

Database Interaction II

MongoDB and Node.js

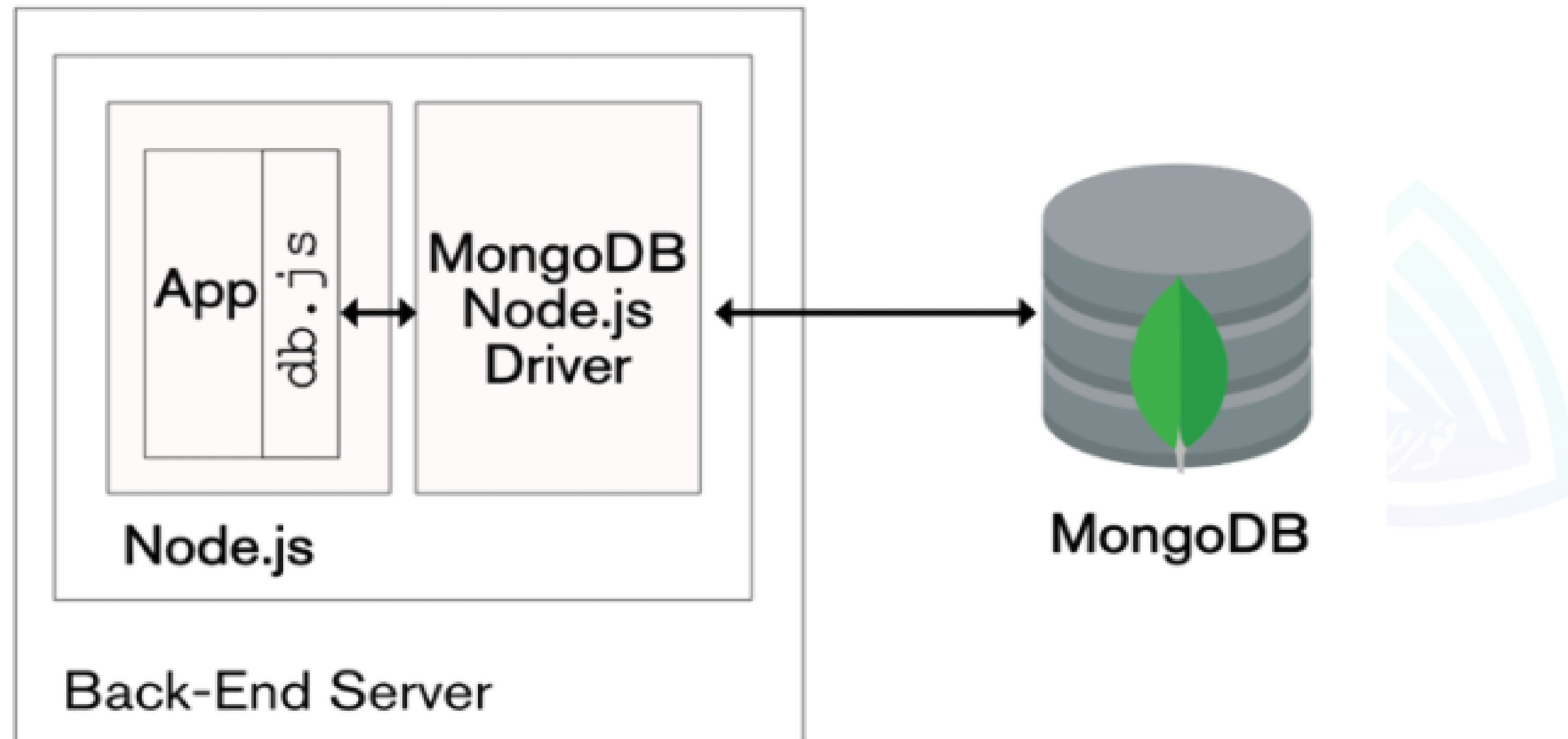


Image source: <https://www.mongodb.com/blog/post/the-modern-application-stack-part-2-using-mongodb-with-nodejs>

Mongoose

- Mongoose:
 - Library that sits on top of the MongoDB driver and abstracts some of the boilerplate code for you
 - Includes built-in typecasting, validation, query building and business logic hooks
 - Object Data Model (ODM: a tool that allows the programmer to treat documents stored in databases as JavaScript objects)

Schemas

What is a Schema?

- A schema is a JSON object that defines the structure and contents of your data.
- Schemas represent types of data rather than specific values. supports many built-in schema types. These include primitives, like strings and numbers, as well as structural types, like objects and arrays, which you can combine to create schemas that represent custom object types.

```
author.js

const mongoose = require('mongoose');
const Schema = mongoose.Schema;

// Create Schema and Model

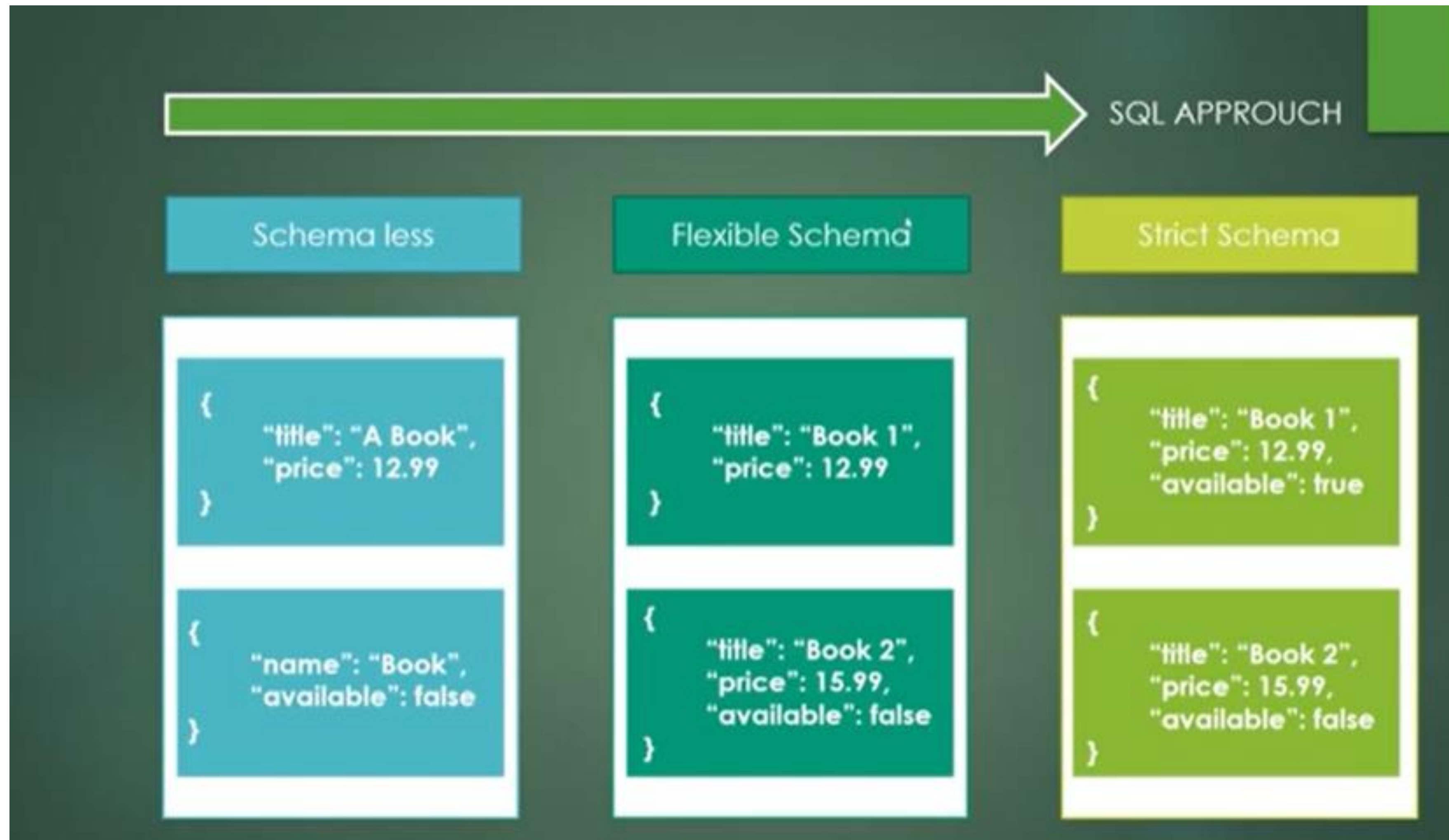
const BookSchema = new Schema({
  title: String,
  pages: Number
});

const AuthorSchema = new Schema({
  name: String,
  age: Number,
  books: [BookSchema]
});

const Author = mongoose.model('author', AuthorSchema);

module.exports = Author;
```

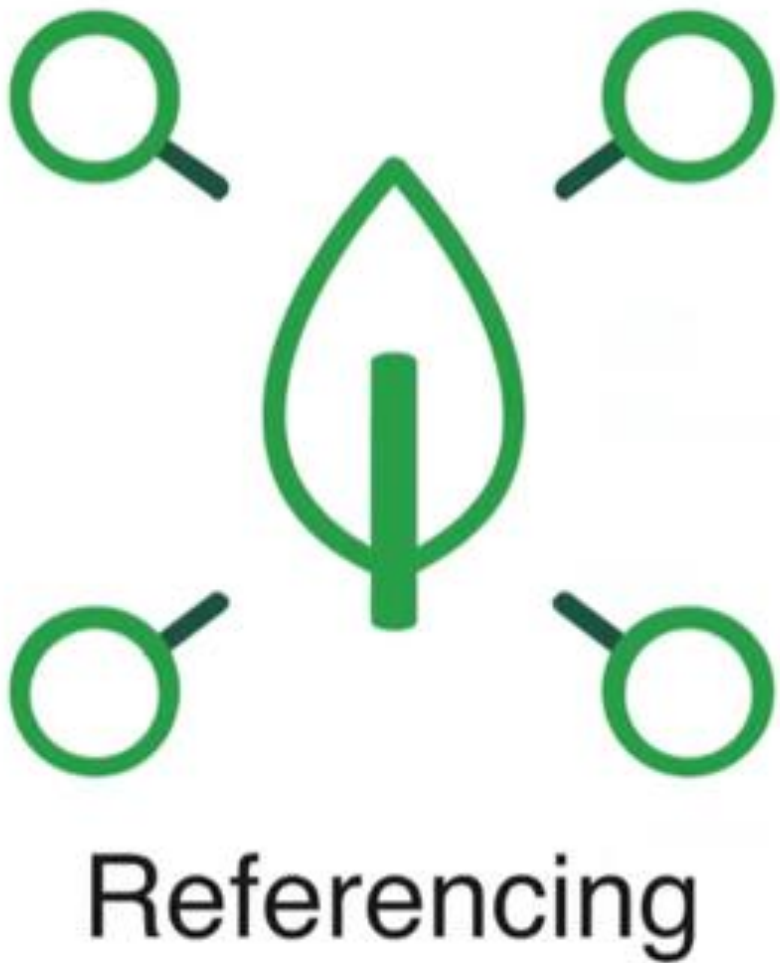
Different Schema Approache



Data type in MongoDB

Text	"Jeff", "Some description"		
Boolean	True , False		
Number	NumberInt	NumberLong	NumberDecimal
	2,147,483,647	9,223,372,036,854,775,807	3456.89
ObjectId	ObjectId("5f8075a15104f46744383ae9")		
ISODate	ISODate("2012-12-19T06:01:17.171Z")		
Embedded Document	Array		
{ details: { title: "something" } }		{ tags: ["tag1", "tag2"] }	

Relationship in MongoDB



```
{
  name: 'left-handed smoke shifter',
  manufacturer: 'Acme Corp',
  catalog_number: 1234,
  parts: [
    {
      _id: ObjectID('AAAA'),
      partno: '123-aff-456',
      name: '#4 grommet',
      qty: 94,
      cost: 0.94,
      price: 3.99
    },
    {
      _id: ObjectID('BBB'),
      partno: '425-EFF-123',
      name: '#8 Frombet',
      qty: 13,
      cost: 0.34,
      price: 7.99
    }
  ]
}
```

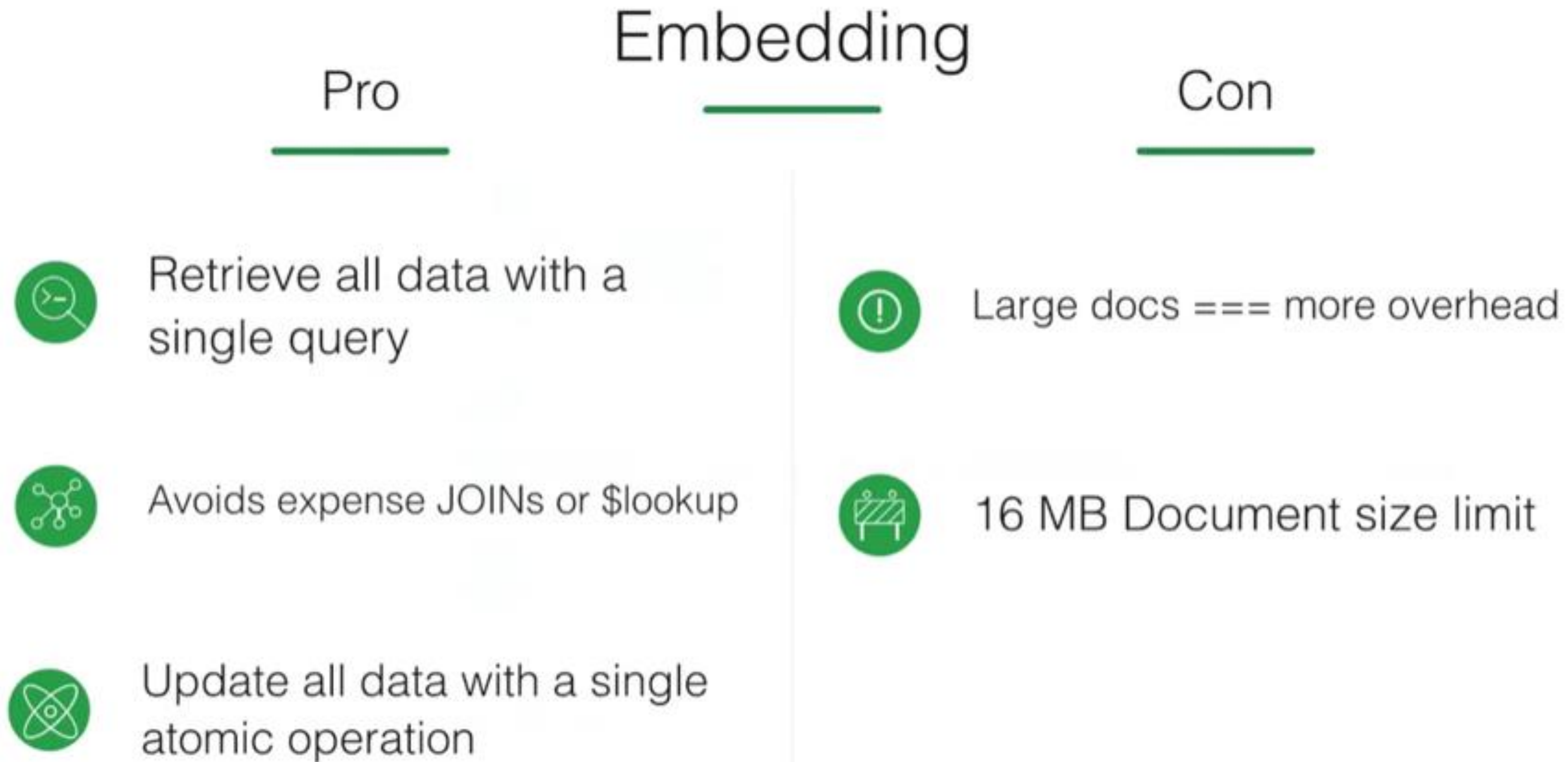
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```
{
  _id: ObjectID('AAA'),
  name: 'Kate Monster',
  ssn: '123-456-7890',
  addresses: [
    {
      street: '123 Sesame St',
      city: 'Anytown',
      cc: 'USA'
    },
    {
      street: '123 Avenue Q',
      city: 'New York',
      cc: 'USA'
    }
  ]
}
```

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Relationship in MongoDB



Relationship in MongoDB

Referencing

Pro

- ❗ Smaller documents
- 📄 Less likely to reach 16 MB limit
- ✅ No duplication of data
- ✅ Infrequently accessed data not accessed on every query

Con

- ❗ Two queries or \$lookup required to retrieve all data

Relationship in MongoDB

One-to-One Embedded

```
Book = {
  "_id": 1,
  "title": "Harry Potter and the Methods of Rationality",
  "slug": "9781857150193-hpmor",
  "author": {
    "firstName": "Eliezer",
    "lastName": "Yudkowsky"
  },
  // more fields follow...
}
```

One-to-One Linked

```
Book = {                                     // either side can track
  "_id": 1,
  "title": "Harry Potter and the Methods of Rationality",
  "slug": "9781857150193-hpmor",
  "author": 1,                               // more fields follow...
}

Author = {
  "_id": 1,
  "firstName": "Eliezer",
  "lastName": "Yudkowsky",
  "book": 1,                                 // more fields follow...
}
```

Relationship in MongoDB

One-to-Many: Scalar in Child

```
Book1= {
  "_id": 1,
  "title": "Harry Potter and the Methods of Rationality",
  "slug": "9781857150193-hpmor",
  "author": 1,           // more fields follow...
}

Book2= {
  "_id": 5,
  "title": "How to Actually Change Your Mind",
  "slug": "1939311179490-how-to-change",
  "author": 1,           // more fields follow...
}
```

One-to-Many: Array in Parent

```
Author= {
  "_id": 1,
  "firstName": "Eliezer",
  "lastName": "Yudkowsky",
  "books": [1, 5, 17],
  // more fields follow...
}
```


Relationship in MongoDB

Many-to-Many: Arrays on either side

```
Book = {                                     //either side can track
  "_id": 5,
  "title": "Harry Potter and the Methods of Rationality",
  "slug": "9781857150193-hpmor",
  "authors": [1, 3],                        // more fields follow...
}

Author = {
  "_id": 1,
  "firstName": "Eliezer",
  "lastName": "Yudkowsky",
  "books": [5, 7],                          // more fields follow...
}
```

Create Code Using Mongoose

- Step 1: Install Mongoose `npm install mongoose`
- Step 2: Create a Models Folder
- Step 3: Create a schema

```
const mongoose = require('mongoose');

let TodoSchema = mongoose.Schema({
  description :{
    type:String,
    required:true
  },
  title:{
    type:String,
    required:true
  },
});
```

Create Code Using Mongoose

- How to create a model using model() method:

- Two arguments passed:

1. Name of the model

2. Schema object you created

```
let Todos= mongoose.model('Todos', TodoSchema);
```

- Since you are inside the models folder, you will need to export this module/Schema so you can use it elsewhere



Create Code Using Mongoose

- Step 3: Create a controller file to perform CRUD operations
 - Create: save()

```
8
9 app.post('/todos', async (req, res) => {
10   // const todo = new todo(req.body)
11   const todo = new Todo({
12     description: req.body.description,
13     title: req.body.title,
14     author: req.body.author
15   })
16   console.log(todo)
17   // create an instance of the todos
18   try {
19     await todo.save()
20     res.status(201).send(todo)
21   }
22   catch(e){
23     console.error(e)
24   }
25   console.log('Added');
26 })
27
```

Create Code Using Mongoose

- Read: find()

```
app.get('/todos', async (req, res) => {  
  try{  
    const todos = await Todo.find()  
    res.send(todos)  
  } catch(e){  
    res.status(500).send()  
    console.error(e)  
  }  
})
```

Create Code Using Mongoose

- Read: findOne()

```
app.get('/todos/:id', async (req, res) => {  
  // grab specific ID  
  const _id = req.params.id  
  try{  
    const todo = await Todo.findOne({_id});  
    res.send(todo);  
  }  
  // If there is no error  
  catch(e) {  
    res.status(500).send()  
    // any errors being sent back  
    console.error(e)  
  }  
})
```


Create Code Using Mongoose

- Update: update(), updateOne(), updateMany() or findOneAndUpdate()

```
app.patch('/todos/:id', async (req, res) => {
  const allowedUpdates = ['description', 'title', 'author'];
  const updates = Object.keys(req.body)
  const isValidOperation = updates.every((update) => allowedUpdates.includes(update))

  if(!isValidOperation) {
    return res.status(400).send({error: 'Invalid updates'});
    // anything not expected from the todos
  }
  try{
    const todo = await Todo.findOne({_id: req.params.id});
    // find id passed into the function
    if(!todo) {return res.status(404).send(404).send()}
    updates.forEach((update) => {
      todo[update] = req.body[update]
      // update the values and keys dynamically
    })
    await todo.save()
    res.status(200).send(todo)

  } catch(e) {
    res.status(400).send(e)
    console.error(e)
  }
})
```

Create Code Using Mongoose

- Delete: remove()

```
app.delete('/todos/:id', async (req, res) => {
  try{
    const todo = await Todo.findByIdAndDelete({_id: req.params.id});
    // grab current todos
    if(!todo) {
      return res.status(404).send()
    }
    // If all is well
    res.send(todo)
    // send the deleted todos
  } catch(e){
    res.status(500).send()
    console.error(e)
    // if all fails
  }
})
```

Create Code Using Mongoose

- Step 4: Connect to the database and execute appropriate CRUD operations

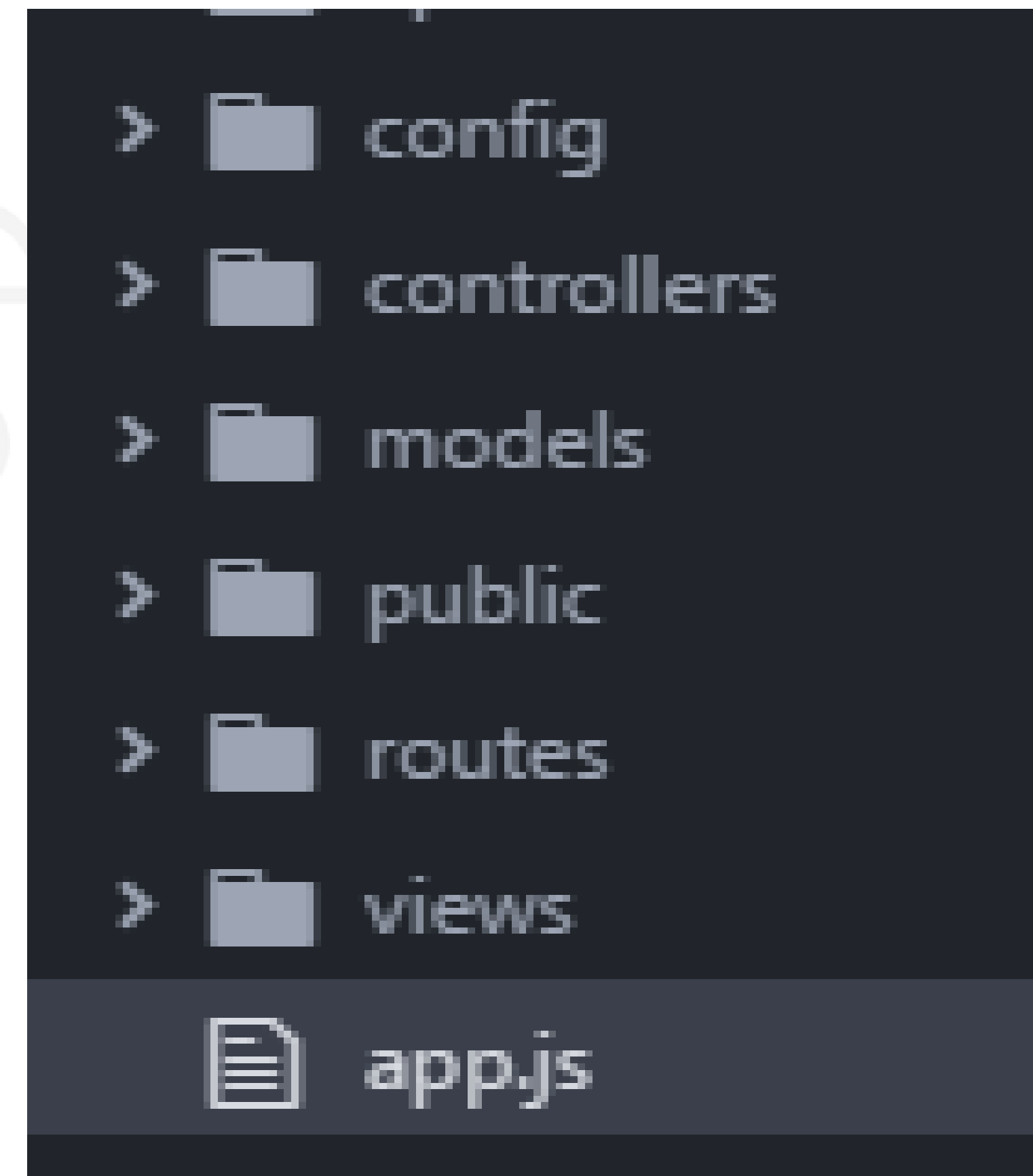
```
const mongoose = require('mongoose');

const uri = 'mongodb://hyperionDB:password@hyperion-shard-00-00-f78fc.m...';
mongoose.connect(uri, {
  useNewUrlParser: true, useUnifiedTopology: true
});

const connection = mongoose.connection
connection.once('open', () => console.log('Connected to DB'),
connection.on('error', err => {console.log('connection error', err)}))
```


MongoDB and Express

- It is recommended that your project is based on a recognised software architecture pattern
- A project structure that is based on the MVC architecture pattern:





Resources

- MongoDB Schema Design Best Practices: <https://www.youtube.com/watch?v=leNCfU5SYR8>
- MongoDB Crash Course - Schemas and Relationships: <https://www.youtube.com/watch?v=DdvhZj7SsEM>
- Data Modeling with MongoDB: <https://www.youtube.com/watch?v=3GHZd0zv170>
- MongoDB Tutorial : <https://www.youtube.com/watch?v=9JZJsChpwKs>
- Create MongoDB database models in Node.js: <https://javascript.plainenglish.io/node-js-models-and-database-3836f0c7f2da>