytes+
Minimum read linearization latency	Network RTT	No read linearization	RTT + fsync	Clock barriers (atomic, NTP)



Apache APISIX 技术选型

开发平台：Lua 或 Golang

- OpenResty \geq 1.15.8
- Tengine \geq 2.3.2
- 基于 Nginx
- 调用动态库：C/C++，Golang 等



Apache APISIX 技术选型

数据校验: jsonschema

- 数据校验规范: Google 排名第一
- 有多个不同语言客户端, 涵盖了几乎目前主流的所有语言实现。
- 有现成的压测结果供参考供对比



Apache APISIX 技术选型

validator: iresty/jsonschema

- 刚需: draft4 (可满足 99% 的场景), draft6 和 draft7 是未来
- 经历: lua-rapidjson -> iresty/jsonschema
- 后者支持 draft6/draft7, 性能提升 5 - 10 倍
- 是 xeipuuv/gojsonschema 性能的 1000 倍



Apache APISIX 技术选型

路由是 API 网关的生命

- 必须高性能
- 匹配条件灵活且易扩展
 - 必需：uri、host
 - 可选：IP 地址、请求参数、请求头、Cookie等，可以做数值、字符串以及正则匹配。
- 自定义函数



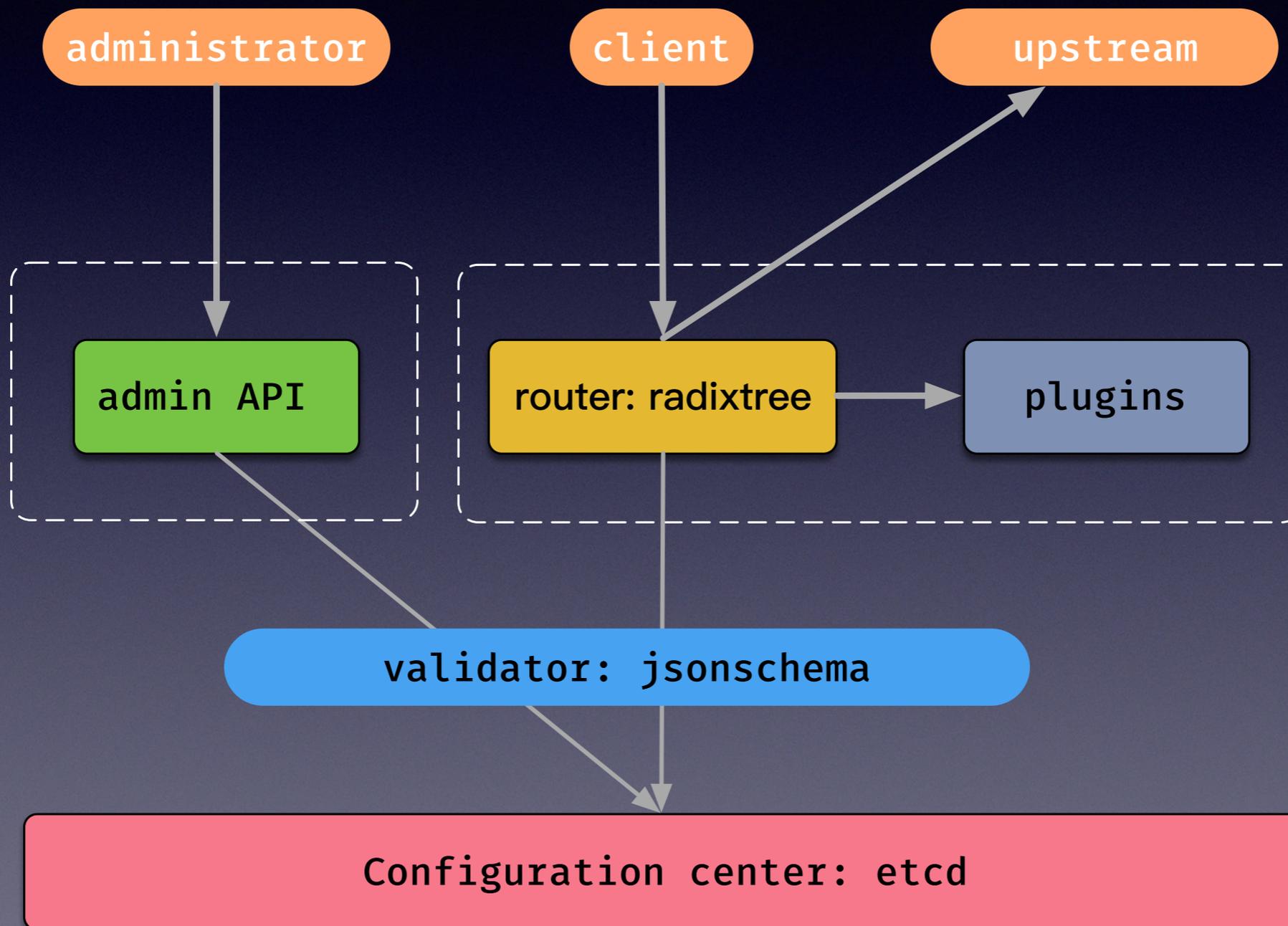
Apache APISIX 技术选型

路由：lua-resty-radixtree

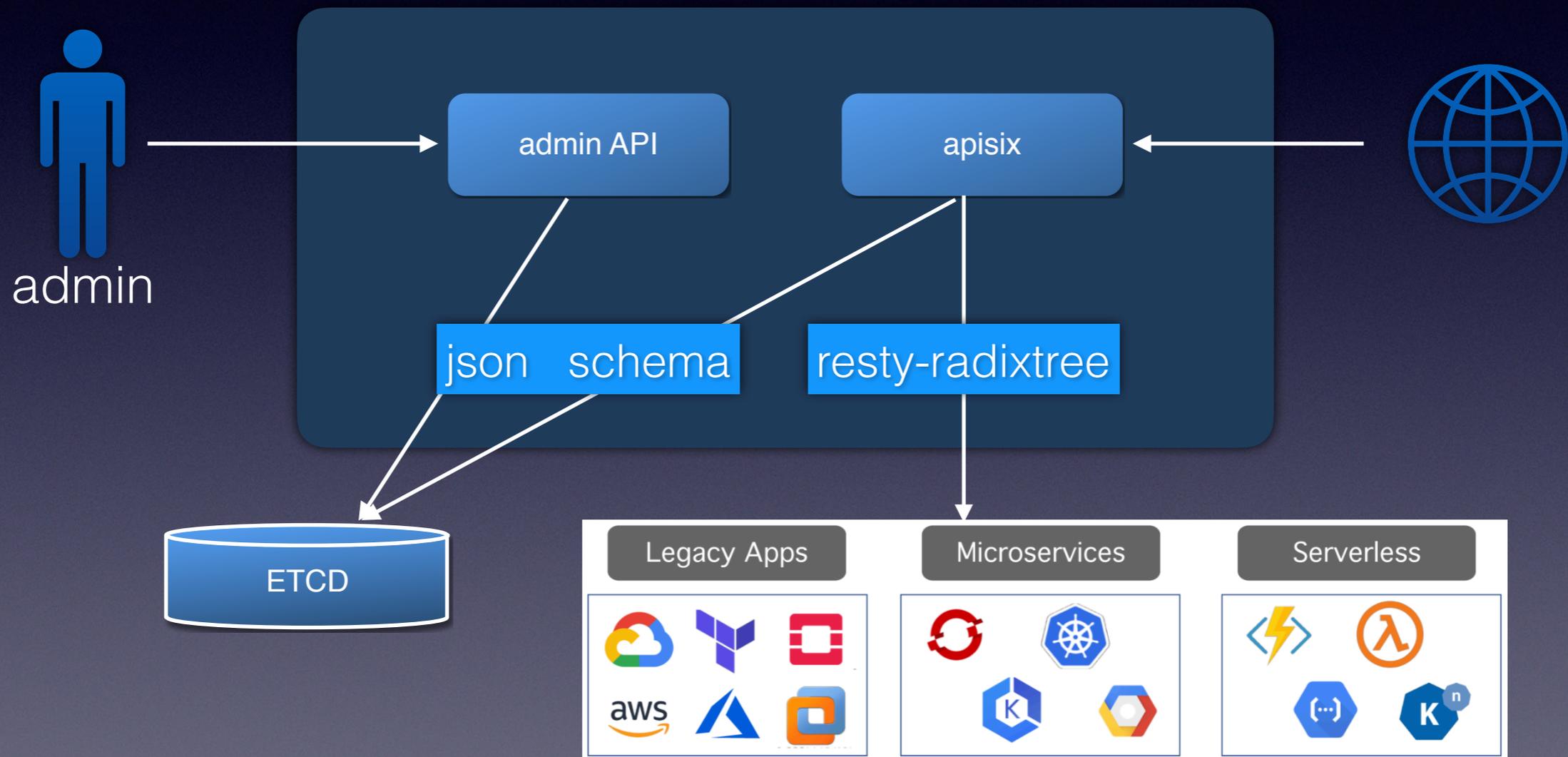
- 单核心每秒百万次匹配
- 相比 libr3 性能提升有一个数量级
- 允许引用任意 ngx 内置变量，作为路由条件
- 可选择索引：only uri 或者 host+uri



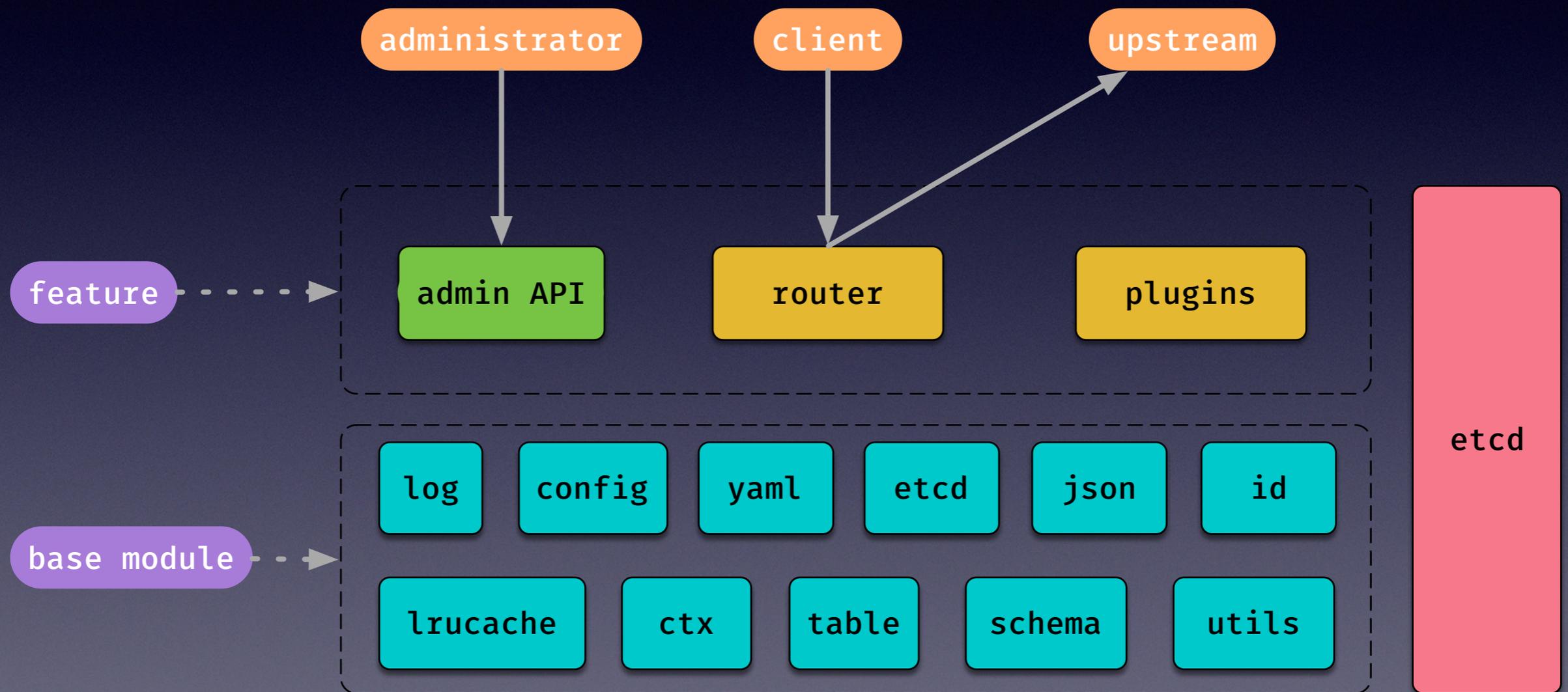
API 网关基本架构



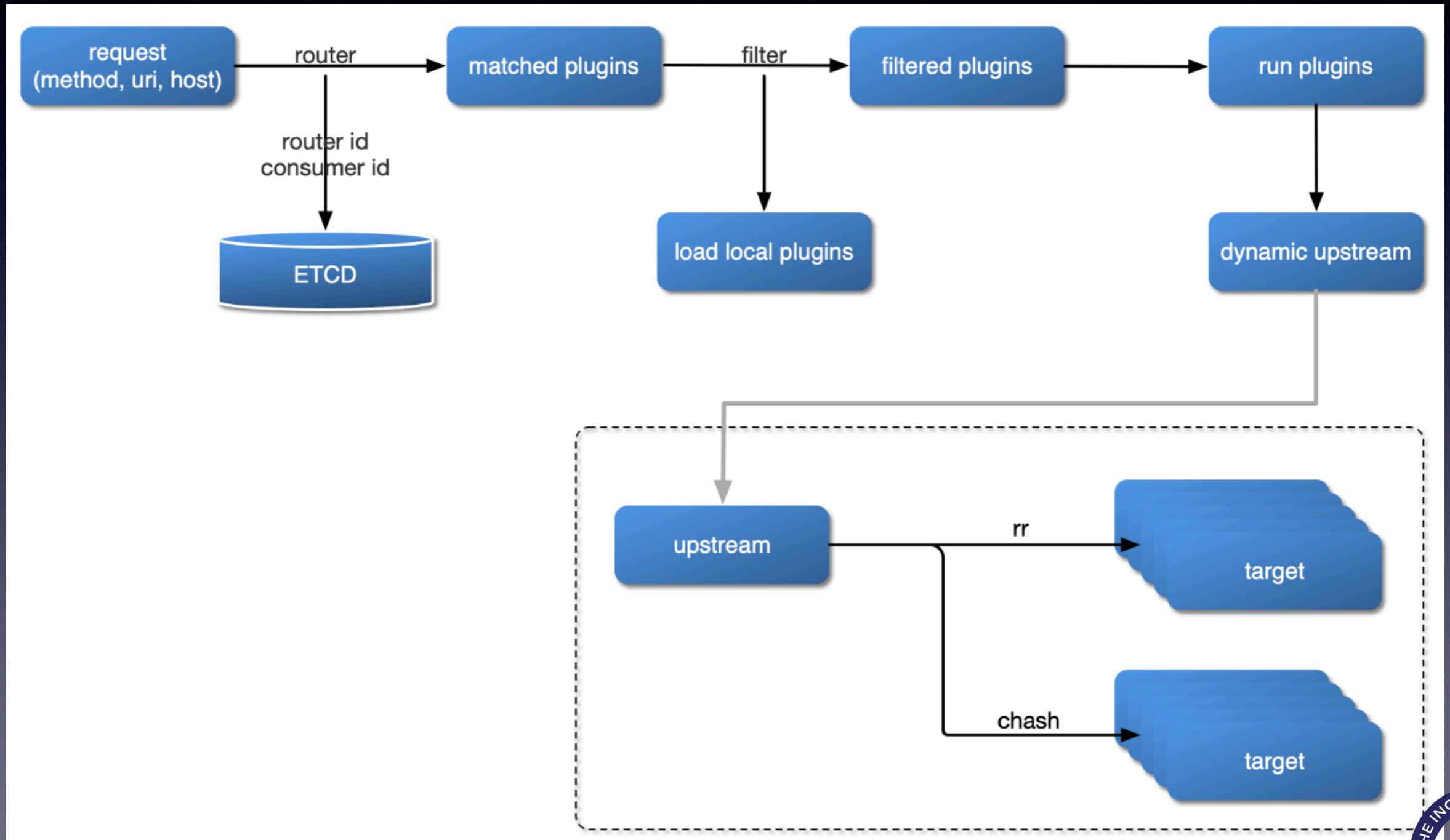
Apache APISIX 架构



Apache APISIX 架构

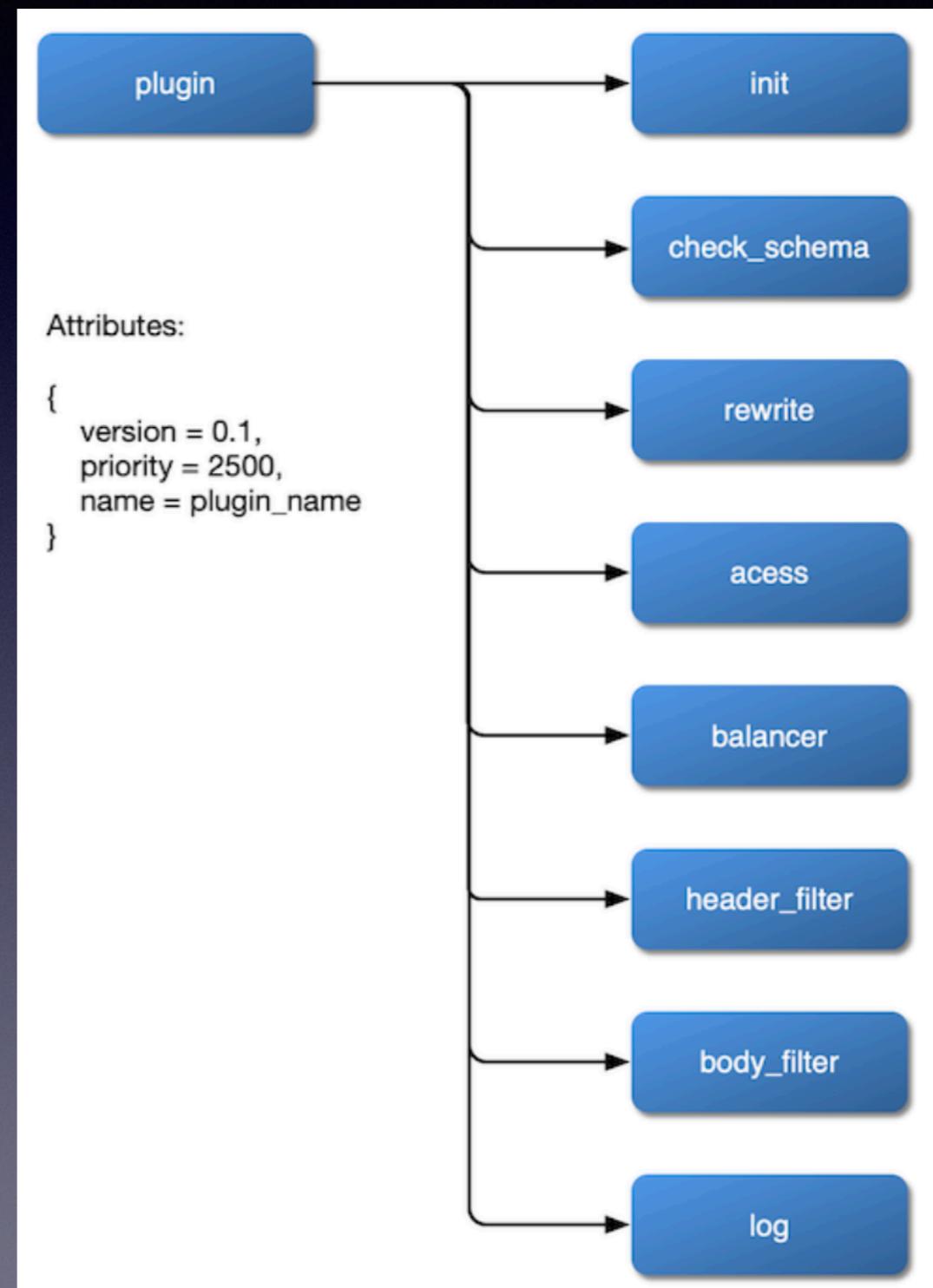


Apache APISIX 插件



Apache APISIX 插件

- 按需“继承”
- 优先级排序
- 挂载 Nginx 所有阶段
- 插件热加载、卸载
- 插件临时禁用



Apache APISIX 插件

plugins

grpc-transcode

heartbeat

ip-restriction

jwt-auth

key-auth

limit-conn

limit-count

limit-req

openid-connect

prometheus

proxy-rewrite

serverless

redirect

zipkin



Apache APISIX 三板斧

- 配置分发借助 etcd，精简核心
- 基于 radixtree 前缀树路由
- apisix/core：高性能基础库
 - Nginx 变量提取增强
 - 错误日志优化
 - table 池优化



Apache APISIX 功能



Apache APISIX 功能

- Cloud-Native
- Dynamic Load Balancing
- Hash-based Load Balancing
- SSL
- Forward Proxy
- Authentications
- Limit-rate
- OpenTracing
- Limit-count
- Limit-concurrency
- CLI
- REST API
- Clustering
- Scalability
- High performance
- Custom plugins



Apache APISIX 功能

- Hot Updates And Hot Plugins
- Health Checks
- Circuit-Breaker
- Proxy Rewrite
- Prometheus
- gRPC transcoding
- gRPC proxy
- Global Rule
- Serverless
- Dashboard
- Version Control
- IPv6
- IP Whitelist/Blacklist
- Stand-alone mode
- TCP/UDP Proxy
- Dynamic MQTT Proxy



Apache APISIX 压测



VS

性能只下降 15%

单 worker: 23-24k 的 QPS

4 worker: 68k 的 QPS

平台: alicloud ecs.ic5.3xlarge

```
function _M.http_access_phase()
    local uri = ngx.var.uri
    local host = ngx.var.host
    local method = ngx.req.get_method()
    local remote_addr = ngx.var.remote_addr
    fake_fetch(uri, host, method, remote_addr)
end

function _M.http_header_filter_phase()
    if ngx.ctx then
        -- do something
    end
end

function _M.http_log_phase()
    if ngx.ctx then
        -- do something
    end
end

function _M.http_admin()
end

function _M.http_ssl_phase()
    if ngx.ctx then
        -- do something
    end
end
```

Q & A

- github.com/iresty/apisix
- 基础库推荐: [apisix/core](#)
- QQ 交流群: 552030619
- 提供企业一对一服务对接



APISIX: 云原生 API 网关
扫一扫二维码, 加入群聊。

