



# ArchitectNow

**Session:**

## NoSQL Query Smells

**PRESENTED BY**

## Alex Will

---

[info@architectnow.net](mailto:info@architectnow.net)  
[www.architectnow.net](http://www.architectnow.net)

# TRANSFORMATION THROUGH TECHNOLOGY

## WELCOME TO **ARCHITECTNOW**

Whether launching new Cloud or mobile apps or modernizing your legacy platforms we can help you identify the best options and work with you on bringing those ideas to life. To get the ball rolling, reach out and tell us a bit about your needs and we can start identifying solutions. There is no risk and we can quickly get to the point of providing initial ideas along with rough estimates of the costs and implementation times required with various recommendations.

**info@architectnow.net**  
**www.architectnow.net**



**ArchitectNow**



**ArchitectNow**

# CONTACT INFORMATION

**Kevin Grossnicklaus**

President

ArchitectNow

[kvgros@architectnow.net](mailto:kvgros@architectnow.net)

[LinkedIn](#)

[@kvgros](#)

**Alex Will**

Chief Technology Officer

ArchitectNow

[awill@architectnow.net](mailto:awill@architectnow.net)

[LinkedIn](#)

[YouTube](#)

[@alwill\\_dotnet](#)


[www.ArchitectNow.net](http://www.ArchitectNow.net)

[@architectnow](#)

[LinkedIn](#)



# The Data

- We are going to use sample data from Mongo Atlas
  - We will specifically be looking at the mflix database
- 


# Compass

- Free tool from Mongo
- Great for looking at explain plans, and schemas
- Not the best UI for using the queries
- <https://www.mongodb.com/products/compass>





# CLI

- Another way is to use the CLI
  - Nice for running queries
  - Good shell for quick things
  - No easy interface editing or visualizing
- 

# A Look at the Data

```
▼ {  
  ▼ {  
    "_id": {  
      "$oid": "573a1390f29313caabcd4135"  
    },  
    "plot": "Three men hammer on an anvil and pass a bottle of beer around.",  
    "genres": ["Short"],  
    "runtime": 1,  
    "cast": ["Charles Kayser", "John Ott"],  
    "num_mflix_comments": 1,  
    "title": "Blacksmith Scene",  
    "fullplot": "A stationary camera looks at a large anvil with a blacksmith behind",  
    "countries": ["USA"],  
    ▶ "released": {📅},  
    "directors": ["William K.L. Dickson"],  
    "rated": "UNRATED",  
    ▶ "awards": {📅},  
    "lastupdated": "2015-08-26 00:03:50.133000000",  
    "year": 1893,  
    ▶ "imdb": {📅},  
    "type": "movie",  
    ▶ "tomatoes": {📅}  
  }  
}
```

- Movies Collection
- 23.5k documents
- Multiple 1 to many relationships

sample\_mflix.movies

DOCUMENTS 23.5k TOTAL SIZE 35.9MB AVG. SIZE 1.6KB INDEXES 2 TOTAL SIZE 13.2MB AVG. SIZE 6.6MB

Documents Aggregations Schema Explain Plan Indexes Validation

**FILTER {year: 2014}** **OPTIONS** **FIND** **RESET** **...**

**PROJECT** **MAXTIMEMS** 5000

**SORT** **SKIP** 0 **LIMIT** 0

**COLLATION**

**ADD DATA** **VIEW** **{}** **REFRESH**

Displaying documents 1 - 20 of 1147

```
{
  "_id": {
    "$oid": "573a13b0f29313caabd333e7"
  },
  "plot": "In order to escape crime and clutches of a ruthless mafia, a Bangkok based hit man seeks the help of his lookalike, a Mumbai based goon.",
  "genres": ["Action", "Comedy", "Drama"],
  "runtime": 144,
  "cast": ["Ajay Devgn", "Shahid Kapoor", "Sonakshi Sinha", "Prabhas"],
  "num_mflix_comments": 2,
  "title": "Action Jackson",
  "fullplot": "Vishi is a local goon who basically likes beating up people to get his work done but is nonetheless a kind-hearted person. On the other hand Khushi is an extremely clumsy girl who keeps losing her chances with destiny and get:",
  "languages": ["Hindi"],
  "released": {},
  "directors": ["Prabhudheva"],
  "writers": ["A.C. Mughil", "Prabhudheva", "Shiraz Ahmed (dialogue)"],
  "awards": {},
  "lastupdated": "2015-09-10 17:20:55.697000000",
  "year": 2014,
  "imdb": {},
  "countries": ["India", "Austria"],
  "type": "movie",
  "tomatoes": {}
}
```

Let's find all  
movies from 2014

Cool it found 1,147 movies!



# Not Cool!

sample\_mflix.movies

DOCUMENTS 23.5k TOTAL SIZE 35.9MB AVG. SIZE 1.6KB INDEXES 2 TOTAL SIZE 13.2MB AVG. SIZE 6.6MB

Documents Aggregations Schema Explain Plan Indexes Validation

**FILTER** {year: 2014} **PROJECT** **SORT** **COLLATION** **MAXTIME** 5000 **SKIP** 0 **LIMIT** 0

**EXPLAIN** **RESET** ...

VIEW DETAILS AS **VISUAL TREE** RAW JSON

### Query Performance Summary

Documents Returned: <b>1147</b>	Actual Query Execution Time (ms): <b>18</b>
Index Keys Examined: <b>0</b>	Sorted in Memory: <b>no</b>
Documents Examined: <b>23530</b>	No index available for this query.

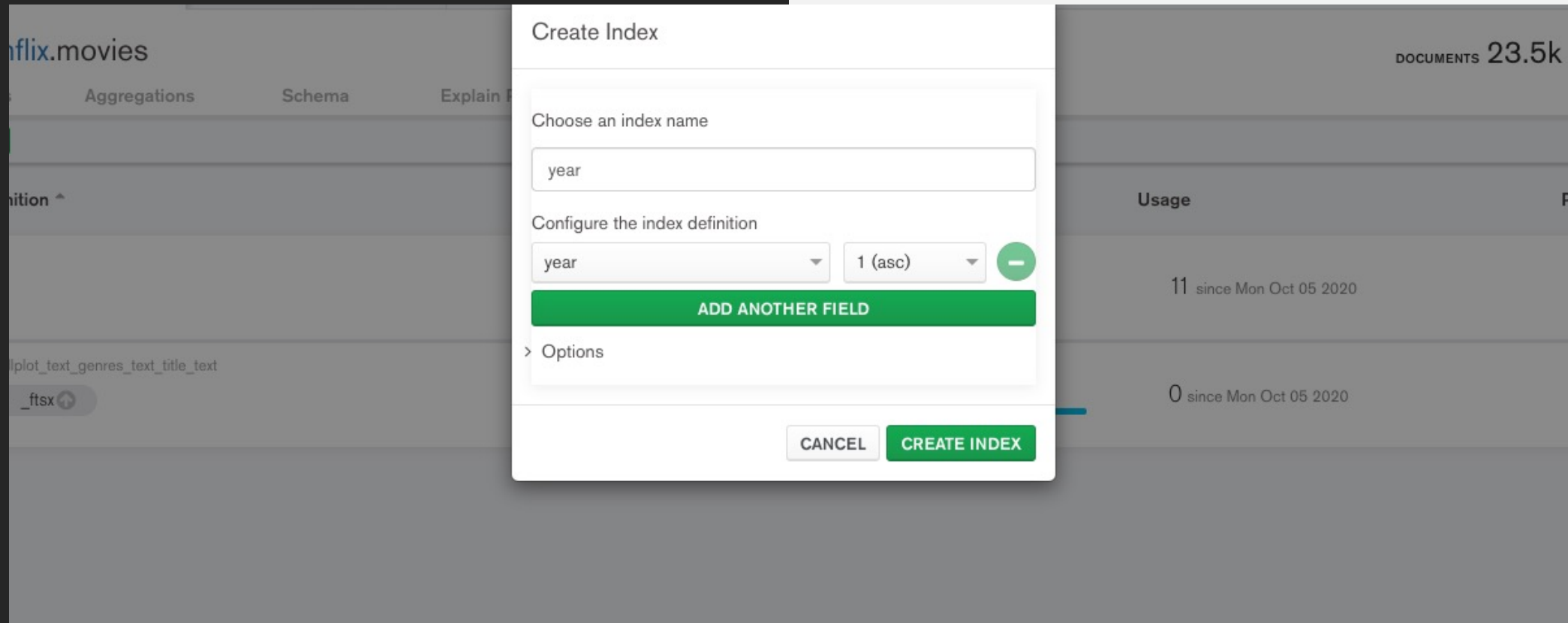
**COLLSCAN**

nReturned: **1147** Execution Time: **0** ms

Documents Examined: **23530**

**DETAILS**

# Add an Index!



The image shows a screenshot of the MongoDB Compass interface with a 'Create Index' dialog box open. The background is dimmed, showing the 'nflix.movies' collection with tabs for Aggregations, Schema, and Explain. A 'Usage' section shows document counts over time. The dialog box is titled 'Create Index' and contains the following elements:

- Choose an index name:** A text input field containing 'year'.
- Configure the index definition:** A section with two dropdown menus. The first dropdown is set to 'year' and the second is set to '1 (asc)'. To the right of these dropdowns is a green circular button with a minus sign.
- ADD ANOTHER FIELD:** A prominent green button located below the configuration section.
- Options:** A section header with a right-pointing chevron, indicating expandable options.
- Buttons:** At the bottom right of the dialog are two buttons: a 'CANCEL' button and a 'CREATE INDEX' button.

# Explain with Index

sample\_mflix.movies

Documents Aggregations Schema **Explain Plan** Indexes

**FILTER** {year: 2014}

**PROJECT**

**SORT**

**COLLATION**

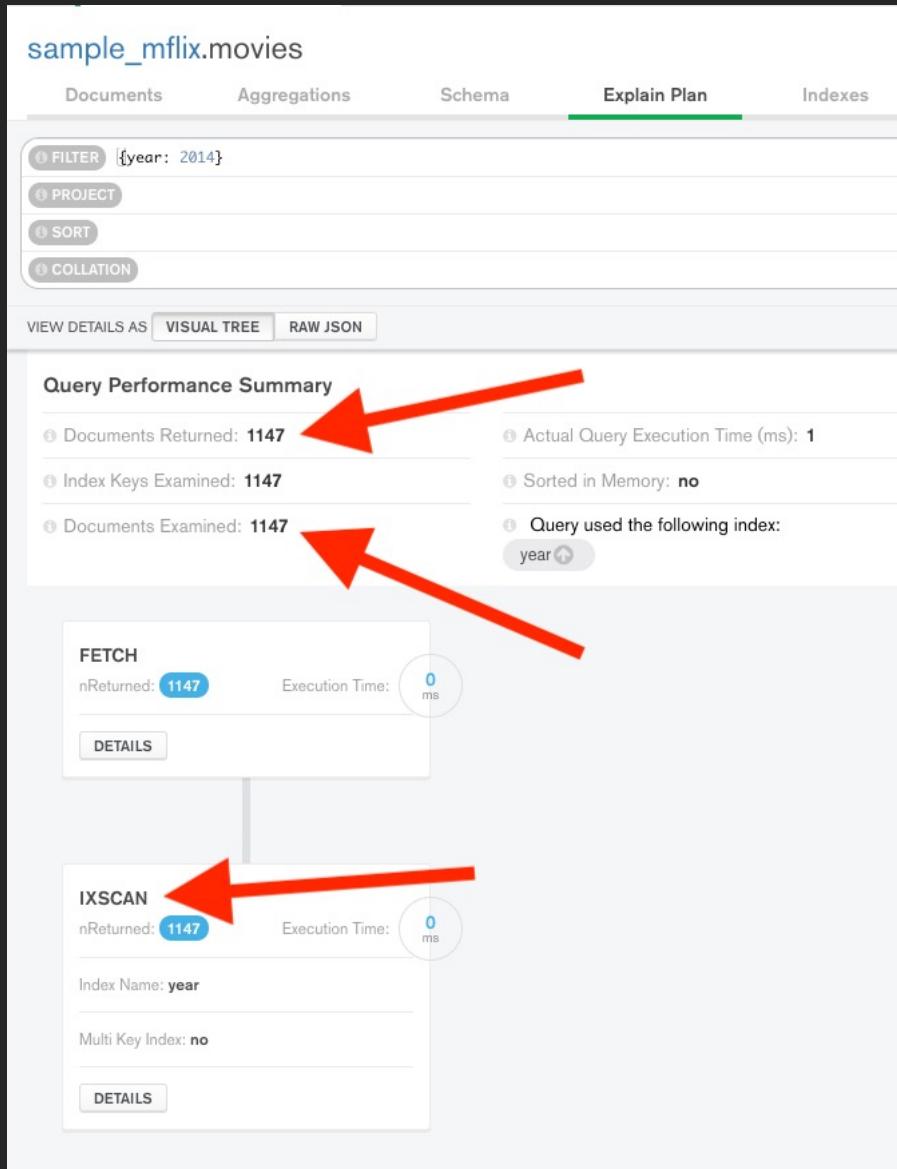
VIEW DETAILS AS **VISUAL TREE** RAW JSON

**Query Performance Summary**

- Documents Returned: **1147**
- Index Keys Examined: **1147**
- Documents Examined: **1147**
- Actual Query Execution Time (ms): **1**
- Sorted in Memory: **no**
- Query used the following index:  
**year**

**FETCH**  
nReturned: **1147** Execution Time: **0** ms  
**DETAILS**

**IXSCAN**  
nReturned: **1147** Execution Time: **0** ms  
Index Name: **year**  
Multi Key Index: **no**  
**DETAILS**



sample\_mflix.movies

DOCUMENTS 23.5kTOTAL SIZE 35.9MBAVG. SIZE 1.6KB

DocumentsAggregationsSchemaExplain PlanIndexesValidation

FILTER {year: 2014}

PROJECT

SORT {metacritic: -1}

COLLATION

MAXTIMES 5000

SKIP 0

LIMIT 0

ADD DATA

VIEW

Displaying documents 1 - 20 of 1

↵

{

\_id: {

\$oid: "573a13bef29313caabd5c06c"

},

plot: "The life of Mason, from early childhood to his arrival at college.",

genres: ["Drama"],

runtime: 165,

metacritic: 100,

rated: "R",

cast: ["Ellar Coltrane", "Patricia Arquette", "Elijah Smith", "Lorelei Linklater"],

num\_mflix\_comments: 1,

poster: "https://m.media-amazon.com/images/M/MV5BMTYzNDc2Mdc0N15BMl5BanBnXkFtZTgwOTcwMDQ5MTE@.\_V1\_SY1000\_SX677\_AL\_.jpg",

title: "Boyhood",

lastupdated: "2015-09-14 06:39:58.670000000",

languages: ["English", "Spanish"],

released: {},

directors: ["Richard Linklater"],

writers: ["Richard Linklater"],

awards: {},

year: 2014,

indb: {},

countries: ["USA"],

type: "movie",

tomatoes: {}

}

↵

{

\_id: {

\$oid: "573a13ebf29313caabdd187b"

},

plot: "A group of brave individuals risk their lives to save the last of the world's mountain gorillas; in the midst of renewed civil war and a scramble for Congo's natural resources.",

genres: ["Documentary", "War"],

runtime: 100,

metacritic: 95,

rated: "NOT RATED",

cast: ["André Bauma", "Emmanuel de Merode", "Mélanie Gouby", "Rodrigue Mugaruka Katembo"],

num\_mflix\_comments: 1,

poster: "https://m.media-amazon.com/images/M/MV5BMjI0NzESMzc5OF5BMl5BanBnXkFtZTgwODk3Njg0MzE@.\_V1\_SY1000\_SX677\_AL\_.jpg",

title: "Virunga",

fullplot: "In the forested depths of eastern Congo lies Virunga National Park, one of the most bio-diverse places in the world and home to the last of the mountain gorillas. In this wild, but enchanted environment",

languages: ["English", "French", "Swahili"],

released: {},

directors: ["Orlando von Eisinger"],

writers: ["Orlando von Eisinger"],

awards: {},

lastupdated: "2015-09-13 00:39:21.383000000",

}

Find the best  
movies in  
2014

# Looks fine, Right?

sample\_mflix.movies

DOCUMENTS 23.5k TOTAL SIZE 35.9MB AVG. SIZE 1.6KB INDEXES 3 TOTAL SIZE 13.3MB AVG. SIZE 4.4MB

Documents Aggregations Schema Explain Plan Indexes Validation

**FILTER** {year: 2014} **PROJECT** **SORT** {metacritic: -1} **COLLATION**

**OPTIONS** **EXPLAIN** **RESET** ...

**MAXITEMS** 5000 **SKIP** 0 **LIMIT** 0

VIEW DETAILS AS **VISUAL TREE** RAW JSON

### Query Performance Summary

<b>Documents Returned:</b> 1147	<b>Actual Query Execution Time (ms):</b> 6
<b>Index Keys Examined:</b> 1147	<b>Sorted in Memory:</b> yes
<b>Documents Examined:</b> 1147	<b>Query used the following index:</b> year

**SORT**  
nReturned: 1147 Execution Time: 0 ms  
**DETAILS**

**SORT\_KEY\_GENERATOR**

sample\_mflix.movies

Documents Aggregations Schema Explain

CREATE INDEX

sample\_mflix.movies

DOCUMENTS 23.5k TOTAL SIZE 35.9MB AVG. SIZE 1.6KB INDEXES 3

Name and Definition ^

\_id\_

\_id\_

cast\_text\_fullplot\_text\_genres\_text\_title\_text

\_fts text \_ftsx

example\_index

metacritic year

Create Index

Choose an index name

example\_index

Configure the index definition

metacritic -1 (desc)

year 1 (asc)

ADD ANOTHER FIELD

Options

CANCEL CREATE INDEX

Usage Properties

11 since Mon Oct 05 2020 UNIQUE

0 since Mon Oct 05 2020 COMPOUND

0 since Mon Oct 05 2020 COMPOUND

# Another Index

Much Better

sample\_mflix.movies

Documents

Aggregations

Schema

Explain Plan

Indexes

Validation

FILTER {year: 2014}

PROJECT

SORT {metacritic : -1}

COLLATION

VIEW DETAILS AS

VISUAL TREE

RAW JSON

### Query Performance Summary

Documents Returned: 1147

Index Keys Examined: 1147

Documents Examined: 1147

Actual Query Execution Time (ms): 1

Sorted in Memory: no

Query used the following index:

year ↑ metacritic ↓

#### FETCH

nReturned: 1147

Execution Time: 0 ms

DETAILS

#### IXSCAN

nReturned: 1147

Execution Time: 1 ms

Index Name: year\_1\_score\_-1

Multi Key Index: no

DETAILS

# Find the best movies from 2014 longer than 2 hours

sample\_mflix.movies

DOCUMENTS 23.5k TOTAL SIZE 35.9MB AVG. SIZE 1.6KB INDEXES 2 TOTAL SIZE 13.2MB AVG. SIZE 6.6MB

Documents Aggregations Schema Explain Plan Indexes Validation

**FILTER** {year: 2014, runtime: {\$gt: 120}}

**PROJECT**

**SORT** {metacritic: -1}

**MAXTIMES** 5000

**SKIP** 0 **LIMIT** 0

**ADD DATA** **VIEW** **REFRESH**

Displaying documents 1 - 20 of 145

```
{
  "_id": {
    "oid": "573a13bef29313caabd5c06c"
  },
  "plot": "The life of Mason, from early childhood to his arrival at college.",
  "genres": ["Drama"],
  "runtime": 165,
  "metacritic": 100,
  "rated": "R",
  "cast": ["Ellar Coltrane", "Patricia Arquette", "Elijah Smith", "Lorelei Linklater"],
  "num_mflix_comments": 1,
  "poster": "https://m.media-amazon.com/images/M/MV5BMTYzNDc2M0c0N1S0M1S0anBnXkFtZTgwOTcwMDQ5MTE@._V1_S1000_SX677_AL_.jpg",
  "title": "Boyhood",
  "lastupdated": "2015-09-14 06:39:58.670000000",
  "languages": ["English", "Spanish"],
  "released": {},
  "directors": ["Richard Linklater"],
  "writers": ["Richard Linklater"],
  "awards": {},
  "year": 2014,
  "imdb": {},
  "countries": ["USA"],
  "type": "movie",
  "tomatoes": {}
}
```

```
{
  "_id": {
    "oid": "573a13def29313caabd5500"
  },
  "fullplot": "Mr. Turner explores the last quarter century of the great if eccentric British painter J.M.W. Turner (1775-1851). Profoundly affected by the death of his father, loved by a housekeeper he takes for granted and occasionally ex",
  "imdb": {},
  "year": 2014,
  "plot": "An exploration of the last quarter century of the great, if eccentric, British painter J.M.W. Turner's life.",
  "genres": ["Biography", "Drama", "History"],
  "rated": "R",
  "metacritic": 94,
  "title": "Mr. Turner",
  "lastupdated": "2015-09-13 00:39:14.857000000",
  "languages": ["English"],
  "writers": ["Mike Leigh (screenplay)"],
  "type": "movie",
  "tomatoes": {},
  "poster": "https://m.media-amazon.com/images/M/MV5BMjUzNTg0MzNfS0M1S0anBnXkFtZTgwNDg3NTY5MjE@._V1_S1000_SX677_AL_.jpg",
  "num_mflix_comments": 1,
  "released": {}
}
```



sample\_mflix.movies

Indexes

Documents Aggregations Schema Explain

CREATE INDEX

Name and Definition

example\_index

year ↑ metacritic ↓ runtime ↑

DOCUMENTS 23.5k TOTAL SIZE 35.9MB

Usage Properties

11 since Mon Oct 05 2020 UNIQUE

0 since Mon Oct 05 2020 COMPOUND

1 since Mon Oct 05 2020 COMPOUND

### Create Index

Choose an index name

example\_index

Configure the index definition

year	1 (asc)	—
runtime	1 (asc)	—
metacritic	-1 (desc)	—

ADD ANOTHER FIELD

> Options

CANCEL CREATE INDEX

Add runtime to  
the index

# Better Index???

The image shows the MongoDB Explain Plan interface. At the top, there are tabs for Documents, Aggregations, Schema, Explain Plan (selected), Indexes, and Validation. Below the tabs, the query is defined as: `{year: 2014, runtime: {$gt: 120}}`. The explain plan shows a SORT stage with `{metacritic: -1}`. The performance summary indicates that 145 documents were returned, 145 index keys were examined, and 145 documents were examined. The actual query execution time was 1 ms, and the query was sorted in memory. The query used the index `year runtime metacritic`. The execution plan shows the SORT stage returning 145 documents in 0 ms, followed by the SORT\_KEY\_GENERATOR stage returning 145 documents in 0 ms.

Documents Aggregations Schema **Explain Plan** Indexes Validation

**QUERY** `{year: 2014, runtime: {$gt: 120}}` **OPTIONS** **EXPLAIN** **RESET** **...**

**STAGES**

- FILTER** `{year: 2014, runtime: {$gt: 120}}` **MAXTIMEMS** 5000
- PROJECT**
- SORT** `{metacritic: -1}` **SKIP** 0 **LIMIT** 0
- COLLATION**

**VIEW DETAILS AS** **VISUAL TREE** **RAW JSON**

**Query Performance Summary**

- Documents Returned: **145**
- Index Keys Examined: **145**
- Documents Examined: **145**
- Actual Query Execution Time (ms): **1**
- Sorted in Memory: **yes**
- Query used the following index: `year runtime metacritic`

**SORT** **nReturned:** 145 **Execution Time:** 0 ms

**DETAILS**

**SORT\_KEY\_GENERATOR** **nReturned:** 145 **Execution Time:** 0 ms

(E)quality  
(S)ort  
(R)ange

---

Create Index

Choose an index name

example\_index

Configure the index definition

year	1 (asc)	+
metacritic	-1 (desc)	+
runtime	1 (asc)	+

ADD ANOTHER FIELD

> Options

CANCEL CREATE INDEX

# ESR

ⓘ FILTER

{year: 2014, runtime: {sgt : 120}}

ⓘ PROJECT

ⓘ SORT

{metacritic : -1}

ⓘ COLLATION

ⓘ MAXTIMEMS

5000

ⓘ SKIP

0

ⓘ LIMIT

0

▼ OPTIONS

EXPLAIN

RESET

...

VIEW DETAILS AS

VISUAL TREE

RAW JSON

Query Performance Summary

ⓘ Documents Returned: 145

ⓘ Index Keys Examined: 222

ⓘ Documents Examined: 145

ⓘ Actual Query Execution Time (ms): 0

ⓘ Sorted in Memory: no

ⓘ Query used the following index:

year ↕ metacritic ↕ runtime ↕

FETCH

nReturned: 145

Execution Time: 0 ms

DETAILS

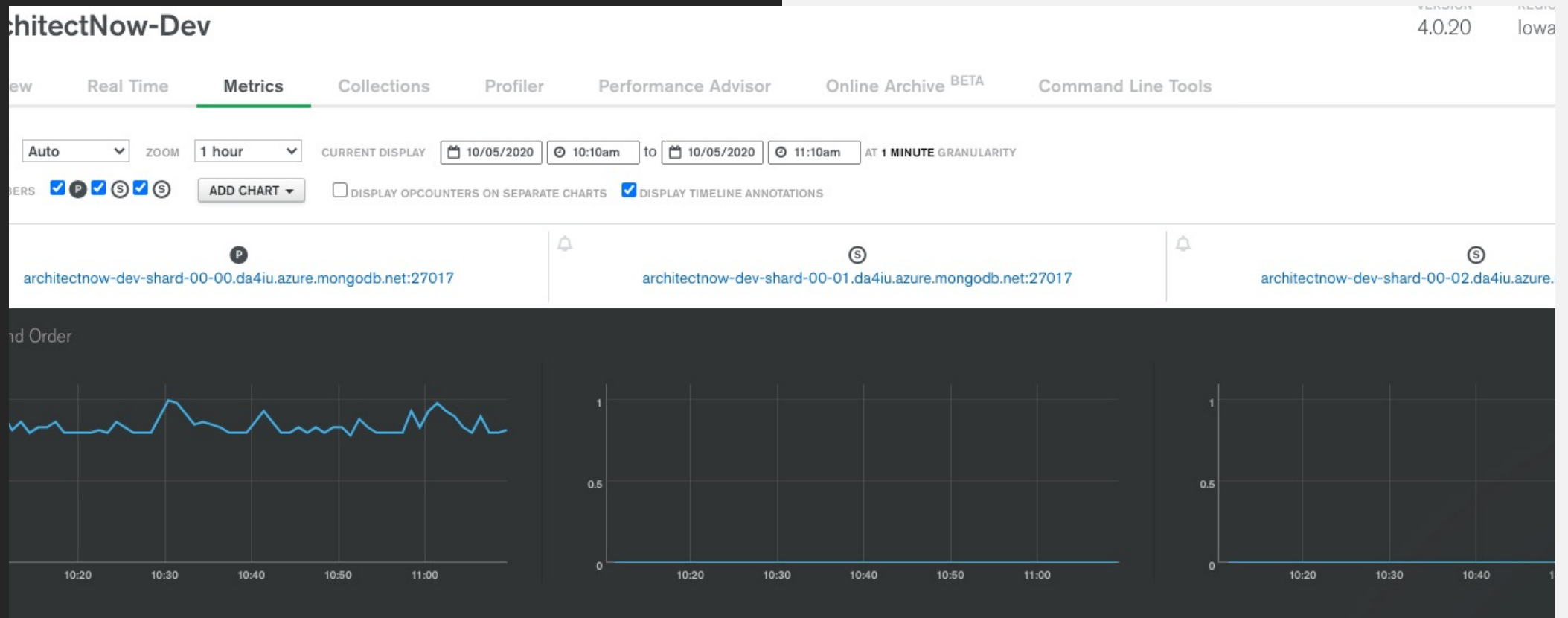
IXSCAN

nReturned: 145

Execution Time: 0 ms

Index Name: example\_index

# Performance Metrics



# Resources

- ESR Article <https://emptysqua.re/blog/optimizing-mongodb-compound-indexes/#setup>
- Great Doc DB vid: <https://www.youtube.com/watch?v=HaEPXoXVf2k>
  - Seriously, watch this
- <https://developer.mongodb.com/article/performance-tuning-tips>
- Check your Profile <https://severalnines.com/database-blog/overview-mongodb-database-profiler>
- Sample Data: <https://docs.atlas.mongodb.com/sample-data/#load-sample-data>