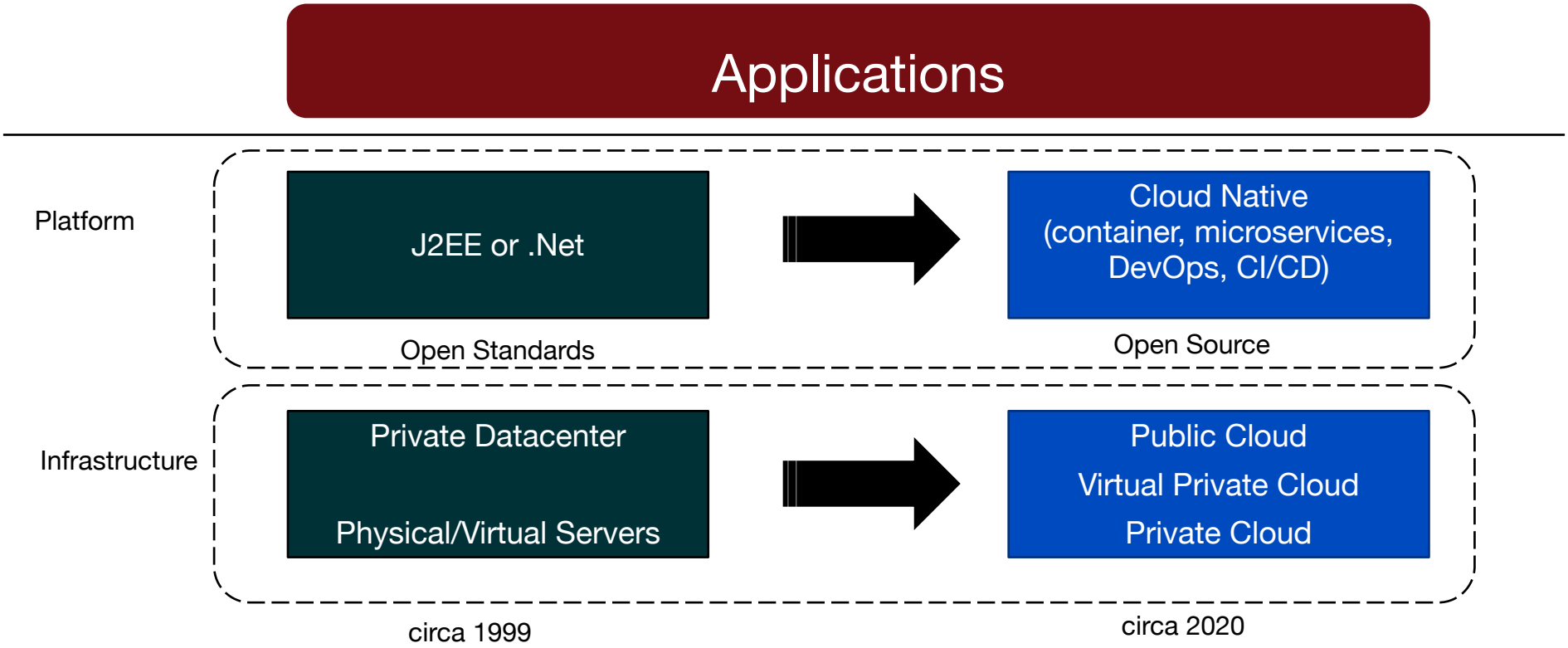
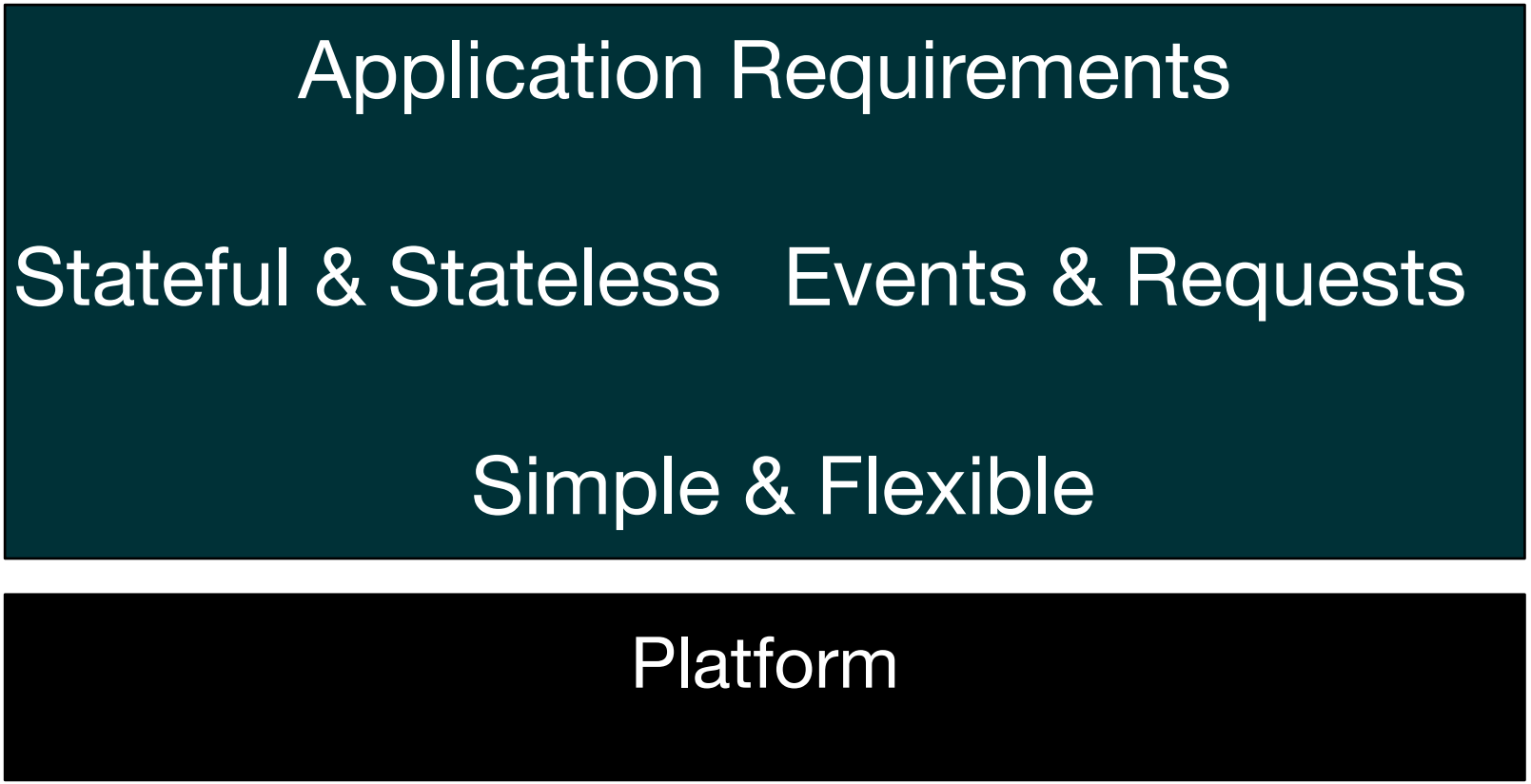
# Cloud Native - Runtimes and Frameworks

# Evolution of the App Platform



# Tradeoffs in Application Design



# Runtime and frameworks



Runtime is a platform for executing commands

For e.g.

JRE,  (a Java runtime environment)

Node.js (a JavaScript runtime environment)

Do not enforce any development patterns


A framework focuses more on best practices

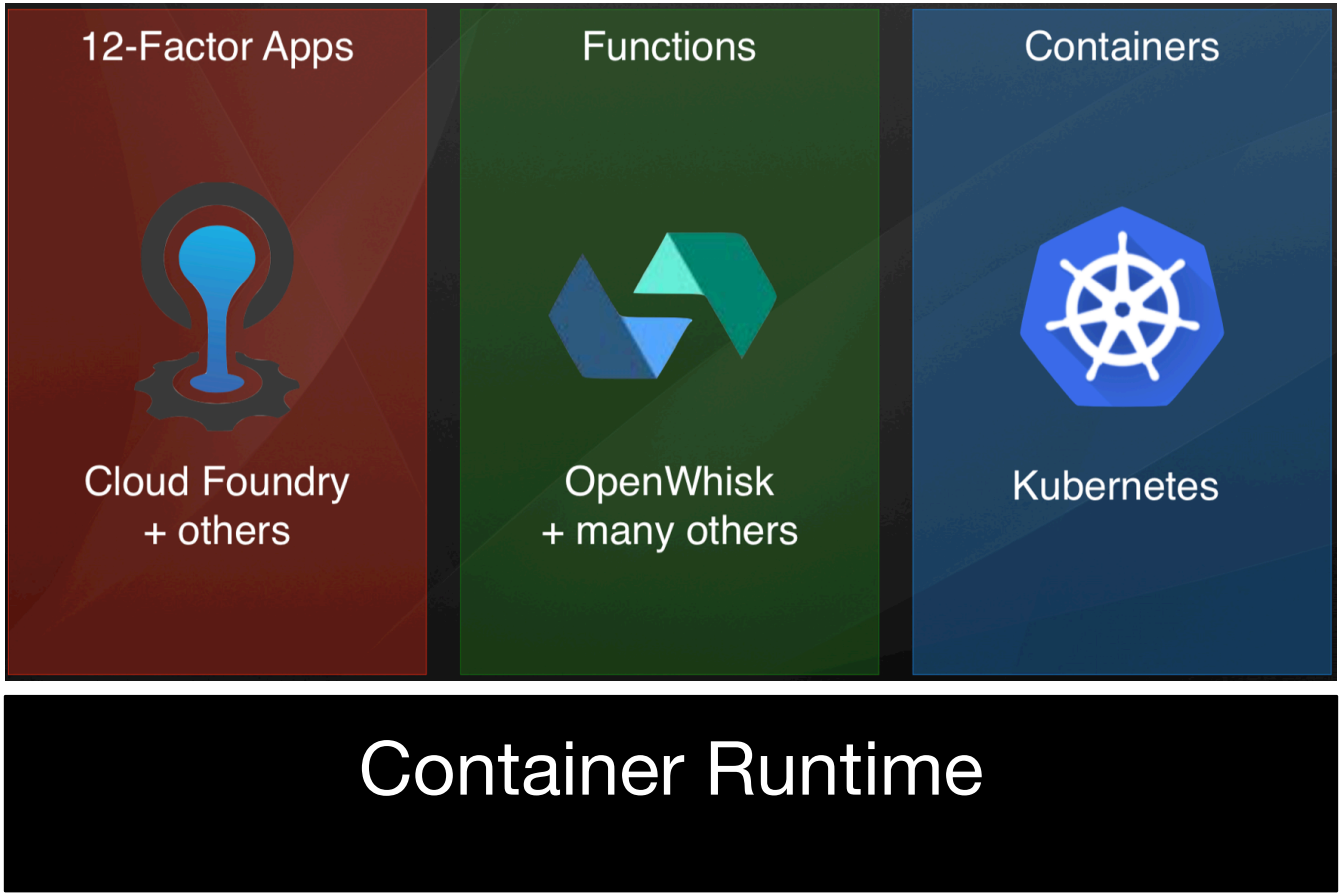
Frameworks are typically opinionated, designed to produce predictable outcomes.

For e.g. Spring Framework (An opinionated way to create a web server that runs on the java runtime)

Frameworks are often used to fill knowledge gaps

Simply make developers more efficient by providing reliable/predictable outcomes.

# Three stacks for three styles for their runtimes..



# Runtimes & Frameworks – Features, Benefits & why

### Simpler development

Integrate the capabilities of programming model of multiple runtimes.

### More runtimes for development

Offer the flexibility developers need to pick the right runtimes for their development choices.

### Strategic flexibility

Get the flexibility to pick the right blend of containerized runtimes and middleware services for your application.

### DevOps integration and automation

Provide developers with a self-service platform for provisioning, building, and deploying both apps and their components.

- Cloud-native development - simpler and more flexible
- Needs portability across multiple cloud infrastructures -> allowing the developer to use *microservices*, containers, and DevOps automation.
- Build new apps—faster than ever

# Infrastructure as Code (IaC)

*Infrastructure as code (IaC) - means to provision & manage your IT infrastructure using configuration / scripts files written in code.*

***Scripting / Imperative***
*Creating infrastructure by writing scripts*
*- End state to be reached line by line, i.e recipe*

*ex: shell / bash*

*Example: (step by step to reach end state)*

*ibmcloud cli create K8s*
*ibmcloud cli create VM*
*ibmcloud cli create VPC*

***Declarative***
*Creating infrastructure by writing declarative code, not controlled by the flow of code*
*- End state is important & now how to reach end-state*

*ex: CloudFormation, Terraform*

*Example: (end state)*

*K8s resource*
*-> host:--.--.--.—*
*-> port: --*

*VM resources*
*-> domain: --.--*

*VPN resources*
*-> subnets: --.--.--.--*
*-> IP: --.--.--.--*

# Spring Boot – What ?

Firstly, Spring boot is not a framework & Spring framework has been around.

It’s an approach to develop spring application with less configuration.

It is easy to learn when you know spring framework, it developed on top of existing spring framework.

It’s an innovation of spring team.

It is open source.

# History of Spring Framework

- 1999 J2EE 1.2
- 2001 xDoclet 1.0
- **2004 Spring Framework 1.0**
- 2006 Java EE 5
- **2013 Spring Boot**

# Spring Framework

- Spring is one of the most widely used Java EE Frameworks for building applications.
- One of the major features of the Spring framework is the dependency injection. It helps make things simpler by allowing us to develop loosely coupled applications.
- The Spring framework can be used for all layers of implementation in the development of an application. It supports declarative programming.
- Considering its POJO model, it is a very lightweight framework.
- It allows loose coupling and easy testability.
- • It is capable of eliminating the formation of singleton and factory classes.
- It supports both XML and annotation configurations.
- It provides middleware services.

# Why Spring Boot?

- Easy to developed spring-based application  with java  - Spring Boot doesn’t require you to deploy WAR files.
- It aims to reduce the IOC (DI – Dependency Injection). It reduce lots of development time and increase productivity.
- Avoid writing boilerplate code, annotation and xml configuration
- Easy to integrate with spring ecosystem like **jdbc, security, orm, data** etc.
- It follows opinionated default configuration to spring development
- It provide CLI tool to developed and test spring boot. It simplifies Spring dependencies and runs applications straight from a command line.
- Use Maven and Gradle to build application easily
- It offers production ready features.

# MicroProfile

Optimizing Enterprise Java

for a MicroService Architecture

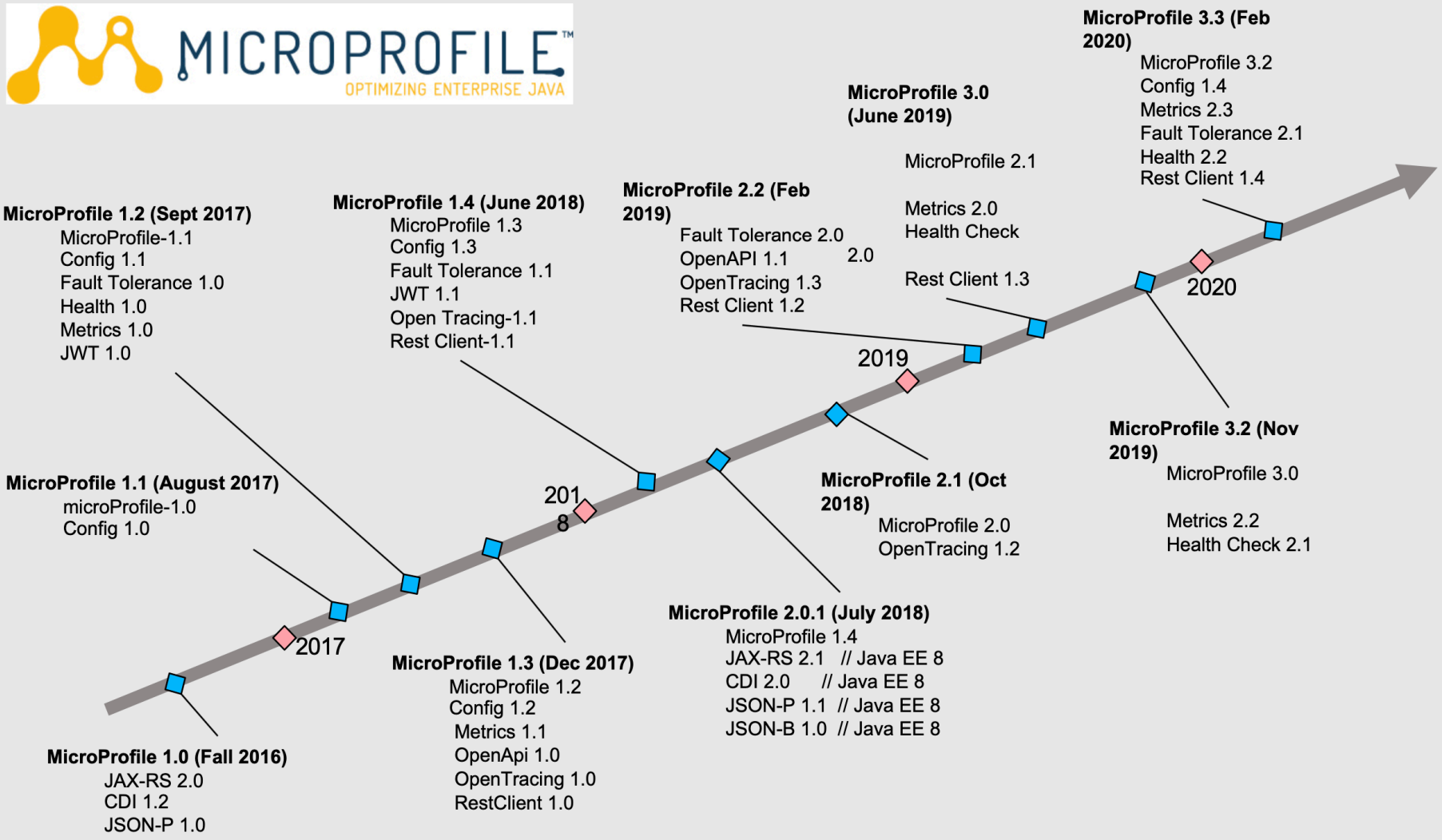
- http://microprofile.io/
- Project @ Eclipse Foundation Open Source (Eclipse)
- Enterprise Java for Microservices
- Builds on Java EE standards

# Need for Eclipse MicroProfile

- With the Java EE full profile becoming so large, over 30 APIs at the last count, it doesn’t seem right to include all those specifications when you are building something that you call ‘micro’,

- Not going to use the vast majority of those Java EE APIs

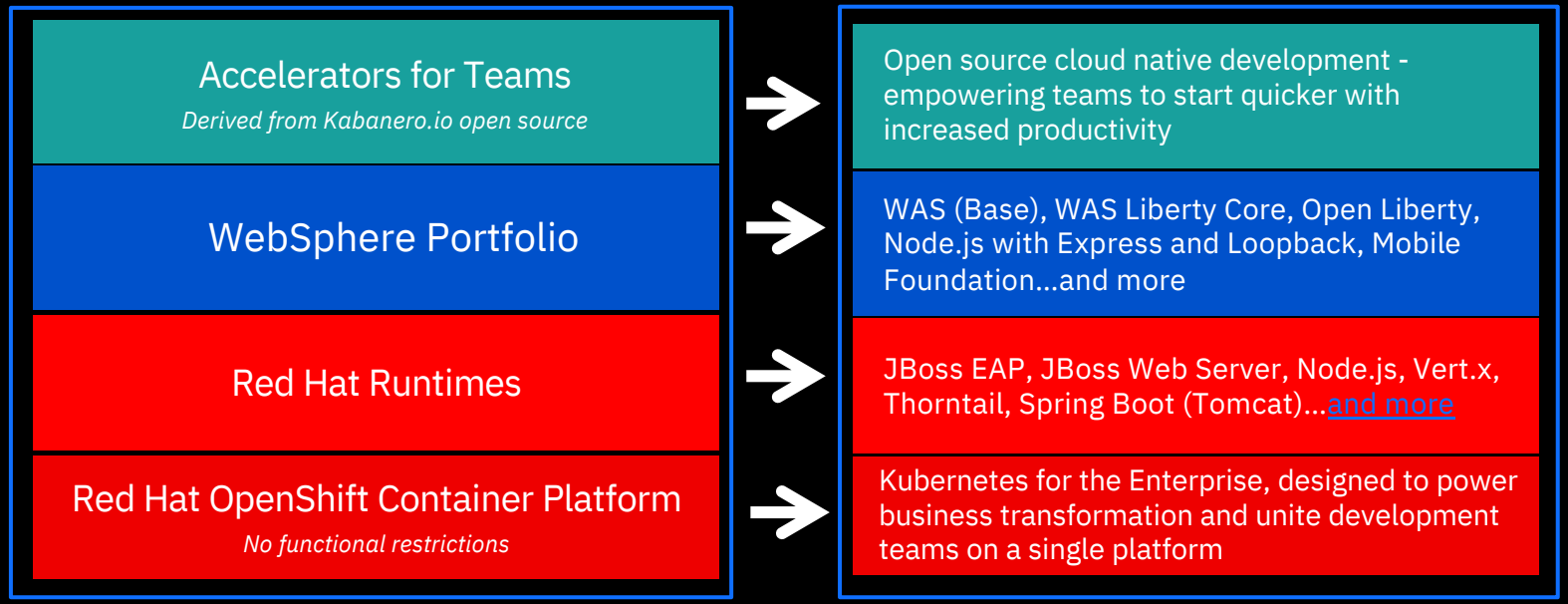
- The space was becoming fragmented, with each vendor implementing their own opinion about the right way to do microservices


MICROPROFILE
OPTIMIZING ENTERPRISE JAVA
MicroProfile 1.0 (Fall 2016)
JAX-RS 2.0
CDI 1.2
JSON-P 1.0
2017
MicroProfile 1.1 (August 2017)
microProfile-1.0
Config 1.0
MicroProfile 1.2 (Sept 2017)
MicroProfile-1.1
Config 1.1
Fault Tolerance 1.0
Health 1.0
Metrics 1.0
JWT 1.0
MicroProfile 1.3 (Dec 2017)
MicroProfile 1.2
Config 1.2
Metrics 1.1
OpenApi 1.0
OpenTracing 1.0
RestClient 1.0
MicroProfile 1.4 (June 2018)
MicroProfile 1.3
Config 1.3
Fault Tolerance 1.1
JWT 1.1
Open Tracing-1.1
Rest Client-1.1
201
8
MicroProfile 2.0.1 (July 2018)
MicroProfile 1.4
JAX-RS 2.1 // Java EE 8
CDI 2.0 // Java EE 8
JSON-P 1.1 // Java EE 8
JSON-B 1.0 // Java EE 8
MicroProfile 2.2 (Feb 2019)
Fault Tolerance 2.0
OpenAPI 1.1
OpenTracing 1.3
Rest Client 1.2
MicroProfile 2.1 (Oct 2018)
MicroProfile 2.0
OpenTracing 1.2
2019
MicroProfile 3.0 (June 2019)
MicroProfile 2.1
Metrics 2.0
Health Check
2.0
Rest Client 1.3
MicroProfile 3.2 (Nov 2019)
MicroProfile 3.0
Metrics 2.2
Health Check 2.1
2020
MicroProfile 3.3 (Feb 2020)
MicroProfile 3.2
Config 1.4
Metrics 2.3
Fault Tolerance 2.1
Health 2.2
Rest Client 1.4

# IBM Cloud Pak for Applications

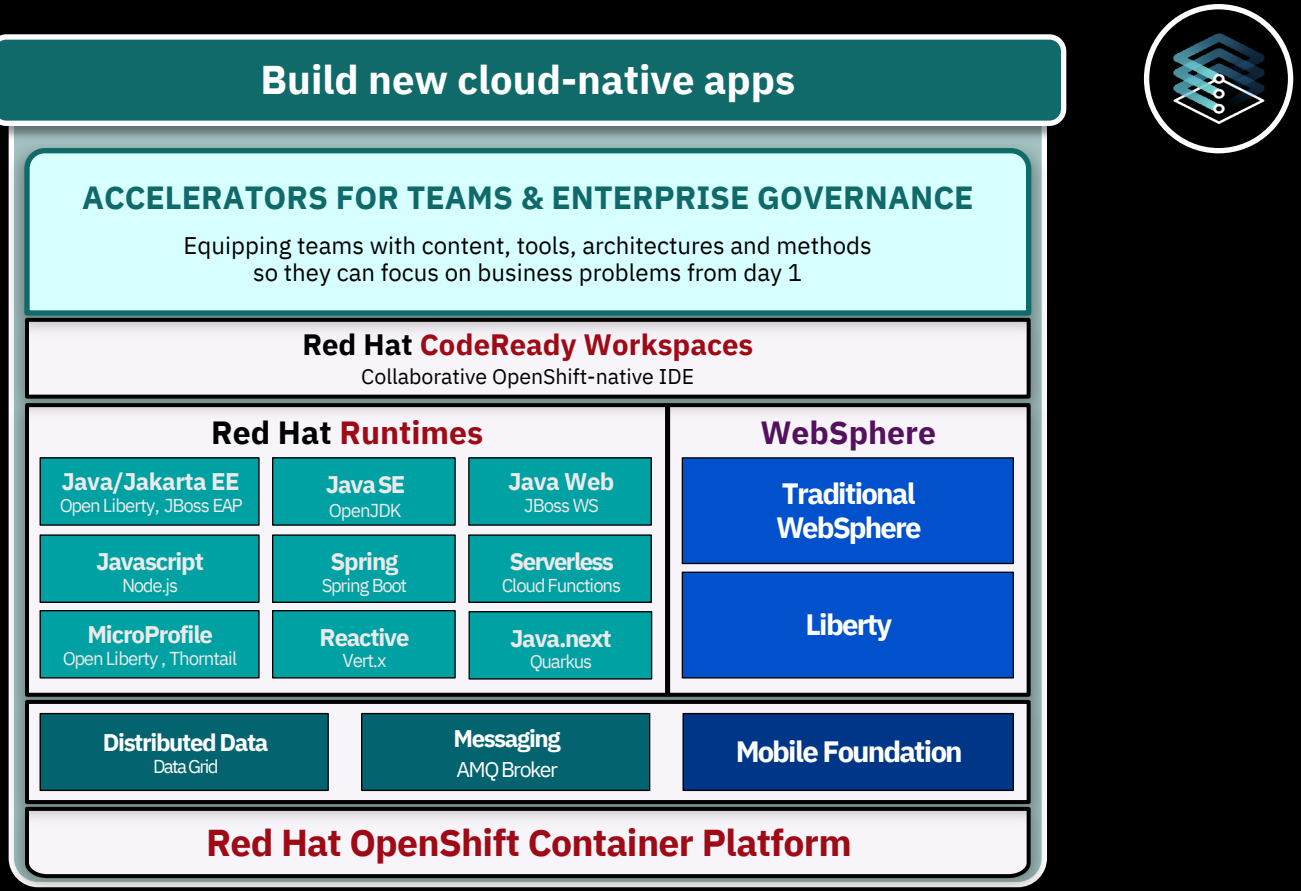
*What is "OpenShift plus enterprise runtimes plus enterprise runtimes and accelerators for teams"?*

**OpenShift plus WebSphere portfolio and RH Runtimes and accelerators for teams**




*Best combination of platform, runtimes, and tools for Cloud Native development*

# *Cloud Pak for Applications: what you need today, what you need tomorrow*



# Cloud Pak for Apps Components:

# Red Hat Runtimes

Red Hat Runtimes provides a set of open runtimes, tools, and components for developing and maintaining cloud-native applications. It offers lightweight runtimes and frameworks for highly distributed cloud architectures, such as microservices.

https://access.redhat.com/articles/4394291

| Product or Service | Product Information & Documentation |
|---|---|
| Red Hat JBoss® Enterprise Application Platform | Red Hat JBoss Enterprise Application Platform |
| Red Hat JBoss® Web Server | Red Hat JBoss® Web Server |
| Node.js | node.js |
| Eclipse Vert.x | VERT.X |
| Thorntail | THORNTAIL |
| Spring Boot | Spring Boot |
| Open Liberty | Open Liberty |
| OpenJDK | OpenJDK |
| Red Hat Data Grid | Red Hat Data Grid |
| Red Hat AMQ Broker | Red Hat AMQ |
| Red Hat Single Sign-On | Red Hat Single Sign-On |
| Red Hat Core Services | Red Hat Core Services |
| Launcher Service | Launcher on developers.redhat.com |

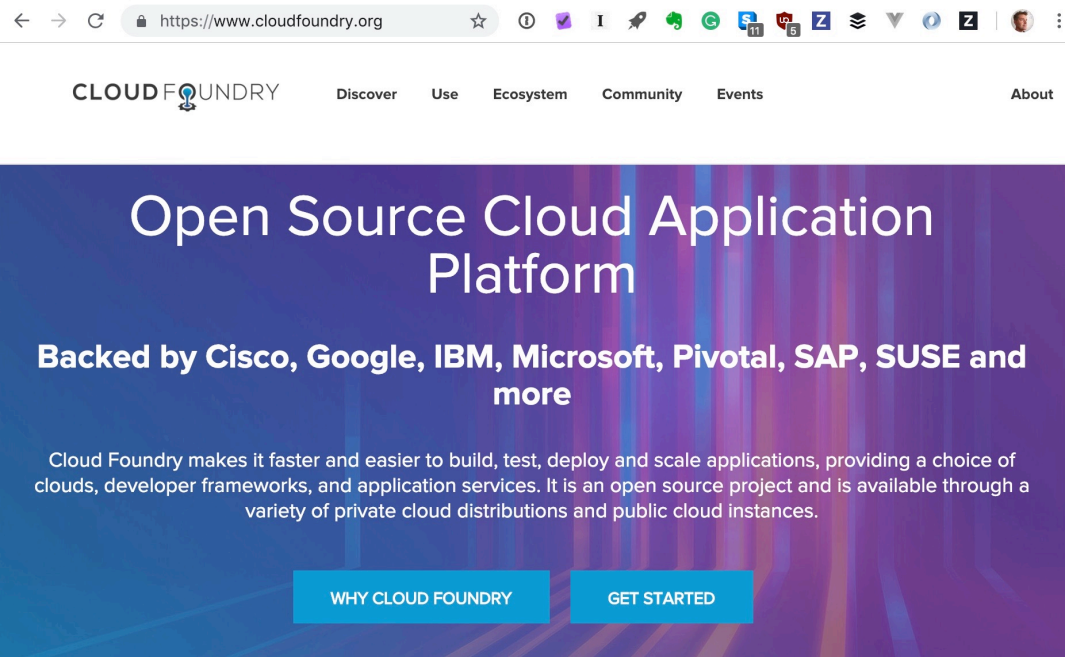
# IBM WebSphere Liberty

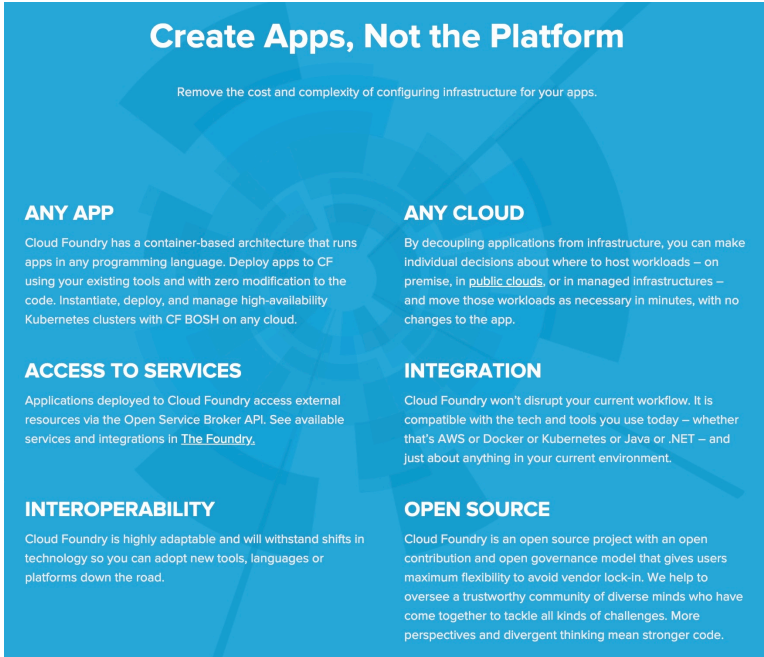
| | |
|---|---|
| Open Liberty | Open Liberty is the OS foundation for the WebSphere Liberty product portfolio that can be used for developing new cloud-native applications with zero start-up cost. |
| WebSphere Application Server | Use this version for Java EE Full Profile applications that need to integrate with existing Java EE applications such as those using JMS. |
| WebSphere Liberty Core | The ideal version for Web applications or microservices that rely only on the Java EE Web Profile. |
| WebSphere Application Server ND | Use this version for managing Java EE Full Profile applications that run outside of a containerized environment. |
| WebSphere Application Server Family edition | The Family edition offers increased license flexibility across your enterprise for three WebSphere products: WebSphere Application Server, WebSphere Liberty Core and WebSphere Application Server ND. |

# IBM Cloud Foundry

CLOUD FOUNDRY

*”Here is my source code*
*Run it on the cloud for me*
*I do not care how”*

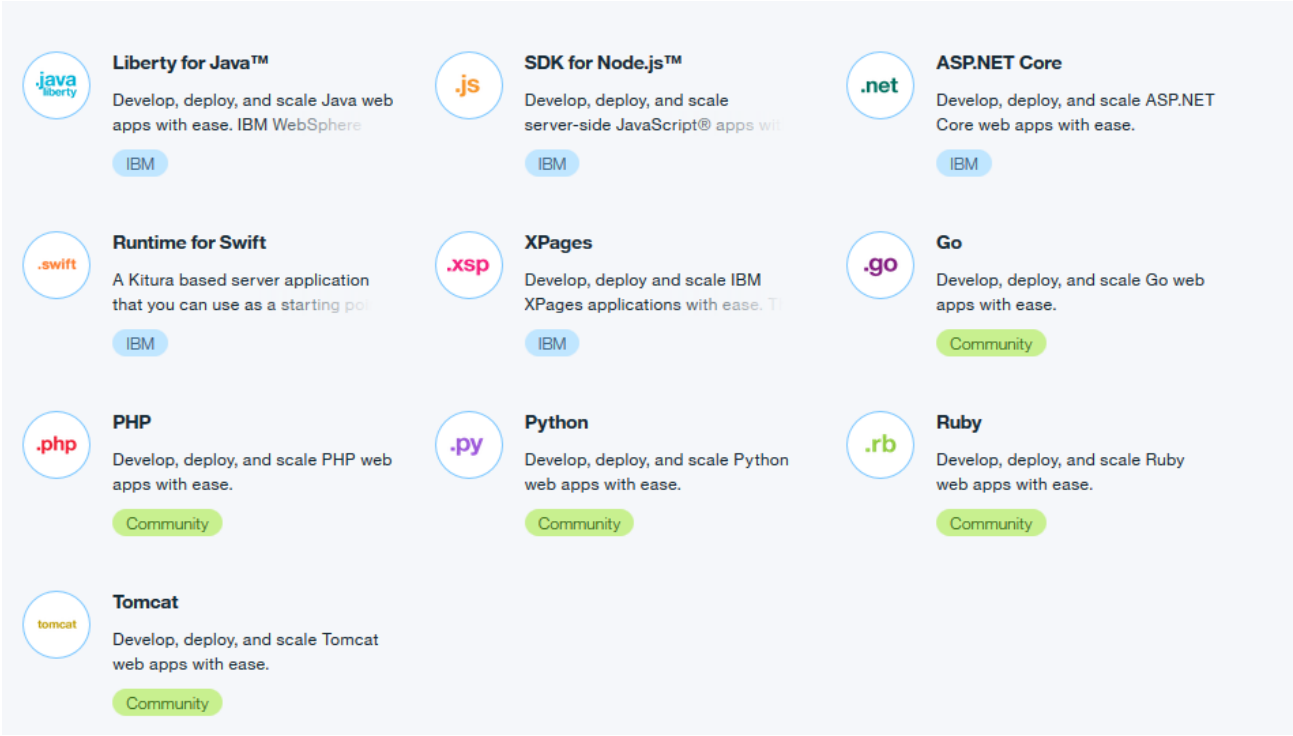


# Application runtimes and buildpacks

## Cloud Foundry Buildpacks

- specific runtime
- build framework
- types on IBM Cloud
  - IBM
  - Cloud Foundry Community
  - External (bring your own!)

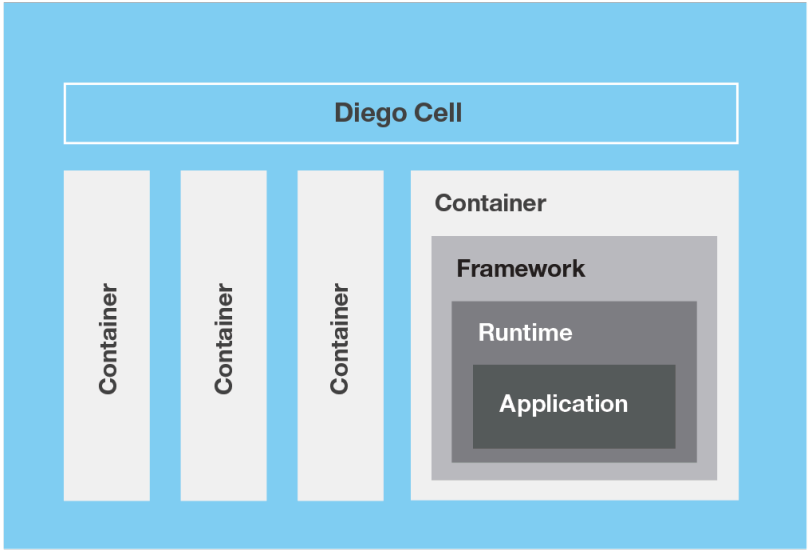


# Buildpacks provide support for a language runtime

Buildpack

- collection of scripts
- app framework dependencies
- prepares runtime
- packages application into a droplet for deployment

Automatically selected




Simplifies Cloud deployment – just provide your application code

# What is Serverless?

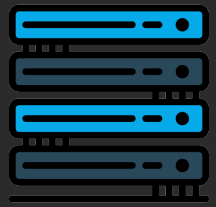
“Focus on your application & code, not the infrastructure”

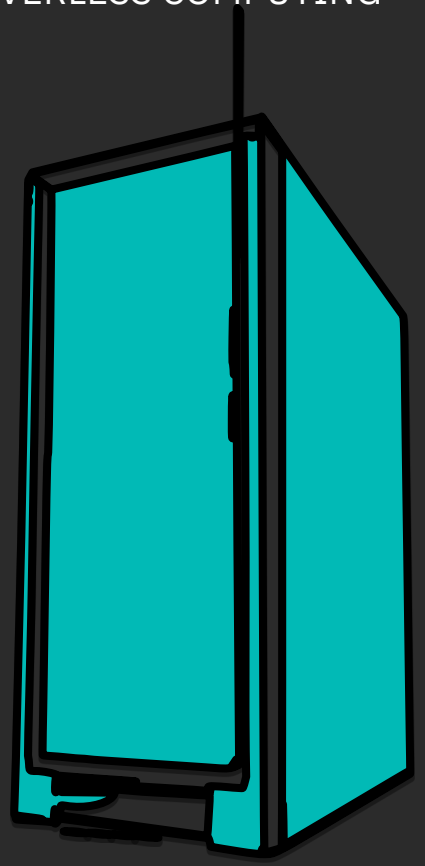
“backend as a service”



https://readwrite.com/2018/06/04/the-future-of-e-commerce/

Traditionally, we built our applications and controlled how they can communicate with a server. A server that we are **managing** and **provisioning** for. There are some issues that arose though.





## What is Serverless Computing | Functions as a service (FaaS)?

1. Requires no management and operation of infrastructure, enabling developers to focus more narrowly on code/custom business logic.

2. It's a computing service runs code only on-demand on a per-request basis, scaling transparently with the number of requests being served (event-based)

3. $$
Enables end users to pay only for resources being used, never paying for idle capacity.

https://cloud.ibm.com/functions/

# Serverless Computing

Does not refer to a specific technology.

Apache OpenWhisk

IBM's Cloud Functions started as the OpenWhisk research project at the IBM Watson Research center

IBM Cloud Functions

AWS Lambda

Azure Functions

# Backend as a Service progression

| IaaS | CaaS | PaaS | FaaS/Serverless |
|---|---|---|---|
| Functions | Functions | Functions | Functions |
| Applications | Application | Applications | Applications |
| Runtimes | Runtimes | Runtimes | Runtimes |
| Operating Systems | Operating Systems | Operating Systems | Operating Systems |
| Infrastructure | Infrastructure | Infrastructure | Infrastructure |

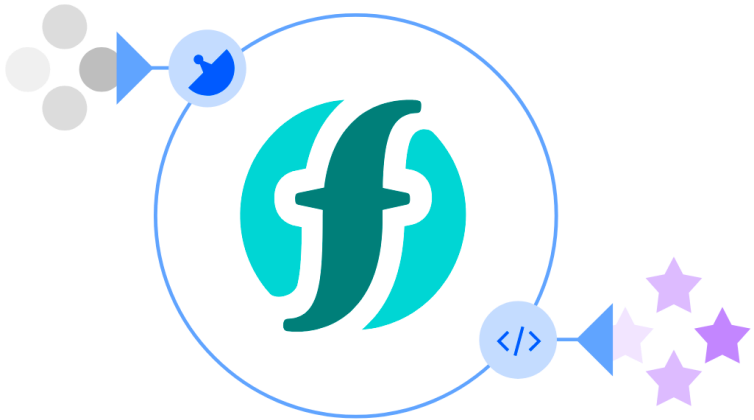
Provided by Developer

Virtualization Provided by Cloud

# IBM Cloud Functions

nibzkn
Washington DC

Functions-as-a-Service (FaaS) platform based on Apache OpenWhisk



## Run your application code without servers, scale it automatically, and pay nothing when it's not in use.

Download CLI

Start Creating

## Runtimes

Work with what you already know and love. Develop your functions directly in your most favorite language, or provide us with a Docker container to develop using any compiled language such as Go, C, etc.

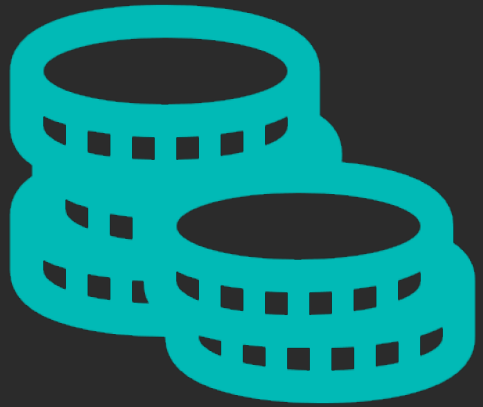
- JS/NodeJS
- Swift
- Java
- Python
- Ruby
- Go
- PHP
- .NET
- Any language (Docker)

# Responsibilities with traditional servers

- Costs 

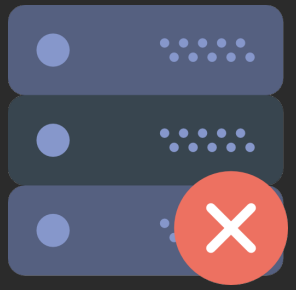
- Maintenance 

- Scaling up and down according to the application usage 



# Serverless Computing

Serverless computing refers to a model where the existence of servers is entirely abstracted away.



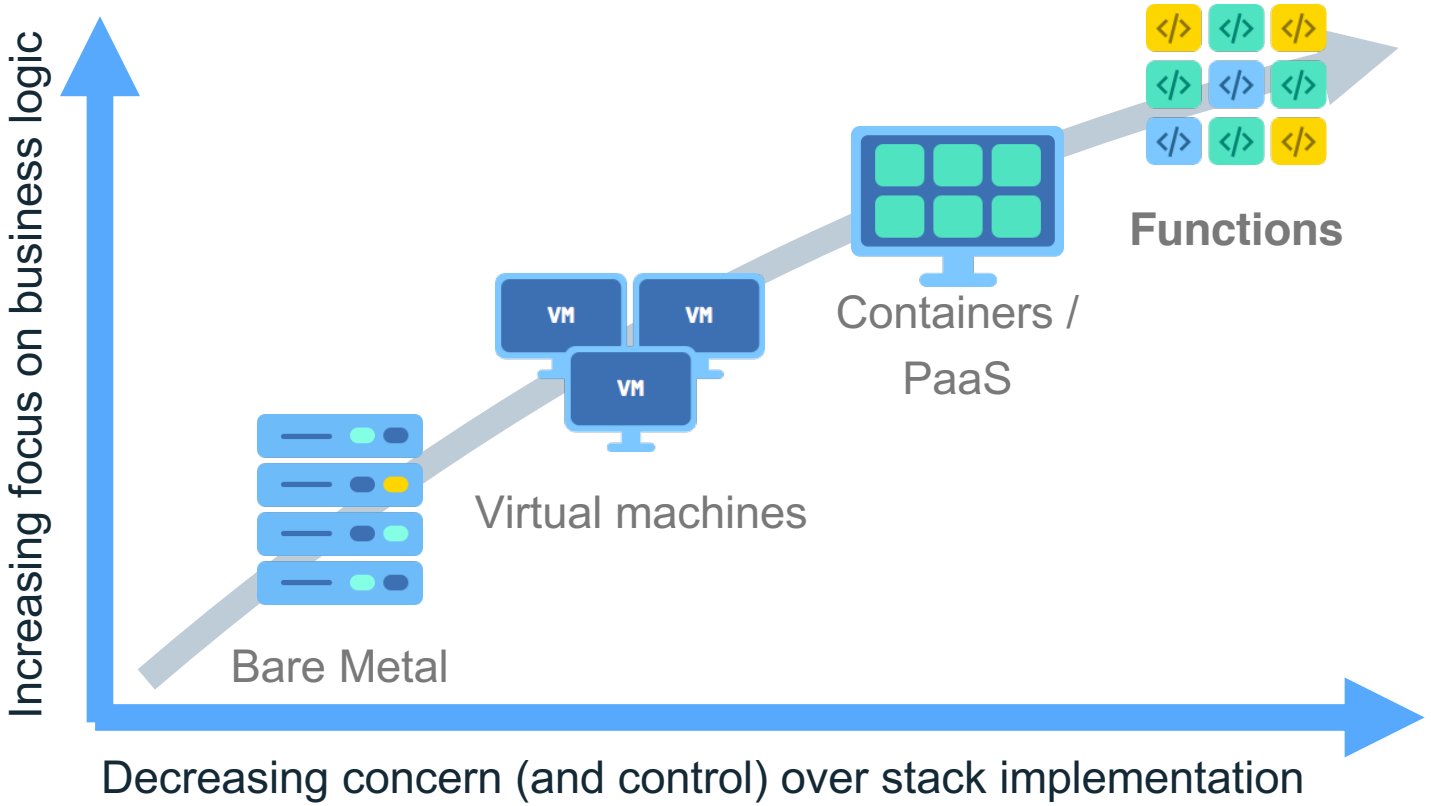
## Cost Effective Computing

## Low maintenance

## Easy to scale

# What is Serverless computing (Functions-as-a-Service)?





## Event Providers..

Benefit from an ecosystem of event consumers and emitters from different areas like analytics, cognitive, data, IoT, mobile, and more. Using our open event-provider interface, you can enable any service you would like to use.

- Github
- Event Streams
- Periodic
- Cloud Object storage
- Cloudant
- Mobile Push

## Runtimes..

Work with what you already know and love. Develop your functions directly in your most favorite language, or provide us with a Docker container to develop using any compiled language such as Go, C, etc.

- JS/NodeJS
- Go
- Swift
- PHP
- Java
- .NET
- Python
- Any language (Docker)
- Ruby

# What can I use Cloud functions for ?

### Cognitive Data Processing

Analyze data as soon as it becomes available. Let your function make use of powerful cognitive services like IBM Watson to detect objects or people appearing in images or videos.

Case-study: Skylink (drone image analyzing)


### Data Processing

Execute code whenever data is updated in your datastore. Easily automate processes like audio normalization, image rotation, sharpening, noise reduction, thumbnail generation, or video transcoding.


### Serverless Backends

Expose application logic by implementing serverless microservices. Simply map your functions to well-defined API endpoints any client can call by making use of Web Actions or our latest API Gateway integration.

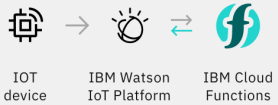
Go to tutorial


### Mobile Backend

Allow mobile developers to easily access server-side logic and to outsource compute-intensive tasks to a scalable cloud platform. Let them implement functions in languages like Swift and easily consume server-side functions using our iOS SDK.


### IoT Ready

React to and process IoT sensor data. Let any IoT device send data to our IBM Watson IoT platform and define cloud rules to call your functions and execute custom application logic.




### Scheduled Tasks

Execute your functions periodically. Define schedules following a cron-like syntax to specify when actions are supposed to be executed.

# In a Nut-shell