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# Empower Autonomous Driving with cloud native Serverless technologies

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# Empower Autonomous Driving with Cloud Native Serverless Technologies



PromCon  
North America 2021



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@KubeSphere

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Architect, UISEE

# Agenda

- ❑ Why we need an open source cloud native FaaS platform?
- ❑ How to build a cloud agnostic FaaS platform?
- ❑ OpenFunction Intro: Build, Serving, Events, Functions Framework, Tracing
- ❑ Early adopters & Contributors
- ❑ Roadmap
- ❑ Demo
- ❑ Using OpenFunction in autonomous driving

# Why we need an open source cloud native FaaS platform?

- ❑ Kubernetes brings the possibility of cloud-agnostic:
  - Multi Cloud
  - Distributed Cloud
- ❑ But it's difficult to be cloud-agnostic for FaaS
  - Each cloud provider has its own FaaS platform
  - Further more, these platforms are coupled with their own cloud backend services
- ❑ Is it possible to build a cloud agnostic FaaS platform?

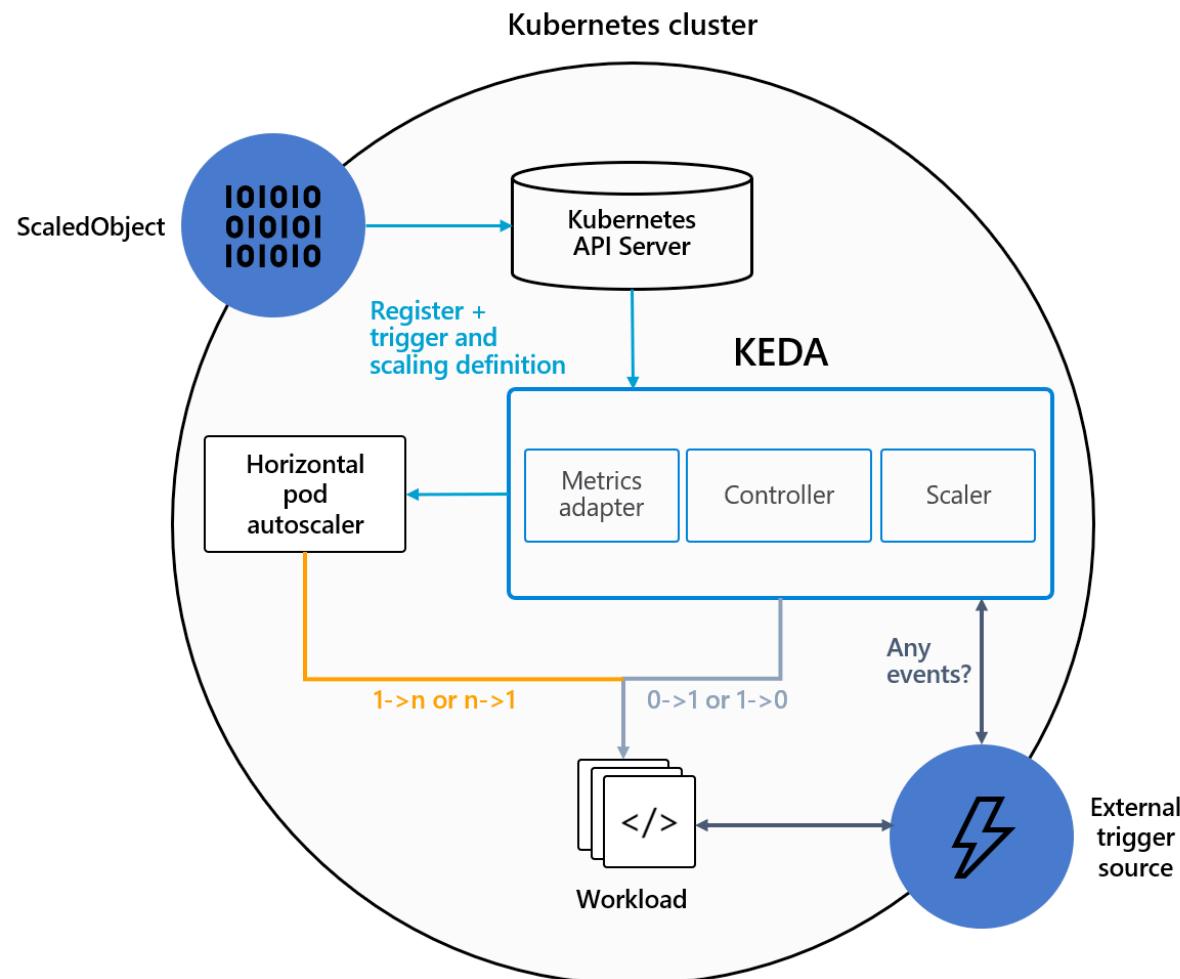
# How to build a cloud agnostic FaaS platform?

❑ New progress of cloud native serverless technologies make it possible:

- Dapr
- KEDA
- Knative Serving
- Tekton
- Shipwright
- Cloud Native Buildpacks

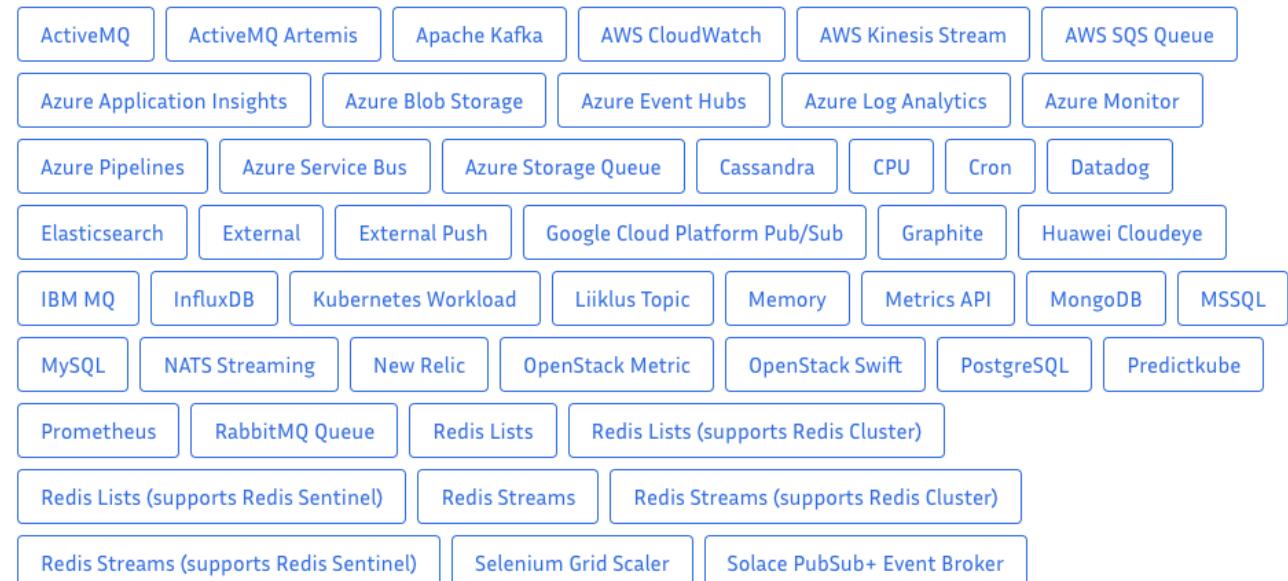
# How to build a cloud agnostic FaaS platform?

KEDA to decouple the autoscaling of applications with various event sources



## Event sources and scalers

KEDA has a wide range of **scalers** that can both detect if a deployment should be activated or deactivated, and feed custom metrics for a specific event source. The following scalers are available:



# How to build a cloud agnostic FaaS platform?

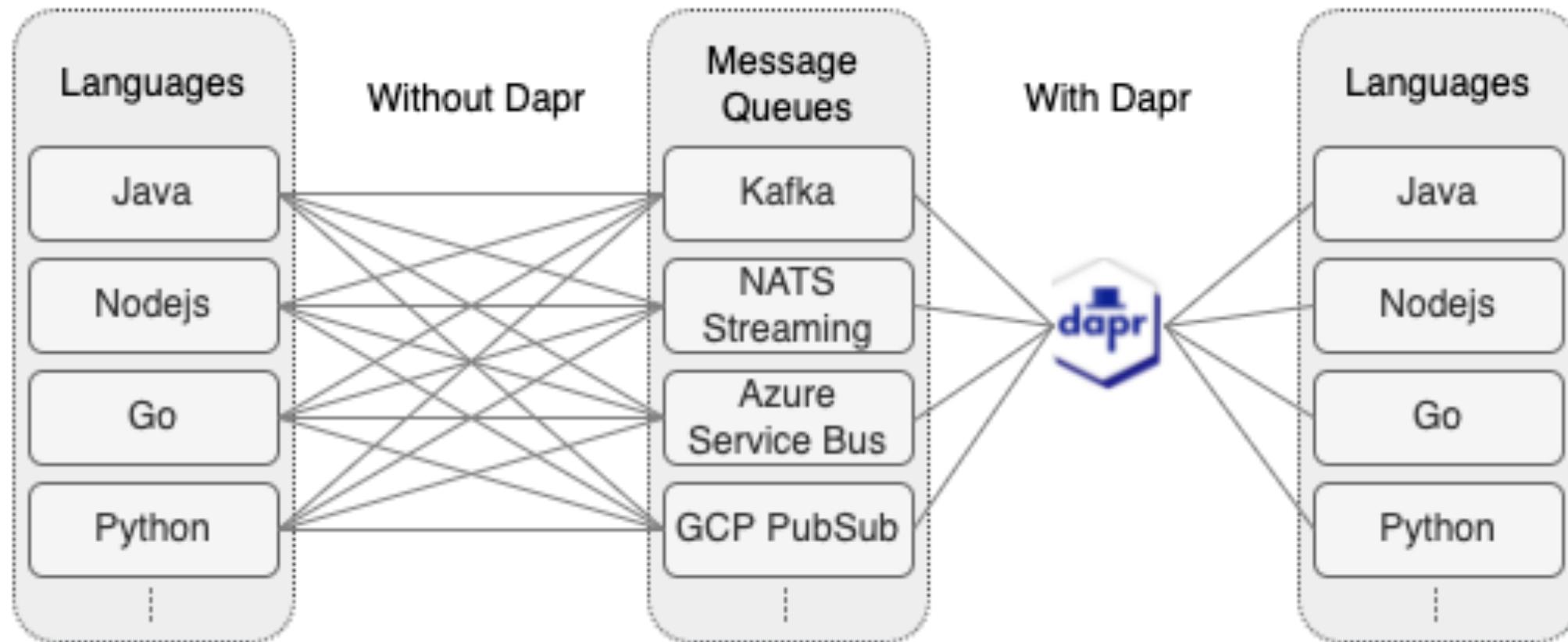
Dapr to decouple the distributed applications with underlying backend services

							
<b>Service-to-service invocation</b>	<b>State management</b>	<b>Publish and subscribe</b>	<b>Bindings (input/output)</b>	<b>Actors</b>	<b>Observability</b>	<b>Secrets</b>	<b>Configuration</b>
Perform direct, secure, service-to-service method calls	Create long running, stateless and stateful services	Secure, scalable messaging between services	Trigger code through events from a large array of inputs Input and output bindings to external resources including databases and queues	Encapsulate code and data in reusable actor objects as a common microservices design pattern	See and measure the message calls across components and networked services	Securely access secrets from your application	Access application configuration and be notified of updates

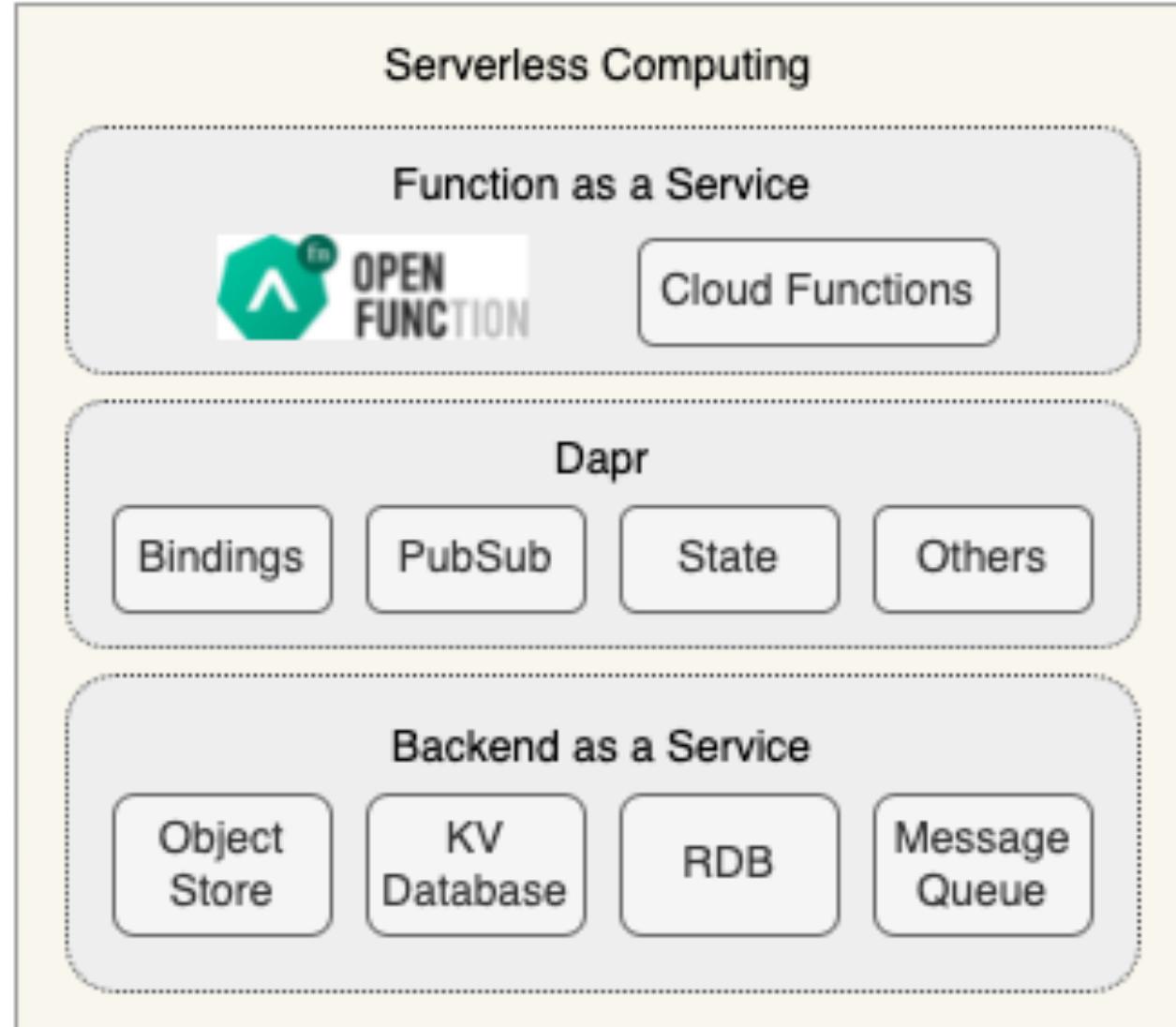
# How to build a cloud agnostic FaaS platform?

Suppose functions need to consume events from message queues:

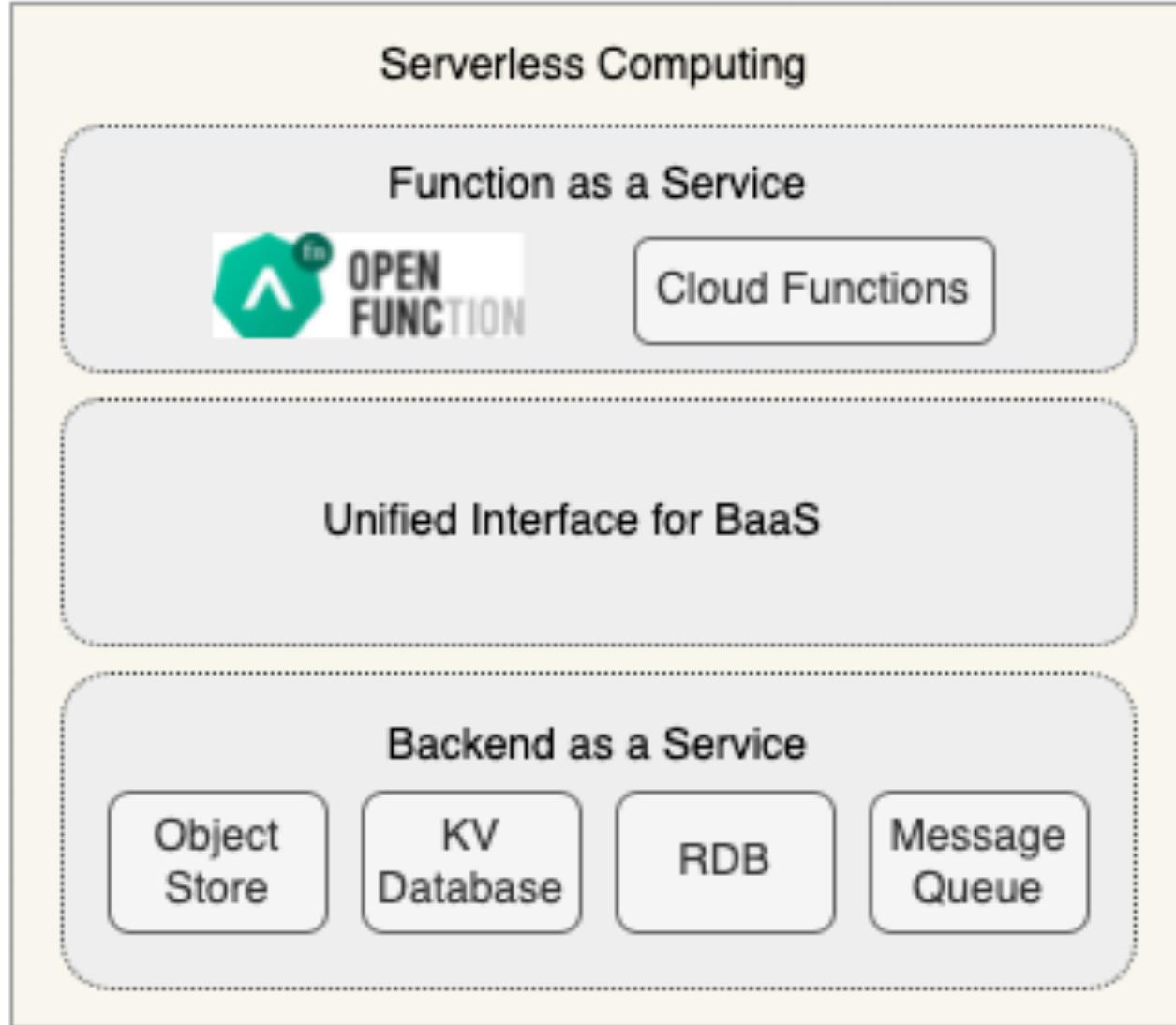
- Without Dapr: 5 languages x 10 message queues = 50 implementations
- With Dapr: 5 languages x 1 virtual message queue = 5 implementations



# How to build a cloud agnostic FaaS platform?



# How to build a cloud agnostic FaaS platform?



# How to build a cloud agnostic FaaS platform?



**Yaron Schneider (@yaronschneider)**

@daprdev is a developer facing technology, and lately we're starting to see it underpin the infra layer of large scale serverless platforms. Watch this call to see how Dapr powers @KubeSphere's OpenFunction project and called out as differentiating tech!

[Translate Tweet](#)

**Dapr (@daprdev)** · 16h

The recording is now available for this week's Dapr Community Call on March 22nd. Enjoy!

[youtu.be/S9e3oI7JCDA](https://youtu.be/S9e3oI7JCDA)

00:28 · 2022/3/24 · Twitter Web App

1 Retweet 1 Quote Tweet 12 Likes

**Mark Fussell (@mfussell)**

It is interesting to see Dapr increasingly being used in many serverless Function runtimes

[Translate Tweet](#)

**Yaron Schneider (@yaronschneider)** · 4h

@daprdev is a developer facing technology, and lately we're starting to see it underpin the infra layer of large scale serverless platforms. Watch this call to see how Dapr powers @KubeSphere's OpenFunction project and called out as different...

00:50 · 2022/3/24 · Twitter Web App

2 Retweets 6 Likes

<https://www.youtube.com/watch?v=S9e3oI7JCDA?start=188>

# OpenFunction Intro

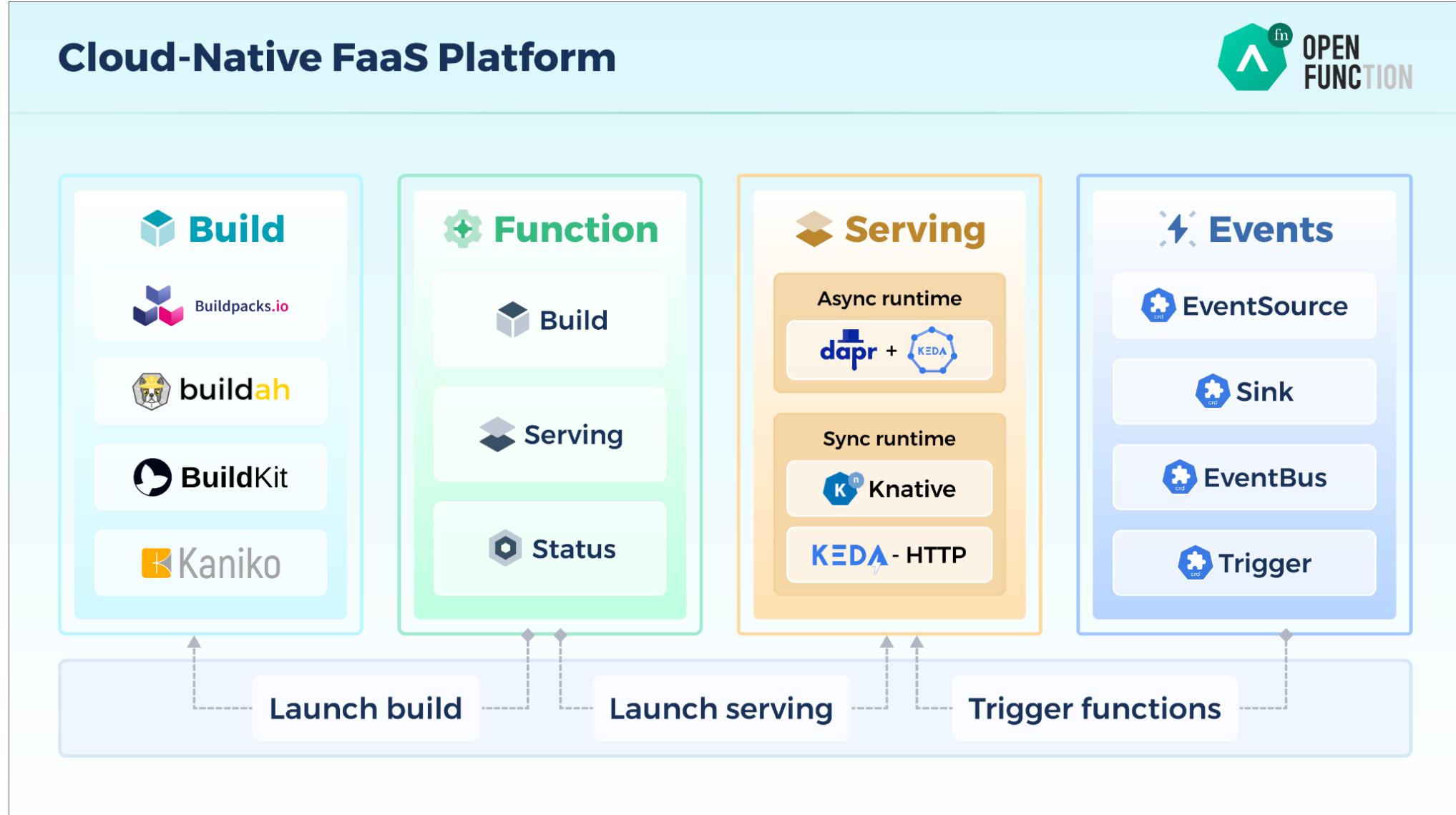


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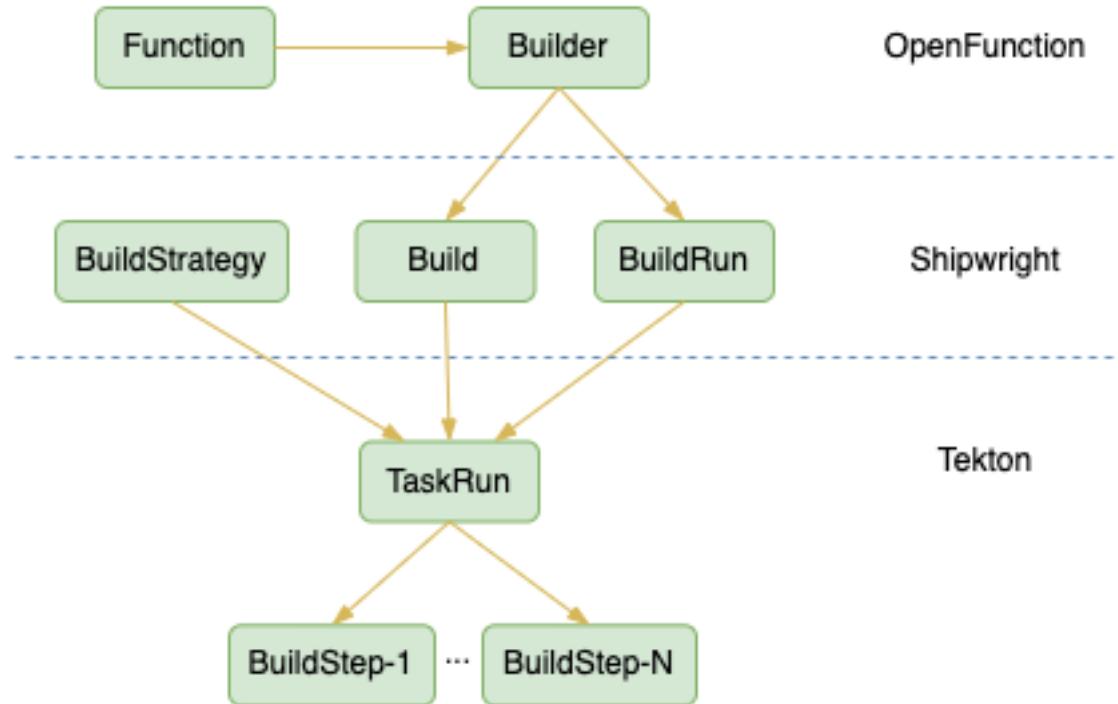


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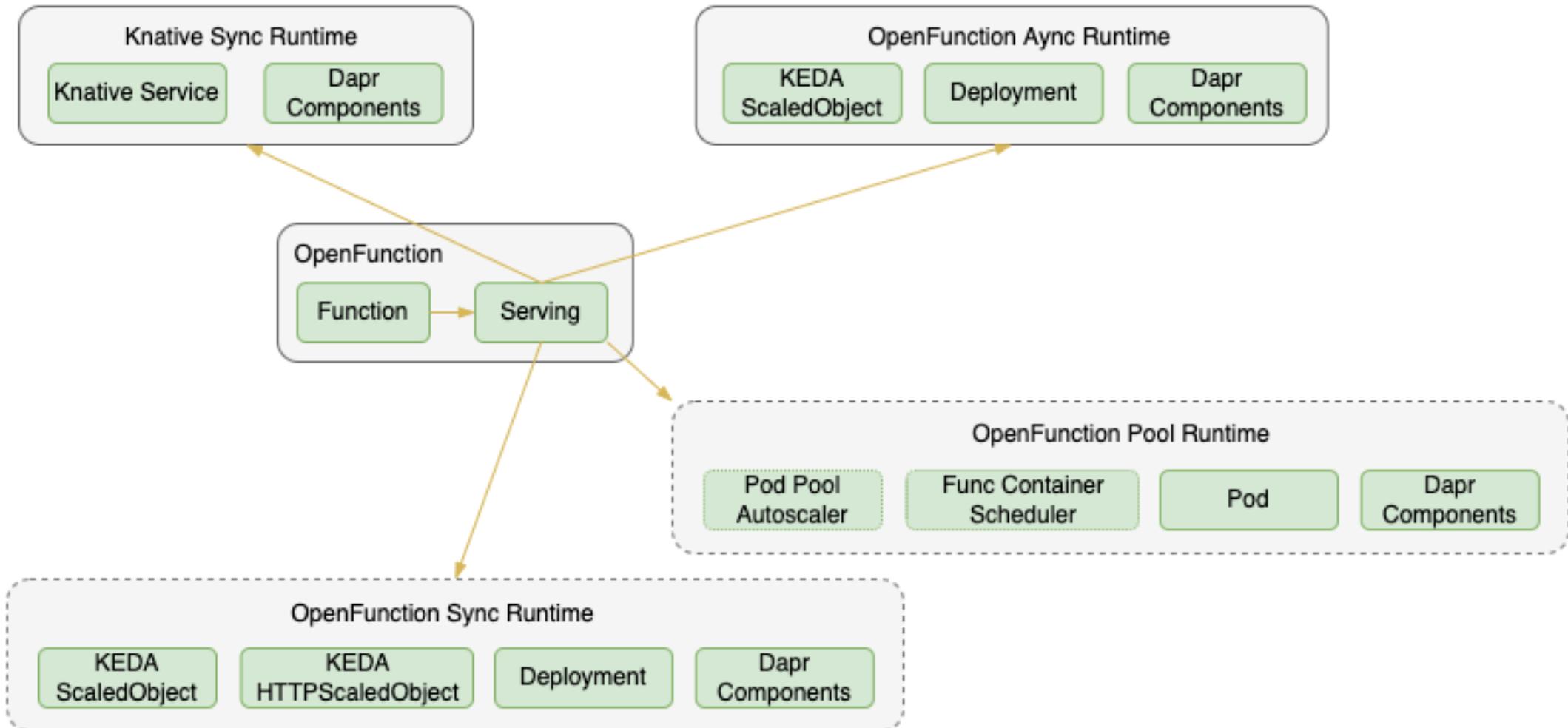
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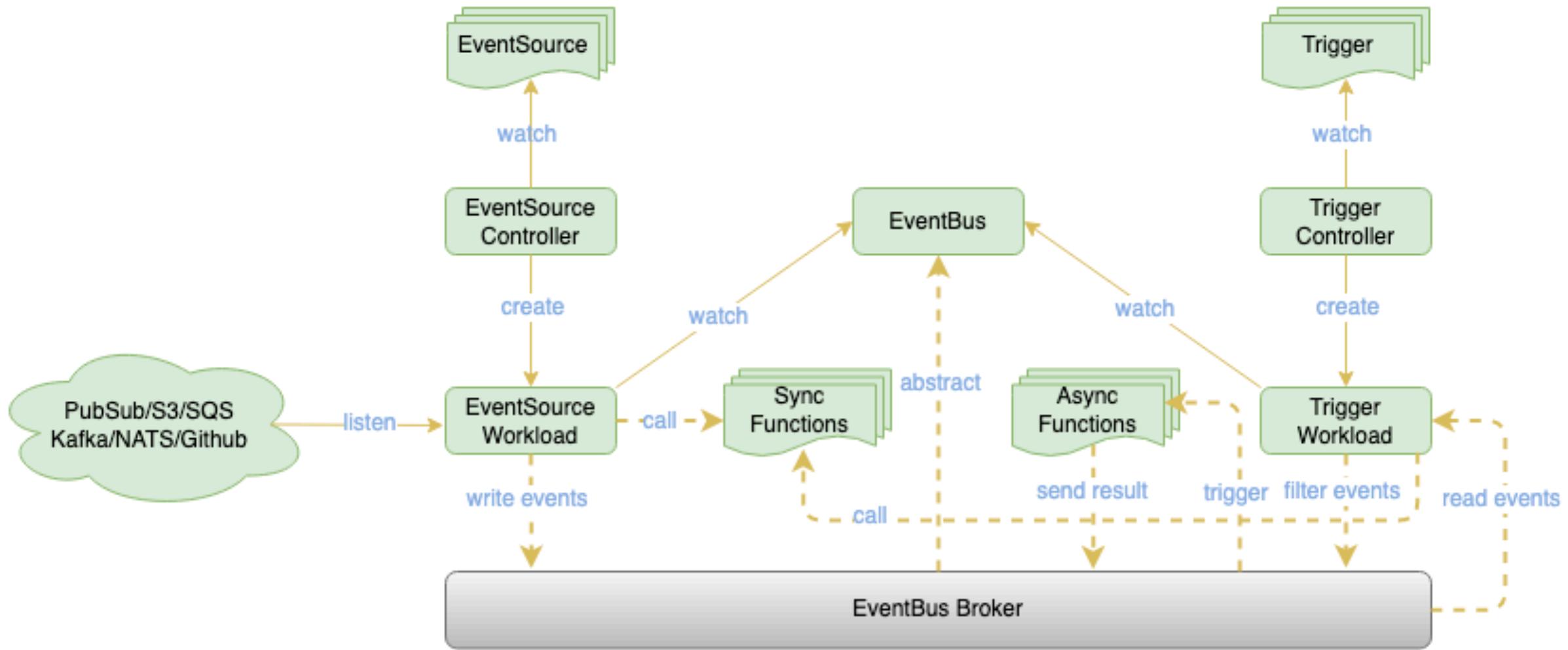
# OpenFunction Build



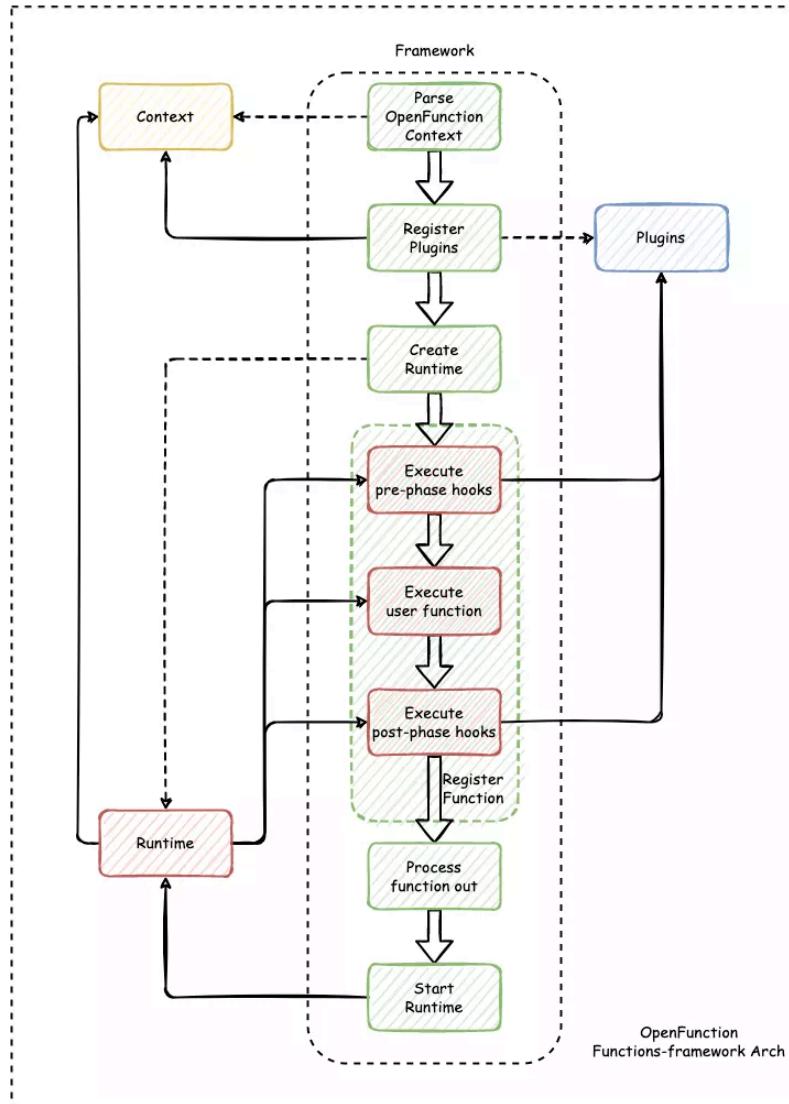
# OpenFunction Serving



# OpenFunction Events

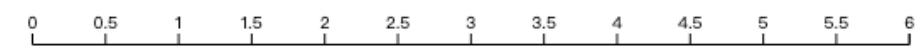
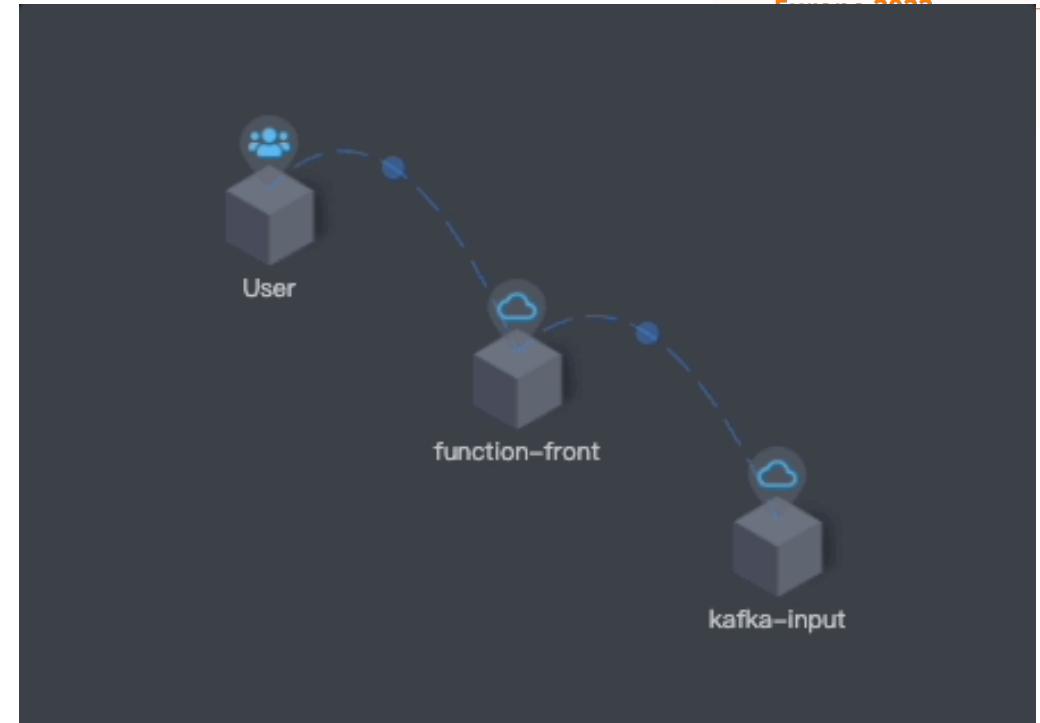
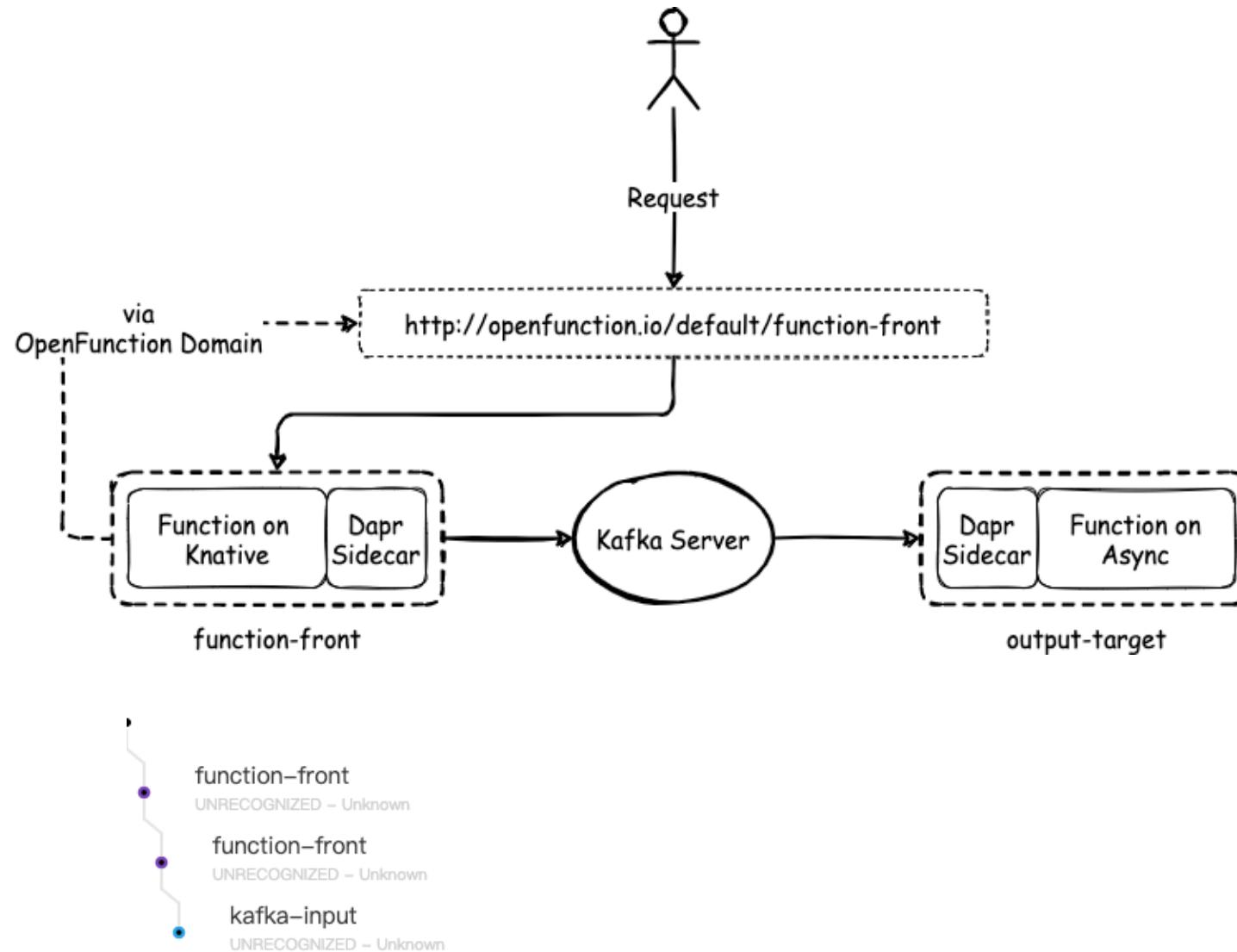


# OpenFunction Functions Framework



```
func (fwk *functionsFrameworkImpl) Register(ctx context.Context, fn interface{}) error {
    if fnHTTP, ok := fn.(func(http.ResponseWriter, *http.Request) error); ok {
        if err := fwk.runtime.RegisterHTTPFunction(fwk.ofContext, fwk.processPreHooks, fwk.processPostHooks, fnHTTP);
            klog.Errorf("failed to register function: %v", err)
            return err
    }
} else if fnOpenFunction, ok := fn.(func(context.Context) (ofctx.Out, error)); ok {
    if err := fwk.runtime.RegisterOpenFunction(fwk.ofContext, fwk.processPreHooks, fwk.processPostHooks, fnOpenFunction);
        klog.Errorf("failed to register function: %v", err)
        return err
}
} else if fnCloudEvent, ok := fn.(func(context.Context, cloudevents.Event) error); ok {
    if err := fwk.runtime.RegisterCloudEventFunction(ctx, fwk.ofContext, fwk.processPreHooks, fwk.processPostHooks, fnCloudEvent);
        klog.Errorf("failed to register function: %v", err)
        return err
}
} else {
    err := errors.New("unrecognized function")
    klog.Errorf("failed to register function: %v", err)
    return err
}
return nil
}
```

# OpenFunction Tracing



Use SkyWalking for OpenFunction as an Observability Solution: <https://github.com/OpenFunction/samples/tree/main/functions/tracing>  
 SkyWalking function tracing demo: <http://demo.skywalking.apache.org/functions>

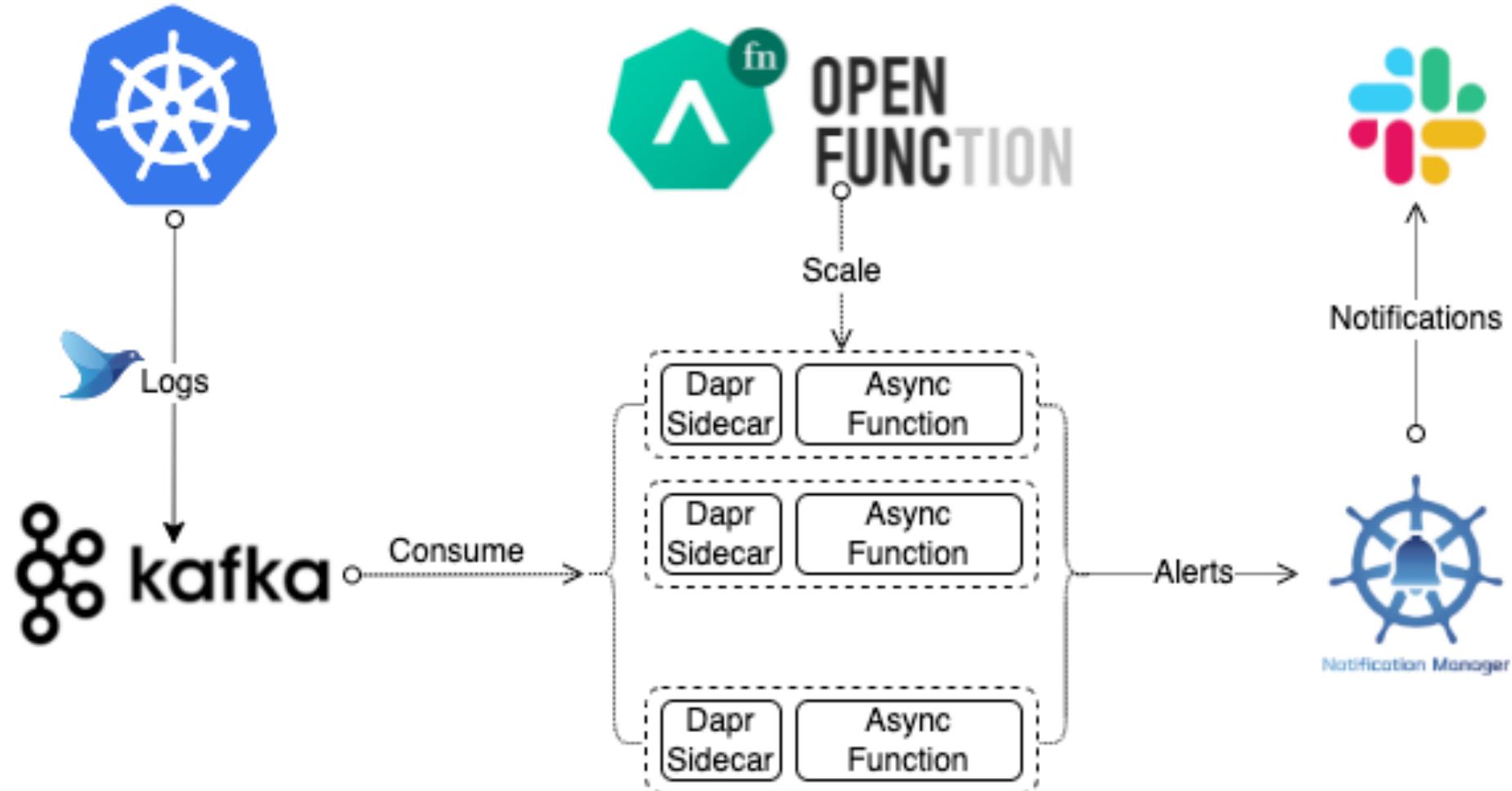
# Early adopters & Contributors

- ❑ One of the major telecom company in China is using OpenFunction to build their cloud FaaS platform
- ❑ [UISEE](#) (Autonomous Driving industry) is using OpenFunction to process Vehicle data
- ❑ [QuanXiang](#) low code platform is using OpenFunction to implement its plugin mechanism
- ❑ @Geffzhang is contributing to the dotNet functions-framework

# Roadmap

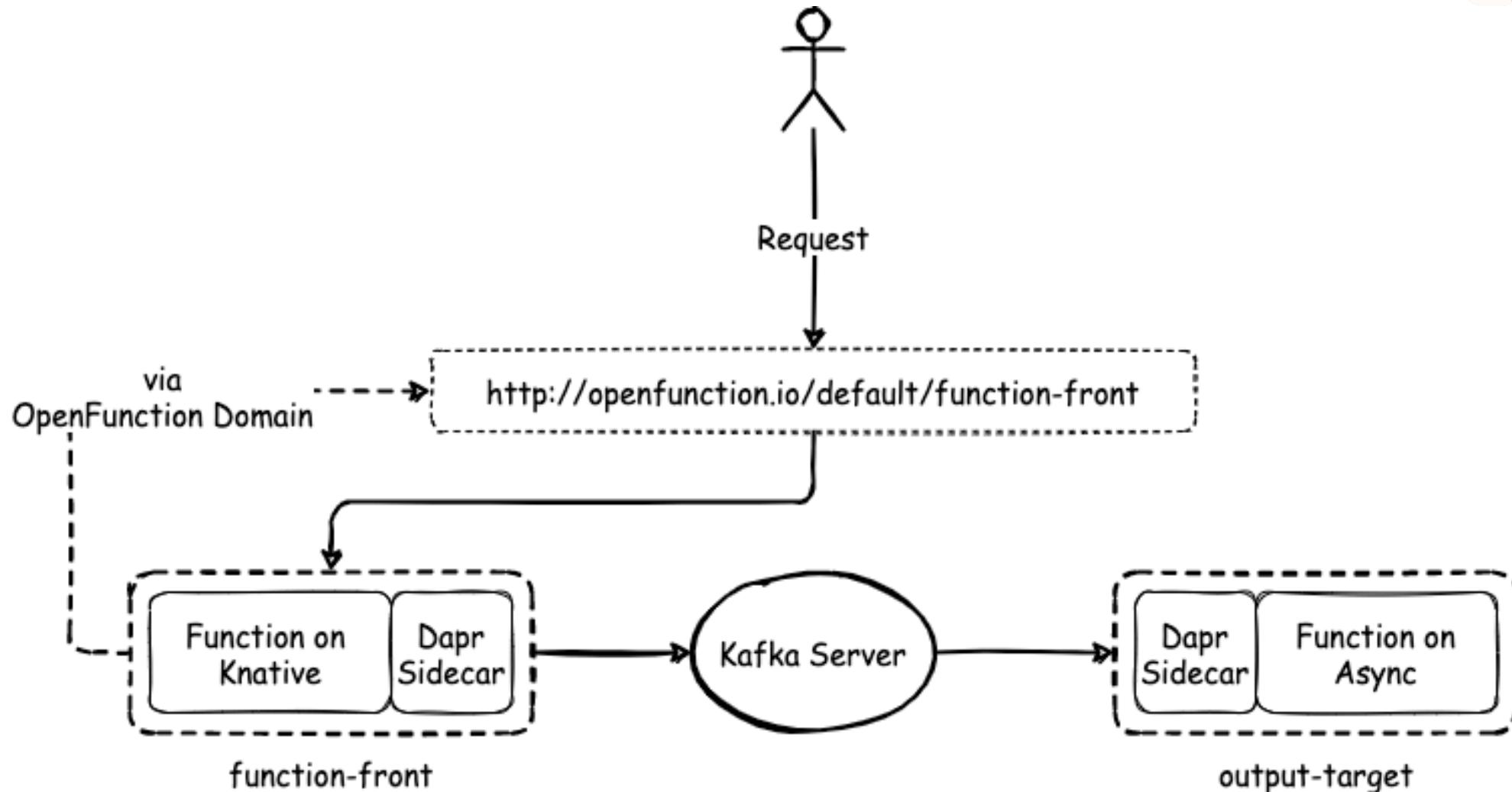
- ❑ Nodejs functions-framework
- ❑ Python functions-framework
- ❑ Java functions-framework
- ❑ Quarkus + Java + Dapr support
- ❑ dotNet functions-framework
- ❑ Add sync runtime (KEDA-HTTP)
- ❑ Support using OpenTelemetry for tracing
- ❑ OpenFunction Console
- ❑ Serverless workflow support

# Demo-1: Elastic log alerting with async functions



<https://github.com/OpenFunction/samples/tree/main/functions/async/logs-handler-function>

## Demo-2: Sync functions trigger async functions



<https://github.com/OpenFunction/samples/tree/main/functions/knative/with-output-binding>

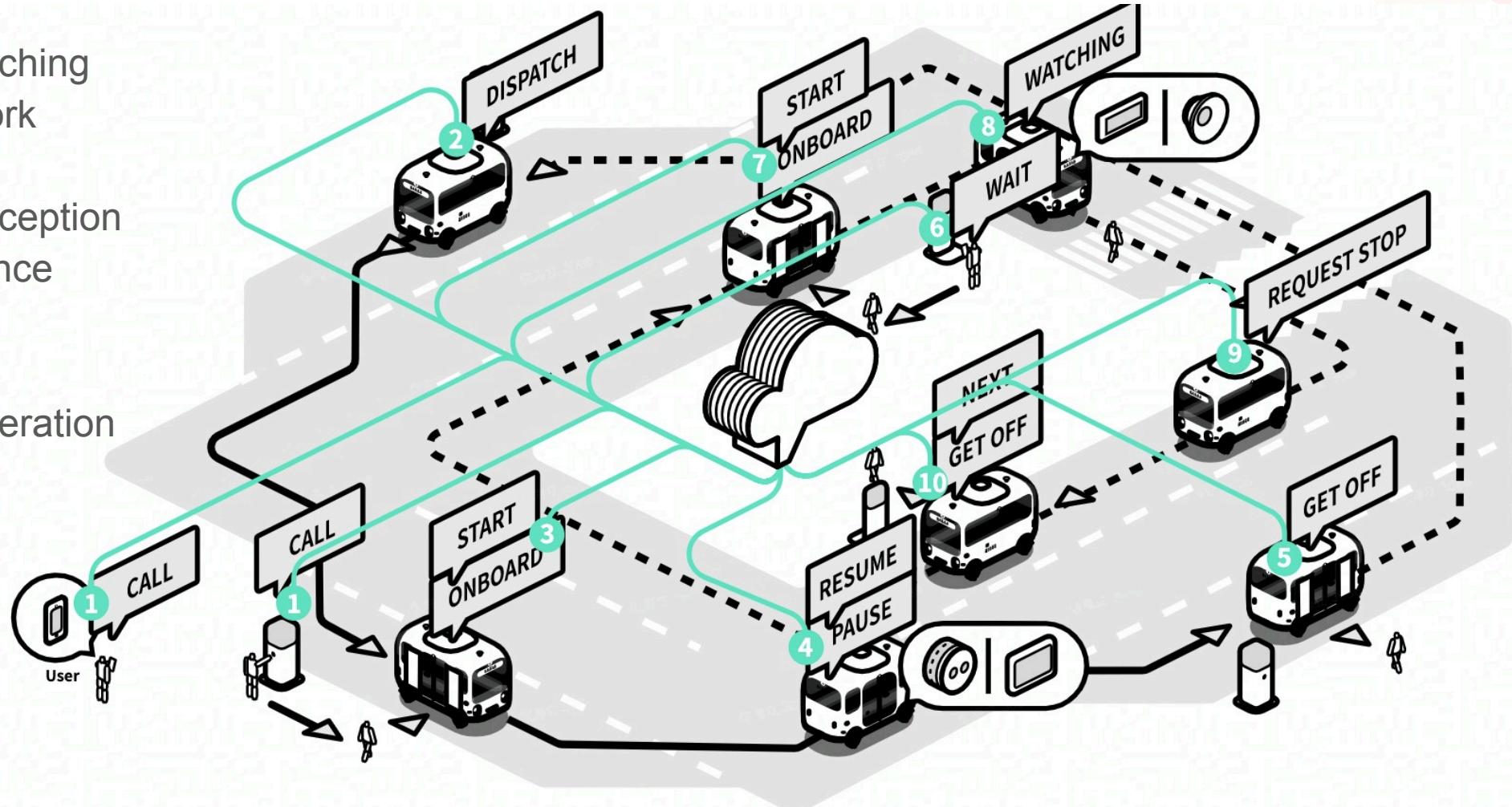
<https://github.com/OpenFunction/samples/tree/main/functions/async/bindings/kafka-input>

# Using OpenFunction in autonomous driving

Xiuming Lu  
Architect, UISEE

# Autonomous Driving Intro

- Vehicle Monitoring
- Commands Dispatching
- Authority Framework
  
- Environmental Perception
- Pedestrian Avoidance
- Route Planning
- Chassis Control
- Multi-vehicle Cooperation
  
- High Availability
- Error Traceability
- Scalability



# Why Autonomous-Driving needs a cloud agnostic FaaS platform?

## Cloud Agnostic

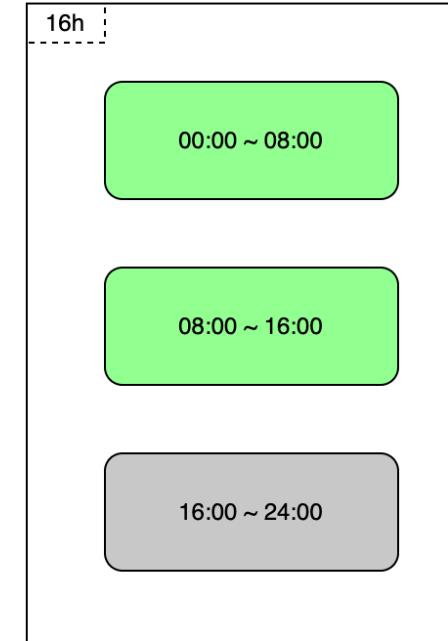
- ❑ Different customers require to use different cloud providers
- ❑ Some customers' vehicle data is sensitive and are required to be isolated from public clouds

## FaaS

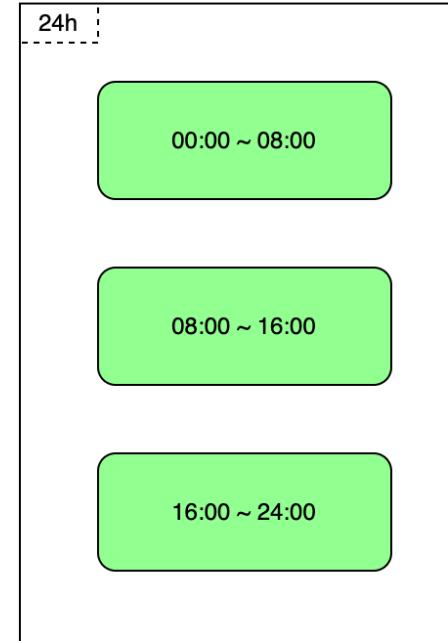
- ❑ Autonomous driving has so many application scenarios, there're requirements to use different processing logics for different scenarios even for the same data source.
- ❑ Data types and processing modules are complex, multi-language support is required
- ❑ Massive events need to be handled in real time
- ❑ Data processing logics tend to be changed frequently based on rapid changing industry requirements

# Why KEDA matters?

- ❑ AI drivers need to retain human working habits to a certain extent, so there are peaks and valleys in traffic based on schedules
- ❑ For security reasons, the data refresh frequently, and sensors produce massive data
- ❑ Resource usage directly affects project cost



Scenario 1

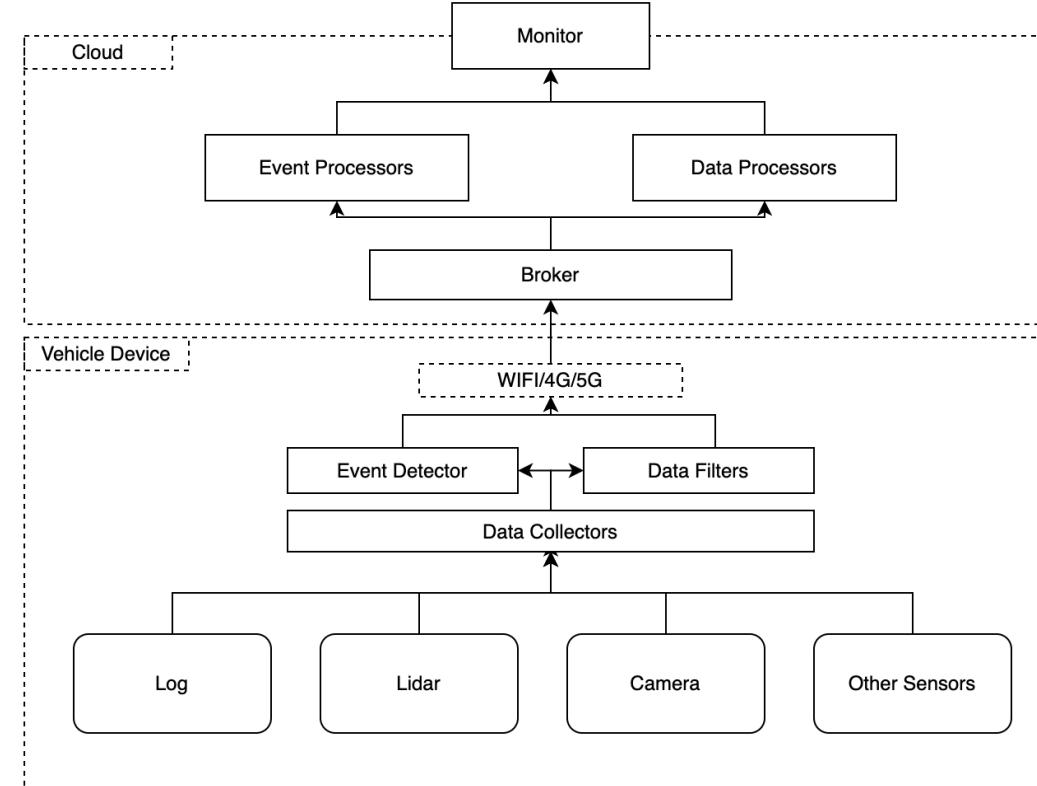


Scenario 2

■ Running  
■ Sleeping

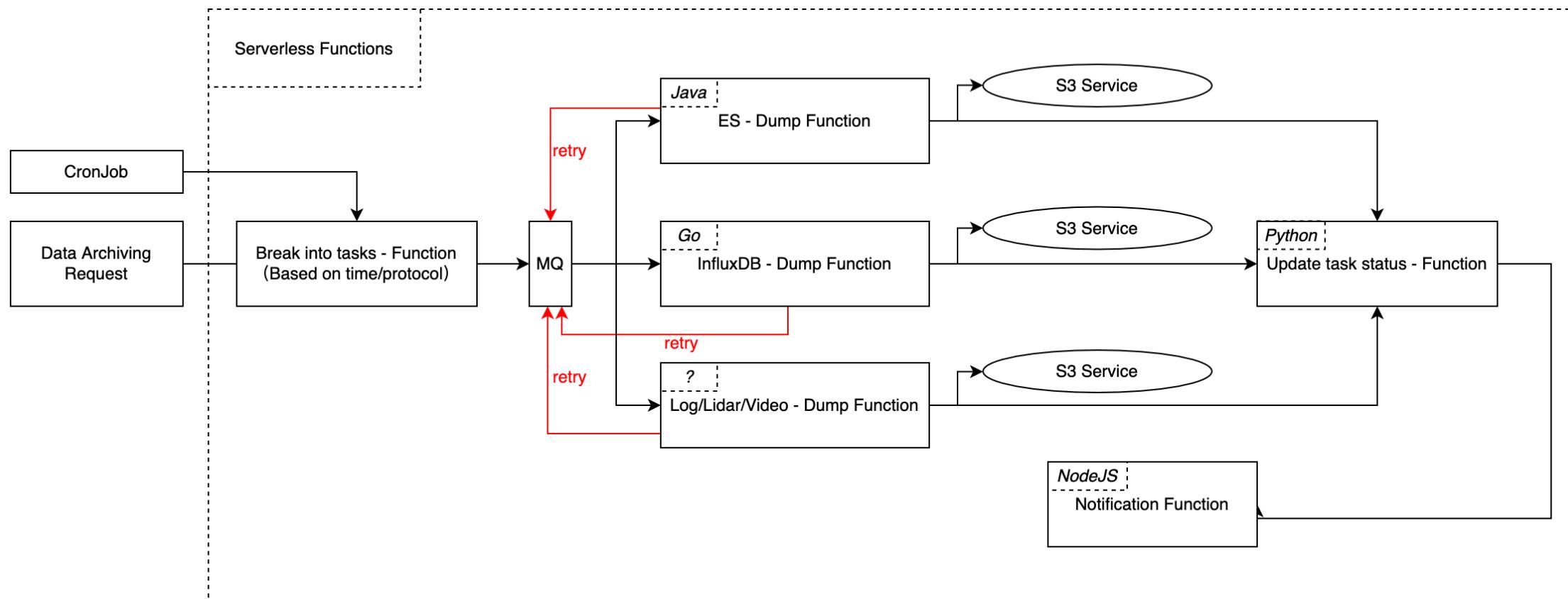
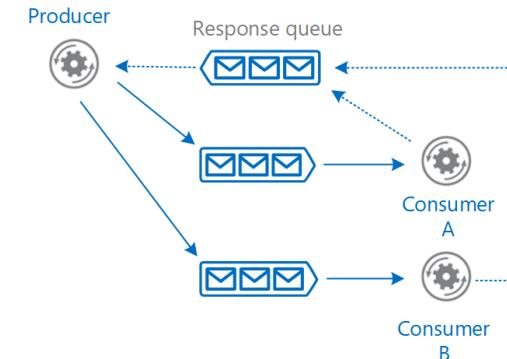
# Why Dapr matters?

- ❑ Data from different sensors and processing modules are complex
- ❑ Different cloud providers have difference backend services that results in a separate implementation for each cloud provider for the same process logic.
- ❑ Async commands other than synch commands is more suitable for shadow devices for performance reasons.



# Archiving vehicle data with OpenFunction

- ❑ Break long running task into pieces
- ❑ Trigger async functions with messages
- ❑ Process data with different languages
- ❑ Use message broker to decouple producer and consumer functions



# What is expected from a cloud agnostic FaaS platform?

## ❑ Tracing & Logging & Metrics

New data needs to go through hundreds of modules and a dozen network communications before it can be archived in the cloud and errors may occur in any step.

Trouble shooting is one of the most important problems in the development of an autonomous-driving system.

Effective observability mechanism saves time and money.

## ❑ Plug-in mechanism & package management mechanism

## ❑ Alternative underlying technology & easy-to-use interface wrapper

## ❑ Active and efficient maintenance team like OpenFunction

```
triggers:
  - type: kafka
    metadata:
      topic: logs
      bootstrapServers: kafka-server-kafka-brokers.default.svc.cluster.local:9092
      consumerGroup: logs-handler
      lagThreshold: "20"
    template:
      containers:
        - name: function
          imagePullPolicy: Always
      inputs:
        - name: kafka
          component: kafka-receiver
      outputs:
        - name: notify
          component: notification-manager
          operation: "post"
      bindings:
        kafka-receiver:
          type: bindings.kafka
          version: v1
          metadata:
            - name: brokers
              value: "kafka-server-kafka-brokers:9092"
            - name: authRequired
              value: "false"
            - name: publishTopic
              value: "logs"
            - name: topics
              value: "logs"
            - name: consumerGroup
              value: "logs-handler"
        notification-manager:
          type: bindings.http
          version: v1
          metadata:
            - name: url
              value: http://notification-manager-svc.kubesphere-monitoring-system.svc.cluster.local:19093/api/v2/alerts
```



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# Thanks!

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

UISEE: <https://www.uisee.com/en/>

