Getting Started with MongoDB

{name: “mongo”, type:“DB”}

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Who's Mike?

- Bachelor of Science, Computer Science
- "Petrochemical Research Organization"
- Java Queue News Editor, InfoQ
- Leadership Council, Jakarta EE Ambassadors
- Amateur Computer Group of New Jersey

RUTGERS
THE STATE UNIVERSITY OF NEW JERSEY

Objectives

- What is MongoDB?
- What is NoSQL?
- Getting Started with MongoDB
- Basic CRUD Operations
- Live Demos (yea!)
- MongoDB Resources

What is MongoDB? (1)

- *"...an open-source document database that provides high performance, high availability, and automatic scaling."*

MongoDB Web Site, http://www.mongodb.org/

- It's name derived from "**humongous**"
- Written in C++

What is MongoDB? (2)

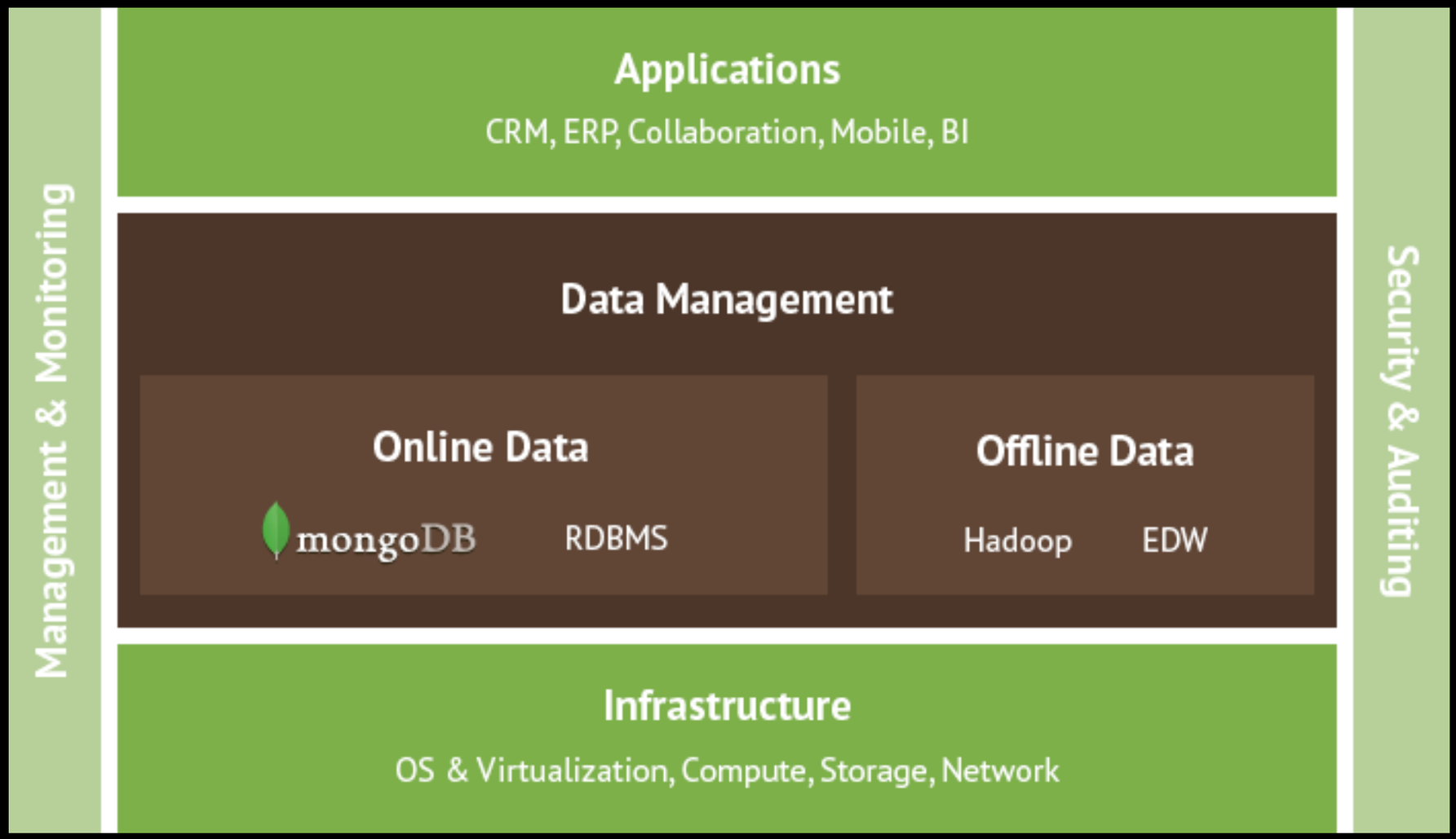
- "*...an open-source database used by companies of all sizes, across all industries and for a wide variety of applications. It is an agile database that allows schemas to change quickly as applications evolve, while still providing functionality developers expect from traditional databases...*"

MongoDB Products Web Site, http://www.mongodb.com/products/mongodb/

What is NoSQL?

- Developed to address shortcomings of a traditional SQL relational database, namely:
  - big data
  - frequency of access to big data
  - performance and scalability

How is MongoDB Used?



Who is Using MongoDB?

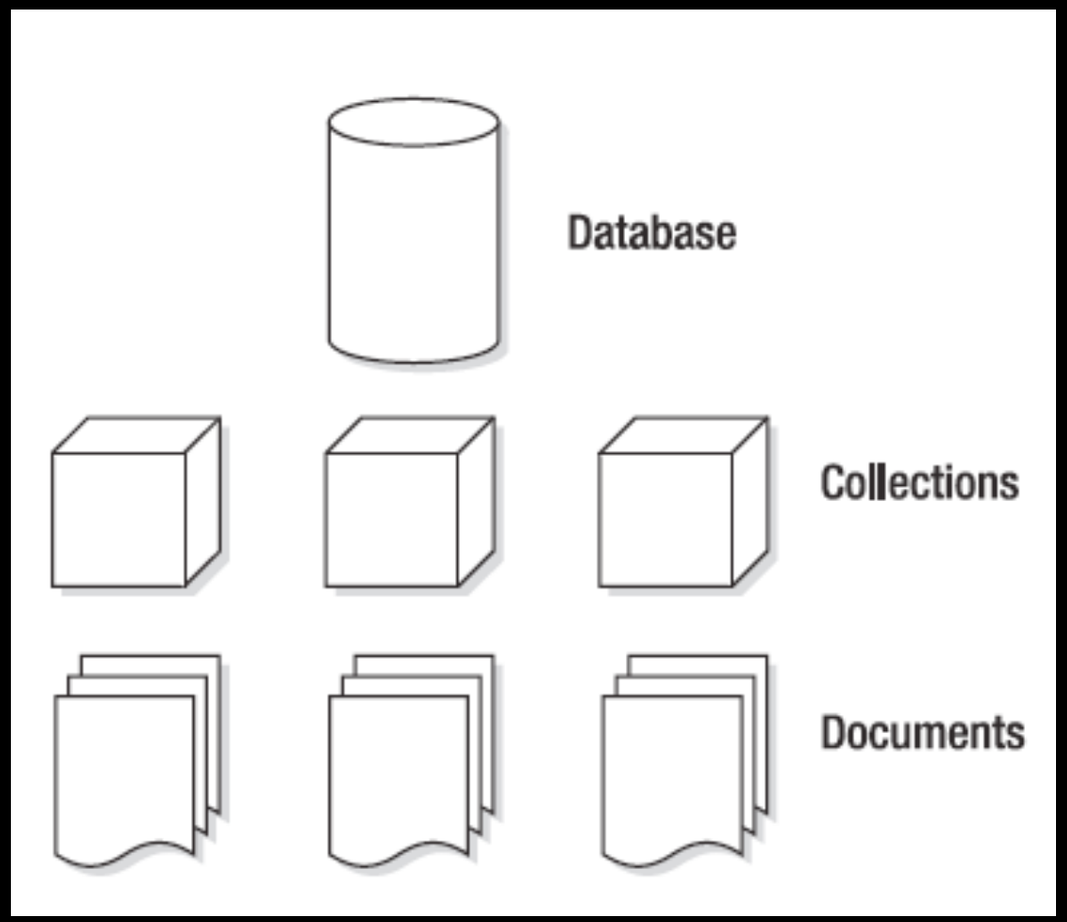
Features of MongoDB

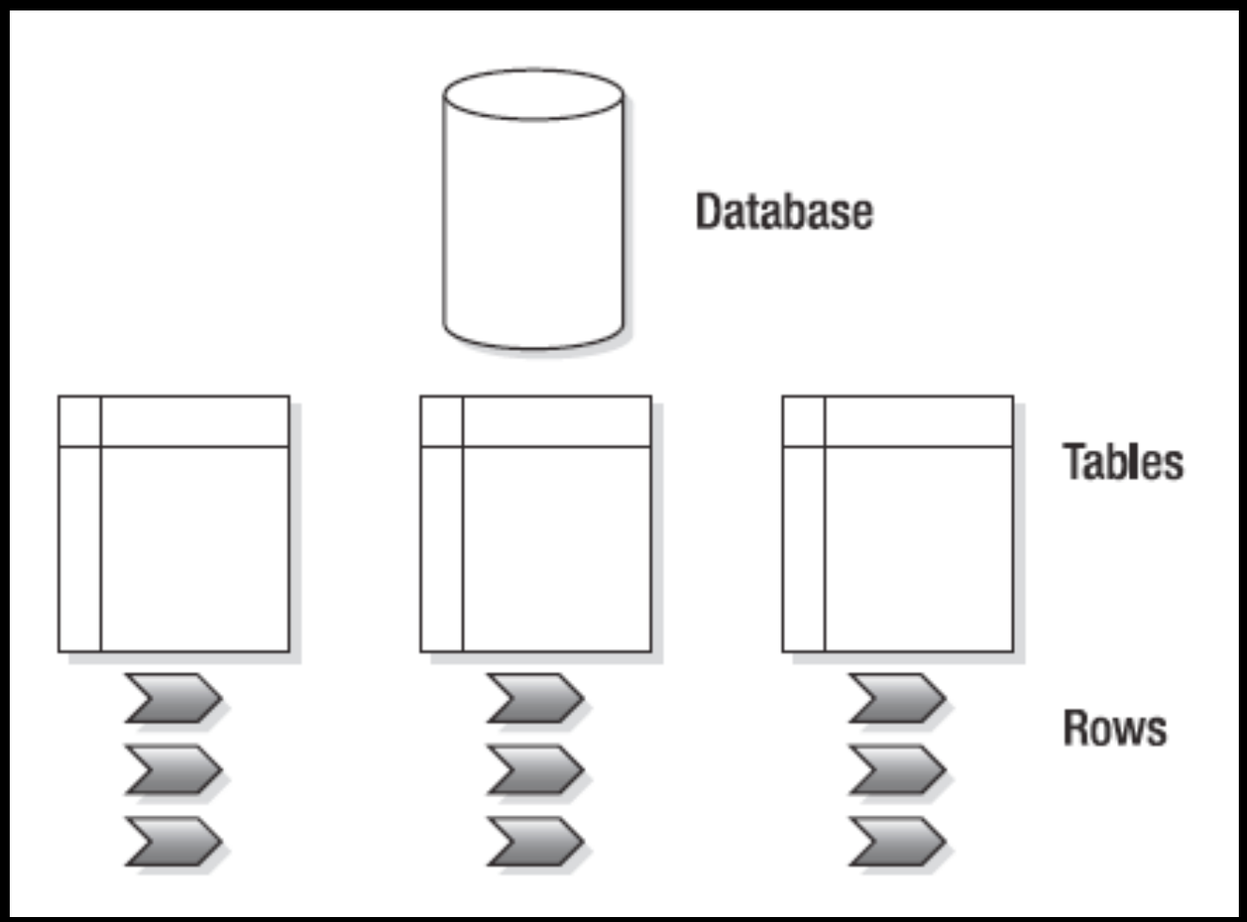
- Document-Oriented Storage
- Full Index Support
- Replication and High Availability
- Auto-Sharding
- Querying
- Fast In-Place Updates
- Map/Reduce
- GridFS
- Professional Support by MongoDB

Nomenclature (1)

RDBMS		MongoDB
Database	→	Database
Table	→	Collection
Row	→	Document
Index	→	Index
Join	→	Embedding & Linking
Foreign Key	→	Reference

Nomenclature (2)





What is a Document?

- Basic unit of data
  - analogous to a row in a RDBMS
- An ordered set of fields (keys) with associated values stored in BSON format
  - similar to JSON

What is BSON?

- "*...a binary-encoded serialization of JSON-like documents.*"

BSON Web Site, http://www.bsonspec.org/

- Binary JSON
- Designed to be lightweight, traversable, and efficient

What is a Collection?

- A group of documents
  - analogous to a table in a RDBMS
- Schema-less

Advantages of Documents

- Documents correspond to native data types in many programming languages
- Embedded documents and arrays reduce the need for expensive joins
- Dynamic schema support fluent polymorphism

Document Structure

```
{
lastName : "Redlich",
firstName : "Michael",
email : "mike@redlich.net"
role : {
        officer : "President",
        sig : "Java Users Group"
        }
}
```

embedded document

field

value

Field Names

- Strings
- Cannot contain:
  - null
  - dots (.)
  - dollar sign ($)
- No duplicate field names

Conventions Used in This Presentation

- Command Prompt (`$`)
- MySQL prompt (`mysql>`)
- MongoDB prompt (`>`)
- Keywords (`db`, `find()`, etc.)
- Variables (*`variable`*)

Example Database

- ACGNJ Board of Directors:
  - lastName
  - firstName
  - roles (embedded documents)
  - tenure

Getting Started

- Download MongoDB
- Create a default data directory
  - `/data/db`
  - `C:\data\db`
- Create your first MongoDB database

Starting MongoDB

- Start an instance of the MongoDB server:

```
$ mongod
```

- Start an instance of the MongoDB client (a JavaScript-based shell):

```
$ mongo
```

Mongo Shell (1)

- Show the list of shell commands:

```
> help
```

- Show the list of databases:

```
> show dbs
```

- Show the current database:

```
> db
```

Mongo Shell (2)

- Specify the database to use or create:

```
> use database
```

- Show the collections within the current database:

```
> show collections
```

- Show the users within the database:

```
> show users
```

Mongo Shell (3)

- Show the recent **`system.profile`** entries:

```
> show profile
```

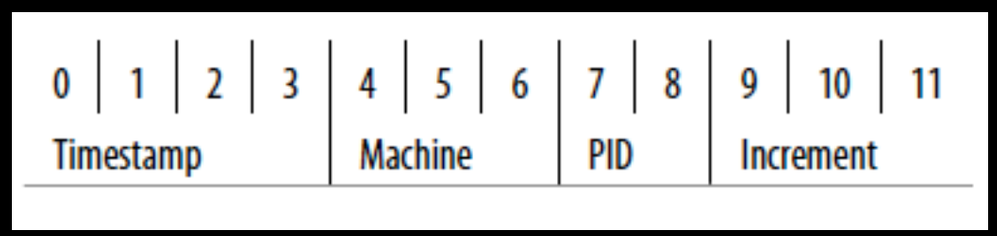
- Tab completion
- Command history

Primary Key

- Denoted by a special field, `_id`
- It can be generated:
  - Implicitly:
    - `{_id : ObjectID(value)}`
  - Explicitly:
    - `{_id : 2 },{ _id : "MPR"}`

ObjectIDs

- Default type for `_id`
- A 12-byte hexadecimal BSON type:



Live Demo!

Create

Create a Database

- Create a database in MySQL:

```
mysql> CREATE DATABASE database;
```

- Create a database in MongoDB:

```
> use database
```

Create a Collection

- Create a new table in MySQL:

```
mysql> CREATE TABLE table(column
datatype,...);
```

- Create a new collection in MongoDB:

```
>
db.collection.insert({field:value,.
..})
```

Insert Data

- Insert a row in MySQL:

```
mysql> INSERT INTO
table(column,...)
VALUES(value,...);
```

- Insert a document in MongoDB:

```
>
db.collection.insert({field:value,.
..})
```

Insert Data with Loops

- Insert multiple documents with an array:

```
> for(int i = 0;i < j;++i)
db.collection.insert({field:array[i
]});
```

- Insert multiple documents with variable:

```
> for(int i = 0;i < j;++i)
db.collection.insert({field:i})
```

Live Demo!

Read

Query (1)

- Retrieve all rows in MySQL:

```
mysql> SELECT * FROM table;
```

- Retrieve all documents in MongoDB:

```
> db.collection.find()
```

Query (2)

- Retrieve specified columns in MySQL:

```
mysql> SELECT column1,column2 FROM
table;
```

- Retrieve specified fields in MongoDB:

```
> db.collection.find({},
{field1:true,field2:true})
```

Query (3)

- Retrieve specific rows in MySQL:

```
mysql> SELECT * FROM table WHERE
column = value;
```

- Retrieve specific documents in MongoDB:

```
> db.collection.find({field:value})
```

Query (4)

- Retrieve specific rows in MySQL:

```
mysql> SELECT * FROM table WHERE
column = value ORDER BY value ASC;
```

- Retrieve specific documents in MongoDB:

```
>
db.collection.find({field:value}).s
ort({field:1})
```

Query (5)

- Query for multiple documents (returns a cursor):

```
> db.collection.find()
```

- Query for one document (returns a single document):

```
> db.collection.findOne()
```

Query Selectors

- Scalar:
  - `$ne`, `$mod`, `$exists`, `$type`, `$lt`, `$lte`, `$gt`, `$gte`
- Vector:
  - `$in`, `$nin`, `$all`, `$size`

Query (6)

- Retrieve specific rows in MySQL:

```
mysql> SELECT * FROM table WHERE
column != value;
```

- Retrieve specific documents in MongoDB:

```
> db.collection.find({field:
{$ne:value}})
```

Query (7)

- Retrieve specific rows in MySQL:

```
mysql> SELECT * FROM table WHERE
column1 = value OR column2 = value;
```

- Retrieve specific documents in MongoDB:

```
> db.collection.find({$or:
[{field:value},{field:value}])
```

Query (8)

```
> db.members.aggregate({$project:
{officer:"$roles.officer"}})

> db.members.find({tenure:
{$gt:ISODate("2014-12-31")}})

> db.members.find({"roles.officer":
{$exists:true}}).sort({"roles.offic
er":1})
```

Query (9)

```
>
db.members.find({"roles.director":
{$all:["Director"]}})

>
db.members.find({"roles.committee":
{$in:["Historian","Newsletter"]}})

> db.members.find({roles:{$size:
3}})
```

Live Demo!

Update

Update (1)

- Update a row in MySQL:

```
mysql> UPDATE table SET column =
value WHERE id = id;
```

- Update a document in a MongoDB:

```
> db.collection.update({_id:value},
{$set:{field:value}},{multi:true})
```

-

Update (2)

- Update a row in MySQL:

```
mysql> UPDATE table SET column1 =
value WHERE column2 > value;
```

- Update a document in MongoDB:

```
> db.collection.update({field1:
{$gt:value}},{$set:{field2:value}},
{multi:true})
```

-

Update (3)

- Update a document using **findOne()**:

```
> redlich =
db.members.findOne({lastName:
"Redlich"})

> redlich.roles = [{sig:"Java Users
Group"}]

> db.members.update({lastName:
"Redlich"},redlich)
```

Atomic Update Operators

- Scalar:
  - **`$inc`**, **`$set`**, **`$unset`**
- Vector:
  - **`$push`**, **`$pop`**, **`$pull`**, **`$pushAll`**, **`$pullAll`**, **`$addToSet`**

Update (4)

```
> db.members.update({lastName:
"Redlich"},{$set:
{"ISODate("2016-12-31")}})

> db.members.update({"roles.sig"},
{$set:{"roles.sig":"JUG"}})
```

Delete

Delete (1)

- Delete all rows in MySQL:

```
mysql> DELETE FROM table;
```

- Delete all documents in MongoDB:

```
> db.collection.remove()
```

Delete (2)

- Delete specific rows in MySQL:

```
mysql> DELETE FROM table WHERE
column = value;
```

- Delete specific documents in MongoDB:

```
>
db.collection.remove({field:value})
```

Delete (2)

- Delete a MySQL database

```
mysql> DROP DATABASE database;
```

- Delete a MongoDB database

```
> use database
> db.dropDatabase()
```

Backup/Restore

Export (1)

- Export a collection to a JSON file
- Ensure **mongod** is running

```
$ mongoexport --db database --
collection collection --out path/
filename.json
```

Export (2)

- Export a collection to a CSV file
- Ensure **`mongod`** is running
- A list of fields is required

```
$ mongoexport --db database --
collection collection --fields
field1,field2,... --csv --out path/
filename.json
```

Import

- Import a collection from a JSON, CSV, or TSV file
- Ensure **mongod** is running

```
$ mongoimport --db database --
collection collection < path/
filename.json
```

Dump

- Dump a specified MySQL database:

```
$ mysqldump -u root --opt database
> path.filename.sql
```

- Dump all MongoDB databases:
- Ensure **mongod** is not running

```
$ mongodump --dbpath /data/db --out
path
```

Live Demo!

Package Components (1)

- Core Processes
  - **`mongod`** - core DB process
  - **`mongos`** - controller & query router (sharding)
  - **`mongo`** - interactive JavaScript-based shell

Package Components (2)

- Binary Import and Export
  - **`mongodump`** - creates BSON dump files
  - **`mongorestore`** - restores BSON dump files
  - **`bsondump`** - converts BSON to JSON
  - **`mongooplog`** - streams oplog entries

Package Components (3)

- Data Import and Export
  - **`mongoimport`** - imports JSON, CSV, or TSV data formats
  - **`mongoexport`** - exports to JSON, CSV, or TSV data formats

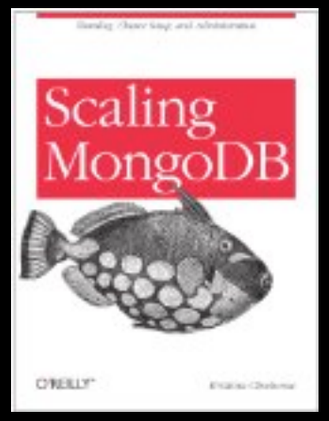
Package Components (4)

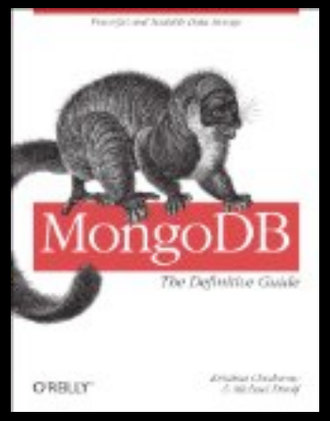
- Diagnostic Tools
  - **`mongostat`** - captures database operations by type (insert, query, etc.)
  - **`mongotop`** - tracks read/write activity
  - **`mongosniff`** - provides tracing/sniffing view into database activity
  - **`mongoperf`** - performance testing tool

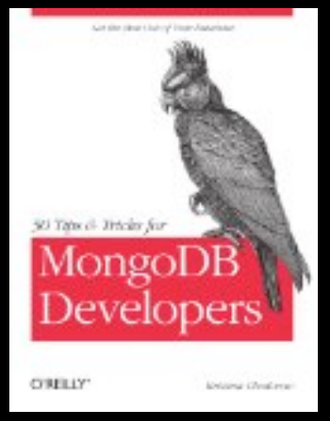
Package Components (5)

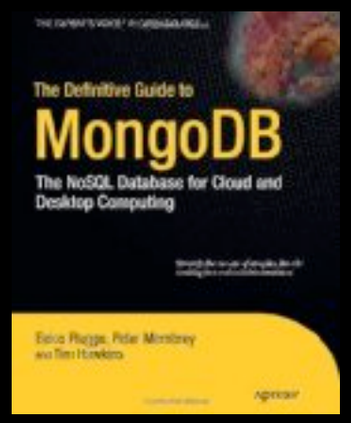
- GridFS
  - **`mongofiles`** - provides a command-line interaction to a GridFS storage system

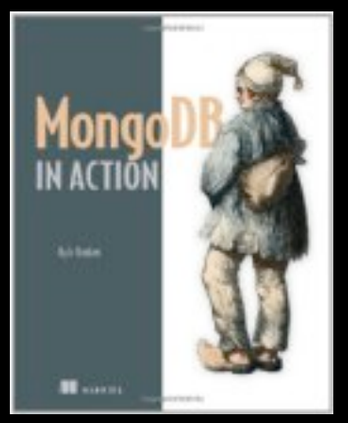
MongoDB Resources (1)











MongoDB Resources (2)

- `mongodb.org`
- `docs.mongodb.org`
- `mongodb.org/books`
- `mongodb.com/products/mongodb`
- `mongodb.com/reference`
- `bsonspec.org`
- `education.mongodb.com`

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Thanks!