Intro to Java on AWS

Lee Packham – Senior Developer Advocate
Ben Maizels – Senior Software Development Engineer

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What we'll cover

- The JVM ecosystem in relation to AWS
- Amazon Corretto and Amazon Corretto Crypto Provider
- The AWS Java SDK v2
- AWS Cloud Development Kit (CDK)

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`whoami`

Lee Packham

Senior Developer Advocate

Amazon Web Services

>20 years experience of dev, systems architecture and DevOps across Startup and Enterprise; 10 years of AWS experience

Developer (Python/Go/Java/Scala/Kotlin/C/Node/Rust)

Contributor to the CDK and works with Development Tools in AWS

Twitter: **@joolz** / Email: **leepac@amazon.com**

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`whoami`

Ben Maizels

Senior Software Development Engineer

Amazon Web Services

- Joined Amazon in 2002
- >20 years working as a developer and tech lead building services and libraries for analytics, big data, AI, e-commerce and online gaming
- Collaborator for the AWS Java SDK and recently a contributor and usability consultant for the Java interface of the AWS CDK.

GitHub: **bmaizels** / Email: **bmaizels@amazon.com**

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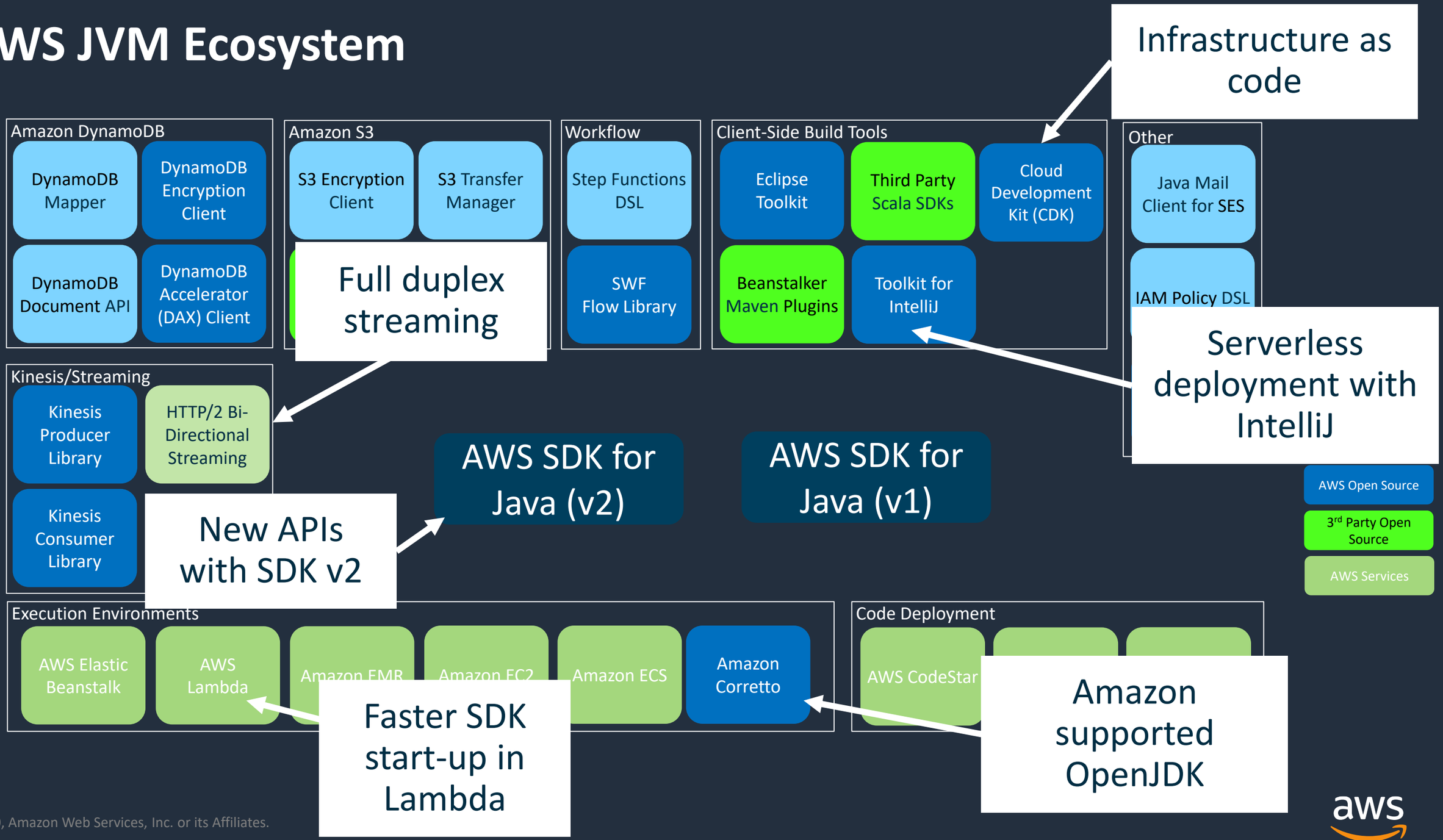
AWS JVM Ecosystem



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Amazon Corretto

- Amazon supported distribution of OpenJDK
  - Run internally on thousands of production services
- Multiplatform: Amazon Linux 2, Windows, macOS, Docker, Ubuntu, etc.
- No cost – Distributed under open source license - no charge for use or distribution
- No cost LTS (patches, performance improvements)
- Both Corretto 8 and 11 are Generally Available
- Open source – all patches and enhancements will be upstreamed to OpenJDK - https://github.com/corretto
- More info - https://aws.amazon.com/corretto

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Amazon Corretto Crypto Provider

- A collection of high-performance cryptographic implementations exposed via the standard JCA/JCE interfaces
- Drop in replacement for many different Java applications
- Currently algorithms are primarily backed by OpenSSL's implementations (1.1.1d)
- Compatible with OpenJDK 8+ (and Amazon Corretto), Oracle JDK 8+ on Linux x86_64
- Open Source on Github at https://github.com/corretto/amazon-corretto-crypto-provider

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AWS Toolkit for Jetbrains

Meeting developers where they are

- IntelliJ
- PyCharm

Broad ecosystem

- WebStorm
- Clion
- RubyMine
- Rider
- AppCode
- GoLand

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AWS Toolkit for IntelliJ IDEA & PyCharm

- Make it easier to develop on AWS
- Open Source
- Initial focus: Serverless
  - AWS Lambda
  - AWS SAM CLI Integration
  - Local debugging
  - Serverless application support
- Basic resource/credential management
- Will grow support across AWS
- https://aws.amazon.com/intellij

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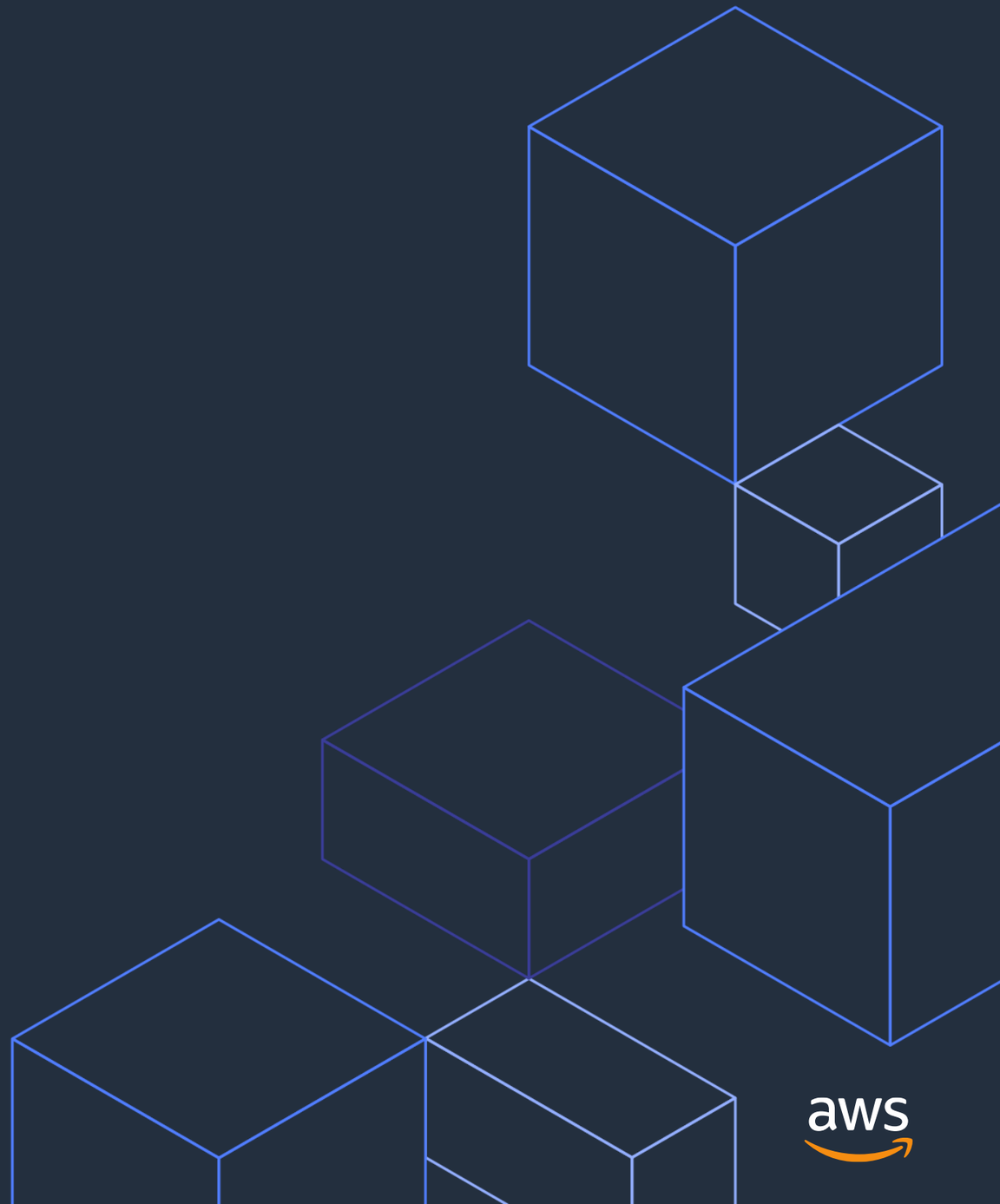
AWS SDK for Java



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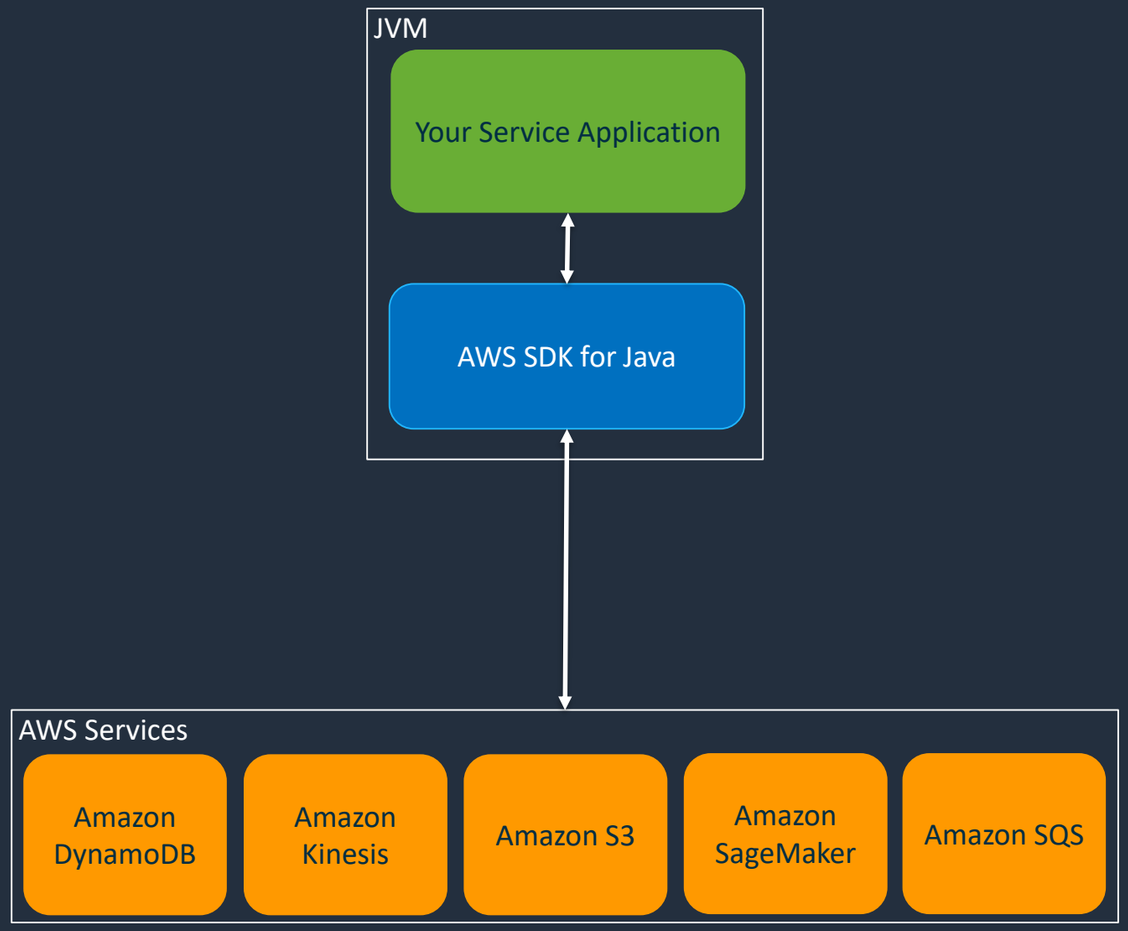
AWS SDK for Java



AWS SDK for Java

- Credentials management
- Endpoint construction
- AWS Service protocols translation
- Request signing
- Transport (HTTP, HTTP/2)
- Streaming I/O
- Timeouts and retries
- Errors and exception modelling
- Asynchronous execution orchestration

Legend

AWS Open Source

3rd Party Source

AWS Service

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AWS SDK for Java v2

- Launched in November 2018
- Leverages Java 8 language features
- Optimized for AWS Lambda:
    - Smaller dependency footprint
    - Faster client initialization time
- Non-blocking asynchronous support
- Streaming over HTTP/2 support for some services
- Pluggable HTTP client
- Open-source on GitHub

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AWS SDK for Java comparison

V1

```
public List<String> getBucketKeys(String bucket) {
  AmazonS3 s3 = AmazonS3ClientBuilder.defaultClient();
  ListObjectsV2Result result = new ListObjectsV2Result();
  List<String> keys = new ArrayList<>();

  do {
    ListObjectsV2Request request =
      new ListObjectsV2Request().withBucketName(bucket).withContinuationToken(result.getContinuationToken());

    result = s3.listObjectsV2(request);

    for (S3ObjectSummary objectSummary : result.getObjectSummaries()) {
      keys.add(objectSummary.getKey());
    }
  } while(result.isTruncated());

  return keys;
}
```

V2

```
public List<String> getBucketKeys(String bucket) {
  S3Client s3 = S3Client.create();

  return s3.listObjectsV2Paginator(r -> r.bucket(bucket))
           .stream()
           .map(ListObjectsV2Response::contents)
           .flatMap(contentList -> contentList.stream().map(S3Object::key))
           .collect(Collectors.toList());
}
```

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Using the AWS SDK for Java v2

- Maven:

  pom.xml

```
<dependency>
     <groupId>software.amazon.awssdk</groupId>
     <artifactId>s3</artifactId>
     <version>2.10.60</version>
</dependency>
```

- Source:

  https://github.com/aws/aws-sdk-java-v2

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Getting the most out of the SDK

1. For fastest cold-start initialization time, use UrlConnectionHttpClient
2. Tune your timeouts and retry policies
3. Explicitly specify region when initializing the SDK
4. Explicitly specify credentials provider when initializing the SDK
5. Re-use initialized SDK clients in AWS Lambda containers
6. Avoid using the v1 SDK side-by-side with the v2 SDK even though you can
7. More best-practices can be found in our documentation: https://github.com/aws/aws-sdk-java-v2/blob/master/docs/BestPractices.md

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DynamoDB Enhanced Client

- High-level library in the AWS SDK for Java v2
- Fluent and concise execution style for complex DynamoDB operations
- Type-safe Java object mapping and attribute conversion
- Multiple implementations to suit different scenarios:
    - Schema-less document mapping
    - Introspective bean mapping
    - Static declarative mapping

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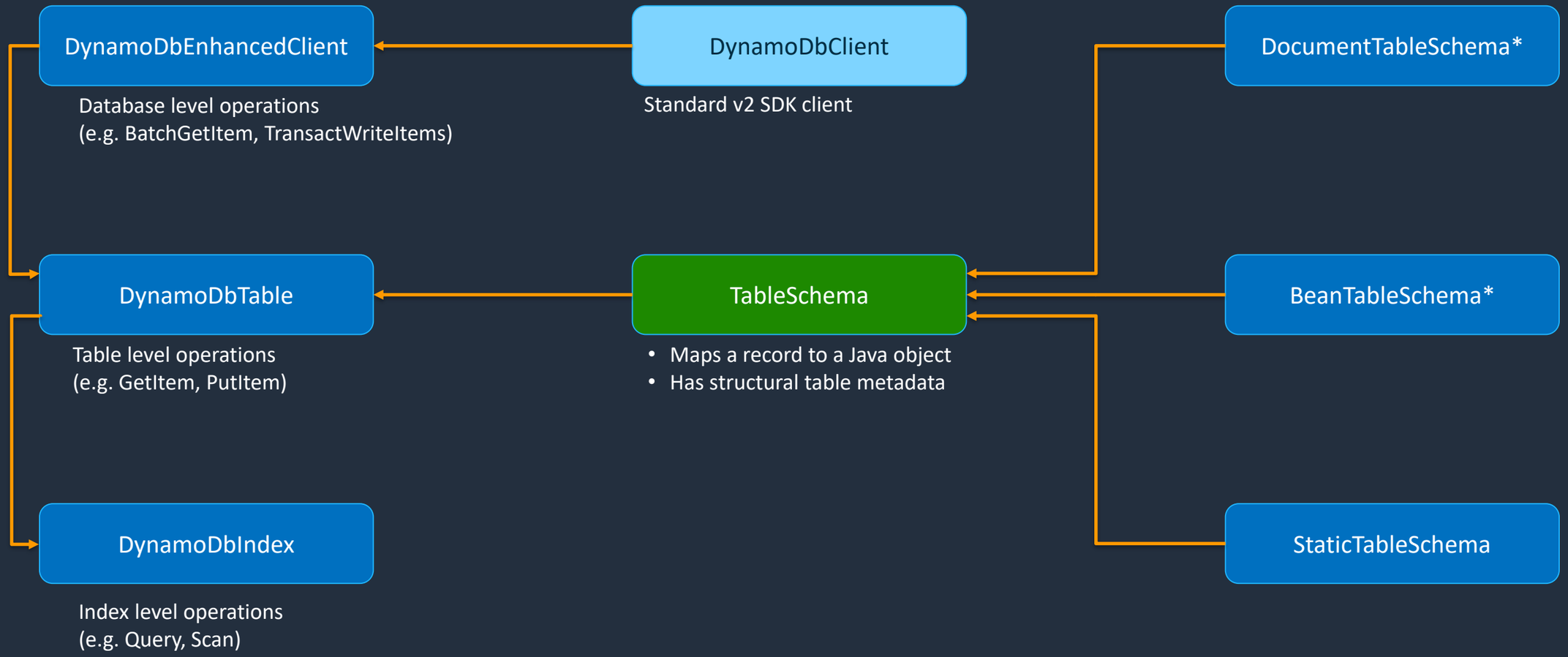
DynamoDB Enhanced Client



* Available soon

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DocumentTableSchema

- Does not require a declared schema
- Lazy conversion of attributes on demand
- Simplest interface
- Ideal for experimentation and proof of concept

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BeanTableSchema

- Reads table metadata and schema directly from your bean class
- Static once initialized, faster than the document table schema
- Familiar to users of the DynamoDBMapper in the v1 SDK
- Ideal for migration from v1 and for applications that already heavily leverage beans

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StaticTableSchema

- Static table metadata and schema declared at initialization time
- Does not require your mapped class to follow bean standard
- More verbose than other implementations
- Fastest initialization, ideal for latency critical AWS Lambda functions

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DynamoDB Enhanced Client Examples

Annotated Bean

```
@DynamoDbBean
public class Customer {
     private String id;
     private String name;
     private Instant createdOn;

     @DynamoDbPartitionKey
     public String getId() { return this.id; }
     public void setId(String id) { this.id = id; }

     public String getName() { return this.name; }
     public void setName(String name) { this.name = name; }

     public Instant getCreatedOn() { return this.createdOn; }
     public void setCreatedOn(Instant createdOn) { this.createdOn = createdOn; }
}
```

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DynamoDB Enhanced Client Examples

DocumentTableSchema

```
TableSchema<Document> customerTableSchema =
  DocumentTableSchema.builder()
                     .partitionKey(stringKey("id"))
                     .build();
```

BeanTableSchema

```
TableSchema<Customer> customerTableSchema = BeanTableSchema.create(Customer.class);
```

StaticTableSchema

```
TableSchema<Customer> customerTableSchema =
  StaticTableSchema.builder(Customer.class)
    .newItemSupplier(Customer::new)
    .attributes(
      attributeOf("id", String.class, Customer::getId, Customer::setId)
        .as(primaryPartitionKey()),
      attributeOf("name", String.class, Customer::getName, Customer::setName),
      attributeOf("createdOn", Instant.class, Customer::getCreatedOn, Customer::setCreatedOn))
    .build();
```

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DynamoDB Enhanced Client Examples

1. Initializing the client

```
DynamoDbClient dynamoDbClient = DynamoDbClient.create();          // Standard SDK client

DynamoDbEnhancedClient dynamoDbEnhancedClient =
      DynamoDbEnhancedClient.builder()
                            .dynamoDbClient(dynamoDbClient);
                            .build();
```

2. Initializing the table

```
DynamoDbTable<Customer> customerTable =
      dynamoDbEnhancedClient.table("customers_table", customerTableSchema);
```

3. Call a table operation

```
Customer updatedCustomer = customerTable.updateItem(r -> r.item(customerToUpdate));
```

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DynamoDB Enhanced Client

Maven:

pom.xml

```
<dependency>
    <groupId>software.amazon.awssdk</groupId>
    <artifactId>dynamodb-enhanced</artifactId>
    <version>2.10.60-PREVIEW</version>
</dependency>
```

Source:

https://github.com/aws/aws-sdk-java-v2/tree/master/services-custom/dynamodb-enhanced

Please try it out and give us your feedback!

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AWS SDK for Java v2

GA as of 11/18

https://github.com/aws/aws-sdk-java-v2

https://docs.aws.amazon.com/sdk-for-java/v2/developer-guide/welcome.html

KCL 2.0 Available Now

https://github.com/awslabs/amazon-kinesis-client

High-Level Libraries Coming Soon

- Enhanced DynamoDB Client
- S3 Managed Multi-Part Uploads/Downloads
- IAM Policy Generation
- API Gateway Client Generation
- And more with your contributions!

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AWS Cloud Development Kit (AWS CDK)

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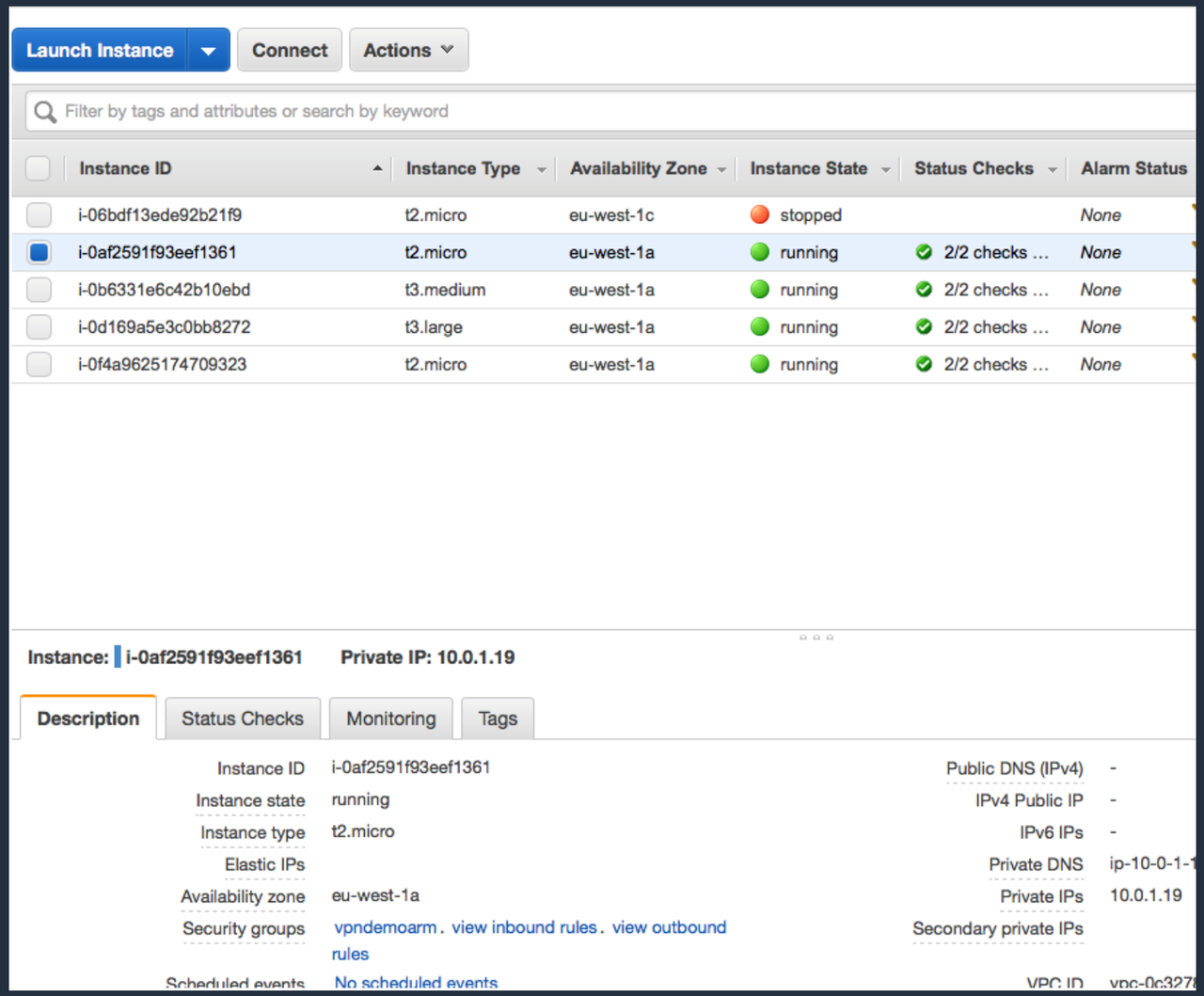
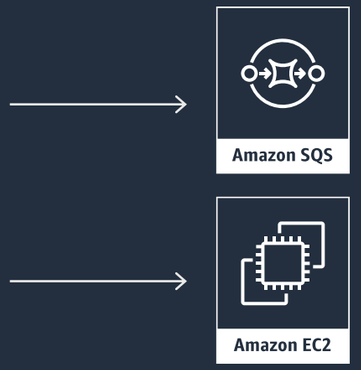
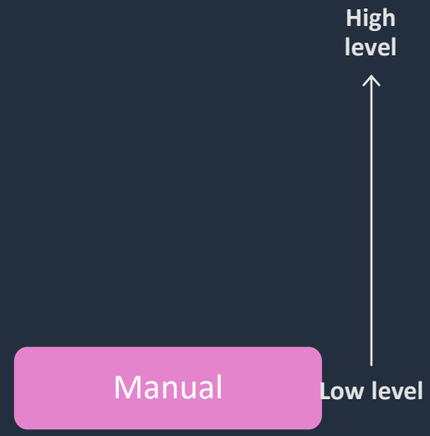
Manual







👍 Easy to get started

🤔 Not reproducible

🤔 Error prone

🤔 Time consuming

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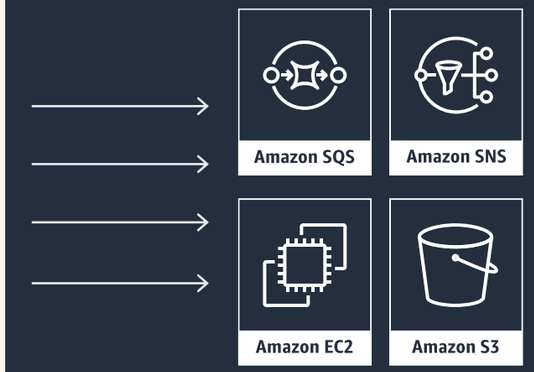
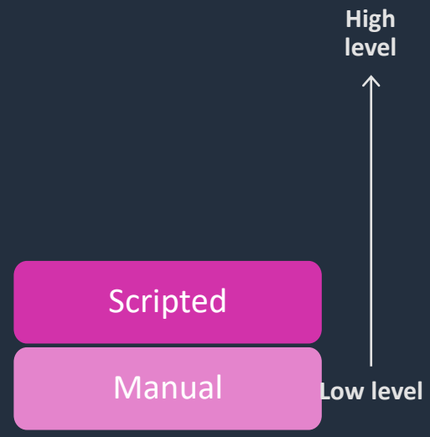
Scripted

```ruby
require 'aws-sdk-ec2'

ec2 = Aws::EC2::Resource.new(region: 'us-west-2')

instance = ec2.create_instances({
  image_id: 'IMAGE_ID',
  min_count: 1,
  max_count: 1,
  key_name: 'MyGroovyKeyPair',
  security_group_ids: ['SECURITY_GROUP_ID'],
  instance_type: 't2.micro',
  placement: {
    availability_zone: 'us-west-2a'
  },
  subnet_id: 'SUBNET_ID',
  iam_instance_profile: {
    arn: 'arn:aws:iam::' + 'ACCOUNT_ID' + ':instance-profile/aws-opsworks-ec2-role'
  }
})
```





What happens if an API call fails?

How do I make updates?

How do I know a resource is ready?

How do I roll back?

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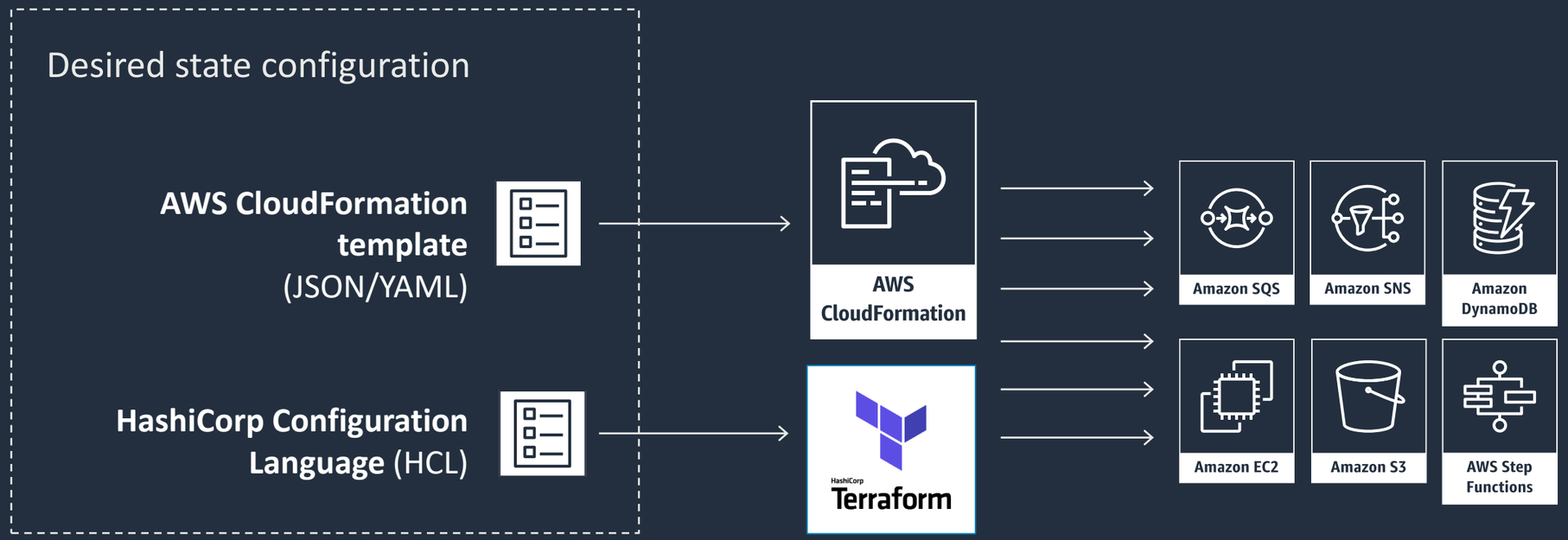
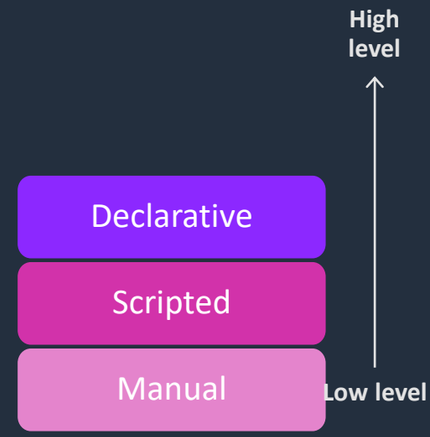
Resource provisioning engines





Easy to automate

Reproducible

Configuration syntax

No abstraction, lots of details

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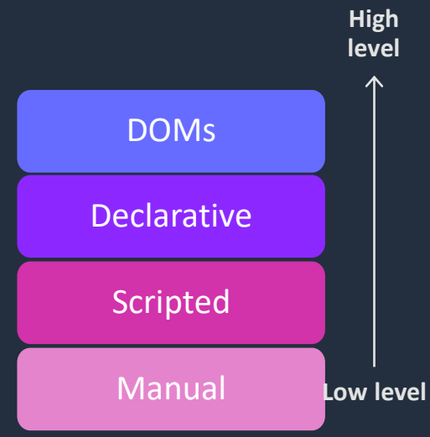
Document Object Models (DOMs)



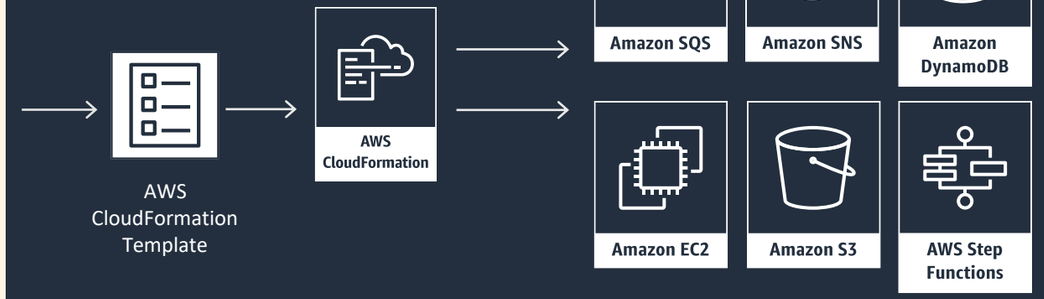

```python
from troposphere import Template
from troposphere.ec2 import VPC, Subnet, InternetGateway

t = Template()

VPC = t.add_resource(
    VPC(
        'VPC',
        CidrBlock='10.0.0.0/16',
        Tags=Tags(
            Application=ref_stack_id)))

subnet = t.add_resource(
    Subnet(
        'Subnet',
        CidrBlock='10.0.0.0/24',
        VpcId=Ref(VPC),
        Tags=Tags(
            Application=ref_stack_id)))
```

Troposphere *Python*
SparkleFormation *Ruby*
GoFormation *Go*
...



👍 Real code ❤️ *if statements, for loops, IDE benefits*
Desired state
😩 Abstraction is not built-in *Ex: 218 lines of Troposphere for a VPC*

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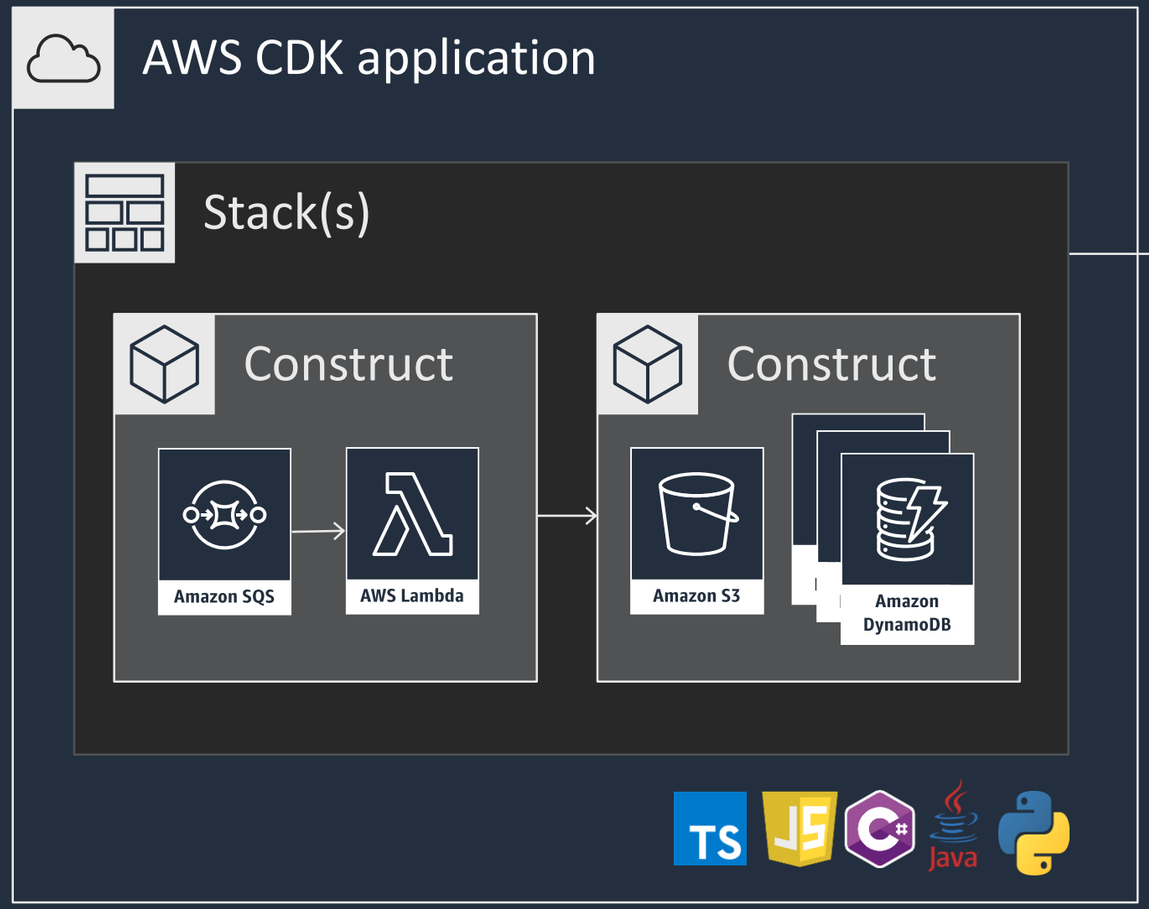
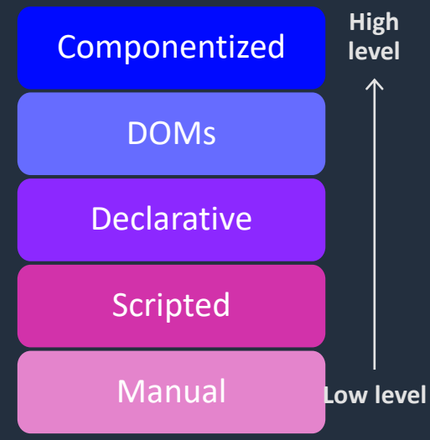
AWS Cloud Development Kit



AWS CloudFormation template

Resources



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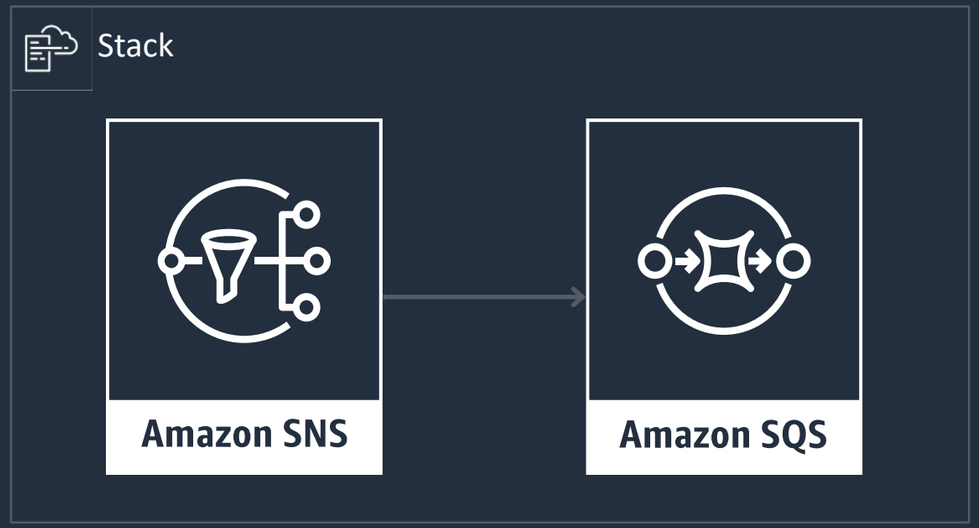
Simple CDK Example



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Simple CDK Example

```
Queue queue = new Queue(this, "MyQueue", QueueProps.builder()
        .visibilityTimeout(Duration.seconds(300))
        .build());

Topic topic = new Topic(this, "MyTopic", TopicProps.builder()
        .displayName("Some Amazing Topic")
        .build());
```

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Simple CDK Example

```
Queue queue = new Queue(this, "MyQueue", QueueProps.builder()
        .visibilityTimeout(Duration.seconds(300))
        .build());

Topic topic = new Topic(this, "MyTopic", TopicProps.builder()
        .displayName("Some Amazing Topic")
        .build());

topic.addSubscription(new SqsSubscription(queue));
```

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Synthesized Template

```
Resources:
  MyQueueE6CA6235:
    Type: AWS::SQS::Queue
    Properties:
      VisibilityTimeout: 300
    Metadata:
      aws:cdk:path: WebinarStack/MyQueue/Resource
  MyQueuePolicy6BBEDDAC:
    Type: AWS::SQS::QueuePolicy
    Properties:
      PolicyDocument:
        Statement:
          - Action: sqs:SendMessage
            Condition:
              ArnEquals:
                aws:SourceArn:
                  Ref: MyTopic86869434
            Effect: Allow
            Principal:
              Service: sns.amazonaws.com
            Resource:
              Fn::GetAtt:
                - MyQueueE6CA6235
                - Arn
        Version: "2012-10-17"
      Queues:
        - Ref: MyQueueE6CA6235
    Metadata:
      aws:cdk:path: WebinarStack/MyQueue/Policy/Re…
  MyQueueWebinarStackMyTopic30897B66B709DBF6:
    Type: AWS::SNS::Subscription
    Properties:
      Protocol: sqs
      TopicArn:
        Ref: MyTopic86869434
      Endpoint:
        Fn::GetAtt:
          - MyQueueE6CA6235
          - Arn
    Metadata:
      aws:cdk:path: WebinarStack/MyQueue/WebinarSt…
  MyTopic86869434:
    Type: AWS::SNS::Topic
    Properties:
      DisplayName: Some Amazing Topic
    Metadata:
      aws:cdk:path: WebinarStack/MyTopic/Resource
```

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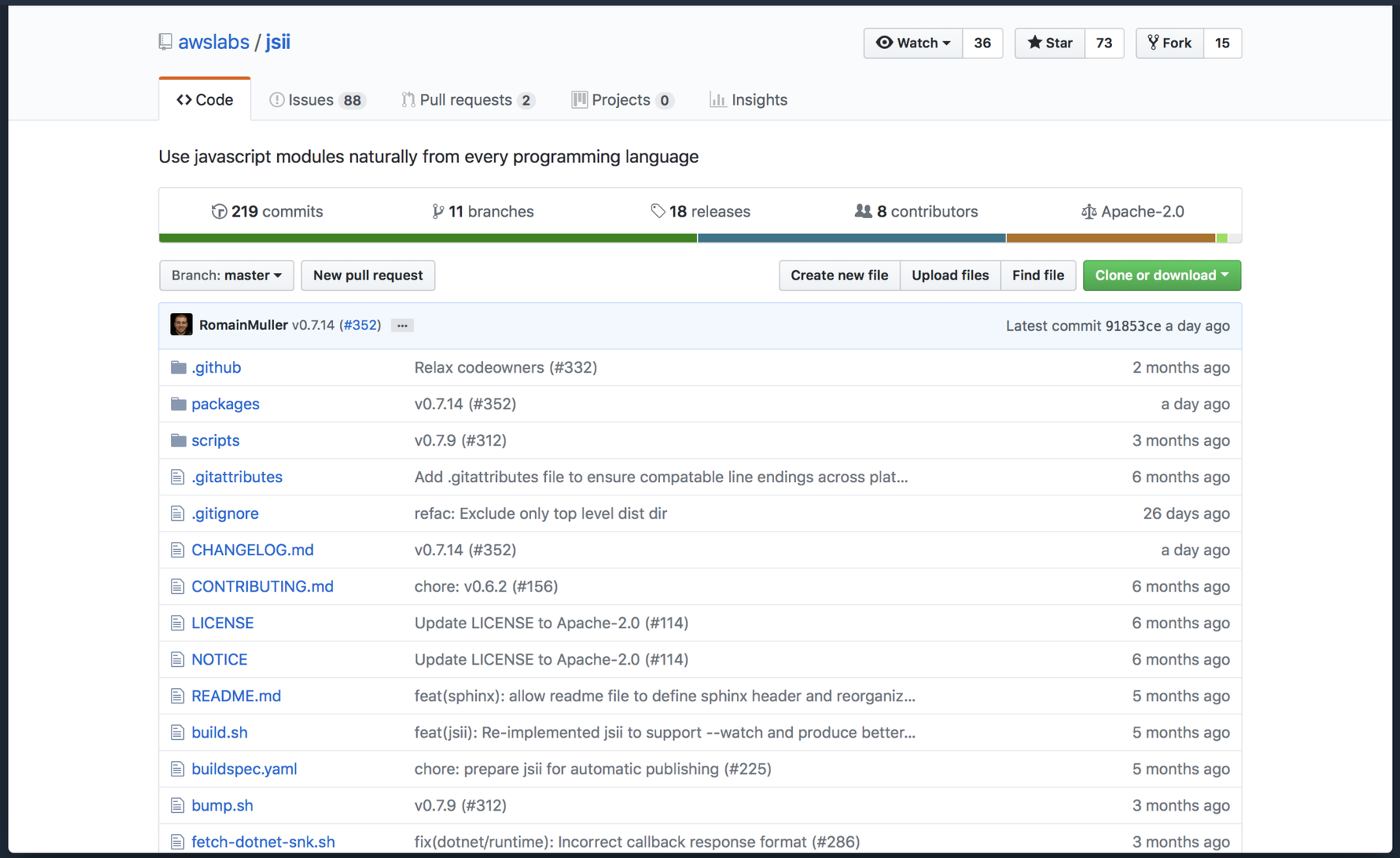

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npm install –g aws-cdk

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```
mkdir –p ~/cdk/myapp
cd "$_"
cdk init app --language=java
```

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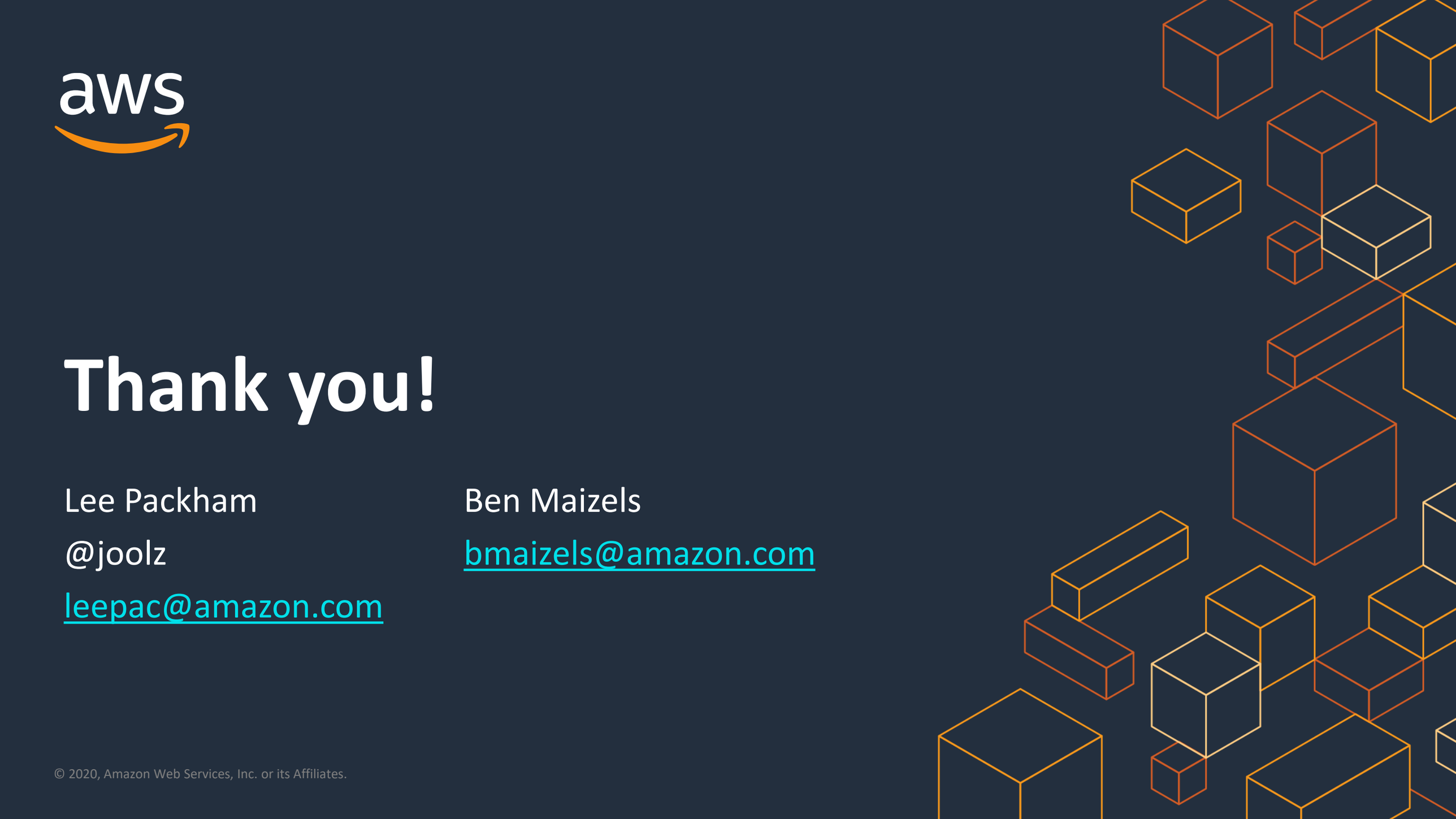

Thank you!

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