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CloudNativeCon
OPEN SOURCE SUMMIT
China 2023

Envoy Gateway: The API Gateway in the Cloud Native Era

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Envoy as a Layer-7 Proxy

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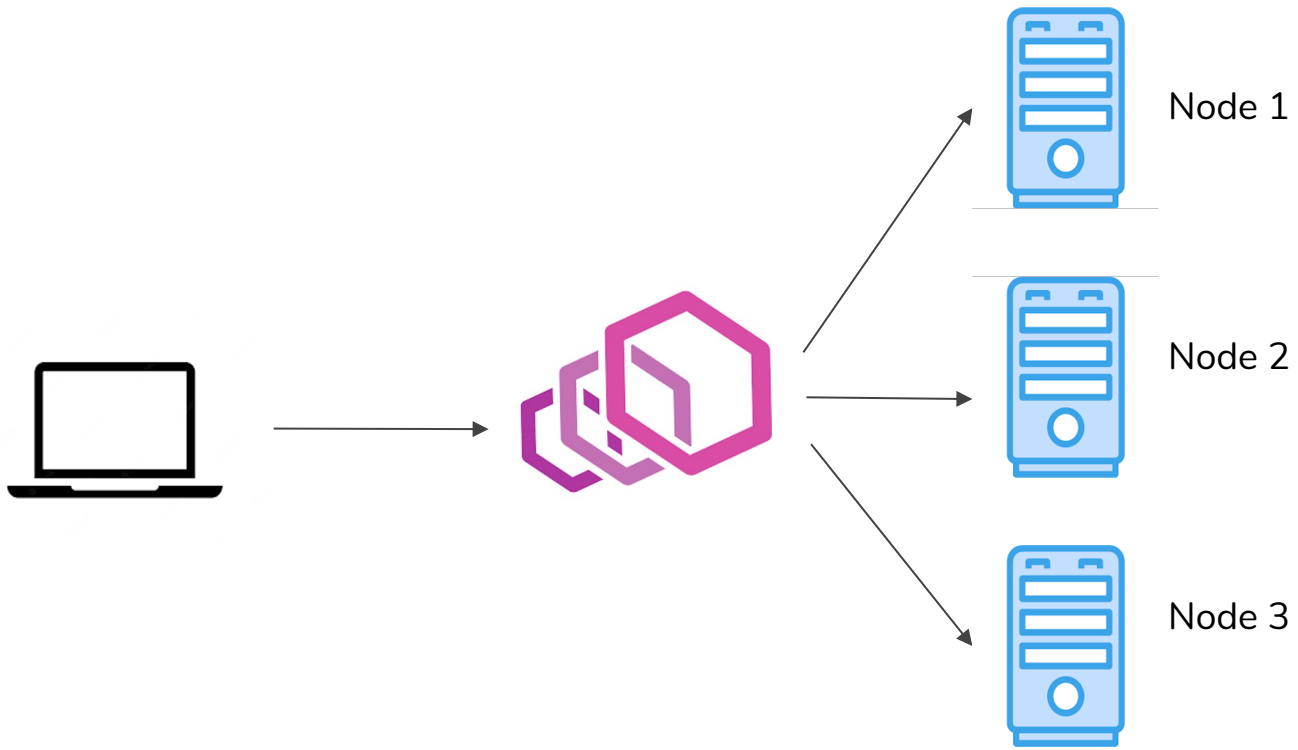
Envoy 是一个为 云原生应用 设计的开源 边缘 和 服务代理 - 摘自 Envoy 官方网站。

Envoy 的设计理念：（七层）网络通信应对业务逻辑透明

- 负载均衡
- 超时、重试
- 断路器
- 七层路由
- 调用追踪
- 访问日志
- 请求指标
- 安全通信
- 访问控制



Created for Cloud-Native

Envoy 与 “传统” 网络代理的本质区别：为云原生架构而生！

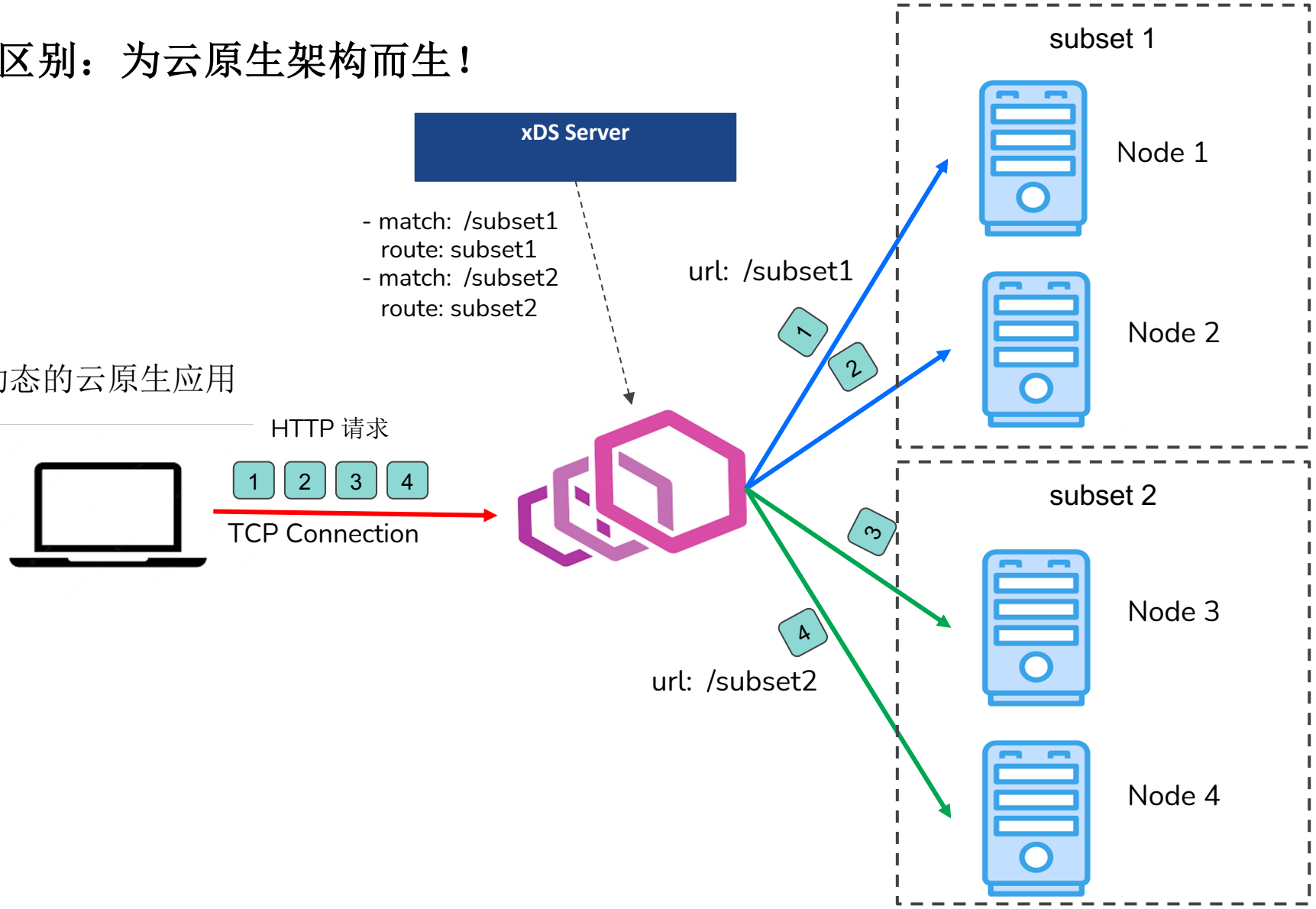
云原生架构的特点：

- 系统由大量微服务构成
- 是“牲口”而不是“宠物”
- 微服务可以动态伸缩

“传统”网络代理的静态配置难以适应高度动态的云原生应用

Envoy 支持动态获取配置

- 服务实例
- 路由配置
- 安全策略
- ……



Created for Cloud-Native

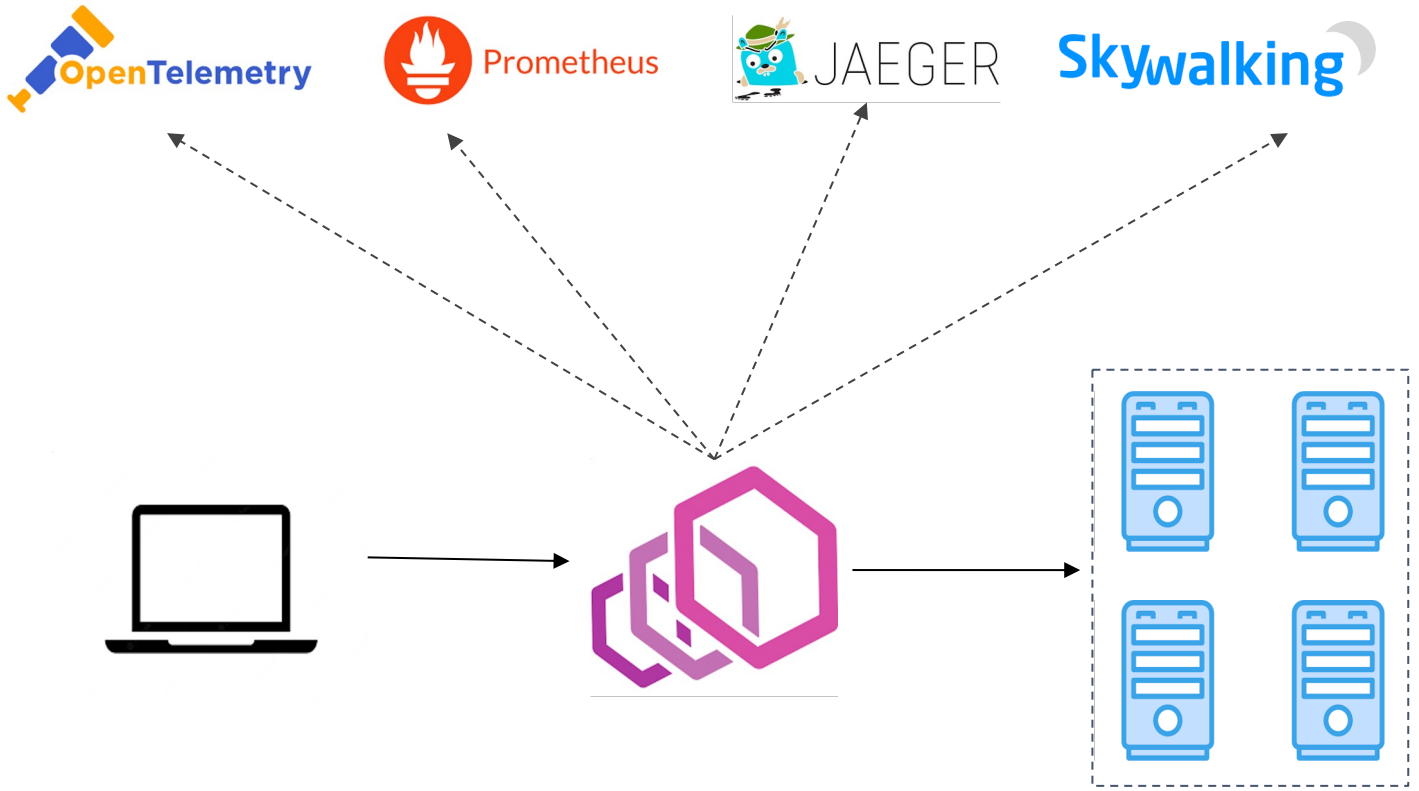
内建 Metrics、Logging、Tracing 支持，快速定位系统故障

云原生应用可观测性挑战：

- 系统包含大量微服务
- 业务调用跨多个 RPC
- 难以查看系统全貌
- 故障定位极其困难

强大的可观测能力：

- OpenTelemetry
- Prometheus
- Jaeger
- GRPC Logging server



Gateway API as Management API

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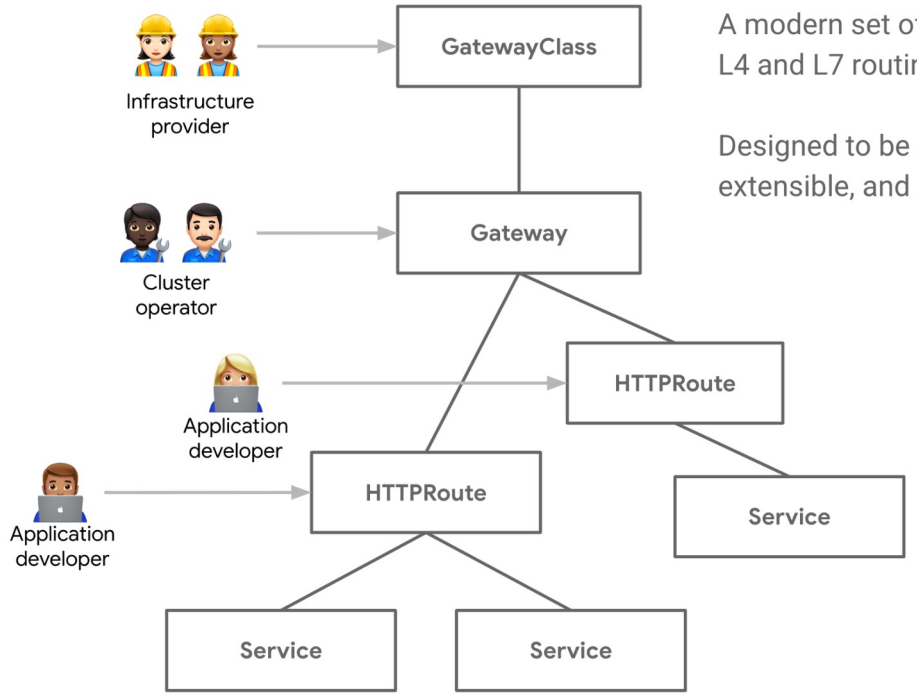
Ingress

```yaml
apiVersion: extensions/v1beta1
kind: Ingress
metadata:
  name: test
spec:
  rules:
    - host: foo.bar.com
      http:
        paths:
          - path: /foo
            backend:
              serviceName: s1
              servicePort: 80
          - path: /bar
            backend:
              serviceName: s2
              servicePort: 80
```

- HTTP host matching
- HTTP path matching
- TLS

Gateway API



A modern set of APIs for deploying L4 and L7 routing in Kubernetes

Designed to be generic, expressive, extensible, and role-oriented

更强大的流量管理能力

- HTTP header-based matching
- HTTP header manipulation
- Weighted traffic splitting
- gRPC,UDP,TCP routing
- Role-oriented resource model

更灵活的扩展机制

- Arbitrary backend
- Custom filters
- Policy Attachment

From Gateway to Service Mesh

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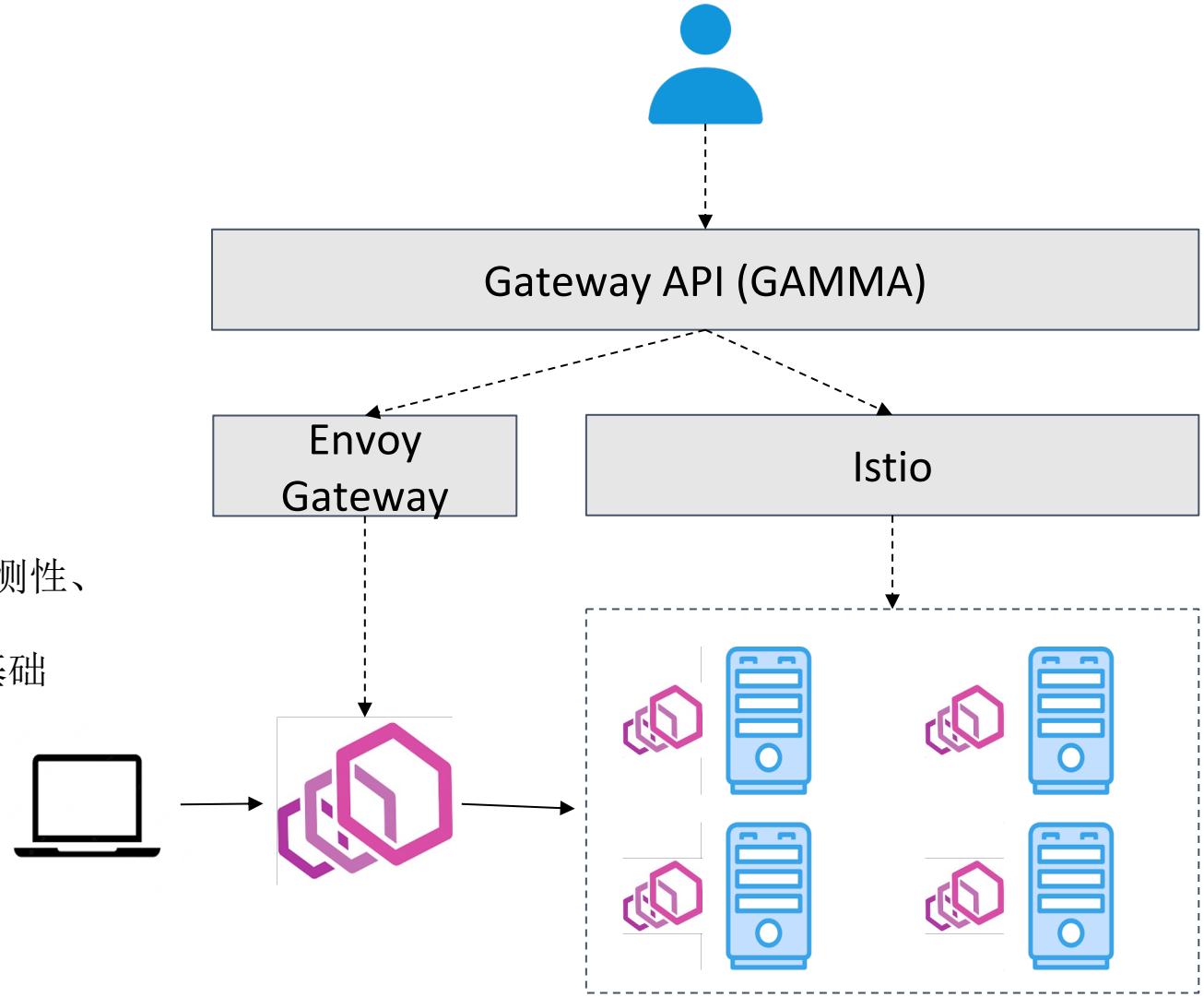
采用 Envoy Gateway 平滑过渡到 Service Mesh

犹豫是否采用服务网格？

- 额外资源占用？
- 应用迁移风险？
- 缺少运维经验？
- 运维团队驱动？

从边缘网关开始！

- 采用 Envoy Gateway 作为边缘网关
- 在边缘网关上获得 Envoy 的所有能力（流量管理、可观测性、应用安全...）
- 熟悉 Envoy 的管理配置，为过渡到 Service Mesh 打好基础
- 标准 Gateway API/GAMMA 提供统一的管理面接口
- 平滑迁移，最大化减小迁移风险



Background of Envoy Gateway

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问题/现状:

- EnvoyProxy 使用门槛高（**xDS、控制面、配置、部署**）
- 围绕**安全、控制平面**和其他**共同关注点**的**存在重复工作**

2022 年 5 月 EnvoyProxy 创始人 Matt Klein

联合 Ambassador Labs, Fidelity, Tetrate, VMware
发起 Envoy Gateway 项目

这样带来的好处？

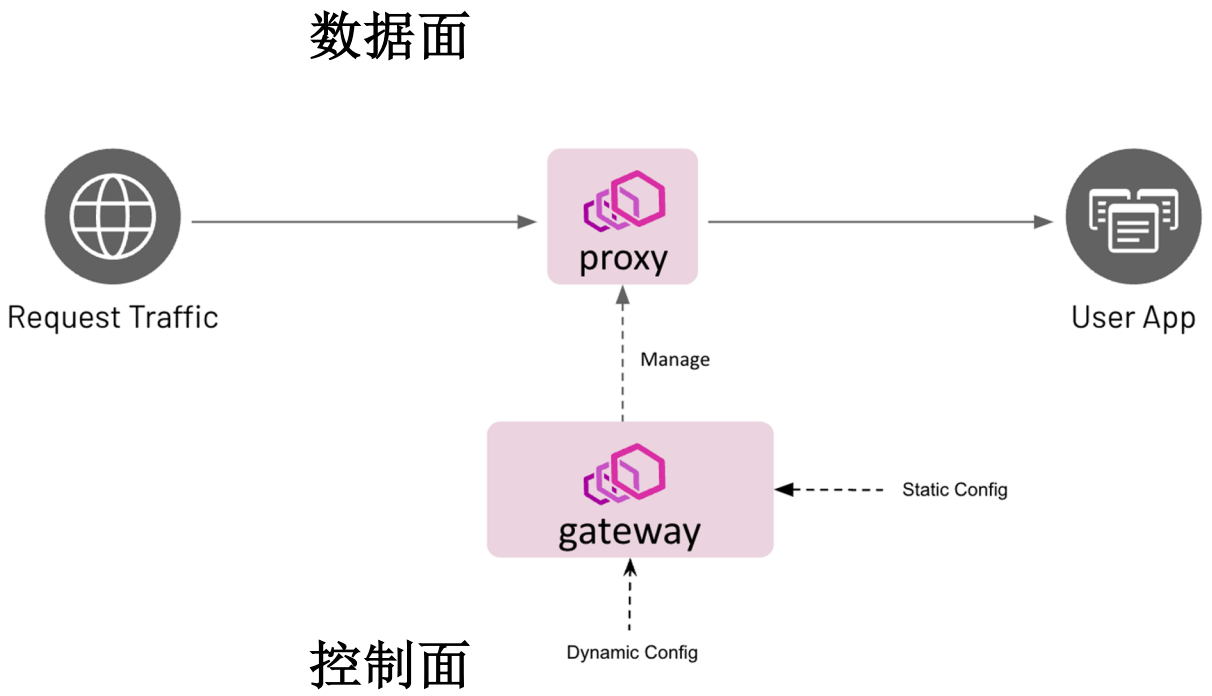
- 供应商专注于以**扩展、管理平面 UI** 等形式上**分层增值功能**
- 形成 **"水涨船高"** 的现象，让全球更多用户，**不管团队规模大小**，技术积累的差异，都能享受 Envoy 带来的好处
- 更多的用户会带来更多潜在客户、更多对 Envoy 核心项目的支持以及更好的整体体验等**良性循环**

合并 CNCF 的 API 网关项目：Contour 和 Emissary，使用 Envoy Gateway 作为其内核，统一 Envoy-based Kubernetes Ingress

Goals / Benefits of Envoy Gateway

Envoy Gateway 的目标

- Expressive API：基于 Gateway API + Envoy-Specific API，提供**简单**且富有**表现力**的 API，**屏蔽 Envoy 底层细节**，让 Envoy 对开发者**开箱即用**
- Batteries included：简化 Envoy 部署和管理，EG 会自动管理 EnvoyProxy 的资源，**GWAPI** 开发/运维/基础设施**关注点分离**
- All environments：支持 Kubernetes 以及非 Kubernetes 环境，额外目标包括支持**多集群**和**各种运行时环境**。
- Extensibility：为供应商和终端用户，提供灵活的扩展机制，如 gRPC Extension Hook、EnvoyPatchPolicy 等，解决通用 API **无法覆盖所有场景**的问题



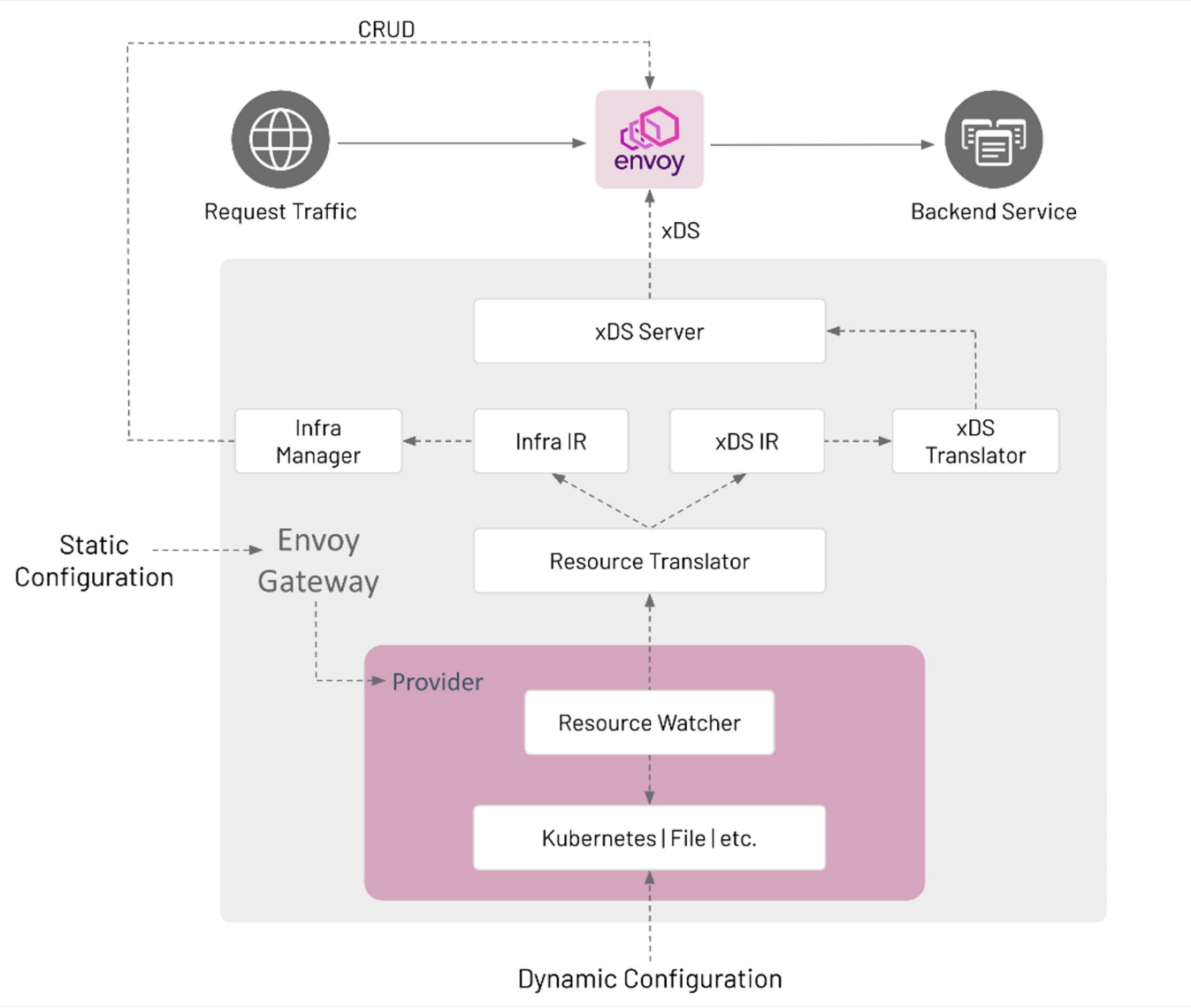
Architecture of Envoy Gateway

Configuration:

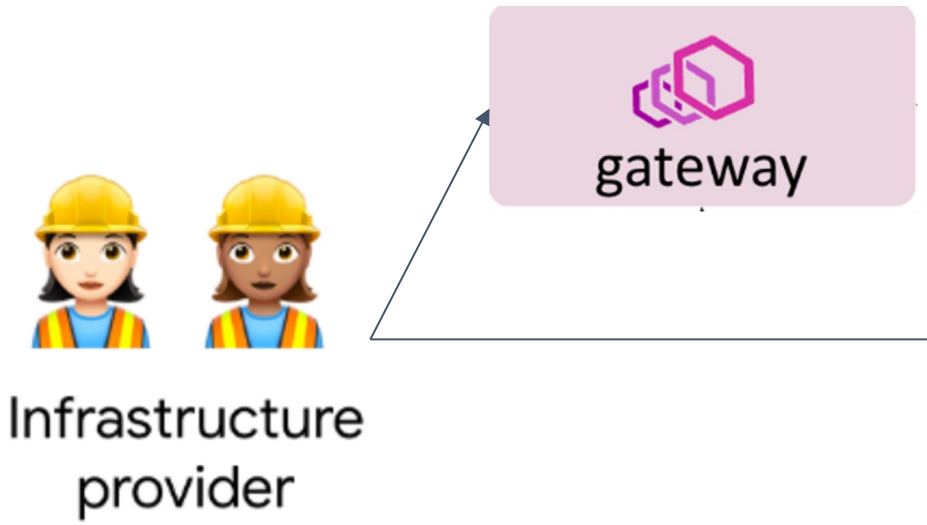
- **Static**: Bootstrap Configuration
- **Dynamic**
  - Infra Management: EnvoyProxy, GatewayClass, Gateway
  - Traffic Routing: xRoute (HTTP, gRPC, TCP, UDP)
  - Extension: EnvoyPatchPolicy

Components:

- **Provider** (Service Discovery, Persist Data)
  - Kubernetes
  - File
- **Resource Watcher**: list/watch dynamic configuration
- **Resource Translator**: translate external configuration to infra/xds IR.
- **Intermediate Representation** (IR):
  - infra IR: data plane infra
  - xds IR: data plane xds configuration
- **xDS Translator**: xds IR to xds Resources
- **xDS Server**: connected to managed data plane envoyproxies.
- **Infra Manager**: infra IR to manage infra resouces.



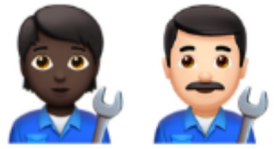
Configure Envoy Gateway




```yaml
kind: GatewayClass
metadata:
  name: eg
spec:
  controllerName:
gateway.envoyproxy.io/gate..
```

Configure Envoy Gateway

Infrastructure provider



Cluster operator

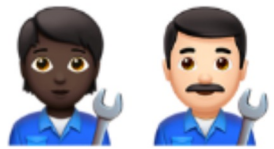
```
kind: GatewayClass
metadata:
  nam
spec:
  con
gatew
```

```
kind: Gateway
metadata:
  name: eg
spec:
  gatewayClassName: eg
  listeners:
    - name: http
      protocol: HTTP
      Port: 8080
```

proxy

Configure Envoy Gateway

Infrastructure provider



Cluster operator

Site Developer

```yaml
kind: GatewayClass
metadata:
  nam
spec:
  con
gatew
```

```yaml
kind: Gateway
metadata:
  name: eg
spec:
  gateway
  listene
    - nam
      pro
      Por
```

```yaml
kind: HTTPRoute
metadata:
  name: backend
spec:
  parentRefs:
    - name: eg
  hostnames:
  - www.example.com
  rules:
   - backendRefs:
     - name: backend
       Port: 3000
```

Roadmap of Envoy Gateway

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- v0.1.0: 设计 Envoy Gateway — 2022年 5 月
- v0.2.0: 建立坚实的基础 — 2022年 10 月
  - 实现核心的 EG 设计
  - 建立测试、e2e、集成等自动化
  - 建立用户与开发者文档
  - 实现自动化 Gateway API Conformance 测试
  - 初步建立完善的 CI/CD 流水线
- v0.3.0: 实现 GWAPI 高级功能 — 2023年 2 月
  - 实现 URLRewrite / Request Mirror / ResponseHeader Modifier 等 Extended Filters
  - 实现 TCP/UDP/gRPC 等 xRoute
  - 实现 ReferenceGrant 权限控制模型
  - 实现 Global Rate Limiting 与 Request Authentication 等扩展能力

Roadmap of Envoy Gateway

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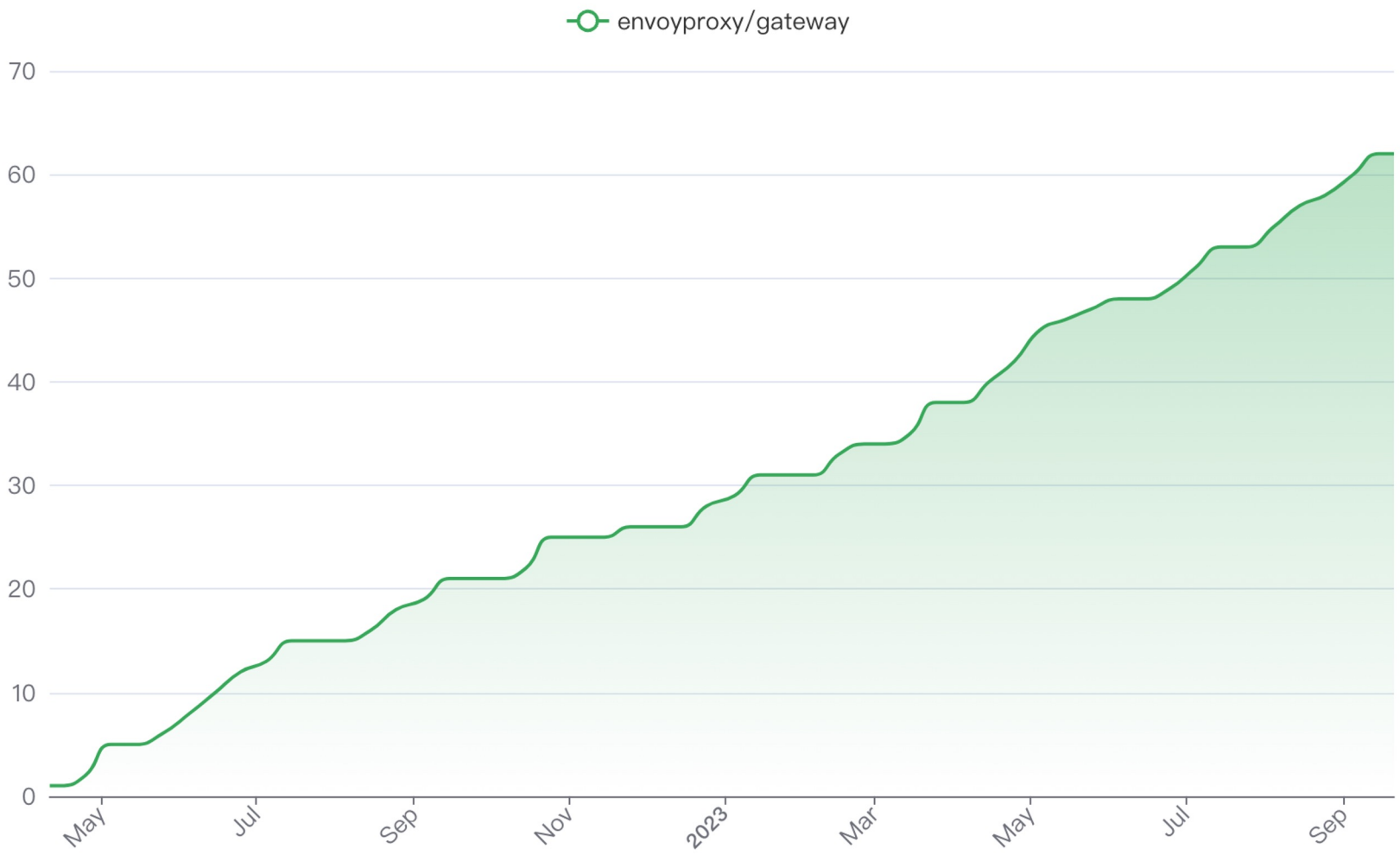
- v0.4.0: 自定义扩展 — 2023年 4 月
  - 实现基于 gRPC 的控制面扩展机制
  - 提供 Helm / egctl 等安装/命令行工具，简化 EG 的使用/安装/运维
  - 实现自定义 EnvoyProxy 的 Kubernetes 资源
  - 实现自定义 EnvoyProxy Bootstrap 配置
- v0.5.0: 可观测性 — 2023年 8 月
  - 实现 Envoy Gateway 数据面的可观测性
  - 实现 EnvoyPatchPolicy 自定义 xDS 资源
- v0.6.0: 为 GA 做准备 — 2023年 11 月
  - 实现 Envoy Gateway 控制面的可观测性
  - Envoy Gateway 性能测试
  - 实现 TrafficPolicy(Client/Server)、Security 等 Policy API 提供更多高级功能
- .....

Thanks To All The Contributors!

- Over 64+ Contributors
- Over 720 + Issues
- Over 1170 + PRs



Get Involved!

Docs: gateway.envoyproxy.io

Project: github.com/envoyproxy/gateway

微信： Liu-Xunzhuo / zhao_huabing