mongoDB

NoSQL

NoSQL Data Models	Cloud Databases	
• Key-value	redis	riak
• Graph database	Neo4j the graph database	HyperGraphDB
• Document-oriented	mongoDB	CouchDB relax
• Column family	Cassandra	H·BASE

Motivations

- **Problems with SQL**
  - Rigid schema
  - Not easily scalable (designed for 90’s technology or worse)
  - Requires unintuitive joins

- **Perks of mongoDB**
  - Easy interface with common languages (Java, Javascript, PHP, etc.)
  - DB tech should run anywhere (VM’s, cloud, etc.)
  - Keeps essential features of RDBMS’s while learning from key-value noSQL systems

Introduction

- A Schema-less / Document Oriented Database
  - Data is stored in documents, not tables / relations
- MongoDB is Implemented in C++ for best performance
- **Platforms** : 32/64 bit Windows Linux, Mac OS-X, FreeBSD, Solaris
- **Language drivers :**Ruby/Ruby-on-Rails, Java, C#, JavaScript , C / C++ ,Erlang,Python, Perl…
- Replication & High Availability
- Map/Reduce
- Querying & Fast In-Place Updates

Why use MongoDB

- Simple queries
- Makes sense with most web applications
- Easier and faster integration of data
- Not well suited for heavy and complex transactions systems.
- Performance / Scalability / Availability
  - No Joins + No multi-row transactions
    - Fast Reads / Writes
  - Async writes
    - you don’t wait for inserts to complete
  - Secondary Indexes
    - Index on embedded document fields for superfast ad-hoc queries

Document store : analogy wrt RDBM

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

MongoDB’s Data Model

- A MongoDB instance may have zero or more databases
- A Database has “Collections”
  - Collections have “Documents”
    - Documents have “Fields”
      - Fields are key = value pairs

–A Collection does not enforce the structure of its documents*

*i.e. Schemaless

JSON

- “JavaScript Object Notation”
- Easy for humans to write/read, easy for computers to parse/generate
- Objects can be nested
- Built on
  - name/value pairs
  - Ordered list of values

BSON

- “Binary JSON”
- Binary-encoded serialization of JSON-like docs
- Also allows “referencing”
- Embedded structure reduces need for joins
- Goals
  - Lightweight
  - Traversable
  - Efficient (decoding and encoding)

BSON Example

```
{
"_id" :         "37010"
"city" :        "ADAMS",
"pop" :         2660,
"state" :       "TN",
“councilman” : {
                    name: “John Smith”
                    address: “13 Scenic Way”
                  }
}
```

BSON Types

Type	Number
Double	1
String	2
Object	3
Array	4
Binary data	5
Object id	7
Boolean	8
Date	9
Null	10
Regular Expression	11
JavaScript	13
Symbol	14
JavaScript (with scope)	15
32-bit integer	16
Timestamp	17
64-bit integer	18
Min key	255
Max key	127

The number can be used with the $type operator to query by type!

The _id Field

- By default, each document contains an _id field. This field has a number of special characteristics:
  - Value serves as primary key for collection.
  - Value is unique, immutable, and may be any non-array type.
  - Default data type is ObjectId, which is “small, likely unique, fast to generate, and ordered.” Sorting on an ObjectId value is roughly equivalent to sorting on creation time.

mongoDB vs. SQL

mongoDB	SQL
Document	Tuple
Collection	Table/View
PK: _id Field	PK: Any Attribute(s)
Uniformity not Required	Uniform Relation Schema
Index	Index
Embedded Structure	Joins
Shard	Partition

Installation and Running MongoDB

1. Download from mongodb.org
2. Unzip
3. Create data directory

```
>mkdir c:\data\db
```

4. Run MongoDB (mongod):

```
>cd c:\mongodb-1.6.3\bin
>mongod
```

5. Run Mongo shell (mongo):

```
>mongo
```

The Mongo Shell

>mongo

>help()

>show dbs

>use <dbname>

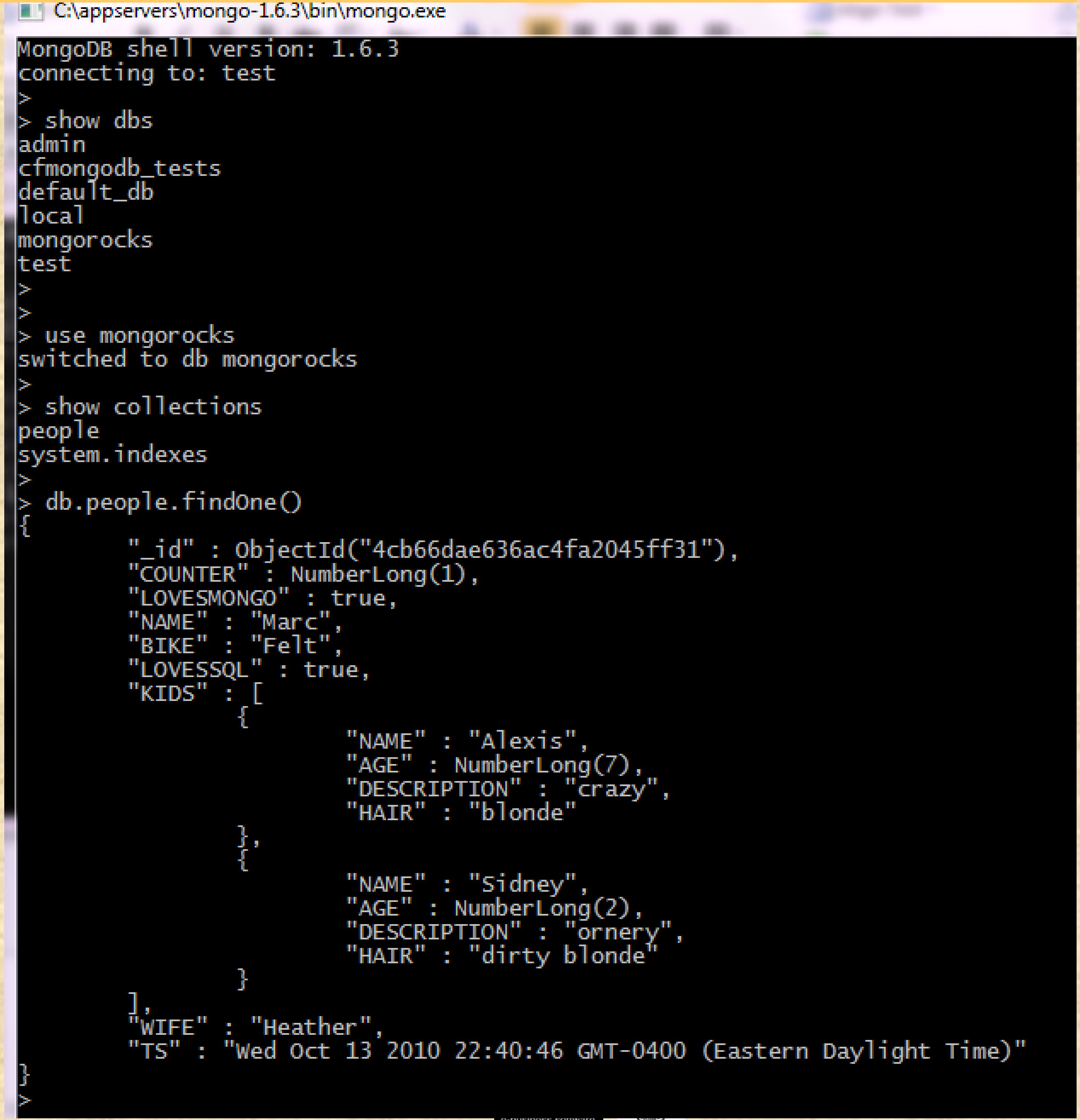
>show collections

>db.collectionName.findOne()

>db.collectionName.find()

>db.help()

>db.collectionName.help()



C:\appservers\mongo-1.6.3\bin\mongo.exe

```
MongoDB shell version: 1.6.3
connecting to: test
>
> show dbs
admin
cfmongodb_tests
default_db
local
mongorocks
test
>
>
> use mongorocks
switched to db mongorocks
>
> show collections
people
system.indexes
>
> db.people.findOne()
{
        "_id" : ObjectId("4cb66dae636ac4fa2045ff31"),
        "COUNTER" : NumberLong(1),
        "LOVESMONGO" : true,
        "NAME" : "Marc",
        "BIKE" : "Felt",
        "LOVESSQL" : true,
        "KIDS" : [
                {
                        "NAME" : "Alexis",
                        "AGE" : NumberLong(7),
                        "DESCRIPTION" : "crazy",
                        "HAIR" : "blonde"
                },
                {
                        "NAME" : "Sidney",
                        "AGE" : NumberLong(2),
                        "DESCRIPTION" : "ornery",
                        "HAIR" : "dirty blonde"
                }
        ],
        "WIFE" : "Heather",
        "TS" : "Wed Oct 13 2010 22:40:46 GMT-0400 (Eastern Daylight Time)"
}
>
```

CRUD

- Create
  - db.collection.insert(<document>)
  - db.collection.save(<document>)
  - db.collection.update(<query>, <update>, { upsert: true })
- Read
  - db.collection.find(<query>, <projection>)
  - db.collection.findOne(<query>, <projection>)
- Update
  - db.collection.update(<query>, <update>, <options>)
- Delete
  - db.collection.remove(<query>, <justOne>)

CRUD example

```
> db.user.insert({
        first: "John",
        last : "Doe",
        age: 39
})
```

```
> db.user.find ()
{
        "_id" : ObjectId("51…"),
        "first" : "John",
        "last" : "Doe",
        "age" : 39
}
```

```
> db.user.update(
        {"_id" : ObjectId("51…")},
        {
             $set: {
                  age: 40,
                  salary: 7000}
        }
)
```

```
> db.user.remove({
        "first": /^J/
})
```