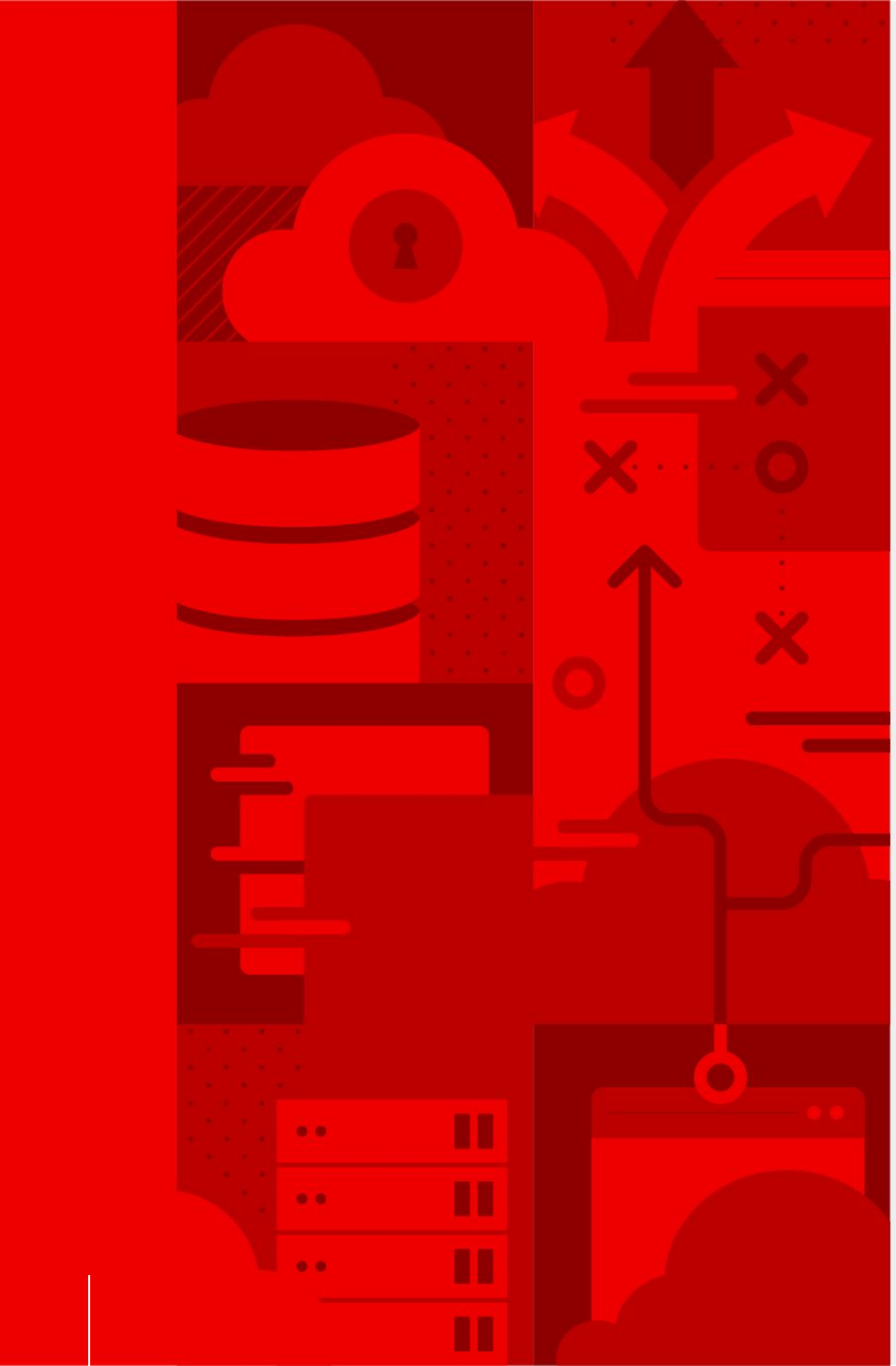

Modern event-driven Workloads with Knative

W-JAX 2021, München

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OpenShift Serverless Architect
Knative TOC member

Wait ... wat ?

AWS LAMBDA
IS JUST
GLORIFIED CGI-BIN
CHANGE MY MIND
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Serverless

"Serverless computing refers to the concept of building and running **applications** that **do not require server management**. It describes a finer-grained **deployment model** where applications, bundled as one or more functions are uploaded to a platform and then **executed**, **scaled**, and **billed** in response to the exact **demand** needed at the moment"

-- CNCF Definition, https://www.cncf.io/blog/2018/02/14/cncf-takes-first-step-towards-serverless-computing/

Serverless vs. FaaS

Serverless is a **Deployment Model** that abstracts away the driving machine infrastructure.

- No server management required
- Executed, scaled and billed according to demand
- Defines a deployment packaging, but otherwise agnostic to the application

FaaS (Function-as-a-Service) is a **Programming Model** that mandates developing your application with fine grained function that match a given signature.

- Deployed as Serverless application
- Typically used as *glue code* to connect services

Knative

Kubernetes-based platform to **deploy** and **manage** modern **serverless workloads**.

https://knative.dev

Components

Serving

A request-driven model that serves the container with your application and can "scale to zero".

Eventing

Common infrastructure for consuming and producing events that will stimulate applications.

Background Information

- Started as an **Open Source** Project mid-2018 by Google
- Community driven with a lot of vendor backing
    - https://github.com/knative
    - https://knative.dev
    - Support by Google, Red Hat, IBM, VMware, Triggermesh, SAP and more
    - Organized in multiple Working Groups with weekly meetings
- Releases
    - Current: **v1.0.0** (yay!)
    - 6 week release cadence

Try Knative !

- Install from resource descriptors on Kubernetes Cluster
    - https://knative.dev/docs/install/
- Google **Cloud Run** (managed and on GKE)
    - https://cloud.google.com/run/
    - Not all Knative features implemented
        - see https://ahmet.im/blog/cloud-run-is-a-knative ?
- IBM Cloud **Code Engine**
    - https://www.ibm.com/cloud/code-engine
    - Vanilla Knative, additional workloads (like batch)
- Red Hat **OpenShift Serverless**
    - https://www.openshift.com/learn/topics/serverless
    - Supports all Knative features

Serving

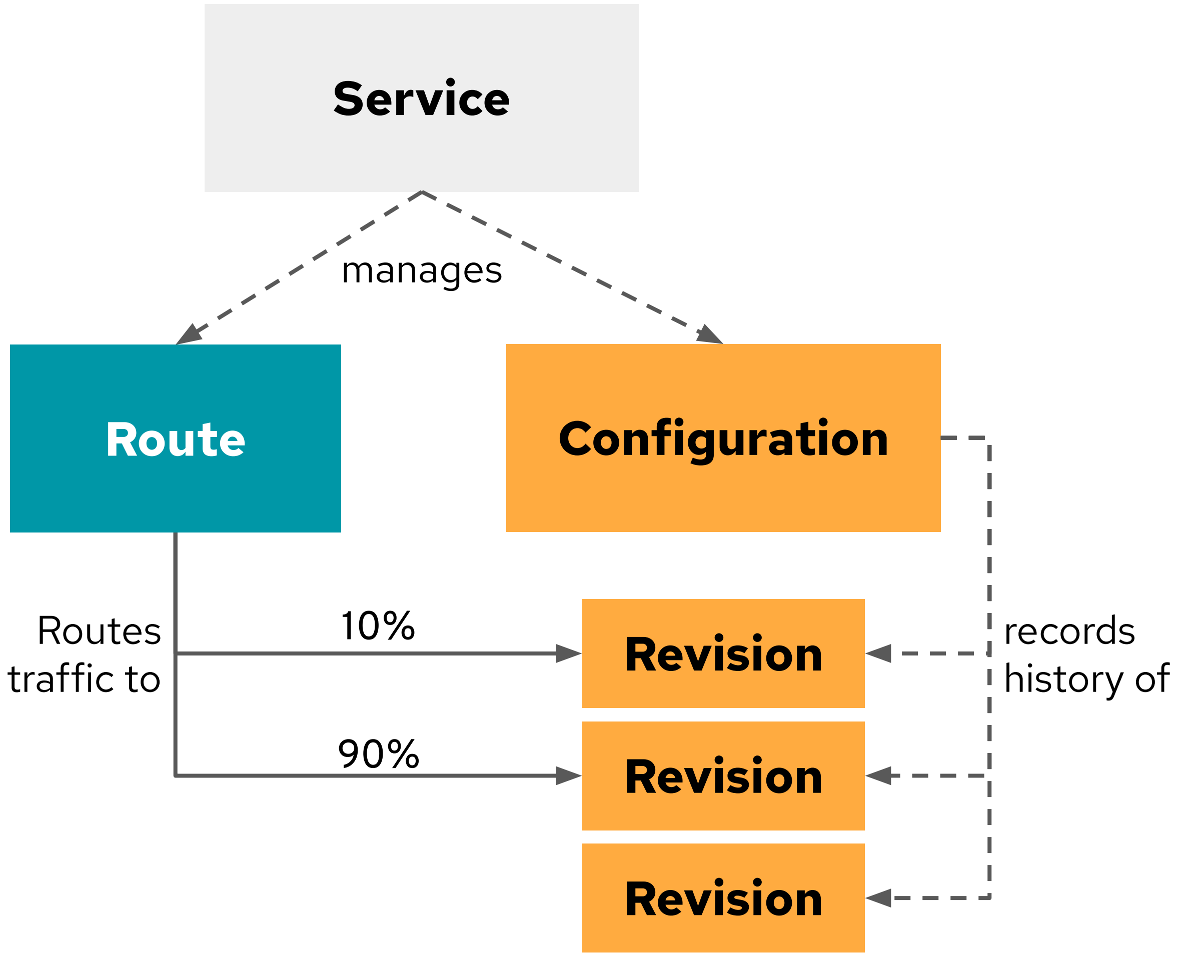
Route, **scale-to-zero** and track application **revisions** with ease.

Concepts

- **Demand-based autoscaling**, including scale-to-zero
- Separation of code and configuration
- Opinionated deployment model catered for **stateless applications**
    - Single Port
    - No PersistentVolumes
    - Single Container (about to change)
- Rich **traffic split capabilities** to enable custom rollout strategies of new versions

Resources

- **Configuration** represent the *floating HEAD* of a history of **Revisions**
- **Revision** represents an immutable snapshot of code and configuration
- **Route** configure ingress over a collection of Revisions
- **Service** (not K8s services !) is a top-level entity that manage a set of Routes and Configurations



From **Deployment** to **KService**

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: random
spec:
  replicas: 1
  selector:
    matchLabels:
      app: random
  template:
    metadata:
      labels:
        app: random
    spec:
      containers:
      - image: rhuss/random
        name: random
        ports:
        - containerPort: 8080
```

```
apiVersion: serving.knative.dev/v1alpha1
kind: Service
metadata:
  name: random
spec:
  replicas: 1
  selector:
    matchLabels:
      app: random
  template:
    metadata:
      labels:
        app: random
    spec:
      containers:
      - image: rhuss/random
        name: random
        ports:
        - containerPort: 8080
```

No more K8s **Service** or **Ingress/Route** required !

Demo

Red Hat

Eventing

Universal subscription, **delivery**, and management of **CloudEvents**.

Red Hat

Eventing

- Based on CloudEvents (CNCF Standard)
- Pluggable event transport via **Channels**
  - In-Memory
  - Apache Kafka
  - Google Pub-Sub
- Flexible routing of events from Sources to Sinks
  - **Source**: Adapter for integrating 3rd party systems and emitting CloudEvents
  - **Sink**: Addressable endpoint for CloudEvents (like a Knative Service)

Event Sources

- Integrating 3rd party systems with Knative
- More often “**Adapter**” than an original event source
- Declared with a **Custom Resource**
- Evaluated by an Operator
- Push or Pull based
- Converting custom event formats to **CloudEvents**

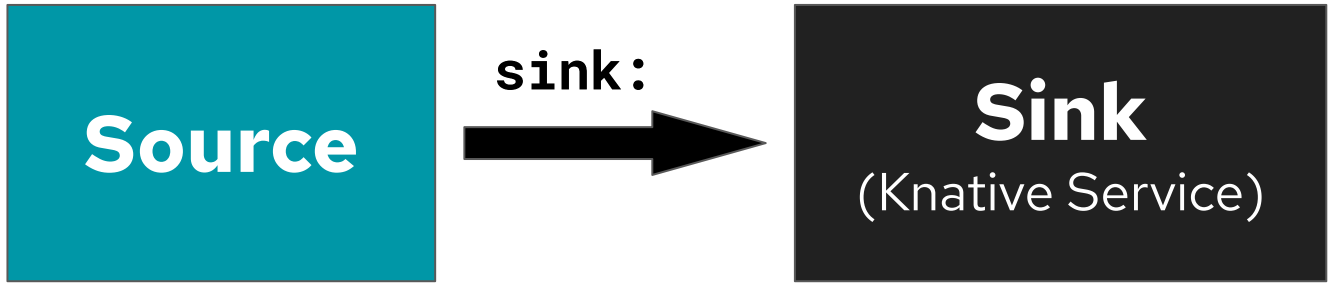
Sources

Builtin Sources	
`PingSource`	Emitting static CloudEvents periodically
`ApiServerSource`	Kubernetes API Server events as CloudEvents
`SinkBinding`	Binds an arbitrary Pod specification to a Sink
`ContainerSource`	Meta-Source combining SinkBinding & Deployment

Contributed Sources	
`GitHubSource`	Converts GitHub webhooks events to CloudEvents
`KafkaSource`	Apache Kafka messages as CloudEvents
`CamelKSource`	Apache Camel components as sources

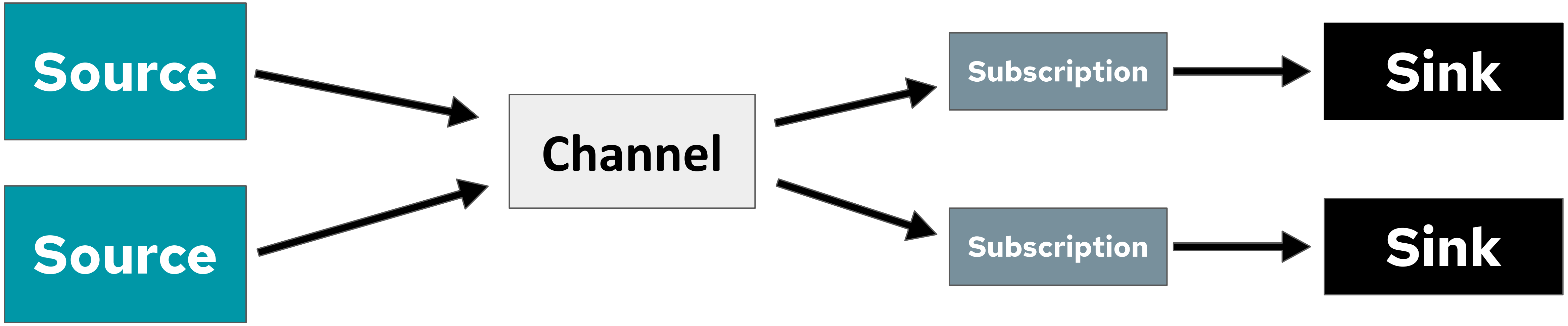
and many more: https://knative.dev/docs/eventing/sources/

Source → Service : Direct Connection



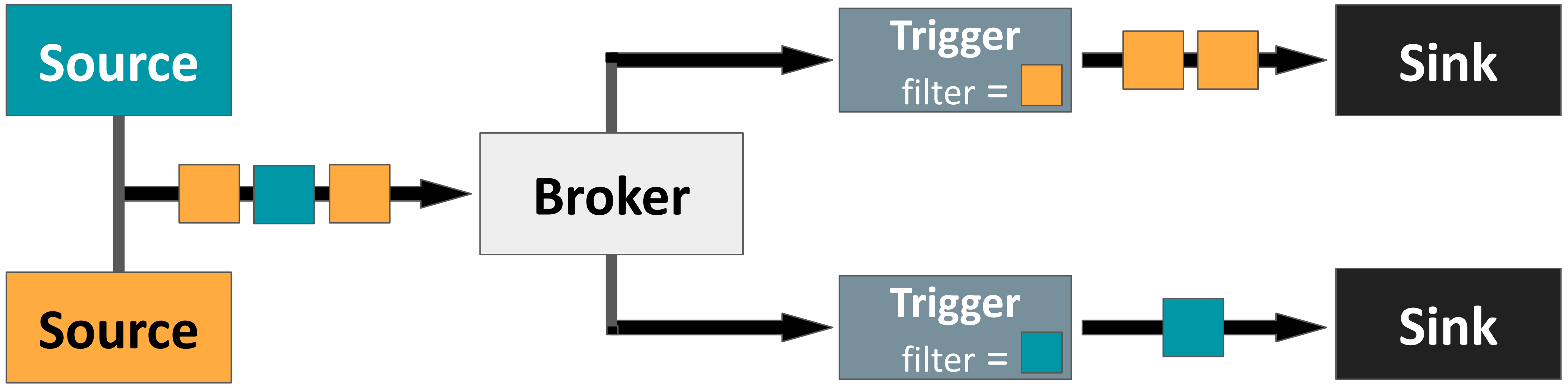
- Simplest way to get CloudEvents to a service
- Drawbacks:
    - No queuing support when service is unavailable
    - No back pressure support
    - Only one Service can consume events
    - No filtering, Service gets always all events

Source → Service : Channel & Subscription



- Multiple Services can consume the same event
- Subscription can point to a reply channel (not shown here)
- Various Channel Backends available
    - In-Memory, Kafka, GCP PubSub, (write your own)
- Drawbacks:
    - Channel Infrastructure needs to be set up manually
    - No filtering, Service gets always all events

Source → Service: Broker & Trigger



Broker

- Eventing Mesh for distributing Events
- Addressed by sources as sink

Trigger

- Filter on CloudEvent attributes (e.g. type)
- Connects a Sink with Broker

Source → Service: Broker & Trigger

- **Broker**
  - Eventing Mesh (or Event Delivery System)
  - Connects Sources with Sinks
  - Uses Channels internally, creating on the fly
  - Multi-tenant
- **Trigger**
  - Filter events (e.g. type and/or source)
  - Can produce new events (returned to Broker)
  - Delivered as CloudEvents

More Knative Eventing

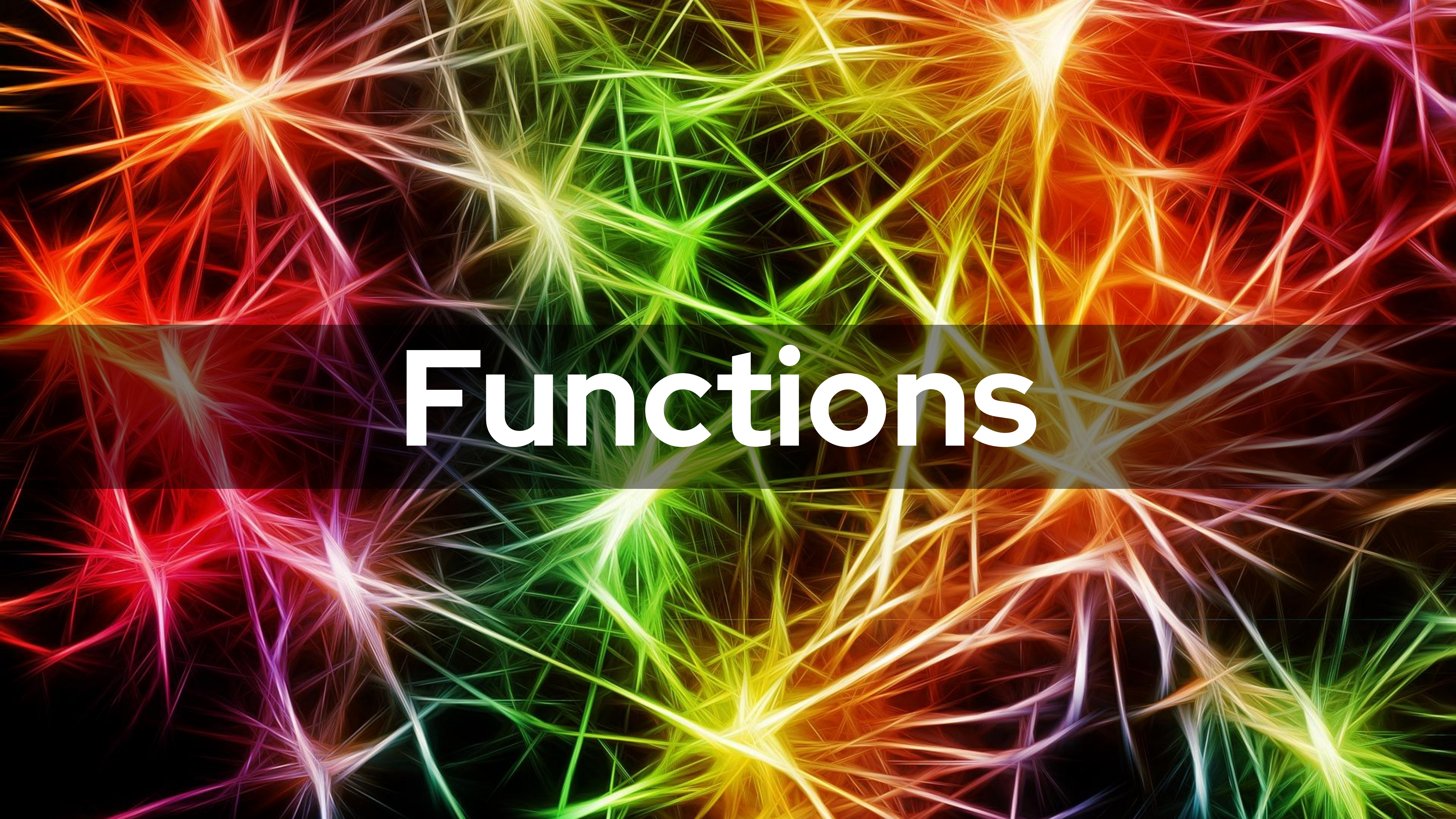
- **EventRegistry**
  - EventType CRD
  - Discoverability of Events
- **Sequence**
  - Chaining multiple Services
  - Sinking to an “Addressable” (Service, Channel, Sequence, Broker ...)
- **Parallel**
  - Branching of events with filters
  - Allows to implement conditional processing

Demo

Kamelets

Kamelets

- Part of **Camel-K**, a runtime platform on top of Kubernetes for Apache Camel routes
- Snippets that contain a **route template**
- Types of Kamelets
  - **Sources** for incoming cloud events
  - **Sinks** for outgoing cloud events
  - **Actions** for transformations
- Kamelets are instantiated via **KameletBindings**
  - Filling in Kamelet parameters, like authentication information
  - Connecting to sink (for sources)
- kn-source-kamelet : Kn **plugin** for managing Kamelets



Functions

kn-func

- Opinionated **programming model** for Knatve
  - Scaffolding of project templates for multiple runtimes
    - Quarkus, Node.js, Spring, Python, …
  - Building and pushing container images
  - Deploying as Knative services
- Available as **plugin** of the Knative CLI
  - https://github.com/knative-sandbox/kn-func
- **Local development** mode
- Technologies
  - Cloud-native Buildpacks
  - Local Docker or Podma
  - Soon: On-cluster builds

Demo

Red Hat

Summary

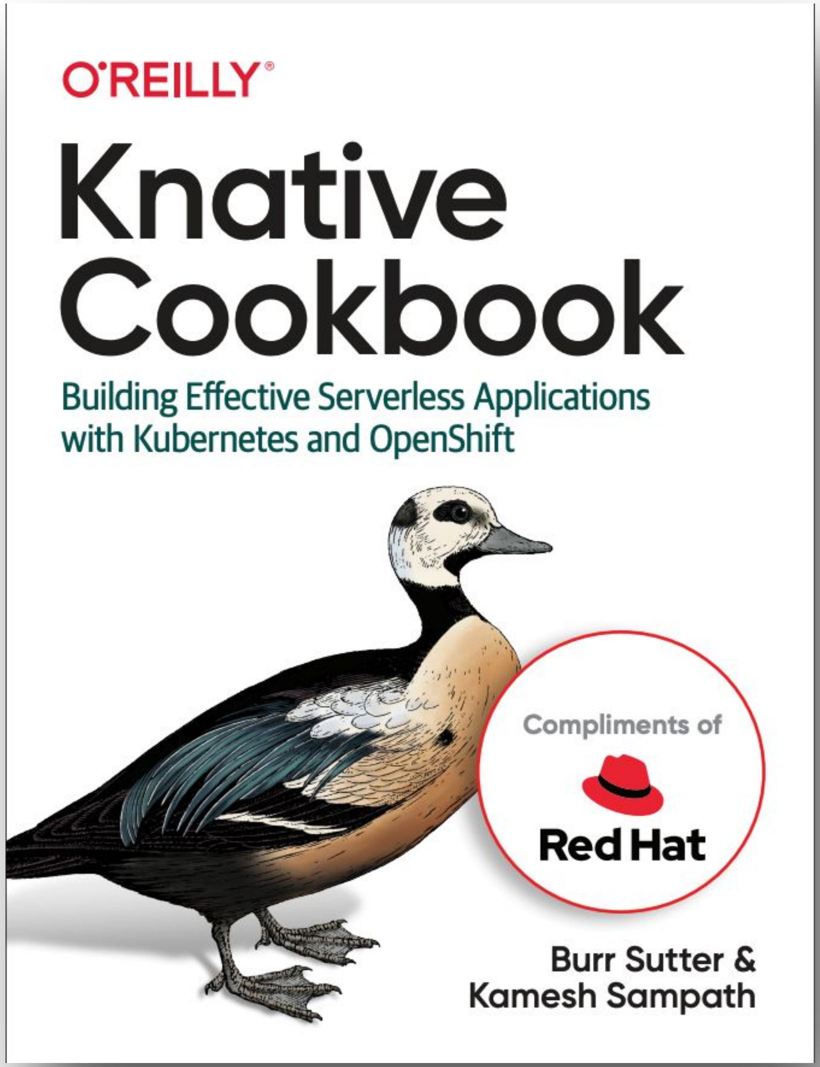
Summary

Knative Serving

- Simplified Deployment for stateless workloads
- Traffic based autoscaling including Scale-to-Zero
- Traffic splitting for custom rollout / rollback scenarios

Knative Eventing

- External Triggers for feeding Knative Services
- Based on CloudEvents
- Backed by proven messaging systems
- Flexible messaging setup



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Knative Cookbook

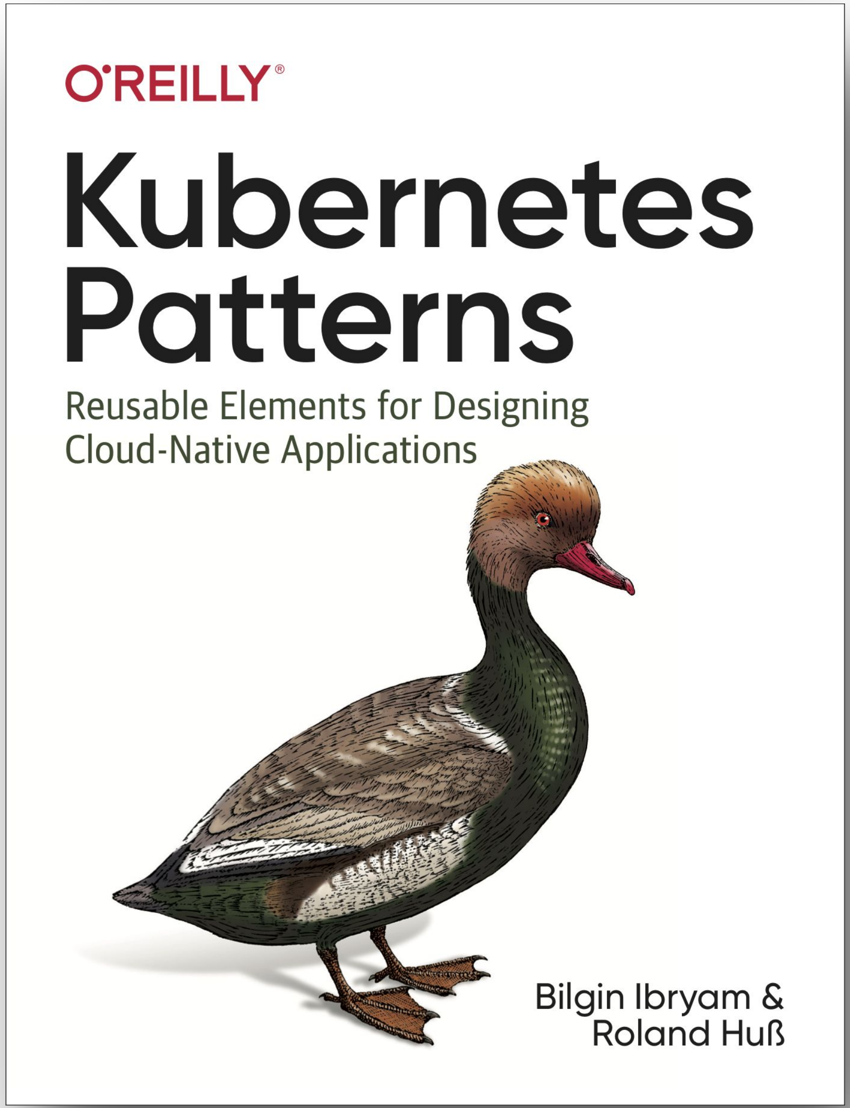
Building Effective Serverless Applications with Kubernetes and OpenShift

Compliments of Red Hat

Burr Sutter & Kamesh Sampath

http://dn.dev/knative-cookbook

Kubernetes Patterns



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Kubernetes Patterns

Reusable Elements for Designing Cloud-Native Applications

Bilgin Ibryam & Roland Huß

https://k8spatterns.io

Thank you

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