Introduction to MongoDB

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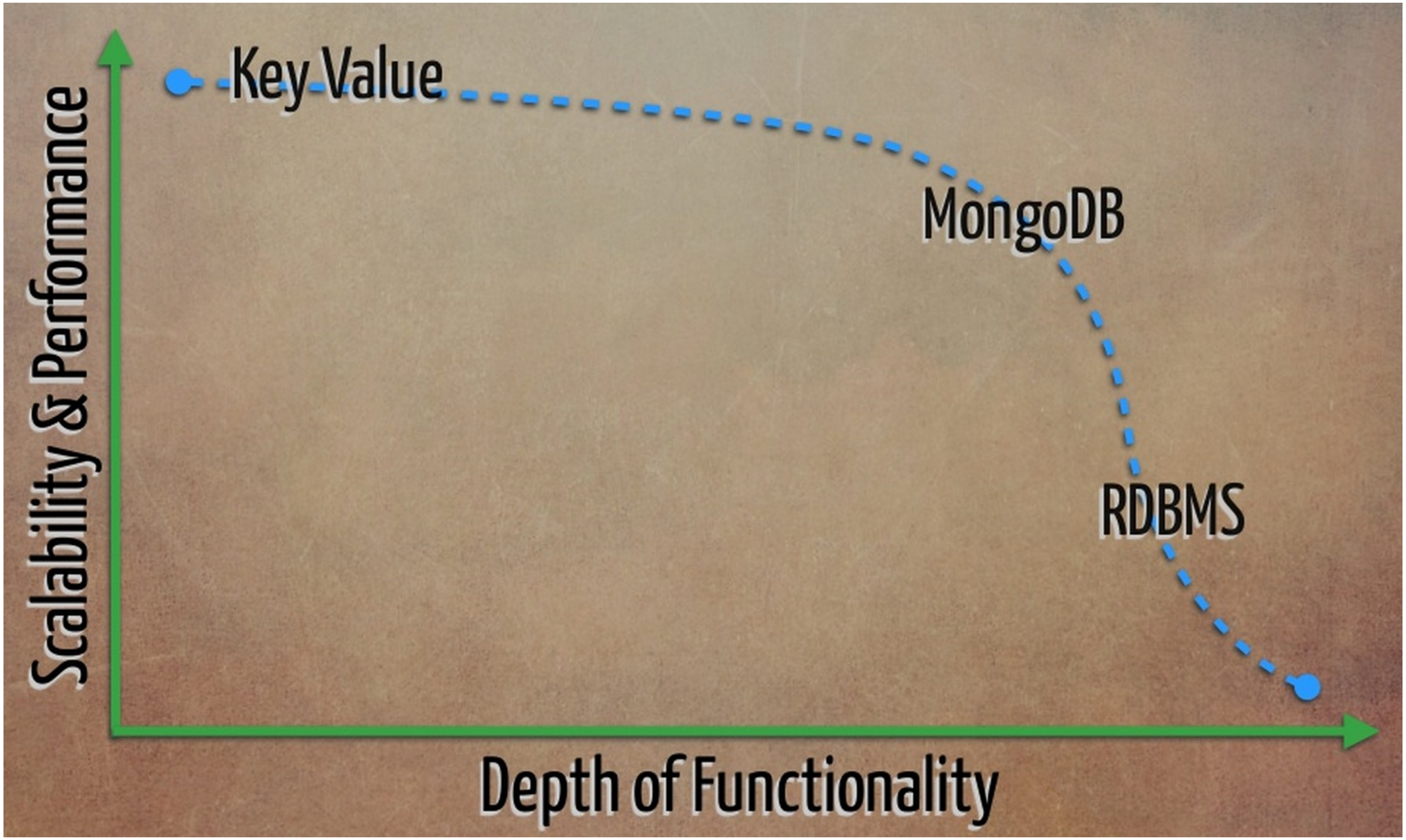
Database compared



What is MongoDB ?

- Scalable High-Performance Open-source, Document-orientated database.
- Built for Speed
- Rich Document based queries for Easy readability.
- Full Index Support for High Performance.
- Replication and Failover for High Availability.
- Auto Sharding for Easy Scalability.

Why use MongoDB?

- SQL was invented in the 70’s to store data.

- MongoDB stores documents (or) objects.

- Now-a-days, everyone works with objects (Python/Ruby/Java/etc.)

- And we need Databases to persist our objects. Then why not store objects directly ?

- Embedded documents and arrays reduce need for joins. No Joins and No-multi document transactions.

What is MongoDB great for?

- RDBMS replacement for Web Applications.
- Semi-structured Content Management.
- Real-time Analytics & High-Speed Logging.
- Caching and High Scalability

Not great for?

- Highly Transactional Applications.
- Problems requiring SQL.

Impedance Mismatch

// your application code

class Foo { int x; string [] tags;}

x	name
1	Abc
2	Xyz

tagIdx	
33	1
34	2
33	2

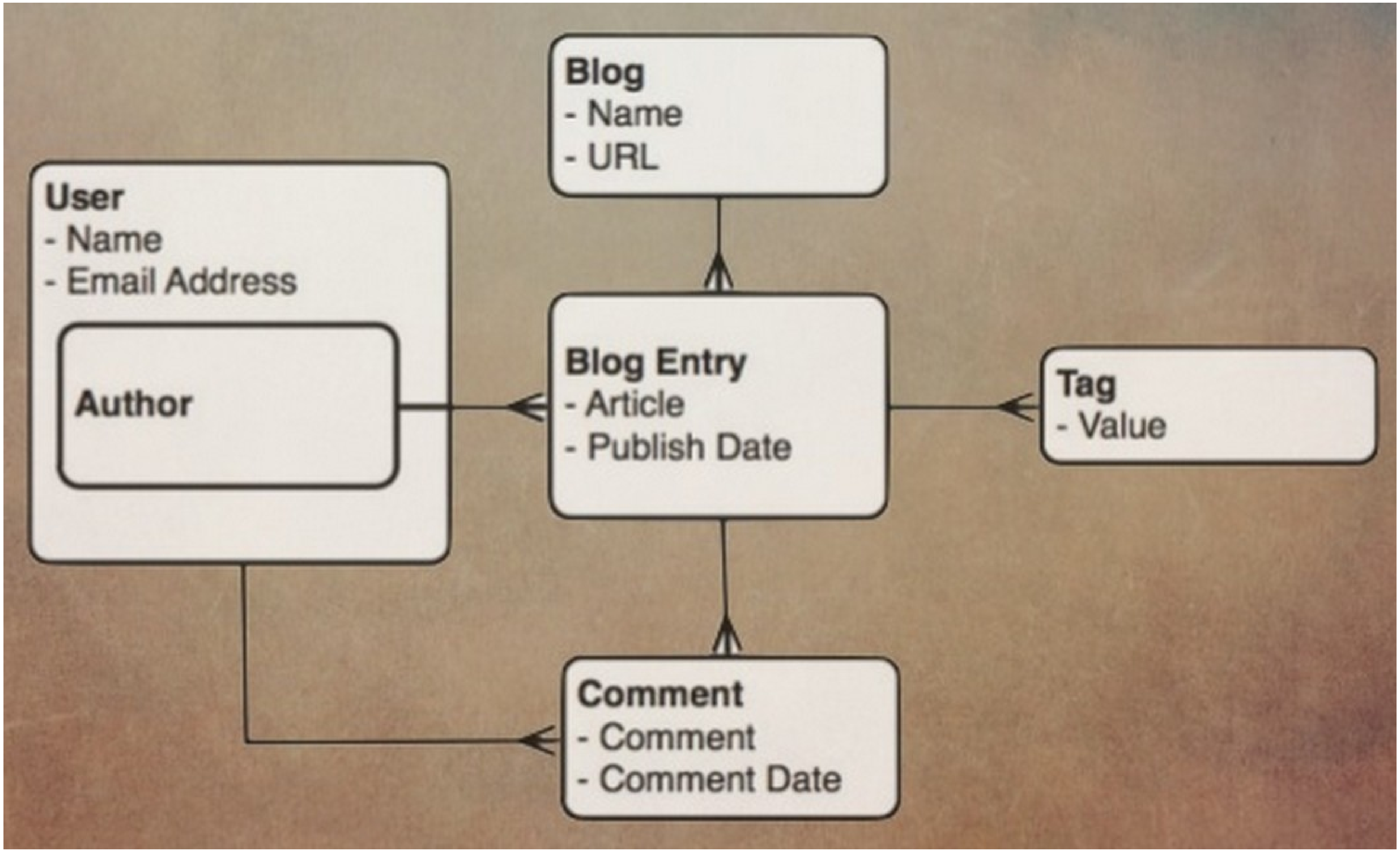
tagId	tag
33	red
34	blue

No Impedance Mismatch

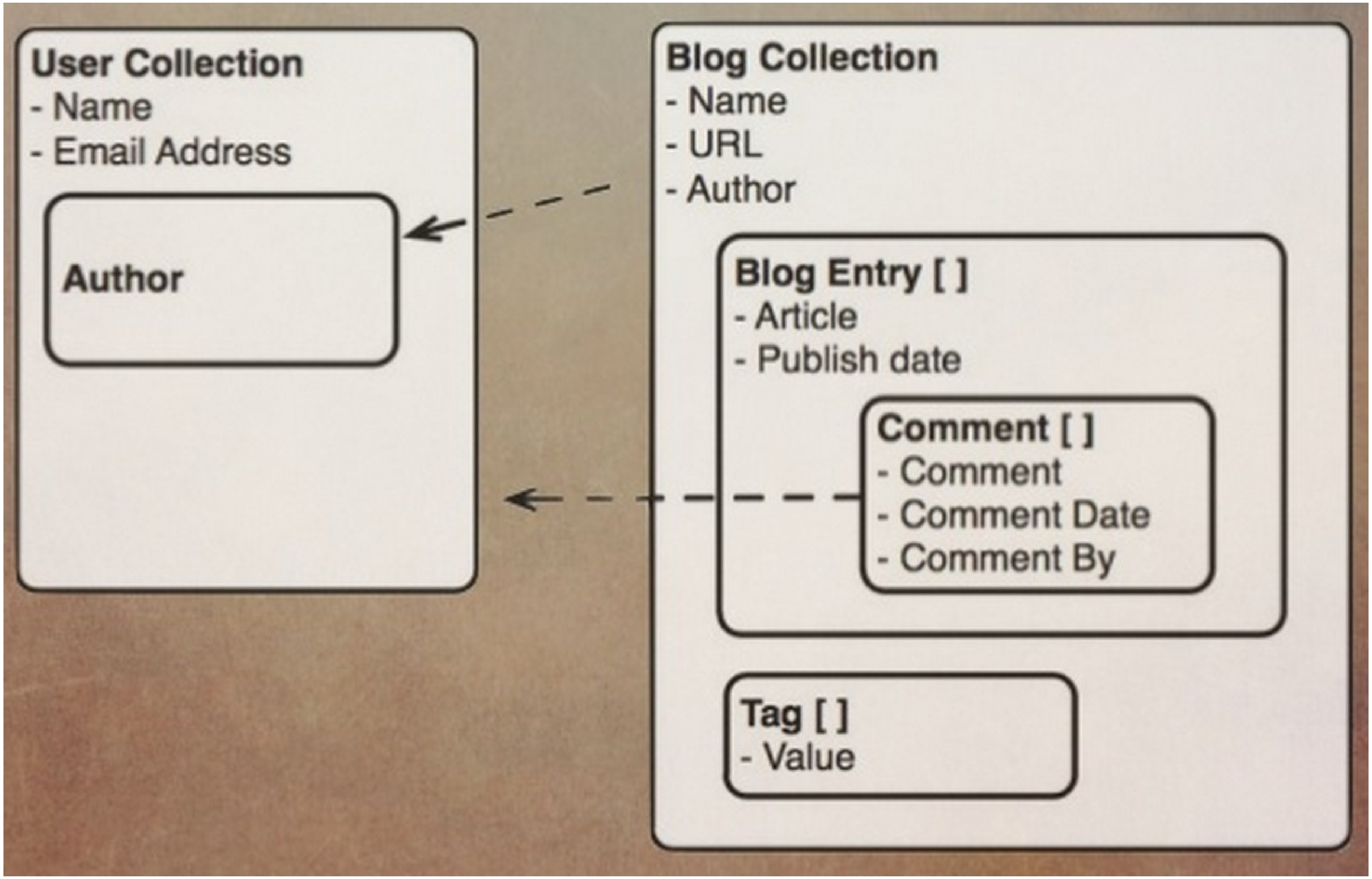
```
// your application code
class Foo { int x; string [] tags;}

// mongo document for Foo
{ x: 1, tags: [‘abc’,’xyz’] }
```

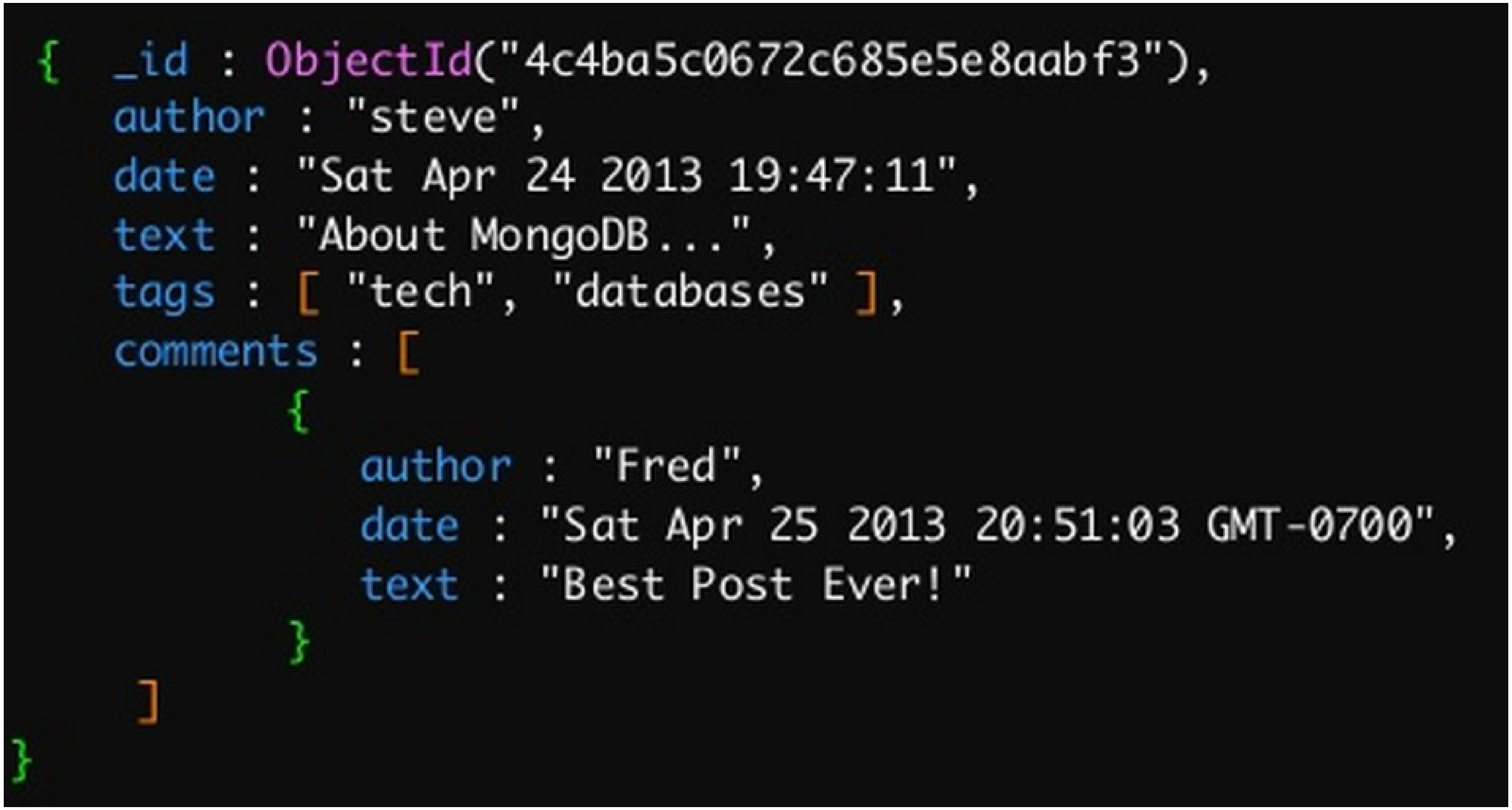
Blog in relational DB



Blog post structure in document DB



Blog post in JSON DB



```
{  _id : ObjectId("4c4ba5c0672c685e5e8aabf3"),
   author : "steve",
   date : "Sat Apr 24 2013 19:47:11",
   text : "About MongoDB...",
   tags : [ "tech", "databases" ],
   comments : [
          {
             author : "Fred",
             date : "Sat Apr 25 2013 20:51:03 GMT-0700",
             text : "Best Post Ever!"
          }
    ]
}
```

When I say

Database

Think

Database

- Made up of Multiple Collections.
- Created on-the-fly when referenced for the first time.

When I say

Collection

Think

Table

- Schema-less, and contains Documents.

- Indexable by one/more keys.

- Created on-the-fly when referenced for the first time.

- Capped Collections: Fixed size, older records get dropped after reaching the limit.

When I say **Document** — Think **Record/Row**

- Stored in a Collection.
- Have _id key – works like Primary keys in MySQL.
- Supported Relationships – Embedded (or) References.
- Document storage in BSON (Binary form of JSON).

Understanding the Document Model

```
var post = {
    ‘_id’: ObjectId(‘3432’),
    ‘author’: ObjectId(‘2311’),
    ‘title’: ‘Introduction to MongoDB’,
    ‘body’: ‘MongoDB is an open sources.. ‘,
    ‘timestamp’: Date(’01-04-12’),
    ‘tags’: [‘MongoDB’, ‘NoSQL’],
    ‘comments’: [{‘author’: ObjectId(‘5331’),
                 ‘date’: Date(’02-04-12’),
                 ‘text’: ‘Did you see.. ‘,
                 ‘upvotes’: 7} ]
}

> db.posts.insert(post);
```

The Problem

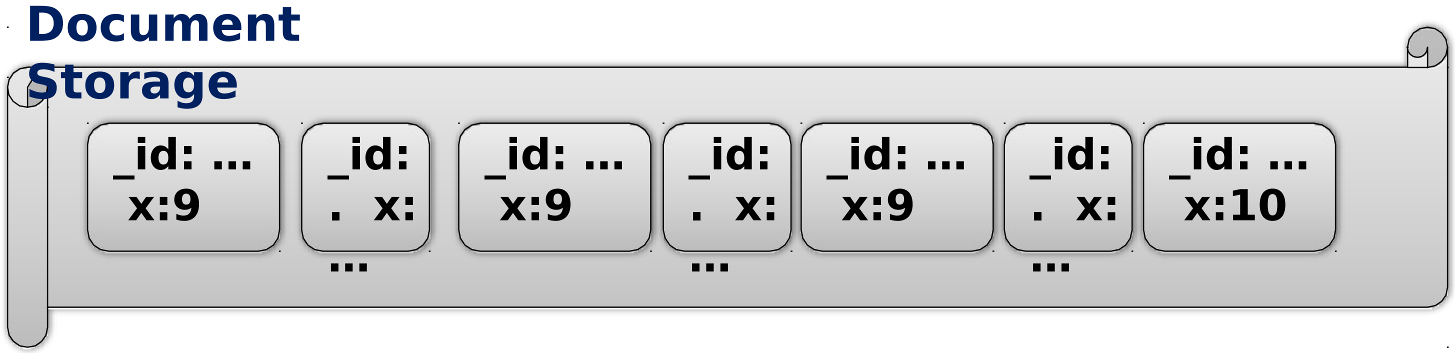
- **You say:**

```
db.foo.find({ x: 10 })
```

- **The server does :**

```
for each doc d in 'foo'{
     if ( d.x == 10 ){
       return d
     }
}
```

Ouch! Reads EVERY document!

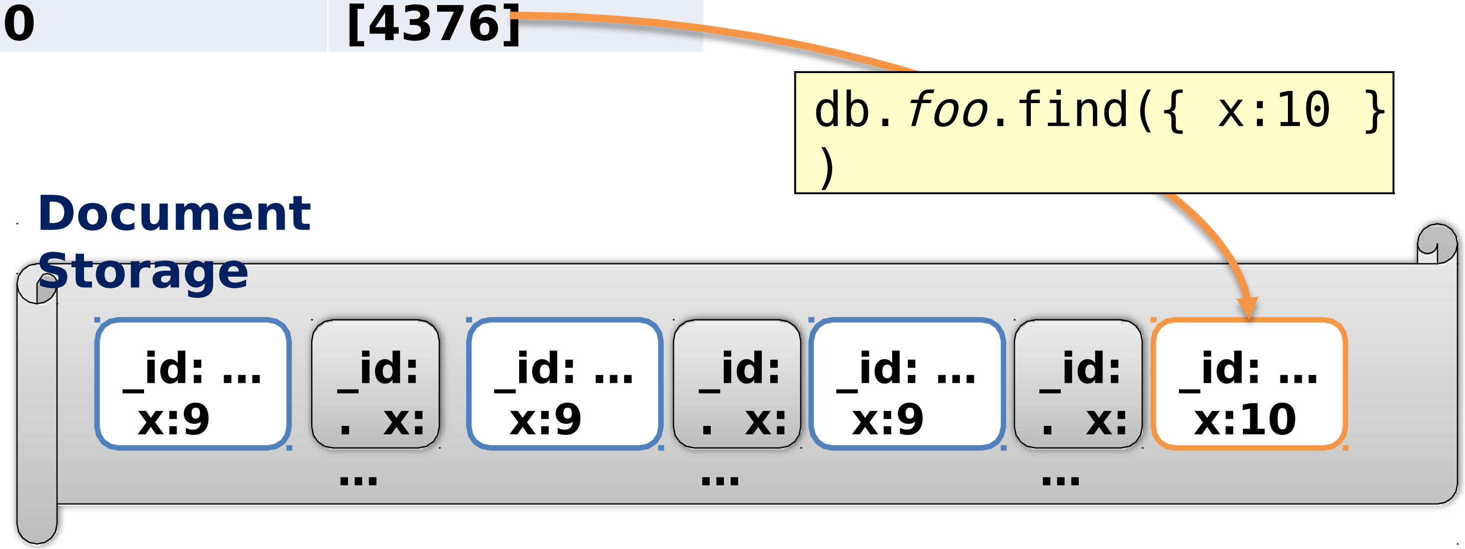


The Solution

Index - field ‘x’, collection ‘foo’

Value	Doc Pointers
9	[171, 819, 2309]
10	[4376]

```
db.foo.find({ x:10 })
```



Create Index

Which fields? In what Order? Geo / Text

```
db.foo.ensureIndex(keys, options)
```

Collection

Name? Build now? Unique Sparse? TTL? Language?

Secondary Indexes

Create Index on any field in the document

```
// 1 means ascending, -1 means descending
> db.posts.ensureIndex({‘author’: 1});

//Index Nested Documents
> db.posts.ensureIndex(‘comments.author’: 1);

// Index on tags
> db.posts.ensureIndex({‘tags’: 1});

// Geo-spatial Index
> db.posts.ensureIndex({‘author.location’: ‘2d’});
```

Find

```
// find posts which has ‘MongoDB’ tag.
> db.posts.find({tags: ‘MongoDB’});

// find posts by author’s comments.
> db.posts.find({‘comments.author’: ‘Johnson’}).count();

// find posts written after 31st March.
> db.posts.find({‘timestamp’: {‘$gte’: Date(’31-03-
12’)}});

// find posts written by authors around [22, 42]
> db.posts.find({‘author.location’: {‘$near’:[22, 42]});
```

$gt, $lt, $gte, $lte, $ne, $all, $in, $nin…

Find

Which fields?

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

Which documents?

Find: projection

```
> db.posts.find({}, {title:1})

  { "_id" : ObjectId("5654381f37f63ffc4ebf1964"),
     "title" : "NodeJS server" }
  { "_id" : ObjectId("5654385c37f63ffc4ebf1965"),
     "title" : "Introduction to MongoDB" }
```

Like

select **title** from **posts**

Empty projection like

select ***** from **posts**

Find

Fin
d

- Query criteria
  - Single value field
  - Array field
  - Sub-document / dot notation

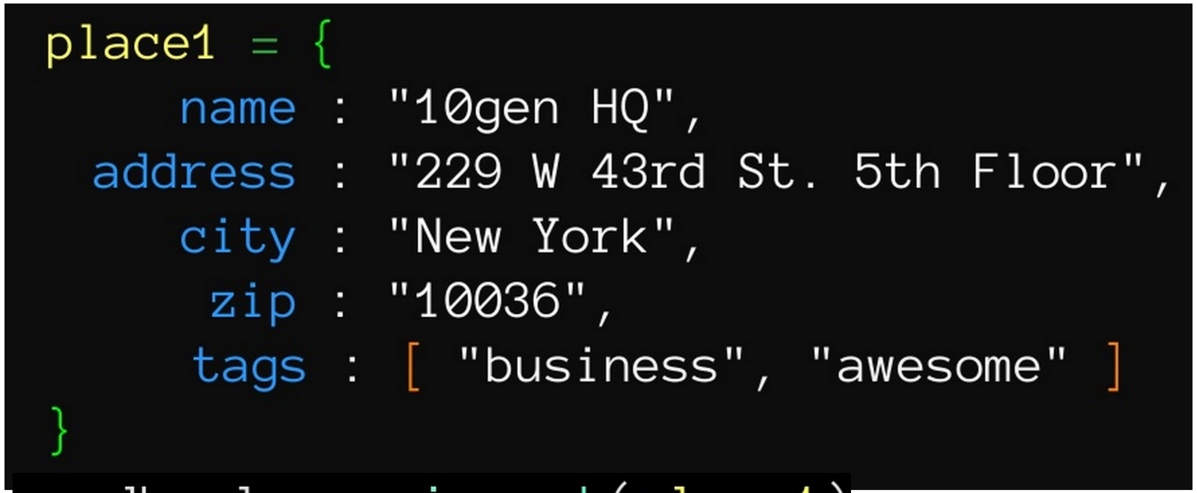
Projecti
on

- Filed inclusion and exclusion

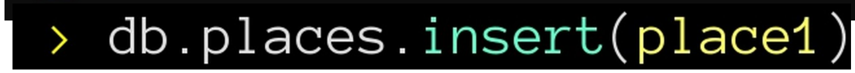
Curs
or

- Sort
- Limit
- Skip

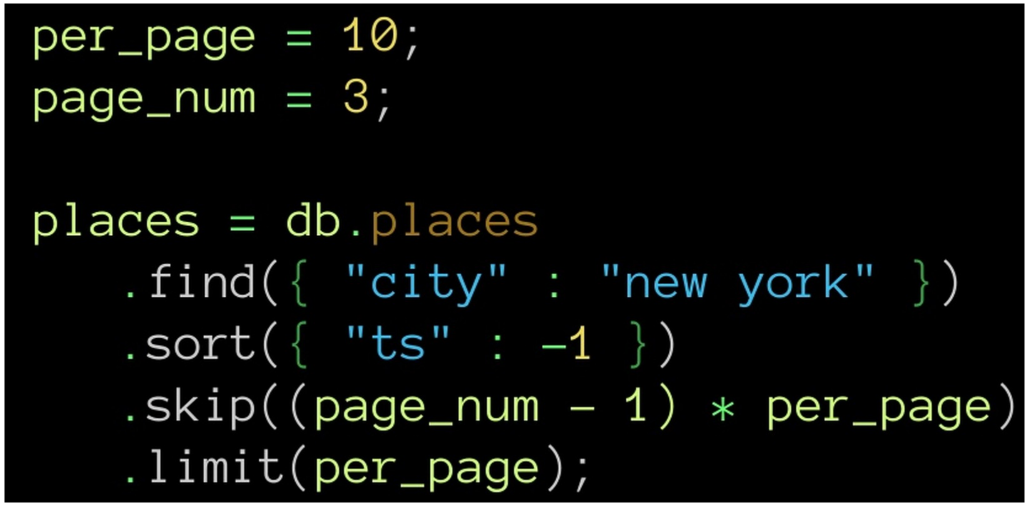
Paging example



```
place1 = {
      name : "10gen HQ",
   address : "229 W 43rd St. 5th Floor",
      city : "New York",
       zip : "10036",
      tags : [ "business", "awesome" ]
}
```



```
> db.places.insert(place1)
```



```
per_page = 10;
page_num = 3;

places = db.places
    .find({ "city" : "new york" })
    .sort({ "ts" : -1 })
    .skip((page_num - 1) * per_page)
    .limit(per_page);
```

Update: replace the document

```
> db.posts.update(
    {"_id" : ObjectId("5654381f37f63ffc4ebf1964")},
    {
        title:"NodeJS server"
    });
```

This will **replace** the document by {title:"NodeJS server"}

Update: change only the part of document

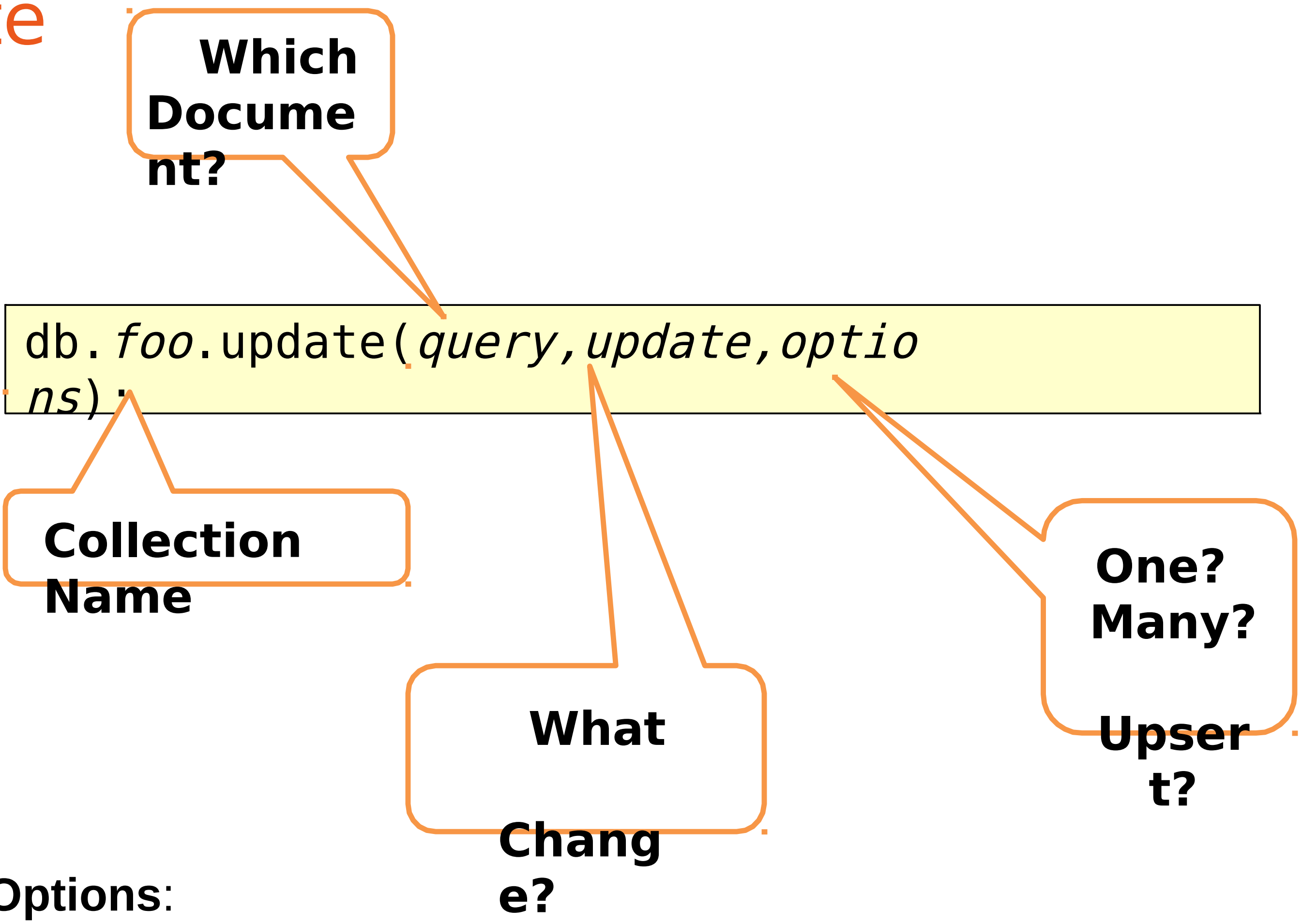
```
> db.posts.update(
    {"_id" : ObjectId("5654381f37f63ffc4ebf1964")},
    {
        $addToSet: {tags:"JS"},
        $set: {title:"NodeJS server"},
        $unset: { comments: 1}
    });
```

$set, $unset

$push, $pull, $pop, $addToSet

$inc, $decr, many more…

Update



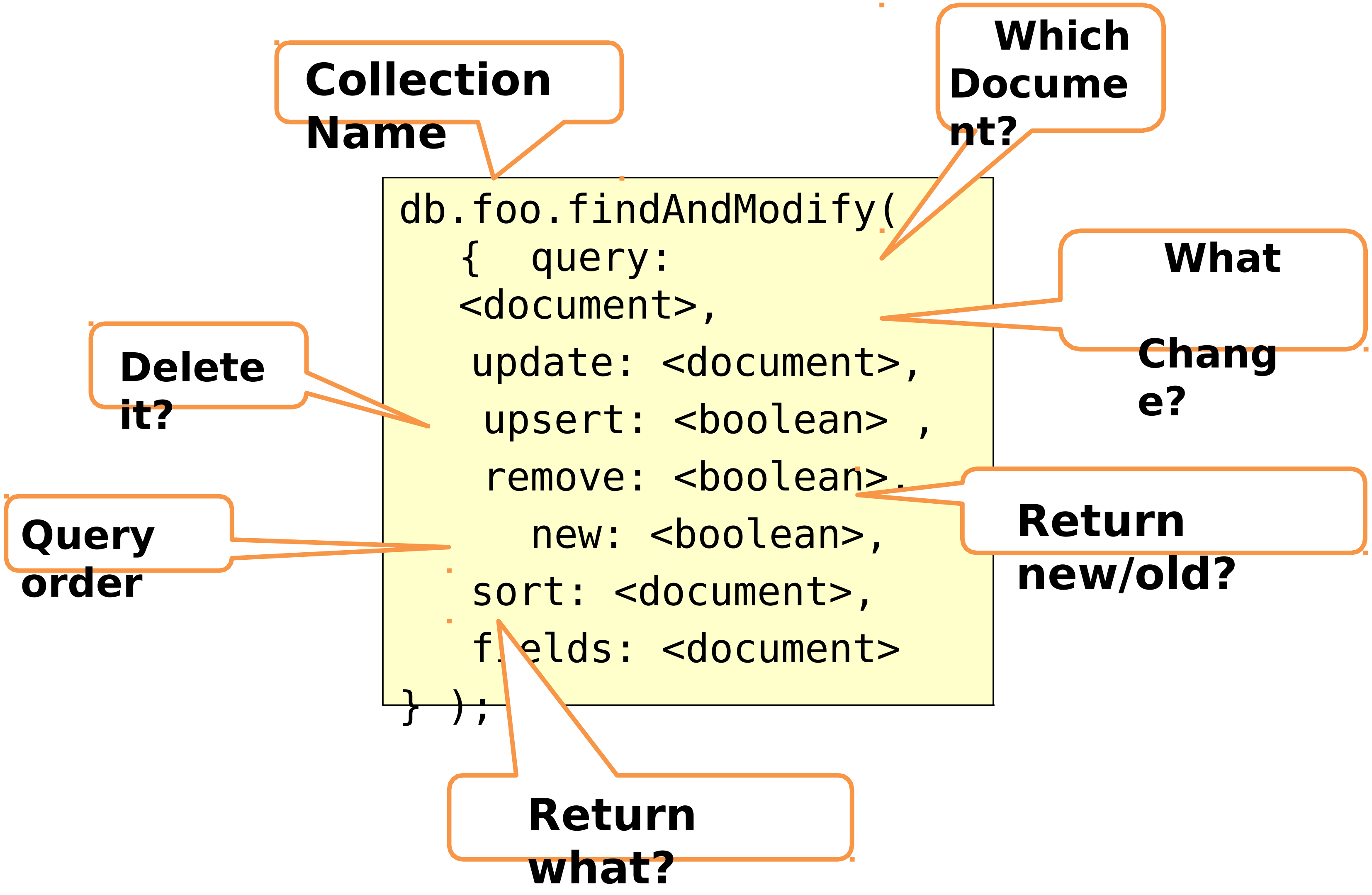
```
db.foo.update(query,update,options);
```

Options:

{multi: true} – will change all found documents; by default only first found will be updated

{upsert: true} – will insert document if it was not found

Find And Modify



```
db.foo.findAndModify(
   {  query: <document>,
    update: <document>,
     upsert: <boolean> ,
     remove: <boolean>,
       new: <boolean>,
    sort: <document>,
    fields: <document>
} );
```

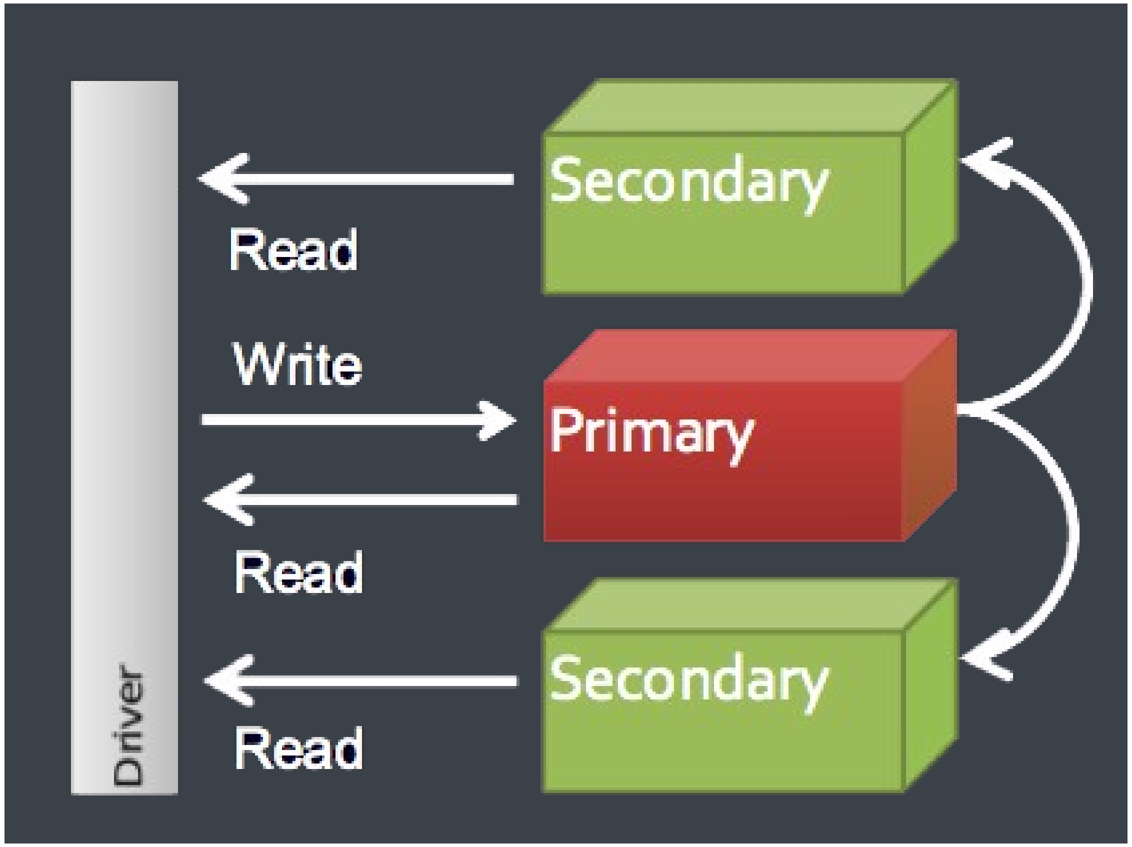
Some Cool features

- Geo-spatial Indexes for Geo-spatial queries.
  $near, $within_distance, Bound queries (circle, box)

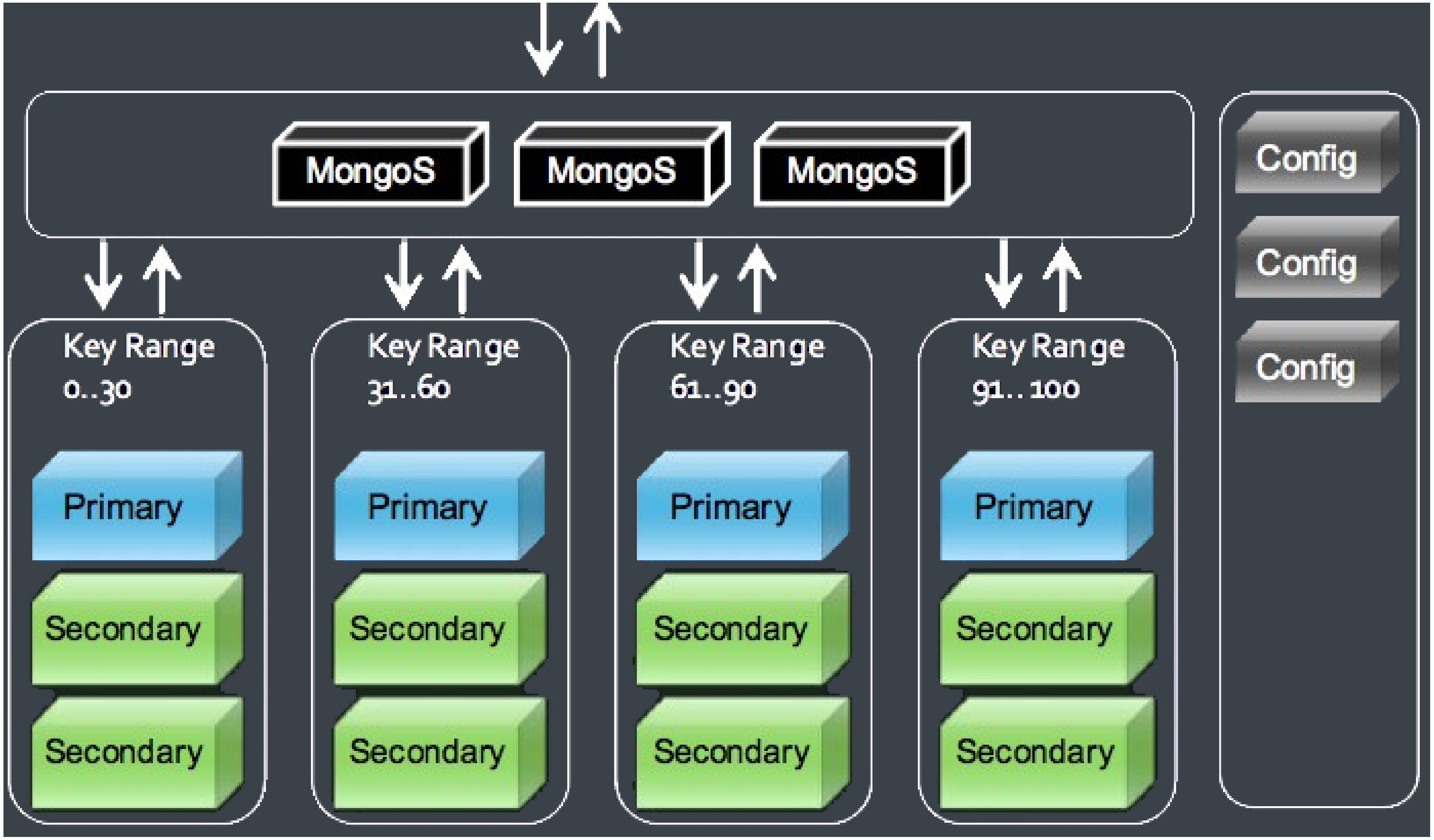
- GridFS
  Stores Large Binary Files.

- Map/Reduce
  GROUP BY in SQL, map/reduce in MongoDB.

Replica Sets



Sharding


MongoS
MongoS
MongoS
Config
Config
Config
Key Range 0..30
Key Range 31..60
Key Range 61..90
Key Range 91..100
Primary
Secondary
Secondary