[SQL调优] “查询SQL过滤和排序条件涉及的表字段未创建索引”引起慢查询问题，优化后执行时间从50+s下降到2s以下

博客分类： MySQL 性能调优

MySQL

前几天发现，线上portal “策略中心”的“证据管理”页面加载很慢。经排查发现，是由于 riskbase_core 库的 evidence 表未对 gmt_create 创建索引 和 evidence_details 表未对 refuuid 创建索引引起（因为查询条件涉及到这些字段），导致SQL执行时间要 1分钟+。

# 查询SQL

select d.type,d.value,e.fraud_type,e.evidence_time,e.evidence_origin,d.uuid,d.refuuid from **evidence_details d** inner join **evidence e** on d.**refuuid**=e.**uuid** order by **gmt_create** desc limit 0,10;

经验教训

只要涉及到SQL查询条件（WHERE、ORDER BY）的相关字段，都应建立索引（唯一索引、联合索引）。

分析过程

1. 核实“SQL的执行时间”

```
select d.type,d.value,e.fraud_type,e.evidence_time,e.evidence_origin,d.uuid,d.refuuid from evidence_details d inner join evidence e on d.refuuid=e.uuid order by gmt_create desc limit 0,10;

.....

10 rows in set (1 min 11.27 sec)
```

哇哦，该条SQL执行时间尽然需要1分11秒，太恐怖啦！！！

2. 分析“该条SQL的查询执行计划”

```
explain select d.type,d.value,e.fraud_type,e.evidence_time,e.evidence_origin,d.uuid,d.refuuid from evidence_details d inner join evidence e on d.refuuid=e.uuid order by gmt_create desc limit 0,10;

+----+-------------+-------+--------+---------------+------+---------+-------------------------+---------+----------------------------------------------+

| id | select_type | table | type   | possible_keys | key  | key_len | ref                     | rows    | Extra                                        |

+----+-------------+-------+--------+---------------+------+---------+-------------------------+---------+----------------------------------------------+

|  1 | SIMPLE      | d     | ALL    | NULL          | NULL | NULL    | NULL                    | 6452641 | Using where; Using temporary; Using filesort |

|  1 | SIMPLE      | e     | eq_ref | uuid          | uuid | 96      | riskbase_core.d.refuuid |       1 | NULL                                         |

+----+-------------+-------+--------+---------------+------+---------+-------------------------+---------+----------------------------------------------+
```

从上面可以看出，查询第一步使用全表扫描（**ALL**），还涉及到临时表和文件排序（**Using where; Using temporary; Using filesort**）。所以，为了提高查询速度，尽量针对相关查询字段（`evidence_details`.`refuuid`、`evidence`.`uuid`、`evidence`.`gmt_create`）建立合理的索引。

3. 查看相应的索引是否创建

```
show index from `riskbase_core`.`evidence`;

+----------+------------+----------+--------------+-------------+-----------+-------------+----------+--------+------+------------+---------+---------------+

| Table    | Non_unique | Key_name | Seq_in_index | Column_name | Collation | Cardinality | Sub_part | Packed | Null | Index_type | Comment | Index_comment |

+----------+------------+----------+--------------+-------------+-----------+-------------+----------+--------+------+------------+---------+---------------+
| evidence |          0 | PRIMARY  |            1 | id          | A         |     6471176 |     NULL | NULL   |      | BTREE      |         |               |
| evidence |          0 | uuid     |            1 | uuid        | A         |     6471176 |     NULL | NULL   |      | BTREE      |         |               |
+----------+------------+----------+--------------+-------------+-----------+-------------+----------+--------+------+------------+---------+---------------+
```

从上面看，`evidence`.`uuid` 字段的索引已创建。还需要创建`evidence`.`gmt_create`字段的索引，创建语句如下：

CREATE INDEX `dex_time` on `riskbase_core`.`evidence` (`gmt_create`);

show index from `riskbase_core`.`evidence_details`;

```
+------------------+------------+-----------+--------------+-------------+-----------+-------------+----------+--------+------+------------+---------+---------------+
| Table            | Non_unique | Key_name  | Seq_in_index | Column_name | Collation | Cardinality | Sub_part | Packed | Null |
Index_type | Comment | Index_comment |
+------------------+------------+-----------+--------------+-------------+-----------+-------------+----------+--------+------+------------+---------+---------------+
| evidence_details |          0 | PRIMARY   |            1 | id          | A         |     6452885 |     NULL | NULL   |      | BTREE      |         |
|
| evidence_details |          0 | uuid      |            1 | uuid        | A         |     6452885 |     NULL | NULL   | YES  | BTREE      |         |
|
| evidence_details |          1 | idx_value |            1 | value       | A         |     6452885 |     NULL | NULL   |      | BTREE      |         |
|
+------------------+------------+-----------+--------------+-------------+-----------+-------------+----------+--------+------+------------+---------+---------------+
```

从上面看，未对`evidence_details`.`refuuid`字段创建索引。所以，需要对`evidence_details`.`refuuid`字段创建索引，创建语句如下：

CREATE INDEX `dex_uuid` on `riskbase_core`.`evidence_details` (`refuuid`);

4. 再次查看“该**SQL**的查询执行计划”

explain select d.type,d.value,e.fraud_type,e.evidence_time,e.evidence_origin,d.uuid,d.refuuid from evidence_details d inner join evidence e on d.refuuid=e.uuid order by gmt_create desc limit 0,10;

```
+----+-------------+-------+-------+---------------+----------+---------+---------------------+------+-------+
| id | select_type | table | type  | possible_keys | key      | key_len | ref                 | rows | Extra |
+----+-------------+-------+-------+---------------+----------+---------+---------------------+------+-------+
|  1 | SIMPLE      | e     | index | uuid          | dex_time | 6       | NULL                |   10 | NULL  |
|  1 | SIMPLE      | d     | ref   | dex_uuid      | dex_uuid | 97      | riskbase_core.e.uuid |    1 | NULL  |
+----+-------------+-------+-------+---------------+----------+---------+---------------------+------+-------+
```

从SQL查询执行计划看，相关索引都使用上了，看起来应该没问题了。现在就用SQL语句测试一下执行时间吧

5. 再次执行该SQL，用“执行时间”来验证优化效果

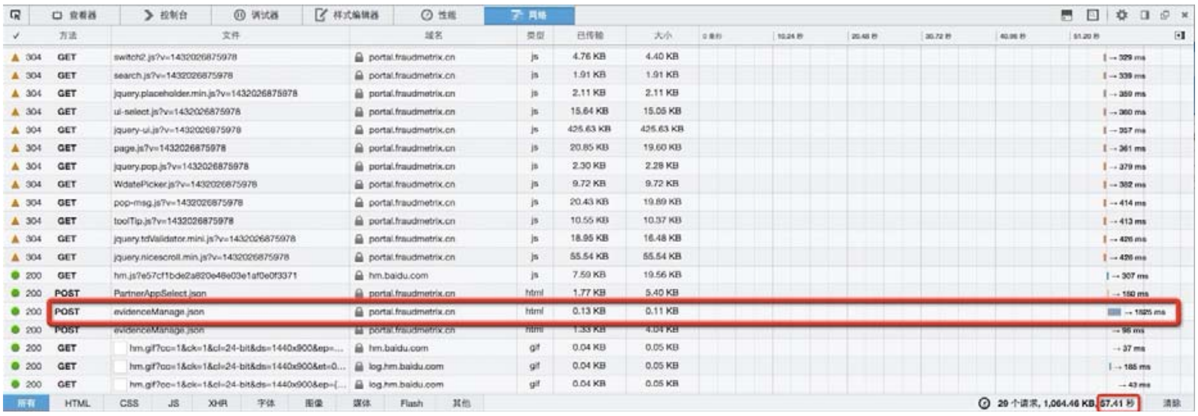
select d.type,d.value,e.fraud_type,e.evidence_time,e.evidence_origin,d.uuid,d.refuuid from evidence_details d inner join evidence e on d.refuuid=e.uuid order by gmt_create desc limit 0,10;   ......

10 rows in set (**0.00 sec**)

好了，从“执行时间”看，问题已彻底修复了。

6. 看一下优化前后，页面的加载效果

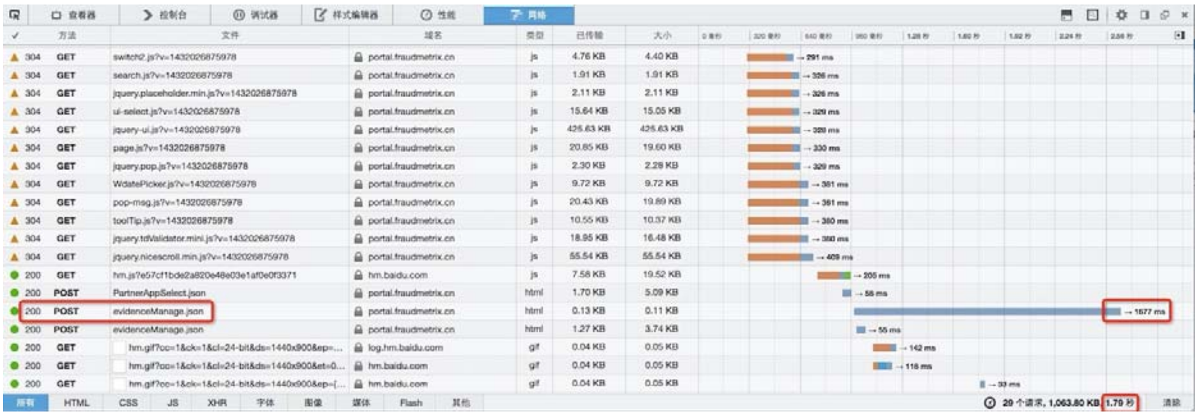
# 优化前 **57.41s**



✓	方法	文件	域名	类型	已传输	大小	0 毫秒 10.24 秒 20.48 秒 30.72 秒 40.96 秒 51.20 秒
▲ 304	GET	switch2.js?v=1432026875978	portal.fraudmetrix.cn	js	4.76 KB	4.40 KB	→ 329 ms
▲ 304	GET	search.js?v=1432026875978	portal.fraudmetrix.cn	js	1.91 KB	1.91 KB	→ 339 ms
▲ 304	GET	jquery.placeholder.min.js?v=1432026875978	portal.fraudmetrix.cn	js	2.11 KB	2.11 KB	→ 359 ms
▲ 304	GET	ui-select.js?v=1432026875978	portal.fraudmetrix.cn	js	15.64 KB	15.05 KB	→ 360 ms
▲ 304	GET	jquery-ui.js?v=1432026875978	portal.fraudmetrix.cn	js	425.63 KB	425.63 KB	→ 357 ms
▲ 304	GET	page.js?v=1432026875978	portal.fraudmetrix.cn	js	20.85 KB	19.60 KB	→ 361 ms
▲ 304	GET	jquery.pop.js?v=1432026875978	portal.fraudmetrix.cn	js	2.30 KB	2.28 KB	→ 379 ms
▲ 304	GET	WdatePicker.js?v=1432026875978	portal.fraudmetrix.cn	js	9.72 KB	9.72 KB	→ 382 ms
▲ 304	GET	pop-msg.js?v=1432026875978	portal.fraudmetrix.cn	js	20.43 KB	19.89 KB	→ 414 ms
▲ 304	GET	toolTip.js?v=1432026875978	portal.fraudmetrix.cn	js	10.55 KB	10.37 KB	→ 413 ms
▲ 304	GET	jquery.tdValidator.mini.js?v=1432026875978	portal.fraudmetrix.cn	js	18.95 KB	16.48 KB	→ 426 ms
▲ 304	GET	jquery.nicescroll.min.js?v=1432026875978	portal.fraudmetrix.cn	js	55.54 KB	55.54 KB	→ 426 ms
● 200	GET	hm.js?e57cf1bde2a820e48e03e1af0e0f3371	hm.baidu.com	js	7.59 KB	19.56 KB	→ 307 ms
● 200	POST	PartnerAppSelect.json	portal.fraudmetrix.cn	html	1.77 KB	5.40 KB	→ 150 ms
● 200	POST	evidenceManage.json	portal.fraudmetrix.cn	html	0.13 KB	0.11 KB	→ 1825 ms
● 200	POST	evidenceManage.json	portal.fraudmetrix.cn	html	1.33 KB	4.04 KB	→ 96 ms
● 200	GET	hm.gif?cc=1&ck=1&cl=24-bit&ds=1440x900&ep=...	hm.baidu.com	gif	0.04 KB	0.05 KB	→ 37 ms
● 200	GET	hm.gif?cc=1&ck=1&cl=24-bit&ds=1440x900&et=0...	log.hm.baidu.com	gif	0.04 KB	0.05 KB	→ 185 ms
● 200	GET	hm.gif?cc=1&ck=1&cl=24-bit&ds=1440x900&ep=[...	log.hm.baidu.com	gif	0.04 KB	0.05 KB	→ 43 ms

20 个请求, 1,064.46 KB, 57.41 秒

# 优化后 **1.79s**



✓	方法	文件	域名	类型	已传输	大小	0 毫秒 320 毫秒 640 毫秒 960 毫秒 1.28 秒 1.60 秒 1.92 秒 2.24 秒 2.56 秒
▲ 304	GET	switch2.js?v=1432026875978	portal.fraudmetrix.cn	js	4.76 KB	4.40 KB	→ 291 ms
▲ 304	GET	search.js?v=1432026875978	portal.fraudmetrix.cn	js	1.91 KB	1.91 KB	→ 326 ms
▲ 304	GET	jquery.placeholder.min.js?v=1432026875978	portal.fraudmetrix.cn	js	2.11 KB	2.11 KB	→ 326 ms
▲ 304	GET	ui-select.js?v=1432026875978	portal.fraudmetrix.cn	js	15.64 KB	15.05 KB	→ 329 ms
▲ 304	GET	jquery-ui.js?v=1432026875978	portal.fraudmetrix.cn	js	425.63 KB	425.63 KB	→ 328 ms
▲ 304	GET	page.js?v=1432026875978	portal.fraudmetrix.cn	js	20.85 KB	19.60 KB	→ 330 ms
▲ 304	GET	jquery.pop.js?v=1432026875978	portal.fraudmetrix.cn	js	2.30 KB	2.28 KB	→ 329 ms
▲ 304	GET	WdatePicker.js?v=1432026875978	portal.fraudmetrix.cn	js	9.72 KB	9.72 KB	→ 361 ms
▲ 304	GET	pop-msg.js?v=1432026875978	portal.fraudmetrix.cn	js	20.43 KB	19.89 KB	→ 361 ms
▲ 304	GET	toolTip.js?v=1432026875978	portal.fraudmetrix.cn	js	10.55 KB	10.37 KB	→ 360 ms
▲ 304	GET	jquery.tdValidator.mini.js?v=1432026875978	portal.fraudmetrix.cn	js	18.95 KB	16.48 KB	→ 360 ms
▲ 304	GET	jquery.nicescroll.min.js?v=1432026875978	portal.fraudmetrix.cn	js	55.54 KB	55.54 KB	→ 409 ms
● 200	GET	hm.js?e57cf1bde2a820e48e03e1af0e0f3371	hm.baidu.com	js	7.58 KB	19.52 KB	→ 205 ms
● 200	POST	PartnerAppSelect.json	portal.fraudmetrix.cn	html	1.70 KB	5.09 KB	→ 58 ms
● 200	POST	evidenceManage.json	portal.fraudmetrix.cn	html	0.13 KB	0.11 KB	→ 1677 ms
● 200	POST	evidenceManage.json	portal.fraudmetrix.cn	html	1.27 KB	3.74 KB	→ 55 ms
● 200	GET	hm.gif?cc=1&ck=1&cl=24-bit&ds=1440x900&ep=...	log.hm.baidu.com	gif	0.04 KB	0.05 KB	→ 142 ms
● 200	GET	hm.gif?cc=1&ck=1&cl=24-bit&ds=1440x900&et=0...	hm.baidu.com	gif	0.04 KB	0.05 KB	→ 118 ms
● 200	GET	hm.gif?cc=1&ck=1&cl=24-bit&ds=1440x900&ep=[...	hm.baidu.com	gif	0.04 KB	0.05 KB	→ 33 ms

20 个请求, 1,063.80 KB, 1.79 秒

页面加载时间，从优化前的 57.41s 降低到 1.79s。

但可能细心的朋友已经发现，优化后 evidenceManage.json 的响应时间还需要 1.677s，而上面那条SQL的执行时间已经降低到10ms之内。那其它的时间都消耗在哪里啦？

其它故事

其实 evidenceManage.json 接口除了执行上面那条SQL语句，**还执行了一条count(*)的SQL语句**。而正是**count(*) SQL语句耗时了 1.67s**，哦哦，原来这里还有其它故事啊～～～

# 总行数统计

select **count(*)** from evidence_details

但通过对“**count(*) SQL语句**”的**查询执行计划**的分析，发现对于InnoDB引擎（**14.2 InnoDB Concepts and Architecture**），很难对此再优化了。

（**建议**：有count(*)相关的操作，数据表的存储引擎（ENGINE）尽量设计为**MyISAM**（**15.2 The MyISAM Storage Engine**），除非该表涉及及**事务**操作！）

总结

针对 InnoDB 存储引擎：

- 索引（**index**）**查询类型**的查询要快于范围（**range**）查询类型
- 二级索引（**dex_uuid**）类型的查询要快于主键索引（**PRIMARY**）类型

参考

[MySQL FAQ系列] 为何 InnoDB 表 select count(*) 很慢 -- 叶金荣(yejr)

[InnoDB系列] InnoDB 表如何更快得到 count(*) 结果 -- 叶金荣(yejr)

分析过程

```
mysql> explain select count(*) from evidence_details \G
*************************** 1. row ***************************
           id: 1
  select_type: SIMPLE
        table: evidence_details
         type: index
possible_keys: NULL
          key: dex_uuid
      key_len: 97
          ref: NULL
         rows: 6479241
        Extra: Using index
1 row in set (0.00 sec)

mysql> select count(*) from evidence_details \G
*************************** 1. row ***************************
count(*): 7640484
1 row in set (1.67 sec)

mysql> explain select count(*) from evidence_details where id >= 0 \G
*************************** 1. row ***************************
           id: 1
  select_type: SIMPLE
        table: evidence_details
         type: range
possible_keys: PRIMARY
          key: PRIMARY
      key_len: 8
          ref: NULL
         rows: 3239629
        Extra: Using where; Using index
1 row in set (0.00 sec)

mysql> select count(*) from evidence_details where id >= 0 \G
*************************** 1. row ***************************
```

```
count(*): 7640505
1 row in set (2.51 sec)

mysql> explain select count(id) from evidence_details \G
*************************** 1. row ***************************
           id: 1
  select_type: SIMPLE
        table: evidence_details
         type: index
possible_keys: NULL
          key: dex_uuid
      key_len: 97
          ref: NULL
         rows: 6479287
        Extra: Using index
1 row in set (0.00 sec)

mysql> select count(id) from evidence_details \G
*************************** 1. row ***************************
count(id): 7640530
1 row in set (1.83 sec)

mysql> explain select count(id) from evidence_details where id >= 0 \G
*************************** 1. row ***************************
           id: 1
  select_type: SIMPLE
        table: evidence_details
         type: range
possible_keys: PRIMARY
          key: PRIMARY
      key_len: 8
          ref: NULL
         rows: 3239652
        Extra: Using where; Using index
1 row in set (0.00 sec)

mysql> select count(id) from evidence_details where id >= 0 \G
*************************** 1. row ***************************
count(id): 7640547
1 row in set (2.64 sec)
```

```
mysql> explain select count(`uuid`) from evidence_details \G
*************************** 1. row ***************************
           id: 1
  select_type: SIMPLE
        table: evidence_details
         type: index
possible_keys: NULL
          key: uuid
      key_len: 99
          ref: NULL
         rows: 6479323
        Extra: Using index
1 row in set (0.00 sec)

mysql> select count(`uuid`) from evidence_details \G
*************************** 1. row ***************************
count(`uuid`): 7640564
1 row in set (2.20 sec)

mysql> explain select count(`uuid`) from evidence_details where id >= 0 \G
*************************** 1. row ***************************
           id: 1
  select_type: SIMPLE
        table: evidence_details
         type: range
possible_keys: PRIMARY
          key: PRIMARY
      key_len: 8
          ref: NULL
         rows: 3239705
        Extra: Using where
1 row in set (0.00 sec)

mysql> select count(`uuid`) from evidence_details where id >= 0 \G
*************************** 1. row ***************************
count(`uuid`): 7640657
1 row in set (3.13 sec)

mysql> explain select count(`refuuid`) from evidence_details \G
```

```
*************************** 1. row ***************************
           id: 1
  select_type: SIMPLE
        table: evidence_details
         type: index
possible_keys: NULL
          key: dex_uuid
      key_len: 97
          ref: NULL
         rows: 6479554
        Extra: Using index
1 row in set (0.00 sec)

mysql> select count(`refuuid`) from evidence_details \G
*************************** 1. row ***************************
count(`refuuid`): 7640812
1 row in set (2.09 sec)

mysql> explain select count(`refuuid`) from evidence_details where id >= 0 \G
*************************** 1. row ***************************
           id: 1
  select_type: SIMPLE
        table: evidence_details
         type: range
possible_keys: PRIMARY
          key: PRIMARY
      key_len: 8
          ref: NULL
         rows: 3239794
        Extra: Using where
1 row in set (0.00 sec)

mysql> select count(`refuuid`) from evidence_details where id >= 0 \G
*************************** 1. row ***************************
count(`refuuid`): 7640852

1 row in set (3.31 sec)
```