Cloud Agnostic Design Patterns and Tips

(for Serverless and Java)

Kevin Dubois,
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The Cloud

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- ★ Principal Developer Advocate at Red Hat
- ★ Java Champion
- ★ Based in Belgium
- ★ Speak English, Dutch, French, Italian
- ★ Open Source Contributor (Quarkus, Camel, Knative, ..)
- ★ Community Member (BeJUG, BeCNCF)

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Cloud Computing:

Respond more quickly to demand

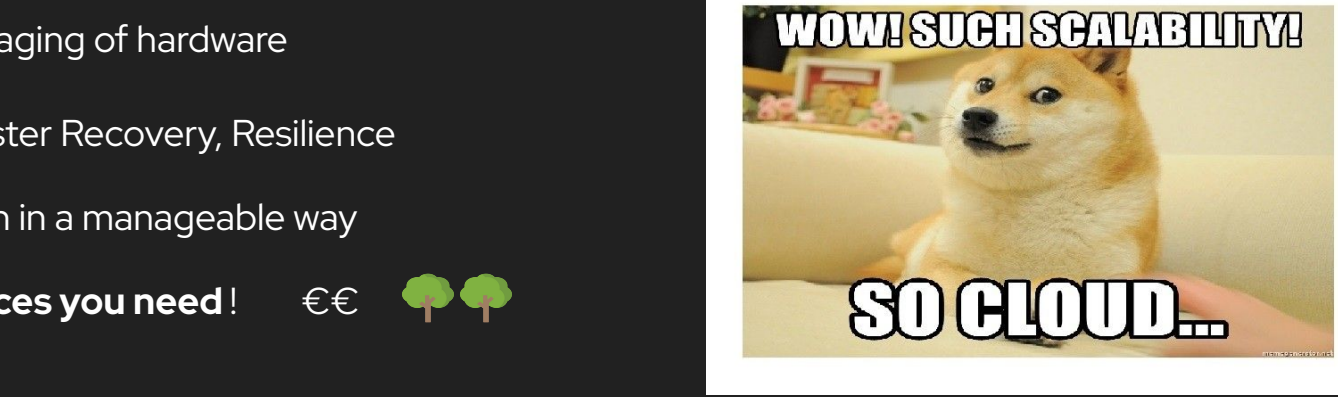
No provisioning/managing of hardware

High availability, Disaster Recovery, Resilience

Grow your application in a manageable way

Use only the resources you need ! €€ 🌳🌳

...



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(Some) Components of an Application Platform

Developer Tools

CI/CD
GitOps

Networking

Monitoring

Logging

Container
Registry

aws | Services | Search [Alt+S]

Console Home

myApplications

All services

Console Home > All services

All services

Services by category

Compute
EC2
Lightsail
Lambda
Batch
Elastic Beanstalk
Serverless Application Repository
AWS Outposts
EC2 Image Builder
AWS App Runner
AWS SimSpace Weaver

Containers
Elastic Container Registry
Elastic Container Service
Elastic Kubernetes Service
Red Hat OpenShift Service on AWS

Storage
S3
EFS
FSx
S3 Glacier
Storage Gateway
AWS Backup
AWS Elastic Disaster Recovery

Database
RDS
ElastiCache
Neptune
Amazon QLDB
Amazon DocumentDB
Amazon Keyspaces
Amazon Timestream
DynamoDB
Amazon MemoryDB for Redis

Migration & Transfer

Customer Enablement
AWS IQ
Managed Services
Activate for Startups
Support
AWS re:Post Private

Robotics
AWS RoboMaker

Blockchain
Amazon Managed Blockchain

Satellite
Ground Station

Quantum Technologies
Amazon Braket

Management & Governance
AWS Organizations
CloudWatch
AWS Auto Scaling
CloudFormation
AWS Config
OpsWorks
Service Catalog
Systems Manager
Trusted Advisor
Control Tower
AWS Well-Architected Tool
AWS Health Dashboard
AWS Chatbot
Launch Wizard
AWS Compute Optimizer
Resource Groups & Tag Editor
Amazon Grafana
Amazon Prometheus

Machine Learning
Amazon SageMaker
Amazon Augmented AI
Amazon CodeGuru
Amazon DevOps Guru
Amazon Comprehend
Amazon Forecast
Amazon Fraud Detector
Amazon Kendra
Amazon Personalize
Amazon Polly
Amazon Rekognition
Amazon Textract
Amazon Transcribe
Amazon Translate
AWS DeepComposer
AWS DeepRacer
AWS Panorama
Amazon Monitron
AWS HealthLake
Amazon Lookout for Vision
Amazon Lookout for Equipment
Amazon Lookout for Metrics
Amazon Lex
Amazon Comprehend Medical
AWS HealthOmics
Amazon Bedrock
AWS HealthImaging
Amazon Q

Analytics
Athena
Amazon Redshift
CloudSearch
Amazon OpenSearch Service
Kinesis
QuickSight
Data Pipeline
AWS Data Exchange

Cloud Financial Management
AWS Marketplace Subscriptions
AWS Billing Conductor
Billing and Cost Management

Front-end Web & Mobile
AWS Amplify
AWS AppSync
Device Farm
Amazon Location Service

Application Integration
Step Functions
Amazon AppFlow
Amazon MQ
Simple Notification Service
Simple Queue Service
SWF
Managed Apache Airflow
Amazon EventBridge
AWS B2B Data Interchange

Business Applications
Amazon Connect
Amazon Honeycode
Amazon Chime
Amazon Simple Email Service
Amazon WorkDocs
Amazon WorkMail
AWS Supply Chain
AWS AppFabric
AWS Wickr
Amazon Chime SDK
Amazon One Enterprise
Amazon Pinpoint

End User Computing
WorkSpaces
AppStream 2.0

Microsoft Azure

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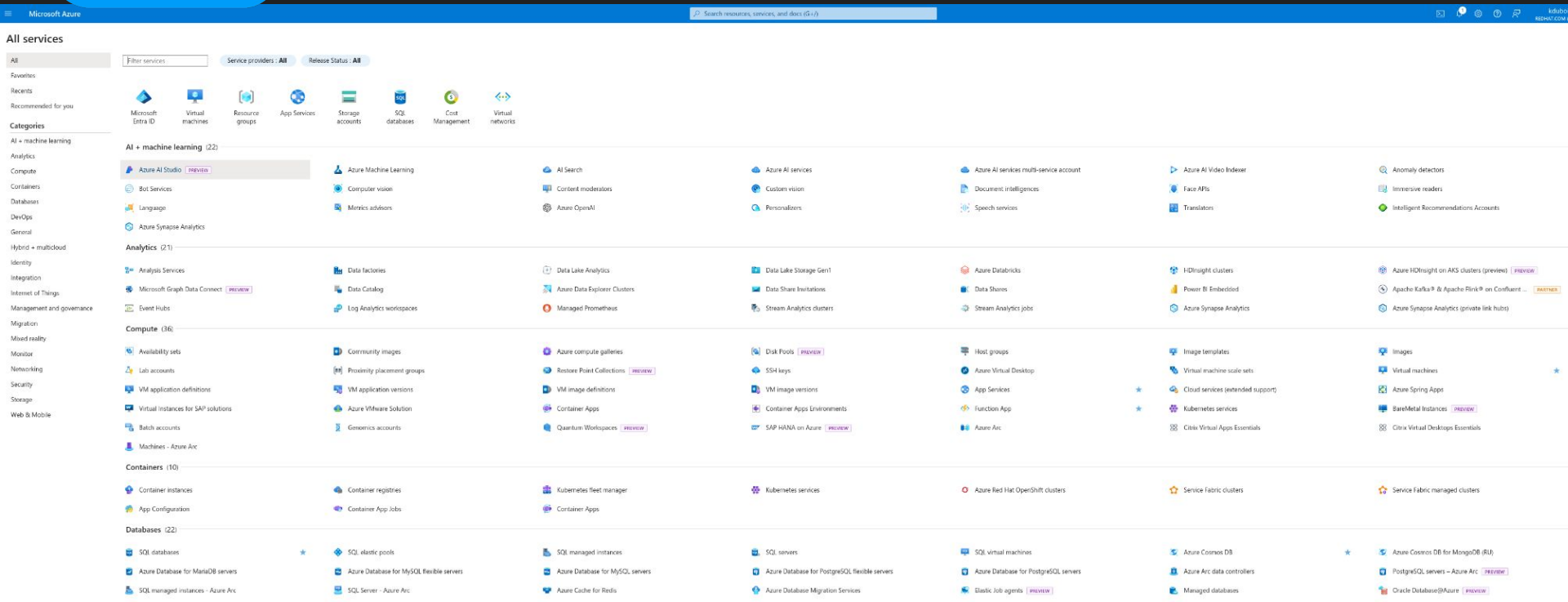

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Free trial status: €271.02 credit and 51 days remaining. Activate your full account to get unlimited access to all of Google Cloud—use any remaining credits, then pay only for what you use.

Google Cloud | Kevin | Search (/) for resources, docs, products, and more | Search

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Products & solutions

- All products
- Jump Start Solutions
- Solution deployments

Categories

- Management
- Compute
- Storage
- Analytics
- Networking
- Distributed Cloud
- Serverless
- Databases
- Operations •
- Security
- CI/CD
- Artificial Intelligence
- Integration Services
- Tools
- Web3

Compute

Run scalable virtual machines and containers

Name	Description
Compute Engine	VMs, GPUs, TPUs, disks
Kubernetes Engine	Managed Kubernetes / containers
VMware Engine	VMware as a service
Anthos	Enterprise hybrid multi-cloud platform
Batch	Jobs as a service

Storage

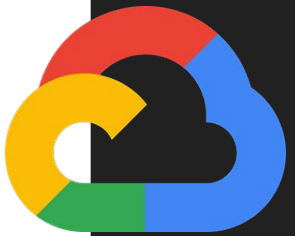
Store long-term, short-term, VM, and Filestore securely

Name	Description
Cloud Storage	Enterprise-ready object storage
Filestore	Fully managed NFS server
Storage Transfer	Secure and flexible way to move data
PowerScale P	Cloud-native enterprise-grade file service
NetApp Volumes	Fully Managed File Storage

Analytics

Collect, store, process, and analyze large amounts of data

Name	Description
BigQuery	Data warehouse/analytics



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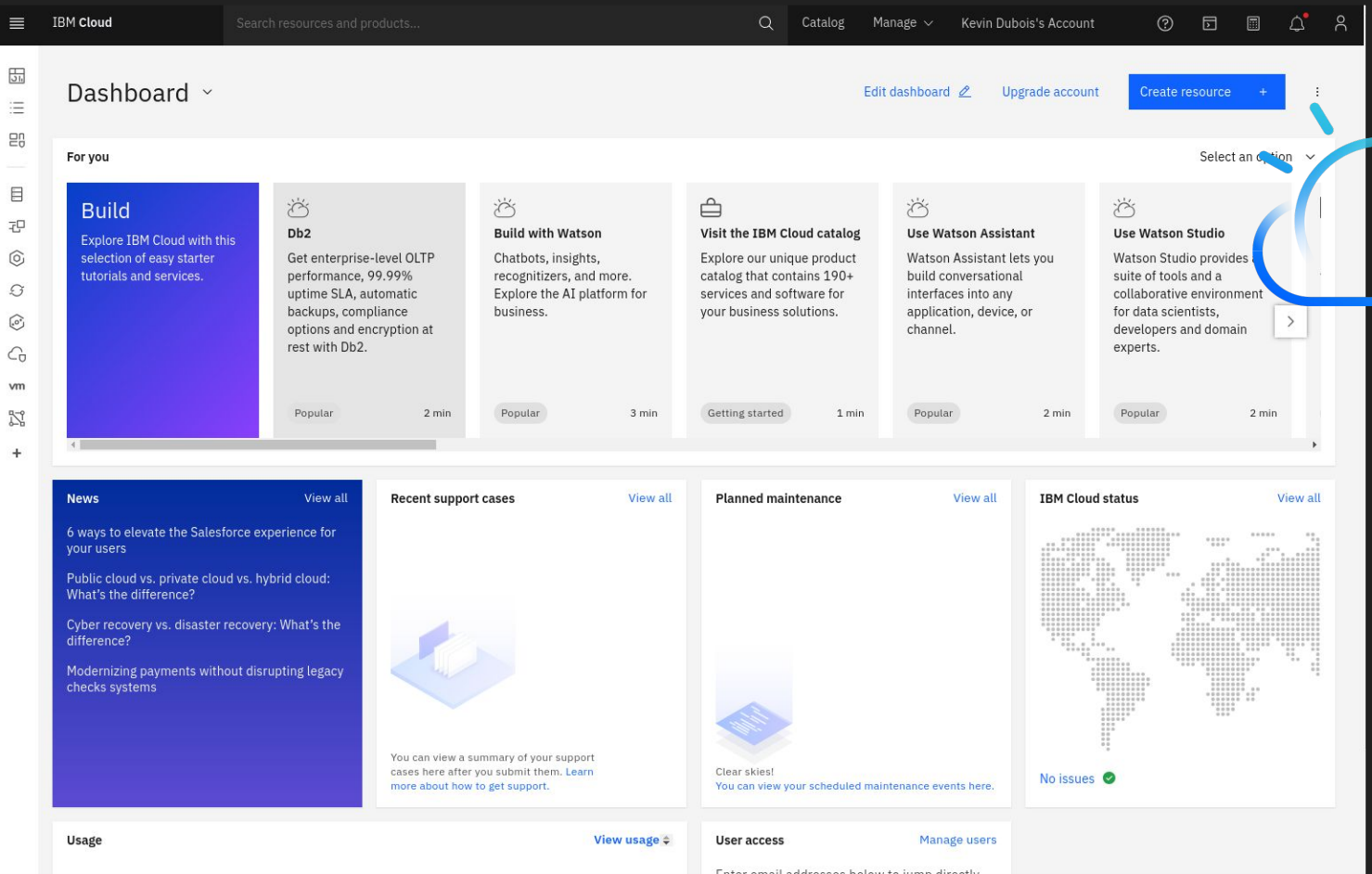

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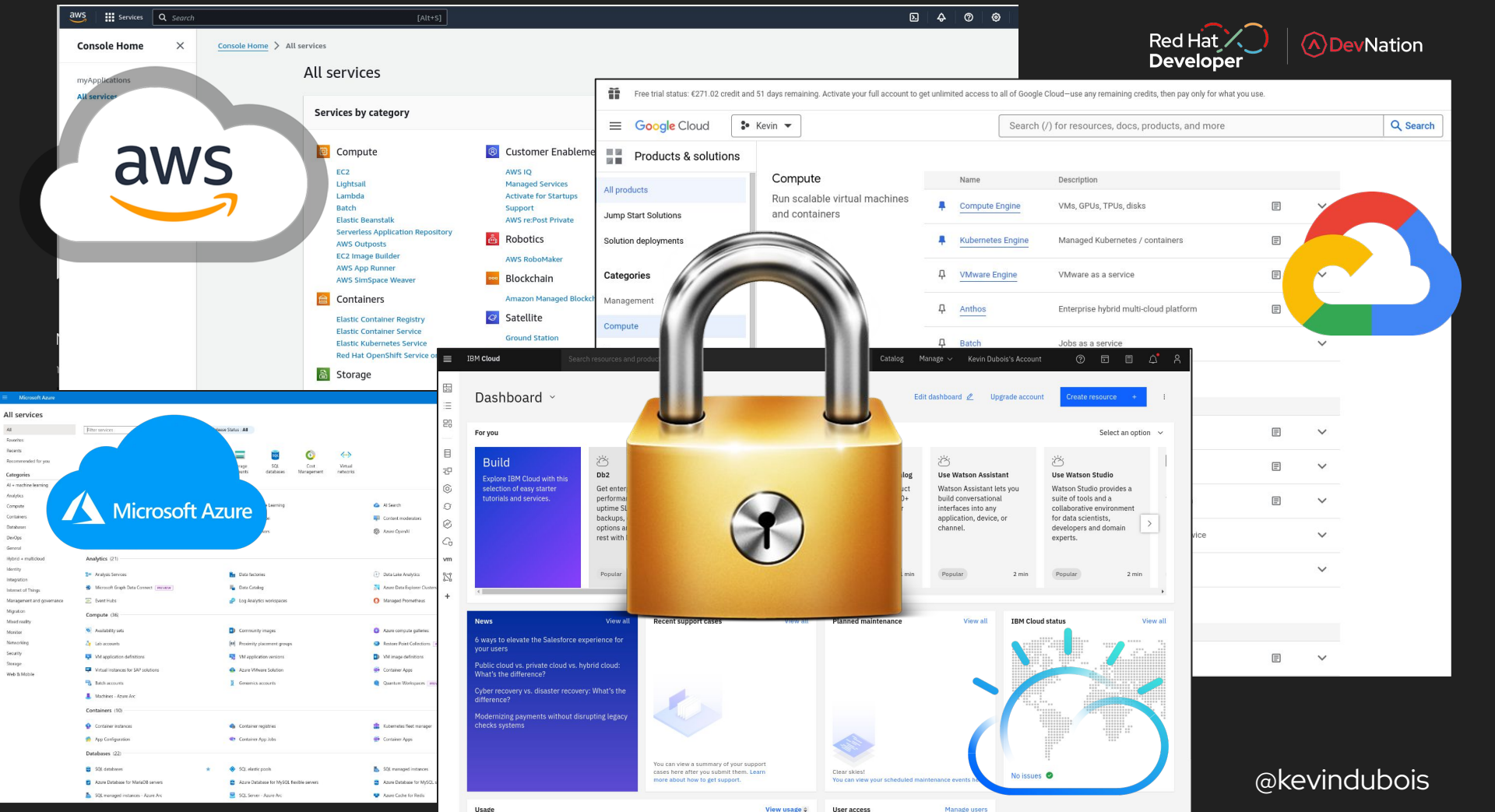
But...

What if ...

- Regulatory changes
- Outages
- Price changes, contract renegotiations
- Other vendor offers better hw / services
- New CIO/CTO
- Shadow IT
- ...



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So ... ?


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Hybrid / Multi Cloud!?
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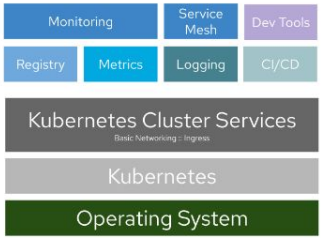
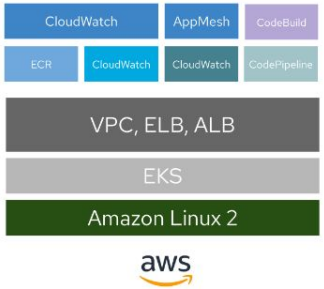
Building an application platform on each cloud

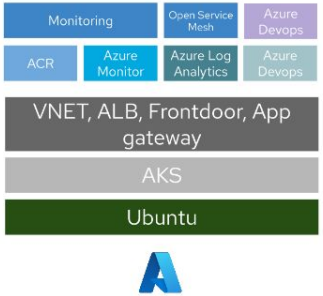
The required Parts



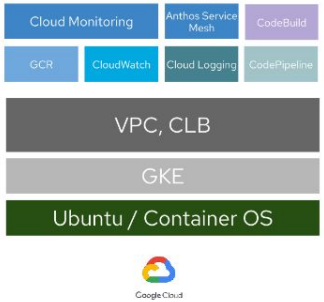
The AWS Car



The Azure Car



The Google Cloud Car



3 different cars

- Different component versions
- Different life cycles
- Different support models
- Different developer and ops tooling

→ **3 different drivers and pit crews needed**

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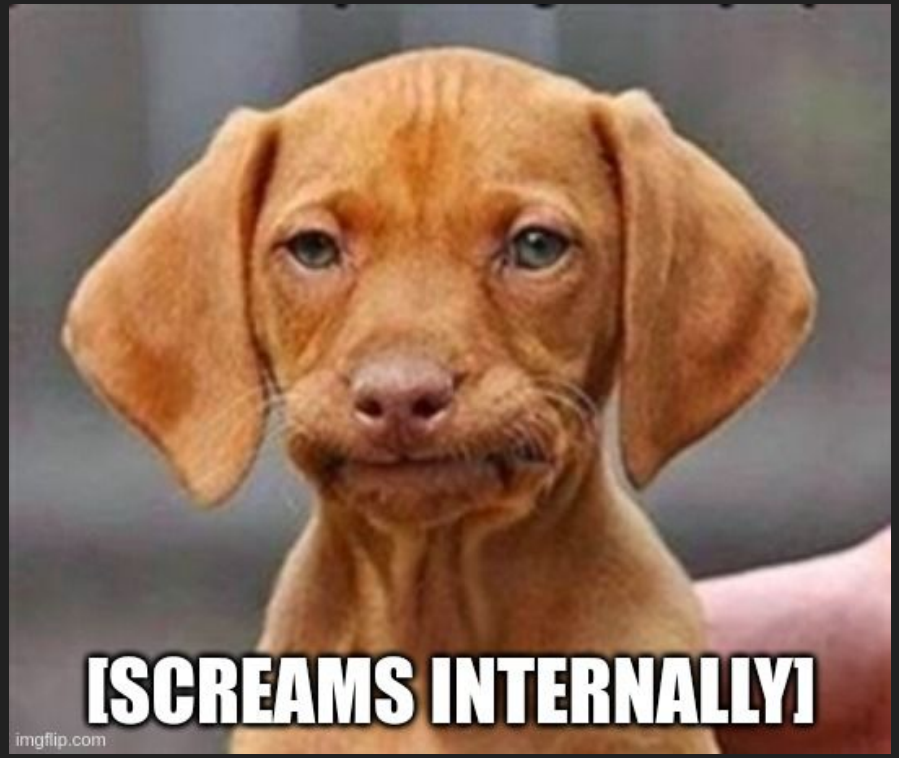
[SCREAMS INTERNALLY]
imgflip.com

Open Source & Cloud Native Ecosystem FTW!

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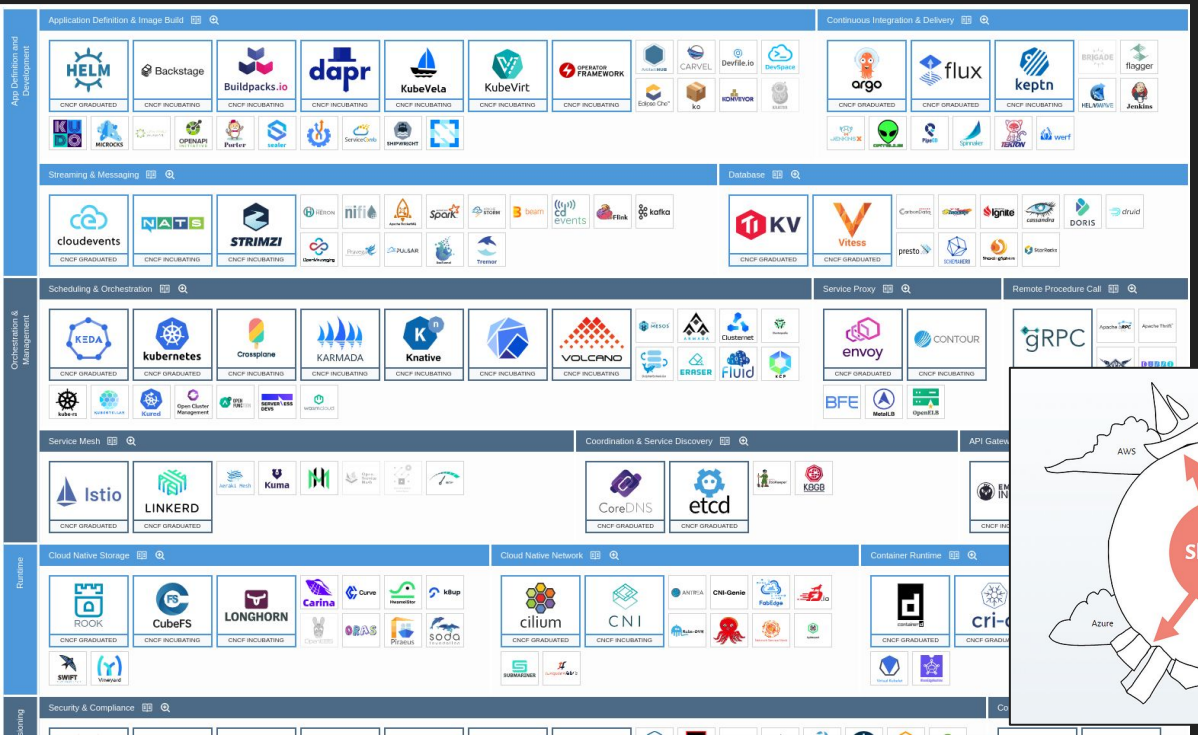

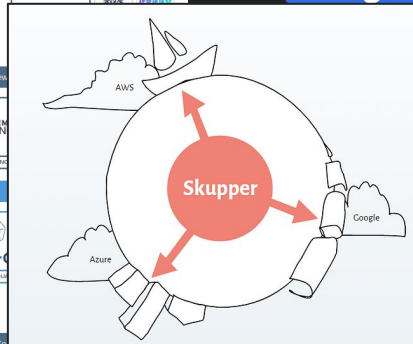

Multicloud communication for Kubernetes

Skupper is a layer 7 service interconnect. It enables secure communication across Kubernetes clusters with no VPNs or special firewall rules.

With Skupper, your application can span multiple cloud providers, data centers, and regions.

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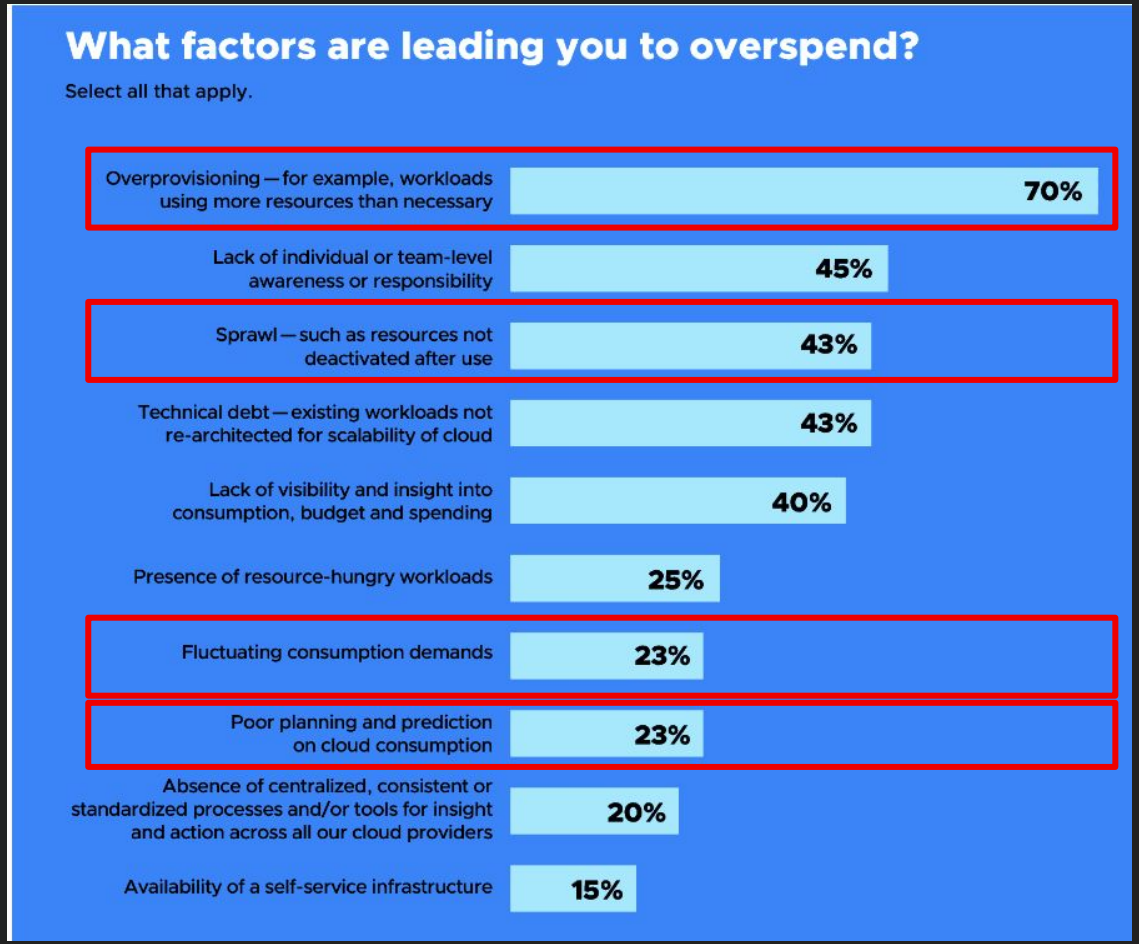
What about Serverless?

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/



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https://www.cncf.io/blog/2023/12/20/cncf-cloud-native-finops-cloud-financial-management-microsurvey/

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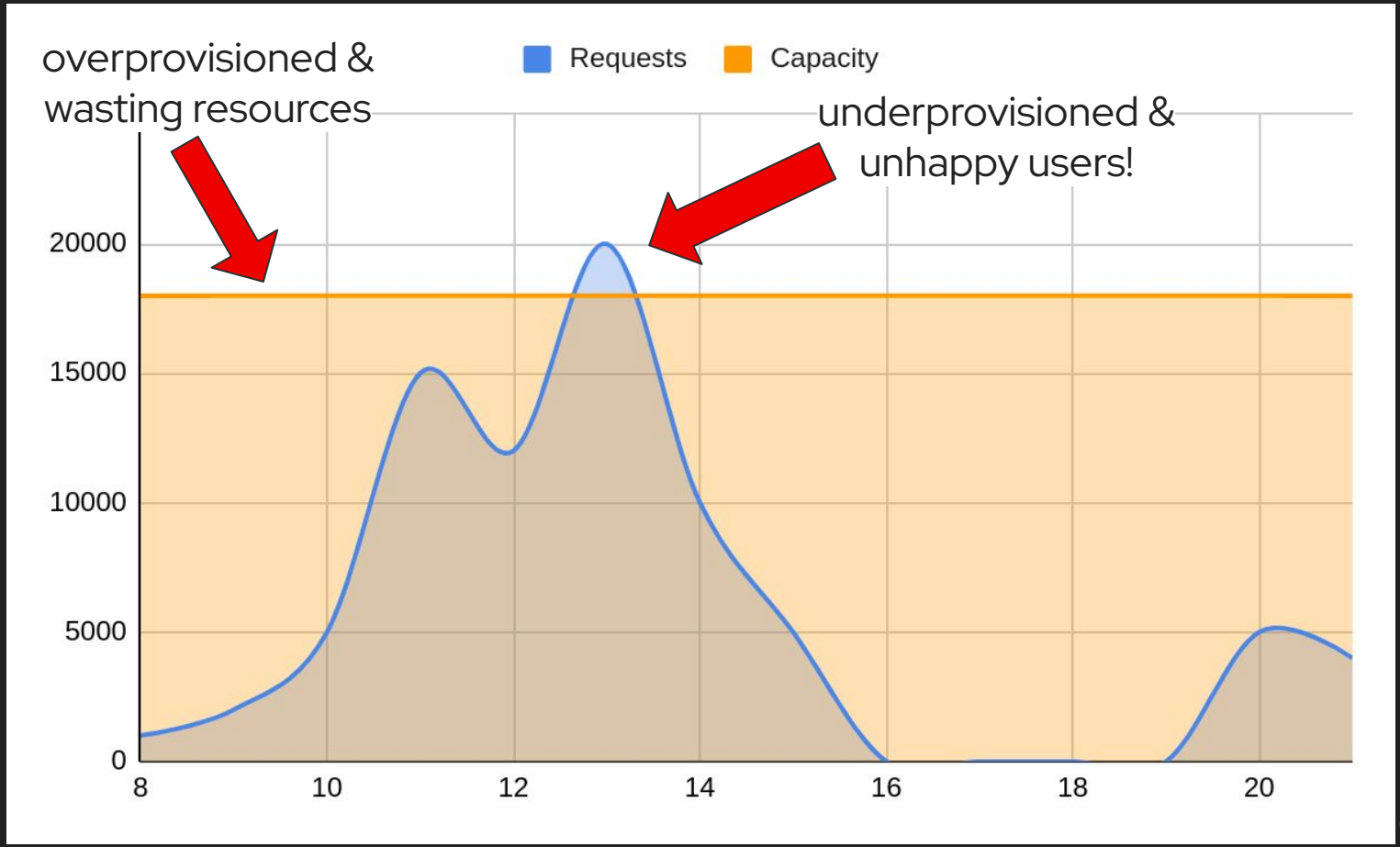
Traditional Deployments



Serverless

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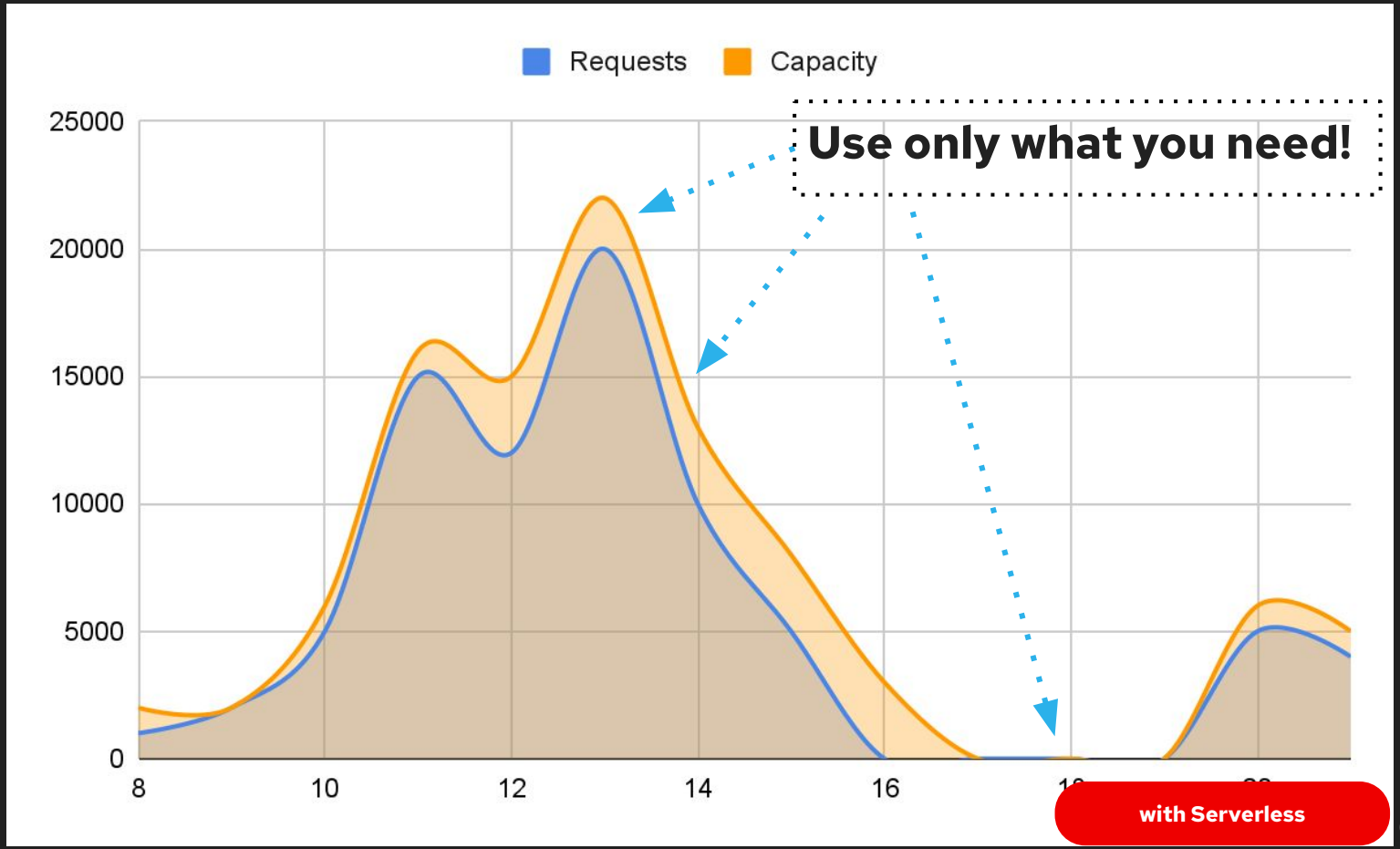

with Serverless

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Java & Serverless

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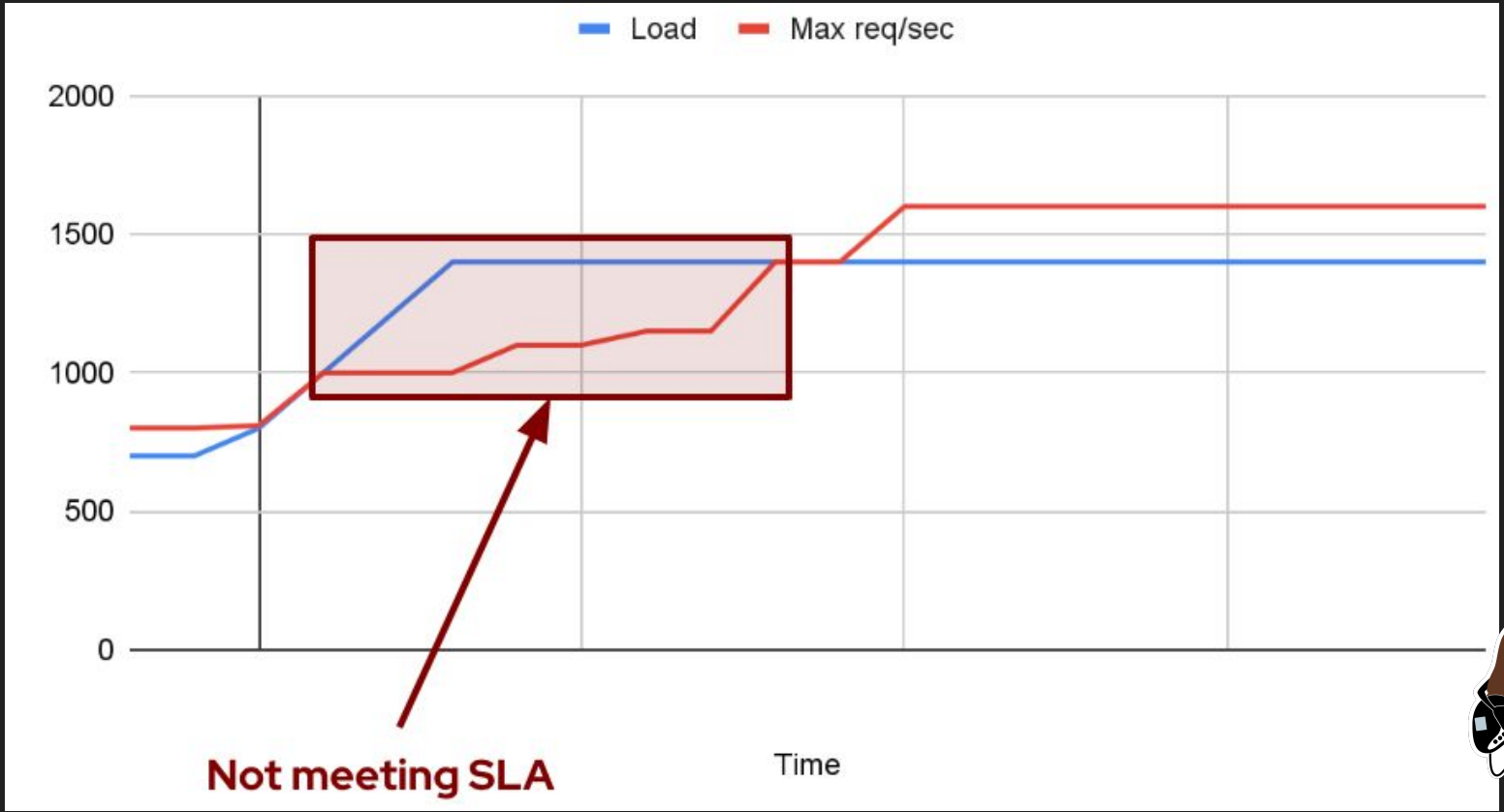
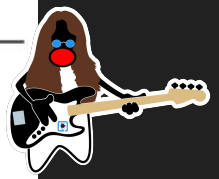
JVM Scaling





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QUARKUS

Supersonic. Subatomic. Java

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The Quarkus Way

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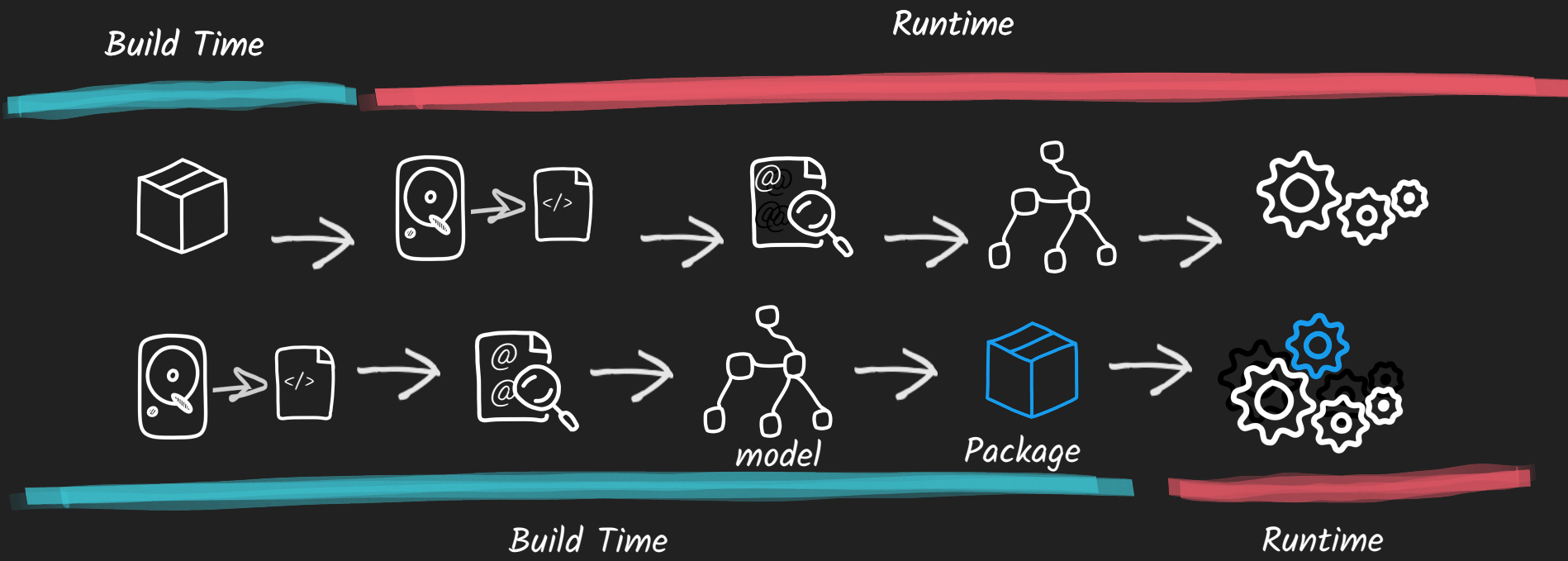

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The Quarkus Way enables Native Compilation OOTB

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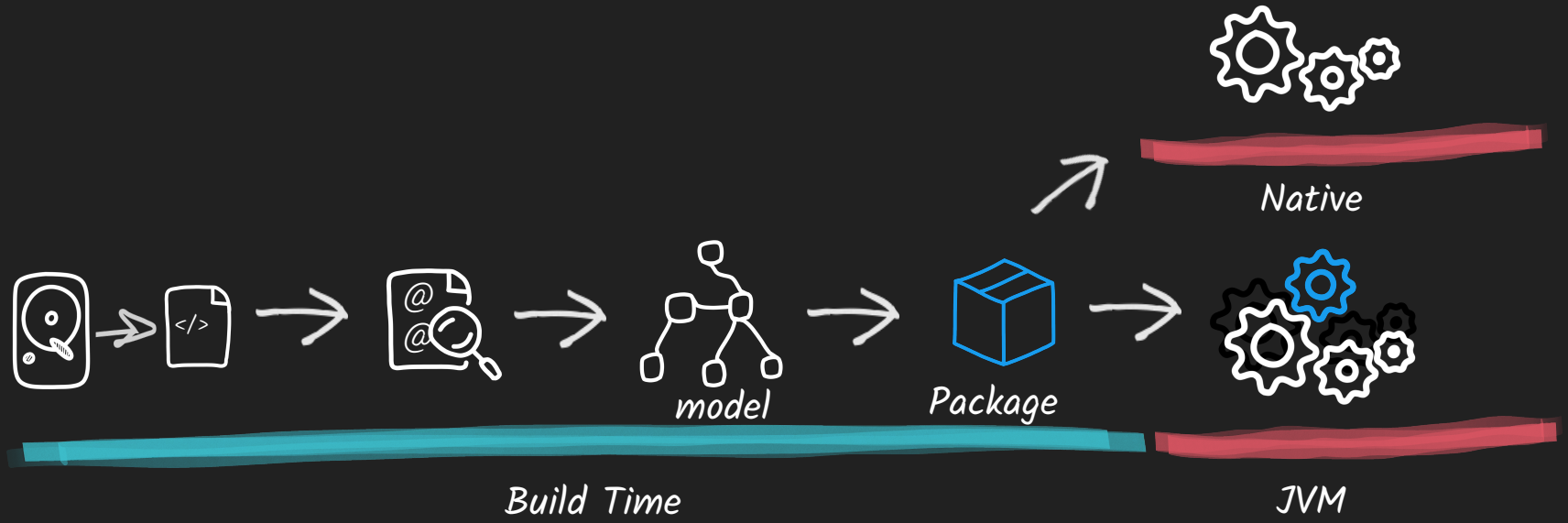

Supersonic, Subatomic Java

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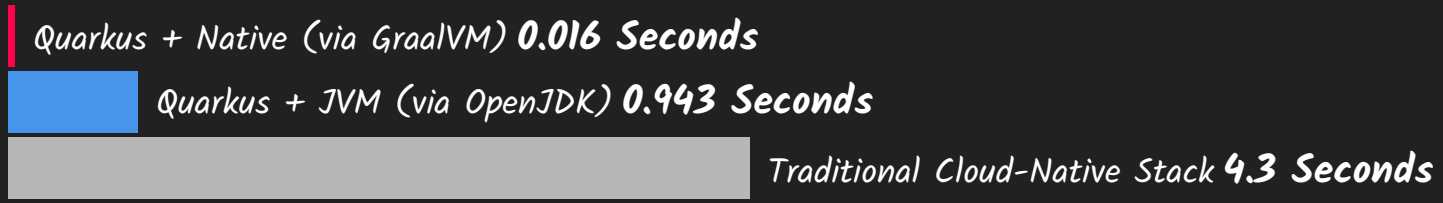

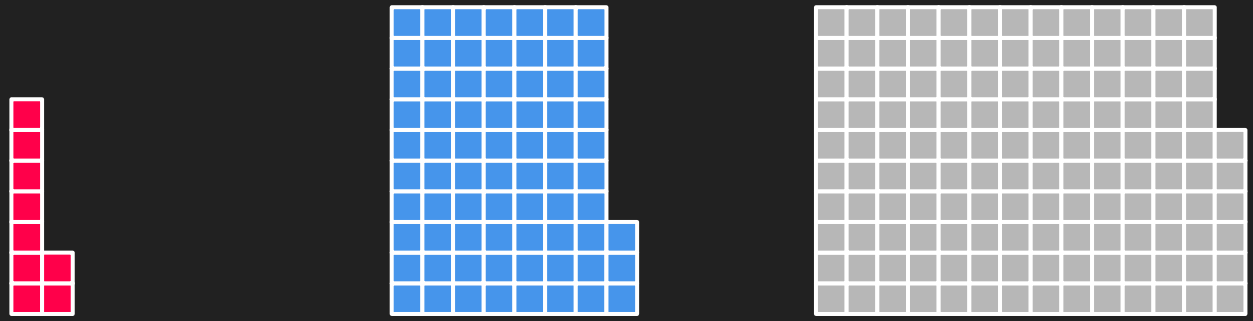

Quarkus + Native (via GraalVM) **12 MB**

Quarkus + JVM (via OpenJDK) **73 MB**

Traditional Cloud-Native Stack **136 MB**

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Java warmup time

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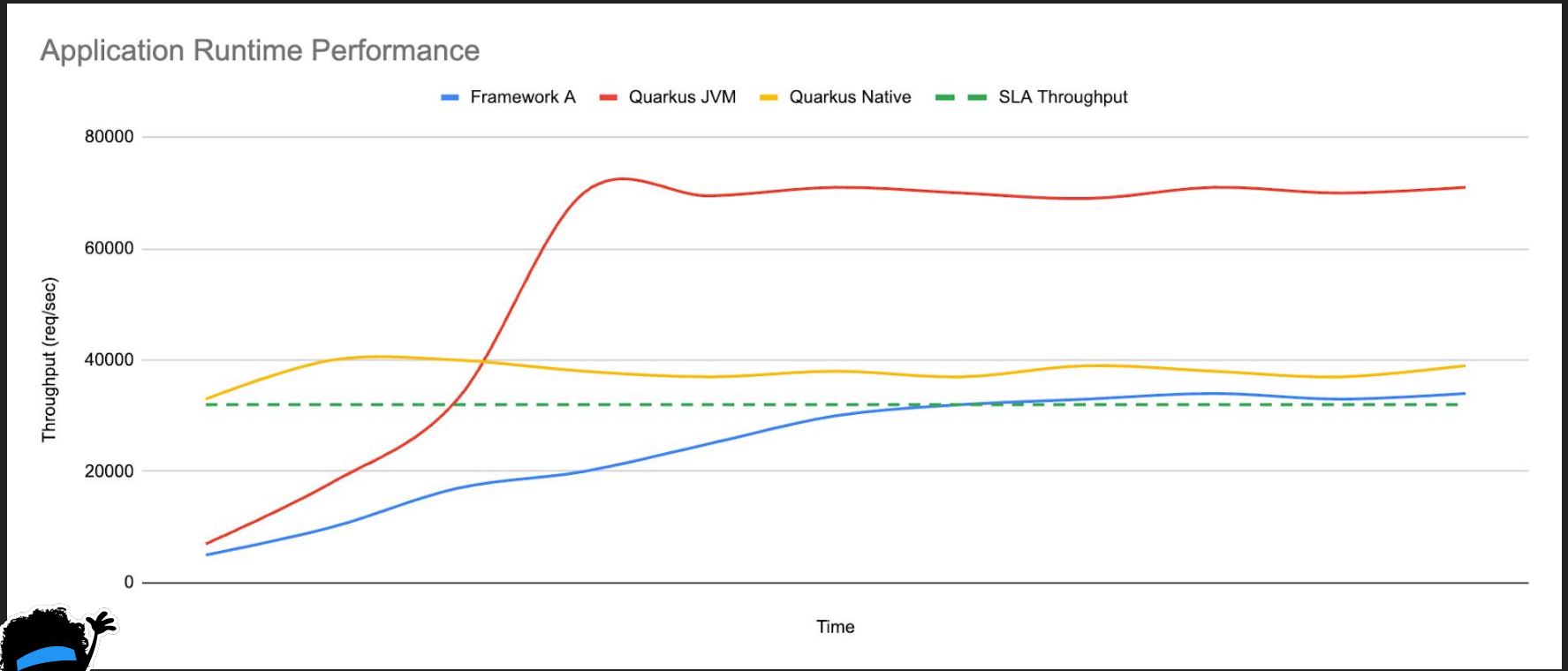

1.0

AWS Lambda, Functions...

Built around the FaaS components and other services such as API Gateways. It enabled a variety of use cases but it is far from ideal for general computing and with room for improvements.

- ➔ HTTP and other few Sources
- ➔ **Functions only**
- ➔ **Limited execution time (5 min)**
- ➔ No orchestration
- ➔ Limited local development experience

FaaS

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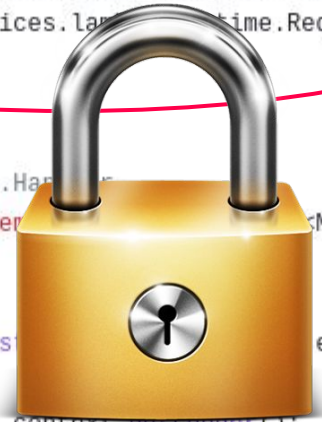
```java
package example;

import com.amazonaws.services.lambda.runtime.Context;
import com.amazonaws.services.lambda.runtime.LambdaLogger;
import com.amazonaws.services.lambda.runtime.RequestHandler;

import java.util.Map;

// Handler value: example.Handler
public class Handler implements RequestHandler<Map<String,String>, Void>{

  @Override
  public Void handleRequest(Map<String,String> event, Context context)
  {
    LambdaLogger logger = context.getLogger();
    logger.log("EVENT TYPE: " + event.getClass());
    return null;
  }
}
```



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Writing cloud agnostic functions with Java & Quarkus

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```java
@WebServlet("/api/getLSBData")
public class LightSpeedBoosterServlet extends HttpServlet {

    private LsbRepository lsbRepository;

    @Override
    public void init() throws ServletException {
        lsbRepository = new LsbRepository();
    }

    @Override
    protected void doGet(HttpServletRequest request, HttpServletResponse response) throws Ser
    ...
    @Override
    protected void doPost(HttpServletRequest request, HttpServletResponse response) throws Se
    ...
}
```

```java
import io.quarkus.funqy.Funq;

public class GreetingFunction {
    @Funq
    public String greet(String name) {
        return "Hello " + name;
    }
}
```

```java
import io.cloudevents.CloudEvent;
import io.cloudevents.core.data.PojoCloudEventData;
import io.cloudevents.jackson.PojoCloudEventDataMapper;
import io.quarkus.funqy.Funq;
import static io.cloudevents.core.CloudEventUtils.mapData;


public class LandingRequestFunction {

    @Funq
    public void landingRequest(CloudEvent ce) {
    ...
}
```

github.com/serverless-java-in-action/examples

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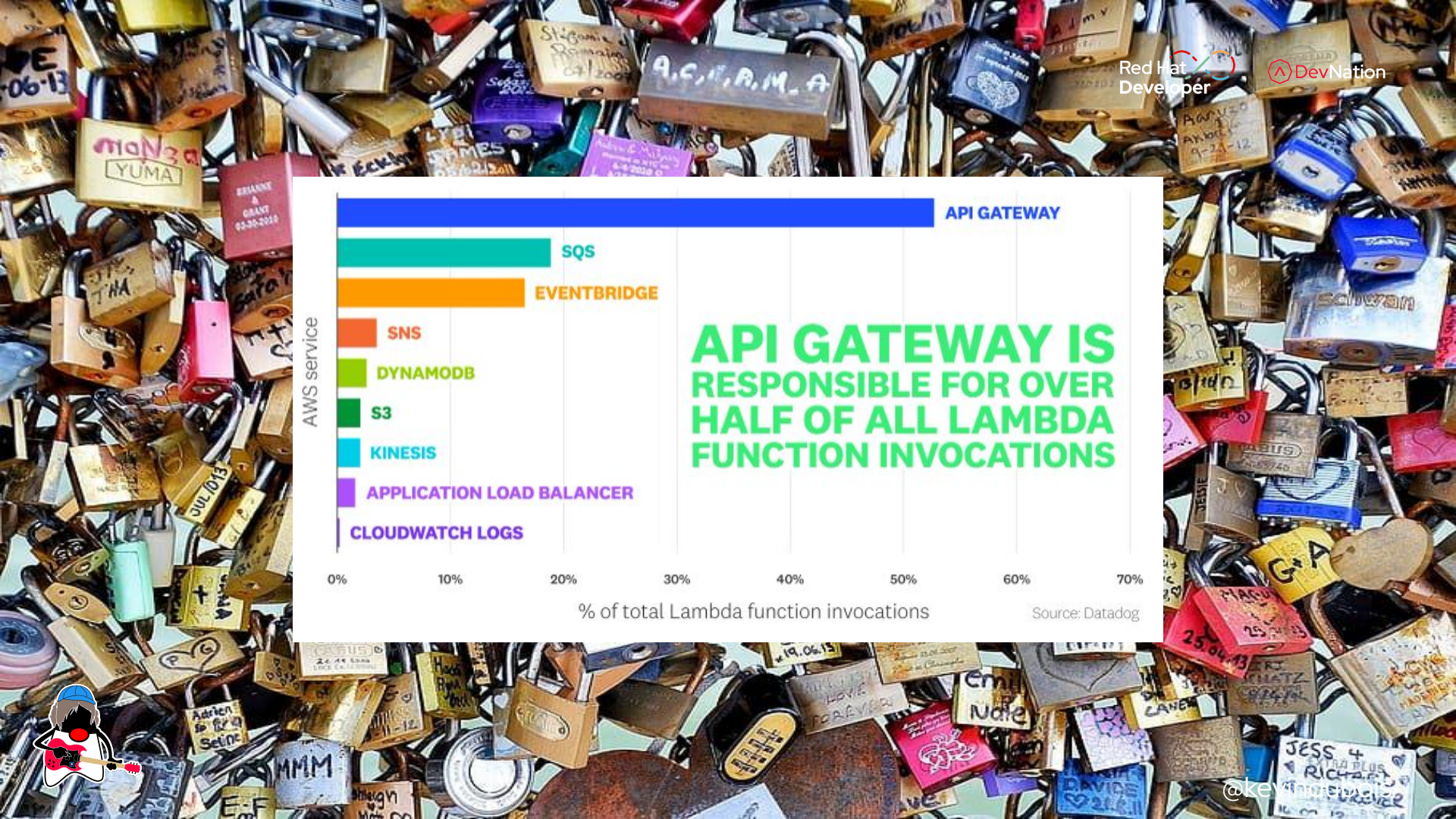
```
quarkus create app funqy \
-x quarkus-funqy-amazon-lambda
```



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1.5

Serverless Containers

With the advent of containers & Kubernetes, many frameworks and solutions started to auto-scale containers. Cloud providers created offerings using managed services completely abstracting Kubernetes APIs.

- ➔ **Fargate, Cloud Run, Container Instances**
- ➔ **Knative, KEDA, etc**
- ➔ Kubernetes based auto-scaling
- ➔ **Microservices and Functions**
- ➔ Easier to debug & test locally
- ➔ **Polyglot & Portable**

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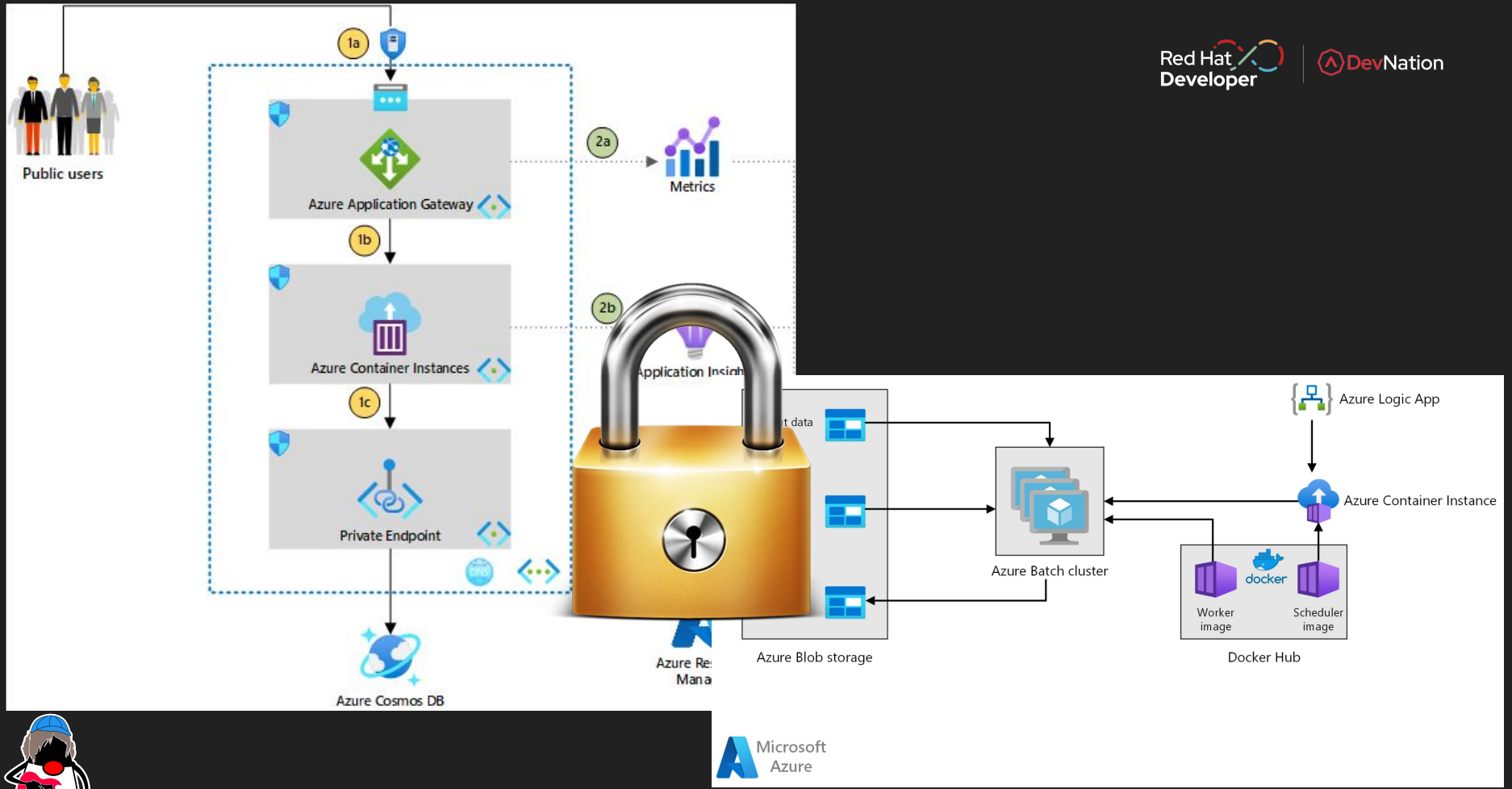
Serverless is evolving...



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Knative

https://github.com/knative

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Knative

Knative is an **Open Source**, **Cloud Agnostic** Solution
to build Serverless and Event Driven Applications on Kubernetes

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Containers made easy

Simplified developer experience to deploy applications/code on serverless containers **abstracting infrastructure** & focusing on what matters.

Ready for the Hybrid Cloud

Truly portable serverless running anywhere Kubernetes runs, that is on-premises or on any public cloud. Leverage data locality and SaaS when needed.

Immutable revisions

Deploy new features: performing canary, A/B or blue-green testing with gradual traffic rollout with no sweat and following best practices.

Any programming language

Use any programming language or runtime of choice. From Java, Python, Go and JavaScript to **Quarkus**, SpringBoot or Node.js.

Automatic scaling

No need to configure number of replicas, or idling. **Scale to zero** when not in use, auto scale to thousands during peak, with built-in reliability and fault-tolerance.

Event Driven Architectures

Build **loosely coupled & distributed apps** connecting with a variety of built-in or third-party event sources or connectors powered by Operators.

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```
$ kn func create -l quarkus myfunc
$ kn func deploy

$ kn service create myservice --image=xyz
```

github.com/serverless-java-in-action/examples

1.0

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2.0

Integration & State

The maturity and benefits of Serverless are recognized industry wide and it adds the missing parts to make pattern suitable for general purpose workloads and used on the enterprise.

- ➔ Basic state handling
- ➔ **Enterprise Integration Patterns**
- ➔ Advanced Messaging Capabilities
- ➔ **Blended with your PaaS**
- ➔ Enterprise-ready event sources
- ➔ **Solutions and outcome focused**

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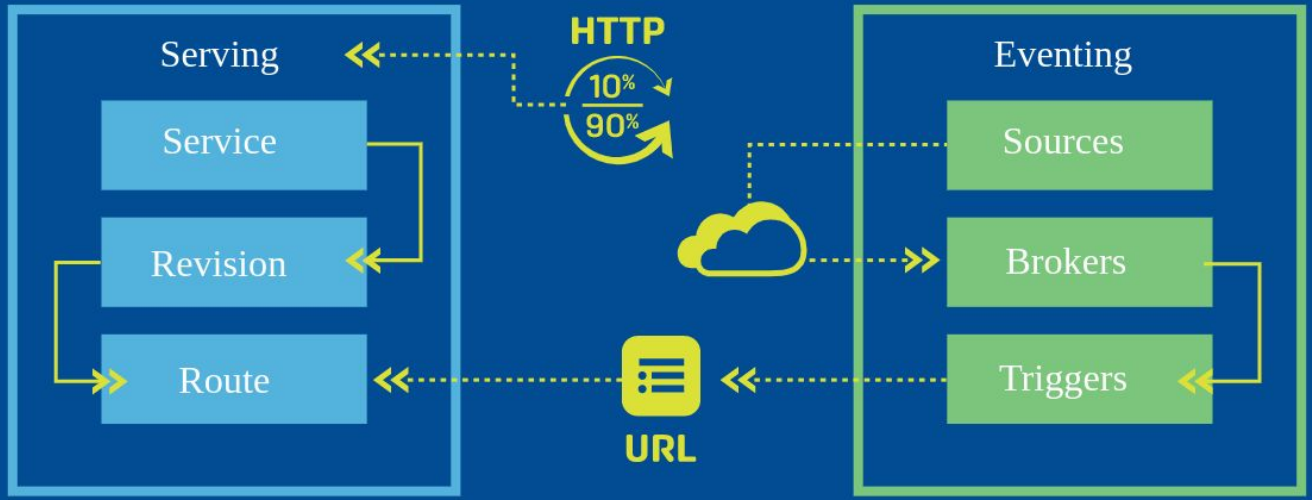
Knative Components

Knative has two main components that empower teams working with Kubernetes. Serving and Eventing work together to automate and manage tasks and applications.



Knative Eventing

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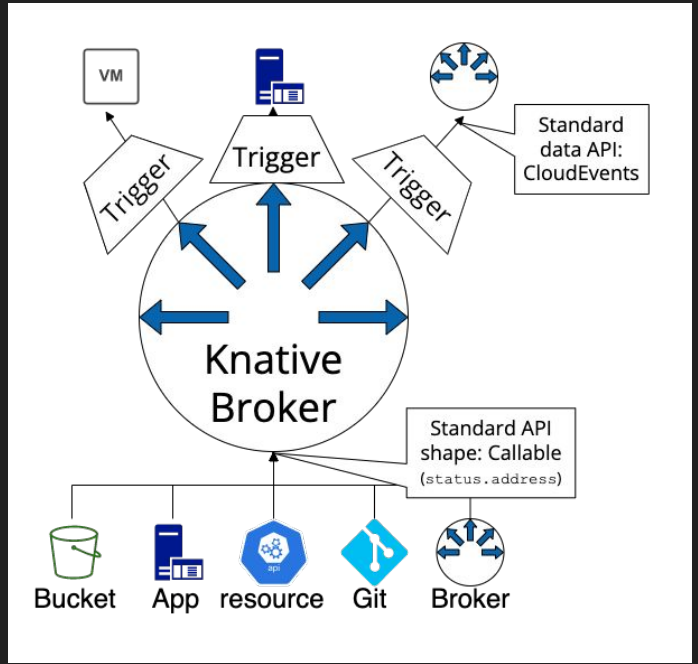
Eventing is a set of APIs for routing events from **Producers** to **Consumers** (known as **Sinks**)

CloudEvent specification

allows for the creation of Serverless components that are driven by Event rather than Traffic



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CloudEvents

cloudevents

CNCF graduated project - https://cloudevents.io/

Provides **a common event schema**
=> Interoperability, portability

Extensible through extension attributes

SDKs for different programming languages

Protocol-agnostic (HTTP, AMQP, MQTT, ...)

Wide adoption

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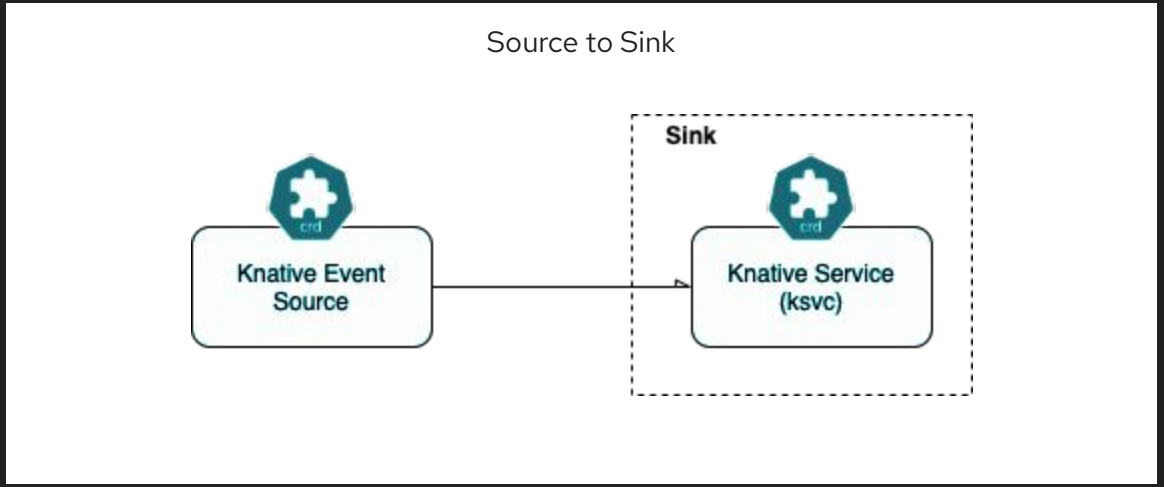
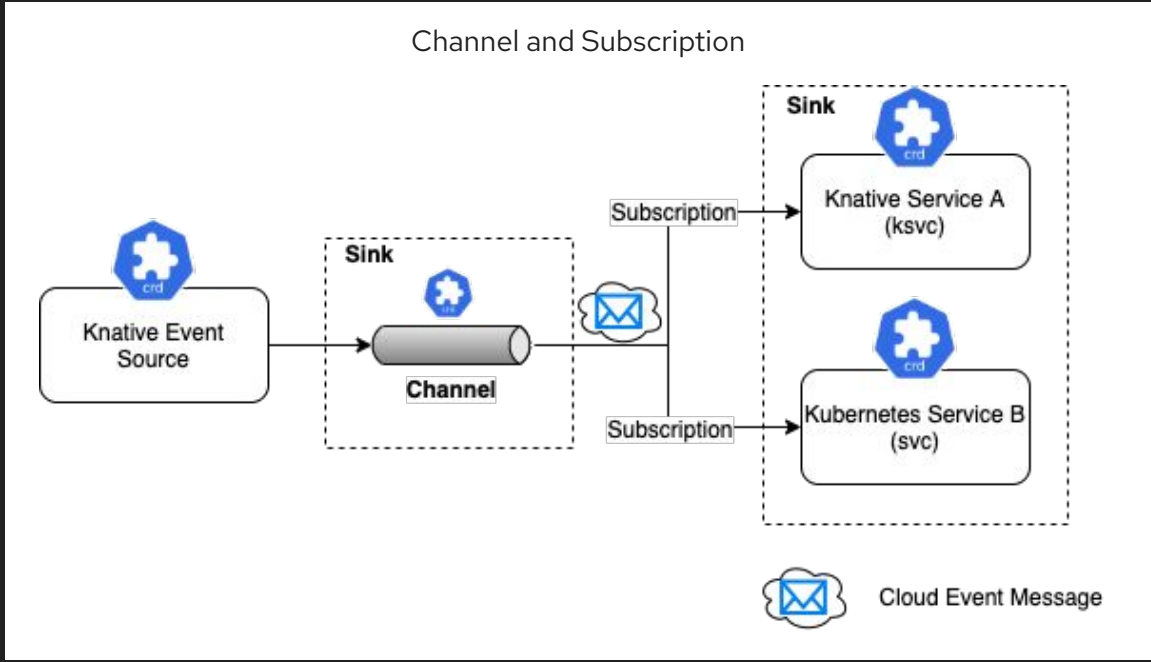
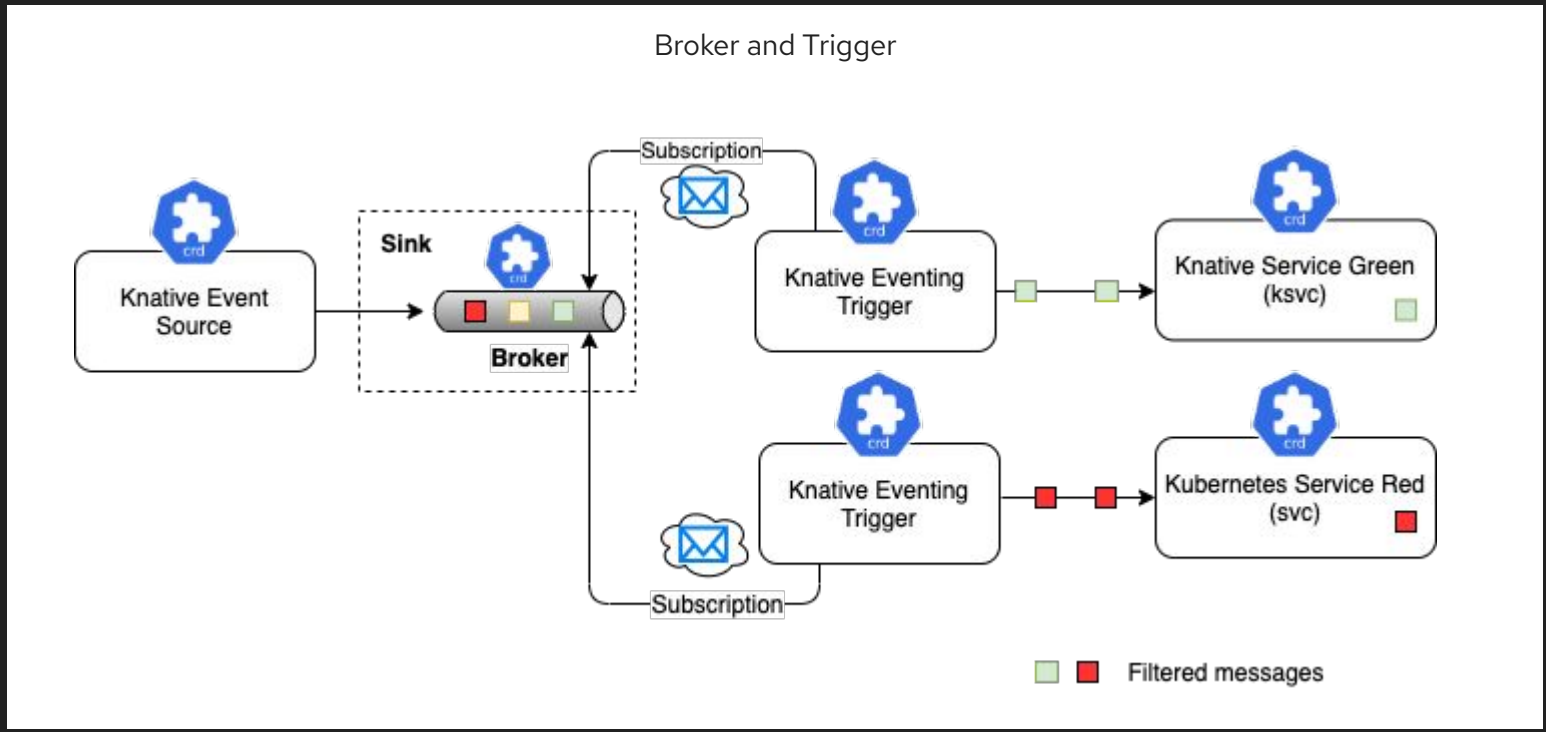
Usage Patterns



Usage Patterns



Usage Patterns



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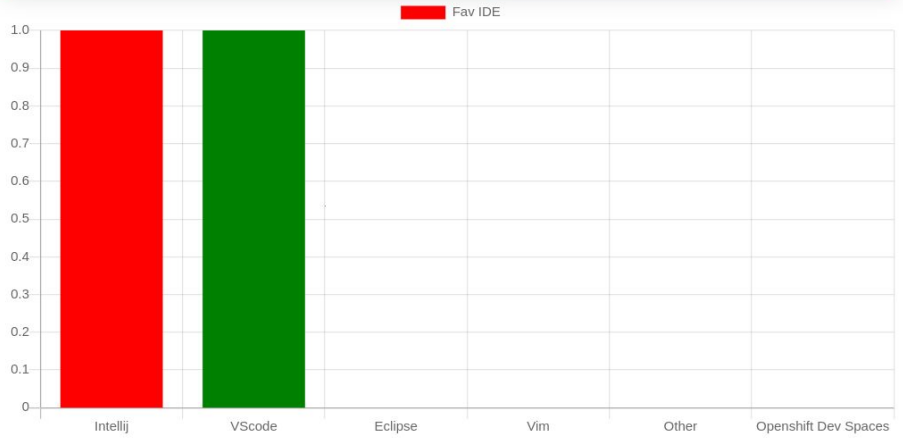
Who wins?

Position	Name	Count	
1	Intellij	1	Vote for Intellij!
2	VScode	1	Vote for VScode!
3	Eclipse	0	Vote for Eclipse!
4	Vim	0	Vote for Vim!
5	Other	0	Vote for Other!
6	Openshift Dev Spaces	0	Vote for Openshift Dev Spaces!



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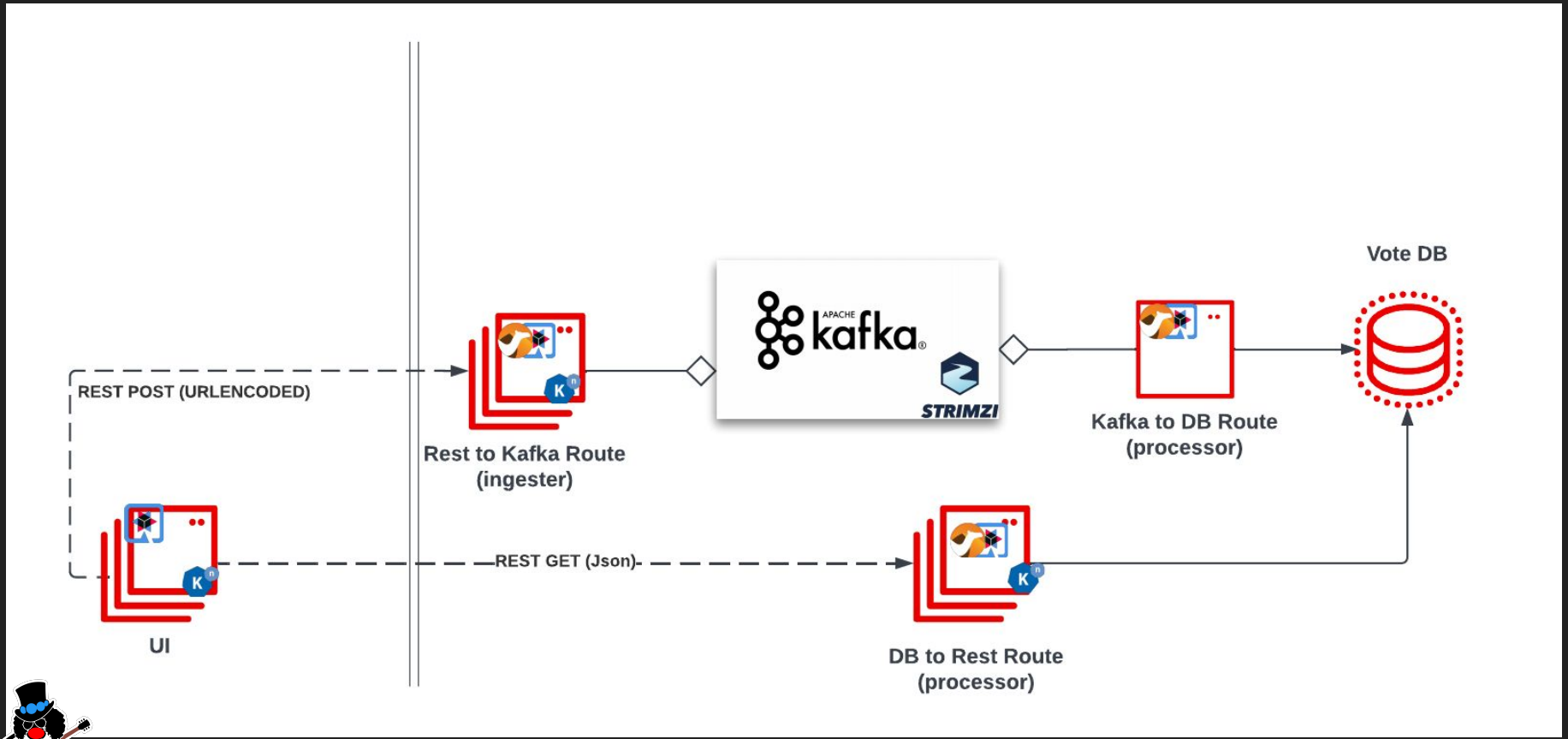
REST POST (URLENCODED)
Rest to Kafka Route
(ingester)
APACHE kafka
STRIMZI
Kafka to DB Route
(processor)
Vote DB
UI
REST GET (Json)
DB to Rest Route
(processor)

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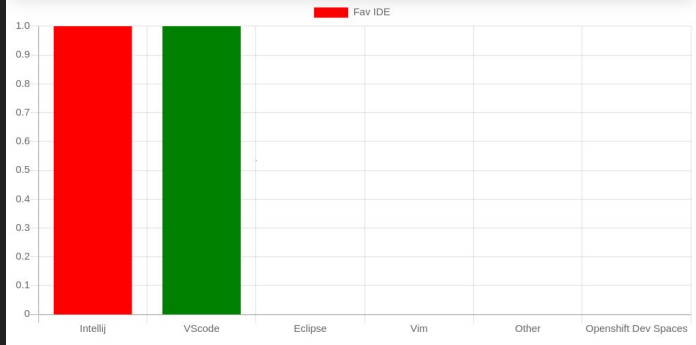
Who wins?

Position	Name	Count	
1	Intellij	1	Vote for Intellij!
2	VScode	1	Vote for VScode!
3	Eclipse	0	Vote for Eclipse!
4	Vim	0	Vote for Vim!
5	Other	0	Vote for Other!
6	Openshift Dev Spaces	0	Vote for Openshift Dev Spaces!



github.com/kdubois/CamelQuarkusVoter

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Serverless + AI ?

https://knative.dev/docs/about/case-studies/deepc/

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Wrapping it up...

- Cloud providers offer a LOT of cool stuff
- We need to be mindful of cloud lock-in
- Serverless is much more than just FAAS
- Use Open Source when you can,
  proprietary services when you must
- If you find yourself limited by Open Source solutions, contribute and participate!

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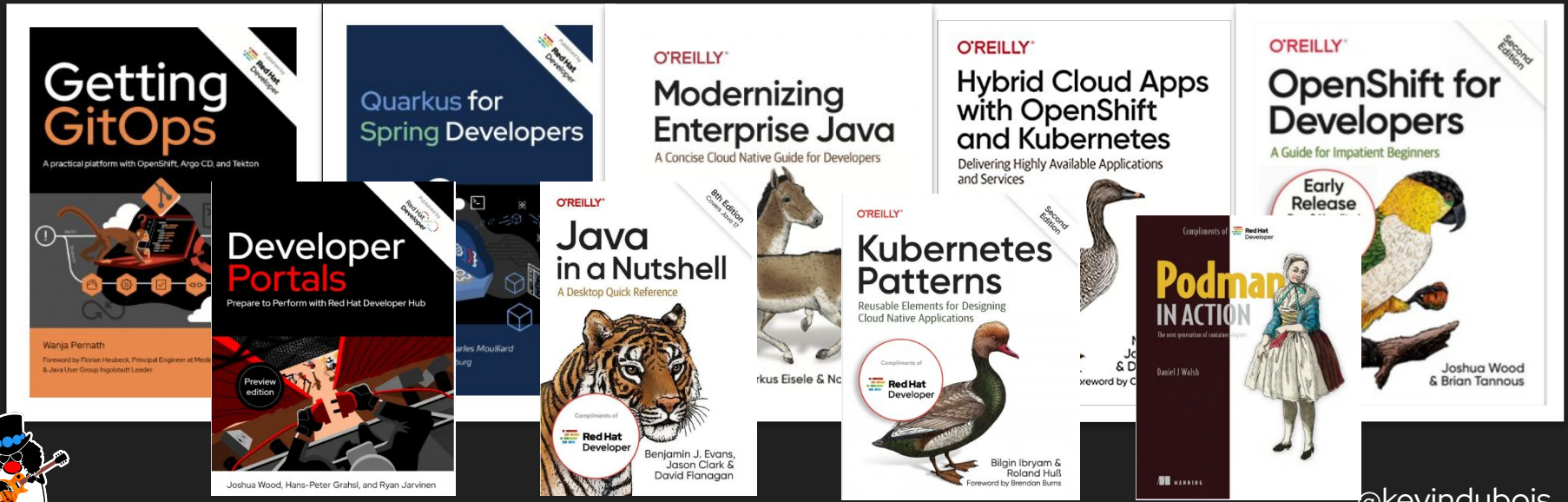
Free Developer e-Books & tutorials!

developers.redhat.com/eventtutorials



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OpenShift Sandbox:

We changed the default deployment type to Serverless

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github.com/serverless-java-in-action

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github.com/kdubois/CamelQuarkusVoter

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Serverless Java in Action

Kevin Dubois & Daniel Oh

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Red Hat

Red Hat Developer

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Thank you!

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