Aggregating Data across Documents in MongoDB

MEETING THE MONGODB AGGREGATION FRAMEWORK

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What Is All That Fuzz with Aggregation?

With Aggregation You Go from This

```
{ "_id" : ObjectId("5e8936cd6347c0057a053363"), "name" : "Modern NYC",
"neighbourhood_cleansed" : "Washington Heights" }
{ "_id" : ObjectId("5e8936cd6347c0057a053364"), "name" : "Skylit Midtown Castle",
"neighbourhood_cleansed" : "Midtown" }
{ "_id" : ObjectId("5e8936cd6347c0057a053365"), "name" : "Cozy Entire Floor of
Brownstone", "neighbourhood_cleansed" : "Clinton Hill" }
{ "_id" : ObjectId("5e8936cd6347c0057a053366"), "name" : "Large Cozy 1 BR Apartment
In Midtown East", "neighbourhood_cleansed" : "Murray Hill" }
{ "_id" : ObjectId("5e8936cd6347c0057a053367"), "name" : "Super Room in Great area.",
"neighbourhood_cleansed" : "Lower East Side" }
```

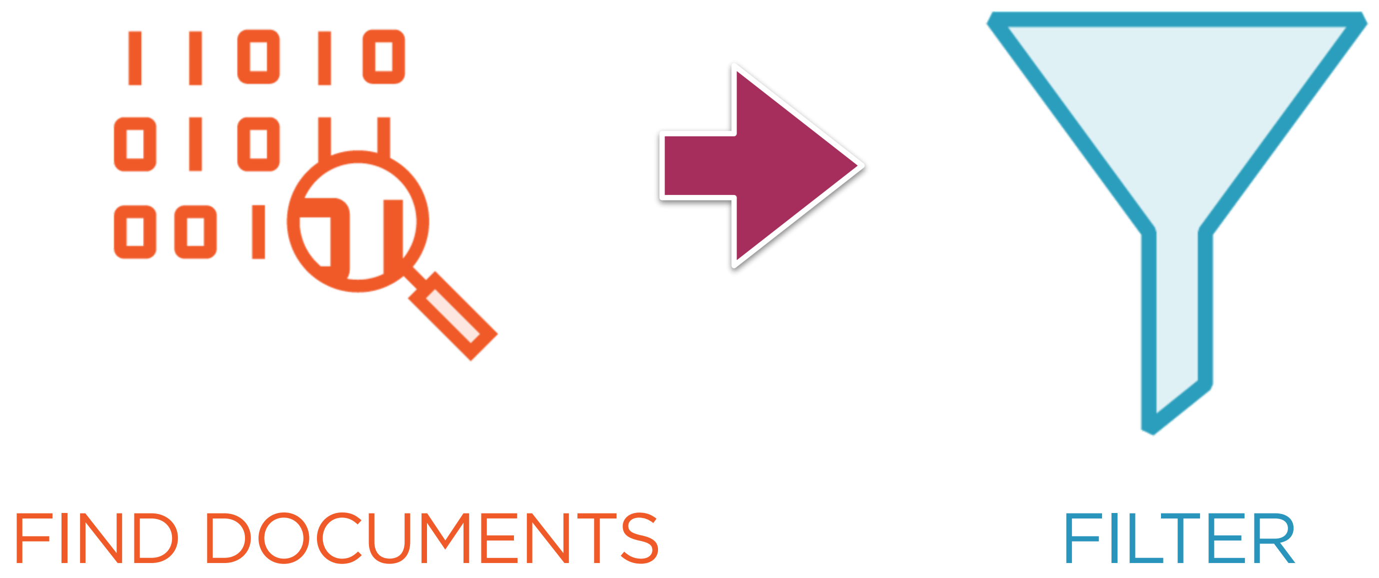
To This

```
> db.rent.aggregate([{$group: { _id: { zone: "$neighbourhood_cleansed"},  count: {$sum :
1}}}, {$sort: {count: -1}}, {$limit: 5}])
{ "_id" : { "zone" : "Williamsburg" }, "count" : 3844 }
{ "_id" : { "zone" : "Bedford-Stuyvesant" }, "count" : 3831 }
{ "_id" : { "zone" : "Harlem" }, "count" : 2753 }
{ "_id" : { "zone" : "Bushwick" }, "count" : 2498 }
{ "_id" : { "zone" : "Hell's Kitchen" }, "count" : 2143 }
```

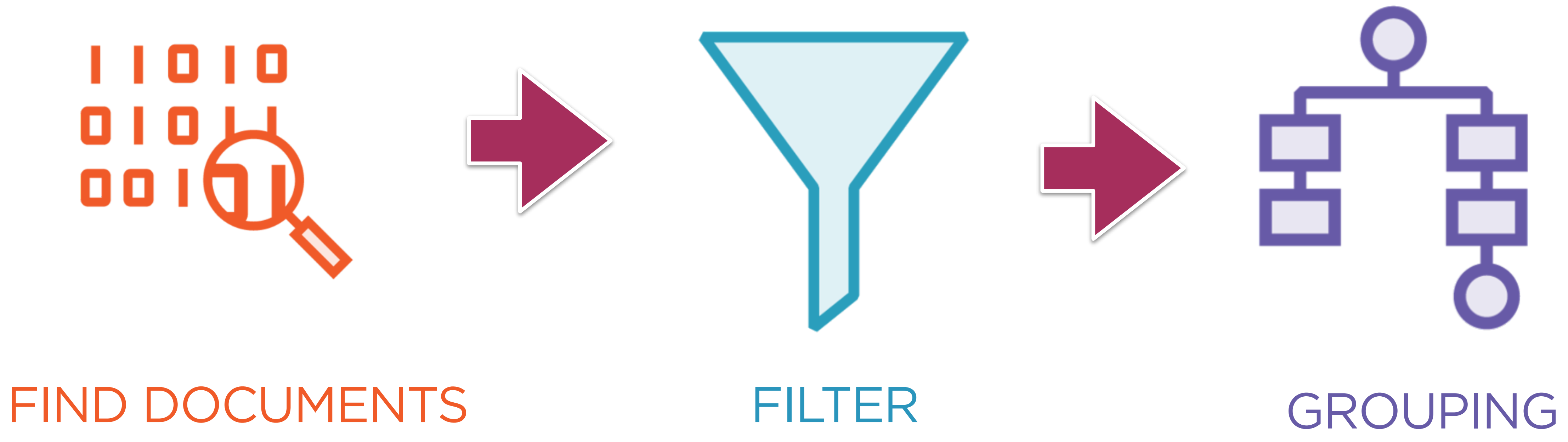
Aggregation at a Glance

FIND DOCUMENTS

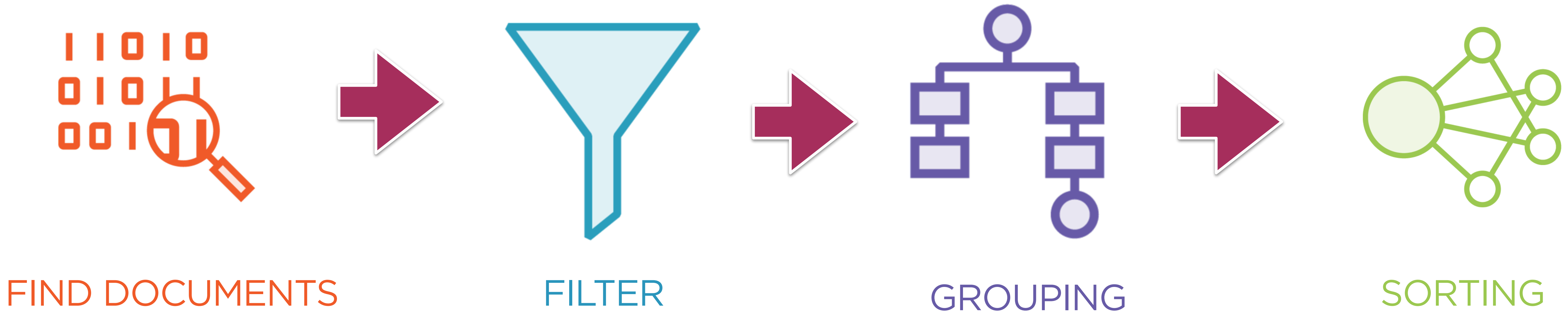
Aggregation at a Glance



Aggregation at a Glance



Aggregation at a Glance



Two Flavors of Aggregation

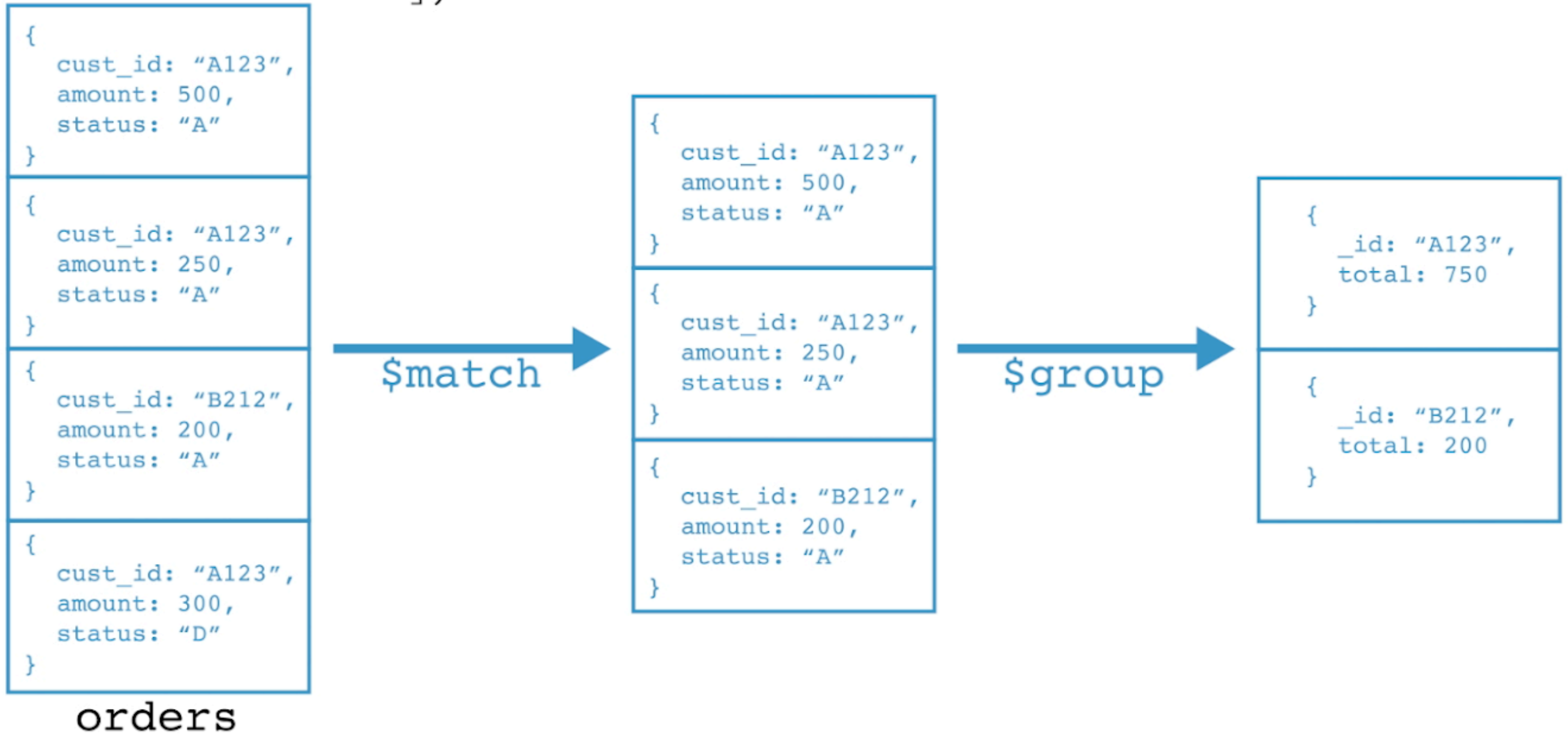
AGGREGATION FRAMEWORK

MAP REDUCE

An Example: Aggregation Framework

Collection

```
db.orders.aggregate( [
  $match stage  →{ $match: { status: "A" } },
  $group stage  →{ $group: { _id: "$cust_id",total:  {$sum: "$amount" } } }
                ])
```

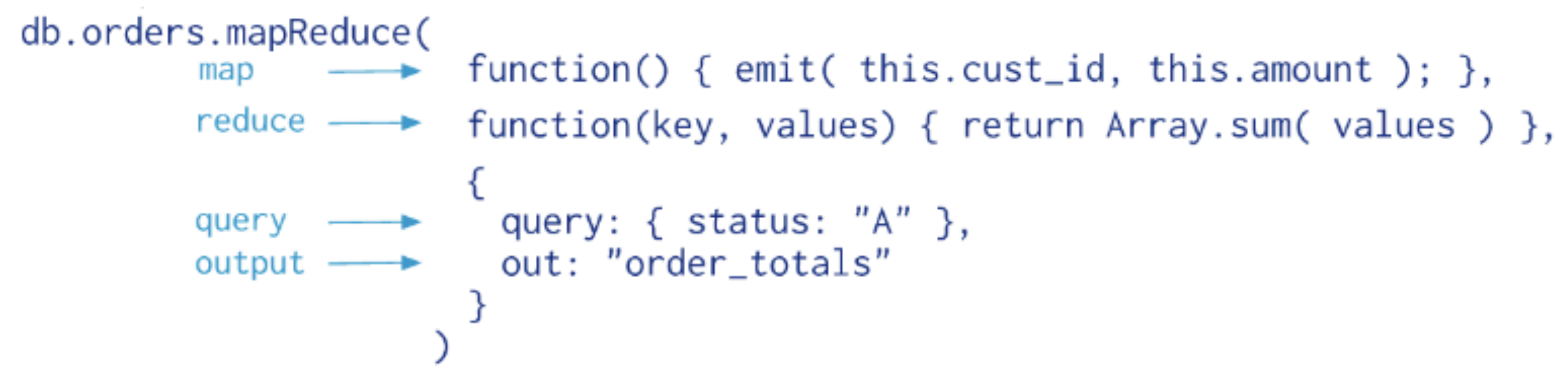


```
{
  cust_id: "A123",
  amount: 500,
  status: "A"
}
{
  cust_id: "A123",
  amount: 250,
  status: "A"
}
{
  cust_id: "B212",
  amount: 200,
  status: "A"
}
{
  cust_id: "A123",
  amount: 300,
  status: "D"
}
```

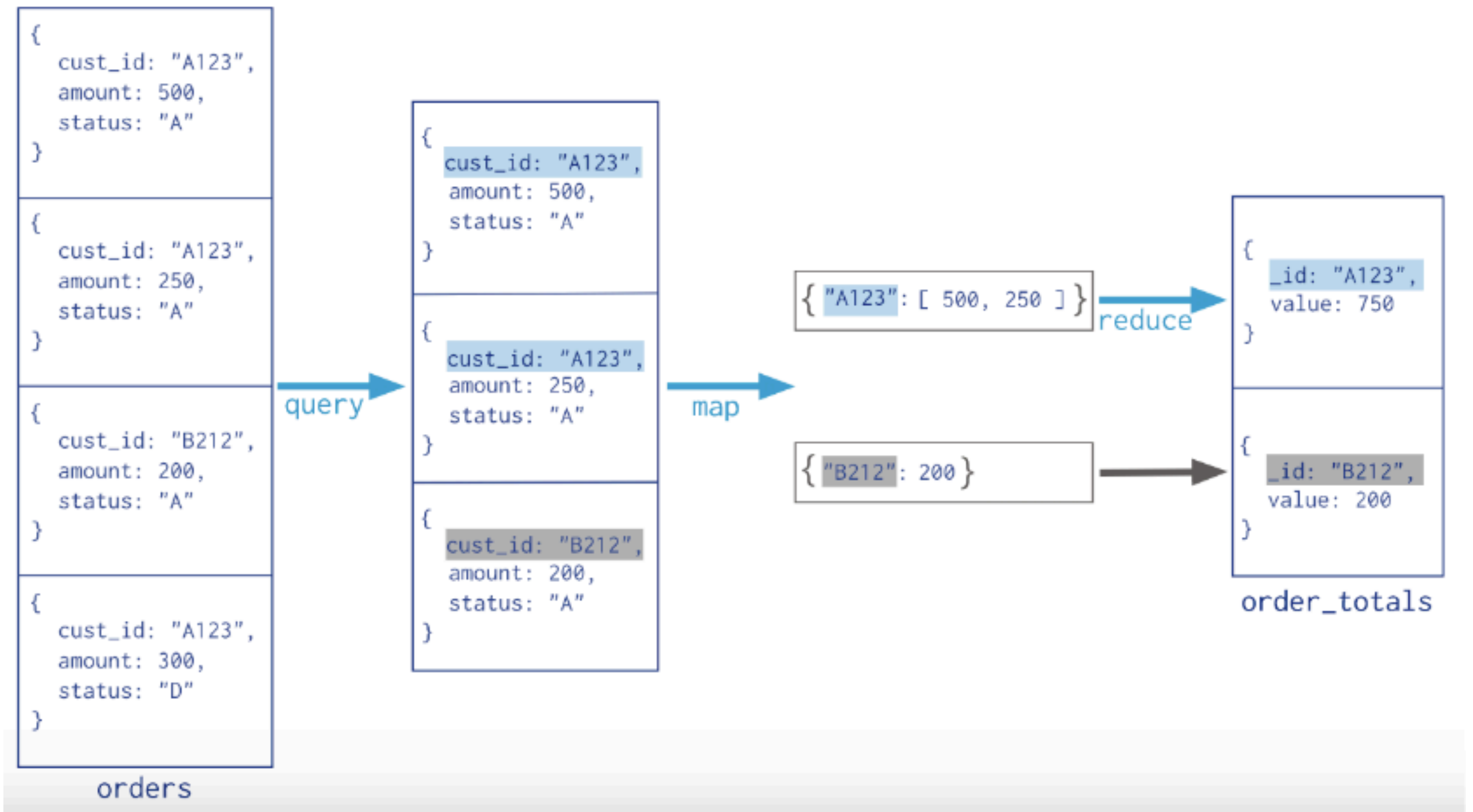
```
{
  cust_id: "A123",
  amount: 500,
  status: "A"
}
{
  cust_id: "A123",
  amount: 250,
  status: "A"
}
{
  cust_id: "B212",
  amount: 200,
  status: "A"
}
```

```
{
  _id: "A123",
  total: 750
}
{
  _id: "B212",
  total: 200
}
```

An Example: Map Reduce



```
db.orders.mapReduce(
           map    ——→  function() { emit( this.cust_id, this.amount ); },
           reduce ——→  function(key, values) { return Array.sum( values ) },
                       {
           query  ——→    query: { status: "A" },
           output ——→    out: "order_totals"
                       }
                      )
```



```
orders:
{
  cust_id: "A123",
  amount: 500,
  status: "A"
}
{
  cust_id: "A123",
  amount: 250,
  status: "A"
}
{
  cust_id: "B212",
  amount: 200,
  status: "A"
}
{
  cust_id: "A123",
  amount: 300,
  status: "D"
}

query ——→
{
  cust_id: "A123",
  amount: 500,
  status: "A"
}
{
  cust_id: "A123",
  amount: 250,
  status: "A"
}
{
  cust_id: "B212",
  amount: 200,
  status: "A"
}

map ——→
{ "A123": [ 500, 250 ] }
{ "B212": 200 }

reduce ——→
order_totals:
{
  _id: "A123",
  value: 750
}
{
  _id: "B212",
  value: 200
}
```

A Difference in Concept

A Difference in Concept

Aggregation Framework

Map Reduce

A Difference in Concept

Aggregation Framework

- ✴ The operators are fixed

Map Reduce

- ✴ The collection is fixed

A Difference in Concept

Aggregation Framework

- ✳ The operators are fixed
- ✳The entire collection passes through pipeline

Map Reduce

- ✳ The collection is fixed
- ✳A function executed a subset of the collection

A More Detailed Comparison

A More Detailed Comparison

AGGREGATION FRAMEWORK

- Uses a “pipeline” approach
- Set of predefined pipeline operators
- Operators can be repeated
- Operators need not produce output
- Easy to setup
- Designed for small to mid-sized collections

A More Detailed Comparison

AGGREGATION FRAMEWORK

- Uses a “pipeline” approach
- Set of predefined pipeline operators
- Operators can be repeated
- Operators need not produce output
- Easy to setup
- Designed for small to mid-sized collections

MAP REDUCE

- Can perform complex or incremental aggregation
- Custom map, reduce and finalize functions
- Flexibility in output
- Complex to setup
- Designed for gigantic collections

95% of cases Aggregation Framework is THE choice

We will analyze the Aggregation Framework *a mondo*

To know more of Map Reduce check out: "Querying Data using Map-Reduce in MongoDB" course at Pluralsight!

Simple Reminder: CRUD in MongoDB

Inserting Data

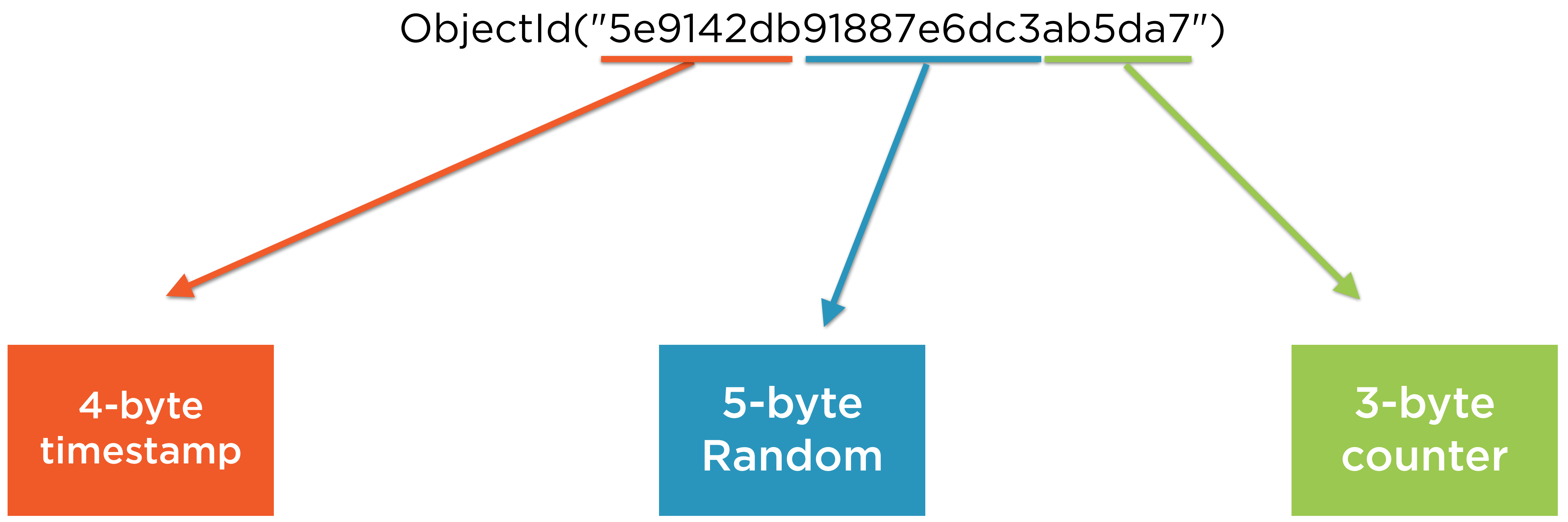
insertOne

insertMany

An Example

```
> db.inventory.insertOne(
...    { item: "canvas", qty: 100, tags: ["cotton"], size: { h: 28, w: 35.5, uom: "cm" } }
... )
{
    "acknowledged" : true,
    "insertedId" : ObjectId("5e9142db91887e6dc3ab5da7")
}
```

The ObjectId



Another Example with Many

```
> db.inventory.insertMany([
...    { item: "journal", qty: 25, tags: ["blank", "red"], size: { h: 14, w: 21, uom: "cm" } },
...    { item: "mat", qty: 85, tags: ["gray"], size: { h: 27.9, w: 35.5, uom: "cm" } },
...    { item: "mousepad", qty: 25, tags: ["gel", "blue"], size: { h: 19, w: 22.85, uom: "cm" } }
... ])
{
    "acknowledged" : true,
    "insertedIds" : [
        ObjectId("5e91466391887e6dc3ab5da8"),
        ObjectId("5e91466391887e6dc3ab5da9"),
        ObjectId("5e91466391887e6dc3ab5daa")
    ]
}
```

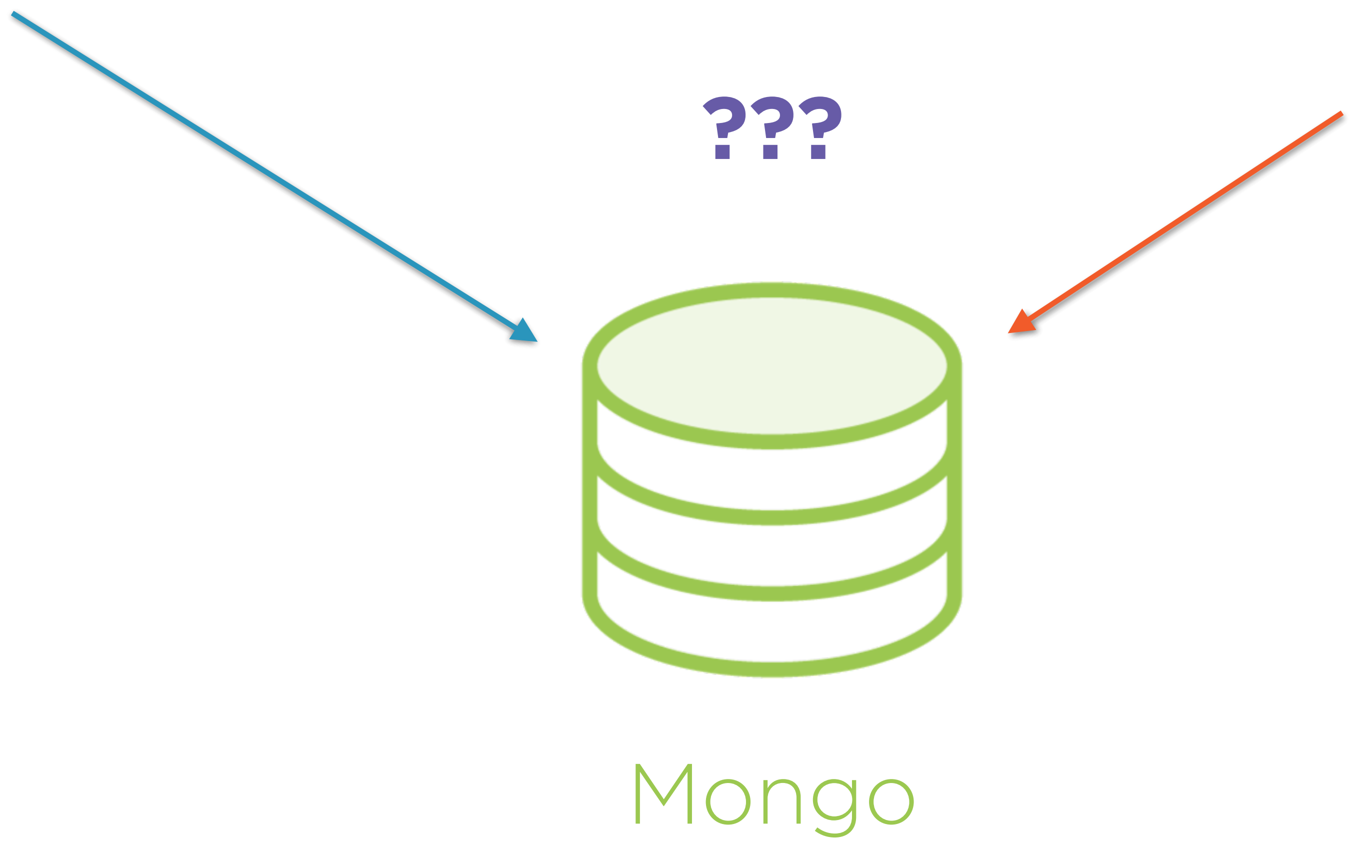
An Ordering App

Python

{ item: "tea", qty: 50,size:
{ h: 12.9, w: 13.2, uom:
"cm" } }

Shell

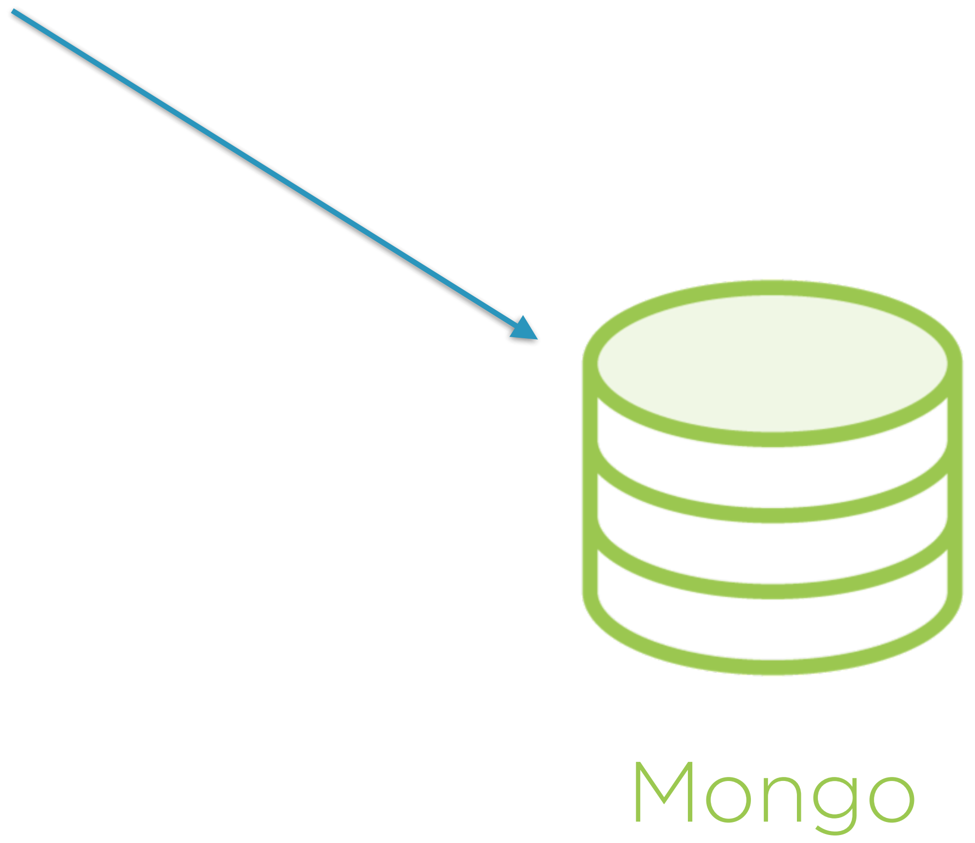
{ item: "coffee", qty: 12,size:
{ h: 12.9, w: 13.2, uom:
"cm" } }
{ item: "mate", qty: 60,size:
{ h: 12.9, w: 13.2, uom:
"cm" } }



An Ordering App: Scenario 1

Python

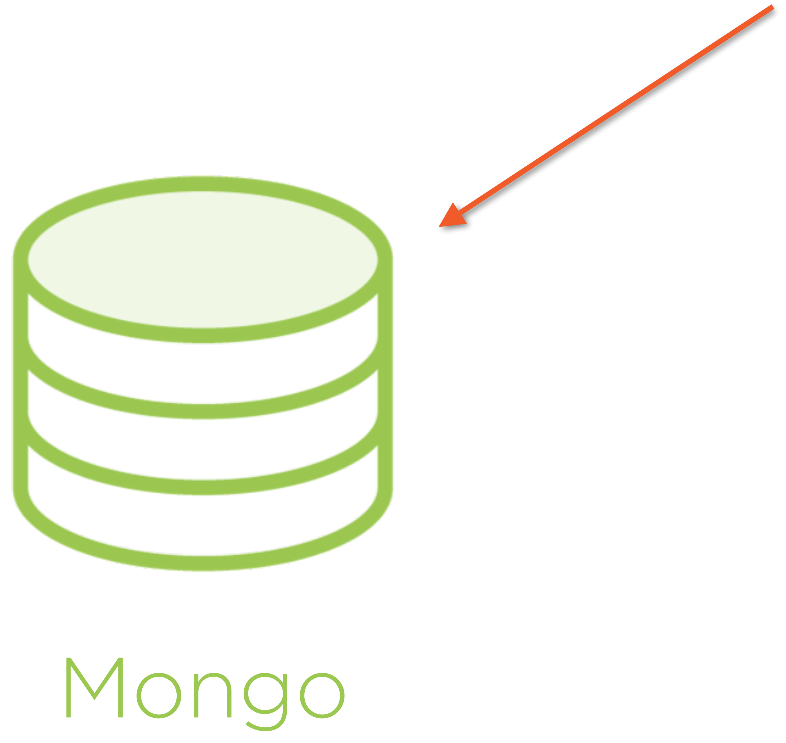
{ item: "tea", qty: 50,size:
{ h: 12.9, w: 13.2, uom:
"cm" } }



An Ordering App: Scenario 1

Shell

```
{ item: "coffee", qty: 12,size:
{ h: 12.9, w: 13.2, uom:
"cm" } }
{ item: "mate", qty: 60,size:
{ h: 12.9, w: 13.2, uom:
"cm" } }
```



An Ordering App: Scenario 1

```
{
    "acknowledged" : true,
    "insertedIds" : [
        ObjectId("5e91466391887e6dc3ab5da8"),
        ObjectId("5e91466391887e6dc3ab5da9")
    ]
}
```

An Ordering App: Scenario 2

Shell

```
{ item: "coffee", qty: 12,size:
{ h: 12.9, w: 13.2, uom:
"cm" } }
{ item: "mate", qty: 60,size:
{ h: 12.9, w: 13.2, uom:
"cm" } }
```

An Ordering App: Scenario 2

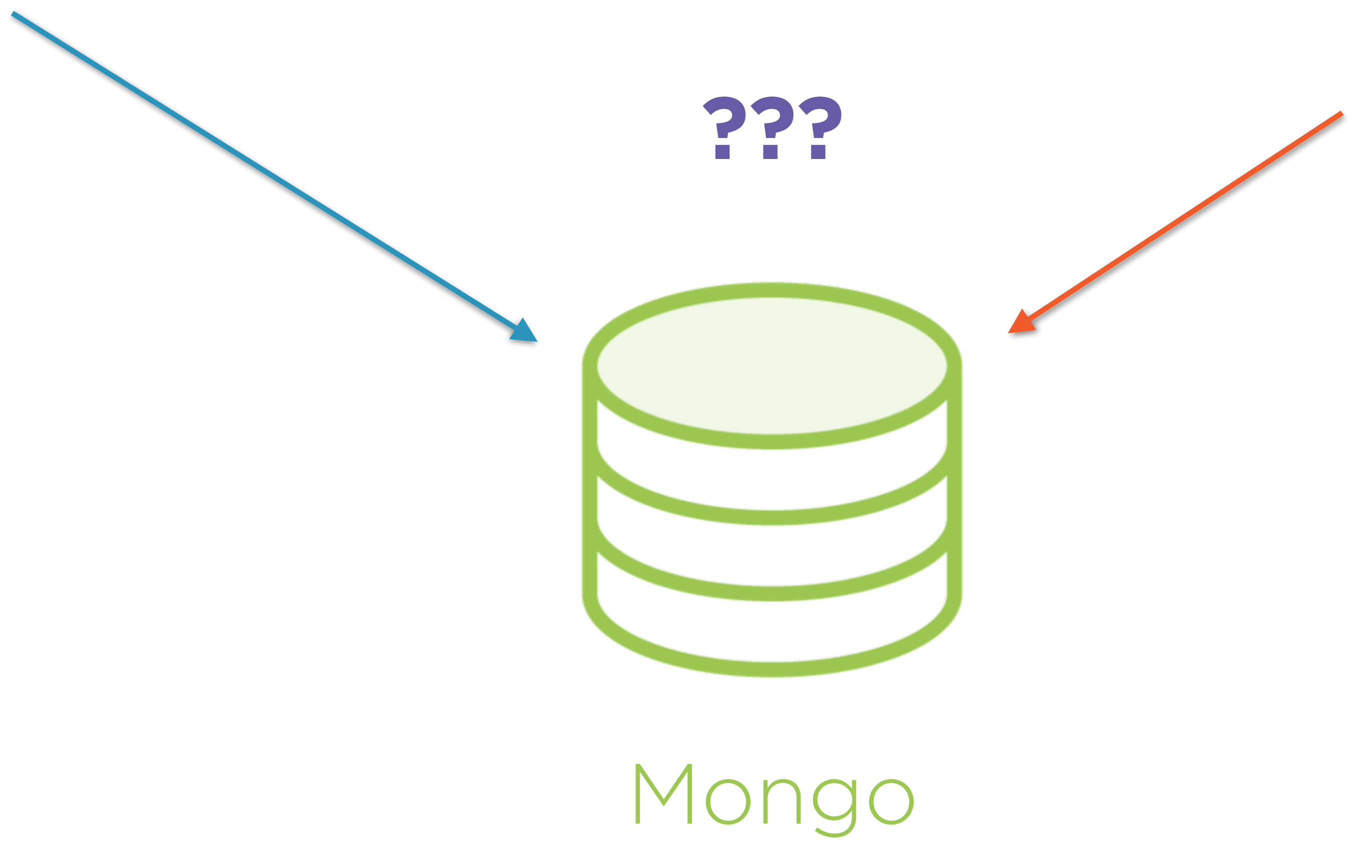
Python

{ item: "tea", qty: 50,size: { h: 12.9, w: 13.2, uom: "cm" } }

Shell

{ item: "coffee", qty: 12,size: { h: 12.9, w: 13.2, uom: "cm" } }

{ item: "mate", qty: 60,size: { h: 12.9, w: 13.2, uom: "cm" } }



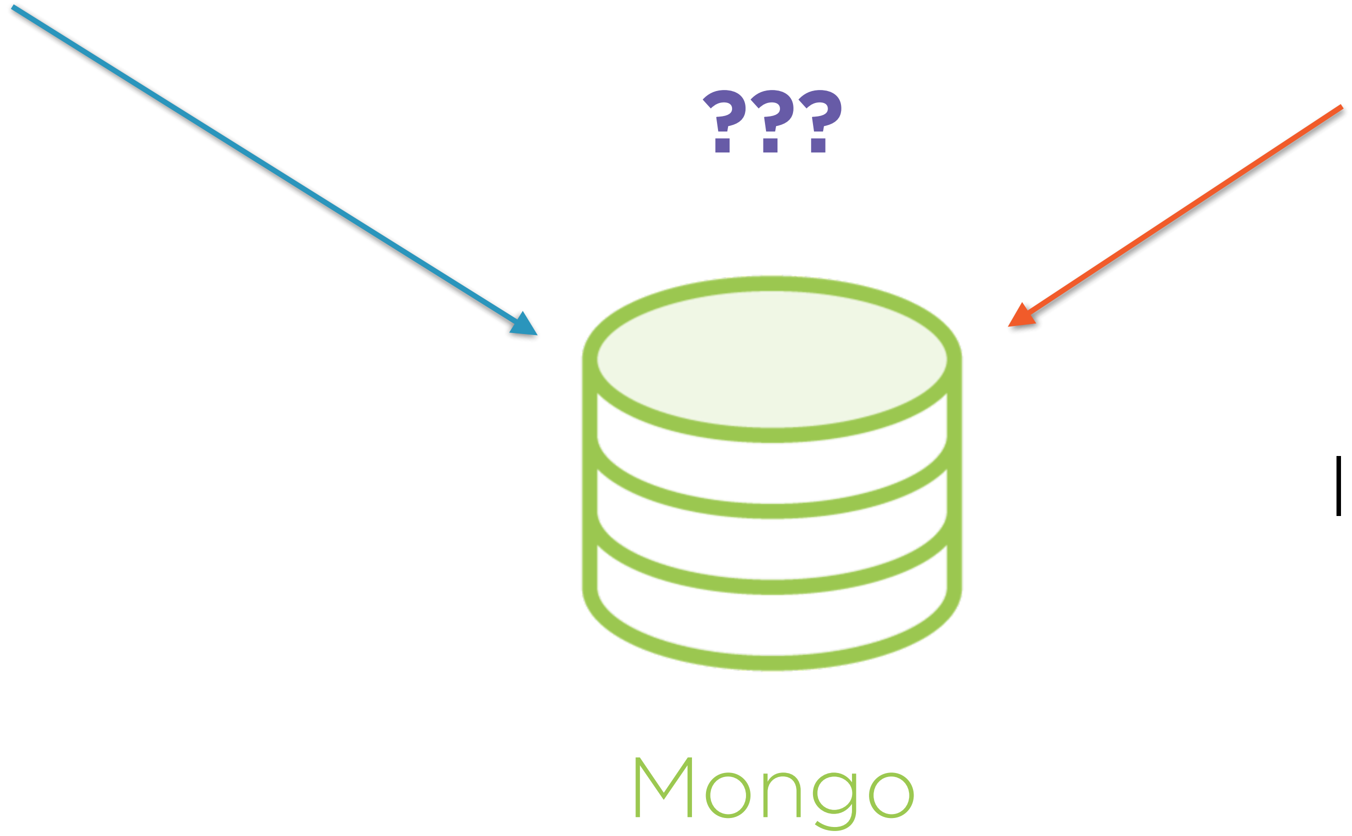
An Ordering App: Scenario 2

Python

```
{ item: "tea", qty: 50,size:
{ h: 12.9, w: 13.2, uom:
"cm" } }
```

Shell

```
{ item: "coffee", qty: 12,size:
{ h: 12.9, w: 13.2, uom:
"cm" } }
{ item: "mate", qty: 60,size:
{ h: 12.9, w: 13.2, uom:
"cm" } }
```



In SQL is clearly this one, but in Mongo it may happen...

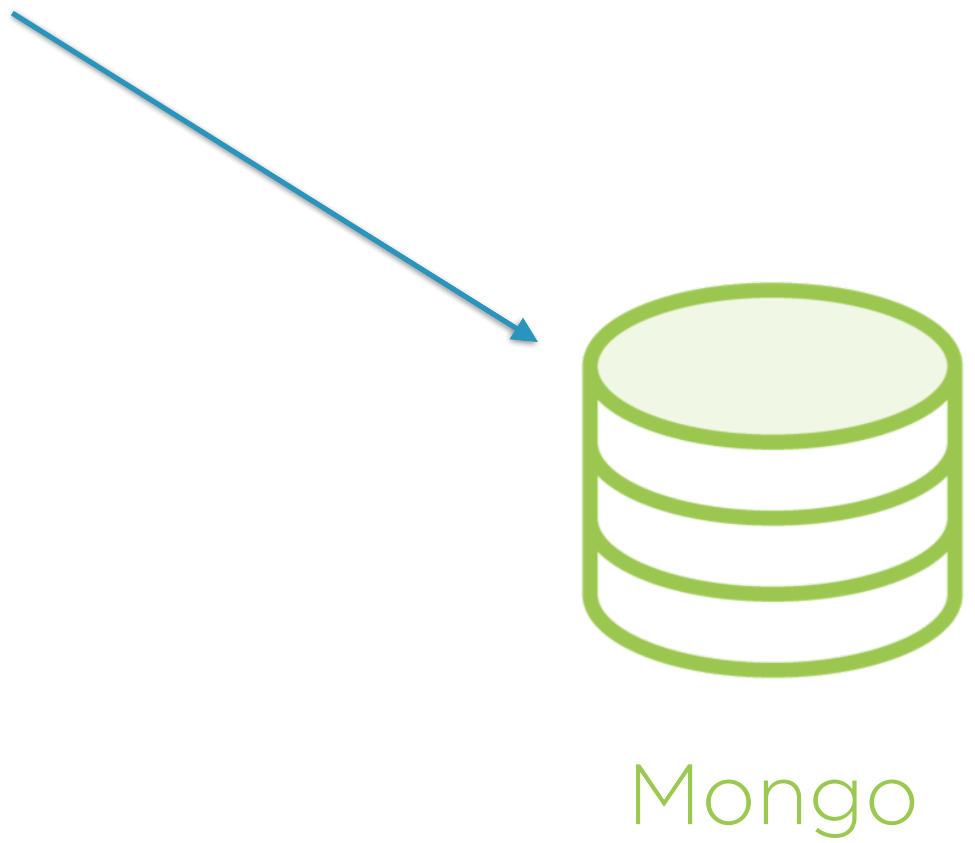
An Ordering App: Scenario 2

Python

```
{ item: "tea", qty: 50,size:
{ h: 12.9, w: 13.2, uom:
"cm" } }
```

Shell

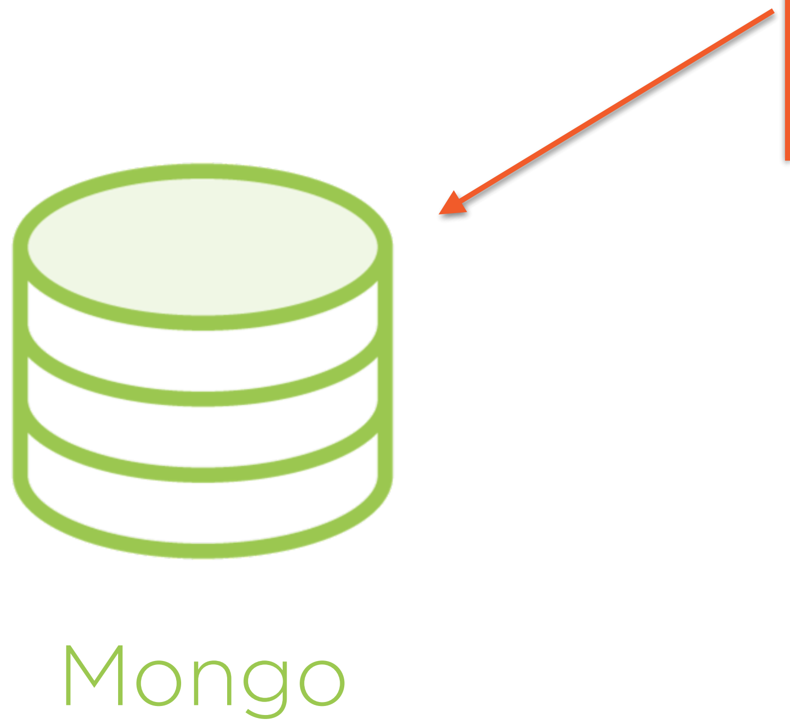
```
{ item: "coffee", qty: 12,size:
{ h: 12.9, w: 13.2, uom:
"cm" } }
{ item: "mate", qty: 60,size:
{ h: 12.9, w: 13.2, uom:
"cm" } }
```



An Ordering App: Scenario 2

Shell

```
{ item: "coffee", qty: 12,size:
{ h: 12.9, w: 13.2, uom:
"cm" } }
{ item: "mate", qty: 60,size:
{ h: 12.9, w: 13.2, uom:
"cm" } }
```



An Ordering App: Scenario 2

```
{
    "acknowledged" : true,
    "insertedIds" : [
        ObjectId("5e91466391887e6dc3ab5da8"),
# Note there is no 5e91466391887e6dc3ab5da89!!!
        ObjectId("5e91466391887e6dc3ab5daa")
    ]

}
```

Querying Data

findOne

Find

More on this topic on the course **Querying Data from MongoDB**

Finding a Document

Finding a Document

Making the query in Mongo

```
> db.inventory.find({item: "journal"})
{
 "_id" : ObjectId("5e91466391887e6dc3ab5da8"),
"item" : "journal", "qty" : 25, "tags" : [ "blank",
"red" ], "size" : { "h" : 14, "w" : 21, "uom" : "cm" }
}
```

Finding a Document

Making the query in Mongo

```
> db.inventory.find({item: "journal"})
{
 "_id" : ObjectId("5e91466391887e6dc3ab5da8"),
"item" : "journal", "qty" : 25, "tags" : [ "blank",
"red" ], "size" : { "h" : 14, "w" : 21, "uom" : "cm" }
}
```

SQL equivalent

```
SELECT * FROM INVENTORY WHERE ITEM = “journal”
```

Another Example with Find

```
> db.inventory.find({tags: {$exists: true } }, {_id:0, item:1, tags:1})
{ "item" : "canvas", "tags" : [ "cotton" ] }
{ "item" : "journal", "tags" : [ "blank", "red" ] }
{ "item" : "mat", "tags" : [ "gray" ] }
{ "item" : "mousepad", "tags" : [ "gel", "blue" ] }
```

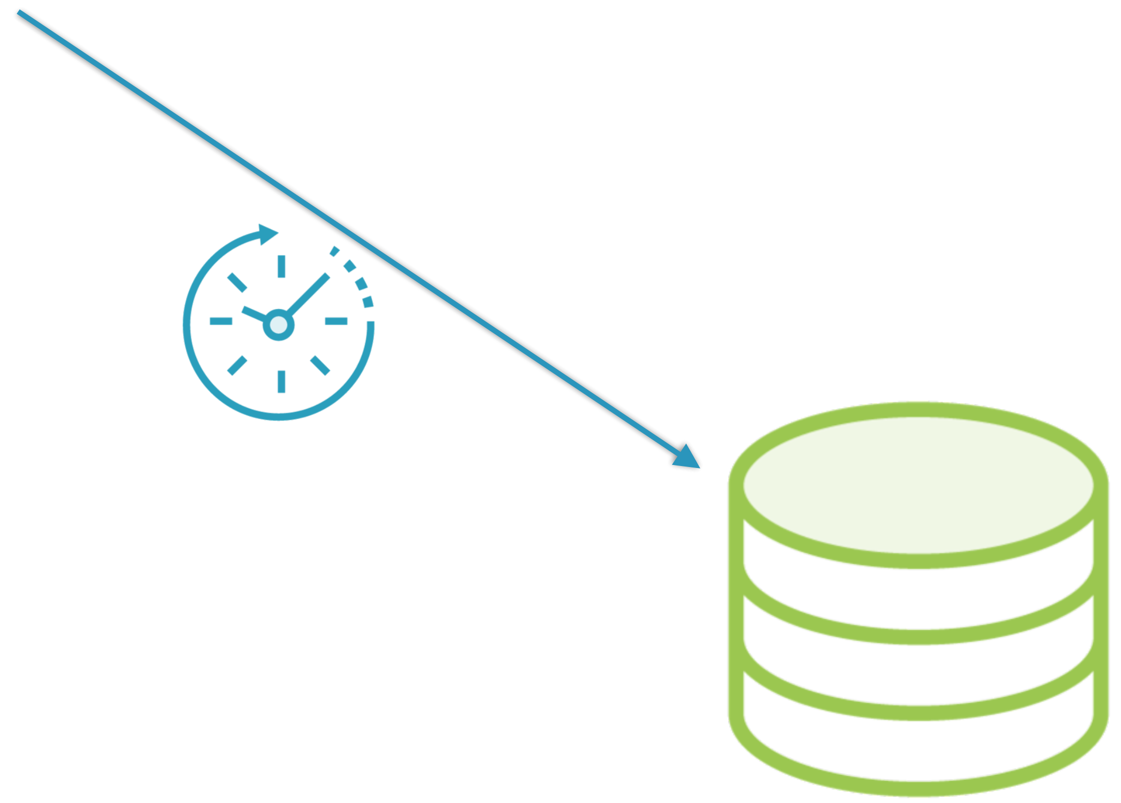
WiredTiger in Action

Query

```
db.inventory.find({tags: {$exists:
true } }, {_id:0, item:1, tags:1})
```

Insert

```
db.inventory.insertOne({tags:
['orange', 'cheap'], name:
"Oranges from the farm" })
```



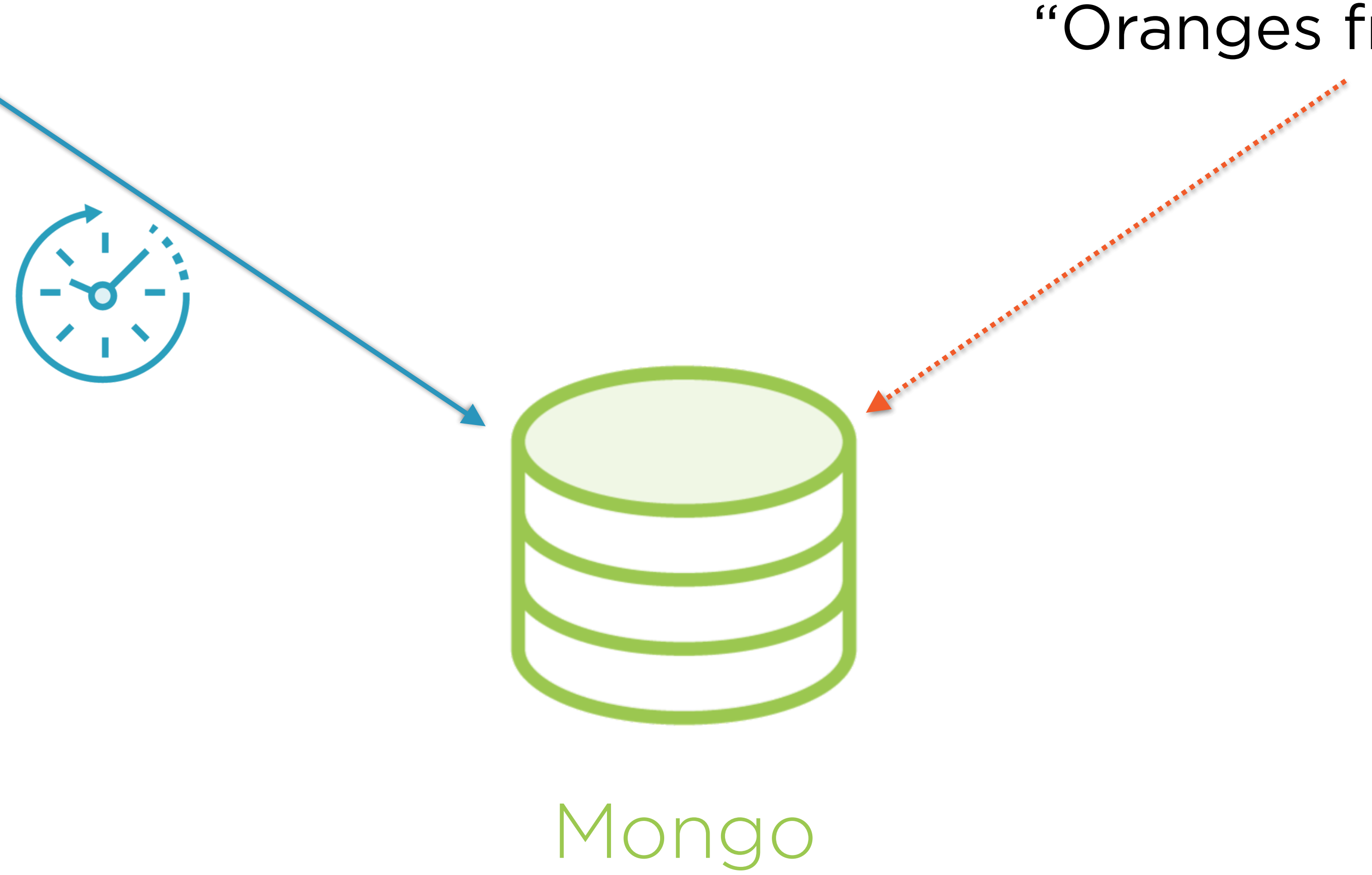
WiredTiger in Action

Query

```
db.inventory.find({tags: {$exists:
true } }, {_id:0, item:1, tags:1})
```

Insert

```
db.inventory.insertOne({tags:
['orange', 'cheap'], name:
"Oranges from the farm" })
```



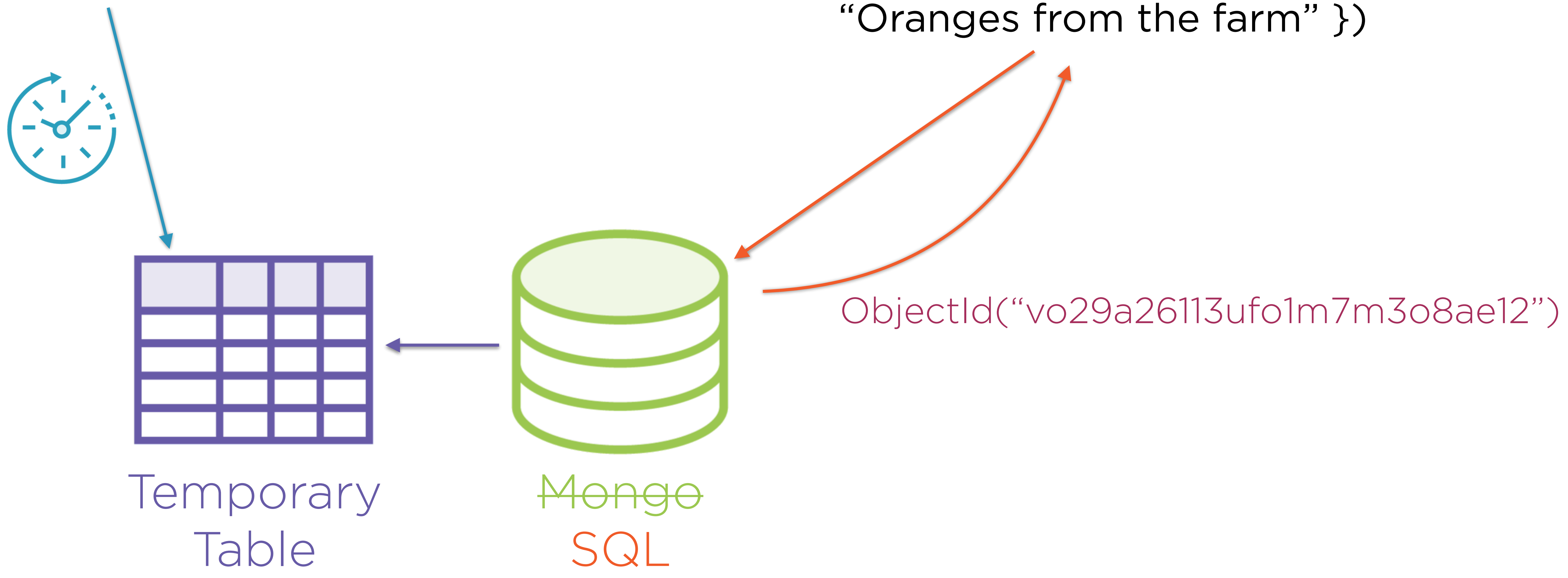
WiredTiger in Action

Query

```
db.inventory.find({tags: {$exists:
true } }, {_id:0, item:1, tags:1})
```

Insert

```
db.inventory.insertOne({tags:
['orange', 'cheap'], name:
"Oranges from the farm" })
```



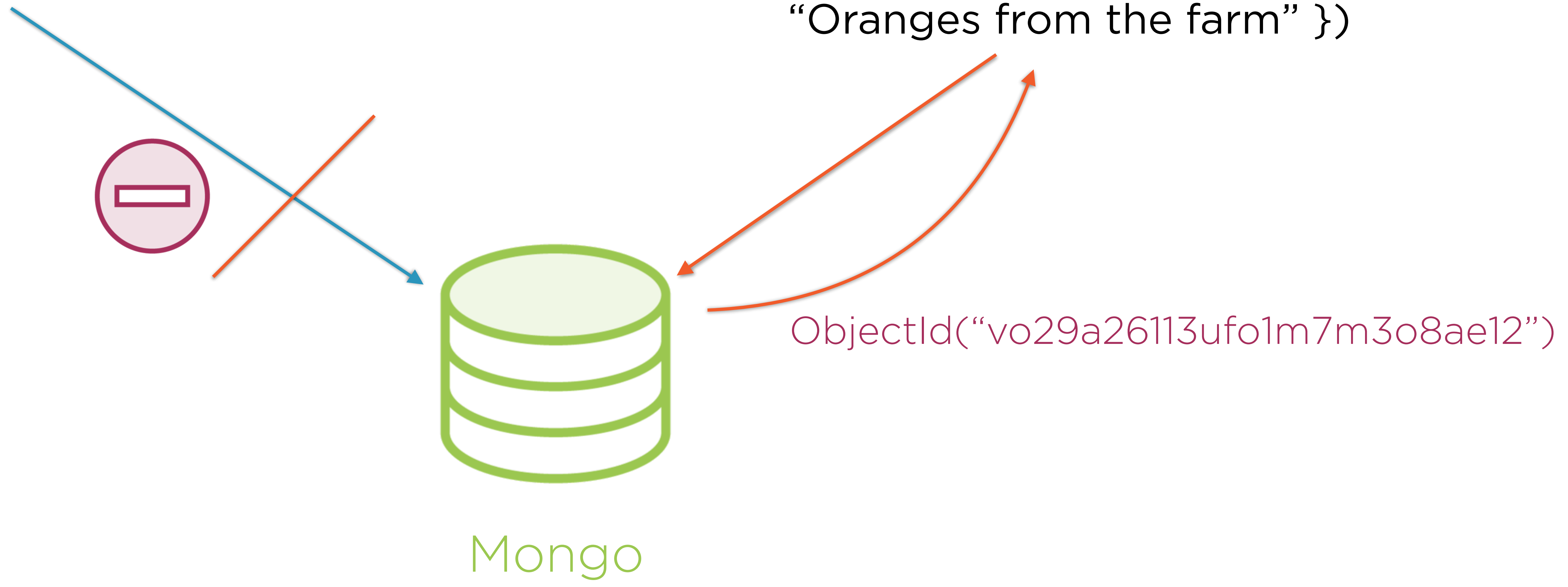
WiredTiger in Action

Query

```
db.inventory.find({tags: {$exists:
true } }, {_id:0, item:1, tags:1})
```

Insert

```
db.inventory.insertOne({tags:
['orange', 'cheap'], name:
"Oranges from the farm" })
```

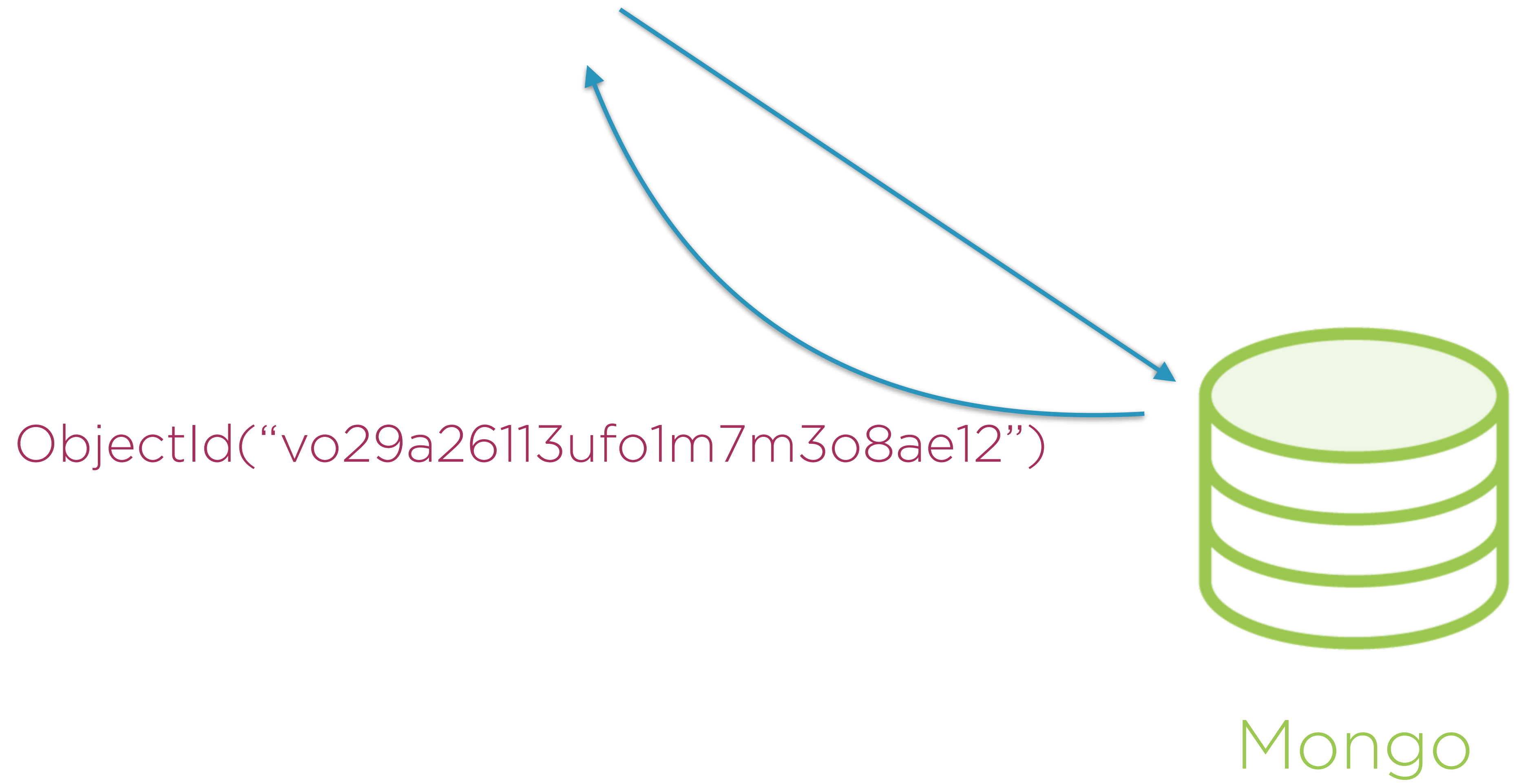


```
ObjectId("vo29a26113ufo1m7m3o8ae12")
```

WiredTiger in Action

Query

db.inventory.find({tags: {$exists: true } }, {_id:1, item:0, tags:0})



Updating Data

updateOne

updateMany

replaceOne

Example with Update

```
>  db.inventory.updateMany(
...    { "qty": { $lt: 50 } },
...    {
...      $set: { "size.uom": "in", status: "P" },
...      $currentDate: { lastModified: true }
...    },
...   {upsert: true}
... )
{ "acknowledged" : true, "matchedCount" : 2, "modifiedCount" : 2 }
> db.inventory.find({ "qty": { $lt: 50 } })
{ "_id" : ObjectId("5e91466391887e6dc3ab5da8"), "item" : "journal", "qty" : 25, "tags" :
[ "blank", "red" ], "size" : { "h" : 14, "w" : 21, "uom" : "in" }, "lastModified" :
ISODate("2020-04-11T15:43:13.287Z"), "status" : "P" }
{ "_id" : ObjectId("5e91466391887e6dc3ab5daa"), "item" : "mousepad", "qty" : 25, "tags" :
[ "gel", "blue" ], "size" : { "h" : 19, "w" : 22.85, "uom" : "in" }, "lastModified" :
ISODate("2020-04-11T15:43:13.287Z"), "status" : "P" }
```

Deleting

```
> db.inventory.deleteMany( { qty: {$lt: 120} } )
{ "acknowledged" : true, "deletedCount" : 1 }
```

FIND DOCUMENTS

Deleting

```
> db.inventory.deleteMany( { qty: {$lt: 120} } )
{ "acknowledged" : true, "deletedCount" : 1 }
```

FIND DOCUMENTS

DELETES THE IDS

Demo

Demo

Demo

Do basic CRUD operations on a collection in MongoDB

Demo

Do basic CRUD operations on a collection in MongoDB

Remembering filters, projections and sets

Basic Aggregations: $match and $project

Some Stages to Recall

$match

$project

$group

$limit/$skip

$unwind

$sort

The $match Stage

✓

✓

✓

✓

The $match Stage

```
{ $match: { <query> } }
```

The $match Stage

- ✓ `{ $match: { <query> } }`
- ✓ The filter can have any expression or search
- ✓
- ✓

The $match Stage

- { $match: { <query> } }
- The filter can have any expression or search
- It leverages indexes!

The $match Stage

- ✓ `{ $match: { <query> } }`
- ✓ The filter can have any expression or search
- ✓ It leverages indexes!
- ✓ Better to use early in the pipeline

Some Examples

```
> db.rent.aggregate([{$match:
{$text: {$search: "Tribeca"}}}])
```

```
> db.rent.aggregate([{$match:
{neighbourhood_cleansed:
"Tribeca"}}])
```

For a reminder on full-text search check **“Searching for Text in MongoDB”**

A More Complex $match

```
> db.rent.aggregate([
   {$match: {
      $text: {$search: "Tribeca"},
      $and: [
         {reviews_per_month: { $gt : 1}},
         { minimum_nights: {$gt : 3 } }
      ]
   }}
])
```

◀ **# Full text search**
◀ **# More than 1 review per month**
◀ **# At least 3 nights**

What Do We Gain?

```
> db.rent.findOne({_id: new ObjectId("5e8936cf6347c0057a0563c7")}, {name:1,
host_response_rate:1, price:1, cleaning_fee: 1})
{
    "_id" : ObjectId("5e8936cf6347c0057a0563c7"),
    "name" : "Tribeca/Soho Garden Apartment",
    "host_response_rate" : "100%",
    "price" : "$400.00",
    "cleaning_fee" : "$100.00"
}
```

What Do We Gain?

```
> db.rent.findOne({_id: new ObjectId("5e8936cf6347c0057a0563c7")}, {name:1,
host_response_rate:1, price:1, cleaning_fee: 1})
{
    "_id" : ObjectId("5e8936cf6347c0057a0563c7"),
    "name" : "Tribeca/Soho Garden Apartment",
    "host_response_rate" : "100%",
    "price" : "$400.00",
    "cleaning_fee" : "$100.00"
}
```

Here is where **$project** comes to the rescue!

The $project Stage

```
$project: {
    ...,
    neighbourhood: "$neighbourhood_cleansed",
    ...,
}
```

◀ # We reference neighbourhood_cleansed and rename it as neighbourhood

# If we had not used $, it would hardcode the string "neighbourhood_cleansed"

What Does $ Mean?

$$\text{\$name} \xrightarrow{\text{Mongo}} \text{\$\$CURRENT.name}$$

What Does $ Mean?

$$\begin{tikzcd}
 & \text{\{name: “Pepito”, surname: “Laguna”\}} \arrow[dl] \arrow[dr] & \\
\text{\$ = \{name: “Pepito”, surname: “Laguna”\}} & & \text{\$name = “Pepito”}
\end{tikzcd}$$

The Power of $project

{name: “Pepito”,
surname: “Laguna”}

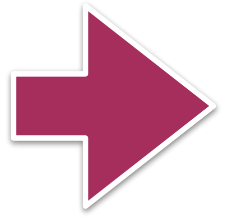
{name:”Sacarias”,
surname: “Flores del
campo”}

```
{
    $project: {
        complete_name: {
            $concat: [
                “$name”,
                “ ”,
                “$surname”
            ]
        }
    }
}
```

The Power of $project

```
{name: "Pepito",
surname: "Laguna"}

{name:"Sacarias",
surname: "Flores del
campo"}
```



```
{
    $project: {
        complete_name: {
            $concat: [
                "$name",
                " ",
                "$surname"
            ]
        }
    }
}
```

$ = {name: "Pepito", surname: "Laguna"}

$.name: "Pepito"
$.surname: "Laguna"

The Power of $project

{name: “Pepito”,
surname: “Laguna”}

{name:”Sacarias”,
surname: “Flores del
campo”}

```
{
    $project: {
        complete_name: {
            $concat: [
                “$name”,
                “ ”,
                “$surname”
            ]
        }
    }
}
```

{complete_name: “Pepito
Laguna”}

$ = {name: “Pepito”, surname: “Laguna”}

$.name: “Pepito”
$.surname: “Laguna”

The Power of $project

{name: “Pepito”,
surname: “Laguna”}

{name:”Sacarias”,
surname: “Flores del
campo”}

```
{
    $project: {
        complete_name: {
            $concat: [
                “$name”,
                “ ”,
                “$surname”
            ]
        }
    }
}
```

The Power of $project

{name: “Pepito”,
surname: “Laguna”}

{name:”Sacarias”,
surname: “Flores del
campo”}

```
{
    $project: {
        complete_name: {
            $concat: [
                “$name”,
                “ ”,
                “$surname”
            ]
        }
    }
}
```

$ = {name: “Sacarias”, surname: “Flores del Campo”}

$.name: “Sacarias”
$.surname: “Flores del Campo”

The Power of $project

{name: “Pepito”,
surname: “Laguna”}

{name:”Sacarias”,
surname: “Flores del
campo”}

```
{
    $project: {
        complete_name: {
            $concat: [
                "$name",
                " ",
                "$surname"
            ]
        }
    }
}
```

{complete_name: “Pepito
Laguna”}

{complete_name:
“Sacarias Flores del
Campo”}

$ = {name: “Sacarias”, surname: “Flores del Campo”}

$.name: “Sacarias”
$.surname: “Flores del Campo”

A Complex Example

```
{
    "_id" :
ObjectId("5e8936cf6347c0057a0563c7"),
    "name" : "Tribeca/Soho Garden Apartment",
    "host_response_rate" : "100%",
    "price" : "$400.00",
    "cleaning_fee" : "$100.00"
}
```

◀ **# How do we remove the ‘%’?**

A Complex Example

```
$project: {
    ...,
    num_accept_rate: {
        $toDouble: {
            $substr: [
                "$host_acceptance_rate",
                0,
                {
                     $subtract: [{$strLenCP:
"$host_acceptance_rate" },1]
                 }
            ]
        }
    }
}
```

- # We transform to a number
- # The substring without the %
- # Which is from the start to length -1
- # That we get by subtracting 1 from the length!

This way we transform '38%' to 38

The $match stage takes a filter and filters out documents that do not match

The $project stage lets us transform the data

Which is key for performance

For more resources on operators, check here

Demo

Demo

Demo

Use $match for filtering bad cases

Demo

Use $match for filtering bad cases

Delve into $project for wild formats

Demo

Use $match for filtering bad cases

Delve into $project for wild formats

Learn about $addFields, $sort and $limit stages

Summary

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Learned about different paradigms for aggregation in MongoDB

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