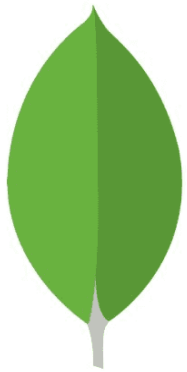



NoSQL Databases

Trainer: Mr. Nilesh Ghule

Document oriented databases

JavaScript Object Notation

eXtensible Markup Language

- Document contains data as key-value pair as JSON or XML.
- Document schema is flexible & are added in collection for processing.
- RDBMS tables → Collections
- RDBMS rows → Documents
- RDBMS columns → Key-value pairs in document
- Examples: MongoDb, CouchDb, …

RDBMS

id	name	author	subject	price
1	A	X	S1	123
2	B	X	S2	234
3	C	Y	S1	456

```
<book>
  <id> 1 </id>
  <name> ABC </name>
  <author> PQR </author>
  <subject> XYZ </subject>
  <price> 123.45 </price>
</book>
```

XML doc

JSON types

numbers: 123, -45, 3.141, ...

strings: "value", 'value', ...

boolean: true, false.

null

object : { — }

array : [.....]

always string

key value

```
{
  "id" : 1,
  "name" : "ABC",
  "author" : "PQR",
  "subject" : "XYZ",
  "price" : 123.45
}
```

JSON doc ← Mango

MongoDb Databases

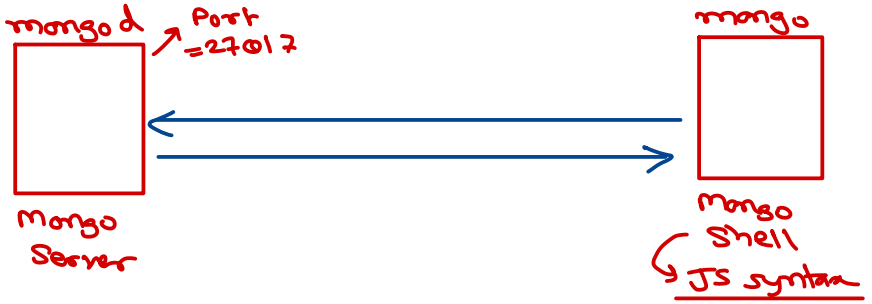
Trainer: Mr. Nilesh Ghule

Mongo Db

- Developed by 10gen in 2007
- Publicly available in 2009
- Open-source database which is controlled by 10gen
- Document oriented database → stores JSON documents
- Stores data in binary JSON.
- Design Philosophy
  - MongoDB wasn't designed in a lab and is instead built from the experiences of building large scale, high availability, and robust systems.

Install MongoDB

- Install MongoDB by downloading community edition
  - (https://www.mongodb.com/download-center/community)
- Linux and Mac Users
  - Extract the downloaded file somewhere in the disk.
  - Set the environment path to use the tools without going to the bin directory in the ~/.bash_profile or ~/.basrc file.
- Ubuntu (20.04) Mongo installation
  - terminal> wget -qO - https://www.mongodb.org/static/pgp/server-4.4.asc | sudo apt-key add -
  - terminal> echo "deb [arch=amd64,arm64] https://repo.mongodb.org/apt/ubuntu focal/mongodb-org/4.4 multiverse" | sudo tee /etc/apt/sources.list.d/mongodb-org-4.4.list
  - terminal> sudo apt-get update
  - terminal> sudo apt-get install -y mongodb-org
- Windows Users
  - Install the MongoDB by following all the steps in the installation wizard
  - Set the the environment path to include the <path>/bin



JSON

- Java Script Object Notation
- Hierarchical way of organizing data
- Defined as part of the JS language by JavaScript creator Douglas Crockford (2000).
- JavaScript objects are associative containers, wherein a string key is mapped to a value
- JSON shows up in many different cases.
  - APIs
  - Configuration files
  - Log messages
  - Database storage
- JSON is not ideal for usage inside of a database.
  - JSON is a text-based format, and text parsing is very slow
  - JSON's readable format is far from space-efficient, another database concern
  - JSON only supports a limited number of basic data types
- Mongo stores JSON data into Binary form.

BSON

- BSON simply stands for “Binary JSON”
- Binary structure encodes type and length information, which allows it to be parsed much more quickly
- It has been extended to add some optional non-JSON-native data types
- It allows for comparisons and calculations to happen directly on data
- MongoDB stores data in BSON format both internally, and over the network
- Anything you can represent in JSON can be natively stored in MongoDB

	JSON	BSON
Encoding	UTF-8 String	Binary

Data Support	• String
	• Boolean
	• Number
	• Array
		• String
		• Boolean
		• Number
		  • Integer
		  • Float
		  • Long
		  • Decimal
		• Array
		• Date
		• Raw Binary

	Human and Machine	Machine Only

Mongo Server and Client

- MongoDb server (mongod) is developed in C, C++ and JS.
- MongoDb data is accessed via multiple client tools
  - mongo : client shell (JS).
  - mongofiles : stores larger files in GridFS.
  - mongoimport / mongoexport : tools for data import / export.
  - mongodump / mongorestore : tools for backup / restore.
- MongoDb data can be accessed in application through client drivers available for all major programming languages e.g. Java, Python, Ruby, PHP, Perl, …
- Mongo shell is follows JS syntax and allow to execute JS scripts.

MongoDb: Data Types

data	bson	values
null	10	
boolean	8	true, false
number	1 / 16 / 18	123, 456.78, NumberInt("24"), NumberLong("28")
string	2	"...."
date	9	new Date(), ISODate("yyyy-mm-ddThh:mm:ss")
array	4	[..., ..., ..., ...]
object	3	{ ... }

→ float/double

NumberDecimal('123.005')
→ 34 places of decimal (precision)

MongoDB Terminology

- Database
  - Like database/schema in RDBMS.
  - mongo> show databases;
  - mongo> use dbname;
- Collection
  - Like table in RDBMS.
  - No fixed structure or schema.
  - mongo> db.createCollection("colname");
- Document
  - Like row in RDBMS.
  - Inserted in JSON format.
  - Each record can have different fields.
- Field
  - Like column in RDBMS.
  - A name-value pair in a document.

Mongo - INSERT

- show databases;
- use database;
- db.contacts.insert({name: "nilesh", mobile: "9527331338"});
- db.contacts.insertMany([

  {name: "nilesh", mobile: "9527331338"},

  {name: "nitin", mobile: "9881208115"}

  ]);

db.contacts.insertOne({ —— 3);

- Maximum document size is 16 MB.
- For each object unique id is generated by client (if _id not provided).
  - 12 byte unique id :: [counter(3) | pid(2) | machine(3) | timestamp(4)]

Mongo – QUERY

- db.contacts.find(); → returns cursor on which following ops allowed:
  - hasNext(), next(), skip(n), limit(n), count(), toArray(), forEach(fn), pretty()
- Shell restrict to fetch 20 records at once. Press "it" for more records.
- db.contacts.find({ name: "nilesh" });
- db.contacts.find({ name: "nilesh" }, { _id:0, name:1 });
- Relational operators: $eq, $ne, $gt, $lt, $gte, $lte, $in, $nin
- Logical operators: $and, $or, $nor, ~~$not~~
- Element operators: $exists, $type
- Evaluation operators: $regex, $where, $mod
- Array operators: $size, $elemMatch, $all, $slice

Thank you!

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