slowlog 慢查询, generall log SQL

server —— binlog 主从复制

engine ⇒ innodb —— undo | 内存
                    redo   磁盘 ⇐

T
| 1 | a a q
| 2 | b b X X X
| 3 | c c c
      ① Insert   回志 undo insert undolog
                          ✓ update undolog
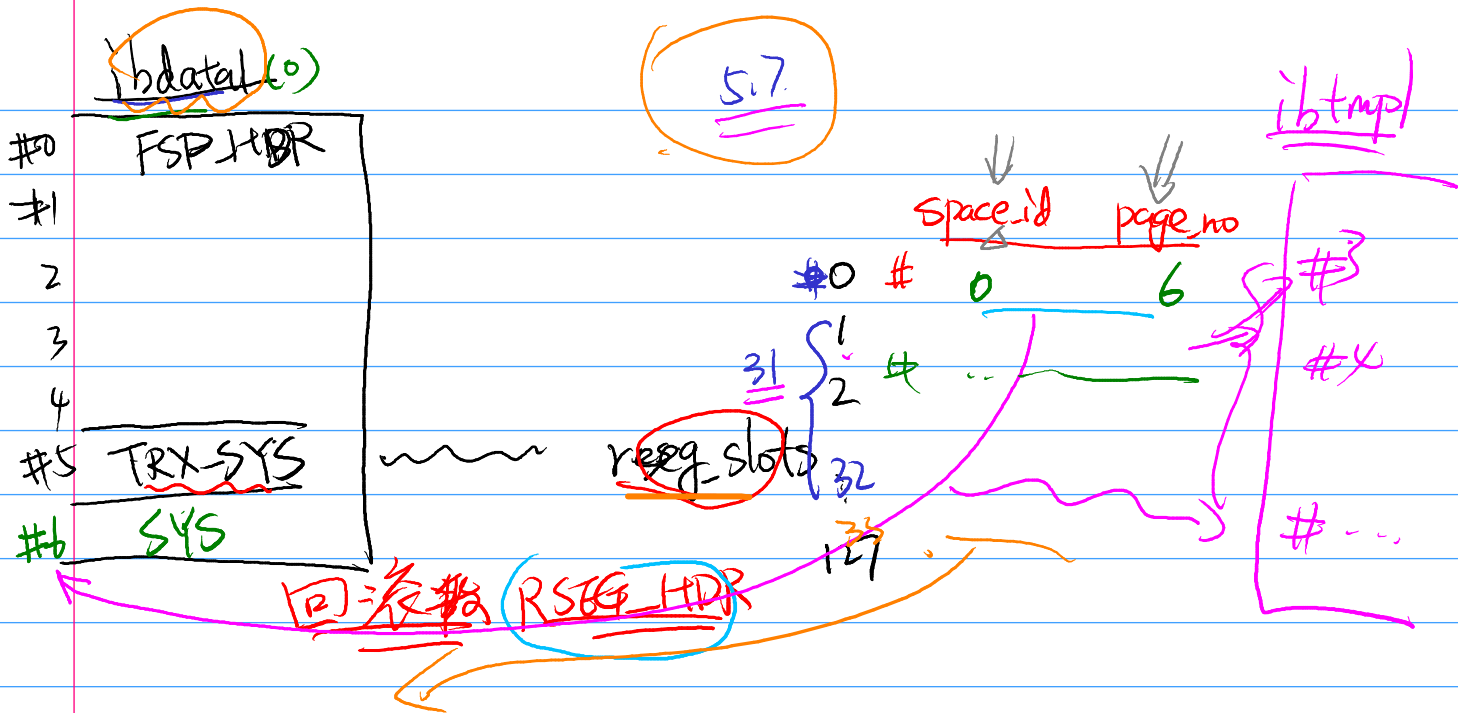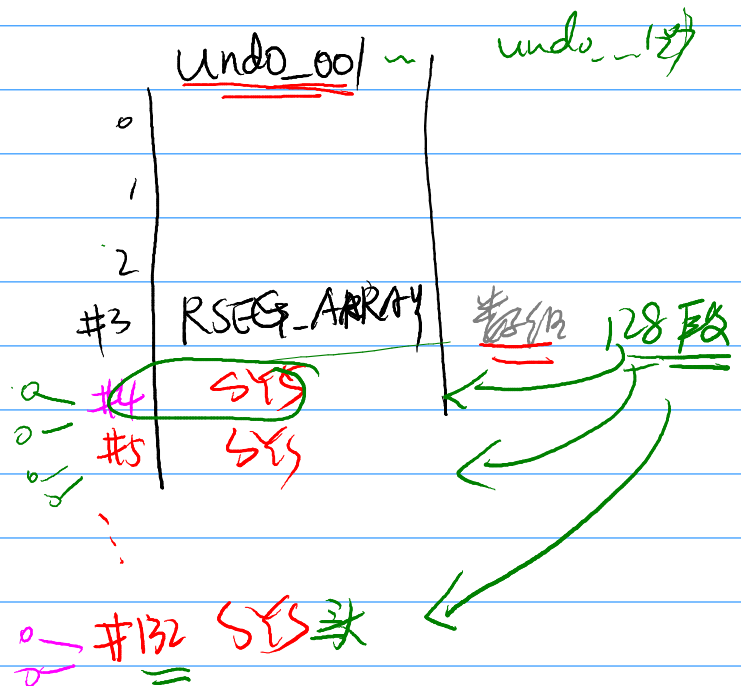
WAL
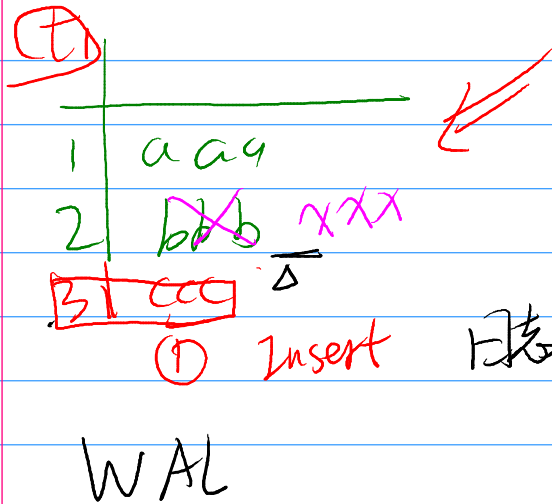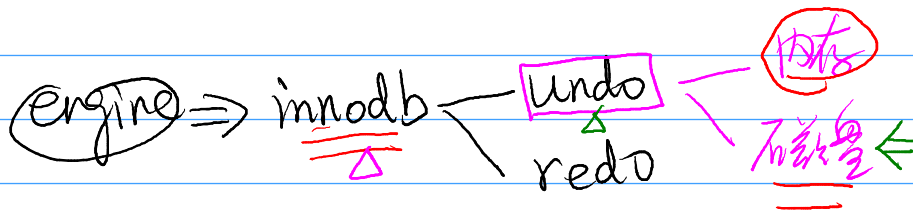
8.0X   回滚路头   RSEG_HDR

```
mysql/data » ibr undo 001 list -l 15
page_no=0, page_type=FSP_HDR, space_id=UndoSpace(1), lsn=3902692189, offset=0x0(0)
page_no=1, page_type=IBUF_BITMAP, space_id=UndoSpace(1), lsn=8213, offset=0x4000(16384)
page_no=2, page_type=INODE, space_id=UndoSpace(1), lsn=436780744, offset=0x8000(32768)
page_no=3, page_type=RSEG_ARRAY, space_id=UndoSpace(1), lsn=1239571, offset=0xc000(49152)
page_no=4, page_type=SYS, space_id=UndoSpace(1), lsn=3902713249, offset=0x10000(65536)
page_no=5, page_type=SYS, space_id=UndoSpace(1), lsn=3902713287, offset=0x14000(81920)
page_no=6, page_type=SYS, space_id=UndoSpace(1), lsn=3902713325, offset=0x18000(98304)
page_no=7, page_type=SYS, space_id=UndoSpace(1), lsn=3068606270, offset=0x1c000(114688)
page_no=8, page_type=SYS, space_id=UndoSpace(1), lsn=3068606616, offset=0x20000(131072)
page_no=9, page_type=SYS, space_id=UndoSpace(1), lsn=2100497087, offset=0x24000(147456)
page_no=10, page_type=SYS, space_id=UndoSpace(1), lsn=3902094138, offset=0x28000(163840)
page_no=11, page_type=SYS, space_id=UndoSpace(1), lsn=3902409545, offset=0x2c000(180224)
page_no=12, page_type=SYS, space_id=UndoSpace(1), lsn=3902713379, offset=0x30000(196608)
page_no=13, page_type=SYS, space_id=UndoSpace(1), lsn=3902409621, offset=0x34000(212992)
page_no=14, page_type=SYS, space_id=UndoSpace(1), lsn=3902715338, offset=0x38000(229376)
```

Undo_001
3 Undo_00r

ibdata1 (0)

517

ibtmp1

#0	FSP HDR
#1	
2	
3	
4	
#5	TRX-SYS
#6	SYS

space_id   page_no
#0   #   0   6

31 { 1 2 ... } 32
reeg_slots

33
127

回滚段 RSEG_HDR

#3
#4
#...

```
mysql-home 8.0.37/data » ibr undo_001 view 3
BasePage {
    addr: 0x0000@(0),
    fil_hdr: FilePageHeader {
        addr: 0x0000@(0),
        check_sum: 0x09d1f351(164754257),
        page_no: 3,
        prev_page: 0x00000000(0),
        next_page: 0x00000000(0),
        lsn: 0x000000000012ea13(1239571),
        page_type: RSEG_ARRAY,
        flush_lsn: 0x0000000000000000(0),
        space_id: UndoSpace(1),
    },
    page_body: RSegArrayPageBody {
        addr: 0x0026@(38),
        rseg_version: 1,
        rseg_arr_size: 0,
        fseg_hdr: FSegHeader {
            addr: 0x002e@(46),
            space_id: UndoSpace(1),
            page_no: 2,
            offset: 50,
        },
        arr_slots: [
            (0, Page(4)),
            (1, Page(5)),
            (2, Page(6)),
            (3, Page(7)),
```

12页 Page(130)

Undo_001 ~   undo_~127

0	
1	
2	
#3	RSEG_ARRAY
#4	SYS
#5	SYS

128段   128页

#132 SYS头

$128 \times 128 \times 1024$

RSEG

```
mysql-home-8.0.37/data » ibr undo_001 view 4
BasePage {
    addr: 0x0000@(0),
    fil_hdr: FilePageHeader {
        addr: 0x0000@(0),
        check_sum: 0xfe46eb52(4266060626),
        page_no: 4,
        prev_page: 0x00000000(0),
        next_page: 0x00000000(0),
        lsn: 0x00000000e89eada1(3902713249),
        page_type: SYS,
        flush_lsn: 0x0000000000000000(0),
        space_id: UndoSpace(1),
    },
    page_body: RSegHeaderPageBody {
        addr: 0x0026@(38),
        rseg_hdr: RollbackSegmentHeader {
            addr: 0x0026@(38),
            max_size: 4294967294,
            history_size: 0,
            history_flst: FlstBaseNode {
                addr: 0x002e@(46),
                len: 0,
                first: FilAddr { addr: 0x0032@(50), page_no: None, boffset: 0 },
                last: FilAddr { addr: 0x0038@(56), page_no: None, boffset: 0 },
            },
            fseg_hdr: FSegHeader {
                addr: 0x003e@(62),
                space_id: UndoSpace(1),
                page_no: 2,
                offset: 242,
            },
        },
        undo_slots: [                    1024
            (0, Page(490)),
            (1, Page(461)),
        ],
    },
    fil_trl: FilePageTrailer {
        addr: 0x3ff8@(16376),
        check_sum: 0xfe46eb52(4266060626),
        lsn_low32bit: 0xe89eada1(3902713249),
    },
},
```
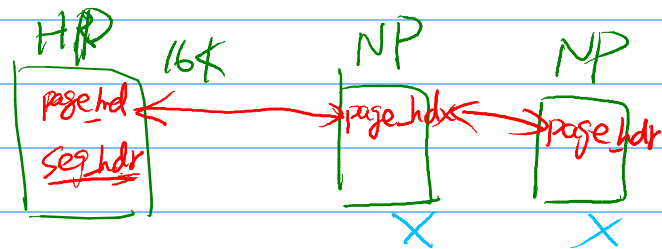
Insert ⟹ UndoLog **490**

update ⟹ UndoLog **461**

#490

```
mysql-home-8.0.37/data » ibr undo_001 view 490
BasePage {
    addr: 0x0000@(0),
    fil_hdr: FilePageHeader {
        addr: 0x0000@(0),
        check_sum: 0xec2405e9(3961783785),
        page_no: 490,
        prev_page: 0x00000000(0),
        next_page: 0x00000000(0),
        lsn: 0x00000000e89eada1(3902713249),
        page_type: UNDO_LOG,
        flush_lsn: 0x0000000000000000(0),
        space_id: UndoSpace(1),
    },
    page_body: UndoLogPageBody {
        addr: 0x0026@(38),
        undo_page_hdr: UndoPageHeader {
            addr: 0x0026@(38),
            page_type: TRX_UNDO_UPDATE,
            page_start: 7153,
            page_free: 7220,
            page_node: FlstNode {
                addr: 0x002c@(44),
```

HP   16K   NP   NP

page hdr ← page hdr ← page hdr

seg hdr

HP

Undo undo_log

undo_page_hdr → ← page_stat
page_free

undo_seg_hdr

数据 { undo_log_hdr
undo_rec[0]
[1]

undo_rec_list

undo_log_hdr

undo_rec_list ←

log_start

undo_log_hdr = log_start

undo_rec_list ← undo_rec[0]
undo_rec[n]

undo_rec[0]
next

next

```
UndoLog {
        addr: 0x1af6@(6902),
        undo_log_hdr: UndoLogHeader {
            addr: 0x1af6@(6902),
            trx_id: 5800705,
            trx_no: 5800706,
            del_marks: 0,
            log_start: 7153,
            undo_flags: [],
            dict_trans: 1,
            table_id: 0,
            next_log: 0,
            prev_log: 6584,
            history_node: FlstNode {
                addr: 0x1b18@(6936),
                prev: FilAddr { addr: 0x1b18@(6936), page_no: None, boffset: 0 },
                next: FilAddr { addr: 0x1b1e@(6942), page_no: None, boffset: 0 },
            },
            xa_trx_info: None,
        },
```

Undo Rec

next_rec_offset(2)

undo_no

tax_id

prev_rec_offset

UR[0]

next_rec-offset
undo_no
=table

prev_rec_offset

UR[1]