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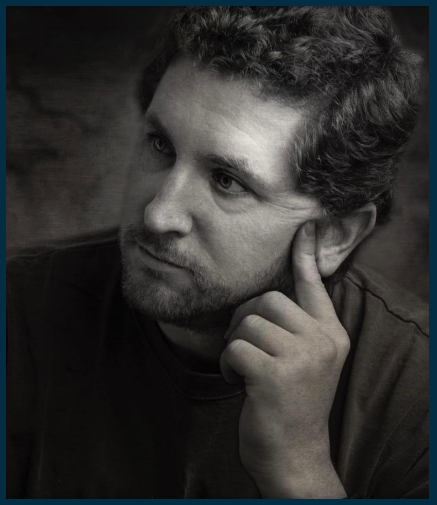
Better JVM Observability With No Code Changes



Tyler Benson
Observability Veteran, ServiceNow

In distributed systems, observability is the ability to collect data about program execution, internal states of modules, and the communication between components.

https://en.wikipedia.org/wiki/Observability_(software)

OpenTelemetry

A collection of standards, conventions, tools, APIs, and SDKs for observability

- Tracing
- Metrics
- Logging
- More in progress

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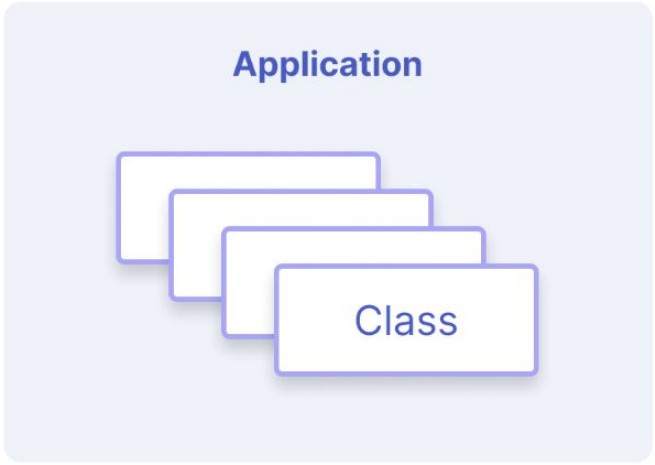
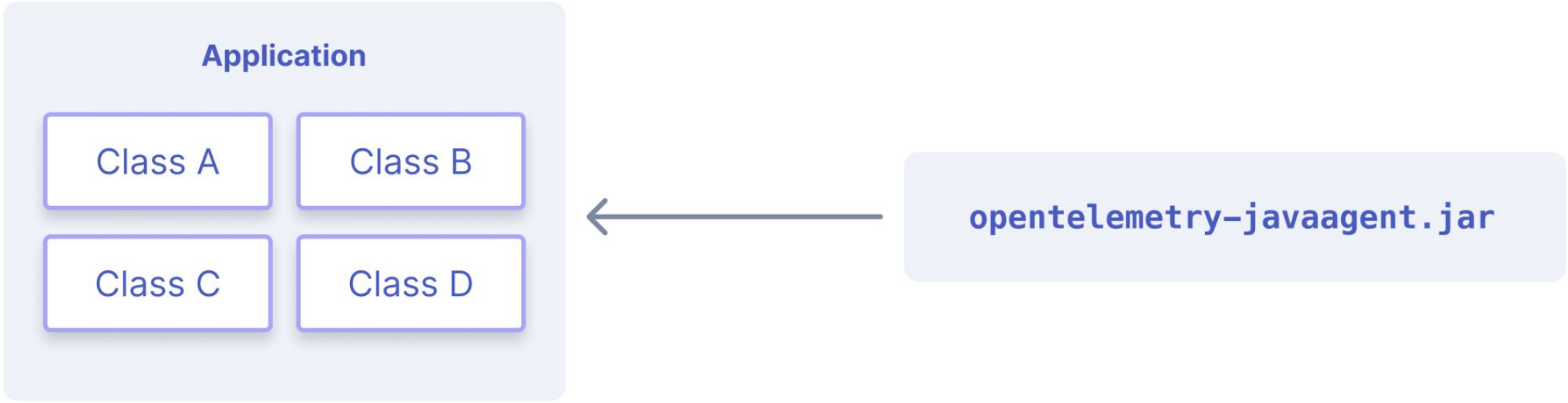
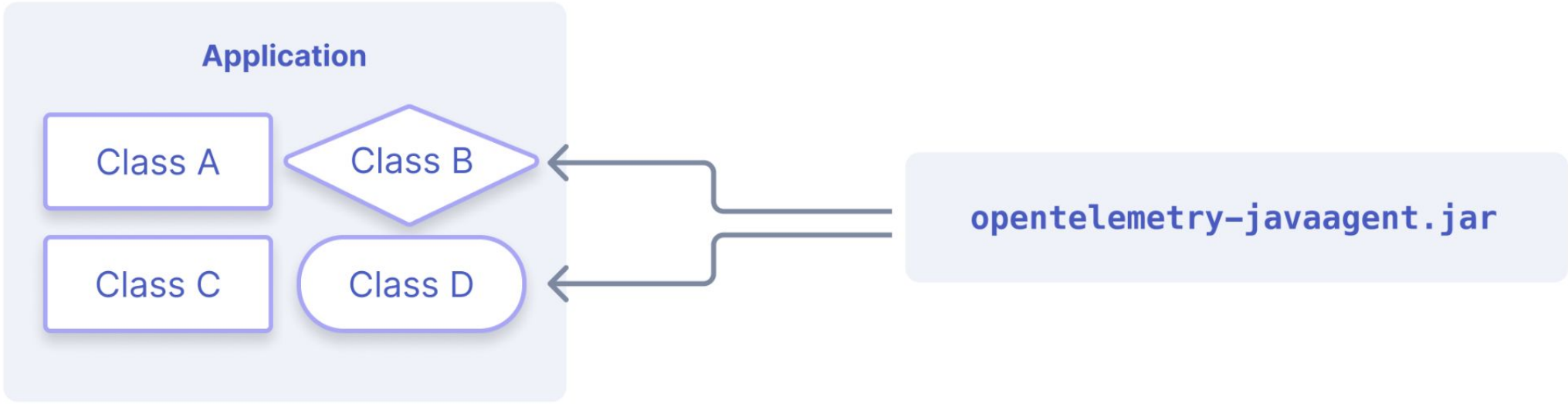



```
java -javaagent:path/to/opentelemetry-javaagent.jar \
-jar my-app.jar
```


Application
Class A
Class B
Class C
Class D
opentelemetry-javaagent.jar


Application
Class A
Class B
Class C
Class D
opentelemetry-javaagent.jar

Supported libraries, frameworks, application servers, and JVMs
(oh my!)

https://github.com/open-telemetry/opentelemetry-java-instrumentation/blob/main/docs/supported-libraries.md

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Aspect Oriented Programming

Advice and pointcuts

```
public void attendSREcon() {
  System.out.println("Hello Singapore!");
}
```

AOP - Advice

```
advice passportCheck() {
    if(!hasPassport()) {
        throw new IllegalAccessException();
    }
}
```

AOP - Join Point or Pointcut

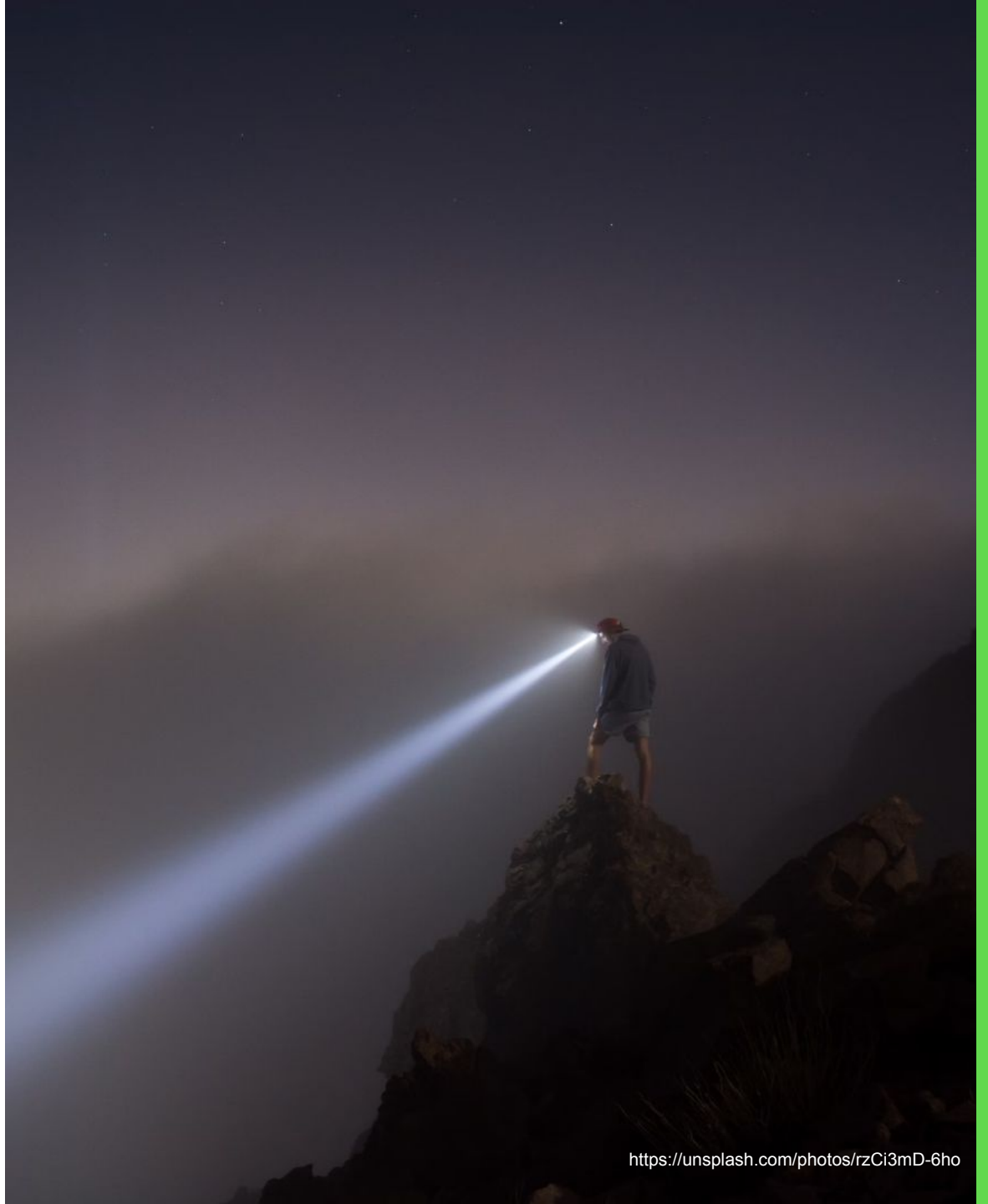
```
pointcut before(attendSREcon()) {
    passportCheck();
}
```

AOP - Applied

```
  public void attendSREcon() {
    if(!hasPassport()) {
      throw new IllegalAccessException();
    }
    System.out.println("Hello Singapore!");
  }
```

Generic Method Advice

- Method Name
- Method execution duration
- Thrown exception details
- Environmental Attributes
- Parent Span



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Defining the Pointcut

Annotation:

- Requires code change
- Evolves with the class
- Preferred if edits are ok

```
@WithSpan
```

Configuration

- No code change needed
- Can break if class/method name is changed without updating config

System property:

```
otel.instrumentation.methods.include
```

Environment variable:

```
OTEL_INSTRUMENTATION_METHODS_INCLUDE
```

```
my.package.MyClass1[method1,method2]
;my.package.MyClass2[method3]
```

Introducing: Flashlight

https://unsplash.com/photos/GewlrE-mkk4

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Available on Github

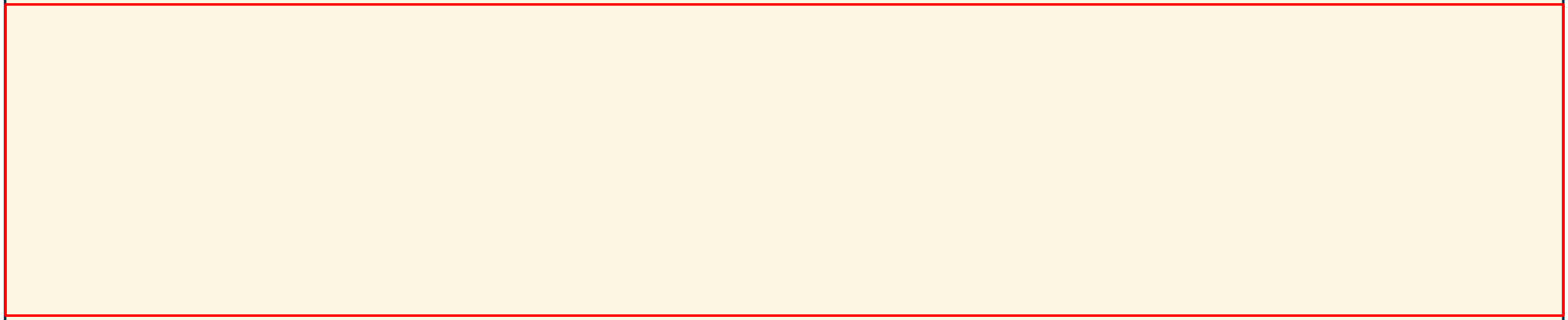
https://github.com/lightstep/flashlight-java

Latest release download:
https://github.com/lightstep/flashlight-java/releases/latest/download/flashlight.jar

```
~/Downloads ❯
```

```
spring-petclinic ❯
```

```
spring-petclinic ❯
```



```
spring-petclinic ❯
```

Heuristics

- Methods with locking/synchronization

Heuristics

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- Methods with networking client calls (http, database, etc)

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- Large/complex methods
  - Many method calls
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Heuristics

- Methods with locking/synchronization
- Methods with networking client calls (http, database, etc)
- Large/complex methods
  - Many method calls
  - High branching logic
- What other generic heuristics can you think of?

Come talk to me after with your ideas.

Ideal Candidates

What to consider when instrumenting methods

- Span value diminishes with over-use. Span limits per trace should be in the hundreds, not thousands.

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Ideal Candidates

What to consider when instrumenting methods

- Target distinct methods in business specific classes. (Avoid overlap with javaagent)

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Ideal Candidates

What to consider when instrumenting methods

- Focus on filling large gaps with useful detail that will help clarify application execution flow.

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Ideal Candidates

What to consider when instrumenting methods

- Identify methods that help differentiate uncommon or important code flows

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Ideal Candidates

What to consider when instrumenting methods

- Add Span attributes for important business classifications using
  - @SpanAttribute
  - Manual instrumentation
  - OTel Javaagent Extension

Ideal Candidates

What to consider when instrumenting methods

- Valuable Business Attributes
  - Account name/id
  - User name/id
  - Product plan level (free vs enterprise)
  - Feature Flags State

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Avoid Instrumenting


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- Don't duplicate instrumentation already available.
- Don't instrument everything… be conservative depending on risk tolerance and validation procedures.
- Especially don't instrument hot methods in a tight loop.
- (Consider performance testing.)

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Next Level: OpenTelemetry Javaagent Extension

- Customize OpenTelemetry Javaagent settings programmatically
- Provide custom samplers, exporters, propagators, etc
- Add additional custom instrumentation

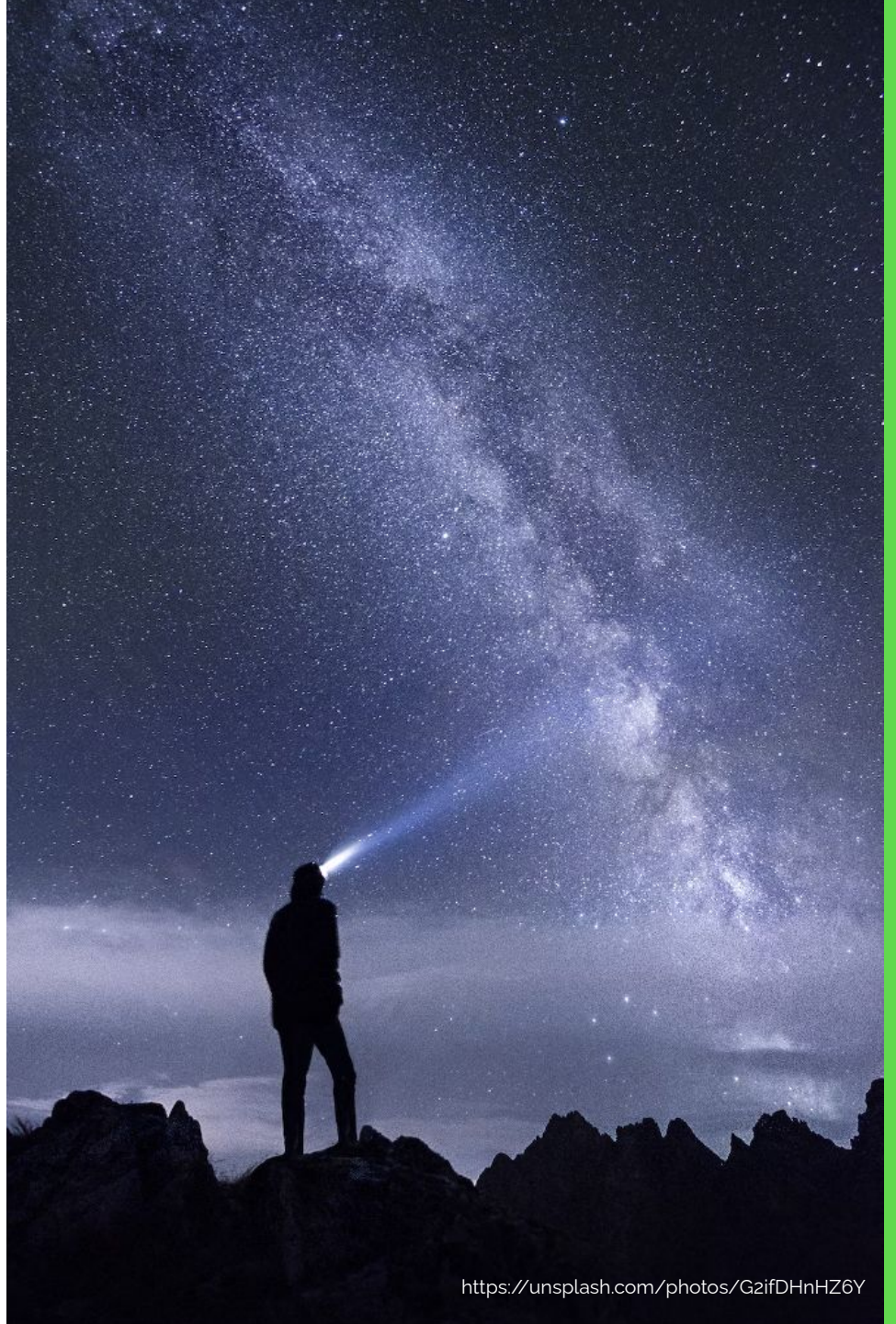
https://github.com/open-telemetry/opentelemetry-java-instrumentation/blob/main/examples/extension/README.md

Next Level: AOP Frameworks

- Spring AOP
- AspectJ
- Byte Buddy (used internally by OTel Javaagent)

Next Level: Complementary tools

- Async Profiler
- Java Flight Recorder
- eBPF



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Q&A

https://github.com/lightstep/flashlight-java

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