



\ Build your serverless glue application

Incontro DevOps Italia 2018

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\ Topics

XPEPPERS

- Prerequisites
- Serverless Core Services
 - API Gateway, Lambda and DynamoDB
- Agility
- SAM
- Twilio
- Step Function
- DynamoDB
- Complete your glue code with Authentication (Optional)



Serverless



\ Serverless

Serverless = Function as a Service ?



What is a Function?

Custom code that's run in an ephemeral context.

- The code/application that we want to execute
- The Service we provide to our users
- Responds to events



What is a Function?

Custom code that's run in an **ephemeral context**.

- Created only to run your code and then destroyed
- Has no state or persistence
- It's still a server!



\ Serverless

IaaS

Functions

Application

Runtime

Operating System

Virtualization

Hardware

PaaS

Functions

Application

Runtime

Operating System

Virtualization

Hardware

FaaS

Functions

Application

Runtime

Operating System

Virtualization

Hardware

Customer Managed

Customer Managed
Unit of scale

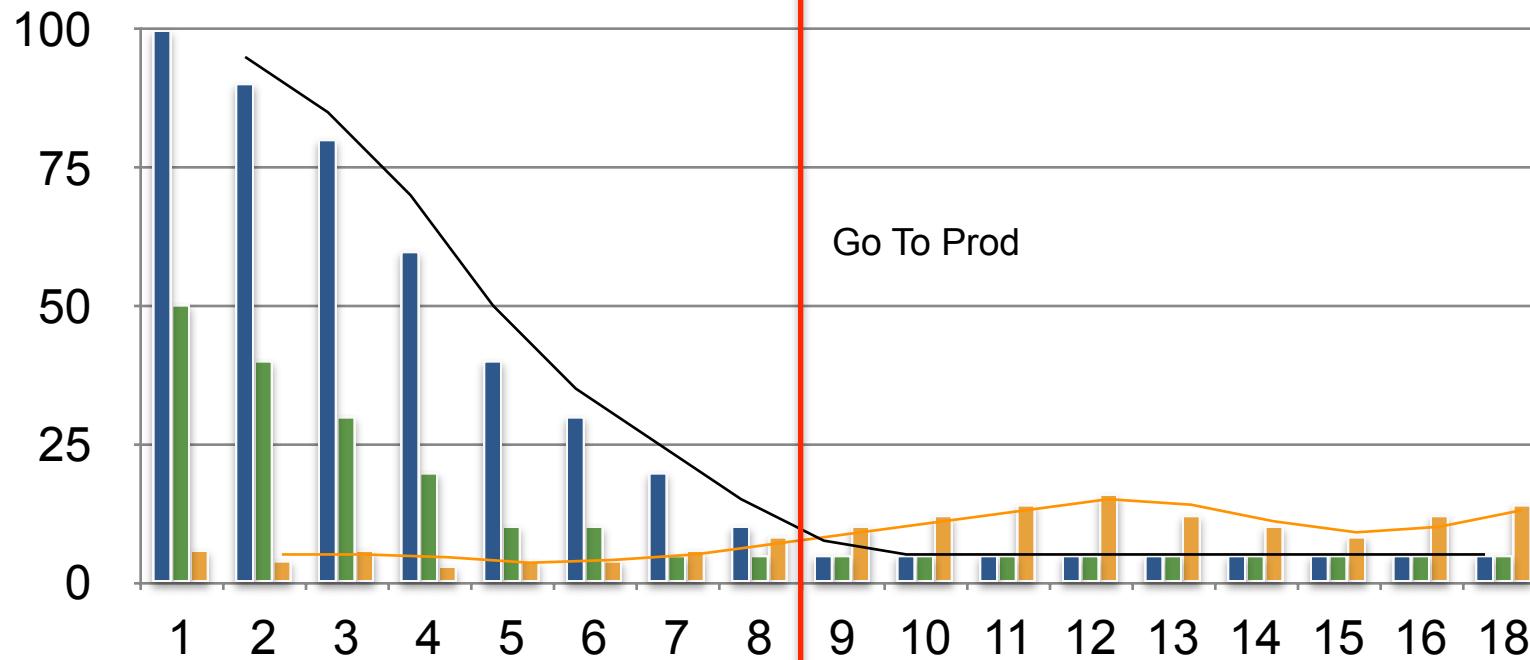
Abstract by vendor



\ Serverless - Costs



Code Ops Service



\ Serverless - Costs - use case

Record HTTP Success Connection

48618

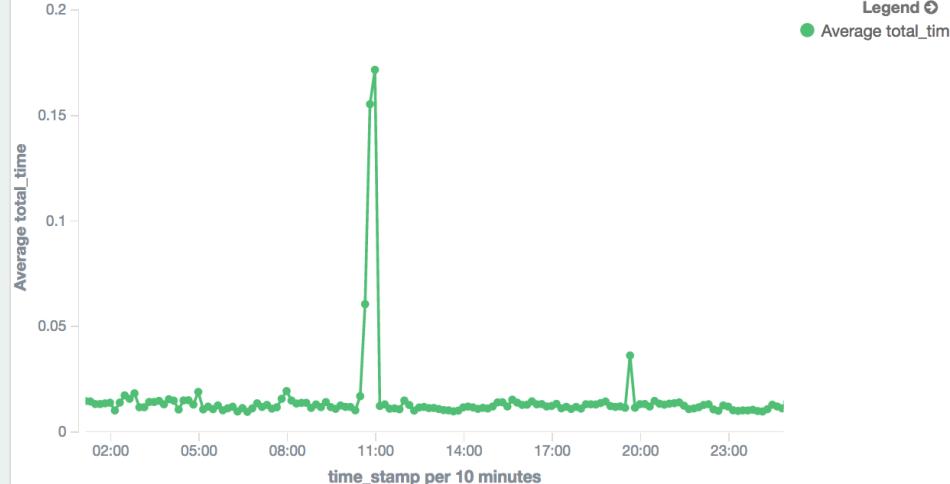
Count

Slow responses (200 status code)

3

Count

Record Average Totale Processing Time



Percentile on Total Time

0.023

95th percentile of total_time

0.876

99.98th percentile of total_time



ElasticSearch Service



\ Serverless - Costs - use case - API-Gateway

Costo totale = Costo chiamate API + Costo trasferimento + Costo cache

Costo chiamate API

3,50 USD per milione di chiamate API ricevute

Costo Cache

- **0,5 GB = 0,020 USD/Ora**
- 1,6 GB = 0,038 USD
- 6,1 GB = 0,200 USD

...

Costo Trasferimento

Tariffe per il trasferimento di dati in uscita di Amazon API Gateway

- **0,09 USD/GB per i primi 10 TB**
- 0,085 USD/GB per i successivi 40 TB
- 0,07 USD/GB per i successivi 100 TB
- 0,05 USD/GB per i successivi 350 TB



\ Serverless - Costs - use case - Costo API Gateway

Costo Chiamate API

- $48.618 * 31 = 1.507.158 * 3,75 \text{ USD} \rightarrow 5,275 \text{ USD/Mese}$

Costo Cache (0,5 GB)

- $0,020 \text{ USD/ora} * 24 \text{ ore} * 31 \text{ giorni} = 14,88 \text{ USD/Mese}$

Costo trasferimento

- $48.618 * 512 \text{ Byte} * 31 \text{ giorni} * 0.09 \text{ USD} = 0,064 \text{ USD/Mese}$

Costo Totale = 20,219 USD/Mese

* = Non considerando il Free Tier



\ Serverless - Costs - use case - Lambda

EU-West-1



Costo totale = Costo elaborazione + Costo richieste

Elaborazione

La durata viene calcolata a partire dal momento in cui viene avviata l'esecuzione del codice e fino al momento in cui viene restituito o comunque terminato il codice, arrotondata al decimo di secondo più vicino. Il prezzo dipende dalla quantità di memoria allocata per la funzione. **Il costo è di 0,00001667 USD per ogni GB/secondo impiegato.**

Richieste

Il costo viene calcolato in base al numero totale di richieste per tutte le funzioni. Lambda conteggia una richiesta ogni volta che avvia un'elaborazione in risposta alla notifica di un evento o a una chiamata Invoke. **Il costo è di 0,20 USD ogni milione di richieste (0,0000002 USD a richiesta).** Il primo milione di richieste ogni mese è gratuito



Costo Elaborazione

- Free Tier: 400.000 GB/secondo al mese
- Il costo dell'elaborazione mensile è 0,00001667 USD per GB/s
- Elaborazione (sec) = $(48.618 * 99.98\%) * 0.876 \text{ sec} = 42581 \text{ sec}$
- Elaborazione (GB/s) = $42581 \text{ secondi} * (512 \text{ MB} / 1024) = 21.290 \text{ GB/s}$
- Costi Elaborazione = $0,00001667 \text{ USD} * 21.290 * 31 = \textcolor{orange}{10,964 \text{ USD/Mese}^*}$

Costo Richieste

- Free Tier: 1.000.000 richieste/mese
- Dalla richiesta successiva, il costo è di 0,20 USD ogni milione di richieste
- Costi Richieste $48.618 * 0,0000002 \text{ USD} = \textcolor{orange}{0,30 \text{ USD/Mese}^*}$

Costo Totale = 11,264 USD/Mese

* = Non considerando il Free Tier



\ Serverless - Costs - use case - DynamoDB

EU-West-1

XPEPPERS

Costo totale = Costo storage + Costo capacità + Costo Trasferimento

Storage

First 25 GB stored per month is free

\$0,283 per GB al mese successivamente

Trasferimento

Trasferimento IN = **\$0,000 per GB**

Trasferimento OUT = **\$0,090 per GB**

Capacità Read/Write

Consente di specificare il throughput per le richieste in lettura e scrittura che deve raggiungere la propria tabella:

- Throughput scrittura: **\$0,00735 all'ora ogni 10 unità** di capacità in scrittura
- Throughput lettura: **\$0,00735 all'ora ogni 50 unità** di capacità in lettura



\ Serverless - Costs - use case - DynamoDB

EU-West-1

Costo Storage

- Storage = 2.5 GB -> Costo = 0 USD/Mese*

Costo Capacità

- Totale RU = 50 -> Costo = \$0.00735 * 24 ore * 31 giorni = **5,47 USD/Mese**
- Totale WU = 10 -> Costo = \$0.00735 * 24 ore * 31 giorni = **5,47 USD/Mese**

Costo Trasferimento OUT

- $48.618 * 512 \text{ Byte} * 31 = 0.718 \text{ GB/Mese}$ -> Costo = 0**

Costo Totale = 10,94 USD/Mese

* = First 25 GB stored per month is free

** = Primo GB/mese is free



\ Serverless - Costs - use case - Total



Costo Totale API Gateway = 20,219 USD/Mese

Costo Totale Lambda = 11,264 USD/Mese

Costo Totale Dynamo = 10,94 USD/Mese

Costo Totale ElasticSearch = 15 USD/Mese

Costo Altri servizi = 10 USD/Mese

Costo Totale = 67,423 USD/Mese



Serverless - AWS Ecosystem



\ Serverless - AWS Ecosystem



Amazon
Athena



AWS WAF



Amazon
CloudFront



Amazon
Cognito



Amazon
Kinesis

Serverless = Function as a Service?



AWS
CloudFormation



Amazon
SES



AWS
Lambda



Amazon
SNS



AWS
CodePipeline



AWS
IoT



Amazon
CloudWatch



Amazon
SQS



AWS
Step
Functions



Amazon
Machine
Learning



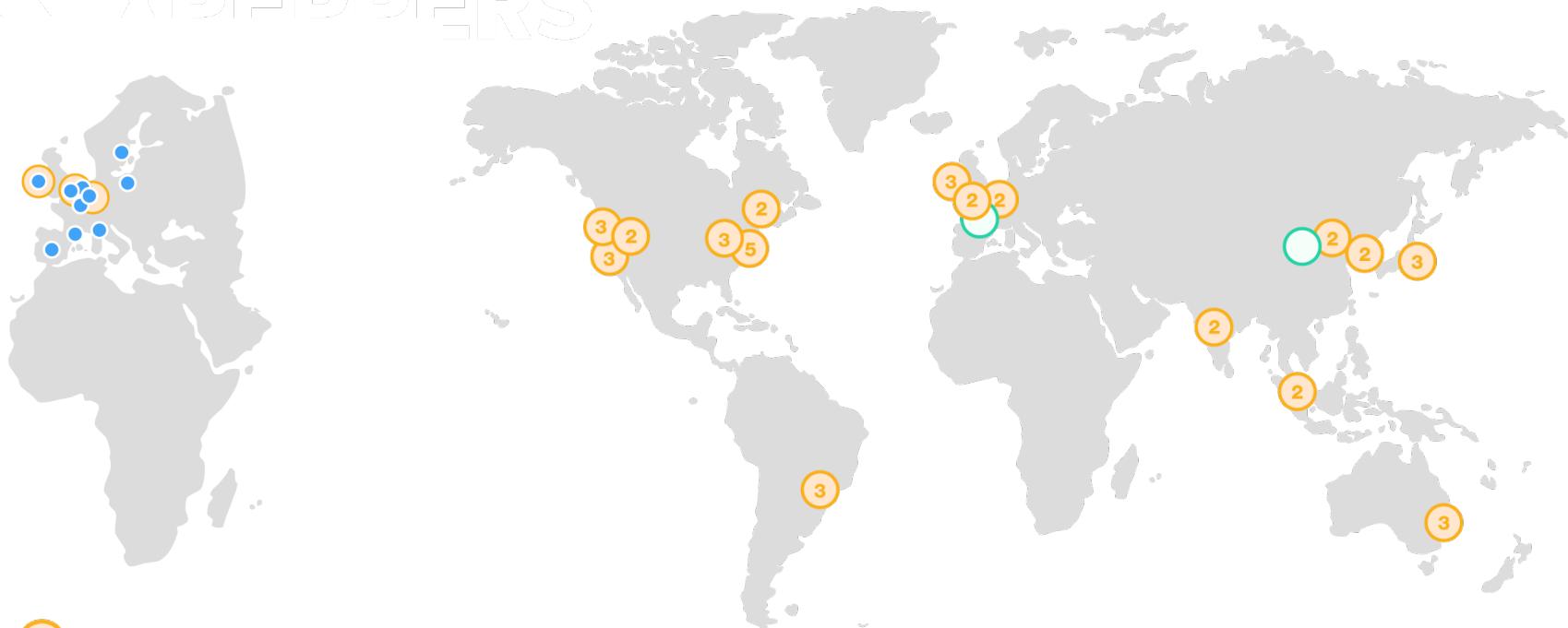
Amazon
API
Gateway*



AWS IAM

\ Serverless - AWS Global Infrastructure

YDFPERS



Regions and number of AZ

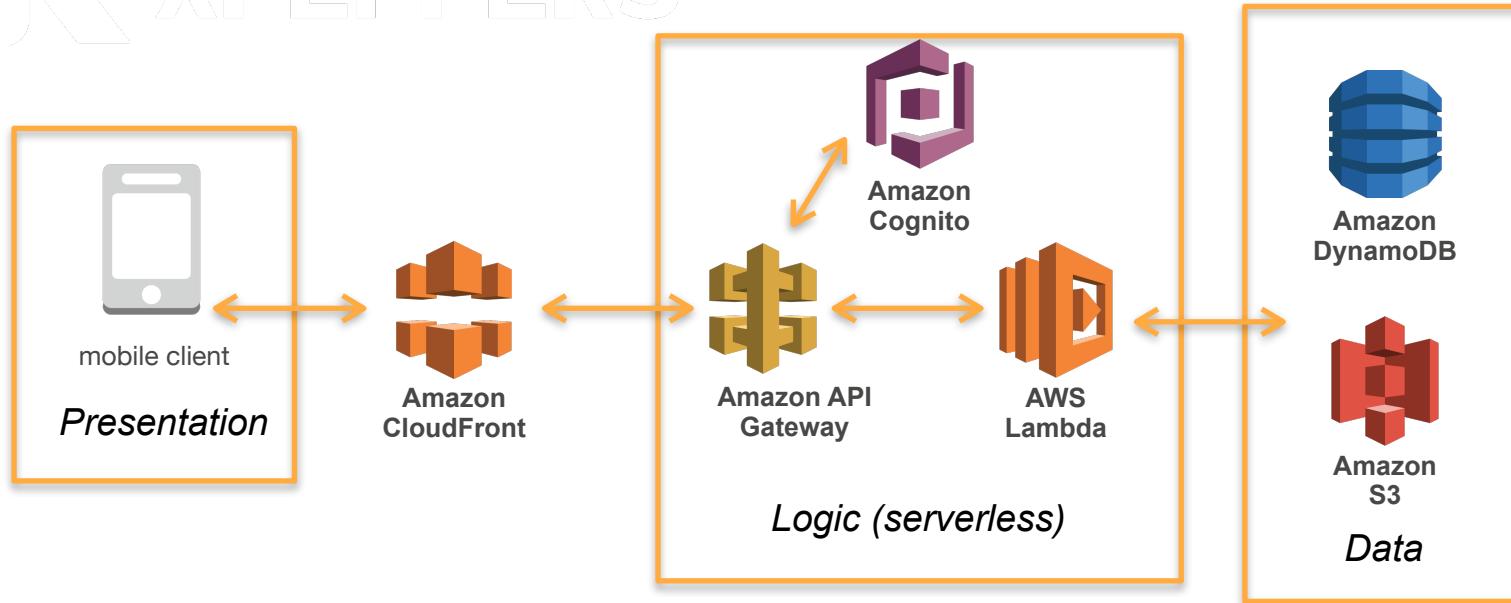
New Region (Paris)

Edge Location (Milano)



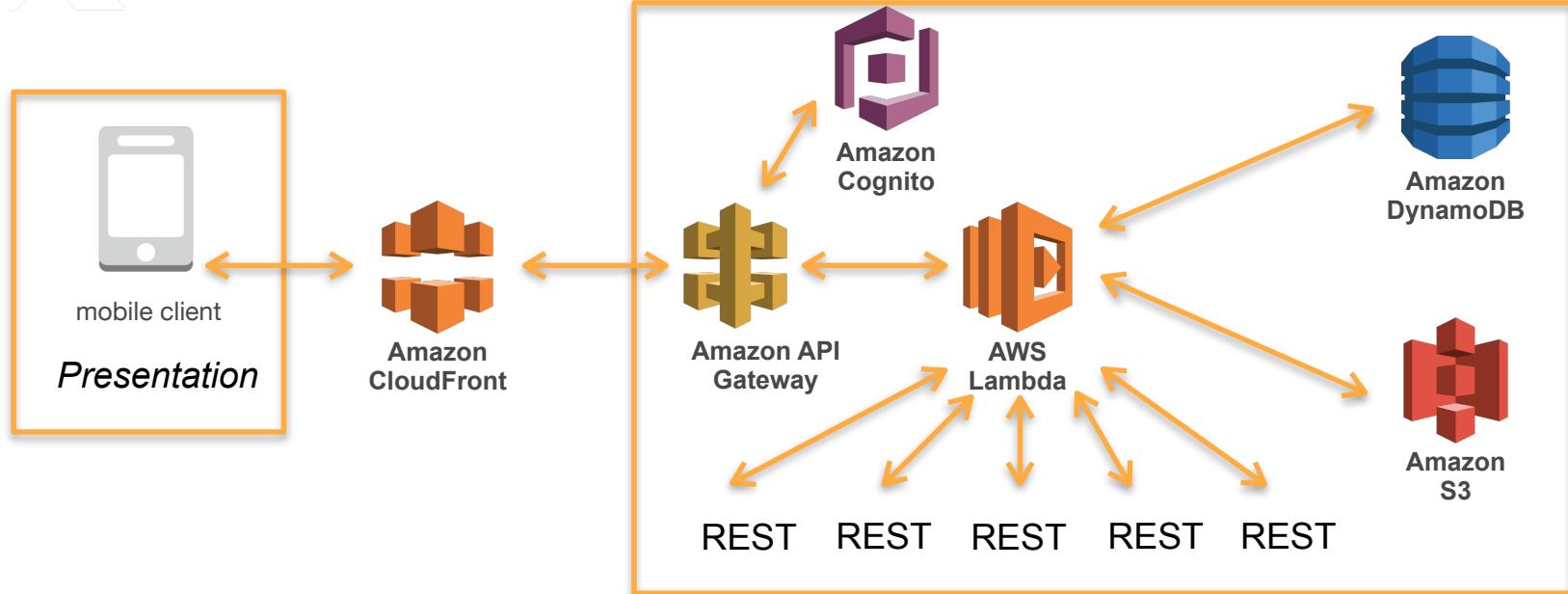
\ Serverless - 3-Tier architecture

XPEPPERS



\ Serverless - Glue Code

XPEPPERS



*In computer programming, glue code is **source** code that serves solely to "adapt" different parts of code that would otherwise be incompatible*
- Wikipedia -



\ Amazon API Gateway

~~API EXPERTS~~

Fully managed HTTPS service that makes it easy for developers to create, publish, maintain, monitor, and secure APIs at any scale.

- Low-Cost
- Performance
- API Monitoring
- API Lifecycle management
- Flexible Security Controls
- Cloudfront, ELB and Lambda Integration



\ AWS Lambda

XPEPPERS

Serverless compute service that runs your code in response to events and automatically manages the underlying resources

- Completely Automated Administration
- Built-in Fault Tolerance
- Run Code at Edge Locations and Step Function (Re:Invent 2016)
- Pay-per-use
- Supports Java, Node.js, C#, Python and Go
- VPC Integration



\ Amazon DynamoDB

~~EXPLORERS~~

Fast and flexible NoSQL database service for all applications that need consistent, single-digit millisecond latency at any scale

- Highly Scalable and Fully Managed
- Document and key-value data structures
- DAX and Cross-region Replication (Re:Invent 2017)
- VPC Integration



\ Amazon S3

XPEPPERS

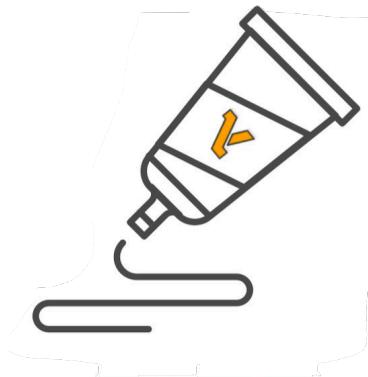
Amazon S3 is object storage built to store and retrieve any amount of data from anywhere – web sites and mobile apps, corporate applications, and data from IoT sensors or devices

- Durability, Availability e Scalability
- Security and Compliance Capability
- Query in place (Re:Invent 2017)
- Integrated with AWS Lambda





Workgroup Time



Some rules:

- Groups: Dev and Ops
- Demo = Look us
- Demo + Lab = Go with us
- Lab = Go alone



\ AWS Console Login



Account ID or alias

IAM user name

Password

[Sign-in using root account credentials](#)



Agility



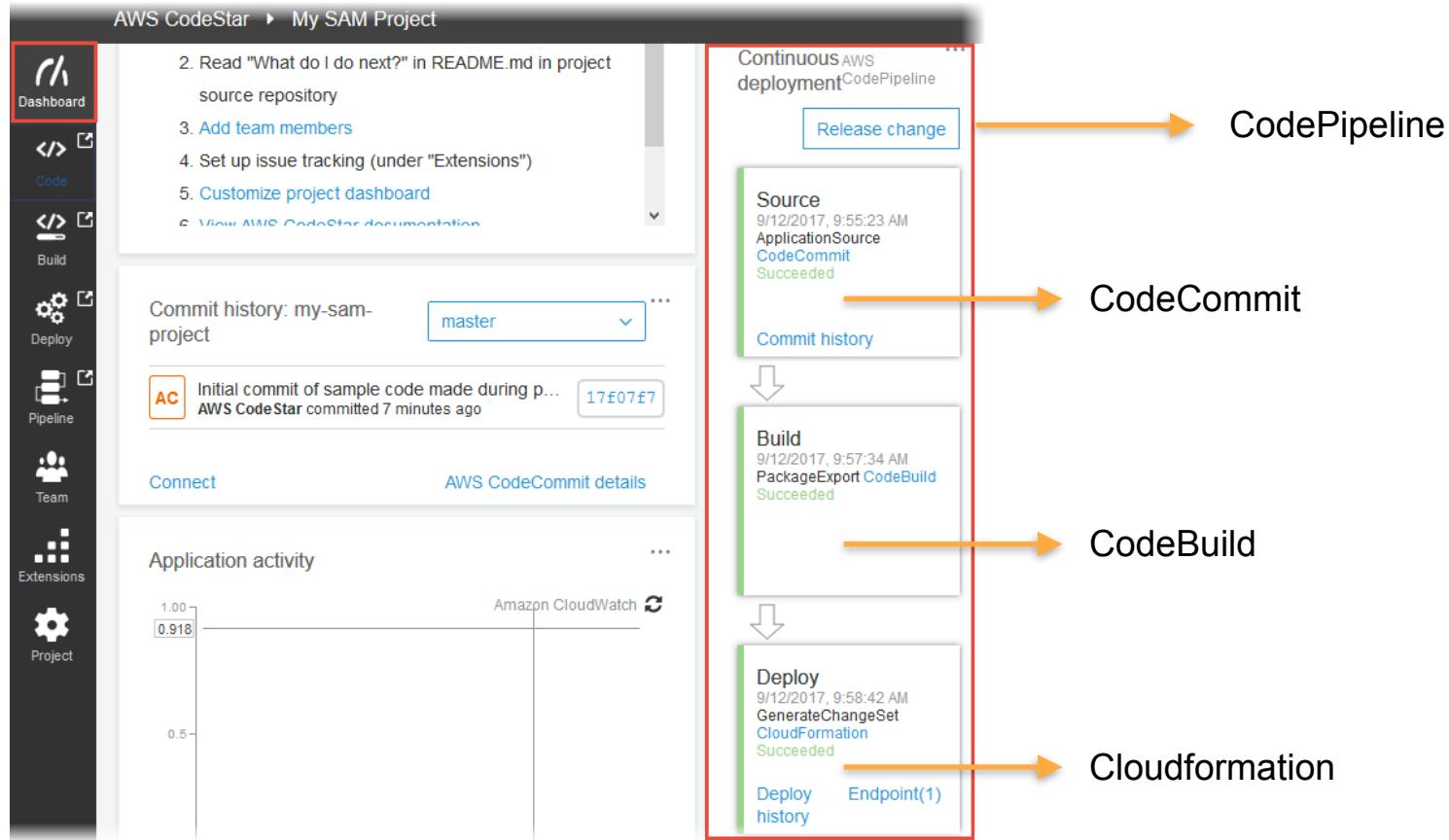
\ Agility - CodeStar

AWS CodeStar enables you to quickly develop, build, and deploy applications on AWS. AWS CodeStar provides a unified user interface, enabling you to easily manage your software development activities in one place.

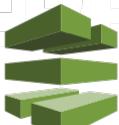
- AWS CodeCommit: Your source repository
- AWS CodeBuild: Package your source code and SAM templates
- AWS CloudFormation: Deploy your Infrastructure as Code
- AWS CodePipeline: Orchestrate your application deployment.



\ Agility - CodeStar



\ Agility - Build and Deploy



AWS
CodePipeline



AWS
CodeCommit



AWS
CodeBuild



AWS
CloudFormation



SAM



Step 1 - Start a CodeStar Project and Git setup

Demo + Lab



\

Serverless Application Model (SAM)



\ Serverless Application Models

The AWS Serverless Application Model (AWS SAM) is a model to define serverless applications.

- Natively supported by AWS CloudFormation
- Simplified syntax for expressing serverless resources
 - APIs, Lambda functions and Amazon DynamoDB tables
 - Others resources on Cloudformation



\ Serverless Application Models

YDDEDDEPSC

AWS::TemplateFormatVersion: '2010-09-09'

Transform: AWS::Serverless-2016-10-31

Resources:

FunctionName:

Type: AWS::Serverless::Function

Properties:

Handler: *index.handler*

Runtime: *runtime*

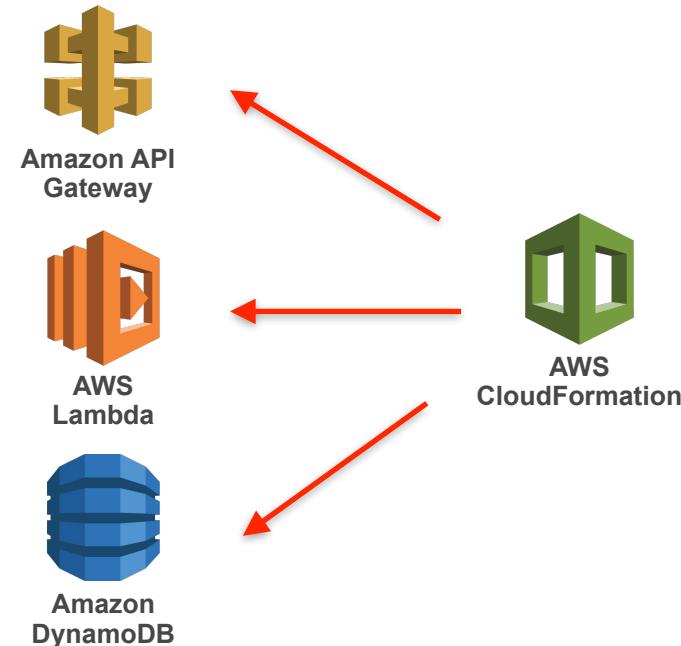


Serverless Application Model (SAM)

```
1 AWSTemplateFormatVersion: '2010-09-09'
2 Transform: AWS::Serverless-2016-10-31
3 Description: Simple CRUD webservice.
4 Resources:
5   APIGatewayGetAPI:
6     Type: AWS::Serverless::Api
7     Properties:
8       StageName: prod
9       DefinitionUri: swaggerFile.yml
10  LambdaGetFunction:
11    Type: AWS::Serverless::Function
12    Properties:
13      Handler: index.get
14      Runtime: nodejs4.3
15      CodeUri: s3://<bucket>/api_backend.zip
16      Policies: AmazonDynamoDBReadOnlyAccess
17      Events:
18        GetResource:
19          Type: Api
20          Properties:
21            Path: /resource/{resourceId}
22            Method: get
23  DynamoDBTable:
24    Type: AWS::Serverless::SimpleTable
25    PrimaryKey:
26      Name: id
27      Type: String
28    ProvisionedThroughput:
29      ReadCapacityUnits: 5
30      WriteCapacityUnits: 5
```

<https://github.com/awslabs/serverless-application-model>

PODERS



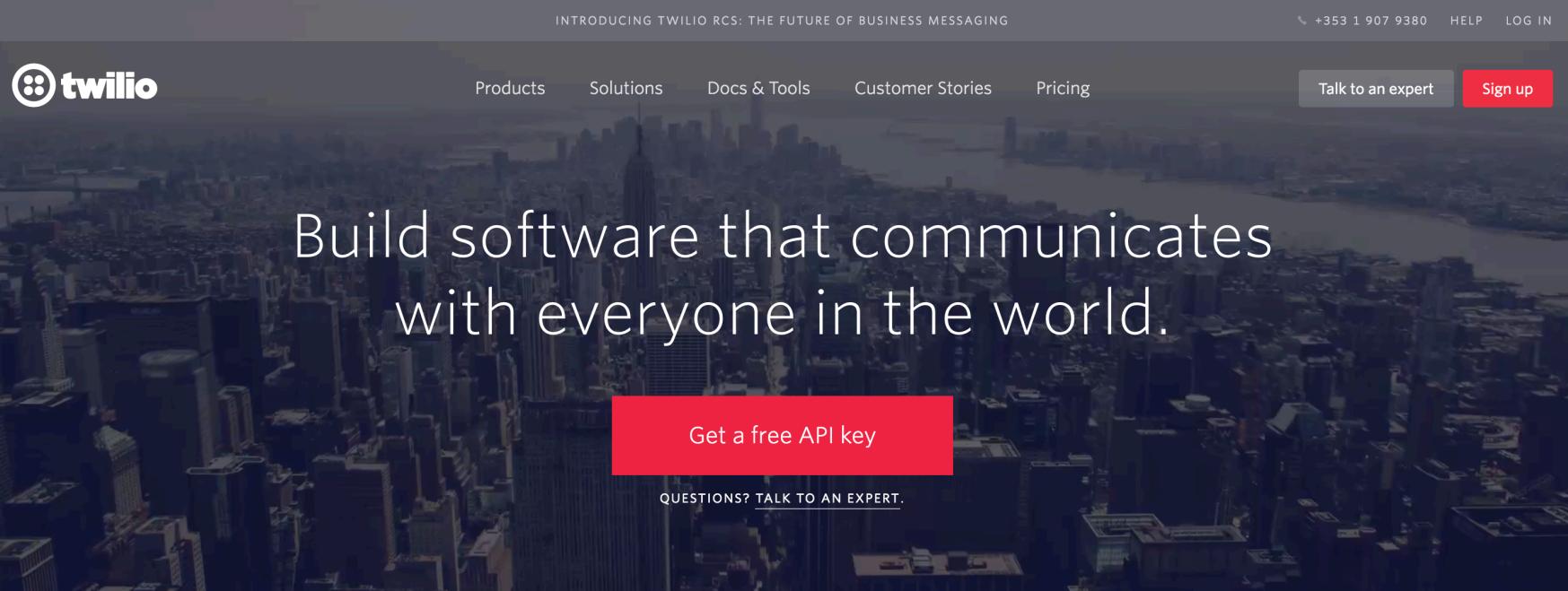
Step 2 - Implement receiver Lambda Lab



\

Twilio - Cloud Communication Platform





INTRODUCING TWILIO RCS: THE FUTURE OF BUSINESS MESSAGING

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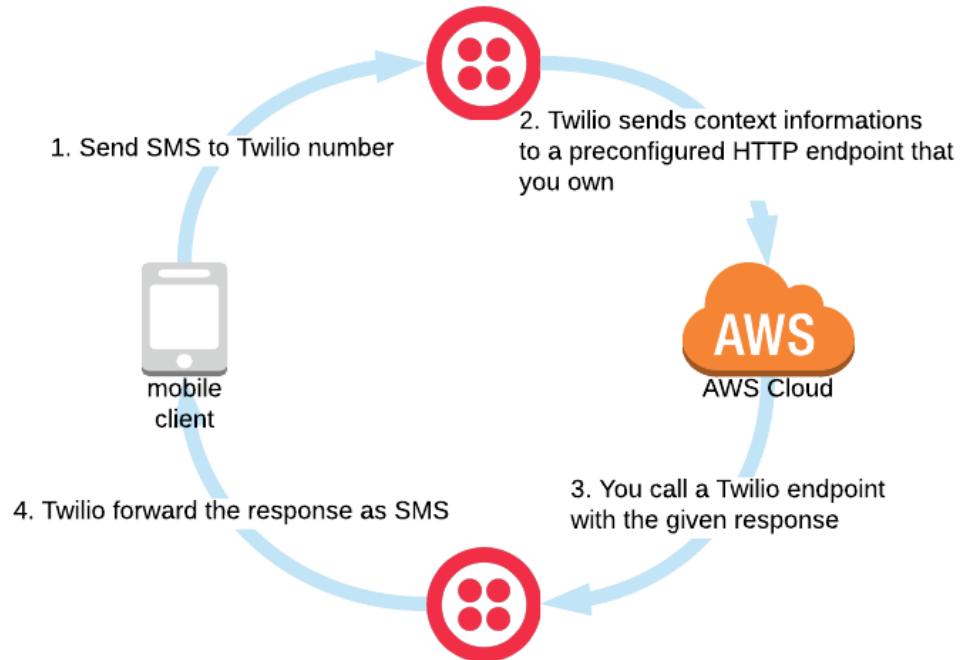
Build software that communicates with everyone in the world.

Get a free API key

QUESTIONS? TALK TO AN EXPERT.



\ Twilio - Callback

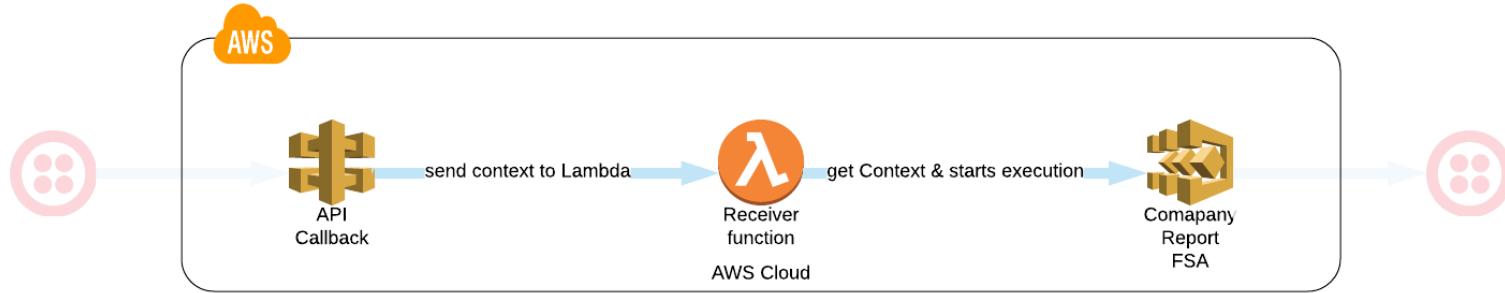


\ Demo and Lab

Step 2 bis - Configure Twilio Demo + Lab



\ Step Functions - API Gateway and Twilio



\ Demo and Lab

Step 3 - extend receiver Lambda Lab



\ Demo and Lab

Step 4 - Lambda send notification Lab



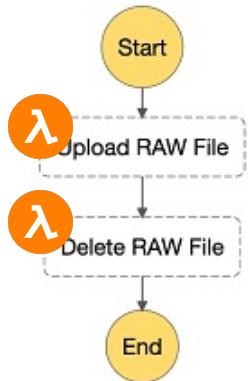
\

Step Functions

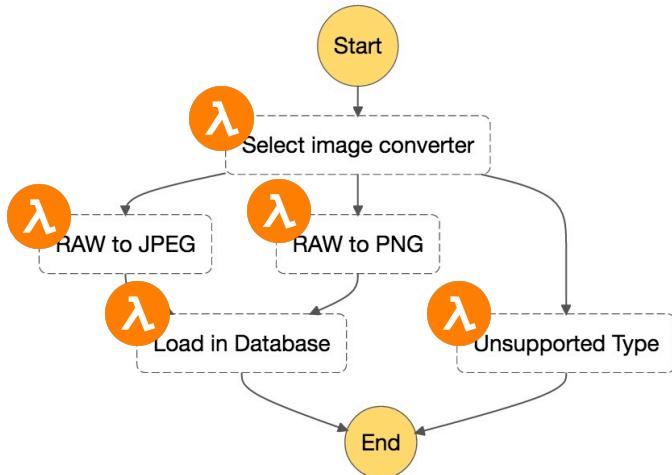


\ Step Functions

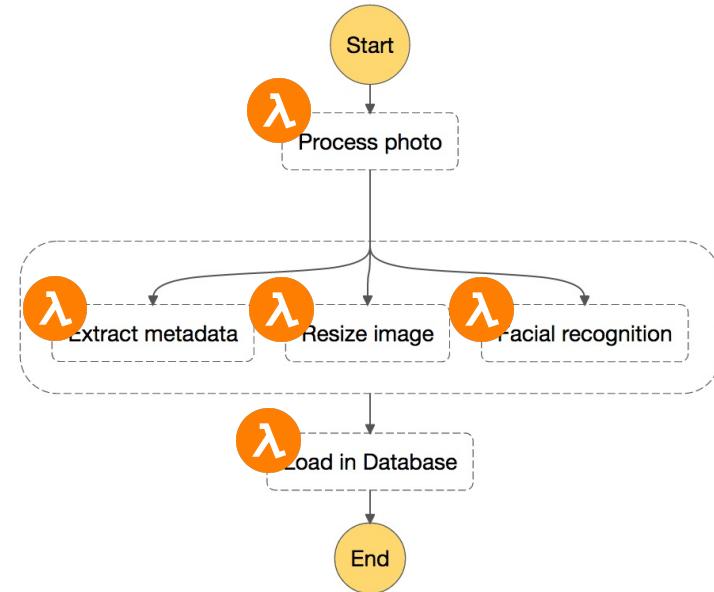
Sequential Steps



Branching Steps (Choice of Path)



Parallel Steps



\ Step Functions - States

States can perform a variety of functions in your state machine:

- Do some work in your state machine (**Task state**).
- Make a choice between branches of execution (**Choice state**)
- Stop an execution with a failure or success (**Fail** or **Succeed state**)
- Simply pass its input to its output or inject fixed data (**Pass state**)
- Provide a delay (**Wait state**)
- Begin parallel branches of execution (**Parallel state**)

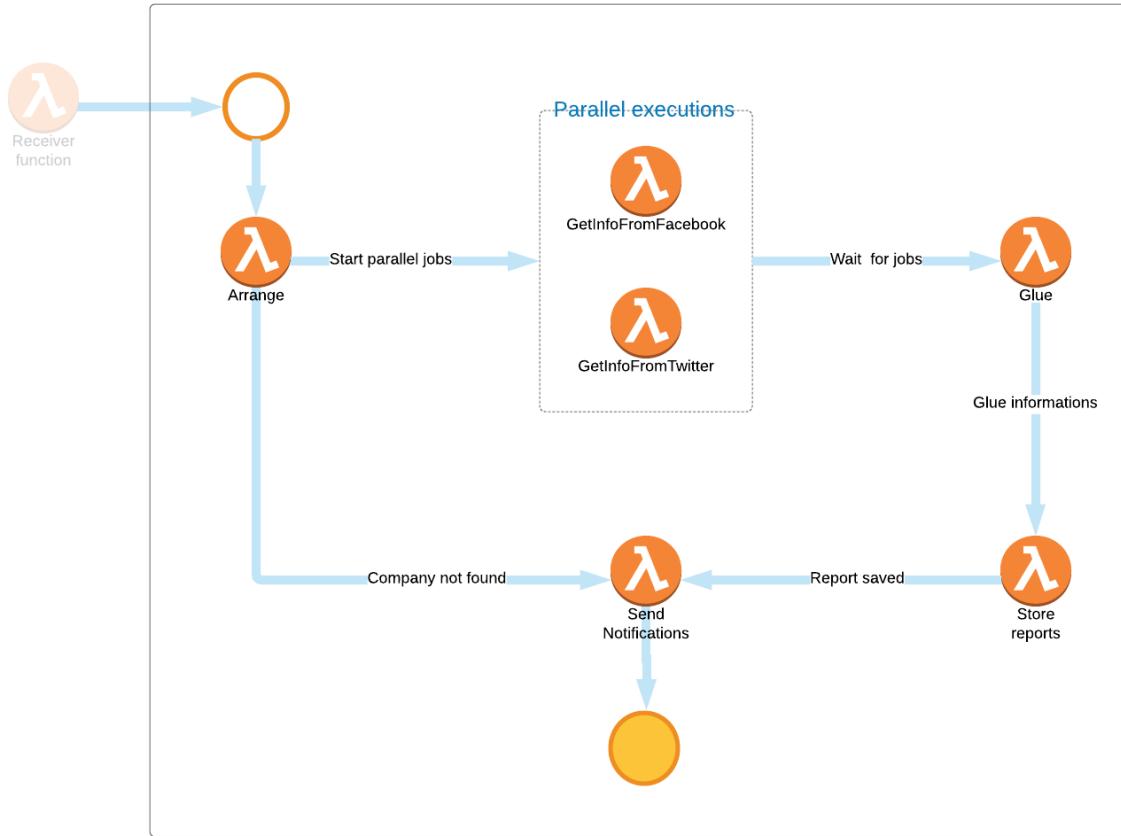


\ Step Functions - States - Hello World

```
"HelloWorld": {  
    "Type": "Task",  
    "Resource": "arn:aws:lambda:us-east-1:123456789012:function:HelloFunction",  
    "Next": "AfterHelloWorldState",  
    "Comment": "Run the HelloWorld Lambda function"  
}
```



\ Step functions



Step 5 - Implement Step Functions

Demo + Lab



Step 6 - Bind receiver with Step Functions

Lab



DynamoDB



\ Amazon DynamoDB

~~EXPLORERS~~

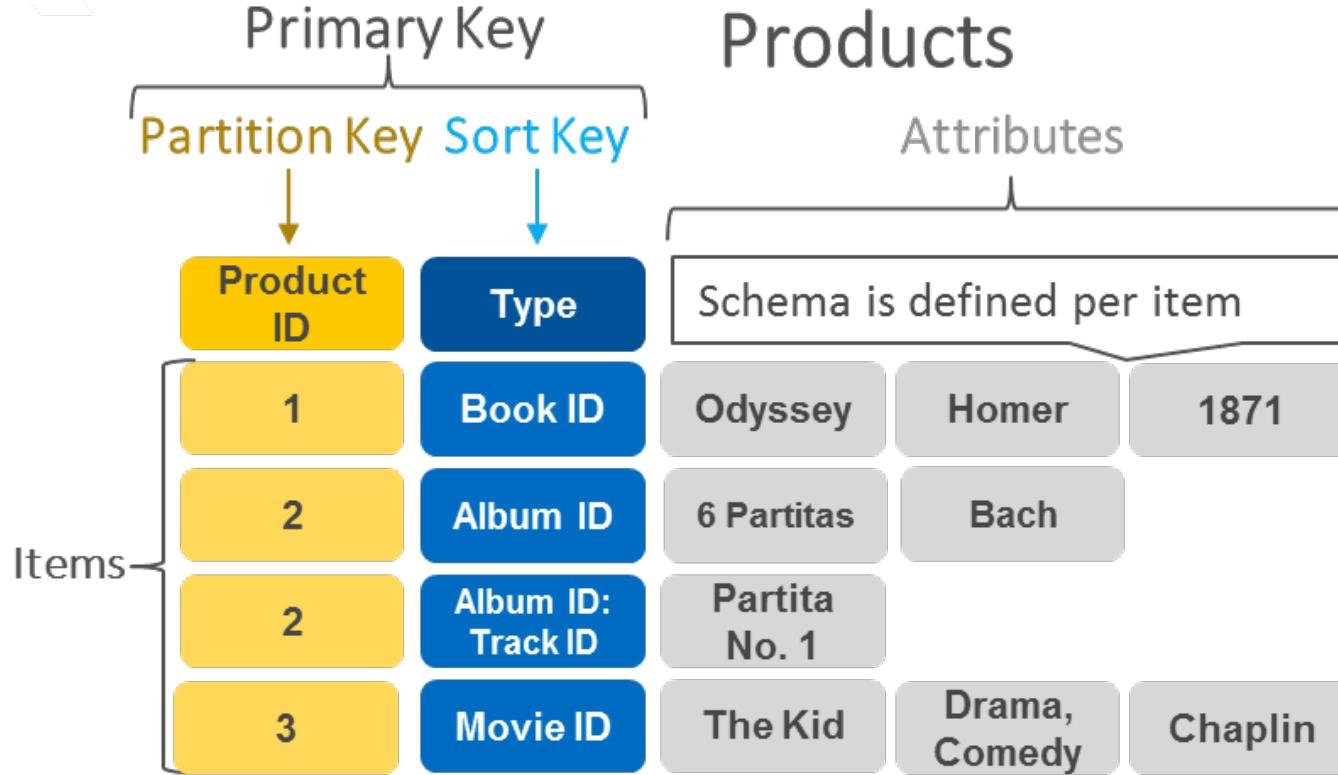
Fast and flexible NoSQL database service for all applications that need consistent, single-digit millisecond latency at any scale

- Highly Scalable and Fully Managed
- Document and key-value data structures
- DAX and Cross-region Replication (Re:Invent 2017)
- VPC Integration



\ Amazon DynamoDB

XPEPPERS



\ Amazon DynamoDB



DynamoDB supports two types of secondary indexes:

- **Global secondary index** — an index with a partition key and a sort key that can be different from those on the base table. A global secondary index is considered "global" because queries on the index can span all of the data in the base table, across all partitions.
- **Local secondary index** — an index that has the same partition key as the base table, but a different sort key. A local secondary index is "local" in the sense that every partition of a local secondary index is scoped to a base table partition that has the same partition key value.

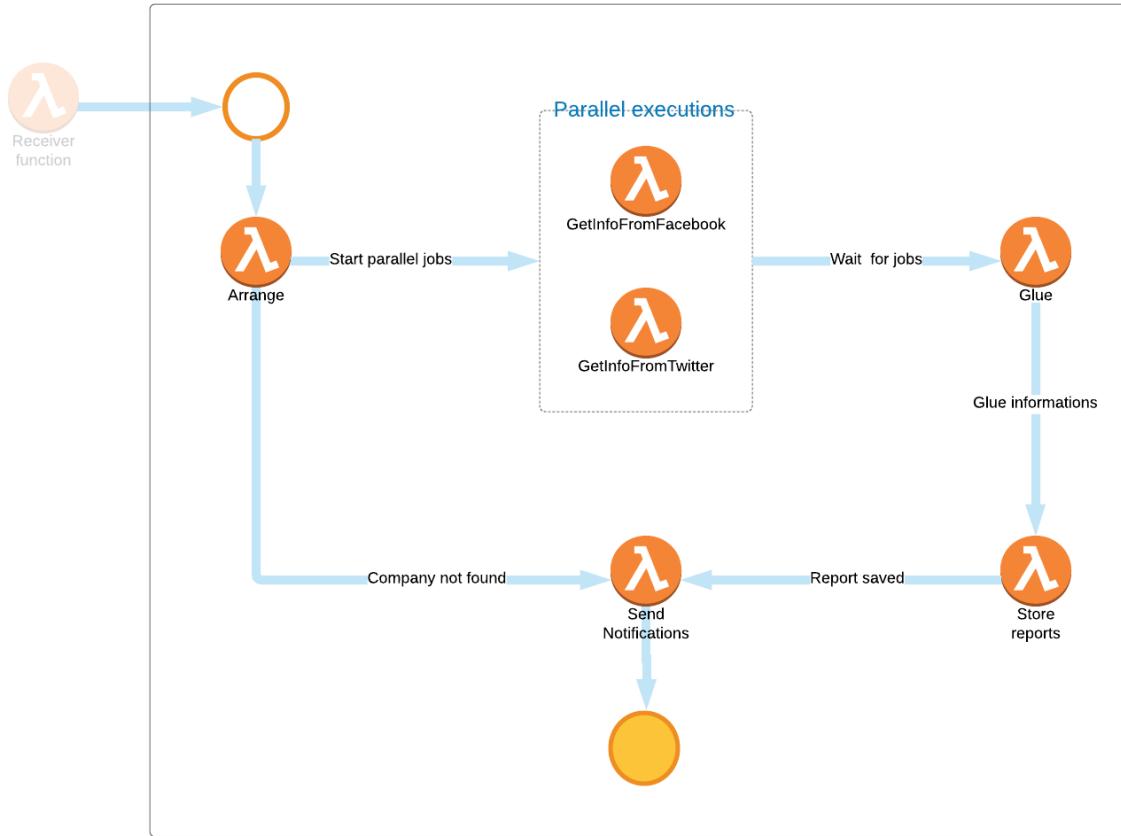


Step 7 - Extende SAM with Table Companies

Demo + Lab



\ Step functions



Step 8 - Setup “arrange” Lambda Lab



Step 9 - Put “arrange” Lambda in Step Functions Lab



\

Step 10 - Handle workflow error Lab



Step 11 - Implement parallel state Lab



Step 12 - Implement Glue state Lab



Step 13 - Implement report database

Lab



Step 14 - Setup *getReportById* API Lab



Authentication and Authorization



\ Authentication - Amazon Cognito



XPEPPERS

Cognito is a fully managed service for *sign-up/sign-in* functionality and can scale to hundreds of millions of users



\ Amazon Cognito



Amazon Cognito lets you easily add user sign-up and sign-in to your mobile and web apps.

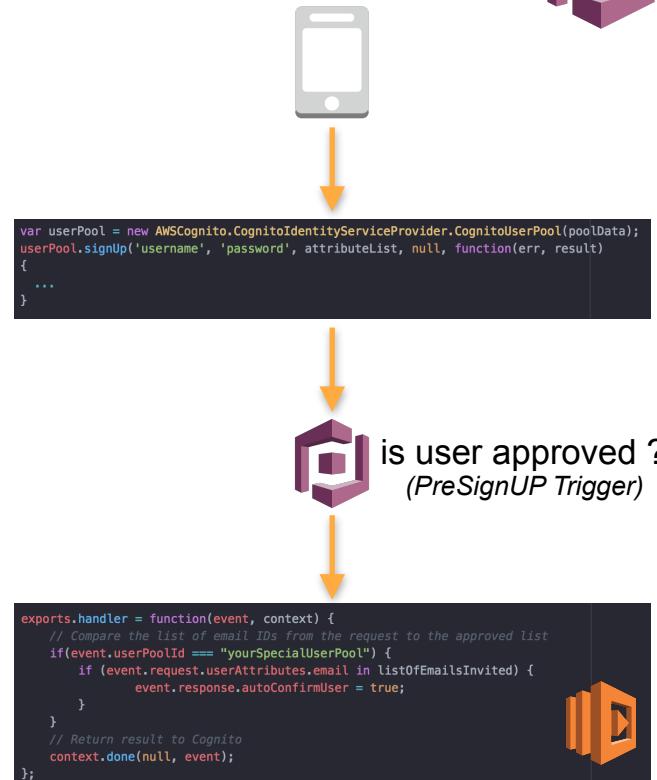
- Simple, secure, and low-cost authentication options
- Authenticate users on Facebook, Twitter, or Amazon
- Cognito Authentication Flow
- Custom Authentication Flow (AWS Lambda triggers)
- Enhanced security features, such as email and phone number verification, and multi-factor authentication



Amazon Cognito - Custom Authentication Flow



triggerSource value	Triggering event
PreSignUp_SignUp	Pre-sign up
PostConfirmation_ConfirmSignUp	Post confirmation
PreAuthentication_Authentication	Pre authentication
PostAuthentication_Authentication	Post authentication
CustomMessage_SignUp	Custom message – To send confirmation code post sign-up
CustomMessage_ResendCode	Custom message – To resend confirmation code to an existing user
CustomMessage_ForgotPassword	Custom message – To send confirmation code for Forgot Password request
CustomMessage_UpdateUserAttribute	Custom message – When a user's email or phone number is changed, this trigger sends a verification code automatically to the user. Cannot be used for other attributes.
CustomMessage_VerifyUserAttribute	Custom message – This trigger sends a verification code to the user when they manually request it for a new email or phone number.
CustomMessage_Authentication	Custom message – To send MFA code during authentication
DefineAuthChallenge_Authentication	Define Auth Challenge
CreateAuthChallenge_Authentication	Create Auth Challenge
VerifyAuthChallengeResponse_Authentication	Verify Auth Challenge Response



<http://docs.aws.amazon.com/cognito/latest/developerguide/cognito-user-identity-pools-working-with-aws-lambda-triggers.html>



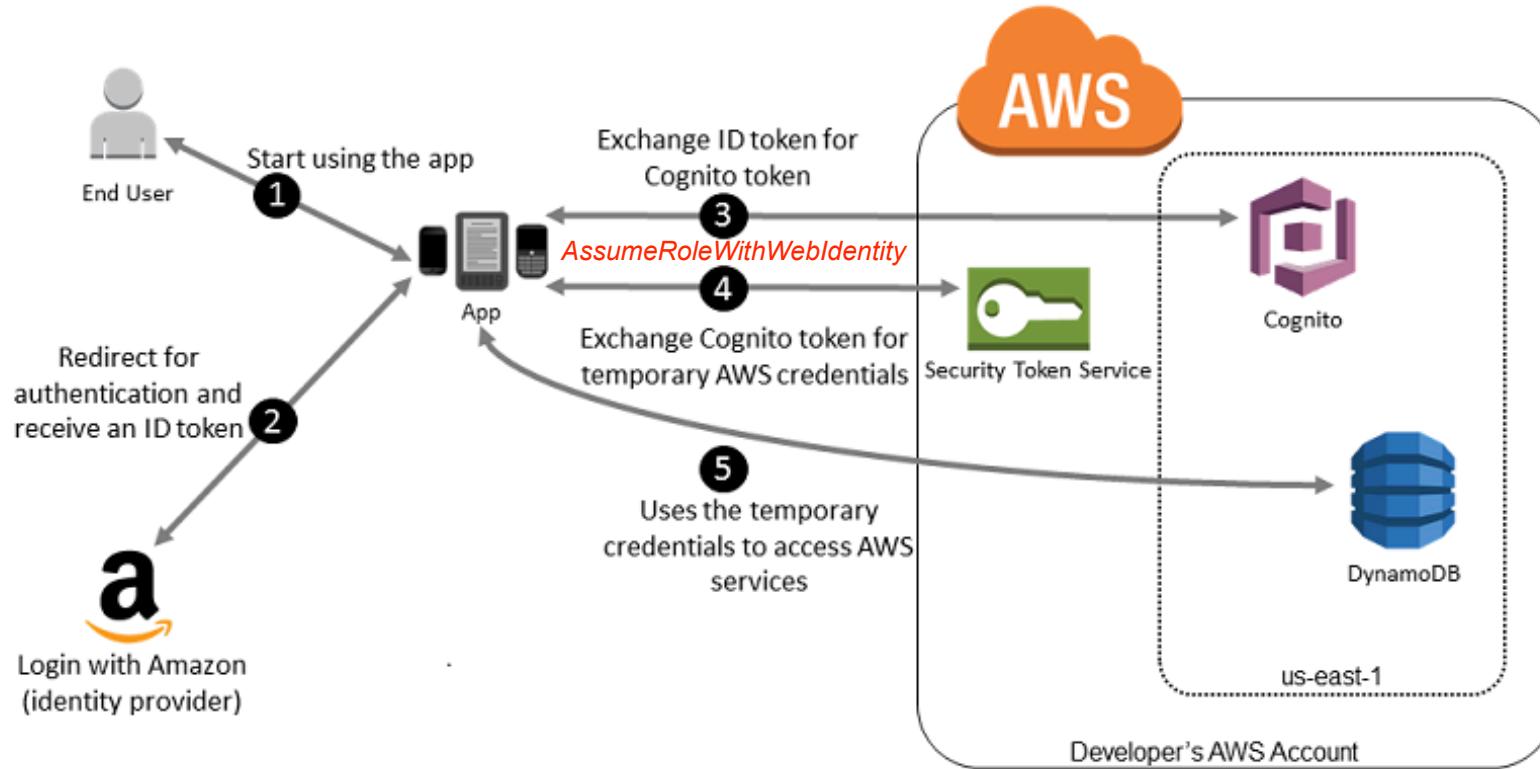
\ Authorization - IAM



- AWS **Identity and Access Management** (IAM) is a web service that helps you securely control access to AWS resources
 - Roles
 - Policies
- AWS **Security Token Services** (STS) is a web service that enables you to request temporary, limited-privilege credentials for IAM
 - Use action *AssumeRoleWithWebIdentity* for federation



\ IAM - Web Identity Federation



http://docs.aws.amazon.com/IAM/latest/UserGuide/id_roles_providers_oidc_cognito.html



\ Authorization - API Gateway Access Control



XPEPPERS

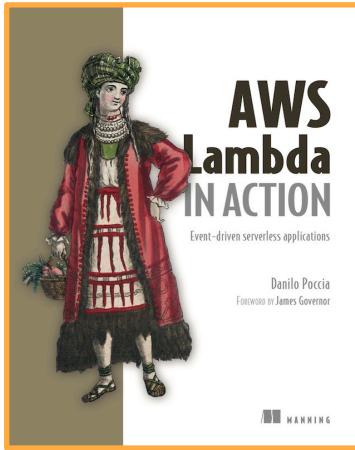
API Gateway supports multiple mechanisms of access control, including metering or tracking API uses by clients using API keys.

- Control Access for Managing an API
 - IAM Policy ("Action": "apigateway:*")
- Control Access for Invoking an API
 - IAM Policy ("Action": "execute-api:Invoke")
 - Custom Authorizers (Lambda functions)
 - Amazon Cognito User Pools

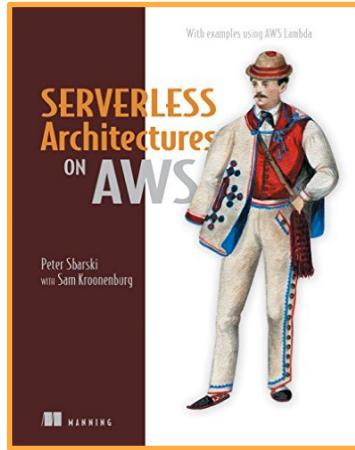


\ Reference

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<https://www.manning.com/books/aws-lambda-in-action>



<https://www.manning.com/books/serverless-architectures-on-aws>

<http://docs.aws.amazon.com/cognito/latest/developerguide/cognito-user-identity-pools-working-with-aws-lambda-triggers.html>

http://docs.aws.amazon.com/IAM/latest/UserGuide/id_roles_providers_oidc_cognito.html

<https://aws.amazon.com/compliance/services-in-scope/>

<https://github.com/awslabs/serverless-application-model>





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