

Apache APISIX: How to implement plugin orchestration in API Gateway

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Apache APISIX VP



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- Member of TOC of TARS Foundation
- More than 40 security patents



Agenda

- Introduction to Apache APISIX
- Custom plugin development in API Gateway
- Generate APISIX plugins automatically
- The future of API Gateway



Apache APISIX



- Cloud Native API Gateway (<https://github.com/apache/apisix>)
- Cover all features of Nginx
- Fully dynamic: routing, SSL certificates, upstream, plugins...
- More than 40 plugins: authentication, security, logging, observability...

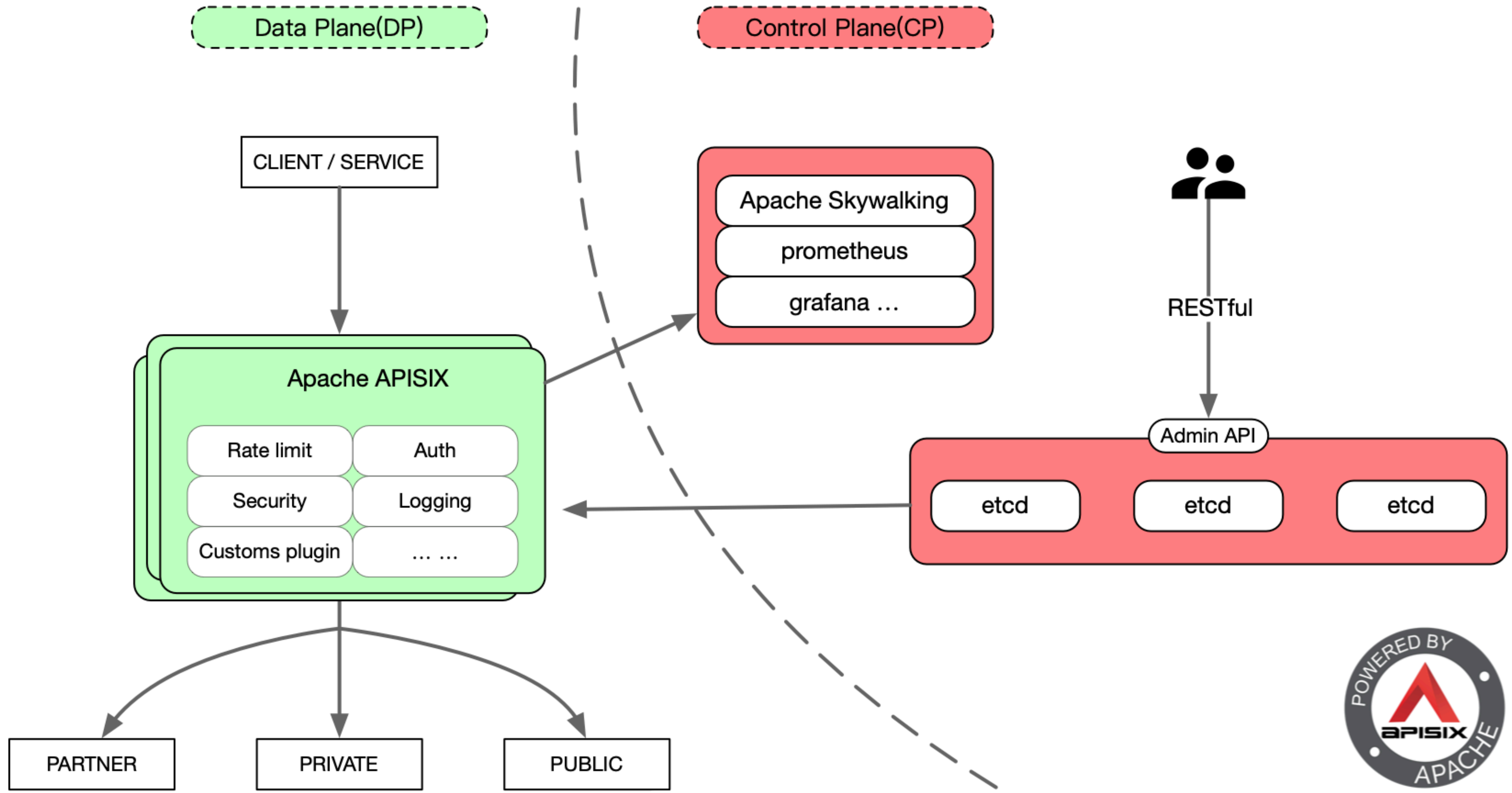


What can Apache APISIX do?

- Handle L4、L7 traffic: HTTP、HTTPS、TCP、UDP、MQTT、Dubbo、gRPC...
- Replace Nginx to handle north-south traffic
- Replace Envoy to handle east-west traffic between services
- k8s ingress controller
- Use MQTT plugin as IoT gateway
- Use IdP plugin as Zero-Trust gateway



Technology Architecture



Source

Protocol

Cloud-Native API Gateway

Applications



HTTP2 gRPC
HTTP(S)

Tars Dubbo
TCP

UDP
MQTT QUIC



AI-Plane



Dashboard



Monitoring

Authentication

Logging

Routing

Security

Caching

Custom plugins

Plugin orchestration

etcd

Consul

NETFLIX
EUREKA

NACOS.

DATADOG

Skywalking

Prometheus

OpenID

Grafana

Vault

kafka



aws



Google Cloud



Azure



Alibaba Cloud

ARM



Custom plugin development in API Gateway



Difficulties of gateway implementation

- API Gateway is not an out-of-the-box infra project, which is different from database and MQ
- Custom development: old systems, special protocols (finance, security, etc.)
- Dozens of plugins, unable to meet all the needs of the enterprise
- Different open source projects have different solutions to this



Kong

- Native Support: Lua plugins
- Few developers are familiar with Lua
- Solution: Go plugin



Envoy

- C++ filter: difficult to get started
- Lua filter: Few features, few developers can write Lua
- Solution: WASM, not good enough in the short term



Apache APISIX

- Both Kong and Envoy's solutions are want more developers to develop plugins
- We are looking for silver bullet!
- solving the following two problems:
 - 1. Most custom plugins are very simple, how to reuse existing plugins?
 - 2. Let the demand side (PM, OPS, Sec) realize the demand at zero cost as much as possible



1. How to reuse exist plugins?

- Micro-plugin: one plugin only do one think, less is more
- Problem: Existing gateway plug-ins are independent of each other, do not share context, so cannot cooperate with each other
- Need a design like “Linux pipe” to connect the micro plugins:
 - uri blocker | if blocked | kafka
- The permutation of more than 40 plugins have unlimited possibilities, enough to meet user needs



2. Zero Develop Cost

- Non-Developer: No technical background, no programming, but they understand the needs best
- Lower the bar for custom development of API Gateway
- From creativity to creation
- How to solve: GUI, Lego build
- How children learn to program? Scratch



Plugin orchestration



Demo

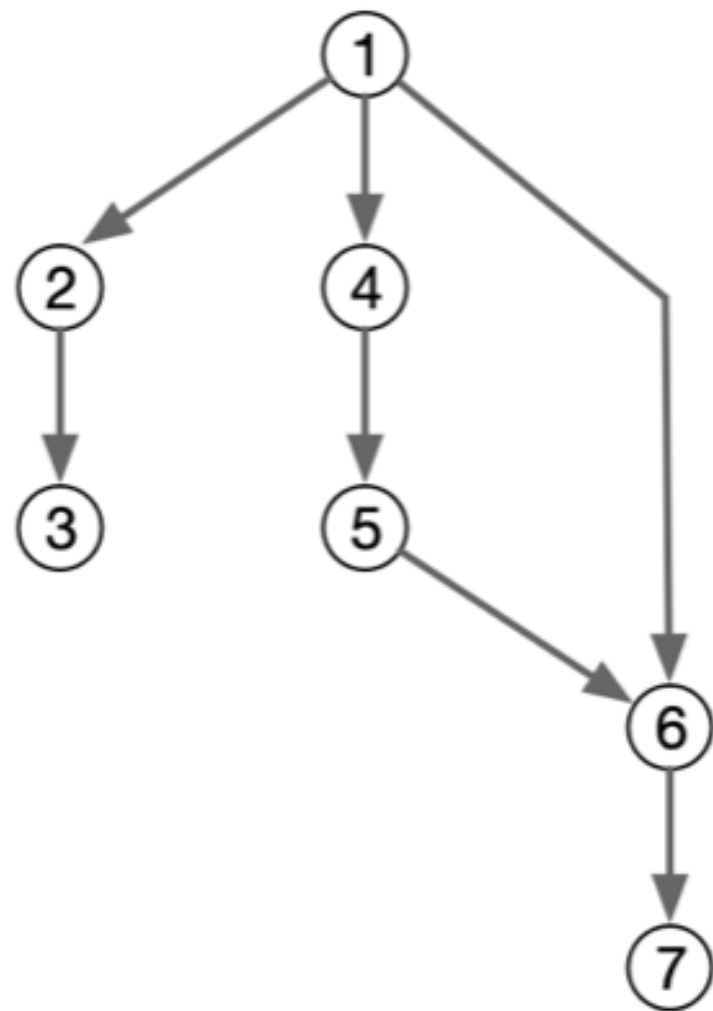
Plugin Orchestration



APISIX

How to implement? Step 1

- use DAG (Directed acyclic graph) for GUI



```
1: [2, 4, 6] # root
2: [3]
3: nil
4: [5]
5: [6]
6: [7]
7: nil
```



- JSON of DAG

```
"script": {
  "rule": {
    "root": "c8152dec-6b88-4e35-bf35-e11f1455ee71",
    "c8152dec-6b88-4e35-bf35-e11f1455ee71": [
      [
        "ret == 200",
        "64de9af6-8337-4e40-aabd-1a855fa34e0e"
      ],
      [
        "",
        "5a7ac510-f246-4fa6-8ecd-8fbb3085a0ce"
      ]
    ]
  },
  "conf": {
    "c8152dec-6b88-4e35-bf35-e11f1455ee71": {
      "name": "uri-blocker",
      "conf": {
        "block_rules": [
          "root.exe"
        ],
        "rejected_code": 403
      }
    },
    "5a7ac510-f246-4fa6-8ecd-8fbb3085a0ce": {
      "name": "kafka-logger"
    },
    "64de9af6-8337-4e40-aabd-1a855fa34e0e": {
      "name": "redirect"
    }
  },
}
```



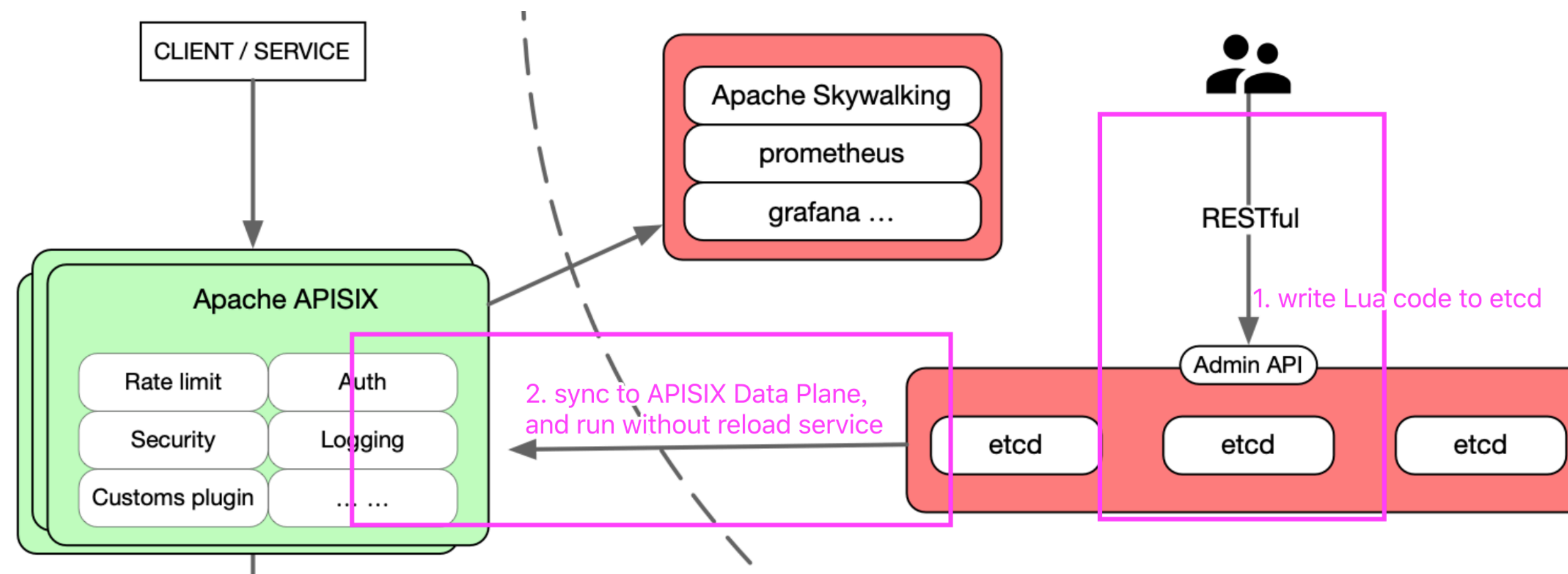
Step 2

- use JSON schema to parse DAG, generate AST(Abstract Syntax Tree)
- Generate Lua codes from AST
- <https://github.com/api7/jsonschema>



Step 3

- Apache APISIX watch and sync Lua code from etcd(like serverless plugin)



More

- Open Source in <https://github.com/apache/apisix-dashboard>
- Online Demo: <http://139.217.190.60/> (Username/Password: admin)



The future of API Gateway



Full Traffic

- North-South API Gateway -> East-West Microservice
- East-west service mesh -> North-south access layer
- Envoy、Kong、Apache APISIX: full traffic access layer
- no longer the traditional functions of Nginx and F5
- Open source projects blooming: BFE、MOSN



Low Code

- PM can directly implement features by plugin orchestration
- developers pay more attention to core of gateway, performance
- Finally, the business and the core of API gateway are decoupled
- maximize the business value of the API Gateway



Real-time

- 5G、IoT
- k8s
- Configuration takes effect in real-time
- Request real-time processing
- Real-time data analysis



OpenSource

- Software eats hardware, open source software eats software
- the same as API Gateway
- No vendor lock-in



<https://github.com/apache/apisix>

