

UNDO TRANSACTION SLOT 被覆盖引起 ORA-01555 的 原理解析

BY SHOUG. 崔宏慧

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SHANGHAI ORACLE USERS GROUP

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SHOUG的全称是ShangHai Oracle Users Group, 中文为上海Oracle用户组。SHOUG的成员仅仅局限于上海地区吗? 上海是国际化大都市, 我们将以上海为中心, 提升华东地区的Oracle技术氛围, 举办一系列的Oracle技术分享活动。实际上我们欢迎 ...

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undo transaction slot 被覆盖引起 ORA-01555 的原理解析

测试环境：oracle 11gR2 Restart

测试目的：模拟 undo header 事务表槽被覆盖引起 ORA-01555 的现象及原理解析

场景介绍：

Session 1：

获取 scott.tabnow1 表中记录对应的 relative_fno 和 block_number；

Update 一条记录，但不 commit，记录下所使用的 xid、uba 信息

Session 2：

以非 SYS 用户连接执行：set transaction read only;

Session 1：

Commit;

Session 3：

对 scott.t1 表连续做 update+commit 操作

Session 2：

成功遍历 scott.tabnow1 表

```
select * from scott.tabnow1;
```

Session 4：

再次对 scott.t1 表连续做 update+commit 操作，继续覆盖事务表

Session 2：

再次遍历 scott.tabnow1 表

得到 ORA-01555 错误

测试数据库配置：

##为简化测试过程，建立了一个 256K 的 undotbs

```
SQL> show parameter undo
```

NAME	TYPE	VALUE
undo_management	string	AUTO
undo_retention	integer	900
undo_tablespace	string	UNDOSIG

```
SQL> select d.name,d.bytes from v$datafile d,v$tablespace t where t.ts#=d.ts# and t.name='UNDOSIG';
```

NAME	BYTES
+STESTDG1/stest2/undosig.dbf	262144

##undosig 里只有一个 undo segment online

```
SQL> select segment_name,tablespace_name,relative_fno,status from dba_rollback_segs where tablespace_name='UNDOSIG';
```

SEGMENT_NAME STATUS	TABLESPACE_NAME	RELATIVE_FNO

_SYSSMU2\$	UNDOSIG	8 ONLINE

##undo segment 里 extent 的分布情况，除去 undo header 所占据的 block 8，block 9~31 都可以被事务用来存放修改前内容：

```
SQL> select segment_name,extent_id,file_id,block_id,blocks from dba_extents where segment_name='_SYSSMU2$';
```

SEGMENT_NAME	EXTENT_ID	FILE_ID	BLOCK_ID	BLOCKS

_SYSSMU2\$	0	8	8	8
_SYSSMU2\$	1	8	16	8
_SYSSMU2\$	2	8	24	8

##测试用到的两张表初始内容：

```
SQL> select * from scott.tabnow1;
```

USERNAME	USER_ID	CREATED

X\$NULLLL	2147483638	21-OCT-11
NEWUSER	84	12-MAR-14
SCOTT	83	21-OCT-11
OWBSYS_AUDIT	82	21-OCT-11
OWBSYS	78	21-OCT-11
APEX	77	21-OCT-11
APEX_PUBLIC	75	21-OCT-11
FLows_FILE	74	21-OCT-11
MGMT_VIEW	73	21-OCT-11
DDD	34	28-MAY-14

```
SQL> select * from scott.t1;
```

ID

34
34

开始测试过程：

```
//////////
```

```
//session 1:
```

```
//////////
```

##确定 scott.tabnow1 表中的记录所在的块，便于之后对 data block 作 dump；所有的行都在同一个 block 中

```
select dbms_rowid.rowid_relative_fno(rowid) rfno,dbms_rowid.rowid_block_number(rowid) blkno from scott.tabnow1;
```

RFNO	BLKNO

4	1779

```

4      1779
4      1779
4      1779
4      1779
4      1779
4      1779
4      1779
4      1779
4      1779
4      1779

```

##记录一下 undo header 的初始状态，slot 0x1e 将成为下一个要用到的 slot

```

TRN CTL:: seq: 0x187e chd: 0x001e ctl: 0x0000 inc: 0x00000000 nfb: 0x0001
          mgc: 0xb000 xts: 0x0068 flg: 0x0001 opt: 2147483646 (0x7ffffffe)
          uba: 0x02000010.187e.18 scn: 0x0000.00ae9095

```

TRN TBL::

index stmt_num	state	cflags cmt	wrap#	uel	scn	dba	parent-xid	nub
0x00 0x00000001	9	0x00 0x00000000	0x11d2	0xffff 1402531961	0x0000.00ae9241	0x02000010	0x0000.000.00000000	
0x01 0x00000003	9	0x00 0x00000000	0x11cf	0x001a 1402531591	0x0000.00ae90f1	0x0200000b	0x0000.000.00000000	
0x02 0x00000003	9	0x00 0x00000000	0x11d2	0x0016 1402531591	0x0000.00ae9199	0x0200001c	0x0000.000.00000000	
0x03 0x00000001	9	0x00 0x00000000	0x11d4	0x0007 1402531756	0x0000.00ae91f4	0x02000010	0x0000.000.00000000	
0x04 0x00000000	9	0x00 0x00000000	0x11cd	0x0006 1402531591	0x0000.00ae90af	0x00000000	0x0000.000.00000000	
0x05 0x00000003	9	0x00 0x00000000	0x11d0	0x000e 1402531591	0x0000.00ae915a	0x02000017	0x0000.000.00000000	
0x06 0x00000001	9	0x00 0x00000000	0x11d2	0x0019 1402531591	0x0000.00ae90b2	0x0200001f	0x0000.000.00000000	
0x07 0x00000001	9	0x00 0x00000000	0x11d3	0x000d 1402531756	0x0000.00ae91f6	0x02000010	0x0000.000.00000000	
0x08 0x00000003	9	0x00 0x00000000	0x11d3	0x0014 1402531591	0x0000.00ae911b	0x0200001b	0x0000.000.00000000	
0x09 0x00000003	9	0x00 0x00000000	0x11d2	0x000a 1402531591	0x0000.00ae916f	0x0200000c	0x0000.000.00000000	
0x0a 0x00000003	9	0x00 0x00000000	0x11d3	0x0012 1402531591	0x0000.00ae9179	0x0200000e	0x0000.000.00000000	
0x0b 0x00000003	9	0x00 0x00000000	0x11d0	0x0017 1402531591	0x0000.00ae90d2	0x02000015	0x0000.000.00000000	
0x0c 0x00000003	9	0x00 0x00000000	0x11ce	0x001b 1402531591	0x0000.00ae9145	0x02000013	0x0000.000.00000000	
0x0d 0x00000001	9	0x00 0x00000000	0x11d2	0x0000 1402531756	0x0000.00ae91f8	0x02000010	0x0000.000.00000000	
0x0e 0x00000003	9	0x00 0x00000000	0x11d1	0x0009 1402531591	0x0000.00ae9164	0x0200000a	0x0000.000.00000000	
0x0f 0x00000003	9	0x00 0x00000000	0x11d0	0x0003 1402531591	0x0000.00ae91ae	0x02000010	0x0000.000.00000000	
0x10 0x00000003	9	0x00 0x00000000	0x11d3	0x000b 1402531591	0x0000.00ae90c7	0x02000013	0x0000.000.00000000	
0x11 0x00000003	9	0x00 0x00000000	0x11d4	0x0008 1402531591	0x0000.00ae9111	0x02000019	0x0000.000.00000000	

```

0x12 9 0x00 0x11d0 0x001f 0x0000.00ae9184 0x02000018 0x0000.000.00000000
0x00000003 0x00000000 1402531591
0x13 9 0x00 0x11cd 0x001c 0x0000.00ae909d 0x0200001d 0x0000.000.00000000
0x00000001 0x00000000 1402531591
0x14 9 0x00 0x11d1 0x0015 0x0000.00ae9126 0x0200001d 0x0000.000.00000000
0x00000003 0x00000000 1402531591
0x15 9 0x00 0x11d1 0x0020 0x0000.00ae9130 0x0200001f 0x0000.000.00000000
0x00000003 0x00000000 1402531591
0x16 9 0x00 0x11d1 0x000f 0x0000.00ae91a3 0x0200001e 0x0000.000.00000000
0x00000003 0x00000000 1402531591
0x17 9 0x00 0x11d1 0x0021 0x0000.00ae90dc 0x02000016 0x0000.000.00000000
0x00000002 0x00000000 1402531591
0x18 9 0x00 0x11d0 0x0011 0x0000.00ae9106 0x0200000f 0x0000.000.00000000
0x00000003 0x00000000 1402531591
0x19 9 0x00 0x11d2 0x0010 0x0000.00ae90bd 0x02000011 0x0000.000.00000000
0x00000003 0x00000000 1402531591
0x1a 9 0x00 0x11d1 0x0018 0x0000.00ae90fc 0x0200000d 0x0000.000.00000000
0x00000003 0x00000000 1402531591
0x1b 9 0x00 0x11d3 0x0005 0x0000.00ae914f 0x02000015 0x0000.000.00000000
0x00000003 0x00000000 1402531591
0x1c 9 0x00 0x11d0 0x001d 0x0000.00ae90a3 0x0200001d 0x0000.000.00000000
0x00000001 0x00000000 1402531591
0x1d 9 0x00 0x11d1 0x0004 0x0000.00ae90ad 0x00000000 0x0000.000.00000000
0x00000000 0x00000000 1402531591
0x1e 9 0x00 0x11d1 0x0013 0x0000.00ae909b 0x0200001c 0x0000.000.00000000
0x00000001 0x00000000 1402531591
0x1f 9 0x00 0x11d0 0x0002 0x0000.00ae918e 0x0200001a 0x0000.000.00000000
0x00000003 0x00000000 1402531591
0x20 9 0x00 0x11d2 0x000c 0x0000.00ae913b 0x02000011 0x0000.000.00000000
0x00000003 0x00000000 1402531591
0x21 9 0x00 0x11d0 0x0001 0x0000.00ae90e7 0x02000009 0x0000.000.00000000
0x00000002 0x00000000 1402531591

```

```
update scott.tabnow1 set username='XS$NULL' where user_id=2147483638;
```

```

select
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN,to_char(START_SCNB,'xxxxxxxx')
start_scn from v$transaction;
      XIDUSN      XIDSLOT      XIDSQN      UBAFIL      UBABLK      UBAREC
UBASQN START_SCN
-----
          2          30          4562           8           16           25           6270      ae9241

```

```
alter system flush buffer_cache;
```

```
alter system dump datafile 8 block 16;
```

```
---data block dump 的结果中摘录了 Rec#0x19 内容 :
```

```

*-----
* Rec #0x19 slt: 0x1e objn: 90344(0x000160e8) objd: 90344 tblspc: 8(0x00000008)
*      Layer: 11 (Row) opc: 1 rci 0x00
Undo type: Regular undo Begin trans Last buffer split: No
Temp Object: No
Tablespace Undo: No
rdba: 0x00000000Ext idx: 0

```

```

flg2: 0
*-----
uba: 0x02000010.187e.18 ctl max scn: 0x0000.00ae9095 prv tx scn: 0x0000.00ae909b
txn start scn: scn: 0x0000.00ae90b2 logon user: 0
  prev brb: 33554460 prev bcl: 0
KDO undo record:
KTB Redo
op: 0x04  ver: 0x01
compat bit: 4 (post-11) padding: 1
op: L  itl: xid: 0x0002.004.0000111f uba: 0x0200001a.177b.09
                flg: C---  lkc: 0      scn: 0x0000.00ad9579
KDO Op code: URP row dependencies Disabled
  xtype: XA flags: 0x00000000  bdba: 0x010006f3  hdba: 0x010006f2
itli: 2  ispac: 0  maxfr: 4858
tabn: 0 slot: 0(0x0) flag: 0x2c lock: 0 ckix: 0
ncol: 3 nnew: 1 size: 2
col 0: [ 9] 58 53 24 4e 55 4c 4c 4c 4c

```

--将 58 53 24 4e 55 4c 4c 4c 4c 转换为 varchar2 , 得到修改前的拷贝

```

select utl_raw.cast_to_varchar2(replace('58 53 24 4e 55 4c 4c 4c 4c',' ')) from dual;
UTL_RAW.CAST_TO_VARCHAR2(REPLACE('5853244E554C4C4C4C',' '))

```

XS\$NULLLL

```
alter system dump undo header "_SYSSMU2$";
```

--下面是 undo header 中有关事务控制和事务表的 dump 内容 , slot 0x1e 处于活动状态 , 0x02000010 即 8/16

```

TRN CTL:: seq: 0x187e chd: 0x0009 ctl: 0x000e inc: 0x00000000 nfb: 0x0001
          mgc: 0xb000 xts: 0x0068 flg: 0x0001 opt: 2147483646 (0x7ffffffe)
          uba: 0x02000014.187e.13 scn: 0x0000.00ae92e6

```

index	state	cflags	wrap#	uel	scn	dba	parent-xid	nub
stmt_num		cmt						
0x00	9	0x00	0x11d4	0x0013	0x0000.00ae92f6	0x02000013	0x0000.000.00000000	
0x00000001		0x00000000	1402532191					
0x01	9	0x00	0x11d2	0x001a	0x0000.00ae9303	0x02000013	0x0000.000.00000000	
0x00000001		0x00000000	1402532191					
0x02	9	0x00	0x11d4	0x0016	0x0000.00ae92ed	0x02000013	0x0000.000.00000000	
0x00000001		0x00000000	1402532191					
0x03	9	0x00	0x11d6	0x0007	0x0000.00ae92f2	0x02000013	0x0000.000.00000000	
0x00000001		0x00000000	1402532191					
0x04	9	0x00	0x11d0	0x0006	0x0000.00ae92fa	0x02000013	0x0000.000.00000000	
0x00000001		0x00000000	1402532191					
0x05	9	0x00	0x11d3	0x000e	0x0000.00ae9310	0x02000014	0x0000.000.00000000	
0x00000001		0x00000000	1402532191					
0x06	9	0x00	0x11d5	0x0019	0x0000.00ae92fc	0x02000013	0x0000.000.00000000	
0x00000001		0x00000000	1402532191					
0x07	9	0x00	0x11d5	0x000d	0x0000.00ae92f4	0x02000013	0x0000.000.00000000	
0x00000001		0x00000000	1402532191					
0x08	9	0x00	0x11d6	0x0014	0x0000.00ae9308	0x02000014	0x0000.000.00000000	
0x00000001		0x00000000	1402532191					
0x09	9	0x00	0x11d4	0x000a	0x0000.00ae92e7	0x02000013	0x0000.000.00000000	
0x00000001		0x00000000	1402532191					

```

0x0a 9 0x00 0x11d5 0x0012 0x0000.00ae92e9 0x02000013 0x0000.000.00000000
0x00000001 0x00000000 1402532191
0x0b 9 0x00 0x11d3 0x0017 0x0000.00ae9300 0x02000013 0x0000.000.00000000
0x00000001 0x00000000 1402532191
0x0c 9 0x00 0x11d1 0x001b 0x0000.00ae930e 0x02000014 0x0000.000.00000000
0x00000001 0x00000000 1402532191
0x0d 9 0x00 0x11d4 0x0000 0x0000.00ae92f5 0x02000013 0x0000.000.00000000
0x00000001 0x00000000 1402532191
0x0e 9 0x00 0x11d4 0xffff 0x0000.00ae9311 0x02000014 0x0000.000.00000000
0x00000001 0x00000000 1402532191
0x0f 9 0x00 0x11d2 0x0003 0x0000.00ae92f0 0x02000013 0x0000.000.00000000
0x00000001 0x00000000 1402532191
0x10 9 0x00 0x11d6 0x000b 0x0000.00ae92ff 0x02000013 0x0000.000.00000000
0x00000001 0x00000000 1402532191
0x11 9 0x00 0x11d7 0x0008 0x0000.00ae9307 0x02000014 0x0000.000.00000000
0x00000001 0x00000000 1402532191
0x12 9 0x00 0x11d2 0x001f 0x0000.00ae92eb 0x02000013 0x0000.000.00000000
0x00000001 0x00000000 1402532191
0x13 9 0x00 0x11d0 0x001c 0x0000.00ae92f7 0x02000013 0x0000.000.00000000
0x00000001 0x00000000 1402532191
0x14 9 0x00 0x11d4 0x0015 0x0000.00ae930a 0x02000014 0x0000.000.00000000
0x00000001 0x00000000 1402532191
0x15 9 0x00 0x11d4 0x0020 0x0000.00ae930b 0x02000014 0x0000.000.00000000
0x00000001 0x00000000 1402532191
0x16 9 0x00 0x11d3 0x000f 0x0000.00ae92ee 0x02000013 0x0000.000.00000000
0x00000001 0x00000000 1402532191
0x17 9 0x00 0x11d4 0x0021 0x0000.00ae9301 0x02000013 0x0000.000.00000000
0x00000001 0x00000000 1402532191
0x18 9 0x00 0x11d3 0x0011 0x0000.00ae9306 0x02000014 0x0000.000.00000000
0x00000001 0x00000000 1402532191
0x19 9 0x00 0x11d5 0x0010 0x0000.00ae92fe 0x02000013 0x0000.000.00000000
0x00000001 0x00000000 1402532191
0x1a 9 0x00 0x11d4 0x0018 0x0000.00ae9304 0x02000013 0x0000.000.00000000
0x00000001 0x00000000 1402532191
0x1b 9 0x00 0x11d6 0x0005 0x0000.00ae930f 0x02000014 0x0000.000.00000000
0x00000001 0x00000000 1402532191
0x1c 9 0x00 0x11d3 0x001d 0x0000.00ae92f8 0x02000013 0x0000.000.00000000
0x00000001 0x00000000 1402532191
0x1d 9 0x00 0x11d4 0x0004 0x0000.00ae92f9 0x02000013 0x0000.000.00000000
0x00000001 0x00000000 1402532191
0x1e 10 0x80 0x11d2 0x0002 0x0000.00ae9241 0x02000010 0x0000.000.00000000
0x00000001 0x00000000 0
0x1f 9 0x00 0x11d2 0x0002 0x0000.00ae92ec 0x02000013 0x0000.000.00000000
0x00000001 0x00000000 1402532191
0x20 9 0x00 0x11d5 0x000c 0x0000.00ae930c 0x02000014 0x0000.000.00000000
0x00000001 0x00000000 1402532191
0x21 9 0x00 0x11d3 0x0001 0x0000.00ae9302 0x02000013 0x0000.000.00000000
0x00000001 0x00000000 1402532191

```

//////////

//session 2:

//////////

##用 scott 用户登陆，注意这里不能用 SYS 用户登录，否则 set transaction read only 不起作用，记录

下 snapshot SCN 的近似值

sqlplus scott/sdfg0987

```
select 'scn before read only: '||to_char(timestamp_to_scn(sysdate), 'xxxxxxxx') from dual;  
'SCNBEFOREREADONLY:'||TO_CHAR(T
```

```
-----  
scn before read only:      ae931d
```

```
set transaction read only;
```

##记录当前会话的统计信息，system.clean_stat 里存放了与本次测试有关的统计

```
select st.name,my.value from system.clean_stat st,v$mystat my where my.statistic#=st.statistic#;  
NAME VALUE
```

```
-----  
commit cleanouts 0  
commit cleanouts successfully completed 0  
redo KB read for transport 0  
file io wait time 27395  
gc cr blocks served 0  
transaction tables consistent reads - undo records applied 0  
transaction tables consistent read rollbacks 0  
cleanouts only - consistent read gets 0  
cleanouts and rollbacks - consistent read gets 0  
immediate (CR) block cleanout applications 0  
deferred (CURRENT) block cleanout applications 0
```

```
//////////
```

```
//session 1:
```

```
//////////
```

```
commit;
```

```
alter system flush buffer_cache;
```

```
alter system dump datafile 4 block 1779;
```

--摘录 data block dump 结果中 Itl 有关的部分，事务使用 0x02 槽位，xid、uba 与 undo header 0x1e 事务槽中的值匹配，这里很明显这里发生了 delayed block clean out

Itl	Xid	Uba	Flag	Lck	Scn/Fsc
0x01	0x0002.000.000011d2	0x02000010.187e.18	C---	0	scn 0x0000.00ae9241
0x02	0x0002.01e.000011d2	0x02000010.187e.19	----	1	fsc 0x0002.00000000
0x03	0x0002.017.00001139	0x02000011.1788.1f	C---	0	scn 0x0000.00adb1b6

```
//////////
```

```
//session 3:
```

```
//////////
```

##db_block_size=8k 的情况下，undo segment 中有 34 个 slot，执行下面的存储过程完成 340 次的 update，平均每个 slot 将被覆盖 10 次

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##执行后输出历次所使用的 xid，uba 信息

--第 1 轮覆盖

XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :1 2,31,4563,8,20,27,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :2 2,2,4565,8,20,28,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :3 2,22,4564,8,20,29,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :4 2,15,4563,8,20,30,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :5 2,3,4567,8,20,31,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :6 2,7,4566,8,20,32,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :7 2,13,4565,8,20,33,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :8 2,0,4565,8,20,34,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :9 2,19,4561,8,20,35,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :10 2,28,4564,8,20,36,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :11 2,29,4565,8,20,37,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :12 2,4,4561,8,20,38,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :13 2,6,4566,8,20,39,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :14 2,25,4566,8,20,40,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :15 2,16,4567,8,20,41,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :16 2,11,4564,8,20,42,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :17 2,23,4565,8,20,43,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :18 2,33,4564,8,20,44,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :19 2,1,4563,8,20,45,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :20 2,26,4565,8,20,46,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :21 2,24,4564,8,20,47,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :22 2,17,4568,8,16,26,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :23 2,8,4567,8,16,27,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :24 2,20,4565,8,16,28,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :25 2,21,4565,8,16,29,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :26 2,32,4566,8,16,30,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :27 2,12,4562,8,16,31,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :28 2,27,4567,8,16,32,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :29 2,5,4564,8,16,33,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :30 2,14,4565,8,16,34,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :31 2,30,4563,8,16,35,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :32 2,9,4566,8,16,36,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :33 2,10,4567,8,21,1,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :34 2,18,4564,8,21,2,6270

。。。。省略了部分

--第 10 轮覆盖

XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :307 2,31,4572,8,14,3,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :308 2,2,4574,8,14,4,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :309 2,22,4573,8,14,5,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :310 2,15,4572,8,14,6,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :311 2,3,4576,8,14,7,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :312 2,7,4575,8,14,8,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :313 2,13,4574,8,14,9,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :314 2,0,4574,8,14,10,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :315 2,19,4570,8,14,11,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :316 2,28,4573,8,14,12,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :317 2,29,4574,8,14,13,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :318 2,4,4570,8,14,14,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :319 2,6,4575,8,14,15,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :320 2,25,4575,8,14,16,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :321 2,16,4576,8,14,17,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :322 2,11,4573,8,14,18,6271

```

XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :323 2,23,4574,8,14,19,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :324 2,33,4573,8,14,20,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :325 2,1,4572,8,14,21,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :326 2,26,4574,8,14,22,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :327 2,24,4573,8,14,23,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :328 2,17,4577,8,14,24,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :329 2,8,4576,8,14,25,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :330 2,20,4574,8,14,26,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :331 2,21,4574,8,14,27,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :332 2,32,4575,8,14,28,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :333 2,12,4571,8,14,29,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :334 2,27,4576,8,14,30,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :335 2,5,4573,8,14,31,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :336 2,14,4574,8,14,32,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :337 2,30,4572,8,14,33,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :338 2,9,4575,8,14,34,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :339 2,10,4576,8,15,1,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :340 2,18,4573,8,15,2,6271

```

```
alter system flush buffer_cache;
```

```
alter system dump undo header "_SYSSMU2$";
```

--undo header dump 结果，发现 slot : 0x1e 的 wrap#从 0x11d2->0x11dc，的确覆盖了 10 次，control scn : 00ae96dc 远大于 Session 2 查询开始时的 scn : ae931d，也预示着 Session 2 的查询将触发 undo 事务表回滚

```

TRN CTL:: seq: 0x187f chd: 0x001f ctl: 0x0012 inc: 0x00000000 nfb: 0x0001
           mgc: 0xb000 xts: 0x0068 flg: 0x0001 opt: 2147483646 (0x7ffffffe)
           uba: 0x0200000f.187f.02 scn: 0x0000.00ae96dc

```

```
TRN TBL::
```

index	state	cflags	wrap#	uel	scn	dba	parent-xid	nub
stmt_num	cmt							
0x00	9	0x00	0x11de	0x0013	0x0000.00ae96f4	0x0200000e	0x0000.000.00000000	
0x00000001	0x00000000 1402532364							
0x01	9	0x00	0x11dc	0x001a	0x0000.00ae9715	0x0200000e	0x0000.000.00000000	
0x00000001	0x00000000 1402532364							
0x02	9	0x00	0x11de	0x0016	0x0000.00ae96e2	0x0200000e	0x0000.000.00000000	
0x00000001	0x00000000 1402532364							
0x03	9	0x00	0x11e0	0x0007	0x0000.00ae96eb	0x0200000e	0x0000.000.00000000	
0x00000001	0x00000000 1402532364							
0x04	9	0x00	0x11da	0x0006	0x0000.00ae9700	0x0200000e	0x0000.000.00000000	
0x00000001	0x00000000 1402532364							
0x05	9	0x00	0x11dd	0x000e	0x0000.00ae9733	0x0200000e	0x0000.000.00000000	
0x00000001	0x00000000 1402532364							
0x06	9	0x00	0x11df	0x0019	0x0000.00ae9703	0x0200000e	0x0000.000.00000000	
0x00000001	0x00000000 1402532364							
0x07	9	0x00	0x11df	0x000d	0x0000.00ae96ee	0x0200000e	0x0000.000.00000000	
0x00000001	0x00000000 1402532364							
0x08	9	0x00	0x11e0	0x0014	0x0000.00ae9721	0x0200000e	0x0000.000.00000000	
0x00000001	0x00000000 1402532364							
0x09	9	0x00	0x11df	0x000a	0x0000.00ae973c	0x0200000e	0x0000.000.00000000	
0x00000001	0x00000000 1402532364							

```

0x0a 9 0x00 0x11e0 0x0012 0x0000.00ae973f 0x0200000f 0x0000.000.00000000
0x00000001 0x00000000 1402532364
0x0b 9 0x00 0x11dd 0x0017 0x0000.00ae970c 0x0200000e 0x0000.000.00000000
0x00000001 0x00000000 1402532364
0x0c 9 0x00 0x11db 0x001b 0x0000.00ae972d 0x0200000e 0x0000.000.00000000
0x00000001 0x00000000 1402532364
0x0d 9 0x00 0x11de 0x0000 0x0000.00ae96f1 0x0200000e 0x0000.000.00000000
0x00000001 0x00000000 1402532364
0x0e 9 0x00 0x11de 0x001e 0x0000.00ae9736 0x0200000e 0x0000.000.00000000
0x00000001 0x00000000 1402532364
0x0f 9 0x00 0x11dc 0x0003 0x0000.00ae96e8 0x0200000e 0x0000.000.00000000
0x00000001 0x00000000 1402532364
0x10 9 0x00 0x11e0 0x000b 0x0000.00ae9709 0x0200000e 0x0000.000.00000000
0x00000001 0x00000000 1402532364
0x11 9 0x00 0x11e1 0x0008 0x0000.00ae971e 0x0200000e 0x0000.000.00000000
0x00000001 0x00000000 1402532364
0x12 9 0x00 0x11dd 0xffff 0x0000.00ae9742 0x0200000f 0x0000.000.00000000
0x00000001 0x00000000 1402532364
0x13 9 0x00 0x11da 0x001c 0x0000.00ae96f7 0x0200000e 0x0000.000.00000000
0x00000001 0x00000000 1402532364
0x14 9 0x00 0x11de 0x0015 0x0000.00ae9724 0x0200000e 0x0000.000.00000000
0x00000001 0x00000000 1402532364
0x15 9 0x00 0x11de 0x0020 0x0000.00ae9727 0x0200000e 0x0000.000.00000000
0x00000001 0x00000000 1402532364
0x16 9 0x00 0x11dd 0x000f 0x0000.00ae96e5 0x0200000e 0x0000.000.00000000
0x00000001 0x00000000 1402532364
0x17 9 0x00 0x11de 0x0021 0x0000.00ae970f 0x0200000e 0x0000.000.00000000
0x00000001 0x00000000 1402532364
0x18 9 0x00 0x11dd 0x0011 0x0000.00ae971b 0x0200000e 0x0000.000.00000000
0x00000001 0x00000000 1402532364
0x19 9 0x00 0x11df 0x0010 0x0000.00ae9706 0x0200000e 0x0000.000.00000000
0x00000001 0x00000000 1402532364
0x1a 9 0x00 0x11de 0x0018 0x0000.00ae9718 0x0200000e 0x0000.000.00000000
0x00000001 0x00000000 1402532364
0x1b 9 0x00 0x11e0 0x0005 0x0000.00ae9730 0x0200000e 0x0000.000.00000000
0x00000001 0x00000000 1402532364
0x1c 9 0x00 0x11dd 0x001d 0x0000.00ae96fa 0x0200000e 0x0000.000.00000000
0x00000001 0x00000000 1402532364
0x1d 9 0x00 0x11de 0x0004 0x0000.00ae96fd 0x0200000e 0x0000.000.00000000
0x00000001 0x00000000 1402532364
0x1e 9 0x00 0x11dc 0x0009 0x0000.00ae9739 0x0200000e 0x0000.000.00000000
0x00000001 0x00000000 1402532364
0x1f 9 0x00 0x11dc 0x0002 0x0000.00ae96df 0x0200000e 0x0000.000.00000000
0x00000001 0x00000000 1402532364
0x20 9 0x00 0x11df 0x000c 0x0000.00ae972a 0x0200000e 0x0000.000.00000000
0x00000001 0x00000000 1402532364
0x21 9 0x00 0x11dd 0x0001 0x0000.00ae9712 0x0200000e 0x0000.000.00000000
0x00000001 0x00000000 1402532364

```

```

##dump 所有的 undo block , 以便后面作分析
alter system dump datafile 8 block min 9 block max 31;

```

```

//////////
//session 2:

```

//////////

##遍历 scott.tabnow1 表，查到了 session 1 修改前的拷贝

```
select * from scott.tabnow1;
```

USERNAME	USER_ID	CREATED
XS\$NULLLL	2147483638	21-OCT-11
NEWUSER	84	12-MAR-14
SCOTT	83	21-OCT-11
OWBSYS_AUDIT	82	21-OCT-11
OWBSYS	78	21-OCT-11
APEX	77	21-OCT-11
APEX_PUBLIC	75	21-OCT-11
FLows_FILE	74	21-OCT-11
MGMT_VIEW	73	21-OCT-11
DDD	34	28-MAY-14

##会话中事务表一致性读相关的统计值增加

```
select st.name,my.value from system.clean_stat st,v$mystat my where my.statistic#=st.statistic#;
```

NAME	VALUE
commit cleanouts	0
commit cleanouts successfully completed	0
redo KB read for transport	0
file io wait time	40974
gc cr blocks served	0
transaction tables consistent reads - undo records applied	310
transaction tables consistent read rollbacks	1
cleanouts only - consistent read gets	0
cleanouts and rollbacks - consistent read gets	1
immediate (CR) block cleanout applications	1
deferred (CURRENT) block cleanout applications	0

针对上述测试结果的分析：

Undo header 事务表中的每个 slot 被覆盖多达 10 次，session 2 还能正常返回 scott.tabnow1 表修改前的记录，就是利用了 undo 事务表的回滚机制，为了实现这个回滚：当新的事务开始使用某个 undo 事务表槽之前会将事务表 TRN CTL 部分的 scn 与 uba 两个值作为 ctl max scn、uba 字段保存到新事务所拥有的 undo block 里，也会将这个事务表槽中的 scn 与 dba 两个值作为 prv tx scn、prev brb 字段保存到新事务所拥有的 undo block 里，例如 session 1 中事务使用的 uba 为 8/16 Rec #0x19：

*-----

* Rec #0x19 slt: 0x1e objn: 90344(0x000160e8) objd: 90344 tblspc: 8(0x00000008)

* Layer: 11 (Row) opc: 1 rci 0x00

Undo type: Regular undo Begin trans Last buffer split: No

Temp Object: No

Tablespace Undo: No

rdba: 0x00000000Ext idx: 0

flg2: 0

*-----

uba: 0x02000010.187e.18 ctl max scn: 0x0000.00ae9095 prv tx scn: 0x0000.00ae909b

txn start scn: scn: 0x0000.00ae90b2 logon user: 0

```

prev brb: 33554460 prev bcl: 0
KDO undo record:
KTB Redo
op: 0x04 ver: 0x01
compat bit: 4 (post-11) padding: 1
op: L itl: xid: 0x0002.004.0000111f uba: 0x0200001a.177b.09
          flg: C--- lkc: 0 scn: 0x0000.00ad9579
KDO Op code: URP row dependencies Disabled
  xtype: XA flags: 0x00000000 bdba: 0x010006f3 hdba: 0x010006f2
itli: 2 ispac: 0 maxfr: 4858
tabn: 0 slot: 0(0x0) flag: 0x2c lock: 0 ckix: 0
ncol: 3 nnew: 1 size: 2
col 0: [ 9] 58 53 24 4e 55 4c 4c 4c 4c

```

上述 dump 中 uba: 0x02000010.187e.18 ctl max scn: 0x0000.00ae9095 正是来自于事务开始前 undo header 里 TRN CTL 部分所包含的 uba: 0x02000010.187e.18 scn: 0x0000.00ae9095 , 而 prv tx scn : 0x0000.00ae909b 和 prev brb : 33554460 则分别等于事务开始前 slot 0x1e 所对应的 scn : 00ae909b 和 dba : 0x0200001c(转换成 10 进制就是 33554460)。只有事务的首条 undo 记录才会保留上一版本的 undo 信息。将相关的 undo 记录串起来就可以完整的回放事务表所发生过的变更 , 下面较为直观的方式说明一下 undo 记录间的指向关系 , 还是以 proc1.sql 里前三个事务为例 , 它们所使用的 xid , uba 如下 :

```

XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN : 2,31,4563,8,20,27,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN : 2,2,4565,8,20,28,6270
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN : 2,22,4564,8,20,29,6270

```

Undo record 的记录是后修改的指向先修改的 , 所以依次 dump block 8/20 中 Rec #0x1d、Rec #0x1c、Rec #0x1b 的记录 , 仅将相关的内容摘录下来 :

```

*-----
* Rec #0x1d slt: 0x16 objn: 89731(0x00015e83) objd: 89731 tblspc: 8(0x00000008)
* Layer: 11 (Row) opc: 1 rci 0x00
Undo type: Regular undo Begin trans Last buffer split: No
Temp Object: No
Tablespace Undo: No
rdba: 0x00000000Ext idx: 0
flg2: 0
*-----
uba: 0x02000014.187e.1c ctl max scn: 0x0000.00ae92ed prv tx scn: 0x0000.00ae92ee
txn start scn: scn: 0x0000.00ae9357 logon user: 0
prev brb: 33554451 prev bcl: 0

```

```

*-----
* Rec #0x1c slt: 0x02 objn: 89731(0x00015e83) objd: 89731 tblspc: 8(0x00000008)
* Layer: 11 (Row) opc: 1 rci 0x00
Undo type: Regular undo Begin trans Last buffer split: No
Temp Object: No
Tablespace Undo: No
rdba: 0x00000000Ext idx: 0
flg2: 0
*-----
uba: 0x02000014.187e.1b ctl max scn: 0x0000.00ae92ec prv tx scn: 0x0000.00ae92ed

```



```

txn start scn: scn: 0x0000.00ae9354 logon user: 0
prev brb: 33554451 prev bcl: 0

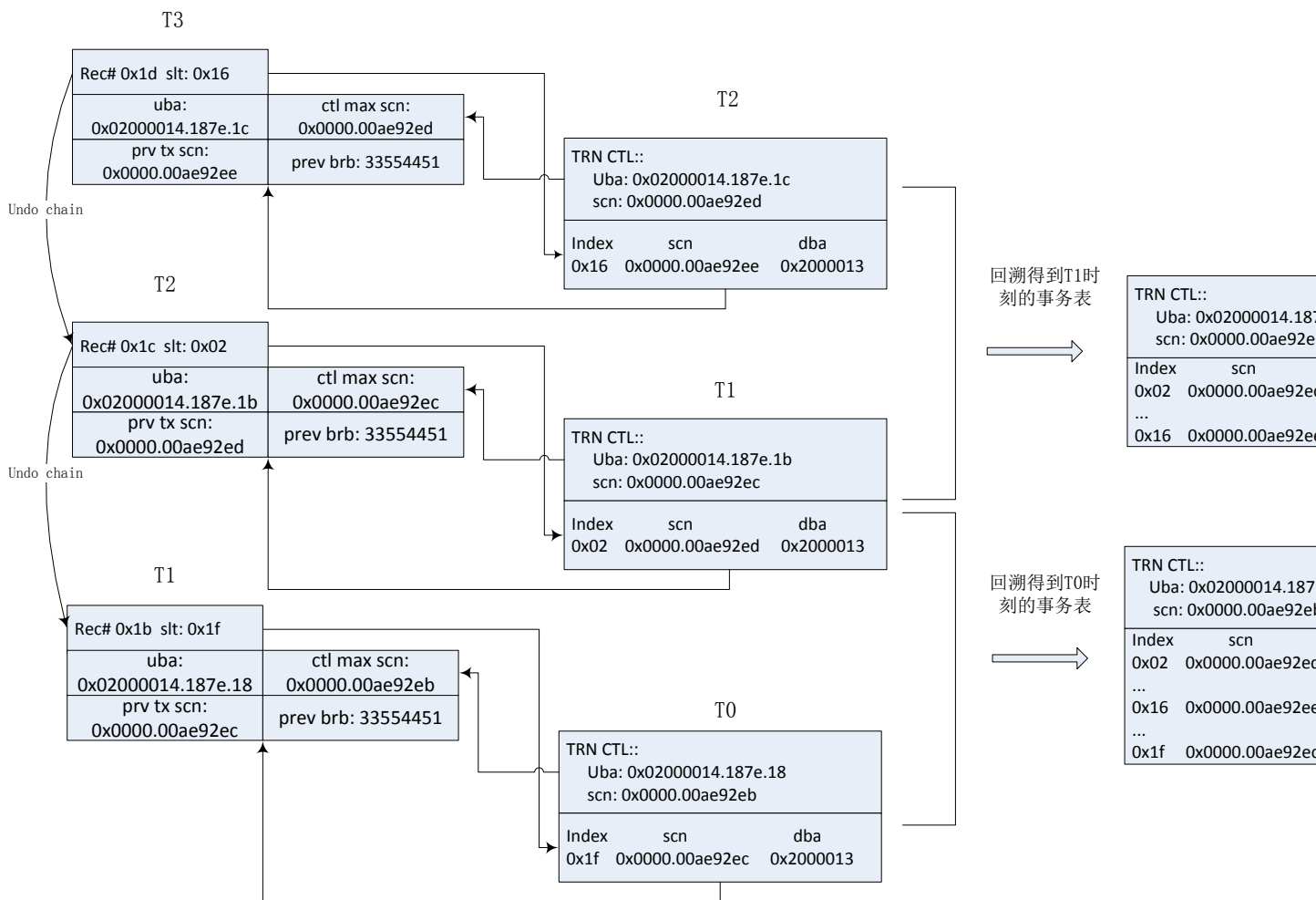
```

```

*-----
* Rec #0x1b slt: 0x1f objn: 89731(0x00015e83) objd: 89731 tblspc: 8(0x00000008)
* Layer: 11 (Row) opc: 1 rci 0x00
Undo type: Regular undo Begin trans Last buffer split: No
Temp Object: No
Tablespace Undo: No
rdba: 0x00000000Ext idx: 0
flg2: 0
*-----
uba: 0x02000014.187e.18 ctl max scn: 0x0000.00ae92eb prv tx scn: 0x0000.00ae92ec
txn start scn: scn: 0x0000.00000000 logon user: 0
prev brb: 33554451 prev bcl: 0

```

通过这三个 undo Record 能够映射得到前一刻的 undo 事务表，假设 $T3 > T2 > T1 > T0$ ，以下图示能够直观的展现这一映射关系：



上面的图能够帮助我们理解 oracle 是如何实现事务表的回滚，只要 undo block 不被覆盖，就能回滚得到足够旧的事务表。

具备了上述知识点后，我们分析一下 session 2 是如何成功遍历 scott.tabnow1 表的：

- (1) Session 2 的 select 语句执行时的 snapshot scn 近似等于 ae931d
- (2) 访问 rdba: 4/1779 时发现 Itl 列表里 slot 0x02 还处于活动状态, 且没有 commit scn, 于是就到xid 所指向的 undo 事务表进一步查询事务是否提交, slot 0x1e 的 state=9 表示事务已经提交, 但提交时的 wrap#值为 0x11dc 远大于 0x11d2, 且 undo 事务表头的 control scn: ae96dc 远大于 snapshot scn: ae931d
- (3) Oracle 判断事务表槽已 slot 0x1e 已经被覆盖, 需要回滚事务表, 回滚的起点是 8/14 Rec #0x21, 这个 Record 是 proc1.sql 中第 337 个 transaction 所使用的 undo record, 因为正是这个 transaction 完成了对 undo slot 0x1e 的最后一次覆盖
- (4) 接下来将如上图所示, oracle 一步一步的对事务表进行回滚, 每重构出一个事务表的版本后, 将事务表头部的 control scn 和 snapshot scn 进行比较, 如果 snapshot scn < control scn 则继续进行回滚, 直到 snapshot scn >= control scn 而且 wrap#的值等于 0x11d2, 事务表才回滚完毕, 从 undo record : 8/16 Rec #0x19 里读出修改前的值:

```
select utl_raw.cast_to_varchar2(replace('58 53 24 4e 55 4c 4c 4c 4c',' ')) from dual;
UTL_RAW.CAST_TO_VARCHAR2(REPLACE('5853244E554C4C4C4C',' '))
```

```
-----
XS$NULLLL
```

Session 2 实现一致性读的两个统计信息 :

NAME	VALUE
transaction tables consistent reads - undo records applied	310
transaction tables consistent read rollbacks	1

transaction tables consistent reads - undo records applied	310
--	-----

表示为了回滚事务表应用了多少 undo records , 这里为何是 310 , 暂无法证实 , 我本来认为应该是 338 的

transaction tables consistent read rollbacks	1
--	---

表示事务表发生了一次回滚的动作

之前我们曾经在 session 3 里通过 alter system dump datafile 8 block min 9 block max 31 将所有的 undo block dump 出来 , 现在回过头来看一下 dump 的结果在 undo Record 8/17 Rec #0x1 里找到了 uba:

0x02000010.187e.19 , 即存放修改前拷贝的 undo record : 8/16 Rec #0x19 , 说明这个 undo record 还在 undo chain 里

```
*-----
```

```
* Rec #0x1 slt: 0x13 objn: 270(0x0000010e) objd: 268 tblspc: 1(0x00000001)
```

```
* Layer: 11 (Row) opc: 1 rci 0x00
```

```
Undo type: Regular undo Begin trans Last buffer split: No
```

```
Temp Object: No
```

```
Tablespace Undo: No
```

```
rdba: 0x00000000Ext idx: 0
```

```
flg2: 0
```

```
*-----
```

```
uba: 0x02000010.187e.19 ctl max scn: 0x0000.00ae909b prv tx scn: 0x0000.00ae909d
```

```
txn start scn: scn: 0x0000.00ae9294 logon user: 0
```

```
prev brb: 33554461 prev bcl: 0
```

```
KDO undo record:
```

```
KTB Redo
```

```
op: 0x04 ver: 0x01
```

```
compat bit: 4 (post-11) padding: 1
```



```
op: L itl: xid: 0x0002.006.000011d2 uba: 0x0200001f.1877.01
          flg: C--- lkc: 0 scn: 0x0000.00ae90b2
KDO Op code: DRP row dependencies Disabled
  xtype: XA flags: 0x00000000bdba: 0x00810de8 hdba: 0x00800192
itli: 2 ispac: 0 maxfr: 4858
tabn: 1 slot: 5(0x5)
```

##进一步 dump 8/16 Rec #0x19 的内容，可以看到修改前的内容还在，所以 session 2 能完成表的遍历

```
*-----
* Rec #0x19 slt: 0x1e objn: 90344(0x000160e8) objd: 90344 tblspc: 8(0x00000008)
* Layer: 11 (Row) opc: 1 rci 0x00
Undo type: Regular undo Begin trans Last buffer split: No
Temp Object: No
Tablespace Undo: No
rdba: 0x00000000Ext idx: 0
flg2: 0
```

```
*-----
uba: 0x02000010.187e.18 ctl max scn: 0x0000.00ae9095 prv tx scn: 0x0000.00ae909b
txn start scn: scn: 0x0000.00ae90b2 logon user: 0
prev brb: 33554460 prev bcl: 0
KDO undo record:
KTB Redo
op: 0x04 ver: 0x01
compat bit: 4 (post-11) padding: 1
op: L itl: xid: 0x0002.004.0000111f uba: 0x0200001a.177b.09
          flg: C--- lkc: 0 scn: 0x0000.00ad9579
KDO Op code: URP row dependencies Disabled
  xtype: XA flags: 0x00000000bdba: 0x010006f3 hdba: 0x010006f2
itli: 2 ispac: 0 maxfr: 4858
tabn: 0 slot: 0(0x0) flag: 0x2c lock: 0 ckix: 0
ncol: 3 nnew: 1 size: 2
col 0: [ 9] 58 53 24 4e 55 4c 4c 4c 4c
```

```
//////////
//session 4:
//////////
```

##对 proc1.sql 脚本的循环次数作略微调整后，分别在循环 34 次、循环 68 次、循环 102 次的情况下，继续对事务槽作覆盖，平均每个事务槽再被覆盖 6 次，执行调整后的 proc1.sql，输出如下：

--proc1.sql 调整为循环 34 次时的输出：

```
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :1 2,2,4575,8,15,17,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :2 2,22,4574,8,15,18,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :3 2,15,4573,8,15,19,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :4 2,3,4577,8,15,20,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :5 2,7,4576,8,15,21,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :6 2,13,4575,8,15,22,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :7 2,0,4575,8,15,23,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :8 2,19,4571,8,15,24,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :9 2,28,4574,8,15,25,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :10 2,29,4575,8,15,26,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :11 2,4,4571,8,15,27,6271
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :12 2,6,4576,8,24,1,6272
```

```

XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :13 2,25,4576,8,24,2,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :14 2,16,4577,8,24,3,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :15 2,11,4574,8,24,4,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :16 2,23,4575,8,24,5,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :17 2,33,4574,8,24,6,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :18 2,1,4573,8,24,7,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :19 2,26,4575,8,24,8,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :20 2,24,4574,8,24,9,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :21 2,17,4578,8,24,10,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :22 2,8,4577,8,24,11,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :23 2,20,4575,8,24,12,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :24 2,21,4575,8,24,13,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :25 2,32,4576,8,24,14,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :26 2,12,4572,8,24,15,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :27 2,27,4577,8,24,16,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :28 2,5,4574,8,24,17,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :29 2,14,4575,8,24,18,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :30 2,30,4573,8,24,19,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :31 2,9,4576,8,24,20,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :32 2,10,4577,8,24,21,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :33 2,18,4574,8,24,22,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :34 2,31,4574,8,24,23,6272

```

--proc1.sql 调整为循环 68 次时的输出 :

```

XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :1 2,21,4576,8,26,1,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :2 2,32,4577,8,26,2,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :3 2,12,4573,8,26,3,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :4 2,27,4578,8,26,4,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :5 2,5,4575,8,26,5,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :6 2,14,4576,8,26,6,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :7 2,30,4574,8,26,7,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :8 2,9,4577,8,26,8,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :9 2,10,4578,8,26,9,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :10 2,18,4575,8,26,10,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :11 2,31,4575,8,26,11,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :12 2,2,4577,8,26,12,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :13 2,22,4576,8,26,13,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :14 2,15,4575,8,26,14,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :15 2,3,4579,8,26,15,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :16 2,7,4578,8,26,16,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :17 2,13,4577,8,26,17,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :18 2,0,4577,8,26,18,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :19 2,19,4573,8,26,19,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :20 2,28,4576,8,26,20,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :21 2,29,4577,8,26,21,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :22 2,4,4573,8,26,22,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :23 2,6,4578,8,26,23,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :24 2,25,4578,8,26,24,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :25 2,16,4579,8,26,25,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :26 2,11,4576,8,26,26,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :27 2,23,4577,8,26,27,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :28 2,33,4576,8,26,28,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :29 2,1,4575,8,26,29,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :30 2,26,4577,8,26,30,6272

```

```

XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :31 2,24,4576,8,26,31,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :32 2,17,4580,8,26,32,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :33 2,8,4579,8,26,33,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :34 2,20,4577,8,26,34,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :35 2,21,4577,8,27,1,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :36 2,32,4578,8,27,2,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :37 2,12,4574,8,27,3,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :38 2,27,4579,8,27,4,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :39 2,5,4576,8,27,5,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :40 2,14,4577,8,27,6,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :41 2,30,4575,8,27,7,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :42 2,9,4578,8,27,8,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :43 2,10,4579,8,27,9,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :44 2,18,4576,8,27,10,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :45 2,31,4576,8,27,11,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :46 2,2,4578,8,27,12,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :47 2,22,4577,8,27,13,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :48 2,15,4576,8,27,14,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :49 2,3,4580,8,27,15,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :50 2,7,4579,8,27,16,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :51 2,13,4578,8,27,17,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :52 2,0,4578,8,27,18,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :53 2,19,4574,8,27,19,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :54 2,28,4577,8,27,20,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :55 2,29,4578,8,27,21,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :56 2,4,4574,8,27,22,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :57 2,6,4579,8,27,23,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :58 2,25,4579,8,27,24,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :59 2,16,4580,8,27,25,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :60 2,11,4577,8,27,26,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :61 2,23,4578,8,27,27,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :62 2,33,4577,8,27,28,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :63 2,1,4576,8,27,29,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :64 2,26,4578,8,27,30,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :65 2,24,4577,8,27,31,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :66 2,17,4581,8,27,32,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :67 2,8,4580,8,27,33,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :68 2,20,4578,8,27,34,6272

```

--proc1.sql 调整为循环 102 次时的输出 :

```

XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :1 2,21,4578,8,28,1,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :2 2,32,4579,8,28,2,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :3 2,12,4575,8,28,3,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :4 2,27,4580,8,28,4,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :5 2,5,4577,8,28,5,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :6 2,14,4578,8,28,6,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :7 2,30,4576,8,28,7,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :8 2,9,4579,8,28,8,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :9 2,10,4580,8,28,9,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :10 2,18,4577,8,28,10,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :11 2,31,4577,8,28,11,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :12 2,2,4579,8,28,12,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :13 2,22,4578,8,28,13,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :14 2,15,4577,8,28,14,6272

```

XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :15 2,3,4581,8,28,15,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :16 2,7,4580,8,28,16,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :17 2,13,4579,8,28,17,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :18 2,0,4579,8,28,18,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :19 2,19,4575,8,28,19,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :20 2,28,4578,8,28,20,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :21 2,29,4579,8,28,21,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :22 2,4,4575,8,28,22,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :23 2,6,4580,8,28,23,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :24 2,25,4580,8,28,24,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :25 2,16,4581,8,28,25,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :26 2,11,4578,8,28,26,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :27 2,23,4579,8,28,27,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :28 2,33,4578,8,28,28,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :29 2,1,4577,8,28,29,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :30 2,26,4579,8,28,30,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :31 2,24,4578,8,28,31,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :32 2,17,4582,8,28,32,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :33 2,8,4581,8,28,33,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :34 2,20,4579,8,28,34,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :35 2,21,4579,8,29,1,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :36 2,32,4580,8,29,2,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :37 2,12,4576,8,29,3,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :38 2,27,4581,8,29,4,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :39 2,5,4578,8,29,5,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :40 2,14,4579,8,29,6,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :41 2,30,4577,8,29,7,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :42 2,9,4580,8,29,8,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :43 2,10,4581,8,29,9,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :44 2,18,4578,8,29,10,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :45 2,31,4578,8,29,11,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :46 2,2,4580,8,29,12,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :47 2,22,4579,8,29,13,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :48 2,15,4578,8,29,14,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :49 2,3,4582,8,29,15,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :50 2,7,4581,8,29,16,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :51 2,13,4580,8,29,17,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :52 2,0,4580,8,29,18,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :53 2,19,4576,8,29,19,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :54 2,28,4579,8,29,20,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :55 2,29,4580,8,29,21,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :56 2,4,4576,8,29,22,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :57 2,6,4581,8,29,23,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :58 2,25,4581,8,29,24,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :59 2,16,4582,8,29,25,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :60 2,11,4579,8,29,26,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :61 2,23,4580,8,29,27,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :62 2,33,4579,8,29,28,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :63 2,1,4578,8,29,29,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :64 2,26,4580,8,29,30,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :65 2,24,4579,8,29,31,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :66 2,17,4583,8,29,32,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :67 2,8,4582,8,29,33,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :68 2,20,4580,8,29,34,6272


```

XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :69 2,21,4580,8,30,1,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :70 2,32,4581,8,30,2,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :71 2,12,4577,8,30,3,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :72 2,27,4582,8,30,4,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :73 2,5,4579,8,30,5,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :74 2,14,4580,8,30,6,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :75 2,30,4578,8,30,7,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :76 2,9,4581,8,30,8,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :77 2,10,4582,8,30,9,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :78 2,18,4579,8,30,10,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :79 2,31,4579,8,30,11,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :80 2,2,4581,8,30,12,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :81 2,22,4580,8,30,13,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :82 2,15,4579,8,30,14,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :83 2,3,4583,8,30,15,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :84 2,7,4582,8,30,16,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :85 2,13,4581,8,30,17,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :86 2,0,4581,8,30,18,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :87 2,19,4577,8,30,19,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :88 2,28,4580,8,30,20,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :89 2,29,4581,8,30,21,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :90 2,4,4577,8,30,22,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :91 2,6,4582,8,30,23,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :92 2,25,4582,8,30,24,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :93 2,16,4583,8,30,25,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :94 2,11,4580,8,30,26,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :95 2,23,4581,8,30,27,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :96 2,33,4580,8,30,28,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :97 2,1,4579,8,30,29,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :98 2,26,4581,8,30,30,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :99 2,24,4580,8,30,31,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :100 2,17,4584,8,30,32,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :101 2,8,4583,8,30,34,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :102 2,20,4581,8,30,35,6272

```

```
//////////
```

```
//session 2:
```

```
//////////
```

##在 session 4 对每个事务槽各覆盖 6 遍的基础上，再次遍历 scott.tabnow1 表，依然能查到

scott.tabnow1 修改前的拷贝

```
select * from scott.tabnow1;
```

```

USERNAME                                USER_ID CREATED
-----
XS$NULLLL                                2147483638 21-OCT-11
NEWUSER                                   84 12-MAR-14
SCOTT   TTT                               83 21-OCT-11
OWBSYS_AUDIT                             82 21-OCT-11
OWBSYS                                    78 21-OCT-11
APEX                                       77 21-OCT-11
APEX_PUBLIC                              75 21-OCT-11
FLOWS_FILE                               74 21-OCT-11
MGMT_VIEW                                73 21-OCT-11
DDD                                       34 28-MAY-14

```

在 session 4 再次尝试覆盖的过程中，通过 proc1.sql 执行输出的 xid，uba 信息获知 undo record : 8/25 Rec#0x19 并没有被使用到。

##dump 所有 undo 块

```
alter system dump datafile 8 block min 9 block max 31;
```

##在生成的 dump 文件中，寻找到 8/25 Rec#0x19 对应的 uba 地址：02000010.187e.19 仍然包含在 8/17 Rec#0x1 中，且 8/25 Rec#0x19 里仍存有修改前的数据拷贝，这样既确保事务表正常回滚，也确保修改前的拷贝能被正常读取

--8/17 Rec #0x1 包含有到 uba: 0x02000010.187e.19 的指向

*-----

* Rec #0x1 slt: 0x13 objn: 270(0x0000010e) objd: 268 tblspc: 1(0x00000001)

* Layer: 11 (Row) opc: 1 rci 0x00

Undo type: Regular undo Begin trans Last buffer split: No

Temp Object: No

Tablespace Undo: No

rdba: 0x00000000Ext idx: 0

flg2: 0

*-----

uba: 0x02000010.187e.19 ctl max scn: 0x0000.00ae909b prv tx scn: 0x0000.00ae909d

txn start scn: scn: 0x0000.00ae9294 logon user: 0

prev brb: 33554461 prev bcl: 0

KDO undo record:

KTB Redo

op: 0x04 ver: 0x01

compat bit: 4 (post-11) padding: 1

op: L itl: xid: 0x0002.006.000011d2 uba: 0x0200001f.1877.01

flg: C--- lkc: 0 scn: 0x0000.00ae90b2

KDO Op code: DRP row dependencies Disabled

xtype: XA flags: 0x00000000 bdba: 0x00810de8 hdba: 0x00800192

itli: 2 ispac: 0 maxfr: 4858

tabn: 1 slot: 5(0x5)

--8/25 Rec#0x19 包含有数据修改前的拷贝

*-----

* Rec #0x19 slt: 0x1e objn: 90344(0x000160e8) objd: 90344 tblspc: 8(0x00000008)

* Layer: 11 (Row) opc: 1 rci 0x00

Undo type: Regular undo Begin trans Last buffer split: No

Temp Object: No

Tablespace Undo: No

rdba: 0x00000000Ext idx: 0

flg2: 0

*-----

uba: 0x02000010.187e.18 ctl max scn: 0x0000.00ae9095 prv tx scn: 0x0000.00ae909b

txn start scn: scn: 0x0000.00ae90b2 logon user: 0

prev brb: 33554460 prev bcl: 0

KDO undo record:

KTB Redo

op: 0x04 ver: 0x01

compat bit: 4 (post-11) padding: 1

op: L itl: xid: 0x0002.004.0000111f uba: 0x0200001a.177b.09
flg: C--- lkc: 0 scn: 0x0000.00ad9579
KDO Op code: URP row dependencies Disabled
xtype: XA flags: 0x00000000 bdba: 0x010006f3 hdba: 0x010006f2
itli: 2 ispac: 0 maxfr: 4858
tabn: 0 slot: 0(0x0) flag: 0x2c lock: 0 ckix: 0
ncol: 3 nnew: 1 size: 2
col 0: [9] 58 53 24 4e 55 4c 4c 4c 4c

select utl_raw.cast_to_varchar2(replace('58 53 24 4e 55 4c 4c 4c',' ')) from dual;
UTL_RAW.CAST_TO_VARCHAR2(REPLACE('5853244E554C4C4C4C',' '))

XS\$NULLLL

//////////
//session 4:
//////////

##下面再次调用 proc1.sql , 循环 340 次 , 这才形成了致命一击 , proc1.sql 输出如下 :

XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:1	2,21,4581,8,31,2,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:2	2,32,4582,8,31,3,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:3	2,12,4578,8,31,4,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:4	2,27,4583,8,31,5,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:5	2,5,4580,8,31,6,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:6	2,14,4581,8,31,7,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:7	2,30,4579,8,31,8,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:8	2,9,4582,8,31,9,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:9	2,10,4583,8,31,10,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:10	2,18,4580,8,31,11,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:11	2,31,4580,8,31,12,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:12	2,2,4582,8,31,13,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:13	2,22,4581,8,31,14,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:14	2,15,4580,8,31,15,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:15	2,3,4584,8,31,16,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:16	2,7,4583,8,31,17,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:17	2,13,4582,8,31,18,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:18	2,0,4582,8,31,19,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:19	2,19,4578,8,31,20,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:20	2,28,4581,8,31,21,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:21	2,29,4582,8,31,22,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:22	2,4,4578,8,31,23,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:23	2,6,4583,8,31,24,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:24	2,25,4583,8,31,25,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:25	2,16,4584,8,31,26,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:26	2,11,4581,8,31,27,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:27	2,23,4582,8,31,28,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:28	2,33,4581,8,31,29,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:29	2,1,4580,8,31,30,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:30	2,26,4582,8,31,31,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:31	2,24,4581,8,31,32,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:32	2,17,4585,8,31,33,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:33	2,8,4584,8,31,34,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:34	2,20,4582,8,31,35,6272
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:35	2,21,4582,8,16,1,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN	:36	2,32,4583,8,16,2,6273

```

XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :37 2,12,4579,8,16,3,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :38 2,27,4584,8,16,4,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :39 2,5,4581,8,16,5,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :40 2,14,4582,8,16,6,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :41 2,30,4580,8,16,7,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :42 2,9,4583,8,16,8,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :43 2,10,4584,8,16,9,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :44 2,18,4581,8,16,10,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :45 2,31,4581,8,16,11,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :46 2,2,4583,8,16,12,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :47 2,22,4582,8,16,13,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :48 2,15,4581,8,16,14,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :49 2,3,4585,8,16,15,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :50 2,7,4584,8,16,16,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :51 2,13,4583,8,16,17,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :52 2,0,4583,8,16,18,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :53 2,19,4579,8,16,19,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :54 2,28,4582,8,16,20,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :55 2,29,4583,8,16,21,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :56 2,4,4579,8,16,22,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :57 2,6,4584,8,16,23,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :58 2,25,4584,8,16,24,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :59 2,16,4585,8,16,25,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :60 2,11,4582,8,16,26,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :61 2,23,4583,8,16,27,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :62 2,33,4582,8,16,28,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :63 2,1,4581,8,16,29,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :64 2,26,4583,8,16,30,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :65 2,24,4582,8,16,31,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :66 2,17,4586,8,16,32,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :67 2,8,4585,8,16,33,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :68 2,20,4583,8,16,34,6273
XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN :69 2,21,4583,8,17,1,6273

```

。。。。。。省略了后面的 271 行

##从上面的输出可以看到 8/16 Rec #0x19 , 8/17 Rec#0x1 先后被覆盖 , 前者包含数据修改前的拷贝 , 后者包含了事务槽回滚所需的 uba 信息 , 这时必然导致下面 session 2 遇到 ORA-01555 错误

```

//////////
//session 2:
//////////
##久违的 ORA-01555 错误终于来了
select * from scott.tabnow1
*
ERROR at line 1:
ORA-01555: snapshot too old: rollback segment number 2 with name "_SYSSMU2$"
too small

alter system dump datafile 8 block min 9 block max 31;

##把所有 undo block dump 到文件 stest2_ora_29753578.trc

```



```
alter system dump datafile 8 block min 9 block max 31;
```

##在 trace 文件中未能查到 02000010.187e.19 , 意味着事务表不能回溯到足够旧的版本

```
cat stest2_ora_29753578.trc | grep 02000010.187e.19 | wc -l
```

```
0
```

##在 8/16 #0x19 中的记录也已经被覆盖掉了 , 意味着即使事务表即使能够顺利回滚 , 但也找不到修改前的数据拷贝了

```
*-----
```

```
* Rec #0x19 slt: 0x10 objn: 89731(0x00015e83) objd: 89731 tblspc: 8(0x00000008)
```

```
* Layer: 11 (Row) opc: 1 rci 0x00
```

```
Undo type: Regular undo Begin trans Last buffer split: No
```

```
Temp Object: No
```

```
Tablespace Undo: No
```

```
rdba: 0x00000000Ext idx: 0
```

```
flg2: 0
```

```
*-----
```

```
uba: 0x02000010.1881.18 ctl max scn: 0x0000.00ae9c40 prv tx scn: 0x0000.00ae9c43
```

```
txn start scn: scn: 0x0000.00ae9ca6 logon user: 0
```

```
prev brb: 33554463 prev bcl: 0
```

```
KDO undo record:
```

```
KTB Redo
```

```
op: 0x04 ver: 0x01
```

```
compat bit: 4 (post-11) padding: 1
```

```
op: L itl: xid: 0x0002.006.000011e8 uba: 0x02000010.1881.17
```

```
flg: C--- lkc: 0 scn: 0x0000.00ae9ca3
```

```
Array Update of 2 rows:
```

```
tabn: 0 slot: 0(0x0) flag: 0x2c lock: 0 ckix: 1
```

```
ncol: 1 nnew: 1 size: 0
```

```
KDO Op code: 21 row dependencies Disabled
```

```
xtype: XAxtype KDO_KDOM2 flags: 0x00000080 bdba: 0x010005be hdba: 0x010005ba
```

```
itli: 2 ispac: 0 maxfr: 4858
```

```
vect = 0
```

```
col 0: [ 2] c1 3b
```

```
tabn: 0 slot: 1(0x1) flag: 0x2c lock: 0 ckix: 1
```

```
ncol: 1 nnew: 1 size: 0
```

```
KDO Op code: 21 row dependencies Disabled
```

```
xtype: XAxtype KDO_KDOM2 flags: 0x00000080 bdba: 0x010005be hdba: 0x010005ba
```

```
itli: 2 ispac: 0 maxfr: 4858
```

```
vect = 0
```

```
col 0: [ 2] c1 3b
```

附 proc1.sql :

```
///Proc1.sql///
```

```
set serveroutput on
```

```

declare
v_xidusn number;
v_xidslot number;
v_xidsqn number;
v_ubafil number;
v_ubablk number;
v_ubasqn number;
v_ubarec number;
v_cnt number:=0;
v_rownum number;
v_startscn varchar2(20);
v_rowid rowid;
begin
select to_char(timestamp_to_scn(sysdate),'xxxxxxx') into v_startscn from dual;
dbms_output.put_line('START SCN:'||v_startscn);
for i in 1..340 loop
    update scott.t1 set id = i;
    select XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN into
v_xidusn,v_xidslot,v_xidsqn,v_ubafil,v_ubablk,v_ubarec,v_ubasqn from v$transaction;
    v_cnt:=v_cnt+1;

dbms_output.put_line('XIDUSN,XIDSLOT,XIDSQN,UBAFIL,UBABLK,UBAREC,UBASQN  :|
|v_cnt||  ||v_xidusn||','||v_xidslot||','||v_xidsqn||','||v_ubafil||','||v_ubablk||','||v_ubarec||','||v_ubasqn);
    commit;
end loop;
end;
/

```

作者个人简介



崔宏慧

任职于中国移动集团上海有限公司，主要从事系统维护工作，先后担任过系统管理员，存储管理员，对 AIX 操作系统、EMC 存储相关领域知识有较为深刻的理解，07 年开始接触 Oracle，目前担任帐务系统数据库 DBA，期间参与了上海移动异地容灾系统建设并多次主导核心数据库容灾演练、数据库升版、数据库存储迁移、BOSS 系统重构等项目。