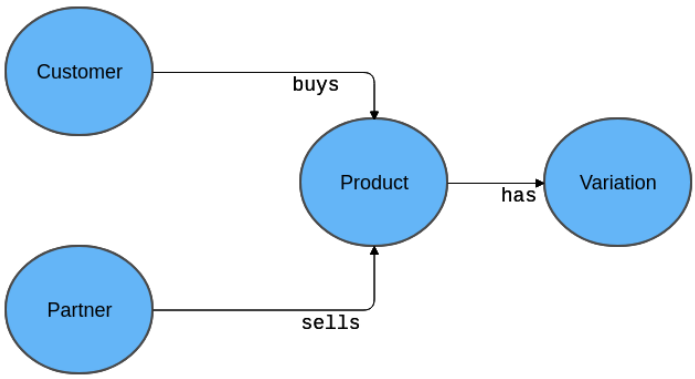
Implementing a GraphQL API using AWS AppSync

GraphQL is an exciting API specification that has been around since 2005 and offers a graph based way to build APIs.

Typically a graph defines a group of nodes that are related to each other and have certain attributes:



The graph based approach allows API consumers to navigate through the different nodes and gather only the information they need, as opposed to REST APIs where response bodies are already defined. This implies that GraphQL is helpful when data can be easily represented in a graph, otherwise it might not be the right solution.

Use case

The aim of this blog post is to demonstrate how to get started with GraphQL using AWS AppSync. Quoting AWS documentation:

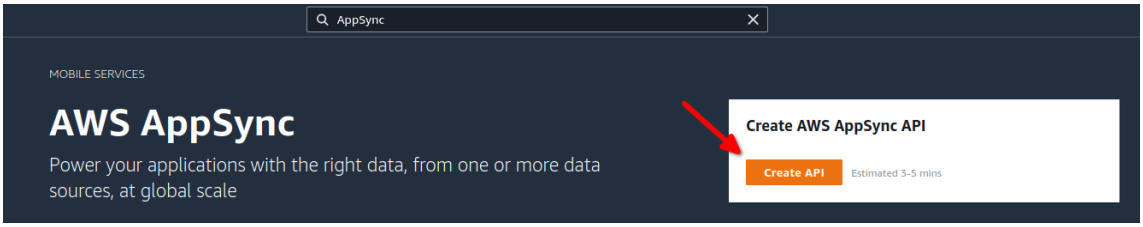
> *AWS AppSync is a fully managed service that makes it easy to develop GraphQL APIs by handling the heavy lifting of securely connecting to data sources like AWS DynamoDB, Lambda, and more.*

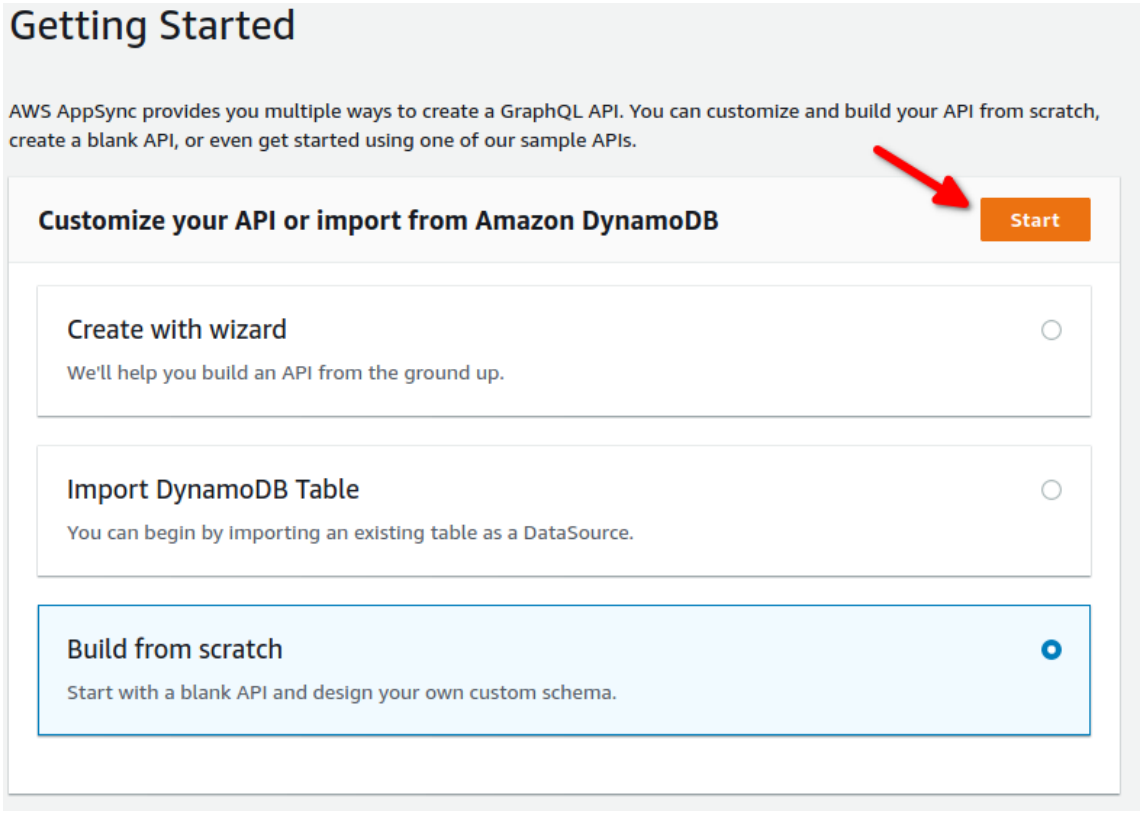
To show you how it works we will implement a small API that creates and queries customer objects stored in a DynamoDB table.

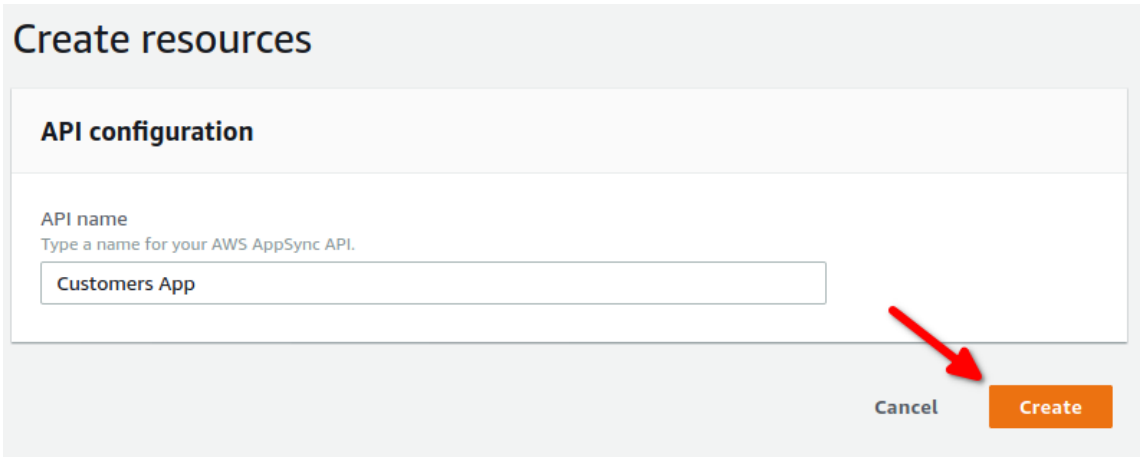
In our use case customers have a first name, last name and an age. We want to be able to create them with an automatically generated ID as well as query the whole collection of customers and single customers.

Implementation

First of all we need to create an AppSync App:

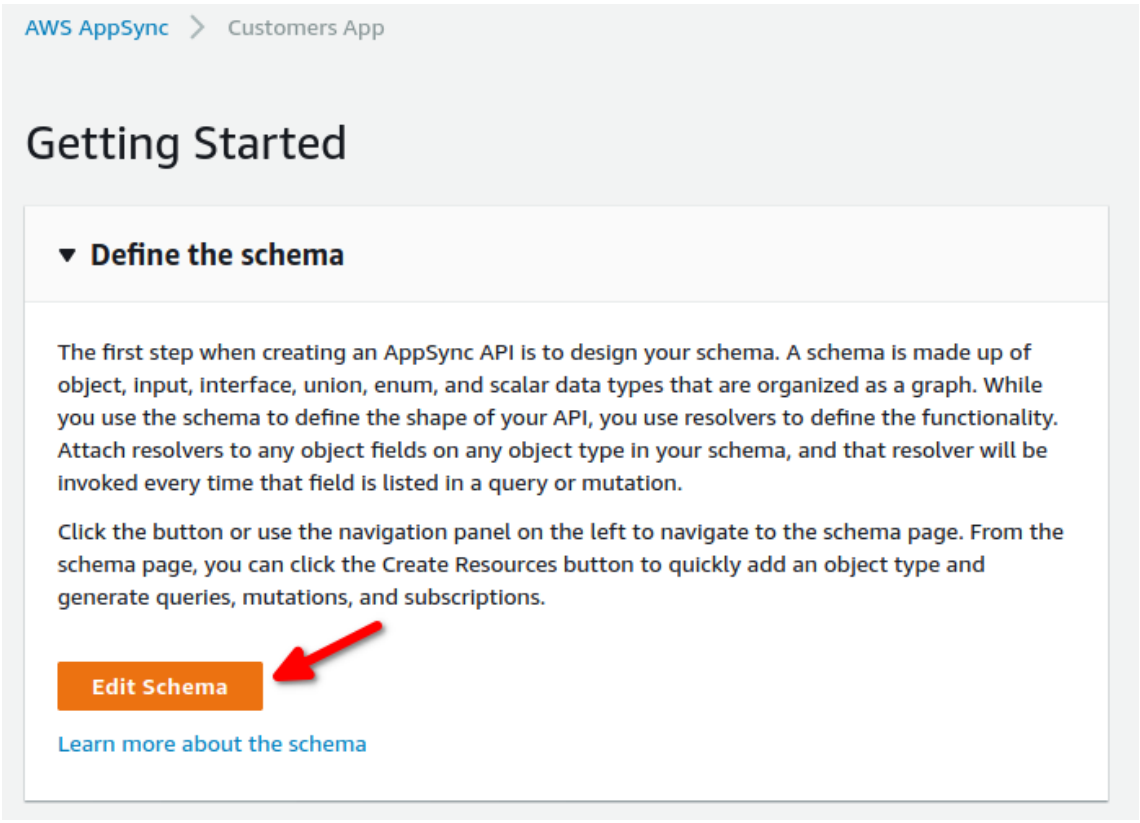

AppSync
MOBILE SERVICES
AWS AppSync
Power your applications with the right data, from one or more data sources, at global scale
Create AWS AppSync API
Create API
Estimated 3-5 mins


Getting Started
AWS AppSync provides you multiple ways to create a GraphQL API. You can customize and build your API from scratch, create a blank API, or even get started using one of our sample APIs.
Customize your API or import from Amazon DynamoDB
Start
Create with wizard
We'll help you build an API from the ground up.
Import DynamoDB Table
You can begin by importing an existing table as a DataSource.
Build from scratch
Start with a blank API and design your own custom schema.


Create resources
API configuration
API name
Type a name for your AWS AppSync API.
Customers App
Cancel
Create

Schema

Now you're ready to start defining the API's schema:



Let's start by creating a Customer:

```
type Customer {
    id: ID!
    firstName: String!
    lastName: String!
    age: Int
}
```

As you can see, `id`, `firstName` and `lastName` have an exclamation mark (!) following their scalar types - that means that they are required fields whereas `age` is not.

Then, we need to specify our queries:

```
type Query {
    getCustomers: [Customer]
    getCustomer(id: ID!): Customer
}
```

This means that `getCustomers` returns a collection of customers and `getCustomer` returns the customer matching the given id.

Creating a customer is done by using so called *Mutations*:

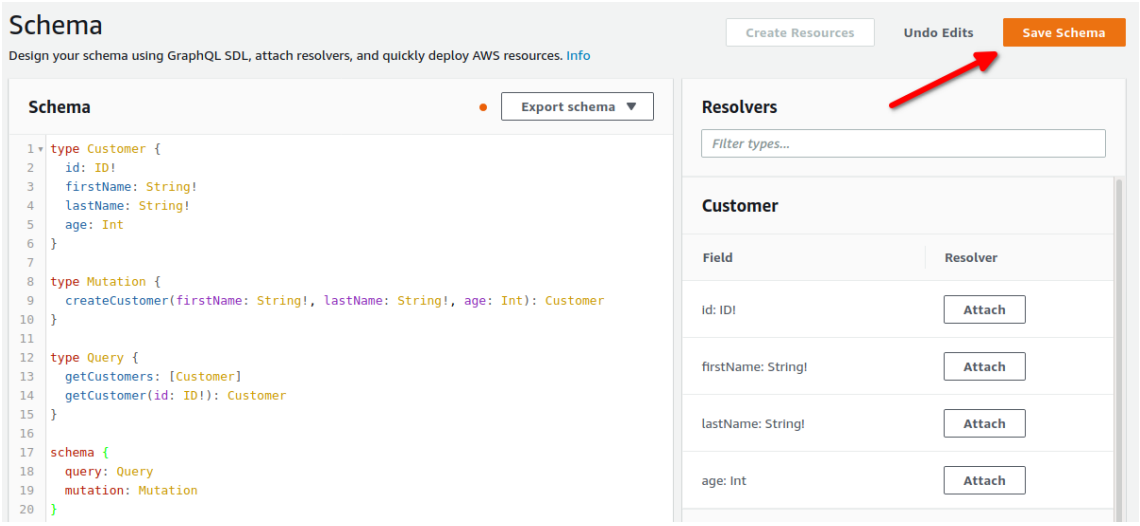
```
type Mutation {
    createCustomer(firstName: String!, lastName: String!, age: Int): Customer
}
```

Using the `createCustomer` Mutation with the mandatory parameters `firstName` and `lastName` and the optional parameter `age` we can create a new customer.

Finally, both queries and mutations need to be specified in the schema:

```
schema {
    query: Query
    mutation: Mutation
}
```

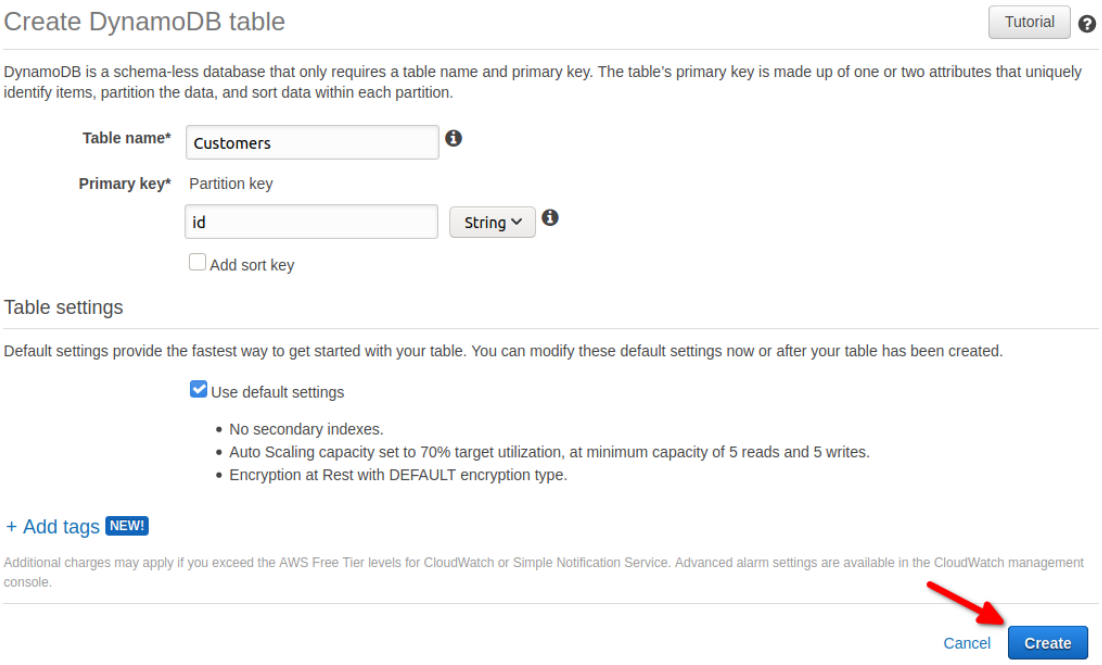
The complete schema should look like this:



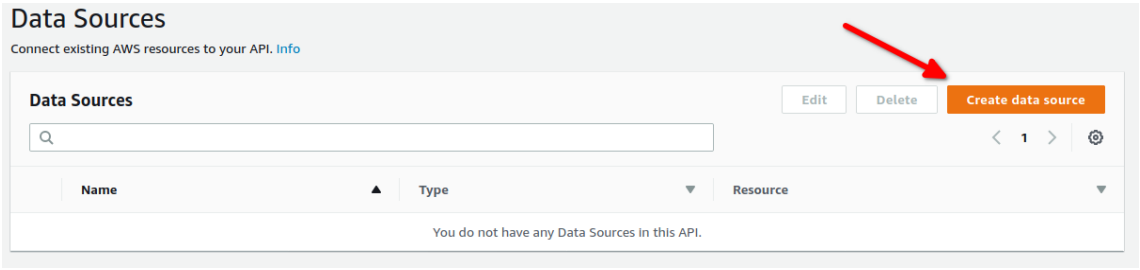
Data source

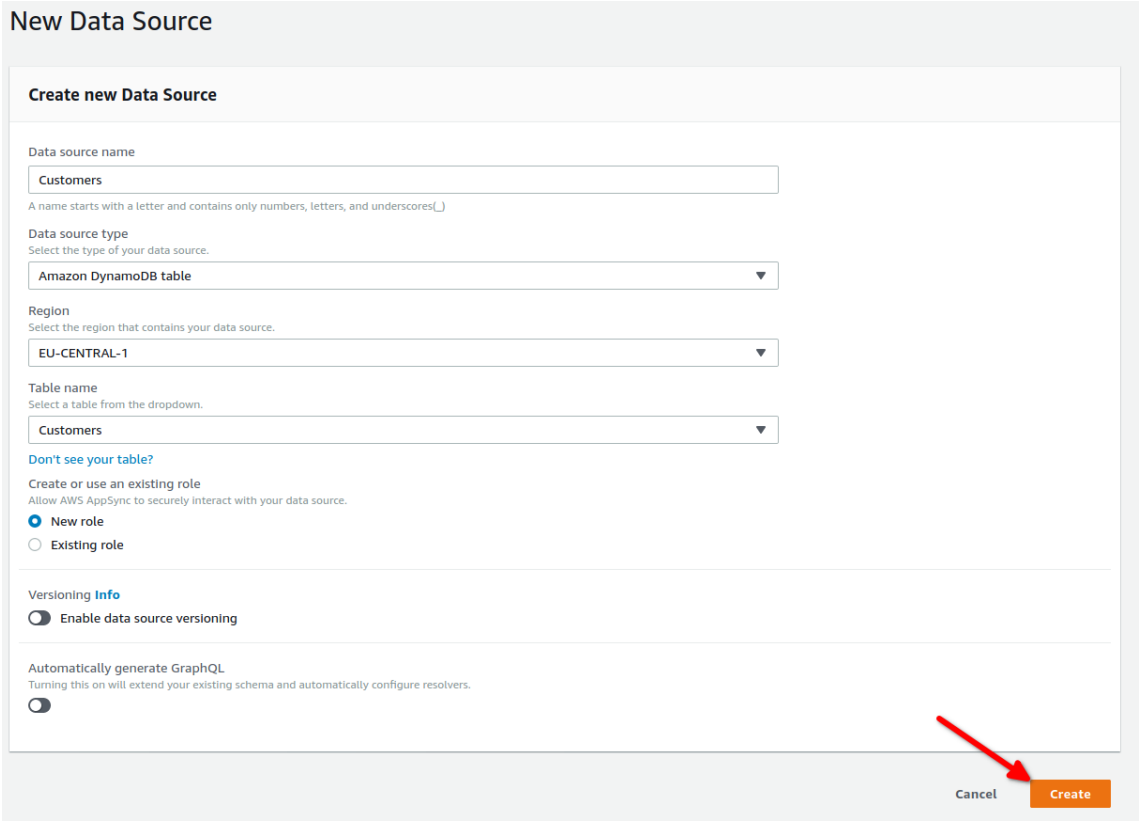
GraphQL itself does not provide any storage functionality. Data may come from different sources including traditional databases such as DynamoDB, RDS or ElasticSearch as well as Lambda or HTTP endpoints. We're going to use DynamoDB because it's a flexible easy to use database solution.

First we will create the `Customers` DynamoDB table:



Then we will add the corresponding data source to AWS App Sync:

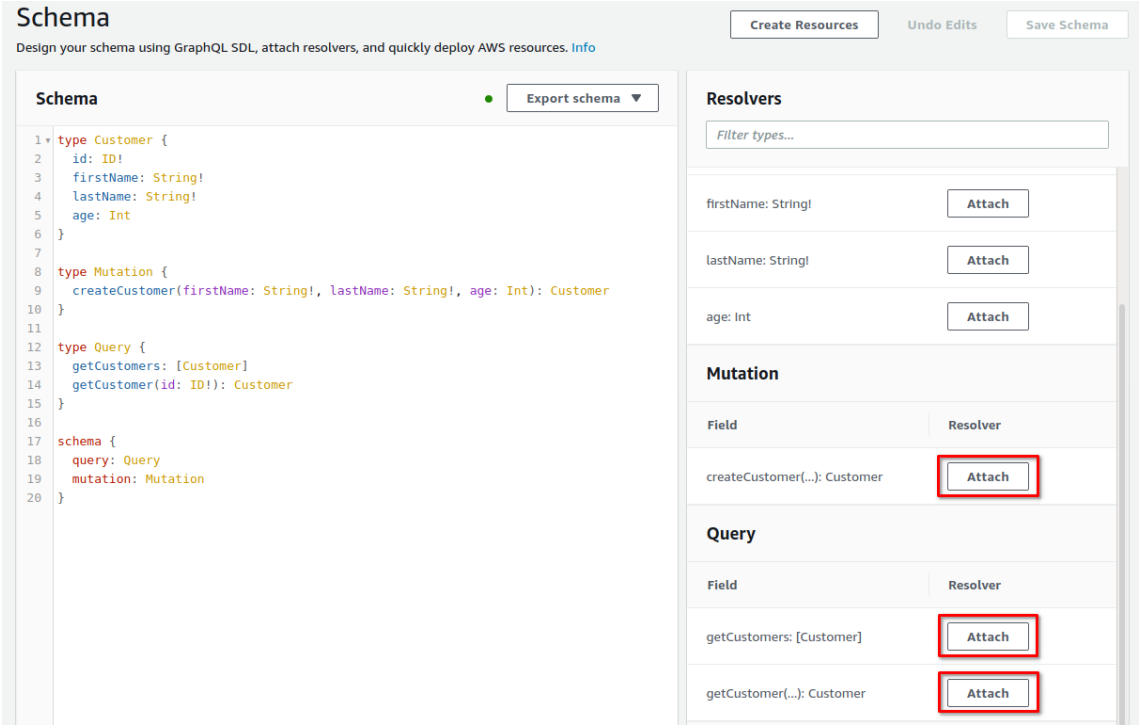




Resolvers

In order to tell AppSync how to interact with DynamoDB we need to define resolvers for each query or mutation in our schema.

Creating a resolver for Mutations or Queries can be done by clicking on *Attach* next to the method name.



Afterwards we need to select `Customers` as data source and configure the mapping templates as follows:

createCustomer

Request mapping template:

```
{
    "version" : "2017-02-28",
    "operation" : "PutItem",
    "key" : {
        "id": $util.dynamodb.toDynamoDBJson($util.autoId())
    },
    "attributeValues" : $util.dynamodb.toMapValuesJson($ctx.args)
}
```

Response mapping template:

```
$util.toJson($ctx.result)
```

This way a new customer will be created using the given parameters and automatically generated Id. As a response we'll receive the created customer.

getCustomers

Getting all customers can be done by scanning the DynamoDB table:

Request mapping template:

```
{
    "version" : "2017-02-28",
    "operation" : "Scan"
}
```

Response mapping template:

```
$util.toJson($ctx.result.items)
```

which will return the whole collection of customers.

getCustomer

Finally, this is how you can get a single customer:

Request mapping template:

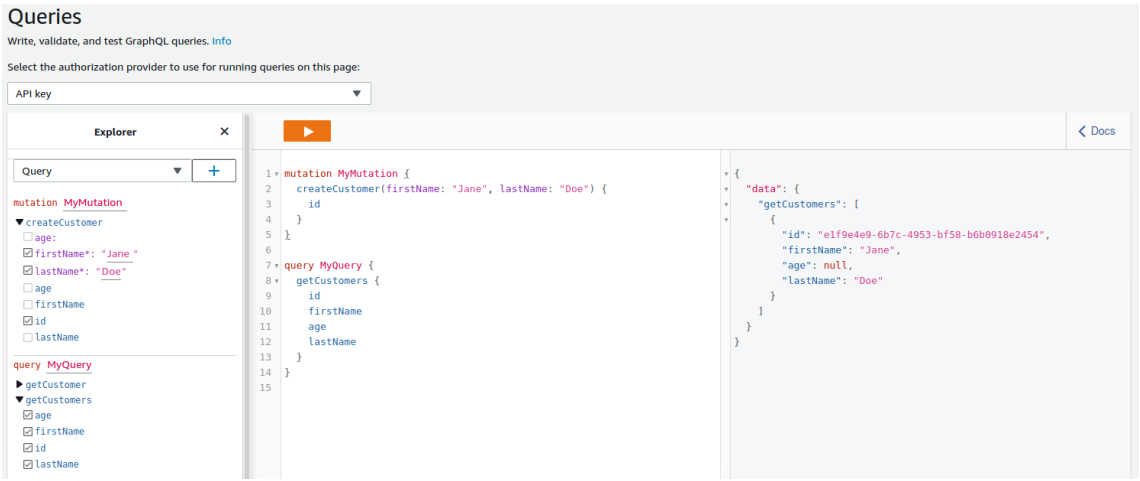
```
{
    "version": "2017-02-28",
    "operation": "GetItem",
    "key": {
        "id": $util.dynamodb.toDynamoDBJson($ctx.args.id)
    }
}
```

Response mapping template:

```
$util.toJson($ctx.result)
```

Testing the API

You can test your API by using the built-in Queries tool:



In this example we created a new customer called "Jane Doe" and afterwards we queried all customers.

Authorization

As you saw in the previous screenshot, we're using an API key that is created by AppSync by default to authorize our requests. However, you can choose among multiple authorization options including IAM and OpenID Connect.

cURL examples

Using the desired authorization method you can now use your API from anywhere you need, e.g. using cURL.

Creating a customer

```
curl -X POST \
  -H 'Content-Type: application/json' \
  -H 'x-api-key: <api_key>' \
  -d '{"query":"mutation {createCustomer(firstName: \"Jane\", lastName: \"Doe\")
{id}}"}' \
  https://<graphql_api>.appsync-api.eu-central-1.amazonaws.com/graphql
```

Retrieving all customers

```
curl -X POST \
  -H 'Content-Type: application/json' \
  -H 'x-api-key: <api_key>' \
  -d '{"query":"{getCustomers {id, firstName, lastName, age}}"}' \
  https://<graphql_api>.appsync-api.eu-central-1.amazonaws.com/graphql
```

Retrieve a customer

```
curl -X POST \
  -H 'Content-Type: application/json' \
  -H 'x-api-key: <api_key>' \
  -d '{"query":"{getCustomer(id: \"<customer_id>\") {id, firstName, lastName, age}}"}'
\
  https://<graphql_api>.appsync-api.eu-central-1.amazonaws.com/graphql
```

Conclusion

GraphQL excels when the data you want to expose can be well described as a graph and offers advantages over REST APIs such as more flexibility for consumers to retrieve exactly the information they need.

It's a promising fast growing technology which is already widely used by big tech players such as GitHub, Twitter or Facebook.

As we have seen in this article, there's already good tooling available in the market to deliver and consume GraphQL APIs.

If you want to see a more detailed terraform automated way to implement what is described here you are welcome to check out this GitHub repository: aws-graphql-demo.