



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

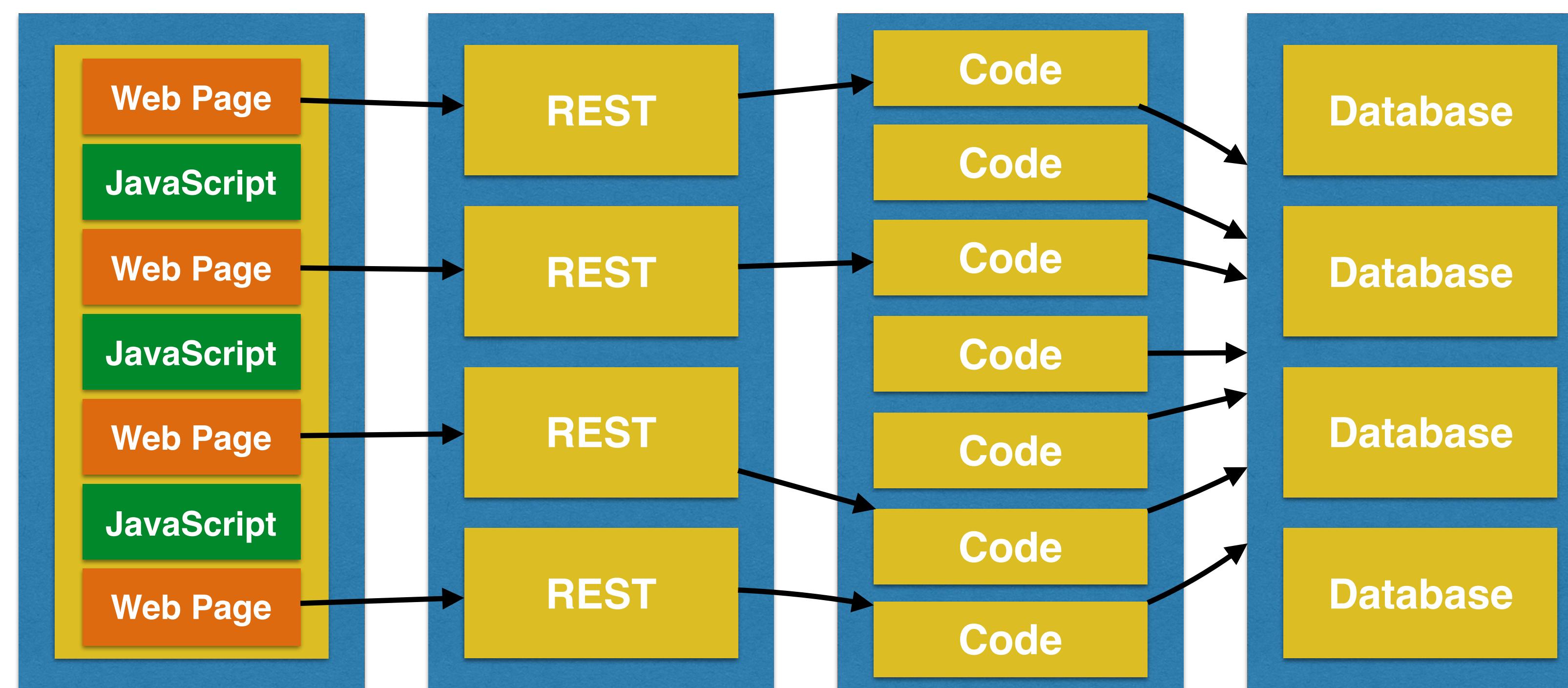
Arun Gupta, @arungupta

*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***

## View

## Controller

## Model

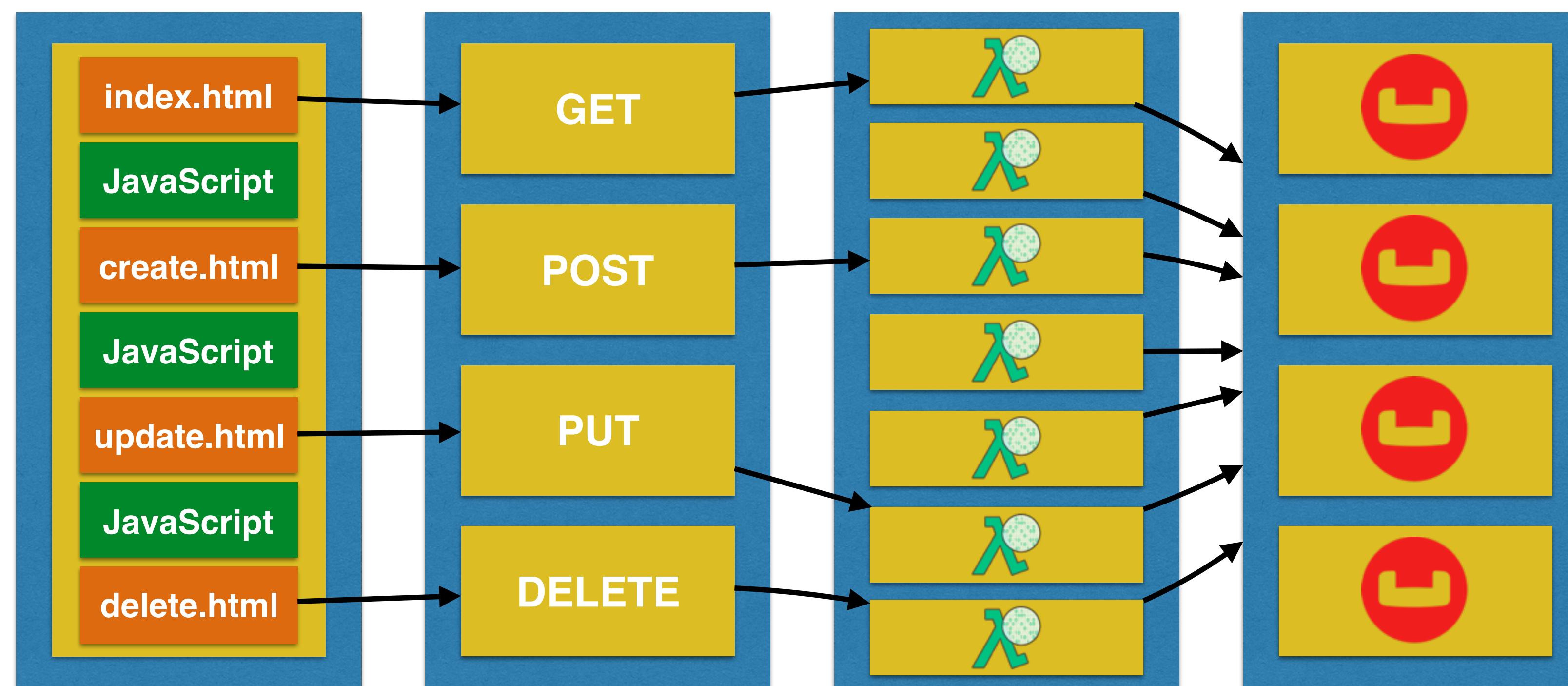


S3

API Gateway

Lambda

Couchbase



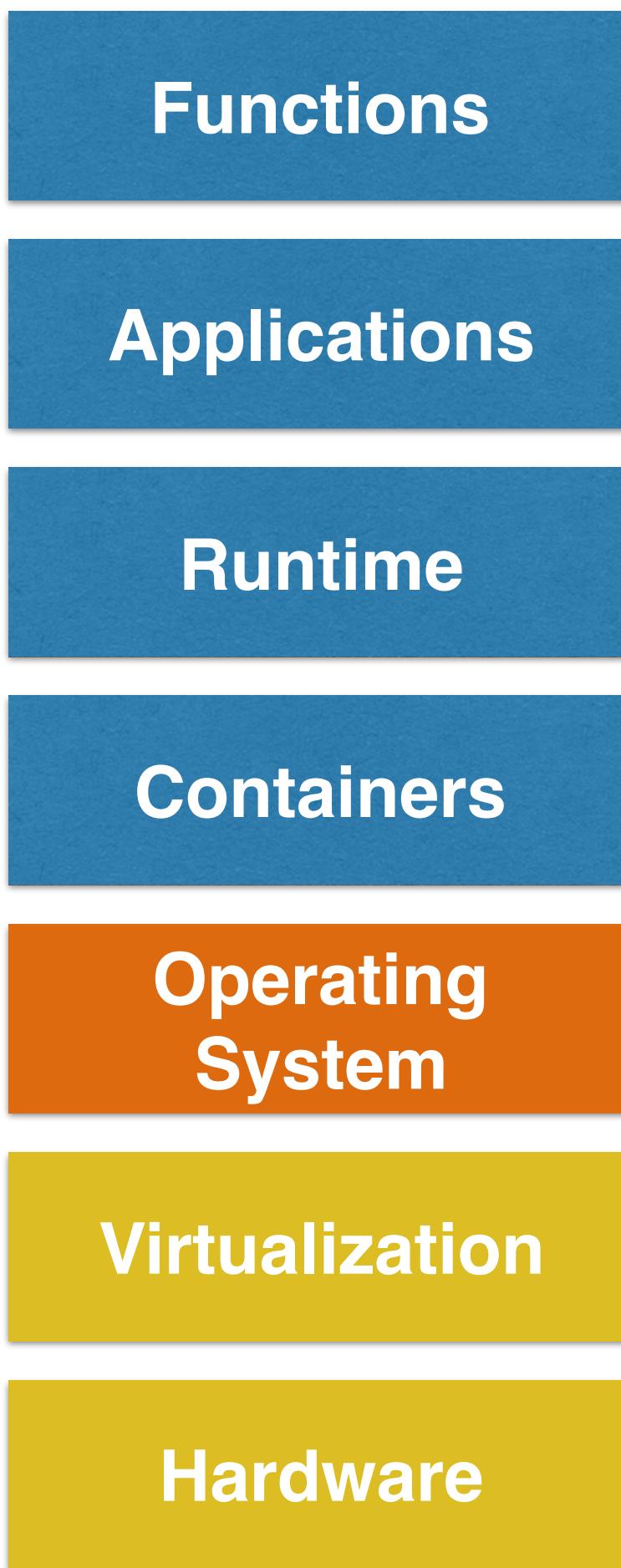
# Serverless Computing

# 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?

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

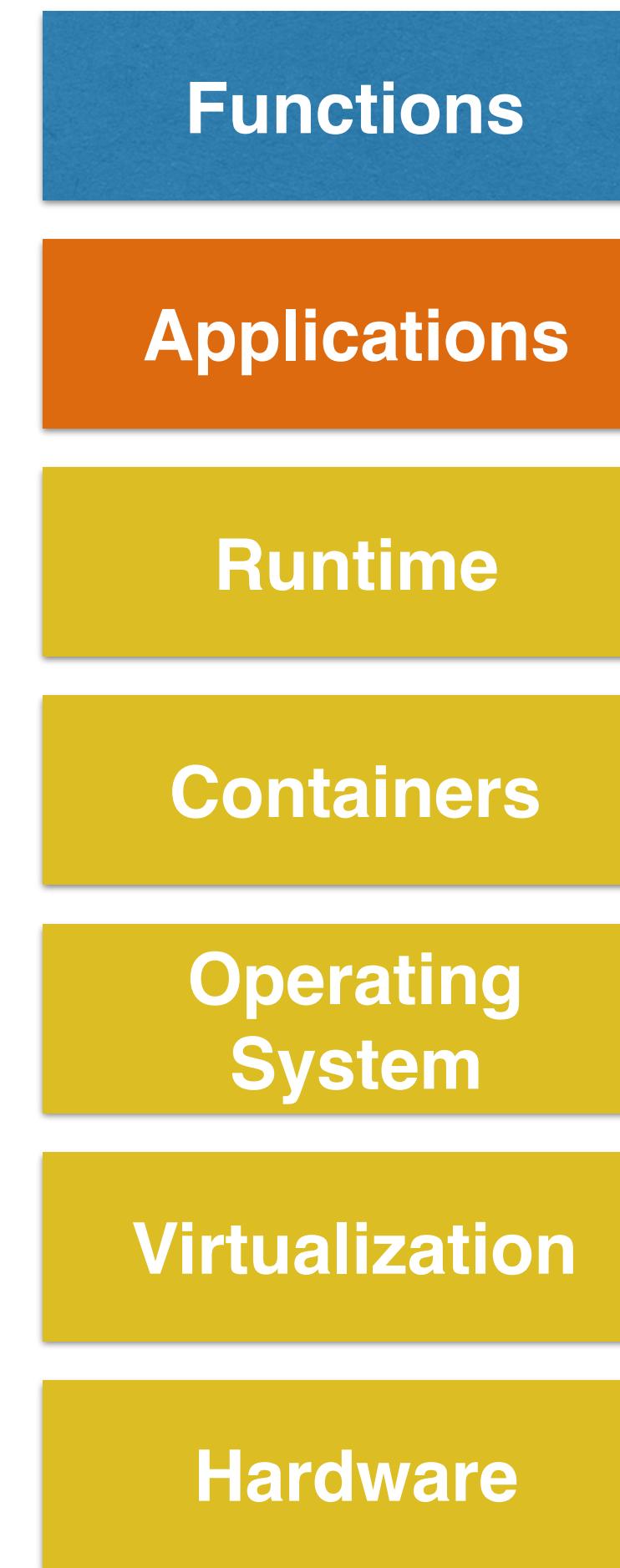
# IaaS



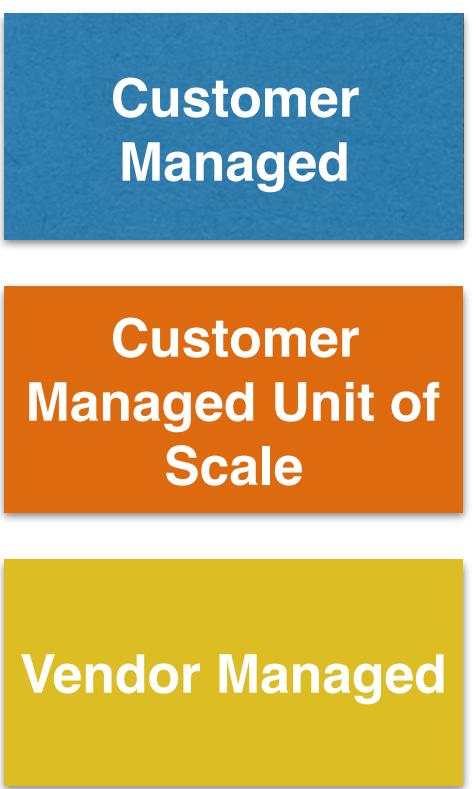
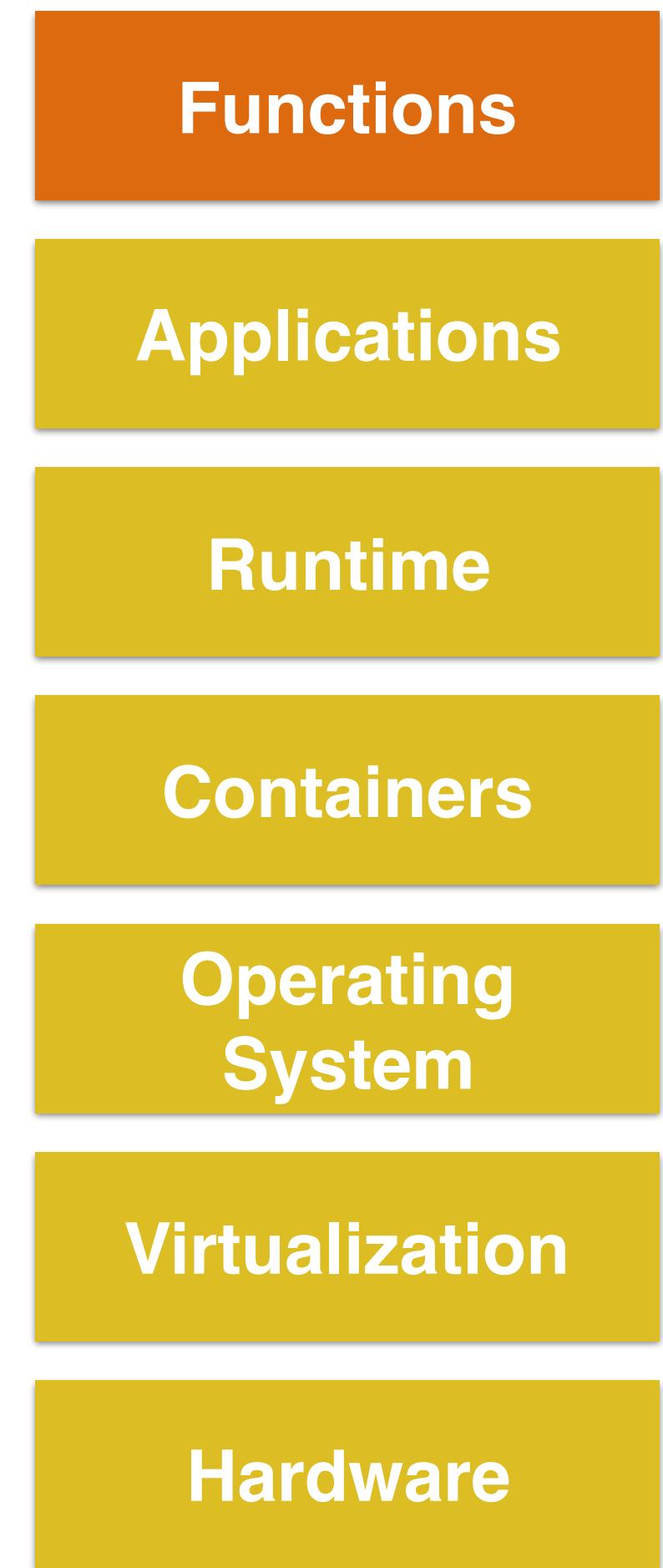
# CaaS



# PaaS



# FaaS





**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

RETWEETS

**158**

LIKES

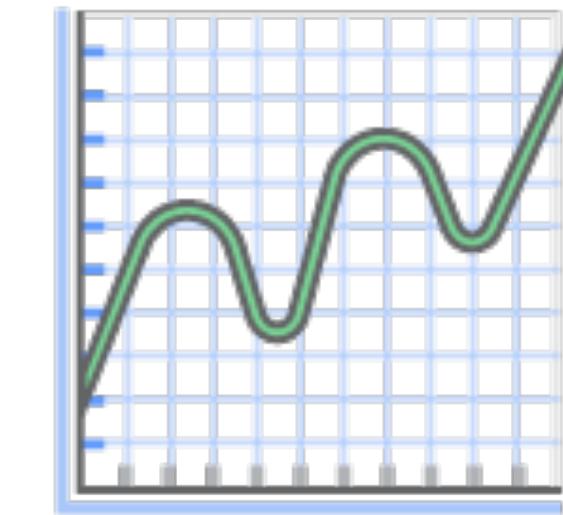
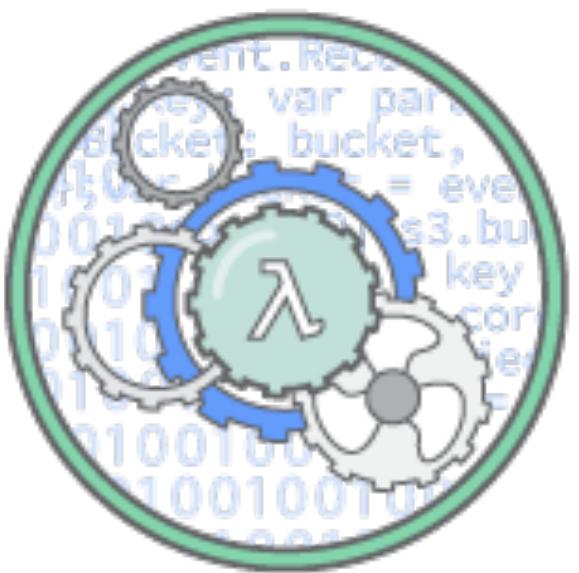
**207**



6:43 AM - 28 May 2016



# 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*

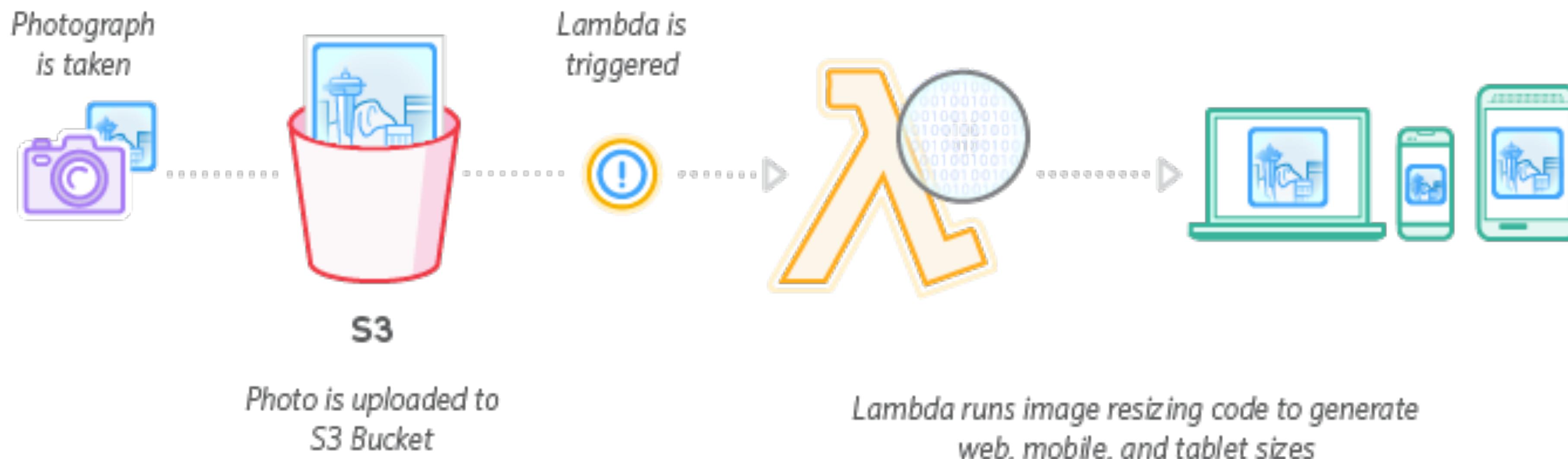
# AWS Lambda Pricing

- 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

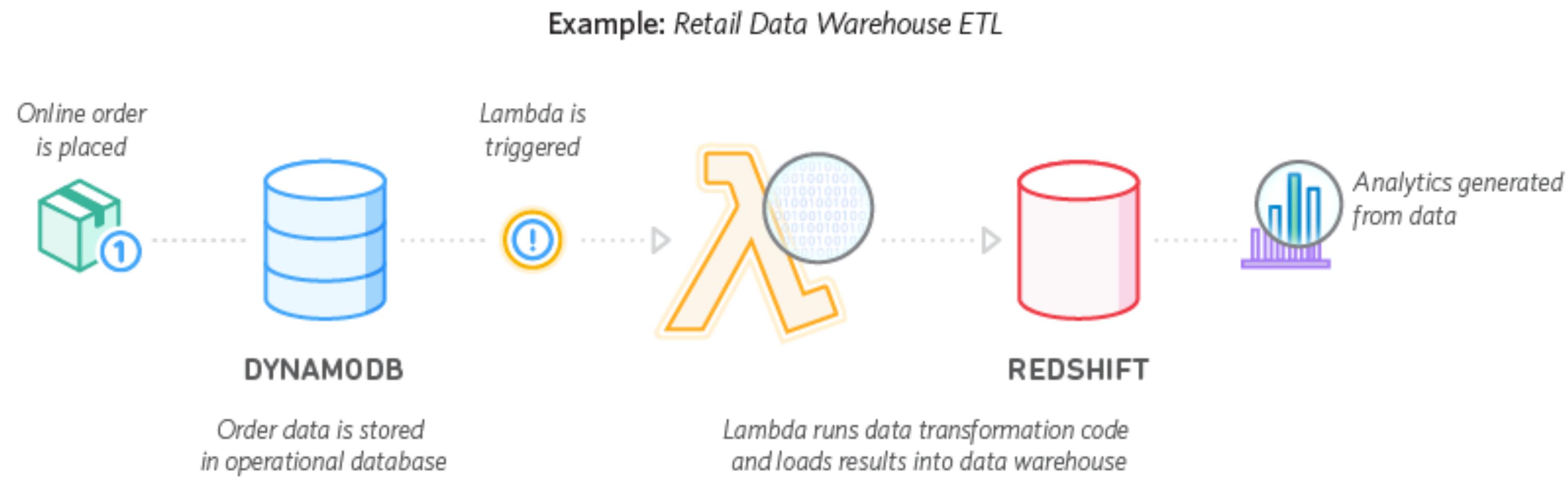
Memory (MB)	Free tier seconds per month	Price per 100ms (\$)
128	3,200,000	0.000000208
192	2,133,333	0.000000313
256	1,600,000	0.000000417
320	1,280,000	0.000000521
384	1,066,667	0.000000625
448	914,286	0.000000729
512	800,000	0.000000834

# AWS Lambda Usecases

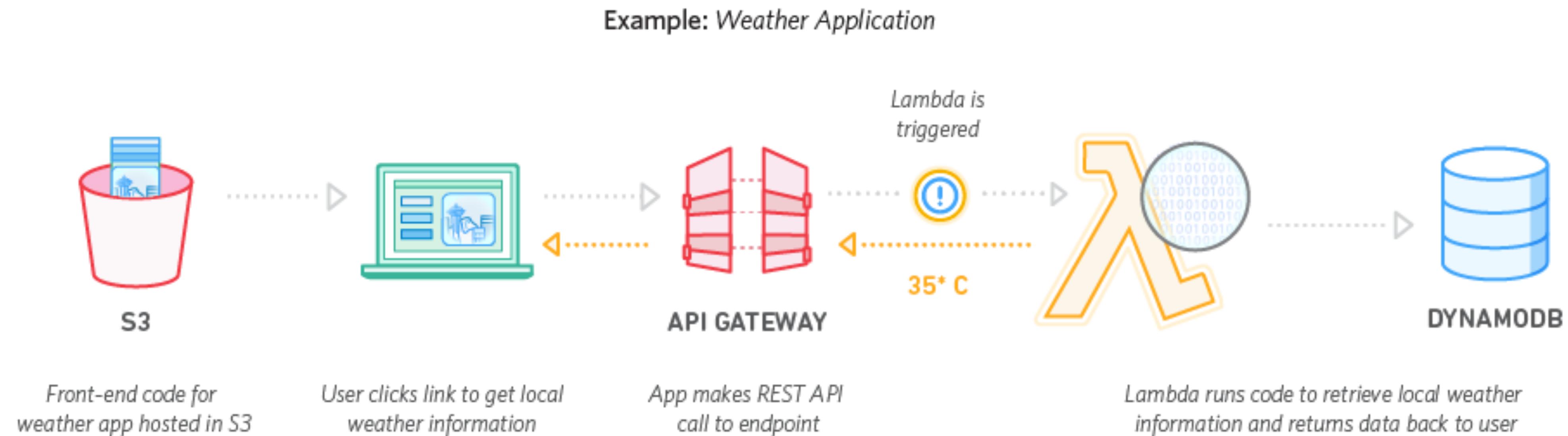
*Example: Image Thumbnail Creation*



# AWS Lambda Usecases



# AWS Lambda Usecases



# Key Components of AWS Lambda

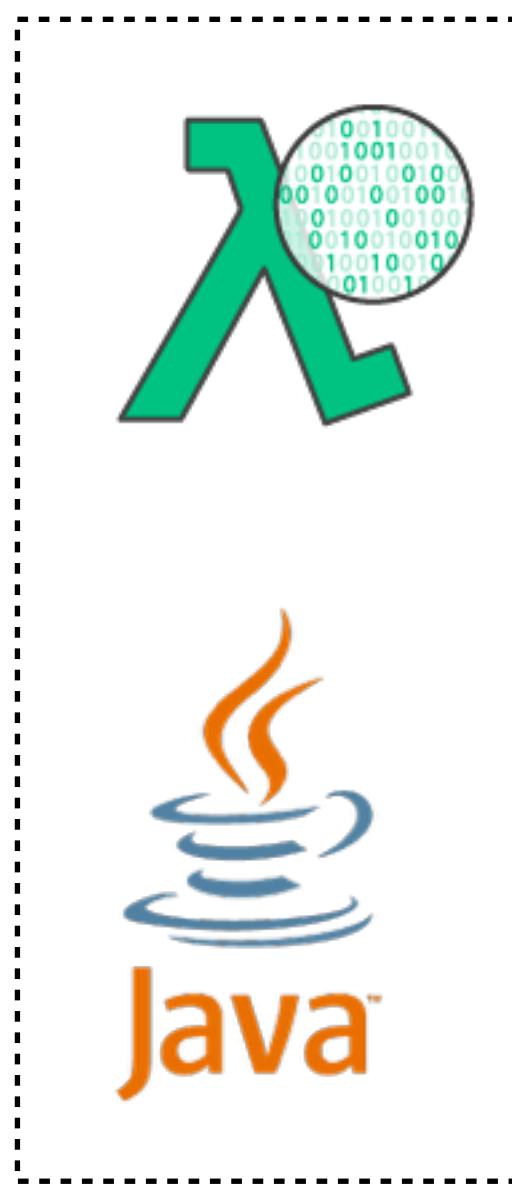
```
public class HelloWorld implements RequestHandler<Request, Response> {  
  
    @Override  
    public Response handleRequest(Request req, Context context) {  
        String greeting =  
            String.format("Hello %s %s.", req.firstName, req.lastName);  
        return new Response(greeting);  
    }  
}
```

Language

Lambda runtime

Data passed to function

# 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 file:///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
```



Services ▾

Resource Groups ▾



arun.gupta@couchbase.com @ ...

N. California ▾

Sup...

## AWS Lambda

Dashboard

Functions

Lambda &gt; Functions

Your Lambda function "HelloWorld" was successfully deleted.

[Create a Lambda function](#)

Actions ▾

	Function name	Description	Runtime	Code size	Last Modified
<input type="radio"/>	MicroservicePost	Microservice HTTP Endpoint - Post	Java 8	6.7 MB	3 months ago
<input type="radio"/>	MicroserviceGetAll	Microservice HTTP Endpoint - Get All	Java 8	6.7 MB	3 months ago
<input type="radio"/>	GetHelloWithName	Returns {"Hello":", a user-provided string, and "}	Node.js 4.3	303 bytes	3 months ago
<input type="radio"/>	GetHelloWorld	Returns {"Hello":"World"}	Node.js 4.3	262 bytes	3 months ago
<input type="radio"/>	hello-world-python	A starter AWS Lambda function.	Python 2.7	360 bytes	4 months ago

# Couchbase



Data



Query



Index



Replication



Mobile

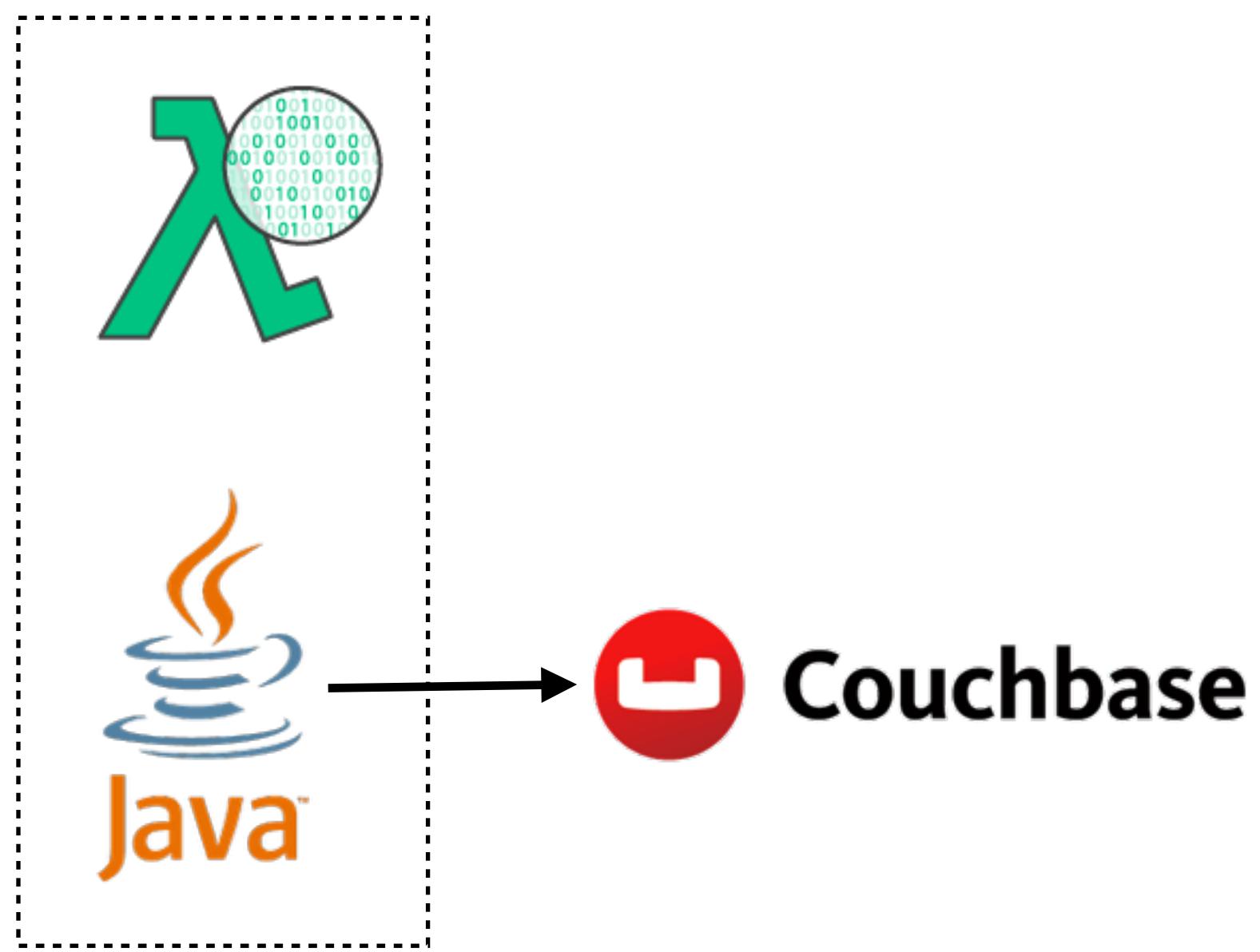


Search



Analytics

# Java + Lambda + Couchbase



# Java + Couchbase Lambda Function

1

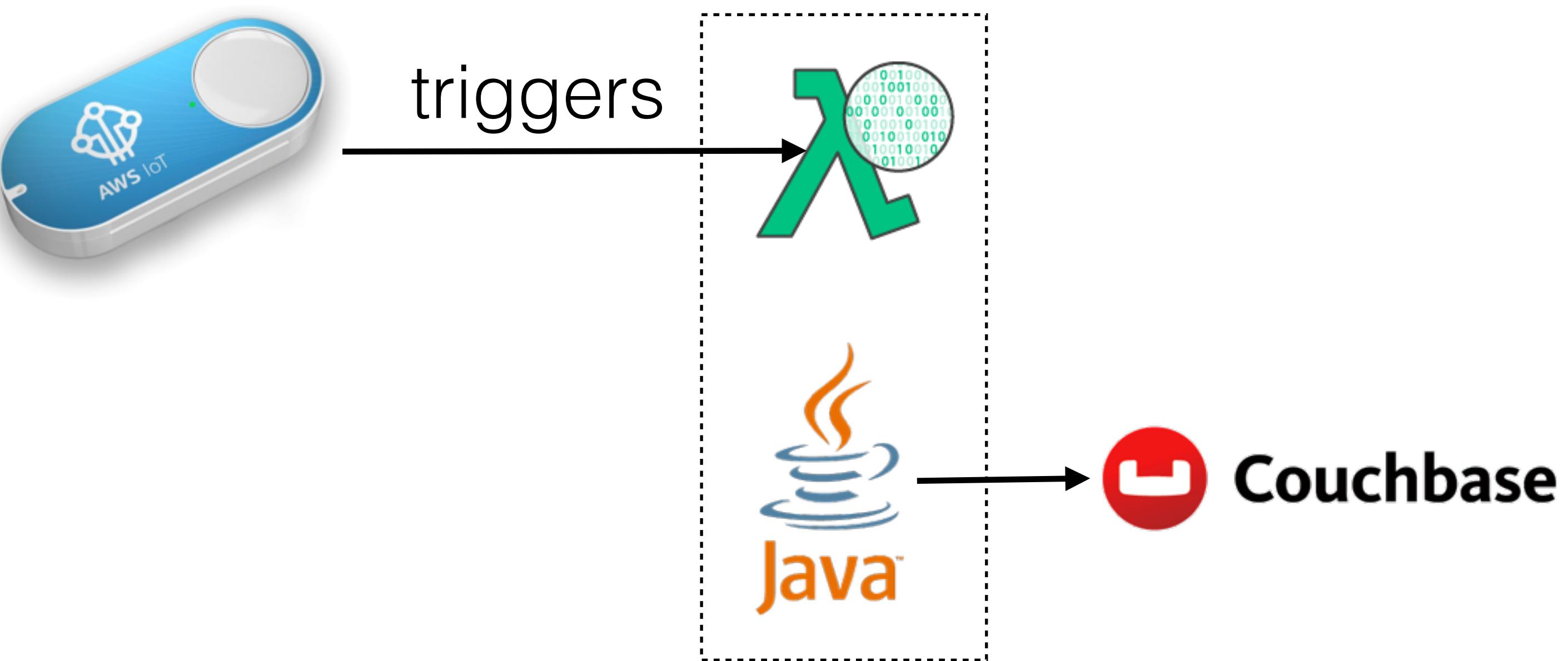
```
<dependency>
  <groupId>com.amazonaws</groupId>
  <artifactId>aws-lambda-java-core</artifactId>
  <version>1.1.0</version>
```

```
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 file:///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
```

# IoT + Lambda + Couchbase



# AWS API Gateway

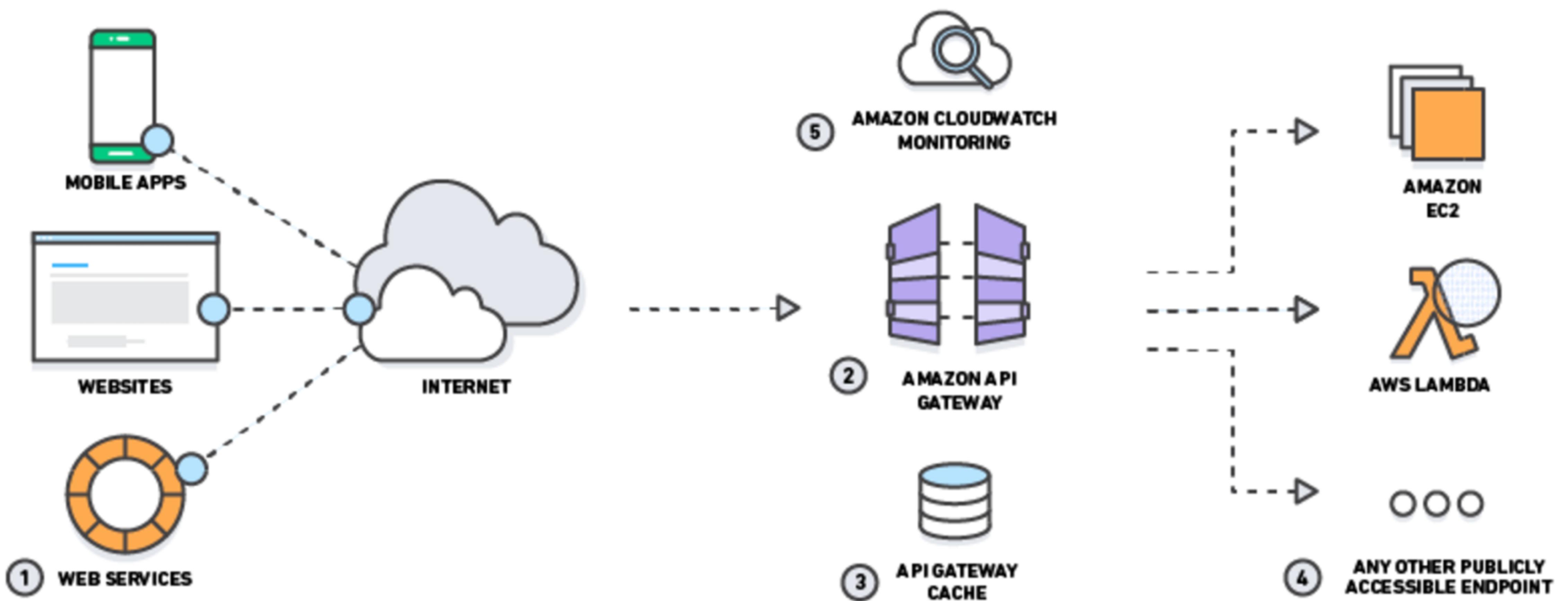
# AWS API Gateway

- Create, publish, maintain, monitor and secure RESTful APIs
- Manage multiple stages and version: Iterate, test and release new versions, with backwards compatibility
- 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



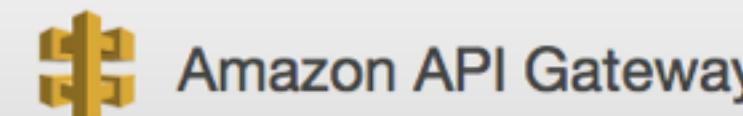


Services

Resource Groups



arun.gupta@couchb...



APIs &gt; Book (lb2qgujjif) &gt; Resources &gt; /books (vrpkod)

APIs

Book

Resources

Stages

Authorizers

Models

Documentation

Binary Support

Dashboard

Usage Plans

API Keys

Custom Domain Names

Client Certificates

Settings

Resources

Actions

/books Methods

/ /books

GET  
POST

GET

arn:aws:lambda:us-west-1:598307997273:functi...

Authorization None

API Key Not required

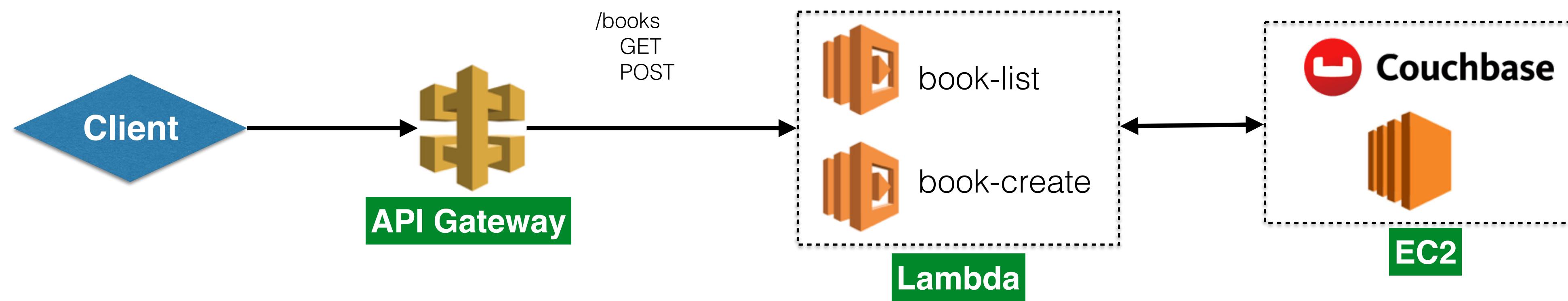
POST

arn:aws:lambda:us-west-1:598307997273:functi...

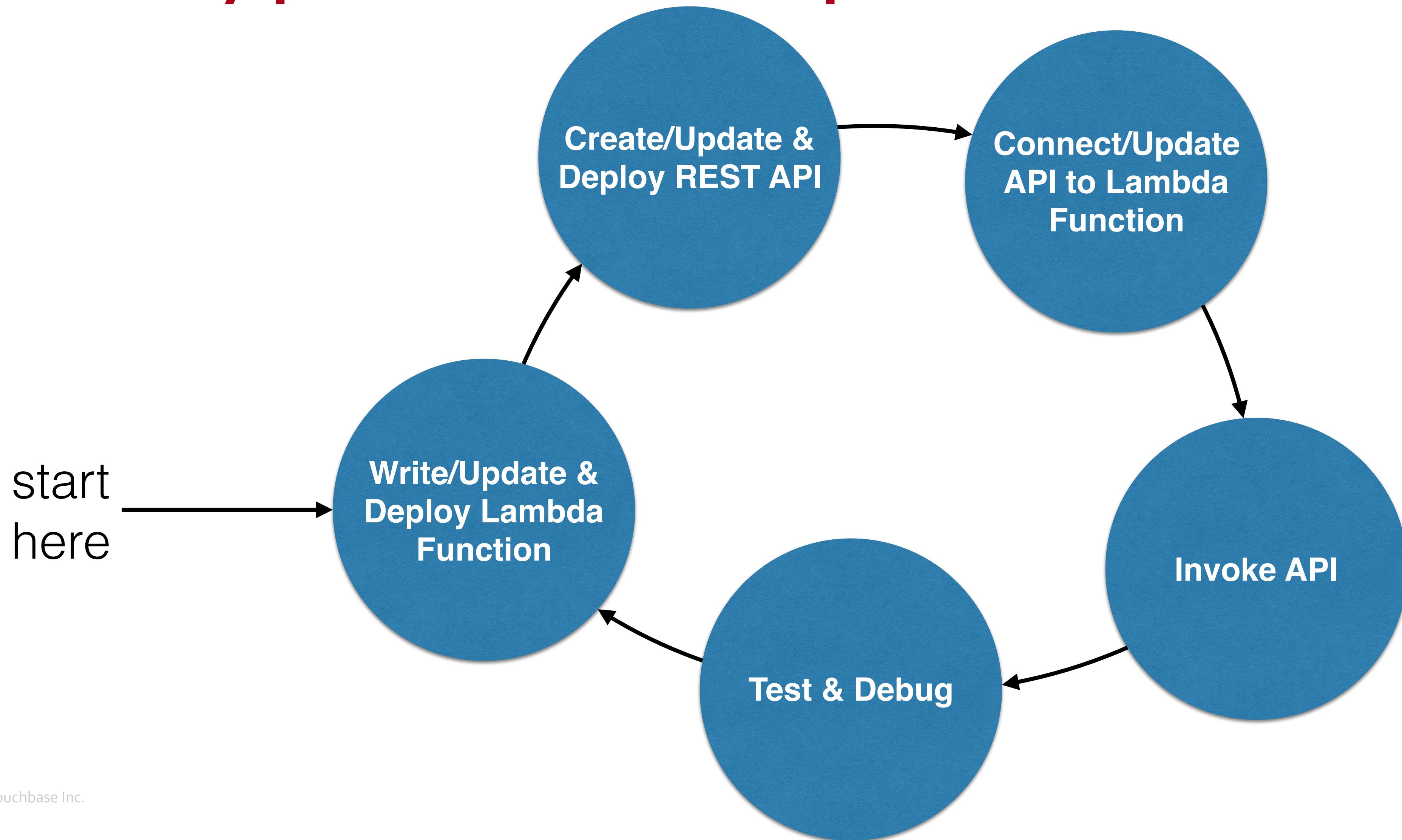
Authorization None

API Key Not required

# 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, ...

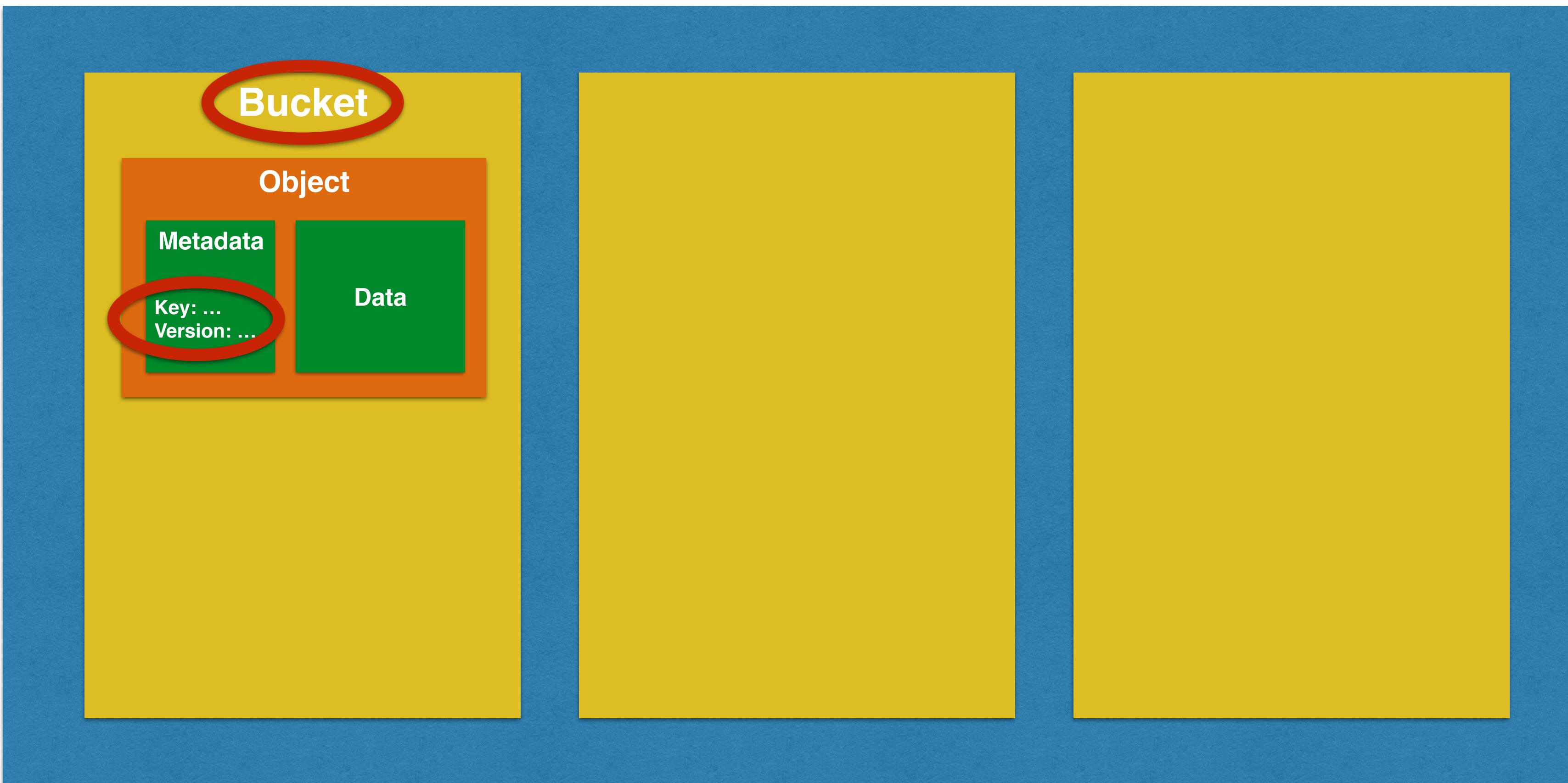
```
1 AwSTemplateFormatVersion : '2010-09-09'
2 Transform: AWS::Serverless-2016-10-31
3 Description: Microservice using API Gateway, Lambda and Couchbase
4 Resources:
5   MicroserviceGetAll:
6     Type: AWS::Serverless::Function
7     Properties:
8       Handler: org.sample.serverless.aws.couchbase.BucketGetAll
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
```

```
29 Microservice GetAllGateway:  
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**: 99.99999999%
- **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

	<b>Standard</b>	<b>Standard - IA</b>	<b>Amazon Glacier</b>
Designed for Durability	99.999999999%	99.999999999%	99.999999999%
Designed for Availability	99.99%	99.9%	N/A
Availability SLA	99.9%	99%	N/A
Minimum Object Size	N/A	128KB*	N/A
Minimum Storage Duration	N/A	30 days	90 days
Retrieval Fee	N/A	per GB retrieved	per GB retrieved**
First Byte Latency	milliseconds	milliseconds	select minutes or hours***
Storage Class	object level	object level	object level
Lifecycle Transitions	yes	yes	yes

# AWS S3 Storage Pricing

- AWS Free Usage Tier

- 5GB of standard storage
- 20k GET, 2k PUT, 15GB transfer

---

Region: US West (Northern California) ▾

---

	<b>Standard Storage</b>	<b>Standard - Infrequent Access Storage †</b>	<b>Glacier Storage</b>
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

---



Objects

Properties

Permissions

Management

## Versioning

Keep multiple versions of an object in the same bucket.

[Learn more](#)

Disabled

## Logging

Set up access log records that provide details about access requests.

[Learn more](#)

Disabled

## Static website hosting

Host a static website, which does not require server-side technologies.

[Learn more](#)

Disabled

## Advanced settings

### Tags

Use tags to track your cost against projects or other criteria.

[Learn more](#)

0 Tags

### Cross-region replication

Automate copying objects across different AWS Regions.

[Learn more](#)

Disabled

### Transfer acceleration

Enable fast, easy and secure transfers of files to and from your bucket.

[Learn more](#)

Suspended

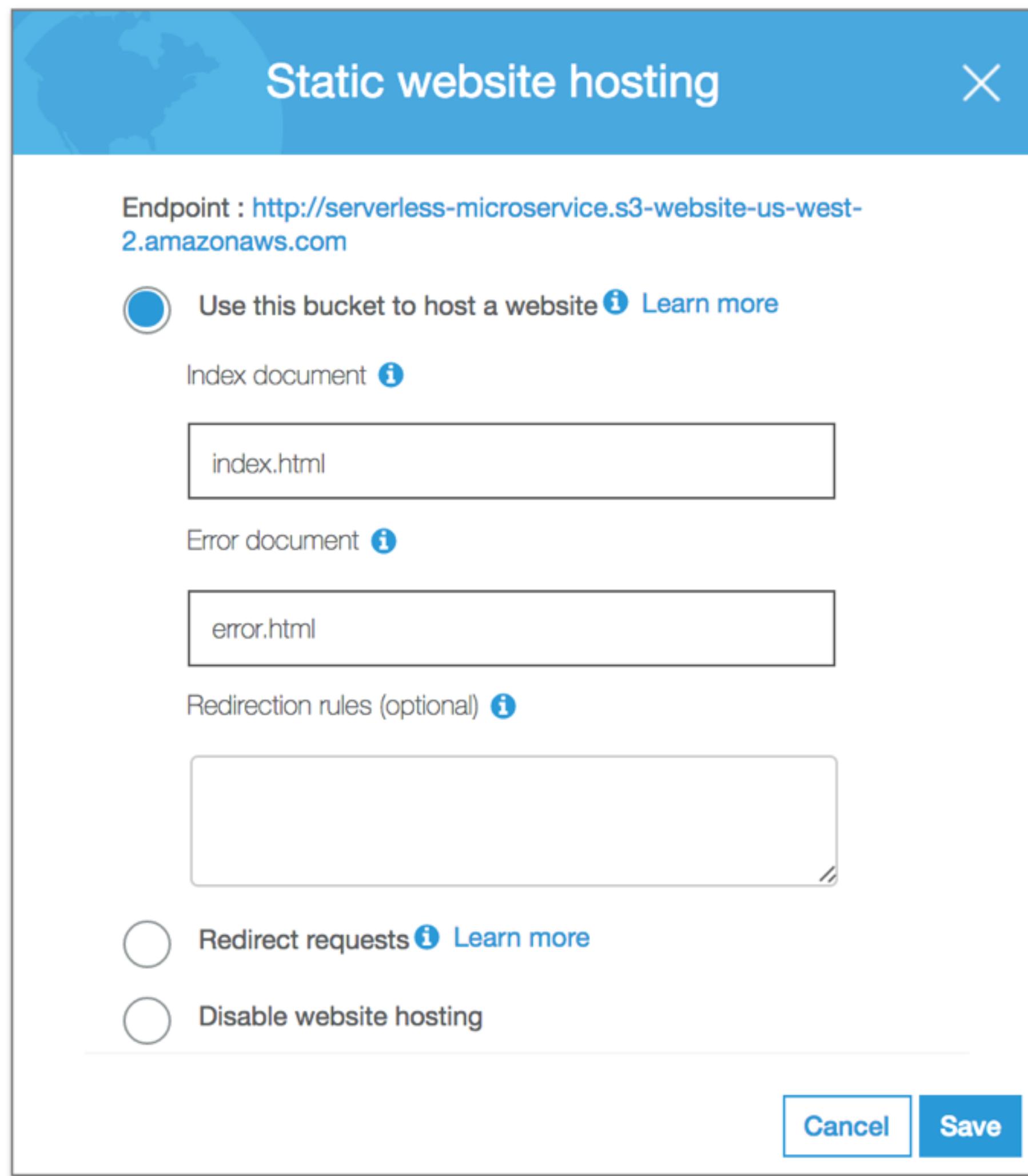
### Events

Receive notifications when specific events occur in your bucket.

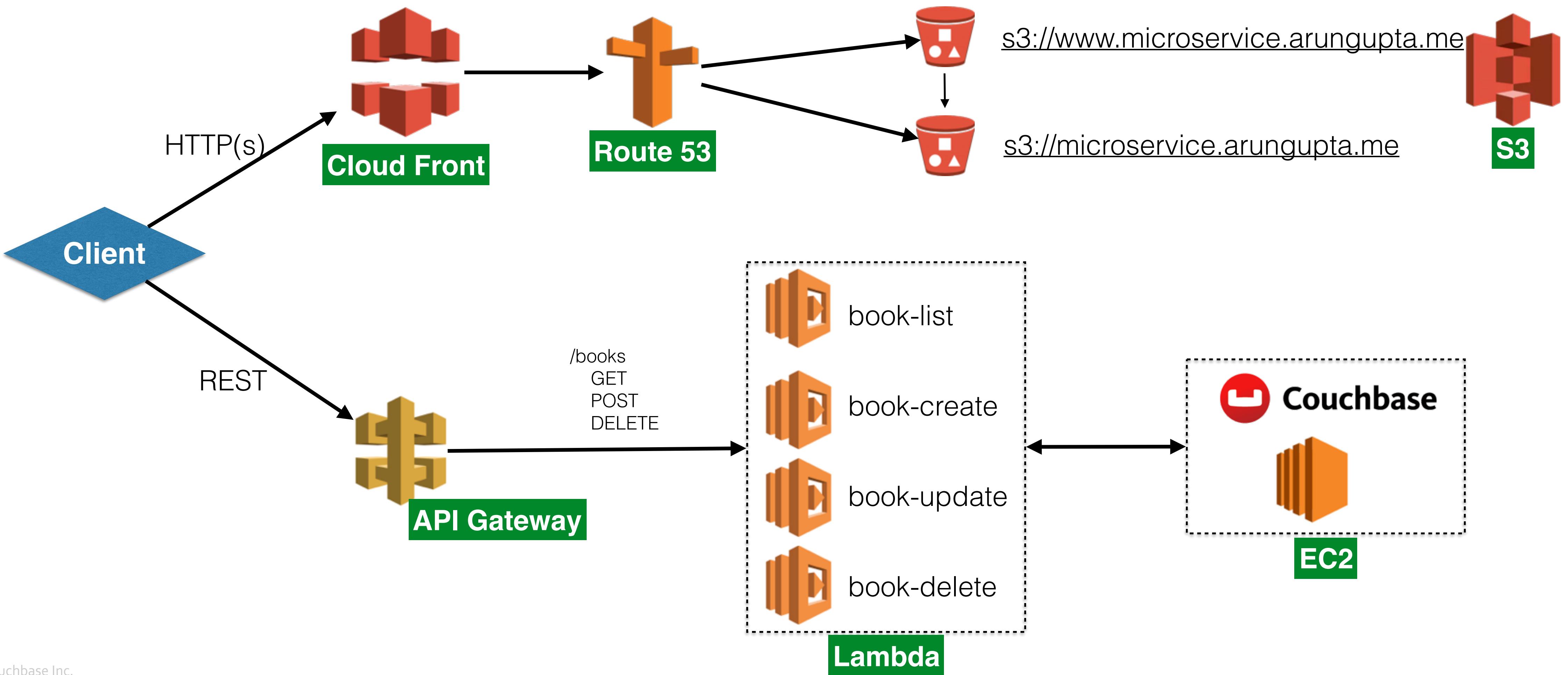
[Learn more](#)

0 Active notifications

# Hosting Static Websites on S3



# Microservice Deployment Architecture



*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***

# References

- Amazon Web Services: [aws.amazon.com](http://aws.amazon.com)
- Couchbase: [couchbase.com](http://couchbase.com)
- Slides + Code: [github.com/arun-gupta/serverless](https://github.com/arun-gupta/serverless)