

SPRINGIO 2023

AWS Lambda Snapstart

Dramatically reduce cold starts for your Java functions

Melina Schweizer

Senior Partner Solutions Architect
Amazon Web Services

Kevin Azijn

Senior Solutions Architect
Amazon Web Services

© 2023, Amazon Web Services, Inc. or its affiliates.

Agenda

- Primer on Serverless and AWS Lambda
- AWS Lambda SnapStart

© 2023, Amazon Web Services, Inc. or its affiliates.

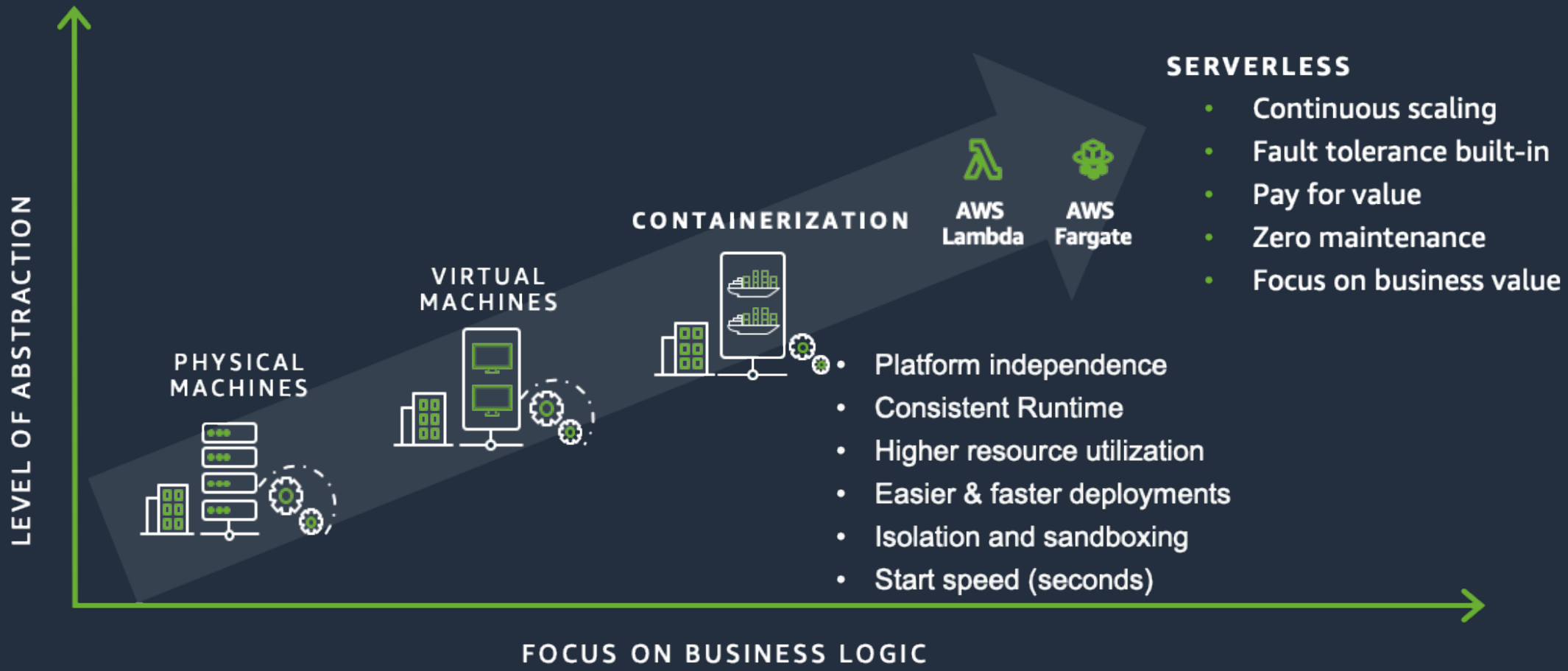


Primer on serverless

Run code without thinking about servers or clusters

© 2023, Amazon Web Services, Inc. or its affiliates.

Modernizing Compute - A paradigm shift for business velocity with AWS services



© 2023, Amazon Web Services, Inc. or its affiliates.

Serverless is more than compute

COMPUTE


AWS Lambda


AWS Fargate

DATA STORES


Amazon S3


Amazon Aurora Serverless


Amazon DynamoDB

INTEGRATION


Amazon API Gateway


AWS AppSync


Amazon EventBridge


Amazon Simple Queue Service (Amazon SQS)


Amazon Simple Notification Service (Amazon SNS)


AWS Step Functions

aws

© 2023, Amazon Web Services, Inc. or its affiliates.



AWS Lambda

Serverless, event-driven compute service

© 2023, Amazon Web Services, Inc. or its affiliates.

What is AWS Lambda

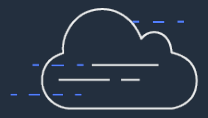
Event Source



Changes in data state



Requests to endpoints



Changes in resource state





Function



Business logic

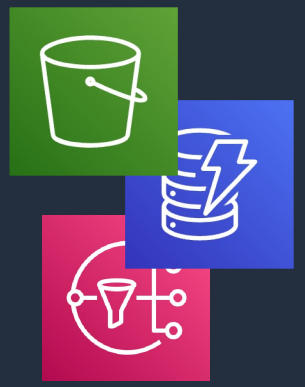
JAVA

Node.js, Python, C#, Go,
Ruby, PowerShell
Bring Your Own



Services / Other



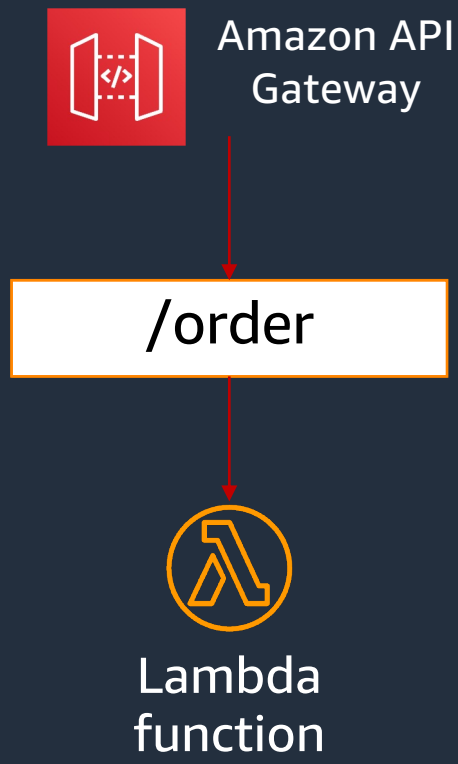


Many more…

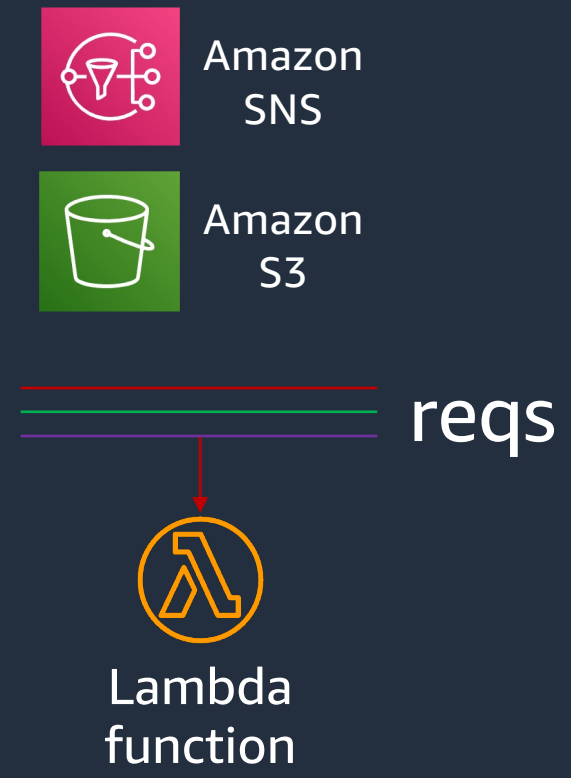
© 2023, Amazon Web Services, Inc. or its affiliates.

Lambda Execution Models

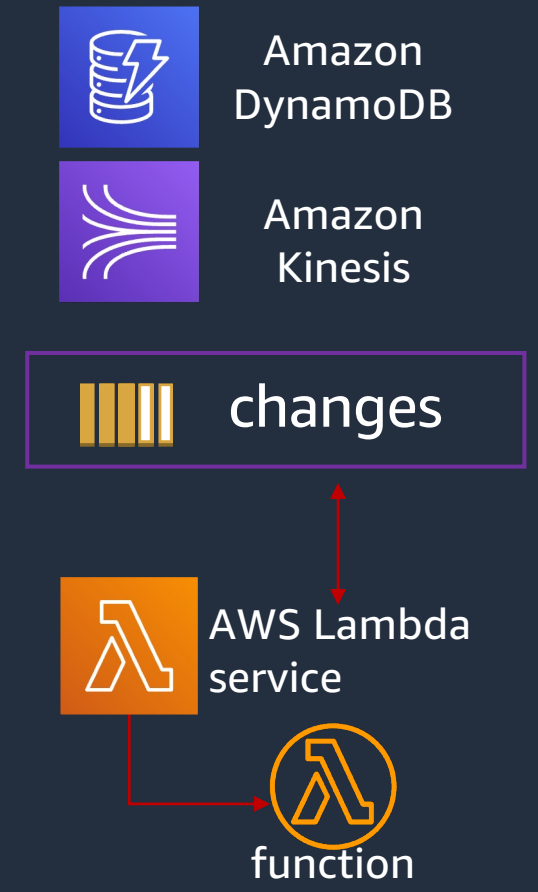
Synchronous



Asynchronous

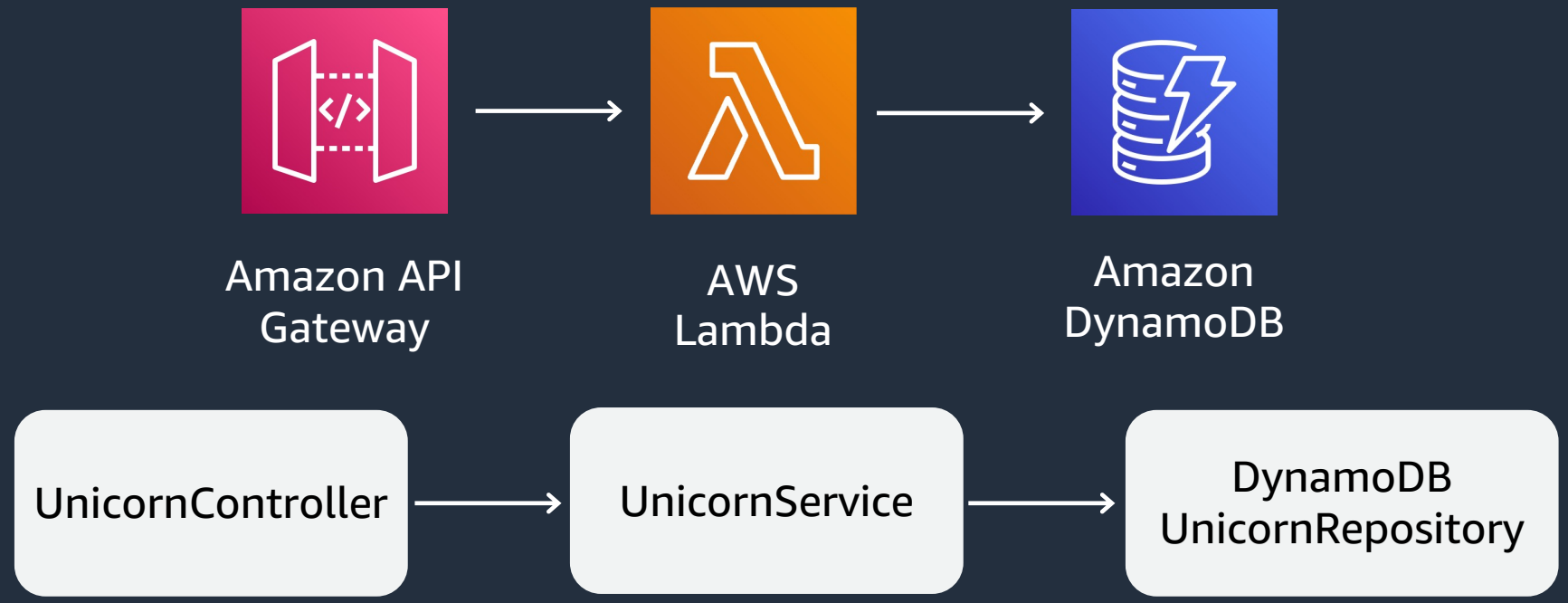


Poll



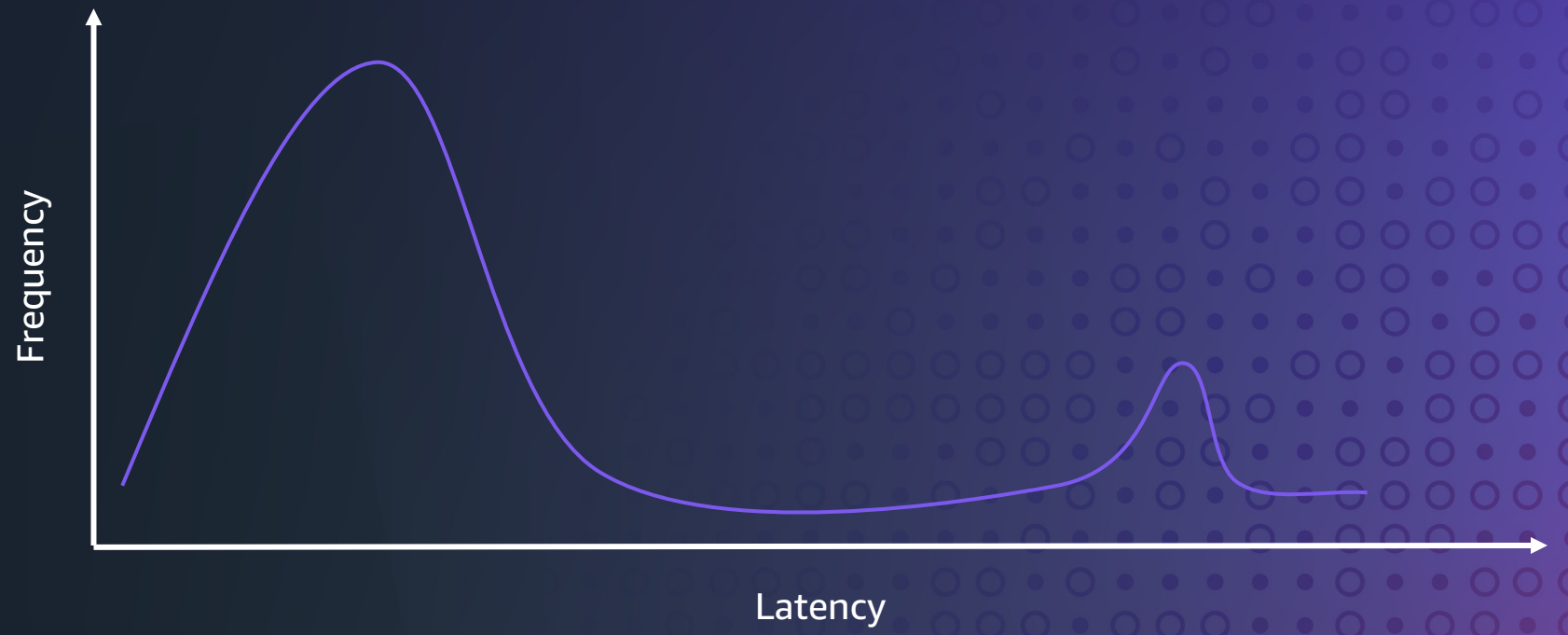
aws
© 2023, Amazon Web Services, Inc. or its affiliates.

Example Spring Boot Function



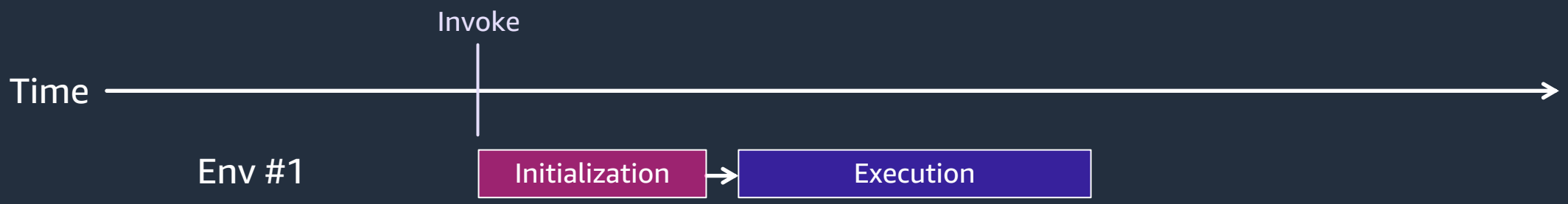
aws
© 2023, Amazon Web Services, Inc. or its affiliates.

Lambda function performance



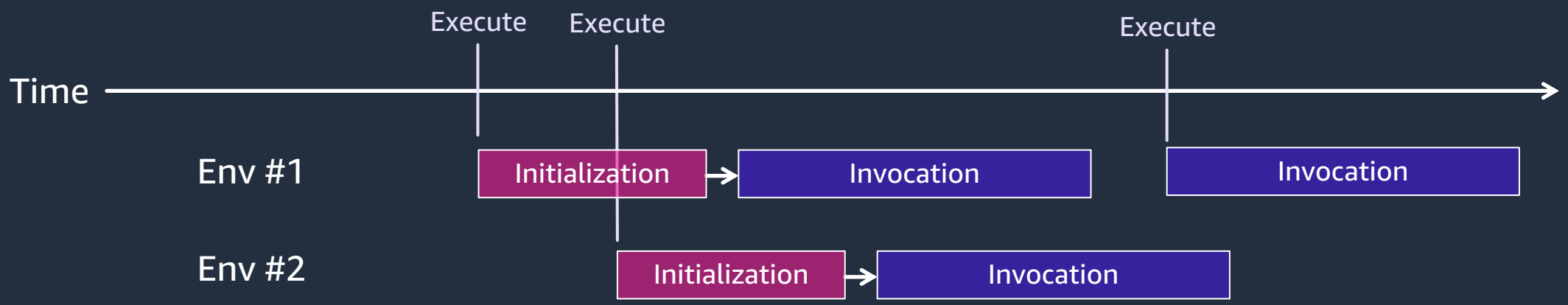
© 2023, Amazon Web Services, Inc. or its affiliates.

How Lambda scales: Concurrency



© 2023, Amazon Web Services, Inc. or its affiliates.

How Lambda scales: Concurrency



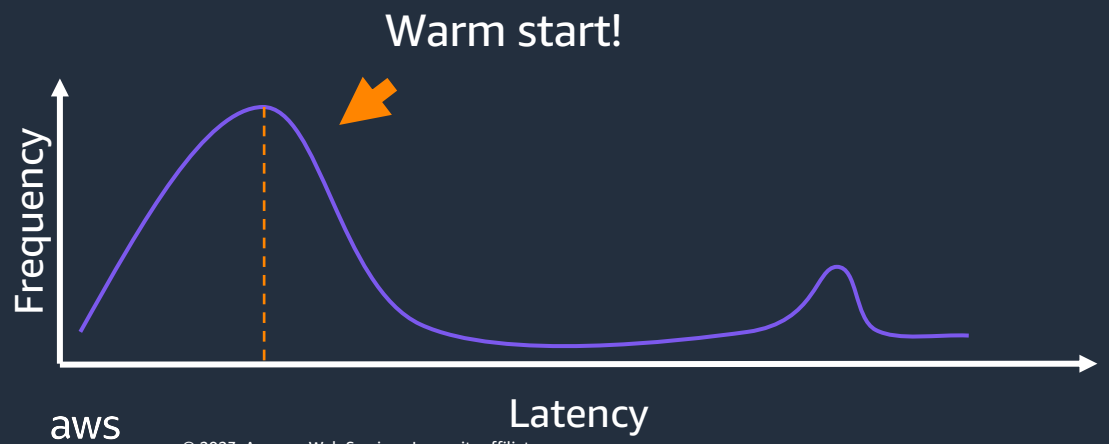
© 2023, Amazon Web Services, Inc. or its affiliates.

Execution environment lifecycle



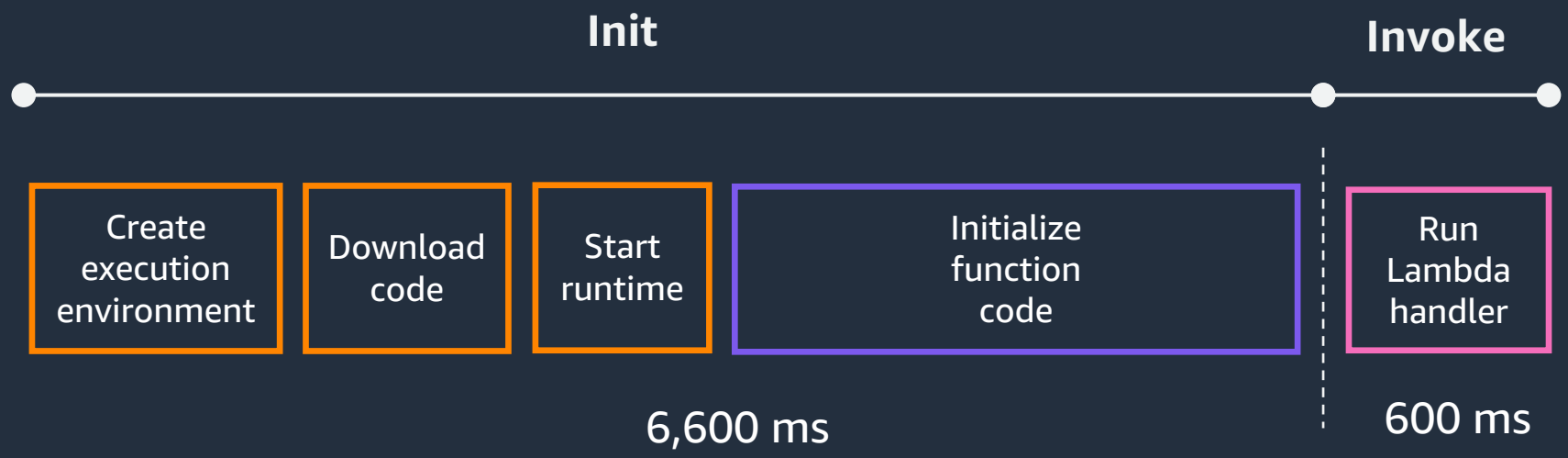
Run Lambda handler

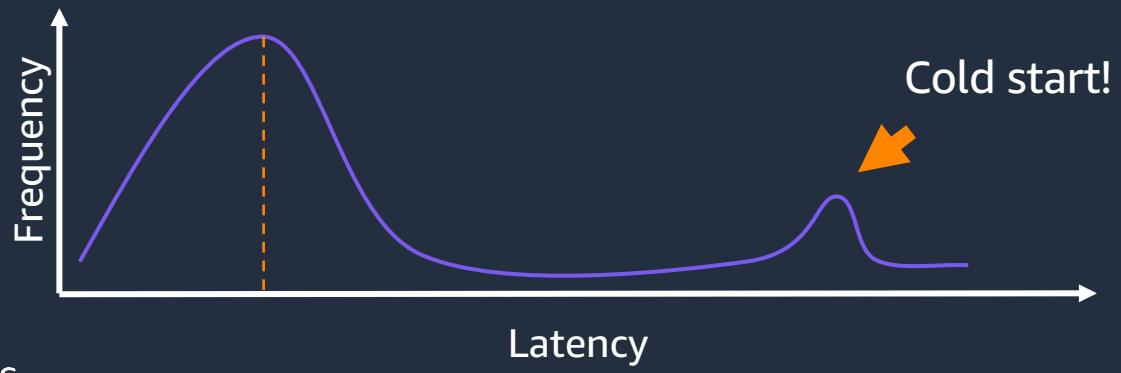
~10 ms



aws
© 2023, Amazon Web Services, Inc. or its affiliates.

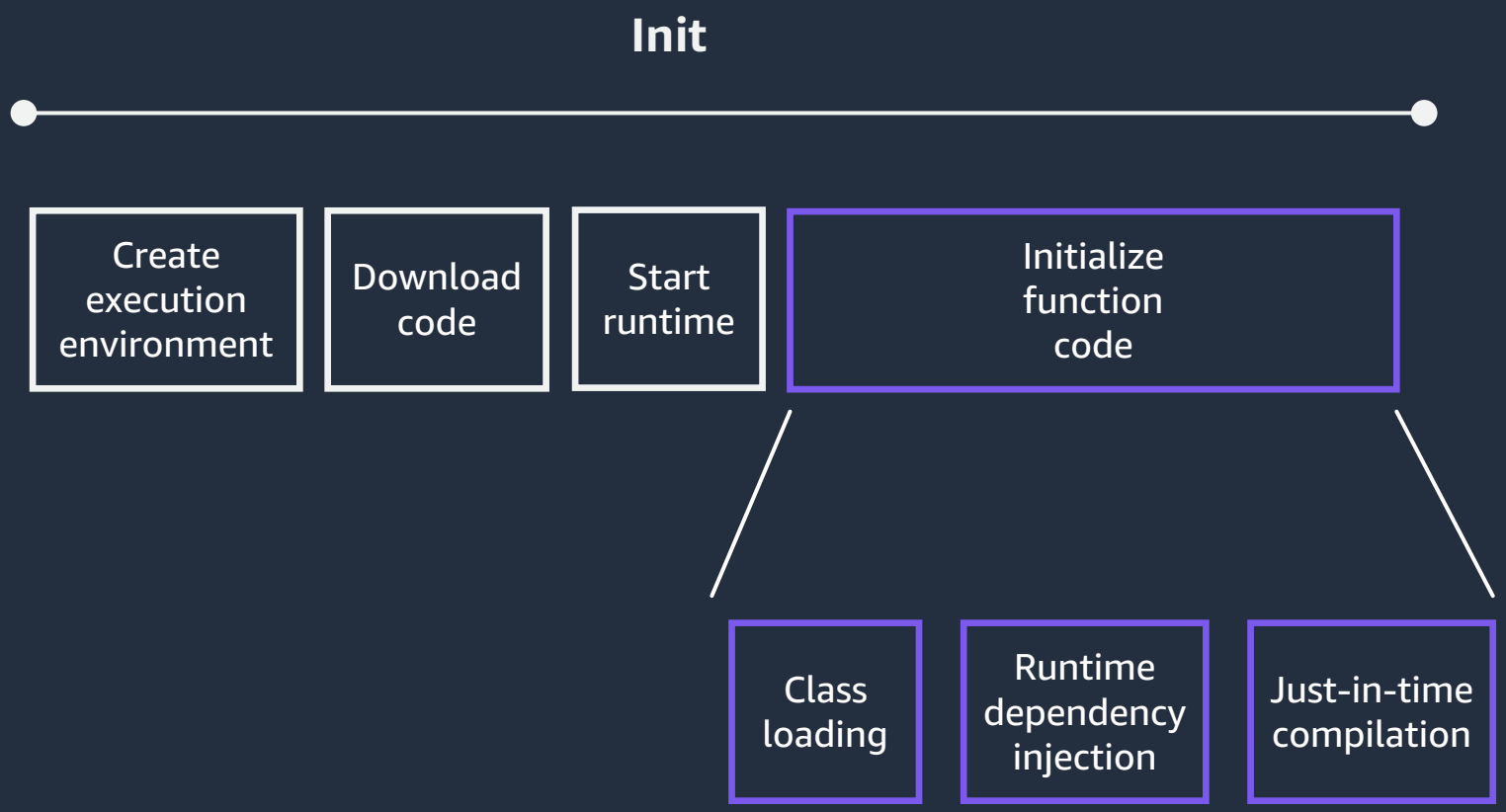
Invocation model





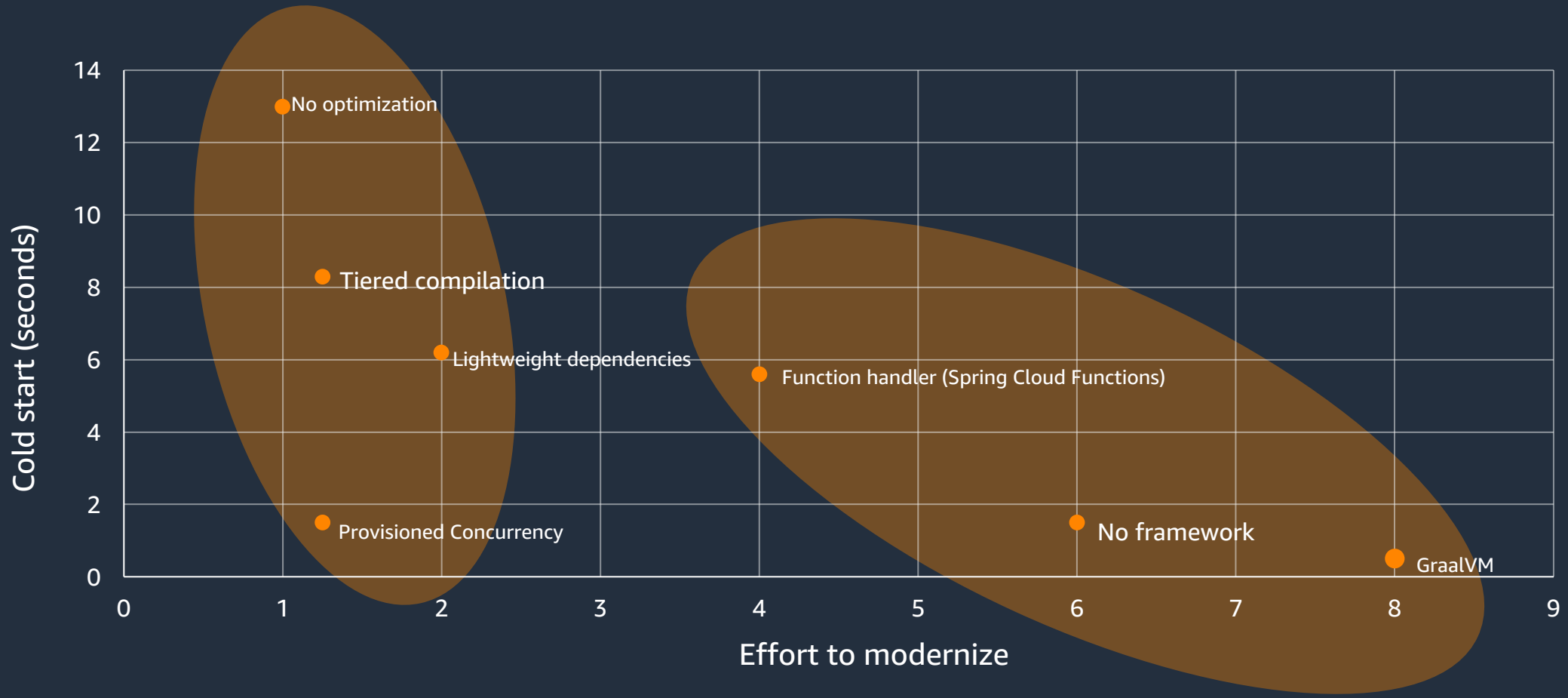
aws
© 2023, Amazon Web Services, Inc. or its affiliates.

Java initialization



aws
© 2023, Amazon Web Services, Inc. or its affiliates.

Cold start optimizations for a Spring Boot Migration



aws
© 2023, Amazon Web Services, Inc. or its affiliates.



NEW

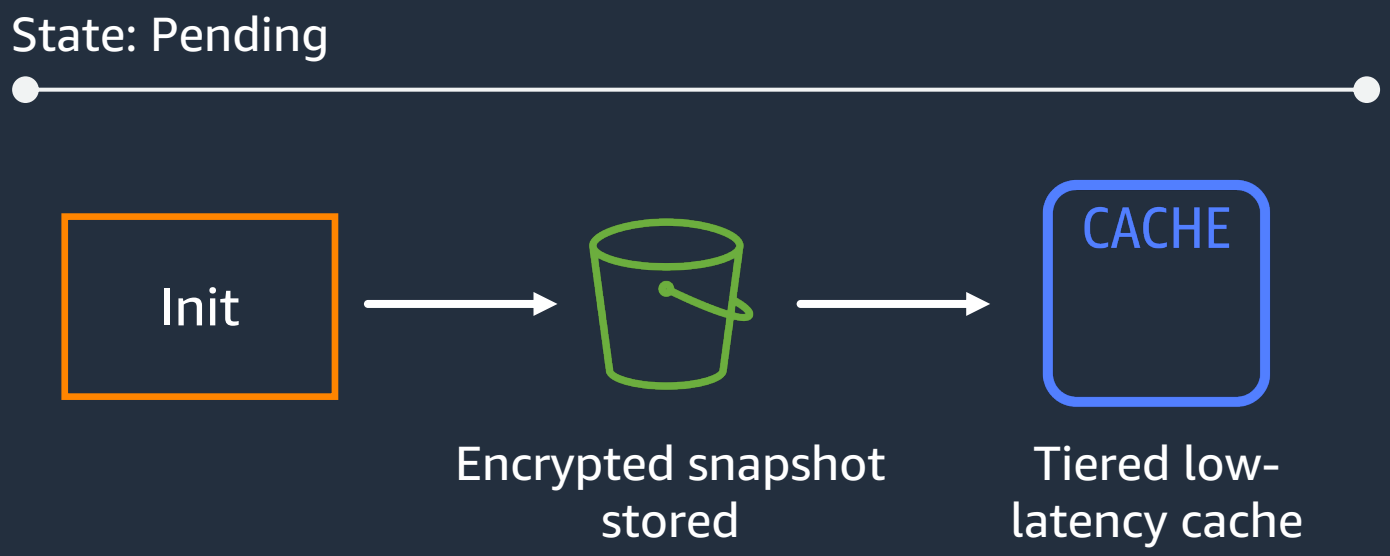
AWS Lambda SnapStart

Up to 10x faster startup performance

© 2023, Amazon Web Services, Inc. or its affiliates.

SnapStart overview

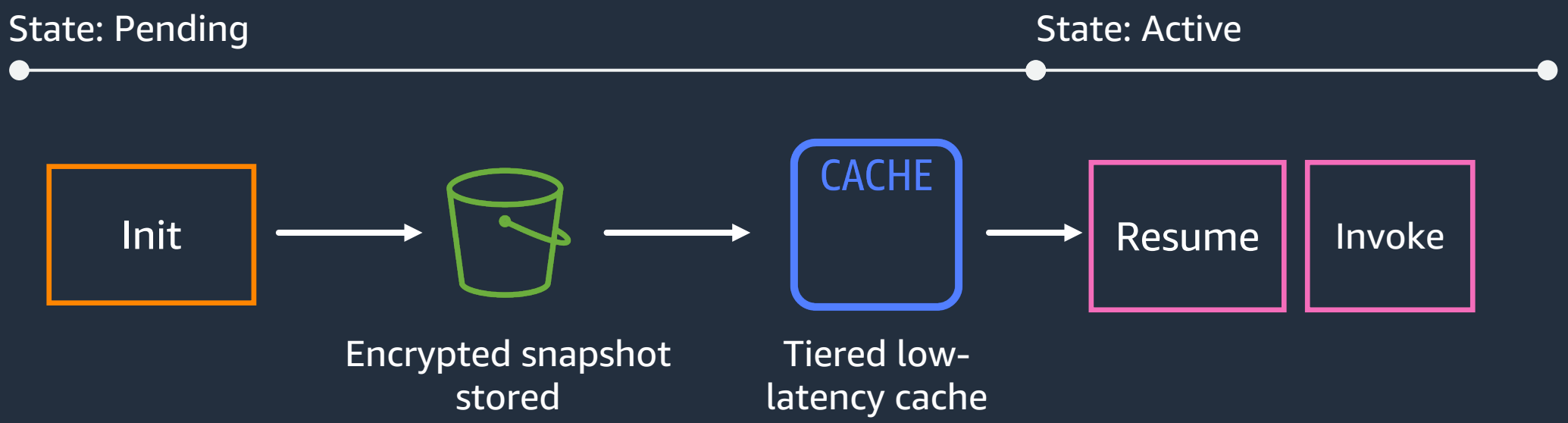
publish-version



aws
© 2023, Amazon Web Services, Inc. or its affiliates.

SnapStart overview

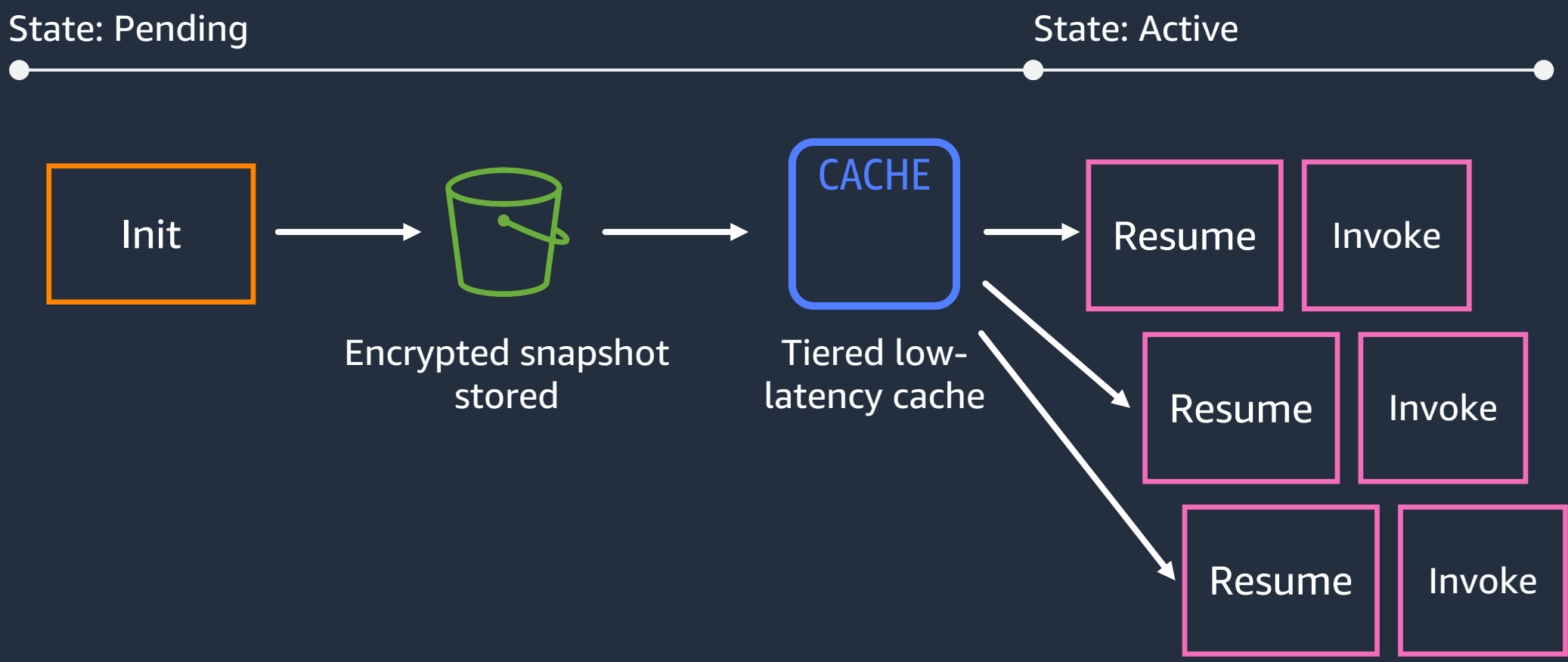
publish-version



© 2023, Amazon Web Services, Inc. or its affiliates.

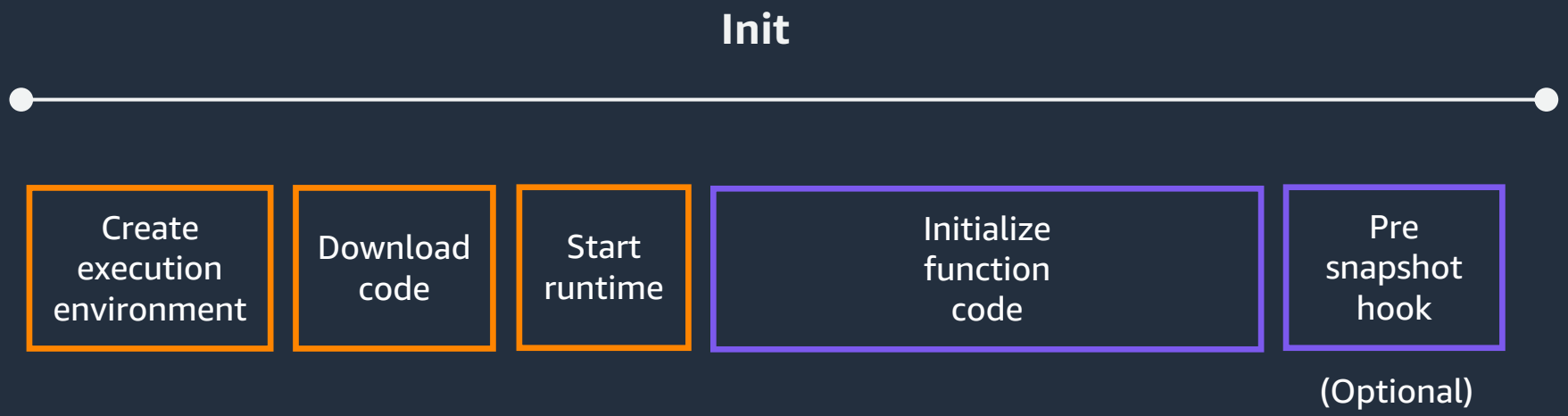
SnapStart overview

publish-version



aws
© 2023, Amazon Web Services, Inc. or its affiliates.

Invocation model

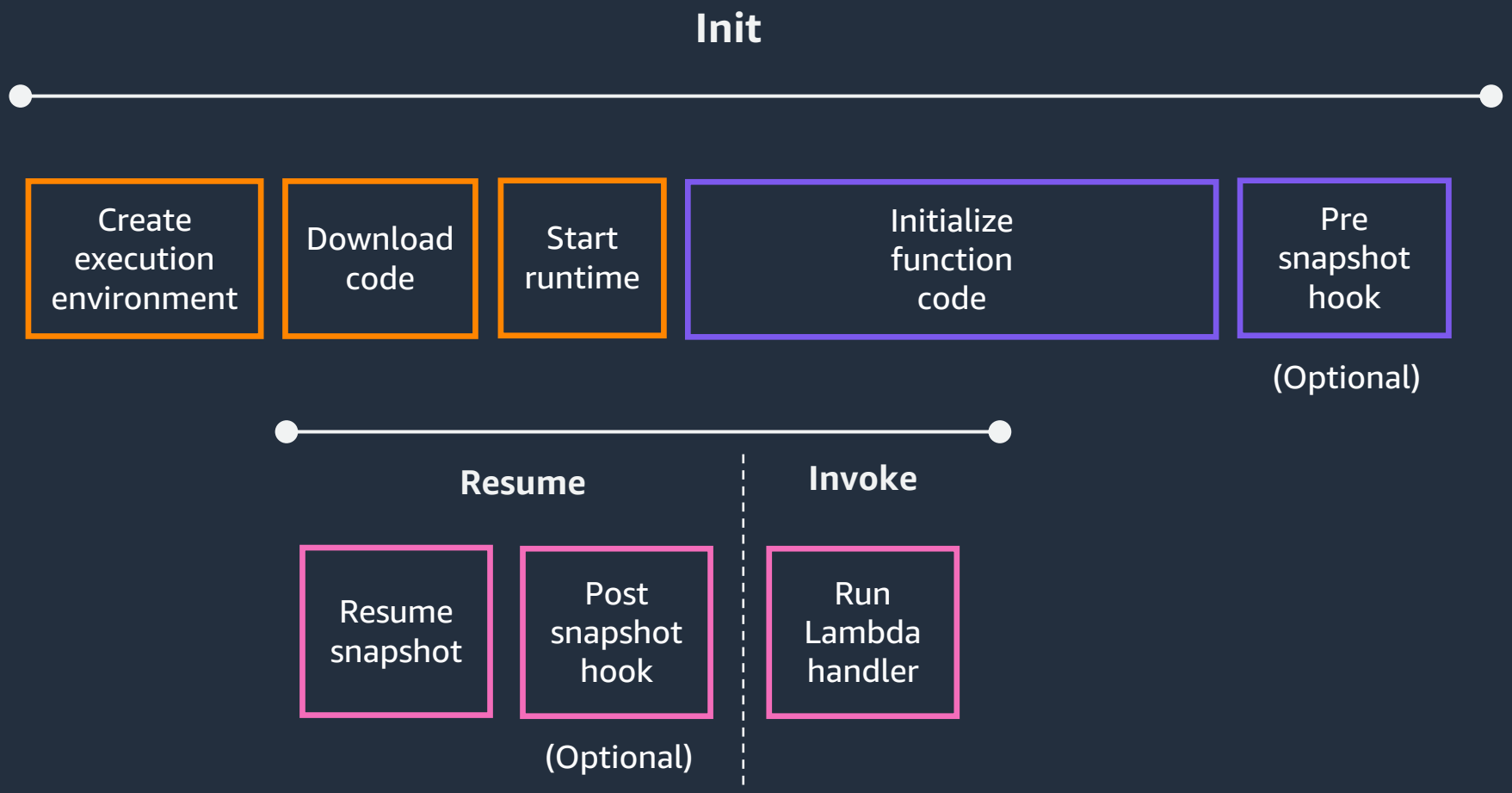


Firecracker

microVM snapshot technology

aws
© 2023, Amazon Web Services, Inc. or its affiliates.

Invocation model



© 2023, Amazon Web Services, Inc. or its affiliates.

Example

```java
import org.crac.Core;
import org.crac.Resource;

public class HelloHandler implements RequestHandler<String, String>, Resource {

    public HelloHandler() {
        Core.getGlobalContext().register(this);
    }

    public String handleRequest(String name, Context context) {
        return "Hello " + name;
    }

    public void beforeCheckpoint() {
        System.out.println("Before Snapshot");
    }

    public void afterRestore() {
        System.out.println("After Resume");
    }
}
```

aws

© 2023, Amazon Web Services, Inc. or its affiliates.

Considerations

© 2023, Amazon Web Services, Inc. or its affiliates.

Considerations



Network connections



Ephemeral data



Uniqueness

aws

© 2023, Amazon Web Services, Inc. or its affiliates.

Network connections

Init



AWS Lambda



Amazon Relational Database Service (Amazon RDS)

© 2023, Amazon Web Services, Inc. or its affiliates.

Network connections

Resume



AWS
Lambda



Amazon Relational
Database Service
(Amazon RDS)

© 2023, Amazon Web Services, Inc. or its affiliates.

Network connections

Invoke



AWS
Lambda



Amazon Relational
Database Service
(Amazon RDS)

`Connection Failed, Retrying`

© 2023, Amazon Web Services, Inc. or its affiliates.

Ephemeral data

Init



AWS Lambda

AWS Secrets Manager

© 2023, Amazon Web Services, Inc. or its affiliates.

Ephemeral data

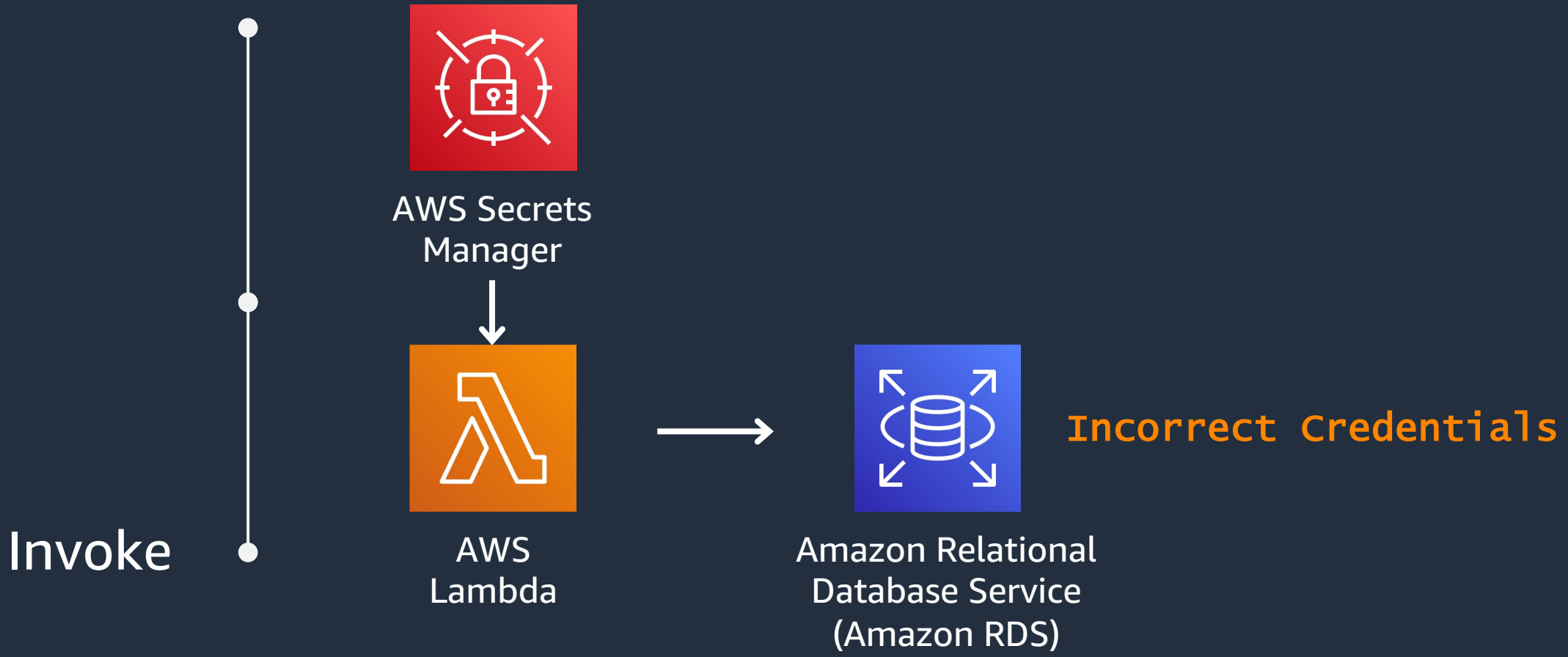
Resume



AWS
Lambda

© 2023, Amazon Web Services, Inc. or its affiliates.

Ephemeral data



© 2023, Amazon Web Services, Inc. or its affiliates.

Uniqueness

AWS tested

Updated

- Amazon Linux 2 and OpenSSL (1.0.2) resilient to snapshot operations
  - OpenSSL
  - /dev/random
  - /dev/urandom

Verified

- Java 11 and 17 runtimes validated
  - java.security.SecureRandom

Please verify uniqueness if you're using other methods

aws

© 2023, Amazon Web Services, Inc. or its affiliates.

Test

100 requests/second
10 minutes



Amazon API Gateway

AWS Lambda

Amazon DynamoDB

© 2023, Amazon Web Services, Inc. or its affiliates.

Results

	P50	P99.9
Without SnapStart	8 ms	5,114 ms

© 2023, Amazon Web Services, Inc. or its affiliates.

Results

	P50	P99.9
Without SnapStart	8 ms	5,114 ms
With SnapStart	8 ms	536 ms

aws
© 2023, Amazon Web Services, Inc. or its affiliates.

Priming

Pre snapshot hook

```
import org.crac.Context;
import org.crac.Core;
import org.crac.Resource;

@Configuration
public class UnicornPrimingResource implements Resource {

    private final UnicornController unicornController;

    public UnicornPrimingResource(UnicornController unicornController) {
        this.unicornController = unicornController;
        Core.getGlobalContext().register(this);
    }

    @Override
    public void beforeCheckpoint(Context<? extends Resource> context) throws Exception {
        unicornController.getUnicorn("123");
    }

    @Override
    public void afterRestore(Context<? extends Resource> context) throws Exception {
        System.out.println("afterRestore hook");
    }
}
```

aws

© 2023, Amazon Web Services, Inc. or its affiliates.

Results

	P50	P99.9
Without SnapStart	8 ms	5,114 ms
With SnapStart	8 ms	536 ms
With SnapStart + Priming	8 ms	488 ms

aws

© 2023, Amazon Web Services, Inc. or its affiliates.

Scanning tool + Runtime hooks

Scans for known anti-patterns

- java.util.Random
  - Unsuitable for cryptographic work



https://github.com/aws/aws-lambda-snapstart-java-rules

aws

© 2023, Amazon Web Services, Inc. or its affiliates.

Lambda Powertools for Java



Tenets
AWS Lambda only
Eases the adoption of best practices
Keep it lean
We strive for backward compatibility
We work backwards from the community
Progressive

aws

© 2023, Amazon Web Services, Inc. or its affiliates.

Lambda Powertools for Java

Our customers grew

The community too

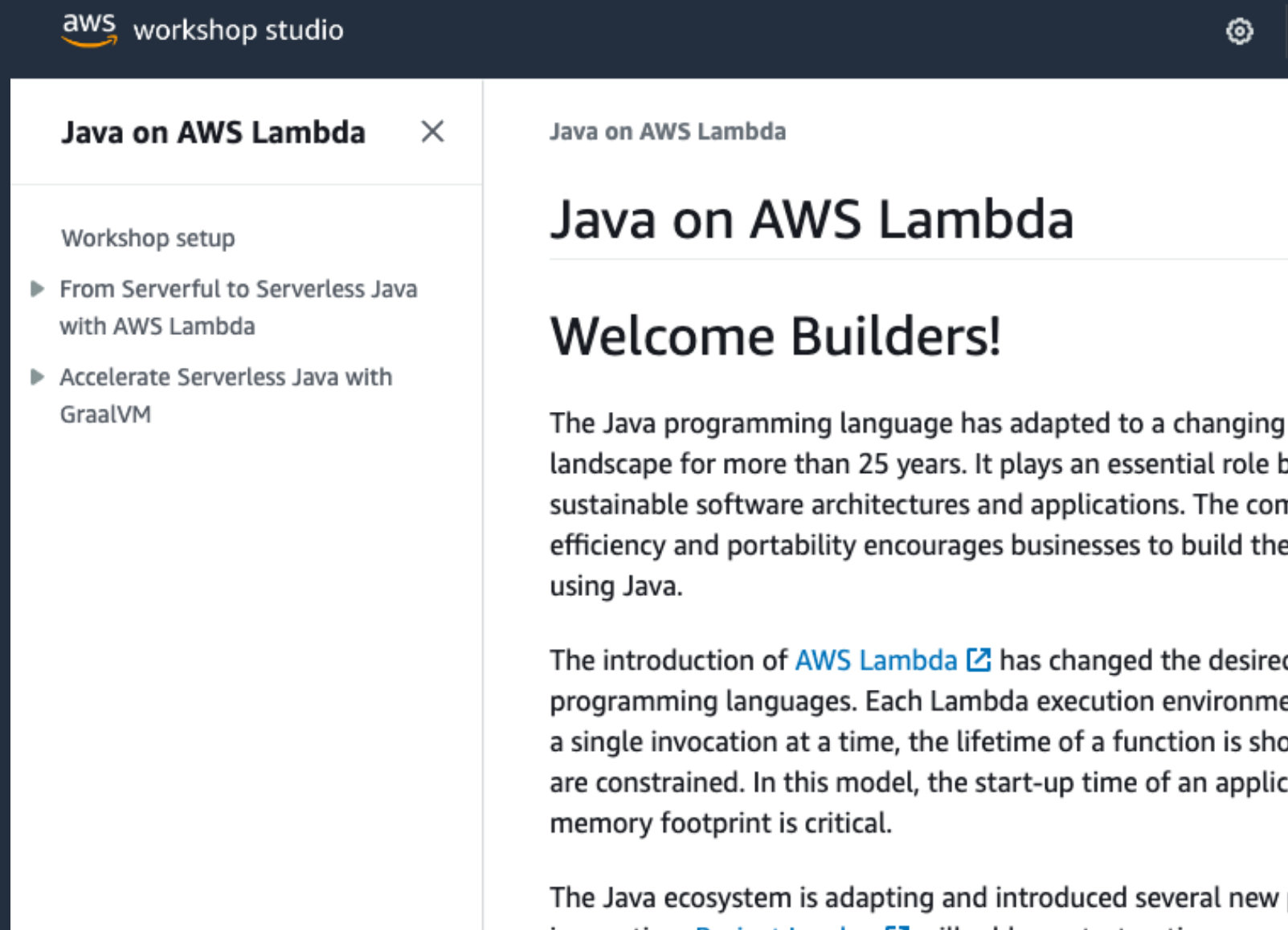
- Batch partial failure
- Config management
- Observability
- Handling secrets
- Input/output validation
- Idempotency
- Caching
- Data extraction

aws

© 2023, Amazon Web Services, Inc. or its affiliates.

SPRINGIO 2023

Java on Lambda workshop



© 2023, Amazon Web Services, Inc. or its affiliates.

Q&A

… or approach us throughout the event for a conversation

© 2023, Amazon Web Services, Inc. or its affiliates.



Thank you!

Melina Schweizer
mschweiz@amazon.es
Medium: @melinas2000

Kevin Azijn
kevazijn@amazon.com

© 2023, Amazon Web Services, Inc. or its affiliates.