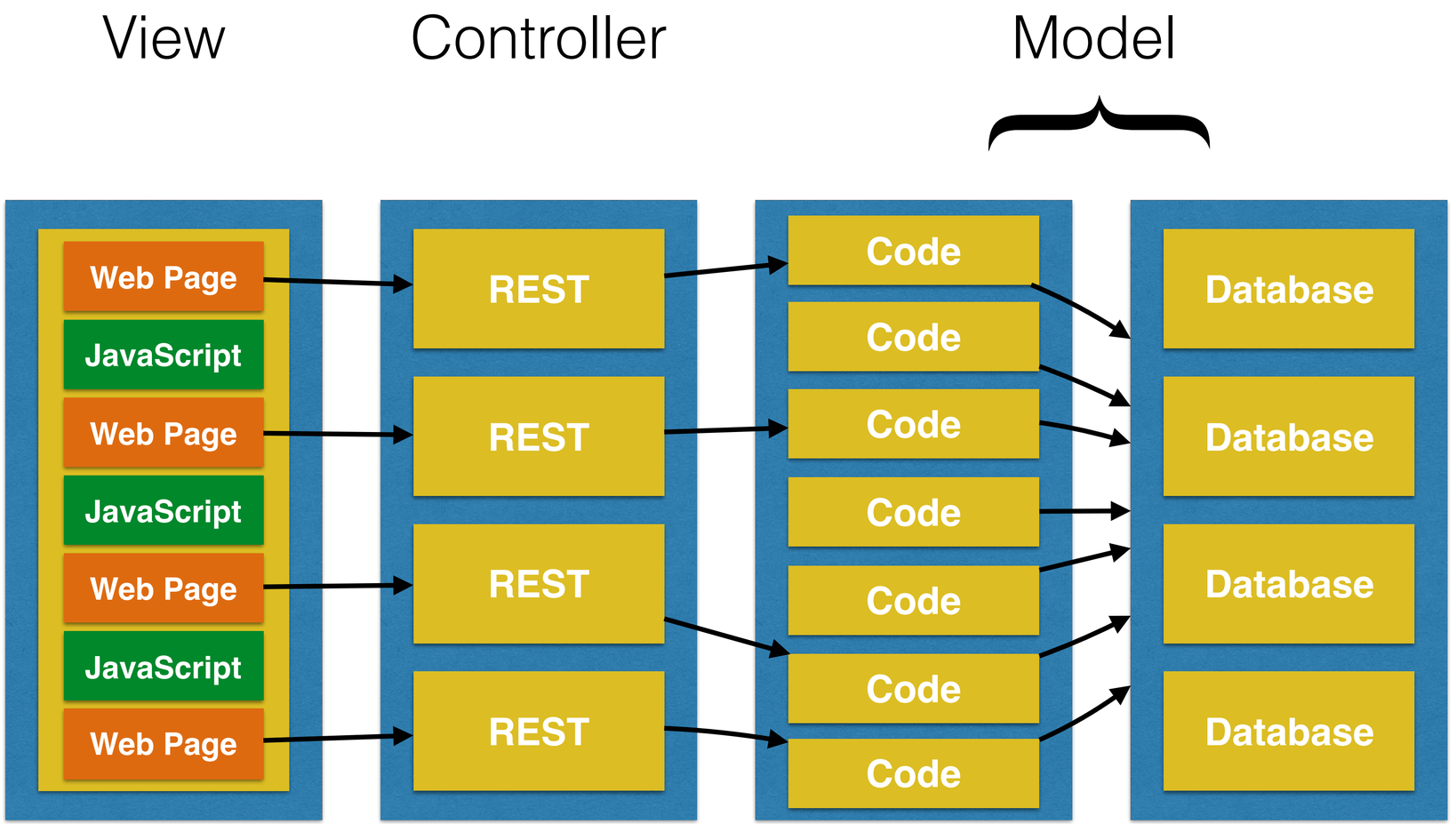
Deploy your microservice using AWS S3, AWS API Gateway, AWS Lambda, and Couchbase

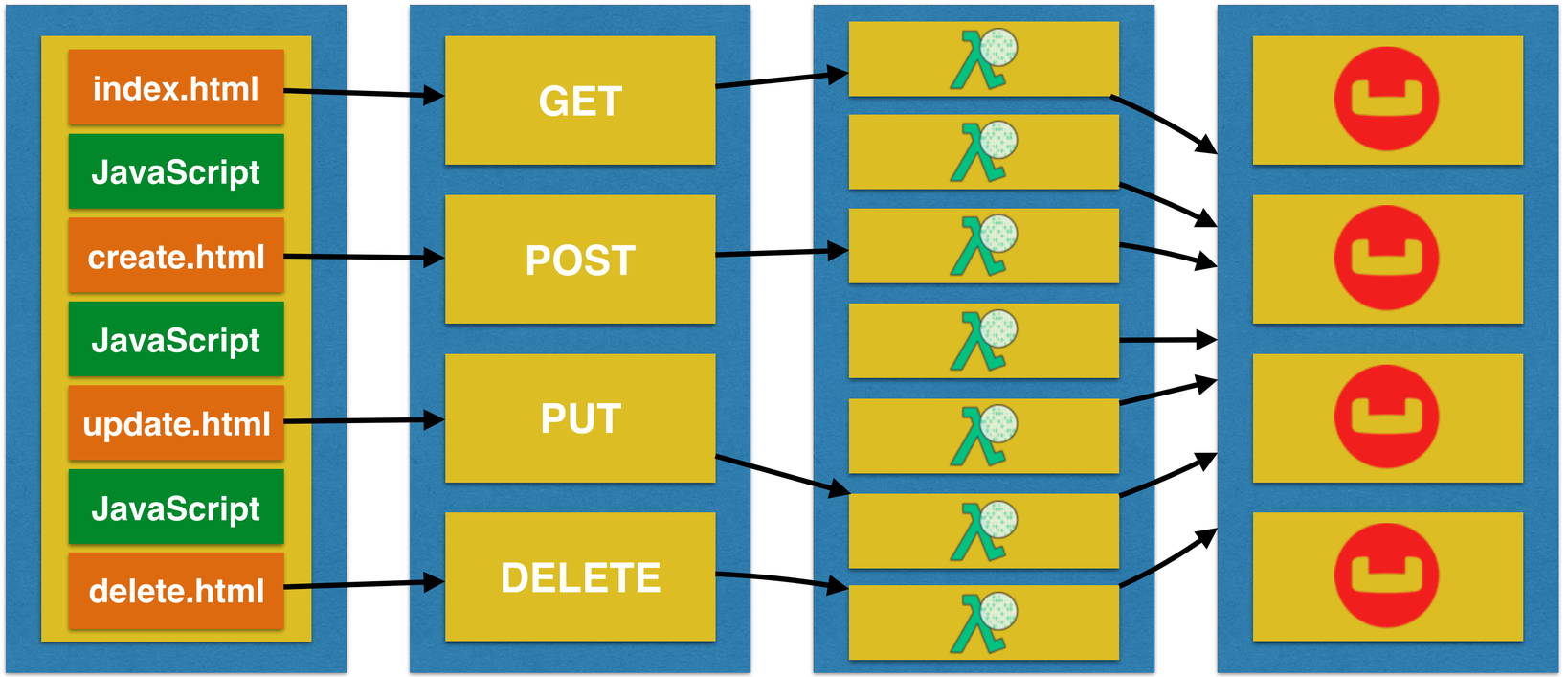
Arun Gupta, @arungupta

the microservice architectural style is an approach to developing a single application as a ***suite of small services****,* ***each running in its own process*** *and communicating with lightweight mechanisms, often an HTTP resource API. These services are built around business capabilities and* ***independently deployable*** *by fully automated deployment machinery. There is a* ***bare minimum of centralized management*** *of these services, which may be written in* ***different programming languages*** *and use* ***different data storage technologies***

https://martinfowler.com/articles/microservices.html



S3 API Gateway Lambda Couchbase

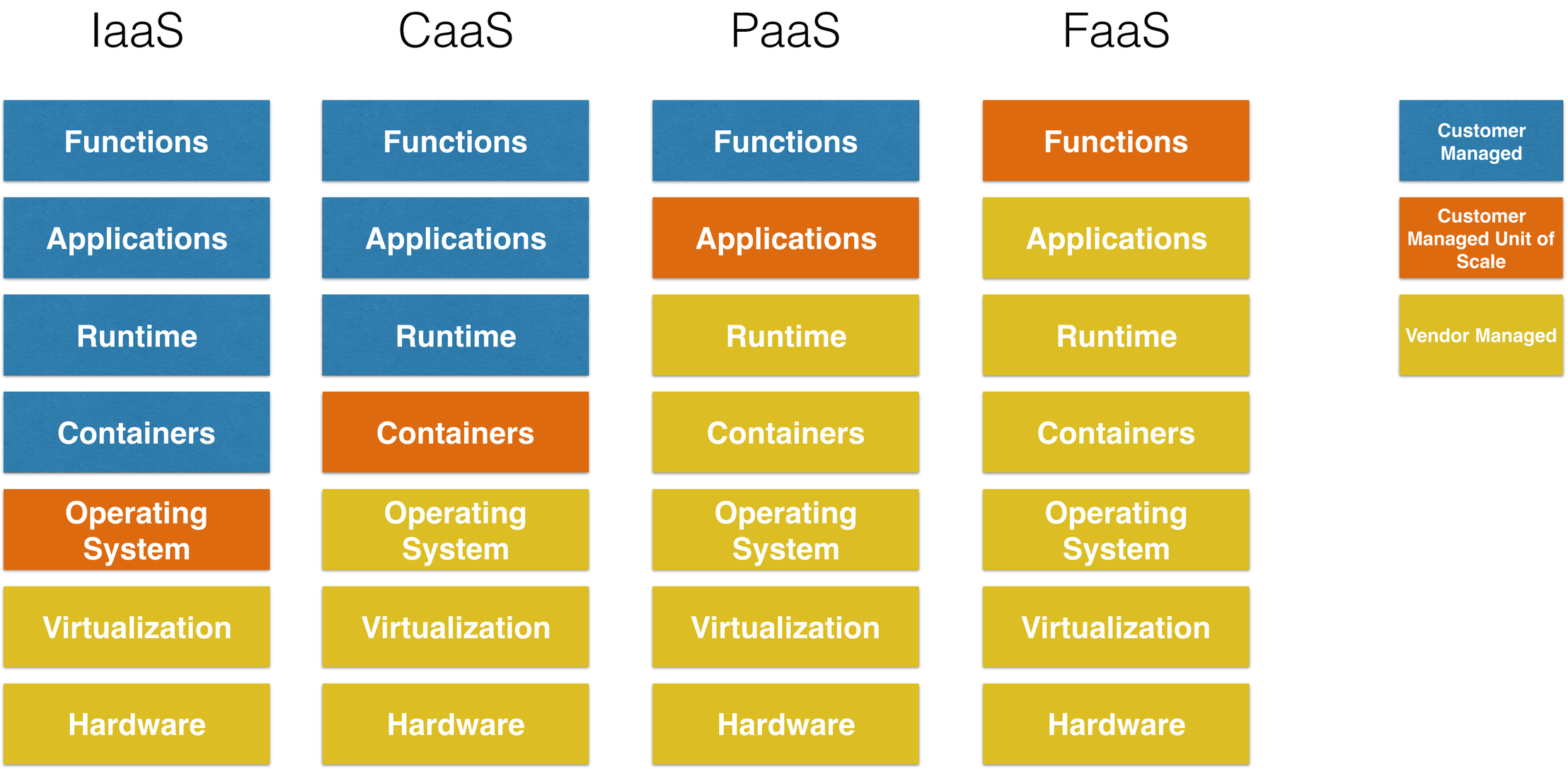


Serverless Computing

Typical Challenges with Server-based Computing

- What size servers for budget/performance?
- Scale servers up/down?
- What O/S?
- O/S settings?
- Patching?
- Control access to servers?
- Deploy new code to server?

	Virtual Machines	Containers	Serverless
Unit of Scale	Machine	Application	Function
Abstraction	Hardware	Operating System	Language Runtime
Packaging	AMI	Container File	Code
Configure	Machine, storage, networking, O/S	Run Servers, configure applications, scaling	Run code when needed
Execution	Multi-threaded, multi-task	Multi-threaded, single task	Single threaded, single task
Runtime	Hours to months	Minutes to days	Microseconds to seconds
Unit of cost	Per VM per hour	Per VM per hour	Per memory/second per request
Amazon	EC2	Docker, Kubernetes, ECS	AWS Lambda



adrian cockcroft
@adrianco

Following

If your PaaS can efficiently start instances in 20ms that run for half a second, then call it serverless.

> **Julz Friedman** @doctor_julz
> if you think serverless is different than PaaS then either you or I have misunderstood what "serverless" or "PaaS" means

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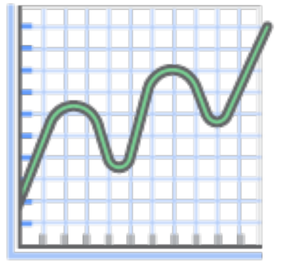
What is AWS Lambda?

Fully Managed

- No provisioning
  - Java, Node, Python, C#
- Zero administration
- High availability

Subsecond Metering

- Charged for every 100ms of execute
- No storage cost



Continuous Scaling

- Automatically
- Scale up and down

How it works?

Upload your code to AWS Lambda

https://aws.amazon.com/lambda/

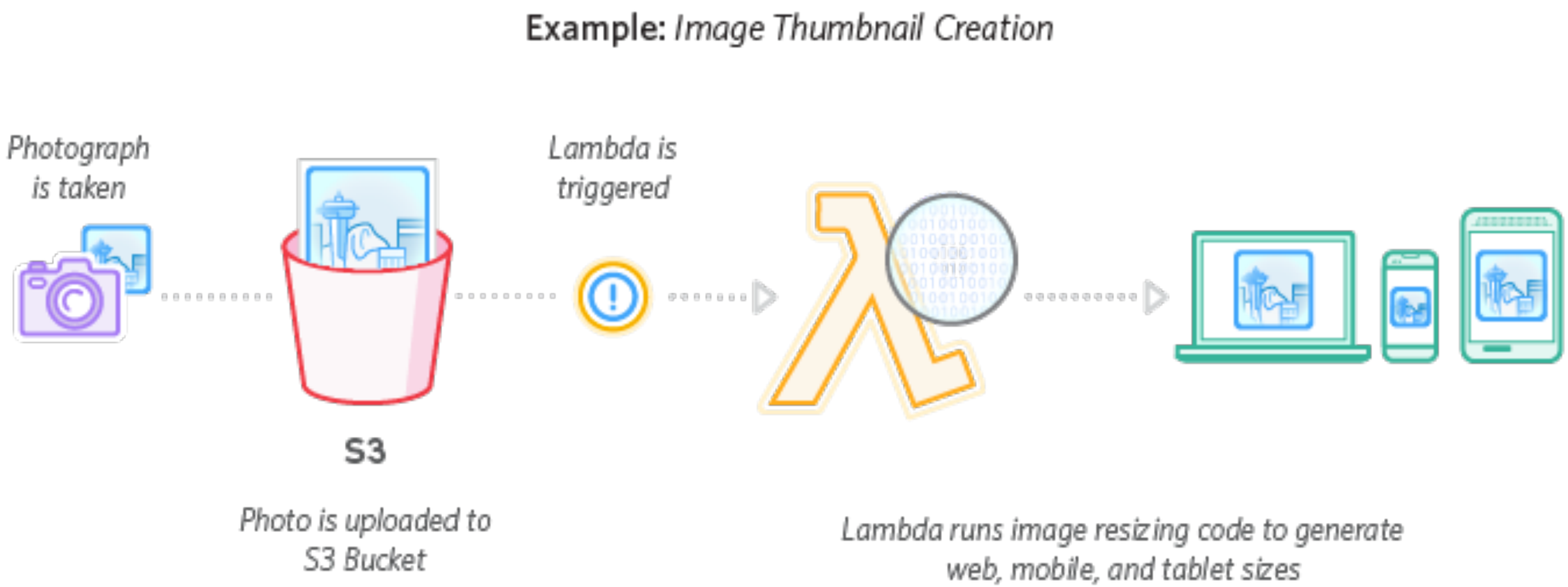
AWS Lambda Pricing

- FREE tier
  - 1M free requests per month
  - 400k GB-seconds of compute time per month
  - CPU and network allocated proportionately
- $0.20 per million requests thereafter

Memory (MB)	Free tier seconds per month	Price per 100ms ($)
128	3,200,000	0.000000208
192	2,133,333	0.000000313
256	1,600,000	0.000000417
320	1,280,000	0.000000521
384	1,066,667	0.000000625
448	914,286	0.000000729
512	800,000	0.000000834

https://aws.amazon.com/lambda/pricing/

AWS Lambda Usecases



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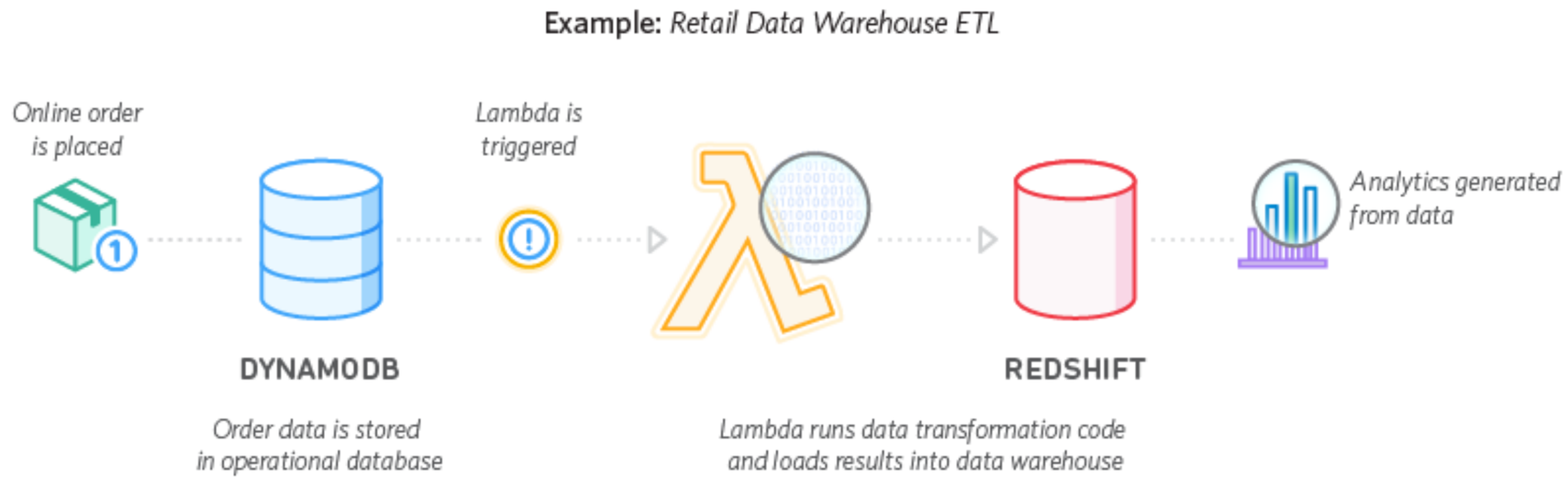
AWS Lambda Usecases



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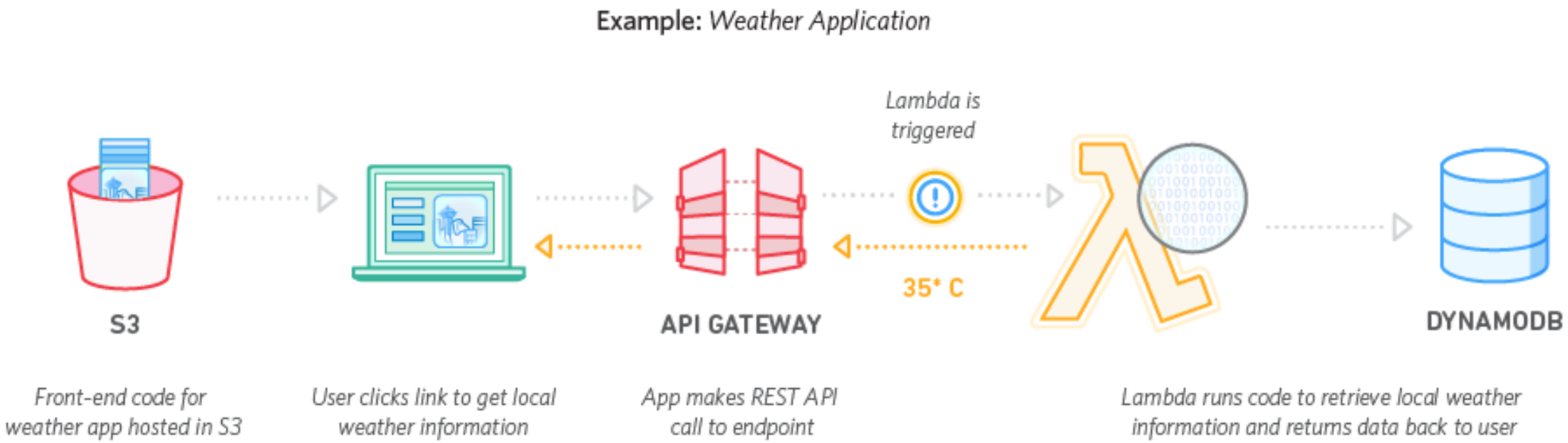
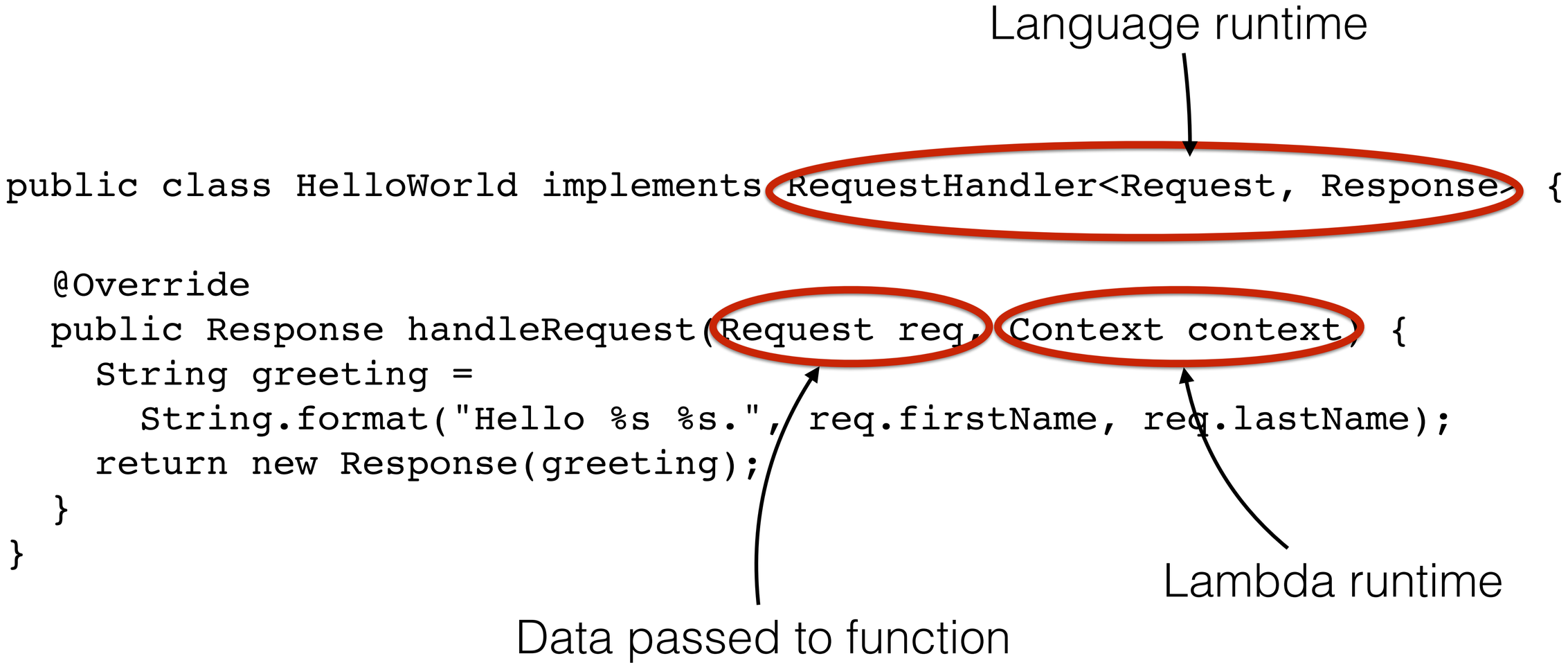
AWS Lambda Usecases



https://aws.amazon.com/lambda/

Key Components of AWS Lambda



Java + Lambda

Deploy First Java Lambda Function

1

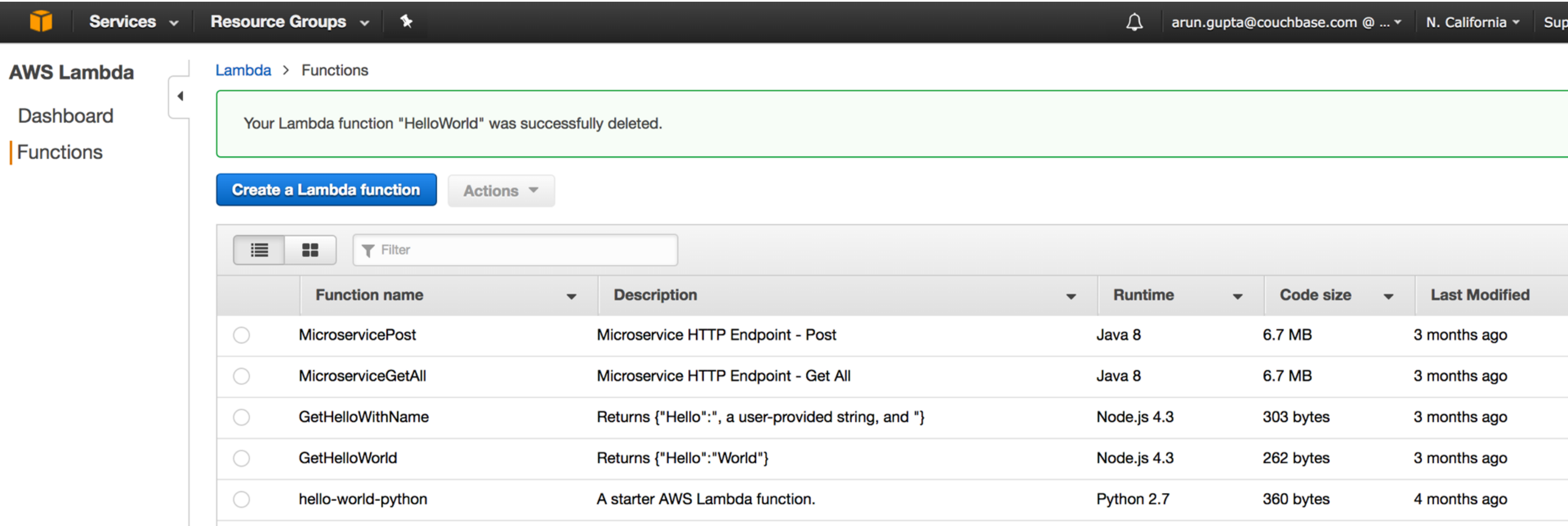
```
<dependency>
  <groupId>com.amazonaws</groupId>
  <artifactId>aws-lambda-java-core</artifactId>
  <version>1.1.0</version>
</dependency>
```

2

```
aws lambda create-function \
--function-name HelloWorld \
--role arn:aws:iam::598307997273:role/service-role/myLambdaRole \
--handler org.sample.serverless.aws.helloworld.HelloWorld \
--zip-file fileb:///Users/arungupta/workspaces/serverless/aws/helloworld/
helloworld/target/helloworld-1.0-SNAPSHOT.jar \
--description "Java Hello World" \
--runtime java8  \
--region us-west-1 \
--timeout 30 \
--memory-size 1024 \
--publish
```

3

```
aws lambda invoke \
--function-name HelloWorld \
--region us-west-1 \
--payload '{ "firstName": "John", "lastName": "Smith" }' \
helloworld.out
```



Couchbase

Data

Query

Index

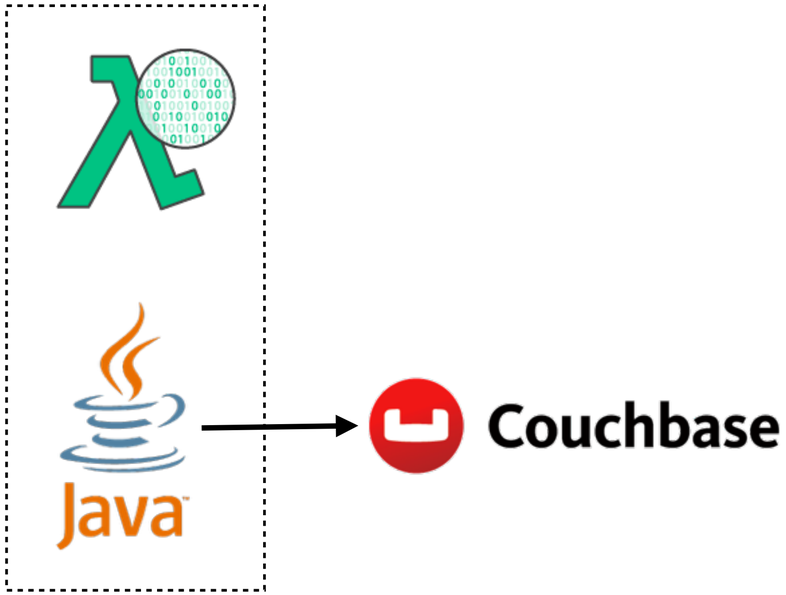
Replication

Mobile

Search

Analytics

Java + Lambda + Couchbase



Java + Couchbase Lambda Function

1

```
<dependency>
  <groupId>com.amazonaws</groupId>
  <artifactId>aws-lambda-java-core</artifactId>
  <version>1.1.0</version>
```

```
aws lambda create-function \
--function-name HelloCouchbaseLambda \
--role arn:aws:iam::598307997273:role/service-role/myLambdaRole \
--handler org.sample.serverless.aws.couchbase.HelloCouchbaseLambda \
--zip-file fileb:///Users/arungupta/workspaces/serverless/aws/hellocouchbase/hellocouchbase/
target/hellocouchbase-1.0-SNAPSHOT.jar \
--description "Java Hello Couchbase" \
--runtime java8 \
--region us-west-2 \
--timeout 30 \
--memory-size 1024 \
--environment Variables={COUCHBASE_HOST=ec2-35-165-249-235.us-west-2.compute.amazonaws.com} \
--publish
```

3

```
--function-name HelloWorld \
--region us-west-1 \
--payload '{ "firstName": "John", "lastName": "Smith" }' \
helloworld.out
```

AWS API Gateway

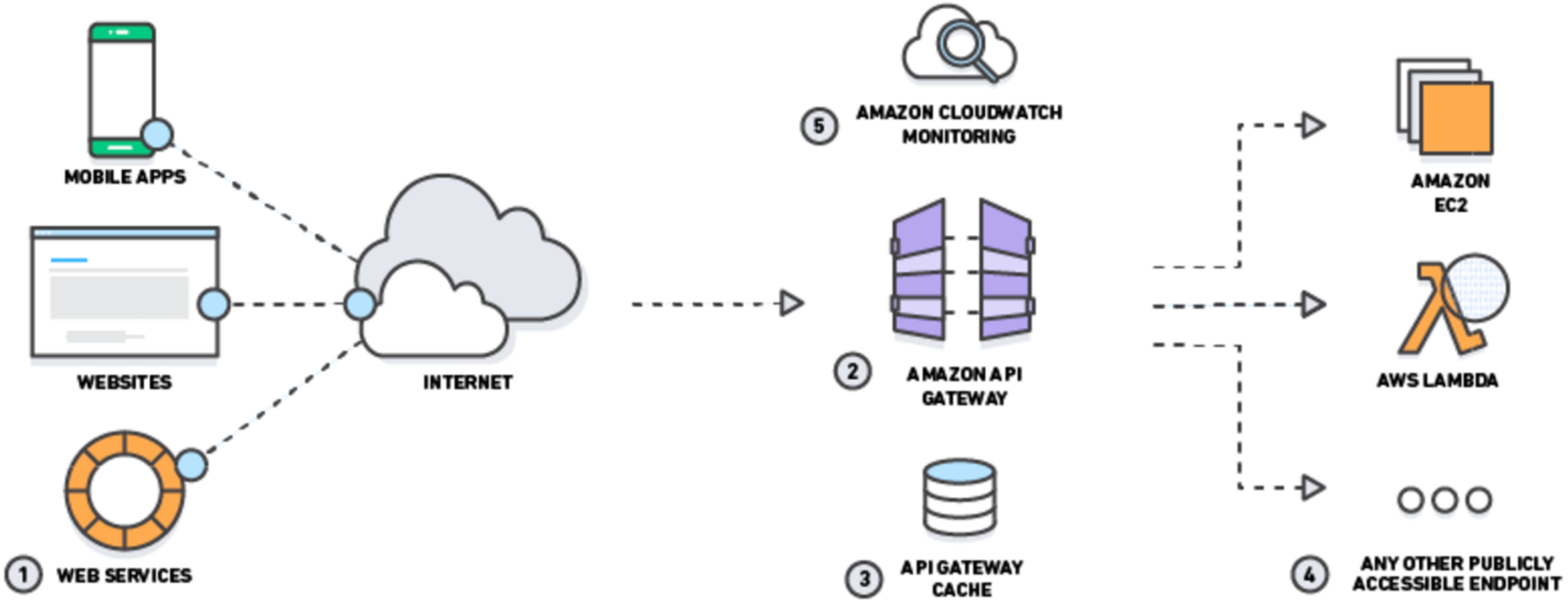
AWS API Gateway

- Create, publish, maintain, monitor and secure RESTful APIs
- Manage multiple stages and version: Iterate, test and release new versions, with backwards compatibiluity
- Operations monitoring: Integrated with CloudWatch
- Low cost and efficient: Only pay for the calls made to APIs and data transfer out

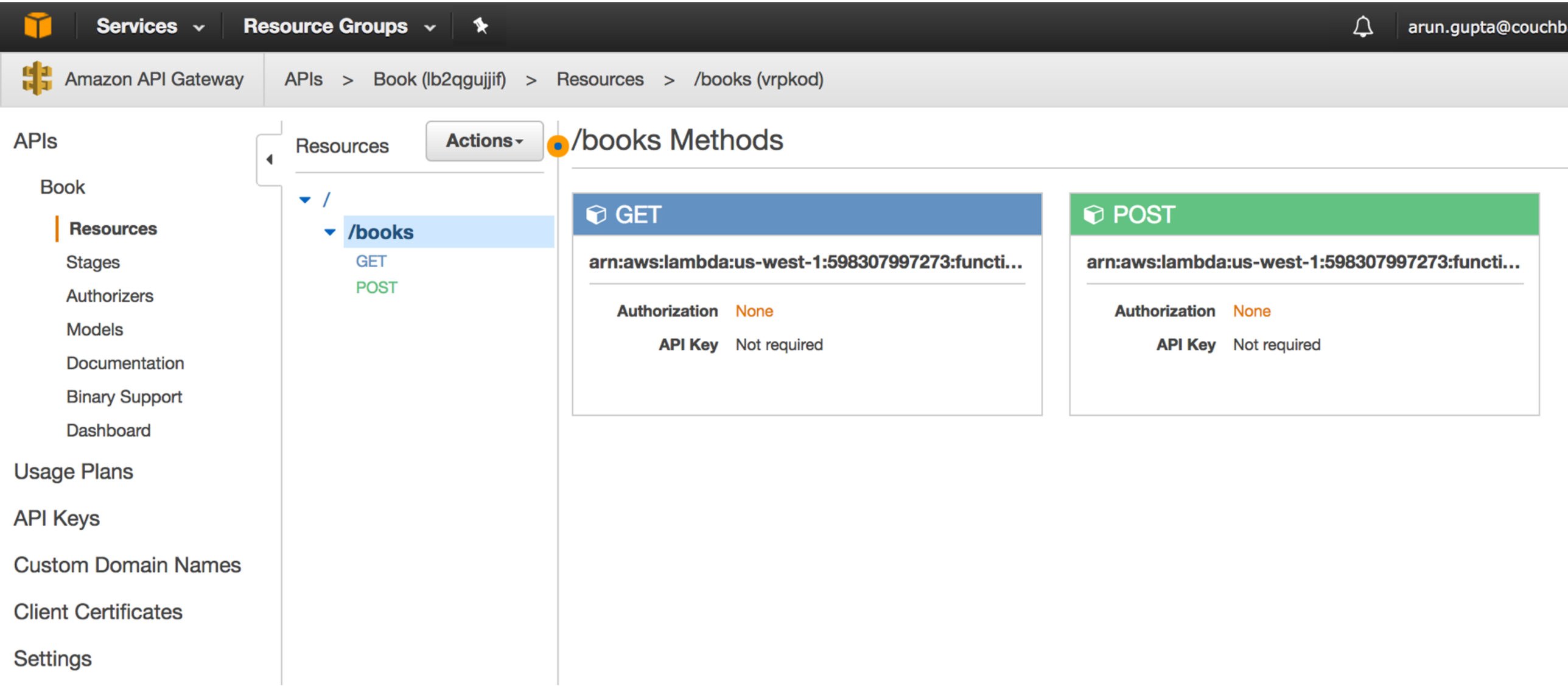
AWS API Gateway

- Traffic management: Set throttle rules
- Authorization and access control: Integrated with AWS IAM and AWS Cognito
- SDK generation
  - JavaScript
  - iOS
  - Android

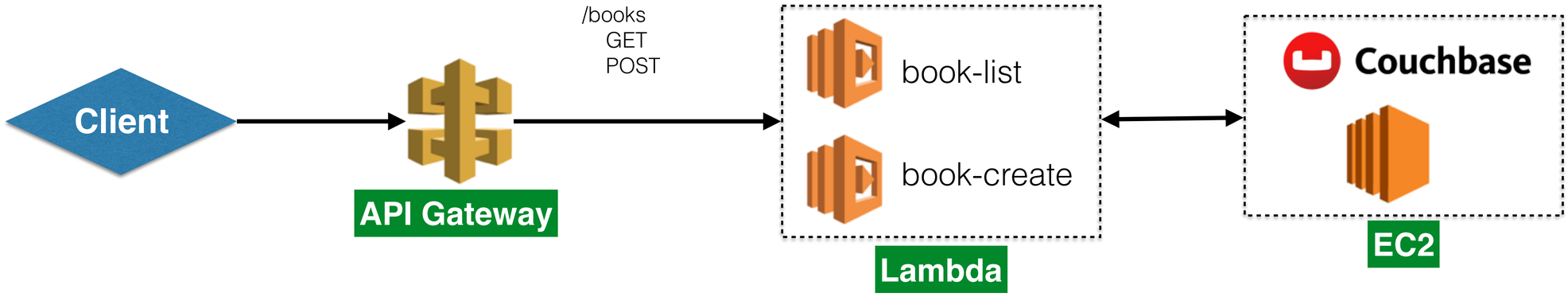
API Call Flow



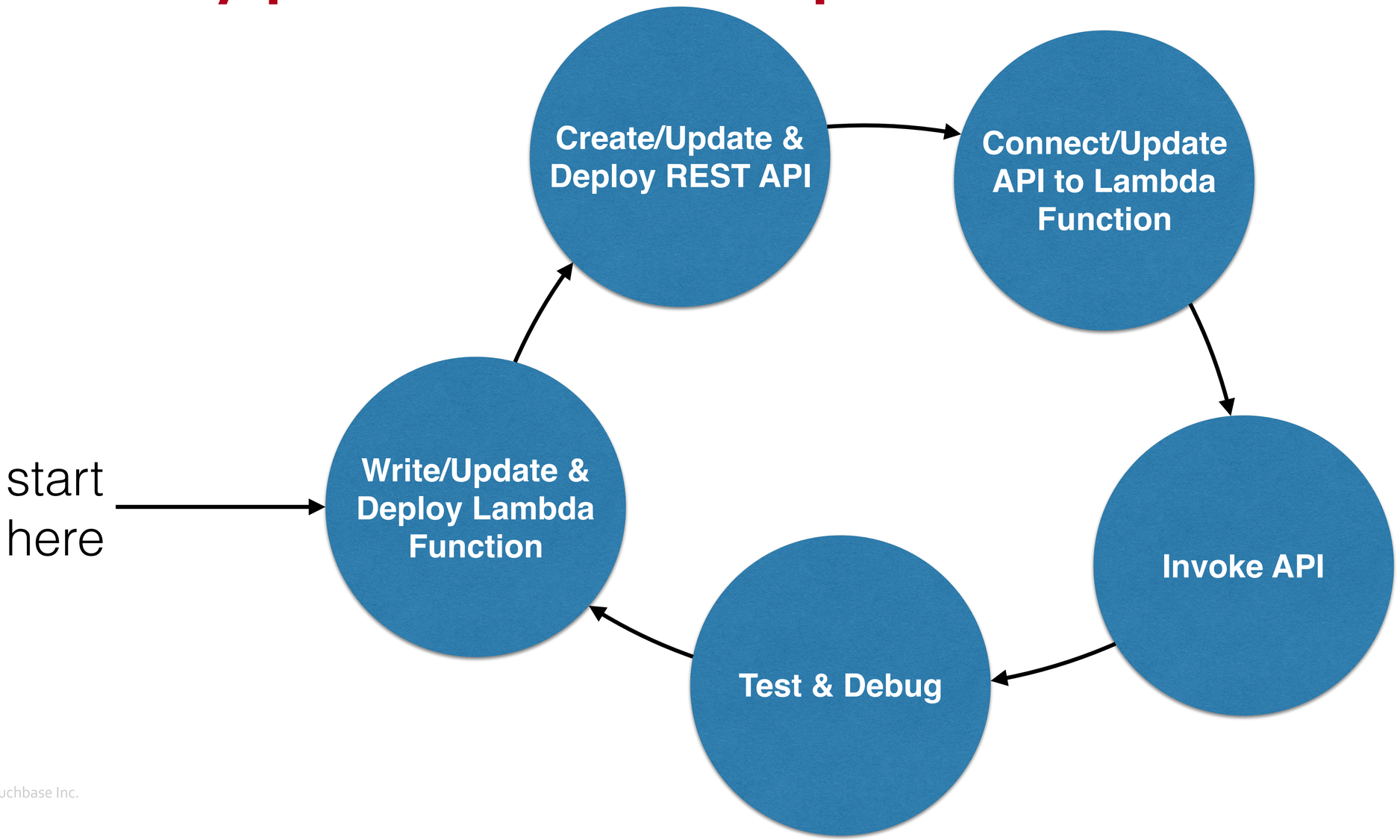
https://aws.amazon.com/api-gateway/details/



Java + Lambda + Couchbase + API



Typical development workflow



AWS Serverless Application Model

- Standard application model (SAM) for serverless applications
- Extends CloudFormation
  - New resource types
    - `AWS::Serverless::Function`
    - `AWS::Serverless::Api`
    - `AWS::Serverless::SimpleTable`
  - New event source types: `S3`, `Api`, `Schedule`, …
  - New property types: environment, event source, …

```
1  AWSTemplateFormatVersion : '2010-09-09'
2  Transform: AWS::Serverless-2016-10-31
3  Description: Microservice using API Gateway, Lambda and Couchbase
4  Resources:
5    MicroserviceGetAll:
6      Type: AWS::Serverless::Function
7      Properties:
8        Handler: org.sample.serverless.aws.couchbase.BucketGetAll
9        Runtime: java8
10       CodeUri: s3://serverless-microservice/microservice-http-endpoint-1.0-SNAPSHOT.jar
11       Timeout: 30
12       MemorySize: 1024
13       Environment:
14         Variables:
15           COUCHBASE_HOST: ec2-35-163-21-104.us-west-2.compute.amazonaws.com
16       Role: arn:aws:iam::598307997273:role/microserviceRole
```

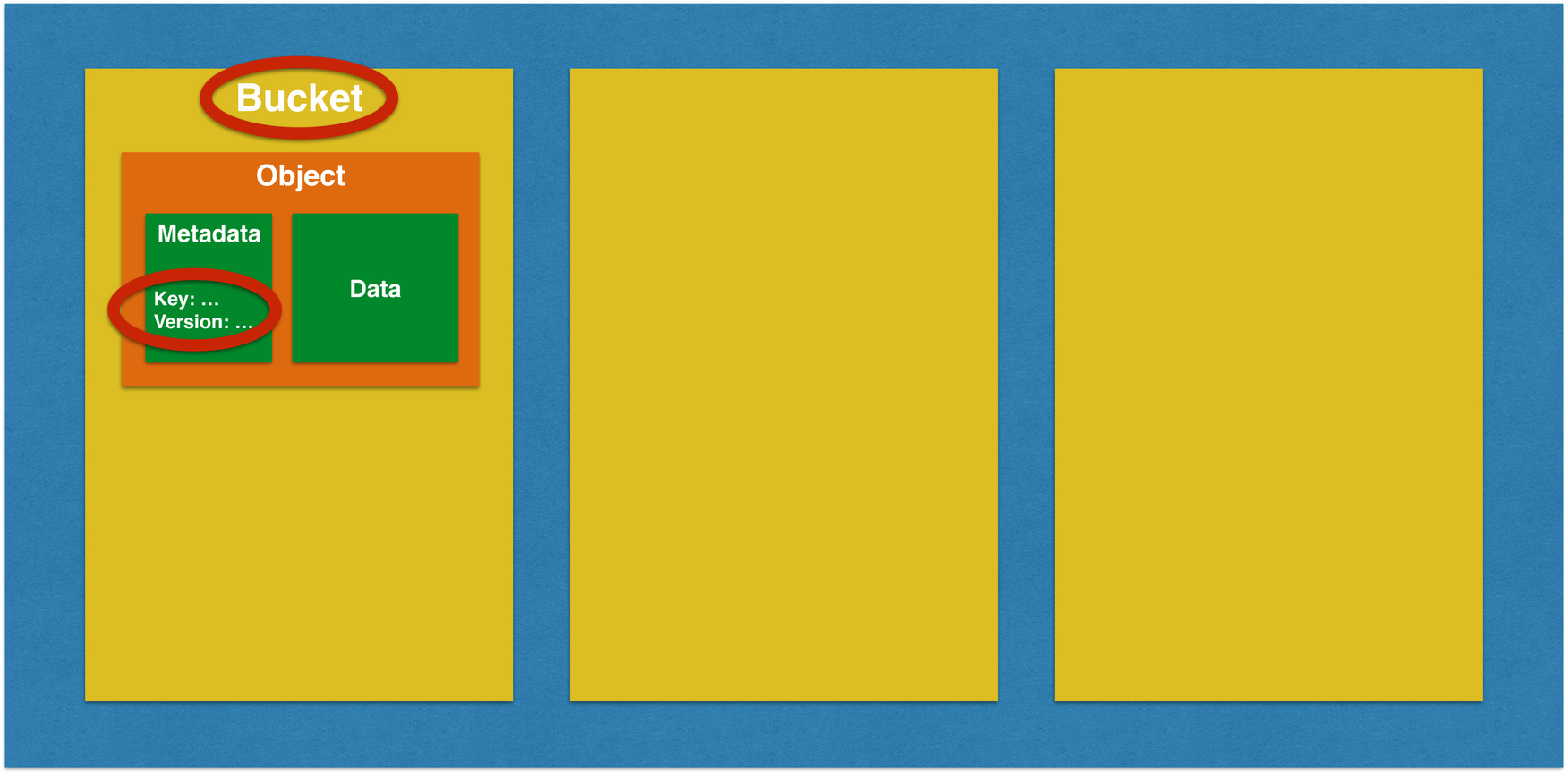

https://github.com/arun-gupta/serverless/blob/master/aws/microservice/template.yml

```
29    MicroserviceGetAllGateway:
30      Type: AWS::Serverless::Function
31      Properties:
32        Handler: org.sample.serverless.aws.couchbase.gateway.BucketGetAll
33        Runtime: java8
34        CodeUri: s3://serverless-microservice/microservice-http-endpoint-1.0-SNAPSHOT.jar
35        Timeout: 30
36        MemorySize: 1024
37        Environment:
38          Variables:
39            COUCHBASE_HOST: ec2-35-163-21-104.us-west-2.compute.amazonaws.com
40        Role: arn:aws:iam::598307997273:role/microserviceRole
41        Events:
42          GetResource:
43            Type: Api
44            Properties:
45              Path: /books
46              Method: get
```

AWS S3 Basics

- **Simple**: Console, REST API and AWS SDKs
- **Durable**: 99.999999999%
- **Scalable**: Gigabytes -> Exabytes
  - Store/retrieve data, any time, anywhere
- **Access control**: type of access (e.g. `READ` and `WRITE`)
- **Authentication**: verify identity of the user

AWS S3 Concepts



AWS S3 Storage Types

- **Standard**
  - Active data
  - Low latency
  - High throughput
- **Standard Infrequent Access**
  - Infrequent data
  - Same latency/throughput
  - Long term storage, backup, data store for DR
- **Glacier**
  - Archive data
  - Extremely low cost
  - Long term archiving

AWS S3 Storage Pricing

- AWS Free Usage Tier
  - 5GB of standard storage
  - 20k GET, 2k PUT, 15GB transfer

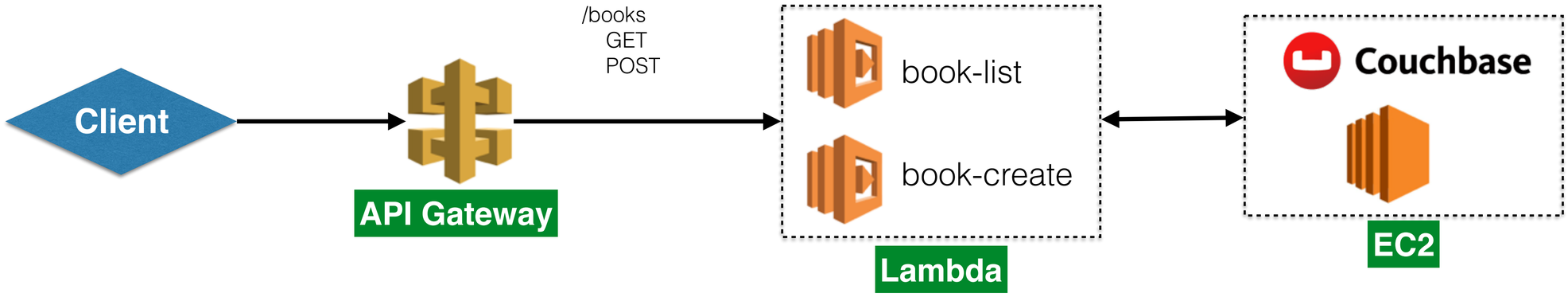
Region: US West (Northern California)

	Standard Storage	Standard - Infrequent Access Storage †	Glacier Storage
First 50 TB / month	$0.026 per GB	$0.019 per GB	$0.005 per GB
Next 450 TB / month	$0.025 per GB	$0.019 per GB	$0.005 per GB
Over 500 TB / month	$0.024 per GB	$0.019 per GB	$0.005 per GB

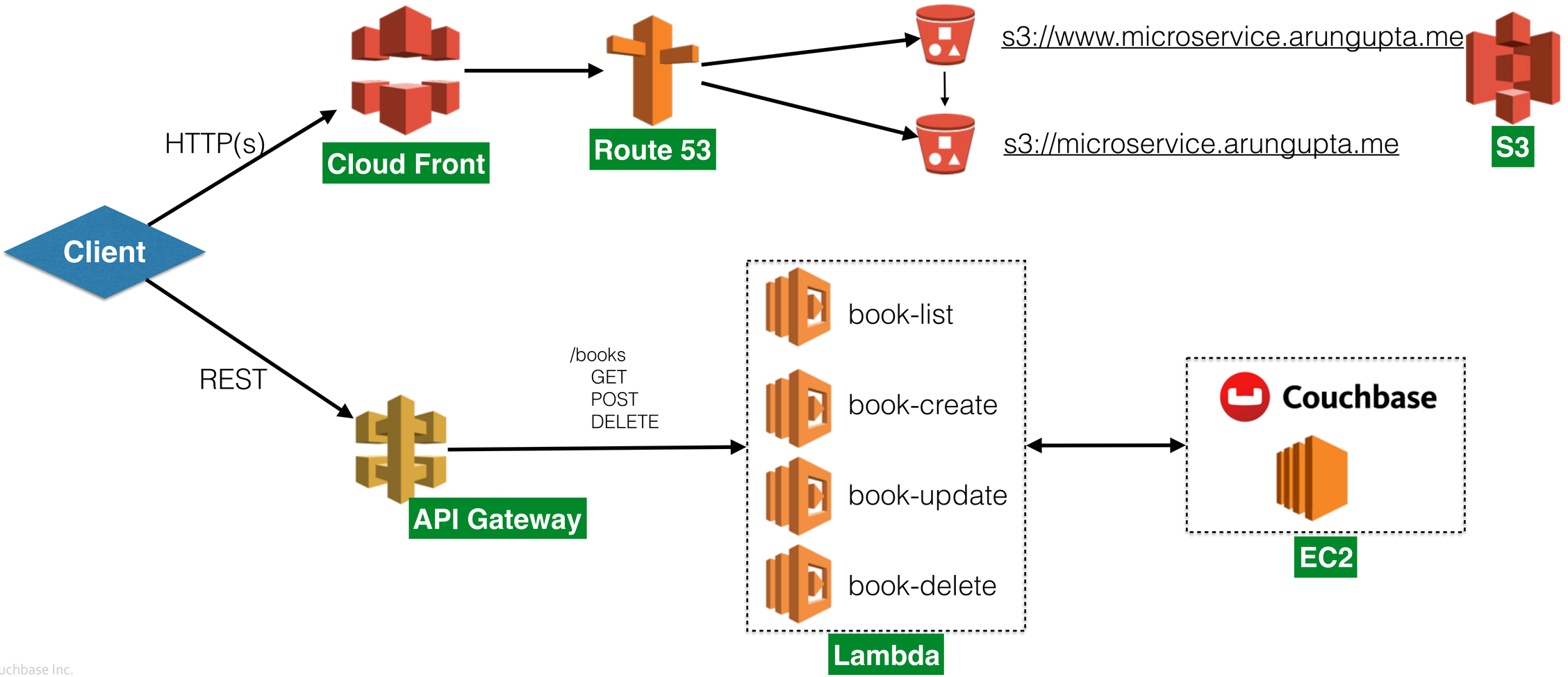
https://aws.amazon.com/s3/pricing/

Hosting Static Websites on S3

Serverless Microservice



Serverless Application



Serverless Application Model

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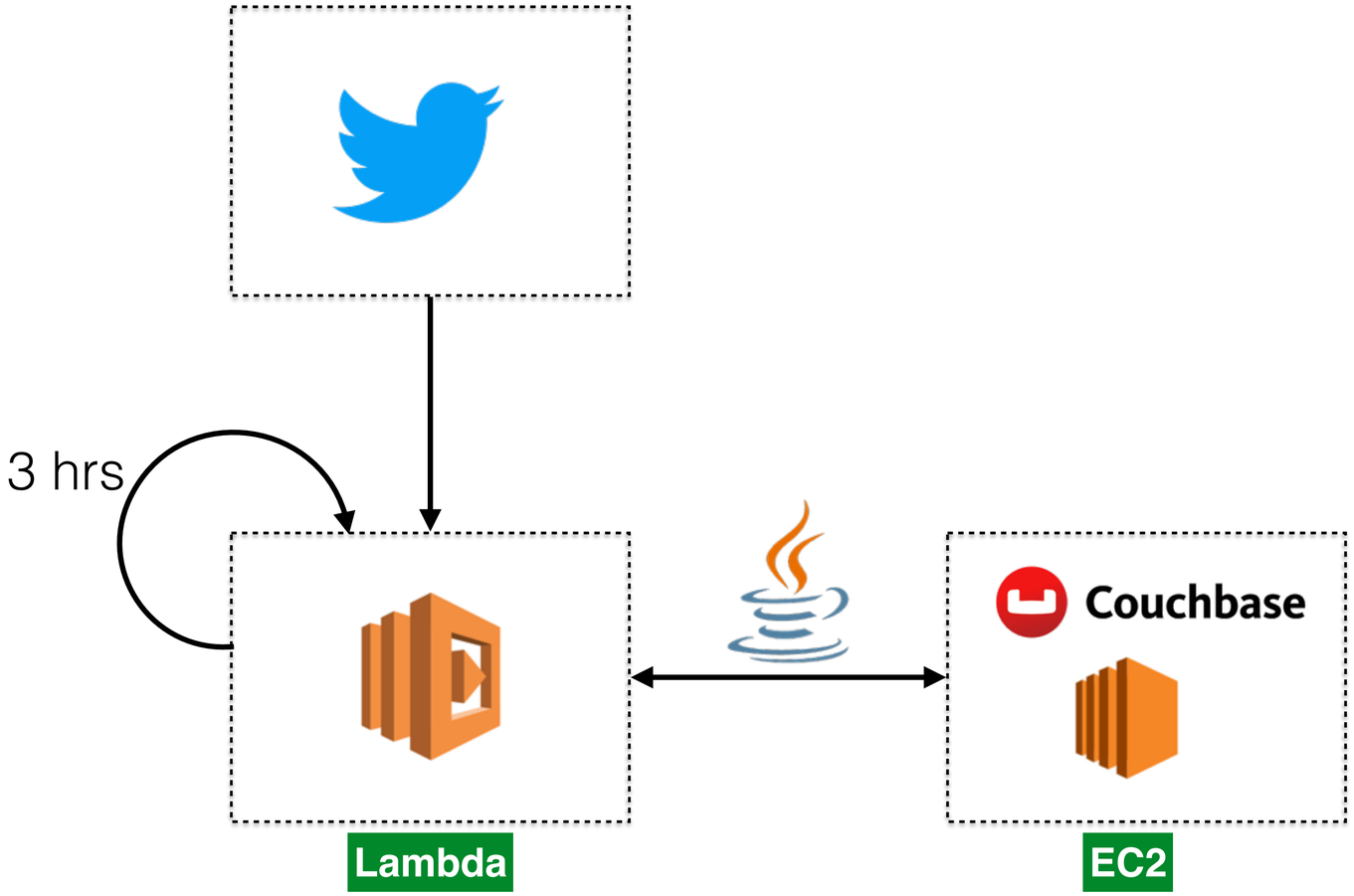
Twitter



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