# Lab 2: SJSU Movie Database using MongoDB

Guided By : Professor Simon Shim

Sadakhya Narnur
Masters in Data Analytics
San Jose State University
California
sadakhya.narnur@sjsu.edu

Nikitha Bramadi
Masters in Data Analytics
San Jose State University
California
nikitha.bramadi@sjsu.edu

Pallavi Jain
Masters in Data Analytics
San Jose State University
California
pallaviamrutkumar.jain@sjsu.edu

**Abstract— SJSU Movie Database is implemented using MongoDB . The system is modularized into Movies, Users and Service Request modules. Each of which are organized into collections and queried. The Users collection follows an embedded document structure with references to the Movies and Service Request collections.**

**Keywords—Collection, Documents, Schema, ObjectId, Aggregation.**

**DatasetURL: https://www.kaggle.com/PromptCloudHQ/imdb**

## I. Problem Statement

The IMDb movie database serves as a useful repository of movie information for our application system. In order to create a low latency solution for viewing movies, creating users and profiles and providing support, there is a need for efficient document design.

## II. Solution Requirements

The goal of our application would be to present users with access to the movies for a monthly subscription of 19.95 and allow 5 members access. Users will be logged in to the application and presented with features like adding or deleting profiles, watching movies, adding to their movie list, access watch history, view monthly bills and support with any account related issues.

## III. Conceptual Database Design

### Schema Design

In MongoDB there are two different kinds of schema representations. One being the **Embedding** and the other being **Referencing** between the collections. Modeling the data depends on the application's data access patterns. We should structure the data to match the ways that our application queries and updates it. Every application has unique needs and requirements, so the schema design should reflect the needs of that particular application.

Here we will discuss the needs of our application from 3 different point of views:

1. A **registered SJSU movie DB user** should be able to perform the following activities:
    - Access movies hosted by the SJSU movie database
    - Create upto 5 profiles under one registered user. Each profile can independently choose to stream their own movies
    - Each profile can create their own list called my_list.
    - A user pays the monthly bills for the access to continue. And choose to discontinue if needed. User can choose their own payment method
    - Create an SR in order for any kind of request for help from the database owners
2. The **service agent** who is also the owner of the database, takes the ownership of the following dependent requirements:
    - When a user profile raises a service request, make sure that the complaint is assigned to an available service agent. At the same time take necessary actions towards that request
3. The application itself will be taking care of the following:
    - Each user profile history will be recorded
    - Bill will be generated for every month
    - Tracks the user registration date
    - Tracks the number of profiles created

For the easy and efficient outcome of these duties mentioned above we have used a combination of both Embedded and Referencing.

All the required operations in the application are done efficiently by our hierarchical approach to the system. The application  is constructed into an embedded collection and in 2 cases references have been added to the rest of the collections.

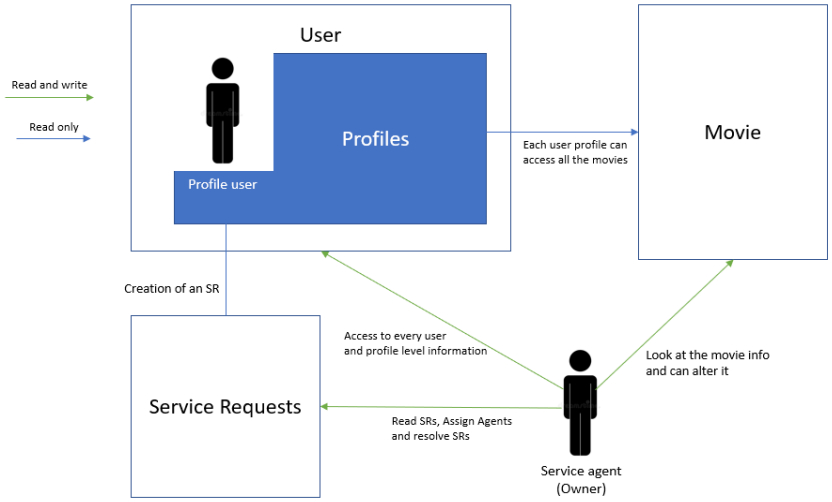



Fig 1. System design in terms of collections

**B. Conceptual Design**

Keeping the requirements in mind, we have created the following 3 collections.

1. users
2. movie
3. service_requests

| Collection | Schema of the data |
|---|---|
| users | **Embedding** profiles and their activities, **References** the movie collection and **References** the service_requests |
| movie | **Embeds** all the information including the movie actors and genres |
| service_requests | **Embeds** all the information related to service requests |

## IV. Document Structure

The core functionalities of the application are divided among the three collections.

```
[Atlas atlas-100xuq-shard-0 [primary] lab2> show collections;
movies
service_requests
users
```

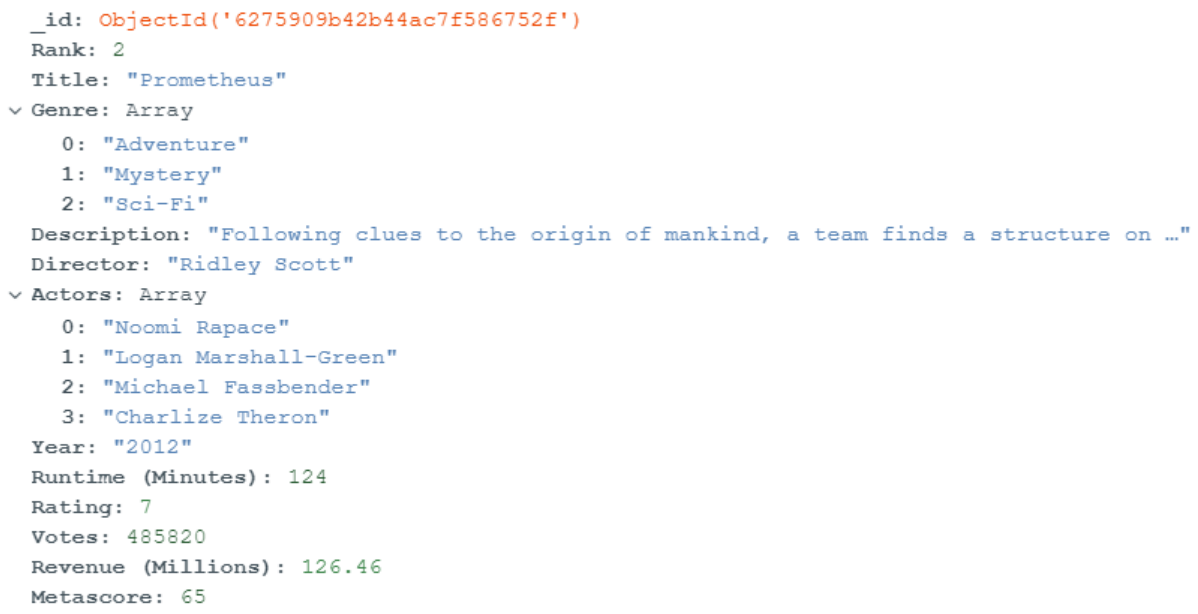
**Movies Collection :**

- It is the base collection that has references from the User collection.
- This has complete data of the movies which is used by another collection. It has fields of different data types including Arrays.
- New movie records can be added and all the details for movies are available, which can be updated and deleted by the admin.
- Genre and Actors are the fields that are arrays of strings.

| Field | Datatype |
|---|---|
| _id | ObjectId |
| imdb_rank | int |
| title | String |
| genre | Array[String] |

| | |
|---|---|
| actors | Array[String] |
| year | Int |
| runtime (minutes) | Int |
| rating | Float |
| votes | Int |
| revenue (millions) | float |
| metascore | int |

The sample Movie document structure is as follows:




**User Collection:**

- This collection begins with the registration of a new user which inserts a new document into the collection.
- This collection includes all the details of a user, registration date, profiles count, statusand etc.
- Profiles is an embedded document that has the profile details associated with a user account.
- Profile_history and Profile_my_list are nested documents within the Profiles embedded document. They have references to the Movies collection.
- Complaints is an array of ObjectId where it has references to the Service_requests collection.

| Fields | Datatype |
|---|---|

| | |
|---|---|
| _id | ObjectId |
| emailid | String |
| phoneno | String |
| name | String |
| dob | Date |
| password | String |
| account_create_date | date |
| no_of_profiles | Int |
| preferred_language | String |
| profiles | Array[Struct] |
| profiles.profile_name | String |
| profiles.service_id | Int |
| profiles.profile_history | Array[Struct] |
| profiles.profile_history.view_timestamp | Date |
| profiles.profile_history.imdb_rank | Int |
| profiles.profile_history.movie_id | ObjectId |
| profiles.profile_my_list | Array[Struct] |
| profiles.profile_my_list.imdb_rank | Int |
| profiles.complaints | Array[ObjectId] |
| profiles.profile_my_list.movie_id | ObjectId |
| billing_date | date |
| status | String |
| payment_method | String |

Sample User document structure as follows:

```
_id: ObjectId("627058250e2a53c322e3b170")
emailid: "5BzoRFTP6tdHfs@hotmail.com"
phoneno: "512-974-6533"
name: "michael smith"
dob: "1917-11-19"
password: "319fat5"
account_create_date: "2020-10-01"
no_of_profiles: "1"
preferred_language: "Hindi"
profiles: Array
  0: Object
    profile_name: "EON"
    service_id: "400005"
    profile_history: Array
      0: Object
        view_timestamp: "2021-07-29 15:16:17"
        imdb_rank: "67"
        movie_id: ObjectId("62701cfc0e2a53c322e3a1d4")
    profile_my_list: Array
      0: Object
        imdb_rank: "4"
        movie_id: ObjectId("62701cfc0e2a53c322e3a195")
    complaints: Array
      0: Object
        _id: ObjectId("627057a10e2a53c322e3b0e7")
      1: Object
billing_date: "2020-11-01"
status: "Active"
payment_method: "DEBIT/CREDIT"
```


**Service_Requests Collection:**

- A profile user raises a service request describing the problem.
- This consists of all the details of a service ticket raised like the description, severity, agent assigned, date of complaint and profiles' service id.
- Any new Service request added will be referenced from the User.profiles.complaint.

| Field | Datatype |
|---|---|
| _id | ObjectId |
| complaint_severity | String |
| service_agent_name | String |
| service_id | Int |
| date_of_complaint | Date |
| complaint_description | String |
| emailid | String |

Sample service_request document structure:

```
_id: ObjectId("627057a10e2a53c322e3b0e2")
complaint_severity: "m"
service_agent_name: "Sandeshn"
service_id: "400000"
date_of_complaint: "2022-01-02"
complaint_description: "Buffering"
emailid: "OoececBAnkd@yahoo.com"
```


# V. DENORMALIZATION

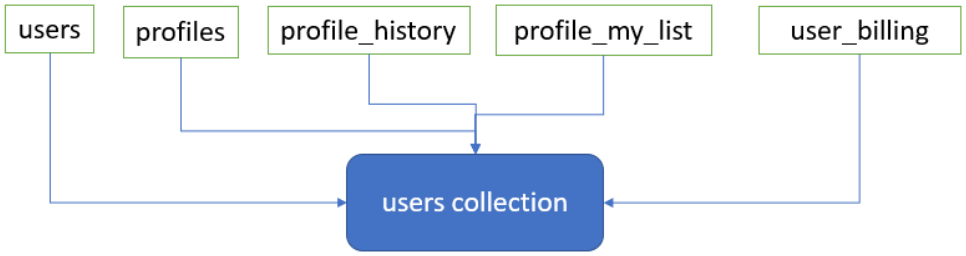
The major consideration that needs to be taken while designing our schema is the weightage of reads to update. It is always a good practice to denormalize data that will be often read and less frequently updated.

We have taken a collection design that optimizes the reads by avoiding joins and performing a $lookup as much as possible. To avoid join we choose the process of embedding which results in a denormalized structure of the collection.

We can showcase our denormalization process in reference to the database we have created in the MySQL database.

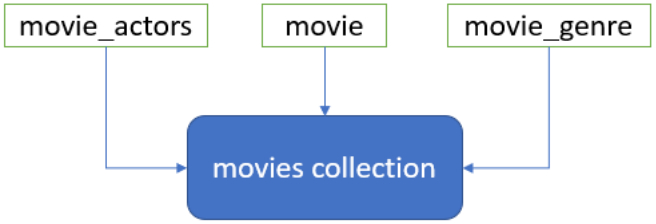
**User Collection Denormalization:**

All the Profile details are embedded into the User document and the watch history of a profile, the wishlist(my_list) for a profile can be embedded or nested within the Profiles. This led to the denormalizing of fields and merging into a single collection.



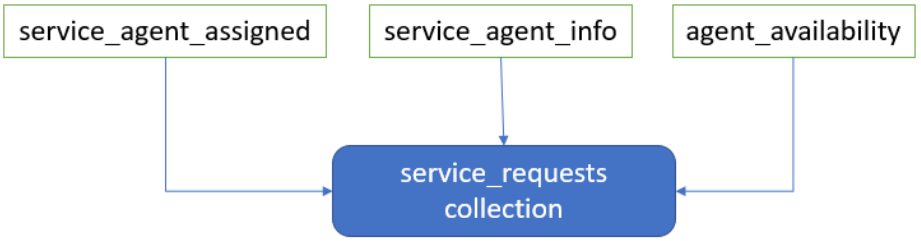

**Movies Collection Denormalization:**

Actors and Genres are multi value fields that need to be normalized for a relational structure. However since there is a flexibility to add these fields as an array of strings they are denormalized and embedded into the same Movie collection which alleviates the joining requirement.




**Service Requests Collection Denormalization:**

All the details that are normalized into multiple tables for a relational database can be now merged into a single document that enables Read operations to be done in a very less execution time.




## VI. FEATURES

The user of the application will have access to the following features:

- **New user registers into the application** : This is a feature that is implemented through the insertOne query for adding the user document to the User collection. All the required fields will be added to the user document.

  db.users.insertOne({"emailid": "new_user@gmail.com","phoneno": "322-370-1228","name": "Ratan Harry","dob": new Date("2001-11-12"),"password": "qwerty12#", "account_create_date": new Date("2010-10-07"),"no_of_profiles": 0,"preferred_language": "English","profiles": [],"billing_date": new Date("2022-04-03"), "status": "Active","payment_method":"DEBIT/CREDIT"})

```
{
  acknowledged: true,
  insertedId: ObjectId("6273091e95942a06cc811d90")
}
```

```
_id: ObjectId('62755e474fd65fe5ef9f6f88')
emailid: "new_user@gmail.com"
phoneno: "322-370-1228"
name: "Ratan Harry"
dob: 2001-11-12T00:00:00.000+00:00
password: "qwerty12#"
account_create_date: 2010-10-07T00:00:00.000+00:00
no_of_profiles: 0
preferred_language: "English"
> profiles: Array
billing_date: 2022-04-03T00:00:00.000+00:00
status: "Active"
payment_method: "DEBIT/CREDIT"
```


- **User adds a profile into his account:** A user can add up to 5 profiles to his accounts and the application runs an update on no of profiles to increment the count when new profile is added, which will be achieved as follows:

    - db.users.updateOne({"emailid":"new_user@gmail.com"},{ "$push": {"profiles": {"profile_name": "Profile1","service_id": 80012, "profile_history": [],"profile_my_list": [],"complaints": []}}})


```
{
  acknowledged: true,
  insertedId: null,
  matchedCount: 1,
  modifiedCount: 1,
  upsertedCount: 0
}
```


**Updating the no_of_profiles:**

- db.users.updateOne({ "emailid": "new_user@gmail.com" },{ "$inc": { "no_of_profiles": 1 } })


```
{
  acknowledged: true,
  insertedId: null,
  matchedCount: 1,
  modifiedCount: 1,
  upsertedCount: 0
}
```

```
_id: ObjectId('62755e474fd65fe5ef9f6f88')
emailid: "new_user@gmail.com"
phoneno: "322-370-1228"
name: "Ratan Harry"
dob: 2001-11-12T00:00:00.000+00:00
password: "qwerty12#"
account_create_date: 2010-10-07T00:00:00.000+00:00
no_of_profiles: 1
preferred_language: "English"
profiles: Array
  0: Object
      profile_name: "Profile1"
      service_id: 80012
    > profile_history: Array
    > profile_my_list: Array
    > complaints: Array
billing_date: 2022-04-03T00:00:00.000+00:00
status: "Active"
payment_method: "DEBIT/CREDIT"
```

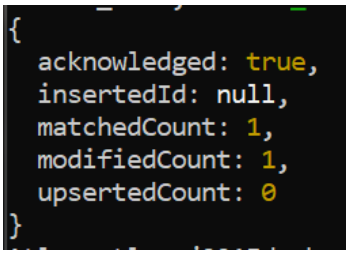

- **Adding a movie to Profile watching list:** A movie can be added to profiles' my list that can be later used to list the movie wishlist. The movie name is looked up in the movies collection and the Reference ObjectId is stored in the users document.
    - var movie = db.movies.findOne({"Title":"Guardians of the Galaxy"})
    - var movieId = movie._id
    - var movie_rank = movie.Rank
    - db.users.updateOne({ "profiles.profile_name" : "Profile1", "emailid":"new_user@gmail.com"}, { "$push": { "profiles.$.profile_my_list": { "imdb_rank": movie_rank, "movie_id":movieId}}})


```
{
  acknowledged: true,
  insertedId: null,
  matchedCount: 1,
  modifiedCount: 1,
  upsertedCount: 0
}
```

```
_id: ObjectId('62755e474fd65fe5ef9f6f88')
emailid: "new_user@gmail.com"
phoneno: "322-370-1228"
name: "Ratan Harry"
dob: 2001-11-12T00:00:00.000+00:00
password: "qwerty12#"
account_create_date: 2010-10-07T00:00:00.000+00:00
no_of_profiles: 2
preferred_language: "English"
profiles: Array
  0: Object
      profile_name: "Profile1"
      service_id: 80012
    > profile_history: Array
    > profile_my_list: Array
        0: Object
            imdb_rank: 1
            movie_id: ObjectId('627564ef42b44ac7f586713e')
    > complaints: Array
billing_date: 2022-04-03T00:00:00.000+00:00
status: "Active"
payment_method: "DEBIT/CREDIT"
```


- **Adding a movie to Profiles' history:** Everytime a profile user watches a movie it is added into their Profile_history with the watched timestamp.
    - var movie = db.movies.findOne({"Title":"Prometheus"})
    - var movieId = movie._id
    - var movie_rank = movie.Rank

  db.users.updateOne({ "profiles.profile_name" : "Profile1", "emailid":"new_user@gmail.com"}, { "$push": { "profiles.$.profile_history": { "view_timestamp":new Date(Date.now()), "imdb_rank": movie_rank, "movie_id":movieId}}})



```
_id: ObjectId('62755e474fd65fe5ef9f6f88')
emailid: "new_user@gmail.com"
phoneno: "322-370-1228"
name: "Ratan Harry"
dob: 2001-11-12T00:00:00.000+00:00
password: "qwerty12#"
account_create_date: 2010-10-07T00:00:00.000+00:00
no_of_profiles: 2
preferred_language: "English"
profiles: Array
  0: Object
    profile_name: "Profile1"
    service_id: 80012
    profile_history: Array
      0: Object
        view_timestamp: 2022-05-06T18:41:28.011+00:00
        imdb_rank: 1
        movie_id: ObjectId('627564ef42b44ac7f586713e')
    profile_my_list: Array
      0: Object
        imdb_rank: 1
        movie_id: ObjectId('627564ef42b44ac7f586713e')
    complaints: Array
billing_date: 2022-04-03T00:00:00.000+00:00
```


- **Deleting a Profile:** A user can delete a profile from their account which is done as follows:
  - db.users.update({"emailid":"0omsUvRjUHZlzEPT@msn.com"},{$pull:{"profiles":{"profile_name":"sush"}}})


```
{
  acknowledged: true,
  insertedId: null,
  matchedCount: 1,
  modifiedCount: 1,
  upsertedCount: 0
}
```


**Updating the no_of_profiles:**

- db.users.updateOne({ "emailid": "0omsUvRjUHZlzEPT@msn.com" },{ "$inc": { "no_of_profiles": -1 } })


```
_id: ObjectId('6271ee61bb962b8695dd11af')
emailid: "0omsUvRjUHZlzEPT@msn.com"
phoneno: "512-974-2015"
name: "john martin"
dob: 1992-05-03T00:00:00.000+00:00
password: "lunareon"
account_create_date: 2017-12-19T00:00:00.000+00:00
no_of_profiles: 3
preferred_language: "Hindi"
profiles: Array
  0: Object
    profile_name: "niva"
    service_id: 400234
    profile_history: Array
    profile_my_list: Array
    complaints: Array
  1: Object
    profile_name: "sush"
    service_id: 400235
    profile_history: Array
    profile_my_list: Array
    complaints: Array
  2: Object
    profile_name: "shat"
    service_id: 400236
    profile_history: Array
    profile_my_list: Array
    complaints: Array
billing_date: 2018-01-19T00:00:00.000+00:00
status: "Active"
payment_method: "DEBIT/CREDIT"
```

```
_id: ObjectId('6271ee61bb962b8695dd11af')
emailid: "0omsUvRjUHZlzEPT@msn.com"
phoneno: "512-974-2015"
name: "john martin"
dob: 1992-05-03T00:00:00.000+00:00
password: "lunareon"
account_create_date: 2017-12-19T00:00:00.000+00:00
no_of_profiles: 2
preferred_language: "Hindi"
profiles: Array
  0: Object
    profile_name: "niva"
    service_id: 400234
    profile_history: Array
    profile_my_list: Array
    complaints: Array
  1: Object
    profile_name: "shat"
    service_id: 400236
    profile_history: Array
    profile_my_list: Array
    complaints: Array
billing_date: 2018-01-19T00:00:00.000+00:00
status: "Active"
payment_method: "DEBIT/CREDIT"
```

- **Deleting a movie from Profiles' watching list:** A movie can be deleted from profiles' my list as follows:

  Before deleting:


```
_id: ObjectId('62755e474fd65fe5ef9f6f88')
emailid: "new_user@gmail.com"
phoneno: "322-370-1228"
name: "Ratan Harry"
dob: 2001-11-12T00:00:00.000+00:00
password: "qwerty12#"
account_create_date: 2010-10-07T00:00:00.000+00:00
no_of_profiles: 1
preferred_language: "English"
profiles: Array
  0: Object
    profile_name: "Profile1"
    service_id: 80012
    profile_history: Array
      0: Object
        view_timestamp: 2022-05-06T20:30:55.858+00:00
        imdb_rank: 2
        movie_id: ObjectId('627564ef42b44ac7f586713f')
    profile_my_list: Array
      0: Object
        imdb_rank: 1
        movie_id: ObjectId('627564ef42b44ac7f586713e')
    complaints: Array
billing_date: 2022-04-03T00:00:00.000+00:00
status: "Active"
payment_method: "DEBIT/CREDIT"
```


  Let's say the profile user requested the movie on his list 'Guardians of the Galaxy' to be removed from his list. Hence we will be doing the following steps

```
var movie = db.movies.findOne({"Title":"Guardians of the Galaxy"})
var movieId = movie._id
var movie_rank = movie.Rank
db.users.update({"emailid":"new_user@gmail.com", "profiles.profile_name": "Profile1"}, { $pull: {"profiles.$.profile_my_list": {imdb_rank: movie_rank} } }, { multi: true })
```

  After executing the query:


```
_id: ObjectId('62755e474fd65fe5ef9f6f88')
emailid: "new_user@gmail.com"
phoneno: "322-370-1228"
name: "Ratan Harry"
dob: 2001-11-12T00:00:00.000+00:00
password: "qwerty12#"
account_create_date: 2010-10-07T00:00:00.000+00:00
no_of_profiles: 1
preferred_language: "English"
profiles: Array
  0: Object
    profile_name: "Profile1"
    service_id: 80012
    profile_history: Array
      0: Object
        view_timestamp: 2022-05-06T20:52:15.948+00:00
        imdb_rank: 2
        movie_id: ObjectId('627564ef42b44ac7f586713f')
    profile_my_list: Array
    complaints: Array
billing_date: 2022-04-03T00:00:00.000+00:00
status: "Active"
payment_method: "DEBIT/CREDIT"
```

- **Deleting a movie from Profiles' history:** A movie can be deleted from Profile history as follows:

  The application deletes the history whenever the user requests. It can we done in 2 ways:

  1. Delete entire history

     db.users.updateOne({"emailid":"new_user@gmail.com","profiles.profile_name":"Profile1"},{$unset:{"profiles.$.profile_history":""}},{multi:true})


  2. Delete a specific movie from the history

     Before:


- var movie = db.movies.findOne({"Title":"Guardians of the Galaxy"})
- var movie_rank = movie.Rank
- db.users.update({"emailid":"new_user@gmail.com", "profiles.profile_name": "Profile1"}, { $pull: {"profiles.$.profile_history": {imdb_rank: movie_rank} } }, { multi: true })

  After:

```
_id: ObjectId('62755e474fd65fe5ef9f6f88')
emailid: "new_user@gmail.com"
phoneno: "322-370-1228"
name: "Ratan Harry"
dob: 2001-11-12T00:00:00.000+00:00
password: "qwerty12#"
account_create_date: 2010-10-07T00:00:00.000+00:00
no_of_profiles: 1
preferred_language: "English"
profiles: Array
  0: Object
      profile_name: "Profile1"
      service_id: 80012
    profile_history: Array
      0: Object
          view_timestamp: 2022-05-06T20:52:15.948+00:00
          imdb_rank: 2
          movie_id: ObjectId('627564ef42b44ac7f586713f')
    profile_my_list: Array
    complaints: Array
billing_date: 2022-04-03T00:00:00.000+00:00
status: "Active"
payment_method: "DEBIT/CREDIT"
```


- **Adding a new movie:** The admin can add new movies to the movie collection.
    - db.movies.insertOne({"imdb_rank": "1001", "Title": "Fantastic Beasts - The Secrets of Dyumbledore", "Genre": ["Action", "Adventure", "Sci-Fi"], "Description": "Professor Albus Dumbledore knows the powerful, dark wizard Gellert Grindelwald is moving to seize control of the wizarding world. ", "Director": "David Yates", "Actors": "", "Year": "2022", "Runtime (Minutes)": "121", "Rating": "8.1", "Votes": "757074", "Revenue (Millions)": "333.13", "Metascore": "80"})


```
_id: ObjectId("6276f9069caf477874466b98")
imdb_rank: "1001"
Title: "Fantastic Beasts - The Secrets of Dyumbledore"
Genre: Array
Description: "Professor Albus Dumbledore knows the powerful, dark wizard Gellert Gri..."
Director: "David Yates"
Actors: ""
Year: "2022"
Runtime (Minutes): "121"
Rating: "8.1"
Votes: "757074"
Revenue (Millions): "333.13"
Metascore: "80"
```

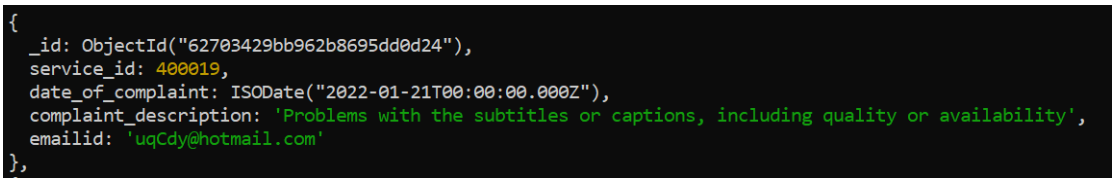

- **Deleting a movie from Movie Collection:** Admin can delete a movie from the movie collection as follows:
    - db.movies.deleteOne({"Title":"Fantastic Beasts - The Secrets of Dyumbledore"});


```
{ acknowledged: true, deletedCount: 1 }
```

- **Creating a Service request:** A user raises a service request with their service id.

  When a user raises a service request.

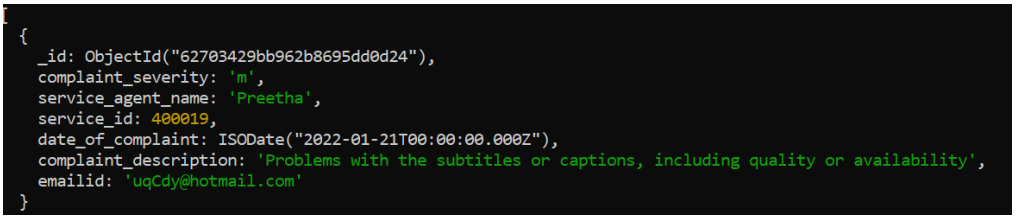
  db.service_requests.insertOne({service_id:400019, date_of_complaint:new Date(Date.now()), complaint_description:"Problems with the subtitles or captions, including quality or availability", emailid:"uqCdy@hotmail.com"})



```
{
  _id: ObjectId("62703429bb962b8695dd0d24"),
  service_id: 400019,
  date_of_complaint: ISODate("2022-01-21T00:00:00.000Z"),
  complaint_description: 'Problems with the subtitles or captions, including quality or availability',
  emailid: 'uqCdy@hotmail.com'
},
```

  When the service agent acknowledges the request raised.

  db.service_requests.updateOne({service_id:400019}, {$set:{complaint_severity: "h", service_agent_name:"Preetha"}},{upsert:true})



```
[
 {
  _id: ObjectId("62703429bb962b8695dd0d24"),
  complaint_severity: 'm',
  service_agent_name: 'Preetha',
  service_id: 400019,
  date_of_complaint: ISODate("2022-01-21T00:00:00.000Z"),
  complaint_description: 'Problems with the subtitles or captions, including quality or availability',
  emailid: 'uqCdy@hotmail.com'
 }
```

  Adding a reference to this complaint raised in the data of the profile

  var serviceid = db.service_requests.findOne({“service_id”:400019})

  var complaintId = serviceid._id

  db.users.updateOne({ "profiles.service_id" : 400019, "emailid":"uqCdy@hotmail.com"}, { "$push": { "profiles.$.complaints”: {_id :complaintId}}});

```
{
  _id: ObjectId("6271ee61bb962b8695dd12f9"),
  emailid: 'uqCdy@hotmail.com',
  phoneno: '512-974-5022',
  name: 'james williams',
  dob: ISODate("1982-01-01T00:00:00.000Z"),
  password: 'zr1659',
  account_create_date: ISODate("2017-10-01T00:00:00.000Z"),
  no_of_profiles: 3,
  preferred_language: 'English',
  profiles: [
    {
      profile_name: 'Paid for the Account',
      service_id: 400019,
      profile_history: [
        {
          view_timestamp: ISODate("2020-01-21T05:00:00.000Z"),
          imdb_rank: 366,
          movie_id: ObjectId("625ddf2139b486fd700dd6c2")
        }
      ],
      profile_my_list: [],
      complaints: [
        { _id: ObjectId("62703429bb962b8695dd0d24") },
        { _id: ObjectId("62703429bb962b8695dd0d74") },
        { _id: ObjectId("627340c030b048a05181c75b") }
      ]
    },
    {
```

- **Deleting a user:** Admin may delete any user from the users collection.
  db.users.deleteOne( { emailid : "2Q@msn.com" } )

```
Atlas atlas-j2215d-shard-0 [primary] sjsu_movie_db> db.users.deleteOne( { emailid : "2Q@msn.com" } )
{ acknowledged: true, deletedCount: 1 }
```

- **Displaying a user bill:** A user can view their bill for the month.
  db.users.find({emailid:'3Gx@aol.com'},{billing_date:1,status:'active',payment_method:1, emailid:1,_id:0});

```
Atlas atlas-j2215d-shard-0 [primary] sjsu_movie_db> db.users.find({emailid:'3Gx@aol.com'},{billing_date:1,status:'active
',payment_method:1,emailid:1,_id:0})
[
  {
    emailid: '3Gx@aol.com',
    billing_date: ISODate("2020-01-31T00:00:00.000Z"),
    payment_method: 'DEBIT/CREDIT',
    status: 'active'
  }
]
```

# VII. QUERIES

## 1. To find directors who have directed more than 1 movie

- db.movies.aggregate([{ "$group":{ "_id" : "$Director","count" : {"$sum" : 1}}}, {"$match" : { "count" : { "$gte" : 2}}}])

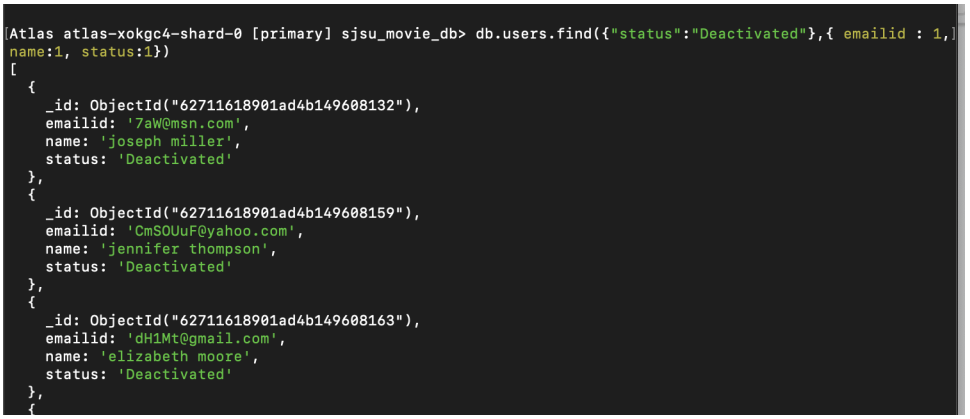
```
Atlas atlas-xokgc4-shard-0 [primary] sjsu_movie_db> db.movies.aggregate([{ "$group":{ "_id" : "$Director"}
,"count" : {"$sum" : 1}}}, {"$match" : { "count" : { "$gte" : 2}}}])
[
  { _id: 'Ang Lee', count: 2 },
  { _id: 'Mike Flanagan', count: 4 },
  { _id: 'Paul McGuigan', count: 2 },
  { _id: 'Michael Bay', count: 6 },
  { _id: 'F. Gary Gray', count: 2 },
  { _id: 'George Nolfi', count: 2 },
  { _id: 'Christopher McQuarrie', count: 2 },
  { _id: 'Denis Villeneuve', count: 5 },
  { _id: 'Gavin Hood', count: 3 },
  { _id: 'Will Gluck', count: 3 },
  { _id: 'Wes Anderson', count: 3 },
  { _id: 'Barry Sonnenfeld', count: 2 },
  { _id: 'Kenneth Branagh', count: 3 },
  { _id: 'Glenn Ficarra', count: 3 },
  { _id: 'Frank Coraci', count: 2 },
  { _id: 'David Lynch', count: 2 },
  { _id: 'Steven Spielberg', count: 4 },
  { _id: 'Edgar Wright', count: 3 },
  { _id: 'Michael Patrick King', count: 2 },
  { _id: 'George Miller', count: 2 }
]
```

## 2. To find which movies that were released between the years 2018 to 2020

- db.movies.find({"Year": {"$gte": "2016", "$lte": "2018"}},{Title:1, Description:1, Year:1,_id:0}).pretty()

3. **Showing Deactivated Users**

- db.users.find({"status":"Deactivated"},{ emailid : 1,name:1, status:1})

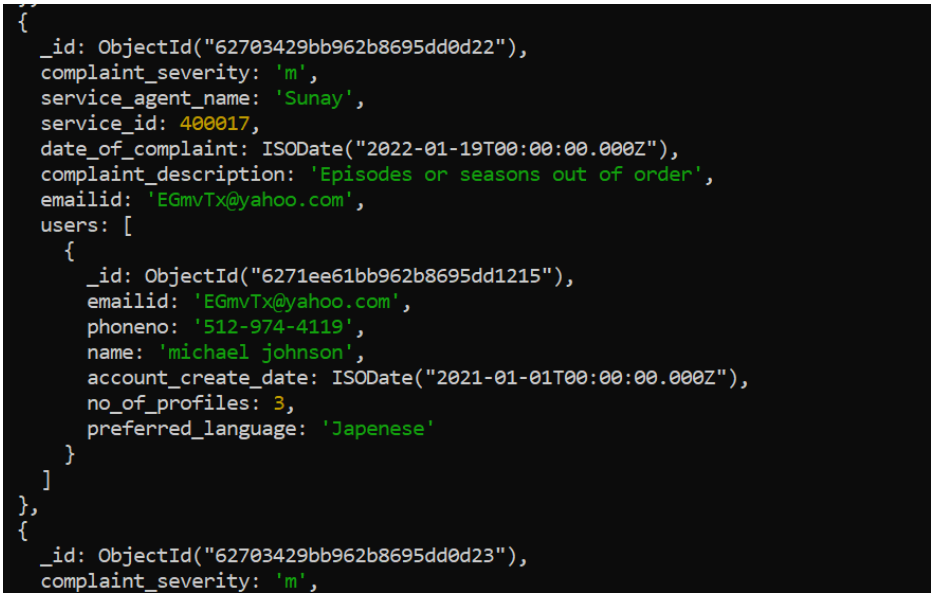



4. **Actors who have performed in more than 1 movie.**

- db.movies.aggregate([{ "$unwind" : "$Actors"},{ "$group":{ "_id" : "$Actors","count" : {"$sum" : 1}}}, {"$match" : { "count" : { "$gt" : 1}}}])


5. **Getting the user details who raised the service request**

- db.service_requests.aggregate([{"$lookup" : {"from" : "users", "localField" : "emailid", "foreignField" : "emailid","as" : "users"}}, {$project : {"users.password":0, "users.dob":0, "users.billing_date":0, "users.status":0, "users.profiles":0, "users.payment_method":0}}])




6. **Top 5 rated movies**

- db.movie.aggregate([{$sort:{Rating:-1}},{$limit:5},{$project:{"imdb_rank":1, "Title":1,"Rating":1,"Votes":1}}])

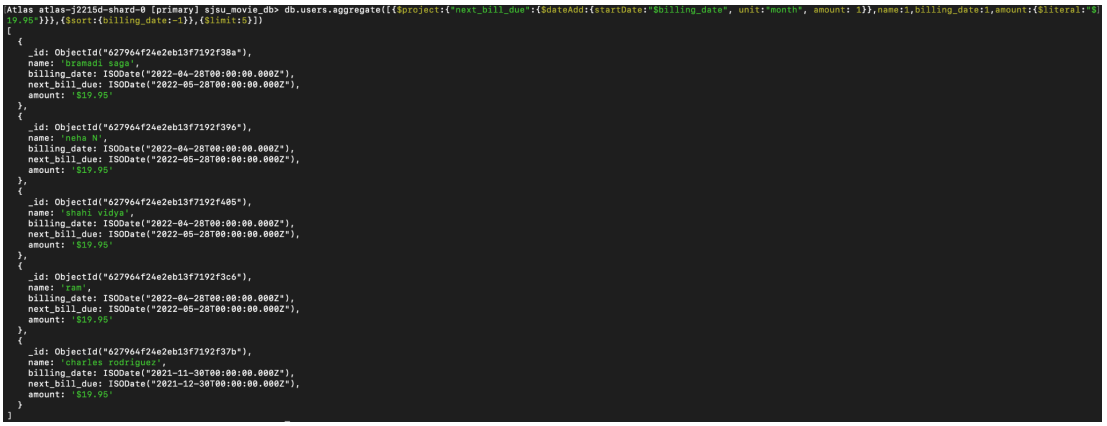

7. **Types of service complaints raised by the user with their counts:**

- db.service_requests.aggregate([{ "$group":{ "_id" : "$complaint_description","count" : {"$sum" : 1}}}])

```
Atlas atlas-xokgc4-shard-0 [primary] sjsu_movie_db>  db.service_requests.aggregate([{ "$group":{ "_id" :
"$complaint_description","count" : {"$sum" : 1}}}])
[
  { _id: 'Not able to access the subtitles', count: 1 },
  { _id: 'Volume levels', count: 21 },
  { _id: 'Buffering', count: 3 },
  {
    _id: 'Problems with the maturity rating or classification',
    count: 21
  },
  { _id: 'Artwork or description errors', count: 1 },
  {
    _id: 'Problems with the subtitles or captions, including quality or availability',
    count: 6
  },
  { _id: 'Problems with the video quality or aspect ratio', count: 7 },
  {
    _id: 'Problems with the audio or dubbing, including quality or availability',
    count: 7
  },
  { _id: 'Episodes or seasons out of order', count: 42 }
]
```

8. **Generate the next bill due date:**

- db.users.aggregate([{$project:{"next_bill_due":{$dateAdd:{startDate:"$billing_date", unit:"month", amount: 1}},name:1,billing_date:1,amount:{$literal:"$19.95"}}},{$sort:{billing_date:-1}},{$limit:5}])




9. **Daily service request counts :**

- db.service_requests.aggregate([{ "$group":{ "_id" : "$date_of_complaint","count" : {"$sum" : 1}}}])

```
Atlas atlas-j2215d-shard-0 [primary] sjsu_movie_db> db.service_requests.aggregate([{ "$group":{ "_id" : "$date_of_compla
int","count" : {"$sum" : 1}}}])
[
  { _id: ISODate("2022-01-19T00:00:00.000Z"), count: 1 },
  { _id: ISODate("2022-02-03T00:00:00.000Z"), count: 1 },
  { _id: ISODate("2022-01-25T00:00:00.000Z"), count: 1 },
  { _id: ISODate("2022-01-18T00:00:00.000Z"), count: 1 },
  { _id: ISODate("2022-01-17T00:00:00.000Z"), count: 1 },
  { _id: ISODate("2022-01-05T00:00:00.000Z"), count: 2 },
  { _id: ISODate("2022-02-16T00:00:00.000Z"), count: 3 },
  { _id: ISODate("2022-02-04T00:00:00.000Z"), count: 1 },
  { _id: ISODate("2022-03-03T00:00:00.000Z"), count: 1 },
  { _id: ISODate("2022-03-04T00:00:00.000Z"), count: 1 },
  { _id: ISODate("2022-01-24T00:00:00.000Z"), count: 1 },
  { _id: ISODate("2022-01-21T00:00:00.000Z"), count: 1 },
  { _id: ISODate("2022-02-22T00:00:00.000Z"), count: 5 },
  { _id: ISODate("2022-03-01T00:00:00.000Z"), count: 1 },
  { _id: ISODate("2022-02-07T00:00:00.000Z"), count: 1 },
  { _id: ISODate("2022-03-02T00:00:00.000Z"), count: 1 },
  { _id: ISODate("2022-02-02T00:00:00.000Z"), count: 1 },
  { _id: ISODate("2022-02-19T00:00:00.000Z"), count: 5 },
  { _id: ISODate("2022-01-15T00:00:00.000Z"), count: 1 },
  { _id: ISODate("2022-01-03T00:00:00.000Z"), count: 2 }
]
```

10. **Movie language preferred by the user with count**
    - db.users.aggregate([{"$group":{"_id":"$preferred_language","count":{"$sum":1}}}])

```
Atlas atlas-xokgc4-shard-0 [primary] sjsu_movie_db> db.users.aggregate([{"$group":{"_id":"$preferred_language" ,as:"Language","count":{"$sum":1}}}])
MongoServerError: The field 'as' must be an accumulator object
Atlas atlas-xokgc4-shard-0 [primary] sjsu_movie_db> db.users.aggregate([{"$group":{"_id":"$preferred_languagee","count":{"$sum":1}}}])
[ { _id: null, count: 404 } ]
Atlas atlas-xokgc4-shard-0 [primary] sjsu_movie_db> db.users.aggregate([{"$group":{"_id":"$preferred_language","count":{"$sum":1}}}])
[
  { _id: 'Japenese', count: 40 },
  { _id: 'english', count: 1 },
  { _id: 'English', count: 148 },
  { _id: 'Korean', count: 74 },
  { _id: 'Hindi', count: 100 },
  { _id: 'Chinese', count: 40 },
  { _id: 'Tamil', count: 1 }
```

11. **View profiles my list**

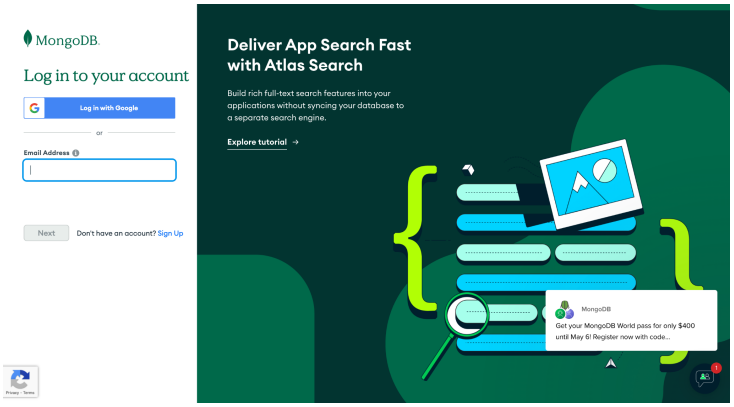
    - db.users.aggregate([{$project:{"profiles":1,"_id":0}},{$unwind:"$profiles"},{$unwind:"$profiles.profile_history"}, {$lookup:{from:"movies", localField:"profiles.profile_history.movie_id",foreignField:"_id", as:"movie_title"}}, {$project:{"profiles.profile_name":1,"movie_title.Title":1,"_id":0}}])

```
tlas atlas-j2215d-shard-0 [primary] sjsu_movie_db> db.users.aggregate([{$project:{"profiles":1,"_id":0}},{$unwind:"$profiles"},{$unwind:"$profiles.profile_hi
tory"}, {$lookup:{from:"movies", localField:"profiles.profile_history.movie_id",foreignField:"_id", as:"movie_title"}}, {$project:{"profiles.profile_name":1,
movie_title.Title":1,"_id":0}}])
[
  {
    profiles: { profile_name: 'doggo' },
    movie_title: [ { Title: 'Rogue One' } ]
  },
  {
    profiles: { profile_name: 'cat' },
    movie_title: [ { Title: 'Moana' } ]
  },
  {
    profiles: { profile_name: 'niva' },
    movie_title: [ { Title: 'What If' } ]
  },
  {
    profiles: { profile_name: 'sush' },
    movie_title: [ { Title: 'Sleeping with Other People' } ]
  },
  {
    profiles: { profile_name: 'shat' },
    movie_title: [ { Title: 'Split' } ]
  },
  {
    profiles: { profile_name: 'joy' },
    movie_title: [ { Title: 'Hidden Figures' } ]
  },
```

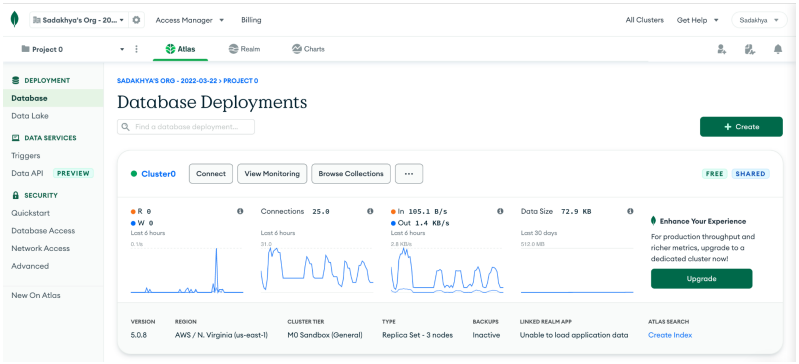
## VIII. CONNECTIVITY TO MONGODB CLOUD

MongoDB Atlas allows our data to be deployed in the cloud and connect with our local terminal or Compass to insert, read and update the data using queries.

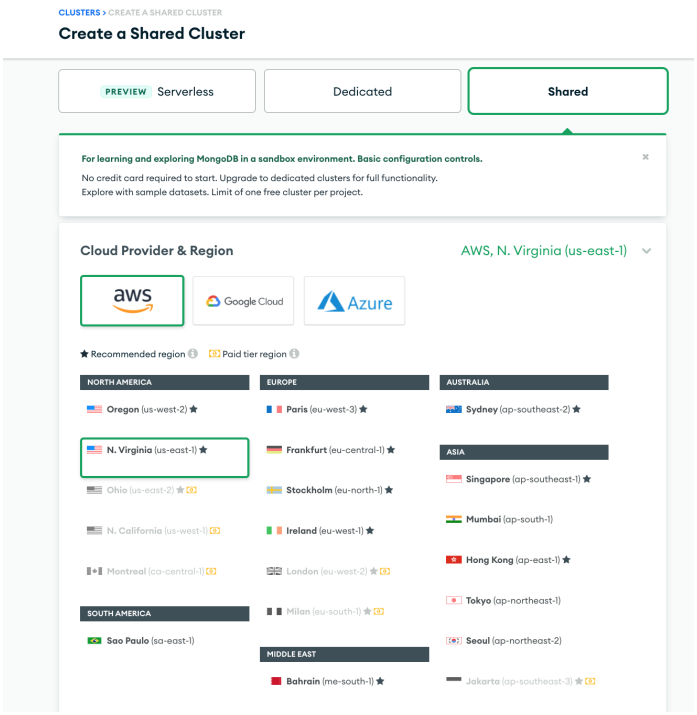
- Login to https://cloud.mongodb.com to deploy the data.

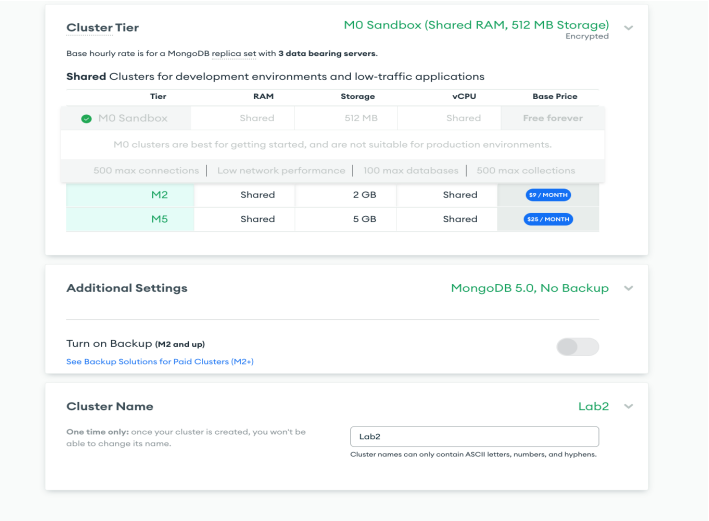



- Create a cluster from the homepage.

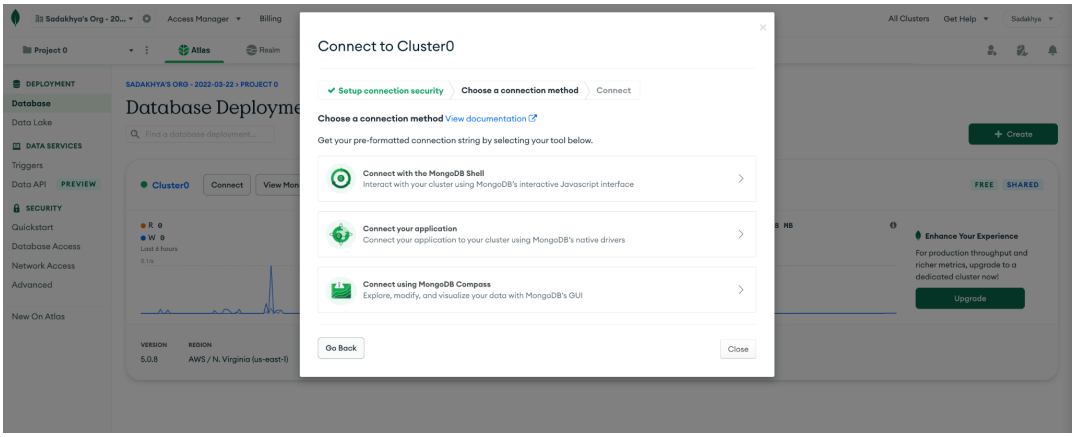



- Provide the required information, cloud as aws and create a new cluster.





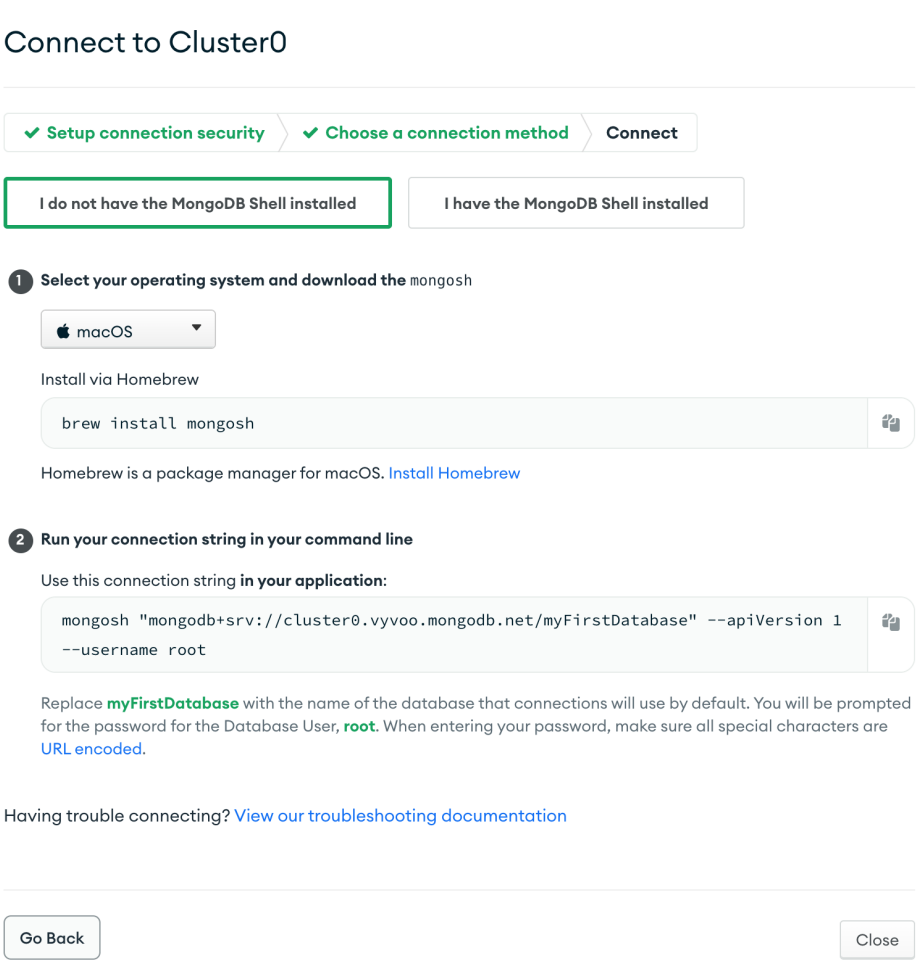

- Connect to the cluster by clicking on the connect option.



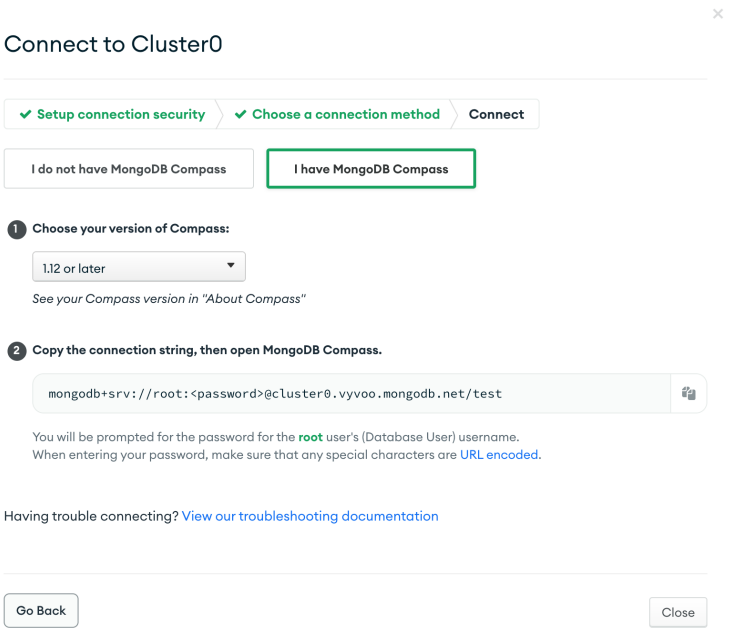

- Select “connect with MongoDB shell” to connect with the command line on the system. Select the OS and install mongosh on the system. Then Run Connection string in the command line.

  **Connection String:**

  **mongosh "mongodb+srv://cluster0.vyvoo.mongodb.net/myFirstDatabase" --apiVersion 1 --username root**



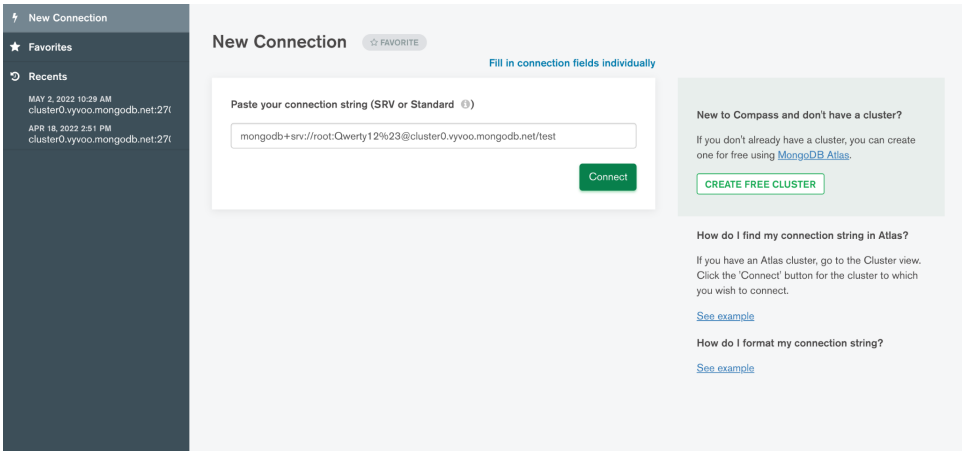

- Select “Connect using Mongodb compass” to connect with compass. Copy the connection string and connect from the compass.



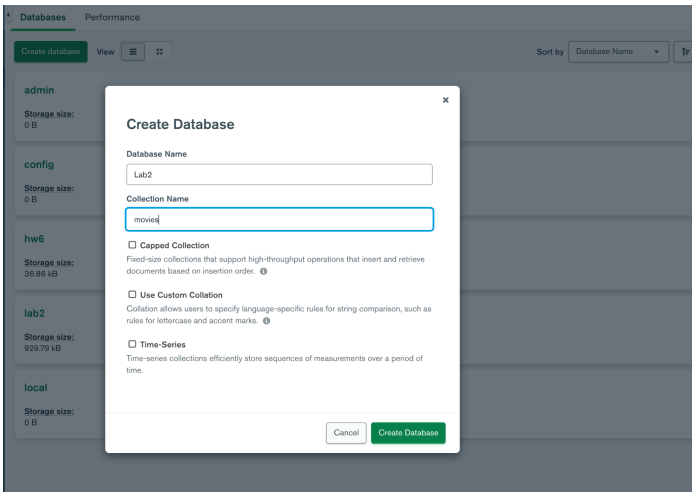

In MongoDB compass click on “New Connection” and paste your connection string with URL encoded password.

**Connection String:**

**mongodb+srv://root:Qwerty12%23@cluster0.vyvoo.mongodb.net/test**

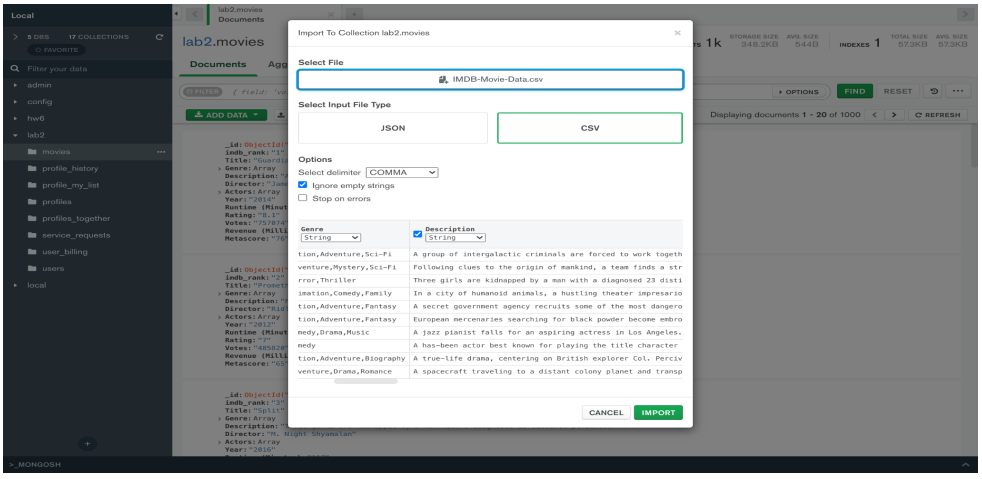



- In compass click on create Database to add collections to the new DB.




- Create 3 collections named Users, movies and service_requests. Once the Collections are created, add the documents.

  Import the IMDb movie dataset into the collection.



We are denormalizing the multi value fields of actors and Genre into arrays as follows:

- db.movies.aggregate([{"$addFields":{"Genre": { "$split": [ "$Genre", "," ]}}},{$out:"movie"}])
- db.movies.aggregate([{"$addFields":{"Actors": { "$split": [ "$Actors", "," ]}}},{$out:"movie"}])

- Create Users collection and add documents using Insert query.

  From shell:

  db.users.insertOne({

  "emailid": "new_user@gmail.com",

  "phoneno": "322-370-1228",

  "name": "Ratan Harry",

  "dob": "2001-11-12",

  "password": "qwerty12#",

  "account_create_date": "2010-10-07",

  "no_of_profiles": "0",

  "preferred_language": "English",

  "profiles": [],

  "billing_date": "2022-04-03",

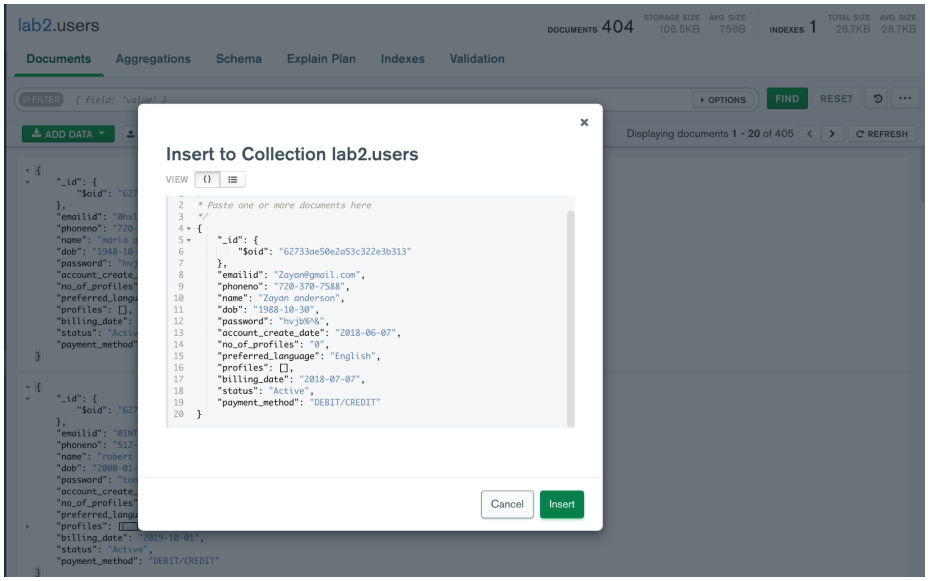
  "status": "Active",

  "payment_method":"DEBIT/CREDIT"

  });

  From Compass:

  Select Add Data-> Insert Document



- Create Service Request collection and add documents using Insert query.

  From shell:

  db.service_requests.insertOne({

  "complaint_severity": "m",

  "service_agent_name": "Sandeshn",

  "service_id": "400000",

  "date_of_complaint": "2022-01-02",

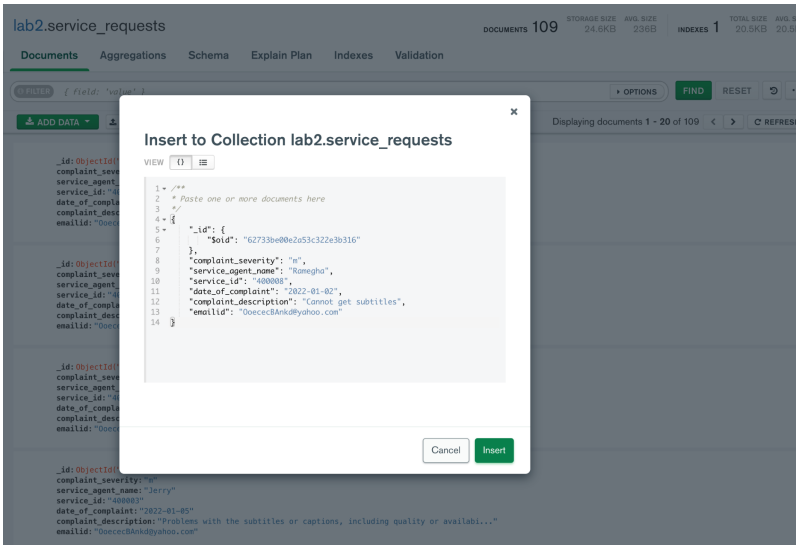
  "complaint_description": "Buffering",

  "emailid": "OoececBAnkd@yahoo.com"

  })

  From Compass:

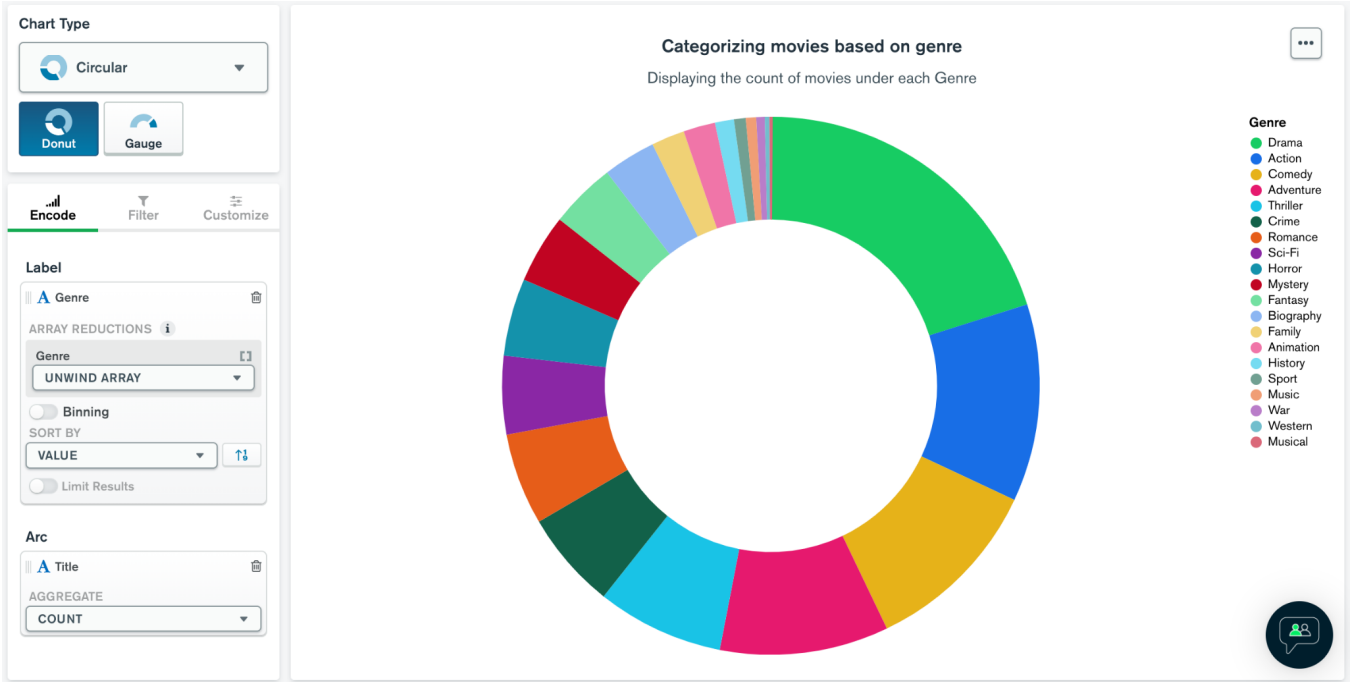
  Select Add Data-> Insert Document



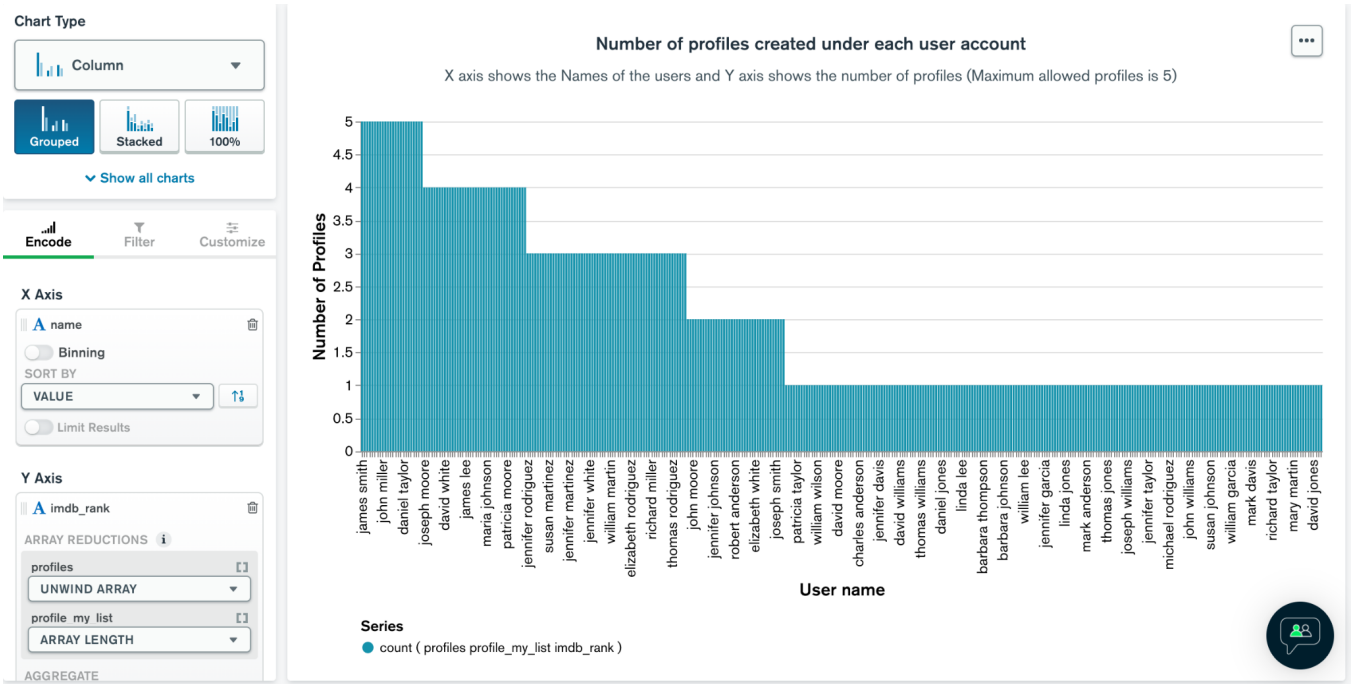

## IX. VISUALIZATION

Mongodb Atlas provides built-in support for Charts. Drag and Drop of the fields for aggregations can be done to visualize the data.

1. **Categorizing movies based on genre:** Displaying the count of movies under each Genre.

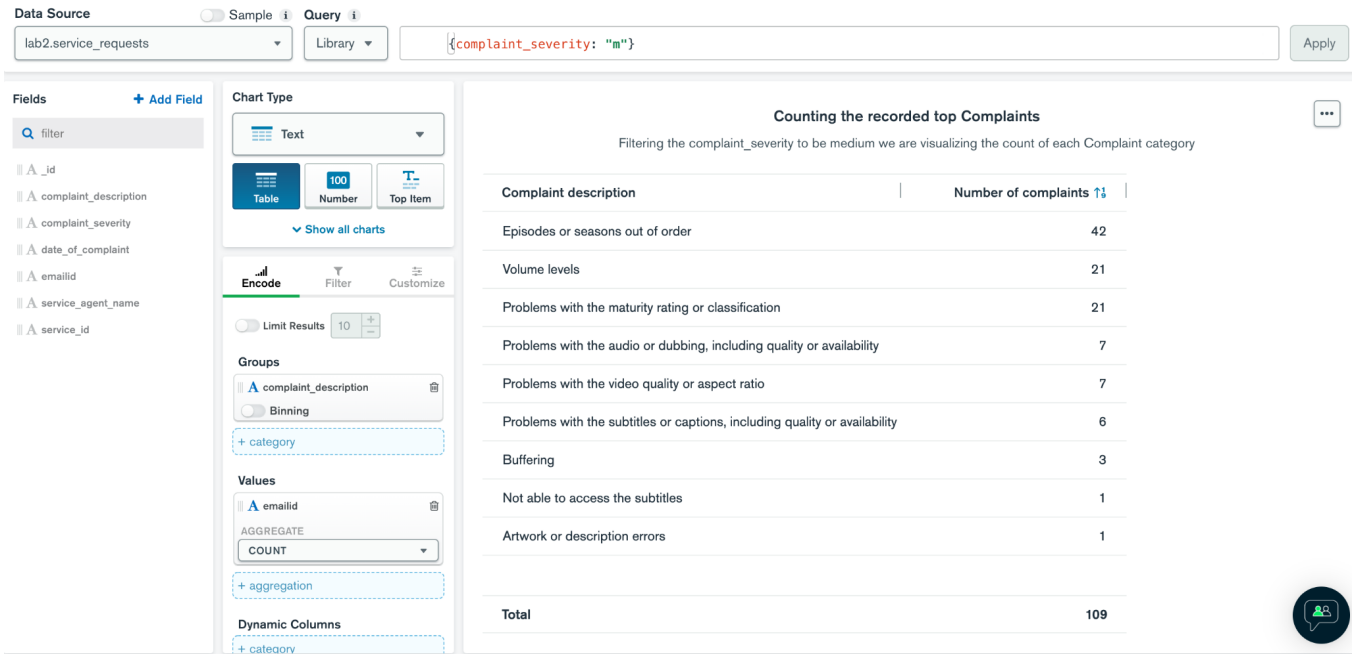



2. **Displaying the count of movies under each Genre:** X axis shows the Names of the users and Y axis shows the number of profiles (Maximum allowed profiles is 5)

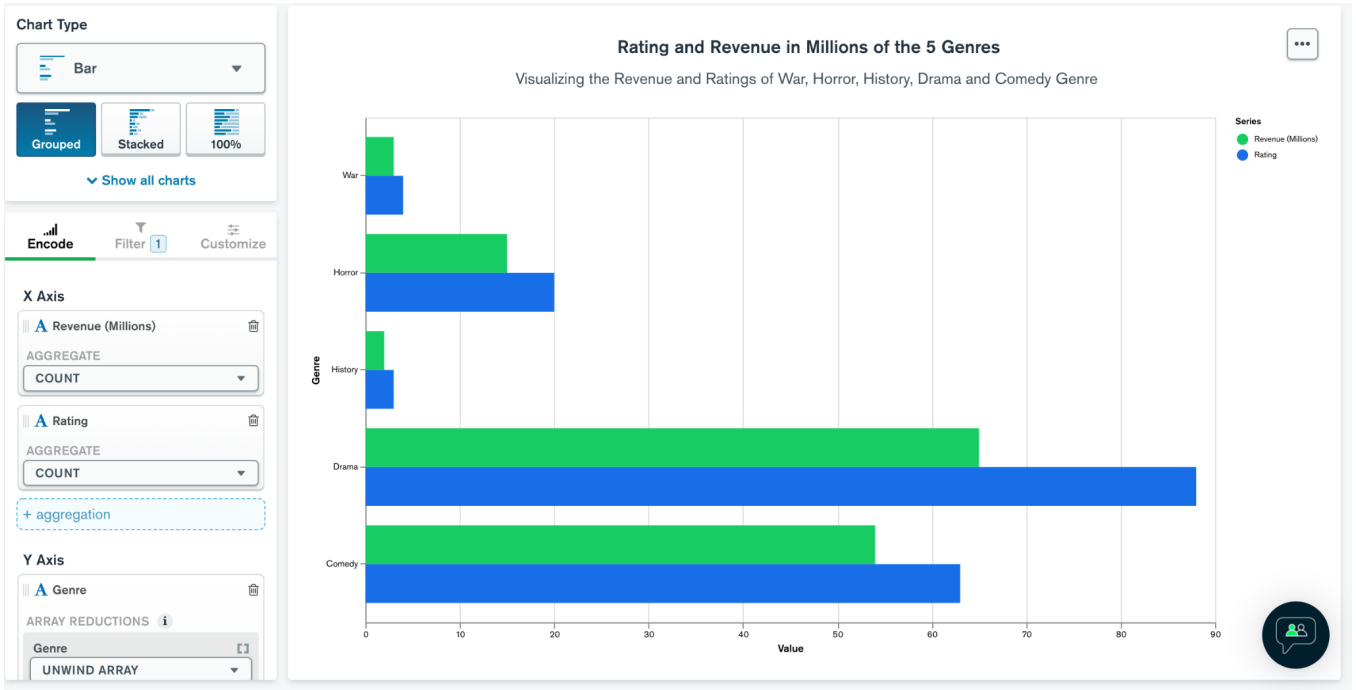



3. **Counting the recorded top Complaints:** Filtering the complaint_severity to be medium we are visualizing the count of each Complaint category.

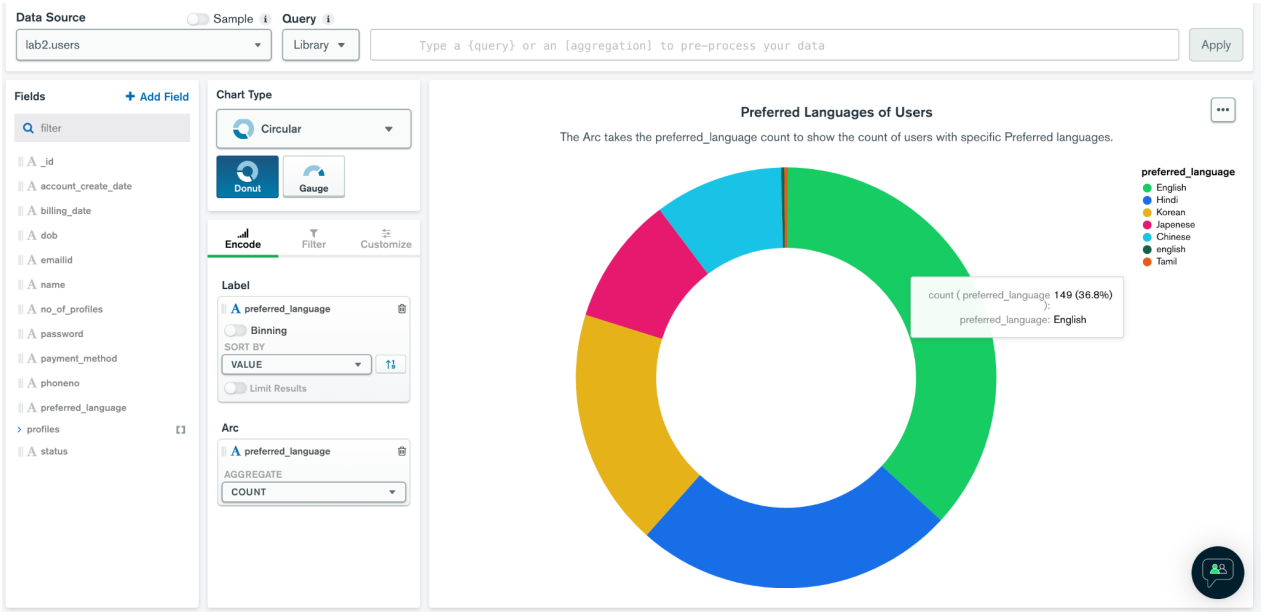
   Initially filter : {complaint_severity: "m"} is applied.



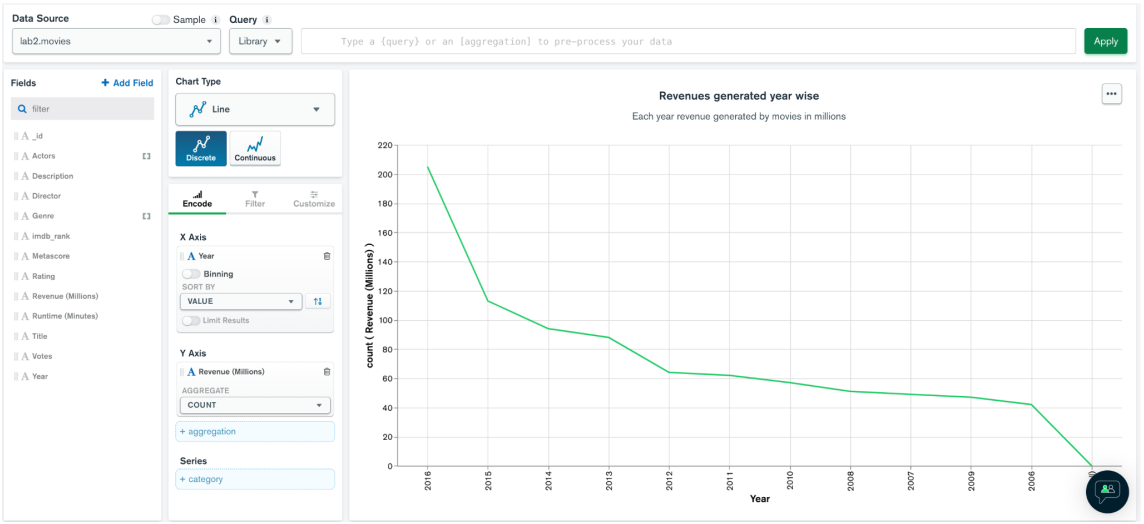

4. **Rating and Revenue in Millions of the 5 Genres:** Visualizing the Revenue and Ratings of War, Horror, History, Drama and Comedy Genre.
   Adding count aggregate on Revenue(Millions), count aggregate on Rating in Xaxis and applying unwind aggregation on Genre array in Y axis and filter with 5 Genres.




5. **Language preferred by the user for a movie:** The below donut chart shows the language preference of the user for watching a movie and it shows English is the most preferred language which takes around 37% from other languages.




6. **Revenue generated by the movies in that year :** The line chart shows the revenue as compared to the previous years. The X Axis takes the Years and Y Axis takes Revenue.



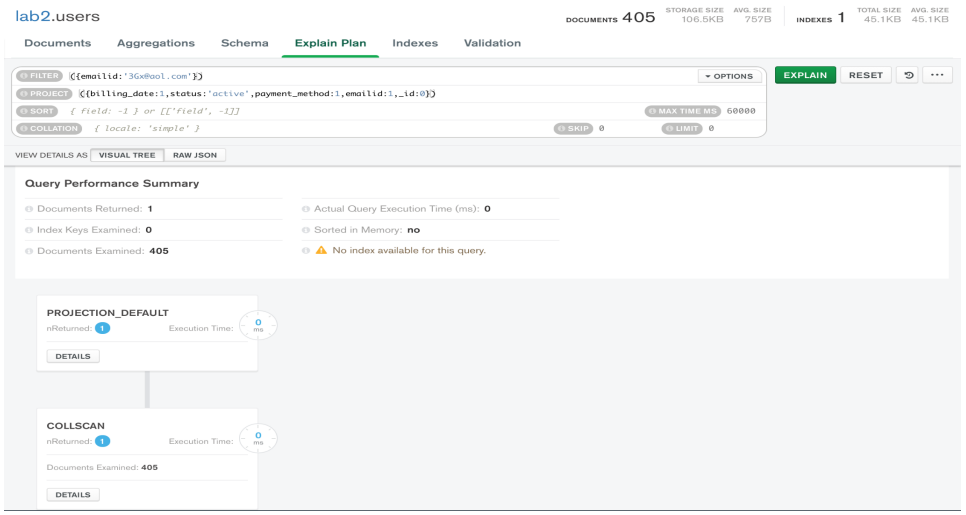

# X. MONGODB QUERIES PERFORMANCE MEASUREMENT

MongoDB document storage provides efficient querying of data. It provides an O(1) lookup for documents.

**Query Performance without indexing:**

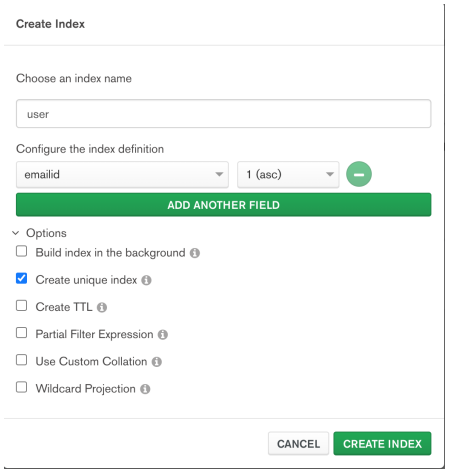
Executing a find query that filters based on an email and projects a few fields in Mongodb will usually scan 405 documents to return 1 matching document with 0ms execution time.

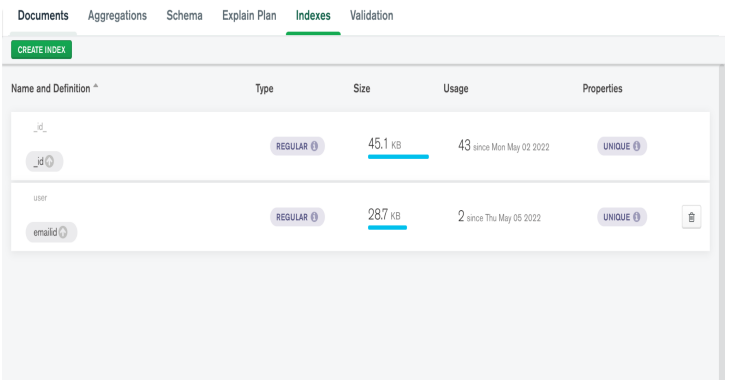
- db.users.find({emailid:'3Gx@aol.com'},{billing_date:1,status:'active',payment_method:1, emailid:1,_id:0});



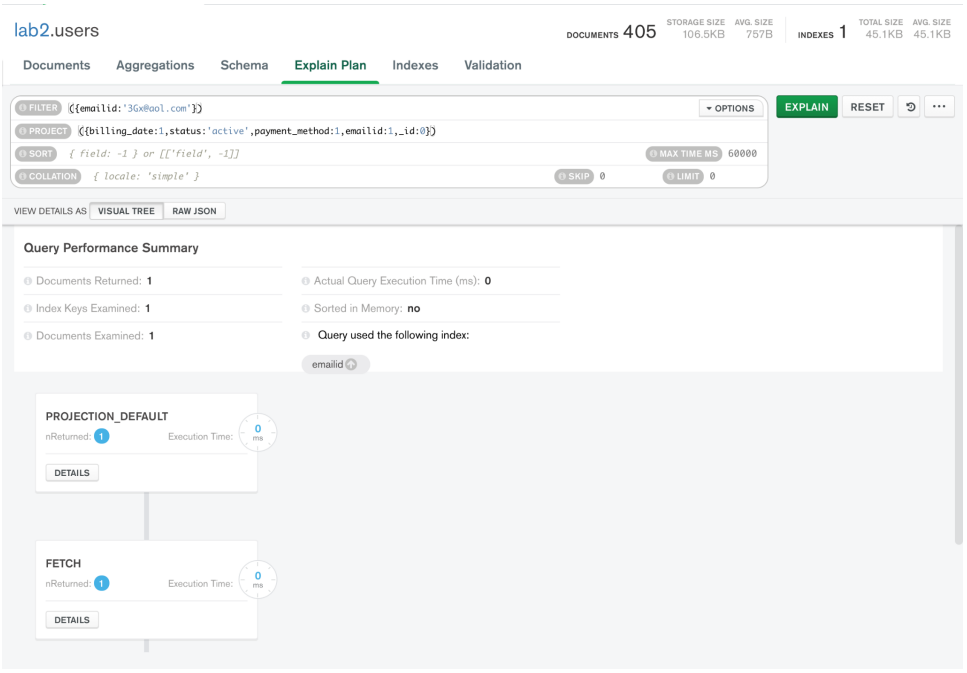

**Query Performance with index:**

Mongodb default does indexing by the _id which is the primary key for the document. We added an index for emailid named user.




Now that an index is added the performance is greatly improved. In place of scanning all the documents it scans 1 index entry and 1 document to return 1 matching document which is very efficient querying.



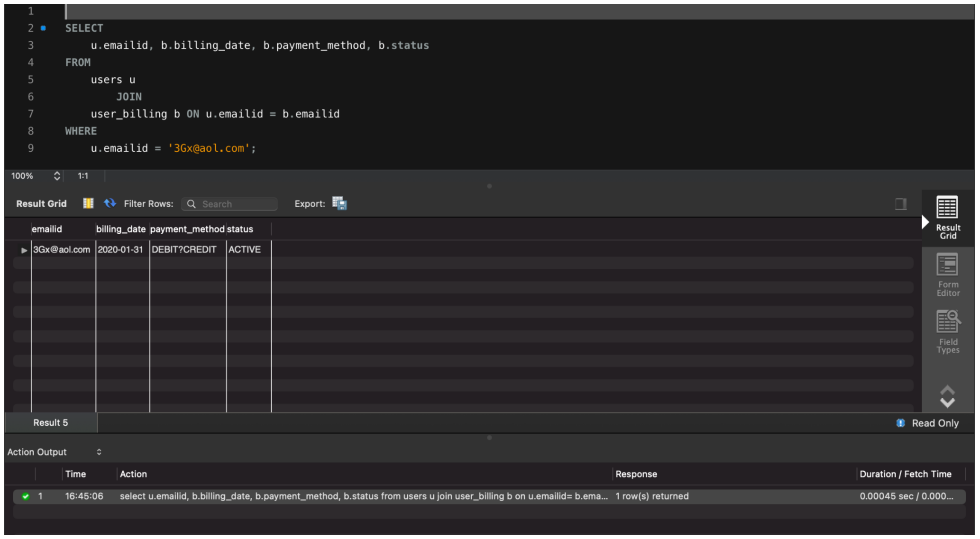

**Comparing MongoDB Vs MySQL query Performance:**

MongoDB gives efficient performance when most of the queries are read operations. The update query operations will be comparatively slow on embedded documents. However this can be seen as a tradeoff for the complex join operations that are avoided using the embedding of documents.

For performing the same operation of viewing the billing details of a user in mysql the following query needs to be run:

```
> SELECT
    u.emailid, b.billing_date, b.payment_method, b.status
FROM
    users u
        JOIN
    user_billing b ON u.emailid = b.emailid
WHERE
    u.emailid = '3Gx@aol.com';
```

This query needs details from 2 tables hence it applies JOIN on both the tables and get the details on first scanning all the rows in Users table for the matching user. This overall takes a lot of execution time.




Hence we can see a clear improvement in querying MongoDB documents with embedded structure where the billing table is embedded into the users table.