

云原生图数据库解谜、容器化实 践与 Serverless 应用实操

Graph DB on K8s Demystified and its Serverless applicaiton in actions.

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KCD China 2021
Nov. 6th @Shanghai

古思为

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🗣 [wey-gu](#)

🐦 [wey_gu](#)

👤 [siwei.io](#)



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方闻

- OpenFunction 社区 Maintainer
- 青云科技研发工程师

 [tipiperatgod](https://github.com/tipiperatgod)

 laminar.fun



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Overview

- 了解 K8s 上的 Serverless 计算平台搭建实践：OpenFunction
- K8s 上的图数据库基于 KubeBuilder 的 Operator 实现，解谜图数据库的知识与应用
- 上手 K8s 上的云原生图数据库、从零到一构建 Serverless 架构的智能问答助手

siwei.io/talks/2021-KCD

laminar.fun/talks/2021-KCD

Serverless 简介

什么是 Serverless ? Serverless / FaaS 领域开源现状如何? Serverless 的新愿景?



什么是 Serverless ?



Applications

Web APIs

Event Data
Processing

Future Serverless Applications

Serverless

Cloud
Functions

Object
Storage

Key-Value
Database

Mobile Backend
Database

Big Data
Query

Big Data
Transform

Messaging

Future Serverless
Cloud Services

Base Cloud
Platform

VM

VPC

Block
Storage

IAM

Billing

Monitoring

Hardware

Server

Network

Storage

Accelerator



Serverless / FaaS 领域开源项目现状

现有开源 FaaS 项目：绝大多数启动较早，大部分都在 Knative 出现前就已经存在了

Knative：非常杰出的 Serverless 平台，Knative Serving 仅仅能运行应用，不能运行函数，还不能称之为 FaaS 平台

Knative Eventing：非常优秀的事件管理框架，但设计有些过于复杂，用户用起来有一定门槛

OpenFaaS：比较流行的 FaaS 项目，但是技术栈有点老旧，依赖于 Prometheus 和 Alertmanager 进行 Autoscaling，也并非最专业和敏捷的做法

近年来云原生 Serverless 相关领域陆续涌现出了很多优秀的开源项目：

KEDA、Dapr、Cloud Native Buildpacks (CNB) 、Tekton、Shipwright



Serverless 新愿景

新一代开源函数计算平台 - 契机

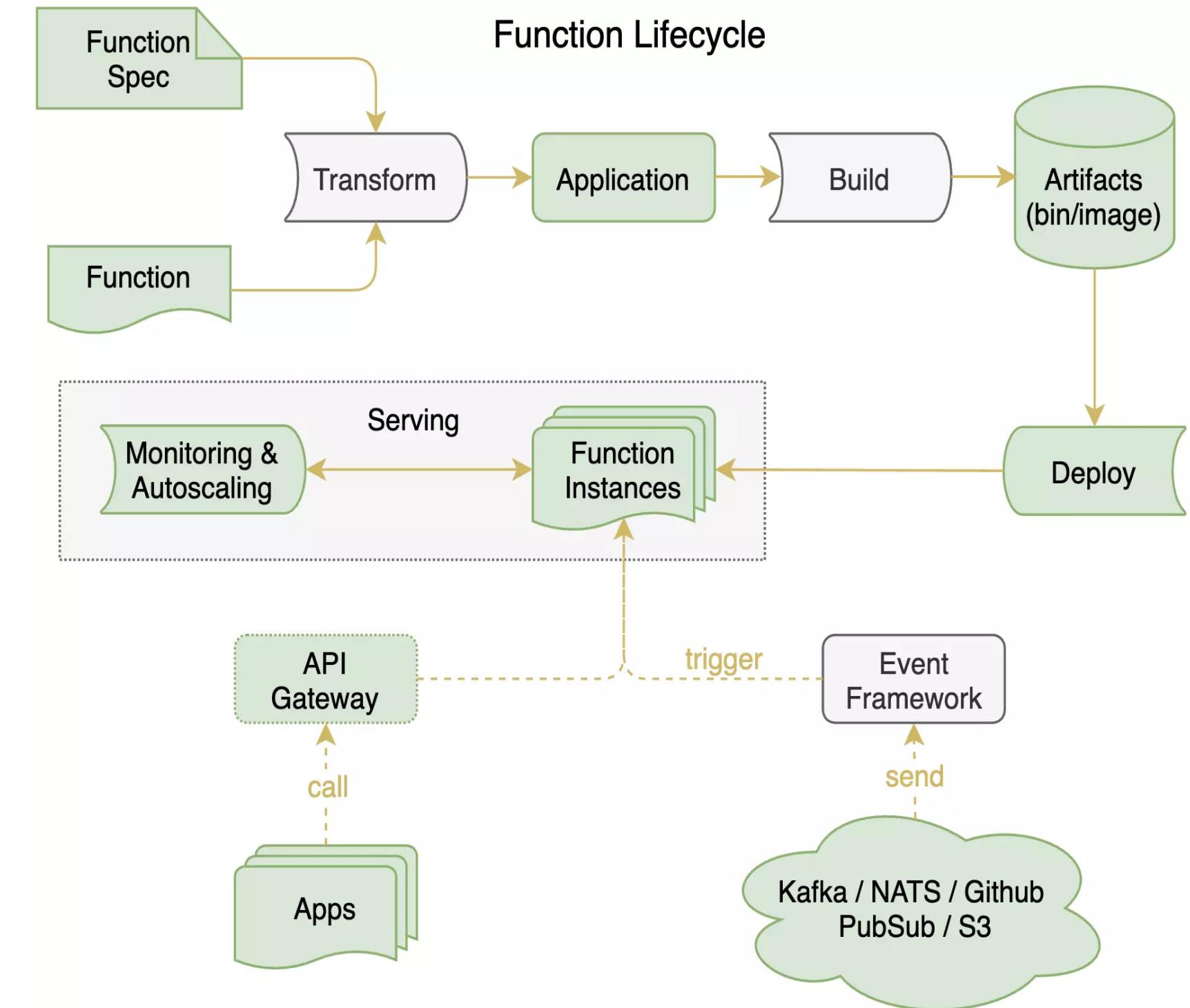
现有开源 Serverless 或 FaaS 平台并不能满足构建现代云原生 FaaS 平台的要求

- 开放的云原生框架
- 涌现的优秀项目
- 日新月异的业务模式

云原生 Serverless 领域的最新进展为构建新一代 FaaS 平台提供了可能

Function Lifecycle

新一代开源函数计算平台 - 契机



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Function Framework

```
package userfunction

import (
    "fmt"
    "net/http"
)

// HelloWorld writes "Hello, World!" to the ResponseWriter
func HelloWorld(w http.ResponseWriter, r *http.Request) {
    fmt.Fprint(w, "Hello, World!\n")
}
```

用户函数示例 ▲

函数注册机制 ►

```
package main

import (
    ...
    userfunction "{{.Package}}"
)

func register(fn interface{}) error {
    ...
    if fnHTTP, ok := fn.(func(http.ResponseWriter, *http.Request)); ok {
        if err := functionframeworks.RegisterHTTPFunction(ctx, fnHTTP); err != nil {
            ...
        }
    }
}

func main() {
    if err := register(userfunction{{.Target}}); err != nil {
        log.Fatalf("Failed to register: %v\n", err)
    }
}
```



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Function Build

K8s 弃用 Docker 作为 Container Runtime

不能再以 Docker in docker 的方式以 Docker build 构建镜像

还有什么选择?

如何管理 Build pipeline?

用 Tekton 管理镜像制作流水线

1. 获取源代码
2. 制作镜像
3. 上传镜像

Function Build

如何在这些工具直接进行选择和切换?

- Cloud Native Buildpacks
- buildah
- buildkit
- kaniko

Status Work in Progress go report A+ license Apache-2.0 go.dev reference



SHIPWRIGHT

Shipwright is an extensible framework for building container images on Kubernetes.

Why?

With Shipwright, developers get a simplified approach for building container images, by defining a minimal YAML that does not require any previous knowledge of containers or container tooling. All you need is your source code in git and access to a container registry.

Shipwright supports any tool that can build container images in Kubernetes clusters, such as:

- Kaniko
- Cloud Native Buildpacks
- BuildKit
- Buildah

Available ClusterBuildStrategies

Well-known strategies can be bootstrapped from [here](#). The currently supported Cluster BuildStrategy are:

Name	Supported platforms
buildah	linux/amd64 only
BuildKit	all
buildpacks-v3-heroku	linux/amd64 only
buildpacks-v3	linux/amd64 only
kaniko	all
ko	all
source-to-image	linux/amd64 only



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Function Serving

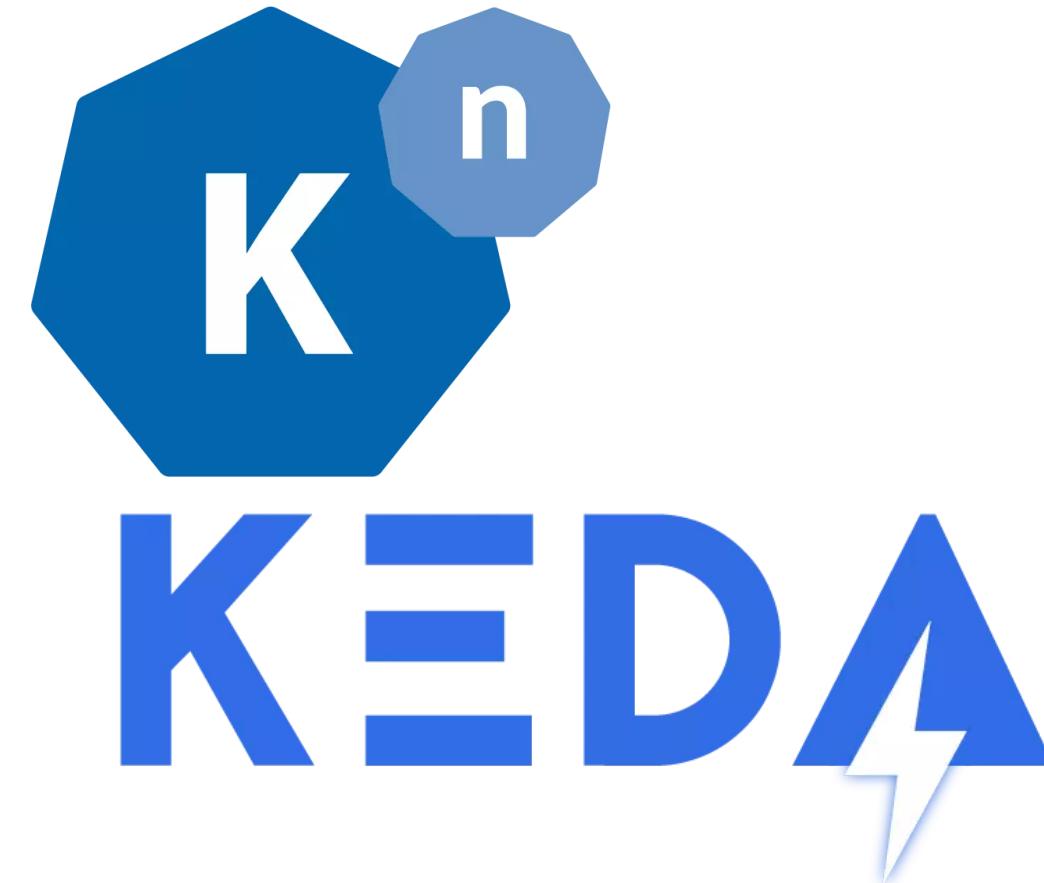
4 种函数调用类型 (CNCF Serverless 白皮书)

Function Serving

同步函数: HTTP / blocking / Req & Resp

运行时:

- Knative Serving
- KEDA + KEDA http-add-on(Beta) + Deployment



异步函数: Event driven

运行时:

- KEDA + Deployment / Job
- Dapr





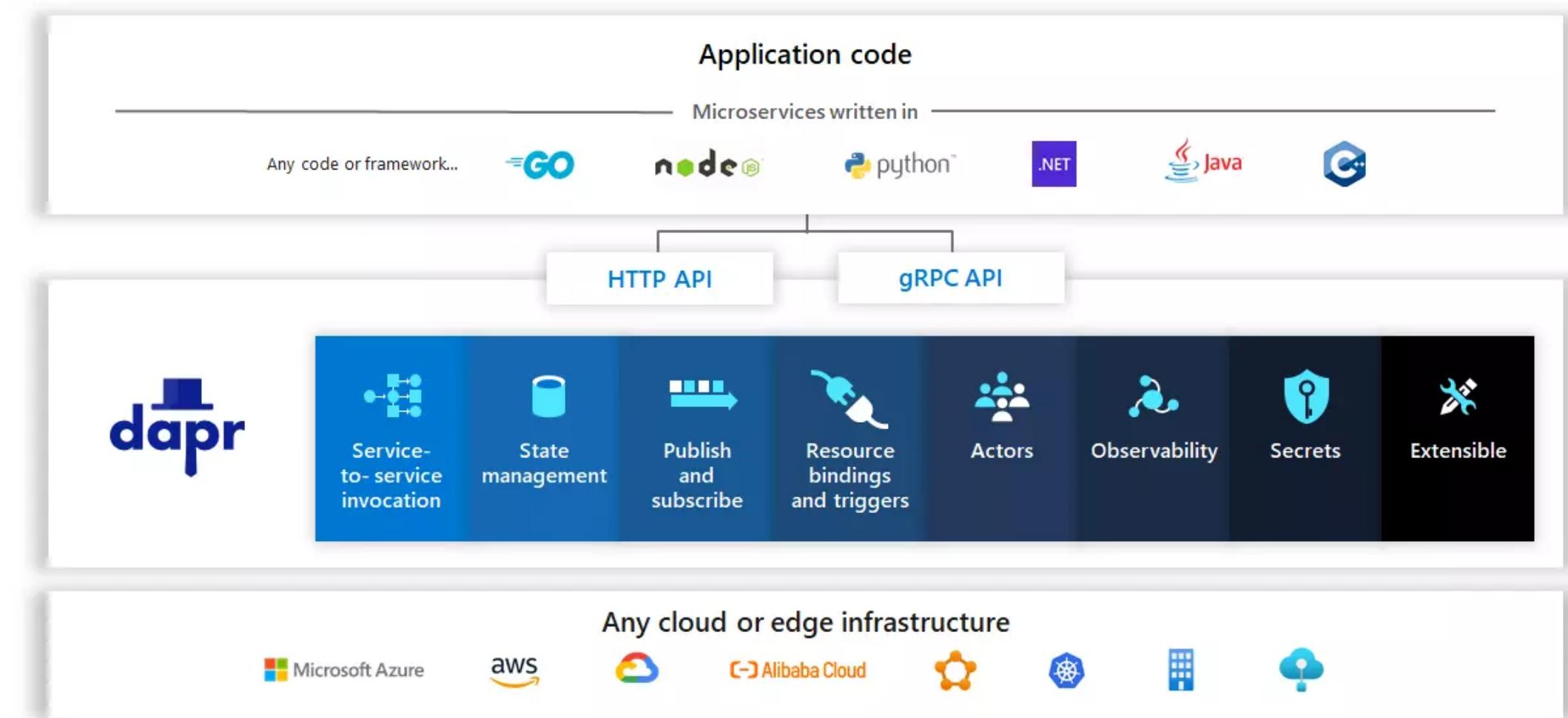
Function Serving - Dapr

- Function Without Dapr

5 种语言 × 10 个 Message Queue = 50 种实现

- Function With Dapr

5 种语言 × 1 个抽象 Message Queue (用 1 种方式即 HTTP/GRPC 对接 10 个 MQ) = 5 种实现



OpenFunction

新一代开源函数计算平台



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OpenFunction 架构图

- core.openfunction.io

Functions | Servings | Builders

- events.openfunction.io

EventSources | Triggers | EventBus(ClusterEventBus)

OpenFunction 案例

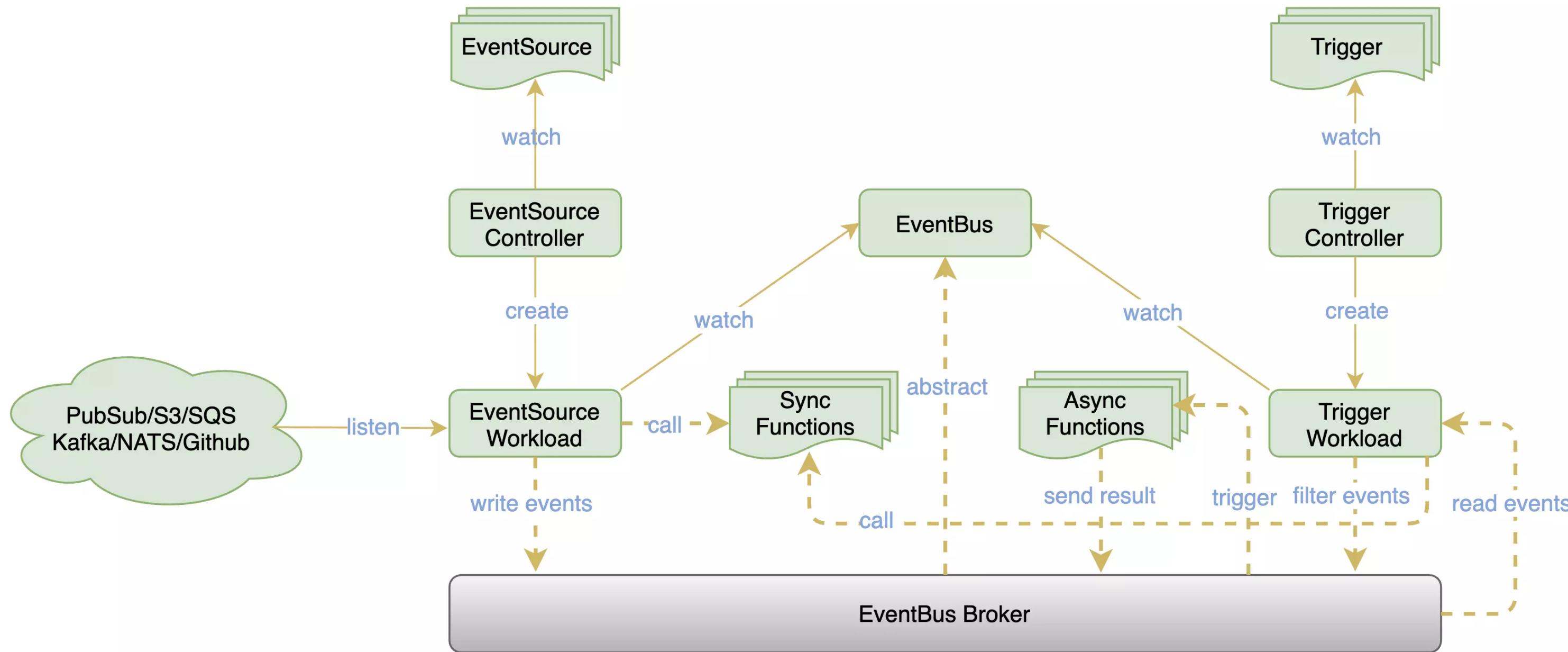
OpenFunction 有哪些应用场景？OpenFunction 还能做什么？

事件管理框架



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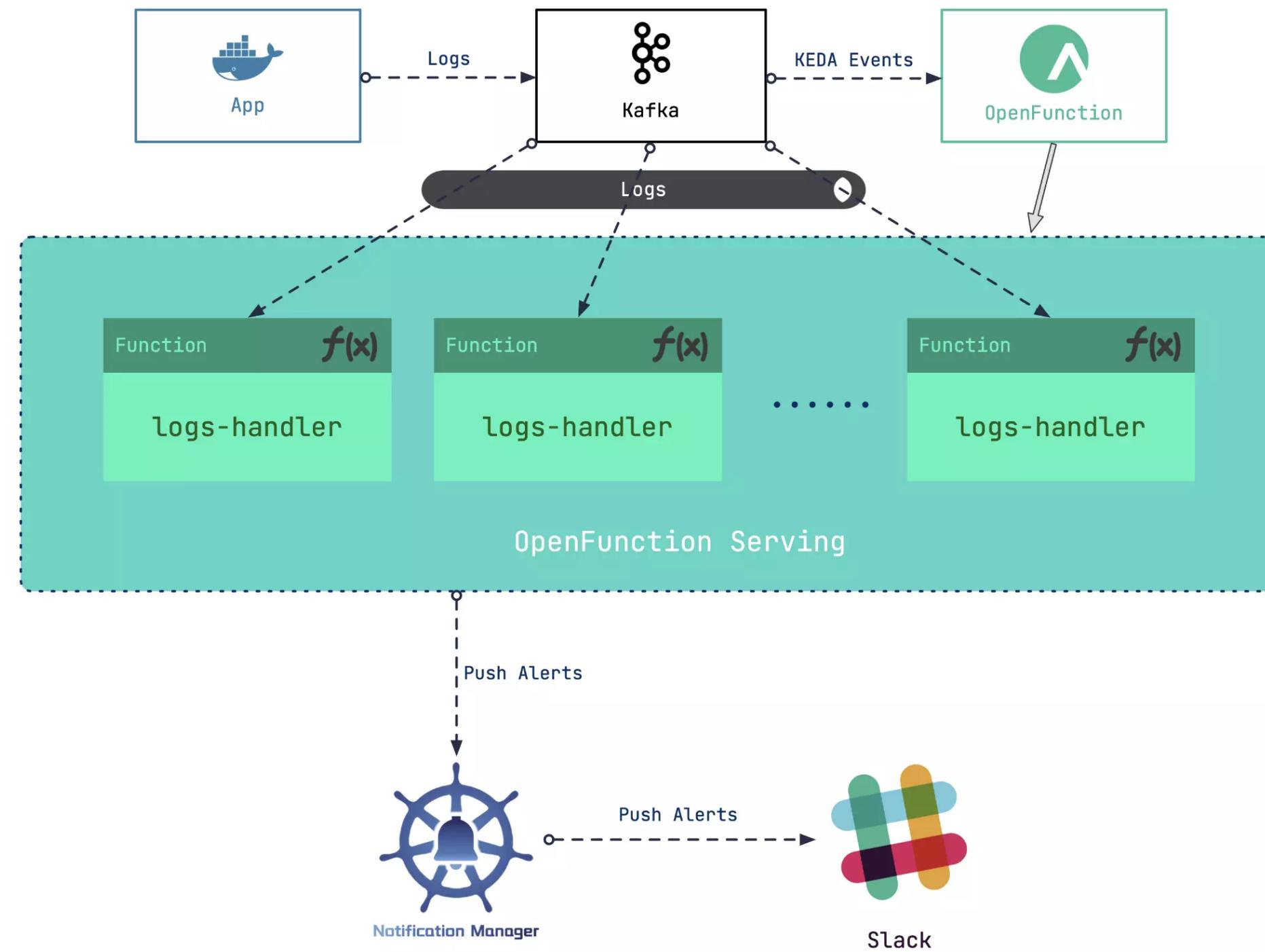
本质上来看，事件框架也是一个由事件驱动的工作负载，那么它本身可以是 Serverless 形式的工作负载吗？
可以用 OpenFunction 的异步函数来驱动吗？



自定义日志告警



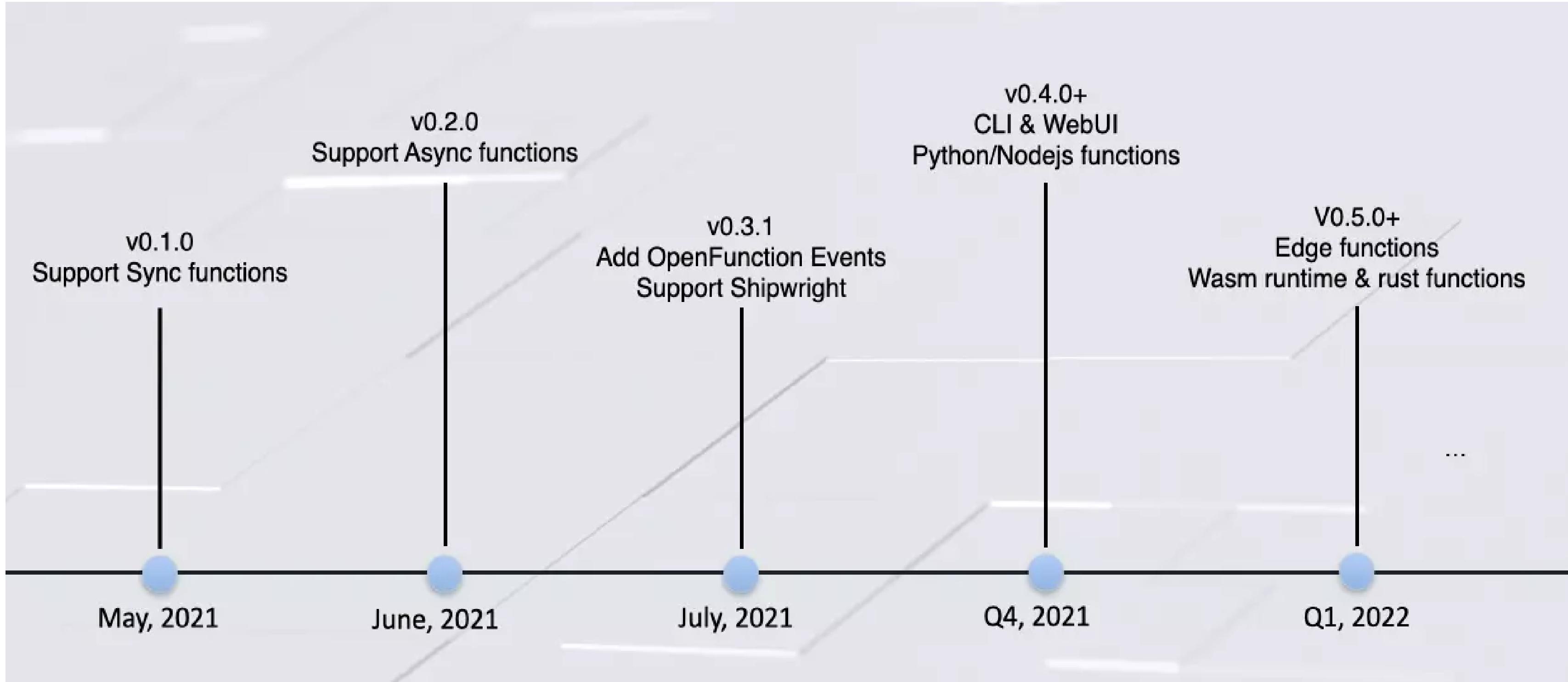
以 Serverless 的方式用 OpenFunction 异步函数实现日志告警



OpenFunction 社区

交流、参与、演进

OpenFunction Roadmap



OpenFunction Community



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TION

→ <https://github.com/OpenFunction>

主要仓库

→ <https://github.com/OpenFunction/OpenFunction>

→ <https://github.com/OpenFunction/functions-framework>

→ <https://github.com/OpenFunction/builder>

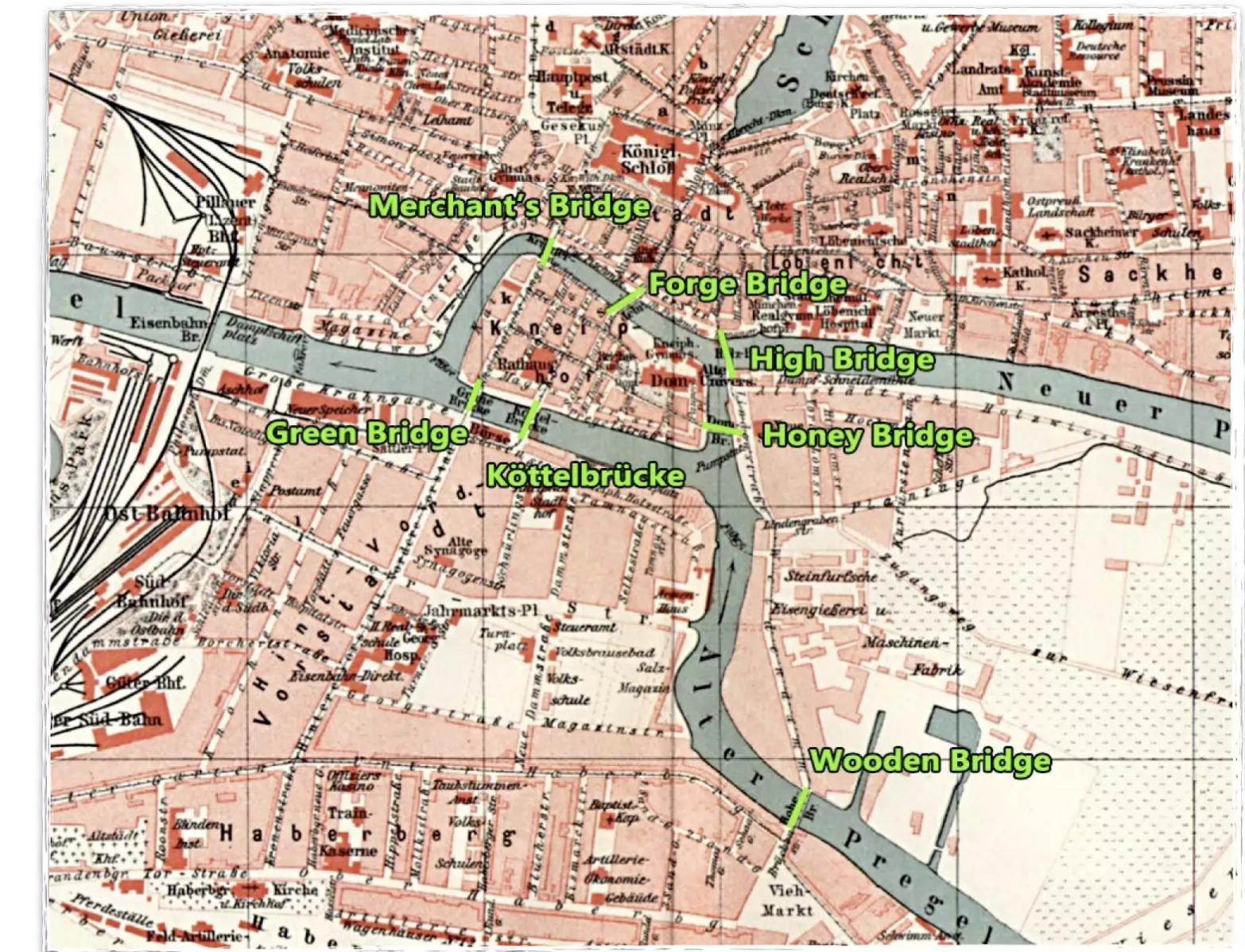
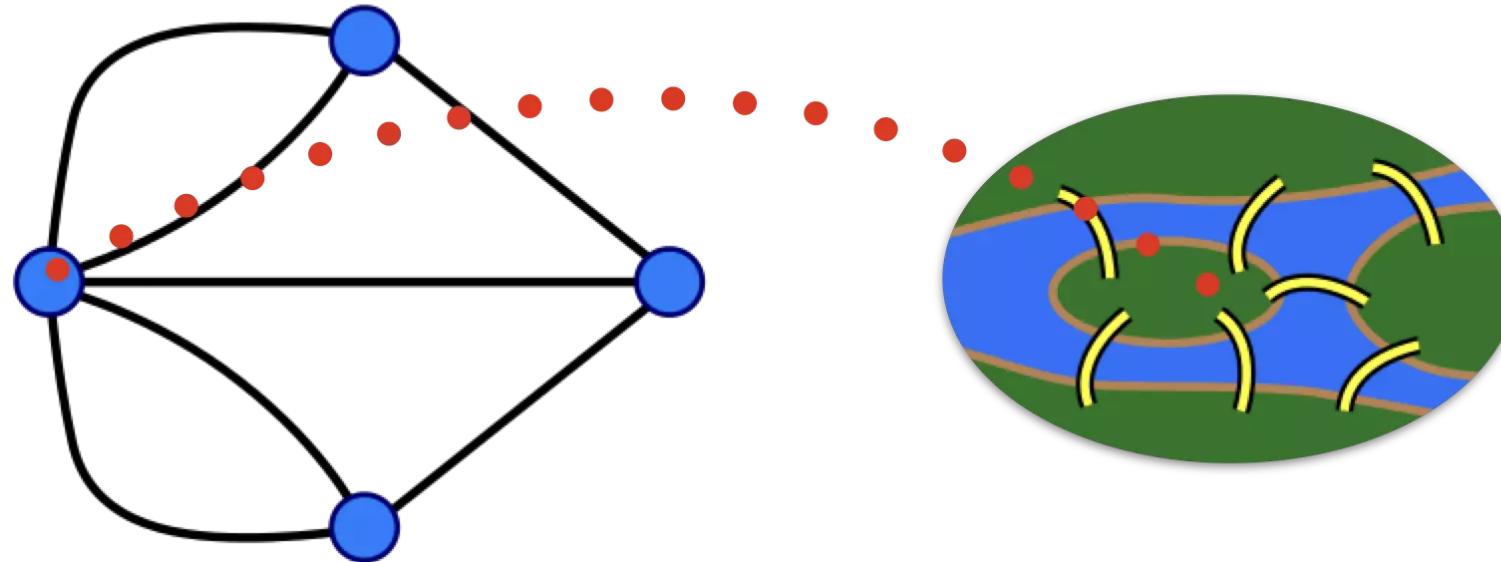
→ <https://github.com/OpenFunction/samples>

图数据库简介

什么是图？ 什么是图数据库？ 为什么我们需要一个专门的数据库？



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Map of Königsberg with the seven bridges labeled, circa 1905



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"以图结构、图语义来用点、边、属性来查询、表示存储数据的数据库

什么是图数据库

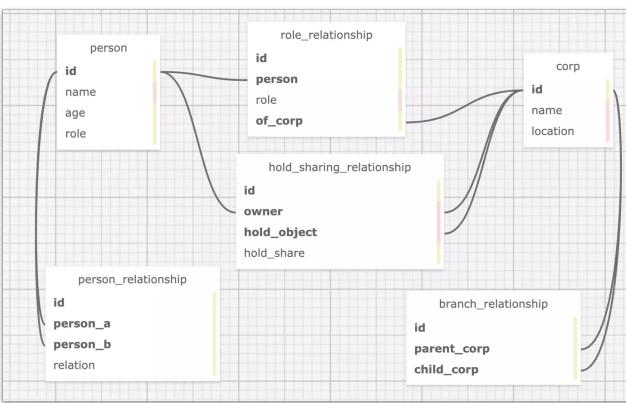
wikipedia.org/wiki/graph_database

了解更多关于 [什么是图数据库](#)

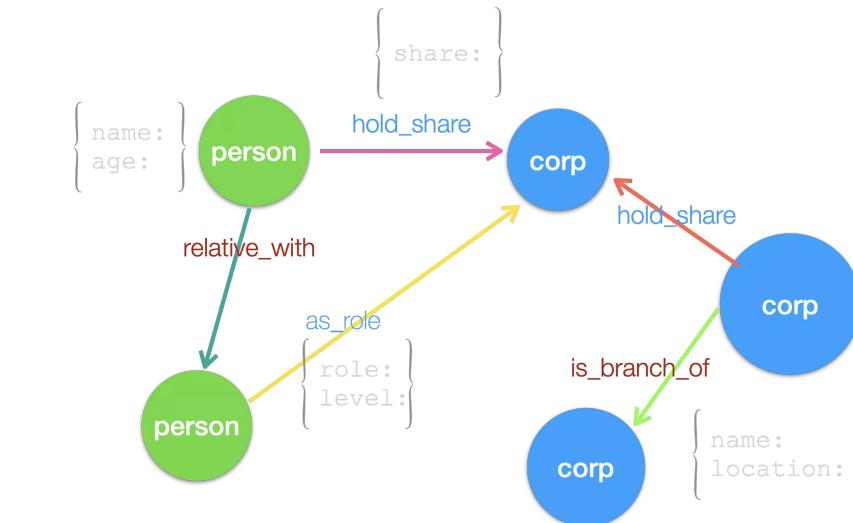
为什么需要图数据库？

传统数据库

图模型的结构



图数据库



图语义的查询

```
SELECT a.id, a.name, c.name
FROM player a
JOIN serve b ON a.id=b.player_id
JOIN team c ON c.id=b.team_id
WHERE c.name IN (SELECT c.name
FROM player a
JOIN serve b ON a.id=b.player_id
JOIN team c ON c.id=b.team_id
WHERE a.name = 'Tim Duncan')
```

```
GO FROM 100 OVER serve YIELD serve._dst AS Team | \
GO FROM $-.Team OVER serve REVERSELY YIELD $$ .player.name;
```

性能

	主要应用场景	2-hop 延时 (~2.5K)	3-hop 延时 (~110K)	4-hop 延时 (~600K)
图数据库	关系遍历	0.01 秒	0.168 秒	1.36 秒
SQL数据库	信息检索	0.016 秒	30 秒	1544 秒



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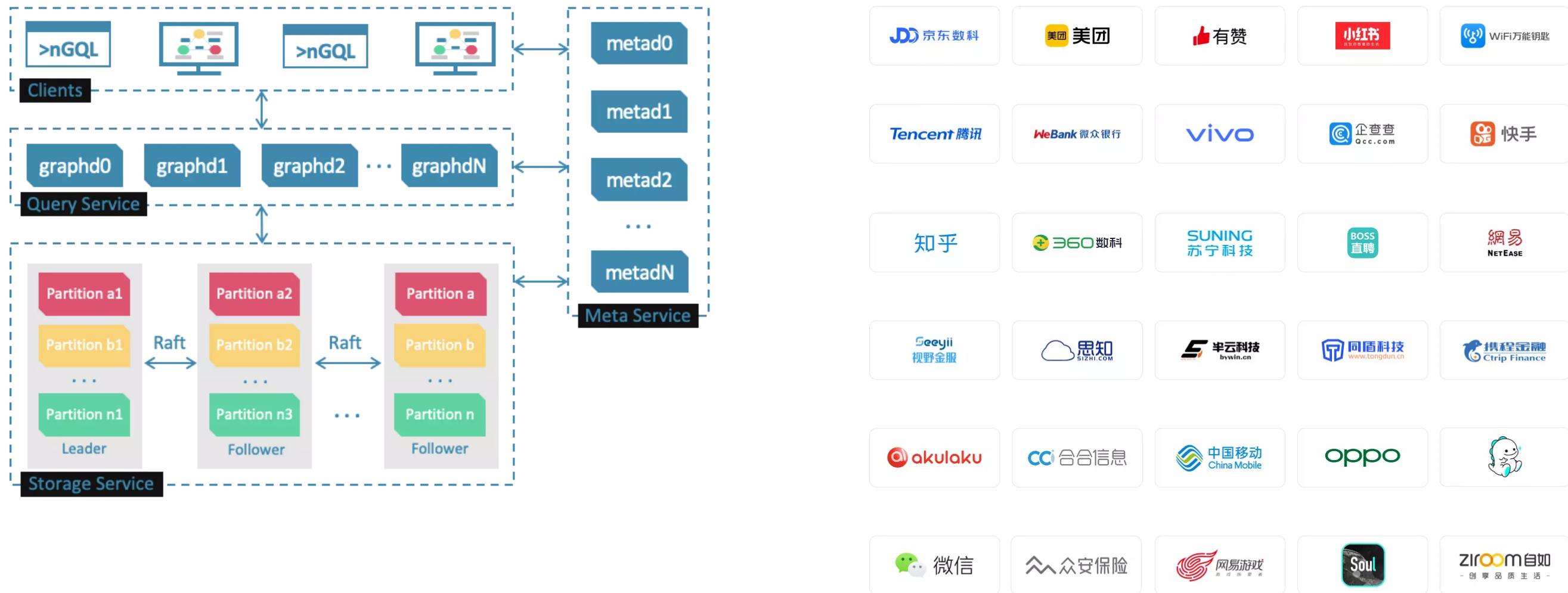
Nebula Graph!

如何发音：['nebjələ]，它有哪些特点？

Nebula Graph 介绍

一个可靠的分布式、线性扩容、性能高效的图数据库

世界上唯一能够容纳千亿顶点和万亿条边，并提供毫秒级查询延时的图数据库解决方案



了解更多 >>>

文档: Nebula 架构

官网: 用户案例



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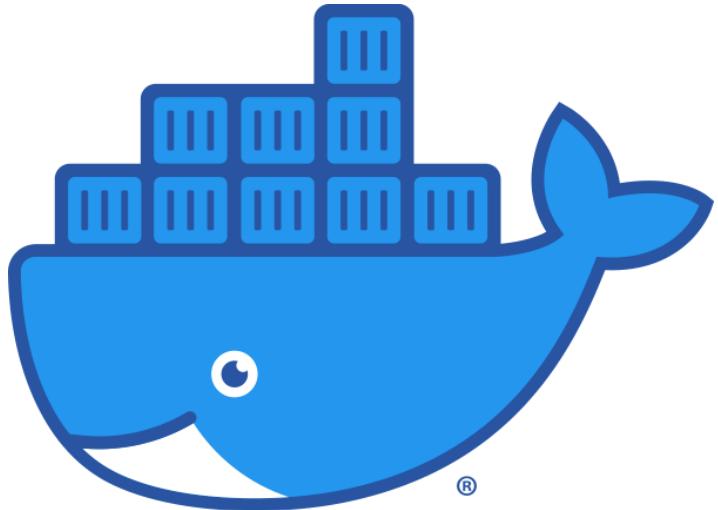


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云原生时代的图数据库

容器化部署演进

Nebula Docker



Nebula
K8s



Nebula Operator



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Nebula Operator 实现

Kubebuilder Scaffold

```
.
├── apis
.. └── apps
└── cmd
    └── ngctl
└── controller-manager
└── config
    └── crd
└── pkg
    ├── controller
    │   └── ngctl
    └── nebula
        └── scheduler
└── hack
└── doc
└── tests
④  vesoft-inc/nebula-operator
```

CRD

```
apiVersion: apps.nebula-graph.io/v1alpha1
kind: NebulaCluster
metadata:
  name: nebula
spec:
  graphd:
    resources:
      requests:
        cpu: "500m"
        memory: "500Mi"
    replicas: 3
    image: vesoft/nebula-graphd
    version: v2.5.0
...
  reference:
    name: statefulsets.apps.kruise.io
    version: v1
    schedulerName: default-scheduler
```

Control Loop

```
while True
    actual_state = get_state(context)
    expected_state = get_expected(context)
    if actual_state == expected_state:
        continue
    else:
        reconcile(context)
```

Calling Nebula Cluster

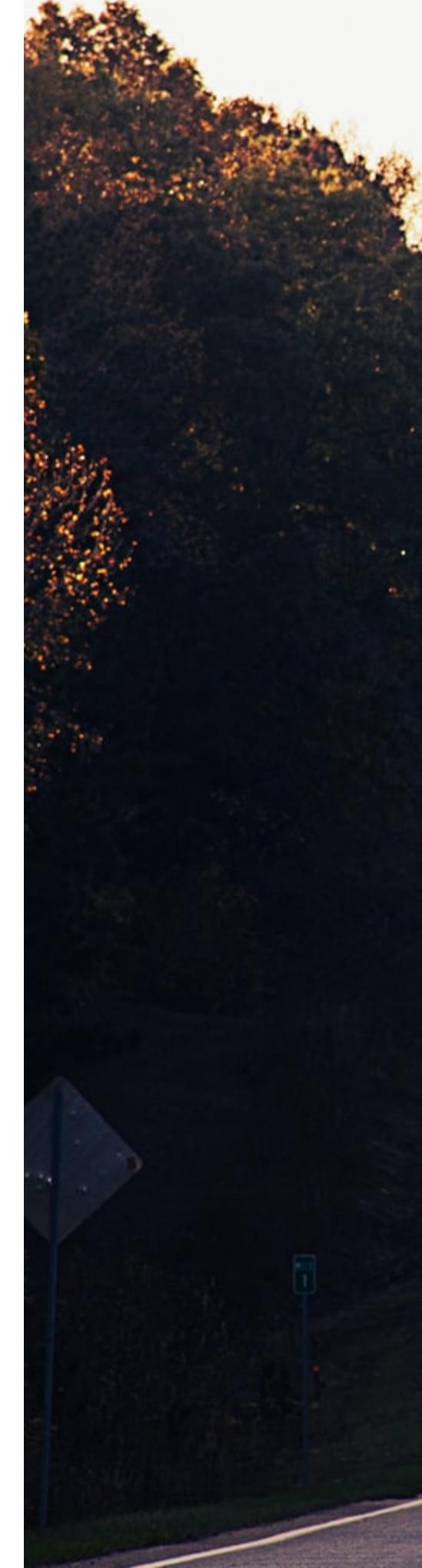
```
func (s *storUpd) updPhase(mc nebula.MI) {
    if err := mc.Balance(); err != nil {
        return err
    }
    hostItem, err := mc.ListHosts()
    if err != nil {
        return err
    }
    if !mc.IsBalanced(hostItem) {
        if err := mc.Balance(); err != nil {
            return err
        }
    }
}
```

Nebula Operator Roadmap

- Rolling Upgrade
- Auto Scaling
- Integration with other Services

Check out our Github Repo and contribute!
[vesoft-inc/nebula-operator](https://github.com/vesoft-inc/nebula-operator)

📍 roadmap of nebula-operator





Wey Gu 古思为
@wey_gu

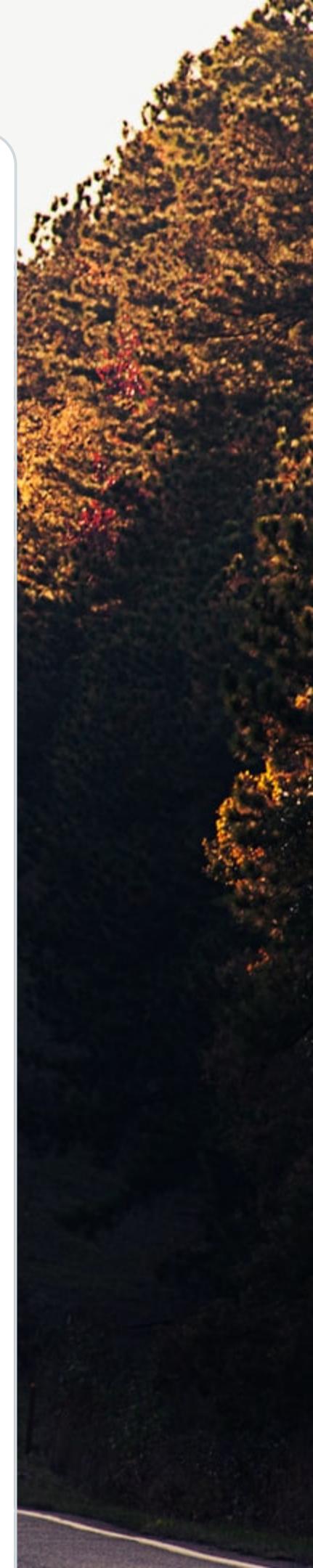
Replying to @wey_gu

Inspired by Carlos Santana's knative-kind, here comes the NGonK **#nebulaGraph #operator** in KinD.
You can now have K8s+all-Deps+Nebula-Operator in a one-liner.



Nebula Operator Kind, 一键单机玩转 Nebula K8s 集群
🔗 siwei.io

5:24 PM · Sep 1, 2021

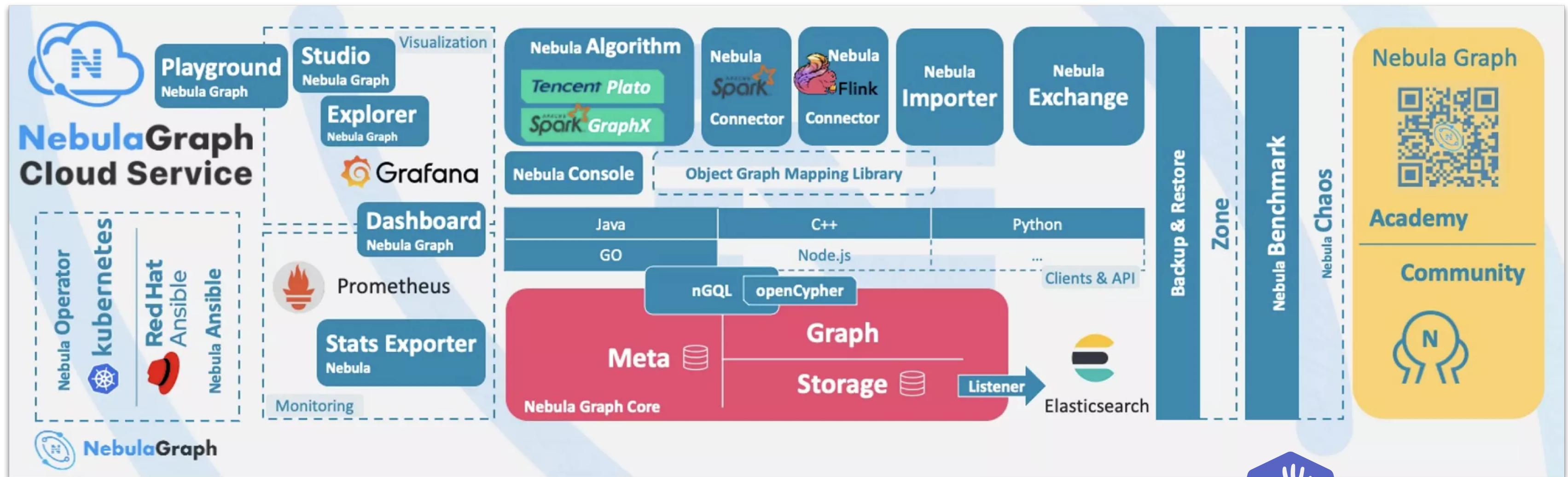


3 Copy link t...

Nebula Landscape

Nebula 社区生态非常丰富，并且还在日益拓展，欢迎同学们了解、参与贡献。

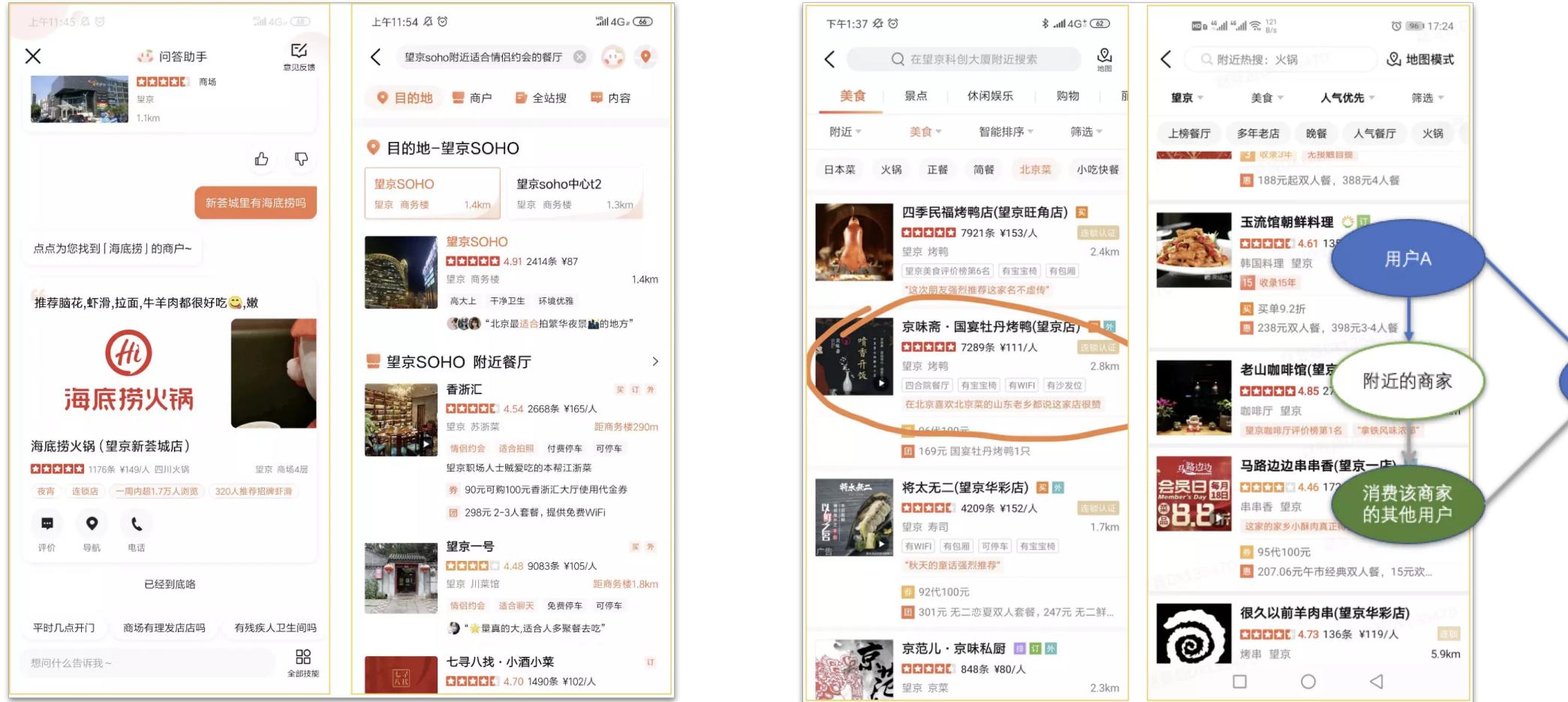
- Deployment, Monitoring
- Data Visualization
- Algorithm, Analytic
- Clients, Connectors, ETL



上手 GraphDB on K8s

应用场景 - Nebula on Kubesphere - Demo

图数据库的应用场景



典型场景

社交网络

风险控制

公共安全

知识图谱

机器学习

生化制药

物联网

区块链

数据血缘

智能运维



KubeSphere + OpenFunction



```
kk create cluster --with-kubernetes v1.20.4 --with-kubesphere v3.1.1
git clone https://github.com/OpenFunction/OpenFunction.git
cd OpenFunction
sh hack/deploy.sh --all
kubectl apply -f https://raw.githubusercontent.com/OpenFunction/OpenFunction/main/config/bundle.yaml
kubectl create secret docker-registry push-secret \
  --docker-server=$REGISTRY_SERVER \
  --docker-username=$REGISTRY_USER \
  --docker-password=$REGISTRY_PASSWORD
kubectl --namespace kourier-system edit service kourier # externalIP
vim config/samples/function-sample.yaml # container image registry
kubectl apply -f config/samples/function-sample.yaml
$ kubectl get function
NAMESPACE      NAME          BUILDSTATE    SERVINGSTATE   BUILDER           SERVING
default        function-sample   Succeeded     Created       function-sample-builder-s2pfg   function-sample-serving-9sszk
$ kubectl get ksvc
NAME                           URL
function-sample-serving-9sszk-ksvc-xlfkz http://function-sample-serving-9sszk-ksvc-xlfkz.default.example.com
$ vim /etc/hosts

$ curl http://function-sample-serving-9sszk-ksvc-xlfkz.default.example.com
Hello, World!
```

KubeSphere + Nebula Graph



```
curl -sL nebula-kind.siwei.io/install-ks-1.sh | bash # kubesphere-all-in-one nebula installer
```

```
$ kubectl get svc nebula-graphd-svc-nodeport
NAME                  TYPE      CLUSTER-IP      EXTERNAL-IP      PORT(S)           AGE
nebula-graphd-svc-nodeport   NodePort  10.233.62.198  <none>        9669:32669/TCP,19669:32001/TCP  3m57s
$ kubectl edit svc nebula-graphd-svc-nodeport
service/nebula-graphd-svc-nodeport edited
$ ./nebula-kind/bin/console -u root -p password --address=192.168.8.137 --port=32669
2021/09/01 20:38:39 [INFO] connection pool is initialized successfully
Welcome to Nebula Graph!
```

```
(root@nebula) [(none)]> show hosts
+-----+-----+-----+-----+-----+
| Host          | Port | Status | Leader count | Leader dist |
+-----+-----+-----+-----+-----+
| "nebula-storaged-0.nebula-storaged-headless.default.svc.cluster.local" | 9779 | "ONLINE" | 0           | "No valid pa
+-----+-----+-----+-----+-----+
| "nebula-storaged-1.nebula-storaged-headless.default.svc.cluster.local" | 9779 | "ONLINE" | 0           | "No valid pa
+-----+-----+-----+-----+-----+
| "nebula-storaged-2.nebula-storaged-headless.default.svc.cluster.local" | 9779 | "ONLINE" | 0           | "No valid pa
+-----+-----+-----+-----+-----+
| "Total"          |      |         | 0           |           |
+-----+-----+-----+-----+-----+
```



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Nebula Graph 数据导入

```
$ wget https://docs.nebula-graph.io/2.0/basketballplayer-2.X.ngql
$ ~/.nebula-kind/bin/console -u root -p password --address=192.168.8.137 --port=32669 -f basketballplayer-2.X.ngql
...
(root@nebula) [basketballplayer]> insert edge serve(start_year,end_year) values "player150"->"team213":(2018, 2019);
Execution succeeded (time spent 946/1091 us)
Wed, 01 Sep 2021 20:47:58 UTC
```

```
[root@wey wey.gu]# ~/.nebula-kind/bin/console -u root -p password --address=192.168.8.137 --port=32669
(root@nebula) [(none)]> show spaces
+-----+
| Name          |
+-----+
| "basketballplayer" |
+-----+
(root@nebula) [(none)]> use basketballplayer
(root@nebula) [basketballplayer]> show tags
+-----+
| Name          |
+-----+
| "player"      |
+-----+
| "team"        |
+-----+
```



参考文档

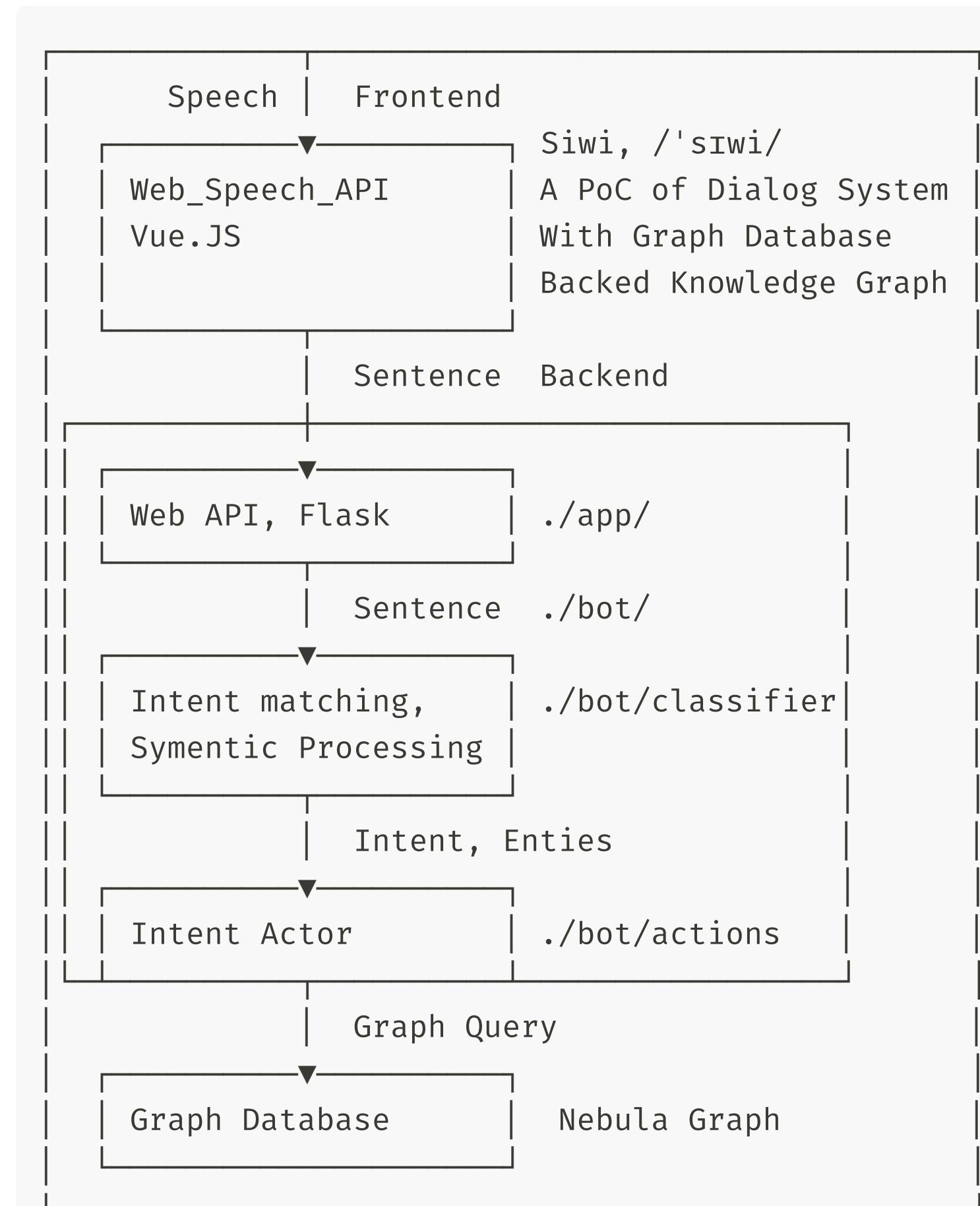
Siwi on KubeSphere + OpenFunction

Siwi (/ˈsɪwi/) is a PoC of Dialog System With Graph Database Backed Knowledge Graph.



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Arch



Code

```
.
├── README.md
└── src
    ├── siwi
    │   ├── app
    │   └── bot
    │       ├── actions
    │       ├── bot
    │       ├── classifier
    │       │   └── test
    │       └── test
    └── siwi_frontend
        ├── README.md
        ├── package.json
        └── src
            ├── App.vue
            └── main.js
wsgi.py
```



[wey-gu/nebula-siwi](https://github.com/wey-gu/nebula-siwi)

The Function

```
apiVersion: core.openfunction.io/v1alpha1
kind: Function
metadata:
  name: nebula-siwi
spec:
  version: "v1.0.0"
  image: "weygu/siwi-api:latest"
  imageCredentials:
    name: push-secret
  build:
    builder: openfunction/builder:v1
  env:
    FUNC_NAME: "siwi_api"
    FUNC_SRC: "main.py"
  srcRepo:
    url: "https://github.com/wey-gu/nebula-si
      sourceSubPath: "src"
  serving:
    runtime: Knative
  params:
    NG_ENDPOINTS: "NEBULA_GRAPH_ENDPOINT"
  template:
    containers:
      - name: function
```



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Live Demo

Siwi on KubeSphere + OpenFunction

Recap

- 了解 K8s 上的 Serverless 计算平台搭建实践：OpenFunction
 - 使用 Tekton、Cloud Native Buildpacks、Shipwright 搭建 OCI 镜像构建流水线
 - 使用 Knative、Dapr、KEDA 等云原生技术驱动具备自动伸缩能力的同步函数与异步函数
 - 以 Argo Events、Knative Eventing 为参考的轻量级 Serverless 事件框架
- K8s 上的图数据库基于 KubeBuilder 的 Operator 实现，解谜图数据库的知识与应用
 - 图、图数据库简介
 - Nebula Graph!
 - Nebula Operator
- 上手 K8s 上的云原生图数据库、从零到一构建 Serverless 架构的智能问答助手
 - KubeSphere 上的图数据库
 - KubeSphere 上的 OpenFunction
 - Siwi，一个基于 Nebula 的单一领域问答机器人
 - Nebula-Siwi on FaaS on KubeSphere



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“获取关于 图数据库与 Nebula Graph 的有用信息”



微信公众号，Nebula Graph 的最新信息 —>



文档：docs.nebula-graph.com.cn



Nebula Graph 架构、实践文章：nebula-graph.com.cn/posts

视频和教程：space.bilibili.com/472621355



用户问答论坛：discuss.nebula-graph.com.cn

github.com/vesoft-inc/nebula



古思为 Wey Gu

Nebula Graph

开发者布道师 @  vesoft

- 程序员
- 开源信徒  github.com/wey-gu
- 博客  siwei.io
- 来打招呼  [@wey_gu](https://twitter.com/wey_gu)  [@古思為](https://weibo.com/u/11011111)



方阗 Laminar

OpenFunction 社区 Maintainer

- www.laminar.fun
- github.com/tipperatgod



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github.com/kubesphere



twitter.com/kubesphere



UP/KubeSphere



kubesphere.io



kubesphere.slack.com

