AT82.02

DATA MODELING AND MANAGEMENT

LAB06: DOCUMENT DB (MONGODB)

DS&AI

Outline

- Scenario: TikTock E-Commerce
- MongoDB: Getting started
- MongoDB Practice
  - INSERT
  - UPDATE
  - DELETE
  - Basic Query

Project: RDB to NoSQL migration

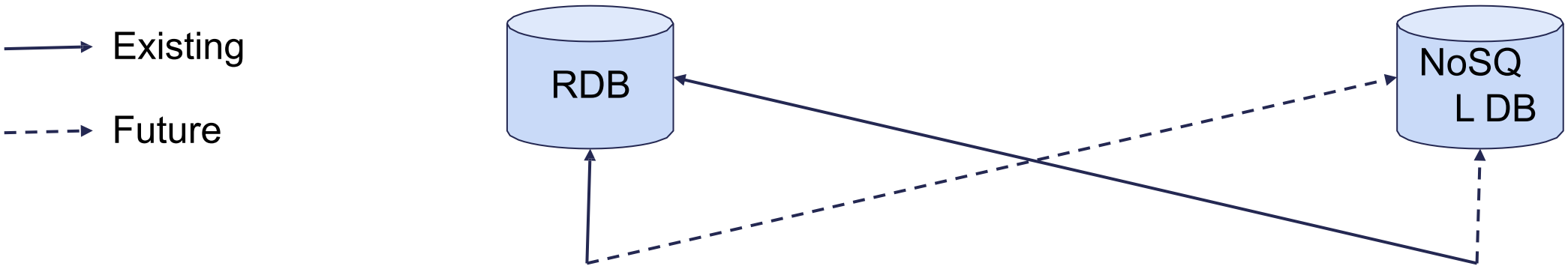
Scenario :

TickTock is an office supply company which has several store locations throughout the world and an online store website with relational database.

With flexibility of schema, performance and scalability features, TickTock is moving to NOSQL database.

YOU, as a db admin should design and implement query for core functions.

Project: RDB to NoSQL migration



TickTock Physical Stores

TickTock an Online Store

Require query statement for these core functions

- **Support e-commerce functions for customers:** (U1) Search product, (U2) Add product(s) to cart, and (U3) Checkout

  Note that: The payment process is excluded to simplify the system.

- **Support daily operation for store staff:** (U4) Add new products, (U5) Update product information, (U6) Delete duplicate product, (U9) Search insight customer behavior

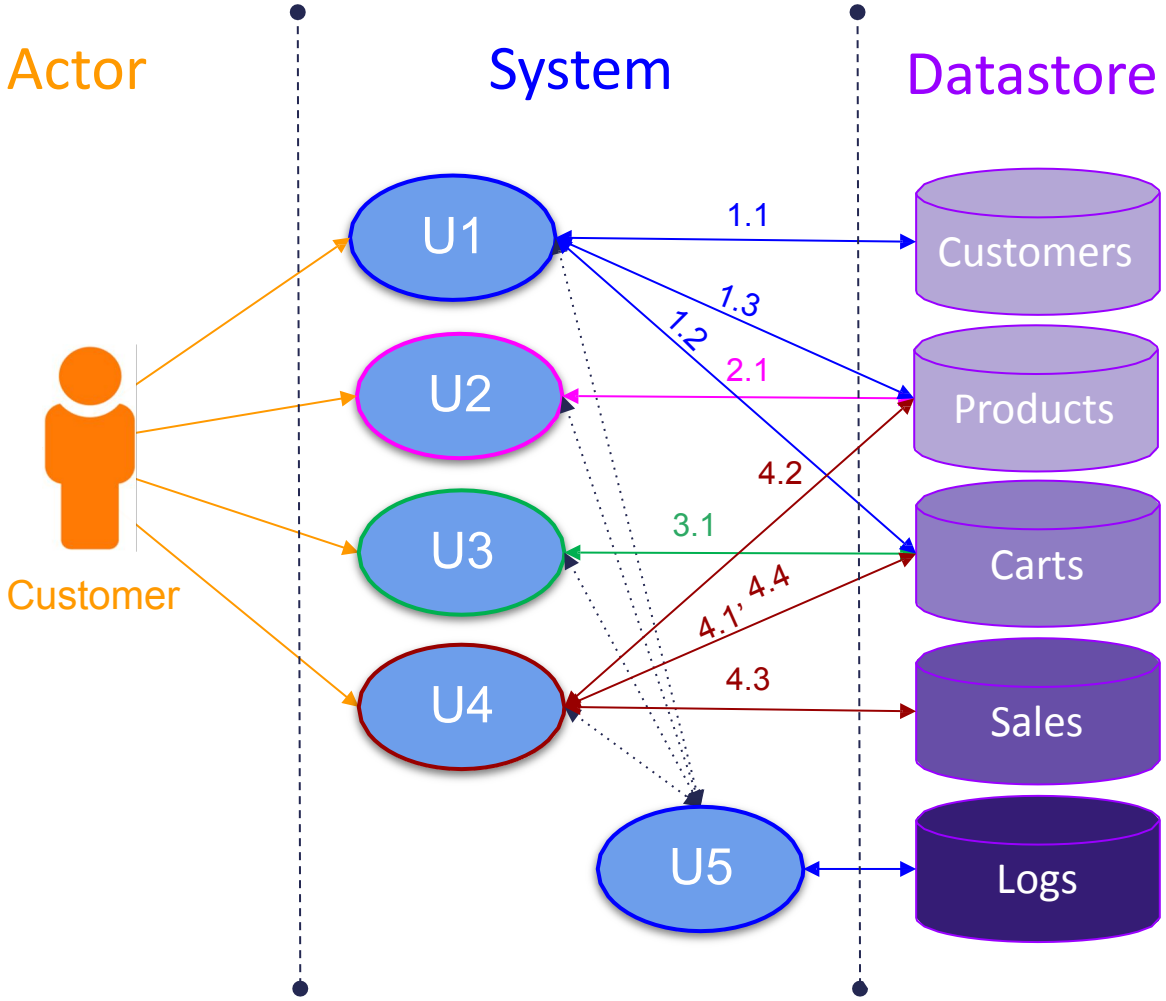
- **Support summary report for owner:** (U7) View popular product report by month, (U8) Total sales, count , average sales

Existing Data in RDB

Data	Description	Fields
Product data	Information about products	product id, name, description ,price, quantity in stock, product keywords
Customer data	Information about customers	email as username as custid,customer name, address, birthdate, password, bank account
Cart data	Information about cart and tentative purchased products	Cartid, product id, quantity, price
Sales data	Information about order and purchased products	the item(s) purchased, information on the customer who made the purchase, several other details regarding the sale.
Log data	Information about customers' activities	Action datetime, Action type, Action description, customer Action type = {''}1

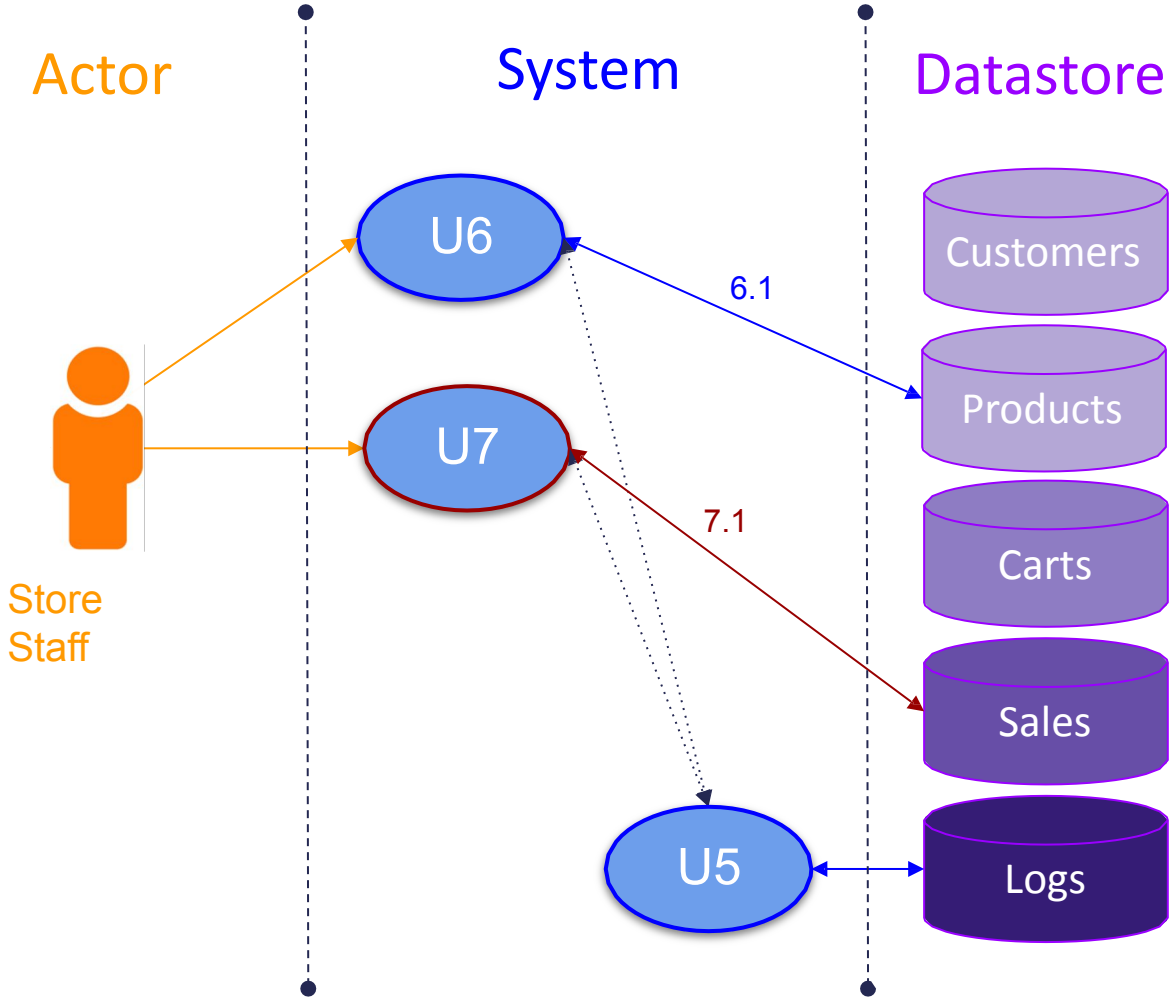
Customer Use Cases & Associated Datastore

Use Cases		Action
U1	Log in	1. Authentication & get customer info. 2. get Cart information 3. get latest price 4. Activate U5 with action='U1'
U2	Find Product	1. Get products by keywords 2. Activate U5 with action='U2'
U3	Update Shopping Cart	3.1(1) add a product to cart 3.1(2) remove products from cart 3.1(3) update quantity 3.2 Activate U5 with action='U3(n)'
U4	Checkout	1. Retrieve cart information 2. Retrieve latest price 3. Add Sales information 4. Remove purchased products from cart 5. Activate U5 with action='U4'
U5	Keep log	Insert action into logs datastore



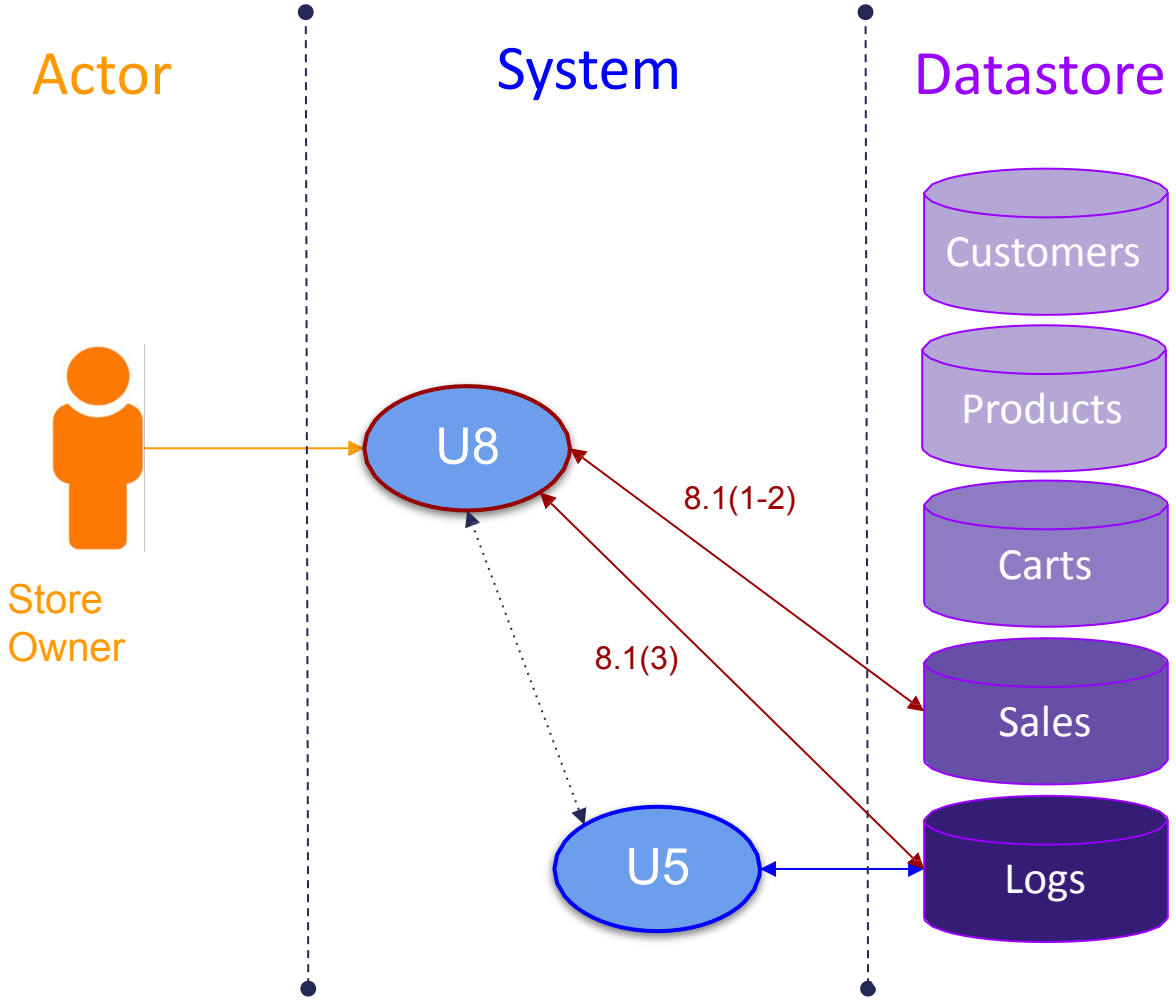
Store Staff Use Cases & Associated Datastore

Use Cases		Action
U6	Update Product and sale information	6.1(1) add a product 6.1(2) update bestseller for products 6.1(3) delete last-5year-sale document from sales 6.2 Activate U5 with action='U6'
U7	View Daily Report	For a given date 7.1(1) Get count sales for a given date 7.1(2) Get Sum total sales 7.1(3) The most/least purchased product 7.1(4) The average purchase cost per customer 7.2 Activate U5 with action='U7'
U5	Keep log	Insert action into logs datastore



Store Owner Use Cases & Associated Datastore

Use Cases		Action
U8	View Summary Report	Group by month, store type (i.e.,Online, Physical store) 8.1(1) Get the most popular product 8.1(2) Get total sales, count, average sales 8.2 Activate U5 with action='U8'
U5	Keep log	Insert action into logs datastore



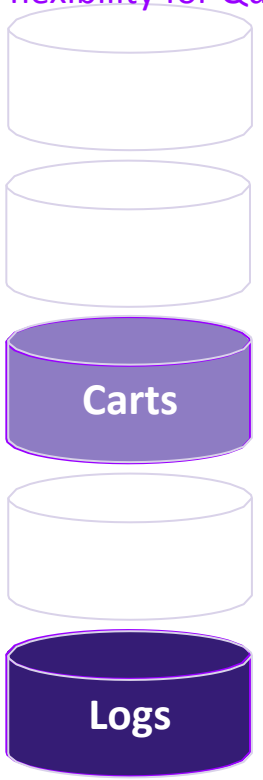
Data Modeling

Our data

Key-value model

+ Higher Speed Read and Write

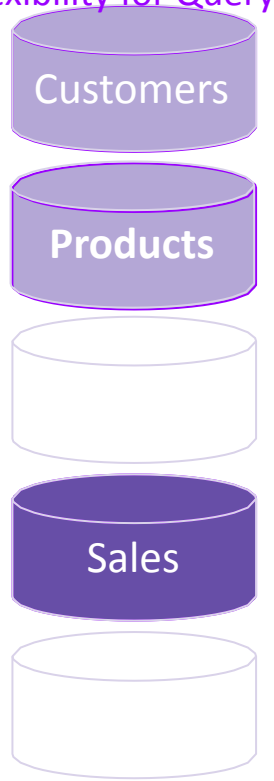
- Less flexibility for Query



Document model

-Lower Speed Read and Write

-Flexibility for Query



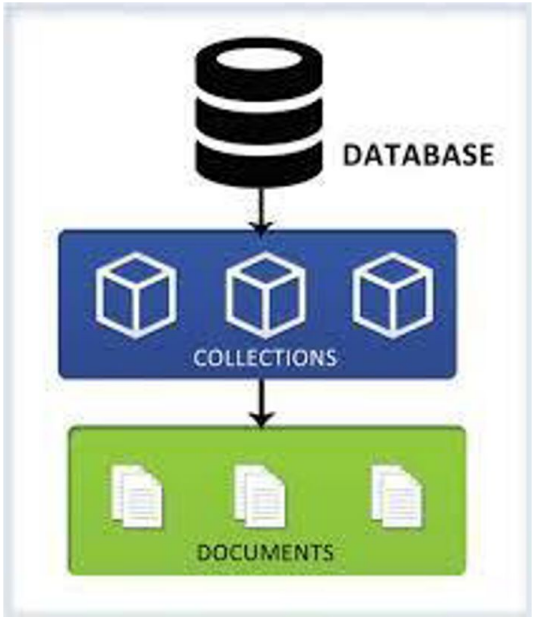
Getting Started

WHAT AND WHY

- Stores data in **JSON-like documents**.
- **Fields can vary** from document to document and data structure can be changed over time
- Distributed database, high availability, horizontal scaling, and geographic distribution
- Scalability
  - Performance Scale: Sustaining 100,000+ database read and writes per second while maintaining strict latency SLAs
  - Data Scale: Storing 1 billion+ documents in the database
  - Cluster Scale: Distributing the database across 100+ nodes, in multiple data centers

MongoDB Architecture

MongoDB Atlas Cloud Database



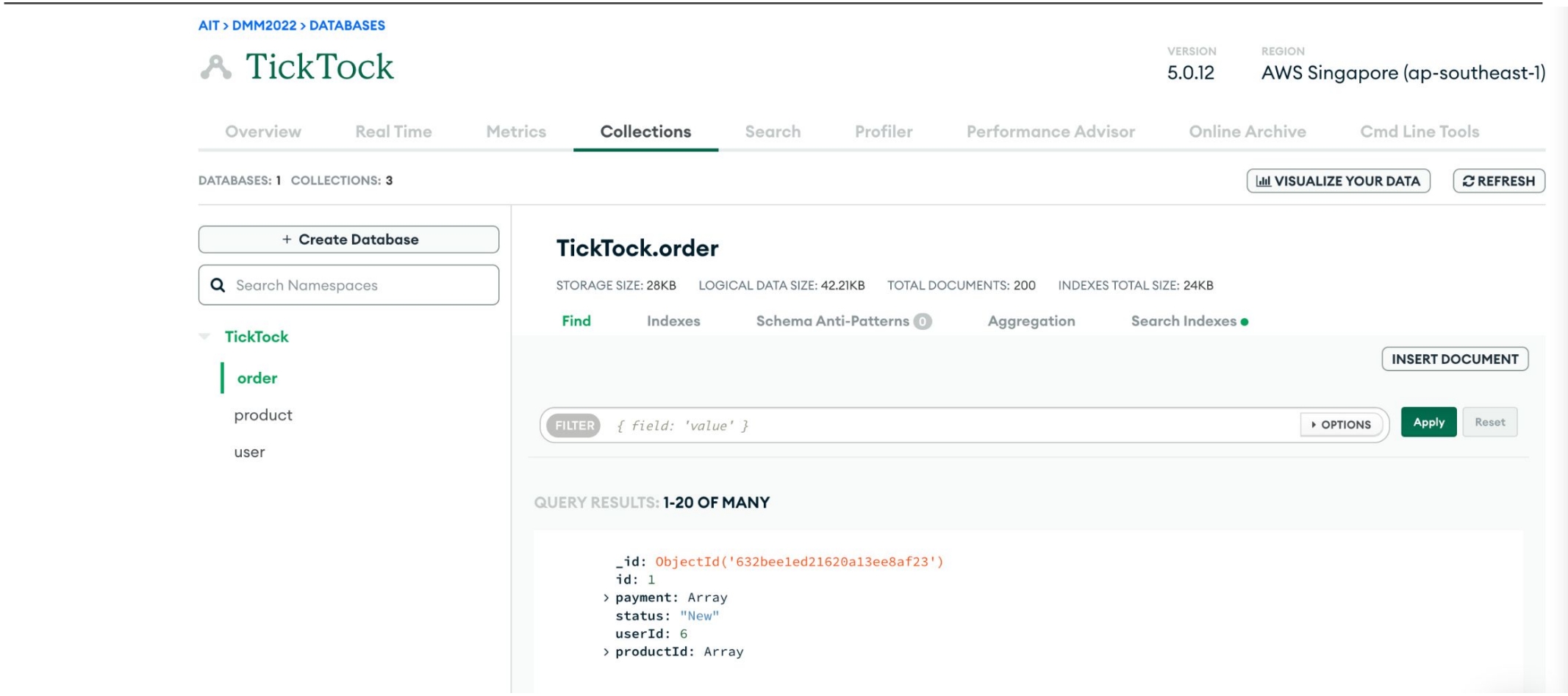
MongoDB Clients

Connect with the mongo shell
Interact with your cluster using MongoDB's interactive Javascript interface

Connect using MongoDB Compass
Explore, modify, and visualize your data with MongoDB's GUI

Connect your application
Connect your application to your cluster using MongoDB's native drivers

MongoDB Atlas

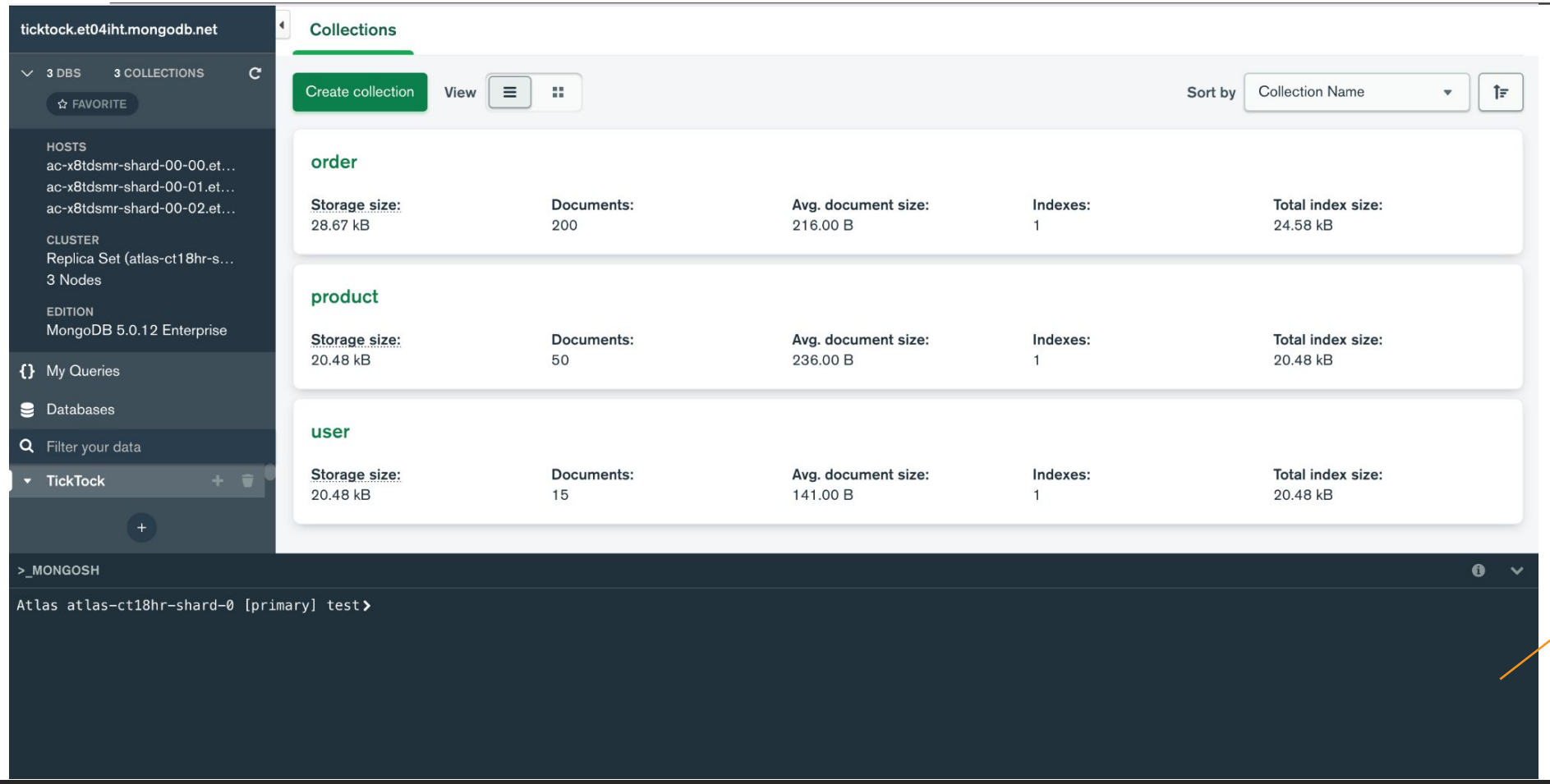


Connecting to MongoDB Atlas

- Download and Install MongoDB Compass
  https://www.mongodb.com/try/download/compass
- Create a new connection

mongodb+srv://root:admin@ticktock.et04iht.mongodb.net/test?authSource=admin&replicaSet=atlas-ct18hr-shard-0&readPreference=primary&ssl=true

MongoDB Compass



MongoShell

MongoDB Practice

- Managing Product Information (U6)
  - INSERT
  - UPDATE
  - DELETE
- Searching Products (U2)
  - Basic Query

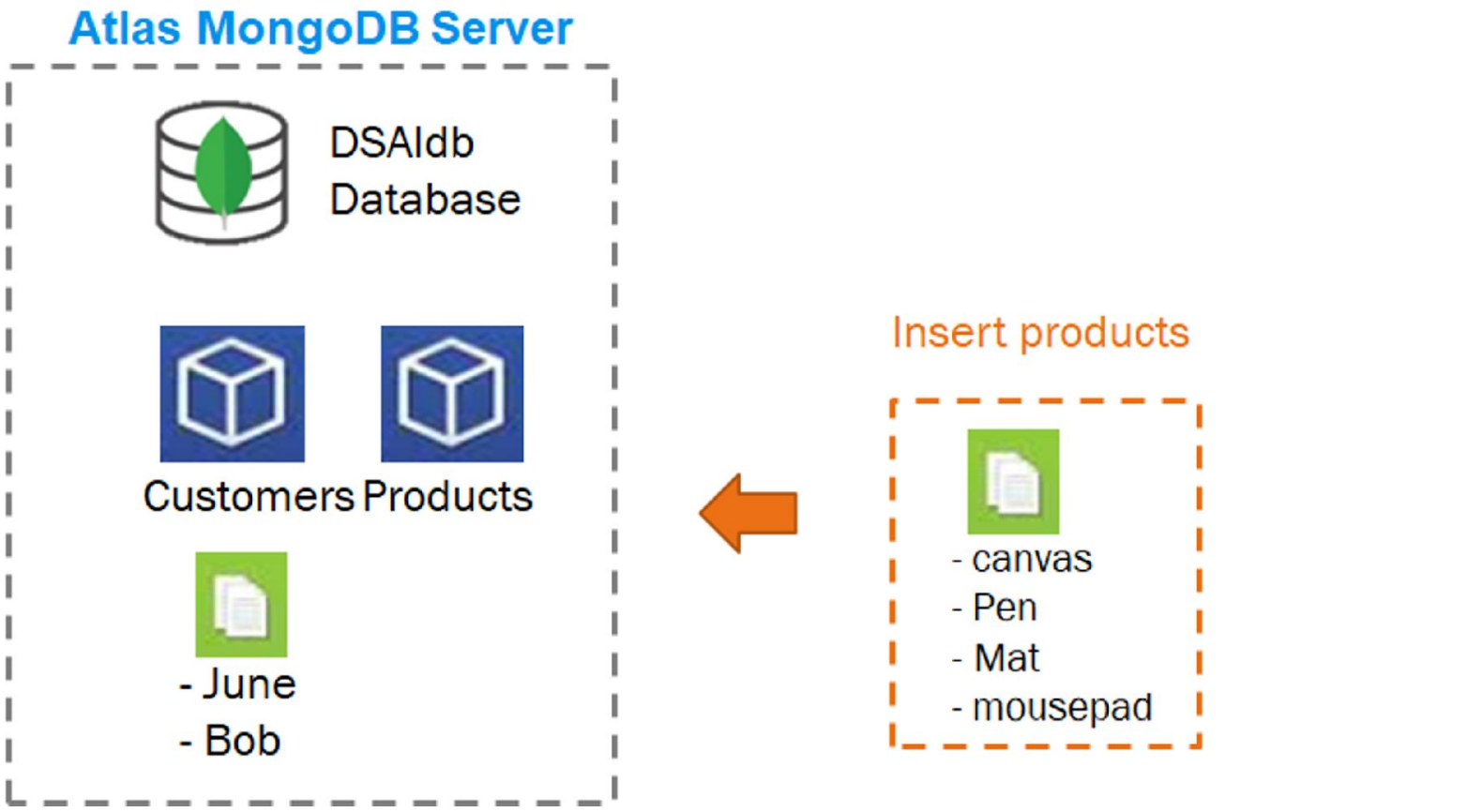
Insert Documents

db.collection.insertMany()

Syntax:

```
db.collection.insertMany(
    [ <document 1> , <document 2>, ... ]
)
```

Document Model Architecture



Insert product documents

```
// Insert only one document
db.product.insertOne(
        { name: "woodplate", quantity: 100, price: 500, tags: ["wood", ”school”] }
)
// Insert multiple documents
db.product.insertMany([
  {
        name: "ruler", quantity: 1250, price: 20, tags: ["ruler",”pooh”],
        size: { h: 30, w: 5, uom: "cm" }
  },
  {
        name: “eraser", quantity: 850, price: 9,   tags: ["gray", ”eraser”, ”pencil”],
        size: { h: 5, w: 2, uom: "cm" }
  },
  {
        name: "mouse", quantity : 250, price: 199, tags: ["wired", "black"]
  }
 ])
```

Update product(s) add “isBestSeller” field

SQL Query	MongoDB command
Alter table products Add isBestSeller boolean + Update products set isBestSeller = FALSE	*Schemaless, no need to define.* *If defined,* db.products.updateMany({}, {$set: {isBestSeller: false}}
Update products set isBestSeller = TRUE Where _id = “603b60852014074d58e9d927”	db.products.updateMany({_id: ObjectId(“603b60852014074d58e9d927”)}, {$set: {isBestSeller: true}}
	To remove bestseller db.products.updateMany({isBestSeller:true},{ $unset: {"isBestSeller": "true"}})

Result

```
> db.products.updateMany(
        {_id: ObjectId("603b60852014074d58e9d927")},
        {$set: {isBestSeller: true}})
< { acknowledged: true,
    insertedId: null,
    matchedCount: 1,
    modifiedCount: 1,
    upsertedCount: 0 }
```

$unset

```
> db.products.updateMany( {isBestSeller:true},{ $unset: {"isBestSeller": "true"}})
< { acknowledged: true,
    insertedId: null,
    matchedCount: 1,
    modifiedCount: 1,
    upsertedCount: 0 }
```

Find Confirmed Order from Order

SQL Query	MongoDB command
Select from Order Where status = ‘Confirmed’	db.order.find ({status:"Confirmed"})

```
> db.order.find({status:"Confirmed"})
< { _id: ObjectId("632bee1ed21620a13ee8af24"),
    id: 2,
    payment:
     [ { paymentMethod: 'Cash On Delivery',
         paymentStatus: 'Completed',
         paymentId: 'Pending',
         total: '$5806.13' } ],
    status: 'Confirmed',
    userId: 9,
    productId: [ 13, 89, 81 ] }
  { _id: ObjectId("632bee1ed21620a13ee8af25"),
    id: 3,
    payment:
     [ { paymentMethod: 'QR',
         paymentStatus: 'Pending',
         paymentId: 'Completed',
         total: '$6186.82' } ],
    status: 'Confirmed',
```

Delete Confirmed Order from Order

```
db.Order.deleteMany(
{status: “Confirmed”})
```

Your Turn

1. Add your own 4 products using insertMany()
2. Try to update your product information by adding a quantity field. Define different quantity for each product.

MongoDB Practice

- Managing Product Information (U6)
- Searching Products (U2)
  - Basic Query

Basic Query

SQL statements	MongoDB statements
SELECT * FROM Product	db.product.find([<query>, <projection>]);

View all products

```
db.product.find({})
```

```
> db.product.find({})
< { _id: ObjectId("632d29d89c05f50cc5b24164"),
    id: 1,
    name: 'Leather Sofa Set 6 Seater',
    status: 'Available',
    description:
     [ { countrOfOrigin: 'Japan',
         material: 'Oak Wood',
         dimension: [ { height: 11, width: 4, weight: 12049 } ] } ],
    price: 615.82 }
  { _id: ObjectId("632d29d89c05f50cc5b24165"),
    id: 2,
    name: 'Dining Table 4 Seater',
    status: 'Available',
    description:
     [ { countrOfOrigin: 'Srilanka',
         material: 'Cashmire Wood',
         dimension: [ { height: 14, width: 2, weight: 6324 } ] } ],
    price: 921.23 }
```

Order By

SELECT * FROM products ORDER BY name	db.product.find({}).sort({name: 1})
SELECT * FROM products ORDER BY name DESC	db.product.find({}).sort({name: -1})

Find()

`db.collection.find(query, projection)`

```
db.products.find({name:"backpack"})
```

- **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

```
db.products.find({},{_id:0,quantity: 0,tags:0})
```

  - 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.

Projection

Fields to return in the resulting data. 0 = Not Show, 1 = Show

```
> db.product.find({},{price:0, userId: 0})
< { _id: ObjectId("632bf1ded21620a13ee8aff3"),
    id: 1,
    name: 'Leather Sofa Set 6 Seater',
    status: 'Available',
    description:
     [ { countrOfOrigin: 'Japan',
         material: 'Oak Wood',
         dimension: [ { height: 11, width: 4, weight: 12049 } ] } ] }
  { _id: ObjectId("632bf1ded21620a13ee8aff4"),
    id: 2,
    name: 'Dining Table 4 Seater',
    status: 'Available',
    description:
     [ { countrOfOrigin: 'Srilanka',
         material: 'Cashmire Wood',
         dimension: [ { height: 14, width: 2, weight: 6324 } ] } ] }
```

Query

db.product.find({name: "Wooden Chair"})

```
> db.product.find({name: "Wooden Chair"})
< { _id: ObjectId("632bf1ded21620a13ee8affe"),
    id: 12,
    name: 'Wooden Chair',
    status: 'Available',
    description:
     [ { countrOfOrigin: 'Mongolia',
         material: 'Synthetic',
         dimension: [ { height: 10, width: 8, weight: 2689 } ] } ],
    price: '$839.36' }
  { _id: ObjectId("632bf1ded21620a13ee8b005"),
    id: 19,
    name: 'Wooden Chair',
    status: 'Unavailable',
    description:
     [ { countrOfOrigin: 'Bangladesh',
         material: 'Synthetic',
         dimension: [ { height: 4, width: 3, weight: 5517 } ] } ],
```

Query Operators

- $eq: Matches values that are equal to a specified value.
- $gt: Matches values that are greater than a specified value.
- $gte: Matches values that are greater than or equal to a specified value.
- $in: Matches any of the values specified in an array.
- $lt: Matches values that are less than a specified value.
- $lte: Matches values that are less than or equal to a specified value.
- $ne: Matches all values that are not equal to a specified value.
- $nin: Matches none of the values specified in an array.

Query Operators : Example

$ne : not equal

```
db.product.find(
{
  name: {$ne:  ”Wooden
  Chair”}
}
);
```

```
> db.product.find({name: {$ne:    "Wooden Chair"}});
< { _id: ObjectId("632bf1ded21620a13ee8aff3"),
    id: 1,
    name: 'Leather Sofa Set 6 Seater',
    status: 'Available',
    description:
     [ { countrOfOrigin: 'Japan',
         material: 'Oak Wood',
         dimension: [ { height: 11, width: 4, weight: 12049 } ] } ],
    price: '$615.82' }
  { _id: ObjectId("632bf1ded21620a13ee8aff4"),
    id: 2,
    name: 'Dining Table 4 Seater',
    status: 'Available',
    description:
     [ { countrOfOrigin: 'Srilanka',
         material: 'Cashmire Wood',
         dimension: [ { height: 14, width: 2, weight: 6324 } ] } ],
    price: '$921.23' }
```

Query Operators : Example

$lt : less than

```
db.order.find
    ({userId:
        {$lt: 5}
    })
```

```
{ _id: ObjectId("632bee1ed21620a13ee8af2f"),
  id: 13,
  payment:
   [ { paymentMethod: 'Credit Card',
       paymentStatus: 'Completed',
       paymentId: 'Completed',
       total: '$9695.96' } ],
  status: 'Confirmed',
  userId: 4,
  productId: [ 12 ] }
{ _id: ObjectId("632bee1ed21620a13ee8af38"),
  id: 22,
  payment:
   [ { paymentMethod: 'Credit Card',
       paymentStatus: 'Completed',
       paymentId: 'Completed',
       total: '$9454.54' } ],
  status: 'Delivered',
  userId: 4,
  productId: [ 26, 16, 29 ] }
{ _id: ObjectId("632bee1ed21620a13ee8af3a"),
```

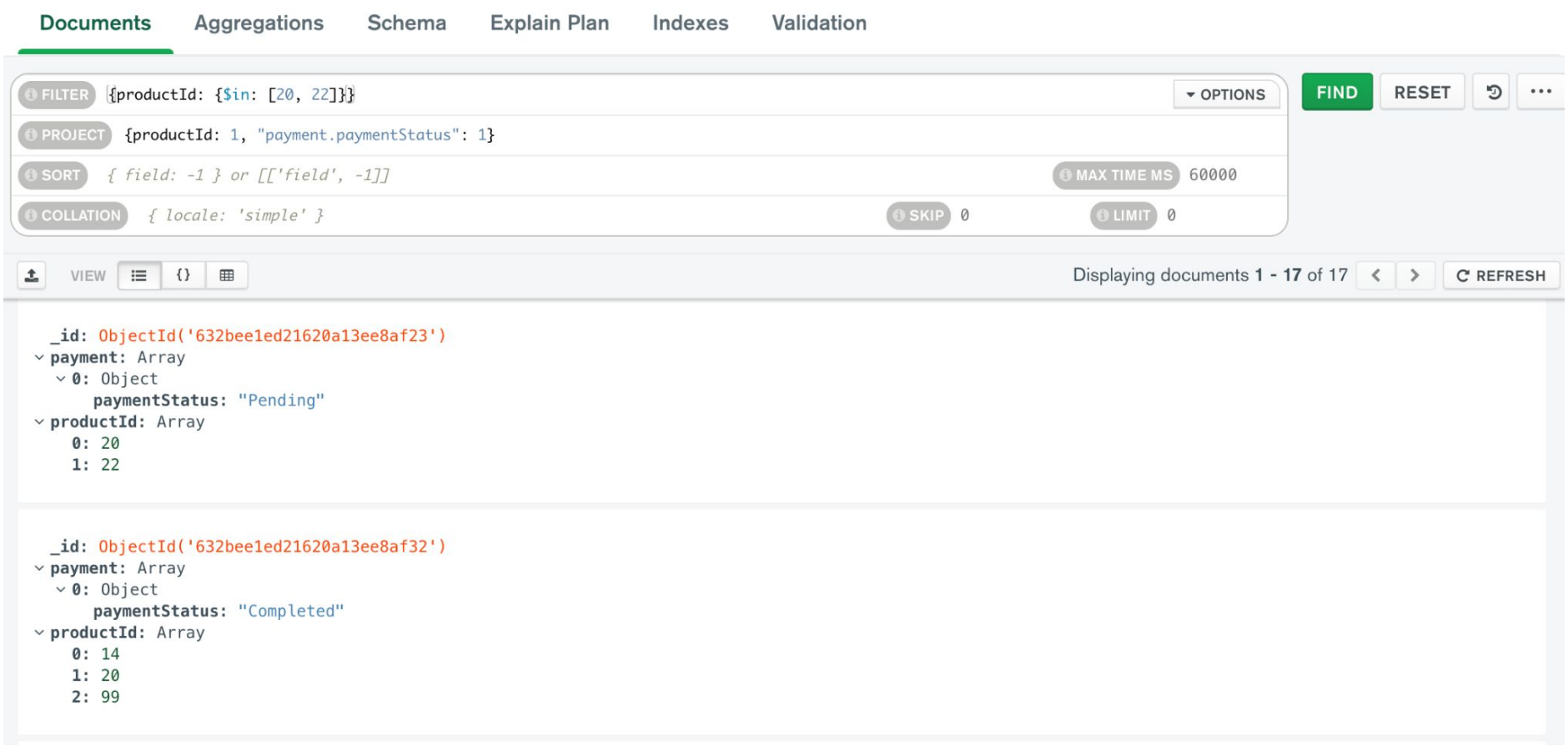
Querying with RegEx

```
db.product.find
        ({
                name: {
                        $regex:
                        /Chair/
                        }
        });
```

```
> db.product.find({name: {$regex: /Chair/}});
< { _id: ObjectId("632bf1ded21620a13ee8aff5"),
    id: 3,
    name: 'Rocking Chair',
    status: 'Available',
    description:
     [ { countrOfOrigin: 'Nepal',
         material: 'Synthetic',
         dimension: [ { height: 13, width: 6, weight: 5048 } ] } ],
    price: '$889.70' }
  { _id: ObjectId("632bf1ded21620a13ee8aff6"),
    id: 4,
    name: 'Rocking Chair',
    status: 'Available',
    description:
     [ { countrOfOrigin: 'Thailand',
         material: 'Synthetic',
         dimension: [ { height: 7, width: 8, weight: 7184 } ] } ],
    price: '$735.67' }
  { _id: ObjectId("632bf1ded21620a13ee8aff7"),
    id: 5,
    name: 'Office Wooden Chair',
```

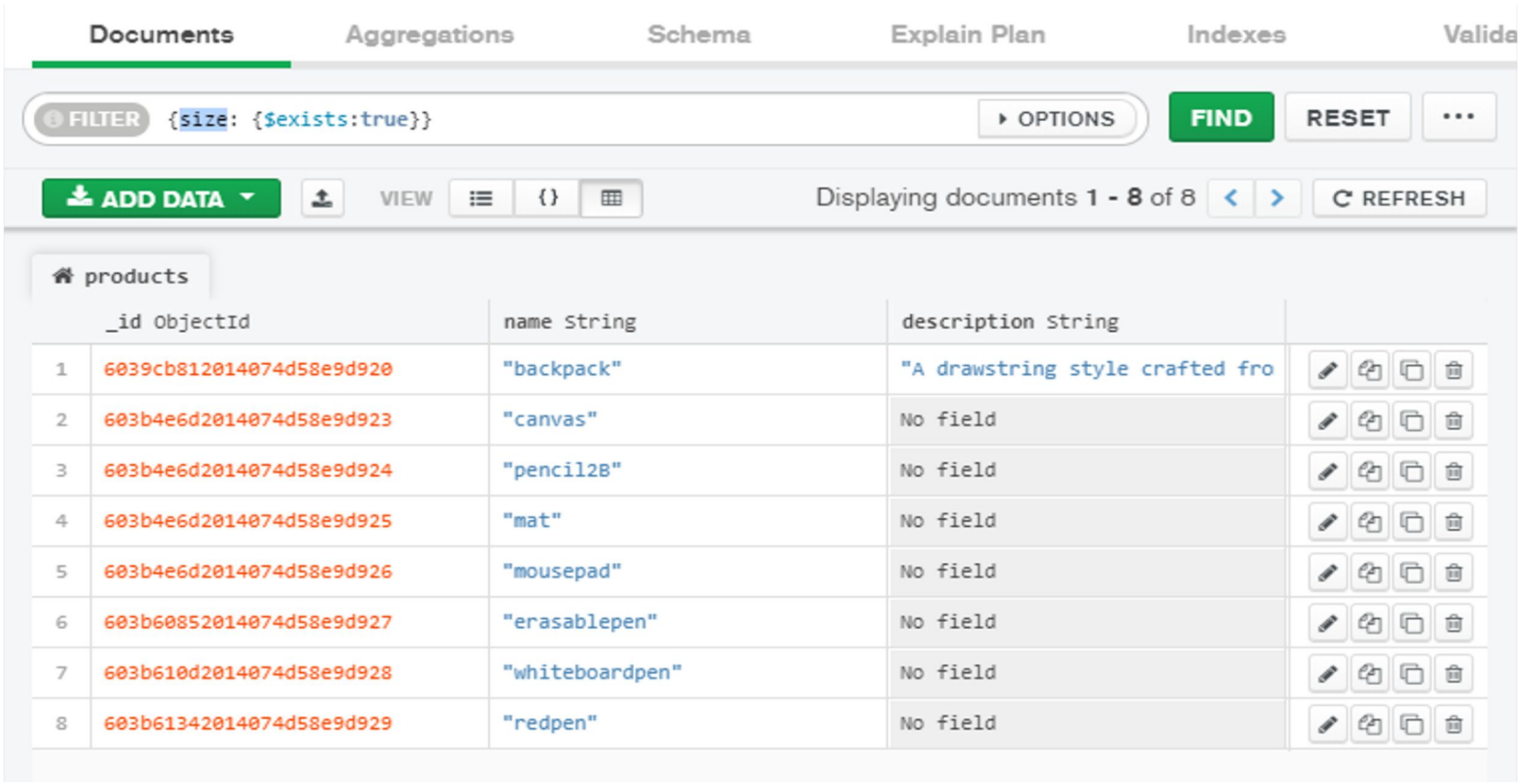
IN

Search for Order status for Order that have product Id 20 or 22



EXISTS

Search products where size exists



	_id ObjectId	name String	description String
1	6039cb812014074d58e9d920	"backpack"	"A drawstring style crafted fro
2	603b4e6d2014074d58e9d923	"canvas"	No field
3	603b4e6d2014074d58e9d924	"pencil2B"	No field
4	603b4e6d2014074d58e9d925	"mat"	No field
5	603b4e6d2014074d58e9d926	"mousepad"	No field
6	603b60852014074d58e9d927	"erasablepen"	No field
7	603b610d2014074d58e9d928	"whiteboardpen"	No field
8	603b61342014074d58e9d929	"redpen"	No field

Specify more than one conditions

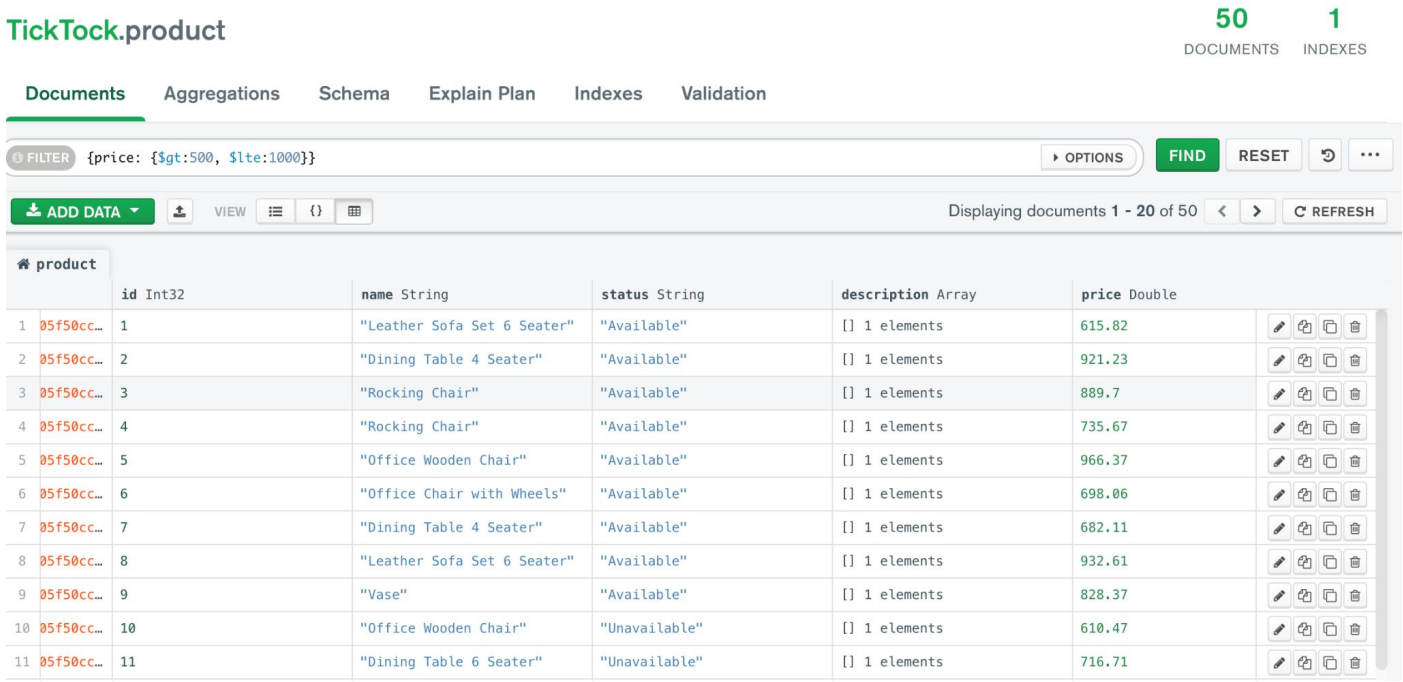
- $AND: both conditions have to be satisfied
- $OR: only a condition satisfy

AND

Search products where price greater than 500 and less than or equal to 1000.

```
db.product.find({
    price: {
            $gt: 500, $lte: 1000
            }
        })
```

Result



	id Int32	name String	status String	description Array	price Double
1	05f50cc… 1	"Leather Sofa Set 6 Seater"	"Available"	[] 1 elements	615.82
2	05f50cc… 2	"Dining Table 4 Seater"	"Available"	[] 1 elements	921.23
3	05f50cc… 3	"Rocking Chair"	"Available"	[] 1 elements	889.7
4	05f50cc… 4	"Rocking Chair"	"Available"	[] 1 elements	735.67
5	05f50cc… 5	"Office Wooden Chair"	"Available"	[] 1 elements	966.37
6	05f50cc… 6	"Office Chair with Wheels"	"Available"	[] 1 elements	698.06
7	05f50cc… 7	"Dining Table 4 Seater"	"Available"	[] 1 elements	682.11
8	05f50cc… 8	"Leather Sofa Set 6 Seater"	"Available"	[] 1 elements	932.61
9	05f50cc… 9	"Vase"	"Available"	[] 1 elements	828.37
10	05f50cc… 10	"Office Wooden Chair"	"Unavailable"	[] 1 elements	610.47
11	05f50cc… 11	"Dining Table 6 Seater"	"Unavailable"	[] 1 elements	716.71

OR

Search product from Japan or Thailand

```
db.product.find({$or: [{"description.countrOfOrigin": "Japan"}, {"description.countrOfOrigin":"Thailand"}]})
```

Result

```
> db.product.find({$or: [{"description.countrOfOrigin": "Japan"}, {"description.countrOfOrigin":"Thailand"}]})
< { _id: ObjectId("632d29d89c05f50cc5b24164"),
    id: 1,
    name: 'Leather Sofa Set 6 Seater',
    status: 'Available',
    description:
     [ { countrOfOrigin: 'Japan',
         material: 'Oak Wood',
         dimension: [ { height: 11, width: 4, weight: 12049 } ] } ],
    price: 615.82 }
  { _id: ObjectId("632d29d89c05f50cc5b24167"),
    id: 4,
    name: 'Rocking Chair',
    status: 'Available',
    description:
     [ { countrOfOrigin: 'Thailand',
         material: 'Synthetic',
         dimension: [ { height: 7, width: 8, weight: 7184 } ] } ],
    price: 735.67 }
```

QUERY on Complex fields

Nested Fields or array fields

Query Nested Field Uses **dot notation** to access fields in an embedded document:

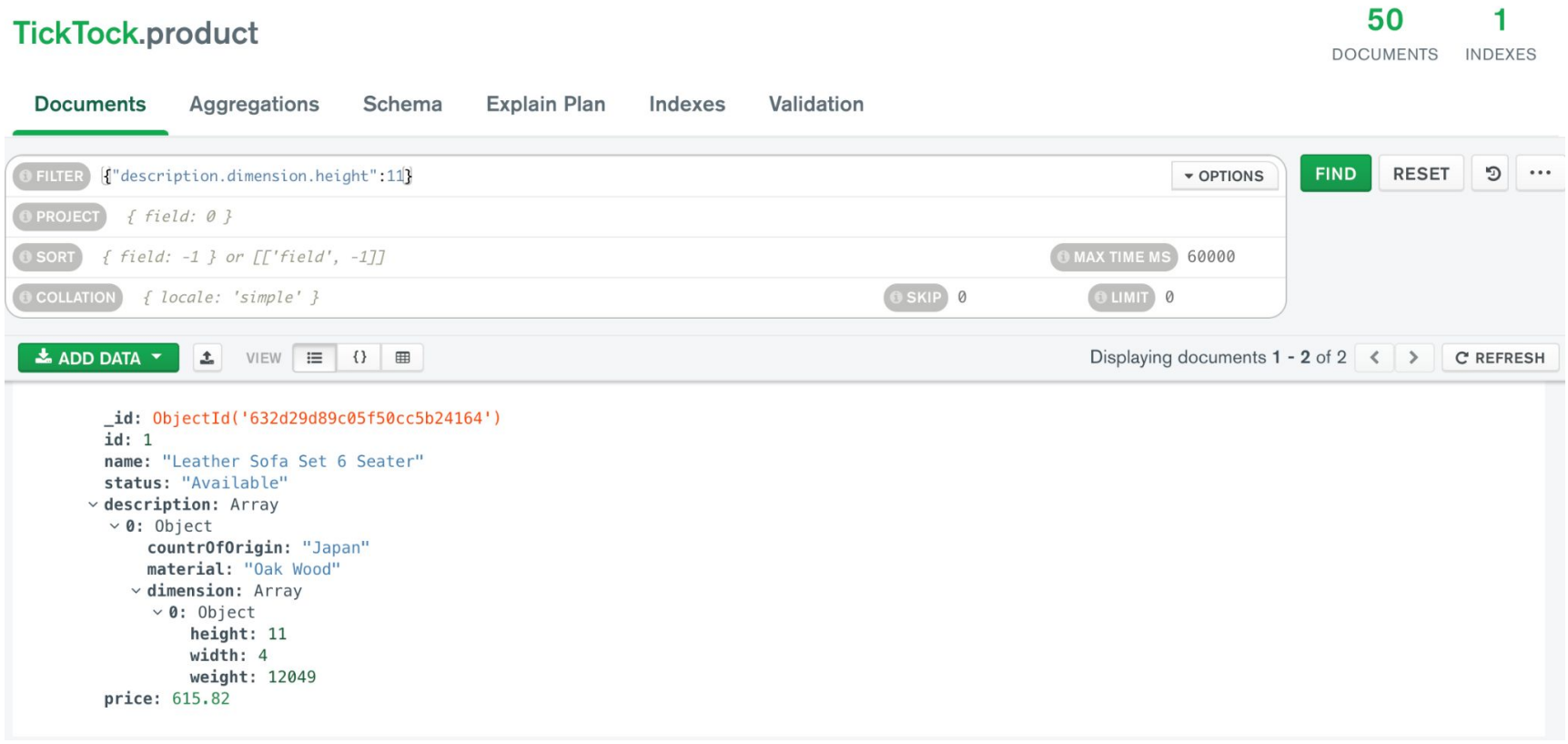
Array Field E.x. tags

Nested Field Ex. size

Query Nested Field

Select all products where height dimension is exactly 11

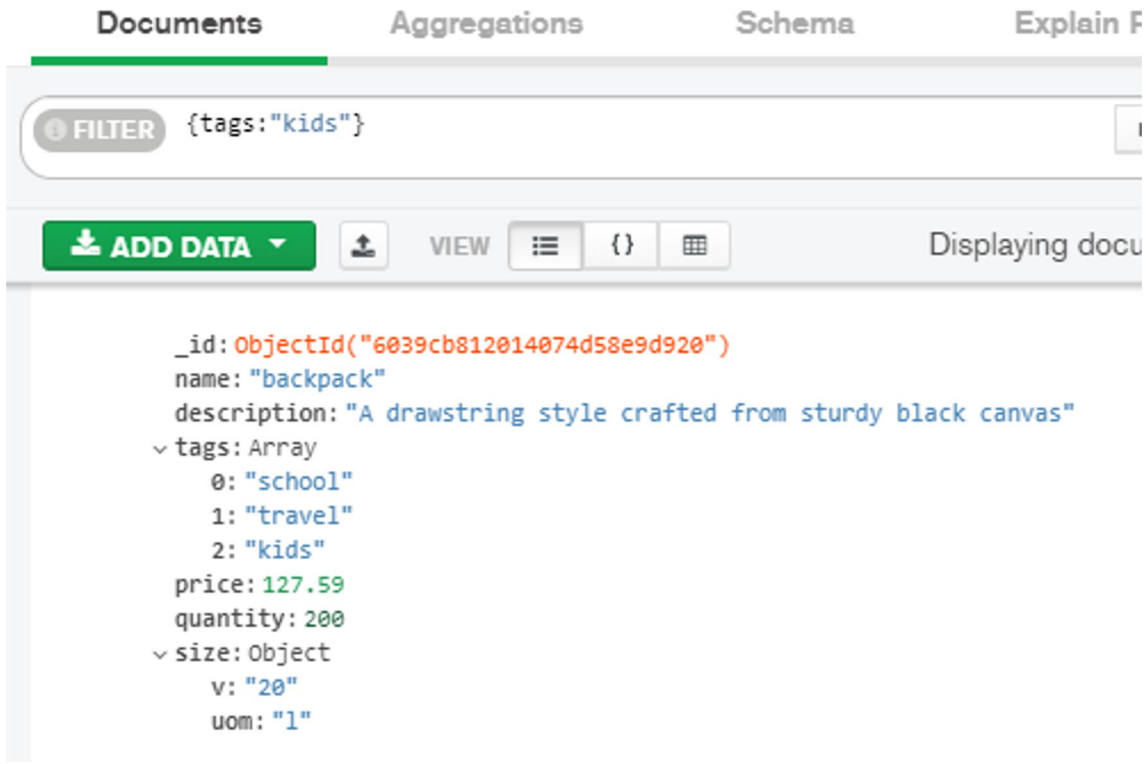
```
db.product.find({"description.dimension.height":11})
```



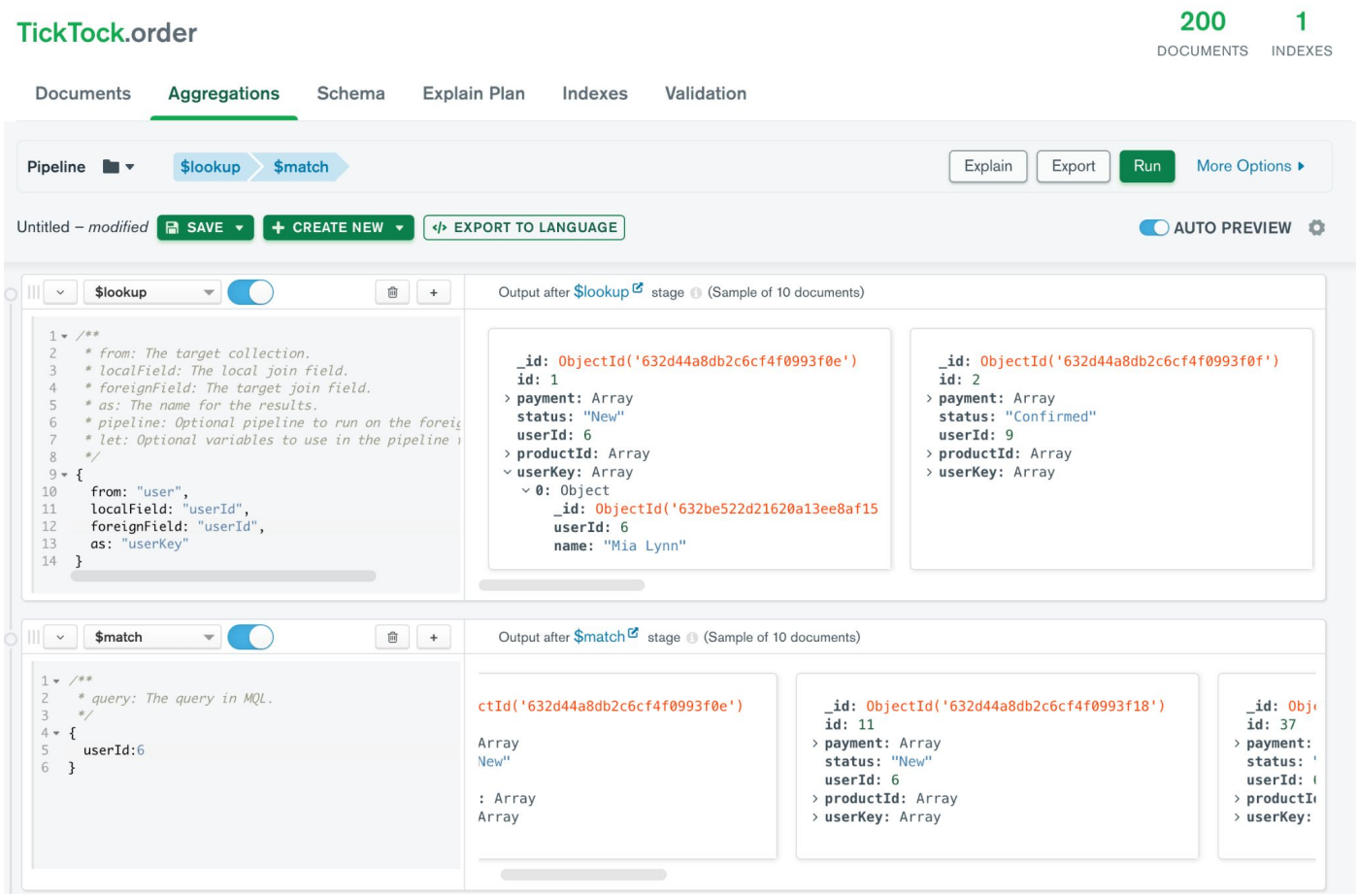
Query Array Field

Search products for kids using tags

```
> db.products.find({tags:"kids"})
< { _id: ObjectId("6039cb812014074d58e9d920"),
    name: 'backpack',
    description: 'A drawstring style crafted fr
    tags: [ 'school', 'travel', 'kids' ],
    price: NumberDecimal("127.59"),
    quantity: 200,
    size: { v: '20', uom: 'l' } }
```



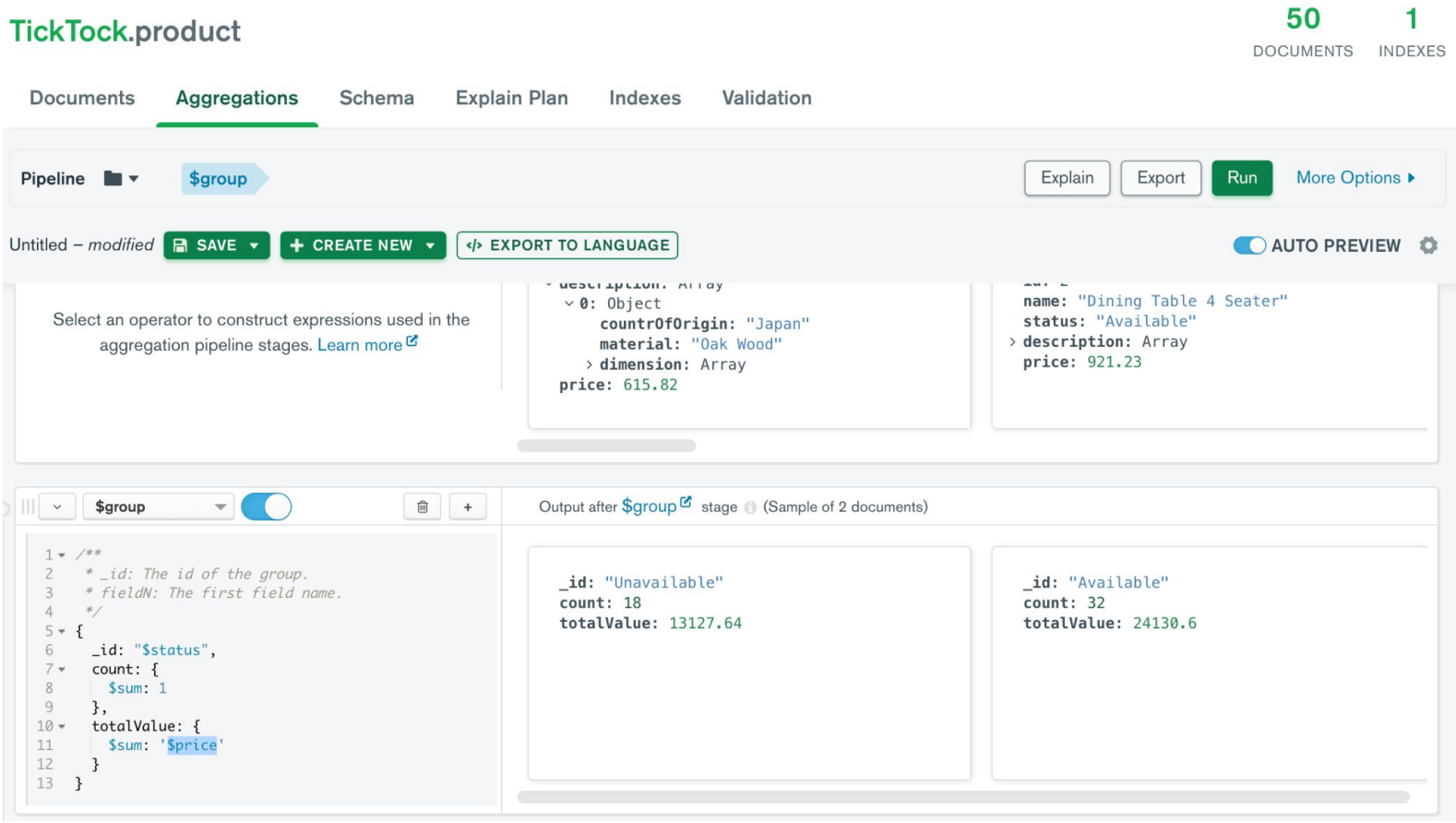
LookUp & Aggregate Queries



LookUp & Aggregate Queries

List the count of product on the basis of their status.

```
db.product.aggregate([
    {
    $group: {
            _id: "$status",
            count: {
            $sum: 1
        },
    totalValue: {
    $sum: '$price'
            }
        }
    }
]);
```



Your Turn

1. Show all products sorted by quantity in descending order.
2. Show all products with a specific tag, ordered by price ascendingly.
3. Select products where their height less than 15 cm and the UOM is in cm.

Additional References

1. Create your own MongoDB server on Atlas
   - https://docs.atlas.mongodb.com/getting-started/
   - https://www.youtube.com/watch?v=S4fi6Qux-4g
2. Using MongoDB plugin on VS Code
   - https://docs.mongodb.com/mongodb-vscode/install/
   - https://www.youtube.com/watch?v=g1EjixJht6g&t=424s
3. Using MongoDB in Python
   - https://docs.mongodb.com/drivers/python/
   - https://www.youtube.com/watch?v=rE_bJl2GAY8


Thank you.