【BBED】BBED 模拟并修复

ORA-08102 错误

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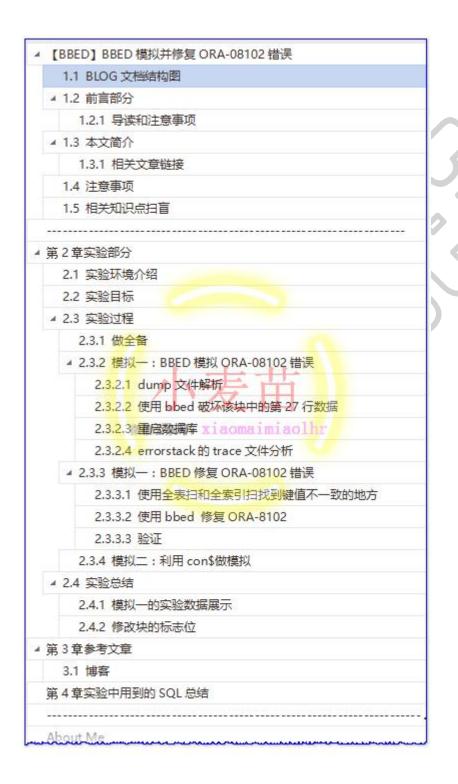
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博客地址：http://blog.itpub.net/26736162/abstract/1/

【BBED】BBED 模拟并修复 ORA-08102 错误

1.1 **BLOG** 文档结构图

1.2 前言部分

1.2.1　　导读和注意事项

各位技术爱好者，看完本文后，你可以掌握如下的技能，也可以学到一些其它你所不知道的知识，~O(∩_∩)O~：

① 使用 **BBED** 修复 **ORA-08102** 错误（重点）

② BBED 的使用

③ 数据块格式的 dump 文件解释

④ ORA-08102 错误的 trace 文件解释

⑤ 从 rdba 获取 ROWID 信息

⑥ 其它实用技能

Tips:

① 本文在 itpub（http://blog.itpub.net/26736162）、博客园（http://www.cnblogs.com/lhrbest）和微信公众号（xiaomaimiaolhr）上有同步更新。

② 文章中用到的所有代码、相关软件、相关资料及本文的 pdf 版本都请前往小麦苗的云盘下载，小麦苗的云盘地址见：http://blog.itpub.net/26736162/viewspace-1624453/。

③ 若网页文章代码格式有错乱，请下载 pdf 格式的文档来阅读。

④ 在本篇 BLOG 中，代码输出部分一般放在一行一列的表格中。

⑤ 本文适合于 Oracle 初中级人员阅读，Oracle 大师请略过本文。

⑥ 不喜勿喷。

本文若有错误或不完善的地方请大家多多指正，您的批评指正是我写作的最大动力。

1.3 本文简介

这几天一个朋友问我有关 ORA-08102 的错误，而且是关于 OBJ$ 表上的 I_OBJ4 索引。这些系统对象的索引，不能采用重建或设置事件的方式来修复该错误。模模糊糊的记得很早以前看过使用 BBED 的方式来修复该错误，只是已经记不清了。正好，趁此机会把该错误再模拟的复现一下，也把 bbed 再熟悉一下吧。

朋友发给我的参考文章也是大师惜分飞的博客地址，大致看了一下过程，主要是找到索引块的相关地址，然后利用 bbed 把键值修改的和表中存储的一致即可。还是那句话，"纸上得来终觉浅，绝知此事要躬行。"，**自己模拟实验，这个过程是必须的。**

废话不多说，开始实验吧。

1.3.1　　相关文章链接

阅读本篇文章，请先阅读以下内容：

1. Oracle 中 Object_iD 和 Data_Object_ID 的区别：http://blog.itpub.net/26736162/viewspace-2145230/

2. Oracle 的 dump 函数：http://blog.itpub.net/26736162/viewspace-2145228/

3. BBED 的几篇文章：

① 【BBED】编译及基本命令(1)：http://blog.itpub.net/26736162/viewspace-2075216/

② 【BBED】丢失归档文件情况下的恢复：http://blog.itpub.net/26736162/viewspace-2079337/

③ 【BBED】 sys.bootstrap$ 对象的恢复：http://blog.itpub.net/26736162/viewspace-2083621/

④ 【BBED】 SYSTEM 文件头损坏的恢复(4)：http://blog.itpub.net/26736162/viewspace-2084329/
⑤ 【BBED】bbed 常用命令：http://blog.itpub.net/26736162/viewspace-2123465/

1.4 注意事项

1、bbed 毕竟是未公开的恢复方式，所以不熟悉的朋友要慎用。
2、startup force 慎用
3、操作 bbed 之前最好先把数据库关闭

1.5 相关知识点扫盲

An ORA-08102 indicates that there is a mismatch between the key(s) stored in the index and the values stored in the table.What typically happens in the index is built and at some future time,some type of corruption occurs,either in the table or index,to cause the mismatch.

ORA-08102 常见于索引键值与表上存的值不一致。

```
[oracle@rhel6lhr ~]$ oerr ora 8102
08102, 00000, "index key not found, obj# %s, file %s, block %s (%s)"
// *Cause:  Internal error: possible inconsistency in index
// *Action:  Send trace file to your customer support representative, along
//           with information on reproducing the error
```

ora-08102 这种错误说明索引或表出现了数据不一致，索引上记录的键值和表里的数据不一致，引起访问失败，一般重建下索引就可以解决。两边不一致改表和索引都能达到目的，只要一致即可，但有一个原则就是索引键值始终要保证按顺序递增。通常有三种情况：

1.如果损坏为索引，则删除索引并重建索引，但对于 index 的 obj#小于 56 的情况，由于是核心的 bootstrap$对象,index 是在 DB 启动时由 DB 自动创建,此种情况下通过设置 event 38003 或 startup migrate 模式都不能解决，但 obj#>56 的则可以。

2.如果损坏为块级别，则采用坏块的处理方法

3.如果损坏的为表的记录级别的则采用 bbed 或其它工具

I_OBJ1、I_OBJ2、I_OBJ3、I_OBJ4、I_OBJ5 这几个都是 OBJ$基表的索引,如果损坏会非常麻烦,因为 ORACLE 对这些对象的 DDL 做了严格限制，没有办法简单修复它们。

Owner	Name	Type	Columns
SYS	I_OBJ1	Unique	OBJ#, OWNER#, TYPE#
SYS	I_OBJ2	Unique	OWNER#, NAME, NAMESPACE, REMOTEOWNER, LINKNAME, SUBNAME, TYPE#, SPARE3, OBJ#
SYS	I_OBJ3	Normal	OID$
SYS	I_OBJ4	Normal	DATAOBJ#, TYPE#, OWNER#
SYS	I_OBJ5	Unique	SPARE3, NAME, NAMESPACE, TYPE#, OWNER#, REMOTEOWNER, LINKNAME, SUBNAME, OBJ#

```
SYS@ora11g > drop index i_obj4;
drop index i_obj5
          *
ERROR at line 1:
ORA-00701: object necessary for warmstarting database cannot be altered
```

第 2 章　实验部分

2.1 实验环境介绍

项目	source db
db 类型	单机
db version	11.2.0.3.0
db 存储	FS
OS 版本及 kernel 版本	RHEL 6.5

2.2 实验目标

实验目标：**使用 BBED 模拟并修复 ORA-08102 错误。**

模拟错误过程：通过 bbed 修改 OBJ$表中 DATAOBJ#列最大的行所在的块，让 DATAOBJ#的值增大，从而和索引中记录的值不一致。重启数据库并创建表让数据库报出 ORA-08102 错误。

修复错误过程：通过 bbed 把表中或索引中的不一致的数据修改成一致的，从而修复 ORA-08102 错误。

2.3 实验过程

2.3.1　　做全备

```
[oracle@rhel6lhr ~]$ more rman_full.sh
rman target / nocatalog <<EOF
run{
 backup database format '/home/oracle/bak/%d_%U.full';
 sql 'alter system archive log current';
 backup archivelog all format '/home/oracle/bak/%d_%U.arc';
 backup current controlfile format '/home/oracle/bak/%d_%U.ctl';
}
EOF

[oracle@rhel6lhr ~]$ sh rman_full.sh

Recovery Manager: Release 11.2.0.3.0 - Production on Wed Sep 20 13:56:41 2017

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connected to target database: ORA11G (DBID=4270446895)
using target database control file instead of recovery catalog

RMAN> 2> 3> 4> 5> 6>
```

```
Starting backup at 2017-09-20 13:56:41
allocated channel: ORA DISK 1
channel ORA DISK 1: SID=21 device type=DISK
channel ORA DISK 1: starting full datafile backup set
channel ORA DISK 1: specifying datafile(s) in backup set
input datafile file number=00004 name=/u01/app/oracle/oradata/ora11g/users01.dbf
input datafile file number=00001 name=/u01/app/oracle/oradata/ora11g/system01.dbf
input datafile file number=00002 name=/u01/app/oracle/oradata/ora11g/sysaux01.dbf
input datafile file number=00005 name=/u01/app/oracle/oradata/ora11g/example01.dbf
input datafile file number=00003 name=/u01/app/oracle/oradata/ora11g/undotbs01.dbf
input datafile file number=00022 name=/u01/app/oracle/oradata/ora11g/ts ogg01.dbf
input datafile file number=00007 name=/u01/app/oracle/oradata/ora11g/DWII CNY BK F 01.dbf
input datafile file number=00008 name=/u01/app/oracle/oradata/ora11g/DWII DPA F 01.dbf
input datafile file number=00009 name=/u01/app/oracle/oradata/ora11g/DWII DPA I 01.dbf
input datafile file number=00010 name=/u01/app/oracle/oradata/ora11g/DWII_DPA_S_01.dbf
input datafile file number=00011 name=/u01/app/oracle/oradata/ora11g/DWII_SOR_F_01.dbf
input datafile file number=00012 name=/u01/app/oracle/oradata/ora11g/DWII_SOR_I_01.dbf
input datafile file number=00013 name=/u01/app/oracle/oradata/ora11g/DW_USER.dbf
input datafile file number=00014 name=/u01/app/oracle/oradata/ora11g/SQCHECK.dbf
input datafile file number=00015 name=/u01/app/oracle/oradata/ora11g/SD_CNY_D_01.dbf
input datafile file number=00016 name=/u01/app/oracle/oradata/ora11g/SD_CNY_F_01.dbf
input datafile file number=00017 name=/u01/app/oracle/oradata/ora11g/SD_DPA_D_01.dbf
input datafile file number=00018 name=/u01/app/oracle/oradata/ora11g/SD_DPA_F_01.dbf
input datafile file number=00019 name=/u01/app/oracle/oradata/ora11g/SD_SORT_T_01.dbf
input datafile file number=00020 name=/u01/app/oracle/oradata/ora11g/DWII_FXDM_F_01.dbf
input datafile file number=00021 name=/u01/app/oracle/oradata/ora11g/SD_SOR_T_01.dbf
input datafile file number=00006 name=/u01/app/oracle/oradata/ora11g/aa.dbf
input datafile file number=00023 name=/u01/app/oracle/oradata/ora11g/test01.dbf
channel ORA_DISK_1: starting piece 1 at 2017-09-20 13:56:42
channel ORA_DISK_1: finished piece 1 at 2017-09-20 13:59:17
piece handle=/home/oracle/bak/ORA11G_27seuekq_1_1.full tag=TAG20170920T135642 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:02:35
Finished backup at 2017-09-20 13:59:17

Starting Control File and SPFILE Autobackup at 2017-09-20 13:59:17
piece
handle=/u05/app/oracle/flash_recovery_area/ORA11G/autobackup/2017_09_20/o1_mf_s_955202357_dw40xohn_.bkp
comment=NONE
Finished Control File and SPFILE Autobackup at 2017-09-20 13:59:18

sql statement: alter system archive log current

Starting backup at 2017-09-20 13:59:18
current log archived
using channel ORA_DISK_1
channel ORA_DISK_1: starting archived log backup set
channel ORA_DISK_1: specifying archived log(s) in backup set
input archived log thread=1 sequence=302 RECID=304 STAMP=955202163
input archived log thread=1 sequence=303 RECID=305 STAMP=955202358
input archived log thread=1 sequence=304 RECID=306 STAMP=955202358
channel ORA_DISK_1: starting piece 1 at 2017-09-20 13:59:18
channel ORA_DISK_1: finished piece 1 at 2017-09-20 13:59:19
piece handle=/home/oracle/bak/ORA11G_29seuepm_1_1.arc tag=TAG20170920T135918 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:01
Finished backup at 2017-09-20 13:59:19

Starting backup at 2017-09-20 13:59:20
using channel ORA_DISK_1
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
including current control file in backup set
channel ORA_DISK_1: starting piece 1 at 2017-09-20 13:59:21
channel ORA_DISK_1: finished piece 1 at 2017-09-20 13:59:22
piece handle=/home/oracle/bak/ORA11G_2aseuepo_1_1.ctl tag=TAG20170920T135920 comment=NONE
```

```
channel ORA DISK 1: backup set complete, elapsed time: 00:00:01
Finished backup at 2017-09-20 13:59:22

Starting Control File and SPFILE Autobackup at 2017-09-20 13:59:22
piece
handle=/u05/app/oracle/flash recovery area/ORA11G/autobackup/2017 09 20/o1 mf s 955202362 dw40xtf0 .bkp
comment=NONE
Finished Control File and SPFILE Autobackup at 2017-09-20 13:59:23

RMAN>

Recovery Manager complete.
```

2.3.2　模拟一：BBED 模拟 ORA-08102 错误

通过 BBED 修改 OBJ$中 DATAOBJ$重现 I_OBJ4 索引报 ORA-08102 错误。定位需要破坏的 OBJ$上 DATAOBJ$列最大的记录，使之和索引 I_OBJ4 中记录不一致，从而实现 ORA-8102 错误。

```
[oracle@rhel6lhr ~]$ ORACLE_SID=ora11g
[oracle@rhel6lhr ~]$ sqlplus / as sysdba

SQL*Plus: Release 11.2.0.3.0 Production on Thu Sep 21 09:24:08 2017

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Connected to:
Oracle Database 11g Enterprise Edition Release 11.2.0.3.0 - 64bit Production
With the Partitioning, OLAP, Data Mining and Real Application Testing options

SYS@ora11g > select object_id,object_type from dba_objects where object_name='I_OBJ4';

 OBJECT_ID OBJECT_TYPE
---------- -------------------
        39 INDEX

SYS@ora11g > select max(DATAOBJ#) from obj$;

MAX(DATAOBJ#)
-------------
        94098

SYS@ora11g > select dump(94098,16) from dual;

DUMP(94098,16)
----------------------
Typ=2 Len=4: c3,a,29,63 ===>>>>> Typ=2 表示 NUMBER，96 表示 CHAR。Len=4 表示 4 位长度，所以，94098 在数据库内部的存储格式为 04c30a2963


SYS@ora11g > SELECT DBMS ROWID.ROWID RELATIVE FNO(ROWID) FILE#,
  2         DBMS ROWID.ROWID BLOCK NUMBER(ROWID) BLOCK#,
  3         DBMS ROWID.ROWID ROW NUMBER(ROWID) ROW#
  4    FROM OBJ$
  5   WHERE DATAOBJ# = 94098;

     FILE#     BLOCK#       ROW#
---------- ---------- ----------
```

```
        1        241        27

SYS@ora11g > SELECT COUNT(*) COUNTS,
  2          MAX(DBMS ROWID.ROWID ROW NUMBER(ROWID)) MAX ROWNUM,
  3          MIN(DBMS ROWID.ROWID ROW NUMBER(ROWID)) MIN ROWNUM
  4    FROM SYS.OBJ$ D
  5    WHERE DBMS ROWID.ROWID RELATIVE FNO(ROWID) = 1
  6      AND DBMS ROWID.ROWID BLOCK NUMBER(ROWID) = 241;


    COUNTS MAX ROWNUM MIN ROWNUM
---------- ---------- ----------
       105        104          0
```

根据以上的 SQL 可以得到下表的内容：

项目	值
OBJ$上 DATAOBJ#列的最大值	94098
OBJ$上 DATAOBJ#列的最大值 dump 值	Typ=2 Len=4: c3,a,29,63　即：04c30a2963
该行所在数据块的地址	``` FILE# BLOCK# ROW# ---------- ---------- ---------- 1 241 27```
该行的存储情况	``` COUNTS MAX_ROWNUM MIN_ROWNUM ---------- ---------- ---------- 105 104 0```

即：**OBJ$表上 DATAOBJ#列的最大值为 94098，该值在 Oracle 数据库中的存储格式为 04c30a2963，该行数据所在的块为 1 号文件，241 号块，第 27 行，该块上共有 105 行数据，最大值的行号为 104，最小值的行号为 0。**

2.3.2.1　**dump** 文件解析

先对 1 号文件，241 号块做 dump：

```
SYS@ora11g >  conn / as sysdba
Connected.
SYS@ora11g >  alter system dump datafile 1  block 241;

System altered.

SYS@ora11g > select value from v$diag info where name='Default Trace File';

VALUE
--------------------------------------------------------------------------------
/u01/app/oracle/diag/rdbms/ora11g/ora11g/trace/ora11g_ora_28221.trc
```

ora11g_ora_28221.trc

关于块格式的详细介绍请参考：http://blog.itpub.net/26736162/viewspace-2141499/

```
Start dump data blocks tsn: 0 file#:1 minblk 241 maxblk 241  ====>>>>> SYSTEM 是 0 号表空间 1 号文件，当前块是
241 号
Block dump from cache:====>>>>> 从内存中 dump 出来的
Dump of buffer cache at level 4 for tsn=0 rdba=4194545====>>>>> cache 中的位置
BH (0x6cfe2658) file#: 1 rdba: 0x004000f1 (1/241) class: 1 ba: 0x6cd1a000====>>>>> 参考链接地址
  set: 5 pool: 3 bsz: 8192 bsi: 0 sflg: 1 pwc: 0,25
```

```
  dbwrid: 0 obj: 18 objn: 18 tsn: 0 afn: 1 hint: f
  hash: [0x773fca58,0x773fca58] lru: [0x6dbedcf0,0x6bbf1e40]
  lru-flags: hot_buffer
  ckptq: [NULL] fileq: [NULL] objq: [0x6e7d8388,0x6d7e82d8] objaq: [0x6d3f0588,0x6d7e82e8]
  st: XCURRENT md: NULL fpin: 'kdswh05: kdsgrp' tch: 11
  flags:
  LRBA: [0x0.0.0] LSCN: [0x0.0] HSCN: [0xffff.ffffffff] HSUB: [65535]
```
Block dump from disk: ====>>>>> 参考链接地址
```
buffer tsn: 0 rdba: 0x004000f1 (1/241)
scn: 0x0000.038f7e74 seq: 0x01 flg: 0x06 tail: 0x7e740601
frmt: 0x02 chkval: 0xc3cc type: 0x06=trans data
Hex dump of block: st=0, typ_found=1
Dump of memory from 0x00007F1583F05A00 to 0x00007F1583F07A00
7F1583F05A00 0000A206 004000F1 038F7E74 06010000  [......@.t~......]
7F1583F05A10 0000C3CC 00000001 00000012 038F7E73  [............s~..]
7F1583F05A20 00000000 0002F801 00000000 00190006  [................]
7F1583F05A30 00000BF4 00C002D5 00030203 00002001  [............. ..]
7F1583F05A40 038F7E74 00690100 00E4FFFF 035F013B  [t~....i.....;._.]
...........省略部分输出................
7F1583F079C0 0215C102 800103C1 4F434905 C102244C  [.........ICOL$..]
7F1583F079D0 C102FF02 6F780703 2F0A1109 6F78070E  [......xo.../..xo]
7F1583F079E0 3B0A1109 6F780701 2F0A1109 02C1020E  [...;..xo.../....]
7F1583F079F0 8001FFFF 028001FF 800102C1 7E740601  [..............t~]
```
Block header dump: 0x004000f1 ====>>>>> 参考链接地址
```
 Object id on Block? Y
 seg/obj: 0x12  csc: 0x00.38f7e73  itc: 1  flg: -  typ: 1 - DATA
     fsl: 0  fnx: 0x0 ver: 0x01


 Itl           Xid                 Uba            Flag  Lck        Scn/Fsc
0x01   0x0006.019.00000bf4  0x00c002d5.0203.03  --U-   1  fsc 0x0000.038f7e74
bdba: 0x004000f1
data_block_dump,data header at 0x7f1583f05a44
===============
tsiz: 0x1fb8
hsiz: 0xe4
pbl: 0x7f1583f05a44
     76543210
flag=---------
ntab=1
```
nrow=105 ====>>>>> 共 105 行数据
```
frre=-1
fsbo=0xe4
fseo=0x13b
avsp=0x35f
tosp=0x35f
0xe:pti[0]  nrow=105    offs=0
0x12:pri[0] offs=0x1f79
0x14:pri[1] offs=0x1f36
...........省略部分输出................
0x44:pri[25]   offs=0x18ff
0x46:pri[26]   offs=0x18c1
```
0x48:pri[27]   offs=0x13b====>>>>> 第 27 行数据的指针偏移位置是 13b，转换为 10 进制是 315，selet to_number('13b','xxx') from dual;
```
...........省略部分输出................
0xde:pri[102]   offs=0x515
0xe0:pri[103]   offs=0x4ce
0xe2:pri[104]   offs=0x48b
block_row_dump:
tab 0, row 0, @0x1f79
```

```
tl: 63 fb: --H-FL-- lb: 0x0  cc: 18
col  0: [ 2]  c1 15
col  1: [ 2]  c1 03
col  2: [ 1]  80
col  3: [ 5]  49 43 4f 4c 24
col  4: [ 2]  c1 02
col  5: *NULL*
col  6: [ 2]  c1 03
col  7: [ 7]  78 6f 09 11 0a 2f 0e
col  8: [ 7]  78 6f 09 11 0a 3b 01
col  9: [ 7]  78 6f 09 11 0a 2f 0e
col 10: [ 2]  c1 02
col 11: *NULL*
col 12: *NULL*
col 13: [ 1]  80
col 14: *NULL*
col 15: [ 1]  80
col 16: [ 2]  c1 02
col 17: [ 1]  80
...........省略部分输出................
tab 0, row 27, @0x13b ====>>>>> 该块中第一个表第 27 行的指针位置，转换为 10 进制是 315
tl: 72 fb: --H-FL-- lb: 0x1  cc: 18
col  0: [ 2]  c1 02
col  1: [ 4]  c3 0a 29 63
col  2: [ 1]  80
col  3: [12]  5f 4e 45 58 54 5f 4f 42 4a 45 43 54
col  4: [ 2]  c1 02
col  5: *NULL*
col  6: [ 1]  80
col  7: [ 7]  78 6f 09 11 0a 2f 0e
col  8: [ 7]  78 75 09 14 13 1d 25
col  9: [ 7]  78 6f 09 11 0a 2f 0e
col 10: [ 1]  80
col 11: *NULL*
col 12: *NULL*
col 13: [ 1]  80
col 14: *NULL*
col 15: [ 1]  80
col 16: [ 4]  c3 07 38 24
col 17: [ 1]  80
...........省略部分输出................
tab 0, row 104, @0x48b
tl: 67 fb: --H-FL-- lb: 0x0  cc: 18
col  0: [ 3]  c2 02 06
col  1: [ 3]  c2 02 06
col  2: [ 1]  80
col  3: [ 7]  41 43 43 45 53 53 24
col  4: [ 2]  c1 02
col  5: *NULL*
col  6: [ 2]  c1 03
col  7: [ 7]  78 6f 09 11 0a 2f 10
col  8: [ 7]  78 6f 09 11 0a 2f 10
col  9: [ 7]  78 6f 09 11 0a 2f 10
col 10: [ 2]  c1 02
col 11: *NULL*
col 12: *NULL*
col 13: [ 1]  80
col 14: *NULL*
col 15: [ 1]  80
```

```
col 16: [ 2]  c1 02
col 17: [ 1]  80
end_of_block_dump
End dump data blocks tsn: 0 file#: 1 minblk 241 maxblk 241
```

由于 SYS.OBJ$表共 21 列，但是最后 3 列都为空，所以，dump 文件里就没有显示出来。将该行数据以 16 进制 dump 出来看看：

```
SELECT DUMP(OBJ#, 16),
       DUMP(DATAOBJ#, 16),
       DUMP(OWNER#, 16),
       DUMP(NAME, 16),
       DUMP(NAMESPACE, 16),
       DUMP(SUBNAME, 16),
       DUMP(TYPE#, 16),
       DUMP(CTIME, 16),
       DUMP(MTIME, 16),
       DUMP(STIME, 16),
       DUMP(STATUS, 16),
       DUMP(REMOTEOWNER, 16),
       DUMP(LINKNAME, 16),
       DUMP(FLAGS, 16),
       DUMP(OID$, 16),
       DUMP(SPARE1, 16),
       DUMP(SPARE2, 16),
       DUMP(SPARE3, 16),
       DUMP(SPARE4, 16),
       DUMP(SPARE5, 16),
       DUMP(SPARE6, 16)
  FROM SYS.OBJ$ D
 WHERE DATAOBJ# = 94098;
```

Row 1	Fields	
▶ DUMP(OBJ#,16)	Typ=2 Len=2: c1,2	...
DUMP(DATAOBJ#,16)	Typ=2 Len=4: c3,a,29,63	...
DUMP(OWNER#,16)	Typ=2 Len=1: 80	...
DUMP(NAME,16)	Typ=1 Len=12: 5f,4e,45,58,54,5f,4f,42,4a,45,43,54	...
DUMP(NAMESPACE,16)	Typ=2 Len=2: c1,2	...
DUMP(SUBNAME,16)	NULL	...
DUMP(TYPE#,16)	Typ=2 Len=1: 80	...
DUMP(CTIME,16)	Typ=12 Len=7: 78,6f,9,11,a,2f,e	...
DUMP(MTIME,16)	Typ=12 Len=7: 78,75,9,14,13,1d,25	...
DUMP(STIME,16)	Typ=12 Len=7: 78,6f,9,11,a,2f,e	...
DUMP(STATUS,16)	Typ=2 Len=1: 80	...
DUMP(REMOTEOWNER,16)	NULL	...
DUMP(LINKNAME,16)	NULL	...
DUMP(FLAGS,16)	Typ=2 Len=1: 80	...
DUMP(OID$,16)	NULL	...
DUMP(SPARE1,16)	Typ=2 Len=1: 80	...
DUMP(SPARE2,16)	Typ=2 Len=4: c3,7,38,24	...
DUMP(SPARE3,16)	Typ=2 Len=1: 80	...

结果和 dump 文件中的内容一致。

列名	10 进制值	16 进制值	dump 文件的存储
OBJ#	1	Typ=2 Len=2: c1,2	col 0: [2] c1 02
DATAOBJ#	94098	Typ=2 Len=4: c3,a,29,63	col 1: [4] c3 0a 29 63

OWNER#	0	Typ=2 Len=1: 80	col 2: [1] 80
NAME	_NEXT_OBJECT	Typ=1 Len=12: 5f,4e,45,58,54,5f,4f,42,4a,45,43,54	col 3: [12] 5f 4e 45 58 54 5f 4f 42 4a 45 43 54
NAMESPACE	1	Typ=2 Len=2: c1,2	col 4: [2] c1 02
SUBNAME		NULL	col 5: *NULL*
TYPE#	0	Typ=2 Len=1: 80	col 6: [1] 80
CTIME	2011-09-17 09:46:13	Typ=12 Len=7: 78,6f,9,11,a,2f,e	col 7: [7] 78 6f 09 11 0a 2f 0e
MTIME	2017-09-20 18:28:36	Typ=12 Len=7: 78,75,9,14,13,1d,25	col 8: [7] 78 75 09 14 13 1d 25
STIME	2011-09-17 09:46:13	Typ=12 Len=7: 78,6f,9,11,a,2f,e	col 9: [7] 78 6f 09 11 0a 2f 0e
STATUS	0	Typ=2 Len=1: 80	col 10: [1] 80
REMOTEOWNER		NULL	col 11: *NULL*
LINKNAME		NULL	col 12: *NULL*
FLAGS	0	Typ=2 Len=1: 80	col 13: [1] 80
OID$		NULL	col 14: *NULL*
SPARE1	0	Typ=2 Len=1: 80	col 15: [1] 80
SPARE2	65535	Typ=2 Len=4: c3,7,38,24	col 16: [4] c3 07 38 24
SPARE3	0	Typ=2 Len=1: 80	col 17: [1] 80

所以，从 dump 文件中还可以得到第 27 行数据的指针偏移位置是 13b，转换为 10 进制是 315。

2.3.2.2   使用 bbed 破坏该块中的第 27 行数据

使用 bbed 破坏记录，修改 dataobj#中的值，使得 obj$.dataobj#和 i_obj4 中的 dataobj#不匹配。

```
SYS@ora11g > select name from v$datafile where file#=1;

NAME
--------------------------------------------------------------------------------
/u01/app/oracle/oradata/ora11g/system01.dbf

最好是干净的关闭数据库
```

```
[oracle@rhel6lhr ~]$ bbed password=blockedit blocksize=8192 mode=edit
filename='/u01/app/oracle/oradata/ora11g/system01.dbf'

BBED: Release 2.0.0.0.0 - Limited Production on Thu Sep 21 10:40:47 2017

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************* !!! For Oracle Internal Use only !!! ***************

BBED> show all
        FILE#           0
        BLOCK#          1
        OFFSET          0
        DBA             0x00000000 (0 0,1)
        FILENAME        /u01/app/oracle/oradata/ora11g/system01.dbf
        BIFILE          bifile.bbd
        LISTFILE
        BLOCKSIZE       8192
        MODE            Edit
```

```
        EDIT          Unrecoverable
        IBASE         Dec
        OBASE         Dec
        WIDTH         80
        COUNT         512
        LOGFILE       ./log.bbd
        SPOOL         No


BBED> set block 241
        BLOCK#        241


BBED> map
 File: /u01/app/oracle/oradata/ora11g/system01.dbf (0)
 Block: 241                              Dba:0x00000000
------------------------------------------------------------
 KTB Data Block (Table/Cluster) ====>>>>> 表明是数据块

  struct kcbh, 20 bytes                   @0

  struct ktbbh, 48 bytes                  @20

  struct kdbh, 14 bytes                   @68

  struct kdbt[1], 4 bytes                 @82

 sb2 kdbr[105]                            @86

 ub1 freespace[87]                        @296

 ub1 rowdata[7805]                        @383

  ub4 tailchk                             @8188    ====>>>>> 块校验位


BBED> p kdbr===>>>>> 块中数据指针位置
sb2 kdbr[0]                               @86      8057
sb2 kdbr[1]                               @88      7990
sb2 kdbr[2]                               @90      7928
○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○   省略。○ ○ ○ ○ ○ ○ ○ ○ ○
sb2 kdbr[24]                              @134     6466
sb2 kdbr[25]                              @136     6399
sb2 kdbr[26]                              @138     6337
sb2 kdbr[27]                              @140     315===>>>>> 第 27 行数据指针位置为 315，和 dump 出来的信息一致
sb2 kdbr[28]                              @142     6268
sb2 kdbr[29]                              @144     6201
○ ○ ○ ○ ○ ○ ○ ○ ○ ○ ○   省略。○ ○ ○ ○ ○ ○ ○ ○ ○
sb2 kdbr[103]                             @292     1230
sb2 kdbr[104]                             @294     1163===>>>>> 表明该块共有 105 行数据


BBED> p *kdbr[27]
rowdata[0]
----------
ub1 rowdata[0]                           @383      0x2c===>>>>> 第 27 行偏移位置为 383


BBED> show offset
        OFFSET        383


BBED> x /rnnncncnttttnccncnnn===>>>>> 打印第 27 行的数据内容，n 代表 number，c 代表 char，t 代表 date
rowdata[0]                               @383
----------
flag@383: 0x2c (KDRHFL, KDRHFF, KDRHFH)
lock@384: 0x01
cols@385:   18===>>>>> 共 18 列

col    0[2] @386: 1
```

```
col    1[4] @389: 94098  ==>>>>> 需要修改该列的值
col    2[1] @394: 0
col    3[12] @396:  NEXT OBJECT
col    4[2] @409: 1
col    5[0] @412: *NULL*
col    6[1] @413: 0
col    7[7] @415: 2011-09-17 09:46:13
col    8[7] @423: 2017-09-20 18:28:36
col    9[7] @431: 2011-09-17 09:46:13
col   10[1] @439: 0
col   11[0] @441: *NULL*
col   12[0] @442: *NULL*
col   13[1] @443: 0
col   14[0] @445: *NULL*
col   15[1] @446: 0
col   16[4] @448: 65535
col   17[1] @453: 0

BBED> set offset 389
        OFFSET          389


BBED> d /v count 32
 File: /u01/app/oracle/oradata/ora11g/system01.dbf (0)
 Block: 241    Offsets:  389 to  420  Dba:0x00000000
------------------------------------------------------
 04c30a29 6301800c 5f4e4558 545f4f42 l ...)c... NEXT_OB
 4a454354 02c102ff 01800778 6f09110a l JECT.......xo...

 <16 bytes per line>


BBED>
```

当然，也可以使用 find 来直接查询：

```
BBED> f /x c30a29
 File: /u01/app/oracle/oradata/ora11g/system01.dbf (0)
 Block: 241          Offsets:  390 to  421         Dba:0x00000000
-----------------------------------------------------------------------
 c30a2963 01800c5f 4e455854 5f4f424a 45435402 c102ff01 8007786f 09110a2f

 <32 bytes per line>

BBED> f
BBED-00212: search string not found
```

94098 和 94099 对应的存储格式：

```
SYS@ora11g > select dump(94098,16),dump(94099,16) from dual;

DUMP(94098,16)          DUMP(94099,16)
----------------------- -----------------------
Typ=2 Len=4: c3,a,29,63 Typ=2 Len=4: c3,a,29,64
```

使用 bbed 修改 04c30a2963 为 04c30a2964，即把 94098 修改为 94099，如下所示：

```
BBED> set offset +2
       OFFSET          392


BBED> d
 File: /u01/app/oracle/oradata/ora11g/system01.dbf (0)
 Block: 241          Offsets:  392 to  423          Dba:0x00000000
------------------------------------------------------------------------
 29630180 0c5f4e45 58545f4f 424a4543 5402c102 ff018007 786f0911 0a2f0e07


 <32 bytes per line>


BBED> m /x 2964
Warning: contents of previous BIFILE will be lost. Proceed? (Y/N) Y
 File: /u01/app/oracle/oradata/ora11g/system01.dbf (0)
 Block: 241          Offsets:  392 to  423          Dba:0x00000000
------------------------------------------------------------------------
 29640180 0c5f4e45 58545f4f 424a4543 5402c102 ff018007 786f0911 0a2f0e07


 <32 bytes per line>


BBED> d /v
 File: /u01/app/oracle/oradata/ora11g/system01.dbf (0)
 Block: 241    Offsets:  392 to  423  Dba:0x00000000
------------------------------------------------------
 29640180 0c5f4e45 58545f4f 424a4543 l )d..._NEXT_OBJEC
 5402c102 ff018007 786f0911 0a2f0e07 l T.......xo.../..


 <16 bytes per line>


BBED> sum
Check value for File 0, Block 241:
current = 0xc3cc, required = 0xc4cc


BBED> sum apply
Check value for File 0, Block 241:
current = 0xc4cc, required = 0xc4cc


BBED> v
DBVERIFY - Verification starting
FILE = /u01/app/oracle/oradata/ora11g/system01.dbf
BLOCK = 241



DBVERIFY - Verification complete

Total Blocks Examined         : 1
Total Blocks Processed (Data) : 1
Total Blocks Failing   (Data) : 0
Total Blocks Processed (Index): 0
Total Blocks Failing   (Index): 0
Total Blocks Empty            : 0
Total Blocks Marked Corrupt   : 0
Total Blocks Influx           : 0
Message 531 not found;  product=RDBMS; facility=BBED
```

修改后查看该行记录的内容：

```
BBED> set offset 383
       OFFSET          383


BBED> x /rnnncncntttncncnnn
rowdata[0]                              @383
----------
```

```
flag@383:  0x2c (KDRHFL, KDRHFF, KDRHFH)
lock@384:  0x01
cols@385:   18

col    0[2] @386: 1
col    1[4] @389: 94099 ==>>>>> 已修改
col    2[1] @394: 0
col    3[12] @396:   NEXT OBJECT
col    4[2] @409: 1
col    5[0] @412: *NULL*
col    6[1] @413: 0
col    7[7] @415: 2011-09-17 09:46:13
col    8[7] @423: 2017-09-20 18:28:36
col    9[7] @431: 2011-09-17 09:46:13
col   10[1] @439: 0
col   11[0] @441: *NULL*
col   12[0] @442: *NULL*
col   13[1] @443: 0
col   14[0] @445: *NULL*
col   15[1] @446: 0
col   16[4] @448: 65535
col   17[1] @453: 0
```

可以看到成功的将 94098 修改为 94099。

2.3.2.3   重启数据库

重现在 obj$的 I_OBJ4 index 上报 ORA-8102 错误，而且不能创建新对象。

```
SYS@ora11g > create table test_8102_lhr as select * from dba_users;

Table created.==>>>>> 需要重启数据库

SYS@ora11g > startup force
ORACLE instance started.

Total System Global Area  409194496 bytes
Fixed Size                  2228864 bytes
Variable Size             306187648 bytes
Database Buffers           92274688 bytes
Redo Buffers                8503296 bytes
Database mounted.
Database opened.
SYS@ora11g >
SYS@ora11g > create table test_8102_lhr_01 as select * from dba_users;
create table test_8102_lhr_01 as select * from dba_users
                                          *
ERROR at line 1:
ORA-00604: error occurred at recursive SQL level 1
ORA-08102: index key not found, obj# 39, file 1, block 94083 (2)

SYS@ora11g > col OBJECT_NAME for a30
SYS@ora11g > select object_name,object_type from dba_objects where object_id=39;

OBJECT_NAME                    OBJECT_TYPE
------------------------------ --------------------
I_OBJ4                         INDEX

==>>>>>39 号为 I_OBJ4 这个索引，在块 94093 上没有找到键值。
```

2.3.2.4 **errorstack** 的 **trace** 文件分析

告警日志会生成 errorstack:

ora11g_ora_46780.trc

```
Thu Sep 21 10:57:39 2017
Errors in file /u01/app/oracle/diag/rdbms/ora11g/ora11g/trace/ora11g_ora_46780.trc:
Thu Sep 21 10:57:41 2017
Dumping diagnostic data in directory=[cdmp_20170921105741], requested by (instance=1, osid=46780),
summary=[abnormal process termination].
```

从日志文件中可以看到：

```
*** 2017-09-21 10:57:39.849
oer 8102.2 - obj# 39, rdba: 0x00416f83(afn 1, blk# 94083)
```
<<<<<<<===发生错误的对象为 39 号对象，1 号文件，94083 号块，rdba（relative data block address）表示相对数据块地址，计算方式参考：
http://blog.itpub.net/26736162/viewspace-2141499/
```
kdk key 8102.2:
  ncol: 4, len: 16
```
<<<<<<<===共 4 列，长度为 16 字节
```
  key: (16):  04 c3 0a 29 64 01 80 01 80 06 00 40 00 f1 00 1b
```
<<<<<<<===在索引中找不到键值 04 c3 0a 29 64（转换为 10 进制即 94099），其中 04 代表行的长度，后面则是列的内容。由于该索引共有 3 列（DATAOBJ#, TYPE#, OWNER#），所以，04 c3 0a 29 64 代表 DATAOBJ#，"01 80"代表 TYPE#，接下来的"01 80"代表 OWNER#，剩下的"06 00 40 00 f1 00 1b"代表该行 ROWID，06 代表长度。索引中的 ROWID=文件号（2 进制前 10 位）+块号（2 进制 22 位）+行号（2 进制 16 位）
00 40 00 f1 00 1b（16 进制）= 0000000001000000000000001111000100000000000011011（2 进制）
文件号=（0000000001）取前 10 位的二进制=第 1 号文件
块号=（0000000000000011110001）取前 2 进制 22 位==>第 241 号
行号=（0000000000011011）取 2 进制 16 位==>第 27 行
这个结果和之前查询出来的结果一致。
```
```
  mask: (4096):
```
○ ○ ○ ○ ○ ○ ○ ○ ○ 省略。○ ○ ○ ○ ○ ○ ○ ○
```
*** 2017-09-21 10:57:39.850
dbkedDefDump(): Starting a non-incident diagnostic dump (flags=0x0, level=3, mask=0x0)
----- Error Stack Dump -----
----- Current SQL Statement for this session (sql_id=4yyb4104skrwj) -----
update obj$ set obj#=:4,
type#=:5,ctime=:6,mtime=:7,stime=:8,status=:9,dataobj#=:10,flags=:11,oid$=:12,spare1=:13, spare2=:14
where owner#=:1 and name=:2 and namespace=:3 and remoteowner is null and linkname is null and subname is
null
```

○ ○ ○ ○ ○ ○ ○ ○ ○ 省略。○ ○ ○ ○ ○ ○ ○ ○

```
Block header dump: 0x00416f83
 Object id on Block? Y
 seg/obj: 0x27 csc: 0x00.38f9bc9 itc: 3 flg: O typ: 2 - INDEX
```
<<<<<<<===注意：块中可能有多个索引，所以需要使用"seg/obj: 0x27"来进行判断，这里 0x27 表示 39 号对象。
```
     fsl: 0 fnx: 0x416f84 ver: 0x01

 Itl   Xid   Uba   Flag Lck   Scn/Fsc
0x01   0x0009.01f.00000f09 0x00c001f6.02d1.01 CB--   0 scn 0x0000.038326d7
0x02   0x000a.009.0000098a 0x00c0030c.01ff.14 ----   1 fsc 0x0000.00000000
0x03   0x0006.008.00000bf2 0x00c002df.0203.16 --U-   1 fsc 0x0000.038f9bdc
```

```
Leaf block dump
===============
header address 1857765492=0x6ebb4074
kdxcolev 0
KDXCOLEV Flags = - - -
kdxcolok 0
kdxcoopc 0x80: opcode=0: iot flags=--- is converted=Y
kdxconco 4
kdxcosdc 1
kdxconro 297
kdxcofbo 630=0x276
kdxcofeo 1722=0x6ba
kdxcoavs 1398
kdxlespl 0
kdxlende 0
kdxlenxt 4213578=0x404b4a
kdxleprv 4288386=0x416f82
kdxledsz 0
kdxlebksz 8008
row#0[7987] flag: ------, lock: 0, len=21
col 0; len 4; (4):  c3 0a 20 26
col 1; len 2; (2):  c1 23
col 2; len 3; (3):  c2 02 26
col 3; len 6; (6):  00 41 6a b1 00 18
。。。。。。。。省略。。。。。。。。
row#284[1861] flag: ------, lock: 0, len=18
col 0; len 4; (4):  c3 0a 29 63<<<<<<===索引中存储的是 c3 0a 29 63
col 1; len 1; (1):  80
col 2; len 1; (1):  80
col 3; len 6; (6):  00 40 00 f1 00 1b<<<<<<===索引中的 ROWID
。。。。。。。。省略。。。。。。。。
row#296[2302] flag: ------, lock: 0, len=15
col 0; NULL
col 1; len 2; (2):  c1 02
col 2; len 1; (1):  80
col 3; len 6; (6):  00 40 2e 9f 00 50
----- end of leaf block dump -----
。。。。。。。。省略。。。。。。。。
```

　　另外通过相关 trace 发现，在创建表操作中会调用 update obj$的一个递归操作，而该操作会更新 dataobj#，但是由于该值在表和 index 中不匹配，因此出现 ORA-08102 导致创建表不成功。也可以通过如下的 SQL 生成 errorstack：

```
ALTER SESSION SET EVENTS '8102 trace name errorstack level 3';
create table t1 as select * from dual;
select value from v$diag_info where name='Default Trace File';
```

　　在 trace 中，需要从索引块中读取 c30a2964：

```
LHR@ora11g > select utl raw.cast to number('c30a2964') from dual;

UTL RAW.CAST TO NUMBER('C30A2964')
--------------------------------
                          94099
```

2.3.3   模拟一：BBED 修复 ORA-08102 错误

2.3.3.1   使用全表扫和全索引扫找到键值不一致的地方

```
SYS@ora11g > create table test_8102_lhr_01 as select * from dba_users;
create table test_8102_lhr_01 as select * from dba_users
                                    *
ERROR at line 1:
ORA-00604: error occurred at recursive SQL level 1
ORA-08102: index key not found, obj# 39, file 1, block 94083 (2)

SYS@ora11g > col OBJECT_NAME for a30
SYS@ora11g > select object_name,object_type from dba_objects where object_id=39;

OBJECT_NAME                    OBJECT_TYPE
------------------------------ -------------------
I_OBJ4                         INDEX

SYS@ora11g > set autot on
SYS@ora11g > set line 9999
SYS@ora11g >
SYS@ora11g > select /*+ index(t i_obj4) */ DATAOBJ# from sys.obj$  t
  2  minus
  3  select /*+ full(t1) */ DATAOBJ# from sys.obj$  t1;

  DATAOBJ#
----------
     94098


Execution Plan
----------------------------------------------------------
Plan hash value: 1107706645


--------------------------------------------------------------------------------
| Id  | Operation            | Name   | Rows  | Bytes |TempSpc| Cost (%CPU)| Time     |
--------------------------------------------------------------------------------
|   0 | SELECT STATEMENT     |        | 85519 |  334K |       | 1116  (47)| 00:00:14 |
|   1 |  MINUS               |        |       |       |       |           |          |
|   2 |   SORT UNIQUE NOSORT |        | 85519 |  167K |       |  603   (1)| 00:00:08 |
|   3 |    INDEX FULL SCAN   | I_OBJ4 | 85519 |  167K |       |  386   (0)| 00:00:05 |
|   4 |   SORT UNIQUE        |        | 85519 |  167K |  680K |  512   (1)| 00:00:07 |
|   5 |    TABLE ACCESS FULL | OBJ$   | 85519 |  167K |       |  295   (1)| 00:00:04 |
--------------------------------------------------------------------------------


Statistics
----------------------------------------------------------
          0  recursive calls
          0  db block gets
       1475  consistent gets
          0  physical reads
          0  redo size
        528  bytes sent via SQL*Net to client
        520  bytes received via SQL*Net from client
          2  SQL*Net roundtrips to/from client
          1  sorts (memory)
          0  sorts (disk)
          1  rows processed

SYS@ora11g > select /*+ full(t1) */ DATAOBJ# from sys.obj$  t1
```

```
  2   minus
  3    select /*+ index(t i obj4) */ DATAOBJ# from sys.obj$  t
  4   ;


  DATAOBJ#
----------
    94099


Execution Plan
----------------------------------------------------------
Plan hash value: 321946325

-----------------------------------------------------------------------------------
| Id | Operation            | Name  | Rows  | Bytes |TempSpc| Cost (%CPU)| Time     |
-----------------------------------------------------------------------------------
|  0 | SELECT STATEMENT     |       | 85519 |  334K|       | 1116  (55)| 00:00:14 |
|  1 |  MINUS               |       |       |       |       |           |          |
|  2 |   SORT UNIQUE        |       | 85519 |  167K|  680K|   512   (1)| 00:00:07 |
|  3 |    TABLE ACCESS FULL| OBJ$   | 85519 |  167K|       |   295   (1)| 00:00:04 |
|  4 |   SORT UNIQUE NOSORT|       | 85519 |  167K|       |   603   (1)| 00:00:08 |
|  5 |    INDEX FULL SCAN  | I_OBJ4 | 85519 |  167K|       |   386   (0)| 00:00:05 |
-----------------------------------------------------------------------------------


Statistics
----------------------------------------------------------
        1  recursive calls
        0  db block gets
     1474  consistent gets
        0  physical reads
        0  redo size
      528  bytes sent via SQL*Net to client
      520  bytes received via SQL*Net from client
        2  SQL*Net roundtrips to/from client
        1  sorts (memory)
        0  sorts (disk)
        1  rows processed
```

即表中记录的是 94099，而索引中记录的是 94098：

```
SYS@ora11g > set autot off
SYS@ora11g >
SYS@ora11g > select /*+ full(t) */  DATAOBJ#,type#,owner# from sys.obj$  t  WHERE t.dataobj# IN (94098,94099);

  DATAOBJ#      TYPE#     OWNER#
---------- ---------- ----------
    94099         0          0

SYS@ora11g > select /*+ full(t i_obj4) */  DATAOBJ#,type#,owner# from sys.obj$  t  WHERE t.dataobj# IN
(94098,94099);

  DATAOBJ#      TYPE#     OWNER#
---------- ---------- ----------
    94098         0          0
```

2.3.3.2 使用 bbed 修复 ORA-8102

```
SYS@ora11g > select dump(94098,16),dump(94099,16) from dual;

DUMP(94098,16)          DUMP(94099,16)
---------------------- ----------------------
Typ=2 Len=4: c3,a,29,63 Typ=2 Len=4: c3,a,29,64
```

```
[oracle@rhel6lhr ~]$ bbed password=blockedit blocksize=8192 mode=edit
filename='/u01/app/oracle/oradata/ora11g/system01.dbf'

BBED: Release 2.0.0.0.0 - Limited Production on Thu Sep 21 11:16:34 2017

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************* !!! For Oracle Internal Use only !!! ***************

BBED> set block 94083
      BLOCK#           94083
BBED> map
 File: /u01/app/oracle/oradata/ora11g/system01.dbf (0)
 Block: 94083                     Dba:0x00000000
------------------------------------------------------------
 KTB Data Block (Index Leaf)<<<<===索引块

 struct kcbh, 20 bytes                 @0

 struct ktbbh, 96 bytes                @20

 struct kdxle, 32 bytes                @116

 sb2 kd_off[297]                       @148

 ub1 freespace[1092]                   @742

 ub1 rowdata[6286]                     @1834

 ub4 tailchk                           @8188

BBED> f /x 0a2963
 File: /u01/app/oracle/oradata/ora11g/system01.dbf (0)
 Block: 94083           Offsets: 1981 to 2492       Dba:0x00000000
------------------------------------------------------------------
 0a296301 80018006 004000f1 001b0000 04c30a29 5b02c103 02c15b06 00416abb
 00110000 04c30a29 5c02c102 02c15b06 00416abb 00100100 04c30a29 5c02c102
 02c15b06 00416abb 000d0100 04c30a29 5b02c103 02c15b06 00416abb 000f0000
 04c30a29 5a02c103 02c15b06 00416abb 000e0100 04c30a29 5a02c103 02c15b06
 00416abb 000d0000 04c30a28 6202c103 02c15b06 00416abb 000c0000 04c30a28
 6302c102 02c15b06 00416abb 000b0000 04c30a29 5902c103 01800600 416abb00
 0a010004 c30a295e 01800180 06004000 f1001b00 0004c30a 283102c1 15018006
 00416abb 00090000 04c30a29 5102c115 01800600 416abb00 08000004 c30a294f
 02c11401 80060041 6abb0007 010004c3 0a295901 80018006 004000f1 001b0000
 04c30a28 2d02c115 01800600 416abb00 06000004 c30a294d 02c11501 80060041
 6abb0005 000004c3 0a294b02 c1140180 0600416a bb000400 0004c30a 282902c1
 15018006 00416abb 00030000 04c30a29 4902c115 01800600 416abb00 02010004
 c30a294e 01800180 06004000 f1001b00 0004c30a 294702c1 14018006 00416abb
 00010000 04c30a28 2502c115 01800600 416abb00 000000ff 02c10201 80060040
 2e9f0050 0000ff02 c1020180 0600402e 9f004800 00ff02c1 02018006 00402e9f
 003e0000 ff02c102 01800600 402e9f00 380000ff 02c10201 80060040 2e9f0032
```

```
 <32 bytes per line>

BBED> f
BBED-00212: search string not found <<<<===只找到 1 个，说明位置就是这里


BBED> set offset -2
      OFFSET          1979
BBED> d /v count 32
 File: /u01/app/oracle/oradata/ora11g/system01.dbf (0)
 Block: 94083   Offsets: 1979 to 2010  Dba:0x00000000
------------------------------------------------------
 04c30a29 63018001 80060040 00f1001b l ...)c......@....
 000004c3 0a295b02 c10302c1 5b060041 l .....)[.....[..A

 <16 bytes per line>
BBED> set offset +4
      OFFSET          1983

BBED> d /v
 File: /u01/app/oracle/oradata/ora11g/system01.dbf (0)
 Block: 94083   Offsets: 1983 to 2014  Dba:0x00000000
------------------------------------------------------
 63018001 80060040 00f1001b 000004c3 l c......@........
 0a295b02 c10302c1 5b060041 6abb0011 l .)[.....[..Aj...

 <16 bytes per line>

BBED> m /x 64
Warning: contents of previous BIFILE will be lost. Proceed? (Y/N) Y
 File: /u01/app/oracle/oradata/ora11g/system01.dbf (0)
 Block: 94083          Offsets: 1983 to 2014          Dba:0x00000000
------------------------------------------------------------------------
 64018001 80060040 00f1001b 000004c3 0a295b02 c10302c1 5b060041 6abb0011

 <32 bytes per line>
BBED> sum
Check value for File 0, Block 94083:
current = 0xb4e3, required = 0xb3e3

BBED> sum apply
Check value for File 0, Block 94083:
current = 0xb3e3, required = 0xb3e3

BBED> set offset 0
      OFFSET          0

BBED> f /x 0a2964
 File: /u01/app/oracle/oradata/ora11g/system01.dbf (0)
 Block: 94083          Offsets: 1981 to 2012          Dba:0x00000000
------------------------------------------------------------------------
 0a296401 80018006 004000f1 001b0000 04c30a29 5b02c103 02c15b06 00416abb

<<<<===已修改成和表中的数据一致
 <32 bytes per line>
BBED> f
BBED-00212: search string not found
BBED> v
DBVERIFY - Verification starting
FILE = /u01/app/oracle/oradata/ora11g/system01.dbf
BLOCK = 94083
```

```
DBVERIFY - Verification complete

Total Blocks Examined         : 1
Total Blocks Processed (Data) : 0
Total Blocks Failing   (Data) : 0
Total Blocks Processed (Index): 1
Total Blocks Failing   (Index): 0
Total Blocks Empty            : 0
Total Blocks Marked Corrupt   : 0  ====>>>>> 若该块被标识为坏块，则需要修改 offset 为 8188 处为 01
Total Blocks Influx           : 0
Message 531 not found;  product=RDBMS; facility=BBED
BBED> set offset 8188
        OFFSET          8188


BBED> d
 File: /u01/app/oracle/oradata/ora11g/system01.dbf (0)
 Block: 94083          Offsets: 8188 to 8191          Dba:0x00000000
------------------------------------------------------------------------
 0106aa4c

 <32 bytes per line>
```

2.3.3.3 验证

```
SYS@ora11g > create table t1 as select * from dual;
create table t1 as select * from dual
                                  *
ERROR at line 1:
ORA-00604: error occurred at recursive SQL level 1
ORA-08102: index key not found, obj# 39, file 1, block 94083 (2)

SYS@ora11g >  startup force;===>>>>> 慎用
ORACLE instance started.

Total System Global Area  409194496 bytes
Fixed Size                  2228864 bytes
Variable Size             306187648 bytes
Database Buffers           92274688 bytes
Redo Buffers                8503296 bytes
Database mounted.
Database opened.
SYS@ora11g >  create table t1 as select * from dual;

Table created.

SYS@ora11g > insert into t1 select * from dual;

1 row created.

SYS@ora11g > commit;

Commit complete.

SYS@ora11g > select * from t1;

D
-
X
X
```

OK，搞定。

2.3.4   模拟二：利用 con$做模拟

看了郭一军大师的博客，也可以使用 con$表来模拟 ORA-08102 错误，所以，小麦苗也尝试了一把。这个模拟实验就不详细解释了。

con$表是 Oracle 数据库中约束的基表，
SELECT * FROM Dba_Dependencies d WHERE d.name='DBA_CONSTRAINTS' AND d.owner='SYS' AND D.referenced_type='TABLE' ;

	OWNER	NAME	TYPE	REFERENCED_OWNER	REFERENCED_NAME	REFERENCED_TYPE	REFERENCED_LINK_NAME	DEPENDENCY_TYPE
1	SYS	DBA_CONSTRAINTS	VIEW	SYS	USER$	TABLE		HARD
2	SYS	DBA_CONSTRAINTS	VIEW	SYS	CON$	TABLE		HARD
3	SYS	DBA_CONSTRAINTS	VIEW	SYS	CDEF$	TABLE		HARD
4	SYS	DBA_CONSTRAINTS	VIEW	SYS	OBJ$	TABLE		HARD

参考文档是郭一军老师的：http://blog.chinaunix.net/uid-28460966-id-4584119.html

```
DROP TABLE T_ORA8102_LHR;
CREATE TABLE T_ORA8102_LHR AS SELECT * FROM USER_OBJECTS;
CREATE UNIQUE INDEX IDX_ORA8102_LHR ON T_ORA8102_LHR(OBJECT_ID);
ALTER TABLE T_ORA8102_LHR ADD PRIMARY KEY(OBJECT_ID);
LHR@ora11g > SELECT CONSTRAINT_NAME FROM DBA_CONSTRAINTS WHERE TABLE_NAME='T_ORA8102_LHR';

CONSTRAINT_NAME
------------------------------
SYS_C0018168


LHR@ora11g > SELECT MAX(CON#) FROM SYS.CON$;

 MAX(CON#)
----------
     18169


LHR@ora11g > SELECT D.NAME,
  2         DBMS_ROWID.ROWID_RELATIVE_FNO(ROWID) FILE#,
  3         DBMS_ROWID.ROWID_BLOCK_NUMBER(ROWID) BLOCK#,
  4         DBMS_ROWID.ROWID_ROW_NUMBER(ROWID) ROW#
  5    FROM SYS.CON$ D
  6   WHERE D.CON# = 18169;

NAME                            FILE#      BLOCK#      ROW#
------------------------------ ---------- ---------- ----------
_NEXT_CONSTRAINT                     1        289         12

LHR@ora11g > SELECT COUNT(*) COUNTS,
  2         MAX(DBMS_ROWID.ROWID_ROW_NUMBER(ROWID)) MAX_ROWNUM,
  3         MIN(DBMS_ROWID.ROWID_ROW_NUMBER(ROWID)) MIN_ROWNUM
  4    FROM SYS.CON$ D
  5   WHERE DBMS_ROWID.ROWID_RELATIVE_FNO(ROWID) = 1
  6     AND DBMS_ROWID.ROWID_BLOCK_NUMBER(ROWID) = 289;

   COUNTS MAX_ROWNUM MIN_ROWNUM
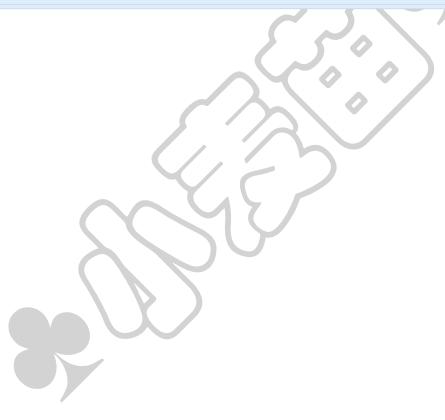---------- ---------- ----------
      311        310          0
```

SELECT D.* FROM SYS.CON$ D WHERE D.CON# = 18169;

	OWNER#	NAME	CON#	SPARE1	SPARE2	SPARE3	SPARE4	SPARE5	SPARE6
1	0	_NEXT_CONSTRAINT ···	18169	0			···	···	▼

```
[oracle@rhel6lhr ~]$ bbed password=blockedit blocksize=8192 mode=edit
filename='/u01/app/oracle/oradata/ora11g/system01.dbf'

BBED: Release 2.0.0.0.0 - Limited Production on Thu Sep 21 13:31:03 2017

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************* !!! For Oracle Internal Use only !!! **************

BBED> set block 289
        BLOCK#          289

BBED> map
 File: /u01/app/oracle/oradata/ora11g/system01.dbf (0)
 Block: 289                                Dba:0x00000000
```

```
-----------------------------------------------------------
 KTB Data Block (Table/Cluster)

 struct kcbh, 20 bytes                  @0

 struct ktbbh, 72 bytes                 @20

 struct kdbh, 14 bytes                  @92

 struct kdbt[1], 4 bytes                @106

 sb2 kdbr[311]                          @110

 ub1 freespace[675]                     @732

 ub1 rowdata[6781]                      @1407

 ub4 tailchk                            @8188


BBED> p kdbr
sb2 kdbr[0]                             @110     8077
sb2 kdbr[1]                             @112     8057
sb2 kdbr[2]                             @114     8038
sb2 kdbr[3]                             @116     8016
sb2 kdbr[4]                             @118     7994
sb2 kdbr[5]                             @120     7972
sb2 kdbr[6]                             @122     7952
sb2 kdbr[7]                             @124     7932
sb2 kdbr[8]                             @126     7910
sb2 kdbr[9]                             @128     7888
sb2 kdbr[10]                            @130     7868
sb2 kdbr[11]                            @132     7848
sb2 kdbr[12]                            @134     1315
sb2 kdbr[13]                            @136     7826
。。。。。。。省略部分内容。。。。。。。。。
sb2 kdbr[303]                           @716     1640
sb2 kdbr[304]                           @718     1618
sb2 kdbr[305]                           @720     1596
sb2 kdbr[306]                           @722     1574
sb2 kdbr[307]                           @724     1552
sb2 kdbr[308]                           @726     1530
sb2 kdbr[309]                           @728     1508
sb2 kdbr[310]                           @730     1486


BBED> p *kdbr[12]
rowdata[0]
----------
ub1 rowdata[0]                          @1407    0x2c

BBED> show offset
      OFFSET          1407

BBED> x /rncnn
rowdata[0]                              @1407
----------
flag@1407: 0x2c (KDRHFL, KDRHFF, KDRHFH)
lock@1408: 0x00
cols@1409:   4

col    0[1] @1410: 0
col    1[16] @1412: _NEXT_CONSTRAINT
col    2[4] @1429: 18169
col    3[1] @1434: 0
```

```
BBED> d /v offset 1429 count 16
 File: /u01/app/oracle/oradata/ora11g/system01.dbf (0)
 Block: 289    Offsets: 1429 to 1444  Dba:0x00000000
------------------------------------------------------
 04c30252 4601802c 00040180 105f4e45 l ...RE..,..... NE


 <16 bytes per line>
```

```
LHR@ora11g > select dump(18169,16),dump(18170,16) from dual;

DUMP(18169,16)          DUMP(18170,16)
---------------------- ----------------------
Typ=2 Len=4: c3,2,52,46 Typ=2 Len=4: c3,2,52,47
```

```
BBED> set offset +4
       OFFSET          1433

BBED> d
 File: /u01/app/oracle/oradata/ora11g/system01.dbf (0)
 Block: 289             Offsets: 1433 to 1448         Dba:0x00000000
----------------------------------------------------------------------
 4601802c 00040180 105f4e45 58545f43


 <32 bytes per line>


BBED> m /x 47
Warning: contents of previous BIFILE will be lost. Proceed? (Y/N) Y
 File: /u01/app/oracle/oradata/ora11g/system01.dbf (0)
 Block: 289             Offsets: 1433 to 1448         Dba:0x00000000
----------------------------------------------------------------------
 4701802c 00040180 105f4e45 58545f43


 <32 bytes per line>

BBED> sum
Check value for File 0, Block 289:
current = 0xeeee, required = 0xecee

BBED> sum apply
Check value for File 0, Block 289:
current = 0xecee, required = 0xecee

BBED> v
DBVERIFY - Verification starting
FILE = /u01/app/oracle/oradata/ora11g/system01.dbf
BLOCK = 289


DBVERIFY - Verification complete

Total Blocks Examined       : 1
Total Blocks Processed (Data) : 1
Total Blocks Failing  (Data) : 0
Total Blocks Processed (Index): 0
Total Blocks Failing  (Index): 0
Total Blocks Empty          : 0
```

```
Total Blocks Marked Corrupt   : 0
Total Blocks Influx           : 0
Message 531 not found;  product=RDBMS; facility=BBED


BBED> p *kdbr[12]
rowdata[0]
----------
ub1 rowdata[0]                          @1407     0x2c


BBED> x /rccnn
rowdata[0]                         @1407
----------
flag@1407: 0x2c (KDRHFL, KDRHFF, KDRHFH)
lock@1408: 0x00
cols@1409:    4

col    0[1] @1410: .
col    1[16] @1412: _NEXT_CONSTRAINT
col    2[4] @1429: 18170
col    3[1] @1434: 0
```

```
SYS@ora11g > startup force
ORACLE instance started.

Total System Global Area  409194496 bytes
Fixed Size                  2228864 bytes
Variable Size             314576256 bytes
Database Buffers           83886080 bytes
Redo Buffers                8503296 bytes
Database mounted.
Database opened.
SYS@ora11g > conn lhr/lhr
Connected.
LHR@ora11g > ALTER TABLE T ORA8102 LHR DROP PRIMARY KEY;

Table altered.

LHR@ora11g > ALTER TABLE T_ORA8102_LHR ADD PRIMARY KEY(OBJECT_ID);
ALTER TABLE T_ORA8102_LHR ADD PRIMARY KEY(OBJECT_ID)
*
ERROR at line 1:
ORA-00604: error occurred at recursive SQL level 1
ORA-08102: index key not found, obj# 52, file 1, block 93040 (2)

LHR@ora11g > SELECT d.OBJECT_NAME,d.OBJECT_TYPE FROM Dba_Objects d WHERE d.OBJECT_ID=52;

OBJECT_NAME                     OBJECT_TYPE
------------------------------ -------------------
I_CON2                          INDEX

LHR@ora11g > SELECT * FROM SYS.BOOTSTRAP$ D WHERE D.OBJ#=52;

     LINE#      OBJ# SQL_TEXT
---------- ---------- -----------------------------------------------
        52         52 CREATE UNIQUE INDEX I_CON2 ON CON$(CON#) PCTFREE 10 INITRANS 2 MAXTRANS 255 STORAGE
(  INITIAL 64K NEXT 1024K MINEXTENTS 1 MAXEXTENTS 2147483645 PCTINCREASE 0 OBJNO 52 EXTENTS (FILE 1 BLOCK
464))

LHR@ora11g > set long 9999
LHR@ora11g > select dbms_metadata.get_ddl('INDEX','I_CON2','SYS') from dual;

DBMS_METADATA.GET_DDL('INDEX','I_CON2','SYS')
--------------------------------------------------------------------------------

  CREATE UNIQUE INDEX "SYS"."I_CON2" ON "SYS"."CON$" ("CON#")
  PCTFREE 10 INITRANS 2 MAXTRANS 255 COMPUTE STATISTICS
  STORAGE(INITIAL 65536 NEXT 1048576 MINEXTENTS 1 MAXEXTENTS 2147483645
  PCTINCREASE 0 FREELISTS 1 FREELIST GROUPS 1
  BUFFER_POOL DEFAULT FLASH_CACHE DEFAULT CELL_FLASH_CACHE DEFAULT)
  TABLESPACE "SYSTEM"
```

Owner	Name	Type	Columns
SYS	I_CON1	Unique	OWNER#, NAME
SYS	I_CON2	Unique	CON#

告警日志：

ora11g_ora_31964.trc

```
Thu Sep 21 14:18:32 2017
Errors in file /u01/app/oracle/diag/rdbms/ora11g/ora11g/trace/ora11g_ora_31964.trc:
```

```
Thu Sep 21 14:18:33 2017
Dumping diagnostic data in directory=[cdmp_20170921141833], requested by (instance=1, osid=31964),
summary=[abnormal process termination].
```

找到：

```
oer 8102.2 - obj# 52, rdba: 0x00416b70(afn 1, blk# 93040)
kdk key 8102.2:
  ncol: 1, len: 5
  key: (5):  04 c3 02 52 47<<<<===在索引中找不到键值 04 c3 02 52 47（转换为 10 进制即 18170）

  mask: (4096):
。。。。。。。。。省略。。。。。。。。

*** 2017-09-21 14:18:32.488
dbkedDefDump(): Starting a non-incident diagnostic dump (flags=0x0, level=3, mask=0x0)
----- Error Stack Dump -----
----- Current SQL Statement for this session (sql_id=bajr90ryjd2w8) -----
update con$ set con#=:3,spare1=:4 where owner#=:1 and name=:2
。。。。。。。。。省略。。。。。。。。
Block header dump:  0x00416b70<<<<===搜 Block header dump
 Object id on Block? Y
 seg/obj: 0x34  csc: 0x00.39125d6  itc: 3  flg: O  typ: 2 - INDEX<<<<===找到 52 号对象
    fsl: 0  fnx: 0x416b71 ver: 0x01
。。。。。。。。。省略。。。。。。。。
row#447[966] flag: ------, lock: 0, len=13, data:(6):  00 41 69 a4 00 d9
col 0; len 4; (4):  c3 02 52 44
row#448[940] flag: ---D--, lock: 3, len=13, data:(6):  00 41 69 a4 00 da
col 0; len 4; (4):  c3 02 52 45
row#449[953] flag: ------, lock: 0, len=13, data:(6):  00 40 01 21 00 0c====>>>>> ROWID
col 0; len 4; (4):  c3 02 52 46====>>>>> 索引中存储的最大键值是 18169
----- end of leaf block dump -----
      ----------------------------------------
      SO: 0x7624b240, type: 56, owner: 0x77896d88, flag: INIT/-/-/0x00 if: 0x3 c: 0x3
       proc=0x77c98660, name=transaction, file=ktccts.h LINE:410, pg=0
```

注意索引中的 ROWID（2 进制共 48 位）=文件号（2 进制前 10 位）+块号（2 进制 22 位）+行号（2 进制 16 位）
00 40 01 21 00 0c（16 进制）= 0000000001000000000000010010000100000000000001100（2 进制）
文件号=（0000000001）取前 10 位的二进制=第 1 号文件
块号=（0000000000000100100001）取前 2 进制 22 位==>第 289 号
行号=（0000000000001100）取 2 进制 16 位==>第 12 行

```
LHR@ora11g > select dump(18169,16),dump(18170,16) from dual;

DUMP(18169,16)          DUMP(18170,16)
---------------------- ----------------------
Typ=2 Len=4: c3,2,52,46 Typ=2 Len=4: c3,2,52,47

LHR@ora11g > select utl_raw.cast_to_number('c3025247'),utl_raw.cast_to_number('c3025246') from dual;

UTL_RAW.CAST_TO_NUMBER('C3025247') UTL_RAW.CAST_TO_NUMBER('C3025246')
-------------------------------- --------------------------------
                  18170                  18169
```

ORA-8102 常见于索引键值与表上存的值不一致。(Corruption related to Index 索引)

ORA-8102 即可能是 ORACLE 的 bug,也可能是由于硬件 I/O 错误所引起。硬件或者 I/O 子系统由于丢失写 Lost Write 造成块的逻辑上讹误,当一个 Lost Io 发生,包含对 key 的修改或者没有写入到 ORACLE 数据文件上,这即可能发生在表块上也可能发生在索引块上。

查看这个对象号为 52 的对象,发现是 SYS.CON$ 表中 I_CON2 索引,这是一个 BOOTSTRAP$ 对象,而且这是一个核心 BOOTSTRP$ 对象,是不能通过 startup migrate 和 event 38003 重建的,所以最终只能通过 BBED 去修改这个块中有问题的地方。

```
[root@rhel6lhr ~]# oerr ora 38003
38003, 00000, "CBO Disable column stats for the dictionary objects in recursive SQL"
// *Cause:
// *Action:
[root@rhel6lhr ~]#
```

先通过下面这个 SQL,查找表和索引之间到底相差什么

```
LHR@ora11g > set autot on
LHR@ora11g >
LHR@ora11g > select /*+ index(t I_CON2) */ T.CON# from sys.CON$ t
  2  minus
  3  select /*+ full(t1) */ T1.CON# from sys.CON$ t1;

     CON#
----------
    18169


Execution Plan
----------------------------------------------------------
Plan hash value: 2332423480

--------------------------------------------------------------------------------
| Id  | Operation          | Name   | Rows  | Bytes |TempSpc| Cost (%CPU)| Time     |
--------------------------------------------------------------------------------
|   0 | SELECT STATEMENT   |        | 16963 |  165K|       |   163  (48)| 00:00:02 |
|   1 |  MINUS             |        |       |      |       |            |          |
|   2 |   SORT UNIQUE NOSORT|       | 16963 | 84815 |       |    88   (3)| 00:00:02 |
|   3 |    INDEX FULL SCAN | I_CON2 | 16963 | 84815 |       |    32   (0)| 00:00:01 |
|   4 |   SORT UNIQUE      |        | 16963 | 84815 |  208K|    76   (3)| 00:00:01 |
|   5 |    TABLE ACCESS FULL| CON$  | 16963 | 84815 |       |    20   (0)| 00:00:01 |
--------------------------------------------------------------------------------


Statistics
----------------------------------------------------------
          1  recursive calls
          0  db block gets
        102  consistent gets
          0  physical reads
          0  redo size
        524  bytes sent via SQL*Net to client
        520  bytes received via SQL*Net from client
          2  SQL*Net roundtrips to/from client
          1  sorts (memory)
          0  sorts (disk)
          1  rows processed

LHR@ora11g > select /*+ full(t1) */ T1.CON# from sys.CON$ t1
  2  minus
  3   select /*+ index(t I_CON2) */ T.CON# from sys.CON$ t
```

```
  4  ;

     CON#
----------
    18170


Execution Plan
----------------------------------------------------------
Plan hash value: 2017867816


--------------------------------------------------------------------------------
| Id  | Operation           | Name  | Rows  | Bytes |TempSpc| Cost (%CPU)| Time     |
--------------------------------------------------------------------------------
|   0 | SELECT STATEMENT    |       | 16963 |  165K|       |   163  (55)| 00:00:02 |
|   1 |  MINUS              |       |       |       |       |            |          |
|   2 |   SORT UNIQUE       |       | 16963 | 84815 |  208K|    76   (3)| 00:00:01 |
|   3 |    TABLE ACCESS FULL| CON$  | 16963 | 84815 |       |    20   (0)| 00:00:01 |
|   4 |    SORT UNIQUE NOSORT|      | 16963 | 84815 |       |    88   (3)| 00:00:02 |
|   5 |     INDEX FULL SCAN | I_CON2| 16963 | 84815 |       |    32   (0)| 00:00:01 |
--------------------------------------------------------------------------------


Statistics
----------------------------------------------------------
          1  recursive calls
          0  db block gets
        102  consistent gets
          0  physical reads
          0  redo size
        524  bytes sent via SQL*Net to client
        520  bytes received via SQL*Net from client
          2  SQL*Net roundtrips to/from client
          1  sorts (memory)
          0  sorts (disk)
          1  rows processed

LHR@ora11g > select /*+ full(t) */  T.CON# from sys.CON$  t  WHERE t.CON# IN (18169,18170);

     CON#
----------
    18170


Execution Plan
----------------------------------------------------------
Plan hash value: 3767504726


---------------------------------------------------------------------------
| Id  | Operation           | Name | Rows  | Bytes | Cost (%CPU)| Time     |
---------------------------------------------------------------------------
|   0 | SELECT STATEMENT    |      |     2 |    10 |    20   (0)| 00:00:01 |
|*  1 |  TABLE ACCESS FULL| CON$ |     2 |    10 |    20   (0)| 00:00:01 |
---------------------------------------------------------------------------


Predicate Information (identified by operation id):
---------------------------------------------------

   1 - filter("T"."CON#"=18169 OR "T"."CON#"=18170)


Statistics
----------------------------------------------------------
          5  recursive calls
```

```
      0  db block gets
     77  consistent gets
      0  physical reads
      0  redo size
    524  bytes sent via SQL*Net to client
    520  bytes received via SQL*Net from client
      2  SQL*Net roundtrips to/from client
      2  sorts (memory)
      0  sorts (disk)
      1  rows processed


LHR@ora11g > select /*+ full(t I CON2) */  T.CON# from sys.CON$  t  WHERE t.CON# IN (18169,18170);


     CON#
----------
    18169



Execution Plan
----------------------------------------------------------
Plan hash value: 1461913314


---------------------------------------------------------------------------------
| Id  | Operation          | Name   | Rows  | Bytes | Cost (%CPU)| Time     |
---------------------------------------------------------------------------------
|   0 | SELECT STATEMENT   |        |    2  |   10  |    3   (0)| 00:00:01 |
|   1 |  INLIST ITERATOR   |        |       |       |           |          |
|*  2 |   INDEX UNIQUE SCAN| I_CON2 |    2  |   10  |    3   (0)| 00:00:01 |
---------------------------------------------------------------------------------


Predicate Information (identified by operation id):
---------------------------------------------------

   2 - access("T"."CON#"=18169 OR "T"."CON#"=18170)



Statistics
----------------------------------------------------------
      1  recursive calls
      0  db block gets
      4  consistent gets
      0  physical reads
      0  redo size
    524  bytes sent via SQL*Net to client
    520  bytes received via SQL*Net from client
      2  SQL*Net roundtrips to/from client
      0  sorts (memory)
      0  sorts (disk)
      1  rows processed
```

利用这样的方法来查询表和索引之间的不一致,通过查询结果确实可以看到表和索引存在不一样的,表里是18170,而索引里存储的是 18169,说明索引键值与表上存的值不一致

那么怎么办呢?如何处理这个问题?我们直接对索引进行 rebuild,看行不行?

```
SYS@ora11g > alter index sys.I_CON2 rebuild;
alter index sys.I_CON2 rebuild
*
ERROR at line 1:
ORA-00701: object necessary for warmstarting database cannot be altered

LHR@ora11g > select dump(18169,16),dump(18170,16) from dual;
```

```
DUMP(18169,16)        DUMP(18170,16)
---------------------- ----------------------
Typ=2 Len=4: c3,2,52,46 Typ=2 Len=4: c3,2,52,47

LHR@ora11g > select utl raw.cast to number('c3025247'),utl raw.cast to number('c3025246') from dual;

UTL RAW.CAST TO NUMBER('C3025247') UTL RAW.CAST TO NUMBER('C3025246')
-------------------------------- --------------------------------
                      18170                          18169
```

```
[oracle@rhel6lhr ~]$ bbed password=blockedit blocksize=8192 mode=edit
filename='/u01/app/oracle/oradata/ora11g/system01.dbf'

BBED: Release 2.0.0.0.0 - Limited Production on Thu Sep 21 16:08:05 2017

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************* !!! For Oracle Internal Use only !!! ***************

BBED> set block 93040
       BLOCK#          93040

BBED> map
 File: /u01/app/oracle/oradata/ora11g/system01.dbf (0)
 Block: 93040                         Dba:0x00000000
------------------------------------------------------------
 KTB Data Block (Index Leaf)

  struct kcbh, 20 bytes                 @0

  struct ktbbh, 96 bytes                @20

  struct kdxle, 32 bytes                @116

  sb2 kd off[450]                  @148

  ub1 freespace[4]                 @1048

  ub1 rowdata[7068]                @1052

  ub4 tailchk                      @8188

BBED> f /x 025246
 File: /u01/app/oracle/oradata/ora11g/system01.dbf (0)
 Block: 93040          Offsets: 1079 to 1590        Dba:0x00000000
------------------------------------------------------------------------
 025246 00 00004169 a400d904 c3025244 01000040 0121000c 04c30252 45000000
 4169a400 d804c302 52430100 00400121 000c04c3 02524400 00004169 a400d704
 c3025242 01000040 0121000c 04c30252 43000000 4169a400 d604c302 52410100
 00400121 000c04c3 02524200 00004169 a400d504 c3025240 01000040 0121000c
 04c30252 41000000 4169a400 d404c302 523f0100 00400121 000c04c3 02524000
 00004169 a400d304 c302523e 01000040 0121000c 04c30252 3f010000 4169a400
 d204c302 523d0100 00400121 000c04c3 02523e01 00004169 a400d104 c302523c
 01000040 0121000c 04c30252 3d010000 4169a400 d004c302 523b0100 00400121
 000c04c3 02523c01 00004169 a400ce04 c302523a 01000040 0121000c 04c30252
 3b010000 4169a400 cd04c302 52390100 00400121 000c04c3 02523a01 00004169
 a400cc04 c3025238 01000040 0121000c 04c30252 39010000 4169a400 cf04c302
 52370100 00400121 000c04c3 02523801 00004169 a400ce04 c3025236 01000040
 0121000c 04c30252 37010000 4169a400 cd04c302 52350100 00400121 000c04c3
 02523601 00004169 a400cc04 c3025234 01000040 0121000c 04c30252 35010000
 4169a400 d004c302 52330100 00400121 000c04c3 02523401 00004169 a400cf04
```

```
 c3025232 01000040 0121000c 04c30252 33010000 4169a400 ce04c302 52310100


 <32 bytes per line>


BBED> f
BBED-00212: search string not found

BBED> d
 File: /u01/app/oracle/oradata/ora11g/system01.dbf (0)
 Block: 93040          Offsets: 1079 to 1590        Dba:0x00000000
------------------------------------------------------------------------
 02524600 00004169 a400d904 c3025244 01000040 0121000c 04c30252 45000000
 4169a400 d804c302 52430100 00400121 000c04c3 02524400 00004169 a400d704
 c3025242 01000040 0121000c 04c30252 43000000 4169a400 d604c302 52410100
 00400121 000c04c3 02524200 00004169 a400d504 c3025240 01000040 0121000c
 04c30252 41000000 4169a400 d404c302 523f0100 00400121 000c04c3 02524000
 00004169 a400d304 c302523e 01000040 0121000c 04c30252 3f010000 4169a400
 d204c302 523d0100 00400121 000c04c3 02523e01 00004169 a400d104 c302523c
 01000040 0121000c 04c30252 3d010000 4169a400 d004c302 523b0100 00400121
 000c04c3 02523c01 00004169 a400ce04 c302523a 01000040 0121000c 04c30252
 3b010000 4169a400 cd04c302 52390100 00400121 000c04c3 02523a01 00004169
 a400cc04 c3025238 01000040 0121000c 04c30252 39010000 4169a400 cf04c302
 52370100 00400121 000c04c3 02523801 00004169 a400ce04 c3025236 01000040
 0121000c 04c30252 37010000 4169a400 cd04c302 52350100 00400121 000c04c3
 02523601 00004169 a400cc04 c3025234 01000040 0121000c 04c30252 35010000
 4169a400 d004c302 52330100 00400121 000c04c3 02523401 00004169 a400cf04
 c3025232 01000040 0121000c 04c30252 33010000 4169a400 ce04c302 52310100


 <32 bytes per line>


BBED> m /x 025247
Warning: contents of previous BIFILE will be lost. Proceed? (Y/N) Y
 File: /u01/app/oracle/oradata/ora11g/system01.dbf (0)
 Block: 93040          Offsets: 1079 to 1590        Dba:0x00000000
------------------------------------------------------------------------
 02524700 00004169 a400d904 c3025244 01000040 0121000c 04c30252 45000000
 4169a400 d804c302 52430100 00400121 000c04c3 02524400 00004169 a400d704
 c3025242 01000040 0121000c 04c30252 43000000 4169a400 d604c302 52410100
 00400121 000c04c3 02524200 00004169 a400d504 c3025240 01000040 0121000c
 04c30252 41000000 4169a400 d404c302 523f0100 00400121 000c04c3 02524000
 00004169 a400d304 c302523e 01000040 0121000c 04c30252 3f010000 4169a400
 d204c302 523d0100 00400121 000c04c3 02523e01 00004169 a400d104 c302523c
 01000040 0121000c 04c30252 3d010000 4169a400 d004c302 523b0100 00400121
 000c04c3 02523c01 00004169 a400ce04 c302523a 01000040 0121000c 04c30252
 3b010000 4169a400 cd04c302 52390100 00400121 000c04c3 02523a01 00004169
 a400cc04 c3025238 01000040 0121000c 04c30252 39010000 4169a400 cf04c302
 52370100 00400121 000c04c3 02523801 00004169 a400ce04 c3025236 01000040
 0121000c 04c30252 37010000 4169a400 cd04c302 52350100 00400121 000c04c3
 02523601 00004169 a400cc04 c3025234 01000040 0121000c 04c30252 35010000
 4169a400 d004c302 52330100 00400121 000c04c3 02523401 00004169 a400cf04
 c3025232 01000040 0121000c 04c30252 33010000 4169a400 ce04c302 52310100


 <32 bytes per line>


BBED> sum
Check value for File 0, Block 93040:
current = 0xde85, required = 0xdf85


BBED> sum apply
Check value for File 0, Block 93040:
current = 0xdf85, required = 0xdf85
```

这个操作完毕后，可以重启数据库，然后测一下建主键。

```
SYS@ora11g > conn lhr/lhr
Connected.
LHR@ora11g > ALTER TABLE T_ORA8102_LHR ADD PRIMARY KEY(OBJECT_ID);
ALTER TABLE T_ORA8102_LHR ADD PRIMARY KEY(OBJECT_ID)
*
ERROR at line 1:
ORA-00604: error occurred at recursive SQL level 1
ORA-08102: index key not found, obj# 52, file 1, block 93040 (2)


LHR@ora11g > conn / as sysdba
Connected.
SYS@ora11g > startup force
ORACLE instance started.

Total System Global Area  409194496 bytes
Fixed Size                  2228864 bytes
Variable Size             314576256 bytes
Database Buffers           83886080 bytes
Redo Buffers                8503296 bytes
Database mounted.
Database opened.

SYS@ora11g > conn lhr/lhr
Connected.
LHR@ora11g >  ALTER TABLE T_ORA8102_LHR ADD PRIMARY KEY(OBJECT_ID);

Table altered.
```

2.4 实验总结

1、ORA-08102 错误发生时会生成一份 errorstack 的 trace 文件，**从该文件中可以获取不一致的详细信息。该 trace 文件指的细读几遍。**
2、实验中的修复过程都是将索引中的键值修改为表中的值，其实，只要保证这 2 者一致即可。也可以根据报错信息找到相关的表的 ROWID 信息，然后使用 bbed 修改表中的值和索引中的值保持一致即可。--小麦苗已实验通过

2.4.1   模拟一的实验数据展示

使用 BBED 修改前获取到的数据：

项目	值
OBJ$上 DATAOBJ#列的最大值	94098
OBJ$上 DATAOBJ#列的最大值 dump 值	Typ=2 Len=4: c3,a,29,63 即：04c30a2963
该行所在数据块的地址	FILE# BLOCK# ROW# ---------- ---------- ---------- 1 241 27
该行的存储情况	COUNTS MAX_ROWNUM MIN_ROWNUM ---------- ---------- ---------- 105 104 0

列名	10 进制值	16 进制值	dump 文件的存储	bbed 中的存储

			tab 0, row 27, @0x13b ====>>>>> 该块中第一个表 第27行的指针位置，转换为 10进制是315 tl: 72 fb: --H-FL-- lb: 0x1 cc: 18	rowdata[0] @383 ---------- flag@383: 0x2c (KDRHFL, KDRHFF, KDRHFH) lock@384: 0x01 cols@385: 18===>>>>> 共18列
OBJ#	1	Typ=2 Len=2: c1,2	col 0: [2] c1 02	col 0[2] @386: 1
DATAOBJ#	94098	Typ=2 Len=4: c3,a,29,63	col 1: [4] c3 0a 29 63	col 1[4] @389: 94098 ==>>>>> 需要修改该列的值
OWNER#	0	Typ=2 Len=1: 80	col 2: [1] 80	col 2[1] @394: 0
NAME	_NEXT_OBJECT	Typ=1 Len=12: 5f,4e,45,58,54,5f,4f,42,4a,45,43,54	col 3: [12] 5f 4e 45 58 54 5f 4f 42 4a 45 43 54	col 3[12] @396: _NEXT_OBJECT
NAMESPACE	1	Typ=2 Len=2: c1,2	col 4: [2] c1 02	col 4[2] @409: 1
SUBNAME		NULL	col 5: *NULL*	col 5[0] @412: *NULL*
TYPE#	0	Typ=2 Len=1: 80	col 6: [1] 80	col 6[1] @413: 0
CTIME	2011/9/17 9:46	Typ=12 Len=7: 78,6f,9,11,a,2f,e	col 7: [7] 78 6f 09 11 0a 2f 0e	col 7[7] @415: 2011-09-17 09:46:13
MTIME	2017/9/20 18:28	Typ=12 Len=7: 78,75,9,14,13,1d,25	col 8: [7] 78 75 09 14 13 1d 25	col 8[7] @423: 2017-09-20 18:28:36
STIME	2011/9/17 9:46	Typ=12 Len=7: 78,6f,9,11,a,2f,e	col 9: [7] 78 6f 09 11 0a 2f 0e	col 9[7] @431: 2011-09-17 09:46:13
STATUS	0	Typ=2 Len=1: 80	col 10: [1] 80	col 10[1] @439: 0
REMOTEOWNER		NULL	col 11: *NULL*	col 11[0] @441: *NULL*
LINKNAME		NULL	col 12: *NULL*	col 12[0] @442: *NULL*
FLAGS	0	Typ=2 Len=1: 80	col 13: [1] 80	col 13[1] @443: 0
OID$		NULL	col 14: *NULL*	col 14[0] @445: *NULL*
SPARE1	0	Typ=2 Len=1: 80	col 15: [1] 80	col 15[1] @446: 0
SPARE2	65535	Typ=2 Len=4: c3,7,38,24	col 16: [4] c3 07 38 24	col 16[4] @448: 65535
SPARE3	0	Typ=2 Len=1: 80	col 17: [1] 80	col 17[1] @453: 0

2.4.2 修改块的标志位

通过 bbed 修改 i_obj4 中的 dataobj#值使之和 obj$中对应值一致。

```
BED> verify
DBVERIFY - Verification starting
FILE = /u01/app/oracle/oradata/xifenfei/system01.dbf
BLOCK = 97266

Block 97266 is corrupt
Corrupt block relative dba: 0x00417bf2 (file 0, block 97266)
Fractured block found during verification
Data in bad block:
 type: 6 format: 2 rdba: 0x00417bf2
 last change scn: 0x0000.00102ed8 seq: 0x1 flg: 0x06
 spare1: 0x0 spare2: 0x0 spare3: 0x0
 consistency value in tail: 0x2ed80602
 check value in block header: 0x7955
 computed block checksum: 0x0
```

```
DBVERIFY - Verification complete

Total Blocks Examined         : 1
Total Blocks Processed (Data) : 0
Total Blocks Failing   (Data) : 0
Total Blocks Processed (Index): 0
Total Blocks Failing   (Index): 0
Total Blocks Empty            : 0
Total Blocks Marked Corrupt   : 1
Total Blocks Influx           : 2
Message 531 not found;  product=RDBMS; facility=BBED



BBED> set offset 8188
        OFFSET          8188


BBED> d
 File: /u01/app/oracle/oradata/xifenfei/system01.dbf (0)
 Block: 97266          Offsets: 8188 to 8191          Dba:0x00000000
-----------------------------------------------------------------------
 0206d82e

 <32 bytes per line>


BBED> m /x 01
 File: /u01/app/oracle/oradata/xifenfei/system01.dbf (0)
 Block: 97266          Offsets: 8188 to 8191          Dba:0x00000000
-----------------------------------------------------------------------
 0106d82e

 <32 bytes per line>

BBED> sum
Check value for File 0, Block 97266:
current = 0x7955, required = 0x7956

BBED> sum apply
Check value for File 0, Block 97266:
current = 0x7956, required = 0x7956

BBED> verify
DBVERIFY - Verification starting
FILE = /u01/app/oracle/oradata/xifenfei/system01.dbf
BLOCK = 97266



DBVERIFY - Verification complete

Total Blocks Examined         : 1
Total Blocks Processed (Data) : 0
Total Blocks Failing   (Data) : 0
Total Blocks Processed (Index): 1
Total Blocks Failing   (Index): 0
Total Blocks Empty            : 0
Total Blocks Marked Corrupt   : 0
Total Blocks Influx           : 0
Message 531 not found;  product=RDBMS; facility=BBED
```

第 3 章　参考文章

3.1　博客

4. ORA-08102: index key not found：http://blog.csdn.net/gumengkai/article/details/53229144

5. 通过 bbed 修改 obj$中 dataobj$重现 I_OBJ4 索引报 ORA-08102 错误：
http://www.xifenfei.com/2015/03/%e9%80%9a%e8%bf%87bbed%e4%bf%ae%e6%94%b9obj%e4%b8%addataobj%e9%87%8d%e7%8e%b0i_obj4%e7%b4%a2%e5%bc%95%e6%8a%a5ora-08102%e9%94%99%e8%af%af.html

6. 使用 bbed 修复 I_OBJ4 index 报 ORA-8102 错误：
http://www.xifenfei.com/2015/03/%e4%bd%bf%e7%94%a8bbed-%e4%bf%ae%e5%a4%8di_obj4-index-%e6%8a%a5ora-8102.html

7. 利用 bbed 来修复 ora-08102 错误 ：http://blog.chinaunix.net/uid-28460966-id-4584119.html

8. 跳过 obj$坏块方法：
http://www.xifenfei.com/2012/01/%E8%B7%B3%E8%BF%87obj%E5%9D%8F%E5%9D%97%E6%96%B9%E6%B3%95.html

9. bootstrap$核心 index(I_OBJ1,I_USER1,I_FILE#_BLOCK#,I_IND1,I_TS#,I_CDEF1 等)异常恢复—ORA-00701 错误解决：
http://www.xifenfei.com/2014/10/%E8%A7%A3%E5%86%B3ora-00701-object-necessary-for-warmstarting-database-cannot-be-altered%E9%94%99%E8%AF%AF.html

10. 分享 I_OBJ4 ORA-8102 故障恢复案例：
http://www.xifenfei.com/2015/03/%E5%88%86%E4%BA%ABi_obj4-ora-8102%E6%95%85%E9%9A%9C%E6%81%A2%E5%A4%8D%E6%A1%88%E4%BE%8B.html

11. How to recreate Bootstrap Index(I_OBJ1,I_USER1,I_FILE#_BLOCK#) to fix ORA-00701 ?：
http://www.killdb.com/2015/10/07/how-to-recreate-bootstrap-indexi_obj1i_user1i_file_block-to-fix-ora-00701.html

12. bootstrap$核心对象数据不一致导致 ORA-08102：
http://www.killdb.com/2011/07/30/bootstrap%e6%a0%b8%e5%bf%83%e5%af%b9%e8%b1%a1%e6%95%b0%e6%8d%ae%e4%b8%8d%e4%b8%80%e8%87%b4%e5%af%bc%e8%87%b4ora-08102.html

第 4 章　实验中用到的 SQL 总结

```
SELECT COUNT(*) COUNTS,
     MAX(DBMS_ROWID.ROWID_ROW_NUMBER(ROWID)) MAX_ROWNUM,
     MIN(DBMS_ROWID.ROWID_ROW_NUMBER(ROWID)) MIN_ROWNUM
  FROM SYS.OBJ$ D
 WHERE DBMS_ROWID.ROWID_RELATIVE_FNO(ROWID) = 1
   AND DBMS_ROWID.ROWID_BLOCK_NUMBER(ROWID) = 241;
```

```
SELECT DBMS_ROWID.ROWID_RELATIVE_FNO(ROWID) FILE#,
       DBMS_ROWID.ROWID_BLOCK_NUMBER(ROWID) BLOCK#,
       DBMS_ROWID.ROWID_ROW_NUMBER(ROWID) ROW#
  FROM SYS.OBJ$
 WHERE DATAOBJ# = 94109;


SELECT DUMP(94098, 16) FROM DUAL;


SELECT DUMP(OBJ#, 16),
       DUMP(DATAOBJ#, 16),
       DUMP(OWNER#, 16),
       DUMP(NAME, 16),
       DUMP(NAMESPACE, 16),
       DUMP(SUBNAME, 16),
       DUMP(TYPE#, 16),
       DUMP(CTIME, 16),
       DUMP(MTIME, 16),
       DUMP(STIME, 16),
       DUMP(STATUS, 16),
       DUMP(REMOTEOWNER, 16),
       DUMP(LINKNAME, 16),
       DUMP(FLAGS, 16),
       DUMP(OID$, 16),
       DUMP(SPARE1, 16),
       DUMP(SPARE2, 16),
       DUMP(SPARE3, 16),
       DUMP(SPARE4, 16),
       DUMP(SPARE5, 16),
       DUMP(SPARE6, 16)
  FROM SYS.OBJ$ D
 WHERE DATAOBJ# = 94098;


SELECT OBJ#,
       DATAOBJ#,
       OWNER#,
       NAME,
       NAMESPACE,
       SUBNAME,
       TYPE#,
       CTIME,
       MTIME,
       STIME,
       STATUS,
       REMOTEOWNER,
       LINKNAME,
       FLAGS,
       OID$,
       SPARE1,
       SPARE2,
       SPARE3
  FROM SYS.OBJ$ D
 WHERE DATAOBJ# = 94098;


SELECT * FROM SYS.OBJ$ D WHERE D.NAME = 'OBJ$';


SELECT 'DUMP(' || D.COLUMN_NAME || ',16),'
  FROM DBA_TAB_COLS D
 WHERE D.TABLE_NAME = 'OBJ$'
```

```
 ORDER BY D.COLUMN_ID;
SELECT D.COLUMN_NAME || ','
  FROM DBA_TAB_COLS D
 WHERE D.TABLE_NAME = 'OBJ$'
 ORDER BY D.COLUMN_ID;



SELECT * FROM sys.Bootstrap$ ;

ORA-08102: index key not found, obj# 39, file 1, block 94083 (2)

select /*+ index(t i_obj4) */ DATAOBJ# from sys.obj$ t
minus
select /*+ full(t1) */ DATAOBJ# from sys.obj$ t1;


select /*+ full(t1) */ DATAOBJ# from sys.obj$ t1
 minus
  select /*+ index(t i_obj4) */ DATAOBJ# from sys.obj$ t
 ;
select /*+ full(t) */ DATAOBJ#,type#,owner# from sys.obj$ t WHERE t.dataobj# IN (94098,94099);
select /*+ full(t i_obj4) */ DATAOBJ#,type#,owner# from sys.obj$ t WHERE t.dataobj# IN (94098,94099);
```

--16进制转换为10进制
```
select utl_raw.cast_to_number('c30a2964') from dual;



show all
map
p kdbr
p *kdbr[27]
x /rnnncncntttnccncnnn
d /v count 32
f /x c30a29
sum
sum apply
v
```

About Me

- QQ 群号：**230161599**（满）、**618766405**
- 微信群：可加我微信，我拉大家进群，非诚勿扰
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