MongoDB 查询性能分析

MongoDB 3.0之后，explain的返回与使用方法与之前版本有了很大的变化，目前所使用的是3.4.7版本，本文仅针对MongoDB 3.0+的explain进行讨论。3.0+的explain有三种模式，分别是：

queryPlanner、**executionStats**、**allPlansExecution**。

常用的是executionStats模式，主要分析这种模式。

重要参数详解：

```
==================
{
        "queryPlanner" : {
                "plannerVersion" : 1,
                "namespace" : "river.user",
                "indexFilterSet" : false,
                "parsedQuery" : {
                        "$and" : [
                                {
                                        "sex" : {
                                                "$eq" : 1
                                        }
                                },
                                {
                                        "username" : {
                                                "$eq" : "liqingjiang"
                                        }
                                }
                        ]
                },
                "winningPlan" : {
                        "stage" : "SORT",
                        "sortPattern" : {
                                "createTime" : -1
                        },
                        "inputStage" : {
                                "stage" : "SORT_KEY_GENERATOR",
                                "inputStage" : {
                                        "stage" : "FETCH",
                                        "filter" : {
                                                "sex" : {
                                                        "$eq" : 1
                                                }
                                        },
                                        "inputStage" : {
                                                "stage" : "IXSCAN",
```

```
                                        "keyPattern" : {
                                                "username" : 1,
                                                "age" : -1
                                        },
                                        "indexName" : "IDX_USERNAME_AGE",
                                        "isMultiKey" : false,
                                        "multiKeyPaths" : {
                                                "username" : [ ],
                                                "age" : [ ]
                                        },
                                        "isUnique" : false,
                                        "isSparse" : false,
                                        "isPartial" : false,
                                        "indexVersion" : 2,
                                        "direction" : "forward",
                                        "indexBounds" : {
                                                "username" : [
                                                        "[\"liqingjiang\", \"liqingjiang\"]"
                                                ],
                                                "age" : [
                                                        "[MaxKey, MinKey]"
                                                ]
                                        }
                                }
                        }
                }
        },
        "rejectedPlans" : [ ]
},
"executionStats" : {
        "executionSuccess" : true,
        "nReturned" : 1,
        "executionTimeMillis" : 0,
        "totalKeysExamined" : 1,
        "totalDocsExamined" : 1,
        "executionStages" : {
                "stage" : "SORT",
                "nReturned" : 1,
                "executionTimeMillisEstimate" : 0,
                "works" : 5,
                "advanced" : 1,
                "needTime" : 3,
                "needYield" : 0,
                "saveState" : 0,
                "restoreState" : 0,
                "isEOF" : 1,
                "invalidates" : 0,
                "sortPattern" : {
```

```
        "createTime" : -1
},
"memUsage" : 157,
"memLimit" : 33554432,
"inputStage" : {
        "stage" : "SORT_KEY_GENERATOR",
        "nReturned" : 1,
        "executionTimeMillisEstimate" : 0,
        "works" : 3,
        "advanced" : 1,
        "needTime" : 1,
        "needYield" : 0,
        "saveState" : 0,
        "restoreState" : 0,
        "isEOF" : 1,
        "invalidates" : 0,
        "inputStage" : {
                "stage" : "FETCH",
                "filter" : {
                        "sex" : {
                                "$eq" : 1
                        }
                },
                "nReturned" : 1,
                "executionTimeMillisEstimate" : 0,
                "works" : 2,
                "advanced" : 1,
                "needTime" : 0,
                "needYield" : 0,
                "saveState" : 0,
                "restoreState" : 0,
                "isEOF" : 1,
                "invalidates" : 0,
                "docsExamined" : 1,
                "alreadyHasObj" : 0,
                "inputStage" : {
                        "stage" : "IXSCAN",
                        "nReturned" : 1,
                        "executionTimeMillisEstimate" : 0,
                        "works" : 2,
                        "advanced" : 1,
                        "needTime" : 0,
                        "needYield" : 0,
                        "saveState" : 0,
                        "restoreState" : 0,
                        "isEOF" : 1,
                        "invalidates" : 0,
                        "keyPattern" : {
```

```
                                        "username" : 1,
                                        "age" : -1
                                },
                                "indexName" : "IDX_USERNAME_AGE",
                                "isMultiKey" : false,
                                "multiKeyPaths" : {
                                        "username" : [ ],
                                        "age" : [ ]
                                },
                                "isUnique" : false,
                                "isSparse" : false,
                                "isPartial" : false,
                                "indexVersion" : 2,
                                "direction" : "forward",
                                "indexBounds" : {
                                        "username" : [
                                                "[\"liqingjiang\", \"liqingjiang\"]"
                                        ],
                                        "age" : [
                                                "[MaxKey, MinKey]"
                                        ]
                                },
                                "keysExamined" : 1,
                                "seeks" : 1,
                                "dupsTested" : 0,
                                "dupsDropped" : 0,
                                "seenInvalidated" : 0
                        }
                }
        }
    },
    "serverInfo" : {
            "host" : "localhost.localdomain",
            "port" : 27017,
            "version" : "3.4.7",
            "gitVersion" : "cf38c1b8a0a8dca4a11737581beafef4fe120bcd"
    },
    "ok" : 1
}
==================
```


queryPlanner :

namespace : 该query所查询的表

indexFilterSet : 该query是否有indexfilter

parsedQuery : 翻译后的查询条件

winningPlan : 查询优化器针对该query所返回的最优执行计划的详细内容

stage : 最优执行计划的stage，这里返回是FETCH，可以理解为通过返回的index位置去检索具体的文档

inputStage ： 用来描述子stage，并且为其父stage提供文档和索引关键字

keyPattern ： 所扫描的index内容

indexName ： winning plan所选用的index 名称

isMultiKey ： 是否是Multikey，此处返回是false，如果索引建立在array上，此处将是true

isUnique ： 是否是唯一索引

direction ： 此query的查询顺序，此处是forward，如果用了.sort({username:-1})将显示backward

indexBounds ： winningplan所扫描的索引范围,如果没有制定范围就是[MaxKey, MinKey]

rejectedPlans ： 其他执行计划（非最优而被查询优化器reject的）的详细返回，其中具体信息与winningPlan的返回中意义相同

executionStats:

executionSuccess ： 是否执行成功

nReturned ： 查询的返回条数

executionTimeMillis ： 整体执行时间

totalKeysExamined ： 索引扫描条目

totalDocsExamined ： 扫描document条目

对于一个查询，我们最理想的状态是：

nReturned = totalKeysExamined = totalDocsExamined

executionStages

stage ： 执行计划的stage

nReturned ： 查询的返回条数

executionTimeMillisEstimate ： 该查询根据index去检索document获得数据的时间

inputStage ：

stage ： child stage，此处是IXSCAN，表示进行的是index scanning

nReturned ： 条查询返回的条目

executionTimeMillisEstimate ： 该查询扫描行index所用时间

stage状态分析

是什么影响到了totalKeysExamined和totalDocsExamined?

是stage的类型。类型列举如下：

COLLSCAN：全表扫描

IXSCAN：索引扫描

FETCH：根据索引去检索指定document

SHARD_MERGE：将各个分片返回数据进行merge

SORT：表明在内存中进行了排序

LIMIT：使用limit限制返回数

SKIP：使用skip进行跳过

IDHACK：针对_id进行查询

SHARDING_FILTER：通过mongos对分片数据进行查询

COUNT：利用db.coll.explain().count()之类进行count运算

COUNTSCAN：count不使用Index进行count时的stage返回

COUNT_SCAN：count使用了Index进行count时的stage返回

SUBPLA：未使用到索引的$or查询的stage返回

TEXT：使用全文索引进行查询时候的stage返回

PROJECTION：限定返回字段时候stage的返回

对于普通查询 ：

我希望看到stage的组合(查询的时候尽可能用上索引)：

Fetch+IDHACK

Fetch+ixscan

Limit+ (Fetch+ixscan)

PROJECTION+ixscan

SHARDING_FITER+ixscan

COUNT_SCAN

不希望看到包含如下的stage：

COLLSCAN(全表扫描),

SORT(使用sort但是无index),

不合理的SKIP,

SUBPLA(未用到index的$or),

COUNTSCAN(不使用index进行count)


```
{
        "queryPlanner" : {
                "plannerVersion" : 1,
                "namespace" : "river.user",
                "indexFilterSet" : false,
                "parsedQuery" : {
                        "$and" : [
                                {
                                        "sex" : {
                                                "$eq" : 1
                                        }
                                },
                                {
                                        "username" : {
                                                "$eq" : "liqingjiang"
                                        }
                                }
                        ]
                },
                "winningPlan" : {
                        "stage" : "SORT",
                        "sortPattern" : {
                                "createTime" : -1
                        },
                        "inputStage" : {
                                "stage" : "SORT_KEY_GENERATOR",
                                "inputStage" : {
                                        "stage" : "FETCH",
                                        "filter" : {
                                                "sex" : {
                                                        "$eq" : 1
                                                }
                                        },
                                        "inputStage" : {
                                                "stage" : "IXSCAN",
                                                "keyPattern" : {
                                                        "username" : 1,
                                                        "age" : -1
                                                },
                                                "indexName" : "IDX_USERNAME_AGE",
                                                "isMultiKey" : false,
                                                "multiKeyPaths" : {
                                                        "username" : [ ],
                                                        "age" : [ ]
                                                },
                                                "isUnique" : false,
                                                "isSparse" : false,
                                                "isPartial" : false,
                                                "indexVersion" : 2,
                                                "direction" : "forward",
                                                "indexBounds" : {
                                                        "username" : [
                                                                "[\"liqingjiang\", \"liqingjiang\"]"
                                                        ],
                                                        "age" : [
                                                                "[MaxKey, MinKey]"
                                                        ]
                                                }
                                        }
                                }
                        }
                },
                "rejectedPlans" : [ ]
        },
        "executionStats" : {
                "executionSuccess" : true,
                "nReturned" : 1,
                "executionTimeMillis" : 0,
                "totalKeysExamined" : 1,
                "totalDocsExamined" : 1,
                "executionStages" : {
                        "stage" : "SORT",
                        "nReturned" : 1,
                        "executionTimeMillisEstimate" : 0,
                        "works" : 5,
                        "advanced" : 1,
                        "needTime" : 3,
                        "needYield" : 0,
                        "saveState" : 0,
                        "restoreState" : 0,
                        "isEOF" : 1
```

```
                        "invalidates" : 0,
                        "sortPattern" : {
                                "createTime" : -1
                        },
                        "memUsage" : 157,
                        "memLimit" : 33554432,
                        "inputStage" : {
                                "stage" : "SORT_KEY_GENERATOR",
                                "nReturned" : 1,
                                "executionTimeMillisEstimate" : 0,
                                "works" : 3,
                                "advanced" : 1,
                                "needTime" : 1,
                                "needYield" : 0,
                                "saveState" : 0,
                                "restoreState" : 0,
                                "isEOF" : 1,
                                "invalidates" : 0,
                                "inputStage" : {
                                        "stage" : "FETCH",
                                        "filter" : {
                                                "sex" : {
                                                        "$eq" : 1
                                                }
                                        },
                                        "nReturned" : 1,
                                        "executionTimeMillisEstimate" : 0,
                                        "works" : 2,
                                        "advanced" : 1,
                                        "needTime" : 0,
                                        "needYield" : 0,
                                        "saveState" : 0,
                                        "restoreState" : 0,
                                        "isEOF" : 1,
                                        "invalidates" : 0,
                                        "docsExamined" : 1,
                                        "alreadyHasObj" : 0,
                                        "inputStage" : {
                                                "stage" : "IXSCAN",
                                                "nReturned" : 1,
                                                "executionTimeMillisEstimate" : 0,
                                                "works" : 2,
                                                "advanced" : 1,
                                                "needTime" : 0,
                                                "needYield" : 0,
                                                "saveState" : 0,
                                                "restoreState" : 0,
                                                "isEOF" : 1,
                                                "invalidates" : 0,
                                                "keyPattern" : {
                                                        "username" : 1,
                                                        "age" : -1
                                                },
                                                "indexName" : "IDX_USERNAME_AGE",
                                                "isMultiKey" : false,
                                                "multiKeyPaths" : {
                                                        "username" : [ ],
                                                        "age" : [ ]
                                                },
                                                "isUnique" : false,
                                                "isSparse" : false,
                                                "isPartial" : false,
                                                "indexVersion" : 2,
                                                "direction" : "forward",
                                                "indexBounds" : {
                                                        "username" : [
                                                                "[\"liqingjiang\", \"liqingjiang\"]"
                                                        ],
                                                        "age" : [
                                                                "[MaxKey, MinKey]"
                                                        ]
                                                },
                                                "keysExamined" : 1,
                                                "seeks" : 1,
                                                "dupsTested" : 0,
                                                "dupsDropped" : 0,
                                                "seenInvalidated" : 0
                                        }
                                }
                        }
                }
        },
        "serverInfo" : {
                "host" : "localhost.localdomain",
                "port" : 27017,
                "version" : "3.4.7",
                "gitVersion" : "cf38c1b8a0a8dca4a11737581beafef4fe120bcd"
        },
        "ok" : 1
}
```

```
> db.user.find({age:26}).explain("executionStats")
{
        "queryPlanner" : {
                "plannerVersion" : 1,
                "namespace" : "river.user",
                "indexFilterSet" : false,
                "parsedQuery" : {
                        "age" : {
                                "$eq" : 26
                        }
                },
                "winningPlan" : {
                        "stage" : "COLLSCAN",
                        "filter" : {
                                "age" : {
                                        "$eq" : 26
                                }
                        },
                        "direction" : "forward"
                },
                "rejectedPlans" : [ ]
        },
        "executionStats" : {
                "executionSuccess" : true,
                "nReturned" : 1,
                "executionTimeMillis" : 1027,
                "totalKeysExamined" : 0,
                "totalDocsExamined" : 2100002,
                "executionStages" : {
                        "stage" : "COLLSCAN",
                        "filter" : {
                                "age" : {
                                        "$eq" : 26
                                }
                        },
                        "nReturned" : 1,
                        "executionTimeMillisEstimate" : 948,
                        "works" : 2100004,
                        "advanced" : 1,
                        "needTime" : 2100002,
                        "needYield" : 0,
                        "saveState" : 16441,
                        "restoreState" : 16441,
                        "isEOF" : 1,
                        "invalidates" : 0,
                        "direction" : "forward",
                        "docsExamined" : 2100002
                }
        },
        "serverInfo" : {
                "host" : "localhost.localdomain",
                "port" : 27017,
                "version" : "3.4.7",
                "gitVersion" : "cf38c1b8a0a8dca4a11737581beafef4fe120bcd"
        },
        "ok" : 1
}
>
```

```
>
>
> db.user.find({username:"liqingjiang", age:26}).explain("executionStats")
{
        "queryPlanner" : {
                "plannerVersion" : 1,
                "namespace" : "river.user",
                "indexFilterSet" : false,
                "parsedQuery" : {
                        "$and" : [
                                {
                                        "age" : {
                                                "$eq" : 26
                                        }
                                },
                                {
                                        "username" : {
                                                "$eq" : "liqingjiang"
                                        }
                                }
                        ]
                },
                "winningPlan" : {
                        "stage" : "FETCH",
                        "inputStage" : {
                                "stage" : "IXSCAN",
                                "keyPattern" : {
                                        "username" : 1,
                                        "age" : -1
                                },
                                "indexName" : "IDX_USERNAME_AGE",
                                "isMultiKey" : false,
                                "multiKeyPaths" : {
                                        "username" : [ ],
                                        "age" : [ ]
                                },
                                "isUnique" : false,
```

```
                                "isSparse" : false,
                                "isPartial" : false,
                                "indexVersion" : 2,
                                "direction" : "forward",
                                "indexBounds" : {
                                        "username" : [
                                                "[\"liqingjiang\", \"liqingjiang\"]"
                                        ],
                                        "age" : [
                                                "[26.0, 26.0]"
                                        ]
                                }
                        }
                },
                "rejectedPlans" : [ ]
        },
        "executionStats" : {
                "executionSuccess" : true,
                "nReturned" : 1,
                "executionTimeMillis" : 70,
                "totalKeysExamined" : 1,
                "totalDocsExamined" : 1,
                "executionStages" : {
                        "stage" : "FETCH",
                        "nReturned" : 1,
                        "executionTimeMillisEstimate" : 0,
                        "works" : 2,
                        "advanced" : 1,
                        "needTime" : 0,
                        "needYield" : 0,
                        "saveState" : 0,
                        "restoreState" : 0,
                        "isEOF" : 1,
                        "invalidates" : 0,
                        "docsExamined" : 1,
                        "alreadyHasObj" : 0,
                        "inputStage" : {
                                "stage" : "IXSCAN",
                                "nReturned" : 1,
                                "executionTimeMillisEstimate" : 0,
                                "works" : 2,
                                "advanced" : 1,
                                "needTime" : 0,
                                "needYield" : 0,
                                "saveState" : 0,
                                "restoreState" : 0,
                                "isEOF" : 1,
                                "invalidates" : 0,
                                "keyPattern" : {
                                        "username" : 1,
                                        "age" : -1
                                },
                                "indexName" : "IDX_USERNAME_AGE",
                                "isMultiKey" : false,
                                "multiKeyPaths" : {
                                        "username" : [ ],
                                        "age" : [ ]
                                },
                                "isUnique" : false,
                                "isSparse" : false,
                                "isPartial" : false,
                                "indexVersion" : 2,
                                "direction" : "forward",
                                "indexBounds" : {
                                        "username" : [
                                                "[\"liqingjiang\", \"liqingjiang\"]"
                                        ],
                                        "age" : [
                                                "[26.0, 26.0]"
                                        ]
                                },
                                "keysExamined" : 1,
                                "seeks" : 1,
                                "dupsTested" : 0,
                                "dupsDropped" : 0,
                                "seenInvalidated" : 0
                        }
                }
        },
        "serverInfo" : {
                "host" : "localhost.localdomain",
                "port" : 27017,
                "version" : "3.4.7",
                "gitVersion" : "cf38c1b8a0a8dca4a11737581beafef4fe120bcd"
        },
        "ok" : 1
}
>
```