



Introduction to Database Systems: CS312

MongoDB

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The Problem with SQL

The Problem With SQL

About Mongo

Schema

Language

Start MongoDB

Collections

Queries

Shutting Down

Queries

Consider this

firstName	lastName	primaryAddr

- Let's say that we have a (perfectly) working SQL table
- The schema has been designed and coded for *current data requirements*

Table Update (i)

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Consider this

firstName	lastName	primaryAddr	secondAddr

- The data we collect has changed.
- We need to update our schema for the *new data requirements*

Table Update (ii)

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Consider this

firstName	lastName	primaryAddr	secondAddr	thirdAddr

- Our needs have changed again and the SQL table must be updated.
- The schema is reprogrammed

Expectations

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
















Collections

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Consider this

firstName	lastName	primaryAddr	secondAddr	thirdAddr
				
				
				
				

- We expect that the table will be full when in use
- Expectations are not always fulfilled...

In Reality, Much Data is Missing

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Consider this

firstName	lastName	primaryAddr	secondAddr	thirdAddr

- But, in reality, much of the table is empty!
- The table can easily get huge and be hard to manage.

We Might Stop and Ask Ourselves...

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Consider this



- What can we do to stop having to redesign our database schema with our changing data?
- Is SQL the right type of database management system for our changing data requirements?

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Consider this



mongoDB®

- NoSQL: *Not Only SQL* database systems that support SQL-like query languages, but are used increasingly in big data applications and real-time web applications.
- The stored data is allowed to change

● <https://www.mongodb.com/>

Database Language Guide

SQL systems versus NoSQL

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Consider this

RDBMS		MongoDB
Database	⇒	Database
Table, View	⇒	Collection
Row	⇒	Document (BSON)
Column	⇒	Field
Index	⇒	Index
Join	⇒	Embedded Document
Foreign Key	⇒	Reference
Partition	⇒	Shard

- The terms are different but their meanings are similar
- *Schema-less*, collections (like tables) are populated by any data
- *Documents* are similar to the *tuples* of Sqlite3 programming



Schema Free

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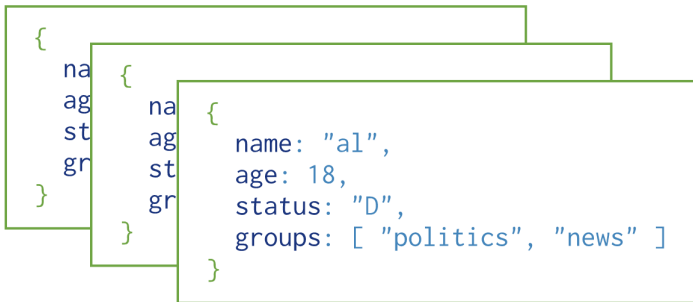
Collections

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Consider this



Collection

- No pre-defined data schema
 - Data may be entered in absence of a defined schema
- **Documents** (*rows*) of **collections** (*DB's*) may have different types of data

Schema Free

Mostly similar documents

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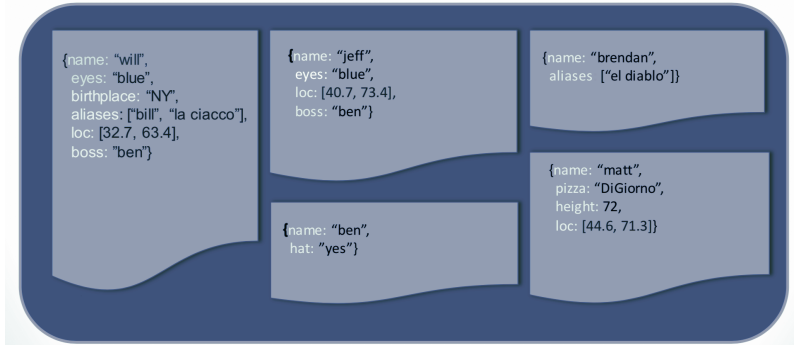
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Consider this



- Sometimes not all the data is available to create a document.
- The query *interprets* missing data as NULL entries

JSON and MongoDB Code

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JSON

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Consider this

- **Data is in name / value pairs**
 - A name/value pair consists of a field name followed by a colon, followed by a value:
 - Example: `{ "name": "R2-D2" }`
- **Data is separated by commas**
 - Example: `{ "name": "R2-D2", race : "Droid" }`
- **Curly braces hold objects**
 - Example: `{ "name": "R2-D2", race : "Droid", affiliation: "rebels" }`
- **An array is stored in brackets []**
 - Example `[{ "name": "R2-D2", race : "Droid", affiliation: "rebels" }, { "name": "Yoda", affiliation: "rebels" }]`

CRUD Operations

Create, Read, Update and Delete

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JSON

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Consider this

We will see more of these commands later!

- **Db.collection** specifies the collection or the *table* in which to store the document (*tuple*)
- **Create**
 - `db.collection.insert()`
 - `db.collection.save()`
 - `db.collection.update()`
- **Read**
 - `db.collection.find()`
 - `db.collection.findOne()`
- **Update**
 - `db.collection.update()`
- **Delete**
 - `db.collection.remove()`

Getting started with Mongo

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Consider this

Setup a data directory (if you have not already done so)

```
mkdir ~/mongodbData
```

Start the Mongo server with data directory as a parameter

Note: Control-C to exit.

```
mongod --dbpath ~/mongodbData/
```

With new another terminal, start the Mongo client

```
mongo
```

Find databases or collections, from Mongo's client

```
show dbs
```

```
show collections
```

Begin a new database, from Mongo's client

```
use myDB
```

Simple Collections

Simple Example of Queries

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Consider this

Simple Insert into the *Greetings* collection

```
db.Greetings.drop()
```

```
db.Greetings.insert({"Hello":"English greeting"})
```

```
db.Greetings.insert({"Goodbye":"English farewell "})
```

```
db.Greetings.insert({"Bonjour":"French greeting"})
```

```
db.Greetings.insert({"Au revoir":"French farewell"})
```

```
db.Greetings.insert({"Buongiorno":"Italian greeting"})
```

```
db.Greetings.insert({"Arrivederci":"Italian farewell"})
```

Find contents of *Greetings* collection:

```
select * from Greetings;
```

```
db.Greetings.find()
```

```
db.Greetings.find({}).pretty();
```

```
db.Greetings.find({}, {_id:0}).pretty();
```

Insert into the *Country* collection



```
db.Country.drop()
db.Country.insert({
  language_en: "English",
  language_fr: "anglais",
  country_en: "England",
  country_fr : "l'angleterre"
})
```




Adding to the Collection

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Consider this

```
db.Country.insert({  
  language_en: "French",  
  language_fr: "français",  
  country_en: "France",  
  country_fr : "la France"  
})
```

```
db.Country.insert({  
  language_en: "Italian",  
  language_fr: "italien",  
  country_en: "Italy",  
  country_fr : "l'Italie"  
})
```

Simple Queries

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Consider this

Find contents of *Country* collection:
`select * from Country;`

```
db.Country.find()  
db.Country.find().pretty()
```

```
> db.Country.find().pretty()  
{  
  "_id" : ObjectId("5c89c87211455eb94061b2f1"),  
  "language_en" : "English",  
  "language_fr" : "anglais",  
  "country_en" : "England",  
  "country_fr" : "l'angleterre"  
}  
{  
  "_id" : ObjectId("5c89c87211455eb94061b2f2"),  
  "language_en" : "French",  
  "language_fr" : "français",  
  "country_en" : "France",  
  "country_fr" : "la France"  
}  
{  
  "_id" : ObjectId("5c89c87311455eb94061b2f3"),  
  "language_en" : "Italian",  
  "language_fr" : "italien",  
  "country_en" : "Italy",  
  "country_fr" : "l'Italie"  
}
```

Simple Queries

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Consider this

Find specific contents of *Country* collection

```
select * from Country where country_en == "France";
```

```
db.Country.find({country_en : "France"}).pretty()
```

Find specific contents of *Country* collection

```
select * from Country where language_en == "English";
```

```
db.Country.find({language_en : "English"}).pretty()
```

Find specific contents of *Country* collection

```
select language_fr, language_en from Country where language_en ==  
"English";
```

```
db.Country.find({language_en : "English"},  
  {_id:0}).pretty()
```

```
db.Country.find({language_en:"English"},  
  {language_fr : 1, language_en : 1}).pretty()
```



How to shut down a session

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Consider this

Drop the collection (Greetings): Destroy the data, remove collection

```
db.Greetings.drop()
```

Drop the collection (Country): Destroy the data, remove collection

```
db.Country.drop()
```

Closing down

- exit in the client terminal
- Control-C in the server terminal

Advanced Data and Queries

Let's horse around with data and code ...

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Consider this



Locate your data file, open it in Atom and copy and past the contents (all at once) into the MondoDB client

```
syntheticData_small.json
```

Synthetic data available from:
<https://next.json-generator.com/>

Investigating Queries

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Consider this



```
db.collection.find({searchSpace},{showAttrib:1})
```

What do the following queries do?

```
db.employee.find({},{"name.last":1, "name.first":1})
db.employee.find({},{company:1})
db.employee.find({},{"name.last":1,address:1})
db.employee.find({},{company:1,registered:1,_id:0})
db.employee.find({},{company:1,"friends.name":1,_id:0})
db.employee.find({company:"RADIANTIX"},
  {"friends.name":1,_id:0})
```

```
db.collection.find({searchSpace},{showAttrib:1})
```

Rewrite the queries to get...

- The last name, first name and balance information of each document
- The company name, latitude and longitude of each document
- The list of friends of record associated with the company PROSURE
- The phone number for the PROSURE company

Consider this...

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Consider this



THINK

- Can you create and populate a new Mongo database?
- Can you write sophisticated queries in your database?