

2.– 5. September 2013
in Nürnberg



Herbstcampus

Wissenstransfer
par excellence

NoSQL hoch drei

3 NoSQL Datenbanken in 70 Minuten

Eberhard Wolff

adesso AG

3 NoSQL Datenbanken in 70 Minuten

Eberhard Wolff
Architecture and
Technology Manager
adesso AG

Why NoSQL?

Exponential growth of data volume

New niches

Less structured data

More complex structured data

Big Data

Technical Challenges for NoSQL

Scaling

Cost

Support for other data structures

Many different trade offs

No single
technology
solves all
these
problems

Redis 

MongoDB 

elasticsearch 

Redis 

MongoDB 

elasticsearch 

What is Redis?

Remote Dictionary Server

Advanced Key Value Store

In memory + persistence

Redis: Technologies

C

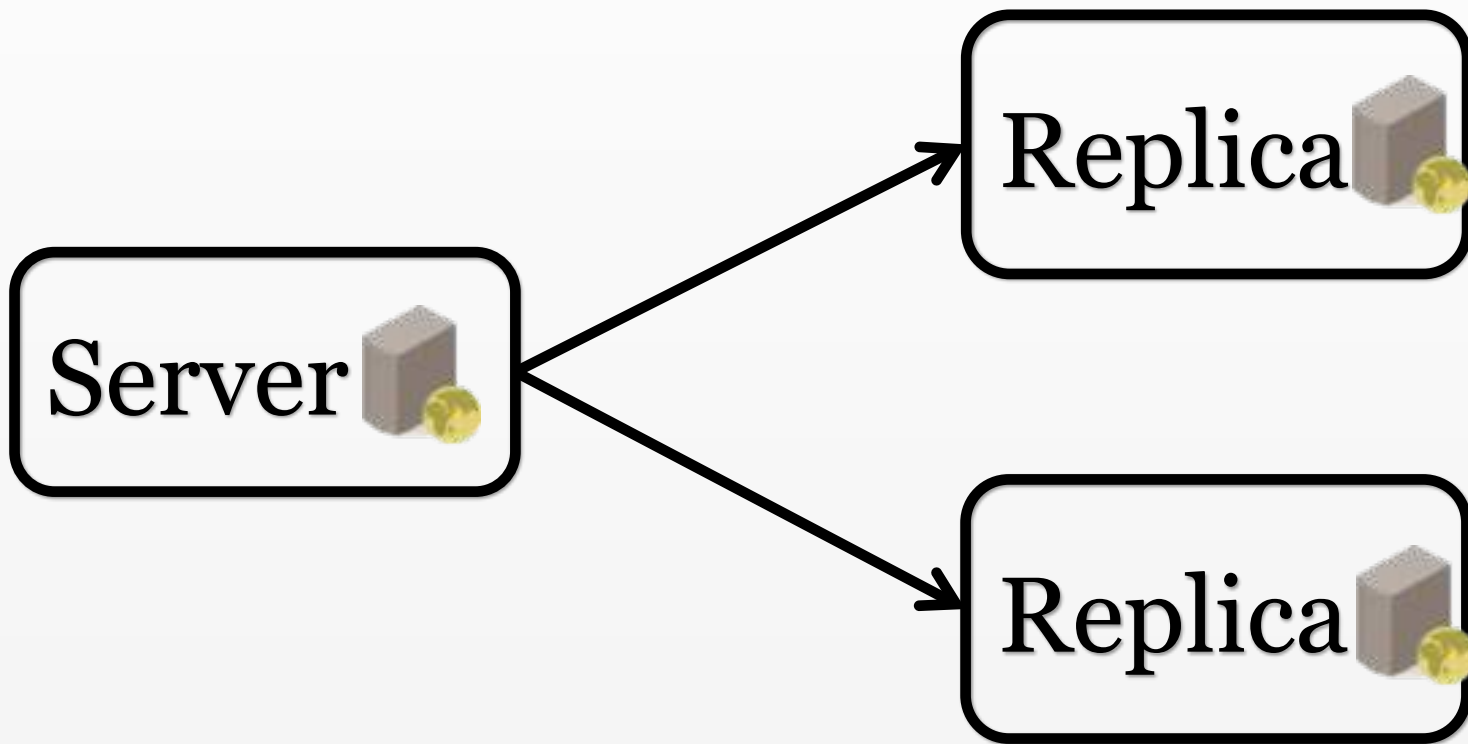
Lua Interpreter built in

Open Source

Small Code Base

Scaling Redis

Asynchronous replication built in





```
Last login: Thu Aug 15 09:34:13 on ttys001
[wolff@ultralight:~]telnet localhost 6379
Trying ::1...
telnet: connect to address ::1: Connection refused
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^['.
```



↑ wolff — bash — 80x24

[wolff@ultralight:~]redis-benchmark

MGET / MSET
even faster

Redis



Scenarios

Fast Data Store

Score for player in online game

Simple data structure

High read and write throughput


```
wolff — telnet — 80x24
[wolff@ultralight:~]telnet localhost 6379
Trying ::1...
telnet: connect to address ::1: Connection refused
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^['.
```

Advanced Data Structures

High score list

Just a sorted list

Fast

Easy to implement

A terminal window titled 'wolff -- telnet -- 80x24' with standard window controls. The text inside shows a telnet session: 'telnet: connect to address ::1: Connection refused', 'Trying 127.0.0.1...', 'Connected to localhost.', and 'Escape character is '^[''.

```
wolff -- telnet -- 80x24
telnet: connect to address ::1: Connection refused
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^['.
```

Centralized Coordination

Unique numbers e.g. for invoices

Integer

+atomic operations

Other shared data structures possible
(lists, sets...)



```
Last login: Thu Aug 15 10:22:27 on ttys001
[wolff@ultralight:~]telnet 127.0.0.1 6379
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
```

Locks

Set value only if non-existent

Allows implementation of locks

+Expiration

wolff — telnet — 49x24
[wolff@ultralight:~]telnet 127.0.0.1
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^['.

wolff — telnet — 49x24
[wolff@ultralight:~]telnet 127.0.0.1 6379
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^['.

Messaging

Could use shared list

Queues e.g. to queue work

Public / subscribe messaging

Last login: Thu Aug 15 10:22:46 on t
[wolff@ultralight:~]telnet 127.0.0.1
Trying 127.0.0.1...
Connected to localhost.

Last login: Thu Aug 15 10:57:53 on ttys003
[wolff@ultralight:~]telnet 127.0.0.1 6379
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.

Cache

Cache e.g. HTML pages

In memory = fast

Add time-to-live global / per key

Persistent = survives restarts

```
Last login: Thu Aug 15 10:57:58 on ttys003
[wolff@ultralight:~]telnet 127.0.0.1 6379
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
```

Redis 

MongoDB 

elasticsearch 

Redis 

MongoDB 

elasticsearch 

Redis 

MongoDB 

elasticsearch 

What is MongoDB?

Document-oriented

Memory-mapped files

Journal

mongo

MongoDB: Technologies

C++

Open Source (AGPL)

Company: was 10gen

Now: MongoDB, Inc.

Scaling MongoDB

Replica 1



Replica 2



Replica 3



Shard 1

Replica 1



Replica 2

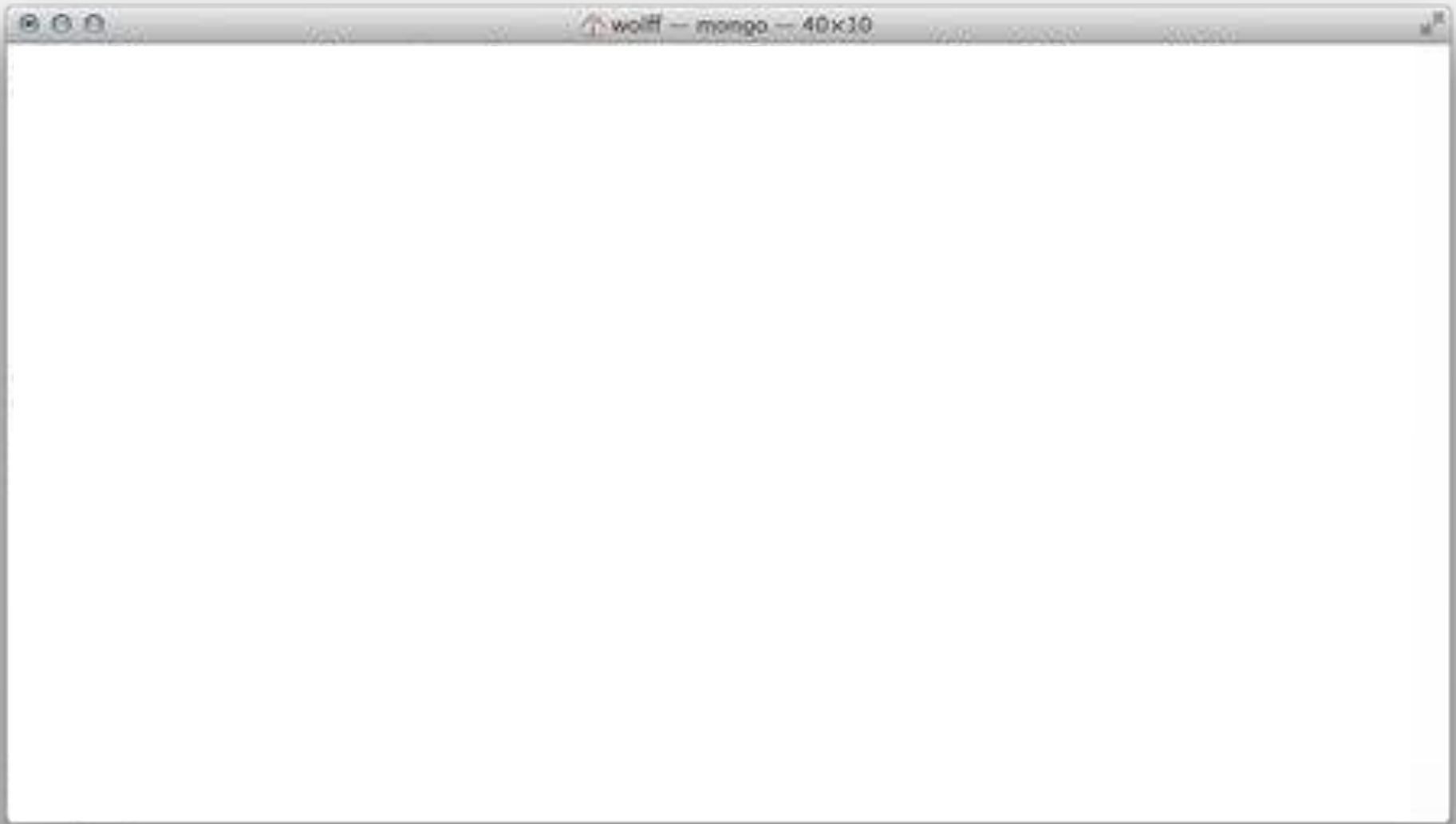


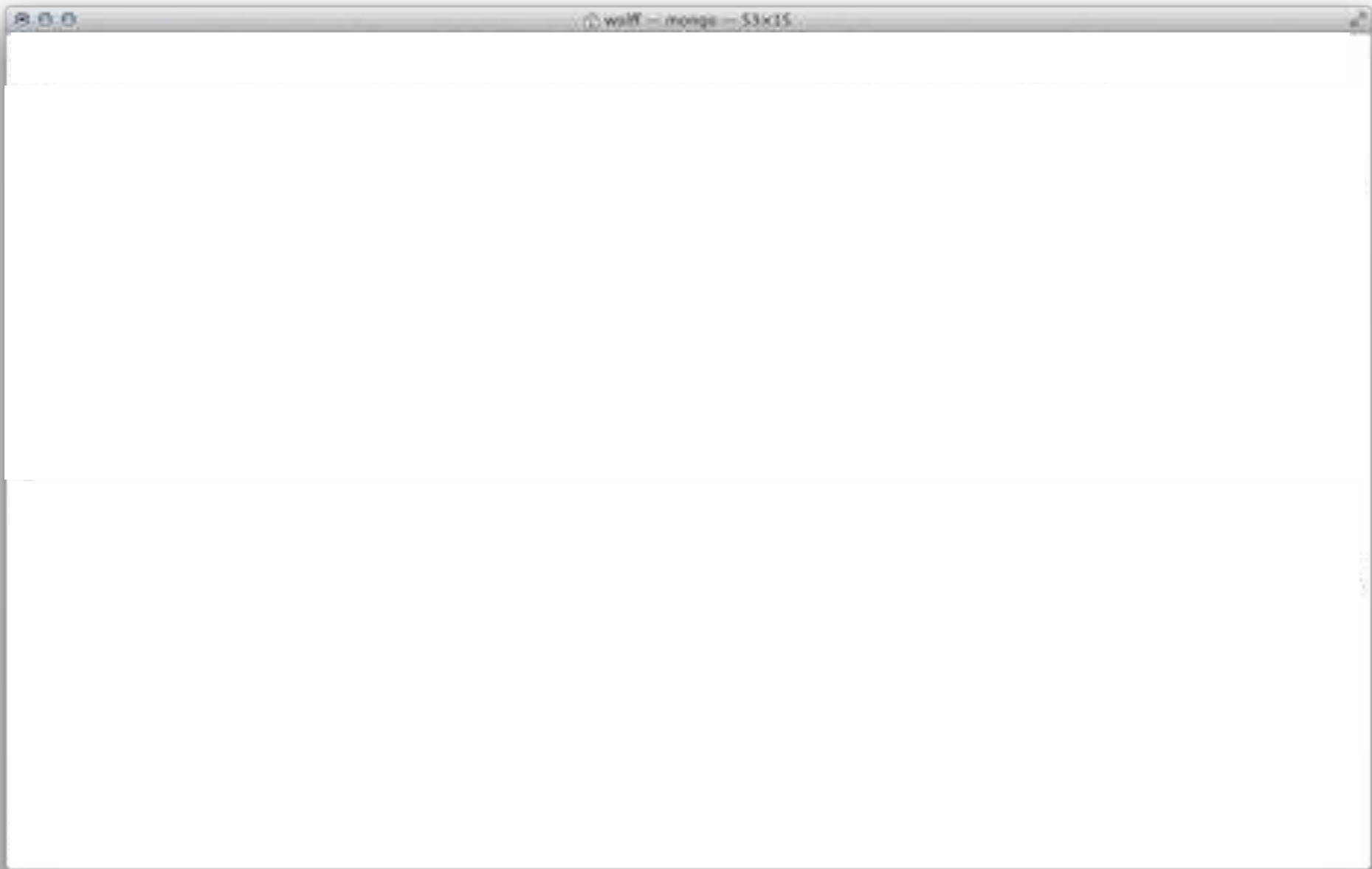
Replica 3



Shard 2

```
wolff — mongod — 80x24
[wolff@ultralight:~]mongod
Thu Aug 15 14:17:50.433 [initandlisten] MongoDB starting : pid=6550 port=27017 d
bpath=/usr/local/var/mongodb 64-bit host=ultralight.localdomain
Thu Aug 15 14:17:50.434 [initandlisten] db version v2.4.5
Thu Aug 15 14:17:50.434 [initandlisten] git version: a2ddc68ba7c9cee17bfe69ed840
383ec3506602b
Thu Aug 15 14:17:50.434 [initandlisten] build info: Darwin bs-osx-106-x86-64-2.1
0gen.cc 10.8.0 Darwin Kernel Version 10.8.0: Tue Jun 7 16:32:41 PDT 2011; root:
xnu-1504.15.3~1/RELEASE_X86_64 x86_64 BOOST_LIB_VERSION=1_49
Thu Aug 15 14:17:50.434 [initandlisten] allocator: system
Thu Aug 15 14:17:50.434 [initandlisten] options: { bind_ip: "127.0.0.1", config:
"/usr/local/etc/mongod.conf", dbpath: "/usr/local/var/mongodb" }
Thu Aug 15 14:17:50.434 [initandlisten] journal dir=/usr/local/var/mongodb/journ
al
Thu Aug 15 14:17:50.434 [initandlisten] recover : no journal files present, no r
ecovery needed
Thu Aug 15 14:17:50.455 [websvr] admin web console waiting for connections on po
rt 28017
Thu Aug 15 14:17:50.455 [initandlisten] waiting for connections on port 27017
```







```
{  
    "_id" : ObjectId("51ac528843e76375d392b6f6"),  
    "author" : "Douglas Adams",  
  
    "pages" : 42,  
    "title" : "The Hitchhicker's Guide",  
    "type" : "book"  
}
```

MongoDB

Scenarios

Document Store

Documents + meta data

Flexibility

Scaling

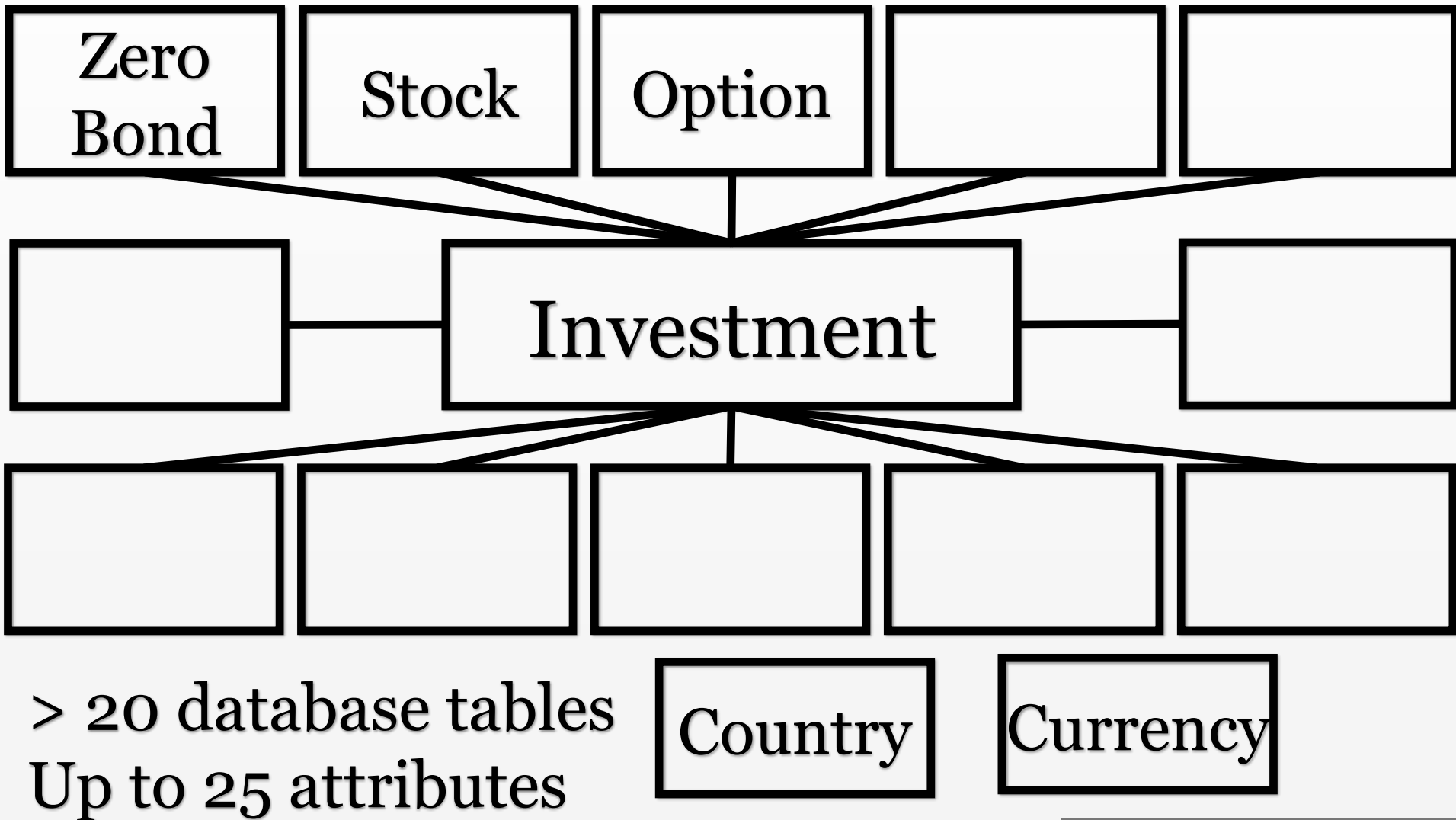
Financial System

Different financial products

Mapping objects / database

Inheritance

E/R Model



Investment Price

Type

ID

Country

Country

Currency

Zero
Bond

Interest
Rate

Fixed
Rate
Bond

Interest
Rate

Stock

Preferred

Option

Underlying
asset

...

Financial System

Schema migration

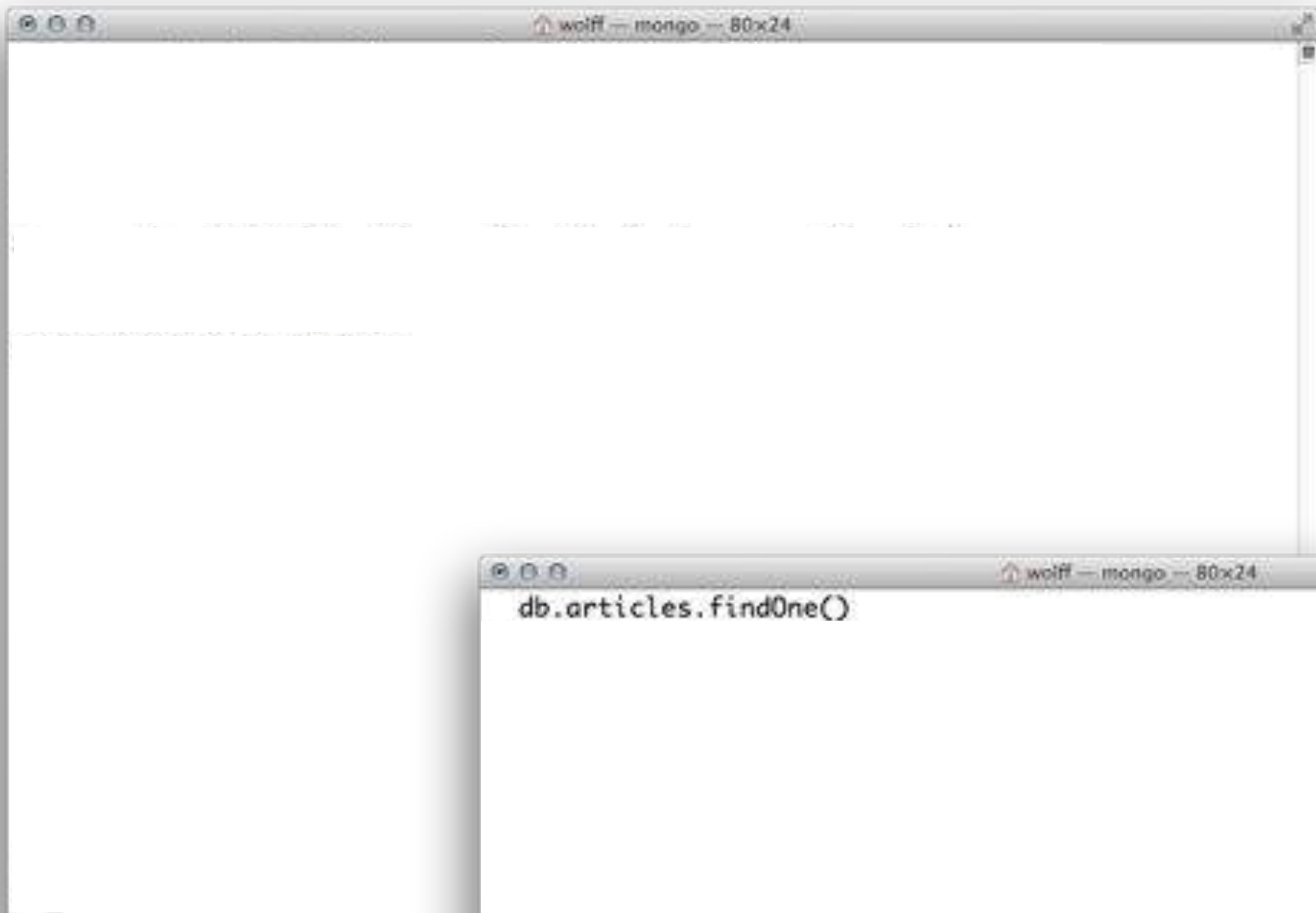
DevOps

Big Data Analytics

Map / Reduce

JavaScript

Distributed execution



```
db.articles.findOne()
```

```
> db.authorPageViews.find()
{ "_id" : "bob", "value" : 47 }
{ "_id" : "ewolff", "value" : 6 }
> []
```

Aggregation Framework

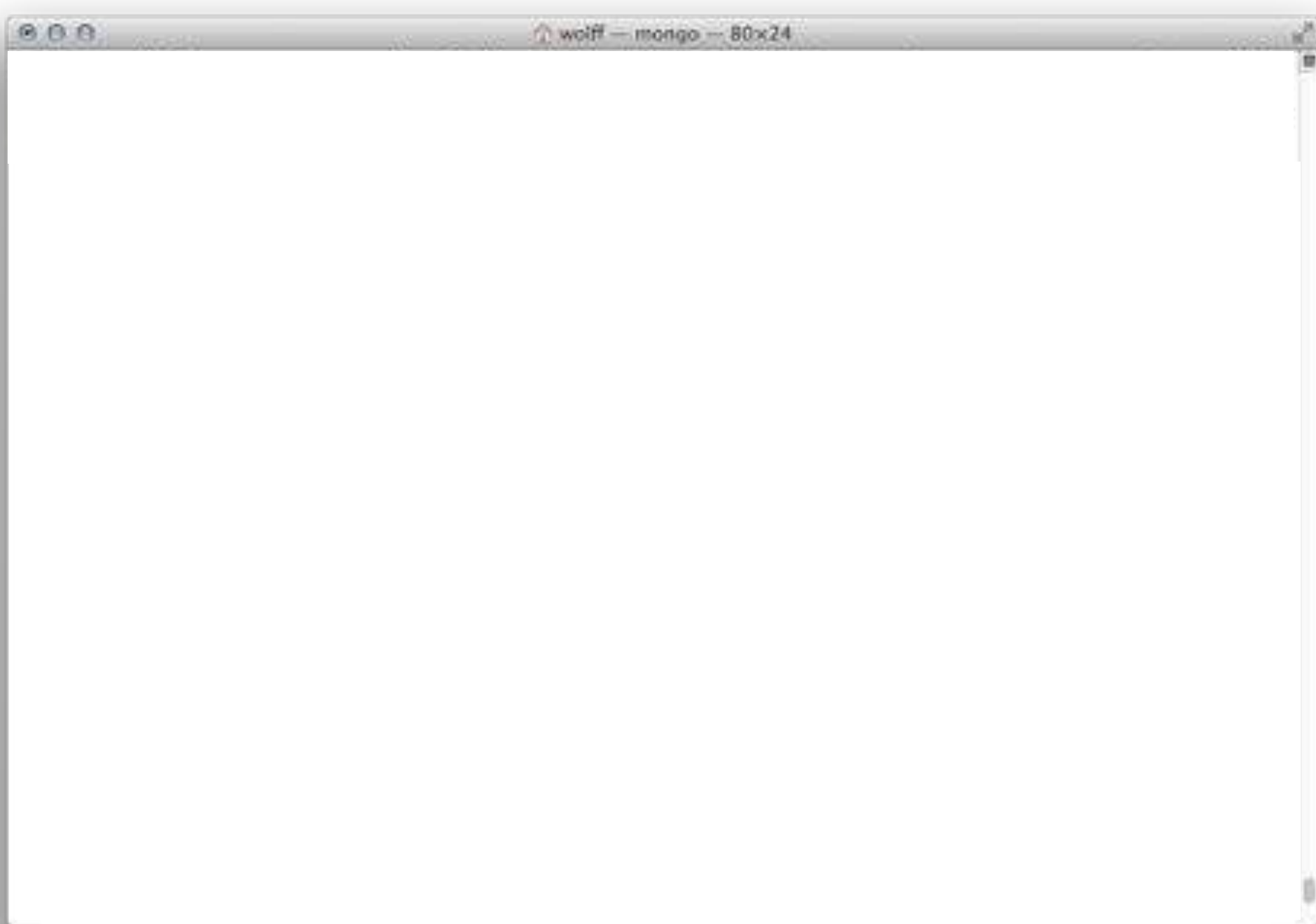
„Pipeline“ with
several steps

```
db.articles.aggregate(  
  { $project : {  
    author : 1,  
    tags : 1,  
  } },  
  { $unwind : "$tags" },  
  { $group : {  
    _id : { tags : "$tags" },  
    authors : { $addToSet : "$author" }  
  } }  
);
```

Choosing
fields

One result per
tag

Group by
author



Backend for BI Tools

Exploring and analyzing data

JasperReports

Qlikview

Pentaho

Redis 

MongoDB 

elasticsearch 

Redis 

MongoDB 

elasticsearch 

Redis 

MongoDB 

elasticsearch 

~~Database~~ research
= Storage
+ Search

What is elasticsearch?

Search Engine

Also stores original documents

Based on Lucene Search Library

Easy scaling

elasticsearch: Technologies

Java

REST

Open Source (Apache)

Backed by the company elasticsearch

Scaling elasticsearch

Shard 1

Replica 2

Server



Replica 1

Shard 3

Server



Shard 2

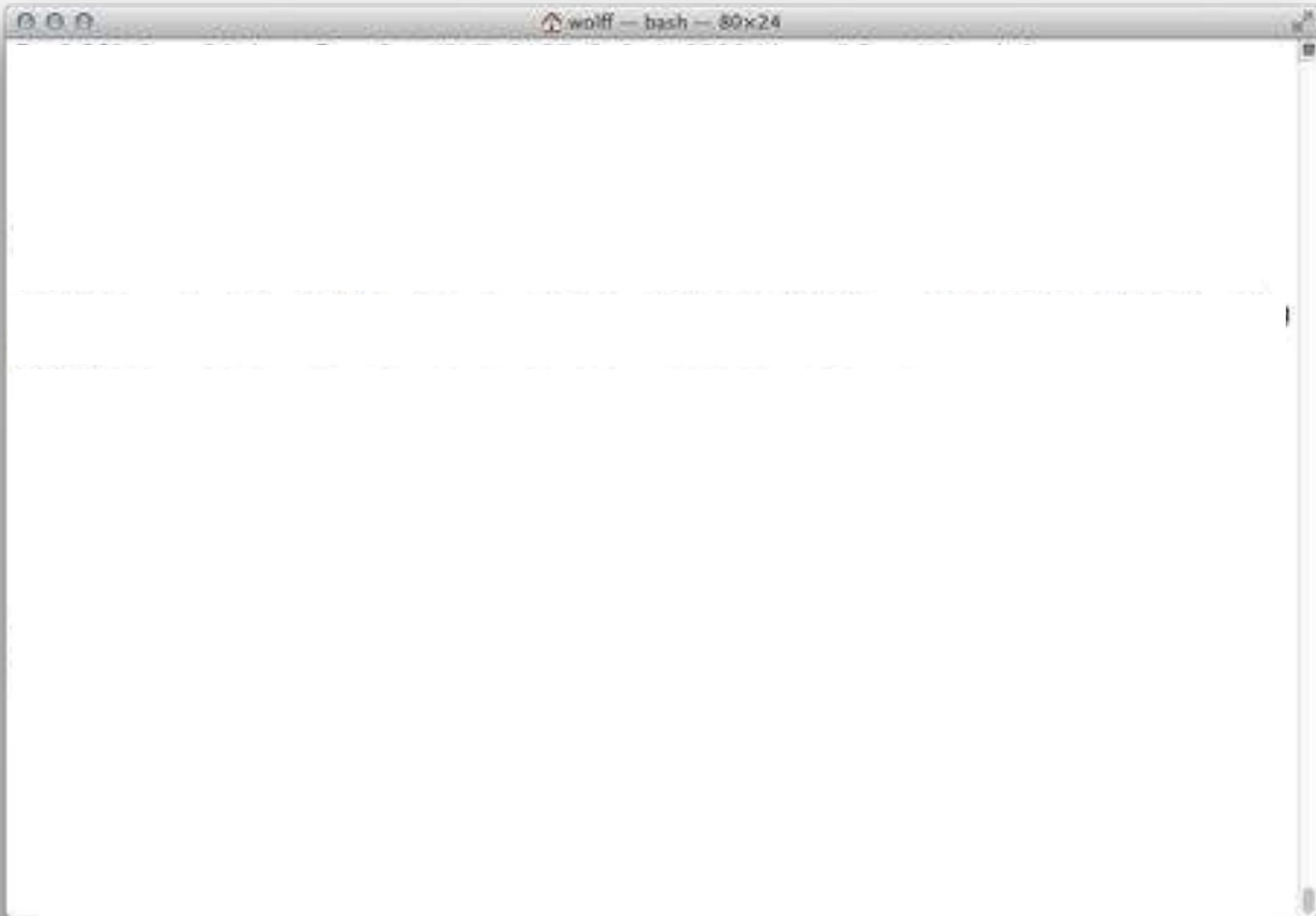
Replica 3

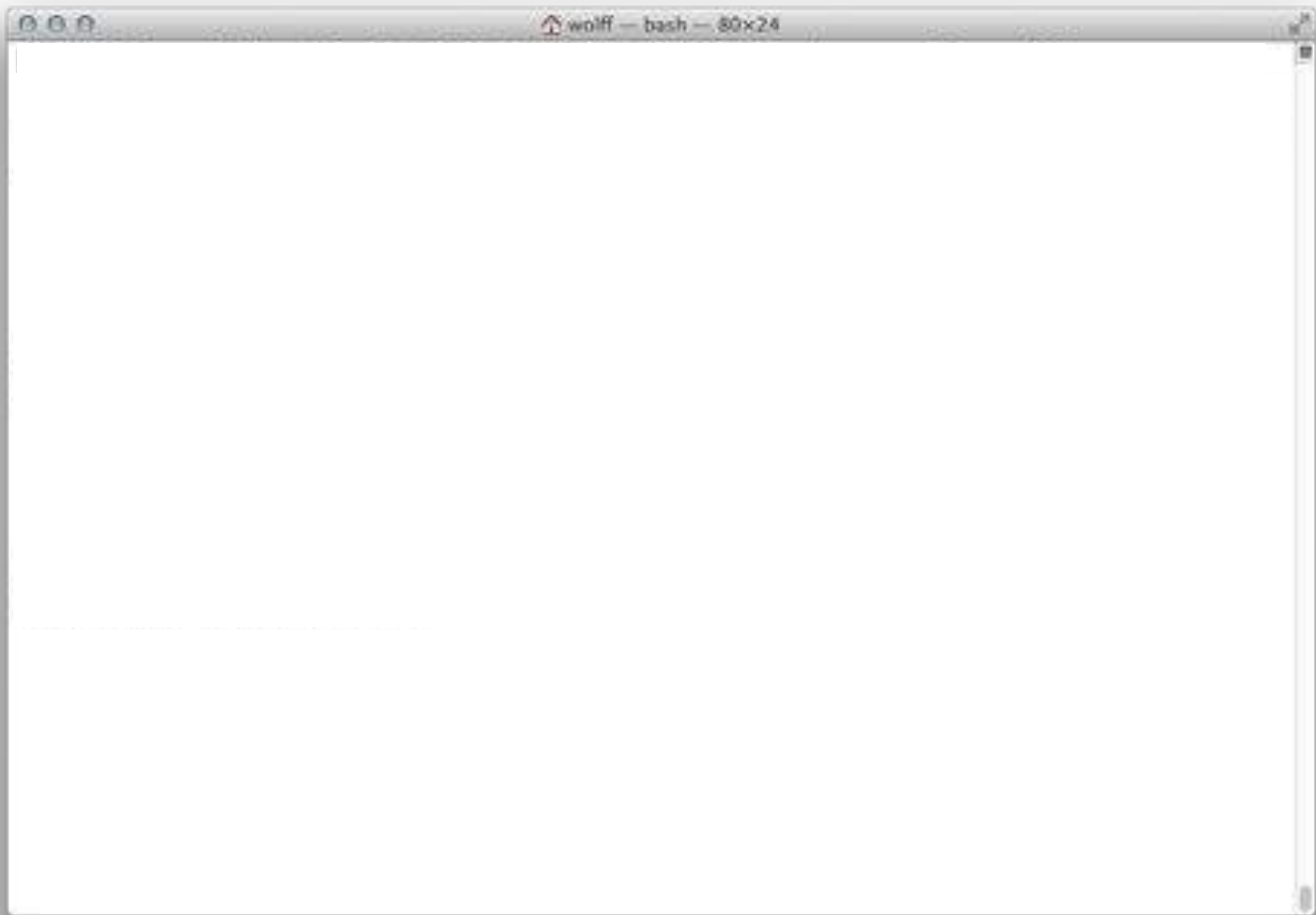
Server



A screenshot of a terminal window. The title bar at the top reads "bin — java — 80x24". The terminal content shows a prompt "[wolff@ultralight:~/elasticsearch-0.90.3/bin] ./elasticsearch -f" followed by a blank line.

```
bin — java — 80x24
[wolff@ultralight:~/elasticsearch-0.90.3/bin] ./elasticsearch -f
```





elasticsearch

Scenarios

Search

Powerful query language

Configurable index

Text analysis

Stop words

Stemming

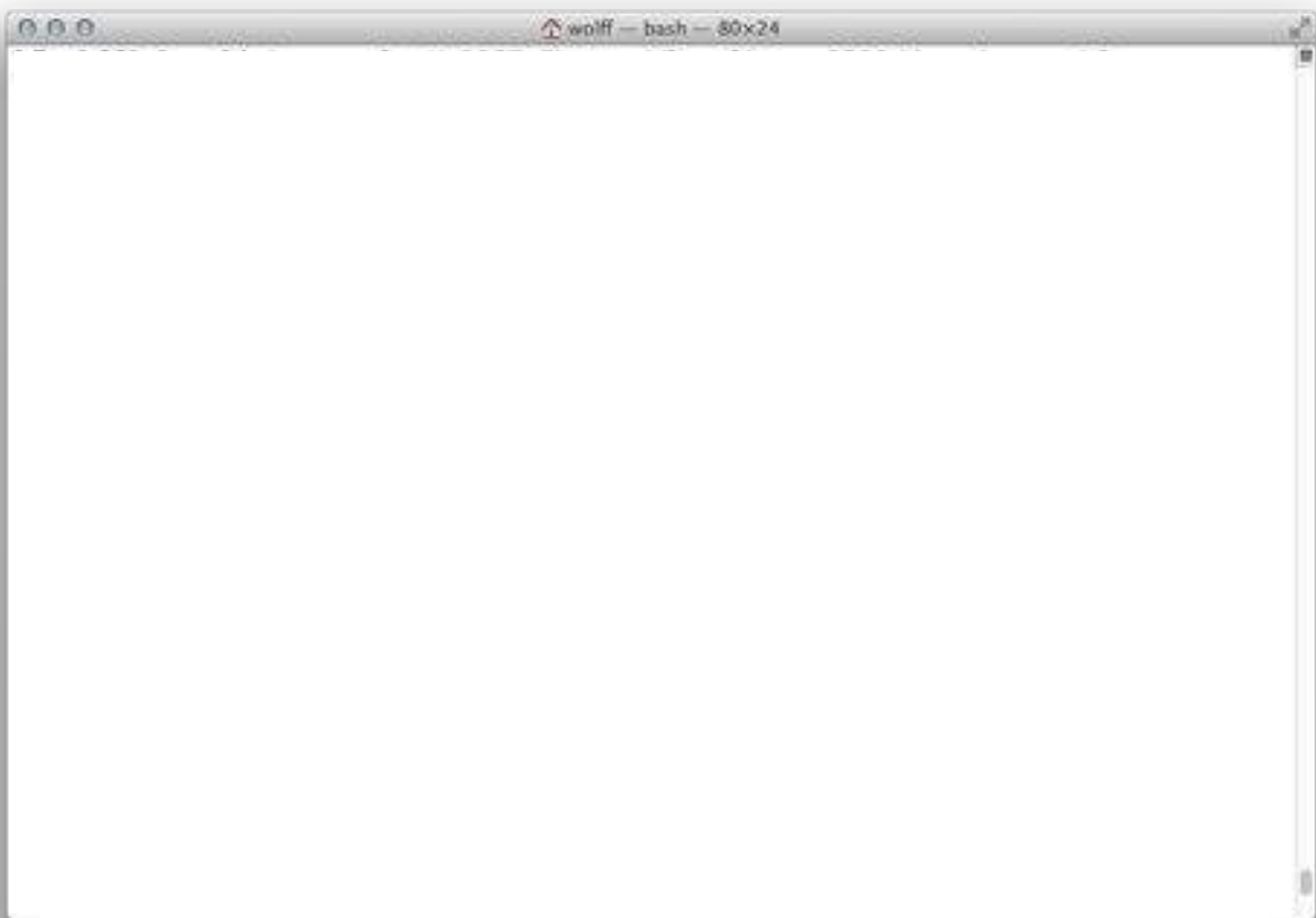
Facets

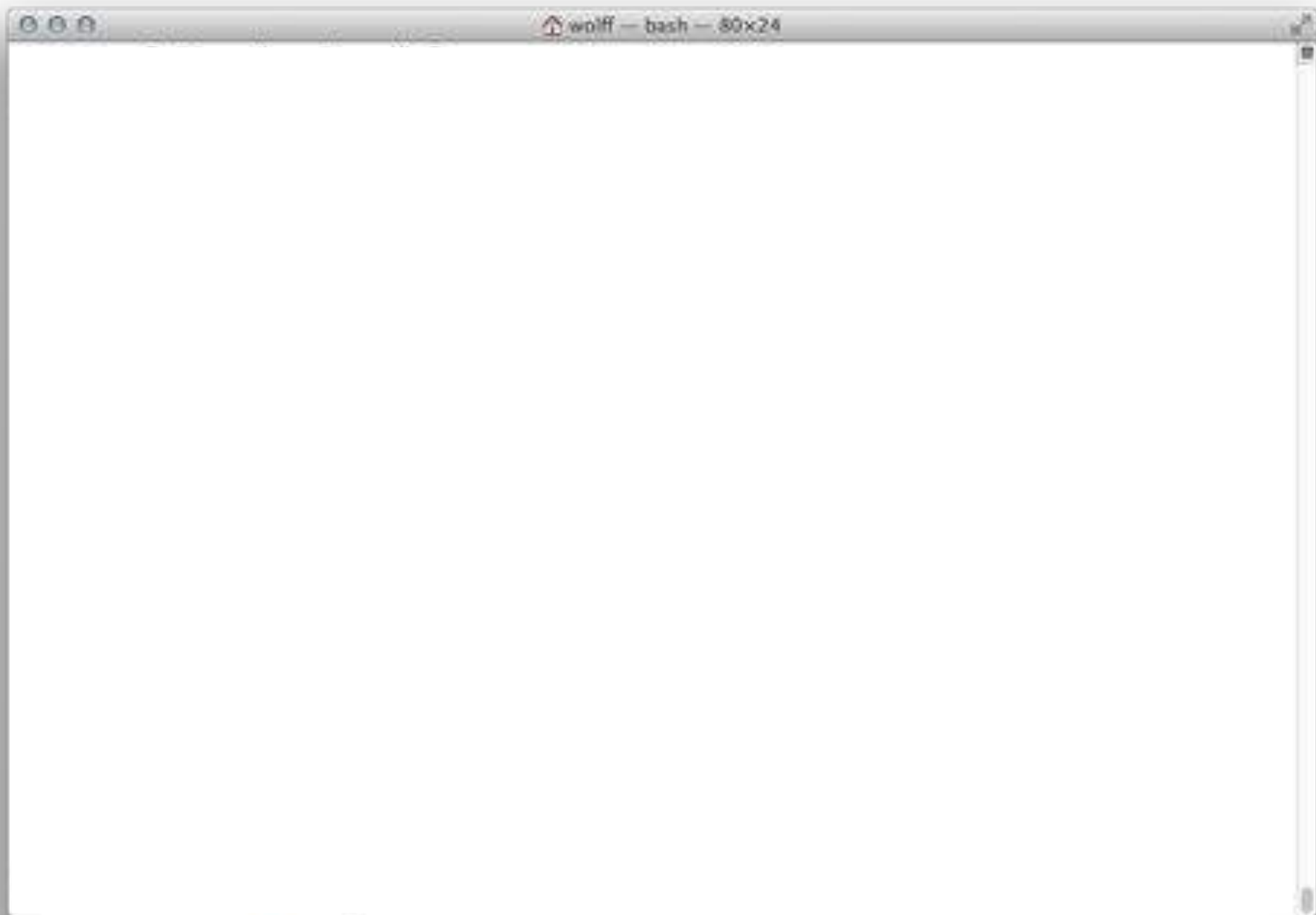
Number of hits by category

Useful for statistics

Statistical facet (+ computation)

Range facets etc.





Redis

MongoDB

elasticsearch

Redis 

MongoDB 

elasticsearch 

Redis

Fast in memory database

Powerful data structures

Central coordination

Cache

Messaging

MongoDB

Document-oriented

General purpose

Business intelligence

elasticsearch

Powerful search

Stores original documents

Effortless scalability

Easy to do (fast) statistics

Spring Data
Redis
MongoDB
elasticsearch

Seven Databases in Seven Weeks

A Guide to Modern Databases
and the NoSQL Movement

Eric Redmond
and Jim R. Wilson

Edited by Jacquelyn Carter



Thank You!