

Обслуживание повреждённой БД

Несмотря на высокую надёжность СУБД ЛИНТЕР, периодически приходится иметь дело с повреждённой БД. Источником повреждений в файлах БД могут быть, например, проблемы с оборудованием.

Общий порядок восстановления СУБД ЛИНТЕР:

1. Остановить СУБД ЛИНТЕР и выполнить полную резервную копию БД средствами операционной системы;
2. Запустить СУБД ЛИНТЕР с целью выявления повреждений и обслуживания журнала;
3. Остановить СУБД ЛИНТЕР и выполнить запуск программы testdb;
4. Выполнить рекомендации, предлагаемые программой testdb;
5. Запустить СУБД ЛИНТЕР для оценки потери данных.

Первичное выявление неполадок в БД

Основные маркеры, уведомляющие о наличии повреждений, могут иметь вид:

- при запуске СУБД ЛИНТЕР

linter.out при запуске СУБД ЛИНТЕР

```
23.08.2016 10:52:41.174 Linter SQL Bastion v. 6.0.15.42 connected to
data base "TEST"
23.08.2016 10:52:41.174 POOL holds 250000 pages (246171 free pages,
100000 pages for in-memory tables)
23.08.2016 10:52:41.174 Table      queue size : 100 (13)
23.08.2016 10:52:41.174 Column    queue size : 500 (250)
23.08.2016 10:52:41.174 Channel  queue size : 100
23.08.2016 10:52:41.174 File      queue size : 51 (26)
23.08.2016 10:52:41.174 User      queue size : 100
23.08.2016 10:52:41.221 Servers table is absent
23.08.2016 10:52:41.221 Security groups table is absent
23.08.2016 10:52:41.221 Security levels table is absent
23.08.2016 10:52:41.221 Replication rules table is absent
23.08.2016 10:52:41.221 Filter table is absent
23.08.2016 10:52:41.221 File extension table is absent
23.08.2016 10:52:41.221 Errors table is absent
23.08.2016 10:52:41.221 In-kernel backup table is absent
23.08.2016 10:52:41.221 Auditing enabled
23.08.2016 10:52:41.221 Events table is absent
23.08.2016 10:52:45.823 Syslog not finished! Addresses : first 2148
105761548 last 2150 99237846
23.08.2016 10:52:45.823          Restore start! Please, wait!
23.08.2016 10:52:45.854 INFO: Incorrect index page type 13 file type
0. Corrected.
23.08.2016 10:52:45.854 INFO: Incorrect index page type 13 file type
0. Corrected.

<>

23.08.2016 10:52:53.592 INFO: Incorrect index page type 13 file type
0. Corrected.
23.08.2016 10:52:53.810
23.08.2016 10:52:53.810          Restore finished: o'key!

23.08.2016 10:52:53.810 Syslog : Transaction Control started !
```

linter.out при запуске СУБД ЛИНТЕР

```
03.10.2016 13:20:40.813 Linter SQL Bastion v. 6.0.17.34 connected to
data base "DEMO Database  "
03.10.2016 13:20:40.813 POOL holds 731147 pages (714725 free pages, 0
pages for in-memory tables)
03.10.2016 13:20:40.813 Table    queue size  : 178 (0)
03.10.2016 13:20:40.813 Column  queue size  : 1070 (0)
03.10.2016 13:20:40.813 Channel queue size  : 100
03.10.2016 13:20:40.813 File    queue size  : 356 (0)
03.10.2016 13:20:40.813 User    queue size  : 100
03.10.2016 13:20:40.832 E-10 (RRID) : Table "SYSTEM"."$$$$SYSRL" (#1),
data file #1, page #16: ROWID 159 not found
03.10.2016 13:20:40.832 E-10 (RRID) : Table "SYSTEM"."$$$$SYSRL" (#1),
data file #1, page #16: ROWID 160 not found
03.10.2016 13:20:40.832 E-10 (RRID) : Table "SYSTEM"."$$$$SYSRL" (#1),
data file #1, page #16: ROWID 161 not found
03.10.2016 13:20:40.832 E-10 (RRID) : Table "SYSTEM"."$$$$SYSRL" (#1),
data file #1, page #16: ROWID 162 not found
03.10.2016 13:20:40.832 E-10 (RRID) : Table "SYSTEM"."$$$$SYSRL" (#1),
data file #1, page #16: ROWID 163 not found
03.10.2016 13:20:40.832 E-10 (RRID) : Table "SYSTEM"."$$$$SYSRL" (#1),
data file #1, page #16: ROWID 164 not found
03.10.2016 13:20:40.832 E-10 (RRID) : Table "SYSTEM"."$$$$SYSRL" (#1),
data file #1, page #16: ROWID 165 not found
03.10.2016 13:20:40.832 E-10 (RRID) : Table "SYSTEM"."$$$$SYSRL" (#1),
data file #1, page #16: ROWID 166 not found
03.10.2016 13:20:40.832 E-10 (RRID) : Table "SYSTEM"."$$$$SYSRL" (#1),
data file #1, page #16: ROWID 167 not found
03.10.2016 13:20:40.832 E-10 (RRID) : Table "SYSTEM"."$$$$SYSRL" (#1),
data file #1, page #16: ROWID 159 not found
03.10.2016 13:20:40.833 E-10 (RRID) : Table "SYSTEM"."$$$$SYSRL" (#1),
data file #1, page #16: ROWID 159 not found
03.10.2016 13:20:40.833 Filter table is absent
03.10.2016 13:20:40.833 File extension table is absent
03.10.2016 13:20:40.833 Errors table is absent
03.10.2016 13:20:40.833 In-kernel backup table is absent
03.10.2016 13:20:40.833 Auditing disabled
03.10.2016 13:20:40.833 Events table is absent
03.10.2016 13:20:40.833 WARNING: Temporary table recovery status 10.
Ignored.
03.10.2016 13:20:40.834 *** Linter status: 10
03.10.2016 13:20:40.834 *** System status: Database is corrupt. Please
repair.
03.10.2016 13:20:40.834
03.10.2016 13:20:40.834 INFO: Linter kernel initialization failed.
Status 2. Exited.
```

- при работе в БД

linter.out при работе СУБД ЛИНТЕР

```
23.08.2016 10:53:15.400 E-10 (RRID) : Table "TEST"."MY_TABLE" (#855),  
data file #1, page #7759505: ROWID 398762994 not found
```

linter.out при работе СУБД ЛИНТЕР

```
03.10.2016 13:12:45.125 E-17 [PID 1217(1217)] (RRID) : Table  
"SYSTEM"."PERSONS" (#170), data file #1, page #2: illegal page length  
0
```

linter.out при работе СУБД ЛИНТЕР

```
03.10.2016 13:25:34.238 E-1506 [PID 1523(1523)] (OPFIL) : Illegal  
file number 59 for data file of table "SYSTEM"."PERSONS" (#170)
```

Восстановление БД

Создание резервной копии базы данных

При возникновении неполадок необходимо выполнить полное резервное копирование файлов базы данных средствами ОС. Для этого необходимо убедиться, что СУБД ЛИНТЕР остановлена для этой БД. Далее, необходимо скопировать файлы в надёжное место. Например:

Пример подготовки резервной копии

```
$ cd linter/  
$ ./bin/shut -u SYSTEM/MANAGER  
$ ls ./db  
00000000.61 11.01 133.01 136.11 141.01 15.11 1.61 163.11 167.01  
17.01 173.01 176.11 18.01 2.11 33.01 4.11 6.01 7.01 79.11  
85.11 makefile  
00000001.61 1.11 133.11 139.01 14.11 159.01 161.01 164.01 167.11  
170.11 173.11 177.01 18.11 25.01 33.11 50.01 6.11 70.11 8.01  
9.01 make_storage  
00000002.61 11.11 134.01 139.11 141.11 159.11 16.11 164.11 168.01  
171.01 174.01 177.11 19.01 25.11 34.01 5.01 62.01 7.11 8.11  
9.11 phrase.idx  
00000003.61 13.01 134.11 140.01 147.01 160.01 161.11 165.01 168.11  
17.11 174.11 178.01 19.11 26.01 34.11 50.11 62.11 73.01 8.21  
linter.out readme.txt  
10.01 1.31 135.01 14.01 147.11 16.01 162.01 165.11 169.01  
171.11 175.01 178.11 20.01 26.11 35.01 51.01 68.01 73.11 83.01  
linucs20561 storage  
1.01 13.11 135.11 140.11 15.01 160.11 162.11 166.01 169.11  
172.01 175.11 179.01 2.01 3.01 35.11 5.11 68.11 73.21 83.11  
make_db
```

```
10.11      13.21  136.01  1.41    1.51    160.21  163.01  166.11  170.01
172.11  176.01  179.11  20.11  3.11    4.01    51.11  70.01  79.01  85.01
```

```
make_db.gdb
```

```
$ zip -3 -r ./db.zip ./db
```

```
adding: db/ (stored 0%)
adding: db/00000000.61 (deflated 68%)
adding: db/00000001.61 (deflated 77%)
adding: db/00000002.61 (deflated 68%)
adding: db/00000003.61 (deflated 69%)
adding: db/1.01 (deflated 95%)
adding: db/1.11 (deflated 98%)
adding: db/1.31 (deflated 100%)
adding: db/1.41 (deflated 97%)
adding: db/1.51 (deflated 99%)
adding: db/1.61 (deflated 99%)
adding: db/10.01 (deflated 99%)
```

```
<>
```

```
adding: db/73.21 (deflated 99%)
adding: db/79.01 (deflated 99%)
adding: db/79.11 (deflated 99%)
adding: db/8.01 (deflated 96%)
adding: db/8.11 (deflated 98%)
adding: db/8.21 (deflated 54%)
adding: db/83.01 (deflated 99%)
adding: db/83.11 (deflated 100%)
adding: db/85.01 (deflated 99%)
adding: db/85.11 (deflated 100%)
adding: db/9.01 (deflated 98%)
adding: db/9.11 (deflated 99%)
adding: db/linter.out (deflated 74%)
adding: db/linucs20561 (deflated 44%)
adding: db/make_db (deflated 78%)
adding: db/make_db.gdb (deflated 7%)
adding: db/make_storage (deflated 55%)
adding: db/makefile (deflated 31%)
adding: db/phrase.idx (stored 0%)
adding: db/readme.txt (deflated 43%)
adding: db/storage/ (stored 0%)
```

```
adding: db/storage/00000000.61 (deflated 99%)
```

```
<>
```

Полученный архив db.zip рекомендуется перенести на другой носитель.

Запуск СУБД ЛИНТЕР

Перед запуском процесса выявления и исправления ошибок следует запустить ядро СУБД для фиксации оставшихся изменений и закрытия журнала. После запуска СУБД ЛИНТЕР и фиксации изменений необходимо корректно завершить. Если запустить СУБД ЛИНТЕР не удалось, то необходимо перейти к следующему шагу.

Выполнение проверки файлов базы данных

Для выявления и исправлений ошибок СУБД ЛИНТЕР применяется утилита testdb. Для первичного анализа повреждений выполнить запуск:

Пример работы testdb

```
$ cd ./linter
$ ./bin/testdb -p 10000 ./db
Database Testing Program v.6.0 for Linter SQL Bastion v. 6.0.17.34 for
LINUX (Socket) 64-bit
Copyright (C) 1990-2016 Relex, Inc. All rights reserved.

Testing database "DEMO Database" located in ./db/
Database created by Linter 6.0.17

Testing system tables...
Testing table #1 "SYSTEM"."$$$$SYSRL"
Testing long VIEW pages...
Testing integrity pages...
Testing file description pages...
Testing table #2 "SYSTEM"."$$$$ATTRI"
Testing table #3 "SYSTEM"."$$$$USR"
Testing work files...
Testing extra files presence...
Testing system database integrity...
Testing integrity system table #26 "$$$$GROUP"      "
Testing integrity system table #25 "$$$$LEVEL"      "

<>

Testing integrity system table #160 "$$$$EVENTS"     "

Testing users...
Testing user #1 "SYSTEM"
Testing user #2 "SYS"

Testing user tables...
Testing table #4 "SYSTEM"."$$$$CHARSET"
```

Testing table #5 "SYSTEM"."\$\$\$TRANSL"
Testing table #6 "SYSTEM"."\$\$\$CSALIAS"

<>

Testing table #168 "SYSTEM"."P"
Testing table #169 "SYSTEM"."SP"
Testing table #170 "SYSTEM"."PERSONS"

* WARNING
* Table #170 index file #1 page #2
* Page modification time "22.10.2089 04:44:43" is later than database
shutdown time "03.10.2016 13:53:47"

* ERROR
* Table #170 data file #1 page #2
Record #1 (offset 8), ROWID #1
* Converter entry for ROWID #1 refers to another page - (#12303291)

* WARNING
* Table #170 index file #1 page #2
* Page modification time "22.10.2089 04:44:43" is later than database
shutdown time "03.10.2016 13:53:47"

* ERROR
* Table #170 data file #1 page #2
Record #2 (offset 74), ROWID #2
* Converter entry for ROWID #2 refers to another page - (#12303291)

* WARNING
* Table #170 index file #1 page #2
* Page modification time "22.10.2089 04:44:43" is later than database
shutdown time "03.10.2016 13:53:47"

* ERROR
* Table #170 data file #1 page #2
Record #3 (offset 130), ROWID #3
* Converter entry for ROWID #3 refers to another page - (#12303291)

* WARNING
* Table #170 index file #1 page #2
* Page modification time "22.10.2089 04:44:43" is later than database
shutdown time "03.10.2016 13:53:47"

* ERROR
* Table #170 data file #1 page #2

<>

Record #26 (offset 1608), ROWID #26
* SECURITY: set non-existent GROUP value #204

* ERROR
* Table #170 data file #1 page #2
Record #26 (offset 1608), ROWID #26
* SECURITY: set non-existent RAL value #12

* ERROR
* Table #170 data file #1 page #2
Record #26 (offset 1608), ROWID #26
* SECURITY: set non-existent WAL value #12

* ERROR
* Table #170 data file #1 page #2

```
Record #26 (offset 1608), ROWID #26, column #1
* Illegal value length of 205
* WARNING
* Table #170 index file #1 page #2
* Page modification time "22.10.2089 04:44:43" is later than database
shutdown time "03.10.2016 13:53:47"
* WARNING
* Table #170 index file #1 page #2
* Page modification time "22.10.2089 04:44:43" is later than database
shutdown time "03.10.2016 13:53:47"
* WARNING
* Table #170 converter page #2
* Converter element contains illegal signature 0xBB
* ERROR
* Table #170 converter, ROWID #1
* Converter element contains illegal file number #187

<>

* ERROR
* Table #170 converter, ROWID #5
* Converter element contains illegal file number #187
* ERROR
* Table #170 converter, ROWID #6
* Converter element contains illegal page number #3003 (of file #1)
* ERROR
* Table #170 description and converter
* Invalid row count 28 instead of 22
* ERROR
* Table #170, converter ROWID #2, column #1 index
* Index contains ROWID not found in converter
* ERROR
* Table #170, converter ROWID #4, column #1 index
* Index contains ROWID not found in converter
* ERROR
* Table #170 converter, ROWID #26
* Data read error!
* ERROR
* Table #170, converter ROWID #5, column #1 index
* Index contains ROWID not found in converter
* ERROR
* Table #170, converter ROWID #6, column #1 index
* Index contains ROWID not found in converter
* ERROR
* Table #170, converter ROWID #3, column #1 index
* Index contains ROWID not found in converter
* ERROR
* Table #170, converter ROWID #1, column #1 index
* Index contains ROWID not found in converter
* ERROR
* Table #170, column #1 index
* Incorrect record count in index, 28 instead of 22
* ERROR
```



```
* Table #170, converter ROWID #1, column #3 index
* Index contains ROWID not found in converter

<>

* ERROR
* Table #170, converter ROWID #4, column #3 index
* Index contains ROWID not found in converter
* ERROR
* Table #170, ROWID #26, column #3 index
index file #1 page #2
* Index contains invalid security value
(G/R/W) : (0/0/0) instead of (204/12/12)
* ERROR
* Table #170, column #3 index
* Incorrect record count in index, 28 instead of 22
* ERROR
* Table #170, converter ROWID #1, column #4 index
* Index contains ROWID not found in converter
* ERROR
* Table #170, converter ROWID #5, column #4 index
* Index contains ROWID not found in converter
* ERROR
* Table #170, ROWID #26, column #4 index
index file #1 page #2
* Index contains invalid security value
(G/R/W) : (0/0/0) instead of (204/12/12)
* ERROR
* Table #170, converter ROWID #3, column #4 index
* Index contains ROWID not found in converter
* ERROR
* Table #170, converter ROWID #4, column #4 index
* Index contains ROWID not found in converter
* ERROR
* Table #170, converter ROWID #6, column #4 index
* Index contains ROWID not found in converter
* ERROR
* Table #170, converter ROWID #2, column #4 index
* Index contains ROWID not found in converter
* ERROR
* Table #170, column #4 index
* Incorrect record count in index, 28 instead of 22
There are errors in table #170 "SYSTEM"."PERSONS"!
Testing table #171 "SYSTEM"."CLUBS"
Testing table #172 "SYSTEM"."COUNTRIES"
Testing table #173 "SYSTEM"."TOPFIVES"
Testing table #174 "SYSTEM"."RATINGS"
Testing table #175 "SYSTEM"."POINTS"
Testing table #176 "SYSTEM"."TR_DATA"
Testing table #177 "SYSTEM"."TR_DATA2"
Testing table #178 "SYSTEM"."TR_DATA3"
Testing table #179 "SYSTEM"."TR_LOG"
```

There are errors in 1 tables:

#170 "SYSTEM"."PERSONS"

Some errors can be fixed by TESTDB utility.

You should run TESTDB -r.

Some errors can be fixed by SQL update file.

You should run TESTDB -s upd_file, and then execute the created SQL update file through Linter Desktop or INL after starting Linter.

```
Use keys -r -dr if you want to clear badly damaged data.
Use keys -r -da [-s file.sql] if you want to delete bad SECURITY
After that you should repeat the database testing procedure.
```

В зависимости от повреждений testdb в конце лога даёт рекомендацию относительно дальнейших действий. В данном примере зафиксированы значительные многочисленные повреждения в таблице PERSONS. Для исправления ошибок рекомендуется выполнить testdb с ключом -r, а также сформировать SQL файл для исправления ошибок по рекомендациям в конце вывода утилиты testdb. Кроме того допускается удаление повреждённых данных и меток безопасности.

Повреждение данных

В зависимости от степени повреждения файлов БД при восстановлении возможна потеря части хранимой информации.

Выполнение рекомендаций testdb

На предыдущем шаге получен план дальнейших действий. Рекомендуется выполнять каждый шаг отдельно и по очереди.

Выполнение testdb с ключом -r

```
$ ./bin/testdb -p 10000 -r ./db
Database Testing Program v.6.0 for Linter SQL Bastion v. 6.0.17.34 for
LINUX (Socket) 64-bit
Copyright (C) 1990-2016 Relex, Inc. All rights reserved.

Testing database "DEMO Database" located in ./db/
Database created by Linter 6.0.17

Testing system tables...
Testing table #1 "SYSTEM"."$$$$SYSRL"
Testing long VIEW pages...

<>

Testing table #169 "SYSTEM"."SP"
Testing table #170 "SYSTEM"."PERSONS"
* WARNING
* Table #170 index file #1 page #2
* Page modification time "22.10.2089 04:44:43" is later than database
shutdown time "03.10.2016 13:53:47"
* ERROR
* Table #170 data file #1 page #2
Record #1 (offset 8), ROWID #1
* Converter entry for ROWID #1 refers to another page - ( #12303291 )
* ERROR
* Table #170 data file #1 page #2
Record #2 (offset 74), ROWID #2
* Converter entry for ROWID #2 refers to another page - ( #12303291 )
* ERROR
* Table #170 data file #1 page #2
Record #3 (offset 130), ROWID #3
* Converter entry for ROWID #3 refers to another page - ( #12303291 )
```

```
* ERROR
* Table #170 data file #1 page #2
Record #4 (offset 188), ROWID #4
* Converter entry for ROWID #4 refers to another page - ( #12303291 )
* ERROR
* Table #170 data file #1 page #2
Record #5 (offset 244), ROWID #5
* Converter entry for ROWID #5 refers to another page - ( #12303291 )
* ERROR
* Table #170 data file #1 page #2
Record #6 (offset 310), ROWID #6
* Converter entry for ROWID #6 refers to another page - ( #3003 )
* ERROR
* Table #170 data file #1 page #2
Record #26 (offset 1608), ROWID #26
* SECURITY: set non-existent GROUP value #204
* ERROR
* Table #170 data file #1 page #2
Record #26 (offset 1608), ROWID #26
* SECURITY: set non-existent RAL value #12
* ERROR
* Table #170 data file #1 page #2
Record #26 (offset 1608), ROWID #26
* SECURITY: set non-existent WAL value #12
* ERROR
* Table #170 data file #1 page #2
Record #26 (offset 1608), ROWID #26, column #1
* Illegal value length of 205
* WARNING
* Table #170 converter page #2
* Converter element contains illegal signature 0xBB
* ERROR
* Table #170 converter, ROWID #1
* Converter element contains illegal file number #187

<>

* ERROR
* Table #170 converter, ROWID #5
* Converter element contains illegal file number #187
* ERROR
* Table #170 converter, ROWID #6
* Converter element contains illegal page number #3003 (of file #1)
* ERROR
* Table #170 description and converter
* Invalid row count 28 instead of 22
* ERROR
* Table #170 data file #1 page #2
Record #26 (offset 1608), ROWID #26, column #1
* Illegal value length of 205
* ERROR
* Table #170 converter, ROWID #26
* Data read error!
```

```
* ERROR
* Table #170, ROWID #26, column #3 index
index file #1 page #2
* Index contains invalid security value
(G/R/W) : (0/0/0) instead of (204/12/12)
* ERROR
* Table #170, ROWID #26, column #4 index
index file #1 page #2
* Index contains invalid security value
(G/R/W) : (0/0/0) instead of (204/12/12)
There are errors in table #170 "SYSTEM"."PERSONS"!
Repeat testing table #170 "SYSTEM"."PERSONS"
* ERROR
* Table #170 data file #1 page #2
Record #26 (offset 1608), ROWID #26
* SECURITY: set non-existent GROUP value #204
* ERROR
* Table #170 data file #1 page #2
Record #26 (offset 1608), ROWID #26
* SECURITY: set non-existent RAL value #12
* ERROR
* Table #170 data file #1 page #2
Record #26 (offset 1608), ROWID #26
* SECURITY: set non-existent WAL value #12
* ERROR
* Table #170 data file #1 page #2
Record #26 (offset 1608), ROWID #26, column #1
* Illegal value length of 205
* ERROR
* Table #170 converter, ROWID #26
* Data read error!
* ERROR
* Table #170, ROWID #26, column #3 index
index file #1 page #2
* Index contains invalid security value
(G/R/W) : (0/0/0) instead of (204/12/12)
* ERROR
* Table #170, ROWID #26, column #4 index
index file #1 page #2
* Index contains invalid security value
(G/R/W) : (0/0/0) instead of (204/12/12)
There are errors in table #170 "SYSTEM"."PERSONS"!
Testing table #171 "SYSTEM"."CLUBS"

<>

Testing table #179 "SYSTEM"."TR_LOG"

Repeat testing system tables...
Repeat testing table #1 "SYSTEM"."$$$$SYSRL"
Testing long VIEW pages...
Testing integrity pages...
Testing file description pages...
```

Repeat testing table #2 "SYSTEM"."\$\$\$ATTRI"

Repeat testing table #3 "SYSTEM"."\$\$\$USR"

Database Testing Report 03.10.2016 14:20:22

There are errors in 1 tables:

#170 "SYSTEM"."PERSONS"

Some errors can be fixed by TESTDB utility.

You should run TESTDB -r.

Some errors can be fixed by SQL update file.

You should run TESTDB -s upd_file, and then execute the created
SQL update file through Linter Desktop or INL after starting Linter.

```
Use keys -r -dr if you want to clear badly damaged data.
Use keys -r -da [-s file.sql] if you want to delete bad SECURITY
After that you should repeat the database testing procedure.
```

Из примера видно, что исправлена часть таких ошибок как:

Исправленные ошибки

```
WARNING
* Table #170 index file #1 page #2
* Page modification time "22.10.2089 04:44:43" is later than database
shutdown time "03.10.2016 13:53:47"
```

Исправленные ошибки

```
ERROR
* Table #170 converter, ROWID #3
* Converter element contains illegal file number #187
```

При этом видно, что рекомендации остались теми же. Допускается повторное выполнение testdb с ключом -r. Если ситуация не меняется, то необходимо перейти к следующему шагу.

Получение файла с исправлениями

```
$ ./bin/testdb -p 10000 -s fix.sql ./db
```

Содержимое файла fix.sql

```
DROP INDEX "NAME" on "SYSTEM"."PERSONS";
CREATE INDEX "NAME" on "SYSTEM"."PERSONS" INDEXFILE 1;
DROP INDEX "COUNTRY" on "SYSTEM"."PERSONS";
CREATE INDEX "COUNTRY" on "SYSTEM"."PERSONS" INDEXFILE 1;
DROP INDEX "CLUB" on "SYSTEM"."PERSONS";
CREATE INDEX "CLUB" on "SYSTEM"."PERSONS" INDEXFILE 1;
```

Выполним запуск СУБД ЛИНТЕР и выполним SQL файл с помощью INL.

Внесение исправлений в БД

```
$ ./bin/inl -u SYSTEM/MANAGER -f ./fix.sql
SQL .6.0 .6.0
Copyright (C) 1990-2016 Relex, Inc. All rights reserved.

INL :      : 17:36:26      : 17:36:26
INL :      : 17:36:26      : 17:36:26
INL :      : 1070
mandatory access control violation

INL :      : 17:36:26      : 17:36:26
INL :      : 17:36:26      : 17:36:26
INL :      : 1070
mandatory access control violation

INL :      : 17:36:26      : 17:36:26
INL :      : 17:36:26      : 17:36:26
INL :      : 1070
mandatory access control violation
```

Видно, что в данном случае выполнить запросы не удалось. Исходя из того, что для примера была использована повреждённая демонстрационная БД и для таблицы PERSONS не применяются расширенные средства защиты информации, то выполним рекомендацию testdb для удаления повреждённых атрибутов безопасности.

Удаление повреждённых атрибутов безопасности

```
$ ./bin/testdb -p 10000 -r -da ./db
Database Testing Program v.6.0 for Linter SQL Bastion v. 6.0.17.34 for
LINUX (Socket) 64-bit
Copyright (C) 1990-2016 Relex, Inc. All rights reserved.

Testing database "DEMO Database" located in ./db/
Database created by Linter 6.0.17

Testing system tables...
Testing table #1 "SYSTEM"."$$$$SYSRL"

<>

Testing table #169 "SYSTEM"."SP"
Testing table #170 "SYSTEM"."PERSONS"
* ERROR
* Table #170 data file #1 page #2
Record #26 (offset 1608), ROWID #26
* SECURITY: set non-existent GROUP value #204
* ERROR
* Table #170 data file #1 page #2
Record #26 (offset 1608), ROWID #26
* SECURITY: set non-existent RAL value #12
* ERROR
* Table #170 data file #1 page #2
```



```
Record #26 (offset 1608), ROWID #26
* SECURITY: set non-existent WAL value #12
* ERROR
* Table #170 data file #1 page #2
Record #26 (offset 1608), ROWID #26, column #1
* Illegal value length of 205
Row #26 deleted from table "PERSONS"
There are errors in table #170 "SYSTEM"."PERSONS"!
Repeat testing table #170 "SYSTEM"."PERSONS"
The errors in table #170 "SYSTEM"."PERSONS" were fixed
Testing table #171 "SYSTEM"."CLUBS"
```

```
<>
```

```
Testing table #179 "SYSTEM"."TR_LOG"
```

```
Repeat testing system tables...
Repeat testing table #1 "SYSTEM"."$$$$SYSRL"
Testing long VIEW pages...
Testing integrity pages...
Testing file description pages...
Repeat testing table #2 "SYSTEM"."$$$$ATTRI"
Repeat testing table #3 "SYSTEM"."$$$$USR"
```

```
Database Testing Report 03.10.2016 15:43:52
```

```
-----
There are errors in 1 tables:
```

```
#170 "SYSTEM"."PERSONS" (fixed)
All errors had been fixed, database can be used.
Use keys -r -dr if you want to clear badly damaged data.
```

Видно, что таблица PERSONS помечена как исправленная. Повторное выполнение testdb не фиксирует ошибок:

Заключительная проверка

```
$ ./bin/testdb -p 10000 ./db
Database Testing Program v.6.0 for Linter SQL Bastion v. 6.0.17.34 for
LINUX (Socket) 64-bit
Copyright (C) 1990-2016 Relex, Inc. All rights reserved.

Testing database "DEMO Database" located in ./db/
Database created by Linter 6.0.17

Testing system tables...
Testing table #1 "SYSTEM"."$$$$SYSRL"

<>

Testing table #179 "SYSTEM"."TR_LOG"

Database Testing Report 03.10.2016 15:47:04
-----
Database contains no errors and can be used.
```

Оценка потерь данных

Поскольку база данных восстановлена после серьёзных повреждений, то необходимо оценить потери среди данных. Так, например, было обнаружено, что из таблицы PERSONS пропала полностью 1 строка, в другой — повреждены данные в столбце POSITION (5-я колонка).

Разница (diff) между выборками из таблицы PERSONS до повреждений и после восстановления

```
5c5
< |Hagi          |George          |Romania          |Barselona
|Mid            | 1965 |Breshia          |
---
> |Hagi          |George          |Romania          |Barselona
|Midback       | 1965 |Breshia          |
25a26
> |Dalin        |Martin         |Sweden           |Borussia
(Menhengladbach)|Forward        | 1968            |
```

