MIE-PDB.16: **Advanced Database Systems**

http://www.ksi.mff.cuni.cz/~svoboda/courses/191-MIE-PDB/

Practical Class 5

MongoDB

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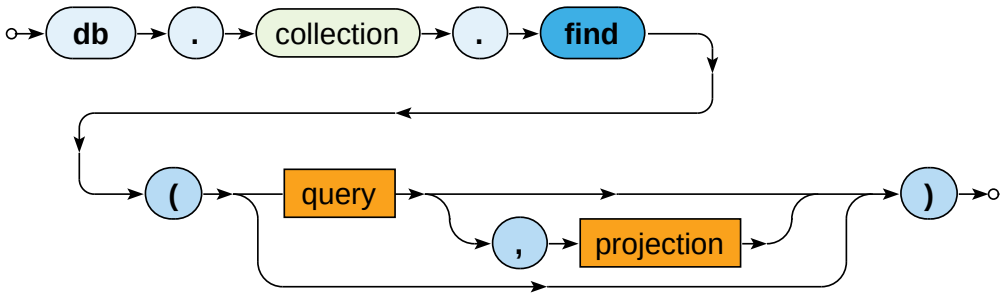
Find Operation

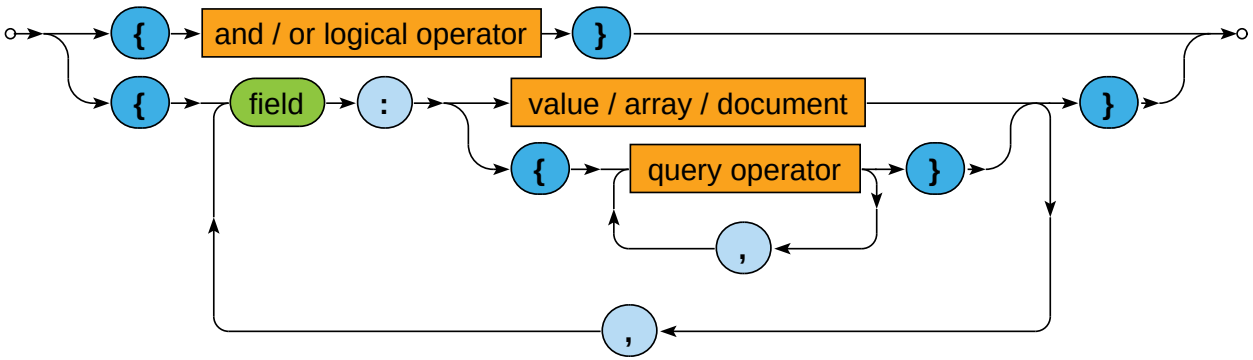
Selects documents from a given collection



- Parameters
  - **Query**: description of documents to be selected
  - **Projection**: fields to be included / excluded in the result

Selection

Query parameter describes the documents we are interested in

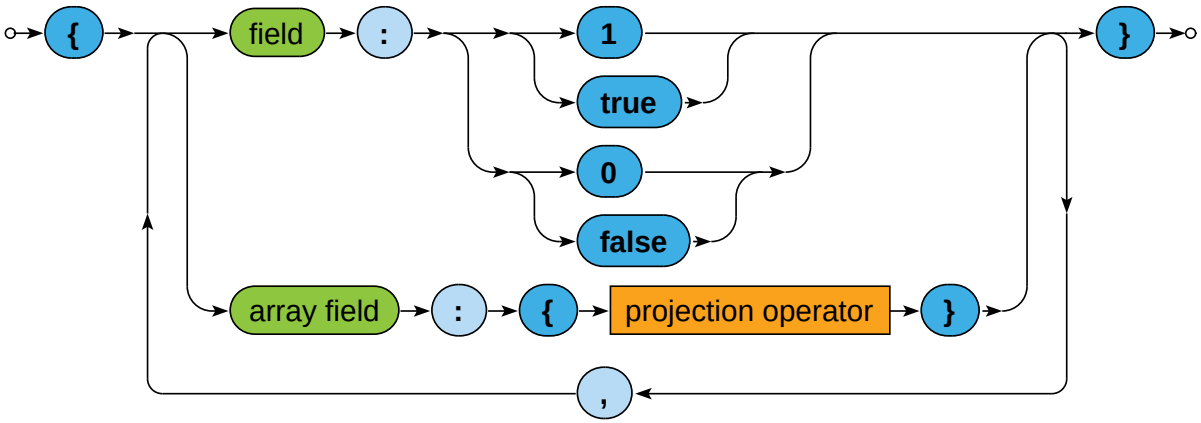


Selection operators

- `$eq`, `$neq`, `$lt`, `$lte`, `$gte`, `$gt`, `$in`, `$nin`
- `$and`, `$or`, `$not`
- `$exists`, `$regex`, `$text`
- …

Projection

Projection allows us to determine fields returned in the result



Projection operators

- `$elemMatch`, `$slice`,…

Sample Data

Assume we have the following data in a collection of actors

```
{ _id: "trojan",
  name: "Ivan Trojan", year: 1964,
  movies: [ "samotari", "medvidek" ] }
```

```
{ _id: "machacek",
  name: "Jiri Machacek", year: 1966,
  movies: [ "medvidek", "vratnelahve", "samotari" ] }
```

```
{ _id: "schneiderova",
  name: "Jitka Schneiderova", year: 1973,
  movies: [ "samotari" ] }
```

```
{ _id: "sverak",
  name: "Zdenek Sverak", year: 1936,
  movies: [ "vratnelahve" ] }
```

```
{ _id: "geislerova",
  name: "Anna Geislerova", year: 1976 }
```

Sample Queries

Explain the meaning of the following queries

```
db.actors.find()
```

```
db.actors.find({ })
```

```
db.actors.find({ _id: "trojan" })
```

```
db.actors.find({ name: "Ivan Trojan", year: 1964 })
```

```
db.actors.find({ year: { $gte: 1960, $lte: 1980 } })
```

```
db.actors.find({ movies: { $exists: true } })
```

```
db.actors.find({ movies: "medvidek" })
```

```
db.actors.find({ movies: { $in: [ "medvidek", "pelisky" ] } })
```

```
db.actors.find({ movies: { $all: [ "medvidek", "pelisky" ] } })
```

Sample Queries

Explain the meaning of the following queries

```
db.actors.find({ $or: [ { year: 1964 }, { rating: { $gte: 3 } } ] })
```

```
db.actors.find({ rating: { $not: { $gte: 3 } } })
```

```
db.actors.find({ }, { name: 1, year: 1 })
```

```
db.actors.find({ }, { movies: 0, _id: 0 })
```

```
db.actors.find({ }, { name: 1, movies: { $slice: 2 }, _id: 0 })
```

```
db.actors.find().sort({ year: 1, name: -1 })
```

```
db.actors.find().sort({ name: 1 }).skip(1).limit(2)
```

```
db.actors.find().sort({ name: 1 }).limit(2).skip(1)
```

First Steps

Connect to our NoSQL server

- SSH / PuTTY and SFTP / WinSCP
- **nosql.ms.mff.cuni.cz:42222**

Start mongo shell

- `mongo`

Switch to your database

- `use login`

Insert sample data into your database

- See `/home/PDB/mongodb/data.js`

Exercise 1

Express the following MongoDB query

- **Find actors born in *1966* with first name *Jiri***

Exercise 2

Express the following MongoDB query

- **Find movies directed by *Jan Hrebejk***
- Note that the order of fields for first and last names can be arbitrary

Exercise 3

Express the following MongoDB query

- **Find actors with first name *Jiri* who played in *Medvidek* movie**
- Return names of these actors only

Exercise 4

Express the following MongoDB query

- **Find movies filmed between years *2000* and *2005* such that they have a director specified**
- Return movie identifier only
- Order the result by ratings in descending order and then by years in ascending order

Exercise 5

Express the following MongoDB query

- **Find actors who stared in *Samotari* or *Medvidek* movies**
- Return actor identifier only
- Propose two different approaches

Exercise 6

Express the following MongoDB query

- **Find actors who played in both *Samotari* and *Medvidek***
- Return actor identifier only
- Propose two different approaches

Exercise 7

Express the following MongoDB query

- **Find movies with Czech title equal to *Vratne lahve***
- Return movie title only
- Note that there are two means how movie titles are defined

Exercise 8

Express the following MongoDB query

- **Find movies that have a *Czech Lion* award from *2005***
- Return movie identifier and all awards

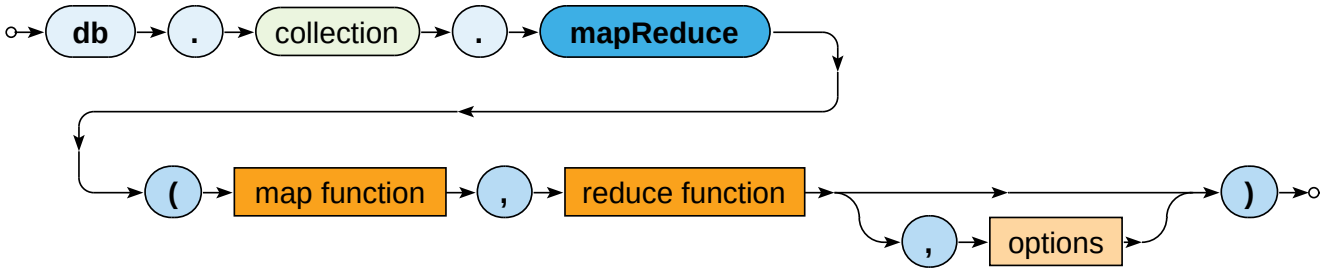
Exercise 9

Express the following MongoDB query

- **Find movies that are *comedies* and *dramas* at the same time**
  or
  have a rating *80* or more
- Return movie identifier and at most 2 countries

MapReduce

Executes a **MapReduce** job on a selected collection



- Parameters
  - **Map**: JavaScript implementation of the Map function
  - **Reduce**: JavaScript implementation of the Reduce function
  - **Options**

MapReduce

Map function

- Current document is accessible via `this`
- `emit(key, value)` is used for emissions

Reduce function

- Intermediate key and values are provided as arguments
- Reduced value is published via `return`

Options

- `query`: only matching documents are considered
- `sort`: they are processed in a specific order
- `limit`: at most a given number of them is processed
- `out`: output is stored into a given collection

MapReduce: Example

Count the number of movies filmed in each year, starting in *2005*

```
db.movies.mapReduce(
  function() {
    emit(this.year, 1);
  },
  function(key, values) {
    return Array.sum(values);
  },
  {
    query: { year: { $gte: 2005 } },
    sort: { year: 1 },
    out: "statistics"
  }
)
```

MapReduce

Implement and execute the following MapReduce jobs

- **Find a list of actors (their names sorted alphabetically) for each year (they were born)**
  - Only consider actors born in year 2000 or before
  - `values.sort()`
  - Use `out: { inline: 1 }` option
- **Calculate the overall number of actors for each movie**
  - `this.movies.forEach(function(m) { … })`
  - `Array.sum(values)`
  - Use `out: { inline: 1 }` option once again