mongoDB

Software Engineering

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2- MongoDB: Import, Export, Querying data

1. Introduction to MongoDB data format for storage and display in the system.
2. Introduction to **JSON**.
3. Introduction to **BSON**.
4. Import/Export data *(on Atlas and Mongo shell)*.
5. Data interaction on Atlas.
6. Querying data with Mongo shell.

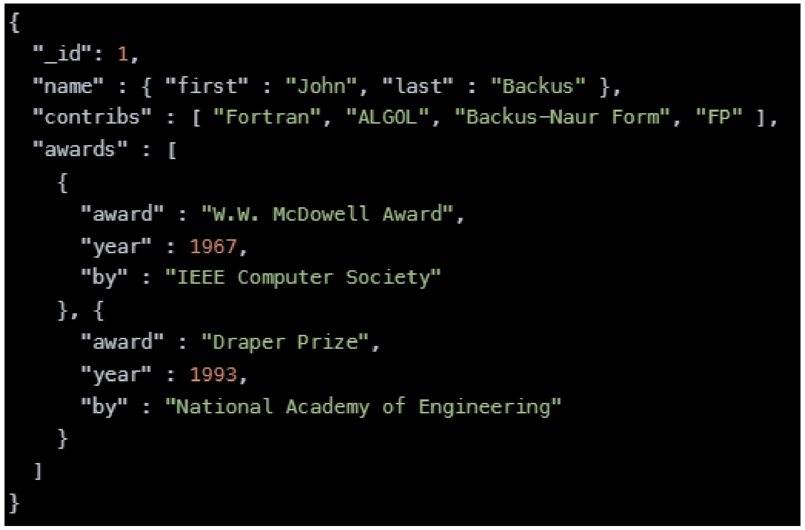
1. How Does MongoDB Store Data?

Presentation
How are documents presented in memory?

Correct syntax
What is the correct syntax for documents?

2. **JSON** *(Javascript Standard Object Notation)*

- When you view or update documents in MongoDB Shell →you are working with JSON
- JSON format:
  - Start and end with **{ }**
  - Separate each **key** and **value** with colon **:**
  - Separate each **key:value** pair with comma **,**
  - **Key** must be surrounded by quotation mark **“ ”**
  - In MongoDB **“keys”** also called **“fields”**.



```
{
  "_id": 1,
  "name" : { "first" : "John", "last" : "Backus" },
  "contribs" : [ "Fortran", "ALGOL", "Backus-Naur Form", "FP" ],
  "awards" : [
    {
      "award" : "W.W. McDowell Award",
      "year" : 1967,
      "by" : "IEEE Computer Society"
    }, {
      "award" : "Draper Prize",
      "year" : 1993,
      "by" : "National Academy of Engineering"
    }
  ]
}
```

JSON Values

Numbers: no quotes.

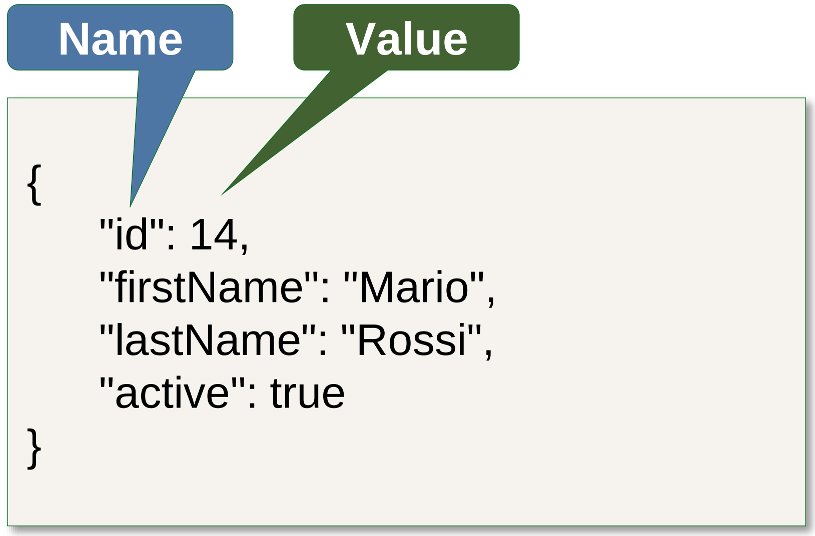
String: in double quotes.

Boolean: true, false.

Nested JSON object.

Array.

Null.



```
{
     "id": 14,
     "firstName": "Mario",
     "lastName": "Rossi",
     "active": true
}
```

Nested JSON Objects

```
{
  "id": 14,
  "firstName": "Mario",
  "lastName": "Rossi",
  "active": true,
  "address" : {
                "street" : "100 Main St",
                "city" : "Philadelphia",
                "state" : "Pennsylvania",
                "zip" : "19103",
                "country" : "USA"
              }
}
```

Nested

JSON Arrays

```
{
  "id": 14,
  "firstName": "Mario",
  "lastName": "Rossi",
  "active": true,
  "languages" : ["Java", "C#", "Python", "Javascript"]
}
```

Pros of JSON

Friendly

Readable

Familiar

Cons of JSON

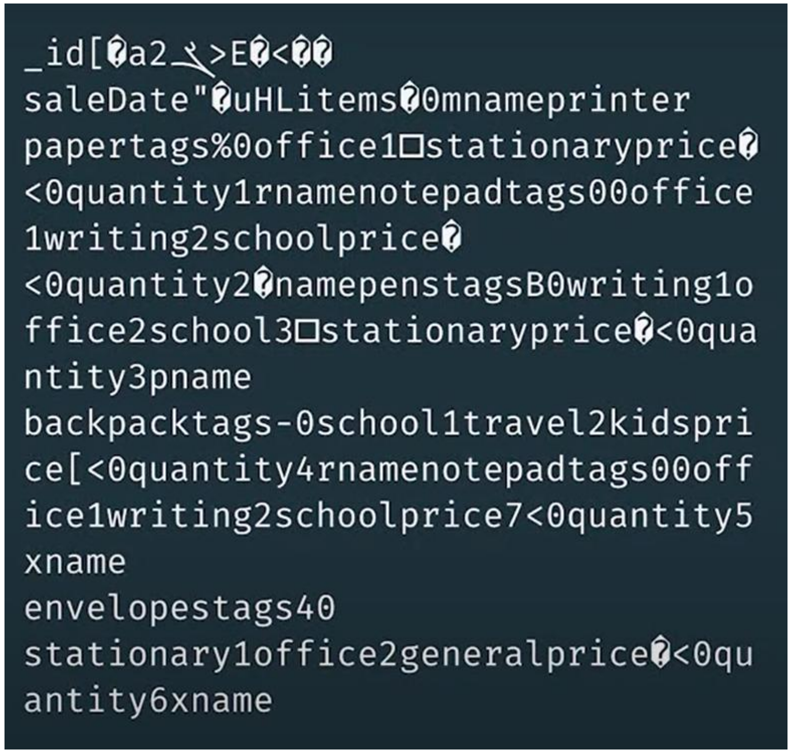
Text–based

Space-Consuming

Limited of data types

3. **BSON** *(Binary JSON)*

- Bridges the gap between binary representation and JSON format
- A binary representation to store data in JSON format
- Optimized for:
    - Speed
    - Space
    - Flexibility
- To achieve high performance



```
_id[�a2_ㄟ>E�<��
saleDate"�uHLitems�0mnameprinter
papertags%0office1□stationaryprice�
<0quantity1rnamenotepadtags00office
1writing2schoolprice�
<0quantity2�namepenstagsB0writing1o
ffice2school3□stationaryprice�<0qua
ntity3pname
backpacktags-0school1travel2kidspri
ce[<0quantity4rnamenotepadtags00off
ice1writing2schoolprice7<0quantity5
xname
envelopestags40
stationary1office2generalprice�<0qu
antity6xname
```

JSON

Encoding

UTF-8 String

Data Support

String, Bollean,

Number, Array

Readability

Human and Machine

BSON

Encoding

Binary

Data Support

String, Boolean, Number (Integer, long, float..),

Array, Date, Raw Binary

Readability

Machine only

Summary

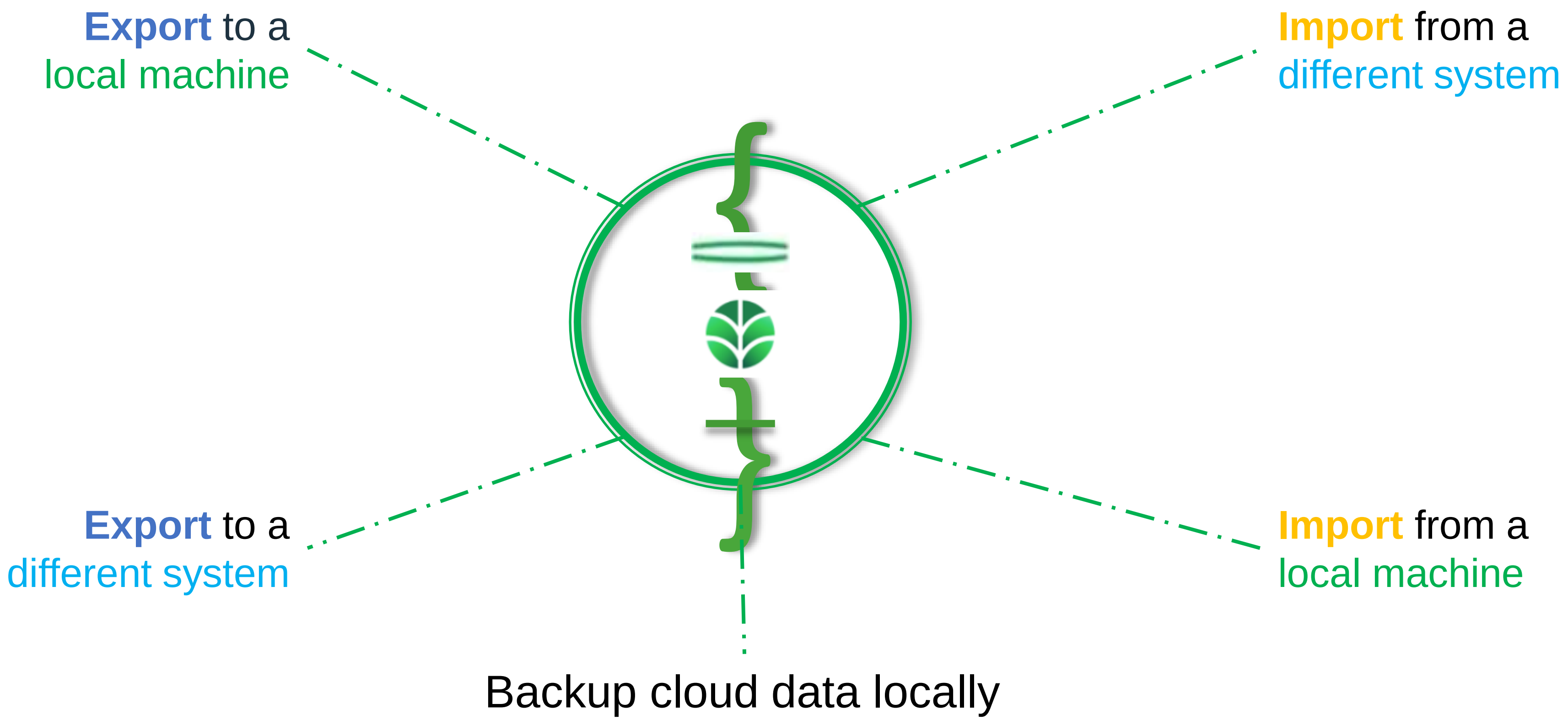
BSON
MongoDB stores data in BSON, internally and over the network

JSON
Can be natively stored and retrieved in MongoDB

Addition Features
BSON , provides addition features like speed and flexibility

4. Import/Export Data

Interacting with Atlas Cluster


Export to a local machine
Import from a different system
Export to a different system
Import from a local machine
Backup cloud data locally

Interacting with Atlas Cluster

Data is stored in BSON but viewed in JSON → Which format we're going to use? (export)

JSON	BSON
mongoexport	mongodump
mongoimport	mongorestore

```
mongoimport --help
<options>:
        -d      database to use,
        -c      collection to use,
        -u      username for authentication,
        -p      password for authentication,
        -o      output directory,
        --host  mongodb host to connect,
        --port  server port (can also use –h hostname:port),
        …
```

Import (JSON)

Syntax: **mongoimport** <options> <file to import>

---

1. From localhost:

```
Mongoimport --drop -d backup -c restaurants res.json
Mongoimport -h localhost:27017 --drop -d backup -c restaurants res.json
```

import the JSON data form the res.json file into the collection restaurants in the backup db to a local mongod instance running on port 27017.

--drop: before restoring the collections from the dumped backup, drop the collections from the target database. does not drop collections that are not in the backup.

---

2. From Atlas:

```
mongoimport --uri mongodb+srv://mongobasic:pass@cluster0.msr5i.mongodb.net/backup --drop -c restaurants res.json
```

Import from the res.json file to MongoDB Atlas Cluster.

Export (JSON)

Syntax: **mongoexport** <options>

1. From localhost:

```
mongoexport -d dbtest -c restaurants -o res.json
```

export the restaurants collection of dbtest db to the res.json output file from a local MongoDB instance running on port 27017.

2. From Atlas:

```
mongoexport --uri
mongodb+srv://mongobasic:pass@cluster0.msr5i.mongodb.net/sample_restaurants -c restaurants
-o res.json
```

connect to a MongoDB Atlas Cluster and export the restaurants collection of sample_restaurant db to res.json output file.

Import (BSON)

Syntax: **mongorestore** <options> <directory or file to restore>

1. From localhost:

```
mongorestore -d backup -c restaurants backup/dbtest/restaurants.bson
```

restores the collection named restaurants in the database backup from the corresponding files located in the backup/dbtest/restaurants.bson

2. From Atlas:

```
mongorestore --uri mongodb+srv://mongobasic:pass@cluster0.msr5i.mongodb.net -d backup -c restaurants backup/dbtest/restaurants.bson
```

restore from a backup/dbtest/ directory to MongoDB Atlas Cluster.

Export (BSON)

Syntax: **mongodump** <options>

1. From localhost:

```
mongodump -d dbtest -c restaurants  -o backup
```

connect to a local MongoDB instance running on port 27017 and use the default settings to export the content (no parameters with all databases and collections)

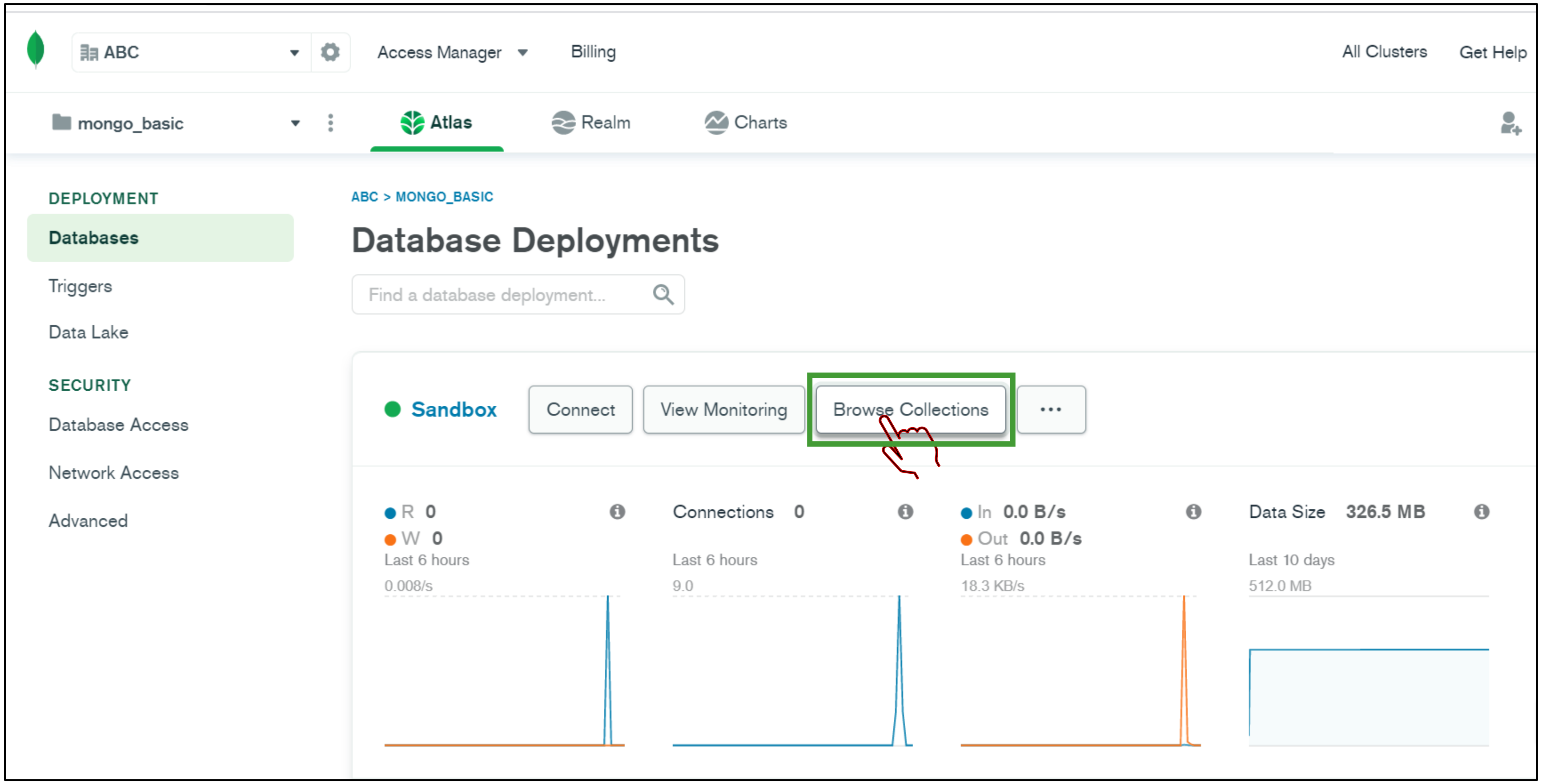
2. From Atlas:

```
mongodump –uri
mongodb+srv://mongobasic:pass@cluster0.msr5i.mongodb.net/sample_restaurants -c restaurants
–o backup
```

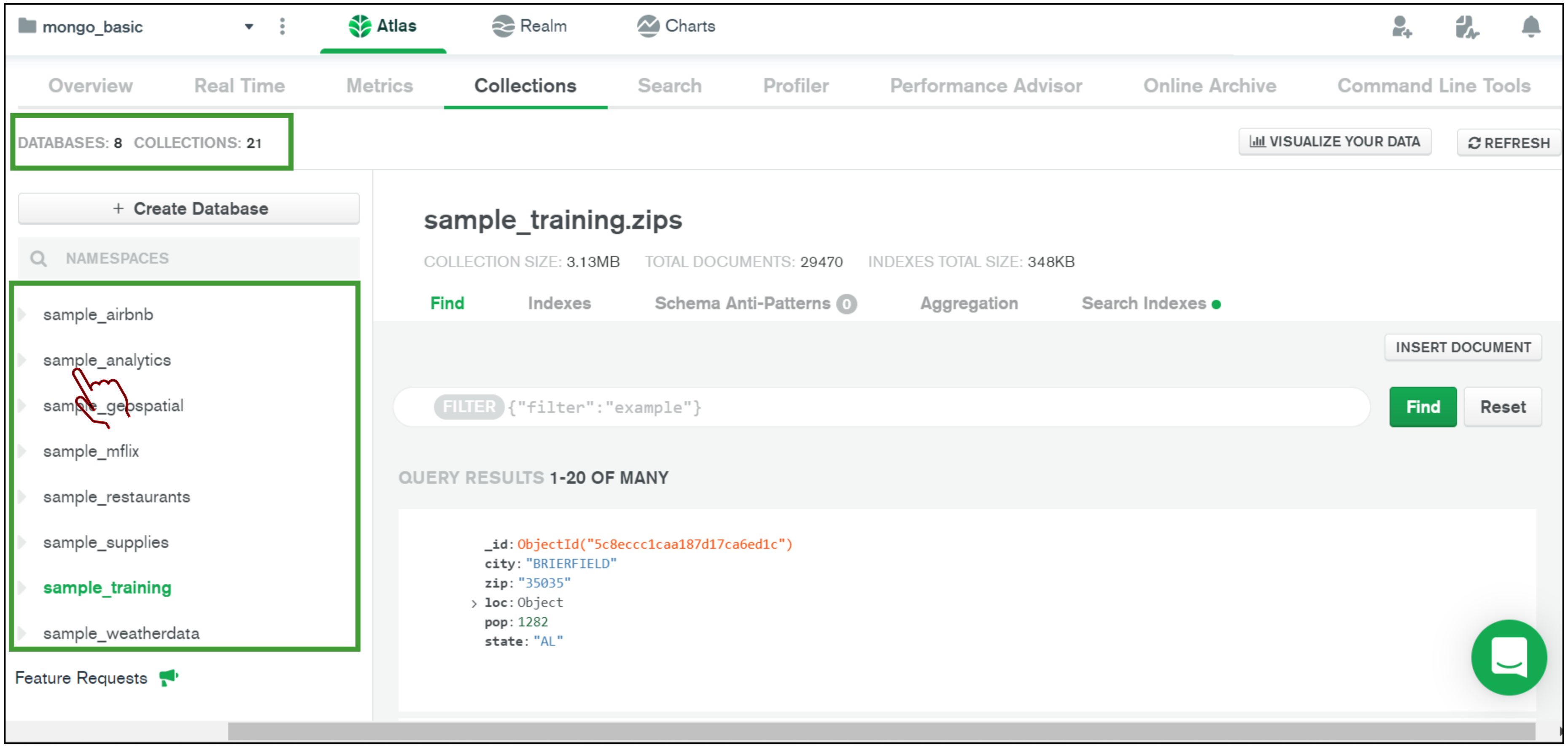
creates a dump file that contains only the collection named restaurants of sample_restaurants database

5- Data Explorer

Data Interaction using the Atlas UI



Data Interaction using the Atlas UI



DATABASES: 8 COLLECTIONS: 21

- sample_airbnb
- sample_analytics
- sample_geospatial
- sample_mflix
- sample_restaurants
- sample_supplies
- sample_training
- sample_weatherdata

sample_training.zips

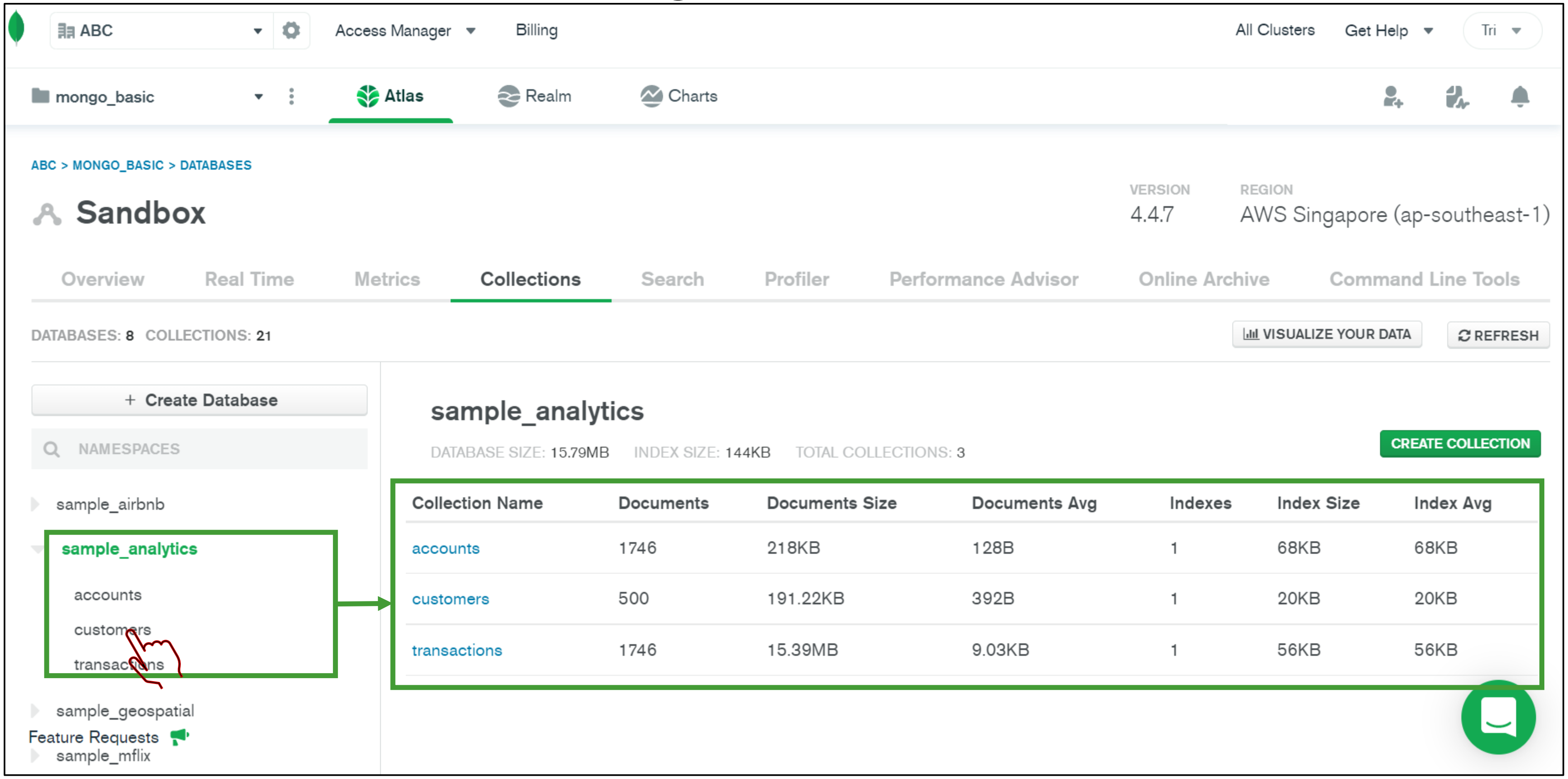
COLLECTION SIZE: 3.13MB TOTAL DOCUMENTS: 29470 INDEXES TOTAL SIZE: 348KB

```
{"filter":"example"}
```

QUERY RESULTS 1-20 OF MANY

```
_id: ObjectId("5c8eccc1caa187d17ca6ed1c")
city: "BRIERFIELD"
zip: "35035"
> loc: Object
pop: 1282
state: "AL"
```

Data Interaction using the Atlas UI



VERSION 4.4.7

REGION AWS Singapore (ap-southeast-1)

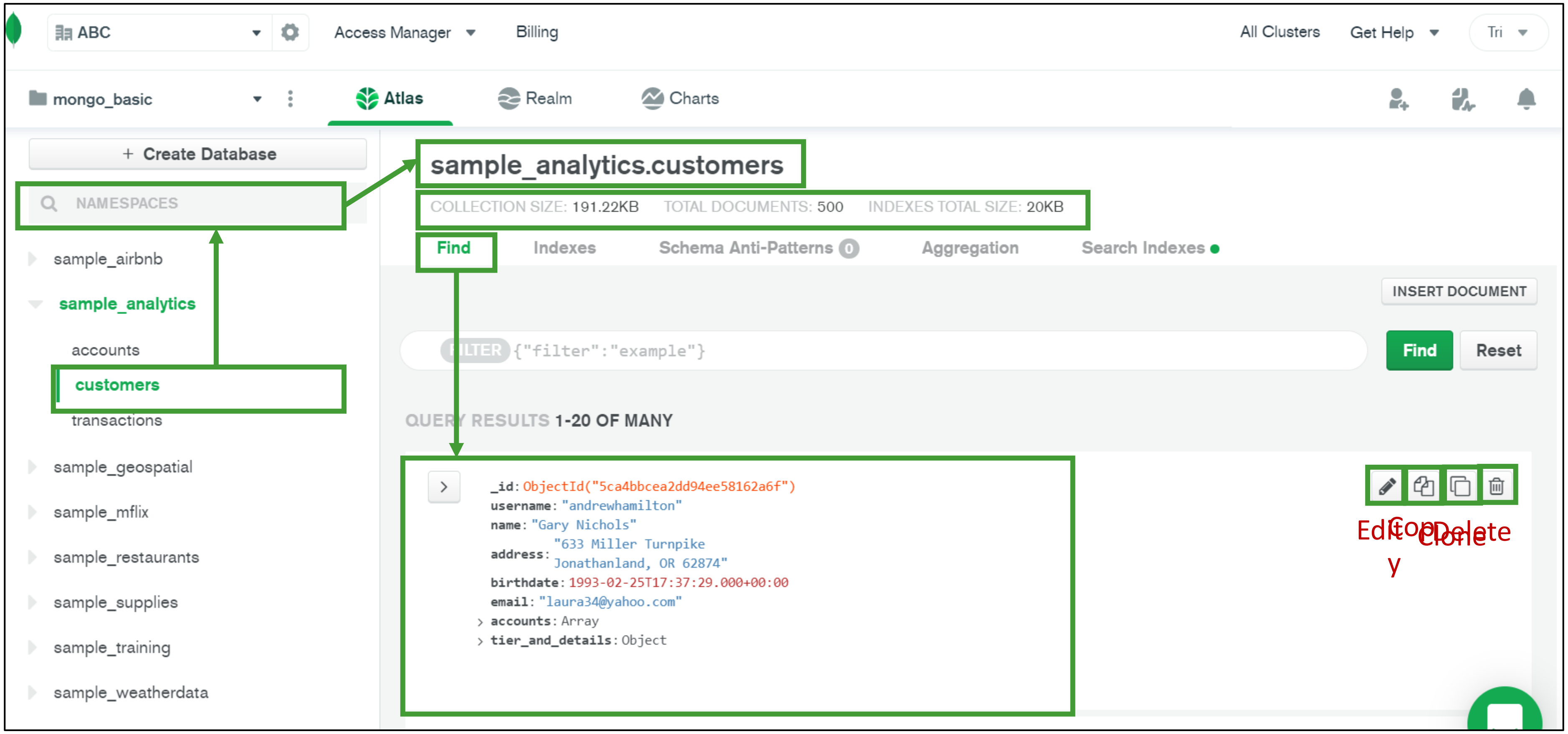
DATABASES: 8 COLLECTIONS: 21

sample_analytics

DATABASE SIZE: 15.79MB INDEX SIZE: 144KB TOTAL COLLECTIONS: 3

Collection Name	Documents	Documents Size	Documents Avg	Indexes	Index Size	Index Avg
accounts	1746	218KB	128B	1	68KB	68KB
customers	500	191.22KB	392B	1	20KB	20KB
transactions	1746	15.39MB	9.03KB	1	56KB	56KB

Data Interaction using the Atlas UI



sample_analytics.customers

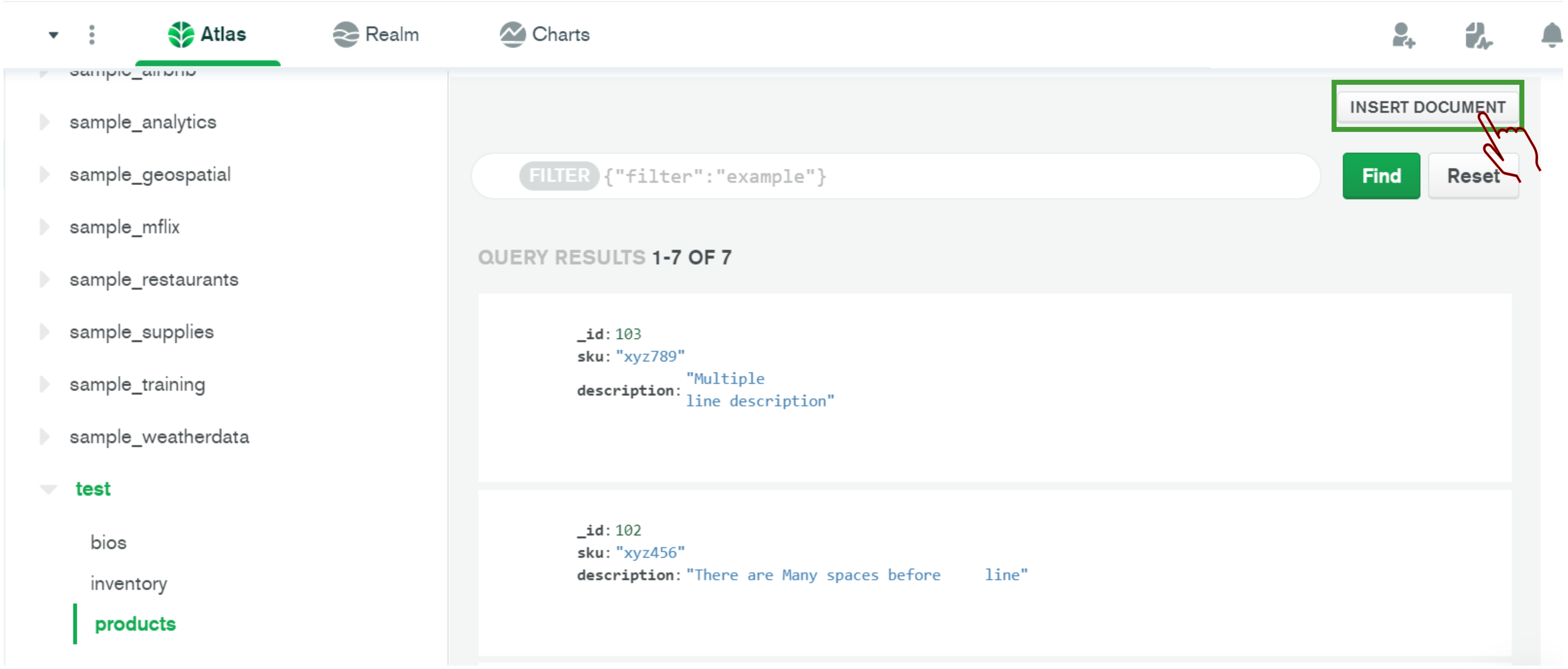
COLLECTION SIZE: 191.22KB TOTAL DOCUMENTS: 500 INDEXES TOTAL SIZE: 20KB

```
{"filter":"example"}
```

QUERY RESULTS 1-20 OF MANY

```
_id: ObjectId("5ca4bbcea2dd94ee58162a6f")
username: "andrewhamilton"
name: "Gary Nichols"
address: "633 Miller Turnpike
         Jonathanland, OR 62874"
birthdate: 1993-02-25T17:37:29.000+00:00
email: "laura34@yahoo.com"
> accounts: Array
> tier_and_details: Object
```

Data Interaction using the Atlas UI

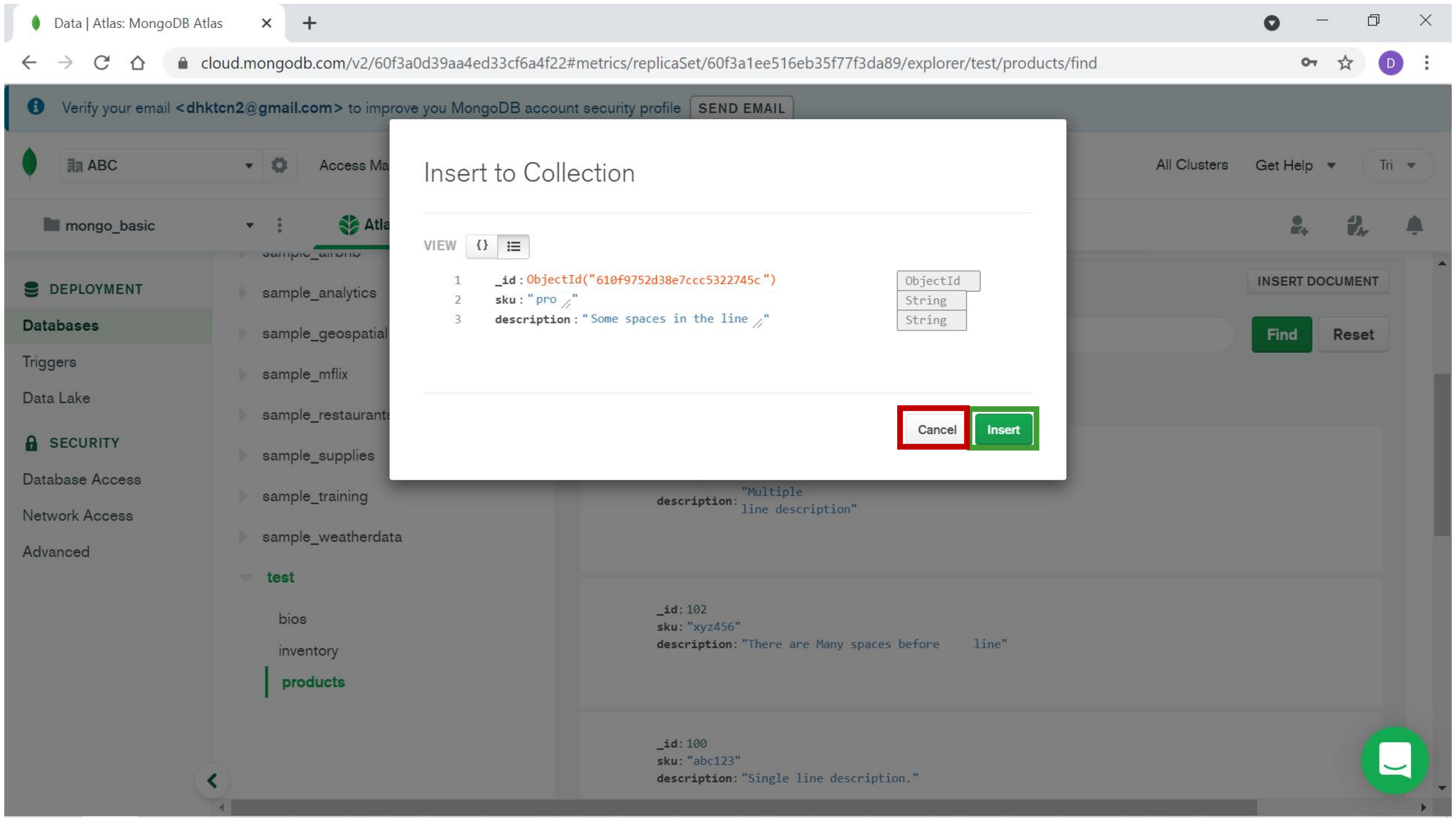


```
{"filter":"example"}
```

```
_id: 103
sku: "xyz789"
description: "Multiple
              line description"
```

```
_id: 102
sku: "xyz456"
description: "There are Many spaces before     line"
```

Data Interaction using the Atlas UI



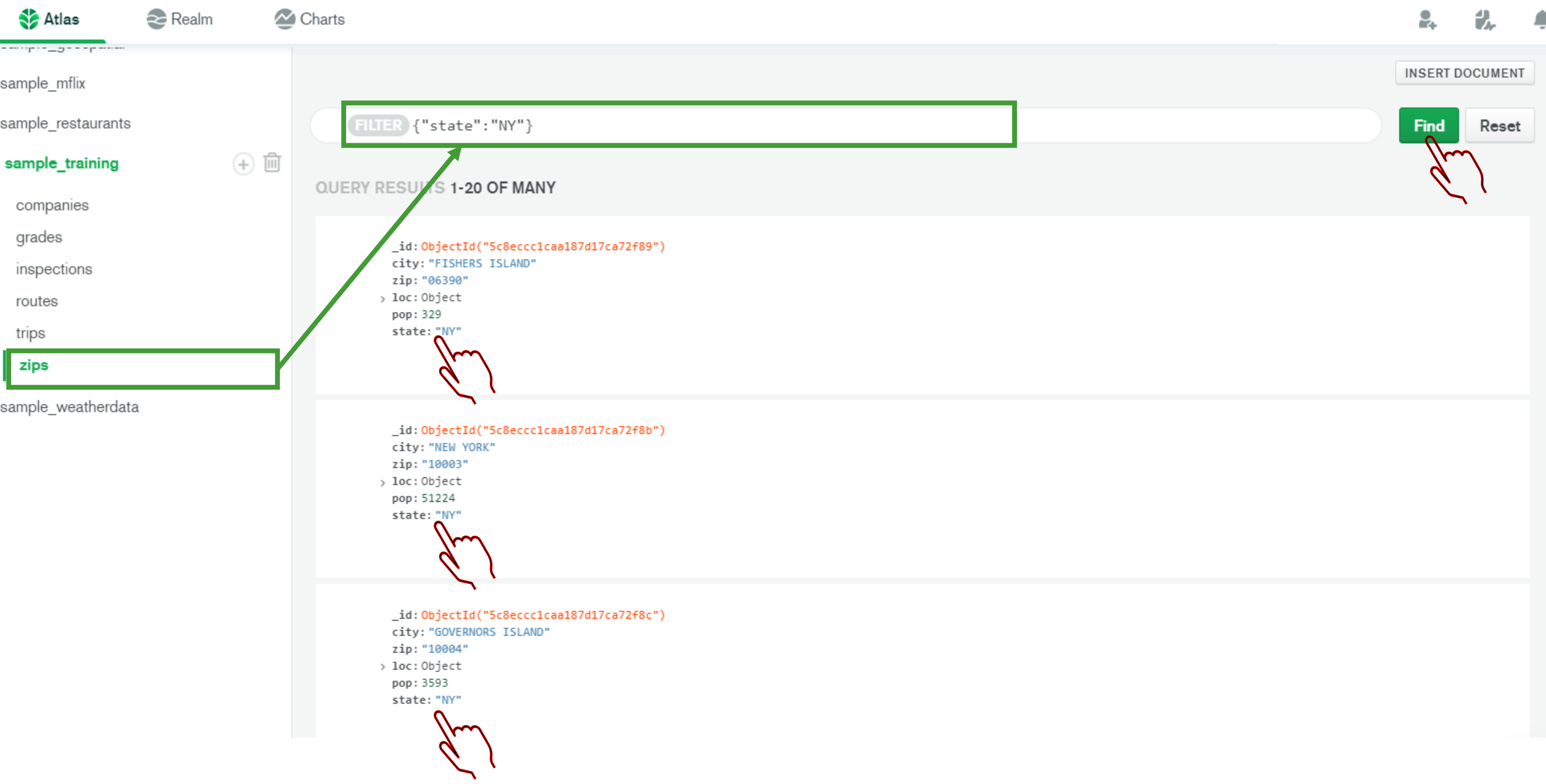
```
_id : ObjectId("610f9752d38e7ccc5322745c")     ObjectId
sku : "pro "                                   String
description : "Some spaces in the line "       String
```

```
description: "Multiple
             line description"

_id: 102
sku: "xyz456"
description: "There are Many spaces before     line"

_id: 100
sku: "abc123"
description: "Single line description."
```

Data Interaction using the Atlas UI



```
{"state":"NY"}
```

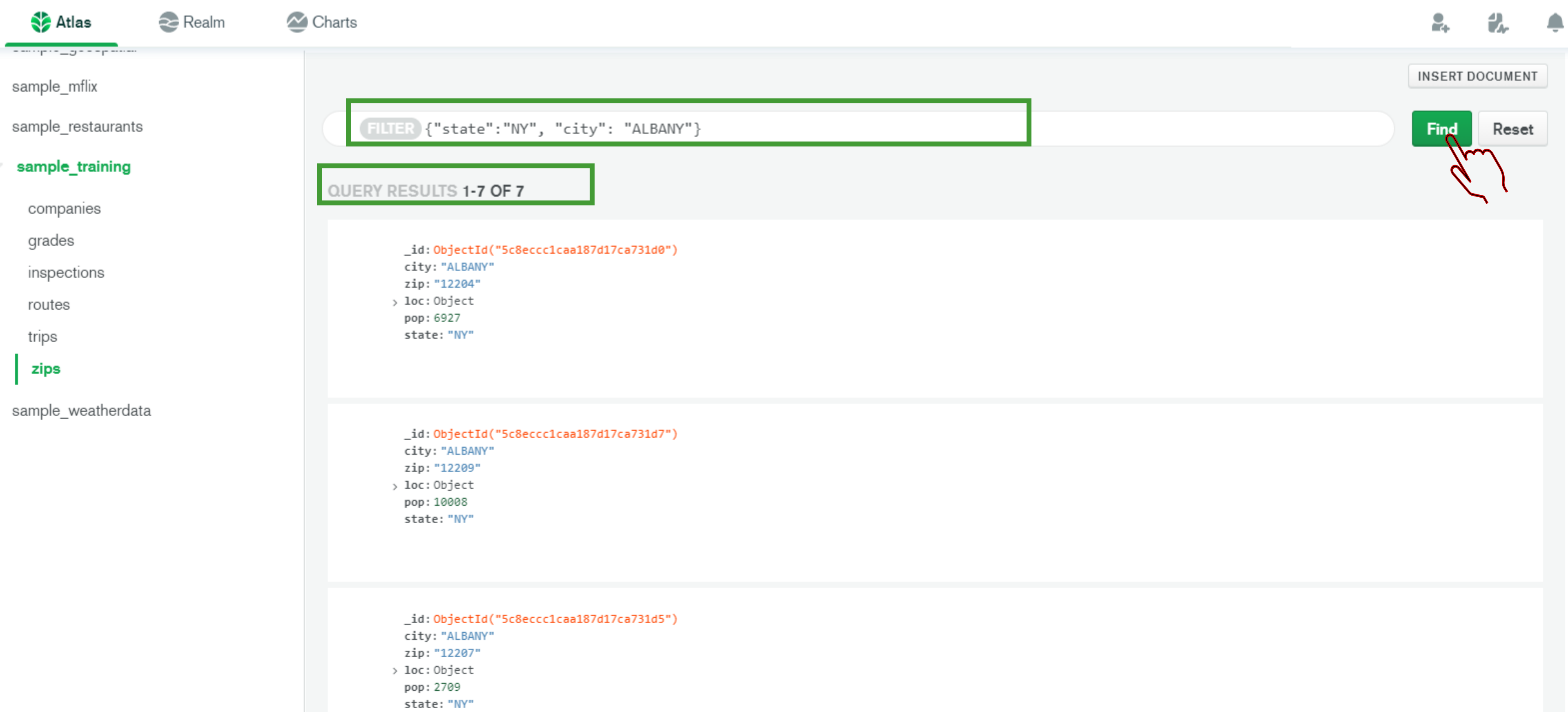
QUERY RESULTS 1-20 OF MANY

```
_id: ObjectId("5c8eccc1caa187d17ca72f89")
city: "FISHERS ISLAND"
zip: "06390"
> loc: Object
pop: 329
state: "NY"

_id: ObjectId("5c8eccc1caa187d17ca72f8b")
city: "NEW YORK"
zip: "10003"
> loc: Object
pop: 51224
state: "NY"

_id: ObjectId("5c8eccc1caa187d17ca72f8c")
city: "GOVERNORS ISLAND"
zip: "10004"
> loc: Object
pop: 3593
state: "NY"
```

Data Interaction using the Atlas UI



```
FILTER {"state":"NY", "city": "ALBANY"}
```

QUERY RESULTS 1-7 OF 7

```
_id: ObjectId("5c8eccc1caa187d17ca731d0")
city: "ALBANY"
zip: "12204"
> loc: Object
pop: 6927
state: "NY"

_id: ObjectId("5c8eccc1caa187d17ca731d7")
city: "ALBANY"
zip: "12209"
> loc: Object
pop: 10008
state: "NY"

_id: ObjectId("5c8eccc1caa187d17ca731d5")
city: "ALBANY"
zip: "12207"
> loc: Object
pop: 2709
state: "NY"
```

6- MongoDB Shell (mongosh) Query Documents

MongoDB Shell (mongosh)

- A fully functional JavaScript and Node.js *(support editing and running scripts).*
- You can use the MongoDB Shell to queries and operations directly with your database.

Connect to a Deployment:

- Connect to local MongoDB instance on default port:
  - `mongosh`
- Connect to local MongoDB instance on non default port:
  - `mongosh --port 28015` or `mongosh --host localhost:28015`
- Connect mongoDB instance on a remote host:
  - `mongosh “mongodb://mongodb0.example.com:28015”`
- Connecting to Atlas:
  - `mongosh "mongodb+srv://cluster0.msr5i.mongodb.net/myFirstDatabase" -u mongobasic`

Mongosh Usage

- List the databases available to the user:
  - show dbs
- Switch/Create databases:
  - use *db_name*
- List of all collections for current database:
  - show collections

Find Method

- **find()** selects documents in a collection or view and returns a cursor to the selected documents

Syntax: db.collectionname.find(query, projection)

Parameter	Type	Description
query	document	Optional. Specifies selection filter using query operators. To return all documents in a collection, omit this parameter or pass an empty document ({}).
projection	document	Optional. Specifies the fields to return in the documents that match the query filter. To return all fields in the matching documents, omit this parameter

Find Examples

- The examples in this section use documents from the bios collection where the documents generally have the form:

```
{
        "_id" : value,
        "name" : { "first" : string, "last" : string },              // embedded document
        "birth" : ISODate,
        "death" : ISODate,
        "contribs" : [ string, ... ],                                 // Array of Strings
        "awards" : [
                { "award" : string, "year": number, "by": string }    // Array of embedded
                                                                      documents
                ...
        ]
}
```

Find Examples

- Find all documents in a collection:
  - `db.bios.find()`
- Find all documents in the bios collection where _id **equals** 5:
  - `db.bios.find( { _id: 5 } )`
- Find all documents in the bios collection where the field last in the name embedded document **equals** "Hopper":
  - `db.bios.find( { "name.last": "Hopper" } )`

  to access fields in an embedded document, use dot notation
- To return all documents in the bios collection where the embedded document name is **exactly** { first: "Yukihiro", last: "Matsumoto" } including the order:
  - `db.bios.find( { name: { first: "Yukihiro", last: "Matsumoto" } })`

Find Examples

- To return all documents in the bios collection where the embedded document name **contains** a field first with the value "Yukihiro" and a field last with the value "Matsumoto“:
  - db.bios.find({ “name.first” : "*Yukihiro*", “name.last” : "*Matsumoto*" })

The query would match documents with name fields that held either of the following values:

{ first: *“Yukihiro”*, aka: *“Matz”*, last: *“Matsumoto”* }

{ last: *“Matsumoto”*, first: *“Yukihiro”* }

- To returns documents in the bios collection where the **array field** contains the element "UNIX“:
  - db.bios.find({ “contribs” : "*UNIX*" })

Find Examples

- To query for all documents where the field tags value is an array with exactly two elements, “A" and “B", in the specified order:
  - db.inventory.find({ tags: [*“A”, “B”*] }) *//match an array*

- To find an array that contains both the elements “A" and “B", without regard to order or other elements in the array, use the $all operator
  - db.inventory.find({ tags: { $all: [*“A”, “B”*] } })

- To returns documents in the bios collection where the awards array **contains an element** with award field **equals** "Turing Award":
  - db.bios.find({ "awards.award": *"Turing Award"* })

Query Operators

Name	Syntax	Description and Example
$eq	{ field: { $eq: *value* } }	db.inventory.find({ qty: { $eq: *20* } }) *Matches values that are equal to a specified value.*
$gt	{field: {$gt: *value*} }	db.inventory.find({ qty: { $gt: *20* } }) *Matches values that are greater than a specified value.*
$gte	{field: {$gte: *value*} }	db.inventory.find({ qty: { $gte: *20* } }) *Matches values that are greater than or equal to a specified value.*

$in	{field: { $in: [*value1, value2, ... valueN*] } }	db.inventory.find({ qty: { $in: [*5, 15*] } })
		db.bios.find({ contribs: { $in: [*"ALGOL", "Lisp"*] } })
		Matches any of the values specified in an array.

$lt	{field: {$lt: *value*} }	db.inventory.find({ qty: { $lt: *20* } }) *Matches values that are less than a specified value.*
$lte	{field: {$lte: *value*} }	db.inventory.find({ qty: { $lte: *20* } }) *Matches values that are less than or equal to a specified value.*

Query Operators

Name	Syntax	Description and Example
$ne	{field: { $ne: *value* } }	db.inventory.find({ qty: { $ne: *20* } }) *Matches all values that are not equal to a specified value.*
$nin	{field: { $nin: [*value1, value2, ... valueN*]}}	db.inventory.find({ qty: { $nin: [*5, 15*] } }) *Matches none of the values specified in an array.*
$and	{ $and: [*{ exp1 }, { exp2 }, ..., { expN }*] }	db.inventory.find({$and: [{price: {$ne: *1.99* }}, {price: {$exists: *true* }}]}) *implicit AND operation* - db.inventory.find({price: {$ne: *1.99*, $exists: *true* }}) *Joins query clauses with a logical AND returns all documents that match the conditions of both clauses.*
$or	{ $or: [*{ exp1 }, { exp2 } , ... , { expN }*] }	db.inventory.find({ $or: [{ quantity: { $lt: *20* } }, { price: *10* }] }) *Joins query clauses with a logical OR returns all documents that match the conditions of either clause.*

Query Operators

Name	Syntax	Description and Example
$not	{ field: { $not: { *operator-expression* } } }	db.inventory.find({ price: { $not: { $gt: *1.99* } } }) *Inverts the effect of a query expression and returns documents that do not match the query expression.*
$nor	{ $nor: [{ *exp1* }, { *exp2* }, ... { *expN* }] }	db.inventory.find({ $nor: [{ price: *1.99* }, { qty: *2* }] }) *Joins query clauses with a logical NOR returns all documents that fail to match both clauses.*
$exists	{ field: { $exists: *<boolean>* } }	db.inventory.find({ qty: { $exists: *true*, $nin: *[5, 15]* } }) *When <boolean> is true, $exists matches the documents that contain the field, including documents where the field value is null*

Query Operators

Name	Syntax	Description and Example

$regex	{ field: { $regex: /pattern/*<options>* } }
	or
	{ field: { $regex: /pattern/, $options: '*<options>*' } }
	or
	{ field: { $regex: 'pattern', $options: '*<options>*' } }
		- matche all documents where the sku field is like "%789":
		db.inventory.find({ sku: { $regex: /789$/ } })
		
		- use the **i** option perform a ***case-insensitive*** match for documents with sku value that starts with ABC
		db.inventory.find({ sku: { $regex: /^ABC/*i* } })
		
		- use the **m** option to match lines **starting with the letter** S for multiline strings:
		db.inventory.find({ description: { $regex: /^S/*m* } })
		
		- Use the **s** option to allow the dot character (i.e. **.**) to match all characters ***including* new line** as well as the i option to perform a case-insensitive match:
		db.inventory.find({ description: { $regex: /m.*line/, $options: 'si' } })

Query Operators

Name	Syntax	Description and Example
$all	{ field: { $all: [*value1, value2 ...*] } }	- **To find an array** that contains both the elements “A” and “B”, without regard to order or other elements in the array: db.inventory.find({ tags: { $all: [*“A”, “B”*] } })
$size	{field:{$size:*number*}}	db.inventory.find({tags:{$size:*3*}}) Selects documents if the array field is a specified size.

Query Operators

Name	Syntax	Description and Example
$elemMatch	{ field: { $elemMatch: {*exp1, exp2, ..., expN* } }	- . The following find() operation queries for all documents where the value of the zipcode field is 63109. The $elemMatch projection returns only the **first** matching element of the students array where the school field has a value of 102: `db.schools.find( { zipcode: “63109” }, { students: { $elemMatch: { school: 102 } } } )` - and the age field is greater than 10 `db.schools.find({ zipcode: “63109” }, { students: { $elemMatch: { school: 102, age: {$gt: 10} } } } )` Selects documents if element in the array field matches all the specified $elemMatch conditions.

count()

- Counts the number of documents referenced by a cursor. Append the count() method to a find() query to return the number of matching documents.
- Example:
  - db.restaurants.find({ 'address.zipcode': '*11369*'}).count()   *// the result is 5*

  or
  - db. restaurants.count({'address.zipcode': '*11369*'})   *// the result is 5*

limit()

- Use limit() to maximize performance and prevent MongoDB from returning more results than required for processing.
- Example:
  - db.restaurants.find({ 'address.zipcode': '*11369*'}).limit(*3*)   *// the result is 3*

skip()

- The skip() method controls the starting point of the results set.
- Example:
  - db.restaurants.find({ ‘address.zipcode’: ‘11369’}).skip(1) *// the result is 4*

sort()

- The sort() method orders the documents in the result set
- Example:
  - db.restaurants.find({ ‘address.zipcode’: ‘11369’}).sort({name: 1})
  - db.restaurants.find({ ‘address.zipcode’: ‘11369’}, {name: 1}).sort({name: 1})

projection

1: ascending

-1: descending

Projection

- The projection parameter determines which fields are returned in the matching documents. The projection parameter takes a document of the following form:

{ field1: *value*, field2: *value*, ... }

field: <1 or true>	Specifies the inclusion of a field. Non-zero integers are also treated as true.
field: <0 or false>	Specifies the exclusion of a field.

You cannot mix zeros and ones in a single projection. you can mix ones and zeros is when you're specifically asking to exclude the _id field

- Example:
  - db.restaurants.find({ 'address.zipcode': *'11369'*}, {name: *1*})
  - db.restaurants.find({ 'address.zipcode': *'11369'*}, {_id: 0, _id: 1, name: *1*})
  - db.restaurants.find({ 'address.zipcode': *'11369'*}, {_id: 1, _id: 0, name: *1*})
  - db.restaurants.find({ 'address.zipcode': *'11369'*}, {name: *1,* name: *0*})

Question?