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Java in Serverless Land

Matthew Gilliard
Twitter: @MaximumGilliard

Fn Project // Container Native Group

javaBin Oslo
Aug 23rd 2018

JavaYourNext (Cloud)

Java Day ORACLE

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Fn Project is a **Serverless platform**. But what *is* that?

- Create applications without thinking about Infrastructure.
- Unit of deployment is a **Function**
- Hence: **Functions-as-a-Service** or **FaaS**

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…and what is **a Function**?

- Short-lived
- Ephemeral / Event-driven
- Stateless

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Java in Serverless Land

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Java is…

- the **No. 1** programming language
- **No. 3** in Serverless

… why?

Source: serverless.com

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- Is it actually possible to use Java on Serverless?
- Is FaaS more than just a “scripting language” for the web?
- Can Java development habits be used for FaaS?
- Can the JVM effectively run short-lived apps?

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- Is it actually possible to use Java on Serverless? **Yes!**
- Is FaaS more than just a “scripting language” for the web? **Yes!**
- Can Java development habits be used for FaaS? **Yes!**
- Can the JVM effectively run short-lived apps? **Yes!**

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JAMES GOVERNOR'S MONKCHIPS

When Web Companies Grow Up They Turn into Java shops

By jgovernor | October 12, 2016

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What does ”Grown-up” Java development look like?

1. Program using **plain** Java
2. Strong acceptance of **Open-Source**
3. Huge number of available **tools** and **libraries**
4. **Complex** applications
5. Use the JVM **effectively**

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Fn Project

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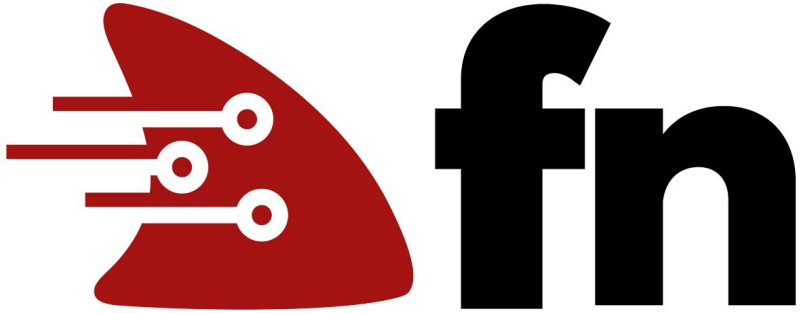
Fn Project – an Open-Source FaaS platform



http://fnproject.io

- Fully **open** (Apache 2.0) with commercial backing from Oracle
- Run **anywhere** - Datacenter / laptop / rPi
- Functions are **containers**
- Fn ♥ Java

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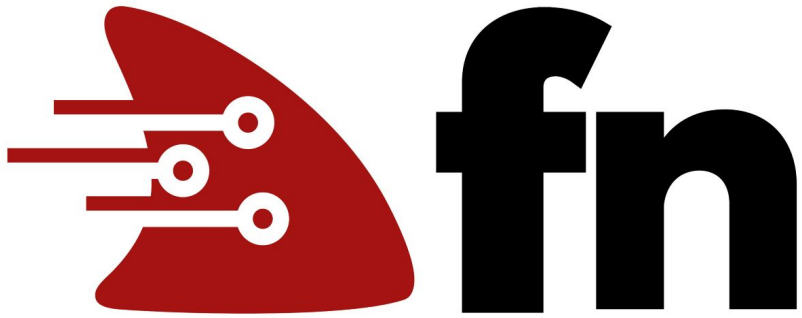

Demo

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Fn Flow

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What is Fn Flow?

- Fn Flow lets you build **reliable** and **scalable** applications out of functions
- Fn Flow supports **rich concurrency** options
- Fn Flow lets **regular functions** define workflows
- Fn Flow functions are written **purely as code**

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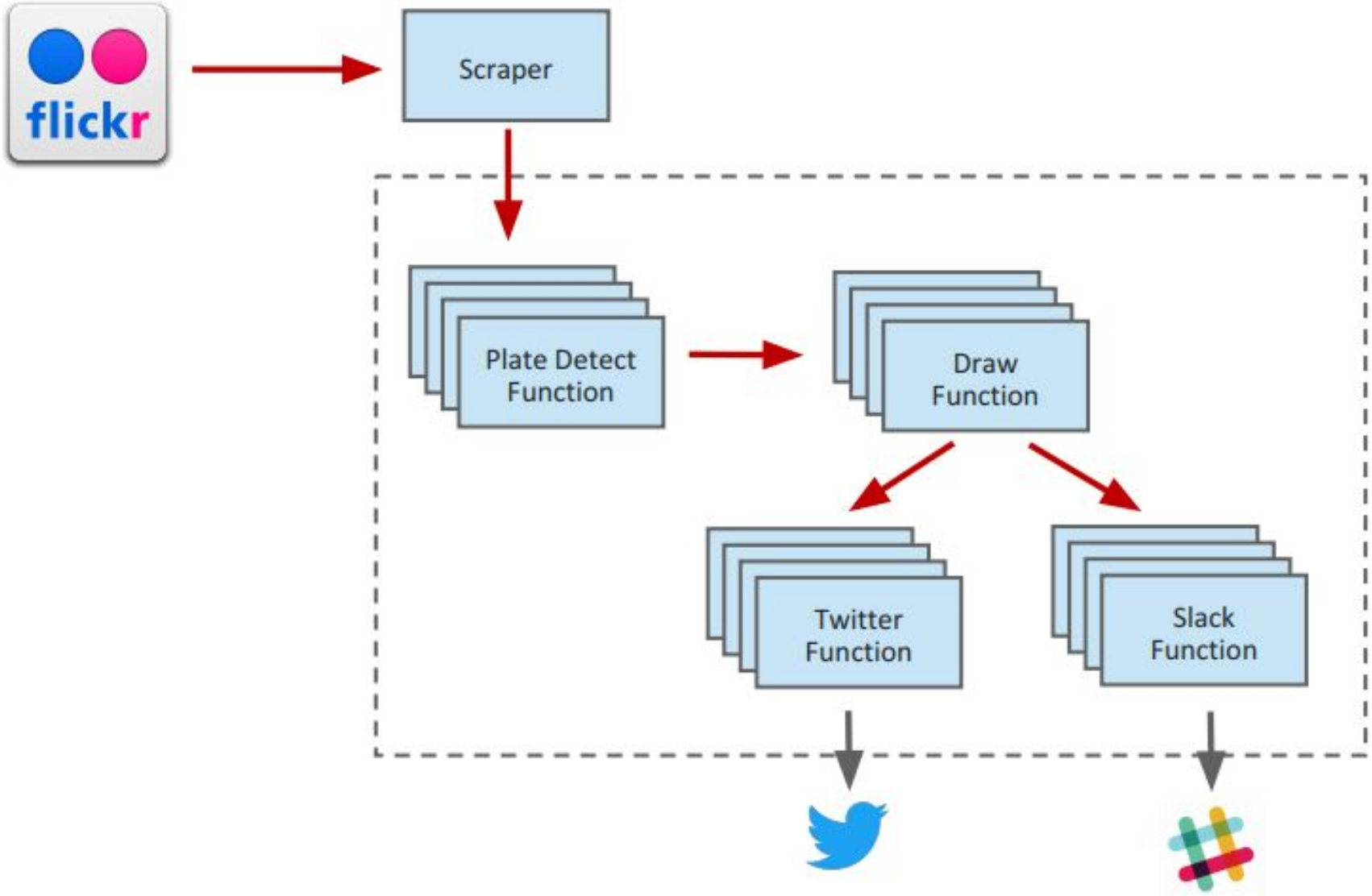

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Fn Flow Under the Hood

- Inspired by the **CompletionStage** API from JDK 8:

```
public class CompletableFuture<T>
implements Future<T>, CompletionStage<T>
```

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```
CompletableFuture<Image> imageRequest = makeHttpImageRequest(imgName);
```

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```
CompletableFuture<Image> imageRequest = makeHttpImageRequest(imgName);

CompletableFuture<FaceDetectionResult> facesResult =
        imageRequest.thenApply( image -> detectFaces(image) );
```

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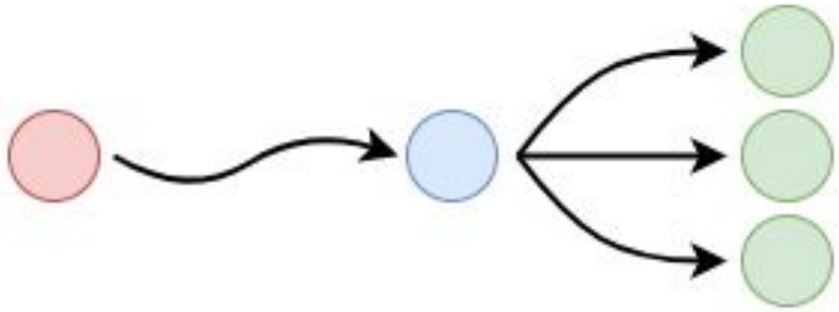
```
CompletableFuture<Image> imageRequest = makeHttpImageRequest(imgName);

CompletableFuture<FaceDetectionResult> facesResult =
        imageRequest.thenApply( image -> detectFaces(image) );

res1 = facesResult.thenApply( moodDetectionMethodSimple );
res2 = facesResult.thenApply( moodDetectionMethodComplex );
res3 = facesResult.thenApply( moodDetectionMethodExperimental );
```



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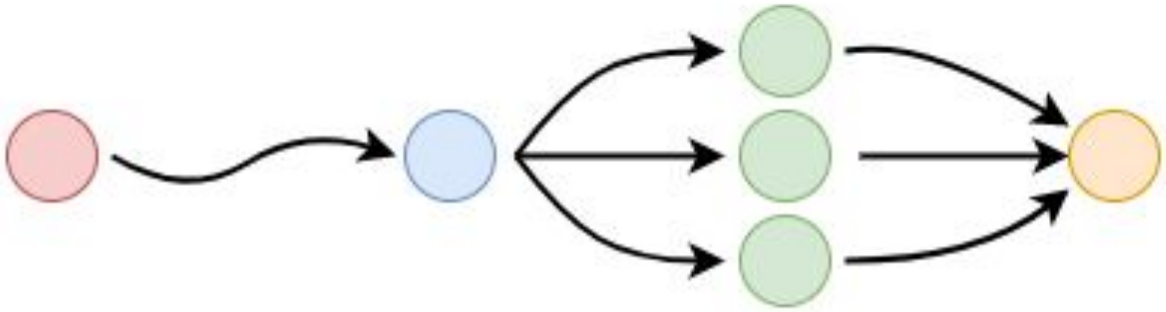
res2 = facesResult.thenApply( moodDetectionMethodComplex );
res3 = facesResult.thenApply( moodDetectionMethodExperimental );

finish = CompletableFuture.allOf(res1, res2, res3).thenRun(
    registerDetectionFinished(imgName);
);
```



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res3 = facesResult.thenApply( moodDetectionMethodExperimental );

finish = CompletableFuture.allOf(res1, res2, res3).thenRun(
    registerDetectionFinished(imgName);
);

finish.exceptionally( ex -> System.out.println("Oh no!") )
```

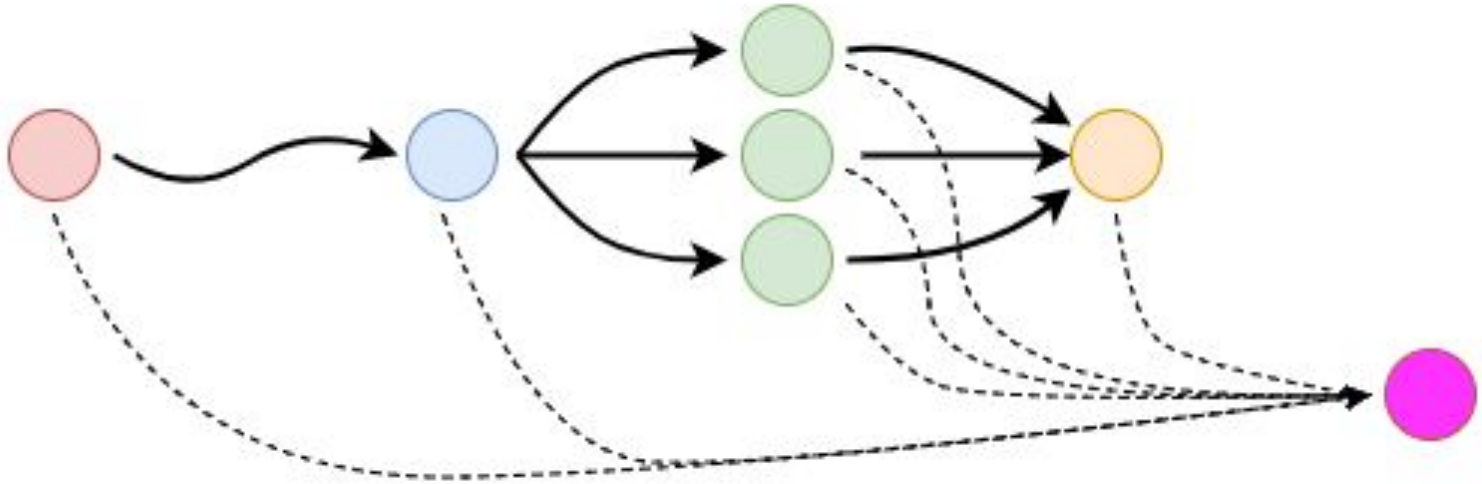

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CompletionStage – What's going on?

A workflow of **asynchronous actions**

is constructed **in memory**

and completed asynchronously using the **ForkJoinPool**.

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Fn Flow – What's going on?

A workflow of **asynchronous functions**

is constructed **in the Flow Server**

and completed asynchronously using the **FaaS**.

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CompletionStage API

A workflow of **asynchronous actions**

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Fn Flow

A workflow of **asynchronous functions**

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4. **Complex** applications
5. Use the JVM **effectively**

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Effective JVM for containers

JavaYourNext

(Cloud)

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Using the JVM effectively

Remember: Fn functions are just **containers**

We want:

- **Fast** Startup
- **Small** Images
- **Respect** the environment

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Using the JVM effectively – Fast Startup

Technique: **Share memory** between JVMs

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Using the JVM effectively – Fast Startup

Technique: **Share memory** between JVMs

Shared image layers => Shared memory:

- **libc**, **libjava.so** & friends can be shared between JVMs by using a common base image

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Using the JVM effectively – Fast Startup

Technique: Move **startup** activities to **build time**, and cache the results

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Using the JVM effectively – Fast Startup

Technique: Move **startup** activities to **build time**, and cache the results

- **CDS** – pre-compute classloading for core classes

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Using the JVM effectively – Fast Startup

Technique: Move **startup** activities to **build time**, and cache the results

- **CDS** – pre-compute classloading for core classes
- **AppCDS** – same, but for application classes

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Using the JVM effectively – Fast Startup

Technique: Move **startup** activities to **build time**, and cache the results

- **CDS** – pre-compute classloading for core classes
- **AppCDS** – same, but for application classes
- **AOT** compilation – compile bytecode to native in advance

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Using the JVM effectively – Small Container images

Technique: Shrink images to enable faster **download** and **startup**

- OS components
- JDK
- Application Code
- JVM

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Using the JVM effectively – Small Container images

Technique: Shrink images to enable faster **download** and **startup**

- OS components **Project Portola** – JVM build for Alpine Linux
- JDK
- Application Code
- JVM

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Using the JVM effectively – Small Container images

Technique: Shrink images to enable faster **download** and **startup**

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Project Portola – JVM build for Alpine Linux

jlink – Removes parts of the JDK you don't need

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Using the JVM effectively – Small Container images

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- Application Code **Your code** - Use fewer and smaller dependencies
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Using the JVM effectively – Small Container images

Technique: Shrink images to enable faster **download** and **startup**

- OS components **Project Portola** – JVM build for Alpine Linux
- JDK **jlink** – Removes parts of the JDK you don't need
- Application Code **Your code** - Use fewer and smaller dependencies
- JVM **SubstrateVM** – New lightweight VM from Oracle Labs

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Using the JVM effectively – Respecting the environment

Technique: Ensure that the JVMs **Ergonomics** chooses appropriate settings:

- Memory
  - Heap size
  - GC region sizes
  - JIT code cache sizes
- CPU
  - ThreadPool sizes
  - Runtime.availableProcessors()

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Using the JVM effectively – Respecting the environment

Technique: Ensure that the JVMs **Ergonomics** chooses appropriate settings:

Starting with JDK8 and improving through 9, 10 and 11 – the JDK supports this **automatically**.

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Thank You for Listening!

Check out Fn Project: **http://fnproject.io**

I've been Matthew Gilliard

Twitter: @MaximumGilliard

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