OpenFunction

"云无关的" 函数计算框架的应用探索

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张海立

KubeSphere Ambassador, CNCF OpenFunction TOC Member

驭势科技 UISEE© 云平台研发总监，开源爱好者

云原生专注领域: Kubernetes, DevOps, FaaS, Observability, Service Mesh

zhanghaili

webup

zhanghaili0610

haili.zhang@uisee.com

ServiceUP · 语雀

1️⃣ CNCF OpenFunction 函数计算框架简介

2️⃣ OpenFunction 的一些应用场景探讨

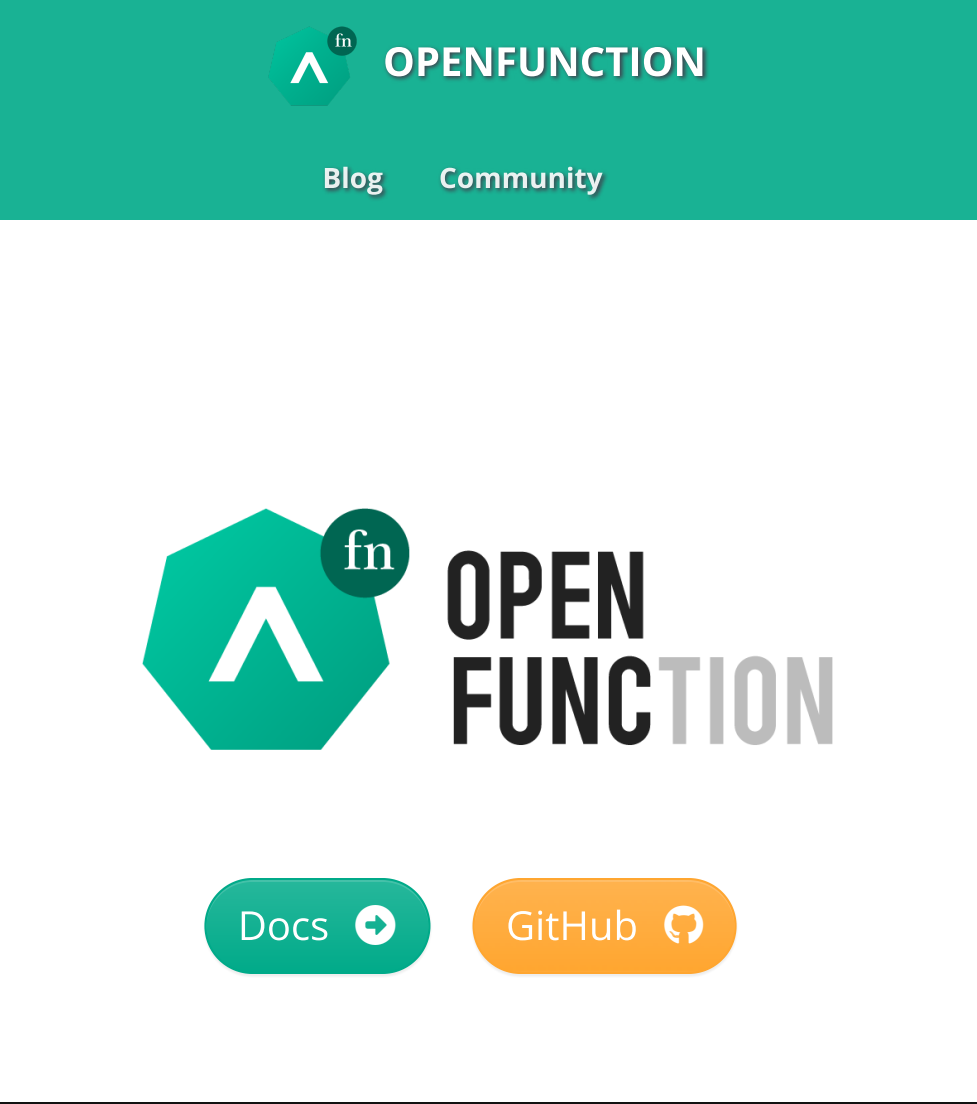
3️⃣ OpenFunction 函数网关的演进及展望

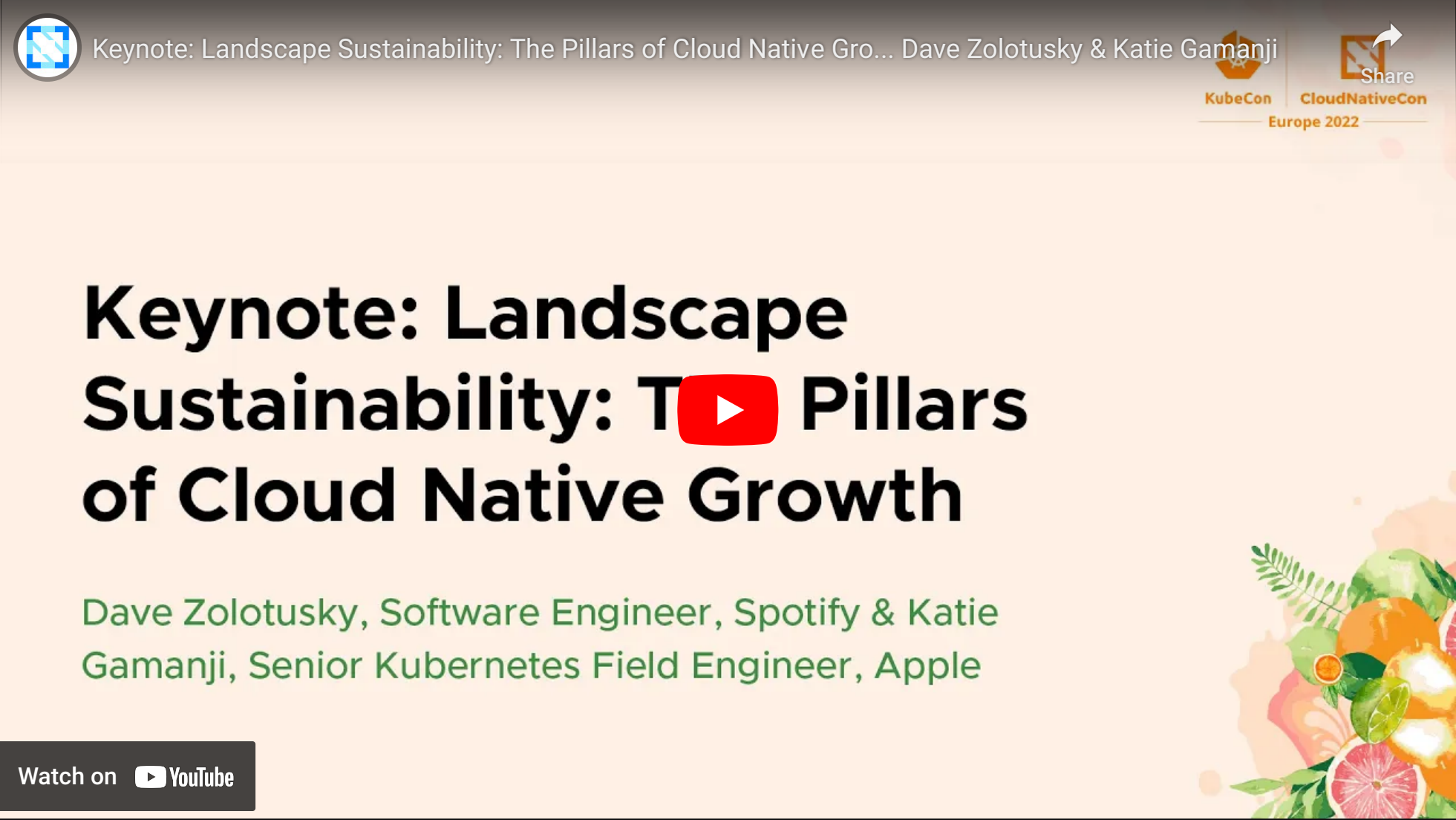
Open? Function!

一个 CNCF Sandbox 函数计算平台项目

OpenFunction 的云原生特性：

- “云无关”：与云商的 BaaS 松耦合
  - 通过 Dapr，简化了对于云商 BaaS 的集成
- 同时支持同步和异步函数
  - 同步函数 Kubernetes Gateway API 支持的高级函数入口和流量管理
  - 异步函数可以直接从事件源消耗事件
- 支持直接从函数源码生成符合 OCI 镜像
  - 基于 Cloud Native Buildpacks 生态实现
- 在 0 和 N 之间灵活的自动缩放
  - 充分利用 KEDA、Knative

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Dave Zolotusky, Software Engineer, Spotify & Katie Gamanji, Senior Kubernetes Field Engineer, Apple
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“云无关”的价值

Cloud Agnostic —— 与云商的 BaaS 解耦

"Serverless computing = FaaS + BaaS." [1]

- 云函数是函数计算的主体
- 各类后端服务是函数实现业务的重要依托

🔒 云商通过提供“托管的”（Hosted）函数计算框架（FaaS）和各类中间件服务（BaaS），把开发者锁定在托管的云平台上。

🤔 即使函数计算框架是跨语言跨平台的，谁又来填补各云商平台 BaaS 服务的接口差异?

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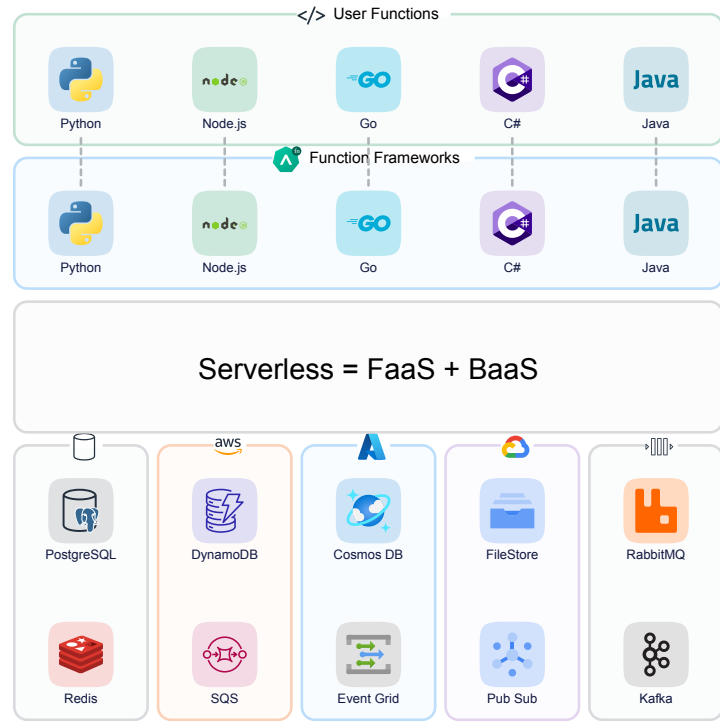
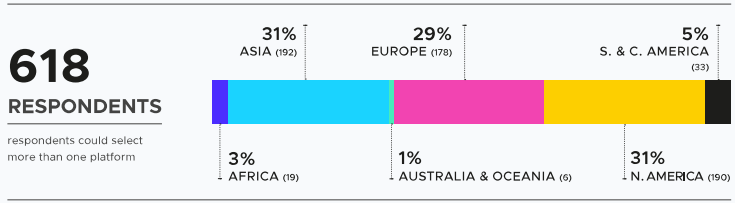
1. Cloud Programming Simplified: A Berkeley View on Serverless Computing. Feb 10, 2019.



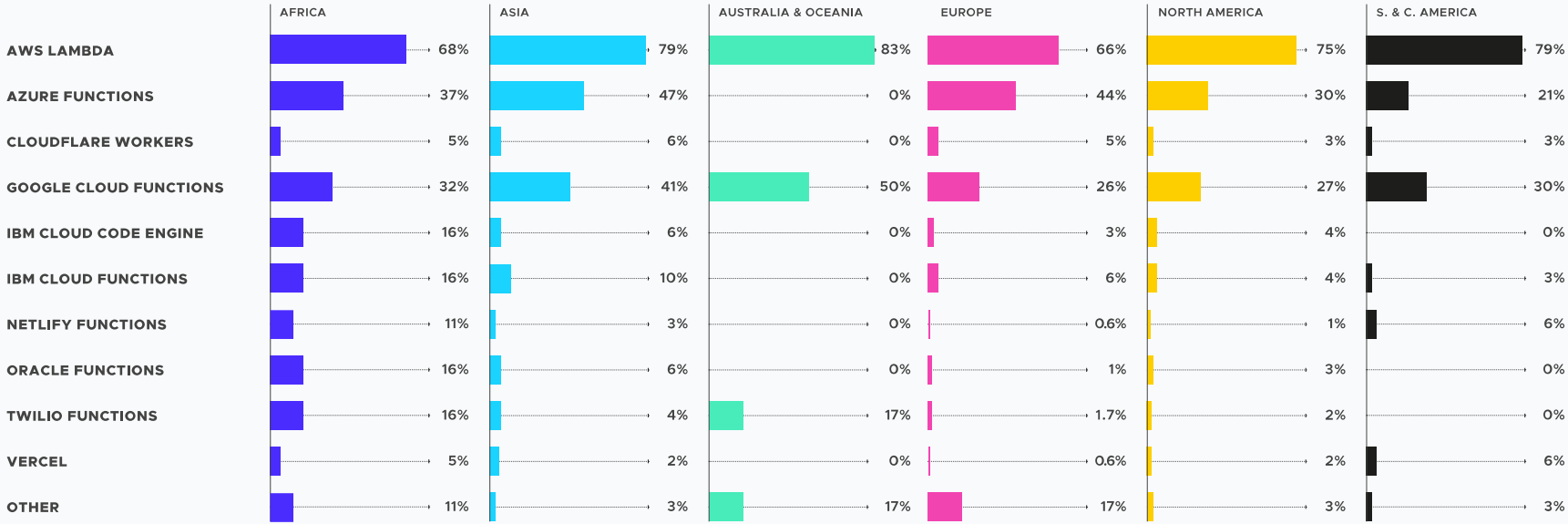
Serverless 平台的战争?

CNCF Annual Survey 2021

"使用 Serverless 技术的受访者，75% 选择了托管平台"

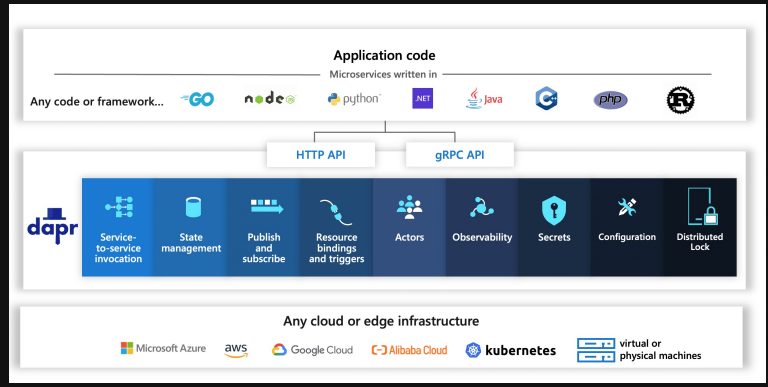


IF YOUR ORGANIZATION IS USING SERVERLESS VIA A 'HOSTED PLATFORM', WHICH HOSTED SERVERLESS PLATFORMS DO YOU USE?



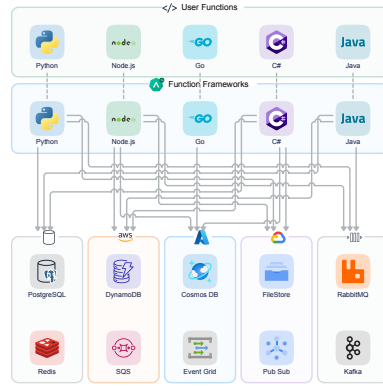
函数？应用！运行时 🎩

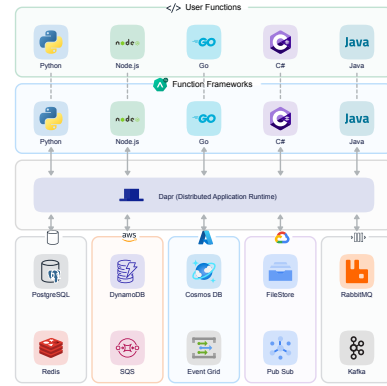
借助 Dapr 来集成各云商平台的 BaaS 服务



Dapr 是一个可移植的、事件驱动的运行时，它使任何开发人员能够轻松构建出弹性的、无状态和有状态的应用程序，并可运行在云平台或边缘计算中，它同时也支持多种编程语言和开发框架。

Dapr 是和平台无关的，这意味着您可以在 Kubernetes 集群、本地或者其它集成 Dapr 的托管环境中运行应用程序。 这使得您能够在云平台和边缘计算中运行微服务应用。





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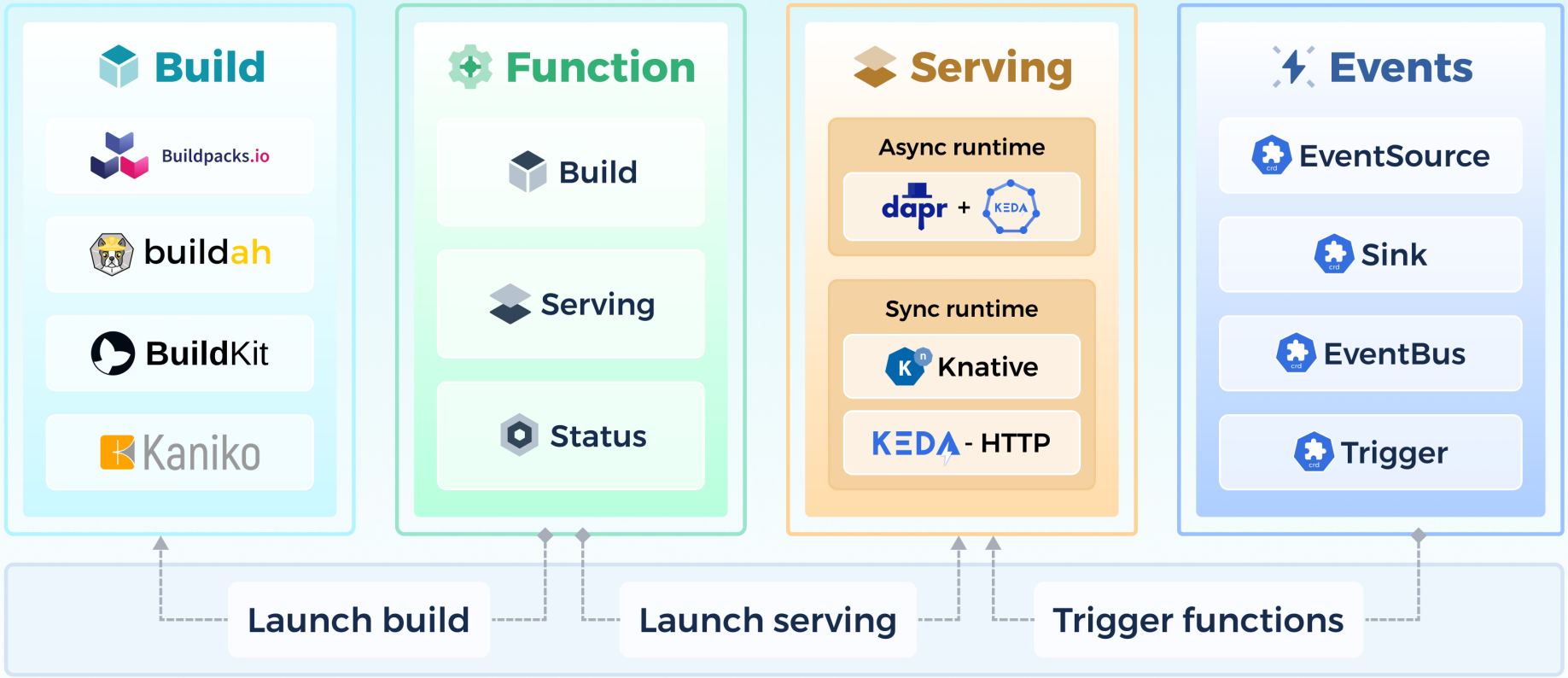
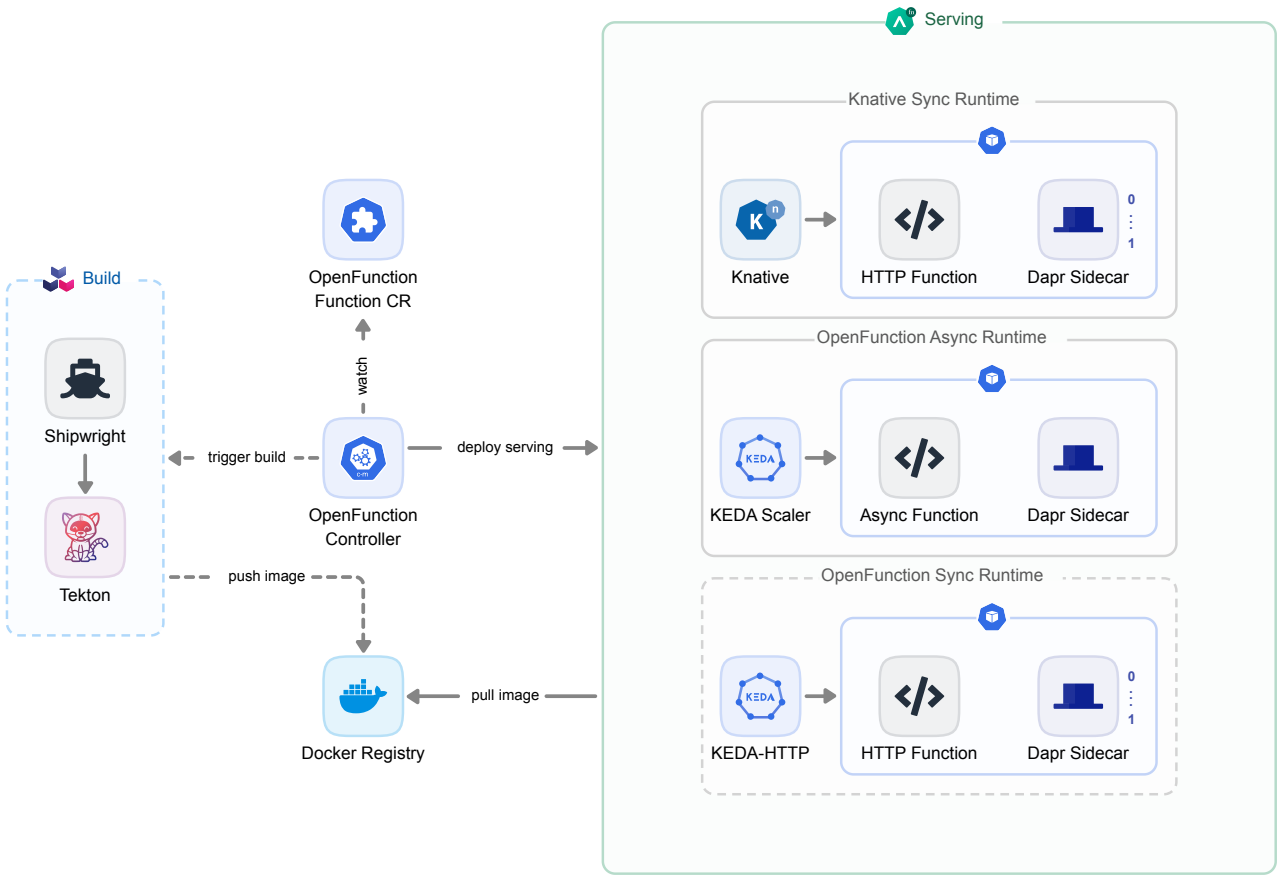
Cloud-Native FaaS Platform

OPEN FUNCTION




Serving
Knative Sync Runtime
Knative
HTTP Function
Dapr Sidecar
0
1
OpenFunction Async Runtime
KEDA Scaler
Async Function
Dapr Sidecar
OpenFunction Sync Runtime
KEDA-HTTP
HTTP Function
Dapr Sidecar
0
1
OpenFunction
Function CR
watch
Build
Shipwright
Tekton
trigger build
OpenFunction
Controller
deploy serving
push image
pull image
Docker Registry

举几个函数的例子 

OpenFunction 现已支持 Go, Node.js, Python, Java, .Net 等多种语言

一个 Node.js 同步函数

INDEX.MJS

```
// Standard Express style HTTP sync function
export const tryKnative = (req, res) => {
  res.send(`Hello, ${req.query.u || 'World'}!`);
};
```

🔍 参见 Express 的 request 和 response 对象的使用

PACKAGE.JSON

```
{
  "main": "index.mjs",
  "scripts": {
    "start": "functions-framework --target=tryKnative"
  },
  "dependencies": {
    "@openfunction/functions-framework": "^0.6.0"
  }
}
```

FUNCTION CR (RAW MANIFEST)

```
apiVersion: core.openfunction.io/v1beta1
kind: Function
metadata:
  name: sample-node-knative
spec:
  version: v2.0.0
  image: '<image-repo>/<image-name>:<image-tag>'
  build:
    builder: openfunction/builder-node:v2-16.15
    env:
      FUNC_NAME: tryKnative
    srcRepo:
      url: https://github.com/OpenFunction/samples.git
      sourceSubPath: functions/async/mqtt-io-node
      revision: main
  # app port default to "8080"
```

🔍 参见 OpenFunction Function CRD 定义

一个 Node.js 异步函数

INDEX.MJS

```
// Standard Express style HTTP sync function
export const tryKnative = (req, res) => {
  res.send(`Hello, ${req.query.u || 'World'}!`);
};

// Async function
export const tryAsync = (ctx, data) => {
  // Function Framework received and parsed "data"
  console.log('Data received: %o', data);
  // Use "send" utility to broadcast data to outputs
  ctx.send(data);
};
```

💡 多个函数可以被放在同一个 JS 文件中，并在 CR 中动态指定

FUNCTION CR (RAW MANIFEST)

```
apiVersion: core.openfunction.io/v1beta1
kind: Function
metadata:
  name: sample-node-async
spec:
  version: v2.0.0
  image: '<image-repo>/<image-name>:<tag>'
  serving:
    # default to knative
    runtime: async
    annotations:
      # default to "grpc"
      dapr.io/app-protocol: http
    template:
      containers:
        - name: function
```

🔍 OpenFunction 函数定义中的输入输出部分：可以直接引用 Dapr Components 的元数据定义

一个可以触发异步函数的 Node.js 同步函数

INDEX.MJS

```mjs
// Standard Express style HTTP sync function
export const tryKnative = (req, res) => {
  res.send(`Hello, ${req.query.u || 'World'}!`);
};

// OpenFunction standard function which could
// set bridge between sync and async function
export const tryKnativeAsync = async (ctx, data) => {
  console.log('Data received: %o', data);

  // Forward HTTP body to Dapr outputs
  await ctx.send(data);

  // Send something back as HTTP response
  // when necessary
  // ctx.res.send(data);
};
```

💡 `openfunction` 函数形态 可以同时支持同步和异步函数

FUNCTION CR (RAW MANIFEST)

```yaml
apiVersion: core.openfunction.io/v1beta1
kind: Function
metadata:
  name: sample-node-knative-async
spec:
  version: v2.0.0
  image: '<image-repo>/<image-name>:<image-tag>'
  serving:
    runtime: knative
    params:
      FUNCTION_TARGET: tryKnativeAsync
      FUNCTION_SIGNATURE_TYPE: openfunction
    outputs:
      - name: mqtt-output
        component: mqtt-out
        operation: create
```

💡 此场景中 Function CRD 只生效 `outputs` 输出部分

案例分享：数据桥接

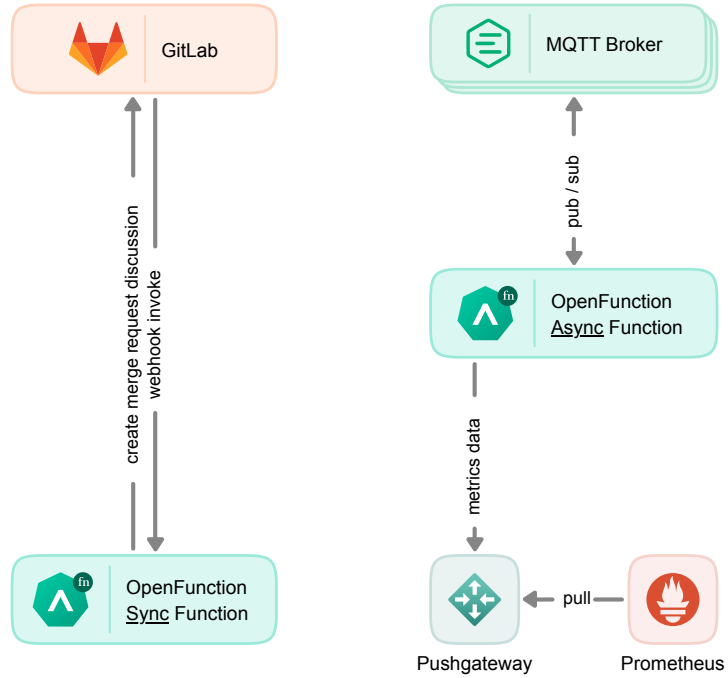
OpenFunction 简化数据预处理

同步：GITLAB WEBHOOK ➡️ CHATOPS

```
import (
  // ...
  "github.com/OpenFunction/functions-framework-go
  "github.com/xanzy/go-gitlab"
)

var GitlabClient *Client

func init() {
  functions.HTTP("HelloWorld", SendBeginUnittest,
```

异步：消息队列实时数据 ➡️ PROMETHEUS 指标

```
  "github.com/prometheus/client_golang/prometheus
)

var speedGauge prometheus.Gauge

func init() {
  speedGauge = prometheus.NewGauge(prometheus.Gau
    Namespace: namespace,
    Subsystem: subsystem,
    Name:      "speed",
    Help:      "vehicle speed",
```



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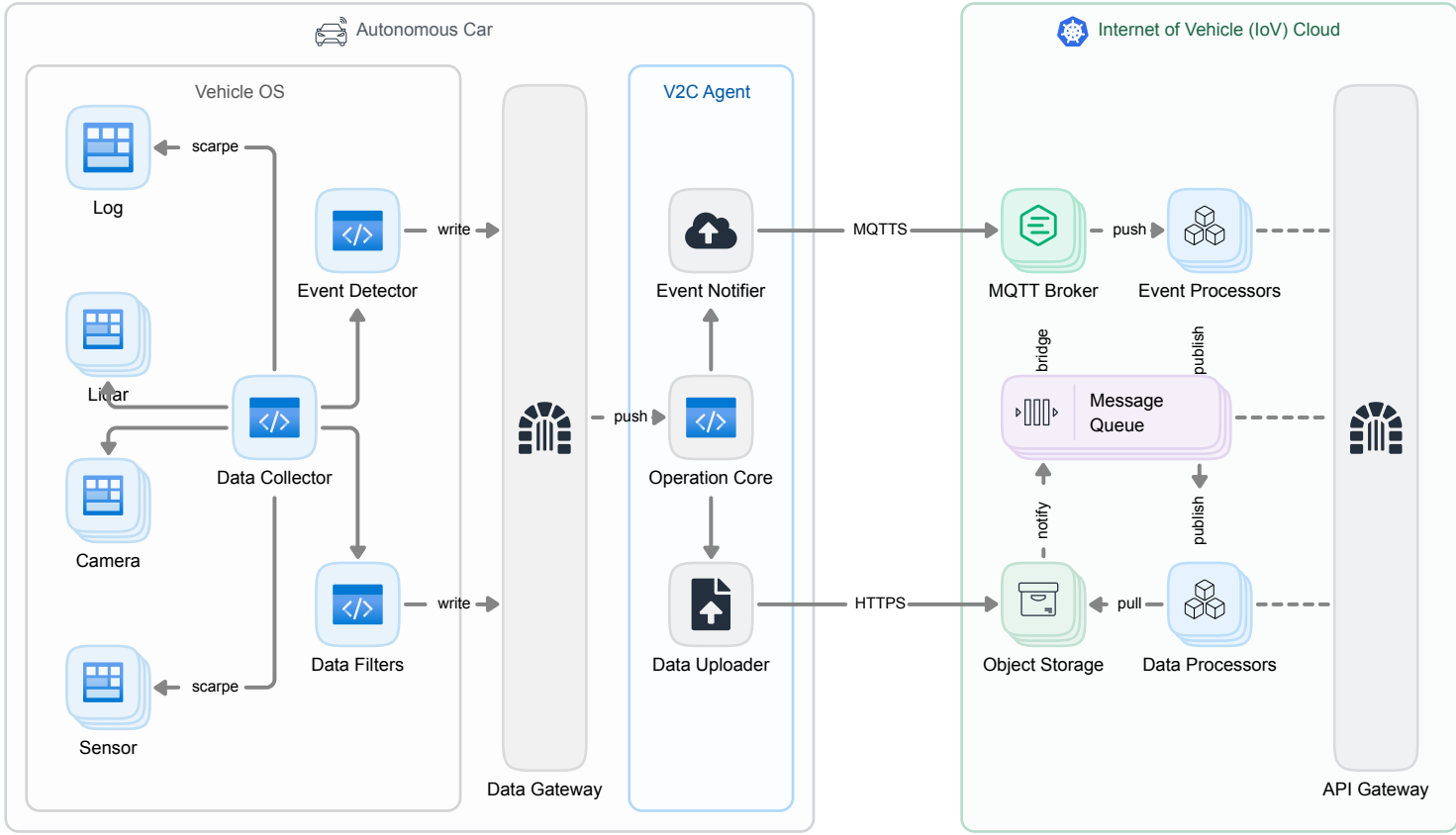
案例分享：实时数据处理

OpenFunction 在无人驾驶业务中的一种应用


Autonomous Car
Vehicle OS
Log
scarpe
Lidar
Camera
Sensor
scarpe
Data Collector
Event Detector
write
Data Filters
write
Data Gateway
push
V2C Agent
Event Notifier
Operation Core
Data Uploader
MQTTS
HTTPS
Internet of Vehicle (IoV) Cloud
MQTT Broker
push
Event Processors
bridge
publish
Message Queue
notify
publish
Object Storage
pull
Data Processors
API Gateway

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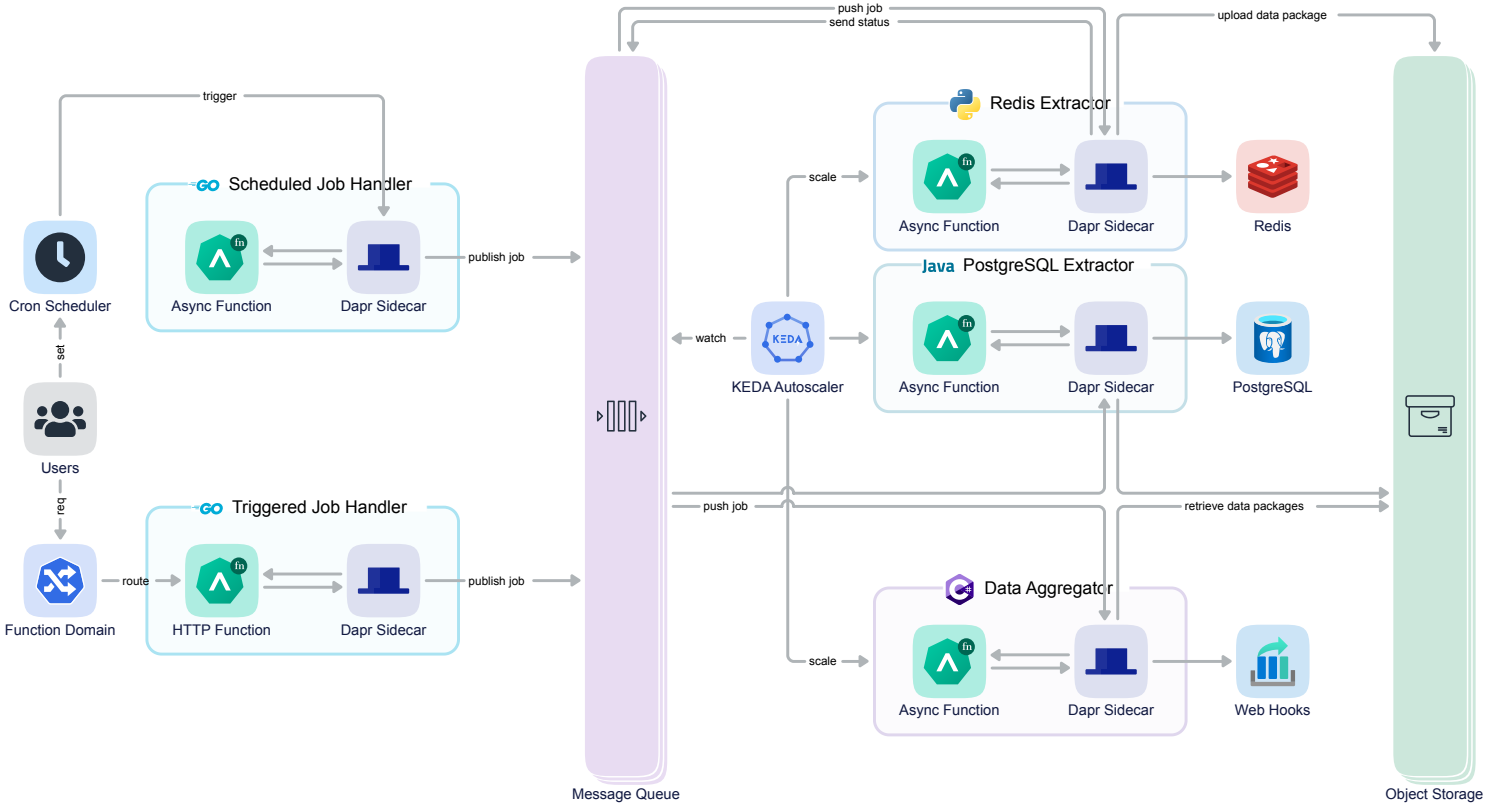

push job
send status
upload data package
trigger
Scheduled Job Handler
Async Function
Dapr Sidecar
publish job
Cron Scheduler
set
Users
req
Function Domain
route
Triggered Job Handler
HTTP Function
Dapr Sidecar
publish job
Message Queue
scale
Redis Extractor
Async Function
Dapr Sidecar
Redis
watch
KEDA
KEDA Autoscaler
Java PostgreSQL Extractor
Async Function
Dapr Sidecar
PostgreSQL
push job
retrieve data packages
scale
Data Aggregator
Async Function
Dapr Sidecar
Web Hooks
Object Storage

聊一聊函数网关 

如何让同步函数可以更方便和更灵活的被访问?

基于 Ingress 的网关

OpenFunction 0.5.0 - 0.6.0 中可使用

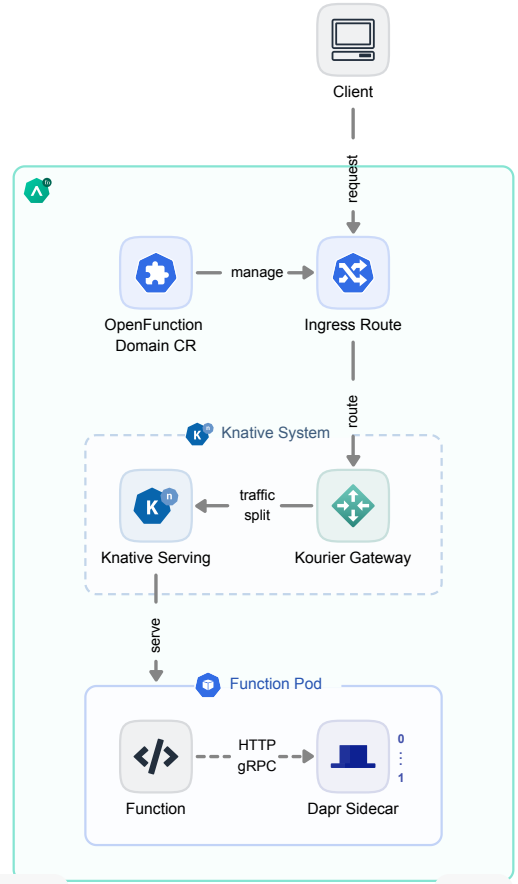
🚧 每个函数对应的 Service 不便于外部直接访问，如 `sample-serving-d55zz-ksvc-gd64w`

💡 直接的想法：由 Ingress 统一函数访问入口

👷 通过 Domain CR 为 Knative 同步函数提供 Ingress 访问入口：`http://<domain_name>.<domain_ns>/<function_ns>/<function_name>`

😵 这个方案可用，但也存在一些问题：

- 强依赖于 Knative 的网关（OpenFunction 默认随 Knative 安装使用 Kourier）
  - Kourier Domain 配置比较麻烦
- 不易适配未来要引入的其它同步函数运行时



基于 Gateway 的网关

OpenFunction 0.7.0 开始可使用

💡 进一步的想法：直接使用 K8s Gateway API

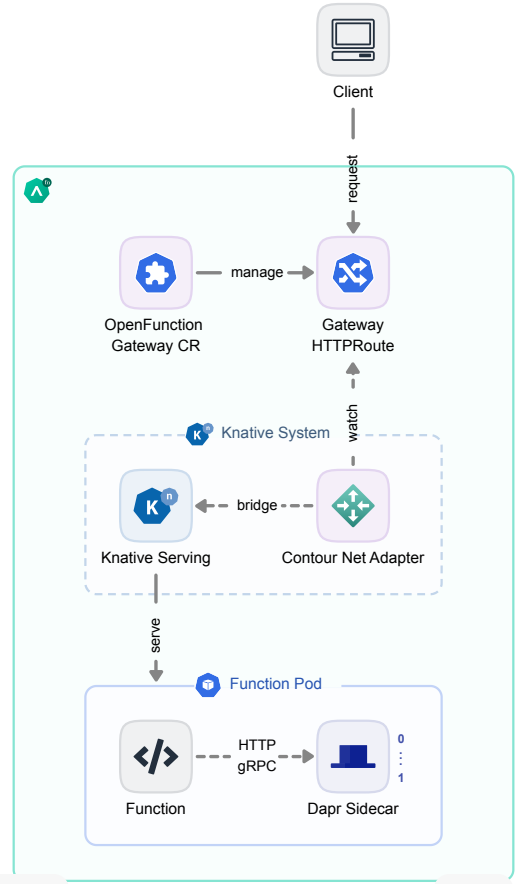
> 更强大更灵活的 Kubernetes 原生网关，越来越多的社区支持：Contour ✅，Istio，Apache APISIX 等等

👷 构建新的 OpenFunction Gateway 体系

> Domain 体系从 OpenFunction 0.7.0 开始被移除

🚀 OpenFunction Gateway 的一些特性：

- 开发者可以自定义函数入口，如 `{{.Name}}.{{.NS}}.{{.Domain}}`
- 开发者可以自定义每个函数的路由规则
- 未来可以支持多个函数版本的流量切分



Apache APISIX®

使用 APISIX Ingress Controller 作为函数网关

- APISIX Ingress Controller 已经从 1.5.0 版本开始 初步支持 Kubernetes Gateway API：
- 需要通过 `enable_gateway_api=true` 开启
- OpenFunction Gateway 所需要的 `HTTPRouteFilter` 计划 在 1.6.0 中支持

💪 APISIX 强大而丰富的插件生态也正在助力 OpenFunction 的应用和发展：

- “最近，APISIX 又新增了不少生态插件，其中就包括与 OpenFunction 集成的无服务插件 `openfunction`“👉 详见 集成细节

Getting Started

What is apisix-ingress-controller

apisix-ingress-controller is yet another Ingress controller for Kubernetes using Apache APISIX as the high performance reverse proxy.

It's configured by using the declarative configurations like ApisixRoute, ApisixUpstream, Ingress. All these resources are

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OpenFunction · Node.js Functions Framework