链滴

postgresql 数据库单表查询时，不同数据量以及查询 sql 分析

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最近项目遇到了一个单表查询慢的情况，需要优化。原因是group by 和limit一起用的时候索引不生，我的解决方法是用子查询，这样索引生效了，查询速度也变快了。

于是我又做了一些其他的测试，这里记录一下我测试分析的过程。ps:懒得造数据了，表名我打马赛克了

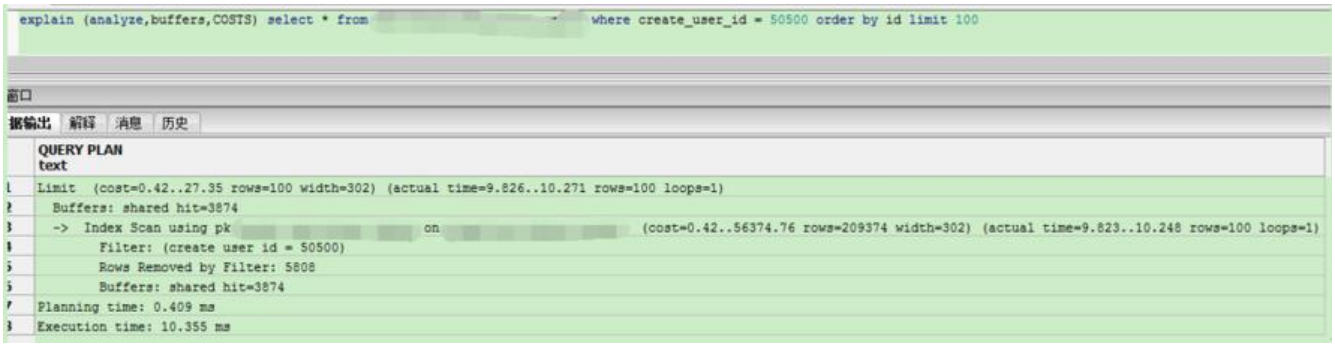
1.因为查询条件需要create_user_id（有btree索引），所以先对表的create_user_id进行分组统计条数

```
select create_user_id,count(*) as user_count from mytable group by create_user_id
ORDER BY user_count desc
```

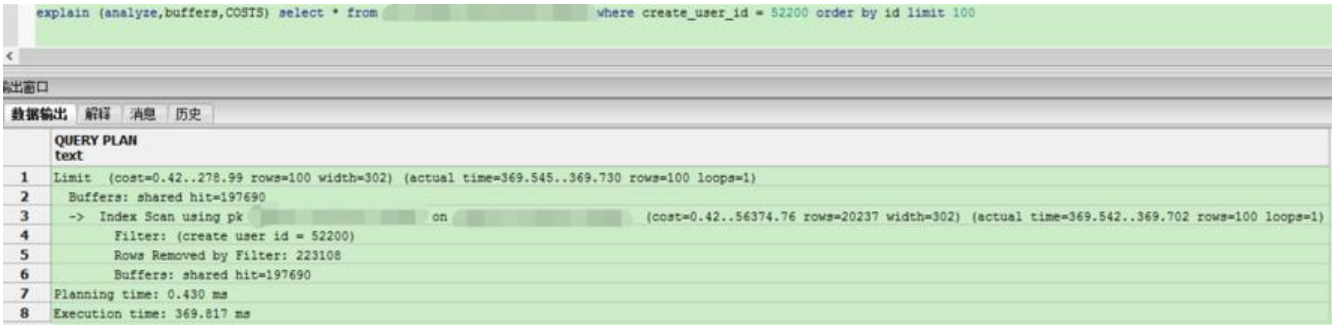
create_user_id	user_count
50500	209123
52200	20166
(Null)	7756
51800	2301
51550	1331
50250	982

取50500,52200,51800的数据查询

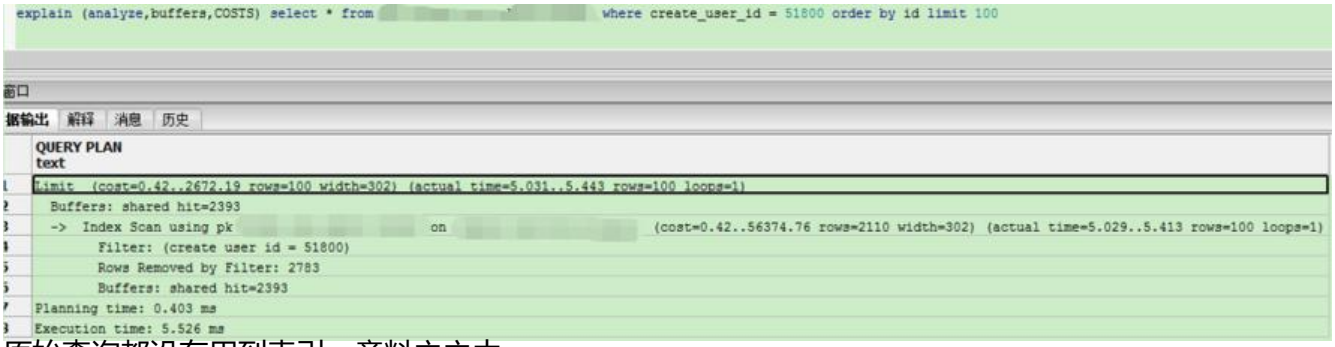
2.直接查询



```
explain (analyze,buffers,COSTS) select * from  where create_user_id = 50500 order by id limit 100

窗口
据输出 | 解释 | 消息 | 历史

QUERY PLAN
text
Limit  (cost=0.42..27.35 rows=100 width=302) (actual time=9.826..10.271 rows=100 loops=1)
  Buffers: shared hit=3874
  ->  Index Scan using pk  on  (cost=0.42..56374.76 rows=209374 width=302) (actual time=9.823..10.248 rows=100 loops=1)
        Filter: (create user id = 50500)
        Rows Removed by Filter: 5808
        Buffers: shared hit=3874
Planning time: 0.409 ms
Execution time: 10.355 ms
```



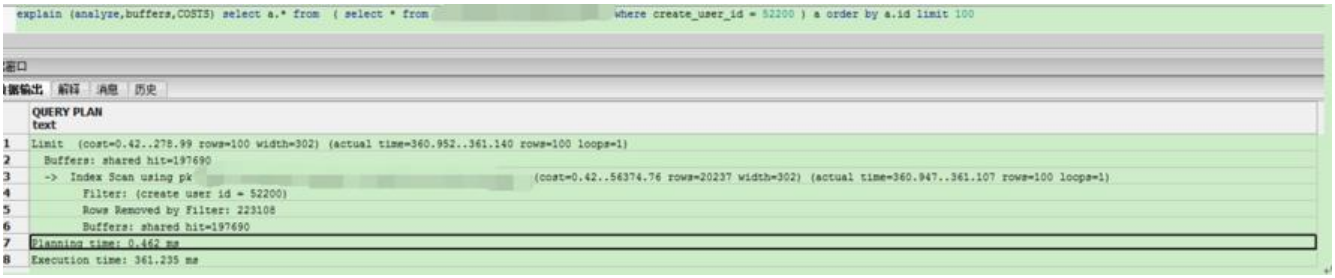
```
explain (analyze,buffers,COSTS) select * from  where create_user_id = 52200 order by id limit 100

出窗口
数据输出 | 解释 | 消息 | 历史

QUERY PLAN
text
1  Limit  (cost=0.42..278.99 rows=100 width=302) (actual time=369.545..369.730 rows=100 loops=1)
2    Buffers: shared hit=197690
3    ->  Index Scan using pk  on  (cost=0.42..56374.76 rows=20237 width=302) (actual time=369.542..369.702 rows=100 loops=1)
4          Filter: (create user id = 52200)
5          Rows Removed by Filter: 223108
6          Buffers: shared hit=197690
7  Planning time: 0.430 ms
8  Execution time: 369.817 ms
```



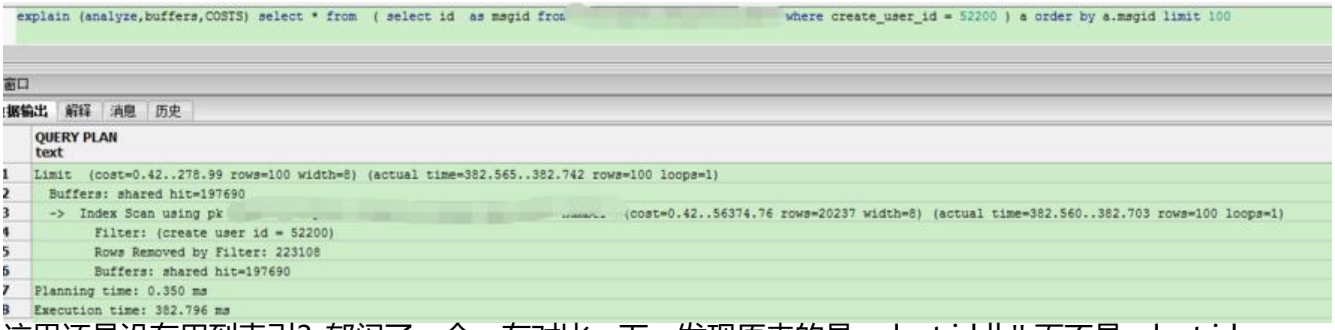
```
explain (analyze,buffers,COSTS) select * from  where create_user_id = 51800 order by id limit 100

窗口
据输出 | 解释 | 消息 | 历史

QUERY PLAN
text
Limit  (cost=0.42..2672.19 rows=100 width=302) (actual time=5.031..5.443 rows=100 loops=1)
  Buffers: shared hit=2393
  ->  Index Scan using pk  on  (cost=0.42..56374.76 rows=2110 width=302) (actual time=5.029..5.413 rows=100 loops=1)
        Filter: (create user id = 51800)
        Rows Removed by Filter: 2783
        Buffers: shared hit=2393
Planning time: 0.403 ms
Execution time: 5.526 ms
```

原始查询都没有用到索引，意料之之中

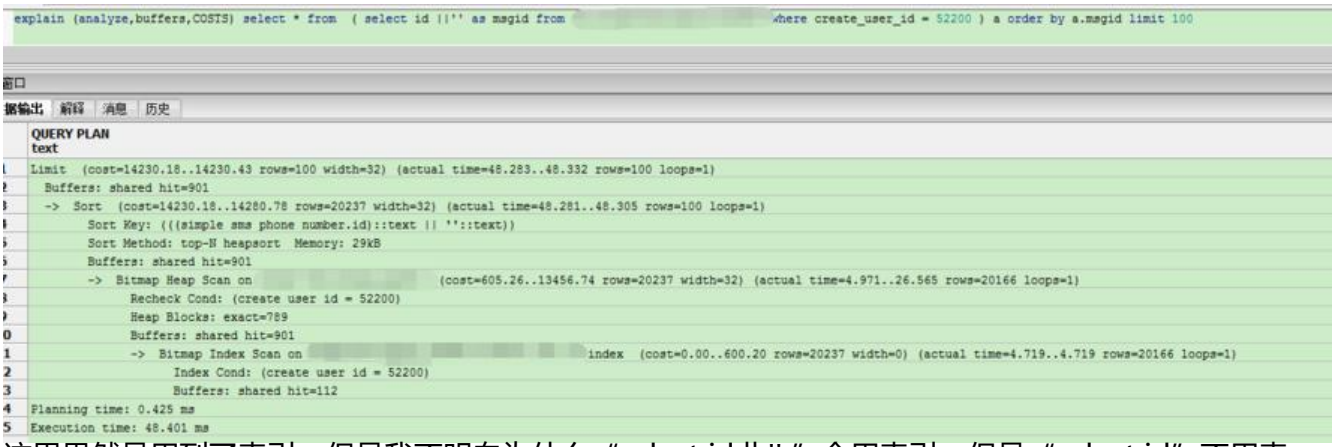
3.子查询



关于这个问题我就是用子查询解决的，但是这里却没有用到索引？？？于是我对比了我解决问题的sq和这个sql的不同，发现我这里是用了select *，于是



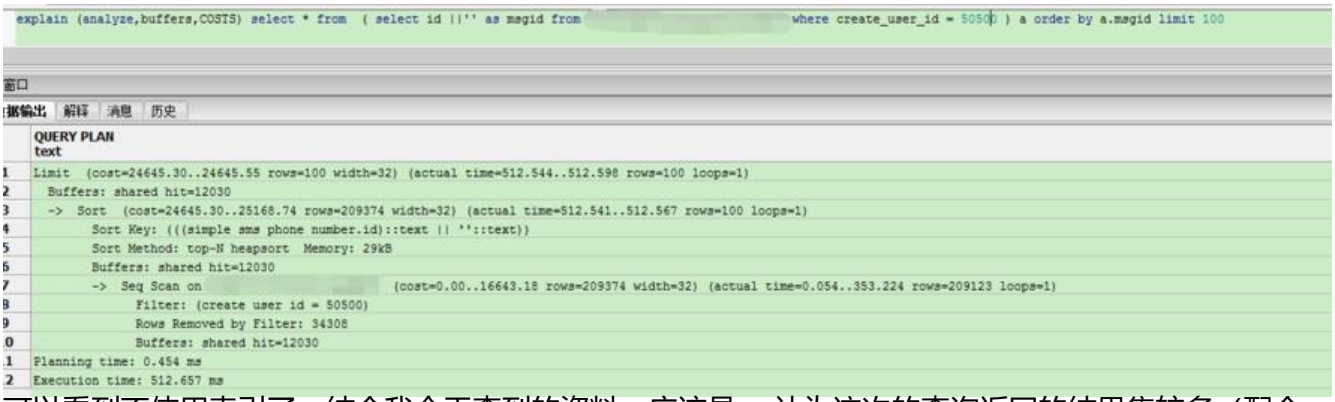
这里还是没有用到索引？郁闷了一会，在对比一下。发现原来的是 select id || '' 而不是select id，是



这里果然是用到了索引，但是我不明白为什么“select id || '' ” 会用索引，但是“select id”不用索，网上资料说是pg在查询时有自己一套策略，会根据当前sql情况决定执行方式。但是我不懂这里明用了索引更快了才对，而且我拼接空字符串应该也要额外消耗吧。可是结果反而是更快了，

lushed 。

继续测试，还是这个sql，id换成50500



```
explain (analyze,buffers,COSTS) select * from  ( select id ||'' as msgid from [illegible] where create_user_id = 50500 ) a order by a.msgid limit 100
```

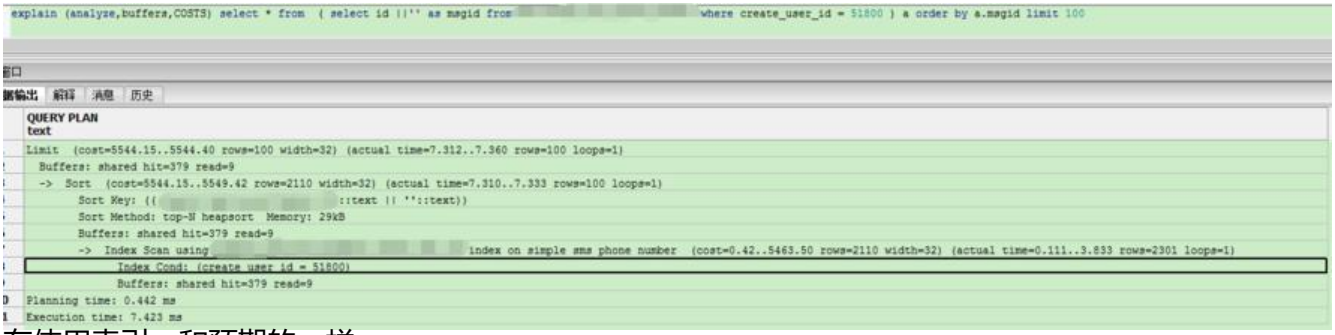
窗口

据输出 | 解释 | 消息 | 历史

```
QUERY PLAN
text
Limit  (cost=24645.30..24645.55 rows=100 width=32) (actual time=512.544..512.598 rows=100 loops=1)
  Buffers: shared hit=12030
  ->  Sort  (cost=24645.30..25168.74 rows=209374 width=32) (actual time=512.541..512.567 rows=100 loops=1)
        Sort Key: (((simple sms phone number.id)::text || ''::text))
        Sort Method: top-N heapsort  Memory: 29kB
        Buffers: shared hit=12030
        ->  Seq Scan on [illegible]  (cost=0.00..16643.18 rows=209374 width=32) (actual time=0.054..353.224 rows=209123 loops=1)
              Filter: (create user id = 50500)
              Rows Removed by Filter: 34308
              Buffers: shared hit=12030
Planning time: 0.454 ms
Execution time: 512.657 ms
```

可以看到不使用索引了，结合我今天查到的资料，应该是pg认为这次的查询返回的结果集较多（配合一张图看），因此不使用索引。

id用51800替换再试试



```
explain (analyze,buffers,COSTS) select * from  ( select id ||'' as msgid from [illegible] where create_user_id = 51800 ) a order by a.msgid limit 100
```

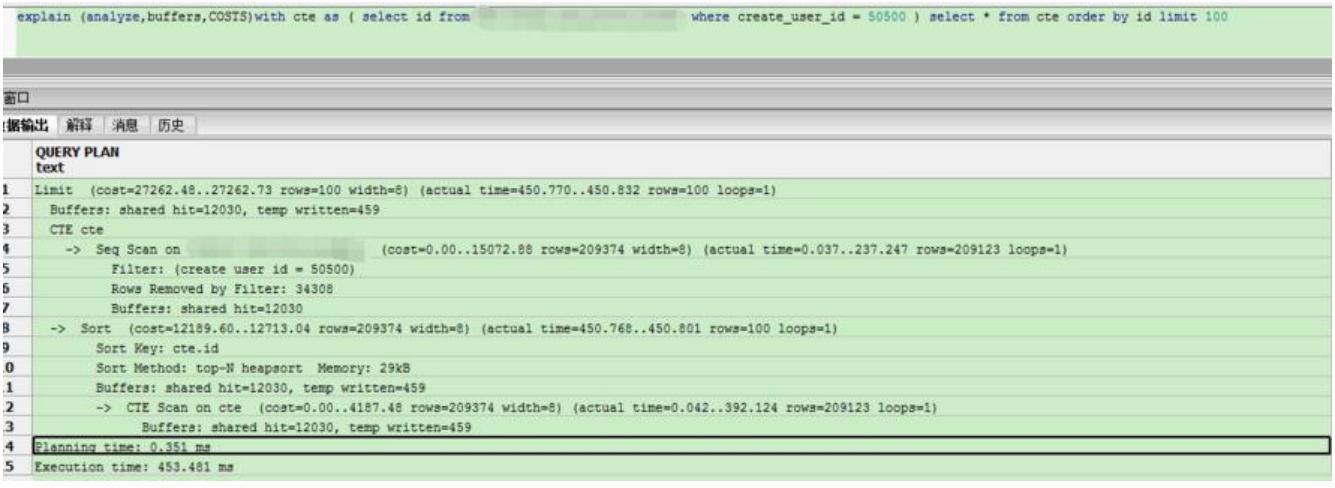
窗口

据输出 | 解释 | 消息 | 历史

```
QUERY PLAN
text
Limit  (cost=5544.15..5544.40 rows=100 width=32) (actual time=7.312..7.360 rows=100 loops=1)
  Buffers: shared hit=379 read=9
  ->  Sort  (cost=5544.15..5549.42 rows=2110 width=32) (actual time=7.310..7.333 rows=100 loops=1)
        Sort Key: ((  [illegible]  ::text || ''::text))
        Sort Method: top-N heapsort  Memory: 29kB
        Buffers: shared hit=379 read=9
        ->  Index Scan using [illegible] index on simple sms phone number  (cost=0.42..5463.50 rows=2110 width=32) (actual time=0.111..3.833 rows=2301 loops=1)
              Index Cond: (create user id = 51800)
              Buffers: shared hit=379 read=9
Planning time: 0.442 ms
Execution time: 7.423 ms
```

有使用索引，和预期的一样

4.用with语句

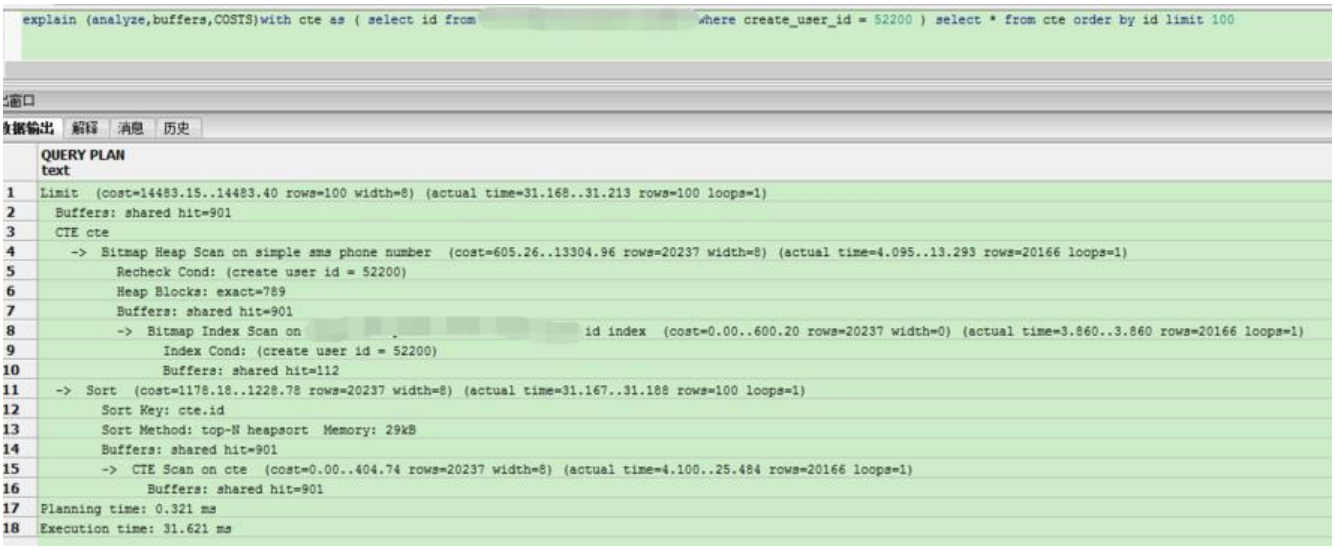


```
explain (analyze,buffers,COSTS)with cte as ( select id from [illegible] where create_user_id = 50500 ) select * from cte order by id limit 100
```

窗口

据输出 | 解释 | 消息 | 历史

```
QUERY PLAN
text
Limit  (cost=27262.48..27262.73 rows=100 width=8) (actual time=450.770..450.832 rows=100 loops=1)
  Buffers: shared hit=12030, temp written=459
  CTE cte
    ->  Seq Scan on [illegible]  (cost=0.00..15072.88 rows=209374 width=8) (actual time=0.037..237.247 rows=209123 loops=1)
          Filter: (create user id = 50500)
          Rows Removed by Filter: 34308
          Buffers: shared hit=12030
  ->  Sort  (cost=12189.60..12713.04 rows=209374 width=8) (actual time=450.768..450.801 rows=100 loops=1)
        Sort Key: cte.id
        Sort Method: top-N heapsort  Memory: 29kB
        Buffers: shared hit=12030, temp written=459
        ->  CTE Scan on cte  (cost=0.00..4187.48 rows=209374 width=8) (actual time=0.042..392.124 rows=209123 loops=1)
              Buffers: shared hit=12030, temp written=459
Planning time: 0.351 ms
Execution time: 453.481 ms
```

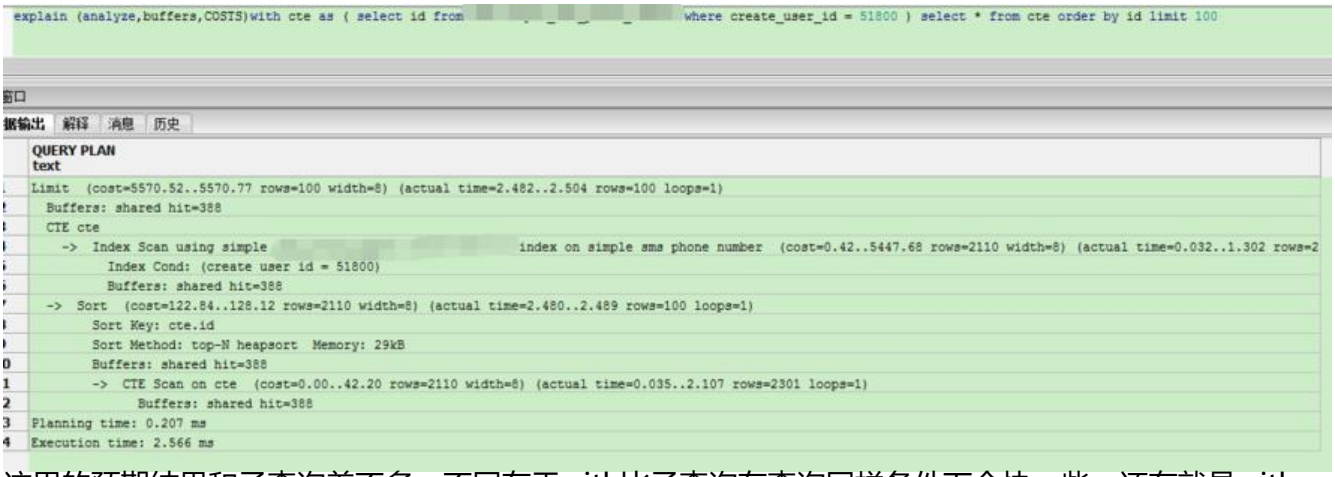


```
explain (analyze,buffers,COSTS)with cte as ( select id from [illegible] where create_user_id = 52200 ) select * from cte order by id limit 100
```

窗口

据输出 | 解释 | 消息 | 历史

```
QUERY PLAN
text
Limit  (cost=14483.15..14483.40 rows=100 width=8) (actual time=31.168..31.213 rows=100 loops=1)
  Buffers: shared hit=901
  CTE cte
    ->  Bitmap Heap Scan on simple sms phone number  (cost=605.26..13304.96 rows=20237 width=8) (actual time=4.095..13.293 rows=20166 loops=1)
          Recheck Cond: (create user id = 52200)
          Heap Blocks: exact=789
          Buffers: shared hit=901
          ->  Bitmap Index Scan on [illegible] id index  (cost=0.00..600.20 rows=20237 width=0) (actual time=3.860..3.860 rows=20166 loops=1)
                Index Cond: (create user id = 52200)
                Buffers: shared hit=112
  ->  Sort  (cost=1178.18..1228.78 rows=20237 width=8) (actual time=31.167..31.188 rows=100 loops=1)
        Sort Key: cte.id
        Sort Method: top-N heapsort  Memory: 29kB
        Buffers: shared hit=901
        ->  CTE Scan on cte  (cost=0.00..404.74 rows=20237 width=8) (actual time=4.100..25.484 rows=20166 loops=1)
              Buffers: shared hit=901
Planning time: 0.321 ms
Execution time: 31.621 ms
```



```
explain (analyze,buffers,COSTS)with cte as ( select id from [illegible] where create_user_id = 51800 ) select * from cte order by id limit 100
```

窗口

据输出 | 解释 | 消息 | 历史

```
QUERY PLAN
text
Limit  (cost=5570.52..5570.77 rows=100 width=8) (actual time=2.482..2.504 rows=100 loops=1)
  Buffers: shared hit=388
  CTE cte
    ->  Index Scan using simple [illegible] index on simple sms phone number  (cost=0.42..5447.68 rows=2110 width=8) (actual time=0.032..1.302 rows=2
          Index Cond: (create user id = 51800)
          Buffers: shared hit=388
  ->  Sort  (cost=122.84..128.12 rows=2110 width=8) (actual time=2.480..2.489 rows=100 loops=1)
        Sort Key: cte.id
        Sort Method: top-N heapsort  Memory: 29kB
        Buffers: shared hit=388
        ->  CTE Scan on cte  (cost=0.00..42.20 rows=2110 width=8) (actual time=0.035..2.107 rows=2301 loops=1)
              Buffers: shared hit=388
Planning time: 0.207 ms
Execution time: 2.566 ms
```

这里的预期结果和子查询差不多，不同在于with比子查询在查询同样条件下会快一些。还有就是with查询不能用“select id || ''，会报错。

最后我的结论是：

1.pg的group by 和limit 共用的时候确实会导致索引不生效，可以用子查询或者with语句解决

2.pg的sql执行策略决定是否使用索引的因素有很多，比如返回结果集占该表百分比的大小（试过在他数据库数测试测试返回结果集也是20多万但是占总表百分比没这么大，也用了索引），select部分容的写法（这里我并不理解为什么）以及其他。